



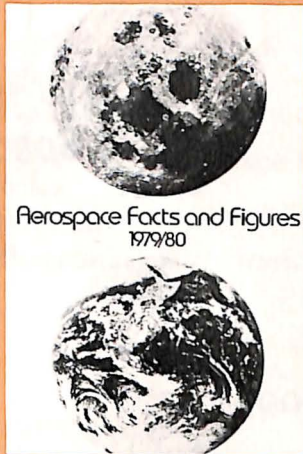
Aerospace Facts and Figures 1979/80





This 27th annual edition of **Aero-space Facts and Figures** commemorates the 10th anniversary of man's initial landing on the moon, which occurred on July 20, 1969 during the Apollo 11 mission. Neil Armstrong and Edwin E. Aldrin were the first moonwalkers and their Apollo 11 teammate was Command Module Pilot Michael Collins. Shown above is NASA's 10th anniversary commemorative logo; created by artist Paull Calle, it depicts astronaut Armstrong preparing to don his helmet prior to the historic Apollo 11 launch.

On the Cover: James J. Fisher's cover art symbolizes the Earth/moon relationship and man's efforts to explore Earth's ancient satellite.



Aerospace Facts and Figures 1979/80

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Foreword

This 27th edition of *Aerospace Facts and Figures* chronicles, in statistical and highlight fashion, the aerospace industry's performance in 1978, a good year by any standard of measurement. Sales and earnings improved over the previous year, and a sharp growth in backlog indicates continuing high levels of activity in the current year.

As has been the case in recent years, the industry again set records in many categories of performance—but records are not what they used to be. It is perhaps superfluous, yet essential to proper perspective, to point out that some records—those involving dollar values—are artificially swollen by the high levels of inflation the nation has been experiencing. When sales figures are converted to constant, or inflation-adjusted dollars, a different picture emerges: the real record year was 1968, and sales in 1978 amount to only 70 percent of the sales record recorded in that peak year.

In comparison with earlier years of this decade, however, industry activity—as measured by constant dollar sales volume—was greater than in any year since 1970. Additionally, industry employment topped the one million mark in October 1978, for the first time since 1970. The industry's earnings as a percentage of sales improved substantially, a welcome gain in a high-technology industry whose capital requirements are of exceptional order.

The industry is particularly proud of its 1978 performance in international trade. In a year when the nation as a whole experienced its largest trade deficit, aerospace achieved its greatest trade *surplus* and led all manufacturing industries in contribution to the U.S. balance of trade. The aerospace surplus of \$9 billion mitigated the adverse effects of deficits in other areas of trade, stressing anew the importance of aerospace exports to the nation's economy. Parenthetically, it might be added that this impressive aerospace trade performance was accomplished at a time when competition from abroad is stronger than ever, satisfying acknowledge-



ment that the industry has lost none of its technological and competitive vigor despite several prior years of generally declining activity.

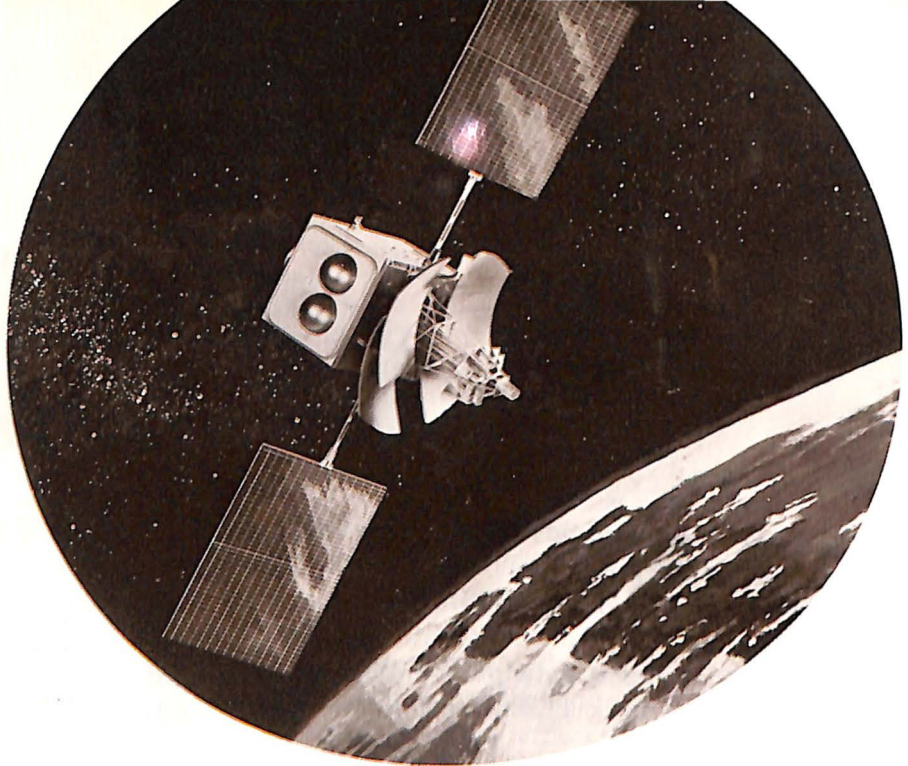
Looking ahead, the backlog of orders for new commercial transports indicates high levels of production in that segment of the industry in near-future years. The industry anticipates further growth in sales of non-aerospace products and services, which have more than doubled over the past five years.

Defense sales volume is less susceptible to accurate prediction. The Administration has expressed its determination to strengthen our national defenses and that intent is reflected in the new budget before Congress. The budget suggests higher levels of industry defense work in the immediate future, but the long term view is clouded by the fact that such workload is dependent upon future appropriation levels in an uncertain economic climate.

Similarly, the forthcoming debut of NASA's Space Shuttle, and the programs envisioned for it, might be expected to generate increased industry activity in fabrication of space equipment. But the new budget, although it adequately supports continuing Shuttle development, allows no new starts in other areas of NASA's space program. Whether future funding considerations will permit realization of the Shuttle's promise remains to be seen.

Summing up, the aerospace industry is experiencing an upturn after years of decline. Indications point to continuing high levels of activity in the immediate future. Given no further declines in the world economy, the outlook for the U.S. aerospace industry in the coming decade is substantially better than it was at the start of this decade.

Karl G. Harr, Jr.
President
Aerospace Industries Association



Aerospace Summary

The year 1978 was characterized by substantial improvement in the aerospace industry's sales, earnings, backlog, export performance and contribution to the U.S. balance of trade. Statistically, it was a record year, with all-time peaks reported in all major categories, but the figures are distorted by the effects of inflation. However, even when the statistics are adjusted for inflation, the industry's 1978 performance was encouraging; using sales as a yardstick of industry activity, 1978 was the best year since 1970.

The main reason for the activity upturn was increased workload in

production of commercial transport aircraft. Additionally, there were substantial increases in defense and non-aerospace sales.

Here is a breakdown of the industry's 1978 performance by major category:

Sales. Total sales amounted to \$37.4 billion, an increase of more than \$5 billion over 1977 sales, the previous peak. The gain was due to significant increases in two of the four industry product groups: aircraft and non-aerospace. Missile sales remained at the previous year's level and sales of space equipment declined. Aerospace in-

dustry sales as a percentage of the Gross National Product increased from 1.7 percent in 1977 to 1.8 percent in 1978; the figures compare with an average of two percent for the prior years of the 1970s. In relation to total sales of all U.S. manufacturing industries, aerospace sales increased from 2.4 to 2.5 percent.

Profit. The industry's net profit after taxes as a percentage of sales was 4.8 percent, which compares with 4.2 percent in 1977. Industry profit edged closer to, but remained below, the average profit for all U.S. manufacturing industries—5.4 percent.

Backlog. The industry's backlog climbed sharply during 1978 and at year-end reached \$57.8 billion, an increase of more than \$12 billion above the previous year's level. Airline orders for new commercial transports constituted the major component of the increase; the number of transports on order increased from 465 at year-end 1977 to 702 at the end of 1978 and the dollar value of orders on the books climbed about \$7 billion, to almost \$16 billion. Major increases were also recorded in U.S. government orders for aircraft, in missile and space equipment backlog, and in orders for non-aerospace products.

Civil Aircraft Production. Civil aircraft shipments of all types totaled 18,965 in 1978, up more than 1,000 over the previous year's shipments. In terms of dollar value,

shipments amounted to \$6.5 billion, which compares with \$4.7 billion in 1977.

The bulk of the dollar value of 1978 shipments was in commercial transports—\$4.3 billion, or two-thirds of the total; the amount represents an increase of \$1.4 billion over the previous year. In terms of numbers, the industry delivered 244 transports, 69 more than in 1977. Due to the lead time involved, these deliveries reflect orders placed in 1977 and prior years. The surge of new orders received in 1978 indicates even higher levels of transport production activity in 1978 and later years.

Manufacture of general aviation planes increased again, both numerically and in dollar value. Shipments totaled 17,817 units, which compares with 16,910 in 1977. Dollar value was \$1.8 billion, up about \$270 million. Both numbers and value were the highest ever recorded.

Civil helicopter production also set new records. The rotary wing segment of the industry delivered 904 helicopters, 56 more than in the previous year and 40 more than in the former record year of 1975. Dollar value of helicopters delivered in 1978 was \$326 million, up from \$251 million in 1977 and more than \$40 million above the earlier high of \$285 million in 1976.

Military Aircraft Production. Because the bulk of airplanes delivered to the military services in 1978 were high-value types, the dollar

value of military aircraft production increased from \$4.4 billion in 1977 to \$4.8 billion in 1978. However, the number of deliveries declined again, as it has in almost every year since the Vietnam war years of 1967/68, when service acceptances of aircraft ran close to 4,500 annually. Including planes produced for security assistance programs, military deliveries dropped to 720 aircraft, down from 862 in the previous year. Air Force and Navy acceptances remained close to 1977 levels, but the Army took delivery of only 136 aircraft, down from 260 in 1977.

The industry built 254 planes which were accepted by the Air Force and the Army for delivery to foreign governments under security assistance programs. The USAF accepted 207 planes, principally fighter/attack aircraft, and the Army accepted 47 helicopters.

Missile Programs. Industry missile sales increased moderately in 1978 to about \$5.4 billion, almost the same as 1977. At year-end 1978, missile backlog, excluding propulsion units, was \$4.7 billion, up from \$4.5 billion a year earlier. Developments of 1978/79, principally the Administration's decision to proceed with full-scale development of the Air Force MX mobile ICBM, indicate a substantial increase in industry missile activity in near-future years.

Space Programs. Civil and military space programs accounted for \$3 billion of the industry's total

sales in 1978, a decline from \$3.4 billion in 1977. Sales of space vehicle systems, excluding propulsion units, totaled \$2.3 billion, up from \$1.9 billion in 1977. The 1978 figure includes \$1 billion in military sales and \$1.3 billion in civil space sales. Space vehicle systems backlog at year-end 1978 was \$2.1 billion.

Non-aerospace Sales. For several years, a particularly encouraging aspect of the aerospace industry's performance has been the strong growth in sales of non-aerospace products and services. In the early years of the 1970s, sales in this category hovered around the \$2.5 billion level and represented ten to eleven percent of the industry's total sales. Since 1973, non-aerospace sales have climbed sharply, reaching the \$4.1 billion level in 1974, topping \$5 billion in 1976 and mounting to the \$6 billion level in 1977. This growth pattern continued in 1978, when non-aerospace sales totaled \$6.8 billion, or more than 18 percent of the industry's total sales. It marked the sixth consecutive year in which non-aerospace sales set new records.

Research and Development. Federal government outlays for research and development, a general indicator of aerospace industry R&D activity, increased sharply in the fiscal year 1979, as they had in the previous year. The two-year upturn marks a reversal of the previously declining trend in *real*, or inflation-adjusted, funding levels.

Estimates for FY 1979 indicate

total federal outlays of \$27.6 billion, an increase of more than \$3 billion. The gain represents an increase of more than 12 percent. Department of Defense outlays of \$12.1 billion are up \$1.4 billion over the previous year. NASA outlays increased by some \$400 million to \$4.2 billion. Outlays by the Department of Energy, another source of aerospace industry R&D contracts, amounted to \$4.5 billion, up about \$600 million.

The FY R&D budget, under consideration by Congress at publication time, calls for a lesser but substantial overall increase of \$2.1 billion. Defense R&D outlays would again climb significantly, by \$1.3 billion or more than 10 percent, but contemplated NASA/Energy increases would be of small order and well below the inflation rate. However, the new budget emphasizes real growth in basic research funding; in that category, the budget provides for increases of 17 percent in defense outlays, almost 19 percent for NASA and 17 percent for the Department of Energy.

Foreign Trade. In 1978, the United States experienced its greatest international trade deficit—about \$32 billion—but in the same year the aerospace industry recorded a trade surplus of \$9 billion, underlining once again the vital importance of aerospace exports to the national economy.

The aerospace trade surplus, the highest among all U.S. manufacturing industries, was due to a level of

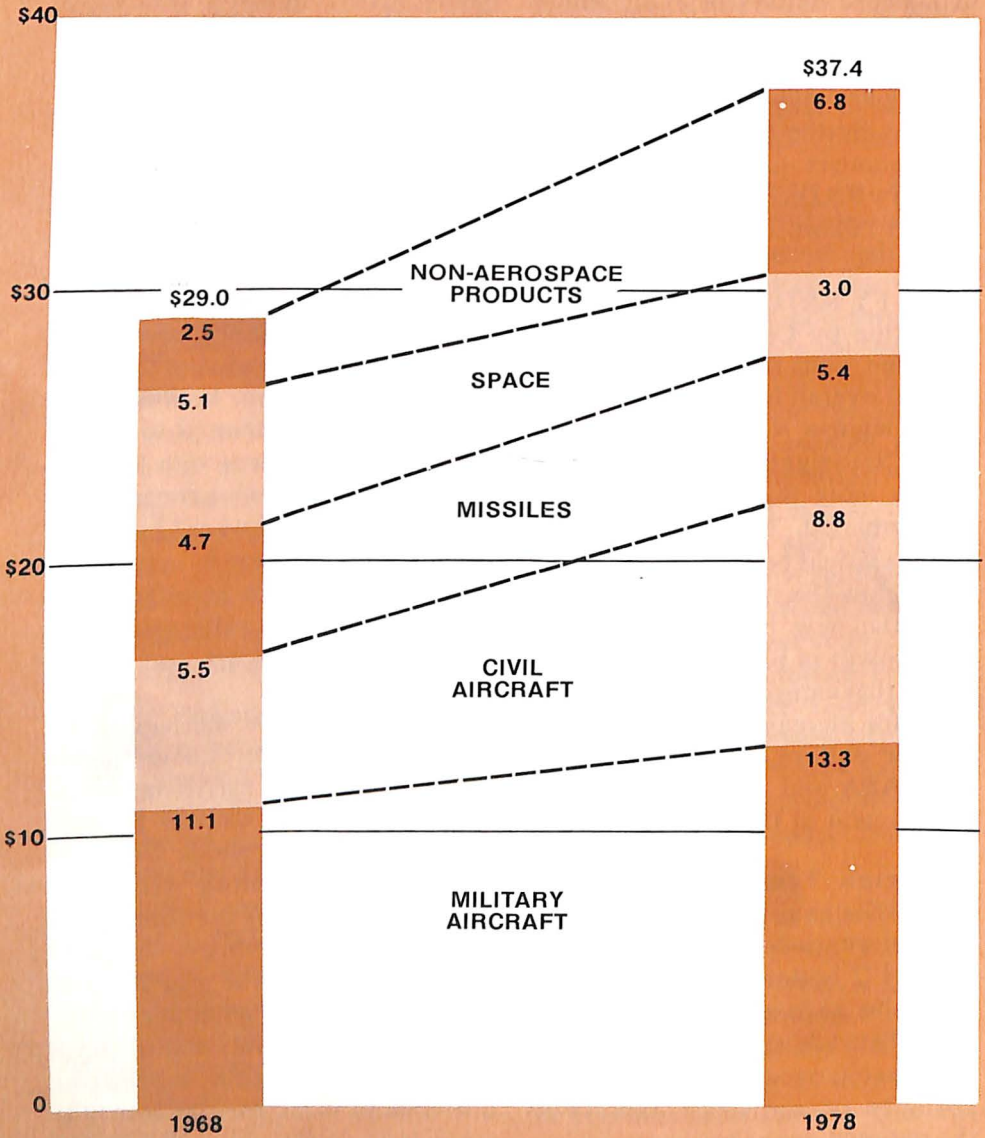
exports which outstripped aerospace imports by a factor of more than 10 to 1. Exports amounted to \$10 billion, an all-time high and nearly 32 percent above 1977's \$7.6 billion. Aerospace imports increased by \$200 million but remained below the \$1 billion level.

Civil aerospace exports valued at more than \$6 billion constituted 60 percent of the industry's 1978 export total. The largest single component among civil exports was commercial transport aircraft, sales of which increased some \$600 million over the previous year to a 1978 figure of \$2.6 billion. Military aerospace exports amounted to \$4 billion, which compares with \$2.5 billion in 1977. The major components in the military total were \$2.2 billion for complete aircraft, especially fighter aircraft, (up \$1 billion) and \$1.1 billion for aircraft engines and parts (up \$200 million).

Employment. The aerospace industry employment curve, influenced primarily by increasing activity in commercial aircraft production, climbed sharply in 1978, reversing a declining trend in evidence in each of the three prior years. Average industry employment during the year was 967,000, a gain of about 8.5 percent over the previous year's level, and in October 1978 employment topped the one million mark for the first time since 1970.

The 1978 increase was compounded of gains in all major categories.

AEROSPACE INDUSTRY SALES BY PRODUCT (In Billions)



Source: AIA estimates

**AEROSPACE INDUSTRY SALES
BY PRODUCT GROUP**
Calendar Years 1950 to Date
(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

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 to Date
(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

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 to Date
(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	

SALES

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 ^r	31,328	19,083	12,245	8,314	7,622	5,880	2,368	1,833	5,311
1977 ^r	33,315	20,704	12,611	8,848	7,530	5,775	2,839	2,219	6,104
1978	37,471	21,951	15,520	8,678	9,996	6,568	3,354	2,086	6,789

BACKLOG—AS OF DECEMBER 31

1966	\$27,547	\$15,711	\$11,836	\$ 8,761	\$ 9,718	\$4,510	\$1,588	\$ 904	\$2,066
1967 ^a	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 ^r	39,702	24,141	15,561	11,950	8,929	6,286	2,046	3,496	6,995
1977 ^r	45,309	26,119	19,190	12,471	12,592	6,743	2,761	3,447	7,295
1978	57,775	30,937	26,838	14,625	19,161	7,604	4,022	3,891	8,472

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

^a Due to revision in the data base, 1967 data are estimates.^r Revised.

AEROSPACE SALES AND THE NATIONAL ECONOMY

Calendar Years 1960 to Date
(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 ^r	1,700.1	1,178.0	604.7	30.0	1.8	2.6	5.0
1977 ^r	1,887.2	1,335.1	699.2	32.3	1.7	2.4	4.7
1978	2,107.6	1,503.8	803.1	37.4	1.8	2.5	4.7

Source: Gross National Product, Manufacturing and Durable Goods Industries: Department of Commerce, "Survey of Current Business," (Monthly). Aerospace: Aerospace Industries Association estimates, based on latest available information.

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

^r Revised.

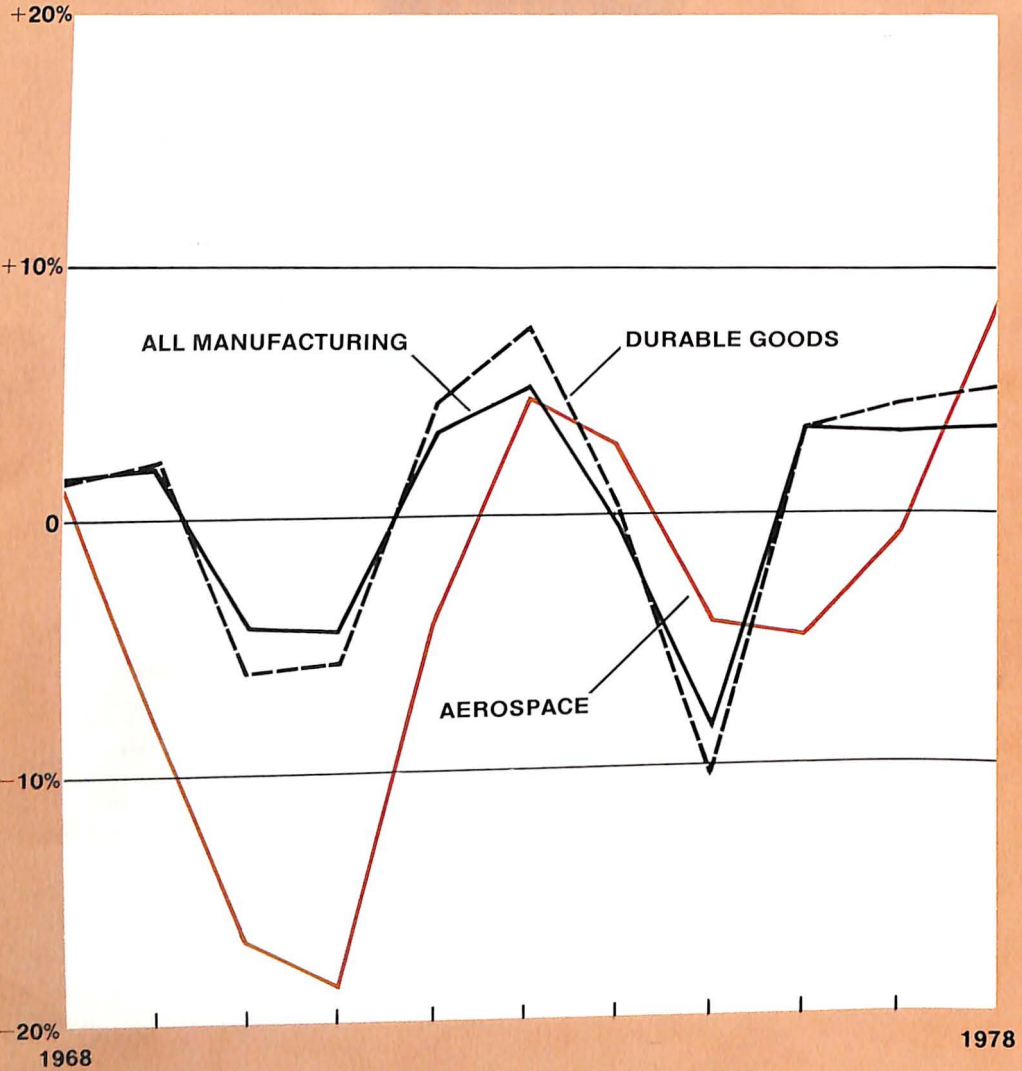
**AEROSPACE SALES AND THE NATIONAL ECONOMY
IN CONSTANT DOLLARS**
Calendar Years 1960 to Date
(Billions of 1972 Dollars)

Year	TOTAL Gross National Product	Sales			GNP Implicit Price Deflator 1972=100
		Manu- facturing Industries	Durable Goods Industry	Aerospace Industry	
1960	\$ 736.9	\$ 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	874.3	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	1,234.6	961.4	498.4	23.4	105.80
1974	1,217.8	914.2	455.9	22.7	116.02
1975 ^r	1,202.4	823.2	414.4	22.3	127.15
1976 ^r	1,271.0	880.7	452.1	22.4	133.76
1977 ^r	1,332.7	942.8	493.8	22.8	141.61
1978	1,324.8	945.3	504.8	24.6	152.09

Source: Deflator Series: "Economic Report of the President," January 1979.

^r Revised.

ANNUAL CHANGE IN EMPLOYMENT BY SELECTED INDUSTRY SECTORS 1968-1978



Source: AIA and Bureau of Labor Statistics

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

Calendar Years 1961 to Date
(Thousands of Employees)

Year	All Manu- facturing Industries	Durable Goods Industries	Aerospace Industry		
			TOTAL	As Percent of	
				All Manu- facturing	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 ^a	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	19,647	11,573	891 ^b	4.5	7.7
1978	20,332	12,160	967	4.8	8.0

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

NOTE: Aerospace employment as shown is the sum of the estimated monthly average employment in the aircraft and missile and space industries (SIC 372 and 376) plus estimated aerospace employment in the communications equipment (SIC 3662) and instruments (SIC 3811 and 3821) industries and in certain other industries (SIC 28, 35, 73, 89, etc.).

^a The Bureau of Labor Statistics has revised its employment statistics benchmarked to 1972 Standard Industrial Classifications. Data prior to 1972 may not be strictly comparable.

^b Aerospace average employment for 1977 reflects a strike against several major companies during the last quarter of the year. Employment in September 1977 reached 903,000.

AEROSPACE INDUSTRY AND ALL MANUFACTURING INDUSTRIES

**Average Annual Employment
(Thousands of Employees)
Calendar Years 1961 to Date**

Year	All Manufacturing Industries TOTAL	Aerospace			Aerospace As Percent of All Manufacturing
		TOTAL	Production Workers	Other ^a	
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 ^b	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	19,647	891	428	463	4.5
1978	20,332	967	472	495	4.8

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

- ^a "Other" employment includes salaried, clerical and maintenance employees, among others.
^b Employment estimates have been revised by the Bureau of the Census benchmarked back to 1972, and may not be comparable to data for prior years.

AEROSPACE INDUSTRY AND ALL MANUFACTURING INDUSTRIES

Annual Average Payroll^a
(Millions of Dollars)
Calendar Years 1961 to Date

Year	All Manufacturing Industries TOTAL	Aerospace			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 ^b	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 ^r	14,608	5,935	8,673	6.9
1976	237,500 ^r	14,881	5,951	8,930	6.3
1977	266,300 ^r	16,268	6,460	9,808	6.1
1978	299,900	19,293	7,805	11,488	6.4

Source: Aerospace Payroll: Aerospace Industries Association estimates, based on latest available information; Manufacturing Payroll: Bureau of Economic Analysis.

- a* Aerospace Payroll is estimated by a method similar to that used to estimate Aerospace Employment. See the glossary.
b Employment estimates have been revised by the Bureau of the Census benchmarked back to 1972, and may not be comparable to data for prior years.
r Revised.

**U.S. TURBINE-ENGINEED AIRCRAFT
IN THE WORLD AIRLINE FLEET
Calendar Years 1974 to Date**

	1974	1975	1976	1977	1978
TOTAL AIRCRAFT IN SERVICE . . .	<u>6,870</u>	<u>7,153</u>	<u>7,195</u>	<u>7,298</u>	<u>7,550</u>
Number Manufactured in U.S.	4,561	4,866	4,891	5,027	5,159
Percent Manufactured in U.S.	66.4%	68.0%	68.0%	68.9%	68.3%
Turbojet Aircraft in Service	<u>4,628</u>	<u>4,919</u>	<u>5,012</u>	<u>5,137</u>	<u>5,288</u>
Number Manufactured in U.S.	3,842	4,129	4,237	4,345	4,467
Percent Manufactured in U.S.	83.0%	83.9%	84.5%	84.6%	84.5%
Turboprop Aircraft in Service	<u>1,972</u>	<u>1,916</u>	<u>1,914</u>	<u>1,856</u>	<u>1,931</u>
Number of Manufactured in U.S.	525	497	455	429	422
Percent Manufactured in U.S.	26.6%	25.9%	23.8%	23.1%	21.9%
Turbine-Powered Helicopters in Service	<u>270</u>	<u>318</u>	<u>269</u>	<u>305</u>	<u>331</u>
Number Manufactured in U.S.	194	240	199	253	270
Percent Manufactured in U.S.	71.9%	75.5%	74.0%	83.0%	81.6%

Source: "Air World Survey," Exxon International Company (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.
 a Air taxi operators no longer included.

U.S. EXPORTS AND EXPORTS OF AEROSPACE PRODUCTS

Calendar Years 1960 to Date
(Millions of Dollars)

Year	TOTAL Exports 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 ^r	106,561	7,792	7.3	2,397	2,926	2,469
1976 ^r	113,666	7,843	6.9	2,468	3,200	2,175
1977 ^r	119,006	7,581	6.4	1,936	3,113	2,532
1978	141,154	10,001	7.1	2,558	3,460	3,983

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 may not be strictly comparable to data for prior years.

^r 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 ^a	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	2,043.4	450.8	103.8	347.0	5.0	22.8
1979—Estimate	2,289.4	493.4	111.9	381.5	4.9	22.7
1980—Estimate	2,505.7	531.6	122.7	408.9	4.9	23.1

Source: Department of Defense, Budget Press Release, OASD (Comptroller) January 22, 1979.
^a "Net Total" is government-wide total less intragovernmental transactions.

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

Fiscal Years^a 1960 to Date
(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	103,042	3,983	12,424	8,765 ^b	3,659	11.6
1979 ^E	111,900	4,402	14,042	9,794	4,248	12.1
1980 ^E	122,700	4,595	16,011	11,571	4,440	12.6

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."

^a For an explanation of the change in the Federal Government's Fiscal Year and the Transition Quarter (Tr. Qtr.), see the Glossary.

^b Effective with FY 1978, DoD outlays for aircraft and missile procurement only.

^E Estimate.

**FEDERAL OUTLAYS FOR
AEROSPACE PRODUCTS AND SERVICES**
Fiscal Years 1960 to Date
(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 ^E	14,042	9,794	7,969	1,825	4,248
1980 ^E	16,011	11,571	9,379	2,192	4,440

Source: Department of Defense, Budget Press Briefing, January 22, 1979. NASA, Budget Briefing, January 22, 1979.

Tr. Qtr.: Transition Quarter. For an explanation of the Transition Quarter and the change in the Federal Government's Fiscal Year, see the Glossary.

^E Estimate.

**DEPARTMENT OF DEFENSE
AEROSPACE OUTLAYS**
Fiscal Years 1960 to Date
(Millions of Dollars)

Year	DOD Aerospace Outlays ^a		
	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 ^E	NA	9,794	NA
1980 ^E	NA	11,571	NA

Source: Department of Defense, Budget Press Briefing, January 22, 1979.

^a Excludes Military Assistance.

Tr. Qtr.: Transition Quarter. For an explanation of the Transition Quarter, and the change in the Federal Government's Fiscal Year, see the Glossary.

^E Estimate.

NA Not Available.

**DEPARTMENT OF DEFENSE
TOTAL OUTLAYS BY FUNCTIONAL TITLE
Fiscal Years 1972 to Date
(Millions of Dollars)**

	1972	1973	1974
TOTAL	\$75,151	\$73,297	\$77,626
PROCUREMENT—TOTAL	-17,131	15,654	15,241
AIRCRAFT	5,927	5,066	5,006
MISSILES	3,009	3,023	2,981
Ships	1,978	1,982	2,104
Combat Vehicles, Weapons & Torpedoes	491	354	446
Ordnance, Vehicles & Related Equipment	3,040	2,508	2,044
Electronics & Communications	946	675	854
Other Procurement	1,740	2,046	1,806
RESEARCH, DEVELOPMENT, TEST & EVALUATION—TOTAL	7,881	8,157	8,582
AIRCRAFT	2,066	2,036	1,893
MISSILES	2,157	2,038	2,160
ASTRONAUTICS	468	512	561
Other	3,190	3,571	3,968
Military Personnel—TOTAL	26,921	27,635	28,856
Active Forces	21,629	21,722	22,150
Reserve Forces	1,407	1,523	1,579
Retired Pay	3,885	4,390	5,127
Military Construction	1,108	1,119	1,407
Family Housing	688	729	884
Civil Defense	75	74	75
Operations and Maintenance	21,675	21,069	22,478
Other	(328)	(1,140)	103

Source: Department of Defense, Budget Press Briefing, January 22, 1979.

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.

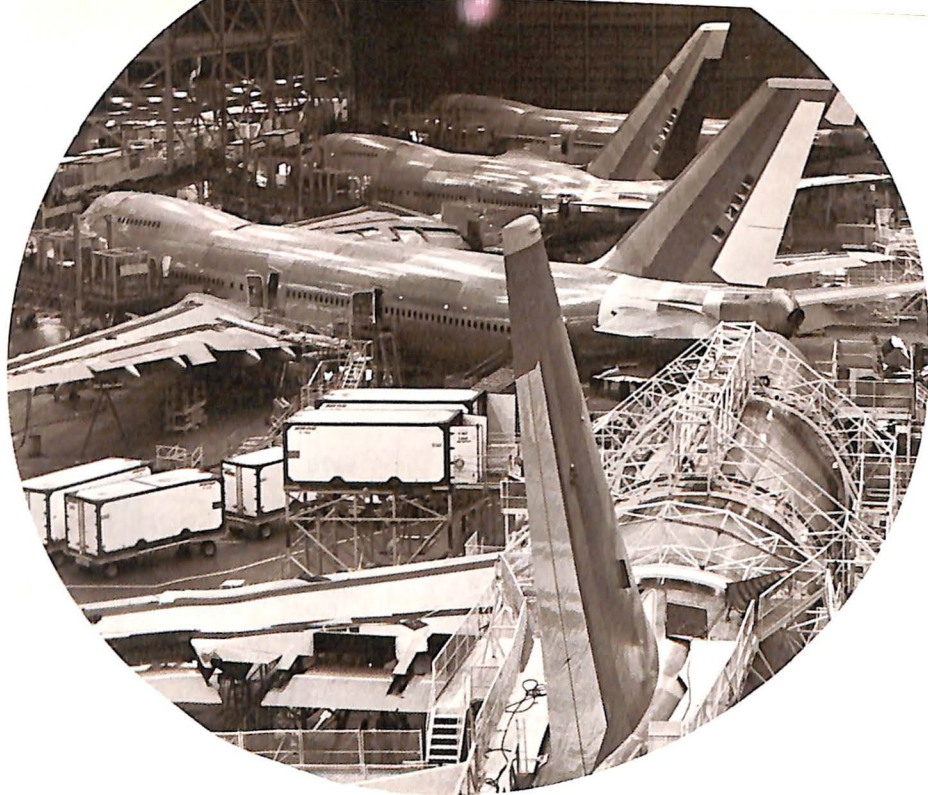
Tr. Qtr.: Transition Quarter. See the Glossary.

E Estimate.

NA Not Available.

DEPARTMENT OF DEFENSE
TOTAL OUTLAYS BY FUNCTIONAL TITLE (Continued)
Fiscal Years 1972 to Date
(Millions of Dollars)

1975	1976	Transition Quarter	1977	1978	1979 ^E	1980 ^E
\$85,020	\$88,036	\$21,927	\$95,650	\$103,042	\$111,900	\$122,700
<u>16,042</u>	<u>15,964</u>	<u>3,766</u>	<u>18,178</u>	<u>19,976</u>	<u>22,476</u>	<u>25,749</u>
5,484	6,520	1,557	6,608	6,971	7,969	9,379
2,889	2,296	402	2,781	1,794	1,825	2,192
2,627	2,606	661	2,841	3,048	3,880	3,844
395	240	134	833	2,140	} 8,802	} 10,334
1,492	856	150	940	732		
897	1,031	271	1,197	1,349		
2,258	2,415	591	2,978	3,942		
<u>8,866</u>	<u>8,923</u>	<u>2,206</u>	<u>9,795</u>	<u>10,508</u>	<u>11,726</u>	<u>13,015</u>
1,698	1,603	410	2,176	} NA	} NA	} NA
2,176	2,295	520	2,259			
515	581	129	537			
4,477	4,444	1,147	4,823			
<u>31,210</u>	<u>32,359</u>	<u>8,305</u>	<u>33,931</u>	<u>36,246</u>	<u>38,501</u>	<u>39,882</u>
23,235	23,259	5,846	23,857	25,116	26,154	26,296
1,733	1,804	512	1,858	1,959	2,066	2,151
6,242	7,296	1,947	8,216	9,171	10,281	11,435
1,462	2,019	376	1,914	1,932	1,854	1,951
1,124	1,192	296	1,358	1,405	1,441	1,493
86	80	18	93	82	NA	NA
26,330	27,902	7,261	30,587	33,578	35,905	38,690
(100)	(403)	(301)	(206)	(685)	(3)	1,920



Aircraft Production

In each year of the 1970s, aircraft production has accounted for more than half of the aerospace industry's total sales. With aircraft sales of \$18.7 billion, that pattern held true in 1978, despite a decline in the dollar value of aircraft delivered to the U.S. government.

The dip in sales of aircraft to the government was more than compensated by a large increase in non-government sales, principally commercial transports. As a result, overall aircraft sales increased by some \$2.3 billion, or 14 percent, over the previous year's figure of \$16.4 billion.

A 1978 surge of new orders of jetliners sparked a major upturn in the industry's aircraft production backlog. At year-end, the backlog reached an all-time high of \$33.8 billion, up \$8.8 billion—about 35 percent—above the 1977 level of \$25 billion.

Among other statistical highlights of aircraft production in 1978 were these:

- Non-government sales totaled just under \$10 billion, an increase of about \$2.5 billion over 1977.
- Government sales declined \$170 million to \$8.7 billion.

- Aircraft deliveries of all types numbered 19,960, the highest figure since the post-World War II record year of 1966.

- General aviation shipments totaled 17,817 units, which compares with 16,910 in 1977. Dollar value was \$1.8 billion, up 17.5 percent.

- The rotary wing segment of the industry produced 904 civil helicopters valued at \$326 million. This represents a substantial increase over the comparable figures for 1977: 848 helicopters worth \$251 million.

In both dollar value and numbers of aircraft, the commercial transport sales curve took a sharp upturn after three years of decline. The industry delivered 244 transports, which compares with 185 in 1977.* Dollar value climbed to \$4.3 billion, up from \$2.9 billion in 1977. Further gains of significant order were indicated for 1979, due to a heavy flow of new transport orders in late 1977 and during 1978. The number of transports on order increased from 465 at year-end 1977 to 702 at the end of 1978; the backlog neared \$16 billion, compared with \$8.9 billion at the start of the year. Of significance to the nation's balance of trade is a backlog of jetliner orders from foreign airlines of \$8.8 billion, up almost \$3 billion from 1977.

Military aircraft production in-

creased in dollar value from \$4.4 billion in 1977 to \$4.8 billion in 1978, but dropped to a modern era low of 720 aircraft delivered, down from 862 in the previous year. Air Force and Navy acceptances remained close to 1977 levels, but the Army took delivery of only 136 aircraft, down from 260 in 1977.

Air Force acceptances in 1978 totaled 196 planes, an increase of 14 over 1977. The bulk of the deliveries were A-10A attack aircraft and F-15 fighters. The USAF also received eight E-3A command/control aircraft and five F-16 fighters, the first production models of a planned large-scale procurement program.

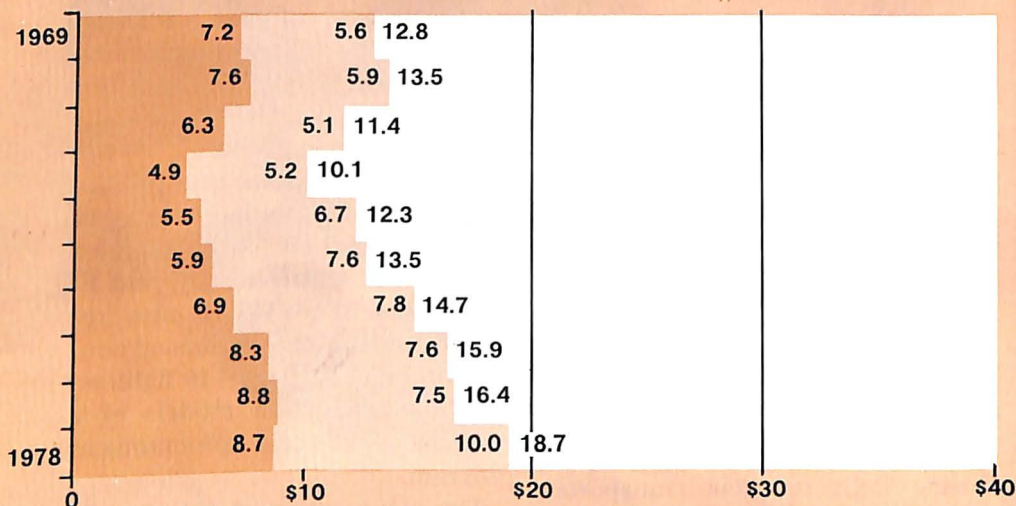
The Navy accepted 181 aircraft, one fewer than in 1977, with production spread over nine different plane types; largest in terms of numbers was the F-14 air superiority fighter, of which 44 were delivered. Included in the Navy total were 51 helicopters of two types—the AH-1T and the UN-1N. In production status during 1978, but not reflected in the year's deliveries, was the F-18 strike fighter, scheduled for quantity production in later years.

In another area of military aircraft production, the USAF and the Army accepted 254 aircraft for delivery to foreign governments under security assistance programs. The USAF accepted 207 planes, principally fighter/attack aircraft and most of them F-15 fighters. The Army's 47 acceptances included three types of helicopters.

*A work-stoppage in late 1977 reduced the number of transport aircraft delivered during the 4th quarter of the year.

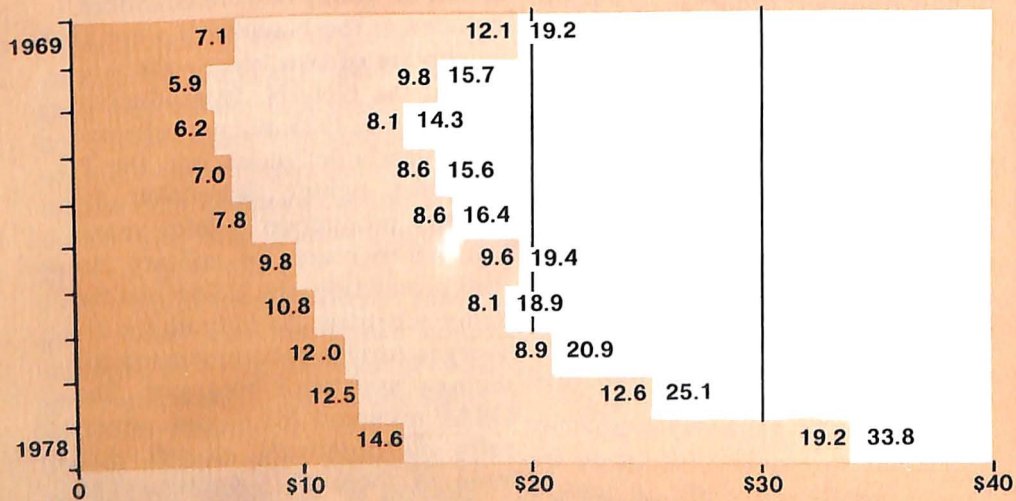
U.S. AIRCRAFT SALES BY CUSTOMER

(Billions of Dollars)



U.S. 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 to Date
 (Millions of Dollars)

Year	TOTAL			Aircraft & Parts ^a		Aircraft Engines & Parts	
	TOTAL	U.S. Gov't	Other	U.S. Gov't	Other	U.S. Gov't	Other
SALES							
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 ^r	15,936	8,314	7,622	6,336	5,900	1,978	1,722
1977 ^r	16,378	8,848	7,530	6,855	5,670	1,993	1,860
1978	18,674	8,678	9,996	6,864	7,624	1,814	2,372
BACKLOG—AS OF DECEMBER 31							
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 ^r	20,879	11,950	8,929	9,905	7,416	2,045	1,513
1977 ^r	25,063	12,471	12,592	9,557	10,152	2,914	2,440
1978	33,786	14,625	19,161	11,425	16,504	3,200	2,657

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

^a Includes Aircraft Propellers and Parts.

^r Revised.

U.S. AIRCRAFT PRODUCTION
Calendar Years 1961 to Date
(Number of Aircraft)

Year	TOTAL	Civil	Military
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 ^r	15,326 ^r	1,110
1975	16,620 ^r	15,251 ^r	1,369
1976	17,605 ^r	16,445 ^r	1,160 ^r
1977	19,077 ^r	17,943 ^r	1,134 ^r
1978	19,960	18,965	995

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

NOTE: As of 1972, aircraft produced for Security Assistance Programs are included.

^r Revised.

CIVIL AIRCRAFT SHIPMENTS

Number and Value
Calendar Year 1966 to Date

Year	TOTAL	Transport Aircraft	Helicopters	General Aviation
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NUMBER OF AIRCRAFT SHIPPED

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 ^r	332	828	14,166 ^r
1975	15,251 ^r	315	864	14,072 ^r
1976	16,445 ^r	238	757 ^r	15,450 ^r
1977	17,943 ^r	185	848 ^r	16,910 ^r
1978	18,965	244	904	17,817

VALUE—Millions of Dollars

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 ^r	3,993	189	909 ^r
1975	5,086	3,779	274	1,033
1976	4,706 ^r	3,192	285 ^r	1,229
1977	4,691 ^r	2,889	251 ^r	1,551
1978	6,480	4,332	326	1,822

Source: Transport aircraft and helicopters: Aerospace Industries Association.
General Aviation: General Aviation Manufacturers' Association.

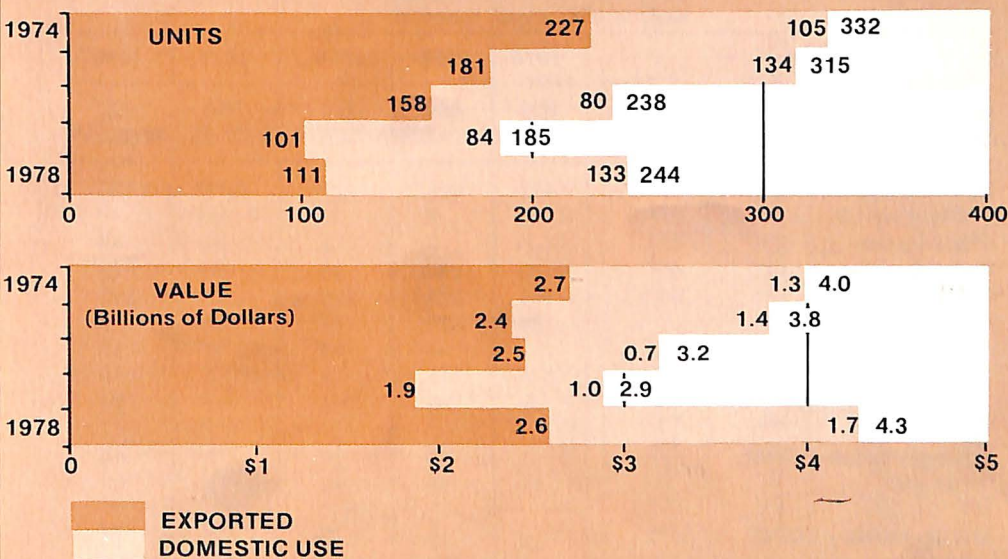
^r Revised.

TRANSPORT AIRCRAFT ORDERS
Calendar Years 1974 to Date

Company and Model	Orders as of December 31				
	1974	1975	1976	1977	1978
TOTAL AIRCRAFT ON ORDER (Domestic and Foreign Orders)	513	340	300	465	702
VALUE (Millions of Dollars)	\$7,281	\$5,959	\$4,810	\$8,903	\$15,952
Boeing—TOTAL	<u>210</u>	<u>130</u>	<u>155</u>	<u>242</u>	<u>426</u>
B-707	14	9	5	4	1
B-727	121	60	106	157	195
B-737	46	29	22	36	111
B-747	29	32	22	45	89
B-767	—	—	—	—	30
Lockheed—TOTAL	<u>127</u>	<u>93</u>	<u>71</u>	<u>61</u>	<u>40</u>
L-1011	112	81	70	61	40
L-100-30	15	12	1	—	—
McDonnell Douglas—TOTAL	<u>176</u>	<u>117</u>	<u>74</u>	<u>162</u>	<u>236</u>
DC-9	91	65	47	101	134
DC-10	85	52	27	61	102
TOTAL FOREIGN ORDERS	305	217	137	232	352
VALUE (Millions of Dollars)	\$4,987	\$4,212	\$2,853	\$5,534	\$8,803
Boeing—TOTAL	<u>112</u>	<u>82</u>	<u>50</u>	<u>95</u>	<u>194</u>
B-707	14	9	5	4	1
B-727	41	20	13	35	51
B-737	32	28	12	16	77
B-747	25	25	20	40	65
B-767	—	—	—	—	—
Lockheed—TOTAL	<u>66</u>	<u>46</u>	<u>33</u>	<u>27</u>	<u>17</u>
L-1011	55	36	32	27	17
L-100-30	11	10	1	—	—
McDonnell Douglas—TOTAL	<u>127</u>	<u>89</u>	<u>54</u>	<u>110</u>	<u>141</u>
DC-9	58	40	30	69	83
DC-10	69	49	24	41	58

Source: Aerospace Industries Association, company reports.

**U.S. TRANSPORT AIRCRAFT
PRODUCTION AND EXPORTS**



Source: AIA and U.S. Department of Commerce

TRANSPORT AIRCRAFT PRODUCTION
Calendar Years 1974 to Date

Company and Model	1974	1975	1976	1977	1978
TOTAL					
Number of Aircraft Shipped	332	315	238	185	244
VALUE (Millions of Dollars)	\$3,993	\$3,779	\$3,192	\$2,889	\$4,332
Boeing—TOTAL	<u>174</u>	<u>169</u>	<u>132</u>	<u>115</u>	<u>193</u>
B-707	21	7	3	3	3
B-727	91	91	61	67	118
B-737	41	51	41	25	40
B-747	21	20	27	20	32
Lockheed—TOTAL	<u>64</u>	<u>68</u>	<u>43</u>	<u>42</u>	<u>13</u>
L-1011	41	25	16	11	8
L-100-30 (Hercules)	} 23	} 43	11	1	} 5
C-130 (Hercules)			16	30	
McDonnell Douglas—TOTAL	<u>94</u>	<u>78</u>	<u>63</u>	<u>28</u>	<u>38</u>
DC-9	48	35	44	16	20
DC-10	46	43	19	12	18

Source: Aerospace Industries Association, company reports.

NOTE: Differs from FAA totals which include executive type aircraft.

**U.S. HELICOPTER
COMMERCIAL PRODUCTION**
Calendar Years 1974 to Date

	1974	1975	1976	1977	1978
Number of Helicopters Shipped	828	864	775	884	935
VALUE (Millions of Dollars)	\$ 189	\$ 274	\$ 305	\$ 316	\$ 365
Bell—TOTAL	<u>467</u>	<u>495</u>	<u>424^a</u>	<u>374^b</u>	<u>438^c</u>
47 Series	3	3	11	—	—
204 Series	—	1	2	—	—
205 Series	26	40	36	28	23
206 Series	368	325	290	283	322
212 Series	70	126	71	47	50
214 Series	—	—	13	9	16
AH-1J	—	—	1	7	—
UH-1H	—	—	—	—	27
Boeing—Vertol—TOTAL	<u>11</u>	<u>10</u>	<u>11</u>	<u>12</u>	<u>4</u>
CH-47C	11	10	11	12	4
Brantly-Hynes—TOTAL	<u>—</u>	<u>—</u>	<u>2</u>	<u>1</u>	<u>11</u>
B-2B	—	—	2	1	11
Enstrom—TOTAL	<u>87</u>	<u>77</u>	<u>87</u>	<u>96</u>	<u>91</u>
F-28A	86	59	4	1	—
F-28C	—	—	40	43	44
280	1	18	3	—	—
280C	—	—	40	52	47
Hiller—TOTAL	<u>3</u>	<u>35</u>	<u>34</u>	<u>40</u>	<u>52</u>
12-E	3	35	29	35	52
12-E4	—	—	2	—	—
12-E (Turbine)	—	—	3	5	—
Hughes—TOTAL	<u>248</u>	<u>214</u>	<u>204</u>	<u>336</u>	<u>312</u>
300's	105	92	94	125	116
500's	143	122	110	211	196
Sikorsky (UTC)—TOTAL	<u>12</u>	<u>33</u>	<u>13</u>	<u>25</u>	<u>27</u>
S-61	12	13	13	25	27
S-64	—	3	—	—	—
S-65	—	17	—	—	—

Source: Aerospace Industries Association, company reports.

NOTE: All figures exclude the production by foreign licensees.

^a Includes 6-206B and 1-AH-1J exported in a military configuration.

^b Includes 17-205 (UH-1H) and 7-AH-1J exported in a military configuration.

^c Includes 27-UH-1H sold in a military configuration.

GENERAL AVIATION AIRCRAFT SHIPMENTS

By Selected Manufacturers
Calendar Years 1974 to Date

	1974	1975	1976	1977	1978
NUMBER OF AIRCRAFT SHIPPED . .	14,166	14,072	15,450	16,910	17,817
Single-Engine	10,227	10,220	11,803	13,167	13,651
Multi-Engine, Piston	2,135	2,116	2,120	2,195	2,630
Agricultural	1,335	1,235	980	890	748
Turboprop	250	305	359	428	548
Turbojet	219	196	188	230	240
VALUE OF SHIPMENTS^a (Millions of Dollars)	\$ 909	\$1,033	\$1,229	\$1,551	\$1,822
Single-Engine	209	257	364	435	486
Multi-Engine, Piston	257	286	343	389	492
Agricultural	42	41	37	39	33
Turboprop	130	174	223	295	393
Turbojet	271	275	262	393	418
Number of Aircraft By Selected Manufacturer					
Ayres	NA	NA	NA	NA	134
Beech	1,303	1,212	1,220	1,203	1,367
Bellanca	636	444	315	252	370
Cessna	7,187	7,564	7,888	8,839	8,770
Gates Learjet	66	79	84	105	102
Gulfstream American	628	758	762	866	933
Lake	71	81	88	99	98
Lockheed Jetstar	1	-0-	3	16	9
Maule	114	114	96	108	88
Mooney	130	210	227	362	379
Piper	3,415	3,069	4,042	4,499	5,272
Rockwell International	545	434	595	432	244
Swearingen	24	26	30	28	51
Ted Smith Aerostar	46	81	100	101	NA

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

^a Manufacturers' Net Billing Price.

NA Not Available.

**MILITARY AIRCRAFT ACCEPTED
BY U.S. MILITARY AGENCIES**
Number and Flyaway Value
Calendar Years 1966 to Date

Year	TOTAL	Bomber/ Patrol	Fighter/ Attack	Trans- port	Trainer	Heli- copter	Other
------	-------	-------------------	--------------------	----------------	---------	-----------------	-------

NUMBER

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 ^r	44	488 ^r	25 ^r	12	273	20
1978	720	22	475	36	—	166	21

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 ^a	3,247	129	2,068	536	100	396	18
1973 ^a	2,571	325	1,490	348	140	268	—
1974 ^a	2,224	584	1,222	101	111	206	—
1975 ^a	3,172	599	2,054	128	27	359	5
1976	4,729	547	3,421	340	27	384	10
1977	4,364 ^r	499	3,190 ^r	331 ^r	14	316	14
1978	4,806	329	3,598	637	—	225	17

Source: Department of Defense.

NOTE: Data excludes gliders and targets, and includes 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.

^a 1972-1975, Flyaway value does not include the value of planes produced for the security assistance programs and accepted by the USAF.

^r Revised.

MILITARY AIRCRAFT PRODUCTION
AIR FORCE ACCEPTANCES BY TYPE AND MODEL
 Calendar Years 1977 and 1978
 (Millions of Dollars)

Type and Model	Number		Flyaway Cost ^a		Weapon System Cost ^b	
	1977 ^r	1978	1977 ^r	1978	1977 ^r	1978
AIR FORCE—TOTAL	182	196	\$1,649	\$1,941	\$1,739	\$2,267
Fighter/Attack—TOTAL	<u>178</u>	<u>188</u>	<u>1,553</u>	<u>1,557</u>	<u>1,613</u>	<u>1,738</u>
A-10A	56	90	290	442	340	493
F-15A/B	122	93	1,263	1,062	1,273	1,177
F-16A/B	—	5	—	53	—	68
Transports/Tankers—TOTAL	—	—	-0-	-0-	-0-	-0-
Command/Control—TOTAL	<u>2</u>	<u>8</u>	<u>94</u>	<u>384</u>	<u>124</u>	<u>529</u>
E-3A	2	8	94	384	124	529
Other Aircraft—TOTAL	<u>2</u>	—	<u>2</u>	-0-	<u>2</u>	-0-
UV-18B	2	—	2	-0-	2	-0-

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. In the case of Security Assistance Programs, Aircraft Configuration and Equipage may vary greatly from country to country causing substantial differences in average unit costs.

- a* Flyaway Cost includes airframe, engines, electronics, communications, armament and other installed equipment.
- b* Weapon System Cost includes flyaway costs, peculiar ground equipment, training equipment and technical data.
- r* Revised.

**MILITARY AIRCRAFT PRODUCTION
REIMBURSABLE PROGRAMS^a BY TYPE AND MODEL
Calendar Years 1977 and 1978
(Millions of Dollars)**

Type and Model	Number of Aircraft Accepted		Flyaway Cost	Weapon System Cost
	1977	1978	1978	1978
Security Assistance—TOTAL	238	207	\$1,071	\$1,210
Fighter/Attack—TOTAL	<u>205</u>	<u>179</u>	<u>834</u>	<u>957</u>
A-37B	23	—	—	—
F-4E/F	58	35	169	174
F-5E	77	108	302	340
F-5F	39	15	54	61
F-15A/B	2	17	309	382
RF-4E	6	4	—	—
Transport/Tankers—TOTAL	<u>23</u>	<u>28</u>	<u>237</u>	<u>253</u>
C-130H	18	24	205	221
HC-130H	3	—	—	—
KC-130R	2	4	32	32
Trainers—TOTAL	<u>10</u>	<u>—</u>	<u>-0-</u>	<u>-0-</u>
T-37C	7	—	—	—
T-41D	3	—	—	—

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. In the case of Security Assistance Programs, Aircraft Configuration and Equipage may vary greatly from country to country causing substantial differences in average units costs.

^a Grant Aid, Foreign Military Sales, other Agencies accepted by the USAF for delivery to foreign governments.

MILITARY AIRCRAFT PRODUCTION
NAVY ACCEPTANCES BY TYPE AND MODEL
 Calendar Years 1977 and 1978
 (Millions of Dollars)

Type and Model	Number		Flyaway Cost ^a		Weapon System Cost ^b	
	1977	1978	1977	1978	1977	1978
NAVY—TOTAL	182	181	\$1,316	\$1,505	\$1,753	\$2,292
Patrol—TOTAL	44	22	499	329	585	783
P-3C	11	14	148	244	173	324
S-3A	33	8	351	85	412	459
Attack—TOTAL	69	64	258	392	312	528
A-4M	24	19	48	61	97	73
A-6E	6	12	37	116	16	144
EA-6B	6	6	65	79	62	121
A-7E	30	27	99	136	125	190
AV-8A	3	—	9	-0-	12	-0-
Fighters—TOTAL	36	44	545	692	839	867
F-14A	36	44	545	692	839	867
Trainers—TOTAL	2	—	10	-0-	12	-0-
TAV-8A	2	—	10	-0-	12	-0-
Helicopters—TOTAL	31	51	4	92	5	114
AH-1T	7	33	3	70	4	86
UH-1N	24	18	1	22	1	28

Source: Department of the Navy.

^a Flyaway Cost includes airframe, engines, electronics, communications, armament and other installed equipment.

^b Weapon System Cost includes flyaway items, initial spares, ground equipment, training equipment and other support items.

**MILITARY AIRCRAFT PRODUCTION
ARMY ACCEPTANCES BY TYPE AND MODEL**
Calendar Years 1977 and 1978
(Millions of Dollars)

Type and Model	Number		Flyaway Cost ^a	
	1977	1978	1977	1978
ARMY—TOTAL	260	136	\$ 324	\$ 150
Helicopters—TOTAL	<u>242</u>	<u>115</u>	<u>312</u>	<u>133</u>
AH-1G	—	2	—	2
AH-1J	35	—	34	—
AH-1S	39	65	43	91
AH-1T	—	32	—	29
UH-1H	3	—	2	—
UH-1N	20 ^a	14	18	7
CH-47C	10	1	33	3
214-A	110	—	150	—
214-C	25	—	32	—
TH-1L	—	1	—	1
Other—TOTAL	18	21	12	17
C-12A	18	21	12	17
Accepted for Shipment to a Foreign Government—TOTAL^b ...	170	47	\$ 215	\$ 39
Helicopters—TOTAL	<u>170</u>	<u>47</u>	<u>215</u>	<u>39</u>
AH-1T	—	32	—	29
AH-1J	35	—	33	—
UH-1H	—	14	—	7
TH-1L	—	1	—	3
214-A	110	—	150	—
214-C	25	—	32	—

Source: Department of the Army, Materiel Development and Readiness Command.

^a Accepted for other Department of Defense branch.

^b Included in ARMY, TOTAL.

**DEPARTMENT OF DEFENSE
OUTLAYS FOR AIRCRAFT PROCUREMENT**

**By Agency
Fiscal Years 1960 to Date
(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 ^E	7,969	4,587	2,965	417
1980 ^E	9,379	5,417	3,337	625

Source: Department of Defense, OASD (Comptroller), FAD 748/78, September 30, 1978 and National Defense Budget Estimates for FY 1980.

Tr. Qtr.: Transition Quarter. For an explanation of the Transition Quarter, and the change in the Federal Government's Fiscal Year, see the Glossary.

^E Estimate.

**MILITARY AIRCRAFT PROGRAM PROCUREMENT
INCLUDING INITIAL SPARES^a**

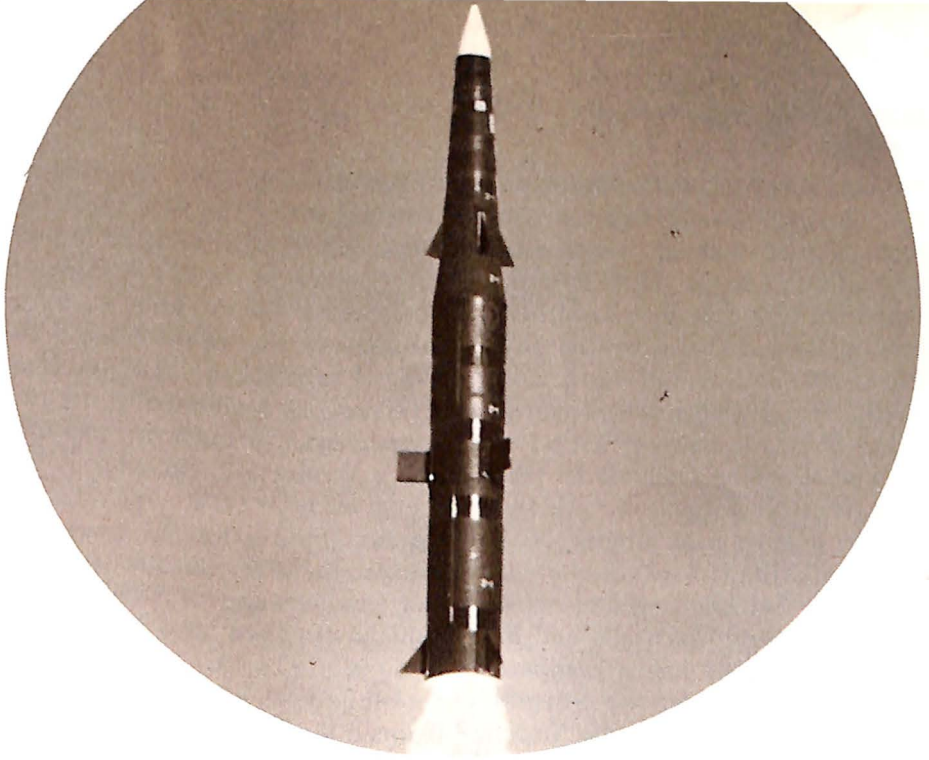
**By Agency, Type and Model
Fiscal Years 1978, 1979 and 1980
(Millions of Dollars)**

Agency, Type and Model	1978		1979 ^E		1980 ^E	
	No.	Cost	No.	Cost	No.	Cost
AIR FORCE						
A-7K	—	\$ —	12	\$ 128.5	—	\$ —
A-10	144	823.8	144	822.6	144	886.1
B-52G Cruise Missile Carrier Aircraft Modification	—	5.0	3	30.8	19	79.7
B-52G/H Avionics Modernization	—	—	5	59.3	29	342.2
C-5 (Wing Modification)	—	—	—	—	5	78.6
Civil Reserve Air Fleet (CRAF)	—	7.5	5	28.5	9	73.6
C-130 Hercules	8	66.5	8	72.3	—	—
C-141 Modification	27	89.5	85	64.0	124	76.0
E-3A (AWACS)	3	267.7	3	242.8	3	332.7
EF-111A (Modification)	1	24.1	5	151.3	1	55.0
F-15 Eagle	97	1,588.3	78	1,433.2	60	989.0
F-16 Multimission Fighter ...	105	1,486.6	145	1,471.0	175	1,671.8
KC-10A (ATCA)	—	—	2	159.5	4	190.1
TR-1	—	—	—	10.2	2	44.2
NATO AWACS Program	—	—	—	85.1	—	250.2
NAVY						
A-4M Skyhawk	—	\$ 12.1	—	\$ —	—	\$ 8
A-6E Intruder	12	181.8	12	172.8	—	69.1
A-6 (Modifications)	—	138.2	—	146.9	—	81.3
A-7E Corsair II	12	126.4	12	119.4	—	15.0
AH-11T Sea Cobra	8	31.4	—	—	—	—
C-9B Skytrain II	—	—	1	16.1	—	—
CH-53E Sea Stallion	—	—	14	183.2	15	190.0
E-2C Hawkeye	6	196.5	6	205.6	6	199.2
EA-6B Prowler	6	141.4	6	172.2	6	179.3
EC-130Q Hercules	—	—	1	32.5	3	99.0
F-4 (Modifications)	—	92.4	—	107.0	—	85.5
F-14A Tomcat	44	822.4	36	866.9	24	638.4
F/A-18 Hornet	—	34.2	9	498.6	15	726.8
H-46 (Modifications)	—	99.2	—	146.4	—	122.7
P-3C Orion	14	323.8	12	328.0	12	333.8
P-3 (Modifications)	—	53.7	—	92.1	—	65.9
S-3A Viking	—	59.6	—	—	—	—
T-34C Mentor	34	28.3	—	.3	—	2.4
T-44A Trainer	23	17.7	—	.8	—	.8
UC-12B	22	21.6	22	27.4	22	26.3
ARMY						
AH-1S Cobra/Tow (Modernization)	11	\$ 46.8	137	\$ 191.4	160	\$ 263.3
UH-60A Blackhawk	56	235.6	129	388.9	145	380.2
CH-47 (Modernization)	—	—	—	1.9	—	34.5

Source: "Program Acquisition Costs by Weapon System," Department of Defense Budget for Fiscal Year 1980.

^a Total Obligational Authority.

^E Estimate.



Missile Programs

Industry missile sales in 1978 amounted to approximately \$3.3 billion. The figure, which includes sales of missile systems and parts but excludes propulsion units, represents an increase of about 4.7 percent over the comparable figure for 1977. Sales backlog as of year-end 1978 was \$4.7 billion, up from \$4.5 billion at the end of the previous year.

Developments during 1978/79 indicated a substantial increase in industry missile activity in near-future years. The Administration announced a decision to proceed with full-scale development of the Air

Force MX mobile ICBM for deployment—in the latter 1980s—of 200 of the weapons. The successor to Minuteman, the MX will have greater survivability as well as improvements in throw-weight and accuracy. The schedule calls for production of 20 prototype missiles by 1983, at which time a final decision will be made as to operational deployment of the full 200 missiles. Target date for initial operational capability is 1986.

In another major missile decision, the Department of Defense ordered full-scale engineering development of the Rolling Airframe

Missile (RAM), formerly known as the Antiship Missile Defense system, a point defense weapon for protection of naval ships. A cooperative NATO program, RAM is intended for initial use by the U.S. Navy, West Germany and Denmark, with possible acquisition by other NATO countries. RAM will be operationally available in 1984.

In fiscal year 1979, the principal missile procurement program is the Navy's Trident 1 advanced sea-launched ballistic missile, which carries multiple warheads and has a range of 4,000 miles, compared with 2,500 miles for the currently operational Poseidon. The Trident 1 flight test program, initiated in 1977, continued in 1978/79 with a number of successful long-range flights. Initial operational status was targeted for late 1979.

Among other major missile systems in production during 1978/79 were the Sparrow and Sidewinder air-to-air missiles, being procured in large quantities for both Air Force and Navy use; the Navy's Harpoon air-to-surface weapon; the Army's Roland anti-aircraft missile; the Army's Stinger short range air defense weapon, also being procured for the Marine Corps; and the TOW antitank missile, in production for the Army, Navy and Air Force.

One of DoD's major development programs—along with MX, Trident and RAM—involves work on air-breathing cruise missiles, princi-

pally the Air Force's Air Launch Cruise Missile (ALCM). The latter program advanced in 1978/79 with further flight testing of two competing systems: the AGM-109, an air-launched version of the Navy's Tomahawk, and the AGM-86. A competitive flyoff evaluation of the two systems was to begin in mid-1979 and a production decision is expected early in 1980; availability of the first production weapons was planned for 1981. Ground-launched and sea-launched versions of the Tomahawk were also undergoing test in 1978/79. The Ground Launched Cruise Missile was planned for production, with initial operational availability in 1982; the Sea Launched Cruise Missile will continue in research and development status.

Other missiles in development during 1978/79 include advanced versions of the Sidewinder and Sparrow for USAF/Navy use; the Navy HARM (High Speed Anti-Radiation) air-to-surface missile; the Army Pershing II intermediate range ballistic missile; and the Army Patriot battlefield air defense system. Two projects aimed at improving the Army's anti-armor capability are the Hellfire helicopter-launched missile and the Viper antitank missile. In research status are the Air Force Bomber Defense Missile (BDM) and the Air Force Advanced Strategic Air-Launched Missile (ASALM).

**MISSILE PROGRAM PROCUREMENT
INCLUDING INITIAL SPARES^a**

By Agency, Type and Model
Fiscal Years 1978, 1979 and 1980
(Millions of Dollars)

Agency, Type and Model	1978		1979 ^E		1980 ^E	
	No.	Cost	No.	Cost	No.	Cost
AIR FORCE						
ALCM	24	\$ 104.6	24	\$ 94.2	225	\$371.2
GLCM	—	—	—	20.2	—	25.0
Maverick (E/O)	—	8.3	—	34.3	—	8.4
Minuteman II/III	—	267.0	—	68.7	—	105.1
Target Drones ^b	—	75.8	—	79.4	—	60.7
NAVY						
Harm	—	\$ —	—	\$ —	—	\$ 57.9
Harpoon	234	133.0	240	137.5	240	146.7
Phoenix	210	88.2	210	92.2	180	111.9
Poseidon	—	20.2	—	24.4	—	25.9
Shrike ^c	650	34.3	600	31.4	—	—
Sidewinder ^c	2900	144.4	3150	132.9	2370	110.4
Sparrow ^c	1725	178.4	1910	186.8	1560	210.7
Standard ER	40	50.7	40	53.7	55	50.7
Standard MR (SM-1)	480	98.5	480	95.4	480	106.9
Standard MR (SM-2)	—	—	—	—	30	20.2
Tomahawk	—	—	—	—	—	3.3
Trident I	96	1,135.1	86	890.2	82	764.3
ARMY						
Chaparral	870	\$ 33.3	850	\$ 34.7	—	\$ 3.2
Dragon ^d	20671	85.8	—	.2	—	—
GSRs	—	—	—	—	1764	61.9
Hawk ^d	559	96.9	608	72.3	197	36.5
Lance	360	73.0	^f	64.3	—	—
Patriot	—	—	—	67.3	155	440.7
Pershing	6	18.7	30	65.6	^f	70.6
Roland	—	55.7	75	167.6	410	296.9
Stringer ^d	258	38.2	2678	123.1	2654	91.1
TOW ^e	12261	75.9	10920	49.1	16805	77.0

Source: "Program Acquisition Costs by Weapon System," Department of Defense Budget for Fiscal Year 1980.

^E Estimate.

^a Total Obligational Authority.

^b Includes Army, Navy and Air Force procurement.

^c Includes Navy and Air Force procurement.

^d Includes Army and Marine Corps procurement.

^e Includes Army, Navy and Air Force procurement.

^f Quantity is classified.

**MAJOR MISSILES
DEVELOPMENT, PRODUCTION AND OPERATION**

Project	Agency	Status	Systems Contractor	Propulsion Manufacturer	Guidance Manufacturer
AIR-TO-AIR					
BDM	USAF	R	Raytheon	—	Raytheon
Falcon	USAF	O	Hughes	Thiokol	Hughes
Phoenix	USN	P,O	Hughes	RI/Rocket-dyne	Hughes
Sidewinder-9G	USN	O	NWC	Raytheon	Raytheon
Sidewinder-9H	USN	P,O	NWC/Raytheon/Ford	Bermite/Rocket-dyne	Raytheon/ Ford Aerospace
Sidewinder-9L	USAF/USN	P,O	NWC/Ford/Raytheon	Bermite/Rocket-dyne	Raytheon
Sidewinder-9M	USN/USAF	D	NWC/Raytheon	—	Raytheon
Sidewinder-9N	USAF	P,O	Ford Aerospace	—	Ford Aerospace
Sparrow-7E	USN	P,O	Raytheon	RI/Rocket-dyne	Raytheon
Sparrow-7F	USAF/USN	P,O	Raytheon/GD	Hercules	Raytheon/GD
Sparrow 3	USAF/USN	D	Raytheon	Hercules	Raytheon
AIR-TO-SURFACE					
ALCM	USAF	D	Boeing	Williams Research	McDonnell Douglas
ASALM	USAF	R	Martin Marietta	—	Raytheon
Bullpup A (12B)	USN	O	Numax	Thiokol	Numax
HARM	USN/USAF	D	NASC/TI	Thiokol	Texas Instruments/IBM
Harpoon	USN	P,O	McDonnell Douglas	Teledyne CAE	Texas Instruments/IBM
Hound Dog	USAF	O	Rockwell	P&W	RI/Autonetics
Maverick	USAF	P,O	Hughes	Thiokol	—
Quail	USAF	O	McDonnell Douglas	General Electric	McDonnell Douglas
Shrike	USAF/USN	P,O	NASC/NWC/PMTC	Aerojet/Hercules	Texas Instruments
SRAM	USAF	P,O	Boeing	Thiokol	Singer
Standard-ARM	USAF/USN	P,O	General Dynamics	NOSIH	General Dynamics
Tomahawk	USAF	D	General Dynamics	Williams Research	McDonnell Douglas
Walleye 1	USN	O	Martin Marietta/Hughes	—	Martin Marietta/Hughes
Walleye 2	USN	O	NAFI	—	NAFI
Walleye 2 (ER/DC)	USN	O	NAFI	—	NAFI

(Continued on next page)

**MAJOR MISSILES
DEVELOPMENT, PRODUCTION AND OPERATION (Continued)**

Project	Agency	Status	Systems Contractor	Propulsion Manufacturer	Guidance Manufacturer
ANTI-SUBMARINE					
Subroc	USN	O	Goodyear Aerospace	Thiokol	Singer
SURFACE-TO-AIR					
Antiship Missile Defense	USN	D	General Dynamics	Bermite/Rocketdyne	General Dynamics
Chaparral	Army	O	Ford Aerospace	RI/Rocketdyne	GE/Raytheon
Improved Chaparral	Army	P,O	Ford Aerospace	—	Ford Aerospace
Improved Hawk	Army	O	Raytheon	Aerojet	Raytheon
Redeye	Army	O	General Dynamics	Atlantic Research	General Dynamics
Patriot	Army	D	Raytheon	Thiokol	Raytheon
Roland	Army	D	Hughes/Boeing	Hercules	Hughes/Boeing
Sea Sparrow	USN	O	Raytheon	Aerojet	Raytheon
Safeguard/Spartan	Army	—	BTL/Western Electric	Thiokol	BTL/Western Electric
Standard (MR)	USN	P,O	General Dynamics	Aerojet/Hercules	General Dynamics
Standard (ER)	USN	P,O	General Dynamics	Atlantic Research	General Dynamics
Stinger	Army/USMC	D	General Dynamics	Atlantic Research	General Dynamics
Talos	USN	P,O	Bendix	Bendix	Bendix
Tartar	USN	O	General Dynamics	Aerojet	General Dynamics
Terrier	USN	O	General Dynamics	Atlantic Research	General Dynamics
SURFACE-TO-SURFACE					
Minuteman 2	USAF	O	AFLC Hill AFB	Thiokol/Aerojet/Hercules	RI/Autonetics
Minuteman 3	USAF	P,O	AFLC Hill AFB	Thiokol/Aerojet	RI/Autonetics

(Continued on next page)

MAJOR MISSILES
DEVELOPMENT, PRODUCTION AND OPERATION (Continued)

Project	Agency	Status	Systems Contractor	Propulsion Manufacturer	Guidance Manufacturer
SURFACE-TO-SURFACE (Cont'd.)					
Missile MX	USAF	R,D	Samsco/TRW	Thiokol/ Aerojet/ Hercules	Autonetics/ Northrop
Polaris A3	USN	O	Lockheed MSC	Aerojet/ Hercules	GE/MIT/ Raytheon
Poseidon	USN	O	Lockheed MSC	Thiokol/ Hercules	GE/MIT/ Hughes/ Raytheon
Tomahawk	USN	D	General Dynamics	Williams Research	McDonnell Douglas
Titan 2	USAF	O	AFLC Hill AFB	Aerojet	GM/Delco Electronics
Trident	USN	D	Lockheed MSC	Hercules/ Thiokol	C. S. Draper Lab
BATTLEFIELD SUPPORT AND ANTIARMOR					
Dragon	Army	P,O	Kollsman/ Raytheon	McDonnell Douglas/ Hercules	Raytheon
Lance	Army	P,O	Vought	RI/Rocket- dyne	Arma/ E-Systems
Pershing 1-A	Army	O	Martin Marietta	Thiokol	Bendix
Pershing 2	Army	D	Martin Marietta	Hercules	Goodyear Aerospace
Sergeant Shillelagh	Army Army	O O	SR/Univac Ford Aero- space	Thiokol Hercules	SR/Univac Ford Aero- space
TOW	Army	P,O	Hughes	Hercules	Emerson Electric
Viper	Army	D	General Dynamics	Atlantic Research	—
Hellfire	Army	D	Rockwell	Thiokol	Rockwell

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

Status: R—Research
D—Development
O—Operational
P—Production

**DEPARTMENT OF DEFENSE
OUTLAYS FOR MISSILES**
Fiscal Years 1960 to Date
(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 ^E	NA	1,825	NA
1980 ^E	NA	2,192	NA

Source: Department of Defense, OASD (Comptroller), Budget Press Briefing, January 22, 1979. Does not include Military Assistance.

Tr. Qtr.: Transition Quarter. For an explanation of the Transition Quarter, and the change in the Federal Government's Fiscal Year, see the Glossary.

^E Estimate.

NA Not Available

**DEPARTMENT OF DEFENSE
OUTLAYS FOR MISSILE PROCUREMENT**
By Agency
Fiscal Years 1960 to Date
(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 ^E	1,825	1,541	NA	284
1980 ^E	2,192	1,635	NA	557

Source: Department of Defense, OASD (Comptroller), FAD 748/78, September 30, 1978 and National Defense Budget Estimates for FY 1980.

NOTE: For data on research and development outlays for missiles, see page 106.

Tr. Qtr.: Transition Quarter. For an explanation of the Transition Quarter, and the change in the Federal Government's Fiscal Year, see the Glossary.

^E Estimate.

NA Not Available.

**SALES AND BACKLOG
MISSILE SYSTEMS AND PARTS**
Calendar Years 1961 to Date
(Millions of Dollars)

Year	Missile Systems and Parts	
	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 ^r	3,237	4,379
1977 ^r	3,118	4,541
1978	3,263	4,725

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

NOTE: Based on data from major companies engaged in the manufacture of aerospace products. Data exclude sales of military engines and propulsion units. See page 56.

^r Revised.

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

Year	Net Sales			Backlog, December 31		
	TOTAL	Military	Non-Military	TOTAL	Military	Non-Military
1961	\$ NA	\$ 784	\$ ^(a)	\$ NA	\$ 367	\$ ^(a)
1962	NA	1,060	^(a)	NA	498	^(a)
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 ^r	641	621	20	673	659	14
1977 ^r	787	757	30	613	595	18
1978	587	559	28 [*]	787	752	35

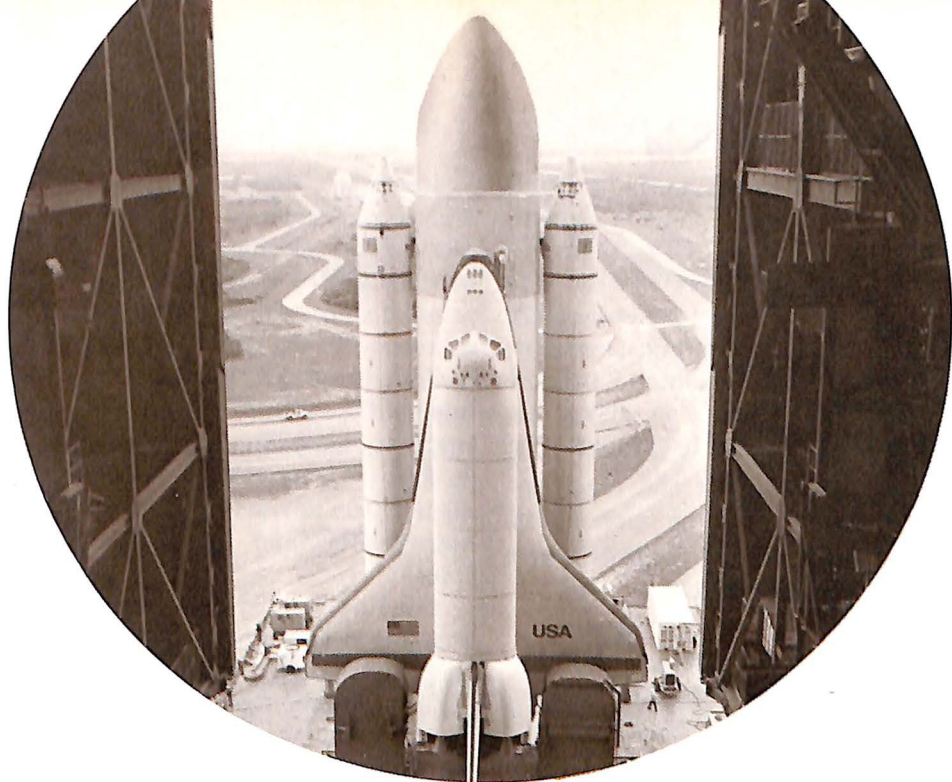
Source: Bureau of the Census, "Current Industrial Reports," Series MQ37D (Quarterly).

NOTE: Based on data from major companies engaged in the manufacture of aerospace products. The figures may be inflated by the inclusion of subcontracts.

^a Data included in totals for space vehicle systems. See page 72.

^r Revised.

NA Not Available.



Space Programs

U.S. space activity, as measured by the number of spacecraft launches, increased sharply in 1978. Including both NASA and military payloads, there were 35 launches during the year, 11 more than in 1977 and the highest number since 1969.

On a worldwide basis, however, space launch activity was well below that of recent years due to a marked decrease in Soviet space operations. In 1978, 95 spacecraft were sent into Earth orbit or interplanetary trajectories; this compares with 124 launches in the previous year. Of the 1978 total, 56

were launched by the Soviet Union (down from 98 in 1977) and four by France. Also represented were several other nations who sponsored or co-sponsored payloads launched by NASA and included in the U.S. total; among them were the multinational groups Intelsat, NATO and the European Space Agency, the United Kingdom, Japan and Canada.

Including two secondary or "piggyback" payloads, NASA launched 25 spacecraft during 1978, nine more than in the previous year. Among NASA's major launches were these:

Pioneer Venus 1 and 2, a spacecraft team consisting of one Venus-orbiting spacecraft (PV 1) and five instrumented probes (PV 2). The probes successfully penetrated the Venusian atmosphere in December 1978 and returned data to Earth; the orbiter will continue to relay scientific data about Venus through 1979.

Landsat 3, third and much improved member of the remote sensing satellite family designed to monitor Earth's resources.

Seasat 1, an ocean surveillance satellite which operated for only 99 days after launch but met some of the program objectives.

The International Ultraviolet Explorer (IUE), a multinational cooperative satellite for study of ultraviolet emissions from stars and other deep space sources.

ISEE-3, third of the International Sun-Earth Explorers which are investigating solar phenomena that influence Earth conditions.

Nimbus 7, a research satellite to test sensors for oceanographic and meteorological monitoring.

Tiros N, a polar-orbiting experimental weather satellite to be operated by the National Oceanic and Atmospheric Administration.

HEAO 2, second of the High Energy Astronomy Observatories which are mapping celestial x-ray sources.

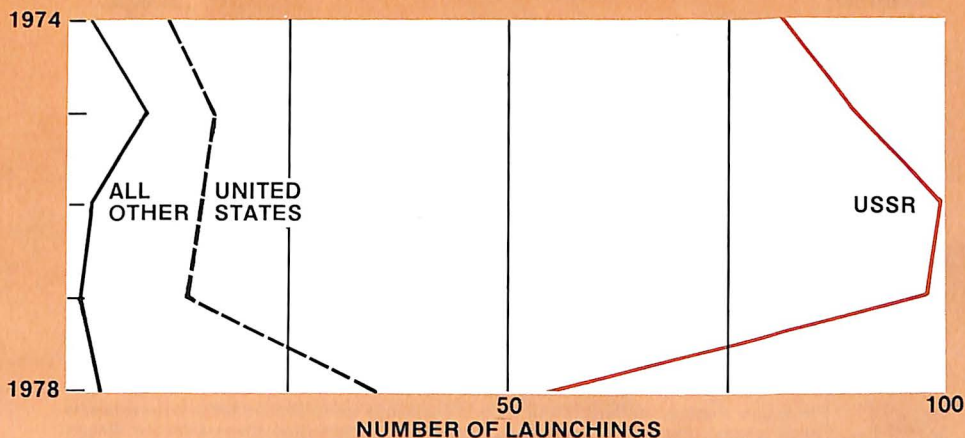
Among military spacecraft launched during the year were the first four NavStar satellites of the

Department of Defense Global Positioning System, designed to provide precise positioning and other information for more effective operation of ships, aircraft, artillery and armored forces. Other DoD spacecraft included the 11th and 12th satellites of the DSCS-II defense communications system, and Fltsatcom 1, first of a new Navy series designed to provide ship-to-shore, ship-to-ship and ship-to-aircraft links.

Heading the list of major space systems in development status during 1978 was the Space Shuttle. Major test programs conducted during the year included full-duration firings of the three-engine main Orbiter propulsion system, successful ground firings of the solid rocket boosters, and a lengthy series of structural vibration tests in which all elements of the Shuttle system were mated together for the first time. The first flight-type Orbiter, the *Columbia*, was essentially completed in 1978 and delivered to Kennedy Space Center, Florida, in March 1979.

Other major NASA development programs include Galileo, a dual-unit spacecraft consisting of an orbiter and a planetary probe, to be launched in 1982 for an extensive survey of Jupiter; Landsat D, the fourth and most advanced of the Landsat Earth resources monitoring satellites; and the Space Telescope, an advanced astronomical system which will permit observations far deeper into space than has ever before been possible.

SPACECRAFT LAUNCHINGS 1974-1978



Source: NASA

SPACECRAFT LAUNCHINGS WHICH ATTAINED EARTH ORBIT OR BEYOND 1957 to Date

Country	Total 1957 to 1978	1974	1975	1976	1977	1978
TOTAL	1,902	106	125	128	124	95
U.S.S.R.	1,131	81	89	99	98	56
United States	730	22	27	26	24	35
France	10	—	3	—	—	4
Japan	14	1	2	1	2	—
Italy	8	2	1	—	—	—
People's Republic of China	7	—	3	2	—	—
Australia	1	—	—	—	—	—
United Kingdom	1	—	—	—	—	—

Source: National Aeronautics and Space Administration, Satellite Situation Report.

NASA MAJOR LAUNCH RECORD, 1978

Date and Designation	Objectives
Jan. 7 Intelsat IV-A F-3	To launch satellite into transfer orbit. Satellite to provide 6250 two-way voice circuits plus two television channels simultaneously or a combination of telephone, TV, and other forms of communication traffic. Fifth in a series of improved Intelsat IV-A spacecraft with almost two-thirds greater communications capacity than Intelsat IV. Launched by NASA for ComSat Corp., manager of Intelsat.
Jan. 26 IUE	To launch spacecraft into elliptical geosynchronous orbit. Satellite to provide an orbital ultraviolet observatory for investigation of stellar atmospheres and interplanetary medium, and celestial objects of different galaxies and quasars. Launched into successful transfer orbit. Apogee boost motor fired Jan. 26 placing spacecraft above South America. Three-axis stabilization obtained Jan. 28. Scientific instrumentation functioning normally and returning data. Preliminary data received suggests possibility of massive black hole at the center of some groups of stars in our galaxy called globular clusters.
Feb. 9 Flitsatcom 1	First of four planned satellites, successfully launched by NASA for the Navy and the Dept. of Defense. Apogee kick motor fired Feb. 11, placing spacecraft in desired synchronous orbit. Still in orbit.
Feb. 22 Navstar 1	To support the Global Positioning System.
Mar. 5 Landsat 3	To acquire multispectral imagery over the U.S. and foreign countries sufficient to improve remote sensing interpretive techniques and to demonstrate the practical applications of Landsat imagery for crop inventory and other data uses for a period of at least one year. Successfully launched into circular, near-polar Sun-synchronous orbit, allowing spacecraft to photograph nearly entire globe during an 18-day period. Landsat 1 launched in 1972, and Landsat 2 placed in orbit in 1975.
Mar. 5 Oscar 8	To place satellite into a Sun-synchronous orbit. Spacecraft to provide continuous radio communications using small amateur ground terminals. Launched by NASA as secondary payload with Landsat 3, as replacement for Oscar 6. Product of cooperative effort by U.S., Canada, Japan, and West Germany.
Mar. 31 Intelsat IV-A F-6	To launch satellite into successful transfer orbit from which synchronous orbit can be achieved. Sixth and last in a series of improved satellites launched by NASA for ComSat Corp., manager of Intelsat. Began operations in Nov.
Apr. 7 BSE	To launch satellite into synchronous transfer orbit. Satellite designed to conduct experiments in direct broadcast television transmission and reception technology. Japanese Director Broadcast Satellite-Experimental (Japan/BSE) launched by NASA for the National Space Development Agency (NASDA). Satellite named Yuri.
Apr. 26 HCMM (AEM1)	To launch spacecraft into near-Earth, circular Sun-synchronous orbit of sufficient accuracy to enable instruments to conduct research into the feasibility of using day/night thermal imagery to generate apparent thermal inertial values and temperature cycle data. Heat Capacity Mapping Mission (HCMM), also known as Applications Explorer Mission A. Satellite is first in a series of low-cost modular spacecraft designed to operate in special orbits that satisfy mission-unique experimental data acquisition requirements.
May 11 OTS 2	To place satellite into synchronous transfer orbit of sufficient accuracy to allow spacecraft to achieve stationary synchronous orbit. To test concepts to be used in providing satellite links in the 1980s for routing of portions of the intra-European telephone, telegraph, and telex traffic as well as television relay for Western Europe. Launched by NASA for the European Space Agency (ESA) as a replacement for OTS A.
May 20 Pioneer Venus 1	To determine structure of upper atmosphere and ionosphere of Venus; to observe interaction of the solar wind with Venus ionosphere and with the small magnetic field; observe characteristics of atmosphere and surface of Venus on a planetary scale by use of remote sensing; to measure planet's gravitational field; and to detect gamma ray bursts. Launched successfully on trans-Venus trajectory, spacecraft taking pictures of Venus and conducting detailed scientific examination of the planet from orbit. Insertion into Venus orbit took place Dec. 4. First image received Dec. 5.
June 16 Goes 3	To launch spacecraft into synchronous orbit of sufficient accuracy to enable satellite to provide continuous observations of the Earth's atmosphere on an operational basis. Third operational spacecraft of a series of Geostationary Operational Environmental Satellites launched by NASA for NOAA. Spacecraft turned over to NOAA for operational use on July 5. Goes 3 to observe much of the Pacific Ocean and the western half of the United States.

(Continued on next page)

NASA MAJOR LAUNCH RECORD, 1978 (Continued)

Date and Designation	Objectives
<u>June 27</u> Seasat 1	To demonstrate techniques for global monitoring of oceanographic phenomena and features, provide data for both applications and scientific users, and determine key features of an operational ocean dynamics monitoring system. Proof-of-concept mission successfully launched. All sensors turned on simultaneously July 7. Spacecraft ceased transmitting data Oct. 9.
<u>June 29</u> Comstar 3	To launch satellite into a transfer orbit of sufficient accuracy for the spacecraft to achieve synchronous orbit. Satellite to provide 14,000 two-way high-quality voice circuits. Launched by NASA for ComSat General Corp. Spacecraft became operational Sept. 7 when American Telephone and Telegraph Company began commercial operations.
<u>July 14</u> Geos 2	To place satellite into synchronous transfer orbit that will allow the satellite to achieve stationary synchronous orbit. Spacecraft to make scientific studies of the magnetosphere. Successfully launched by NASA for the European Space Agency (ESA). Spacecraft to perform same experiments as Geos 1, which failed to achieve satisfactory orbit. Geos 2 to serve as reference spacecraft for the International Magnetospheric Study (IMS).
<u>Aug. 8</u> Pioneer Venus 2	To determine the nature and composition of the clouds of Venus; the composition and structure of the atmosphere; and the general circulation pattern of the atmosphere by means of multiple entry probes and an instrumented bus. Successfully launched toward the cloud-shrouded planet. Large probe separated from bus Nov. 15, three smaller probes separated Nov. 20. Four probes reached Venus' surface, bus burned up in the atmosphere.
<u>Aug. 12</u> ISEE 3	To obtain detailed measurements of the solar wind and its fluctuations. To launch spacecraft into transfer trajectory similar to an interplanetary mission, and insert satellite into halo orbit near the Sun-Earth libration point. Third spacecraft in a series of three International Sun-Earth Explorers. Successfully inserted into halo orbit Nov. 20. All 12 experiments are operational. Unusual orbit of ISEE 3 will enable it to detect solar wind or particles speeding away from the Sun a full hour before the two other spacecraft do so.
<u>Oct. 7</u> Navstar 3	To support the Global Positioning System.
<u>Oct. 13</u> Tiros N	To launch spacecraft into a Sun-synchronous orbit of sufficient accuracy to enable satellite to accomplish its operational mission requirements. Successfully launched by NASA. Spacecraft turned over to NOAA for operation Nov. 6. First of a series of eight third-generation operational meteorological polar orbiting spacecraft. Tiros N, as series prototype, will provide operating experience for subsequent NOAA satellites in this series. Satellite is a primary source of data for the Global Atmospheric Research Program's Global Weather Experiment, an international cooperative program involving some 140 countries, which began Dec. 1, 1978.
<u>Oct. 24</u> Nimbus 7	To provide continuous environmental data to help scientists throughout the world determine the physical characterization of the global atmosphere, the oceans, the dynamic atmosphere-ocean interface, and the Earth's heat balance. Last in a series of Nimbus meteorological satellites first launched in Aug. 1964 achieved satisfactory orbit.
<u>Oct. 24</u> Cameo	To study solar energy and plasma flows and electric fields in Arctic regions through release of barium and lithium in and above the Earth's ionosphere. Project Cameo (Chemically Active Materials Ejected in Orbit) successfully launched as piggy back payload with Nimbus 7.
<u>Nov. 13</u> HEAO 2	To obtain high resolution data on x-ray sources in the range from 0.2 to 4 thousand electron volts, to perform high spectral sensitivity measurements with both high and low dispersion spectrographs, and to perform high sensitivity measurements of transient x-ray behavior; to operate spacecraft and acquire scientific data for at least 1 year. Second in a series of three NASA High Energy Astronomical Observatories.
<u>Nov. 19</u> NATO III C	To place satellite into transfer orbit with sufficient accuracy to allow spacecraft to be placed into a stationary synchronous orbit. Successfully launched by NASA. Third in a series of advanced NATO communications satellites.
<u>Dec. 11</u> Navstar 4	To support the Global Positioning System.
<u>Dec. 16</u> Anik 4 (Telesat D)	To launch spacecraft into a highly elliptical orbit of sufficient accuracy to enable satellite to achieve geosynchronous orbit. Satellite to provide transmission of television, voice, and other data throughout Canada. Launched successfully by NASA. Second generation satellite, fourth in a series orbited for Canada's Domestic Communications Satellite System.

Source: Aeronautics and Space Report of the President.

**U.S. APPLICATIONS SATELLITES
1978**

Launch Date	Name and Launch Vehicle	Remarks
COMMUNICATIONS SATELLITES		
Jan. 7	Intelsat IV-A (F-3) Atlas-Centaur	Positioned over Indian Ocean.
Feb. 9	Fitsatcom 1 Atlas-Centaur	First of a new Defense series.
Mar. 5	Oscar 8 Thor-Delta	Secondary payload with Landsat 3, replacement for Oscar 6 for amateur radio communications.
Mar. 31	Intelsat IV-A (F-6) Atlas-Centaur	Positioned over Indian Ocean.
Apr. 7	BSE Thor-Delta	Japanese experimental direct-broadcast satellite for television; named Yuri; domestic satellite.
May 11	OTS 2 Thor-Delta	European Space Agency experimental relay satellite; domestic satellite.
June 29	Comstar 3 Atlas-Centaur	Positioned south of U.S. over the equator by Comsat; domestic satellite.
Nov. 19	NATO IIIC Thor-Delta	Final one of this military series.
Dec. 14	DSCS II-11, 12 Titan IIIC	Defense communications (dual launch).
Dec. 16	Anik 4 (Telesat D) Thor-Delta	Launched for Canada; domestic satellite.
WEATHER OBSERVATION		
May 1	AMS 3 Thor-Burner 2	A Defense meteorological satellite.
June 16	Goes 3 Thor-Delta	Third of this series for NOAA.
Oct. 13	Tiros-N Atlas F	First of a third generation for NOAA, also experimental satellite for NASA.
Oct. 24	Nimbus 7 Thor-Delta	Last of this experimental series for NASA.
EARTH OBSERVATION		
Apr. 26	HCMM (AEM-1) Scout	Experimental, low-cost, limited-function heat-capacity mapping mission for Earth resources.
June 27	Seasat 1 Atlas F	Proof-of-concept oceanographic-phenomena data-collection satellite.
NAVIGATION		
Feb. 22	Navstar 1 Atlas F	Global Positioning System satellite.
May 13	Navstar 2 Atlas F	Global Positioning System satellite.
Oct. 7	Navstar 3 Atlas F	Global Positioning System satellite.
Dec. 11	Navstar 4 Atlas F	Global Positioning System satellite.

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

**U.S.—LAUNCHED SCIENTIFIC PAYLOADS
1976-1978**

Launch Date	Name and Launch Vehicle	Remarks
<u>1976</u>		
Mar. 15	<u>Solrad HiA-HiB</u> Titan IIIC	Measure radiation and particles at close to 120,000 km circular.
May 22	<u>P-76-5</u> Scout	Plasma effects on radar and communications.
July 8	<u>SESP 74-2</u> Titan IIID	Particle measurements up to 8000 km.
<u>1977</u>		
Apr. 20	<u>Geos</u> Thor-Delta	European Space Agency, study of magnetic and electric fields from geosynchronous orbit (not attained).
Aug. 12	<u>HEAO 1</u> Atlas-Centaur	X-ray and gamma ray astronomy.
Oct. 22	<u>ISEE 1, 2</u> Thor-Delta	Magnetosphere and solar wind measurements (for NASA and European Space Agency respectively).
<u>1978</u>		
Jan. 26	<u>IUE</u> Thor-Delta	Ultraviolet observation of astronomical phenomena, in elliptical geosynchronous orbit.
July 14	<u>Geos 2</u> Thor-Delta	European studies of magnetosphere, in geosynchronous orbit.
Aug. 12	<u>ISEE 3</u> Thor-Delta	International Sun-Earth Explorer, in halo orbit near Earth-Sun liberation point.
Oct. 24	<u>Cameo</u> Thor-Delta	Barium and lithium cloud experiments, carried in rocket body of Nimbus 7 launcher.
Nov. 13	<u>HEAO 2</u> Atlas-Centaur	High-resolution observations of astronomical x-ray sources.

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

**UNITED STATES SPACE LAUNCH VEHICLES
1978**

Vehicle	Stages	Thrust (in Kilo- newtons)	Payload (kg)	
			555 km Miles Orbit	Escape
Scout	1. Algol IIIA* 2. Castor IIA* 3. Antares IIB* 4. Altair III*	481.7 281.1 126.8 26.9	486	38.6
Thor-Delta 2900 Series	1. Thor plus 9 TMX 354-5* 2. Delta (DSV-3) 3. TE 364-4*	911.9 694.2 46.8 61.9	1,769	476
Atlas F/TE 364-4	1. Atlas Booster and Sustainer 2. TE 364-4*	1,970.6 61.9	1,497	—
Atlas-Agena	1. Atlas Booster and Sustainer (SLV-3A) 2. Agena	2,237.5 71.2	2,720	454
Titan IIIB-Agena	1. LR-87 2. LR-91 3. Agena	2,353.1 444.8 71.2	3,629	—
Titan IIIC	1. Two 5-segment* 2. LR-87* 3. LR-91 4. Transtage	11,565.4 2,353.1 444.8 71.2	—	1,461
Titan III (23)D	1. Two 5-segment* 2. LR-87 3. LR-91	11,565.4 2,353.1 444.8	11,113	—
Titan III (34)D	1. Two 5½-segment* 2. LR-87 3. LR-91	13,540.4 2,353.1 444.8	12,564	—
Titan III (34)D/IUS	1. Two 5½-segment* 2. LR-87 3. LR-91 4. IUS 1st Stage* 5. IUS 2nd Stage*	13,540.4 2,353.1 444.8 191.3 71.2	1,909	1,909
Thor LV-2F	1. Thor 2. TE 364-4* 3. TE 364-15*	756.2 61.9 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 61.9 44.5	653	—

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

CHRONOLOGY OF MANNED SPACE FLIGHTS

Calendar Years 1975-1978

Launch Date	Project	Pilots	Nation	Duration
<u>1975</u>				
Jan. 10	Soyuz 17	Aleksey Gubarev Georgiy Grechko	USSR	709 hr. 20 min.
Apr. 5	Anomaly	Vasiley Lazarev Oleg Makarov	USSR	20 min.
May 24	Soyuz 18	Petr Klimak Viraliy Sevastyanov	USSR	1,511 hr. 20 min.
July 15	Soyuz 19	Aleksey Leonov Valeriy Rubasov	USSR	142 hr. 31 min.
July 15	Apollo	Thomas P. Stafford Donald K. Slayton Vance D. Brand	USA	217 hr. 28 min.
<u>1976</u>				
July 6	Soyuz 21	Boris Volynov Vitaliv Zholobov	USSR	1,182 hr. 24 min.
Sept. 15	Soyuz 22	Valeriv 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 Gorbato	USSR	425 hr. 23 min.
Oct. 9	Soyuz 25	Yuriy Glazkov 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	Aleksev Gubarov 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 Klimak Miroslaw Heraszewski ^a	USSR	190 hr. 04 min.
Aug. 26	Soyuz 31	Valeriy Bykovskiy Sigmund Jähn ^b	USSR	1,128 hr. 14 min.

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

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

^a First Polish Cosmonaut.

^b First German Democratic Republic Cosmonaut.

U.S. 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
Dec. 21	Apollo 8 (Borman, Lovell, Anders)	441	03	3,215	20

U.S. SPACE FLIGHT TIME LOG (Continued)
Calendar Years 1961 to Date

Launch Date	Mission	Man-Hours in Mission		Total Cumulative Time	
		Hrs.	Min.	Hrs.	Min.
<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: "Aeronautics and Space Report of the President" (Annually).

**NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
OUTLAYS**

**Fiscal Years 1960 to Date
(Millions of Dollars)**

Year	TOTAL	Research and Development	Construction of Facilities	Research & Program Management
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 ^E	4,402	3,312	154	936
1980 ^E	4,595	3,476	155	964

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

NOTE: For an explanation of the Transition Quarter (Tr. Qtr.) and the change in the Federal Government's Fiscal Year, see the Glossary.

^E Estimate.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
BUDGET AUTHORITY
Fiscal Years 1960 to Date
(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	(a)
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 ^E	4,564	3,477	148	939
1980 ^E	4,725	3,602	158	965

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

NOTE: For an explanation of the Transition Quarter (Tr. Qtr.) and the change in the Federal Government's Fiscal Year, see the Glossary.

^a Included in Research & Development for one year.

^E Estimate.

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

Fiscal Year 1976 to Date
(Millions of Dollars)

	1976	1977	1978	1979 ^E	1980 ^E
TOTAL	\$2,677	\$2,883	\$3,012	\$3,477	\$3,603
Space Transportation Systems—					
TOTAL	<u>1,561</u>	<u>1,764</u>	<u>1,752</u>	<u>2,010</u>	<u>1,904</u>
Space Shuttle	1,206	1,413	1,349	1,628	1,366
Space Flight Operations	189	199	268	310	467
Expendable Launch Vehicles ...	166	152	135	72	71
Space Science—TOTAL	<u>434</u>	<u>380</u>	<u>405</u>	<u>505</u>	<u>602</u>
Physics and Astronomy	159	166	224	283	338
Lunar and Planetary Explorations	254	192	147	182	220
Life Sciences	21	22	34	40	44
Space and Terrestrial Applications—TOTAL	<u>185</u>	<u>206</u>	<u>224</u>	<u>284</u>	<u>344</u>
Space Applications	178	198	235	275	332
Technology Utilization	7	8	9	9	12
Aeronautics and Space Technology—TOTAL	<u>256</u>	<u>278</u>	<u>333</u>	<u>376</u>	<u>420</u>
Aeronautical Research and Technology	175	190	228	264	300
Space Research and Technology	75	82	98	107	117
Energy Technology Applications	6	6	7	5	3
Space Tracking and Data Systems—TOTAL	<u>241</u>	<u>255</u>	<u>278</u>	<u>302</u>	<u>333</u>

Source: NASA, Briefing on the Budget of the United States, January 22, 1979.

^E Estimate.

SPACE ACTIVITIES BUDGET AUTHORITY

Fiscal Years 1959 to Date
(Millions of Dollars)

Year	TOTAL	NASA ^a	DOD	Energy	Other ^b
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. ^c	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 ^E	7,432	4,033	3,237	38	124
1980 ^E	8,628	4,166	4,301	34	127

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

^a Excludes amounts for air transportation.^b Departments of Commerce, Interior and Agriculture, and the National Science Foundation.^c For an explanation of the Transition Quarter (Tr. Qtr.), see the Glossary.

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

Year	Net Sales			Backlog, December 31		
	TOTAL	Military	Non-Military	TOTAL	Military	Non-Military
1961	\$ 775	\$ 551	\$ 224 ^a	\$ 586	\$ 350	\$ 236 ^a
1962	1,319	712	607 ^a	1,435	852	583 ^a
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 ^r	2,002	904	1,098	1,234	902	332
1977 ^r	1,870	814	1,056	1,589	1,263	326
1978	2,315	994	1,321	2,092	1,604	488

Source: Bureau of the Census, "Current Industrial Reports." Series MQ37D (Quarterly).
 NOTE: Based on data from major companies engaged in the manufacturer of aerospace products.
^a Includes engines and propulsion units.
^r Revised.



Air Transportation

The U.S. scheduled airline industry experienced a banner year in 1978, establishing new records for passengers carried, revenues and earnings. A variety of new promotional or discount fares, coupled with a relatively good U.S. economy, brought a rise in the industry's overall load factor, from 56 percent in 1977 to 62 percent in 1978.

The traffic surge continued in the early months of 1979, prompting an Air Transport Association prediction that the airlines will again set traffic records in 1979. However, in the latter part of 1978 and early 1979, adverse financial trends began

to develop as a result of soaring fuel prices and other operating costs. ATA forecast a 1979 drop in airline earnings "significantly below the \$1.2 billion level achieved in 1978," a matter of concern in view of planned expenditures for aircraft procurement estimated at \$6 to \$8 billion annually over the next decade.

U.S. carriers boarded 275 million passengers in 1978, an increase of more than 14 percent over 1977's 240 million. Passenger miles totaled 227 billion, up from 193 billion in 1977, a gain of more than 17 percent.

Among other statistical highlights of the U.S. scheduled airlines' 1978 performance were these:

- Cargo ton-mile increased by about six percent, from 7 billion in 1977 to 7.4 billion in 1978.

- Domestic flights accounted for more than 92 percent of all passengers boarded. The airlines carried 254 million passengers on domestic routes, an all-time high and an increase of more than 14 percent over the previous record set in 1977.

- The number of passengers carried on international flights increased by more than 15 percent to a new record of 20.8 million. This marked the third consecutive annual increase in international traffic following the sharp drops of 1974-75 occasioned by world recession.

- The U.S. air carrier fleet numbered 2,991 aircraft at year-end 1978. Of the total, 2,375, or almost 80 percent, were jet-powered airliners; the breakdown included 336 turboprop aircraft, 277 piston-engine airplanes and three turbine-powered helicopters.

The International Civil Aviation Organization reported substantial gains in 1978 worldwide airline traffic. ICAO estimated the number

of passengers carried by world scheduled services, including those of the Soviet Union, at 678 million; this represents an increase of 11 percent over the 1977 level of 610 million. Passenger miles totaled 575 billion, up from 508 billion in the previous year. Cargo ton-miles topped 18.1 billion, up from 16.2 billion in 1977.

The world fleet of turbine-engine aircraft in commercial service increased to 7,550 in 1978, a gain of 252 airplanes. The number of U.S.-built aircraft in world airline operation was 5,159, or 68.3 percent; the figures compare with 5,027 planes constituting 68.9 percent of the total in 1977. The world breakdown included 5,288 jet-powered airplanes, 1,931 turboprops and 331 turbine-powered helicopters.

As of year-end 1978, there were 14,574 civil airports in the United States, including seaplane bases, heliports, STOLports and military fields with joint civil use. The great majority—12,878 or 88 percent—have runways of less than 5,000 feet; those with runways or more than 5,000 but less than 10,000 feet number 1,428; 268 airports have runways measuring 10,000 feet or more.

**WORLD AIRLINE TRAFFIC
SCHEDULED SERVICES
Calendar Years 1960 to Date
(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 ^r	5,030	517	429,000	14,620	1,830
1978 ^E	5,200	580	492,000	16,440	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 ^r	NA	610	508,000	16,180	2,180
1978 ^E	NA	678	575,000	18,080	2,270

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

NOTE: Excludes states which were not members of ICAO on December 31, 1978. Figures represent revenue traffic on international and domestic scheduled services.

^r Revised.

^E Estimate.

NA Not Available.

**WORLD AIRLINE FLEET
TURBINE-ENGINED AIRCRAFT**

**By Model
1974 to Date**

	1974	1975	1976 ^a	1977	1978
TOTAL AIRCRAFT IN SERVICE . . .	6,870	7,153	7,195	7,298	7,550
Number Manufactured in U.S.	4,561	4,866	4,891	5,027	5,159
Percent Manufactured in U.S.	66.4%	68.0%	68.0%	68.9%	68.3%
Turbojets—TOTAL	<u>4,628</u>	<u>4,919</u>	<u>5,012</u>	<u>5,137</u>	<u>5,288</u>
Aerospatiale Caravelle	232	215	187	141	131
Aerospatiale Corvette	—	8	15	25	22
Airbus A300B	3	8	24	35	53
B.Ae. 111	168	163	163	164	164
B.Ae. 125	31	35	7	6	5
B.Ae. VC-10	33	25	26	22	17
B.Ae./Aerospatiale Concorde . . .	—	—	6	8	9
B.Ae. Comet	19	15	17	16	10
B.Ae. Trident	81	71	86	93	99
Boeing 707/720	741	733	719	702	673
Boeing 727	1,032	1,140	1,185	1,228	1,315
Boeing 737	333	399	436	464	498
Boeing 747	232	253	268	291	308
Cessna Citation	6	15	5	5	4
Convair CV 990	27	26	18	15	13
Dassault-Breguet Falcon	—	—	—	45	47
Dassault-Breguet Mercure	—	9	10	10	10
Dassault-Breguet Mystere	59	57	35	—	—
Douglas DC-8	514	494	482	468	450
Douglas DC-9	678	706	758	774	794
Fokker-VFW F.28	52	73	81	94	103
Gates Learjet	43	60	17	18	11
Grumman Gulfstream II	3	7	4	5	5
Ilyushin IL-62	24	25	26	26	32
Lockheed JetStar	1	1	1	1	1
Lockheed L-1011 TriStar	75	109	126	138	145
McDonnell Douglas DC-10	157	186	218	234	248
Rockwell Sabreliner	—	—	—	2	2
Tupolev Tu.134	38	51	59	60	66
Tupolev Tu.154	16	9	13	15	17
VFW-Fokker 614	1	2	6	5	11
Yakovlev YAK-40	16	15	14	27	25
Other	13	9	—	—	—
Turboprops—TOTAL	<u>1,972</u>	<u>1,916</u>	<u>1,914</u>	<u>1,856</u>	<u>1,931</u>
Aero Spacelines Guppy	—	2	2	2	2
Aerospatiale N.262	25	28	28	34	40
AJ1 Turbo Star (Cessna 400)	—	—	—	4	4
Antonov An.12	—	1	2	2	2

(Continued on next page)

WORLD AIRLINE FLEET
TURBINE-ENGINED AIRCRAFT (Continued)

By Model
1974 to Date

	1974	1975	1976 ^a	1977	1978
Turboprops (continued)					
Antonov An.24	55	45	54	54	65
B.Ae. Britannia	10	10	23	26	14
B.Ae. Vanguard	28	23	25	22	24
B.Ae. Viscount	138	115	104	90	86
B.Ae. Argosy	9	9	8	7	8
B.Ae. 748	136	126	128	122	138
Beechcraft 99	113	129	136	111	110
Beechcraft BS.60	—	—	—	—	1
Beechcraft King Air	19	22	12	14	19
Beechcraft Westwind	9	7	8	6	6
Canadair CL-44	30	26	27	24	24
Casa C.212	—	—	—	2	6
Cessna Conquest	—	—	—	—	1
Convair CV 580	116	81	81	79	79
Convair CV 600/640	57	48	48	24	25
DHC-2 Turbo Beaver	4	8	6	11	7
DHC-6 Twin Otter	282	297	307	308	335
DHC Dash 7	—	—	—	—	4
Embraer EMB-110	14	10	14	43	49
Fairchild Hiller Helicopter	—	—	—	2	—
Fairchild Swearingen Merlin	—	2	1	1	—
Fairchild Swearingen Metro	10	16	14	31	47
Fokker-VFW F.27	379	376	394	354	370
GAF Nomad	—	—	—	3	6
Grumman Gulfstream I	1	2	2	3	—
Grumman Mallard	1	2	1	1	—
Grumman Turbo Goose	2	—	2	2	2
Handley Page Herald	31	26	29	29	32
Handley Page Jetstream	3	5	6	—	8
Ilyushin IL-18	74	80	88	84	72
J. A. Jetstream	—	—	—	7	—
LET L-410	12	12	12	12	12
Lockheed L-188 Electra	112	102	102	96	87
Lockheed L-110 Hercules	30	29	32	40	36
Mitsubishi MU-2	4	6	15	17	15
NAMC YS-11	133	136	123	125	126
NA Turbo Commander	8	8	3	2	1
Pilatus Turbo Porter	47	48	11	10	12
Piper PA-31T	—	1	2	1	2
Potex 840	—	—	—	1	1
Saunders ST-27	4	5	7	4	2
Shorts Skyliner/Skyvan	41	39	35	32	29
Other	35	34	22	14	22

(Continued on next page)

WORLD AIRLINE FLEET
TURBINE-ENGINED AIRCRAFT (Continued)
By Model
1974 to Date

	1974	1975	1976 ^a	1977	1978
Turbine-Powered					
Helicopters—TOTAL	<u>270</u>	<u>318</u>	<u>269</u>	<u>305</u>	<u>331</u>
Aerospatiale Alouette	56	37	27	25	26
Aerospatiale Lama	8	2	10	—	8
Aerospatiale Puma	—	—	—	20	20
Aerospatiale Super Frelon	—	—	1	1	—
Aerospatiale/Westland SA 330 ...	9	26	17	—	—
Aerospatiale/Westland SA 341 ...	1	1	1	—	—
Bell 204	6	16	5	8	9
Bell 205	19	37	26	31	27
Bell 206	65	58	53	71	79
Bell 212	11	13	8	10	15
Fairchild Hiller F-1100	1	4	1	—	—
Fuji Bell 214	—	—	—	—	1
Hughes 500	43	55	50	74	76
M.B.B. Bo.105	1	4	6	6	6
Sikorsky S-55T	2	1	—	1	2
Sikorsky S-58T	13	14	17	14	12
Sikorsky S-61	31	37	34	39	45
Sikorsky S-62	2	2	2	2	2
Sikorsky S-64	1	3	3	3	3
Westland WS-55/Wesser	—	4	—	—	—
Other	1	4	8	—	—

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

^a Air taxi operators no longer included.

AIRLINE TRAFFIC
UNITED STATES SCHEDULED AIRLINES
Calendar Years 1960 to Date
(Millions)

Year	Miles Flown	Passengers Carried	Passenger-Miles	Cargo Ton-Miles ^a
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	2,520	275	226,781	7,395

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.

^a 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.

**PASSENGER SERVICE
U.S. SCHEDULED AIRLINES
Calendar Years 1960 to Date**

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

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^a 1960 to Date
 (Millions of Dollars)

Year	TOTAL NET ASSETS ^b	Value of Flight Equipment				Investment in Flight Equipment as a Percent of Total Assets
		TOTAL Gross Value	Less: Depreciation	Plus: Construction Work in Process	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 ^r	15,452	14,398	6,376	189	8,211	53.1
1977 ^r	16,868	14,822	8,140	187 ^E	6,869	40.7
1978 ^E	17,003	14,849	8,247	188	6,790	40.0

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.

^a Fiscal years ending June 30; effective 1977, fiscal years ending September 30.

^b Comprises net investment in buildings and ground equipment, flight equipment, working capital, etc.

^r Revised.

^E Estimate.

**U.S. AIR CARRIER AIRCRAFT
TYPE OF AIRCRAFT, NUMBER OF ENGINES AND MODEL
As of December 31, 1974 to Date**

	1974	1975	1976	1977	1978
TOTAL	2,472	2,672	2,707	2,747	2,991
Turbojets—TOTAL	2,078	2,171	2,205	2,254	2,375
Four-Engine—TOTAL	<u>632</u>	<u>602</u>	<u>583</u>	<u>543</u>	<u>533</u>
Boeing 707/720	316	293	265	242	228
Boeing 747	104	98	105	107	116
Convair 880/990	5	—	—	—	6
Lockheed L-1329	1	1	2	—	1
McDonnell Douglas DC-8	206	210	211	194	182
Three-Engine—TOTAL	<u>923</u>	<u>994</u>	<u>1,022</u>	<u>1,074</u>	<u>1,166</u>
Boeing 727	747	792	820	869	950
Lockheed L-1011	68	77	77	78	84
McDonnell Douglas DC-10	108	125	125	127	132
Twin-Engine—TOTAL	<u>523</u>	<u>575</u>	<u>600</u>	<u>637</u>	<u>676</u>
Airbus A-300B	—	—	—	4	6
Boeing 737	150	147	152	161	174
BAC-111	36	30	31	31	30
Dassault MD-20, Falcon	—	44	43	45	46
DeHavilland DH-125	—	1	3	2	2
Grumman G-1159	—	2	4	5	6
Learjet LR-23, LR-24	3	—	1	2	—
Learjet LR-25	—	7	8	9	17
Learjet LR-35	—	1	4	6	6
McDonnell Douglas DC-9	334	341	352	366	375
Hamburger Flugzeugbau HF-320	—	1	1	3	4
Rockweel NA-265	—	1	1	2	4
Sud Aviation SE210 Caravelle	—	—	—	1	4
Israel Westwind CJ 1123, 1124	—	—	—	—	2
Turboprops—TOTAL	266	273	260	269	336
Four-Engine—TOTAL	<u>67</u>	<u>68</u>	<u>69</u>	<u>63</u>	<u>81</u>
Lockheed 188, Electra	48	48	49	43	59
Lockheed 382, Hercules	19	20	20	20	20
DHC-7	—	—	—	—	2
Twin-Engine—TOTAL	<u>199</u>	<u>205</u>	<u>191</u>	<u>206</u>	<u>255</u>
Beech 99	—	4	3	—	1
Convair 580	89	71	73	77	81
Convair 600/640	29	32	25	22	28
DeHavilland DHC-6	8	21	18	14	27
Fairchild F-27	15	10	7	4	7
Fairchild FH-227	33	29	27	27	23

(Continued on next page)

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

	1974	1975	1976	1977	1978
Twin-Engine—Cont'd.					
Fairchild Swearingen SA-226	—	—	—	7	13
Grumman G-159	1	2	1	7	8
Hawker-Siddeley HS748	1	1	1	1	1
Nihon YS-11	21	23	23	22	20
Nord ND-262	—	10	12	24	30
Short SD-3	—	—	—	3	9
Short SC-7	2	2	—	—	7
Short SD-330	—	—	1	2	—
Piston-Engine—TOTAL	118	221	235	218	277
Four-Engine—TOTAL	31	40	40	36	52
Douglas DC-4	1	1	1	1	2
Douglas DC-6	28	36	36	33	42
Douglas DC-7	1	2	2	1	—
Lockheed 1049	1	1	1	1	1
Other	—	—	—	—	7
Twin-Engine—TOTAL	75	173	184	181	217
Aero Commander 500/680E	2	3	3	—	4
Beech BE-18	1	3	4	1	—
Britten-Norman BN2	—	—	2	—	10
Cessna CE-310	1	—	—	—	—
Cessna 402	1	—	—	—	1
Cessna CE-421	—	1	—	—	—
Convair 240/340/440	6	14	15	15	26
Curtis CW-46	25	23	21	18	15
Dornier DO-28	—	—	1	—	2
Douglas DC-3	14	104	112	125	125
Fairchild FC-82	2	2	2	2	2
Grumman G-21/G-44/G-73	8	8	5	—	7
Martin 404	15	15	19	20	21
DeHavilland Canada DHC-4	—	—	—	—	3
Other	—	—	—	—	1
Single-Engine—TOTAL	12	8	11	1	8
Helicopters—TOTAL	10	7	7	6	3
Turbine Engine—TOTAL	10	7	6	6	3
Sikorsky S-61	7	7	6	6	3
Bell BL-206	3	—	—	—	—
Piston Engine—TOTAL	—	—	1	—	—

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

NOTE: Effective 1978, includes certified route air carriers, supplemental air carriers, air taxi, commercial operators, and travel clubs.

SOURCES OF OPERATING REVENUE
TOTAL DOMESTIC OPERATIONS^a, ALL AIR CARRIER SERVICES
Calendar Years 1960 to Date
(Millions of Dollars)

Year	TOTAL Operating Revenues	Passenger	Mail (including subsidy)	Express and Freight	Excess Baggage	Other
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 ^r	13,901	11,856	294	933	22	796
1977 ^r	15,821	13,771 ^b	355 ^c	1,109 ^b	21	565
1978 ^E	17,900	15,283	400	1,520	22	675

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.
E Estimate.
r Revised.

REVENUES AND EXPENSES
TOTAL DOMESTIC OPERATIONS^a, ALL AIR CARRIER SERVICES
Calendar Years 1960 to Date
(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 ^r	13,901	13,326	575
1977 ^r	15,821	15,164	657
1978 ^E	17,900	16,870	1,030

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

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

^r Revised.

^E Estimate.

ACTIVE CIVIL AIRCRAFT
as of December 31
Years 1960 to Date

Year	Active Civil Aircraft								
	TOTAL	TOTAL Air Carrier ^a	General Aviation Aircraft					Rotorcraft ^b	Other ^c
			TOTAL	Fixed-Wing Aircraft		Other ^c			
				Multi-Engine	Single-Engine				
4-place & over	3-place & less								
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	

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.

ACTIVE AIRMAN CERTIFICATES HELD

as of December 31
1974 to Date

	1974	1975	1976	1977	1978
Pilots—TOTAL	<u>733,728</u>	<u>728,187</u>	<u>744,246</u>	<u>783,932</u>	<u>798,833</u>
Students	180,795	176,978	188,801	203,510	204,874
Private	305,848	305,863	309,005	327,424	337,644
Commercial	192,425	189,342	187,801	188,763	185,833
Airline	41,002	42,592	45,072	50,149	55,881
Helicopter (only)	5,647	4,932	4,804	4,819	4,874
Glider (only) ^{a,b}	4,824	5,348	5,789	6,208	6,541
Other Pilot ^{a,b}	3,187	3,132	2,974	3,059	3,186
Non-Pilots—TOTAL	<u>314,728</u>	<u>323,934</u>	<u>334,681</u>	<u>348,584</u>	<u>362,350</u>
Mechanics ^a	198,863	205,436	212,303	220,768	228,743
Parachute Rigger ^a	7,900	8,327	8,718	8,994	9,200
Ground Instructor ^a	49,249	51,365	53,464	55,717	57,738
Dispatcher ^a	5,576	5,741	5,838	5,972	6,161
Control Tower Operator	23,342	23,956	24,584	25,107	25,388
Flight Navigator	2,509	2,321	2,214	2,155	2,092
Flight Engineer	26,955	26,788	27,560	29,871	33,028
Flight Instructor Certificates^c	<u>42,418</u>	<u>44,777</u>	<u>46,236</u>	<u>49,362</u>	<u>52,201</u>
Instruments Ratings^c	<u>199,323</u>	<u>203,954</u>	<u>211,364</u>	<u>226,334</u>	<u>236,312</u>

Source: Federal Aviation Administration, Office of Management Systems.

^a No periodic medical examination required, therefore, no determination as to current activity can be made.^b 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.^c Special ratings shown on pilot certificates represented above, not additional certificates.

**GENERAL AVIATION
MILES AND HOURS FLOWN**
By Type of Flying
Calendar Years 1965 to Date

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

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

Source: Federal Aviation Administration, "FAA Statistical Handbook of Aviation" (Annually).
NA Not Available.

U.S. CIVIL AIRPORTS^a
By Length of Runway and Region
December 31, 1978

FAA Region	TOTAL	Airports by Length of Runway (in feet)		
		Under 5,000	5,000- 9,999	10,000 & Over
TOTAL	<u>14,574</u>	<u>12,878</u>	<u>1,428</u>	<u>268</u>
New England	540	457	64	19
Eastern	1,976	1,825	121	30
Great Lakes	3,011	2,775	192	44
Central	1,322	1,241	72	9
Southern ^b	1,719	1,486	218	15
Southwest	2,178	1,916	239	23
Rocky Mountain	992	832	151	9
Western	1,151	973	158	20
Northwest	857	773	71	13
Alaska	756	545	127	84
Pacific	56	49	6	1
South Pacific ^c	16	6	9	1

Source: Department of Transportation, Federal Aviation Administration.

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

b Includes Puerto Rico (27 airports) and the Virgin Islands (5 airports).

c American Samoa, Guam, Saipan, and Trust Territory.



Helicopter Transportation

Over the last decade, the number of civil helicopter operators in the U.S. and Canada has more than doubled. Most of that dramatic increase occurred in the last five years, under the impetus of a continually broadening spectrum of rotary wing applications and growing acceptance of the helicopter as an efficient, versatile, time-saving, money-saving business and commercial vehicle.

The number of civil helicopter operators increased in every year of the past decade but experienced its

greatest gain in 1978, when the total increased by more than 450 and for the first time topped 3,000. The major increase—about 300—was in the number of companies and executives operating private short-haul transportation services; the total of corporate operators climbed to an all-time high of 1,515, marking the sixth consecutive record-setting year. The number of commercial operators—those providing air taxi, charter and specialized services—also increased sharply, from 959 in 1977 to 1,126 in 1978.

There was similar growth during the year in the number of helicopters operated. The 1978 total was 8,023, also an all-time high; the figure compares with 7,160 in 1977. The largest gain was in commercial helicopters, up from 4,294 in 1977 to 4,904 in 1978. The corporate helicopter fleet grew by more than 300 units, to 1,891 helicopters.

During 1978, New York Airways operated the only U.S. scheduled passenger helicopter service. The company carried 282,000 passengers in 1978, flying 403,000 miles and about five million passenger miles.

AIA's Directory of Helicopter Operators lists 2,722 operators in the U.S. (including Puerto Rico) and 281 in Canada. In terms of helicopters in operation, the U.S. has 6,500 and Canada, 1,473. Among the U.S. states, California has the greatest civil helicopter activity with 312 operators and 840 helicopters.

In 1978, there were 72 civil-type helicopters, including U.S. and foreign-built aircraft, operating in the United States and Canada. American manufacturers were producing 22 civil models and developing six civil prototypes.

In production or development during 1978 were three new types of commercial transport helicopters. The Sikorsky S-76 12-passenger twin-turbine helicopter received its Federal Aviation Administration type certificate in November 1978 and the company started deliveries

early in 1979. Bell Helicopter Textron continued flight tests of its Bell 222 6-10 passenger twin-turbine transport, aiming for 1979 FAA certification; first deliveries are scheduled for October 1979. Boeing Vertol announced receipt of the first order for its Model 234 Commercial Chinook, a civil version of the Army's CH-47 transport; British Airways Helicopters Ltd. ordered the Chinooks for servicing North Sea oil rigs. The 44-passenger twin-turbine Model 234 is expected to make its initial flight in 1980; first delivery is planned for late 1980.

In the field of rotary wing research, there were three advanced vertical lift craft in flight status during 1978. The Sikorsky S-72 Rotor Systems Research Aircraft (RSRA) is a flying laboratory for testing new rotor systems; it is being flown as a pure helicopter and—with the addition of wings and engines—as a compound helicopter, a winged rotorcraft capable of greater cruise speed although it retains the vertical lift characteristics of the helicopter. The Bell XV-15 is a tilting-rotor research aircraft whose rotors provide helicopter-like lift for takeoff, then tilt forward to operate as propellers for forward flight. The Sikorsky XH-59A Advancing Blade Concept (ABC) research vehicle can be flown as a pure helicopter or as a relatively high speed wingless aircraft powered by two auxiliary turbojet engines; the high speed phase of the flight test program began in 1978.

**CIVIL HELICOPTER OPERATORS AND HELICOPTERS
OPERATED IN THE UNITED STATES AND CANADA
1965 to Date**

Year	TOTAL	Commercial	Companies and Executives	Government Agencies ^a
CIVIL HELICOPTER OPERATORS				
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	3,003	1,126	1,515	362
HELICOPTERS OPERATED^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	8,023	4,904	1,891	1,228

Source: Aerospace Industries Association, manufacturers' and owner/operators' reports.
^a Federal, state and local governments.
^b Includes helicopters on order.

HELICOPTER TRANSPORTATION

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

**By Region
Selected Years 1970 to Date**

Region	1970	1972	1973	1975	1977 ^b
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 ^a	109	94	96	105	147

Source: Aerospace Industries Association.

NOTE: Totals included proposed facilities.

^a Includes Canada and Puerto Rico.

^b Data for 1977 is the latest available.

**HOSPITAL HELIPORTS
IN THE UNITED STATES AND CANADA**

**By Region
Selected Years 1970 to Date**

Region	1970	1972	1973	1975	1977 ^b
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 ^a	4	3	4	7	9

Source: Aerospace Industries Association.

NOTE: Totals include proposed facilities.

^a Includes Canada and Puerto Rico.

^b Date for 1977 is the latest available.

**CIVIL HELICOPTER FLEET
UNITED STATES AND CANADA
1978**

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

(Continued on next page)

HELICOPTER TRANSPORTATION

**CIVIL HELICOPTER FLEET
UNITED STATES AND CANADA (Continued)
1978**

State	OPERATORS				HELICOPTERS			
	Comm.	Corp. & Exec.	Civil Gov't.	TOTAL	Comm.	Corp. & Exec.	Civil Gov't.	TOTAL
New Jersey	24	47	5	76	41	54	9	104
New Mexico	9	13	2	24	18	14	6	38
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
TOTAL—U.S.	995	1,385	342	2,722	3,756	1,708	1,086	6,550
Canada	131	130	20	281	1,148	183	142	1,473
GRAND TOTAL	1,126	1,515	362	3,003	4,904	1,891	1,228	8,023

Source: Aerospace Industries Association, "1978 Directory of Helicopter Operators."

**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
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.

HELICOPTER TRANSPORTATION

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

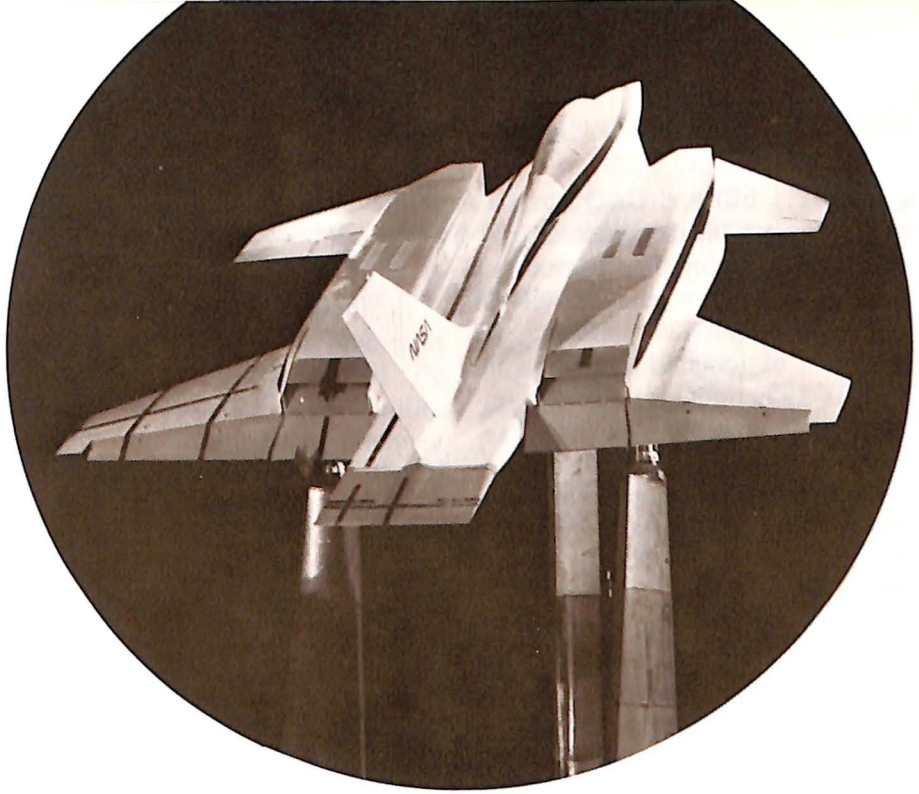
Year	TOTAL TON-MILES	Passenger	U.S. Mail	Express	Freight
1960	1,054	916	91	40	7
1961	963	822	94	40	7
1962	897	780	65	44	6
1963	1,317	1,193	74	44	6
1964	1,668	1,525	92	45	6
1965	1,948	1,794	84	60	10
1966	2,562	2,422	60	70	10
1967	2,960	2,826	61	64	9
1968	2,482	2,367	57	48	8
1969	1,704	1,627	34	37	6
1970	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

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

HELICOPTER TRAFFIC
UNITED STATES SCHEDULED AIRLINES
 Calendar Years 1960 to Date
 (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

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



Research and Development

For most of the years of the 1970s, U.S. government-sponsored research and development was in decline, with annual funding increases generally below the rate of inflation. In recent years, however, government concern for lagging national productivity and international competitiveness sparked a reversal of the trend. The turnaround is particularly evident in estimates for fiscal year 1979 federal R&D outlays: the total of \$27.6 billion represents an increase of more than \$3 billion—more than 12 percent—above the previous year's level.

The bulk of the increase is in areas primarily affecting the aerospace industry. Outlays for Department of Defense R&D, which total \$12.1 billion, are up \$1.4 billion over 1978; NASA outlays (\$4.2 billion) increased by some \$400 million. In another area of considerable aerospace industry involvement, the Department of Energy's outlays (\$4.5 billion) are up almost \$600 million.

The FY 1980 R&D budget, if approved by Congress as submitted by the Administration, calls for a lesser but substantial overall increase of

about \$2.1 billion. DoD outlays would again climb significantly, by \$1.3 billion or more than 10 percent, but NASA/Energy gains would be held to less than \$200 million, well below the anticipated inflation rate. The FY 1980 budget, however, emphasizes real growth in basic research funding; in that R&D category, the budget contemplates increases of 17 percent in defense outlays, almost 19 percent for NASA and 17 percent for DoE.

In the current fiscal year (FY 1979), the Navy leads the Department of Defense in outlays for research, development, test and evaluation (RDT&E) with \$4.2 billion, up from \$3.8 billion in 1978. At \$4 billion, the Air Force is second, with an increase of about \$350 million. Army outlays total \$2.5 billion, up from \$2.3 billion. Under the FY 1980 budget, Air Force outlays of \$4.6 billion would lead defense RDT&E spending, followed by the Navy at \$4.4 billion and the Army at \$2.8 billion.

The major DoD project in FY 1979 aircraft RDT&E is the Navy F-18/A-18 strike fighter/attack bomber, funded at almost \$500 million; a developmental milestone of 1978 was the first flight of the F-18A, scheduled for large-scale production. Other major RDT&E programs in FY 1979 include the Army's Advanced Attack Helicopter (\$177 million) and the Air Force's F-16 multimission fighter

(\$108 million); first production units of the latter airplane were delivered in 1978/79.

In missile RDT&E, cruise missile programs account for the greatest FY 1979 outlays, more than \$600 million. Next is the USAF MX advanced intercontinental ballistic missile, funded at \$423 million and destined to become the primary defense R&D project in coming years. The Navy's Trident 1, in transition from development to production status with initial operational deployment planned for late 1979, is funded at \$200 million. The Army's major RDT&E program is the Patriot battlefield air defense system.

As in previous years, the major NASA R&D program in FY 1979 is the Space Shuttle. In 1978/79, the initial Shuttle system was undergoing final testing preparatory to the first space flight, expected early in 1980. In advanced development were three additional Orbiter spacecraft and their associated launch systems, together with Spacelab, a human-habitable orbital laboratory for Shuttle missions, being jointly developed by NASA and the European Space Agency.

NASA's aeronautical research program received another funding boost in FY 1979, to \$522 million. This represents an increase of 18 percent above the FY 1978 level, which in turn was almost 17 percent higher than in 1977.

RESEARCH AND DEVELOPMENT

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

Calendar Years 1960 to Date
(Millions of Dollars)

Year	All Industries	Aerospace ^a 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 ^r	4,533 ^r	1,230 ^r
1969	18,308	5,882 ^r	4,528 ^r	1,354 ^r
1970	18,062	5,219 ^r	4,005 ^r	1,213
1971	18,311	4,881 ^r	3,864 ^r	1,017 ^r
1972	19,539 ^r	4,950 ^r	3,970 ^r	978 ^r
1973	21,233 ^r	5,052 ^r	3,898 ^r	1,154 ^r
1974	22,867 ^r	5,278 ^r	4,003 ^r	1,275 ^r
1975	24,164 ^r	5,713 ^r	4,434	1,279 ^r
1976	26,906 ^r	6,322 ^r	4,906 ^r	1,416 ^r
1977	29,895 ^r	7,095 ^r	5,517 ^r	1,578 ^r

Source: National Science Foundation.

NOTE: Data for years 1968-1977 were revised by the Bureau of the Census.

^a Includes companies primarily engaged in the manufacture of aircraft and parts, SIC Code 372, and the manufacture of ordnance and accessories, including complete guided missiles and space vehicles, SIC Code 19. As of the 1976 survey, the SIC classification was adjusted to reflect the 1972 OMB revision of SIC codes. The new aircraft and missiles codes are 372 and 376.

^r Revised.

INDUSTRIAL RESEARCH AND DEVELOPMENT IN AEROSPACE

By Type of Research and Fund Source
 Calendar Years 1960 to Date
 (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 ^r	5,694 ^r	4,508 ^r	1,185 ^r	70 ^r	25 ^r	45
1969	5,882 ^r	5,816 ^r	4,500 ^r	1,313 ^r	65 ^r	23 ^r	42
1970	5,219 ^r	5,156 ^r	3,985 ^r	1,170	63	20	43
1971	4,881 ^r	4,831 ^r	3,848 ^r	983 ^r	50 ^r	16 ^r	34
1972	4,950 ^r	4,887 ^r	3,949 ^r	937 ^r	62 ^r	21	41 ^r
1973	5,052 ^r	4,992 ^r	3,871 ^r	1,118 ^r	58 ^r	20	38 ^r
1974	5,278 ^r	5,221 ^r	3,895 ^r	1,236 ^r	57 ^r	18	39 ^r
1975	5,713 ^r	5,659 ^r	4,416 ^r	1,243 ^r	54	18 ^r	36 ^r
1976	6,322 ^r	6,268 ^r	4,884 ^r	1,384 ^r	54 ^r	22 ^r	32 ^r
1977	7,095 ^r	7,039 ^r	NA	NA	56 ^r	NA	NA

Source: National Science Foundation.

NOTE: Data for 1968-1977 were revised by the Bureau of the Census. Totals may not add due to rounding.

^r Revised.

NA Not Available.

FEDERAL OUTLAYS FOR RESEARCH AND DEVELOPMENT

Fiscal Years^a 1960 to Date
(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 ^E	27,577	12,145	4,224	4,508	6,700
1980 ^E	29,668	13,433	4,412	4,639	7,184

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&D facilities and administrative operating costs. AEC research and development programs transferred to ERDA with 1974 reorganization, to Dept. of Energy in 1977.

^a For an explanation of the change in the Federal Government's Fiscal Year, see the Glossary.^E Estimate.

FEDERAL AERONAUTICS RESEARCH AND DEVELOPMENT
New Obligational Authority
Fiscal Years 1967 to Date
(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 ^a
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 ^E	3,111	441	2,572	98
1979 ^E	2,733	522	2,118	93

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

NOTE: FY 1980 estimates were not available at the time of publication.

^a Unobligated balances for SST research and development, rescinded in 1969.

^E Estimate.

Tr. Qtr. Transition Quarter. For an explanation for the changes in the Federal Government's Fiscal Year and the Transition Quarter, see the Glossary.

RESEARCH AND DEVELOPMENT

**DEPARTMENT OF DEFENSE
APPROPRIATIONS FOR
RESEARCH, DEVELOPMENT, TEST AND EVALUATION**

Fiscal Years 1978 to 1980

(Millions of Dollars)

	1978	1979 ^E	1980 ^E
TOTAL—APPROPRIATIONS FOR RDT&E	\$11,474	\$12,774	\$13,536

BY APPROPRIATION

Army	2,419	2,709	2,927
Navy	4,054	4,522	4,484
Air Force	4,222	4,598	5,005
Defense Agencies	754	917	1,087
Director of Test and Evaluation	25	28	33

BY RESEARCH CATEGORIES

Research	416	477	573
Exploratory Development	1,386	1,550	1,739
Advanced Development	2,224	2,898	2,952
Engineering Development	4,226	4,236	4,411
Management and Support	1,346	1,409	1,515
Operational Systems Development	1,876	2,204	2,346

RECAP OF BUDGET ACTIVITIES

Technology Base	1,803	2,027	2,312
Advanced Technology Development	476	513	636
Strategic Programs	2,333	2,383	2,411
Tactical Programs	4,639	5,311	5,251
Intelligence and Communications	553	672	910
Defensewide Mission Support	1,670	1,868	2,016

RECAP OF FYDP PROGRAMS

Strategic Forces	470	798	643
General Purpose Forces	726	579	569
Intelligence and Communications	644	782	1,109
Airlift/Sealift	31	37	13
Research and Development (FYDP Program 6)	9,598	10,570	11,190
Central Supply and Maintenance	3	6	9
Training, Medical and Other	1	1	1
Support of Other Nations	1	1	2

Source: Department of Defense, Budget for FY 1980.

^E Estimate.

DEPARTMENT OF DEFENSE
OUTLAYS FOR RESEARCH, DEVELOPMENT, TEST AND EVALUATION
Fiscal Years 1970 to Date
(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	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 ^E	11,726	3,975	4,198	2,453	1,100
1980 ^E	13,015	4,612	4,415	2,777	1,211

Source: Department of Commerce, Budget FY 1980.

Tr. Qtr.: Transition Quarter. For an explanation of the Transition Quarter, and the change in the Federal Government's Fiscal Year, see the Glossary.

^E Estimate.

MILITARY PRIME CONTRACT AWARDS
RESEARCH, DEVELOPMENT, TEST AND EVALUATION
Fiscal Years 1974-1978
(Millions of Dollars)

Program Categories	1974	1975	1976	1977	1978
TOTAL—RDT&E	<u>\$5,815</u>	<u>\$6,303</u>	<u>\$6,871</u>	<u>\$7,893</u>	<u>\$8,683</u>
Research	278	234	276	319	323
Exploratory Development	506	530	593	673	780
Other Development	4,550	5,027	5,364	6,247	6,895
Management & Support	481	512	638	654	685
Aircraft—TOTAL	<u>\$1,318</u>	<u>\$1,166</u>	<u>\$1,378</u>	<u>\$1,649</u>	<u>\$1,640</u>
Research	3	3	2	3	2
Exploratory Development	16	13	18	31	43
Other Development	1,297	1,146	1,345	1,606	1,591
Management & Support	2	4	13	9	4
Missile and Space Systems—TOTAL ..	<u>1,706</u>	<u>1,895</u>	<u>2,305</u>	<u>2,302</u>	<u>2,721</u>
Research	58	23	34	16	20
Exploratory Development	75	72	107	133	178
Other Development	1,488	1,711	1,991	2,023	2,415
Management & Support	85	89	173	130	108
Electronics & Communications					
Equipment—TOTAL	<u>1,318</u>	<u>1,767</u>	<u>1,491</u>	<u>1,789</u>	<u>1,765</u>
Research	31	26	33	35	37
Exploratory Development	113	96	144	165	156
Other Development	1,001	1,496	1,253	1,500	1,476
Management & Support	173	149	61	89	96
All Other—TOTAL^a	<u>1,473</u>	<u>1,475</u>	<u>1,697</u>	<u>2,153</u>	<u>2,557</u>
Research	186	182	207	265	264
Exploratory Development	302	349	324	344	403
Other Development	764	674	775	1,118	1,413
Management & Support	221	270	391	426	477

Source: Department of Defense, "Military Prime Contract Awards by Service Category and Federal Supply Classification, Fiscal Years 1975, 1976, 1977, 1978."

NOTE: For a description of the Fiscal Year, see the Glossary.

^a "All Other" includes ships, tank-automotive, weapons, ammunition and services.

**MILITARY AIRCRAFT PROGRAMS
RESEARCH, DEVELOPMENT, TEST AND EVALUATION^a**

**By Agency, Type and Model
Fiscal Years 1978, 1979^E and 1980^E
(Millions of Dollars)**

Agency, Type and Model	1978	1979 ^E	1980 ^E
AIR FORCE			
A-10	\$ 17.6	\$ 18.0	\$ 17.8
B-52G Cruise Missile Aircraft Modification ..	32.8	76.7	13.5
B-52G/H Avionics Modification	38.7	38.1	55.0
C-5 (Wing Modification)	30.8	36.5	12.7
E-3A Advanced Warning & Control System (AWACS)	99.9	58.6	74.2
EF-111A	21.1	8.8	7.0
F-15 Eagle	62.7	10.0	.5
F-16 Multimission Fighter	169.1	107.9	27.8
NATO AWACS Program	11.6	10.0	—
*Alternate Fighter Engine (AFE)	26.0	15.0	16.0
NAVY			
A-4M Skyhawk	\$ 1.9	\$ —	\$ —
A-6E Intruder	3.0	7.4	1.2
A-7E Corsair II4	.8	—
CH-53E Super Stallion	18.5	—	5.6
E-2C Hawkeye	—	6.4	11.1
F-14A Tomcat	34.8	15.0	27.7
F/A-18 Hornet	625.1	498.6	310.8
H-46 (Modification)	8.9	—	—
P-3C Orion	—	.5	30.6
S-3A Viking	—	1.0	9.6
*LAMP III Helicopter	135.9	92.9	177.0
ARMY			
AH-1S Cobra/Tow (Modernization)	\$ 12.8	\$ 10.8	\$ 1.0
UH-60A Blackhawk	37.9	3.0	—
CH-47 (Modernization)	32.1	19.5	23.1
*Advanced Attack Helicopter (AAH)	164.9	177.4	176.2

Source: "Program Acquisition Costs by Weapon System," Department of Defense Budget for Fiscal Year 1980.

^a Total Obligation Authority.

^E Estimate.

* Programs in R&D only.

RESEARCH AND DEVELOPMENT

**MISSILE PROGRAMS
RESEARCH, DEVELOPMENT, TEST AND EVALUATION^a**

**By Agency, Type and Model
Fiscal Years 1978, 1979 and 1980
(Millions of Dollars)**

Agency, Type and Model	1978	1979 ^E	1980 ^E
AIR FORCE			
ALCM	\$276.9	\$336.9 ^b	\$ 90.0
GLCM	18.7	33.0	44.1
Minuteman II/III	267.0	68.7	105.1
Target Drones	20.0	34.1	27.8
*ABRES	99.6	105.0	105.3
*AMRAAM	31.9	36.7	54.7
*ASALM	37.2	48.5	25.0
*CASWS	19.9	58.5	54.0
*CMCA	15.0	20.6	30.0
*M-X	134.4	423.2 ^b	670.0
NAVY			
Harm	\$ 31.0	\$ 44.2	\$ 51.4
Harpoon	—	1.5	8.0
Phoenix	7.1	23.8	36.2
Sidewinder	6.1	12.0	8.9
Sparrow	—	15.5	12.6
Standard ER	16.4	44.5	27.0
Standard MR (SM-1)	3.1	10.1	21.9
Standard MR (SM-2)	—	4.5	29.0
Tomahawk	208.5	152.1	103.4
Trident I	327.7	200.0	59.8
*AEGIS Surface-to-Air Missile System	64.0	62.6	70.1
*SM-2 Improvement	10.5	38.9	25.0
*Trident II	5.0	25.0 ^b	40.6
ARMY			
Chaparral	\$ 4.2	\$.1	\$ 6.1
Dragon	2.2	.4	—
GSRS	46.4	62.8	72.3
Hawk	12.5	3.1	10.1
Lance	3.9	5.1	3.3
Patriot	214.4	228.4	128.7
Roland	75.4	22.7	11.3
Stinger	12.6	24.8	17.6
TOW	1.0	17.2	26.2
*AAH	164.9	177.4	176.2
*BMD Systems Technology Program	106.2	114.0	114.8
*Pershing II	29.6	60.0 ^b	144.8
*RVPs	—	18.2	49.4

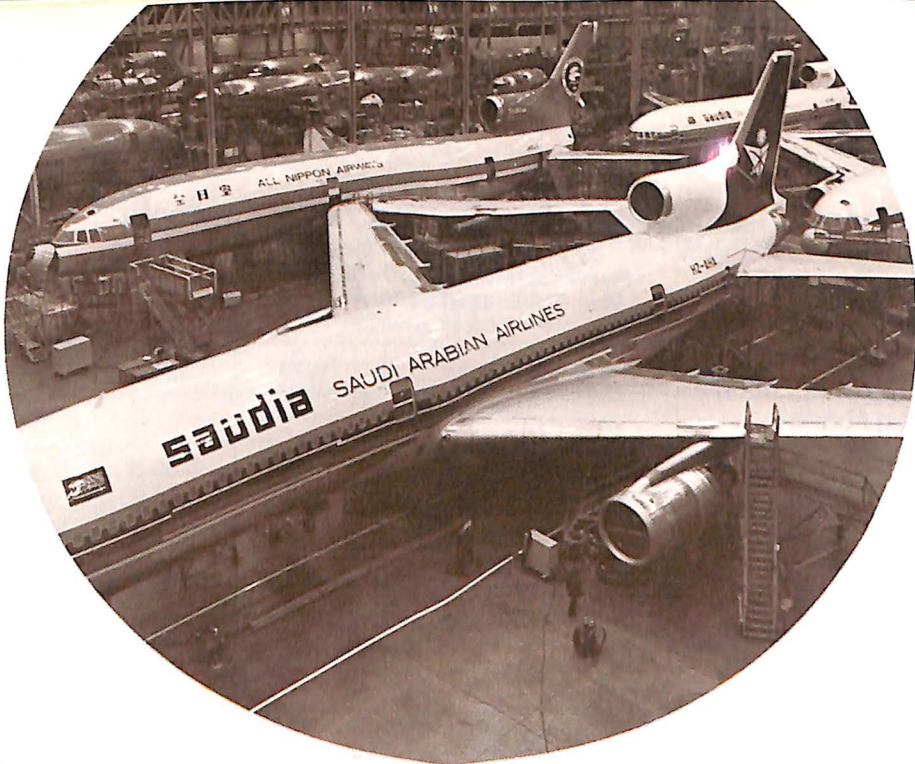
Source: "Program Acquisition Costs by Weapon System," Department of Defense Budget for Fiscal Year 1980.

^E Estimate.

^a Total Obligational Authority.

^b Includes FY 1979 Supplemental appropriation.

* Programs in R&D only.



Foreign Trade

In 1978, the year that the United States experienced its sixth international trade deficit of the 1970's—almost \$32 billion—the aerospace industry recorded its 9th consecutive trade surplus—\$9 billion. Thus, the aerospace industry softened to a considerable degree the adverse impact of deficits incurred in other areas of international trade.

Aerospace led all U.S. manufacturing industries in positive contribution to the nation's balance of trade.

The contrasting trade performance of the nation as a whole and

its most export-productive manufacturing segment underlines once again the vital importance of aerospace exports to the U.S. economy. Large-scale oil importation and lagging U.S. trade in a number of non-petroleum areas indicate continuing American trade deficits in near-future years, with attendant unfavorable effect on the domestic inflation rate and the value of the dollar in relation to foreign currencies. One way of easing the economic strain is to offset U.S. trade deficits in other categories by increased levels of high-value high-technology ex-

ports, such as aerospace products.

Testimony to the confidence of overseas purchasers in the quality of American aerospace products is the industry's consistently strong foreign trade performance in the face of intensifying competition from abroad. Over the five intervening years since the oil embargo of 1973, aerospace trade surpluses have averaged \$7.3 billion a year, providing substantial offsets to overall U.S. deficits suffered in four of those five years.

The 1978 aerospace trade surplus was due to a level of exports which outstripped aerospace imports by a factor of more than 10 to one. Exports amounted to \$10 billion, which was not only a new record but 28 percent above the previous record and more than 30 percent above 1977's \$7.6 billion. Aerospace imports, at \$943 million, represented an increase of some \$200 million over the previous year.

In terms of dollar value, civil aerospace exports constituted 60 percent of the export total. Shipments of civil aircraft engines, parts and accessories were valued at slightly more than \$6 billion, up \$1 billion over 1977. The 1978 civil export total includes \$3.6 billion for complete aircraft, an increase over 1977 of \$1.1 billion; \$2.1 billion for parts, accessories and equipment (up about \$50 million); and \$277 million for aircraft engines (up \$44 million).

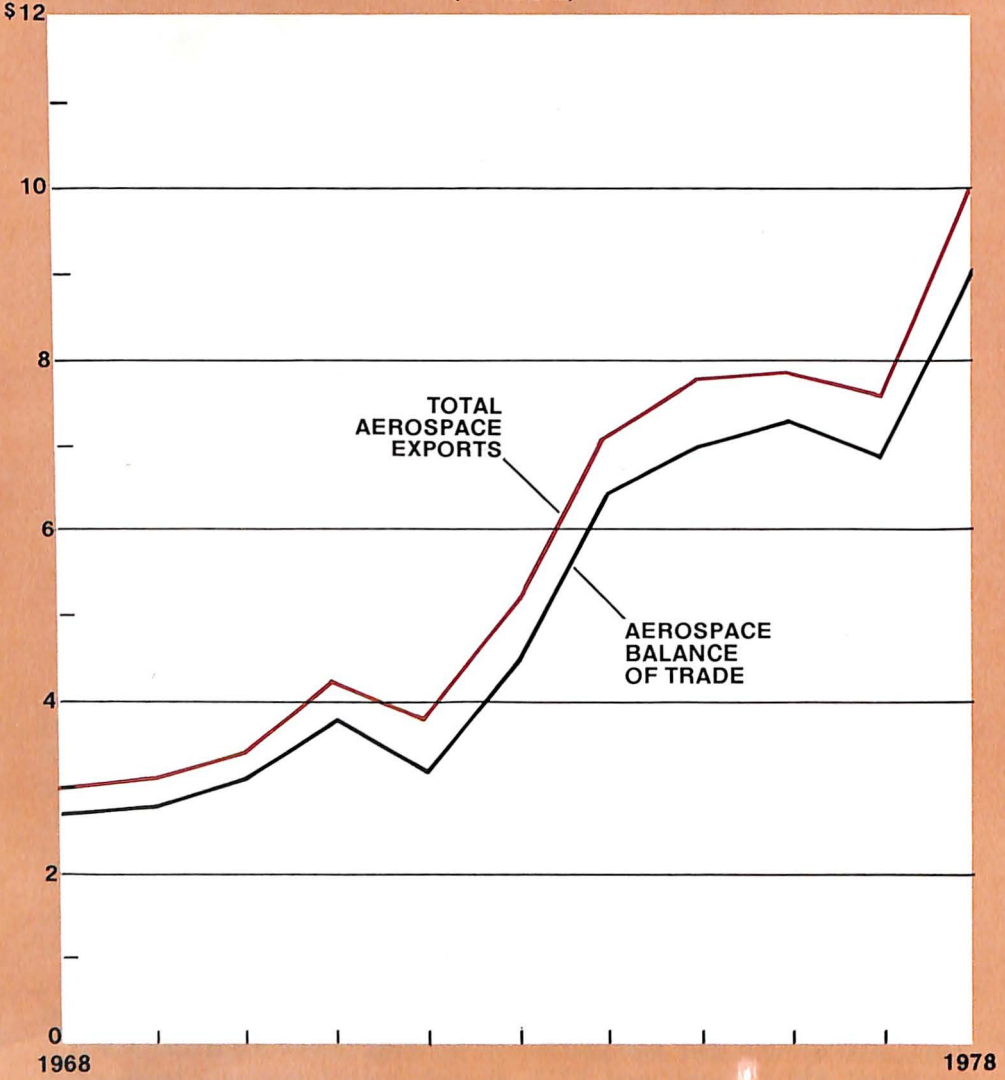
The largest single component among civil aerospace exports was

commercial transport aircraft, sales of which increased some \$600 million over the previous year to a 1978 figure of \$2.5 billion. Helicopter sales amounted to \$156 million, up \$51 million.

Military aerospace exports totaled \$4 billion, compared with \$2.5 billion in 1977. The 1978 breakdown includes \$2.2 billion for complete aircraft (up \$1 billion); \$1 billion for aircraft and engine parts, accessories and equipment (up more than \$200 million); \$608 million for rockets, guided missiles and parts (up \$170 million); and \$64 million for aircraft engines and missile propulsion systems. Among military aircraft shipments the largest component—and the largest increment of gain over 1977 military exports—was fighter/bomber aircraft; 1978 shipments in this category were valued at \$1.7 billion, up more than \$1 billion.

Indications are that aerospace exports will remain at a high level in 1979. For future years, manufacturers hope for an improved international trade climate, of benefit to American export sales, as a result of successfully-concluded Multilateral Trade Negotiations (MTN) conducted under the General Agreement on Tariffs and Trade. The MTN package, which includes a separate agreement on trade in civil aircraft, would eliminate tariffs on aircraft and restrain certain anti-competitive practices that have worked to the disadvantage of American exporters.

**U.S. AEROSPACE EXPORTS
AND BALANCE OF TRADE**
1968-1978
(In Billions)



Source: U.S. Department of Commerce

TOTAL AND AEROSPACE BALANCE OF TRADE

Calendar Years 1960 to Date
(Millions of Dollars)

Year	TOTAL U.S. Trade Balance ^a	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 ^b	3,830	4,203	373	(^c)
1972	-6,351	3,230	3,795	565	(^c)
1973	1,222	4,360	5,142	782	356.8
1974	-2,996	6,350	7,095	745	(^c)
1975 ^r	9,630	7,045	7,792	747	73.2
1976 ^r	-7,786	7,267	7,843	576	(^c)
1977 ^r	-28,970	6,850	7,581	731	(^c)
1978	-31,798	9,058	10,001	943	(^c)

Source: Bureau of the Census, "U.S. Exports, Schedule B, Commodity and Country; "U.S. Exports, Schedule B, Commodity and Country; "U.S. Imports, General and Consumption, Schedule A, Commodity and Country"; "Highlights of U.S. Export and Import Trade."

^a 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).

^b First negative U.S. Balance of Trade since 1888.

^c Not applicable.

^r Revised.

U.S. AEROSPACE IMPORTS
Calendar Years 1974 to Date
(Millions of Dollars)

	1974	1975	1976	1977	1978
TOTAL IMPORTS	\$ 744.5	\$ 747.4	\$ 576.1	\$ 731.2	\$ 943.1
Aircraft—TOTAL	124.0	192.2	155.5	310.2	291.8
Military	27.1	112.5	64.3	50.2	4.9
Non-Military	96.9	79.7	91.1	259.8	286.6
Gliders & Kites	0.6	0.6	1.1	1.8	2.1
Helicopters	8.0	6.9	4.5	18.1	28.0
Single-Engine	} 44.3	} 35.0	} 26.3	} 27.8	0.5
Multi-Engine Under 4400 lbs. ...					2.8
Multi-Engine 4400-10,000 lbs. ...					42.1
Multi-Engine 10,000-33,000 lbs. ...	26.7	20.4	40.8	80.7	101.4
Over 33,000 lbs.	5.6	5.1	7.8	100.1	58.1
Used or Rebuilt	11.7	11.6	10.6	31.3	51.6
Balloons & Airships	^(b)	0.1	0.1	0.2	0.3
Aircraft Engines—Total	235.7	229.5	144.9	131.4	283.0
Internal Combustion ^a	1.5	1.3	1.0	1.7	1.6
Turbine Engines, New	203.9	190.5	119.6	89.5	263.1
Non-Piston, NES	30.3	37.7	24.3	40.2	18.3
Parts & Accessories—TOTAL ...	384.8	325.7	275.7	289.6	368.3

Source: Bureau of the Census, "U.S. Imports for Consumption and General Imports, TSUSA Commodity," FT246.
^a Includes some toy engines.
^b Less than \$50,000.
 NES Not elsewhere specified.

EXPORTS OF U.S. AEROSPACE PRODUCTS

Calendar Years 1974 to Date
(Millions of Dollars)

	1974	1975	1976	1977	1978
GRAND TOTAL	\$7,095	\$7,792	\$7,843	\$7,581	\$10,001
TOTAL CIVILIAN	5,273	5,324	5,677	5,049	6,018
Complete Aircraft—TOTAL	<u>3,366</u>	<u>3,203</u>	<u>3,211</u>	<u>2,747</u>	<u>3,625</u>
Transports	2,654	2,397	2,468	1,936	2,558
General Aviation ^a	297	312	362	389	496
Helicopters	110	105	113	105	156
Other, Including Used	305	389	268	317	415
Engines—TOTAL	<u>229</u>	<u>231</u>	<u>254</u>	<u>233</u>	<u>277</u>
Jet & Gas Turbines	195	186	213	196	231
Internal Combustion	34	45	41	37	46
Parts, Accessories & Equipment for Aircraft and Engines, Including Spares—TOTAL	<u>1,678</u>	<u>1,890</u>	<u>2,212</u>	<u>2,069</u>	<u>2,116</u>
Engine Spares & Accessories	474	492	515	483	644
Other Spares & Equipment	1,204	1,398	1,697	1,586	1,472
TOTAL MILITARY	1,822	2,468	2,166	2,532	3,983
Complete Aircraft—TOTAL	<u>1,101</u>	<u>1,306</u>	<u>967</u>	<u>1,186</u>	<u>2,243</u>
Transports	190	235	151	317	232
Helicopters	50	123	102	84	82
Fighters & Bombers	845	905	513	686	1,707
Other, Including Used	16	43	201	99	222
Engines—TOTAL	<u>50</u>	<u>94</u>	<u>71</u>	<u>76</u>	<u>64</u>
Jet & Gas Turbines	36	83	58	64	59
Missile Turbines	2	2	5	5	3
Internal Combustion	12	9	8	7	2
Parts, Accessories & Equipment for Aircraft and Engines, Including Spares—Total	<u>515</u>	<u>771</u>	<u>649</u>	<u>832</u>	<u>1,068</u>
Engine Spares & Accessories	120	205	138	147	156
Other Spares & Equipment	395	566	511	685	912
Rockets, Guided Missiles & Parts—TOTAL	<u>156</u>	<u>297</u>	<u>479</u>	<u>438</u>	<u>608</u>
Complete Rockets & Guided Missiles	37	47	93	168	335
Parts & Accessories for Rockets and Guided Missiles	119	250	386	270	273

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

^a Includes transports under 33,000 pounds.

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

EXPORT-IMPORT BANK
GROSS AUTHORIZATIONS OF CREDITS AND GUARANTEES

Fiscal Years 1966 to Date
(Millions of Dollars)

Year	TOTAL Credits ^a	Credits in Support of Commercial Aircraft Exports			
		TOTAL	Percent of TOTAL Credits	Jets	Other
1966	\$ 1,149	\$ 99.3	8.6%	\$ 94.4	\$ 4.9
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
Year	TOTAL Guarantees ^b	Guarantees in Support of Commercial Aircraft Exports			
		TOTAL	Percent of TOTAL Guarantees	Jets	Other
1966	\$ 300	\$ 32.8	10.9%	\$ 27.9	\$ 4.9
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

Source: Export-Import Bank of the United States.

Tr. Qtr.: For an explanation of the Transition Quarter (Tr. Qtr.) and the change in the Fiscal Year, see page 0.

a "Credit" is a commitment of direct financing by the Export-Import Bank.

b "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 1974 to Date

	1974	1975	1976	1977	1978
TOTAL NUMBER OF AIRCRAFT	5,589	4,372	4,283	4,368	4,399
Helicopters, Under 2000 lbs.	267	210	201	233	243
Helicopters, Over 2000 lbs.	128	126	114	88	125
Single-Engine Aircraft	3,367	2,460	2,374	2,664	2,640
Multi-Engine Aircraft, Under 4400 lbs.	116	168	228	273	455
Multi-Engine Aircraft, 4400-10,000 lbs.	780	640	612	525	339
Multi-Engine Aircraft, 10,000-33,000 lbs.	14	6	4	7	37
Passenger Aircraft, Over 33,000 lbs.	} 227	} 181	} 158	} 101	99
Cargo Aircraft, Over 33,000 lbs.					3
Other Aircraft, Over 33,000 lbs.					9
Other Aircraft, Including Balloons, Gliders & Kites	(^a)	(^a)	(^a)	(^a)	(^a)
Used or Rebuilt Aircraft	690	581	592	477	449
TOTAL VALUE (Millions of Dollars) . .	\$3,366	\$3,203	\$3,211	\$2,747	\$3,625
Helicopters, Under 2000 lbs.	30	28	28	38	42
Helicopters, Over 2000 lbs.	80	77	85	68	114
Single-Engine Aircraft	81	71	74	93	103
Multi-Engine Aircraft, Under 4400 lbs.	6	11	17	27	62
Multi-Engine Aircraft, 4400-10,000 lbs.	199	225	269	262	240
Multi-Engine Aircraft, 10,000-33,000 lbs.	10	5	2	6	91
Passenger Aircraft, Over 33,000 lbs.	} 2,655	} 2,397	} 2,468	} 1,936	2,111
Cargo Aircraft, Over 33,000 lbs.					142
Other Aircraft, Over 33,000 lbs.					305
Other Aircraft, Including Balloons, Gliders & Kites	6	2	4	4	27
Used or Rebuilt Aircraft	299	387	264	313	388

Source: Bureau of the Census, "U.S. Exports, Schedule B, Commodity and Country."

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

^a Number of units not available.

EXPORTS OF MILITARY AIRCRAFT
Calendar Years 1974 to Date

	1974	1975	1976	1977	1978
TOTAL NUMBER OF AIRCRAFT . . .	736	951	751	721	589
Bombers, Land & Carrier Type	90	3	—	—	—
Fighters, Land & Carrier Type	309	475	331	244	286
Cargo Transports	47	51	32	53	25
Rotary Wing Aircraft	73	116	139	95	108
New Aircraft, NEC	195	290	191	288	110
Used or Rebuilt Aircraft	19	16	58	41	60
Airships, Balloons, Gliders, etc. . . .	3	—	—	—	(^a)
TOTAL VALUE (Millions of Dollars)	\$1,101	\$1,306	\$ 967	\$1,186	\$2,243
Bombers, Land & Carrier Type	105	1	—	—	—
Fighters, Land & Carrier Type	740	904	513	686	1,707
Cargo Transports	190	235	151	317	232
Rotary Wing Aircraft	50	123	102	84	82
New Aircraft, NEC	14	39	145	20	187
Used or Rebuilt Aircraft	2	4	56	79	11
Airships, Balloons, Gliders, etc. . . .	(^b)	—	—	—	24

Source: Bureau of the Census, "U.S. Exports, Schedule B, Commodity and Country."

NEC Not elsewhere classified.

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

^a Number of units not given.

^b Less than \$0.5 million.

EXPORTS OF USED OR REBUILT AIRCRAFT

Calendar Years 1960 to Date
(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	(^a)
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

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

^a Less than \$0.05 million.

EXPORTS OF NEW AND USED CIVIL AIRCRAFT ENGINES

Calendar Years 1960 to Date

(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

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

EXPORTS OF CIVIL HELICOPTERS

**By Selected U.S. Manufacturers
Calendar Years 1974 to Date**

	1974	1975	1976	1977	1978
TOTAL NUMBER EXPORTED	420	437	356	346	399
Canada & Greenland	67	67	45	41	31
Latin America	103	80	78	104	60
Europe	121	103	73	75	83
Middle East	28	58	49	10	9
Asia	61	72	64	76	186
Oceania	31	19	34	34	22
Africa	9	21	13	6	8
Countries not identified	—	17	—	—	—
TOTAL VALUE (Millions of Dollars)^a	\$123.7	\$219.9	\$146.3	\$135.6	\$208.1
Canada & Greenland	13.1	20.4	12.1	12.7	13.4
Latin America	24.5	35.9	24.2	34.4	31.5
Europe	63.4	58.7	32.6	46.6	51.3
Middle East	4.9	40.4	46.2	6.4	7.3
Asia	14.2	21.9	21.2	30.5	99.2
Oceania	2.5	3.7	7.8	4.0	3.7
Africa	1.1	2.2	2.2	1.0	1.7
Countries not identified	—	36.7	—	—	—

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

^a Manufacturers' Net Billing Price.

EXPORTS OF GENERAL AVIATION AIRCRAFT

**By Selected U.S. Manufacturers
Calendar Year 1974 to Date**

	1974	1975	1976	1977	1978
TOTAL NUMBER EXPORTED	4,248	3,512	3,539	3,611	3,612
Canada & Greenland	514	610	637	498	455
Latin America	1,583	1,206	1,221	1,382	1,195
Europe	1,177	925	927	1,023	1,171
Asia	153	172	165	68	102
Oceania	450	237	382	440	482
Africa	371	362	207	200	207
TOTAL VALUE (Millions of Dollars)^a	\$286.4	\$318.6	\$331.4	\$354.6	\$486.3
Canada & Greenland	23.2	26.0	31.9	25.6	42.3
Latin America	99.1	102.4	101.4	122.5	156.6
Europe	92.9	90.4	101.6	139.2	173.4
Asia	21.6	34.5	44.2	17.8	36.6
Oceania	21.0	18.9	20.2	27.4	49.1
Africa	28.6	46.4	32.1	22.1	28.3

Source: General Aviation Manufacturers' Association.

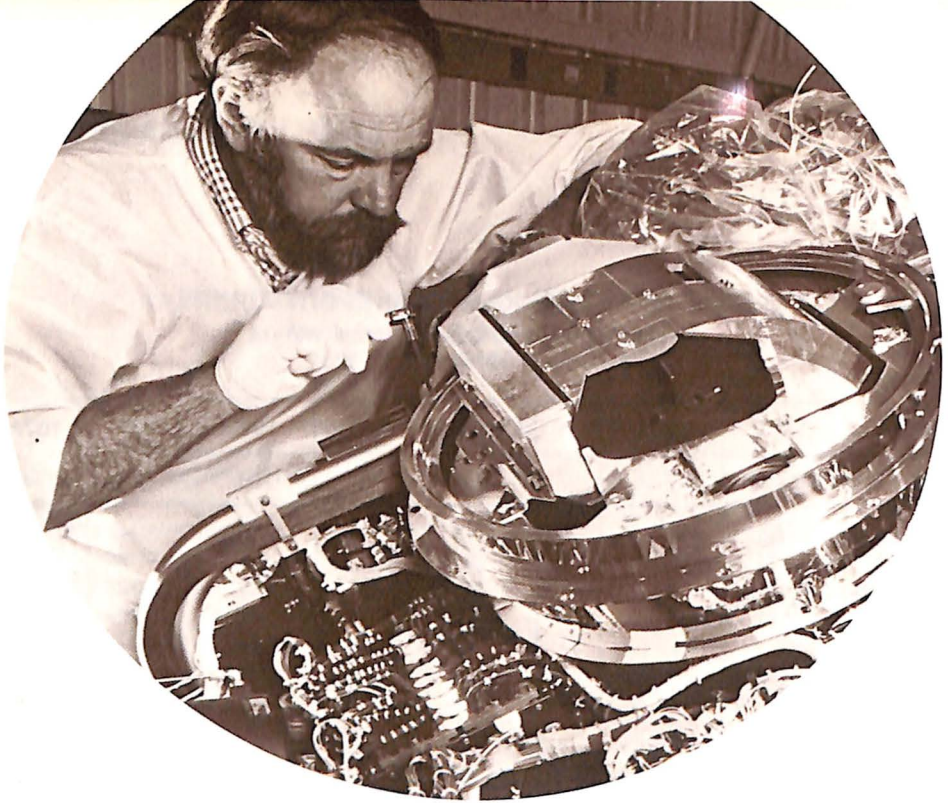
NOTE: Data are based on exports reported by Beech, Bellanca, Cessna, Gates Learjet, Grumman American Aviation, Lake, Maule, Mooney, Piper, Rockwell and Swearingen of new civil aircraft.

^a Manufacturers' Net Billing Price.

EXPORTS OF COMMERCIAL TRANSPORT AIRCRAFT
33,000 Pounds and Over Airframe Weight
Calendar Years 1974 to Date

	1974	1975	1976	1977	1978
TOTAL UNITS	227	181	158	101	111
Canada	15	18	1	—	4
Latin America	31	27	15	7	14
Europe	91	67	49	32	36
Middle East	16	11	31	20	17
Asia	49	32	20	22	24
Oceania	11	9	4	4	6
Africa	14	17	38	16	10
TOTAL VALUE (Millions of Dollars)	\$2,655	\$2,397	\$2,468	\$1,936	\$2,558
Canada	187	162	6	—	132
Latin America	268	213	138	59	187
Europe	1,044	935	700	571	906
Middle East	163	264	504	467	541
Asia	686	525	549	468	478
Oceania	175	147	82	155	118
Africa	132	151	489	216	196

Source: Bureau of the Census, "U.S. Exports, Schedule B, Commodity and Country."



Employment

The aerospace industry employment curve, influenced primarily by increasing activity in commercial aircraft production, climbed sharply in 1978 and further improvement in industry employment is expected in 1979.

Average industry employment in 1978 was 967,000, a gain of about 8.5 percent over the previous year's level. This represents a reversal of the employment trend, which had declined in each of the three prior years and had dropped by more than 45 percent from the peak year (1968) level.

The 1978 increase was com-

pounded of gains in all major categories. The greatest improvement was among workers engaged in aircraft manufacture, including civil and military aircraft, engines, parts and related equipment; employment rose by 46,000, or more than nine percent. A gain of 10,000 employees, approximately eight percent, was recorded in the communications equipment category. Missile/space employment was up 3,000, less than four percent.

The number of production workers in the 1978 labor force increased by more than 10 percent, from 428,000 in 1977 to 472,000 in 1978.

Some 275,000 production workers, almost 60 percent of the total, were engaged in aircraft manufacture. Average hourly earnings for production workers in aircraft and parts plants was \$7.54, which compares with \$6.92 in the previous year. Average weekly earnings of more than \$318 represented an increase over 1977 of 9.7 percent.

Another reversal of a trend was evident in the number of scientists and engineers working on aerospace research and development projects. In 1964, aerospace R&D-engaged scientists and engineers numbered 101,000 and constituted almost 30 percent of all U.S. scientific/engineering personnel in R&D work. The percentage gradually declined thereafter until 1977, when a modest gain was reported. In 1978, there was a further increase in both numbers and percentage of the total. At year-end 1978, there were 77,400 scientists and engineers in aerospace R&D programs (up 5,400 over the previous year), representing 19.4 percent of the total. The latter figure compares with 18.8 percent in 1977. The increase of 7.5 percent over the 1977 employment figure was a faster rate of increase than that shown for the nation as a whole, where the rate of increase was only 4.7 percent.

An Aerospace Industries Association survey—conducted early in 1979—indicates employment gains of even greater order in 1979. The survey found that employment in

October 1978 topped the one million mark for the first time since 1970. By the end of 1979, the labor force is expected to exceed 1,100,000. That figure compares with the all-time high of 1,500,000 (average employment for 1968).

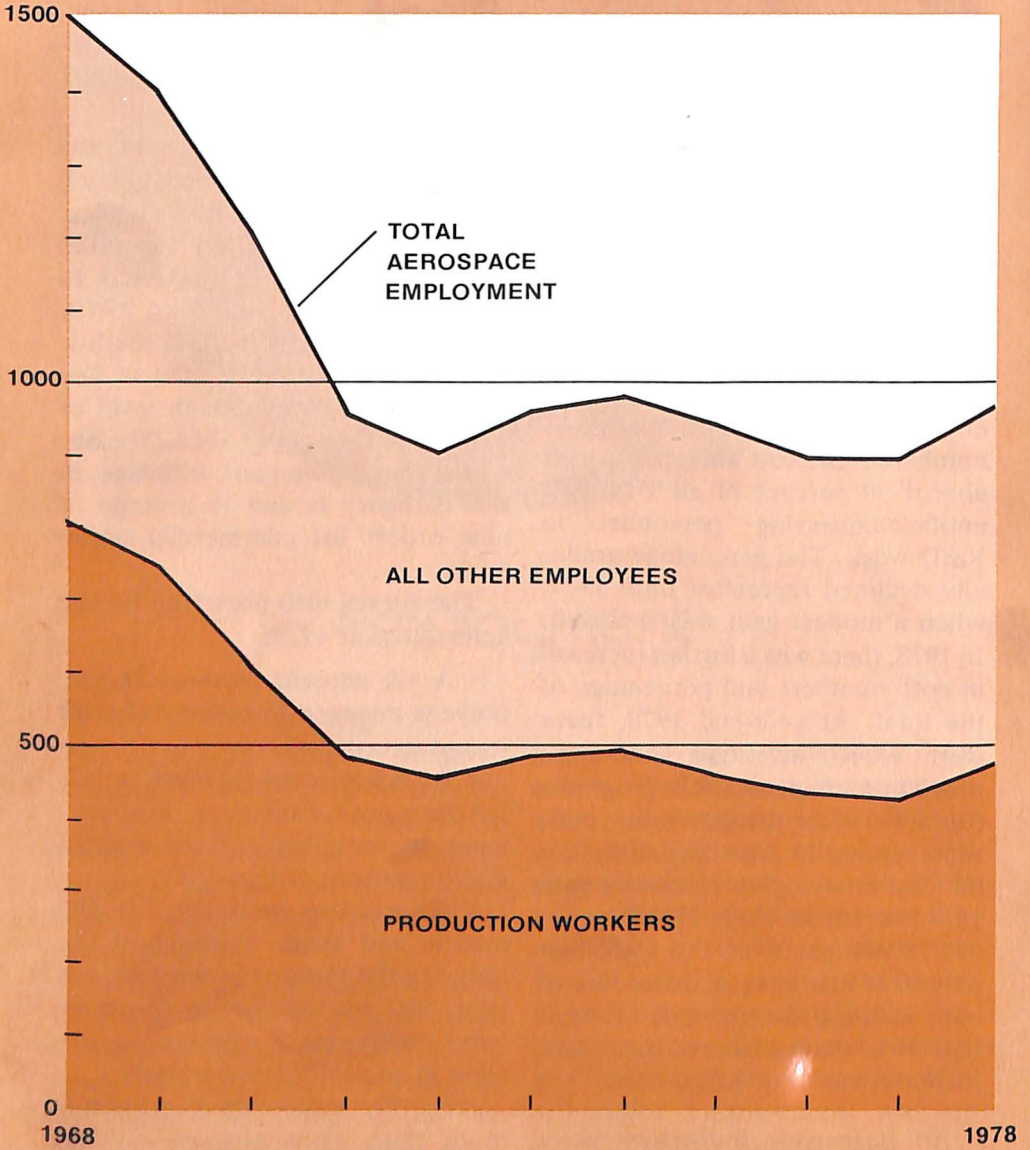
The AIA projection predicted that the major employment gain will be in production of commercial transport aircraft, where the number of employees is expected to reach 81,000 by year-end 1979; comparison figures include the low level of 44,700 experienced in December 1976 and the high level of 126,000 in December 1968. The anticipated employment increase in this category is due to a surge of new orders for commercial transports.

The survey also projected for the calendar year 1979:

- A six percent increase in employees engaged in military aircraft manufacturing.
- An 8.6 percent increase in helicopter manufacturing employment, a continuance of the gradual growth pattern of the 1970s.
- An employment level in the missile and space segment of the industry the same as in the previous year, with an increase in space-related employment offsetting a decline in missile-related activity.
- Further employment growth—more than eight percent—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 to Date
(Thousands of Employees)

Year	TOTAL	Aircraft	Missiles & Space	Communi- cations Equipment	Other
TOTAL EMPLOYMENT					
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 ^a	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	891	483	80	121	207
1978	967	529	83	131	224
PRODUCTION WORKERS					
1966	731	446	55	73	157
1967	804	502	55	78	169
1968	807	506	52	80	169
1969	746	464	41	86	155
1970	604	369	31	77	127
1971	480	285	26	66	103
1972 ^a	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	428	247	26	56	99
1978	472	275	26	62	109

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

NOTE: Aerospace employment as shown is the sum of the estimated monthly average employment in the aircraft and missile and space industries (SIC 372 and 376) plus estimated aerospace employment in the communications industry (SIC 3662) and estimated aerospace employment in the instruments and certain other industries (SIC 3811, 3821, 28, 35, 73, 89, etc.)

^a The Bureau of Labor Statistics has revised its employment statistics benchmarked to 1972, using the 1972 Standard Industrial Classifications. Data prior to 1972 may not be strictly comparable.

LABOR TURNOVER RATES IN THE AEROSPACE INDUSTRY

Calendar Years 1966 to Date
(Rates per 100 Employees per Year)

Year	Complete Missiles and Spacecraft	Aircraft			
		TOTAL	Airframes	Engines and Engine Parts	Other Parts & Equipment
ACCESSIONS					
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 ^a	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	39.8
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
SEPARATIONS					
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 ^a	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	18.0	18.0	15.6	13.2	30.0

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

^a The Bureau of Labor Statistics has revised its employment statistics benchmarked to 1972, using the 1972 Standard Industrial Classifications. Data prior to 1972 may not be strictly comparable.

WORK STOPPAGES
AIRCRAFT AND PARTS INDUSTRY
SIC 372
Calendar Years 1966 to Date

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

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

WORK-INJURY RATES^a
AEROSPACE AND ALL MANUFACTURING
Calendar Years 1971 to Date

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

Source: Department of Labor, Bureau of Labor Statistics, Occupational Injuries and Illnesses, Annual.

^a 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 to Date
(Thousands of Employees)

Monthly Average for the Year	TOTAL	Aircraft (Airframes)	Aircraft Engines and Parts	Other Aircraft Parts and Equipment
TOTAL EMPLOYMENT				
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 ^a	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

PRODUCTION WORKERS

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 ^a	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

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

^a The Bureau of Labor Statistics has revised its employment statistics benchmarked to 1972, using the 1972 Standard Industrial Classifications. Data prior to 1972 may not be strictly comparable.

EARNINGS IN AIRCRAFT AND PARTS PLANTS

**Production Workers Only
(Includes Overtime Premiums)
Calendar Years 1966 to Date**

Year	TOTAL	Aircraft (Airframes)	Aircraft Engines and Parts	Other Aircraft Parts and Equipment
AVERAGE HOURLY EARNINGS				
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 ^a	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	6.92	7.07	7.04	6.41
1978	7.54	7.70	7.80	6.85
AVERAGE WEEKLY EARNINGS				
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 ^a	185.26	180.89	193.52	186.52
1973	202.10	199.53	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	289.95	296.23	291.46	271.78
1978	318.19	324.17	325.26	295.24

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

^a The Bureau of Labor Statistics has revised its employment statistics benchmarked to 1972, using the 1972 Standard Industrial Classifications. Data prior to 1972 may not be strictly comparable.

**EMPLOYMENT OF SCIENTISTS AND ENGINEERS^a
FOR RESEARCH AND DEVELOPMENT**

**Total and Aerospace
1960 to Date**

Year	TOTAL	Aerospace	Aerospace as a Percent of Total
AS OF DECEMBER 31			
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 ^r	25.8
1970	384,100 ^r	92,200 ^r	24.0 ^r
1971	366,800	78,200 ^r	21.3
1972	349,900	70,800 ^r	20.2 ^r
1973	357,300 ^r	72,100 ^r	20.2 ^r
1974	359,600 ^r	70,600 ^r	19.6 ^r
1975	362,800 ^r	67,500 ^r	18.6 ^r
1976	364,300 ^r	66,900	18.4 ^r
1977	382,200 ^r	72,000 ^r	18.8 ^r
1978	400,000 ^r	77,400 ^r	19.4 ^r

Source: National Science Foundation.

NOTE: Data for years 1969-1977 were revised by the Bureau of the Census.

^a Scientists and engineers working less than full time have been included in terms of their full time equivalent number.

^r Revised.

**EMPLOYMENT ON NATIONAL AERONAUTICS
AND SPACE ADMINISTRATION PROGRAMS
1960 to Date**

Year	TOTAL	NASA Employees	Contractor Employees^E
AS OF JUNE 30			
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
AS OF SEPTEMBER 30			
1977	124,136	23,636	100,500
1978	126,037	23,237	102,800
1979 ^E	NA	22,831	NA
1980 ^E	NA	22,563	NA

Source: NASA, Briefing on the Budget of the United States, January 22, 1979.

^E Estimate.

NA Not Available.



Finance

The aerospace industry's financial position improved in 1978 with a substantial increase in profit. The industry's profit rate after taxes, measured as a percentage of sales, amounted to 4.8 percent. This compares with 4.2 percent in the previous year and a 1970-77 average profit of less than three percent.

A number of factors have influenced the profit gains of recent years, among them the relatively good national economy, continuing efforts by industry to reduce overhead costs and the industry's cur-

rent business "mix." There has been a trend toward higher levels of commercial sales, non-aerospace sales and export sales and a reduction of government business as a percentage of total sales; this boosts overall profits because commercial/non-aerospace/export sales usually generate greater earnings than government contracts.

Another major reason is the cyclical workload situation known as "program maturity," characterized by a higher ratio of production programs to research and development

programs. Generally, production programs yield greater profits than R&D work, and with fewer program starts R&D investment requirements have been reduced.

A related factor is a recent change in industry accounting procedures whereby expenses incurred in R&D programs are written off in the year they are incurred, rather than stretched over several years. This practice depresses profits in years of high R&D activity, but permits profits to rise in periods of reduced R&D investment.

Still another contributor to higher profit margins is the industry's level of expenditure for new plant and equipment. Plant modernization aids operational efficiency, hence improves profit rates. In the aerospace recession years of the early 1970s, annual plant and equipment expenditures ranged from \$380 million to \$550 million, but they increased in the mid-seventies and climbed above the \$1 billion level in 1977. Those earlier investments in modernization are now being reflected in the improved profit levels of 1977/78. Future operating improvements should be expected due to still-mounting expenditures for plant and equipment; outlays totaled more than \$1.5 billion in 1978 and it is estimated that they will approximate \$2 billion in 1979.

With 1978 gain, aerospace industry profits edged closer to, but remained below the national average for manufacturing corporations.

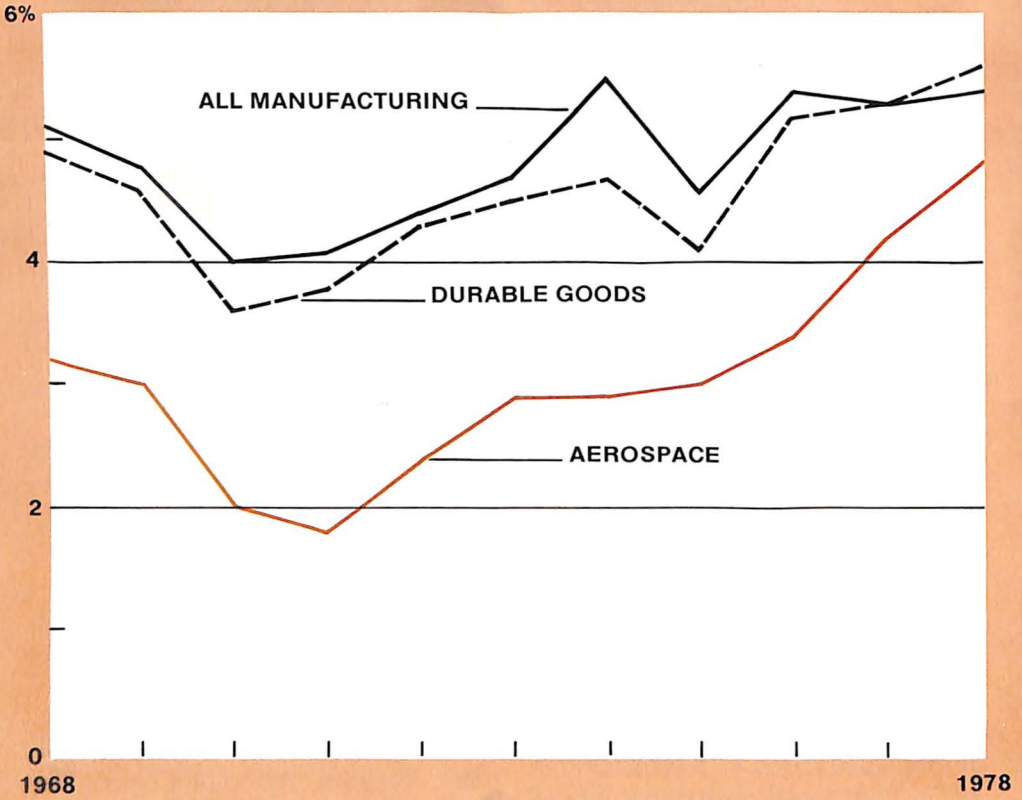
The 1978 aerospace profit rate of 4.8 percent compares with 5.6 percent for durable goods manufacturers and 5.4 percent for all U.S. manufacturing corporations.

The aerospace balance sheet for 1978 showed increases in total assets and net worth. The industry's total assets amounted to almost \$31 billion, up from \$26.1 billion in 1977; net worth increased from \$9.9 billion in 1977 to \$11.3 billion in 1978. The industry's net working capital declined to \$5.7 billion from \$6.4 billion in the previous year.

In terms of fiscal year 1978 contract dollar value, General Dynamics Corporation headed the list of contractors working on Department of Defense programs. Others among the top 10, all with contract values of \$1 billion or more, were (in order): McDonnell Douglas Corporation, United Technologies Corporation, Lockheed Corporation, General Electric Company, Litton Industries Inc., The Boeing Company, Hughes Aircraft Company, Raytheon Company and Grumman Corporation.

Rockwell International Corporation maintained top ranking among NASA contractors. The top 10 for that agency also includes Martin Marietta Corporation, McDonnell Douglas Corporation, Bendix Corporation, Lockheed Electronics Company, IBM Corporation, Hughes Aircraft Company, General Electric Company, Thiokol Corporation and Computer Services Corporation.

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 to Date

Year	All Manufacturing Corporations ^a	Non-Durable Goods	Durable Goods	Aerospace
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	3.0
1976	5.4	5.5	5.2	3.4
1977	5.3	5.3	5.3	4.2
1978	5.4	5.3	5.6	4.8

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

^a Does not include newspapers.

**INCOME ACCOUNTS
AEROSPACE COMPANIES**
Calendar Years 1974 to Date
(Millions of Dollars)

	1974	1975	1976	1977 ^r	1978
Net Sales	\$29,565	\$31,373	\$31,828	\$34,307	\$37,961
Net Profit from Operations	1,678	1,616	1,874	2,338	2,777
Total Income before Federal Income Taxes	1,328	1,348	1,649	2,296	2,855
Provision for Federal Income Taxes	537	520	694	1,003	1,249
As a Percent of Total Income	40.4%	38.9%	41.2%	43.7%	43.7%
Net Profit after Taxes ..	866	927	1,091	1,427	1,841
As a Percent of Net Sales	2.9%	3.0%	3.4%	4.2%	4.8%
Net Profit Retained in Business	562	623	750	1,012	1,285

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

NOTE: Does not include data for companies which produce aerospace products but are classified in other than industry group 372.

^r Revised.

BALANCE SHEET
AEROSPACE COMPANIES
 Calendar Year 1974 to Date
 (Millions of Dollars)

	1974	1975	1976	1977 ^r	1978
Assets:					
Current Assets					
Cash	\$ 564	\$ 548	\$ 765	\$ 2,138	\$ 2,605
U.S. Government Securities	14	88	79	31	119
Other Securities	197	206	810	1,097	1,076
Total Cash and U.S. Gov-					
ernment Securities	\$ 773	\$ 842	\$ 1,654	\$ 3,267	\$ 3,801
Receivables (total)	3,225	3,263	3,088	3,564	4,246
Inventories (gross)	12,180	12,285	10,779	10,568	12,247
Other current assets	436	527	516	677	822
Total Current Assets	\$16,614	\$16,917	\$16,037	\$18,075	\$21,117
Total Net Plant	4,077	4,326	4,149	4,320	5,062
Other Non-Current Assets	3,157	3,752	3,693	3,705	4,792
Total Assets	\$23,848	\$24,994	\$23,879	\$26,100	\$30,971
Liabilities					
Current Liabilities					
Short Term Loans	\$ 1,114	\$ 523	\$ 152	\$ 279	\$ 165
Advances by U.S. Govt.	2,821	3,804	3,233	1,886	2,868
Trade accounts and notes					
payable	2,171	2,029	1,814	2,757	3,011
Income taxes accrued	821	788	938	1,779	2,043
Installments due on long					
term debts	382	291	434	307	234
Other current liabilities	4,104	4,080	4,350	4,612	7,079
Total Current Liabilities	\$11,413	\$11,514	\$10,920	\$11,621	\$15,399
Long Term Debt	3,753	4,322	3,554	4,117	3,413
Other Non-Current Liabilities	403	495	398	496	849
Total Liabilities	\$15,569	\$16,331	\$14,872	\$16,233	\$19,661
Stockholders' Equity:					
Capital Stock	\$ 3,033	\$ 3,083	\$ 3,255	\$ 3,452	\$ 3,636
Earned Surplus and Reserves	5,246	5,580	5,753	6,415	7,675
Total Net Worth	\$ 8,279	\$ 8,663	\$ 9,007	\$ 9,866	\$11,310
Total Liabilities and Stock-					
holders' Equity	\$23,848	\$24,994	\$23,879	\$26,100	\$30,971
Net Working Capital	\$ 5,201	\$ 5,402	\$ 5,118	\$ 6,454	\$ 5,718

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

NOTE: Includes 72 companies classified in industry group 372 which filed reports with the Securities and Exchange Commission.

^r Revised.

NEW PLANT AND EQUIPMENT EXPENDITURES

Calendar Years 1960 to Date
(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 ^r	135.80	60.16	27.77	1.02
1978 ^r	153.82	67.62	31.66	1.51
1979 ^E	171.14	77.54	37.84	1.98

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.

^E Estimate, based on BEA survey.

^r Revised.

**NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
MAJOR CONTRACTORS**

By rank according to net value of NASA prime
contracts awarded during Fiscal Year 1978
(Millions of Dollars)

Company	1974	1975	1976	1977	1978
TOTAL PROCUREMENTS	\$2,714	\$2,866	\$3,205	\$3,532	\$3,660
TOTAL Awards to Business Firms	2,119	2,255	2,536	2,838	2,954
Percent of TOTAL PROCUREMENTS	78%	79%	79%	80%	81%
Rockwell International Corp.	487	682	906	1,011	890
Martin Marietta Corp.	202	130	110	119	145
McDonnell Douglas Corp.	156	125	125	139	140
Bendix Corp	80	76	75	91	95
Lockheed Electronics Co., Inc.	35	46	56	68	75
IBM Corp.	48	54	43	66	73
Hughes Aircraft Co.	18	26	48	39	73
General Electric Co.	65	70	61	69	69
Thiokol Corp.	17	29	47	62	68
Computer Sciences Corp.	27	27	29	41	66
General Dynamics Corp.	80	85	76	79	64
RCA Corp.	35	40	47	42	53
United Technologies Corp.	50	36	18	34	51
Boeing Services International, Inc.	(^a)	3	5	16	43
Boeing Company	60	44	55	53	43
Vought Corporation	17	19	16	22	33
Ford Aerospace & Comm. Corp.	36	29	20	26	30
Planning Research Corp.	4	14	22	26	29
Sperry Rand Corp.	22	22	32	19	26
Frank Brisco Co., Inc.	(^a)	9	4	(^a)	24
Air Products & Chemicals, Inc.	2	3	6	7	23
Lockheed Missile & Space Co., Inc.	8	7	9	10	21
Singer Company	4	9	15	21	20
TRW Inc.	21	34	45	29	20
United Space Boosters, Inc.	(^a)	(^a)	(^a)	4	18
Ball Corp.	2	6	10	8	18
Perkin-Elmer Corp.	(^a)	2	2	(^a)	17
Northrop Services, Inc.	16	17	17	19	16
Chicago Bridge & Iron Co.	(^a)	(^a)	(^a)	13	14
(JV) Computer Sciences Corp./ Technicolor Graphics D.P. Assoc.	9	10	11	11	14

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

^a Not in list of major contractors for indicated years.

**DEPARTMENT OF DEFENSE
MAJOR CONTRACTORS**

Listed by rank according to net value of military prime contracts awarded during fiscal year^a 1978
(Millions of Dollars)

	1974	1975	1976	1977	1978
U.S. TOTAL—ALL CONTRACTS	\$34,357	\$39,501	\$41,976	\$50,385	\$59,582
General Dynamics Corp.	1,853	1,289	1,073	1,372	4,154
McDonnell Douglas Corp.	1,309	1,398	2,465	2,574	2,863
United Technologies Corp.	1,212	1,407	1,233	1,585	2,400
Lockheed Corp.	1,464	2,080	1,510	1,673	2,226
General Electric Co.	1,211	1,264	1,347	1,520	1,786
Litton Industries, Inc.	926	1,038	978	609	1,557
Boeing Company	1,076	1,561	1,176	1,580	1,525
Hughes Aircraft Co.	825	1,026	911	1,093	1,489
Raytheon Co.	740	681	784	1,041	1,307
Grumman Corp.	687	1,343	982	1,428	1,180
Rockwell International Corp.	819	732	966	1,480	890
Textron Inc.	418	546	372	455	868
Chrysler Corp.	412	283	469	620	743
Sperry Rand Corp.	393	437	506	652	612
Northrop Corp.	491	620	1,480	1,047	586
RCA Corp.	243	286	330	364	565
Honeywell, Inc.	281	292	386	457	545
Westinghouse Electric Corp.	461	315	482	802	539
Martin Marietta Corp.	246	320	249	426	539
Fairchild Industries	100	192	227	429	508
American Telephone & Telegraph Co.	692	510	447	457	457
Texas Instruments, Inc.	115	144	157	324	434
Reynolds (RJ) Industries, Inc.	98	154	134	^(b)	421
General Motors Corp.	300	390	345	380	420
Tenneco Inc.	264	242	768	745	407
Ford Motor Company	175	260	285	352	406
International Business Machines Corp.	252	360	256	547	396
LTV Corp.	269	366	316	296	384
Todd Shipyards Corp.	^(b)	^(b)	314	468	379
FMC Corp.	351	145	418	245	361

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

^a Fiscal Years ending June 30; effective FY 1977, Fiscal year ends September 30.

^b 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^a 1975, 1976, 1977

Program and Region	Millions of Dollars			Percent of Program Total		
	1975	1976	1977	1975	1976	1977
AIRCRAFT—TOTAL . . .	\$8,547	\$9,622	\$10,748	100.0%	100.0%	100.0%
New England	1,641	1,568	1,953	19.2	16.3	18.2
Middle Atlantic	1,771	1,410	2,209	20.7	14.7	20.6
East North Central	702	656	684	8.2	6.8	6.4
West North Central	1,069	2,064	1,913	12.5	21.4	17.8
South Atlantic	600	397	471	7.0	4.1	4.4
East South Central	61	78	80	0.7	0.8	0.7
West South Central	698	768	1,301	8.2	8.0	12.1
Mountain	88	76	100	1.0	0.8	0.9
Pacific ^b	1,917	2,605	2,037	22.4	27.1	18.9
MISSILE & SPACE SYSTEMS—TOTAL	\$5,313	\$5,653	\$ 6,286	100.0%	100.0%	100.0%
New England	711	727	859	13.4	12.9	13.7
Middle Atlantic	370	414	438	7.0	7.3	7.0
East North Central	112	75	135	2.1	1.3	2.1
West North Central	389	464	420	7.3	8.2	6.7
South Atlantic	442	516	426	8.3	9.1	6.8
East South Central	82	135	137	1.5	2.4	2.2
West South Central	80	130	113	1.5	2.3	1.8
Mountain	550	528	653	10.4	9.3	10.4
Pacific ^b	2,577	2,664	3,105	48.5	47.1	49.4
ELECTRONICS & COMMUNICATIONS EQUIPMENT—TOTAL . . .	\$5,286	\$5,003	\$ 7,135	100.0%	100.0%	100.0%
New England	577	507	598	10.9	10.1	8.4
Middle Atlantic	920	882	1,330	17.4	17.6	18.6
East North Central	288	333	428	5.4	6.7	6.0
West North Central	252	320	398	4.8	6.4	5.6
South Atlantic	879	808	1,283	16.6	16.2	18.0
East South Central	39	42	32	0.7	0.8	0.5
West South Central	240	227	329	4.5	4.5	4.6
Mountain	160	202	205	3.0	4.0	2.9
Pacific ^b	1,932	1,682	2,532	36.5	33.6	35.5

Source: Department of Defense, Office of the Secretary of Defense, Directorate for Information Operations, "Military Prime Contract Awards by Region and State, Fiscal Years 1975, 1976, 1977."

NOTE: The data for FY 1978 were not available at the time of publication.

^a Fiscal Years ending June 30.

^b Includes Alaska and Hawaii.

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

**By Region and Type of Contractors
Fiscal Year^a 1977**

REGION	TOTAL	Type of Contractor		
		Educational Institutions	Other Non-Profit Institutions ^b	Business Firms
TOTAL—Millions of Dollars . . .	\$7,804	\$ 437	\$ 283	\$7,084
New England	1,027	127	104	796
Middle Atlantic	877	34	16	827
East North Central	529	27	26	476
West North Central	473	3	2	468
South Atlantic	878	142	51	685
East South Central	132	2	5	125
West South Central	448	17	5	426
Mountain	192	24	1	167
Pacific ^c	3,248	61	73	3,114
PERCENT OF TOTAL	100.0%	100.0%	100.0%	100.0%
New England	13.2	29.1	36.8	11.2
Middle Atlantic	11.2	7.8	5.5	11.7
East North Central	6.8	6.0	9.4	6.7
West North Central	6.1	0.7	0.7	6.6
South Atlantic	11.2	32.4	18.0	9.7
East South Central	1.7	0.6	1.6	1.8
West South Central	5.7	3.8	1.9	6.0
Mountain	2.5	5.5	0.2	2.4
Pacific ^c	41.6	14.0	25.8	44.0

Source: Department of Defense, Office of the Secretary of Defense, Directorate for Information Operations, "Military Prime Contract Awards by Region and State, Fiscal Years, 1975, 1976, 1977."

NOTE: The data for FY 1978 were not available at the time of publication.

- ^a Fiscal Years ending June 30.
- ^b Includes contracts with other government agencies.
- ^c Includes Alaska and Hawaii.

Glossary

Accessions: the total number of permanent and temporary additions to the employment roll, including both new and rehired employees (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: the sum of the monthly average employment in the aircraft and missile and space industries (SIC 372 and 376), plus estimated aerospace employment in the communications equipment (SIC 3662) and instruments (SIC 3811 and 3821) industries, plus estimated direct employment in selected related 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 is developed by summing the (1) DOD outlays for "Procurement" of aircraft and missiles; (2) estimates of DOD outlays for **RDT&E** of aircraft, mis-

siles and astronautics; (3) NASA outlays for research and development; (4) DOE outlays for space propulsion systems and space electric power development; (5) net sales to customers other than the U.S. Government by major aerospace companies and (6) **non-aerospace** sales reported by the major aerospace companies to the Department of Commerce, Bureau of the Census.

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, depre-

ciation 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.

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. The Gross National Product in constant dollars is arrived at by dividing components of the current dollar figures by appropriate price indexes.

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: comprises major manufacturing industry groups with Standard Industrial Classification Codes 19, 24, 25 and 32 through 39. All other major manufacturing industry groups in SIC Codes 19 through 39 are

considered as nondurable goods manufacturing industry groups.

Earnings: the actual return to the worker for a stated period of time while rates are the amounts stipulated for a given unit of work or 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.

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.

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

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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—a vertical and/or short take-off and landing aircraft.

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 employment 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.

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.

N.A.T.O.: 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): Re-

search, 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**.

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 Corporations."

STOL: short take-off and landing aircraft.

Test (Department of Defense): An experiment designed to assess progress in attainment or accomplishment of development 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:** the three-month interval from July 1, 1976 to September 30, 1976. Beginning with the 1977 budget, the **fiscal year (FY)** will run from October 1 through September 30. To facilitate the conversion, this transition period has been 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 State 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 take-off and landing aircraft.
- Wages:** the payroll (see **Payroll**) of production and related workers.

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The Bendix Corporation
The Boeing Company
CCI Corporation
 The Marquardt Company
Chandler Evans, Inc.
 Control Systems Division of
 Colt Industries Inc.
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 Systems Division
Goodyear Aerospace Corporation
Gould Inc.
Grumman Corporation
Heath Tecna 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
Lear Siegler, Inc.
Lockheed Corporation
Martin Marietta Aerospace
McDonnell Douglas Corp.
Menasco Inc.
Northrop Corporation
Parker Hannifin Corporation
Pneumo Corporation
 Cleveland Pneumatic Co.
 National Water Lift Co.

Raytheon Company
RCA Corporation
Rockwell International Corporation
Rohr Industries, Inc.
The Singer Company
Sperry Rand Corporation
Sundstrand Corporation
 Sundstrand Advanced Technology Group
Teledyne CAE
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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