AEROSPACE

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Key Technologies Legacy for the 21st Century

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Key Technologies

Legacy for the 21st Century

Aerospace Industries Association of America, Inc.

$16.95

Compiled by

Economic Data Service
Aerospace Research Center

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Design: Gwen Hoelscher and Associates

Published by

Aviation Week
& Space Technology
A McGraw-Hill Publication

1221 Avenue of the Americas
New York, N.Y. 10020
1-800-433-0880

Library of Congress Catalog No. 46-25007

Acknowledgments

Air Transport Association of America
Battelle Memorial Institute
Council of Economic Advisers
Export-Import Bank of the United States
Exxon International Company
General Aviation Manufacturers Association
Helicopter Association International
International Air Transport Association
International Civil Aviation Organization
McGraw-Hill Publications Company
National Aeronautics and Space Administration
National Science Foundation
Office of Management and Budget
Price Waterhouse
U.S. Departments of
- Commerce (Bureau of the Census, Bureau of Economic Analysis, International Trade Administration)
- Defense (Comptroller; Directorate for Information, Operations and Reports: Army, Navy, Air Force)
- Labor (Bureau of Labor Statistics)
- Transportation (Federal Aviation Administration)

■ Focused development of key ''enabling'' technologies will determine the U.S. aerospace industry's technological and market leadership into the next century. These technologies will help ensure U.S. defense superiority and will also provide endless possibilities for a range of products to revolutionize the way we live—from fully-automated factories to crash-resistant, ultra-safe automobiles to greatly improved medical diagnostic equipment.

Technological foundations laid now will provide a legacy for tomorrow. The technologies that will make the difference: ○ advanced composites; ○ software development; ○ artificial intelligence; ○ propulsion systems; ○ advanced sensors; ○ optical information processing; ○ ultra-reliable electronic systems; and ○ very large scale integrated circuits.

ON THE COVER: Technician works with ion micro-probe used for microelectronic chip fabrication. A focus on electronics microminiaturization has provided very large scale integrated (VLSI) circuits. By the turn of the century, the number of transistors per chip will reach into the tens of millions.

Contents

Foreword

This 36th edition of *Aerospace Facts and Figures* tells the statistical story of the aerospace industry in 1987, a banner year by almost every yardstick.

The industry posted new records for sales, backlog, earnings, export volume and international trade balance. This outstanding performance, however, was tempered by some disquieting indicators of a coming decline in the industry's defense workload coupled with sharply reduced earnings on defense programs.

Overall sales in 1987 increased by a solid 6.5 percent over the inflation rate and backlog grew by six percent. And, as has been the case for many years, the most gratifying aspect of the industry's 1987 performance was its achievement in international trade. Aerospace exports represented almost 10 percent of the total dollar value of *all* U.S. exports and our impressive $24 billion export volume offset U.S. deficits in other areas of international trade. Those achievements once again underline the importance to the U.S. economy of high value, high technology aerospace exports.

The industry's profit was at record high, due in large part to the record sales level and to some extent to high levels of commercial business (generally more profitable than government business); a cylical influence in which some defense programs evolved in 1987 from R&D status to the more profitable production phase; a favorable change in tax rates; and the

industry's considerable success in cost cutting programs.

Looking down the road, however, we see a serious threat to the industry's financial health occasioned by a number of legislative and regulatory changes in the defense procurement process introduced over the last several years. Generally, these so-called procurement reforms threaten industry with substantially increased risk on defense contracts.

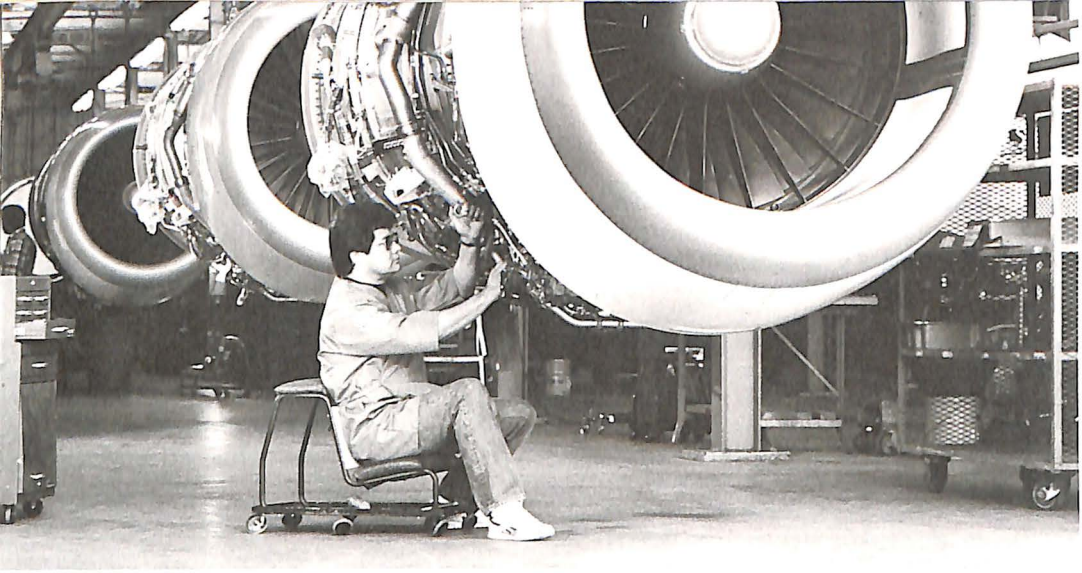
Since defense sales in 1987 represented 66 percent of the industry's total sales, this prospect is a matter of great concern. Aerospace Industries Association is making a vigorous effort to seek modification of these "reforms," which are not in the national interest because they threaten the defense industrial base as well as the defense industry.

Another negative factor is evidence of a marked decline in defense business in coming years. Due to the long lead times of high technology defense equipment, the industry has not yet felt the full impact of several years of zero growth or negative growth defense budgets. But the first indicators showed up in 1987 data. For example, although the industry's overall backlog grew at a healthy rate, it was due largely to a big surge in orders for commercial aircraft. Orders from government agencies declined markedly for the second straight year, heralding substantially lower government sales—particularly defense sales—as we begin the decade of the 1990s.

The degree of defense decline cannot accurately be quantified at this time, nor how long it will continue. But the prospects are good for offsetting gains in other areas of our business. We look for a rather large increase in civil space workload, assuming on-schedule continuance of the Space Station *Freedom* program. And, if we are able to cope with intensifying foreign competition in the commercial aerospace arena, the very large market for commercial transport aircraft suggests high levels of civil aircraft manufacture through the end of the century.

To summarize the industry's outlook, civil orders for aerospace systems are taking over from the military sector as the primary driver of industry workload. Our prospects for civil space and commercial aircraft business are sufficiently bright that we hope to maintain something close to our current activity level despite the indicated decline in defense business.

Don Fuqua
President
Aerospace Industries Association



Aerospace Summary

In 1987, the aerospace industry achieved a new record level of sales and an inflation-adjusted increase of 6½ percent over the prior year's sales. New orders for aerospace systems and the yearend backlog similarly reached all-time highs, as did export volume and the aerospace trade balance.

Here is a breakdown of the industry's performance in 1987:

Sales. Total sales amounted to $112.1 billion, up from $106.2 billion in the previous year. As is customary, sales of aircraft predominated in a breakdown by product group, representing well over half of total sales. Aircraft sales amounted to $60.3 billion, compared with $56.4 billion in 1986.

Sales of space systems ranked second among product categories, as they have since 1983. Space sales, civil and military, totaled $22.9 billion, up from $20.1 billion in the previous year, an increase of more than 13 percent. There was also an increase in the "related products and services" grouping (up roughly $1 billion to $18.7 billion).

Aerospace sales represented 2.5 percent of the U.S. Gross National Product and 4.7 percent of total sales by all U.S. manufacturing industries (both figures were the same as in 1986).

Earnings. The industry recorded a net profit after taxes of $4.6 billion, an all-time high. The profit reversed a downward trend in evidence for the two prior years. The record sales level was a contributing factor to the record earnings, but there were other factors, among them strong commercial business, which is generally more profitable than government business; a cyclical influence in which a number of major programs were evolving from R&D status to the more profitable production phase; and considerable success in industry cost-cutting programs.

Aerospace profit *rates* also increased, but they remained below the averages for all U.S. manufacturing corporations when expressed as a percentage of sales or assets. As a percentage of sales, the rate was 4.1 percent (2.8 percent in 1986) compared with the all-industry average of 4.9 percent (3.7 percent in 1986). When the 1987 profit is expressed as a per-

centage of equity, the aerospace figure is 14.6 percent (up from 9.4 percent in 1986), topping the all-industry average of 12.8 percent.

Orders and Backlog. Reflecting the zero growth or negative growth defense budgets of Fiscal Years 1985-88, the flow of new orders from government agencies dipped for the second straight year, but a surge of non-government orders more than offset declining government business. Total new orders amounted to $119.1 billion, up from $110.8 billion in 1986. The breakdown: U.S. government orders $64.9 billion (down from $68 billion in 1986), non-government orders $54.2 billion (up from $42.8 billion). The major component of net new orders was $35.3 billion in non-government orders for aircraft, engines and parts (mostly airline transport equipment).

Backlog also reached a record level. As of December 31, 1987 backlog was $157.3 billion, up from $148.2 billion at the end of 1986. The 1987 figure was compounded of $91.4 billion in government orders (down from $95 billion) and $65.8 billion in non-government business (up from $53.2 billion). As is perennially true, the principal element of the backlog was in orders for aircraft, engines and parts—$80 billion, roughly 51 percent of the total.

Civil Aircraft Production. For the ninth consecutive year, the number of general aviation planes produced dropped in 1987, thus lowering the overall civil aircraft production to the lowest level in more than 30 years, 1,800 units. The year's civil aircraft production was less than one-tenth the number built in the peak year 1978.

Because production of high value civil transport aircraft increased, the dollar volume of civil aircraft sales climbed to a new high $12.1 billion, up from $11.9 billion in 1986. Commercial transports accounted for $10.5 billion of the total, or more than 86 percent.

Numerically, the 1,800 aircraft produced include 1,085 general aviation planes, 358 helicopters and 357 commercial transports. Compared with the previous year, general aviation production declined by 410 units, helicopters increased by 32 units and transport sales were up 27 units.

The yearend 1987 backlog for commercial transports reached $32.4 billion for 824 aircraft. Some $20.2 billion (418 aircraft) was in orders from foreign customers, promising con-

tinuing high levels of export sales into the 1990s.

Military Aircraft Production. Production of military aircraft was up in 1987, marking a second year of increase in numbers delivered after three years of decline. The gain was not, however, indicative of a new trend; to the contrary, all indicators point to declining levels of military aircraft production in the late 1980s and early 1990s.

Numerically, the industry produced 1,199 military aircraft, 92 more than in the previous year. Deliveries to the U.S. military services totaled 714, up from 708 in 1986. Military aircraft exported totaled 485, up from 399 in 1986; they included direct exports (sales by U.S. manufacturers to foreign governments) of 352 aircraft (up from 289) and 133 aircraft shipped abroad under Foreign Military Sales programs (up from 110).

Department of Defense outlays for aircraft procurement in Fiscal Year 1987 reached a peak of $33 billion, but estimates for later years indicated the anticipated decline occasioned by reduced defense budgets in the mid-1980s. The estimate for FY 1988 was $29.7 billion. Procurement will decline further in FY 1989 to $28 billion.

Missile Systems. Aerospace Industries Association estimated Fiscal Year 1987 sales of missile systems at $10.2 billion, a decline from the previous year's $12 billion. Bureau of the Census data, which exclude missile propulsion units and R&D, show missile sales still gaining in 1987: $9.5 billion compared with the previous year's 8.2 billion.

According to Census, the flow of orders for new missile systems (again excluding propulsion units) increased moderately, from 1986's $11 billion to $11.7 billion. Missiles and parts backlog at yearend 1987 was $14.6 billion. Up from $12.8 billion in 1986.

Space Programs. Industry sales of space equipment continued on the ascending trend in evidence throughout the 1980s. In 1985, sales of space vehicles, systems and related equipment amounted to $22.9 billion, up from $20.1 billion in the previous year. The bulk of the sales volume was in military equipment, but specific figures on the military/civil sales ratio are not available. Some idea is provided by government outlays.

For Fiscal Year 1987, total U.S. government space activity outlays amounted to $21.9 billion. Department of Defense outlays are $14.3 billion, or 65 percent; NASA outlays came to $7.3 billion, or 33 percent. The remainder was in programs operated by the Department of Commerce ($299.2 million), the Department of Energy ($47.3 million) and other federal agencies ($26 million). In FY 1988 and later years, NASA outlays are expected to grow more rapidly than DoD's.

New orders for space vehicle systems (excluding propulsion units) amounted to $11.2 billion, a gain of 51 percent over 1986's $7.4 billion.

Research and Development. In 1987, U.S. funding for research and development of all types reached an all-time high of $123.1 billion, up from $114.7 billion in 1986, according to data supplied by the National Science Foundation. Using dollar value as a yardstick, industry performed some 73 percent of the nation's R&D, government agencies 13 percent, colleges and universities nine percent. In terms of funding, industry financed $58.6 billion or 48 percent of the total, government $60.4 billion or more than 49 percent. For 1988, NSF expected total expenditures to increase by seven percent to $131.6 billion with industrially performed work, at $96 billion, again accounting for almost three quarters of all U.S. R&D.

In a related projection for 1988 by Battelle Memorial Institute, industrial R&D was also estimated at $96 billion, with the aerospace industry as leading R&D performer, as has been customary in the 1980s. Battelle estimated that the aerospace industry will conduct R&D with $24 billion in combined government/industry funds. Second place in the Battelle projection goes to the electrical machine/communications industry at $20.4 billion, followed by non-electrical machinery ($11.9 billion).

Foreign Trade. Once again the U.S. aerospace industry posted new records for export volume and trade balance, offsetting to some degree a massive national trade deficit and underlining the importance to the U.S. economy of high value, high technology exports. In 1987, aerospace exports amounted to $23.9 billion (up from $20.7 billion in 1986) and represented almost 10 percent of total U.S. exports. Aerospace imports were approximately the same as in 1986, so the aerospace trade balance increased by $3.2 billion to $16 billion.

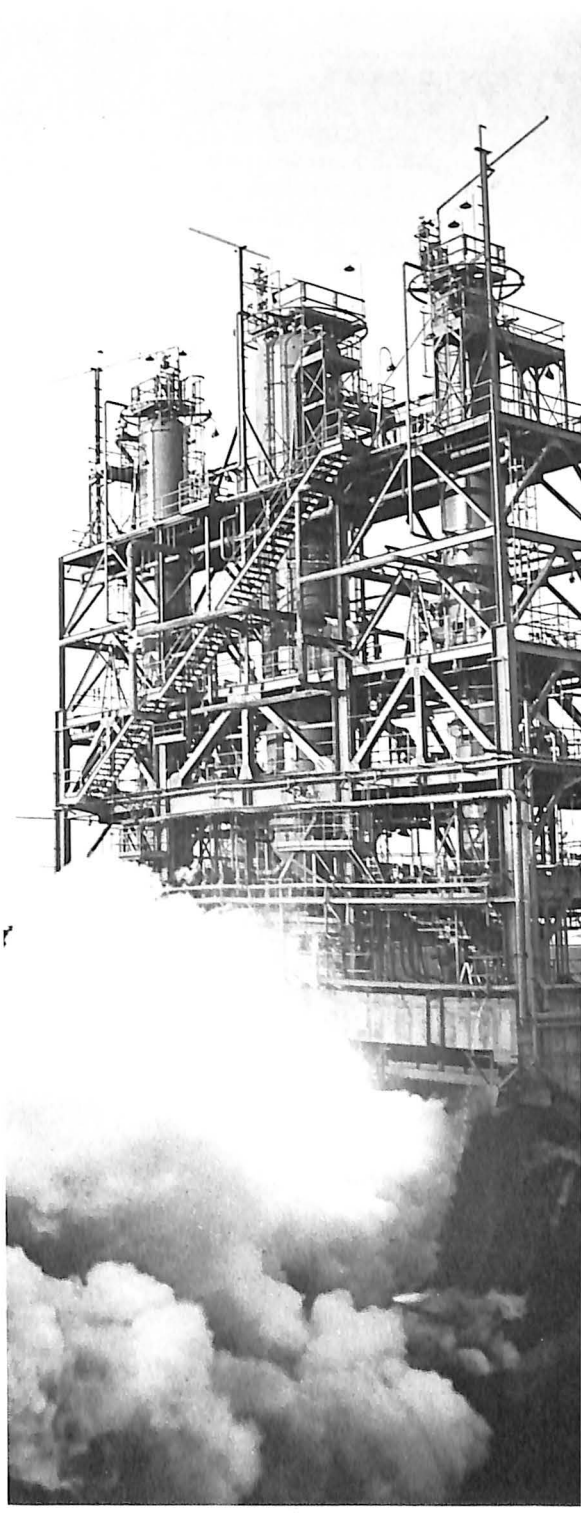
The composition of the aerospace export volume was roughly two thirds civil products,

one third military. Sparked by another increase in sales of civil aircraft—predominantly transports—civil exports increased from $14.8 billion in 1986 to $16.2 billion in 1987. At $7.7 billion, military exports reached an all-time high; the figure compared with $5.9 billion in 1986.

Employment. Aerospace employment averaged 1,309,000 in 1987, an increase of 4.6 percent over the 1986 average of 1,251,000. In 1987, aerospace employment amounted to 6.8 percent of the total employment in all U.S. manufacturing industries.

The aerospace payroll amounted to $34 billion, up 5.7 percent over the $32.2 billion paid in 1986. In 1987, the aerospace payroll represented seven percent of the total U.S. manufacturing payroll.

The employment curve may have peaked in 1987. AIA projected an employment decline of indefinite proportions, beginning in 1988, due to anticipated impacts of several years of zero-to-negative-growth defense budgets. □



STANDARD INDUSTRIAL CLASSIFICATIONS APPLICABLE TO THE AEROSPACE INDUSTRY

3721 **AIRCRAFT**
- 37211 Complete Aircraft, Military Type
- 37212 Complete Aircraft, Personal & Utility Type
- 37213 Complete Aircraft, Commercial Transport Type
- 37214 Modifications, Conversions, Overhaul of Aircraft
- 37216 Other Aeronautical Services on Aircraft

3724 **AIRCRAFT ENGINES AND ENGINE PARTS**
- 37241 Aircraft Engines for U.S. Military Customers
- 37242 Aircraft Engines for Other than U.S. Military
- 37243 Aeronautical Services on Aircraft Engines
- 37244 Aircraft Engine Parts and Accessories

3728 **AIRCRAFT PARTS AND AUXILIARY EQUIPMENT, NEC**
- 37281 Aircraft Parts & Accessories, NEC
- 37283 Research and Development on Aircraft Parts
- 37285 Aircraft Propellers and Parts

3761 **GUIDED MISSILES AND SPACE VEHICLES**
- 37611 Missile Systems, Excluding Propulsion
- 37612 Space Vehicle Systems, Excluding Propulsion
- 37613 Research & Development on Complete Missiles
- 37614 Research & Development on Complete Space Vehicles
- 37615 All Other Services on Complete Missiles & Space Vehicles

3764 **SPACE PROPULSION UNITS AND PARTS**
- 37645 Complete Missile or Space Vehicle Engines and/or Propulsion Units
- 37646 Research and Development on Complete Missile or Space Vehicle Engines and/or Propulsion Units
- 37647 All Other Services on Complete Missile or Space Vehicle Engines and/or Propulsion Units
- 37648 Missile and Space Vehicle Engine and/or Propulsion Unit Parts and Accessories

3769 **SPACE VEHICLE EQUIPMENT, NEC**
- 37692 Missile & Space Vehicle Parts & Subassemblies, NEC
- 37694 Research & Development on Missile & Space Vehicle Parts & Components, NEC

3663 **RADIO AND TELEVISION COMMUNICATION EQUIPMENT**
- 36631 Communication Systems and Equipment, Including Space Satellite Communications Systems
- 36635 Search & Detection Systems and Navigation and Guidance Systems & Equipment
- 36639 Electronic Systems and Equipment NEC, including Electronic Trainers and Simulators

3812 **SEARCH, DETECTION, NAVIGATION, GUIDANCE, AERONAUTICAL AND NAUTICAL SYSTEMS, INSTRUMENTS AND EQUIPMENT**
- 38121 Aeronautical, Nautical, and Navigational Instrumens, except Aircraft Engine Instruments

3829 **MEASURING AND CONTROLLING DEVICES, NEC**
- 38291 Aircraft Engine Instruments except Flight

Source: U.S. Government Office of Management and Budget, *Standard Industrial Classification Manual, 1987.*
NOTE: The Standard Industrial Classification (SIC) is a system developed by the U.S. Government to define the industrial composition of the economy, facilitating comparability of statistics. It is revised periodically to reflect the changing industrial composition of the economy.
NEC: Not elsewhere classified.

AEROSPACE INDUSTRY SALES BY CUSTOMER

Calendar Years 1973-1987
(Millions of Dollars)

Year	TOTAL SALES	Aerospace Products and Services				Related Products and Services
		Total	U.S. Government		Other Customers	
			Dept. of Defense	NASA and Other Agencies		
CURRENT DOLLARS						
1973	$25,837	$22,494	$12,939	$2,459	$ 7,096	$3,343
1974	27,454	23,387	12,638	2,608	8,141	4,067
1975	29,686	24,894	13,125	2,838	8,931	4,792
1976	29,825	24,514	13,403	2,938	8,173	5,311
1977	32,199	26,095	14,368	3,012	8,715	6,104
1978	37,702	30,889	15,533	3,151	12,205	6,813
1979	45,420	37,705	18,918	3,453	15,334	7,715
1980	54,697	45,878	22,795	4,106	18,977	8,819
1981	63,974	53,090	27,244	4,709	21,137	10,884
1982	67,756	56,366	34,016	4,899	17,451	11,390
1983	79,975	66,646	41,558	5,910	19,178	13,329
1984	83,486	69,572	45,969	6,063	17,540	13,914
1985	96,571	80,476	53,178	6,262	21,036	16,095
1986[r]	106,183	88,486	59,161	6,236	23,089	17,697
1987	112,066	93,388	61,817	6,865	24,706	18,678
CONSTANT DOLLARS (Aerospace Composite Price Deflator, 1982 = 100)						
1973	$60,226	$52,434	$30,161	$5,732	$16,541	$7,792
1974	58,165	49,548	26,775	5,525	17,248	8,617
1975	56,011	46,970	24,764	5,355	16,851	9,041
1976	51,422	42,265	23,109	5,065	14,091	9,157
1977	51,850	42,021	23,137	4,850	14,034	9,829
1978	57,648	47,231	23,751	4,818	18,662	10,417
1979	62,822	52,151	26,166	4,776	21,209	10,671
1980	68,116	57,133	28,387	5,113	23,633	10,983
1981	70,768	58,728	30,137	5,209	23,382	12,040
1982	67,756	56,366	34,016	4,899	17,451	11,390
1983	76,239	63,533	39,617	5,634	18,282	12,706
1984[r]	73,491	61,243	40,466	5,337	15,440	12,248
1985[r]	85,994	71,662	47,354	5,576	18,732	14,332
1986[r]	92,173	76,811	51,355	5,413	20,043	15,362
1987	98,217	81,848	54,178	6,017	21,653	16,370

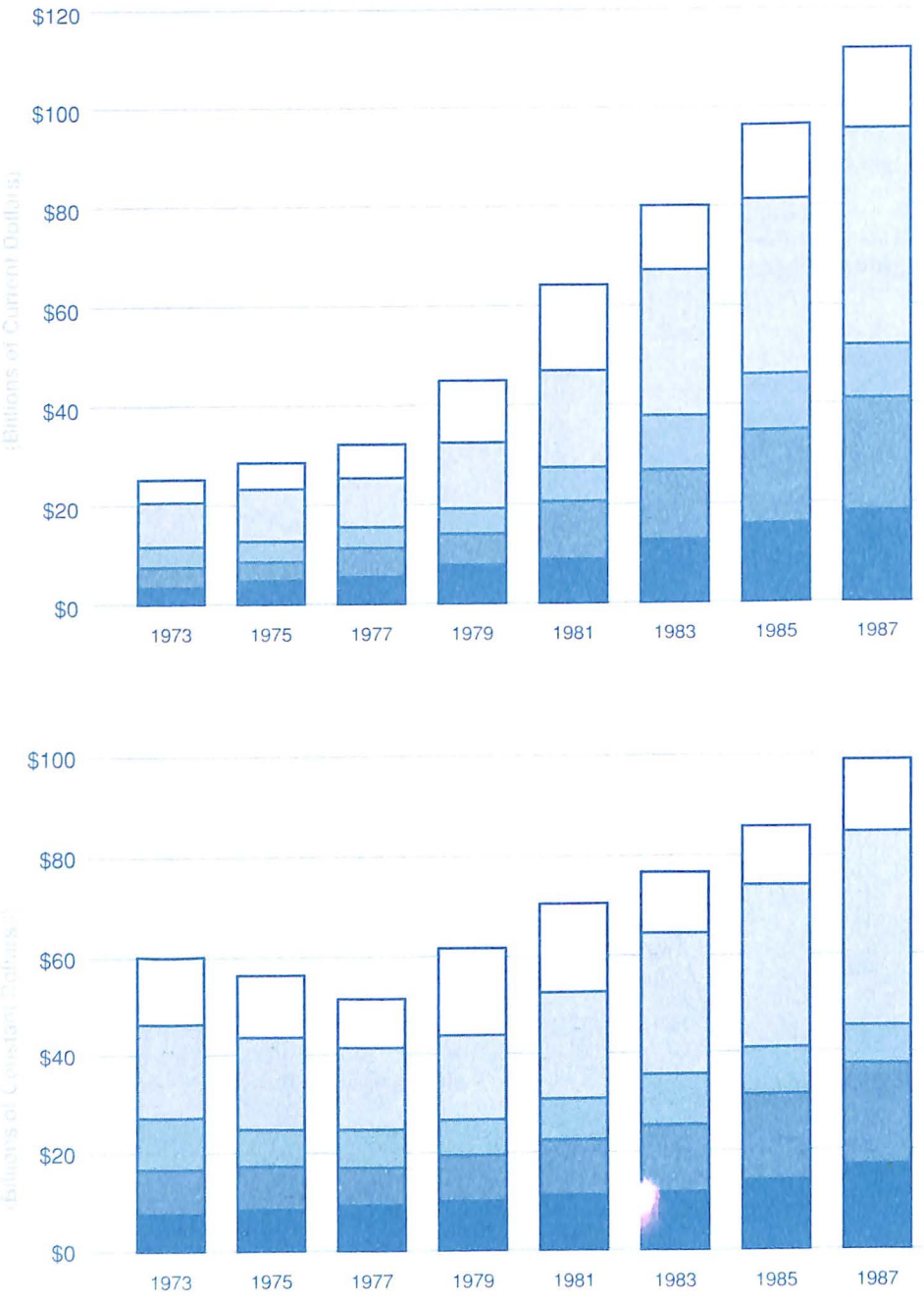
Source: Aerospace Industries Association.

NOTE: See Glossary for explanation of "Aerospace Industry," "Aerospace Sales," "Other Customers," and "Related Products and Services."

A comprehensive revision of the AIA aerospace industry sales series for 1967-1984 was completed in 1985 in order to incorporate different data sources and estimating procedures selected to better reflect the evolving composition of the aerospace industry.

r Revised.

AEROSPACE SALES BY PRODUCT



Source: Aerospace Industries Association

[2] Based on revised aerospace composite price deflator (1982 = 100)

AEROSPACE INDUSTRY SALES BY PRODUCT GROUP

Calendar Years 1973-1987
(Millions of Dollars)

Year	TOTAL SALES	Aircraft			Missiles	Space	Related Products & Services
		Total	Civil	Military			
CURRENT DOLLARS							
1973	$25,837	$14,144	$ 5,742	$ 8,402	$ 4,224	$ 4,126	$ 3,343
1974	27,454	14,867	6,320	8,547	4,108	4,412	4,067
1975	29,686	16,433	6,463	9,970	3,775	4,686	4,792
1976	29,825	16,056	6,007	10,049	3,671	4,787	5,311
1977	32,199	16,988	6,183	10,805	4,106	5,001	6,104
1978	37,702	21,074	8,222	12,852	4,098	5,717	6,813
1979	45,420	26,382	13,227	13,155	4,778	6,545	7,715
1980	54,697	31,464	16,285	15,179	6,469	7,945	8,819
1981	63,974	36,062	16,427	19,635	7,640	9,388	10,884
1982	67,756	35,484	10,982	24,502	10,368	10,514	11,390
1983	79,975	42,431	12,373	30,058	10,269	13,946	13,329
1984	83,486	41,905	10,690	31,215	11,335	16,332	13,914
1985	96,571	50,482	13,730	36,752	11,438	18,556	16,095
1986[r]	106,183	56,405	15,718	40,687	11,964	20,117	17,697
1987	112,066	60,290	15,465	44,825	10,195	22,903	18,678
CONSTANT DOLLARS (Aerospace Composite Price Deflator, 1982 = 100)							
1973	$60,226	$32,970	$13,385	$19,585	$ 9,846	$ 9,618	$ 7,792
1974	58,165	31,498	13,390	18,108	8,703	9,347	8,617
1975	56,011	31,005	12,194	18,811	7,123	8,842	9,041
1976	51,422	27,683	10,357	17,326	6,329	8,253	9,157
1977	51,850	27,356	9,957	17,399	6,612	8,053	9,829
1978	57,648	32,223	12,572	19,651	6,266	8,742	10,417
1979	62,822	36,490	18,295	18,195	6,609	9,052	10,671
1980	68,116	39,183	20,280	18,903	8,056	9,894	10,983
1981	70,768	39,891	18,171	21,720	8,451	10,385	12,040
1982	67,756	35,484	10,982	24,502	10,368	10,514	11,390
1983	76,239	40,449	11,795	28,654	9,789	13,295	12,706
1984[r]	73,491	36,888	9,410	27,478	9,978	14,377	12,248
1985[r]	85,994	44,953	12,226	32,727	10,185	16,524	14,332
1986[r]	92,173	48,963	13,644	35,319	10,385	17,463	15,362
1987	98,217	52,840	13,554	39,286	8,935	20,073	16,370

Source: Aerospace Industries Association.
NOTE: See Glossary for explanation of "Aerospace Industry," "Aerospace Sales," and "Related Products & Services." A comprehensive revision of the AIA aerospace industry sales series for 1967-1984 was completed in 1985 in order to incorporate different data sources and estimating procedures selected to better reflect the evolving composition of the aerospace industry.
r Revised.

SALES OF MAJOR AEROSPACE COMPANIES AS REPORTED BY THE BUREAU OF THE CENSUS

Calendar Years 1973-1987
(Millions of Dollars)

Year	GRAND TOTAL	TOTAL		Aircraft, Engines, & Parts		Missiles & Space Incl. Propulsion	Other Aerospace		Non-Aerospace
		U.S. Gov't.	Other	U.S. Gov't.	Other		U.S. Gov't.	Other	
CURRENT DOLLARS									
1973	$24,305	$14,431	$ 9,874	$ 5,539	$ 6,739	$ 5,580	$ 2,103	$1,001	$ 3,343
1974	26,849	15,196	11,653	5,982	7,560	5,854	2,101	1,285	4,067
1975	29,473	17,314	12,159	6,859	7,797	6,310	2,070	1,645	4,792
1976	31,328	19,083	12,245	8,314	7,622	5,880	2,368	1,833	5,311
1977	33,315	20,704	12,611	8,848	7,530	5,775	2,839	2,219	6,104
1978	37,968	21,888	16,080	8,724	10,581	6,380[a]	3,363	2,107[a]	6,813
1979	46,173	23,229	22,944	8,649	16,023	7,197	3,930	2,659	7,715
1980	58,440	26,674	31,766	9,427	20,097	8,393	6,869	2,609	11,045
1981	69,944	33,039	36,905	12,047	21,527	9,722	8,155	3,384	15,109
1982	75,487	42,239	33,248	15,120	16,766	11,980	9,909	4,953	16,759
1983	83,453	49,056	34,397	17,074	18,805	12,745	12,685	2,804	19,340
1984	88,941	55,777	33,164	20,216	17,069	13,624	12,734	2,768	22,530
1985	100,522	63,532	36,990	21,899	22,041	16,741	15,228	2,938	21,675
1986	105,577	65,326	40,251	22,755	25,002	17,535	16,243	3,564	20,478
1987	109,053	67,680	41,373	23,769	25,293	20,267	15,505	3,561	20,658
CONSTANT DOLLARS (1982 = 100)[b]									
1973	$56,655	$33,639	$23,016	$12,911	$15,709	$13,007	$ 4,902	$2,333	$ 7,793
1974	56,883	32,195	24,689	12,674	16,017	12,403	4,451	2,722	8,617
1975	55,609	32,668	22,942	12,942	14,711	11,906	3,906	3,104	9,042
1976	54,014	32,902	21,112	14,334	13,141	10,138	4,083	3,160	9,157
1977	53,647	33,340	20,308	14,248	12,126	9,300	4,572	3,573	9,829
1978	58,055	33,468	24,587	13,339	16,179	9,755	5,142	3,222	10,417
1979	63,863	32,129	31,734	11,963	22,162	9,954	5,436	3,678	10,671
1980	72,777	33,218	39,559	11,740	25,027	10,452	8,554	3,249	13,755
1981	77,372	36,548	40,824	13,326	23,813	10,754	9,021	3,743	16,713
1982	75,487	42,239	33,248	15,120	16,766	11,980	9,909	4,953	16,759
1983	79,555	46,765	32,790	16,276	17,927	12,150	12,092	2,673	18,437
1984[r]	78,293	49,099	29,194	17,796	15,026	11,993	11,209	2,437	19,833
1985[r]	89,512	56,573	32,939	19,500	19,627	14,907	13,560	2,616	19,301
1986[r]	91,647	56,707	34,940	19,753	21,703	15,221	14,100	3,094	17,776
1987	95,577	59,316	36,260	20,832	22,167	17,762	13,589	3,121	18,105

Source: Bureau of the Census, "Aerospace Industry (Orders, Sales, and Backlog)," Series MA37D (Annually).
a AIA estimate based on M37D data.
b Based on revised aerospace composite price deflator; detail may not add to totals because of rounding.
r Revised.

ORDERS AND BACKLOG OF MAJOR AEROSPACE COMPANIES AS REPORTED BY THE BUREAU OF THE CENSUS

Calendar Years 1973-1987
(Millions of Current Dollars)

Year	GRAND TOTAL	TOTAL		Aircraft, Engines, & Parts		Missiles & Space Incl. Propulsion	Other Aerospace		Non-Aerospace
		U.S. Gov't.	Other	U.S. Gov't.	Other		U.S. Gov't.	Other	
NET NEW ORDERS									
1973	$27,044	$15,804	$11,240	$ 6,327	$ 6,684	$ 5,978	$ 1,904	$1,107	$ 5,044
1974	32,704	19,390	13,314	7,956	8,612	6,827	2,208	1,872	5,229
1975	28,995	18,593	10,402	7,821	6,336	6,082	2,127	2,068	4,561
1976	35,992	21,056	14,936	9,513	8,410	5,751	2,431	3,241	6,646
1977	38,922	22,682	16,240	9,369	11,193	6,232	3,554	2,170	6,404
1978	49,819	25,992	23,827	11,150	16,961	7,072[b]	4,631	2,450[b]	7,555
1979[a]	67,561[a]	28,107	37,101	8,762	30,695	7,609	5,184	4,487	8,471
1980	69,624	33,496	36,128	16,555	18,123	9,818	8,528	4,081	12,519
1981	74,922	42,431	32,491	16,946	17,911	12,376	9,350	3,250	15,089
1982[a]	89,168[a]	58,849[a]	30,319[a]	20,547	13,591	13,988	13,643	4,762	20,369
1983	91,647	60,290	31,357	22,171	16,428	14,248	15,209	2,641	20,950
1984	104,863	66,968	37,895	25,829	21,273	16,485	14,050	3,461	23,765
1985	110,968	70,240	40,728	23,751	26,191	20,328	14,466	3,064	23,168
1986	110,836	68,001	42,835	21,642	26,315	20,445	16,439	3,907	22,088
1987	119,098	64,892	54,206	17,019	35,328	26,186	13,636	4,301	22,628
BACKLOG AS OF DECEMBER 31									
1973	$29,661	$16,695	$12,966	$ 7,815	$ 8,550	$ 5,670	$ 1,819	$1,078	$ 4,729
1974	35,516	20,889	14,627	9,789	9,602	6,643	1,926	1,665	5,891
1975	35,038	22,168	12,870	10,751	8,141	6,415	1,983	2,088	5,660
1976	39,702	24,141	15,561	11,950	8,929	6,286	2,046	3,496	6,995
1977	45,309	26,119	19,190	12,471	12,592	6,743	2,761	3,447	7,295
1978	57,160	30,223	26,937	14,897	18,972	7,557	4,029	3,668	8,037
1979[a]	78,548[a]	36,136	42,123	17,316	33,168	7,388	5,613	5,112	9,662
1980	89,732	37,199	52,533	17,435	39,800	8,941	8,421	5,127	10,008
1981	94,710	46,591	48,119	21,292	35,022	11,255	9,052	4,940	13,149
1982[a]	108,391[a]	63,201[a]	45,190[a]	26,644	31,920	13,262	13,268	4,269	16,760
1983	116,585	74,435	42,150	30,688	29,684	14,962	18,489	3,684	19,078
1984	132,507	85,626	46,881	36,312	33,877	17,823	19,684	4,498	20,313
1985	142,953	92,334	50,619	38,150	38,041	21,410	18,677	4,869	21,806
1986	148,212	95,009	53,203	37,044	39,350	24,320	19,133	4,952	23,416
1987	157,250	91,436	65,814	30,323	49,692	30,259	17,325	5,589	24,062

Source: Bureau of the Census, "Aerospace Industry (Orders, Sales, and Backlog)," Series MA37D (Annually).
a 1979 and 1982 Orders and Backlog Totals are final revisions for which product group detail is not available.
b AIA estimate based on M37D data.

AEROSPACE SALES AND THE NATIONAL ECONOMY

Calendar Years 1973-1987
(Billions of Dollars)

Year	Gross National Product[c]	Industry Sales			Aerospace Sales As Percent of		
		Manufacturing	Durable Goods	Aerospace	GNP	Manufacturing	Durable Goods
CURRENT DOLLARS							
1973	$1,359.3	$ 875.2	$ 476.2	$25.8	1.9%	2.9%	5.4%
1974	1,472.8	1,017.5	530.8	27.5	1.9	2.7	5.2
1975	1,598.4	1,039.1	523.9	29.7	1.9	2.9	5.7
1976	1,782.8	1,185.6	608.4	29.8	1.7	2.5	4.9
1977	1,990.5	1,358.4	711.2	32.2	1.6	2.4	4.5
1978	2,249.7	1,522.9	814.2	37.7	1.7	2.5	4.6
1979	2,508.2	1,727.2	912.7	45.4	1.8	2.6	5.0
1980	2,732.0	1,852.7	930.6	54.7	2.0	3.0	5.9
1981	3,052.6	2,017.5	1,006.5	64.0	2.1	3.2	6.4
1982	3,166.0	1,910.3	922.3	67.8	2.1	3.5	7.4
1983[r]	3,405.7	2,045.3	1,019.4	80.0	2.3	3.9	7.8
1984[r]	3,772.2	2,274.9	1,182.0	83.5	2.2	3.7	7.1
1985[r]	4,010.3	2,279.1	1,187.2	96.6	2.4	4.2	8.1
1986[r]	4,235.0	2,273.3	1,201.7	106.2	2.5	4.7	8.8
1987[r]	4,488.5	2,408.6	1,263.6	112.1	2.5	4.7	8.9
CONSTANT DOLLARS (1982 = 100)[a]					**Real Annual Growth[b]**		
					GNP	Mfg.	Durs.	Aero.
1973	$2,746.1	$1,768.1	$ 962.0	$60.2	5.3%	8.7%	9.6%	(2.1)%
1974	2,727.4	1,884.3	983.0	58.2	(0.7)	6.6	2.2	(3.3)
1975	2,695.4	1,752.3	883.5	56.0	(1.2)	(7.0)	(10.1)	(3.8)
1976	2,825.4	1,878.9	964.2	51.4	4.8	7.2	9.1	(8.2)
1977	2,957.7	2,018.4	1,056.8	51.9	4.7	7.4	9.6	1.0
1978	3,115.9	2,109.3	1,127.7	57.6	5.3	4.5	6.7	11.0
1979	3,191.1	2,197.5	1,161.2	62.8	2.4	4.2	3.0	9.0
1980	3,187.9	2,161.8	1,085.9	68.1	(0.1)	(1.6)	(6.5)	8.4
1981	3,247.4	2,146.3	1,070.7	70.8	1.9	(0.7)	(1.4)	4.0
1982	3,166.0	1,910.3	922.3	67.8	(2.5)	(11.0)	(13.9)	(4.2)
1983[r]	3,277.9	1,968.5	981.1	76.2	3.5	3.0	6.4	12.4
1984[r]	3,502.5	2,112.3	1,097.5	73.5	6.9	7.3	11.9	(3.5)
1985[r]	3,606.4	2,049.6	1,067.6	86.0	3.0	(3.0)	(2.7)	17.0
1986[r]	3,711.7	1,992.4	1,053.2	92.2	2.9	(2.8)	(1.3)	7.2
1987	3,820.0	2,049.9	1,075.4	98.2	2.9	2.9	2.1	6.5

Source: Gross National Product and GNP Implicit Price Deflator: "Economic Report of the President" (Annually) and "Survey of Current Business" (Monthly). Sales of Manufacturing and Durable Goods Industries: "Survey of Current Business" (Monthly). Aerospace Sales: Aerospace Industries Association.

NOTE: See Glossary for explanation of "Aerospace Sales."

a Based on aerospace composite price deflator for aerospace industry sales, and GNP implicit price deflator for other series.

b Parentheses indicate negative real annual growth.

c Calendar year GNP figures have been changed to reflect revisions to the National Income and Product Accounts (NIPA).

r Revised.

GROSS NATIONAL PRODUCT, FEDERAL BUDGET AND DEFENSE BUDGET

Fiscal Years 1954-1989
(Billions of Dollars)

Year	Fiscal Year GNP[r]	Federal Budget Outlays		Defense Outlays as Percent of	
		Net Total[a]	Defense[b]	GNP	Federal Budget
1954	$ 369.5	$ 70.9	$ 49.3	13.3%	69.5%
1955	386.4	68.4	42.7	11.1	62.4
1956	418.1	70.6	42.5	10.2	60.2
1957	440.5	76.6	45.4	10.3	59.3
1958	450.2	82.4	46.8	10.4	56.8
1959	481.5	92.1	49.0	10.2	53.2
1960	506.7	92.2	48.1	9.5	52.2
1961	518.2	97.7	49.6	9.6	50.8
1962	557.7	106.8	52.3	9.4	49.0
1963	587.8	111.3	53.4	9.1	48.0
1964	629.2	118.5	54.8	8.7	46.2
1965	672.6	118.2	50.6	7.5	42.8
1966	739.0	134.5	58.1	7.9	43.2
1967	794.6	157.5	71.4	9.0	45.3
1968	849.4	178.1	81.9	9.6	46.0
1969	929.5	183.6	82.5	8.9	44.9
1970	990.2	195.6	81.7	8.3	41.8
1971	1,055.9	210.2	78.9	7.5	37.5
1972	1,153.1	230.7	79.2	6.9	34.3
1973	1,281.4	245.7	76.7	6.0	31.2
1974	1,416.5	269.4	79.3	5.6	29.4
1975	1,522.5	332.3	86.5	5.7	26.0
1976	1,698.2	371.8	89.6	5.3	24.1
1977	1,933.0	409.2	97.2	5.0	23.8
1978	2,171.8	458.7	104.5	4.8	22.8
1979	2,447.8	503.5	116.3	4.7	23.1
1980	2,670.6	590.9	134.0	5.0	22.7
1981	2,986.4	678.2	157.5	5.3	23.2
1982	3,139.1	745.7	185.3	5.9	24.8
1983	3,321.9	808.3	209.9	6.3	26.0
1984	3,687.6	851.8	227.4	6.2	26.7
1985	3,943.6	946.3	252.7	6.4	26.7
1986	4,192.4	990.3	273.4	6.5	27.6
1987	4,408.7	1,004.6	282.0	6.4	28.1
1988[E]	4,705.8	1,055.9	285.4	6.1	27.0
1989[E]	5,023.3	1,094.2	294.0	5.9	26.9

Source: "The Budget of the United States Government" (Annually) and Office of Management and Budget, "Federal Government Finances, 1985 Budget Data."

a "Net Total" is government-wide total less intragovernmental transactions.

b "Defense" includes the military budget of DOD and other defense-related activities. Beginning in FY 1985, the Federal Budget reflects establishment of a military retirement trust fund. Defense budget data for prior years adjusted for comparable treatment of military retired pay.

E Estimate.

r Revised.

FEDERAL OUTLAYS
DEFENSE, NASA AND AEROSPACE PRODUCTS AND SERVICES

Fiscal Years 1961-1989
(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[a]	NASA	
1961	$ 49,601	$ 744	$ 9,516	$ 8,870	$ 646	18.9%
1962	52,345	1,257	11,244	10,101	1,143	21.0
1963	53,400	2,552	12,453	10,126	2,327	22.3
1964	54,757	4,171	13,363	9,630	3,733	22.7
1965	50,620	5,093	11,858	7,296	4,561	21.3
1966	58,111	5,933	14,064	8,704	5,360	22.0
1967	71,417	5,426	15,478	10,341	5,137	20.1
1968	81,926	4,724	16,279	11,681	4,598	18.8
1969	82,497	4,251	15,871	11,686	4,185	18.3
1970	81,692	3,753	14,559	10,860	3,699	17.0
1971	78,872	3,382	13,109	9,771	3,338	15.9
1972	79,174	3,422	12,308	8,936	3,372	14.9
1973	76,681	3,315	11,359	8,089	3,270	14.2
1974	79,347	3,256	11,168	7,987	3,181	13.5
1975	86,509	3,266	11,554	8,373	3,181	12.9
1976	89,619	3,669	12,364	8,816	3,548	13.3
Tr. Qtr.	22,269	952	2,855	1,959	926	12.3
1977	97,241	3,945	13,229	9,389	3,840	13.1
1978	104,495	3,983	13,926	10,067	3,859	12.8
1979	116,342	4,196	16,686	12,622	4,064	13.8
1980	133,995	4,852	20,270	15,558	4,712	14.6
1981	157,513	5,426	24,280	19,002	5,278	14.9
1982	185,309	6,035	29,501	23,575	5,926	15.4
1983	209,903	6,664	35,364	28,808	6,556	16.3
1984	227,413	7,048	39,662	32,723	6,939	16.9
1985	252,748	7,251	44,416	37,335	7,081	17.1
1986	273,375	7,403	49,773	42,558	7,215	17.7
1987	281,999	7,591	50,561	43,119	7,442	17.5
1988[E]	285,423	9,112	48,362	39,404	8,958	16.4
1989[E]	294,020	10,978	54,969	44,1	10,805	18.0

Source: "The Budget of the United States Government" (Annually).
NOTE: "National Defense" includes the military budget of the Department of Defense and other defense-related activities. "TOTAL NASA" includes all categories of the NASA budget. NASA construction not included in "Aerospace Products and Services." See additional explanation with following table.

a Outlays for aircraft and missile procurement. Does not include RDT&E, which DOD has not reported by product group since 1977, and which, for comparability, has been subtracted from data previously reported in this table for earlier years. Also included are revisions to missile procurement data.

E Estimate. Latest year reflects Administration's budget proposal.

FEDERAL OUTLAYS FOR AEROSPACE PRODUCTS AND SERVICES

Fiscal Years 1961-1989
(Millions of Dollars)

Year	TOTAL	Department of Defense[a]			NASA[b]
		TOTAL	Aircraft	Missiles[c]	
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	12,308	8,936	5,927	3,009	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	13,926	10,067	6,971	3,096	3,859
1979	16,686	12,622	8,836	3,786	4,064
1980	20,270	15,558	11,124	4,434	4,712
1981	24,280	19,002	13,193	5,809	5,278
1982	29,501	23,575	16,793	6,782	5,926
1983	35,364	28,808	21,013	7,795	6,556
1984	39,662	32,723	23,196	9,527	6,939
1985	44,416	37,335	26,586	10,749	7,081
1986	49,773	42,558	30,828	11,730	7,215
1987	50,561	43,119	29,065	14,054	7,442
1988[E]	48,362	39,404	25,066	14,338	8,958
1989[E]	54,969	44,164	28,402	15,762	10,805

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

a Outlays for aircraft and missile procurement. Does not include RDT&E, which DOD has not reported by product group since 1977, and which, for comparability, has been subtracted from data previously reported in this table for earlier years.

b Includes Research & Development, and Research & Program Management, and, effective with 1984 data, Space Flight, Control and Data Communications; excludes Construction of Facilities.

c 1978 and subsequent years revised by AIA from previously published data to include Navy Weapons Procurement in Missiles Procurement. Beginning 1978, DOD combined Navy Missile Procurement with torpedoes and other related products into Navy Weapons Procurement, of which missiles comprise approximately 80 percent.

E Estimate. Latest year reflects Administration's budget proposal.

DEPARTMENT OF DEFENSE
TOTAL MILITARY OUTLAYS BY FUNCTIONAL TITLE[a]

Fiscal Years 1980-1989
(Millions of Dollars)

	1980	1981	1982
TOTAL[d]	$130,894[r]	$153,847[r]	$180,694[r]
Procurement—TOTAL	$29,021	$35,191	$43,271
Aircraft	11,124	13,193	16,793
Missiles[b]	4,434	5,809	6,782
Ships	4,222	5,218	6,739
Weapons[b]	1,249	1,848	2,144
Ammo	1,271	1,368	1,647
Communications & Electronics[c]	1,976	2,399	2,733
Other	4,745	5,355	6,433
Military Personnel—TOTAL	40,897	47,941	55,170
Active Forces	28,465	33,378	38,522
Reserve Forces	2,376	3,031	3,818
Retired Pay	11,920	13,729	14,938
Adjustment: Retirement Trust Fund Accrual[d]	(1,864)	(2,197)	(2,109)
Research, Development, Test, & Evaluation	13,127	15,278	17,729
Operations & Maintenance	44,770	51,864	59,674
Military Construction	2,450	2,458	2,922
Family Housing	1,680	1,721	1,993
Other	(1050)[r]	(605)[r]	(65)[r]

Source: Department of Defense Budget (Annually) and "Status of Funds" (Annual Summaries).
NOTE: Data in parentheses are credit items. Detail may not add to totals because of rounding.

a Includes all items in the DOD military budget; excludes the DOD civil budget for the Army Corps of Engineers and other non-defense-related activities.
b Beginning in 1978, DOD combined Navy Missiles Procurement with torpedoes and other related products into Navy Weapons Procurement. Missiles comprise approximately 80 percent of the value of this category.
c Not available as separate item after 1982; included in Other Procurement.
d Beginning in FY1985, the Federal Budget reflects establishment of a military retirement trust fund. Data for previous years have been adjusted on a comparable basis.
E Estimate. Latest year reflects Administration's budget proposal.
r Revised.

DEPARTMENT OF DEFENSE
MILITARY OUTLAYS BY FUNCTIONAL TITLE[a] (Continued)

Fiscal Years 1980-1989
(Millions of Dollars)

1983	1984	1985	1986	1987	1988[E]	1989[E]
$204,393[r]	$220,909[r]	$245,130[r]	$265,452[r]	$274,008	$277,275[E]	$285,500[E]
$ 53,624	$ 61,879	$70,381	$76,517	$80,744	$79,166	$79,820
21,013	23,196	26,586	30,828	32,956	29,639	27,989
7,795	9,527	10,749	11,730	11,473	12,343	13,897
7,504	8,487	9,145	9,501	9,316	9,343	10,066
3,420	3,691	3,801	4,343	4,962	4,104	4,203
1,966	1,826	2,080	1,933	2,111	1,859	2,130
} 11,926	} 15,152	} 18,020	} 18,182	} 19,926	} 21,878	} 21,535
60,886	64,158	67,842	71,511	72,020	75,453	77,827
41,015	42,732	60,344	63,139	63,810	66,753	68,837
4,508	4,923	7,498	8,373	8,210	8,700	8,990
15,945	16,503	(*d*)	(*d*)	(*d*)	(*d*)	(*d*)
(583)	(2)	—	—	—	—	—
20,554	23,117	27,103	32,283	33,596	33,127	36,295
64,915	67,369	72,348	75,259	76,178	80,433	82,725
3,524	3,706	4,260	5,067	5,853	5,419	5,668
2,126	2,413	2,642	2,819	2,908	3,022	3,229
(1,236)[r]	(1,732)[r]	553[r]	1,995[r]	2,709	655	(63)

FEDERAL PRICE DEFLATORS FOR GNP, DEFENSE, PPI and CPI

1961-1989

Year	GNP		Federal Gov't Defense Purchases		PPI Capital Equip. (CY 1982 = 100)	CPI (Urban) All Items (CY 1982 = 100)
	FY GNP (FY 1982 = 100)	CY GNP (CY 1982 = 100)	Durables (FY 1982 = 100)	Goods & Services (CY 1982 = 100)		
1961	31.44	31.2	32.96		32.8	31.0
1962	32.00	31.9	33.54		33.0	31.3
1963	32.58	32.4	34.65		33.1	31.7
1964	33.05	32.9	34.67		33.4	32.1
1965	33.76	33.8	35.24		33.8	32.7
				NA		
1966	34.74	35.0	36.12		34.6	33.6
1967	35.93	35.9	37.67		35.8	34.6
1968	37.19	37.7	39.07		37.0	36.0
1969	39.20	39.8	40.50		38.3	38.0
1970	41.48	42.0	42.26		40.1	40.2
1971	43.66	44.4	44.54		41.7	42.0
1972	46.06	46.5	46.58	41.8	42.8	43.3
1973	48.35	49.5	48.71	45.3	44.2	46.0
1974	52.16	54.0	51.32	50.6	50.5	51.1
1975	57.52	59.3	56.34	55.6	58.2	55.8
1976	62.08	63.1	59.80	59.3	62.1	59.0
1977	67.03	67.3	63.89	63.4	66.1	62.8
1978	71.72	72.2	67.66	67.8	71.3	67.6
1979	77.90	78.6	73.86	74.2	77.5	75.2
1980	84.74	85.7	82.02	83.4	85.8	85.4
1981	93.22	94.0	91.36	92.9	94.6	94.2
1982	100.00	100.0	100.00	100.0	100.0	100.0
1983*r*	104.23	103.9	104.04	103.6	102.8	103.2
1984*r*	108.19	107.7	107.94	107.2	105.2	107.6
1985*r*	111.69	111.2	108.48	109.5	107.6	111.4
1986	114.86	114.1	110.09	110.8	110.0	113.6
1987*p*	117.98	117.5	106.58	111.7	111.7	117.7
1988*E*	122.35	121.5	110.53	NA	NA	NA
1989*E*	127.00	126.1	114.73	NA	NA	NA

Source: GNP and Defense Purchases from U.S. Department of Commerce, Bureau of Economic Analysis; PPI-Capital Equipment Deflator and CPI Deflator from U.S. Department of Labor, Bureau of Labor Statistics, 1967 = 100, converted to 1982 base year by AIA. Estimates from Economic Assumptions of the Budget of the United States Government (latest year).

p Preliminary.
E Estimate.
r Revised.
NA Not Available
Key: CY = Calendar Year.
FY = Fiscal Year.
GNP = Gross National Product.
PPI = Producer Price Index for Capital Equipment.
CPI = Consumer Price Index (for all items), for All Urban Consumers for 1978 and subsequent years, and for All Urban Wage Earners for prior years.

FEDERAL PRICE DEFLATORS FOR AEROSPACE INDUSTRY[r]

Calendar Years 1964-1988

Year	Aerospace Deflators (CY 1982 = 100)[a]						
	Composite	SIC 3721	SIC 3724	SIC 3728	SIC 3761	SIC 3764	SIC 3769
1964	29.8	30.7	27.5	31.3	30.1	27.2	27.4
1965	30.3	31.4	27.8	31.9	30.5	27.4	28.3
1966	31.2	35.7	28.5	32.8	31.9	28.1	29.2
1967	32.3	33.1	29.3	33.6	33.4	29.0	30.1
1968	33.3	34.2	29.9	34.5	34.8	29.5	31.0
1969	34.6	35.6	31.3	35.6	36.1	30.9	32.4
1970	36.6	37.7	32.9	37.4	38.1	32.5	34.2
1971	38.0	39.3	34.2	38.8	39.7	33.7	35.7
1972	38.4	44.5	35.3	43.4	42.5	35.4	38.1
1973	42.9	45.9	36.3	45.2	42.2	36.6	39.5
1974	47.2	49.9	41.0	52.2	44.5	41.7	44.0
1975	53.0	53.8	49.6	61.2	48.4	50.6	52.2
1976	58.0	58.8	53.9	67.0	53.9	55.4	56.7
1977	62.1	62.6	57.6	69.6	59.5	59.9	61.4
1978	65.4	66.1	64.1	65.5	65.0	65.4	66.1
1979	72.3	72.8	71.5	69.9	74.6	72.0	72.7
1980	80.3	81.2	77.8	77.4	84.4	80.8	80.9
1981	90.4	90.0	90.4	88.8	93.2	92.1	89.5
1982	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1983	104.9	105.2	105.0	104.2	105.5	104.4	102.8
1984[r]	113.6	118.0	115.1	111.0	107.8	105.9	110.8
1985[r]	112.3	112.2	116.4	112.0	109.6	106.2	116.5
1986	115.2	118.5	116.5	116.1	108.6	107.6	116.9
1987[p]	114.1	109.2	117.3	118.5	116.0	109.3	125.2
1988[E]	118.2	113.5	121.9	122.5	119.5	112.6	128.9

Source: U.S. Department of Commerce, Bureau of Economic Analysis and International Trade Administration.

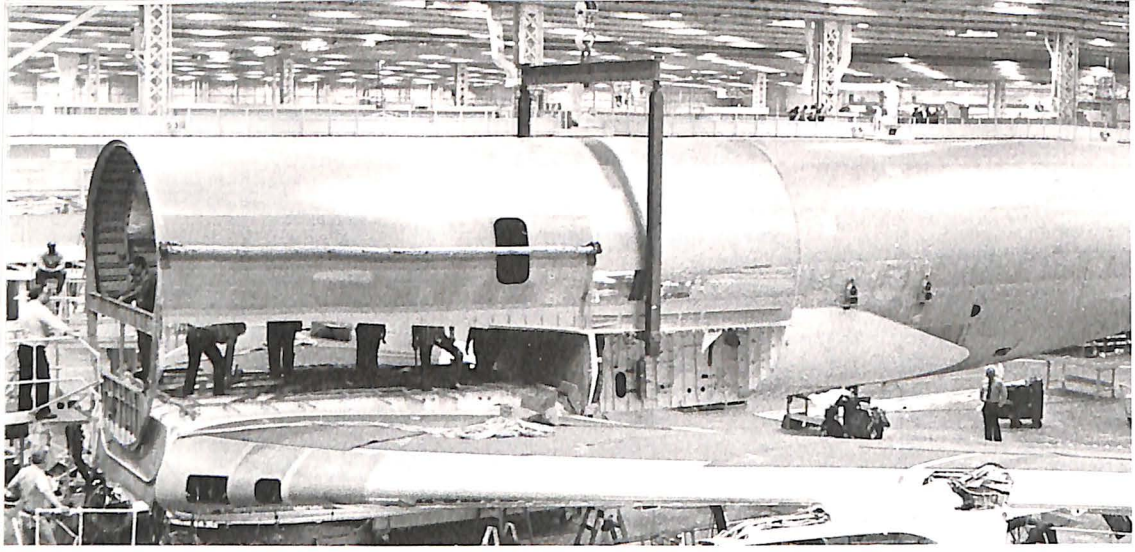
a Reported by Dept. of Commerce with 1982 base year; years prior to 1972 converted to 1982 base year for comparability.

p Preliminary

r Revised.

E Estimate.

Key: SIC = Standard Industrial Classification. SIC 3721 = Aircraft; SIC 3724 = Aircraft Engines and Engine Parts; SIC 3728 = Aircraft Parts; SIC 3761 = Missiles and Space Vehicles; SIC 3764 = Space Propulsion; SIC 3769 = Space Equipment not elsewhere classified. Aerospace Composite aggregated by weighting individual SIC categories according to constant dollar value of industry shipments.



Aircraft Production

High levels of civil transport sales coupled with moderate gains in general aviation and military aircraft combined to elevate 1987 aircraft sales to a record level.

Total sales of aircraft, engines and parts amounted to $49.1 billion, up from $47.8 billion in the previous year. In inflation-adjusted constant dollar terms, the gain represented an increase of more than 3½ percent.

Numerically, U.S. aircraft production continued to decline. The industry produced 2,999 aircraft of all types, 1,800 of them civil aircraft and 1,199 military. The comparable figures for 1986 were 3,258 total, 2,151 civil, 1,107 military. The decline in numbers was due to another drop—the ninth consecutive—in production of general aviation planes.

Net new orders for aircraft—$52.3 billion in 1987—were the highest ever recorded in a single year, despite continuing decline in orders from the U.S. government. Reflecting the low growth or negative growth federal budgets of recent years, government orders—mostly for military aircraft—fell to $17 billion in 1987, down from $21.6 billion in 1986 and the third consecutive drop. This downward trend in new military aircraft orders, reinforced by negative growth defense budgets in Fiscal Years 1988-89, was expected to continue into the 1990s.

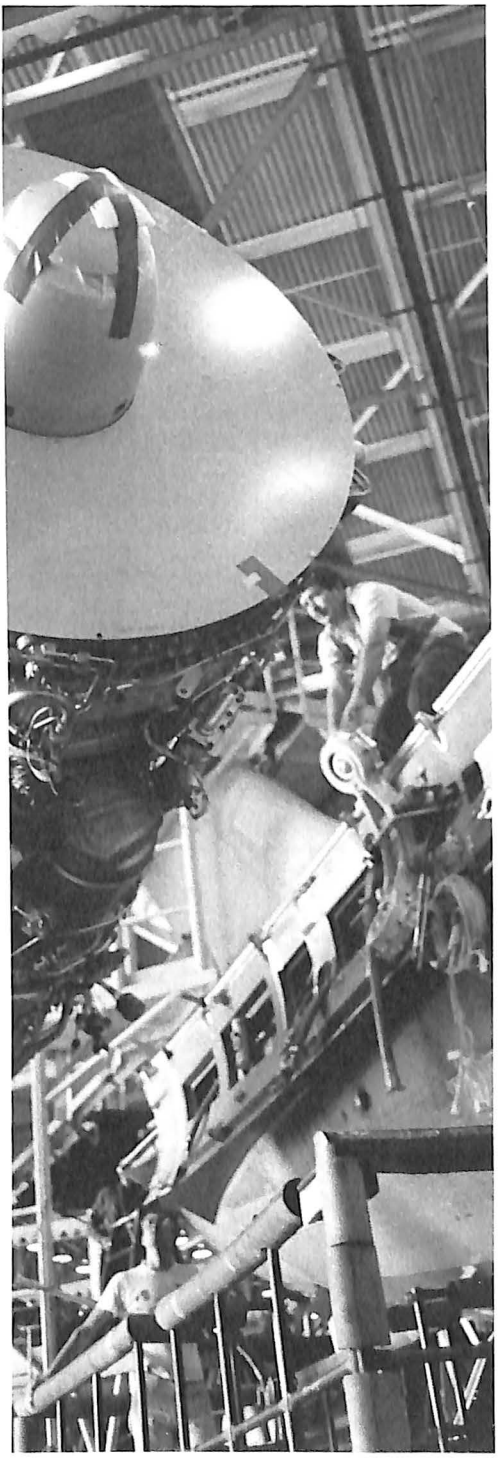
The backlog of orders for new aircraft, engines and parts climbed to a new record level of $80 billion at yearend 1987 due to a big surge of non-government orders, for the most part orders for civil transports. The composition of the backlog was $30.3 billion in government orders and $49.7 billion in non-government orders.

Among other 1987 aircraft production highlights:

- Sales of commercial transports, at $10.5 billion, topped the record level of the previous year ($10.3 billion). In terms of numbers, the industry delivered 357 transports, up from 330 in 1987. The yearend backlog for civil transports reached $32.4 billion for 824 aircraft. Some $20.2 billion (418 aircraft) was in orders from foreign customers, promising continuing high levels of exports into the 1990s.
- Although general aviation production dropped numerically from 1,495 planes in 1986 to 1,085 units in 1987, the overall dollar value increased to $1.4 billion, up from $1.3 billion

in 1986. This upturn followed two years of decline.

- Production of civil helicopters increased numerically (358 units, compared with 326 in the previous year) but dipped in dollar value, from $287 million to $277 million.
- Although it is not indicative of a new trend, deliveries of military aircraft in 1987 rebounded to the highest level in more than a decade. Deliveries to the U.S. military services totaled 714 units, up from 708 in 1986. Exports of military aircraft also increased to 485 units from 1986's 399. The latter gain was entirely in direct exports (sales by U.S. manufacturers to foreign governments), which rose to 352 aircraft from the previous year's 289. Aircraft shipped abroad under Foreign Military Sales programs totaled 133 in 1987, up from 110 in 1986.
- Department of Defense outlays for aircraft procurement in Fiscal Year 1987 reached a highwater mark of $33 billion (USAF $20 billion, Navy $9.7 billion, Army $3.3 billion). Estimates for FY 1988 were: total $29.7 billion, USAF $17.2 billion, Navy $9.7 billion, Army $2.8 billion. Procurement will decline further in FY 1989 to a total of $28 billion (USAF $16.1 billion, Navy $9.1 billion, Army $2.8 billion). □



SALES OF AIRCRAFT, ENGINES, AND PARTS

Calendar Years 1973-1987
(Millions of Dollars)

Year	GRAND TOTAL	TOTAL		Complete Aircraft & Parts		Aircraft Engines & Parts	
		U.S. Gov't.	Other	U.S. Gov't.	Other	U.S. Gov't.	Other
CURRENT DOLLARS							
1973	$12,278	$ 5,539	$ 6,739	$ 4,231	$ 5,322	$1,308	$1,417
1974	13,542	5,982	7,560	4,562	5,846	1,420	1,714
1975	14,656	6,859	7,797	5,269	6,001	1,590	1,796
1976	15,936	8,314	7,622	6,336	5,900	1,978	1,722
1977	16,378	8,848	7,530	6,855	5,670	1,993	1,860
1978	19,305	8,724	10,581	6,853	7,873	1,871	2,708
1979	24,672	8,649	16,023	6,378	12,701	2,271	3,322
1980	29,524	9,427	20,097	6,724	15,901	2,703	4,196
1981	33,574	12,047	21,527	8,197	16,877	3,850	4,650
1982	31,886	15,120	16,766	10,903	12,316	4,217	4,450
1983	35,879	17,074	18,805	12,898	14,419	4,176	4,386
1984	37,285	20,216	17,069	15,136	13,121	5,080	3,948
1985	43,940	21,899	22,041	17,783	16,466	4,116	5,575
1986	47,757	22,755	25,002	18,788	19,177	3,967	5,825
1987	49,062	23,769	25,293	18,131	18,899	5,638	6,394
CONSTANT DOLLARS (1982 = 100)[a]							
1973	$28,620	$12,911	$15,709	$ 9,862	$12,406	$3,049	$3,303
1974	28,691	12,674	16,017	9,665	12,386	3,008	3,631
1975	27,653	12,942	14,711	9,942	11,323	3,000	3,389
1976	27,476	14,334	13,141	10,924	10,172	3,410	2,969
1977	26,374	14,248	12,126	11,039	9,130	3,209	2,995
1978	29,518	13,339	16,179	10,479	12,038	2,861	4,141
1979	34,124	11,963	22,162	8,822	17,567	3,141	4,595
1980	36,767	11,740	25,027	8,374	19,802	3,366	5,225
1981	37,139	13,326	23,813	9,067	18,669	4,259	5,144
1982	31,886	15,120	16,766	10,903	12,316	4,217	4,450
1983	34,203	16,276	17,927	12,296	13,745	3,981	4,181
1984[r]	32,821	17,796	15,026	13,324	11,550	4,472	3,475
1985[r]	39,127	19,500	19,627	15,835	14,663	3,665	4,964
1986[r]	41,456	19,753	21,703	16,309	16,647	3,444	5,056
1987	42,999	20,832	22,167	15,890	6,564	4,941	5,604

Source: Bureau of the Census, "Aerospace Industry (Orders, Sales, and Backlog)," Series MA37D (Annually).
a Based on revised aerospace composite price deflator; detail may not add to totals because of rounding.
r Revised.

ORDERS AND BACKLOG OF AIRCRAFT, ENGINES, AND PARTS

Calendar Years, 1973-1987
(Millions of Current Dollars)

Year	GRAND TOTAL	TOTAL		Complete Aircraft & Parts		Aircraft Engines & Parts	
		U.S. Gov't.	Other	U.S. Gov't.	Other	U.S. Gov't.	Other
NET NEW ORDERS							
1973	$13,011	$ 6,327	$ 6,684	$ 4,838	$ 5,199	$1,489	$1,485
1974	16,568	7,956	8,612	5,948	6,467[a]	2,008	2,145[a]
1975	14,157	7,821	6,336	6,314	4,758[a]	1,507	1,578[a]
1976	17,923	9,513	8,410	7,498	6,316[a]	2,015	2,094[a]
1977	20,562	9,369	11,193	6,507	8,406	2,862	2,787
1978	28,111	11,150	16,961	9,055	14,229	2,095	2,732
1979	39,457	8,762	30,695	8,762	25,084[a]	2,348	5,611[a]
1980	34,678	16,555	18,123	11,606	14,427	4,949	3,696
1981	34,857	16,946	17,911	11,760	12,621	5,186	5,290
1982	34,138	20,547	13,591	15,978	10,540	4,569	3,051
1983	38,599	22,171	16,428	17,402	11,688	4,769	4,740
1984	47,240	25,829	21,411	19,228	18,286	6,601	3,125
1985	49,942	23,751	26,191	20,062	20,153	3,689	6,038
1986	47,957	21,642	26,315	17,361	20,083	4,281	6,232
1987	52,347	17,019	35,328	12,742	26,411	4,277	8,917
BACKLOG AS OF DECEMBER 31							
1973	$16,365	$ 7,815	$ 8,550	$ 6,312	$ 7,232	$1,503	$1,318
1974	19,391	9,789	9,602	7,698	7,791	2,091	1,811
1975	18,892	10,751	8,141	8,743	6,646	2,008	1,495
1976	20,879	11,950	8,929	9,905	7,416	2,045	1,513
1977	25,063	12,471	12,592	9,557	10,152	2,914	2,440
1978	33,869	14,897	18,972	11,759	16,508	3,138	2,464
1979	50,484	17,316	33,168	13,331	27,955	3,985	5,213
1980	57,235	17,435	39,800	12,702	33,258	4,733	6,542
1981	56,314	21,292	35,022	15,626	27,683	5,666	7,339
1982	58,564	26,644	31,920	20,626	25,980	6,018	5,940
1983	60,372	30,688	29,684	24,091	23,377	6,597	6,307
1984	70,327	36,312	34,015	28,183	28,542	8,129	5,473
1985	76,191	38,150	38,041	30,462	32,091	7,688	5,950
1986	76,391	37,041	39,350	29,035	32,997	8,006	6,353
1987	80,015	30,323	49,692	23,645	40,849	6,678	8,843

Source: Bureau of the Census, "Aerospace Industry (Orders, Sales, and Backlog)," Series MA37D (Annually).
a AIA estimate, based on MQ37D data.

U.S. AIRCRAFT PRODUCTION—CIVIL

Calendar Years 1969-1987

Year	TOTAL	Domestic Shipments			Export Shipments		
		Trans-ports[a]	Heli-copters	General Aviation	Trans-ports	Heli-copters	General Aviation
1969	13,505	332	282	9,996	182	252	2,461
1970	8,076	127	150	5,246	184	332	2,037
1971	8,158	50	171	5,900	173	298	1,566
1972	10,576	79	319	7,702	148	256	2,072
1973	14,709	143	342	10,482	151	428	3,163
1974	15,326	91	433	9,903	241	395	4,263
1975	15,251	127	528	10,804	188	336	3,268
1976	16,429	64	442	12,232	158	315	3,218
1977	17,913	54	527	13,441	101	321	3,469
1978	18,962	130	536	14,346	111	368	3,471
1979	18,460	176	570	13,177	200	459	3,878
1980	13,634	150	841	8,703	237	525	3,178
1981	10,916	132	619	6,840	255	453	2,617
1982	5,085	111	333	3,326	121	254	940
1983	3,356	133	187	2,172	129	216	519
1984	2,999	102	143	2,013	83	233	425
1985	2,683	126	239	1,545	152	137	484
1986	2,151	171	116	1,031	159	210	464
1987	1,800	187	77	576	170	281	509

Source: Civil shipments data from company reports to AIA and General Aviation Manufacturers Association. Export data from Dept. of Commerce (Bureau of Census) Report FT410.

a Prior to 1976, includes the C-130 military transport.

U.S. AIRCRAFT PRODUCTION—MILITARY

Calendar Years 1969-1987

Year	MILITARY AIRCRAFT				
	TOTAL	U.S. Military Agencies	Exports		
			Total	FMS[a]	Direct[b]
1969	4,290	3,644	646	NA	NA
1970	3,720	3,085	635	NA	NA
1971	2,914	2,232	682	NA	NA
1972	2,530	1,993	537	124	413
1973	1,821	1,243	578	129	449
1974	1,513	799	714	365	349
1975	1,779	844	935	525	410
1976	1,318	625	693	518	175
1977	1,134	454	680	408	272
1978	996	467	529	256	273
1979	837	531	306	203	103
1980	1,047	625	422	194	228
1981	1,062	703	359	215	144
1982	1,159	690	469	68	401
1983	1,053	766	287	70	217
1984[r]	936	561	375	71	304
1985	919	643	276	134	142
1986[r]	1,107	708	399	110	289
1987	1,199	714	485	133	352

Source: Military acceptances for use of U.S. military agencies and for reimbursable programs reported by USAF, USN and Army. Export data from Dept. of Commerce (Bureau of the Census) Report FT 410.

a Also includes acceptances of NATO AWACS aircraft.

b Military aircraft exported via commercial contracts, directly from manufacturers to foreign governments.

r Revised.

NA Not available.

CIVIL AIRCRAFT SHIPMENTS

Calendar Years 1973-1987

Year	TOTAL	Transport Aircraft[a]	Helicopters	General Aviation
NUMBER OF AIRCRAFT SHIPPED				
1973	14,709	294	770	13,645
1974	15,326	332	828	14,166
1975	15,251	315	864	14,072
1976	16,429	222	757	15,450
1977	17,913	155	848	16,910
1978	18,962	241	904	17,817
1979	18,460	376	1,029	17,055
1980	13,634	387	1,366	11,881
1981	10,916	387	1,072	9,457
1982	5,085	232	587	4,266
1983	3,356	262	403	2,691[b]
1984	2,999	185	376	2,438
1985	2,683	278	376	2,029
1986	2,151	330	326	1,495
1987	1,800	357	358	1,085
VALUE—Millions of Dollars				
1973	$ 4,665	$3,718	$ 121	$ 826
1974	5,091	3,993	189	909
1975	5,086	3,779	274	1,033
1976	4,592	3,078	285	1,229
1977	4,451	2,649	251	1,551
1978	6,458	4,308	328	1,822
1979	10,644	8,030	403	2,211
1980	13,058	9,895	656	2,507
1981	13,223	9,706	597	2,920
1982	8,610	6,246	365	1,999
1983	9,773	8,000	303	1,470[b]
1984	7,717	5,689	330	1,698
1985	10,384	8,448	505	1,431
1986	11,857	10,308	287	1,262
1987	12,148	10,507	277	1,364

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

a U.S.-manufactured fixed-wing aircraft over 33,000 pounds e ty weight, including all jet transports plus the four-engine turboprop-powered Lockheed L-100.

b Includes 3 off-the-shelf Gulfstream G-III's delivered to the U S Air Force for C-20 VIP transports.

r Revised.

CIVIL TRANSPORT AIRCRAFT BACKLOG[a]

As of December 31, 1983-1987

Company and Model	1983	1984	1985	1986	1987
TOTAL AIRCRAFT ON ORDER					
(Domestic and Foreign Orders)	352	489	662	660	824
Value (Millions of Dollars)	$12,591	$16,588	$19,519	$22,264	$32,401
Boeing—TOTAL	273	345	472	451	573
B-727	8	—	—	—	—
B-737	93	170	304	269	342
B-747	22	38	51	84	120
B-757	58	62	77	63	67
B-767	92	75	40	35	44
Lockheed—TOTAL	1	2	2	—	2
L-1011	1	2	—	—	—
L-100	—	—	2	—	2
McDonnell Douglas—TOTAL	78	142	188	209	249
MD-11	—	—	—	—	29
MD-80	78	137	180	203	213
DC-10	—	5	8	6	7
TOTAL FOREIGN ORDERS	139	167	252	293	418
Value (Millions of Dollars)	$ 5,420	$6,941	$7,929	$12,467	$20,196
Boeing—TOTAL	100	120	158	192	420
B-737	29	45	98	93	137
B-747	18	38	38	68	95
B-757	16	7	8	9	28
B-767	37	30	16	22	33
Lockheed—TOTAL	1	2	2	—	2
L-1011	1	2	—	—	—
L-100	—	—	2	—	2
McDonnell Douglas—TOTAL	38	45	90	101	125
MD-11	—	—	—	—	27
MD-80	38	45	90	99	95
DC-10	—	—	—	2	3

Source: Aerospace Industries Association, company reports.

a Unfilled firm orders on the books, excluding options, and new aircraft contracted for lease from manufacturer to customer, for U.S. manufactured transport aircraft over 33,000 lbs. including all jet transports plus the turboprop-powered Lockheed L-100.

SHIPMENTS OF CIVIL TRANSPORT AIRCRAFT[a]

Calendar Years 1983-1987

Company and Model	1983	1984	1985	1986	1987
TOTAL					
Number of Aircraft Shipped	262	185	278	330	357
Value (Millions of Dollars)	$8,000	$5,689	$8,500	$10,308	$10,507
Boeing—TOTAL	196	138	200	238	257
B-727	11	8	—	—	—
B-737	82	67	115	141	161
B-747	23	16	24	35	23
B-757	25	18	36	35	40
B-767	55	29	25	27	33
Lockheed—TOTAL	11	7	7	1	2
L-1011	6	4	2	—	—
L-100	5	3	5	1	2
McDonnell Douglas—TOTAL	55	40	71	91	98
MD-80	51	38	71	86	95
DC-10	4	2	—	5	3

Source: Aerospace Industries Association, company reports.

a U.S.-manufactured fixed-wing aircraft over 33,000 lbs. empty weight; all are jet-powered except the four-engine turboprop-powered Lockheed L-100.

r Revised.

SPECIFICATIONS OF U.S. CIVIL JET TRANSPORT AIRCRAFT[a]

On Order or In Production as of 1987

Number of Engines and Crew, and Model Designation[b]	Initial Service	Standard Mixed Class	Operating Empty Weight (000's lbs)	Maximum Takeoff Gross Weight (000's lbs)	Range (Nautical Miles)[c]	Engines (Manufacturer[d] and Model)
FOUR ENGINES/CREW OF 3						
747-200B*	1971	452	374	775-833	5,350	P&W JT9D-7R4G2
747SP*	1976	331	333	700	7,670	R-R RB.211-524D4
747-300B*	1983	496	383	775-833	7,310	P&W JT9D-7R4G2
747-400*	1988	509	390	870	8,380	P&W 4000 or GE CF6-80C2
THREE ENGINES/CREW OF 3						
DC-10-10*	1971	250	243	440	3,750	GE CF6-6D
DC-10-15*	1981	278	249	455	4,422	GE CF6-50C2-F
DC-10-30*	1972	275	267	580	6,357	GE CF6-50C2
DC-10-40*	1972	275	271	580	5,988	P&W JT9D-59A
MD-11*	1989	321-405	277	603	8,070	P&W PW4360 or GE CF6-80C2
MD-11ER*	1989	277	265	603	8,525	P&W PW4360 or GE CF6-80C2
TWO ENGINES/CREW OF 2						
737-200	1971	110	61	116-119	1,800	P&W JT8D-9A/15/17/17R
737-300	1984	141	69	125-136	2,300	CFMI-CFM56-3
737-400	1988	159	73	139	2,250	CFMI-CFM56-3B2
757-200	1982	186	128	220-240	4,550	RR RB211-535C/E4 or P&W 2037
767-200*	1982	216	176	315	4,566	P&W JT9D-7R4 or GE CF6-80A
767-200ER*	1984	216	180	351	5,942	P&W JT9D-7R4 or GE CF6-80A
767-300*	1986	261	190	351	4,650	P&W JT9D-7R4 or GE CF6-80A
767-300ER	1987	261	196	400	6,650	P&W 4000 or GE CF6-80C2
MD-80:						
MD-81	1980	142	78	140	1,700	P&W JT8D-209
MD-82	1981	142	78	149	2,080	P&W JT8D-217A
MD-83	1985	142	80	160	2,590	P&W JT8D-219
MD-87	1987	130	73	140	2,740	P&W JT8D-217C
MD-88	1987	142	78	150	2,150	P&W JT8D-217C

Source: Aerospace Industries Association, based on company reports.

a All jet-powered passenger transport aircraft 33,000 pounds or more empty weight.

b Manufacturers are The Boeing Company (727, 737, 747, 757, and 767), and McDonnell Douglas Corporation (MD-80, MD11, and DC-10).

c Full passenger load and baggage.

d P&W = Pratt and Whitney Aircraft Company of United Technologies Corporation; GE = General Electric Company; RR = Rolls-Royce Limited; CFMI = General Electric/Snecma.

* Wide-body aircraft.

SPECIFICATIONS OF U.S. CIVIL HELICOPTERS

In Production as of 1987

Company	Commercial Model	Number of Places	Useful load (Lbs.)	Range with Useful Load (N. Miles)	External Cargo Payload (Lbs.)
Bell Helicopter Textron Textron Inc.	206 Series 206L Series 212 214 Series 222 412	4-5 7 15 16-18 7-10 15	1315-1630 1894-1931 5238 5450-8035 2985 5333	240-304 297-308 226 219-435 356 232	1200-1500 2000 5000 6000-8000 2500 5000
Boeing Vertol Company	234 (LR) 234 (UT)	47 3	23,300 30,000	620 264	28,000 28,000
The Enstrom Helicopter Corp.	F-28 Series 280 Series	3 3	700-850 700-850	238-272 243-272	500-1000 500-1000
Hiller Helicopters Rogerson Aircraft Corp.	12-E Series 12-ET Series RH-1100	3-4 3-4 5	1264-1341 1450 1355	215 351 396	1000 1000 1500
Hynes Helicopter, Inc.	B-2B 305	2 5	670 1200	225 275	400 800
McDonnell Douglas Helicopter Co.[b]	300 Series[a] 500 Series	3 4-7	698-1004 1320-1660	191-224 276-287	1104 1560-2000
Robinson Helicopter Co.	R22	2	468	208	—
Schweizer Aircraft Corp.	300C[a]	3	698-1004	191-224	1104
Sikorsky Aircraft Div. United Technologies Corp.	S-76 (MARK II) S-70C Commercial Utility	14 19	4525 11,862	466 297	4200 8000

Source: Aerospace Industries Association, "Directory of Helicopter Operators in the United States, Canada, Mexico and Puerto Rico, 1982/83 " and "AIA Directory of VTOL Aircraft, 1983."

a In 1983, Schweizer Aircraft became the licensed manufacturer for the Hughes 300C, redesignated the Schweizer-Hughes 300C, with product support beginning in 1983, and production beginning in 1984.

b McDonnell Douglas Corporation acquired Hughes Helicopters in January 1984.

CIVIL HELICOPTER SHIPMENTS[a]

Calendar Years 1983-1987

Company and Model	1983	1984	1985	1986	1987
CIVIL SHIPMENTS	403	376	376	326	358
Value (Millions of Dollars)	$303	$330	$505	$287	$277
Bell—TOTAL	159	151	146	125	127
206 series	107	94	87	67	74
212	6	18	8	11	11
214 series	11	13	10	15	13
222	17	26	22	20	12
412	18	—	19	12	17
Boeing Vertol—TOTAL	4	—	4	—	—
234	4	—	4	—	—
Enstrom—TOTAL	9	5	18	10	12
F-28 series	8	2	11	3	7
280 series	1	3	7	7	5
Hiller—TOTAL	7	—	2	—	—
12-E series	6	—	2	—	—
12-ET series	1	—	—	—	—
McDonnell Douglas[c]—TOTAL	137	92	56	65	41
300 series	67	(b)	(b)	(b)	(b)
269 series	—	—	—	1	—
500 series	70	85	48	40	37
530 series	—	7	8	24	4
Robinson—TOTAL	64	79	79	90	127
R22	64	79	79	90	127
Schweizer—TOTAL	—	11	24	23	37
300C[b]	—	11	24	23	37
Sikorsky (UTC)—TOTAL	23	38	47	13	14
S-76	23	27	19	10	13
S-70A	—	2	—	—	—
S-70B-3	—	—	2	—	—
S-70C-series	—	9	26	3	1

Source: Aerospace Industries Association, company reports.
NOTE: All data exclude production by foreign licensees.
a Domestic and export helicopter shipments for non-military use. The data in this table have been revised to separate out direct military exports (involving commercial contracts between U.S. manufacturers and foreign governments) which are now reported elsewhere in this chapter. Models which may be shipped in either a civil or a military configuration appear in both tables.
b Beginning with 1984 production, Schweizer Aircraft became the licensed manufacturer for the Hughes 300C, redesignated the Schweizer-Hughes 300C.
c Formerly models manufactured by Hughes.

DIRECT EXPORT SHIPMENTS OF MILITARY HELICOPTERS[a]

Calendar Years 1983-1987

Model	1983	1984	1985	1986	1987
DIRECT MILITARY EXPORT SHIPMENTS	54	31	38	10	21
Value (Millions of Dollars)	$90	$59	$75	$77	$57
Bell AH-1S	15	—	10	—	—
Boeing Vertol CH-47/414/352	—	3	3	6	4
McDonnell Douglas 500MD (TOW)/ 500 Scout	26	24	25	—	11
Schweizer 300C	—	—	—	4	6
Sikorsky S-76	13	4	—	—	—

Source: Aerospace Industries Association, company reports.

a Shipments of helicopters in military configuration exported directly from U.S. manufacturers to foreign governments. Military helicopters exported via Foreign Military Sales (FMS) are reported with Dept. of Defense (DOD) aircraft acceptance data elsewhere in this chapter. Some models reported on this page may be shipped in either military or civil configuration; see Civil Helicopter Shipments table for additional data.

GENERAL AVIATION AIRCRAFT SHIPMENTS

By Selected Manufacturers
Calendar Years 1983-1987

	1983	1984	1985	1986	1987
NUMBER OF AIRCRAFT SHIPPED	2,691[b]	2,438	2,029	1,495	1,085
Single-Engine, Piston	1,811	1,621	1,370	985	613
Multi-Engine, Piston	417	374	193	138	87
Turboprop	321	272	321	250	263
Turbojet	142[b]	171	145	122	122
VALUE OF SHIPMENTS[a] (Millions of Dollars)	$1,470[b]	$1,698	$1,431	$1,262	$1,364
Single-Engine, Piston	$ 145	$ 149	$ 124	$ 80	$ 80
Multi-Engine, Piston	115	135	56	43	18
Turboprop	460	443	542	430	477
Turbojet	750[b]	971	709	709	789
Number of Aircraft By Selected Manufacturer					
Ayres	9[c]	*(c)*	*(c)*	*(c)*	*(c)*
Beech	402	411	288	305	314
Cessna	1,219	978	881	549	187
Fairchild	39	29	35	37	36
Gates Learjet	45	33	33	20	16
Gulfstream	71[b]	58	55	26	30
Lake	28	26	20	26	23
Maule	36	65	88	64	54
Mooney	154	151	90	142	143
Piper	661	664	538	326	282
Schweizer Aircraft	27	23	*(d)*	*(d)*	*(d)*

Source: General Aviation Manufacturers' Association and Aerospace Industries Association.
a Manufacturers' net billing price.
b Includes 3 off-the-shelf Gulfstream G-3's delivered to the U.S. Air Force for C-20 VIP transports.
c Data not reported after August 1983.
d Data not reported after 1984.

MILITARY AIRCRAFT ACCEPTED BY U.S. MILITARY AGENCIES

Number and Flyaway Value
Calendar Years 1973-1987

Year	TOTAL	Bomber/ Patrol/ Command/ Control	Fighter/ Attack	Trans- port/ Tanker	Trainer	Heli- copter	Other
NUMBER							
1973	1,372	30	422	22	90	808	—
1974	1,110	50	478	27	49	506	—
1975	1,369	62	624	34	40	601	8
1976	1,143	55	646	67	11	348	16
1977	862	44	488	25	12	273	20
1978	723	30	478	28	—	166	21
1979	734	17	529	16	—	158	14
1980	819	16	551	15	18	189	30
1981	918	19	649	17	60	158	15
1982	758	26	478	14	60	172	8
1983	836	34	421	22	120	233	6
1984	632	34	298	18	30	240	12
1985	777	34	409	25	—	306	3
1986r	818	52	424	76	—	266	—
1987	847	74	483	36	—	254	—
FLYAWAY VALUE—Millions of Dollars							
1973	$2,571	$325	$1,490	$348	$140	$ 268	$ —
1974	2,224	584	1,222	101	111	206	—
1975	3,172	599	2,054	128	27	359	5
1976	4,729	547	3,421	340	27	384	10
1977	4,364	499	3,190	331	14	316	14
1978	4,664	689	3,496	237	—	225	17
1979	5,470	442	4,660	136	—	219	13
1980	6,514	475	5,282	178	32	516	31
1981	8,446	526	6,518	509	32	825	19
1982	8,605	886	6,383	410	42	872	12
1983	9,640	1,259	6,708	575	79	1,009	10
1984	9,308	1,270	5,774	627	18	1,597	22
1985	14,122	3,640	7,923	838	—	1,715	6
1986r	20,903	8,177	8,004	2,665	—	2,057	—
1987	21,559	8,533	8,909	2,276	—	1,841	—

Source: Departments of the Army, Navy, and Air Force.
NOTE: Data represent new U.S.-manufactured aircraft, excluding gliders and targets. Values include spares, spare parts, and support equipment that are procured with the aircraft. Effective 1972, includes aircraft accepted for shipment to foreign governments for military assistance programs and foreign military sales. 1972-1975, flyaway value does not include the value of planes produced for the security assistance programs and accepted by the USAF.
r Revised.

MILITARY AIRCRAFT ACCEPTANCES BY UNITED STATES AIR FORCE[a]

Calendar Years 1986 and 1987
(Millions of Dollars)

Type and Model	Number		Flyaway Cost[b]		Weapon System Cost[c]	
	1986[r]	1987	1986[r]	1987	1986[r]	1987
AIR FORCE—TOTAL	294	304	$13,063	$13,723	$15,551	$15,484
Fighter/Attack—TOTAL	187	213	3,079	3,458	4,156	4,607
F-15	35	39	1,115	1,197	1,667	1,826
F-16	152	174	1,964	2,261	2,489	2,781
Bombers—TOTAL	27	52	7,258	7,945	8,505	8,407
B-1B	27	52	7,258	7,945	8,505	8,407
Transports/Tankers—TOTAL	76	36	2,665	2,276	2,727	2,319
C-5B	8	13	1,656	1,657	1,695	1,670
C-12F[d]	40	—	52	—	52	—
C-130H	16	16	244	216	248	235
KC-10A	12	7	713	403	732	414
Command/Control—TOTAL	4	3	61	44	163	151
TR-1A	4	3	61	44	163	151

Source: Department of the Air Force.
NOTE: Costs shown are approximate. Calendar year acceptances may derive from procurement quantities funded in more than one fiscal year.
a Air Force acceptances for own use; exclude FMS/MAP shipments.
b Flyaway Cost includes airframe, engines, electronics, communications, armament, other installed equipment and non-recurring costs associated with the manufacture of the aircraft.
c Weapon System Cost includes flyaway costs, peculiar ground equipment, training equipment and technical data.
d Excludes 3 C-20's (off-the-shelf Gulfstream G-3's) delivered to the Air Force (for VIP transport) and included in civil general aviation shipments.
r Revised

MILITARY AIRCRAFT ACCEPTANCES BY UNITED STATES ARMY[a]

Calendar Years 1986 and 1987
(Millions of Dollars)

Type and Model	Number		Flyaway Cost[b]		Weapon System Cost[c]	
	1986	1987	1986	1987	1987	1987
ARMY—TOTAL	196[r]	206	$ 1,492[r]	$ 1,445	$ 1,637[r]	$ 1,530
Helicopters—TOTAL	196[r]	206	1,492[r]	1,445	1,637[r]	1,530
AH-64	117	125	1,148[r]	1,073	1,266[r]	1,102
UH-60A	79[r]	81	344[r]	372	371[r]	428

Source: Department of the Army.
a Army acceptances for own use; exclude FMS/MAP shipments.
b Flyaway cost includes airframes, engines, electronics, communications, armament and other installed equipment.
c Weapon System Cost includes flyaway items, initial spares, ground equipment, training equipment and other support items.
r Revised.
NA Not available.

MILITARY AIRCRAFT ACCEPTANCES BY UNITED STATES NAVY[a]

Calendar Years 1986 and 1987
(Millions of Dollars)

Type and Model	Number		Flyaway Cost[b]		Weapon System Cost[c]	
	1986[r]	1987	1986[r]	1987	1986[r]	1987
NAVY—TOTAL	218[r]	204	$4,273[r]	$3,729	$6,108[r]	$5,228
Patrol—TOTAL	15	18	$ 407	$ 437	$ 847	$ 820
P-3C	7	9	225	230	351	370
EA-6B	8	9	182	207	496	450
Fighter/Attack—TOTAL	146[r]	138	3,354[r]	2,896	4,289[r]	3,584
F-14A	27	8	882[r]	274	1,057[r]	317
F/A-18	83[r]	87	1,810[r]	1,964	2,255[r]	2,331
AV-8B	30	36	517	511	720	659
A-6E	6	7	145[r]	147	257[r]	277
Helicopters—TOTAL	57	48	512	396	972	824
AH-1W	13	13	7	5	175	159
CH-53E	7	10	90	128	110	170
MH-53E	3	—	49	—	100	—
SH-60B	24	19	295	218	504	440
SH-2F	10	6	71	45	83	55

Source: Department of the Navy.
a Navy acceptances for own use; excludes FMS shipments.
b Flyaway Cost includes airframe, engines, electronics, communications, armament, other installed equipment, non-recurring costs and ancillary equipment.
c Weapon System Cost (Investment Cost) includes flyaway items, initial spares, ground equipment, training equipment and other support items.
r Revised.
NA Not available.

MILITARY AIRCRAFT ACCEPTANCES FOR REIMBURSABLE PROGRAMS[a]

Calendar Years 1986 and 1987
(Millions of Dollars)

Accepting Agency, Type and Model	Number of Aircraft Accepted		Flyaway Cost[b]	
	1986	1987	1986	1987
TOTAL ACCEPTANCES FOR **REIMBURSABLE PROGRAMS**	110[r]	133	$2,075[r]	$2,662
AIR FORCE—TOTAL	63	93	$1,173	$1,671
Fighter/Attack—TOTAL	57	92	722	1,564
F-5E	6	—	63	—
F-5F	2	—	20	—
F-16 A/B	19	—	181	—
F-16 C/D	30	92	458	1,564
Command/Control—TOTAL	4	1	428	107
E-3 (NATO AWACS)	4	1	428	107
Patrol—TOTAL	2	—	23	—
RF-SE	2	—	23	—
NAVY—TOTAL	34[r]	40	$ 849[r]	$ 991
Fighter/Attack—TOTAL	34[r]	40	849	991
A-6 E/F	11	—	232	—
F/A-18	23[r]	40	617[r]	991
ARMY—TOTAL	13[r]	—	$ 53[r]	$ —
Helicopters—TOTAL	13	—	53	—
UH-1H	—[r]	—	—[r]	—
AH-1S	13	—	53	—

Source: Departments of the Air Force, Navy, and Army.
a Foreign Military Sales and NATO AWACS Program.
b Flyaway cost includes airframes, engines, electronics, communications, armament, other installed equipment and nonrecurring costs associated with the manufacture of the aircraft.
r Revised.

MILITARY AIRCRAFT PROGRAM PROCUREMENT[a]

Fiscal Years 1987, 1988 and 1989
(Millions of Dollars)

Agency, Type and Model	1987		1988[E]		1989[E]	
	No.	Cost	No.	Cost	No.	Cost
AIR FORCE						
AC-130U	—	$ —	—	$ —	6	$ 288.0
AD Air Defense Aircraft	20	380.0	—	—	—	—
C-5B Galaxy	21	1,610.8	—	—	—	—
C-17	—	49.1	2	655.3	4	1,004.0
C-130H Hercules	8	150.0	16	300.0	—	—
Civil Air Patrol (CAP) Aircraft	38	2.2	38	1.5	38	0.5
F-15 D/E Eagle	42	1,650.3	42	1,463.4	36	1,392.3
F-16 Falcon	180	2,676.8	180	2,624.6	80	3,441.7
HC-130	—	—	2	44.0	—	—
KC-10A ATCA Extender	8	98.9	—	—	—	—
KC-135 Re-engining/Modern	50	725.9	47	701.7	36	570.8
LANTIRN (Night Precision Attack)	—	761.7	—	741.4	—	688.2
MC-130H Combat Talon	5	231.4	7	344.8	4	209.5
MH-606	—	—	16	117.0	6	51.0
TR-1/U-2[b]	3	87.9	—	10.7	—	12.7
TTTS	—	—	—	—	1	9.6
ARMY						
AH-64 Attack Helicopter	101	$1,023.5	77	$ 847.0	72	$ 809.1
C-12	4	11.7	—	—	—	—
C-20	2	36.5	1	20.0	—	—
C-23 SHERPA	—	—	9	60.0	—	—
CH-47 Modernization	—	251.1	—	226.9	—	256.3
Cessna Skylane	—	—	2	0.2	—	—
EH-60A Quick Fix	18	110.5	—	7.3	—	—
Golden Knights Replacement AC	—	—	2	13.6	—	—
OH-58D AHIP Modification	36	147.1	36	160.1	24	161.0
RC-12D Guard Rail	—	—	3	43.8	6	97.3
RPVs	—	25.0	—	—	—	—
UH-60A Black Hawk[c]	82	368.6	72	488.4	72	457.2
NAVY						
A-6 Intruder	11	$ 252.3	10	$ 445.9	—	$ —
AH-1W Sea Cobra	—	28.8	34	221.5	—	—
AV-8B Harrier	42	572.6	24	558.8	24	519.4
C-2 Greyhound	9	98.2	—	—	—	—
CH/MH-53E Super Stallion	14	215.6	14	224.5	14	195.0
E-2C Hawkeye	10	431.0	6	379.2	6	338.0

(Continued on next page)

MILITARY AIRCRAFT PROGRAM PROCUREMENT[a] (Continued)

Agency, Type and Model	1987		1988[E]		1989[E]	
	No.	Cost	No.	Cost	No.	Cost
NAVY (Continued)						
E-6A	3	293.4	3	302.9	7	334.5
EA-6B Prowler	12	411.9	12	453.9	9	491.8
F-14 A/D Tomcat	15	640.0	12	751.1	12	879.8
F/A-18 Hornet	84	2,192.2	84	2,286.9	72	2,286.7
KC-130T	2	40.0	2	40.0	—	—
P-3C Orion	9	379.3	6	211.7	—	—
SH-2F Seasprite (LAMPS MK-I)	6	60.2	—	—	—	—
SH-60B Seahawk LAMPS MK-111	17	215.8	6	115.1	6	112.6
SH-60F CV ASW	7	143.6	18	291.3	18	345.3
T-45 Training System	—	55.4	12	368.1	24	415.9
HH-60H[c]	4	38.0	9	99.0	—	15.5
V-22[d]	—	—	—	—	—	335.3
VH-60[c]	—	24.2	—	—	—	—

Source: "Program Acquisition Costs by Weapon System," "Procurement Programs (p-1)" Department of Defense Budget, (Annually).
NOTE See Research and Development Chapter for aircraft program RDT&E authorization data.
a Total Obligational Authority for procurement, excluding initial spares.
b Includes ground stations.
c Army, Navy and Air Force funding.
E Estimate. Latest year reflects Administration's budget proposal.
d Navy and Air Force funding.

ACTIVE U.S. MILITARY AIRCRAFT IN CONTINENTAL U.S. [a]

Fiscal Years 1978-1989

Fiscal Year	Total	Fixed Wing Aircraft				Helicopter
		Total	Jet	Turboprop	Piston	
1978	18,931	11,748	8,898	1,794	1,056	7,183
1979	18,526	11,365	8,656	1,859	850	7,161
1980	18,969	11,362	8,794	1,869	699	7,607
1981	19,363	11,645	9,111	1,943	591	7,718
1982	21,728	12,063	9,647	1,900	516	9,665
1983	18,652	11,603	9,495	1,745	363	7,049
1984	18,833	11,661	9,551	1,777	333	7,172
1985	19,333	11,929	9,640	1,881	408	7,404
1986	20,157	11,919	9,730	1,803	386	8,238
1987[P]	20,514	12,054	9,819	1,865	370	8,460
1988[E]	20,729	12,149	9,899	1,890	360	8,580
1989[E]	20,971	12,173	9,905	1,910	358	8,798

Source: Department of Defense, Office of the Secretary of Defense, reported in "FAA Aviation Forecasts" (Annually).
a Includes Army, Air Force, Navy, and Marine regular service aircraft, as well as Reserve and National Guard aircraft.
p Preliminary.
E Estimate.

DEPARTMENT OF DEFENSE
OUTLAYS FOR AIRCRAFT PROCUREMENT

By Agency
Fiscal Years 1961-1989
(Millions of Dollars)

Year	TOTAL AIRCRAFT PROCUREMENT	Air Force	Navy	Army
1961	$ 5,898	$ 3,926	$1,832	$ 140
1962	6,659	4,387	2,102	170
1963	6,309	3,747	2,328	234
1964	6,053	3,894	1,859	300
1965	5,200	3,115	1,739	346
1966	6,635	4,074	2,021	540
1967	8,411	4,842	2,607	962
1968	9,462	5,079	3,244	1,139
1969	9,177	5,230	2,821	1,126
1970	7,948	4,623	2,488	837
1971	6,631	3,960	2,125	546
1972	5,927	3,191	2,347	389
1973	5,066	2,396	2,557	113
1974	5,006	2,078	2,806	122
1975	5,484	2,211	3,137	136
1976	6,520	3,323	3,061	136
Tr. Qtr.	1,557	859	672	26
1977	6,608	3,586	2,721	301
1978	6,971	3,989	2,602	380
1979	8,836	5,138	3,140	558
1980	11,124	6,647	3,689	787[r]
1981	13,193	7,941	4,397	855
1982	16,793	9,624	5,872	1,297
1983	21,013	11,799	7,490	1,724
1984	23,196	12,992	8,040	2,165
1985	26,586	15,619	8,263	2,705
1986	30,828	18,919	8,922	2,987
1987	32,956	20,036	9,614	3,306
1988[E]	29,639	17,177	9,681	2,781
1989[E]	27,989	16,090	9,126	2,773

Source: Department of Defense Budget (Annually).
NOTE: Detail may not add to totals because of rounding.
E Estimate. Latest year reflects Administration's budget proposal.
r Revised.
Tr. Qtr. Transition Quarter: Until June 30, 1976, the fiscal years ran from July 1 to June 30. 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.

SPECIFICATIONS OF U.S. MILITARY AIRCRAFT ON ORDER OR IN PRODUCTION AS OF 1987

Primary Mission, DOD Designation, & Popular Name	Manufacturer	U.S. Military Service	Crew	Empty Weight (000's lbs)	Engines	Performance Typical for Primary Mission	Remarks
ATTACK							
A-6E Intruder	Grumman	USN/USMC	2	27	2 × P&W J52	Mach.8 sea level	Also EA-6A/B & KA-6D
A-6F	Grumman	USN/USMC	2	27	2 × GE F404-GE-400	Ordnance & missiles	Improved radar & avionics
AV-8B Harrier 2	MDC/Br.Aer.	USMC	1	13	1 × RR F402	Mach.9 +	Graphite/epoxy super-critical wing
BOMBERS							
B-1B	Rockwell	USAF	4	182	4 × GE F101	High subsonic penetration	Intercont'l range, unrefueled
ELECTRONIC WARFARE							
EA-6A Intruder	Grumman	USN/USMC	2	28	2 × P&W J52	597n.m. standoff radius	Limited strike capability
EA-6B Prowler	Grumman	USN/USMC	4	33	2 × P&W J52	493n.m. standoff radius	Tactical jamming system
FIGHTERS							
F-5E Tiger 2	Northrop	USAF/USN	1	10	2 × GE J85	Mach 1.6 class	More than 1,200 F-5E/Fs delivered
F-5F Tiger 2	Northrop	USAF/USN	2	11	2 × GE J85	Mach 1.5 class	2-seat trainer/fighter
F-14A Tomcat	Grumman	USN	2	40	2 × P&W TF30	Mach 2.3 class	Missile, gun fleet defense
F14A+	Grumman	USN	2	42	2 × GE F110	Mach 2.3 class	F14A with upgraded engines and radar
F14D	Grumman	USN	2	—	2 × GE F110	Mach 2.3 class	F14A+ with improved avionics and infrared track and search system
F-15C/D Eagle	MDC	USAF	1-2	31	2 × P&W F100	Mach 2.5 class	Air superiority, defense, guns, missiles; 15D = 2 seat trainer
F-15E	MDC	USAF	2	—	2 × P&W F100	Mach 2.5 class	Dual role fighter/long range interdiction
F-16 A/B Fighting Falcon	GD	USAF	1-2	15	1 × P&W F100	Mach 2 + class	Multirole fighter; fully fly-by-wire; missiles, guns
F-16 C/D	GD	USAF	1-2	—	1 × P&W F100/ 1 × GE F110	Mach 2+ class	Provisions for AMRAAM, LANTIRN and new EW Nav. Comm. systems.
F/A-18 Hornet	MDC/Northrop	USN/USMC	1	24	2 × GE F404	Mach 2 + class	Missiles, guns; also export
F-20 Tigershark	Northrop	Export	1	12	1 × GE F404	Mach 2 class	Multirole; adv. avionics
COMMAND/CONTROL AND PATROL							
RC-12D	Beech	Army	2	9	2 × PWC PT6-41	Max 294 kias	Modification of super king air 200
TR-1/U-2	Lockheed	USAF	1	18	1 × P&W J75	Altitudes 70,000 ft +	High alt. tactical recon.
P-3C Orion	Lockheed	USN	10	67	4 × All T56	14 + hr. mission duration	Torpedoes, missiles, sono-buoys, mines; also export
E-2C Hawkeye	Grumman	USN	5	38	2 × All T56	6 hr. mission duration	AEW command & control; passive detection
E-3A AWACS	Boeing	USAF/NATO	17	188	4 × P&W TF33	Long range, subsonic	Surveillance radar, command, control
CARGO-TRANSPORT							
C-2A Greyhound	Grumman	USN	2	34	2 × All T56	Cruise 260kt; 1,560n.m. range	First Navy multi-year procurement contract
C/KC-130 Hercules	Lockheed	USAF, USN, Export	4	74-78	4 × All T56	Cruise 385mph; 2,038n.m. range	92-128 troops or 39-43 thsnd. lbs.
C-5B Galaxy	Lockheed	USAF	6	363	4 × GE TF39	Cruise 563mph; 3,000n.m. range	Global strategic logistics; 208,000 lb. cargo capacity
C-12 Huron	Beech	Army/USAF	2	8	2 × PWC PT6A	Cruise 259kt. at 14,000ft.	10-place; pass. or cargo
KC-10A Extender	MDC	USAF	5	241	3 × GE CF6	600 + mph.	Tanker or cargo
C-20A G3	Gulfstream	USAF	2	32	2 × RR Spey	Mach.77; 3,650 n.m.	VIP transport, 14 pass.
TRAINING							
T-45A	MDC/Br.Aer.	USN	2	9	1 × RR MK871	Cruise 609 mph at 8,000 ft.	Next generation trainer
HELICOPTERS							
AH-1T Sea Cobra	Bell-Textron	USN	2	9	2 × PWC T400	Max 218 mph; 360 mi.	TOW w/20 mm gun
AH-1S Cobra	Bell-Textron	Army	2	6	1 × Lyc T53	Max 195 mph; 380 mi.	TOW w/mini gun
AH-1W Super Cobra	Bell-Textron	USN	2	10	2 × GE T700	Max 218 mph	TOW, hellfire
AH-64 Apache	Hughes-MDC	Army	2	11	2 × GE T700	Max 197 mph; 445 mi.	Attack helicopter
CH/MH-53E	Sikorsky-UTC	USN	3-8	33-36	3 × GE T64	Max 196 mph; 710 mi.	55 passengers, aux. tanks. minesweeping
SH-2F Seasprite	Kaman	USN	3	7	2 × GE T58	Max 165 mph; 400 mi.	LAMPS Mk.I helicopter
TH-57A Sea Ranger	Bell-Textron	USN	2	2	1 × All 250	Max 140 mph; 425 mi.	Primary trainer
SH-60B Seahawk	Sikorsky-UTC	USN	3	14	2 × GE T700	Max 171 mph	ASW
SH-60F Cv-Helo	Sikorsky-UTC	USN	4	14	2 × GE T700	Max 177 mph	Inner Zone ASW
UH-1H Iroquois	Bell-Textron	Army	2	5	1 × Lyc. T53	Max 127 mph; 286 mi.	Succeeds UH-1D
UH-60A Black Hawk	Sikorsky-UTC	Army/USAF	3	11	2 × GE T700	Max 196 mph; 370 mi.	UTTAS

Source: Aerospace Industries Association, based on information from "Aviation Week & Space Technology Magazine."

CODE
Manufacturers: MDC = McDonnell Douglas; Br.Aer. = British Aerospace; GD = General Dynamics.
U.S. Military Service: USN = Navy; USMC = Marine Corps; USAF = Air Force; ANG = Air National Guard.
Engines: P&W = Pratt & Whitney; PWC = Pratt & Whitney of Canada; All = Detroit Diesel Allison Div. of General Motors; Lyc = Avco Lycoming; RR = Rolls Royce.

Missile Programs

Despite reduced overall defense budgets in the mid-1980s, 1987 industry sales of missile systems continued on the upward trend in evidence during the two prior years.

According to Bureau of the Census reports, sales of missile systems and parts amounted to $9.5 billion, up from $8.2 billion in 1986. The 1987 figure was the all-time high in current dollars but in constant dollar terms it was below the level of the early 1970s.

The flow of new orders for missile systems similarly increased. Orders received in 1987 totaled $11.7 billion, compared with $11.0 billion in 1986. Backlog as of December 31, 1987 was $14.6 billion, up from $12.8 billion at the end of 1986.

The Bureau of the Census separately reported sales of missile-related propulsion systems as part of a statistical grouping that also includes propulsion units for both military and civil space launch vehicles.

The 1987 figure for that grouping was $3.0 billion, almost identical to the 1986 total. Military sales, at $1.6 billion dropped from 1986's $1.8 billion; non-military sales, at $1.4 billion were up from $1.2 billion in 1986. Net new orders totaled $3.3 billion, a large increase over the $2.0 billion recorded for the previous year. Backlog at year end 1987 was $3.8 billion, up from $3.5 billion a year earlier.

Under the Department of Defense Fiscal Year 1989 budget plan, DoD contemplated missile procurement outlays of $13.9 billion, including $7.7 billion for the USAF, $3.9 billion for the Navy and $2.3 billion for the Army. However, the Congress reduced the overall DoD budget request by more than 10 percent. At publication time, a revised missile procurement plan was not available. The original version is nonetheless useful as a general indicator of planned program scopes and priorities.

Under that plan, the missile program with the highest dollar value was the Navy's Trident II Fleet Ballistic Missile; the Navy planned a buy of 66 additional missiles worth $1.9 billion following procurement of 66 in FY 1988 and 21 in FY 1987.

The next largest planned procurement was an $865 million buy of AMRAAM (Advanced Medium Range Air-to-Air Missile) for 1,520 units to be used by both the Air Force and Navy. Third among high value procurements

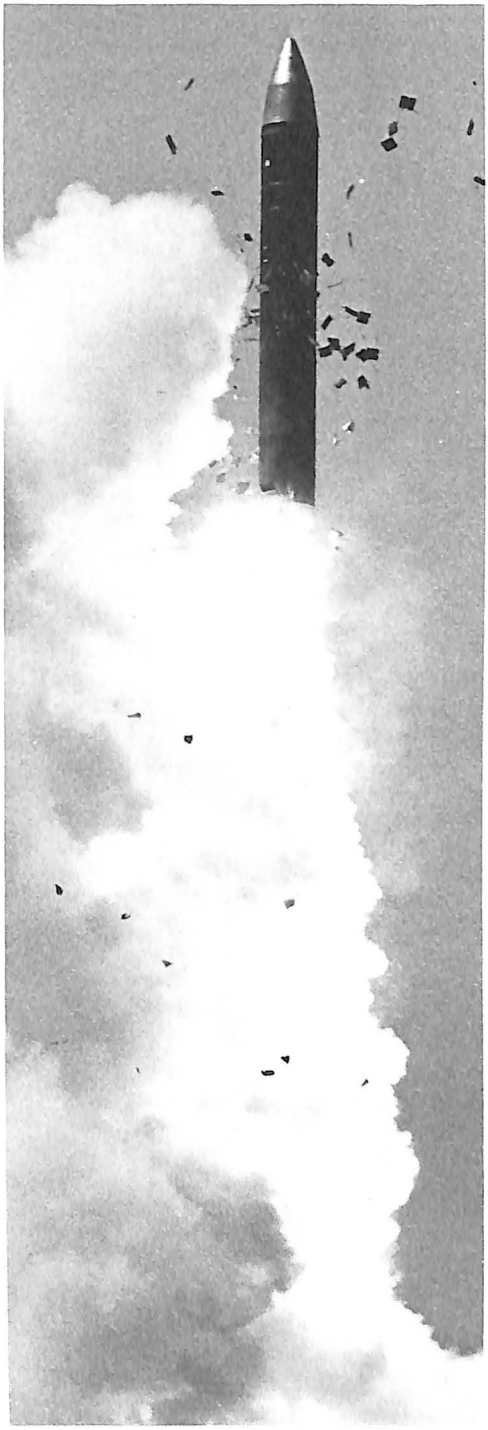
was the Army's Patriot long-range air defense missile; the plan called for production of 815 missiles at a cost of $819 million. The Air Force planned another buy of 12 Peacekeeper ICBMs at $807 million, following procurements of 12 in each of the two preceding Fiscal Years.

Other major missiles in production during 1987/1988 or planned for initial production under FY 1989 funding included:

Air Force. The Infrared Imaging Maverick, budgeted at $260 million for 2,931 missiles to be used by both USAF and Navy aircraft.

Army. The Multiple Launch Rocket System, a mobile rocket battery ($407 million); the TOW 2 Army/Marine Corps antitank weapon ($289 million); the Stinger short-range antiaircraft weapon ($243 million) and, in a separate procurement, the Pedestal Mounted Stinger ($92 million); the Laser Hellfire helicopter-borne antiarmor missile, used by the Army and Navy ($190 million); the LOS-F-H (Line of Sight, Forward, Heavy) air defense missile ($109 million); the ATACMS (Army Tactical Missile System) ($81 million); and the Chaparral infrared homing surface-to-air missile ($58 million).

Navy. The ship-launched Tomahawk Cruise Missile ($711 million); the Standard ship defense surface-to-air missile ($698 million); the HARM antiradiation missile for Navy/USAF use ($519 million); the Phoenix long-range air-to-air weapon ($465 million); the Harpoon air-launched antiship missile ($170 million); the Marine Corps Hawk surface-launched air defense system ($140 million); the Maverick air-to-surface weapon ($82 million); the Sparrow air-to-air missile, being procured for Navy and Air Force use ($56 million); the RAM (Rolling Airframe Missile), a system for defense against antiship missiles ($52 million); the Sidewinder air-to-air missile, another joint Navy/USAF procurement ($48 million); the Penguin antiship missile, a first-time production buy ($42 million); and the new VLA (Vertical Launch ASROC) antisubmarine rocket ($17.6 million). □



MISSILE PROGRAM PROCUREMENT[a]

Fiscal Years 1987, 1988 and 1989
(Millions of Dollars)

Agency, Type and Model	1987		1988[E]		1989[E]	
	No.	Cost	No.	Cost	No.	Cost
AIR FORCE						
AGM-130	—	$ 1.5	—	$ —	—	$ —
ALCM	—	9.4	—	2.3	—	—
AMRAAM[b]	180	579.5	400	670.0	1,520	885.1
GLCM	76	110.7	—	4.1	—	0.6
IIR MAVERICK[b]	3,472	393.0	3,125	350.0	2,931	260.4
Peacekeeper (M-X)	12	1,082.9	12	864.0	12	807.0
Rapier	—	6.2	—	12.6	—	—
NAVY						
Harm[b]	2,398	$ 600.6	2,411	$ 554.1	2,200	$ 518.8
Harpoon	96	121.8	124	142.7	138	169.7
Hawk[e]	430	104.8	525	140.0	467	139.7
Laser MAVERICK[e]	—	2.8	1,300	157.3	—	—
MAVERICK[h]	—	—	—	—	732	82.4
PENGUIN	—	—	—	3.5	64	42.1
Phoenix	205	285.3	350	343.6	560	465.3
RAM	—	37.2	240	44.9	260	52.1
Sidearm[g]	256	21.4	276	25.4	—	—
Sidewinder[b]	1,135	71.4	1,244	86.9	760	48.3
Sparrow[b]	2,120	289.3	1,158	163.5	354	56.1
Standard	1,194	683.0	1,310	581.1	1,635	698.1
Tomahawk	324	695.6	475	847.3	510	711.1
Trident II	21	1,344.9	66	2,041.3	66	1,865.6
VLA	—	37.6	—	—	—	17.6
ARMY						
ATACMS	—	$ —	—	$ 9.1	66	$ 80.6
Chaparral	—	25.8	122	30.2	368	57.9
Laser Hellfire[d]	—	—	6,393	212.6	5,200	189.5
LOS-F-H	—	—	—	33.5	60	108.8
MLRS	72,000	442.8	72,000	404.7	48,000	406.8
Patriot	700	962.3	715	872.5	815	818.7
Pershing II	—	26.8	—	6.7	—	—
PMS Stinger	—	—	—	43.6	—	92.2
Stinger[f]	4,716	300.7	4,625	189.3	6,750	242.5
TOW 2[c]	11,939	139.8	15,386	252.7	14,585	288.7

Source: "Program Acquisition Costs by Weapon System," and "Procurement Programs (p-1)" Department of Defense Budget (Annually).

NOTE See Research and Development Chapter for missile program RDT&E authorization data.

E Estimate. Latest year reflects Administration's budget proposal.

a Total Obligational Authority excluding initial spares.

b Navy and Air Force funding.

c Army and Marine Corps funding.

d Army and Navy funding.

e Marine Corps funding.

f Army, Marine Corps and Air Force funding.

g Navy and Marine Corps funding.

h Previously budgeted under II MAVERICK and Laser MAVERICK designations.

MAJOR MISSILES
RESEARCH, DEVELOPMENT, PRODUCTION, OPERATION

Program	Agency	Status	Systems Contractor(s)	Propulsion Manufacturer	Guidance Manufacturer
AIR-TO-AIR					
AMRAAM	USAF/USN	D	Hughes	Hercules	Hughes
Phoenix-54A	USN	O	Hughes	Hercules	Hughes
Phoenix-54C	USN	P	Hughes	Hercules	Hughes
Sidewinder-9J	USAF	O	Ford Aerospace	Hercules/ Aerojet	Ford Aerospace
Sidewinder-9L	USN/USAF	O	NASC	Bermite/ Hercules	Raytheon/ Ford Aero.
Sidewinder-9M	USN/USAF	P	NASC	Morton Thiokol/ Hercules	Raytheon/ Ford Aero.
Sidewinder-9N	USAF	O	Ford Aero.	—	Ford Aero.
Sidewinder-9P	USAF	P,O	Ford Aero.	Hercules/ Aerojet	Ford Aero.
Sidewinder-9R	USN	P	Ford Aero.	MTI/Hercules	Raytheon/ Ford Aero.
Sparrow-7F	USN/USAF	O	NASC	Hercules	Raytheon/GD
Sparrow-7M	USN/USAF	P	Raytheon/GD	Hercules	Raytheon/GD
AIR-TO-SURFACE					
ALCM	USAF	P	Boeing	Williams International	Honeywell/ Litton
HARM	USN/USAF	P	Texas Instr.	Morton Thiokol/ Hercules	Texas Instr.
Harpoon*	USN	P,O	McDonnell Douglas	Teledyne CAE	TI/IBM/LSI/ Northrop
GBU-15	USAF	P	Rockwell	Hughes	Hughes/ Rockwell
Maverick-65A/B	USAF	P,O	Hughes	MTI/Aerojet	Hughes
Maverick-65D	USAF	P,O	Hughes	MTI/Aerojet	Hughes
Maverick-65E	USMC	P	Hughes	MTI/Aerojet	Hughes
Maverick-65F	USN	P	Hughes	MTI/Aerojet	Hughes
Maverick-65G	USAF	D	Hughes	MTI/Aerojet	Hughes
Shrike	USN/USAF	O	NWC/PMTC	Aerojet/ Hercules	Texas Instruments
Sidearm 1	USN/USMC	P	Motorola	Hercules	Motorola
SLAM	USN	D	McDonnell Douglas	Teledyne CAE	MDC/Hughes/ Rockwell
SRAM	USAF	O	Boeing	Lockheed	Singer
Standard ARM	USN/USAF	O	GD	NOSIH	GD
Walleye 1	USN	O	Martin Marietta	—	Martin Marietta/ Hughes
Walleye 1ER	USN	R,D	NAC	—	NAC
Walleye 2	USN	O	NAC	—	NAC
Walleye 2 (ER/DL)	USN	O	NAC	—	NAC

*Also Surface-to-Surface

(Continued on next page)

MAJOR MISSILE PROGRAMS (Continued)

Program	Agency	Status	Systems Contractor(s)	Propulsion Manufacturer	Guidance Manufacturer
AIR-TO-SURFACE (Cont'd.)					
AGM-130A	USAF	D	Rockwell	Hercules	Rockwell
AGM-130B	USAF	D	Rockwell	Hercules	Rockwell
ANTI-SUBMARINE					
Subroc	USN	O	Goodyear Aerospace	Morton Thiokol	Singer
SURFACE-TO-AIR					
Chaparral	Army	O	Ford Aerospace	Hercules/ Bermite	GE/Raytheon
Improved Chaparral	Army	P,O	Ford Aerospace	Bermite	Ford Aerospace
Hawk	Army	P,O	Raytheon	Aerojet	Raytheon
Patriot	Army	P	Raytheon	Morton Thiokol	Raytheon
RAM	USN	D	General Dynamics	Bermite/ Hercules/ MTI	General Dynamics
Redeye	Army/ USMC	O	General Dynamics	Atlantic Research	General Dynamics
Roland	Army	O	Hughes/ Boeing	Hercules	Hughes/ Boeing
Sea Sparrow	USN	P,O	Raytheon/ GD	Aerojet/ Hercules	Raytheon/ GD
Standard MR (SM-1)	USN	P,O	General Dynamics	Aerojet/ NOSIH	General Dynamics
Standard MR (SM-2)	USN	P,O	General Dynamics	Aerojet/MTI	General Dynamics
Standard ER (SM-1)	USN	O	General Dynamics	Atlantic Research/ NOSIH	General Dynamics
Standard ER (SM-2)	USN	P,O	General Dynamics	Atlantic Research/ NOSIH/ MTI	General Dynamics
Stinger	Army/ USMC	P,O	General Dynamics	Atlantic Research	General Dynamics
Tartar	USN	O	GD	Aerojet	GD
Terrier	USN	O	General Dynamics	Atlantic Research/ NOSIH	General Dynamics
SURFACE-TO-SURFACE					
Harpoon*	USN	P,O	McDonnell Douglas	Teledyne CAE	TI/IBM/LSI/ Northrop
Minuteman 2	USAF	O	AFLC Hill AFB	MTI/Aerojet/ Hercules/	Rockwell Autonetics
Minuteman 3	USAF	O	AFLC Hill AFB/	MTI/ Aerojet	Rockwell Autonetics

(Continued on next page)

*Also Air-to-Surface

MAJOR MISSILE PROGRAMS (Continued)

Program	Agency	Status	Systems Contractor(s)	Propulsion Manufacturer	Guidance Manufacturer
SURFACE-TO-SURFACE (Cont'd.)					
Peacekeeper (MX)	USAF	P,O	BMO/TRW	MTI/Avco/ Aerojet/ Hercules/ Rocketdyne/ GE	Rockwell/ Northrop/ Honeywell
Polaris A3	USN	O	Lockheed MSC	Aerojet/ Hercules	GE/Hughes/ MIT/Raytheon
Poseidon C3	USN	O	Lockheed MSC	MTI/ Hercules	GE/MIT/Hughes Raytheon
Tomahawk (SLCM)	USN	P	GD/MDC	Williams International	MDC/GD
Gryphon (GLCM)	USAF	P	GD/MDC	Williams International	MDC/GD
Trident 1 (C4)	USN	P,O	Lockheed MSC	Hercules/ MTI	GE/Draper/ Raytheon/ Hughes
Trident 2 (D-5)	USN	D,P	Lockheed MSC	Hercules/ MTI/UTC	GE/Draper/ Sperry/ Rockwell
BATTLEFIELD SUPPORT AND ANTIARMOR					
Dragon	Army	P,O	MDC	MDC	MDC
Hellfire	Army/ USMC	P	Rockwell	Morton Thiokol	Martin Marietta
Lance	Army	O	Vought	RI Rocket-dyne	E-Systems/ Sys-Don-ner/Arma
MLRS	Army	P,O	Vought.	Atlantic Res.	—
Pershing 1A	Army	O	Martin Marietta	Morton Thiokol	Allied Bendix
Pershing 2	Army	P	Martin Marietta	Hercules	Goodyear Aerospace
Shillelagh	Army	O	Ford Aerospace	Hercules	Ford Aerospace
TOW	Army	O	Hughes	Hercules	Emerson El.
ITOW	Army	P,O	Hughes	Hercules	Emerson El.
TOW2	Army	P,O	Hughes	Hercules/MTI	Emerson El.
TOW2A	Army	P,O	Hughes	Hercules/MTI	Emerson El.

Source: Aerospace Industries Association, based on information from "Aviation Week & Space Technology Magazine."
Status: R—Research; D—Development; P—Production; O—Operational.

Abb:
AFB - Air Force Base
AFLC - Air Force Logistics Cmd.
BMO - Ballistic Missile Office
GD - General Dynamics
GE - General Electric
LSI - Lear Siegler
MM - Martin Marietta
MDC - McDonnell Douglas
MIT - Massachusetts Institute of Technology
MTI - Morton Thiokol, Inc.
NAC - Naval Avionics Center
NASC - Naval Air Systems Command
NOSIH - Naval Ordnance Station, Indian Head
NWC - Naval Weapons Center
PMTC - Pacific Missile Test Center
RI - Rockwell International
TI - Texas Instruments
USAF - United States Air Force
USMC - United States Marine Corps
USN - United States Navy

DEPARTMENT OF DEFENSE OUTLAYS FOR MISSILE PROCUREMENT[a]

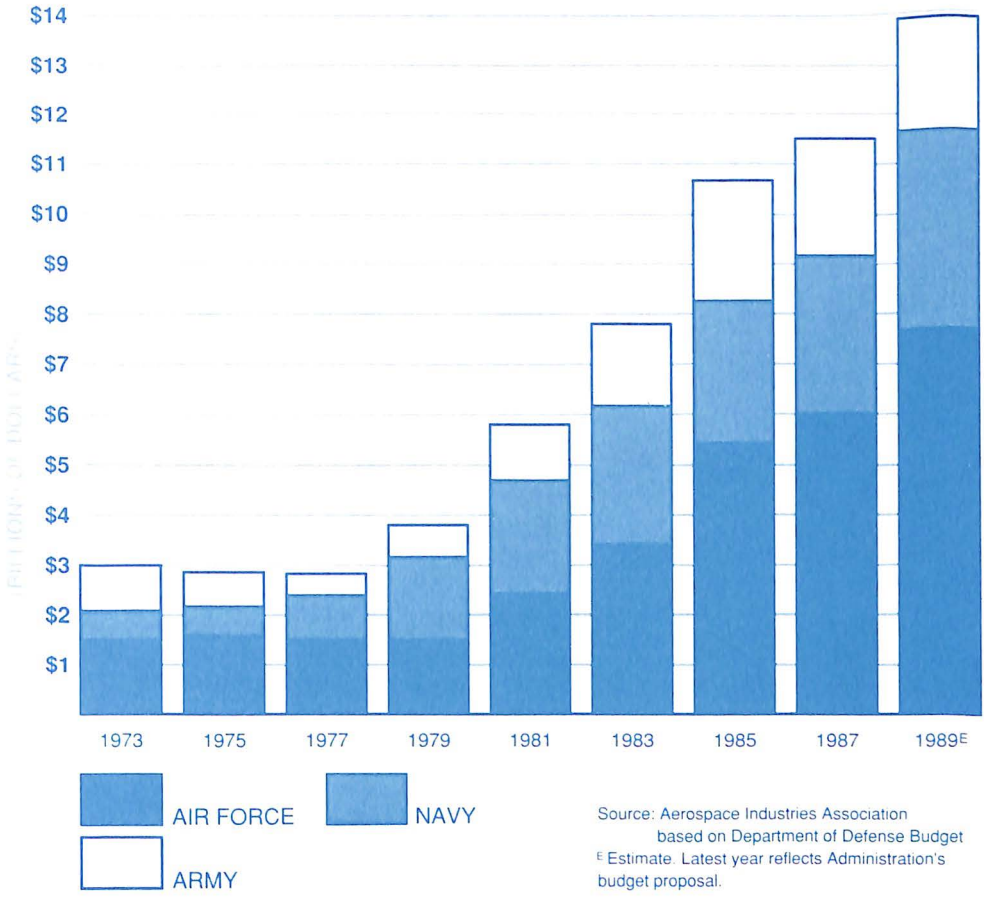
By Agency
Fiscal Years 1961-1989
(Millions of Dollars)

Year	TOTAL MISSILE PROCUREMENT[a]	Air Force	Navy[a]	Army
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	1,501[r]	905	374
1978	3,096	1,376	1,302	418
1979	3,786	1,537	1,702	547
1980	4,434	1,810	1,973	651
1981	5,809	2,366[r]	2,297	1,146
1982	6,782	3,069	2,444	1,269
1983	7,795	3,383	2,812	1,600
1984	9,527	4,640	2,809	2,079
1985	10,749	5,409	2,941	2,399
1986	11,731	6,473	2,780	2,478
1987	11,473	6,002	3,157	2,314
1988[E]	12,342	6,596	3,413	2,333
1989[E]	13,897	7,737	3,869	2,291

Source: Department of Defense Budget (Annually).
NOTE: Detail may not add to totals because of rounding.
a Revised by AIA from previously published data to include Navy Weapons P· urement in Total Missile Procurement. Beginning 1978, DOD combined Navy Missile Procurement with torpedo· and other related products into Navy Weapons Procurement. Missiles comprise approximately 80 percent of the value of this category.
E Estimate. Latest year reflects Administration's budget proposal.
Tr. Qtr. Transition Quarter: Until June 30, 1976, the fiscal years ran from July 1 to June 30. 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.

DEPARTMENT OF DEFENSE
OUTLAYS FOR MISSILE PROCUREMENT

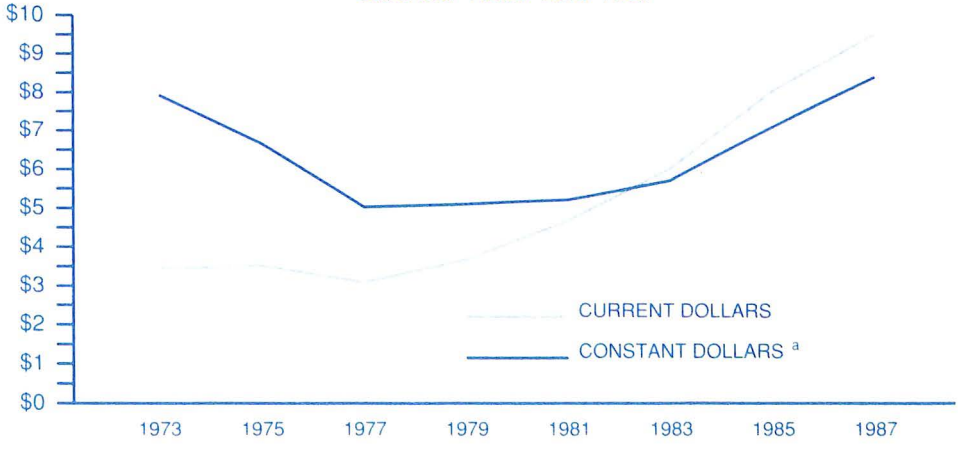
By Agency
Fiscal Years 1973-1989



Source: Aerospace Industries Association based on Department of Defense Budget
[E] Estimate. Latest year reflects Administration's budget proposal.

SALES OF MISSILE SYSTEMS & PARTS

Calendar Years 1973-1987



Source: Aerospace Industries Association based on Bureau of Census data.
[a] Based on revised aerospace composite deflator (1982 = 100)

ORDERS, SALES, AND BACKLOG MISSILE SYSTEMS AND PARTS[a]

Calendar Years 1973-1987
(Millions of Dollars)

Year	SALES-Current Dollars	SALES-Constant Dollars[c]
1973	$3,391	$7,904
1974	3,454	7,318
1975	3,548	6,694
1976	3,237	5,581
1977	3,118	5,021
1978	3,264[b]	4,991
1979	3,706	5,126
1980	3,971	4,945
1981	4,662	5,157
1982	5,676	5,676
1983	5,991	5,711
1984	6,094	5,364[r]
1985	7,975	7,102[r]
1986	8,236	7,149[r]
1987	9,528	8,351

Year	NET NEW ORDERS	BACKLOG AS OF DECEMBER 31
1973	$3,617	$3,868
1974	4,059	4,473
1975	3,655	4,580
1976	3,036	4,379
1977	3,280	4,541
1978	2,948	4,581
1979	3,724	4,916
1980	4,961	5,558
1981	6,030	6,749
1982	6,034	7,107
1983	7,231	8,406
1984	7,731	10,043
1985	8,122	10,190
1986	11,023	12,754
1987	11,652	14,625

Source: Bureau of the Census, "Aerospace Industry (Orders, Sales, and Backlog)," Series MA37D (Annually).
a Prior to 1980, includes space vehicle systems and parts sold to other than U.S. Government customers.
b AIA estimate based on MQ37D.
c Based on revised aerospace composite price deflator (1982 = 100).
r Revised.

ORDERS, SALES, AND BACKLOG ENGINES AND PROPULSION UNITS FOR MISSILES AND SPACE VEHICLES[a]

Calendar Years 1973-1987
(Millions of Dollars)

Year	SALES-Current Dollars			SALES-Constant Dollars[c]		
	TOTAL	Military[b]	Non-Military	TOTAL	Military[b]	Non-Military
1973	$ 627	$ 607	$ 20	$1,462	$1,415	$ 47
1974	649	633	16	1,375	1,341	34
1975	643	626	17	1,213	1,181	32
1976	641	621	20	1,105	1,071	34
1977	787	757	30	1,267	1,219	48
1978	792	760	32	1,211	1,162	49
1979	952	915	37	1,317	1,266	51
1980	939	661	278	1,169	823	346
1981	1,204	786	418	1,332	869	462
1982	1,555	899	656	1,555	899	656
1983	1,814	951	863	1,729	907	823
1984	2,305	1,116	1,189	2,029[r]	982[r]	1,047[r]
1985	2,466	1,256	1,210	2,196[r]	1,118[r]	1,078[r]
1986	2,995	1,778	1,217	2,600[r]	1,543[r]	1,057[r]
1987	2,993	1,563	1,430	2,623	1,370	1,253

Year	NET NEW ORDERS			BACKLOG AS OF DECEMBER 31		
	TOTAL	Military[b]	Non-Military	TOTAL	Military[b]	Non-Military
1973	$ 581	$ 563	$ 18	$ 625	$ 615	$ 10
1974	702	680	22	678	662	16
1975	496	481	15	531	517	14
1976	783	763	20	673	659	14
1977	727	693	34	613	595	18
1978	967	919	48	788	754	34
1979	1,187	1,141	46	1,024	980	44
1980	1,121	653	568	1,284	871	413
1981	1,284	746	538	1,343	828	515
1982	2,112	1,134	978	1,901	1,063	838
1983	1,618	942	676	1,691	1,052	639
1984	3,770	2,258	1,512	3,156	2,194	962
1985	3,823	1,323	2,500	4,513	2,261	2,252
1986	1,985	1,224	761	3,503	1,689	1,814
1987	3,335	1,995	1,340	3,849	2,121	1,728

Source: Bureau of the Census, "Aerospace Industry (Orders, Sales, and Backlog)," Series MA37D (Annually).
a See table in Space Programs Chapter for Orders, Sales, and Backlog, Space Vehicle Systems.
b Prior to 1980 includes figures for nonmilitary U.S. Government customers.
c Based on revised aerospace composite price deflator (1982 = 100).
r Revised.

Space Programs

Industry sales of space equipment continued on the ascending trend in evidence throughout the 1980s, with a 1987 gain of approximately 14 percent in either current dollar or inflation-adjusted constant dollar terms.

Aerospace Industries Association data showed sales of space vehicles, systems and related equipment at $22.9 billion, up from $20.1 billion in the previous year.

As has been the case since 1982, the bulk of the sales volume was in military equipment. Although exact figures on the military/civil sales ratio are not available, government data on overall federal funding for space activities provide an indication of relative Department of Defense/NASA outlays.

For Fiscal Year 1987, total space activity outlays amounted to $21.9 billion. Of that total, outlays by DoD, at $14.3 billion, represented some 65 percent. With outlays of $7.3 billion, NASA accounted for 33 per cent. The remainder was in programs operated by the Department of Commerce ($299 million), the Department of Energy ($47 million) and other federal agencies ($26 million).

Estimates for FY 1988, in which overall DoD funding was cut sharply by the Congress, show that NASA space outlays will increase by more than 22 percent while DoD outlays will grow by only eight percent. The estimates are $15.4 billion for DoD, $8.9 billion for NASA. Total space activity outlays, including Commerce, Energy and other agencies, are estimated at $24.7 billion.

A different measure of aerospace industry space activity is found in data supplied by the Bureau of the Census, which reported calendar year 1987 sales of $7.7 billion for space vehicle systems, a gain of 23 percent over the previous year's $6.3 billion. The Census figures cover both military and civil sales but do not include propulsion systems, which in space vehicles represent a major element of cost; the data, therefore, serve only as general trend indicators rather than an expression of industry activity level.

Census also reported a dramatic jump in net new orders for space vehicle systems, again excluding propulsion units. New orders in 1987 amounted to $11.2 billion, a gain of more than 50 percent over 1986's $7.4 billion. The bulk of the increase was in military orders, which

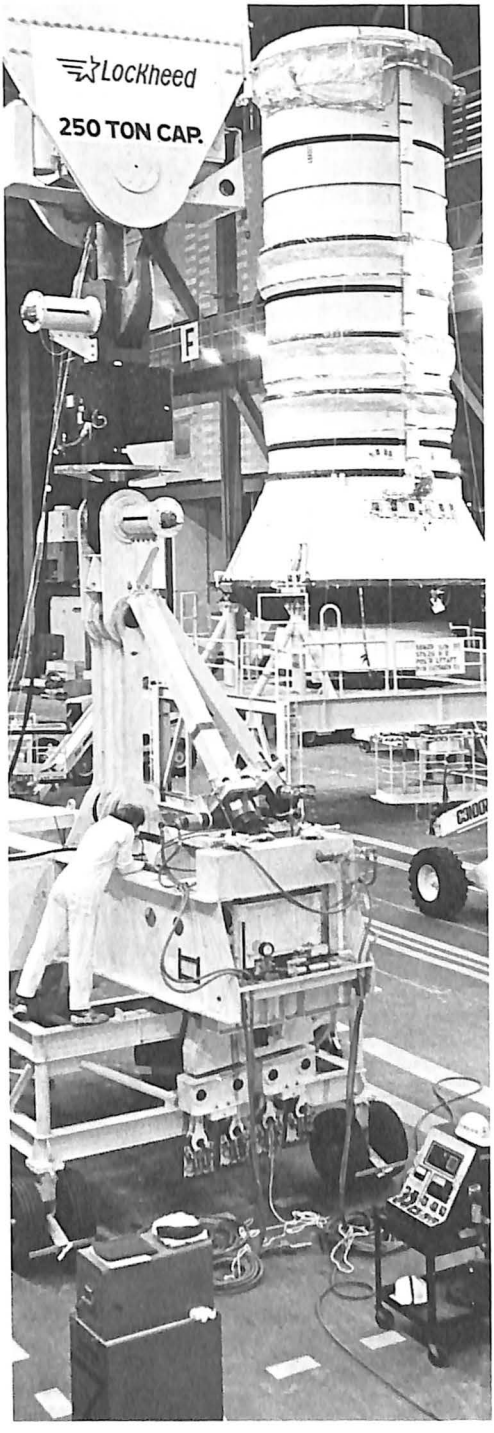
constituted more than 75 percent of the total.

Backlog for space vehicle systems reached an all-time high of $11.8 billion, compared with $8.1 billion at the end of the 1986; almost 80 percent of the backlog was in military systems.

The principal DoD space-related program in 1987-88 was the Strategic Defense Initiative with estimated funding for FY 1988 of $3.6 billion. Other major programs, in order of funding level, included space boosters, with combined procurement/R&D funding of $957 million; the USAF Medium Launch Vehicle, procurement only, $211 million; the National Aerospace Plane, funded only for research, development, test and evaluation (RDT&E), $183 million; the Navy's Fleet Satellite Communications Program, procurement and RDT&E, $139 million; Space Defense System, RDT&E only, $132 million; the Defense Satellite Communications System, procurement and RDT&E, $115 million; the Defense Meteorological Satellite Program, procurement/RDT&E, $114 million; and the Navstar Global Positioning System, procurement/RDT&E, $119 million.

NASA's two major space programs in 1987-88 were the Space Station *Freedom* and the Space Shuttle flight restoration program. Following a series of tests of modified solid rocket boosters and Orbiter main engines, the Shuttle *Discovery* was rolled to the launch pad for a targeted restart of flight operations in September 1988. At publication time, the Congress had passed a NASA appropriation that included the bare minimal funding to keep the *Freedom* program on a schedule that calls for start of assembly-in-orbit operations in 1995 and first human occupancy in 1996.

Among major unmanned space systems planned for launch in 1989-92 were the Hubble Space Telescope, first of NASA's Great Observatory series; the Galileo Jupiter orbiter/probe; the Magellan Venus radar mapping satellite; the Ulysses mission around the poles of the Sun; the Mars Observer Planetary Explorer; and the Astro Shuttleborne observatory intended to measure ultraviolet radiation from celestrial sources. □



U.S. SPACECRAFT RECORD[a]

Calendar Years 1957-1987

Year	Earth Orbit[b]		Earth Escape[b]		Year	Earth Orbit[b]		Earth Escape[b]	
	Success	Failure	Success	Failure		Success	Failure	Success	Failure
1957	0	1	0	0	1972	33	2	8	0
1958	5	8	0	4	1973	23	2	3	0
1959	9	9	1	2	1974	27	2	1	0
1960	16	12	1	2	1975	30	4	4	0
1961	35	12	0	2	1976	33	0	1	0
1962	55	12	4	1	1977	27	2	2	0
1963	62	11	0	0	1978	34	2	7	0
1964	69	8	4	0	1979	18	0	0	0
1965	93	7	4	1	1980	16	4	0	0
1966	94	12	7	1[c]	1981	20	1	0	0
1967	78	4	10	0	1982	21	0	0	0
1968	61	15	3	0	1983	31	0	0	0
1969	58	1	8	1	1984	35	3	0	0
1970	36	1	3	0	1985	37	1	0	0
1971	45	2	8	1	1986	11	4	0	0
					1987	8	1	0	0
					TOTAL	1,120	143	79	15

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

a Payloads, rather than launchings; some launches account for multiple spacecraft. Includes spacecraft from cooperating countries launched by U.S. launch vehicles.

b The criterion of success or failure used is attainment of earth orbit or earth escape rather than judgment of mission success. "Escape" flights include all that were intended to go at least an altitude equal to lunar distance from the earth.

c This earth-escape failure did attain earth orbit and therefore is included in the earth-orbit success totals.

WORLDWIDE SPACE LAUNCHINGS WHICH ATTAINED EARTH ORBIT OR BEYOND[a]

Calendar Years 1957-1987

Country	Total 1957-1987	1983	1984	1985	1986	1987
TOTAL	2,976	127	129	121	103	110
U.S.S.R.	2,017	98	97	98	91	95
United States	867	22	22	17	6	8
Japan	34	3	3	2	2	3
People's Republic of China	19	1	3	1	2	2
European Space Agency	16	2	4	3	2	2
India	3	1	—	—	—	—
Other[b]	20[b]	—	—	—	—	—

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

a Number of launchings rather than spacecraft; some launches orbited multiple spacecraft.

b Includes 10 by France, 8 by Italy (5 were U.S. spacecraft), 1 by Australia, and 1 by the United Kingdom.

U.S. SPACE LAUNCH VEHICLES

As of 1987

Vehicle and Initial Launch & First Launch of this Modification	Stages	Thrust (Kilo-newtons)	Maximum Payload (Kg)[a]		
			185-Km Orbit	Geo-synch.-Transfer Orbit	Circular Sun-Synch. Orbit
Scout (1960; 1979)	1. Algol IIIA* 2. Castor IIA* 3. Antares IIIA* 4. Altair IIIA*	431.1 285.2 83.1 25.6	255 205[b]	—	155[b]
Delta 2900 Series (Thor-Delta) (1960; 1973)	1. Thor plus 9 TX 354-5* 2. Delta 3. TE 364-4*	912.0 147[c] 44.2 65.8	2,000 1,410[b]	705	1,250[b]
Delta 3900 Series (Thor-Delta)[d] (1960; 1982)	1. Thor plus 9 TX 526-2* 2. Delta	912.0 375[c] 44.2	3,045 2,180[b]	1,275	2,135[b]
Atlas E (1967; 1972)	1. Atlas booster & sustainer	1,722.0	2,090[b,e]	—	1,500[b]
Atlas-Centaur (1962; 1984)	1. Atlas booster & sustainer 2. Centaur	1,913.0 146.0	6,100	2,360[h]	—
Vehicle and Launch Date	**Stages**	**Thrust (Kilo-newtons)**	**Maximum Payload (Kg)[a]**		
			185-Km Orbit	**Direct Geo-synch Orbit**	**Sun-Synch. Transfer Orbit**
Titan IIIB-Agena (1966)	1. LR-87 2. LR-91 3. Agena	2,341.0 455.1 71.2	3,600[b]	—	3,060[b]

(Continued on next page)

U.S. SPACE LAUNCH VEHICLES

As of 1987 (Continued)

Vehicle and Launch Date	Stages	Thrust (Kilo-newtons)	Maximum Payload (Kg)[a]		
			185-Km Orbit	Direct Geo.-Synch. Orbit	Sun Synch. Transfer Orbit
Titan III(34)D/ IUS (1982)	1. Two 5½-segment 3.05-m. dia*	11,564.8	14,920	1,850[b]	—
	2. LR-87	2,366.3			
	3. LR-91	449.3			
	4. IUS 1st stage*	275.8			
	5. IUS 2nd stage*	115.7			
Titan III(34)D/ Transtage (1984)	1. Two 5½-segment 3.05-m. dia*	11,564.8	14,920	1,850[b]	—
	2. LR-87	2,366.3			
	3. LR-91	449.3			
	4. Transtage	69.8			
Space Shuttle (reusable) (1981)	1. Orbiter; 3 main engines (SSMEs) fire in parallel with SRBs	1,670[c]	29,500 in full performance configuration (280-420 km orbit)		
	2. Two solid-fueled rocket boosters (SRBs) mounted on external tank (ET) fire in parallel with SSMEs	11,790[c]			

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

* Solid propellant; all others are liquid.

a Due east launch except as indicated.

b Polar launch.

c Each.

d Maximum performance based on 3920 and 3920/PAM (payload assist module) configurations.

e With dual TE 364-4.

f 96° flight azimuth.

ORDERS, SALES, AND BACKLOG
SPACE VEHICLE SYSTEMS

(Excluding Engines and Propulsion Units)[a]
Calendar Years 1973-1987
(Millions of Dollars)

Year	SALES-Current Dollars			SALES-Constant Dollars[c]		
	TOTAL	Military[b]	Non-Military	TOTAL	Military[b]	Non-Military
1973	$1,562	$ 902	$ 660	$3,641	$2,103	$1,538
1974	1,751	944	807	3,710	2,000	1,710
1975	2,119	1,096	1,023	3,998	2,068	1,930
1976	2,002	904	1,098	3,452	1,559	1,893
1977	1,870	814	1,056	3,011	1,311	1,700
1978	2,324	1,006	1,318	3,554	1,538	2,015
1979	2,539	1,105	1,434	3,512	1,528	1,983
1980	3,483	1,461	2,022	4,337	1,819	2,518
1981	3,856	1,736	2,120	4,265	1,920	2,345
1982	4,749	2,606	2,143	4,749	2,606	2,143
1983	4,940	2,420	2,520	4,709	2,307	2,402
1984	5,225	3,019	2,206	4,599[r]	2,658[r]	1,942[r]
1985	6,300	4,241	2,059	5,610[r]	3,777[r]	1,833[r]
1986	6,304	4,579	1,725	5,472[r]	3,975[r]	1,497[r]
1987	7,746	5,325	2,421	6,789	4,667	2,122

Year	NET NEW ORDERS			BACKLOG AS OF DECEMBER 31		
	TOTAL	Military[b]	Non-Military	TOTAL	Military[b]	Non-Military
1973	$1,780	$1,179	$ 601	$1,177	$ 923	$ 254
1974	2,066	1,152	914	1,492	1,131	361
1975	1,931	984	947	1,304	1,019	285
1976	1,932	787	1,145	1,234	902	332
1977	2,225	1,175	1,050	1,589	1,263	326
1978	3,157	1,436	1,721[d]	2,188	1,693	495
1979	2,698	1,018	1,680	1,448	909	539
1980	3,636	1,625	2,011	2,099	1,218	881
1981	5,062	2,878	2,184	3,163	2,166	997
1982	5,842	2,718	3,124	4,254	2,277	1,977
1983	5,399	3,016	2,383	4,865	2,733	2,132
1984	4,984	3,385	1,599	4,624	3,099	1,525
1985	8,383	6,083	2,300	6,707	4,941	1,766
1986	7,437	5,666	1,771	8,063	6,028	2,035
1987	11,199	8,654	2,545	11,785	9,036	2,749

Source: Bureau of the Census, "Aerospace Industry (Orders, Sales, and Backlog)," Series MA37D (Annually).

a See table in Missile Program Chapter for Orders, Sales, and Backlog, Engine and Propulsion Units for Missiles and Space Vehicles.

b Space vehicle systems and parts sold to other than U.S. Government customers included as of 1980; previously, this product group combined with missile systems and parts.

c Based on revised aerospace composite price deflator (1982 = 100); detail may not add to totals because of rounding.

d AIA estimate based on MQ37D data.

r Revised.

FEDERAL SPACE ACTIVITIES OUTLAYS

Fiscal Years 1961-1988
(Millions of Current Dollars)

Year	TOTAL	NASA[a]	DOD	Energy	Commerce	Other[b]
1961	$ 1,467.9	$ 693.6	$ 710.0	$ 64.3	$ —	$ —
1962	2,386.6	1,225.9	1,028.8	130.0	1.0	0.9
1963	4,078.6	2,516.8	1,367.5	181.0	12.2	1.1
1964	5,929.8	4,131.3	1,563.5	220.1	12.3	2.6
1965	6,886.1	5,035.0	1,591.8	232.2	24.1	3.0
1966	7,718.5	5,857.9	1,637.4	188.3	28.1	6.8
1967	7,237.3	5,336.7	1,673.1	183.6	38.6	5.3
1968	6,666.7	4,595.3	1,890.2	146.5	29.0	5.7
1969	6,326.1	4,078.0	2,095.0	117.5	31.0	4.6
1970	5,453.2	3,565.2	1,756.1	102.6	24.0	5.3
1971	4,999.0	3,171.0	1,693.0	97.3	29.8	7.9
1972	4,771.8	3,194.9	1,470.0	59.6	37.4	9.9
1973	4,719.4	3,069.4	1,557.0	51.1	29.4	12.5
1974	4,853.9	2,960.4	1,777.0	38.8	64.0	13.7
1975	4,890.8	2,950.9	1,831.1	34.3	63.6	10.9
1976	5,313.9	3,336.3	1,864.4	25.7	71.1	16.4
Tr. Qtr.	1,361.0	868.6	458.1	7.5	23.2	3.6
1977	5,559.1	3,599.5	1,832.7	22.2	86.9	17.8
1978	6,188.2	3,582.4	2,457.0	28.6	100.7	19.5
1979	6,808.3	3,743.9	2,891.8	54.7	97.4	20.5
1980	7,667.7	4,340.1	3,162.3	48.8	88.7	27.8
1981	9,165.5	4,877.1	4,130.5	46.9	81.0	30.0
1982	10,466.2	5,463.3	4,771.5	59.5	142.4	29.5
1983	12,590.4	6,100.9	6,246.7	39.6	178.0	25.2
1984	14,726.1	6,461.4	8,000.2	33.4	208.7	22.4
1985	17,254.8	6,607.4	10,441.3	34.0	155.4	16.7
1986	18,581.0	6,756.0	11,448.5	34.7	316.9	24.9
1987[E]	21,878.7	7,254.0	14,252.2	47.3	299.2	26.0
1988[E]	24,680.0	8,851.0	15,395.8	90.3	316.1	26.8

Source: NASA, "Aeronautics and Space Report of the President" (Annually).
NOTE: Detail may not add to totals because of rounding.
a Excludes amounts for air transportation.
b Departments of Interior and Agriculture, and The National Science Foundation. NSF funding transferred to NASA after 1982.
E Estimate. Latest year reflects Administration's budget proposal.

FEDERAL SPACE ACTIVITIES OUTLAYS IN CONSTANT DOLLARS

Fiscal Years 1961-1988
(Millions of Constant Dollars, 1982 = 100[a])

Year	TOTAL	NASA[b]	DOD	Energy	Commerce	Other[c]
1961	$ 4,668.9	$ 2,206.1	$2,258.3	$204.5	$ —	$ —
1962	7,458.1	3,830.9	3,215.0	406.3	3.1	2.8
1963	12,518.7	7,725.0	4,197.4	555.6	37.4	3.4
1964	17,941.9	12,500.2	4,730.7	666.0	37.2	7.9
1965	20,397.2	14,914.1	4,715.0	687.8	71.4	8.9
1966	22,217.9	16,862.1	4,713.3	542.0	80.9	19.6
1967	20,142.8	14,853.0	4,656.6	511.0	107.4	14.8
1968	17,926.1	12,356.3	5,082.5	393.9	78.0	15.3
1969	16,138.0	10,403.1	5,344.4	299.7	79.1	11.7
1970	13,146.6	8,595.0	4,233.6	247.3	57.9	12.8
1971	11,449.8	7,262.9	3,877.7	222.9	68.3	18.1
1972	10,360.0	6,936.4	3,191.5	129.4	81.2	21.5
1973	9,760.9	6,348.3	3,220.3	105.7	60.8	25.9
1974	9,305.8	5,675.6	3,406.8	74.4	122.7	26.3
1975	8,502.8	5,130.2	3,183.4	59.6	110.6	18.9
1976	8,559.8	5,374.2	3,003.2	41.4	114.5	26.4
Tr. Qtr.	2,108.3	1,345.5	709.6	11.6	35.9	5.6
1977	8,293.5	5,370.0	2,734.1	33.1	129.6	26.6
1978	8,628.3	4,995.0	3,425.8	39.9	140.4	27.2
1979	8,739.8	4,806.0	3,712.2	70.2	125.0	26.3
1980	9,048.5	5,121.7	3,731.8	57.6	104.7	32.8
1981	9,832.1	5,231.8	4,430.9	50.3	86.9	32.2
1982	10,466.2	5,463.3	4,771.5	59.5	142.4	29.5
1983[r]	12,079.4	5,853.3	5,993.2	38.0	170.8	24.2
1984[r]	13,611.3	5,972.3	7,394.6	30.9	192.9	20.7
1985[r]	15,448.8	5,915.8	9,348.5	30.4	139.1	15.0
1986	16,177.1	5,881.9	9,967.4	30.2	275.9	21.7
1987[E]	18,544.4	6,148.5	12,080.2	40.1	253.6	22.0
1988[E]	20,171.6	7,234.2	12,583.4	73.8	258.4	21.9

Source: AIA, derived from NASA, "Aeronautics and Space Report of the President" (Annually).
NOTE: Detail may not add to totals because of rounding.
a Based on fiscal year GNP implicit price deflator.
b Excludes amounts for air transportation.
c Departments of Interior and Agriculture, and The National Science Foundation. NSF funding transferred to NASA after 1982.
E Estimate. Latest year reflects Administration's budget proposal.
r Revised.

FEDERAL SPACE ACTIVITIES BUDGET AUTHORITY

Fiscal Years 1961-1988[a]
(Millions of Current Dollars)

Year	TOTAL	NASA[a]	DOD	Energy	Commerce	Other[b]
1961	$ 1,808	$ 926	$ 814	$ 68	$ —	$ 1
1962	3,295	1,797	1,298	148	51	1
1963	5,435	3,626	1,550	214	43	2
1964	6,831	5,016	1,599	210	3	3
1965	6,956	5,138	1,574	229	12	3
1966	6,970	5,065	1,689	187	27	3
1967	6,710	4,830	1,664	184	29	3
1968	6,529	4,430	1,922	145	28	4
1969	5,976	3,822	2,013	118	20	3
1970	5,341	3,547	1,678	103	8	4
1971	4,741	3,101	1,512	95	27	5
1972	4,575	3,071	1,407	55	31	10
1973	4,825	3,093	1,623	54	40	15
1974	4,640	2,759	1,766	42	60	14
1975	4,914	2,915	1,892	30	64	13
1976	5,320	3,225	1,983	23	72	16
Tr. Qtr.	1,341	849	460	5	22	4
1977	5,983	3,440	2,412	22	91	18
1978	6,518	3,623	2,738	34	103	20
1979	7,244	4,030	3,036	59	98	21
1980	8,689	4,680	3,848	40	93	28
1981	9,978	4,992	4,828	41	87	30
1982	12,441	5,528	6,679	61	145	29
1983	15,589	6,328	9,019	39	178	25
1984	17,136	6,648	10,195	34	236	22
1985	20,167	6,925	12,768	34	423	17
1986	21,659	7,165	14,126	35	309	25
1987[E]	25,876	9,809	15,717	47	277	26
1988[E]	26,409	8,756	17,196	90	340	27

Source: NASA, "Aeronautics and Space Report of the President" (Annually).
Note: Detail may not add to totals because of rounding.
a Excludes amounts for air transportation.
b Departments of Interior and Agriculture, and the National Science Foundation. NSF funding transferred to NASA after 1982.
E Estimate. Latest year reflects Administration's budget proposal.

FEDERAL SPACE ACTIVITIES BUDGET AUTHORITY IN CONSTANT DOLLARS

Fiscal Years 1961-1988
(Millions of Constant Dollars, 1982 = 100[a])

Year	TOTAL	NASA[b]	DOD	Energy	Commerce	Other[c]
1961	$ 5,751	$ 2,945	$ 2,589	$216	$ —	$ 3
1962	10,297	5,616	4,056	463	159	3
1963	16,682	11,130	4,758	657	132	6
1964	20,669	15,177	4,838	635	9	9
1965	20,604	15,219	4,662	678	36	9
1966	20,063	14,580	4,862	538	78	9
1967	18,675	13,443	4,631	512	81	8
1968	17,556	11,912	5,168	390	75	11
1969	15,245	9,750	5,135	301	51	8
1970	12,876	8,551	4,045	248	19	7
1971	10,859	7,103	3,463	218	62	11
1972	9,933	6,667	3,055	119	67	22
1973	9,979	6,397	3,357	112	83	31
1974	8,896	5,289	3,386	81	115	27
1975	8,543	5,068	3,289	52	111	23
1976	8,570	5,195	3,194	37	116	26
Tr. Qtr.	2,077	1,315	713	8	34	6
1977	8,926	5,132	3,598	33	136	27
1978	9,088	5,052	3,818	47	144	28
1979	9,299	5,173	3,897	76	126	27
1980	10,254	5,523	4,541	47	110	33
1981	10,704	5,355	5,179	44	93	32
1982	12,441	5,528	6,679	61	145	29
1983[r]	14,956	6,071	8,653	37	171	24
1984[r]	15,839	6,145	9,423	31	218	20
1985[r]	18,056	6,200	11,432	30	379	15
1986	18,857	6,238	12,298	30	269	22
1987[E]	21,933	8,314	13,322	40	235	22
1988[E]	21,585	7,157	14,055	74	278	22

Source: AIA, derived from NASA, "Aeronautics and Space Report of the President," (Annually).
a Based on fiscal year GNP implicit price deflator.
b Excludes amounts for air transportation.
c Departments of Interior and Agriculture, and The National Science Foundation. NSF funding transferred to NASA after 1982.
E Estimate. Latest year reflects Administration's budget proposal.
r Revised.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION BUDGET AUTHORITY

Fiscal Years 1962-1989
(Millions of Current Dollars)

Year	TOTAL	Research and Development	Construction of Facilities	Research & Program Management
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	602
1967	4,968	4,235	85	648
1968	4,589	3,912	38	639
1969	3,995	3,314	33	648
1970	3,749	2,993	53	703
1971	3,312	2,556	26	730
1972	3,308	2,523	53	732
1973	3,408	2,599	79	730
1974	3,040	2,194	101	745
1975	3,231	2,323	143	765
1976	3,552	2,678	82	792
Tr. Qtr.	932	700	11	221
1977	3,819	2,856	118	845
1978	4,064	3,012	162	890
1979	4,559	3,477	148	934
1980	5,243	4,088	159	996
1981	5,522	4,334	117	1,071
1982	6,020	4,772	114	1,134
1983	6,875	5,539	139	1,197

Year	TOTAL	Research and Development	Space Flight Control and Data Communications	Construction of Facilities	Research and Program Management
1984	$7,316	$2,064	$3,772	$223	$1,256
1985	7,573	2,468	3,594	178	1,332
1986	7,807	2,619	3,670	176	1,342
1987	10,923	3,154	6,100	217	1,453
1988*E*	8,926	3,199	3,811	178	1,738
1989*E*	11,488	4,447	4,841	285	1,915

Source: "The Budget of the United States" (Annually).
NOTE: Detail may not add to totals because of rounding.
a Included in Research and Development for one year.
E Estimate. Latest year reflects Administration's budget proposal.
Tr. Qtr. Transition Quarter: Until June 30, 1976, the fiscal years ran from July 1 to June 30. 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.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION BUDGET AUTHORITY IN CONSTANT DOLLARS

Fiscal Years 1962-1989
(Millions of Constant Dollars 1982 = 100[a])

Year	TOTAL	Research and Development	Construction of Facilities	Research & Program Management
1962	$ 5,703	$ 4,016	$1,019	$ 669
1963	11,274	8,990	2,284	*(b)*
1964	15,428	11,770	2,157	1,501
1965	15,551	12,915	791	1,845
1966	14,896	12,959	176	1,733
1967	13,827	11,787	237	1,804
1968	12,339	10,519	102	1,718
1969	10,191	8,454	84	1,653
1970	9,038	7,216	128	1,695
1971	7,586	5,854	60	1,672
1972	7,182	5,478	115	1,589
1973	7,049	5,375	163	1,510
1974	5,828	4,206	194	1,428
1975	5,617	4,039	249	1,330
1976	5,722	4,314	132	1,276
Tr. Qtr.	1,444	1,084	17	342
1977	5,697	4,261	176	1,261
1978	5,666	4,200	226	1,241
1979	5,852	4,463	190	1,199
1980	6,187	4,824	188	1,175
1981	5,924	4,649	126	1,149
1982	6,020	4,772	114	1,134
1983[r]	6,596	5,314	133	1,148

Year	TOTAL	Research and Development	Space Flight Control and Data Communications	Construction of Facilities	Research and Program Management
1984[r]	$6,762	$ 1,908	$ 3,486	$ 206	$1,161
1985[r]	6,780	2,210	3,218	159	1,193
1986[r]	6,797	2,280	3,195	153	1,168
1987	9,258	2,673	5,170	184	1,232
1988[E]	7,295	2,615	3,115	145	1,421
1989[E]	9,046	3,502	3,812	224	1,508

Source: AIA, derived from "The Budget of the United States" (Annually).
NOTE: Detail may not add to totals because of rounding
a Based on fiscal year GNP implicit price deflator.
b Included in Research and Development for one year.
E Estimate. Latest year reflects Administration's budget proposal.
r Revised.
Tr. Qtr. Transition Quarter: Until June 30, 1976, the fiscal years ran from July 1 to June 30. 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.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION OUTLAYS

Fiscal Years 1962-1989
(Millions of Current Dollars)

Year	TOTAL	Research and Development	Construction of Facilities	Research & Program Management
1962	$1,257	$ 936	$114	$ 207
1963	2,552	1,912	225	416
1964	4,171	3,317	438	416
1965	5,093	3,984	531	578
1966	5,933	4,741	573	619
1967	5,426	4,487	289	650
1968	4,724	3,946	126	652
1969	4,251	3,530	65	656
1970	3,753	2,992	54	707
1971	3,382	2,630	44	708
1972	3,422	2,623	50	749
1973	3,315	2,541	45	729
1974	3,256	2,421	75	760
1975	3,266	2,420	85	761
1976	3,669	2,749	121	799
Tr. Qtr.	952	731	26	195
1977	3,945	2,980	105	860
1978	3,983	2,989	124	870
1979	4,196	3,139	133	925
1980	4,852	3,702	140	1,010
1981	5,426	4,228	147	1,050
1982	6,035	4,796	109	1,130
1983	6,664	5,316	108	1,240

Year	TOTAL	Research and Development	Space Flight Control and Data Communications	Construction of Facilities	Research and Program Management
1984	$7,048	$2,792	$2,915	$109	$1,232
1985	7,251	2,118	3,707	170	1,322
1986	7,403	2,615	3,267	189	1,332
1987	7,591	2,436	3,597	149	1,409
1988*E*	9,112	3,038	4,270	153	1,650
1989*E*	10,978	3,799	5,109	172	1,896

Source: "The Budget of the United States" (Annually).
NOTE: Detail may not add to totals because of rounding.
E Estimate. Latest year reflects Administration's budget proposal.
Tr. Qtr. Transition Quarter: Until June 30, 1976, the fiscal years ran from July 1 to June 30. 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.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION OUTLAYS IN CONSTANT DOLLARS

Fiscal Years 1962-1989
(Millions of Constant Dollars, 1982 = 100[a])

Year	TOTAL	Research and Development	Construction of Facilities	Research & Program Management
1962	$ 3,928	$ 2,925	$ 356	$ 647
1963	7,833	5,869	691	1,277
1964	12,620	10,036	1,325	1,259
1965	15,086	11,801	1,573	1,712
1966	17,078	13,647	1,649	1,782
1967	15,102	12,488	804	1,809
1968	12,702	10,610	339	1,753
1969	10,844	9,005	166	1,673
1970	9,048	7,213	130	1,704
1971	7,746	6,024	101	1,622
1972	7,429	5,695	109	1,626
1973	6,856	5,255	93	1,508
1974	6,242	4,641	144	1,457
1975	5,678	4,207	148	1,323
1976	5,910	4,428	195	1,287
TR. QTR.	1,474	1,132	40	302
1977	5,885	4,446	157	1,283
1978	5,553	4,168	173	1,213
1979	5,386	4,030	171	1,187
1980	5,726	4,369	165	1,192
1981	5,821	4,536	158	1,126
1982	6,035	4,796	109	1,130
1983[r]	6,394	5,100	104	1,190

Year	TOTAL	Research and Development	Space Flight Control and Data Communications	Construction of Facilities	Research and Program Management
1984[r]	$6,514	$2,581	$2,694	$ 101	$1,139
1985[r]	6,492	1,896	3,319	152	1,184
1986[r]	6,445	2,277	2,844	165	1,160
1987	6,434	2,065	3,049	126	1,194
1988[E]	7,447	2,483	3,490	125	1,349
1989[E]	8,644	2,991	4,023	136	1,493

Source: AIA, derived from "The Budget of the United States" (Annually).
NOTE: Detail may not add to totals because of rounding.
a Based on fiscal year GNP implicit price deflator.
E Estimate. Latest year reflects Administration's budget proposal.
r Revised.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION BUDGET AUTHORITY FOR RESEARCH AND DEVELOPMENT AND SPACE FLIGHT, CONTROL & DATA COMMUNICATIONS[a]

Fiscal Years 1988-1989
(Millions of Dollars)

	1988[E]	1989[E]
RESEARCH AND DEVELOPMENT—TOTAL	$3,295	$4,447
Space Station—Total	$ 392	$ 967
Space Transportation Capability Development—Total	610	631
Space Science & Applications—Total	1,576	1,860
Physics and Astronomy	611	792
Planetary Exploration	329	404
Life Sciences	70	102
Space Applications	566	562
Commercial Use of Space—Total	74	58
Aeronautical Research & Technology—Total	335	414
Research & Technology	224	391
Transatmospheric Research & Technology	53	84
Safety, Reliability and Quality Assurance—Total	14	22
Tracking and Data Advanced Systems—Total	18	19
SPACE FLIGHT, CONTROL AND DATA COMMUNICATIONS—TOTAL	$3,811	$4,841
Space Shuttle Production & Capability Development—Total	$1,088	$1,401
Orbiter	329	320
Launch & Mission Support	165	344
Propulsion Systems	595	712
Changes & Systems Upgrading	—	25
Space Shuttle Operations—Total	1,838	2,405
Flight Operations	584	660
Flight Hardware	777	1,035
Launch & Landing Operations	450	515
Expendable Launch Vehicles	28	196
Space and Ground Networks, Communications & Data Systems—Total	684	1,035

Source: "NASA Budget Briefing Background Material" (Annually).
NOTE: Detail may not add to totals because of rounding.
a Amounts shown reflect the termination of the Advanced Communications Technology Satellite.
E Estimate. Latest year reflects Administration's budget proposal.

DEPARTMENT OF DEFENSE SPACE PROGRAMS[a] PROCUREMENT (INCLUDING INITIAL SPARES) AND RDT&E

Fiscal Years 1987, 1988 and 1989
(Millions of Dollars)

Agency and Program	1987		1988[E]		1989[E]	
	Procurement	RDT&E	Procurement	RDT&E	Procurement	RDT&E
AIR FORCE						
Defense Meteorological Satellite Program (DMSP)	$ 17.9	$ 59.6	$ 71.6	$ 42.7	$159.3	$ 53.4
Defense Satellite Communications System (DSCS)	109.6	16.8	71.9	43.3	54.4	38.1
Medium Launch Vehicle	186.9	—	210.8	—	275.3	—
National Aerospace Plane	—	110.0	—	183.0	—	245.0
Navstar Global Positioning System	78.2	32.8	92.6	26.2	75.6	53.2
Space Boosters	514.7	290.5	502.2	454.9	376.2	488.8
Space Defense System	—	169.2	—	131.9	—	—
Space Shuttle Operations	13.0	90.9	108.5	51.2	23.6	58.7
NAVY						
Fleet Satellite Communications (Fltsatcom)	$ 59.6	$ 9.7	$123.9	$ 15.1	$174.6	$ 21.5
JOINT PROGRAMS						
Strategic Defense Initiative	$ —	$3,279.7	$ —	$3,551.0	$ —	$4,545.9

Source: "Program Acquisition Costs by Weapon System," "Procurement Program (P-1)," and "R,D,T&E Programs (R-1)," Department of Defense Budget (Annually).

a Total Obligational Authority.

E Estimate. Latest year reflects Administration's budget proposal.

NA Not available.

STRATEGIC DEFENSE INITIATIVE ORGANIZATION BUDGET PROGRAM

Fiscal Years 1986-1989
(Millions of Dollars)

Program	1986	1987	1988[E]	1989[E]
TOTAL	$2,675.1	$3,279.7	$3,551.0	$4,545.9
Surveill, Acquisit, Tracking & Kill Assess—TOTAL	$ 844.0	$ 923.0	$ 955.5	$1,124.6
Radar Discrimination Technology & Data Base	19.0	12.1	16.3	22.0
Optical Discrimination Technology & Data Base	106.5	93.5	99.4	122.0
Microwave Radar Technology	27.5	24.5	18.6	25.0
Laser Radar Technology	68.4	87.2	90.6	110.0
Passive Sensor Technology	74.3	71.7	61.0	90.0
Booster Surveill & Tracking System Dem/Val	73.2	127.1	201.0	179.0
Midcourse Dem/Val	43.7	39.6	28.4	90.0
Midcourse Experiment	122.7	109.8	114.2	84.0
Terminal Dem/Val	28.7	24.7	37.2	73.0
SATKA Support	103.3	118.2	97.7	106.8
Signal Processing Technology	85.8	91.6	71.5	195.0
Shuttle Recovery	—	13.6	—	—
Support Programs	84.7	93.6	97.6	107.8
Directed Energy Weapons Technology—TOTAL	796.0	853.1	832.3	1,029.9
GL Technology	125.3	87.0	108.5	261.0
FEL Technology	143.9	184.3	155.5	229.0
NPB Technology	83.6	144.7	102.6	120.0
ATP-FC Technology	248.0	239.7	248.6	220.0
MIRACL/T	18.7	36.7	20.0	—
Support Programs	33.7	63.3	37.3	49.7
CDTI/Emerging Tech	143.0	97.5	159.9	150.2
Kinetic Energy Weapons Technology—TOTAL	596.0	722.5	791.5	936.3
Endoatmospheric Interceptor Dev	76.7	100.1	112.1	150.0
Exoatmospheric Interceptor Dev	61.5	104.5	137.8	202.0
Space Based Interceptor Dev	135.2	118.8	204.8	330.0
Mini Projectiles	55.4	72.9	66.7	77.0
Test & Evaluation	198.7	239.1	162.1	31.0
Technology Support	28.6	43.9	56.9	84.9
Support Programs	40.1	43.3	51.3	61.4

(Continued on Next Page)

STRATEGIC DEFENSE INITIATIVE ORGANIZATION BUDGET PROGRAM (Continued)

Program	1986	1987	1988[E]	1989[E]
Systems Analysis and Battle Management—TOTAL	212.3	385.8	503.2	639.9
SDS Phase I Engineering	—	—	27.5	74.5
SDS Engineering and Support	74.2	88.9	111.0	135.0
Theater Defense	1.7	33.4	41.5	31.4
BM/C^3 Technology	68.1	83.2	70.9	106.0
BM/C^3 Experimental Systems	23.1	68.0	99.1	114.0
National Test Bed	11.7	46.5	87.0	115.0
Support Programs	33.5	65.8	66.2	64.0
Survivability, Lethality & Key Technologies—TOTAL	214.0	375.3	448.7	790.4
System Survivability	45.0	58.7	100.2	175.4
Lethality & Target Hardening	80.3	76.4	74.7	98.0
Power & Power Conditioning	46.6	83.9	98.3	182.0
Space Transportation & Support	18.8	82.6	80.0	200.0
Materials and Structures	2.1	13.8	26.1	54.0
Support Programs	21.4	59.9	69.3	81.0
Management Headquarters—TOTAL	12.8	20.0	19.8	24.8
Management Headquarters	12.8	20.0	19.8	24.8

Source: U.S. Government, "Report to The Congress on the Strategic Defense Initiative, 1987," and Department of Defense, "R, D, T&E Programs (R-1)."
NOTE: Detail may not add to totals because of rounding.
E Estimate. Latest two years represent Administration's budget proposal.

Air Transportation

For the U.S. airline industry, 1987 was a banner year in which traffic, revenues and operating profit all reached record levels.

U.S. air carriers recorded an operating profit of $2.4 billion, approximately double the figure for 1986. Operating revenues totaled $56.7 billion, compared with $50.1 billion in the previous year.

Domestic operations accounted for 80 percent of total revenues and 70 percent of the profit. Domestic revenues of $45.5 billion produced an operating profit of $1.7 billion; the comparable prior year figures were $41.0 billion and $1.1 billion. In international service, revenues increased sharply to $10.9 billion (up from $8.6 billion) and the operating profit jumped dramatically, from $165 million in 1986 to $693 million in 1987.

Traffic on U.S. scheduled airlines increased by more than 10 percent in terms of total revenue ton miles, to 50.5 billion in 1987 from the 1986 level of 45.7 billion. The breakdown was 40.4 billion passenger ton miles and 10.0 billion cargo ton miles; both figures were new records. The total revenue load factor increased to 54.7 percent, up from 53.7 percent in 1986.

In domestic operations, U.S. scheduled air carriers boarded more than 416 million passengers, another record; the comparable figure for 1986 was 394 million. The airlines flew 324.5 billion revenue passenger miles, up from the previous year's 302.1 billion. The domestic service load factor was 61.6 percent, up from 60.7 percent.

International traffic carried by U.S. scheduled airlines boomed in 1987, increasing by almost 23 percent (passengers boarded) over the 1986 figure for a new all-time high. Enplanements in 1987 totaled 30.8 million, up from 25.1 million. Revenue passenger miles amounted to 79.8 billion, a 24 percent gain over 1986's 64.5 billion. The international service load factor was 65.6 percent, compared with 58.9 percent in 1986.

The U.S. air carrier fleet expanded significantly in 1987 with the addition of 341 aircraft. The number of multi-engine aircraft in service at year-end 1987 was 5,250, which compares with 4,909 in the fleet at the end of

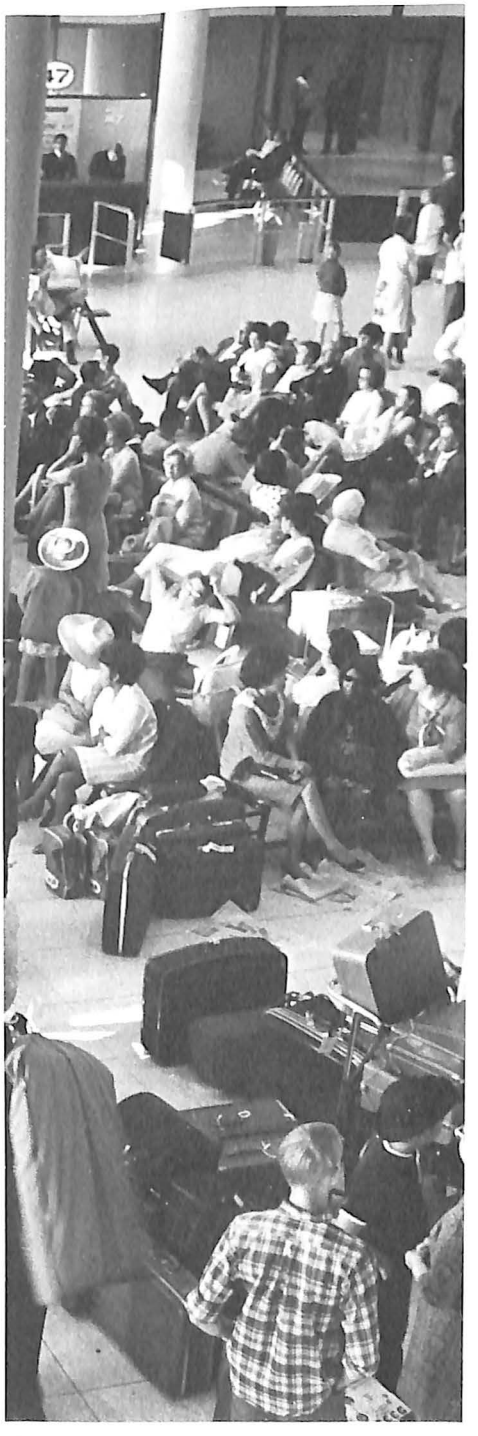
the previous year. The 1987 total included 3,575 turbojet aircraft (more than two-thirds of the total), 1,241 turboprops (up from 1,204) 421 piston engine aircraft (up from 420) and 13 helicopters (up from two).

World scheduled airline service also showed solid gains in traffic and operating revenues, and profits, which had been depressed in 1985-86, rebounded. Airlines of the International Civil Aviation Organization boarded more than one billion passengers (a first) and flew them 989 billion passenger miles; the comparable 1986 figures were 956 million and 901 billion. Overall passenger load factor was 67 percent, up from 65 percent.

ICAO carriers generated combined operating revenues of $144.5 billion and an operating profit of $6.5 billion, which compares with $124.6 billion and $4.6 billion. Expressed as a percentage of total operating revenues, the operating profit was 4.5 percent, up from 3.7 percent in each of the two prior years.

The world fleet of turbine engine aircraft in airline service increased by 712 units, according to Exxon International's annual survey, which excludes air taxi operators and aircraft operated by the Soviet Union's Aeroflot. Exxon reported a total of 11,711 transports in service as of March 31, 1987; that compared with 10,999 in the previous year. The 1987 figure breaks down this way: turbojets, 7,600 (up from 7,188); turboprops, 3,808 (up from 3,546); turbine-powered helicopters 303 (up from 265).

Despite intense competition from foreign companies in the transport sales arena, analysis of the world turbine engine fleet shows that U.S.-built aircraft still number almost two-thirds of the total. As of March 1987, turbine-power transports of U.S. manufacture numbered 7,699 or 65.7 percent of the total; the latter figure compares with 66.2 percent in 1986 and 66 percent in 1985. Among turbojets, the percentage was 83.1 percent (same as in 1986), but U.S. manufacturers produced only 31.1 percent of the turboprop transports in service (down from 31.5 percent). □



OPERATING REVENUES AND EXPENSES OF WORLD SCHEDULED AIRLINES[a]

Calendar Years 1982-1987
(Millions of U.S. Dollars)

	1982	1983	1984	1985	1986	1987[p]
OPERATING REVENUES:						
Scheduled Services:						
Passenger	$74,860	$77,600	$ 81,720	$ 87,000	$94,900	
Freight	9,560	10,830	12,560	13,300	15,200	
Mail	1,480	1,470	1,500	1,700	1,800	NA
Total Schedule Services	$85,900	$89,900	95,780	102,000	111,900	
Non-Scheduled Services	3,100	2,800	3,010	3,500	4,500	
Incidental	4,240	5,600	6,610	6,700	8,200	
Total Operating Revenues	$93,240	$98,300	$105,400	$112,200	$124,600	$144,500
OPERATING EXPENSES:						
Flight Operations	$34,600	$33,050	$ 33,350	34,930	32,710	
Maintenance & Overhaul	9,150	9,620	10,120	11,070	13,850	
Depreciation & Amortization	6,330	6,920	7,240	7,770	9,070	
User Charges & Station Expenses	14,540	15,260	16,080	17,340	21,340	NA
Passenger Services	8,540	8,810	9,190	10,310	12,140	
Ticketing, Sales & Promotion	14,510	15,810	16,560	18,470	21,480	
General, Administrative & Other	5,730	6,730	7,760	8,210	9,410	
Total Operating Expenses	$93,400	$96,200	$100,300	$108,100	$120,000	$138,000
OPERATING RESULT	$ (160)	$ 2,100	$ 5,100	$ 4,100	$ 4,600	$ 6,500
Percent of Revenue	(0.2%)	2.1%	4.8%	3.7%	3.7%	4.5%
NET RESULT[b]	$(1,300)	$(700)	$ 2,000	$ 2,100	$ 1,500	NA
Percent of Revenue	(1.4%)	(0.7%)	1.9%	1.9%	1.2%	NA

Source: International Civil Aviation Organization.
NOTE: Data in parentheses represent negative values.
a Excludes domestic operations in the USSR.
b Net Result equals Operating Result minus non-operating items, including interest, income taxes, retirement of property and equipment, affiliated companies and subsidies.
NA Not available.
p Preliminary.
r Revised.

TRAFFIC STATISTICS
WORLD AIRLINE SCHEDULED SERVICE[a]

Calendar Years 1970-1987

Year	Passengers Carried	Freight Tons Carried	Passenger-Miles Performed	Seat-Miles Available	Passenger Load Factor	Ton-Miles Performed		
						Freight	Mail	TOTAL (Passengers & Baggage, Freight, Mail)
	(Millions)		(Billions)		(Percent)	(Millions)		
1970[r]	383	6.7	286	522	55%	8,180	2,150	38,810
1971	411	7.4	307	568	54	9,060	1,990	41,420
1972[r]	450	8.0	348	609	57	10,290	1,900	46,690
1973[r]	489	9.0	384	667	58	12,010	1,970	51,910
1974[r]	515	9.5	408	688	59	13,030	1,980	55,270
1975	534	9.6	433	733	59	13,270	1,990	58,080
1976	576	10.3	475	789	60	14,750	2,080	63,880
1977[r]	610	11.1	508	837	61	16,190	2,180	68,790
1978	679	11.7	582	902	65	17,770	2,240	77,770
1979[r]	754	12.1	659	999	66	19,190	2,350	86,900
1980	748	12.2	677	1,071	63	20,120	2,520	89,710
1981	752	12.0	695	1,091	64	21,150	2,600	92,800
1982[r]	766	12.8	710	1,115	64	21,600	2,650	94,830
1983[r]	798	13.5	739	1,151	64	24,050	2,740	100,270
1984[r]	847	14.7	794	1,224	65	27,150	2,950	108,970
1985[r]	898	15.1	849	1,291	66	27,270	3,010	114,750
1986[r]	956	16.2	901	1,387	65	29,570	3,100	122,360
1987[p]	1,037	17.4	989	1,471	67	33,120	3,260	134,690

Source: International Civil Aviation Organization (ICAO).

a Includes international and domestic traffic on scheduled service performed by the airlines of the 157 States which were members of ICAO in 1987.

r Revised.

p Preliminary.

OPERATING REVENUES AND EXPENSES OF U.S. AIR CARRIERS[a] DOMESTIC AND INTERNATIONAL OPERATIONS

Calendar Years 1963-1987
(Millions of Dollars)

Year	TOTAL OPERATIONS[b]			Domestic Operations			International Operations		
	Operating Revenues	Operating Expenses	Operating Profit (or Loss)	Operating Revenues	Operating Expenses	Operating Profit (or Loss)	Operating Revenues	Operating Expenses	Operating Profit (or Loss)
1963	$ 3,759	$ 3,479	$ 280	$ 2,790	$ 2,646	$ 144	$ 969	$ 833	$136
1964	4,251	3,781	470	3,169	2,849	320	1,082	932	150
1965	4,958	4,286	672	3,691	3,239	452	1,267	1,047	220
1966	5,745	4,970	775	4,171	3,670	502	1,574	1,300	274
1967	6,865	6,157	708	4,981	4,560	421	1,884	1,597	287
1968	7,753	7,248	505	5,691	5,397	295	2,062	1,852	210
1969	8,791	8,403	387	6,936	6,613	322	1,855	1,790	65
1970	9,290	9,247	43	7,180	7,181	(1)	2,109	2,066	44
1971	10,046	9,717	328	7,753	7,496	257	2,292	2,221	71
1972	11,163	10,578	584	8,652	8,158	493	2,512	2,420	91
1973	12,419	11,834	585	9,694	9,200	494	2,725	2,633	91
1974	14,703	13,978	725	11,546	10,761	785	3,157	3,218	(60)
1975	15,356	15,229	128	12,020	11,902	117	3,336	3,326	11
1976	17,503	16,781	721	13,899	13,324	575	3,605	3,457	147
1977	19,926	19,018	908	15,822	15,166	657	4,104	3,852	252
1978	22,892	21,527	1,366	18,189	17,172	1,018	4,703	4,355	348
1979	27,227	27,028	199	21,652	21,523	129	5,575	5,505	69
1980	33,728	33,949	(222)	26,404	26,409	(6)	6,543	6,766	(223)
1981	36,211	36,612	(401)	28,788	29,051	(264)	6,390	6,574	(184)
1982	36,066	36,804	(739)	28,728	29,478	(750)	6,435	6,452	(17)
1983	38,593	38,231	362	31,014	31,186	(171)	7,163	6,693	470
1984	44,060	41,946	2,114	35,394	33,812	1,582	7,975	7,485	490
1985	48,580	47,207	1,372	37,628	36,610	1,018	8,302	7,984	319
1986[r]	50,086	48,855	1,231	41,043	39,983	1,060	8,626	8,461	165
1987	56,699	54,262	2,437	45,468	43,756	1,712	10,907	10,214	693

Source: U.S. Department of Transportation Office of Aviation Information Management, Financial Data Branch.
NOTE: Detail may not add to totals because of rounding.
a Scheduled and non-scheduled service for all certificated route air carriers. Excludes supplemental air carriers, commuters, and air taxis.
b For 1980 and subsequent years, includes 'Other' operations not reported as 'Domestic' or 'International.'
r Revised.

SOURCES OF OPERATING REVENUES OF U.S. AIR CARRIERS[a] DOMESTIC AND INTERNATIONAL OPERATIONS

Calendar Years 1973-1987
(Millions of Dollars)

Year	TOTAL Operating Revenues	Passenger Service[b]	Mail[c]	Freight[b] & Air Express	Excess Baggage	Other[c]
DOMESTIC OPERATIONS						
1973	$ 9,694	$ 8,518	$263	$ 703	$14	$ 196
1974	11,546	9,903	264	772	17	589
1975	12,020	10,301	253	792	19	655
1976	13,899	12,104	294	942	22	537
1977	15,822	13,773	355	1,109	21	564
1978	18,189	15,753	336	1,347	23	730
1979	21,652	18,931	417	1,485	28	791
1980	26,404	23,317	446	1,582	32	1,027
1981	28,788	25,504	497	1,659	36	1,091
1982	28,728	25,440	524	1,505	42	1,218
1983	31,014	27,519	516	1,602	52	1,326
1984	35,393	31,437	552	1,690	70	1,644
1985	37,628	33,044	733	1,528	78	2,245
1986[r]	41,043	33,475	679	4,207	85	2,597
1987	45,468	37,043	704	4,735	67	2,919
INTERNATIONAL OPERATIONS						
1973	$ 2,725	$ 2,112	$109	$ 438	$15	$ 51
1974	3,157	2,353	118	542	21	122
1975	3,336	2,469	122	591	25	129
1976	3,605	2,665	112	626	27	175
1977	4,104	3,047	112	710	21	215
1978	4,703	3,534	117	750	20	282
1979	5,575	4,271	131	837	23	313
1980	6,543	4,984	175	1,011	25	348
1981	6,390	4,917	165	984	25	299
1982	6,435	4,959	177	990	25	284
1983	7,163	5,605	152	999	23	384
1984	7,975	6,074	158	1,169	27	547
1985	8,302	6,098	160	1,009	28	1,007
1986[r]	8,626	6,205	154	1,309	28	930
1987	10,907	7,840	180	1,580	33	1,274

Source: U.S. Department of Transportation, Office of Aviation Information Management, Financial Data Branch.
NOTE: Detail may not add to totals because of rounding.
a Scheduled and non-scheduled service for all certificated route air carriers. Excludes supplemental air carriers, commuters, and air taxis.
b Scheduled and charter.
c Subsidy included with Mail through 1979, and then included in Other, which also includes revenues not related to transport, plus, beginning in 1981, transport revenues not specifically broken out by category by some small carriers.
r Revised.

OPERATING EXPENSES OF U.S. AIR CARRIERS[a] DOMESTIC AND INTERNATIONAL OPERATIONS

Calendar Years 1973-1987
(Millions of Dollars)

Year	TOTAL Operating Expenses	Flying Operations	Maintenance	Passenger Service	Aircraft & Traffic Servicing	Promotion and Sales	Depreciation & Amortization	Other[b]
DOMESTIC OPERATIONS								
1973	$ 9,200	$ 2,638	$1,408	$ 968	$1,835	$1,057	$ 839	$ 456
1974	10,761	3,345	1,514	1,027	2,026	1,178	871	799
1975	11,902	3,919	1,611	1,117	2,158	1,271	891	936
1976	13,324	4,448	1,816	1,260	2,443	1,495	927	935
1977	15,166	5,288	2,001	1,461	2,728	1,713	967	1,008
1978	17,172	5,669	2,155	1,711	3,120	2,040	1,231	1,246
1979	21,523	7,998	2,457	2,091	3,702	2,564	1,373	1,337
1980	26,409	11,029	2,758	2,329	4,051	3,096	1,586	1,560
1981	29,051	12,037	2,822	2,522	4,497	3,708	1,723	1,742
1982	29,478	11,529	2,709	2,668	4,665	4,160	1,876	1,869
1983	31,186	11,370	2,878	2,983	5,104	4,764	2,107	1,980
1984	33,812	12,161	3,176	3,192	5,369	5,310	2,223	2,380
1985	36,610	12,684	3,604	3,464	5,781	6,089	2,318	2,670
1986[r]	39,983	11,379	4,484	3,793	7,680	6,820	2,656	3,171
1987	43,756	12,435	4,904	4,168	8,571	7,395	2,846	3,437
INTERNATIONAL OPERATIONS								
1973	$ 2,633	$ 752	$ 338	$ 302	$ 501	$ 368	$ 225	$ 148
1974	3,218	1,136	381	295	538	386	230	252
1975	3,326	1,175	392	292	565	422	225	254
1976	3,457	1,215	399	300	597	473	205	268
1977	3,852	1,303	450	351	668	526	253	301
1978	4,355	1,351	498	427	768	623	323	363
1979	5,505	1,960	571	538	922	774	352	388
1980	6,766	2,775	616	600	1,049	917	385	423
1981	6,574	2,757	540	583	932	945	382	435
1982	6,452	2,596	512	577	893	954	396	525
1983	6,693	2,490	548	664	936	1,162	389	505
1984	7,485	2,629	677	749	975	1,308	446	701
1985	7,984	2,738	768	852	1,069	1,414	482	662
1986[r]	8,461	2,403	901	877	1,386	1,665	518	711
1987	10,214	2,830	1,092	1,059	1,748	2,094	533	858

Source: U.S. Department of Transportation, Office of Aviation Information Management, Financial Data Branch.
NOTE: Detail may not add to totals because of rounding.
a Scheduled and non-scheduled service for all certificated route air carriers. Excludes supplemental air carriers, commuters, and air taxis.
b General and administrative, and other transport-related expenses.
r Revised.

U.S. AIR CARRIERS
TOTAL ASSETS AND INVESTMENT IN EQUIPMENT

Calendar Years 1968-1987
(Millions of Dollars)

Year	TOTAL Assets	Value of Flight Equipment	Value of Ground Property & Equipment, & Other[a]	Less: Reserves for Depreciation & Overhaul	Equals: Net Value of Owned Operating Property & Equipment	Investment in Operating Property and Equipment as a Percent of Total Assets
1968	$10,992	$ 9,021	$1,269	$ 3,009	$ 7,281	66.2%
1969	12,069	9,943	1,516	3,560	7,899	65.4
1970	12,913	10,950	1,951	4,120	8,782	68.0
1971	12,998	11,221	2,028	4,649	8,600	66.2
1972	13,635	11,918	2,225	5,115	9,028	66.2
1973	14,464	12,908	2,424	5,693	9,639	66.6
1974	15,200	13,538	2,539	6,252	9,826	64.6
1975	15,064	14,035	2,635	6,823	9,847	65.4
1976	15,454	14,399	2,792	7,585	9,605	62.2
1977	16,869	14,822	2,997	8,141	9,679	57.4
1978	20,745	16,127	3,367	8,799	10,696	51.6
1979	24,907	18,561	3,985	9,746	12,800	51.4
1980	28,900	20,859	4,682	10,309	15,233	52.7
1981	30,513	22,375	5,175	11,028	16,521	54.1
1982	31,525	23,786	5,424	11,405	17,804	56.5
1983	35,213	26,588	6,191	12,910	19,868	56.4
1984	36,769	28,509	6,061	14,043	20,527	55.8
1985	40,978	30,402	6,772	15,467	21,707	53.0
1986[r]	47,105	31,750	8,468	14,764	25,454	54.0
1987	51,246	33,178	9,218	15,595	26,801	52.3

Source: U.S. Department of Transportation, Office of Aviation Information Management, Financial Data Branch.
a Includes land and construction in progress.
r Revised.

TRAFFIC STATISTICS
U.S. AIR CARRIER SCHEDULED SERVICE[a]

Calendar Years 1963-1987

Year	Revenue Ton Miles (Millions)			Total Available Ton Miles (Millions)	Total Revenue Load Factor	Aircraft Revenue Miles (Millions)	Average Over-All Flight Stage Length (Miles)	Average Available Seats per Aircraft Mile
	Passenger	Cargo[b]	Total					
1963	4,839	1,507	6,346	13,257	47.9%	1,095	289	91
1964	5,630	1,803	7,434	15,514	47.9	1,189	301	93
1965	6,629	2,356	8,986	18,408	48.8	1,354	322	96
1966	7,736	2,949	10,686	20,939	51.0	1,482	339	98
1967	9,561	3,475	13,036	26,968	48.3	1,834	371	101
1968	11,023	4,226	15,249	33,221	45.9	2,146	401	107
1969	12,197	4,701	16,898	38,664	43.7	2,385	443	112
1970	13,171	4,994	18,166	41,693	43.6	2,426	473	117
1971	13,565	5,120	18,685	44,139	42.3	2,378	476	125
1972	15,241	5,506	20,746	45,583	45.5	2,376	471	129
1973	16,196	6,046	22,242	49,019	45.4	2,448	477	135
1974	16,292	6,133	22,425	46,848	47.9	2,258	478	140
1975	16,281	5,905	22,186	47,254	46.9	2,241	476	143
1976	17,899	6,222	24,121	49,325	48.9	2,320	480	146
1977	19,322	6,587	25,909	52,284	49.6	2,419	490	149
1978	22,678	7,001	29,679	54,765	54.2	2,520	502	152
1979	26,202	7,189	33,390	60,844	54.9	2,791	517	154
1980	25,519	7,084	32,603	62,983	51.8	2,816	526	158
1981	24,889	7,060	31,949	61,186	52.2	2,703	519	161
1982	25,964	6,886	32,850	62,401	52.6	2,699	544	167
1983	28,183	7,573	35,756	65,385	54.7	2,809	558	169
1984	30,512	8,185	38,697	72,223	53.6	3,134	575	168
1985	33,640	7,689	41,329	76,059	54.3	3,320	569	168
1986[r]	36,655	9,026	45,681	85,140	53.7	3,725	580	168
1987	40,436	10,015	50,451	92,171	54.7	3,984	606	168

Source: U.S. Department of Transportation, Office of Aviation Information Management, Financial Data Branch.
NOTE: Detail may not add to totals because of rounding.
a Includes international and domestic operations.
b Includes freight, air express, U.S. and foreign mail.
r Revised.

PASSENGER STATISTICS
U.S. AIR CARRIER SCHEDULED SERVICE
DOMESTIC AND INTERNATIONAL OPERATIONS

Calendar Years 1973-1987

Year	Revenue Passenger Enplanements (Thousands)	Average Passenger Trip-Length (Miles)	Revenue Passenger Miles (Millions)	Available Seat Miles (Millions)	Revenue Passenger Load Factor[a]
DOMESTIC OPERATIONS					
1973	183,272	689	126,317	244,699	51.6%
1974	189,733	684	129,732	233,880	55.5
1975	188,746	698	131,728	241,282	54.6
1976	206,279	704	145,271	261,248	55.6
1977	222,283	705	156,609	280,619	55.8
1978	253,957	719	182,669	299,542	61.0
1979	292,700	714	208,891	332,796	62.8
1980	272,829	736	200,829	346,028	58.0
1981	265,304	749	198,715	346,172	57.4
1982	274,342	766	210,149	359,528	58.5
1983	296,721	765	226,909	379,150	59.8
1984	321,047	759	243,692	422,507	57.7
1985	357,109	758	270,584	445,826	60.7
1986[r]	393,864	767	302,090	497,991	60.7
1987	416,468	779	324,481	526,663	61.6
INTERNATIONAL OPERATIONS					
1973	18,936	1,882	35,640	65,898	54.1%
1974	17,725	1,872	33,186	63,126	52.6
1975	16,316	1,905	31,082	61,724	50.4
1976	17,039	1,979	33,717	61,574	54.8
1977	18,043	2,029	36,610	64,947	56.4
1978	20,759	2,125	44,112	69,209	63.7
1979	24,163	2,199	53,132	83,330	63.8
1980	24,074	2,258	54,363	86,507	62.8
1981	20,672	2,427	50,173	78,725	63.7
1982	19,760	2,505	49,495	80,591	61.4
1983	21,917	2,506	54,920	85,388	64.3
1984	23,636	2,599	61,424	92,817	66.2
1985	24,913	2,642	65,819	101,963	64.6
1986[r]	25,082	2,570	64,456	109,445	58.9
1987	30,839	2,589	79,827	121,751	65.6

Source: U.S. Department of Transportation, Office of Aviation Information Management, Financial Data Branch.
a Revenue passenger miles as a percent of available seat miles.
r Revised.

TURBINE-ENGINED AIRCRAFT IN THE WORLD AIRLINE FLEET

By Model Years 1983-1987

	1983	1984	1985	1986	1987
TOTAL AIRCRAFT IN SERVICE	9,643	10,248	10,496	10,999	11,711
Turbojets—TOTAL	6,462	6,802	6,900	7,188	7,600
Aerospatiale SE-210 Caravelle	105	100	89	67	60
Aerospatiale SN-601 Corvette	10	12	12	11	11
Airbus A300	206	220	237	247	267
Airbus A310	4	29	50	79	94
B.Ae. 111	155	154	156	162	166
B.Ae. 146	—	10	21	37	59
B.Ae. HS-125	9	10	11	14	18
B.Ae./Aerospatiale Concorde	14	14	14	14	14
B.Ae. Trident	71	65	48	34	34
Boeing 707/720	435	365	322	284	273
Boeing 727	1,602	1,696	1,658	1,678	1,676
Boeing 737	879	940	1,008	1,135	1,284
Boeing 747	533	556	571	597	629
Boeing 757	10	33	56	89	117
Boeing 767	37	79	106	133	163
Cessna 500/550/650 Citation I/II	22	26	36	29	28
Convair 880/990	15	14	11	10	12
Dassault Falcon 10/20/50	46	43	28	32	30
Dassault Mercure	10	10	11	11	11
Fokker F-28 Fellowship	124	151	171	189	197
Gates Learjet	27	27	32	30	43
Gulfstream II/III G-1159	14	15	15	13	15
Ilyushin IL-62	47	48	52	56	60
Ilyushin IL-76	17	37	36	42	44
Israel Aircraft 1121/1124	12	9	4	8	9
Lockheed L-1329 JetStar	7	8	8	7	12
Lockheed L-1011 TriStar	224	231	222	217	230
MBB Hansa HFB-320	—	1	—	1	1
McDonnell Douglas DC8	336	337	302	244	258
McDonnell Douglas DC-9/ MD-80	971	1,021	1,066	1,149	1,218
McDonnell Douglas DC-10	346	346	357	356	355
Rockwell/Sabreliner 60	—	—	1	—	—
Tupolev Tu-124	2	—	—	—	—
Tupolev Tu-134	86	95	95	98	98
Tupolev Tu-154	39	47	45	57	74
Yakolev Yak-40/42	47	52	50	58	42
Turboprops—TOTAL	2,956	3,191	3,350	3,546	3,808
Aerospatiale N.262 Mohawk 298	30	35	3	28	28
Aerospatiale/Aeritalia ATR 42	—	—	—	10	36
Antonov An.12	8	11	9	11	14
Antonov An.24/26/30	159	152	143	163	200
B.Ae. (HP-137) Jetstream 31	18	33	49	88	114

(Continued on next page)

TURBINE-ENGINED AIRCRAFT IN THE WORLD AIRLINE FLEET
By Model 1983-1987 (Continued)

	1983	1984	1985	1986	1987
Turboprops (continued)					
B.Ae. Vanguard	8	10	10	7	8
B.Ae. Viscount	67	94	87	68	47
B.Ae. HS-748	154	151	156	155	157
Beech 18 Turbo	1	6	12	8	15
Beech 99	146	163	174	179	169
Beech 90 King Air	24	29	36	39	36
Beech 100 King Air	7	8	9	13	21
Beech 200 King Air	44	43	42	53	62
Beech 1900	—	5	35	42	64
Bristol 175 Britannia	8	7	8	8	8
Canadair CL-44	12	17	17	16	15
CASA/Nurtanio C-212 Aviocar	66	91	106	105	97
Cessna 208 Caravan I	—	—	3	64	74
Cessna 425/441 Conquest I/II	13	16	17	16	16
Convair 580/600/640	156	141	149	146	142
DHC-2 Turbo Beaver	11	11	11	9	3
DHC-5 Buffalo	2	2	2	2	2
DHC-6 Twin Otter	464	488	468	455	450
DHC-7 Dash 7	78	85	89	90	95
DHC-8 Dash 8	—	—	2	21	55
Dornier DO 128 Turbo-Skyservant	1	1	1	—	—
Dornier DO-228	5	18	31	39	59
Douglas DC-3T Turbo Express	—	1	1	1	1
Embraer EMB-110 Bandeirante	220	232	217	207	232
Embraer EMB-120 Brasilia	—	—	—	8	28
Fokker/Fairchild F-27/FH-227 Friendship	405	411	426	434	436
GAF Nomad	34	25	23	23	23
Grumman G-159 Gulfstream I	20	23	28	26	31
Grumman G-73 Turbo Mallard	6	6	6	7	8
Grumman G-21C Turbo Goose	1	—	—	—	—
Handley Page Herald	34	27	22	15	21
Hawker-Siddeley Argosy	7	7	7	7	5
Ilyushin IL-18	74	75	74	72	71
Israel Aircraft Arava 101B	5	1	—	—	—
Lockheed L-188 Electra	85	84	91	76	77
Lockheed L-100/L-382 Hercules	51	59	62	60	56
Mitsubishi MU-2B	17	17	10	10	12
NAMC YS-11	113	118	118	117	108
Pilatus PC-6 Turbo Porter	9	27	30	33	25
Pilatus Britten-Norman BN-2T Turbo Islander	—	5	5	5	5
Piper PA-31T/42 Cheyenne	10	12	16	21	18
Piper T-1040	1	4	7	11	8
Rockwell Turbo Commander	10	8	6	10	9
Saab SF-340	—	—	16	39	67
Saunders ST-27	9	10	10	10	11

(Continued on next page)

TURBINE-ENGINED AIRCRAFT IN THE WORLD AIRLINE FLEET (Continued)

By Model 1983-1987

	1983	1984	1985	1986	1987
Turboprops (continued)					
Shorts SC-5 Belfast	5	5	5	5	5
Shorts SC-7 Skyliner/Skyvan	37	34	27	29	15
Shorts 330	88	81	81	76	71
Shorts 360	7	41	66	78	106
Swearingen Merlin	2	17	26	30	52
Swearingen Metro	218	234	263	291	302
Transall C-160	6	9	9	9	8
Xian (Antonov) Y-7	—	1	1	1	10
Turbine-Powered Helicopters—TOTAL	225	255	246	265	303
Aerospatiale SA-315 Lama	7	5	5	3	3
Aerospatiale SA-316 Alouette III	3	12	12	12	11
Aerospatiale SA-318 Alouette II	1	2	1	1	4
Aerospatiale SA-319 Alouette III Astazou	1	2	2	2	4
Aerospatiale (Nurtanio) SA-330 Puma	—	19	19	18	23
Aerospatiale AS-332 Super Puma	1	5	5	5	5
Aerospatiale AS-335	—	—	—	1	—
Aerospatiale AS-350 Ecureuil/ AStar	3	5	5	5	5
Aerospatiale AS-355 Ecureuil 2/ Twinstar	1	2	2	2	2
Aerospatiale SA-360 Dauphin	8	8	—	—	—
Aerospatiale SA-365 Dauphin II	1	8	8	9	9
Bell (Agusta/Fuji) 204	10	12	10	8	6
Bell 205	6	6	6	6	2
Bell 206 Jetranger/Longranger	35	32	46	52	53
Bell 212	15	14	14	27	27
Bell (Fuji) 214/214ST	7	7	7	6	5
Bell 222 UT	—	—	4	5	5
Bell 412	—	1	4	5	5
Boeing Vertol 234 Chinook	6	6	4	4	3
Hughes (Kawasaki) 500	30	22	15	13	10
Kawasaki BK 117	—	—	—	1	1
M.B.B./Nurtanio Bo. 105	7	7	7	9	34
Sikorsky S-55T	3	3	3	3	5
Sikorsky S-58T	15	14	12	11	13
Sikorsky S-61	44	42	36	37	41
Sikorsky S-76	16	15	15	20	27
Westland 30	5	6	3	—	—

Source: Exxon International Company, "Air World Survey," compiled by Aviation Data Service, Inc. (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 as of March 31. Excludes air taxi operators.

U.S. TURBINE-ENGINED AIRCRAFT IN THE WORLD AIRLINE FLEET

Calendar Years 1983-1987

	1983	1984	1985	1986[r]	1987
TOTAL AIRCRAFT IN SERVICE	9,643	10,248	10,496	10,999	11,711
Number Manufactured in U.S.	6,440	6,728	6,930	7,284	7,699
Percent Manufactured in U.S.	66.8%	65.7%	66.0%	66.2%	65.7%
Turbojet Aircraft in Service	6,462	6,802	6,900	7,188	7,600
Number Manufactured in U.S. ..	5,458	5,695	5,770	5,971	6,313
Percent Manufactured in U.S. ..	84.5%	83.7%	83.6%	83.1%	83.1%
Turboprop Aircraft in Service ...	2,956	3,191	3,350	3,546	3,808
Number Manufactured in U.S. ..	795	859	983	1,116	1,184
Percent Manufactured in U.S. ..	26.9%	26.9%	29.3%	31.5%	31.1%
Turbine-Powered Helicopters In Service	225	255	246	265	303
Number Manufactured in U.S. ..	187	174	177	197	202
Percent Manufactured in U.S. ..	83.1%	68.2%	72.0%	74.3%	66.7%

Source: Exxon International Company, "Air World Survey," compiled by Aviation Data Service, Inc. (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 as of March 31. Excludes air taxi operators.
r Revised.

JET FUEL COSTS AND CONSUMPTION BY U.S. AIR CARRIERS[a]

Calendar Years 1973-1987

Year	Gallons Consumed (Millions)	Total Cost (Millions)	Cost Per Gallon (Cents)	Cost Index (1972 = 100)	Cost of Fuel as Percent of Cash Operating Expenses
1973	10,700.4	$ 1,365.3	12.8¢	109.4	12.1%
1974	9,565.2	2,333.5	24.4	209.2	17.3
1975	9,495.3	2,777.3	29.2	250.8	18.9
1976	9,820.8	3,116.1	31.7	272.0	19.2
1977	10,282.0	3,729.8	36.3	311.0	20.1
1978	10,627.1	4,178.2	39.3	337.1	19.7
1979	11,278.1	6,503.0	57.7	494.4	24.4
1980	10,874.0	9,769.5	89.8	770.3	29.7
1981	10,087.8	10,498.0	104.1	892.2	29.3
1982	9,935.4	9,755.2	98.2	841.8	27.2
1983	10,207.8	9,073.1	88.9	762.0	24.5
1984	11,006.6	9,361.7	85.1	729.2	23.9
1985	11,595.1	9,326.7	80.4	689.6	22.3
1986[r]	12,545.8	6,929.7	55.2	473.6	16.3
1987	13,409.8	7,464.0	55.7	477.2	16.0

Source: Air Transport Association of America
a Includes Majors and Nationals, per CAB classifications effective 1981, corresponding to previous categories of System Trunks and Local Service Carriers. Revised from previously reported data. Air Florida, Capitol and Transamerica not included in 1984 data, and excluded from prior year data for comparability.
r Revised.

U.S. CIVIL AND JOINT-USE AIRCRAFT FACILITIES[a] BY TYPE AND STATE

As of December 31, 1987

State	TOTAL[a]	Public[b]	Paved	Lighted	State	TOTAL[a]	Public[b]	Paved	Lighted
Alabama	193	104	130	98	Nevada	128	63	59	31
Alaska	593	425	60	135	New Hampshire	62	28	36	19
Arizona	265	78	149	67	New Jersey	317	61	130	61
Arkansas	173	97	108	82	New Mexico	174	71	79	54
California	909	280	642	269	New York	507	181	202	135
Colorado	333	86	163	99	N. Carolina	316	128	130	111
Connecticut	120	27	70	29	N. Dakota	487	104	75	97
Delaware	35	11	14	13	Ohio	716	207	272	195
Dist. of Col.	15	2	12	5	Oklahoma	403	166	205	136
Florida	607	131	261	154	Oregon	366	108	147	85
Georgia	334	118	174	119	Pennsylvania	744	159	278	152
Hawaii	54	14	42	13	Rhode Island	22	8	15	7
Idaho	207	117	72	42	S. Carolina	146	72	70	63
Illinois	913	126	233	173	S. Dakota	158	75	56	75
Indiana	530	118	147	123	Tennessee	201	91	119	86
Iowa	277	146	132	152	Texas	1,687	409	833	421
Kansas	389	151	128	142	Utah	109	50	69	43
Kentucky	139	73	90	60	Vermont	62	20	17	9
Louisiana	381	94	217	79	Virginia	308	80	139	89
Maine	144	78	44	31	Washington	408	138	184	137
Maryland	154	42	67	45	W. Virginia	95	40	54	33
Massachusetts	158	51	97	42	Wisconsin	423	152	137	137
Michigan	431	218	175	170	Wyoming	104	45	47	36
Minnesota	477	163	120	139	**50 States-Total**	16,949	5,682	7,190	4,898
Mississippi	194	93	103	82	Puerto Rico	27	11	23	10
Missouri	440	153	193	145	Virgin Islands	8	2	3	3
Montana	210	125	92	82	S. Pacific[c]	31	28	16	11
Nebraska	331	105	102	96	**TOTAL**	17,015	5,723	7,232	4,922

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

a 17,015 aircraft facilities consist of 12,907 airports (5,385 for public use and 7,522 for private use), 3,653 heliports (117 for public use and 3,536 for private use), 67 stolports (9 for public use and 58 for private use), and 388 seaplane bases (212 for public use and 176 for private use). Included in these data are facilities having joint civil-military use.

b 'Public' refers to use, whether publicly or privately owned.

c American Samoa, Guam, and Trust Territories.

ACTIVE MULTI-ENGINE U.S. AIR CARRIER FLEET

By Type of Aircraft, Number of Engines and Model
Active as of December 1983-1987

	1983	1984	1985	1986	1987
TOTAL	4,203	4,370	4,678	4,909	5,250
Turbojets—TOTAL	2,767	2,959	3,164	3,283	3,575
Four-Engine—TOTAL	309	349	322	322	382
Boeing 707/720	25	22	27	35	31
Boeing 747	146	156	151	150	156
B.Ae. 146	3	14	29	25	57
Convair 880(22)/990(30)	2	—	—	—	—
McDonnell Douglas DC-8	133	157	115	112	138
Three-Engine—TOTAL	1,393	1,438	1,488	1,466	1,469
Boeing 727	1,122	1,161	1,195	1,172	1,168
Lockheed L-1011	116	103	114	114	116
McDonnell Douglas DC-10	155	174	179	180	185
Twin-Engine—TOTAL	1,065	1,172	1,354	1,495	1,724
Airbus A-300	34	38	46	52	52
Airbus A-310	—	—	4	7	13
Boeing 737	348	391	476	555	633
Boeing 757	15	19	48	73	95
Boeing 767	49	53	59	69	83
B.Ae. BAC-111	36	33	32	45	39
Canadair CL600	1	—	—	—	—
Cessna C500 Citation I	1	1	2	—	—
Dassault MD-20, Falcon	12	11	2	—	—
Fokker F-28	6	23	41	50	47
Grumman G-1159	1	1	—	—	—
Hamburger Flugzeugbau HF-320	1	—	—	—	—
Hawker-Siddeley HS125	—	—	—	—	—
Israel Westwind 1123/1124	—	1	—	—	—
Learjet LR-23/LR-24	—	—	—	—	—
Learjet LR-25	—	—	—	—	—
Learjet LR-35	4	8	3	1	2
Learjet LR36	—	—	—	—	—
McDonnell Douglas DC-9/MD-80	557	594	641	643	760
Rockwell NA-265 Sabreliner	—	—	—	—	—
Sud Aviation SE210 Caravelle	1	—	—	—	—
Turboprops—TOTAL	876	956	1,076	1,204	1,241
Four-Engine—TOTAL	99	109	108	96	102
Canadair CL44D	2	5	6	2	6
De Havilland DHC-7	46	46	42	40	41
Lockheed 188 Electra	37	34	38	33	34
Lockheed 382/L-100 Hercules	11	22	22	21	21
Vickers V745	3	2	—	—	—

(Continued on next page)

ACTIVE MULTI-ENGINE U.S. AIR CARRIER FLEET

By Type of Aircraft, Number of Engines and Model (Continued)

	1983	1984	1985	1986	1987
Twin-Engine—TOTAL	777	847	968	1108	1139
Beech BE1900	—	17	42	60	48
Beech BE99	101	85	103	95	52
Beech BE90	2	2	3	1	4
Beech BE200	4	6	1	2	5
Beech STC 18	1	1	—	—	—
Beech 100	1	2	1	1	—
CASA C212 Aviocar	28	27	24	19	16
Cessna C441	1	3	1	3	2
Convair 580/600/640	100	107	100	91	77
DeHavilland DHC-6	112	107	86	68	71
DeHavilland DHC-8	—	—	10	26	34
Dornier DO 228	—	—	6	12	18
Douglas DC-3	—	—	1	—	—
Embraer EMB110/EMB120	83	81	79	107	133
Fairchild/Fokker F-27/FH-227	35	46	63	63	47
Fairchild Swearingen SA-226	99	121	113	122	101
Fairchild Swearingen SA-227	55	70	101	135	163
GAF N22/N24 Nomad	—	—	—	—	—
Grumman G-73	4	—	3	—	—
Grumman G-159	16	21	23	15	14
BAE Jetstream	10	10	46	69	113
Hawker-Siddeley HS748	5	2	—	—	—
Israel Aircraft AR101B	—	—	—	—	—
Mitsubishi MU-2	2	1	3	6	1
Nihon YS-11	35	30	42	36	36
Nord ND-262/STC-262	9	14	14	15	12
Piper PA31T	6	8	4	5	6
Rockwell Aero Commander 690	1	4	4	4	1
Saab-Fairchild SF340A	—	3	17	34	51
Short SD-3/SD-330	66	78	77	110	110
Short SC-7	1	1	1	1	—
Societe Nationale Industrielle Aerospatiale SNAIS ATR-42	—	—	—	8	20
Piston-Engine—TOTAL	551	443	433	420	421
Four-Engine—TOTAL	52	50	38	32	38
DeHavilland DHC-114	11	6	—	—	—
Douglas DC-4	3	3	3	1	—
Douglas DC-6	38	41	34	30	37
Douglas DC-7	—	—	1	1	1
Three-Engine—TOTAL	—	4	4	3	3
Pilatus Britten-Norman BN2A-MK-3 Trislander	—	4	4	3	3
Twin-Engine—TOTAL	499	389	391	385	380
Helicopters—TOTAL	9	12	5	2	13

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

NOTE: Effective 1978, includes certified route air carriers, supplemental air carriers (charters), and all aircraft over 12,500 pounds operated by air taxis, commercial operators and travel clubs. Effective 1978 includes multi-engine aircraft in passenge service of commuters. "Active aircraft" must have a current U.S. registration and have been flown during the calendar year.

ACTIVE U.S. CIVIL AIRCRAFT[a]

As of December 31, 1962-1986

Year	TOTAL	Air Carrier[b]	General Aviation Aircraft					
			TOTAL	Fixed-Wing Aircraft			Rotor-craft[c]	Other[d]
				Multi-Engine	Single-Engine			
					4-place & over	3-place & less		
1962	86,168	2,047	84,121	9,186	41,120	32,341	967	507
1963	87,167	2,079	85,088	9,695	42,647	30,977	1,171	588
1964	90,823	2,081	88,742	10,644	45,777	30,367	1,306	648
1965	97,567	2,125	95,442	11,977	49,789	31,364	1,503	809
1966	106,978	2,272	104,706	13,548	52,972	35,687	1,622	877
1967	116,638	2,452	114,186	14,651	56,865	39,675	1,899	1,096
1968	126,823	2,586	124,237	16,760	60,977	42,830	2,350	1,320
1969	133,496	2,690	130,806	18,111	63,703	45,001	2,557	1,434
1970	134,422	2,679	131,743	18,291	64,759	44,884	2,255	1,554
1971	133,790	2,642	131,148	17,855	64,464	44,792	2,352	1,685
1972	147,593	2,583	145,010	19,849	70,998	49,448	2,787	1,928
1973	156,139	2,599	153,540	21,929	74,831	51,386	3,143	2,251
1974	163,974	2,472	161,502	23,418	78,924	53,008	3,610	2,542
1975	170,970	2,495	168,475	24,559	82,621	54,390	4,073	2,832
1976	180,796	2,492	178,304	25,684	88,211	56,730	4,505	3,174
1977	186,767	2,473	184,294	26,652	91,960	57,340	4,726	3,616
1978	201,321	2,543	198,778	28,782	101,466	59,185	5,315	4,028
1979	213,948	3,609	210,339	31,311	106,028	62,362	5,864	4,770
1980	214,853	3,808	211,045	31,664	107,930	60,505	6,001	4,945
1981	217,196	3,970	213,226	33,301	107,983	59,914	6,974	5,049
1982	213,851	4,072	209,779	33,228	106,503	57,670	6,169	6,209
1983	217,496	4,203	213,293	34,404	107,228	59,199	6,540	5,923
1984	225,313	4,370	220,943	35,648	109,433	61,989	7,096	6,275
1985	215,332	4,678	210,654	33,588	105,555	58,829	6,418	6,263
1986	224,953	4,909	220,044	34,313	109,351	62,427	6,943	7,010

Source: Federal Aviation Administration, "FAA Statistical Handbook of Aviation," (Annually).
NOTE: Detail may not add to totals because of estimating procedures.

a Before 1971, an active aircraft was one certified as eligible to fly. Currently, an "active aircraft" must have a current U.S. registration and have been flown during the previous calendar year.

b Effective 1978, includes certificated route air carriers, supplemental air carriers (charters), and all aircraft over 12,500 pounds operated by air taxis, commercial operators and travel clubs. Effective 1979, includes multi-engine aircraft in commuter passenger service. Excludes single-engine aircraft as of 1978.

c Includes autogiros; excludes air carrier helicopters.

d Includes gliders, dirigibles and balloons.

ACTIVE U.S. CIVIL AIRCRAFT BY PRIMARY USE AND TYPE OF AIRCRAFT

As of December 31, 1986

Primary Use[a]	TOTAL	Fixed Wing			Rotor-craft[b]	Other[c]
		Turbojet	Turboprop	Piston		
TOTAL—ALL AIRCRAFT	224,953	7,763	7,168	196,066	6,945	7,010
Air Carrier—TOTAL	4,909	3,283	1,204	420	2	—
Large	3,799	3,282	416	101	—	—
Small	1,110	1	788	319	2	—
General Aviation—						
TOTAL	220,044	4,480	5,964	195,646	6,943	7,010
Executive	12,075	3,119	3,094	4,842	1,010	9
Business	43,780	270	819	42,030	644	18
Commuter[d]	1,721	3	795	826	97	0
Air Taxi[d]	7,568	510	532	5,145	1,381	0
Instructional	15,812	0	2	14,608	496	707
Personal	120,308	252	135	113,844	713	5,364
Aerial Application	7,068	0	101	6,104	858	5
Aerial Observation	4,716	8	29	3,428	969	283
Other Work	1,274	0	21	792	145	316
Other	5,707	318	437	4,012	631	309

Source: Federal Aviation Administration, "FAA Statistical Handbook of Aviation," (Annually).
NOTE: Detail may not add to totals because of estimating procedures.
a Definitions of "primary use" categories available in Glossary of "FAA Statistical Handbook."
b Includes helicopters and autogiros.
c Includes gliders, dirigibles and balloons.
d Air taxis under 12,500 pounds and single-engine commuters; other aircraft in these categories included with "air carriers."

U.S. GENERAL AVIATION
ACTIVE AIRCRAFT AND HOURS FLOWN
BY PRIMARY USE

Calendar Years 1982-1986

Primary Use[a]	1982	1983	1984	1985	1986
ACTIVE AIRCRAFT AS OF DECEMBER 31					
TOTAL	209,779	213,293	220,943	210,654	220,044
Executive	15,739	17,064	16,675	13,610	12,075
Business	47,873	45,025	47,098	45,544	43,780
Commuter	1,070	1,479	1,232	875	1,721
Air Taxi	8,122	6,857	7,292	6,459	7,568
Instructional	14,708	15,450	15,287	14,410	15,812
Rental[d]	9,844	7,674	9,406	7,919	—
Personal	94,820	101,484	105,309	103,053	120,308
Aerial Application[c]	7,155	7,051	7,332	7,286	7,068
Aerial Observation[c]	4,164	4,023	5,173	4,533	4,716
Other Work[c]	1,733	2,392	1,328	1,620	1,274
Other[c]	4,546	4,791	4,777	5,344	5,707
THOUSANDS OF HOURS FLOWN					
TOTAL	36,457	35,249	36,119	34,063	34,416
Executive	4,983	5,241	4,773	4,176	3,781
Business	6,861	5,956	6,635	6,534	5,896
Commuter[b]	1,086	1,602	1,504	674	2,185
Air Taxi[b]	3,187	2,528	3,019	2,719	2,913
Instructional	4,924	4,865	4,553	4,264	4,677
Rental[d]	2,961	2,389	2,855	2,646	—
Personal	8,182	8,477	8,418	8,392	10,097
Aerial Application[c]	2,043	1,762	2,008	2,168	1,985
Aerial Observation[c]	1,256	1,138	1,314	1,315	1,620
Other Work[c]	467	642	312	343	323
Other[c]	638	553	729	831	939

Source: Federal Aviation Administration, "FAA Statistical Handbook of Aviation," (Annually).
NOTE: Detail may not add to totals because of rounding and estimating procedures.
a Definitions of "primary use" categories available in Glossary of "FAA Statistical Handbook."
b Air taxis under 12,500 pounds and single-engine commuters; other aircraft in these categories classified as "air carriers."
c Prior to 1981, reported as Aerial Application (differently defined), Industrial, and Other.
d Rental is not reported as a separate use category after 1985.

U.S. GENERAL AVIATION
TYPE OF AIRCRAFT AND HOURS FLOWN

Calendar Years 1982-1986

	1982	1983	1984	1985	1986
Number of Active Aircraft by Type					
All Aircraft—TOTAL	209,779	213,293	220,943	210,654	220,044
Fixed Wing: Piston:					
Single Engine: 1-3 Seats	57,670	59,199	61,989	58,829	62,427
4+ Seats	106,503	107,228	109,933	105,555	109,351
Twin-Engine: 1-6 Seats	16,381	16,249	16,539	15,627	16,166
7+ Seats	8,501	8,660	8,719	8,032	7,555
Other	140	143	262	148	148
Turboprop:					
Twin Engine: 1-12 Seats	4,427	4,733	4,992	4,633	4,809
13+ Seats	610	578	640	607	970
Other	149	142	176	167	185
Turbojet: Twin Engine	3,309	3,447	3,780	3,914	4,037
Other	687	451	540	460	444
Rotorcraft: Piston	2,419	2,541	2,936	2,877	2,921
Turbine	3,749	3,998	4,160	3,541	4,022
Balloons, Dirigibles, and Gliders	5,233	5,923	6,275	6,263	7,010
Thousands of Hours Flown by Type of Aircraft					
All Aircraft—TOTAL	36,457	35,249	36,119	34,063	34,416
Fixed Wing: Piston	29,950	28,911	29,194	27,793	26,861
Turboprop	2,168	2,173	2,506	2,080	2,882
Turbojet	1,611	1,473	1,566	1,622	1,654
Rotorcraft: Piston	579	572	592	564	804
Turbine	1,771	1,700	1,903	1,590	1,821
Balloons, Dirigibles, and Gliders	379	420	358	414	394
Average Hours Flown per Year per Aircraft by Type					
All Aircraft—TOTAL	174	164	158	158	149
Fixed Wing: Piston:					
Single Engine: 1-3 Seats	146	140	139	135	125
4+ Seats	151	139	137	142	130
Twin-Engine: 1-6 Seats	187	187	181	174	172
7+ Seats	317	318	303	274	280
Other	247	240	433	184	111
Turboprop:					
Twin Engine: 1-12 Seats	356	301	342	319	335
13+ Seats	853	1,139	1,112	831	1,013
Other	394	579	339	396	499
Turbojet: Twin Engine	407	392	349	375	385
Other	385	274	3 3	325	154
Rotorcraft: Piston	237	221	187	192	273
Turbine	474	432	469	460	459
Balloons, Dirigibles, and Gliders	72	71	56	67	56

Source: General Aviation Manufacturers Association, "General Aviation Statistical Databook," (Annually), based on data from the Federal Aviation Administration.

NOTE: Detail may not add to totals because of rounding and/or estimating procedures.

ACTIVE U.S. AIRMAN CERTIFICATES HELD

As of December 31, 1983-1987

	1983	1984	1985	1986	1987
Pilots—TOTAL	718,004	722,376	709,540	709,118	699,653
Students	147,197	150,081	146,652	150,273	146,016
Private	318,643	320,086	311,086	305,736	300,949
Commercial	159,495	155,929	151,632	147,798	143,645
Airline Transport	75,938	79,192	82,740	87,186	91,287
Helicopter (only)	7,237	7,532	8,123	8,581	8,702
Glider (only)[a]	8,157	8,390	8,168	8,411	7,901
Lighter-Than-Air[a]	1,337	1,166	1,139	1,133	1,153
Non-Pilots—TOTAL	432,890	447,462	412,741	410,079	427,962
Mechanics[b]	288,335	298,028	274,100	284,241	297,178
Parachute Rigger[b]	10,074	10,194	9,395	9,535	9,659
Ground Instructor[b]	66,385	67,463	58,214	59,443	60,861
Dispatcher[b]	8,223	8,980	8,511	9,025	9,491
Flight Navigator	1,636	1,603	1,542	1,512	1,445
Flight Engineer	38,546	40,534	43,377	46,323	49,328
Flight Instructor Certificates[c]	62,201	61,173	58,940	57,355	60,316
Instrument Ratings[c]	254,271	256,584	258,559	262,388	266,122

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

a Glider and lighter-than-air pilots are not required to have a medical examination; however, the totals above are the pilots who received a medical.

b No periodic medical examination required; therefore, no determination as to current activity can be made.

c Special ratings shown on pilot certificates represented above, not additional certificates.

Helicopter Transportation

In 1987, there were 3,760 heliports/helipads in the United States, according to the *1988 Helicopter Annual* published by the Helicopter Association International. The number represents an increase of 435 facilities over the prior year's total.

More than 95 percent of the helicopter landing areas were private facilities. HAI provided a breakdown that showed 3,579 private heliports/helipads and 181 public use facilities. Only 92 of the landing areas, or 2.4 percent, were located at airports.

The figures are not directly comparable to HAI's 1986 listings because the latter included Puerto Rico and the U.S. Virgin Islands. The 1986 figures were 3,158 private, 182 public facilities with 97 of the landing areas (2.9 percent) at airports.

With 406 heliports/helipads, Texas topped the list of states in number of facilities in operation during 1987; Texas' total was up 28 units from the figure in HAI's 1986 survey. In second place was California with 363 heliports/helipads, up 44 from 1986, and Pennsylvania ranked third with 247, up 20. The top three states also led the 1986 survey in the same order.

Rounding out the top 10 for 1987 were: Illinois (198), New Jersey and Ohio (both 186), Louisiana (175), Florida (169), New York (124) and Colorado (113).

The *1988 Helicopter Annual* also provided a summary of owner/operators of heliports/helipads in the United States. HAI's data showed 3,909 owners/operators, more than 400 above the prior year's total. Corporate owner/operators represented the largest single category with 1,591 faciltiies, 37 percent of the total; the number compared with 1,319 in 1986. Hospital facilities totaled 1,123 or 25.8 percent, up from 937 in 1986.

Other figures in the 1987 owner/operator breakdown by type of organization were: government (519), individuals (352), military (139), oil companies (107), and hotels (78).

Within the corporate category, the owner/operator breakdown by states followed a top-10 pattern similar to that of facilities: Texas placed first with 224 corporate owner/operators, followed by California (163), Pennsyl-

vania (129), New Jersey (122), Louisiana (107), Florida (75), New York (67), Ohio (61), Illinois (60) and Colorado (49).

In the hospital breakdown, however, Illinois was top ranked with 88 owners/operators, followed by Texas (84), California (78), Ohio (62), Florida (56), then Oklahoma (47), which did not appear in the corporate or facilities top-10 listings. Rounding out the hospital top 10 were Louisiana and Missouri (both 46), Colorado (36), Virginia (33) and Washington (30). □

OPERATORS/OWNERS OF HELIPADS IN THE UNITED STATES

By State
As of 1987

State	HOSPITAL public	HOSPITAL private	Military	Government	Oil	Hotels	Corporate	Individual
Alaska	3	1	2	16	4	0	6	1
Alabama	0	16	6	5	0	0	12	5
Arkansas	0	12	1	2	0	0	0	3
Arizona	0	29	1	8	0	2	42	5
California	1	77	10	93	18	9	163	12
Colorado	1	35	1	21	4	3	49	4
Connecticut	0	9	0	1	0	1	43	2
Washington, D.C.	0	2	4	7	2	0	4	0
Delaware	0	0	0	3	0	0	10	1
Florida	0	56	2	21	0	5	75	15
Georgia	0	28	5	15	0	4	20	4
Hawaii	0	6	1	10	0	2	4	3
Idaho	0	9	2	5	0	0	3	3
Illinois	0	88	2	27	1	4	60	15
Indiana	0	22	5	10	0	2	32	16
Iowa	0	28	4	4	0	1	4	3
Kansas	0	14	0	5	0	0	3	3
Kentucky	0	10	1	2	0	2	8	3
Louisiana	1	45	2	18	53	3	107	2
Maine	0	3	0	2	0	0	4	0
Maryland	0	16	2	5	0	1	11	7
Massachusetts	0	11	8	3	0	1	36	11
Michigan	0	17	1	6	0	2	30	12
Minnesota	0	9	0	3	0	0	8	7
Mississippi	0	11	0	7	0	0	1	4
Missouri	1	45	2	5	0	3	17	12
Montana	0	12	1	1	0	0	3	2
Nebraska	0	13	1	1	0	0	2	4
Nevada	0	1	1	9	0	5	8	0
New Hampshire	0	1	0	0	0	0	15	3
New Jersey	0	15	7	42	1	3	122	17
New Mexico	0	7	0	5	0	1	4	0
New York	0	25	4	21	0	0	67	8
North Carolina	0	18	8	6	0	0	11	2

(Continued on next page)

OPERATORS/OWNERS OF HELIPADS IN THE UNITED STATES (Continued)

By State
As of 1987

State	HOSPITAL public	HOSPITAL private	Military	Government	Oil	Hotels	Corporate	Individual
North Dakota	0	1	1	1	0	0	1	2
Ohio	1	61	1	28	0	7	61	26
Oklahoma	1	46	5	7	0	3	22	2
Oregon	0	30	3	5	0	0	34	8
Pennsylvania	0	68	7	9	0	4	129	34
Rhode Island	0	5	0	4	0	0	1	1
South Carolina	0	8	3	0	0	0	8	0
South Dakota	0	2	0	1	0	0	4	0
Tennessee	0	17	2	5	0	1	22	5
Texas	2	82	7	33	24	6	224	52
Utah	0	12	1	7	0	1	8	3
Virginia	0	33	7	18	0	0	31	4
Vermont	1	0	9	0	0	0	2	2
Washington	0	30	6	6	0	2	35	16
Wisconsin	0	12	1	3	0	0	7	6
West Virginia	0	8	0	1	0	0	14	2
Wyoming	0	5	2	2	0	0	4	0
Totals	12	1111	139	519	107	78	1591	352

Source: Helicopter Association International, "1988 Helicopter Annual."
NOTE: Corporate operator/owners control 42.3 percent of all helicopter landing areas; government 13.8 percent; individuals 9.3 percent; oil companies 2.8 percent; and hotels 2.1 percent.

HELIPORTS/HELIPADS[a] IN THE UNITED STATES

By State
As of 1987

State	Total of heliports in state	Private Use		Public Use	
		Heliports	Heliports at Airports	Heliports	Airports
Alaska	27	14	3	8	2
Alabama	44	42	0	1	1
Arkansas	18	16	1	0	1
Arizona	88	86	1	0	1
California	363	338	1	3	21
Colorado	113	108	0	1	4
Connecticut	59	55	1	2	1
District of Columbia	19	17	0	0	2
Delaware	15	14	0	1	0
Florida	169	168	0	1	0
Georgia	77	76	0	0	1
Hawaii	22	18	0	1	3
Idaho	22	22	0	0	0
Illinois	198	189	3	5	1
Indiana	90	84	2	3	1
Iowa	44	43	0	0	1
Kansas	26	23	0	0	3
Kentucky	27	27	0	0	0
Louisiana	175	168	2	5	0
Maine	9	8	0	1	0
Maryland	47	45	2	0	0
Massachusetts	72	68	0	2	2
Michigan	63	59	1	3	0
Minnesota	24	21	1	0	2
Mississippi	21	21	0	0	0
Missouri	84	77	2	3	2
Montana	19	18	0	1	0
Nebraska	21	21	0	0	0
Nevada	28	27	0	1	0
New Hampshire	21	19	0	1	1
New Jersey	186	181	0	5	0
New Mexico	15	14	0	1	0

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HELIPORTS/HELIPADS[a] IN THE UNITED STATES (Continued)

By State
As of 1987

State	Total of heliports in state	Private Use		Public Use	
		Heliports	Heliports at Airports	Heliports	Airports
New York	124	112	0	10	2
North Carolina	46	44	1	1	0
North Dakota	6	6	0	0	0
Ohio	186	161	1	21	3
Oklahoma	84	80	0	4	0
Oregon	79	74	2	3	0
Pennsylvania	247	236	1	10	0
Rhode Island	10	9	0	1	0
South Carolina	18	18	0	0	0
South Dakota	7	7	0	0	0
Tennessee	52	47	1	3	1
Texas	406	394	1	10	1
Utah	29	27	0	0	2
Virginia	87	82	0	3	2
Vermont	14	13	0	1	0
Washington	95	91	1	1	2
Wisconsin	27	27	0	0	0
West Virginia	25	25	0	0	0
Wyoming	12	11	0	0	1
Total U.S.	3760	3551	28	117	64

Source: Helicopter Association International, "1988 Helicopter Annual".
NOTE: 95.2 percent of all U.S. helicopter landing areas are private, while 4.8 percent are public. 29.9 percent of all U.S. helicopter landing areas are at hospitals. 2.4 percent are located at airports.
a Excludes temporary heliports, offshore heliports or infrequently used helicopter landing sites.

CIVIL HELICOPTER FLEET
UNITED STATES, CANADA, MEXICO AND PUERTO RICO
1985[e]

State	OPERATORS				HELICOPTERS			
	TOTAL	Com-mercial	Corp. and Exec.	Civil Gov't.	TOTAL	Com-mercial	Corp. and Exec.	Civil Gov't.
Alabama	34	12	16	6	91	38	23	30
Alaska	51	34	13	4	280	256	16	8
Arizona	60	34	19	7	183	139	22	22
Arkansas	16	9	6	1	42	34	7	1
California	277	140	96	41	846	495	170	181
Colorado	64	25	34	5	156	94	47	15
Connecticut	26	10	16	—	59	38	21	—
Delaware	6	—	5	1	6	—	5	1
Dist. of Col.	7	1	—	6	31	3	—	28
Florida	169	75	60	34	292	239	65	88
Georgia	39	13	14	12	99	47	17	35
Hawaii	24	20	3	1	56	52	3	1
Idaho	38	20	15	3	80	55	20	5
Illinois	46	21	19	6	115	67	29	19
Indiana	42	18	17	7	109	62	33	15
Iowa	18	8	5	5	35	15	6	14
Kansas	19	12	4	3	36	23	6	7
Kentucky	37	8	27	2	57	21	32	4
Louisiana	46	22	17	7	699	632	54	13
Maine	8	4	3	1	21	12	4	5
Maryland	17	8	7	2	61	39	7	15
Massachusetts	24	10	12	2	63	42	19	2
Michigan	41	18	18	5	87	44	23	20
Minnesota	27	19	7	1	62	51	8	3
Mississippi	11	2	5	4	19	8	5	6
Missouri	29	13	12	4	71	48	12	11
Montana	24	14	5	5	48	33	6	9
Nebraska	15	7	6	2	31	15	7	9
Nevada	16	7	5	4	40	22	12	6
New Hampshire	17	9	8	—	40	30	10	—
New Jersey	54	21	27	6	151	99	38	14
New Mexico	12	5	5	2	[illegible]	12	7	5

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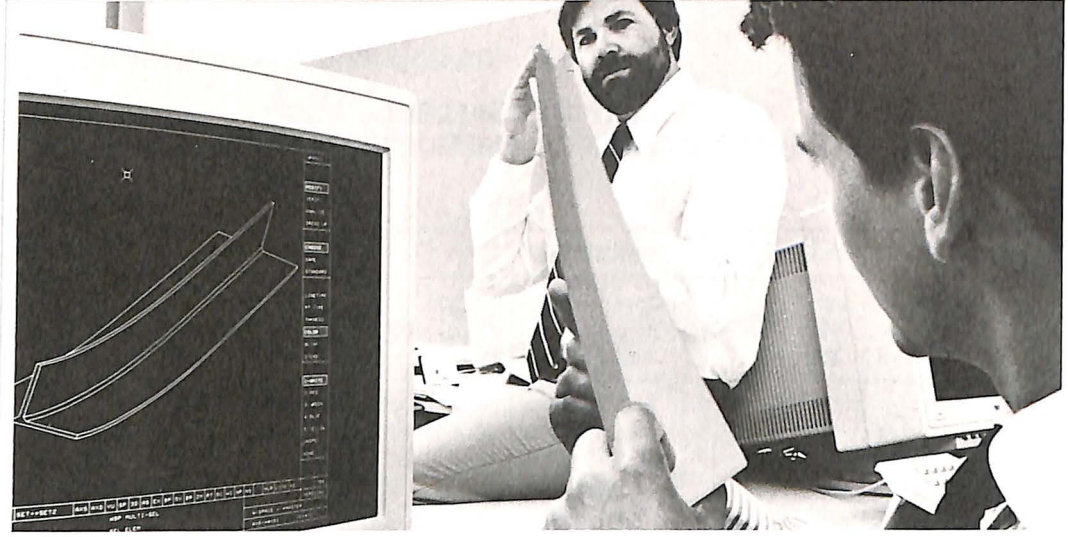
CIVIL HELICOPTER FLEET
UNITED STATES, CANADA, MEXICO AND PUERTO RICO (Continued)
1985[e]

State	OPERATORS				HELICOPTERS			
	TOTAL	Commercial	Corp. and Exec.	Civil Gov't.	TOTAL	Commercial	Corp. and Exec.	Civil Gov't.
New York	77	27	41	9	198	98	72	28
North Carolina	19	7	8	4	37	14	14	9
North Dakota	17	12	4	1	39	31	5	3
Ohio	72	30	37	5	116	71	37	8
Oklahoma	36	21	13	2	125	107	13	5
Oregon	76	40	35	1	322	271	45	6
Pennsylvania	100	35	64	1	238	126	105	7
Rhode Island	6	2	3	1	7	2	4	1
South Carolina	23	12	7	4	59	46	7	6
South Dakota	5	4	—	1	9	8	—	1
Tennessee	31	12	15	4	69	33	17	19
Texas	217	72	132	13	548	259	244	45
Utah	26	17	8	1	130	116	13	1
Vermont	4	1	3	—	5	2	3	—
Virginia	36	10	19	7	64	25	24	15
Washington	86	50	29	7	208	148	43	17
West Virginia	39	7	29	3	48	11	30	7
Wisconsin	12	10	2	—	51	49	2	—
Wyoming	19	12	7	—	37	29	8	—
Puerto Rico	6	1	2	3	11	2	2	7
U.S. Total	2,221	1,002	963	256	6,412	4,244	1,391	777
Canada	217	125	75	17	1,236	1,008	131	97
Mexico	43	9	13	21	256	18	30	208
TOTAL	2,481	1,136	1,051	294	7,904	5,270	1,552	1,082

Source: Aerospace Industries Association, "Directory of Helicopter Operators in the United States,Canada, Mexico and Puerto Rico, 1985/86".



Research and Development

In 1987, total U.S. funding for research and development reached an all-time high of $123 billion, according to data supplied by the National Science Foundation (NSF).

The figure includes R&D work performed by industry, government agencies, colleges and universities, federally-funded R&D centers and non-profit institutions. It represents an increase of more than seven percent over 1986's $114.7 billion.

Using dollar value as a yardstick, industry performed some 72 percent of the nation's R&D, government agencies approximately 13 percent, colleges and universities nine percent. In terms of funding, industry financed $58.6 billion or 48 percent of the total, the federal government $60.4 billion or more than 49 percent.

For 1988, NSF expected total R&D expenditures to increase by another seven percent to $131.6 billion. The projection indicates that industrially-performed work, at $96 billion, will again account for almost three-quarters of all U.S. R&D. The government/industry funding ratio is expected to be about the same as in 1987.

In a related projection for 1988, data compiled by Battelle Memorial Institute also estimates industrial R&D at $96 billion, with the aerospace industry as leading R&D performer, as has been customary in the 1980s. Battelle estimates that the aerospace industry will conduct R&D worth $24.0 billion in federal and industry funds. Second place in the Battelle projection goes to the electrical machine/communications industry at $20.4 billion, followed by non-electrical machinery ($11.9 billion); chemicals ($9.6 billion) and autos, trucks and transportation equipment ($9.2 billion). The top five industries held the same relative positions in 1987.

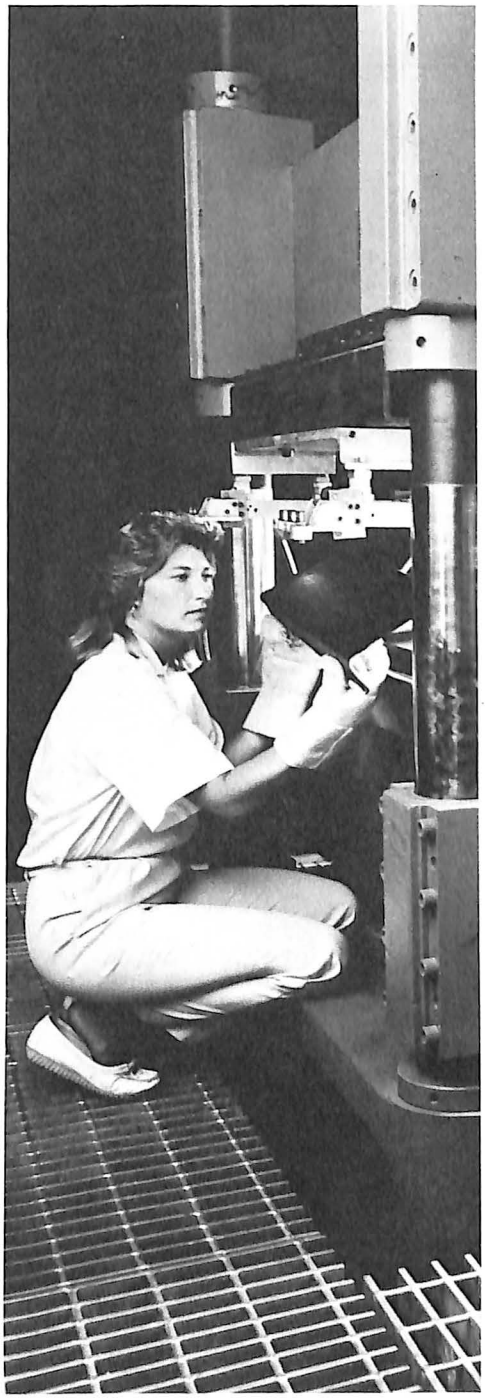
DoD is by far the largest conductor of government-funded R&D, with FY 1988 outlays that represented more than 62 percent of the total. Within DoD, the USAF continues to lead the other services in terms of outlays for RDT&E. In FY 1988, USAF outlays amounted to $12.9 billion, or almost 40 percent of the DoD total. The Navy, at $8.3 billion was second. Army outlays totaled $4.5 billion and all other DoD agencies combined expended $7.3 billion.

DoD total outlays for RDT&E in FY 1988

($33.1 billion) fell below those of the preceding year ($33.6 billion), reflecting the sharp reductions in the Administration's budget imposed by the Congress. For FY 1989, DoD projected a rebound to $36.3 billion, but the Congress similarly cut the overall DoD budget; the final RDT&E figure was not available at publication time.

A breakdown of contractor-performed defense RDT&E for FY 1987 showed that the Pacific region, perennial leader, again topped the list of prime contract awards and increased its margin of leadership. The Pacific area won contracts—including industry, college and university and other performers—worth $7.7 billion or more than 36 percent of the total. Rounding out the top five regions were South Atlantic ($2.7 billion, 12.7 percent); New England (just under $2.7 billion, 12.6 percent); Middle Atlantic ($2.5 billion, 11.8 percent); and the Mountain region ($2.4 billion, 11.2 percent).

NSF's annual survey of industry expenditures for R&D showed that the aerospace industry continues to exceed the mean for all U.S. manufacturing industries when R&D funding is measured as a percentage of sales. In 1986, the latest year for which such information is available, aerospace funding for R&D (exclusive of government contractual funding) amounted to 4.0 percent of net sales, compared with a 3.1 percent average for all manufacturing industries. When company and government funds combined, the aerospace lead widened significantly: 15.7 percent compared with the all-industry average of 4.7 percent. □



FUNDS FOR INDUSTRIAL RESEARCH AND DEVELOPMENT ALL INDUSTRIES AND THE AEROSPACE INDUSTRY

By Funding Source Calendar Years 1972-1986
(Millions of Dollars)

Year	All Industries[a]			Aerospace Industry[b]		
	Total	Federal Funds	Company Funds[c]	Total	Federal Funds	Company Funds[c]
CURRENT DOLLARS						
1972	$19,552	$ 8,017	$11,535	$ 4,950	$ 3,970	$ 978
1973	21,249	8,145	13,104	5,052	3,899	1,154
1974	22,887	8,220	14,667	5,278	4,000	1,278
1975	24,187	8,605	15,582	5,713	4,428	1,285
1976	26,997	9,561	17,436	6,339	4,921	1,418
1977	29,825	10,485	19,340	7,033	5,486	1,547
1978	33,304	11,189	22,115	7,536	5,713	1,823
1979	38,226	12,518	25,708	8,041	5,840	2,201
1980	44,505	14,029	30,476	9,198	6,628	2,570
1981	51,810	16,382	35,428	11,968	8,528	3,440
1982	57,995	18,483	39,512	13,658	9,776	3,882
1983	63,403	20,542	42,861	13,853	10,405	3,448
1984	71,470	23,162	48,308	16,033	12,228	3,804
1985[r]	78,776	26,830	51,947	17,918	13,726	4,192
1986[r]	80,629	27,782	52,847	16,240	12,099	4,141
CONSTANT DOLLARS (1982 = 100)[d]						
1972	$42,056	$17,244	$24,812	$10,645	$ 8,538	$2,103
1973	42,893	16,441	26,452	10,206	7,877	2,331
1974	42,415	15,234	27,181	9,774	7,407	2,367
1975	40,781	14,509	26,272	9,634	7,467	2,167
1976	42,805	15,159	27,646	10,046	7,799	2,247
1977	44,330	15,584	28,746	10,450	8,152	2,299
1978	46,115	15,493	30,622	10,438	7,913	2,525
1979	48,652	15,932	32,720	10,230	7,430	2,800
1980	51,919	16,366	35,553	10,733	7,734	2,999
1981	55,140	17,435	37,705	12,732	9,072	3,660
1982	57,995	18,483	39,512	13,658	9,776	3,882
1983	61,047	19,779	41,268	13,346	10,024	3,322
1984	66,342	21,500	44,842	14,883	11,351	3,531
1985[r]	70,861	24,134	46,728	16,118	12,347	3,771
1986	70,696	24,359	46,337	14,239	10,609	3,631

Source: National Science Foundation.
NOTE: Detail may not add to totals because of rounding.

a Includes all manufacturing industries, plus those non-manufacturing industries known to conduct or finance research and development.

b Companies classified in SIC codes 372 and 376, having as their principal activity the manufacture of aircraft, guided missiles, space vehicles, and parts.

c Company funds include all funds for industrial R&D work performed within company facilities except funds provided by the Federal Government. Excluded are company-financed research and development contracted to outside organizations such as research institutions, universities and colleges, or other non-profit organizations.

d Based on GNP implicit price deflator.

r Revised.

TOTAL U.S. FUNDS FOR RESEARCH AND DEVELOPMENT BY SOURCE AND PERFORMER[a]

Calendar Years 1985-1988
(Millions of Current Dollars)

Source of Funds	Total All Performers	Performer				
		Federal Government	Industry	Colleges & Universities	Federally-Funded Research & Development Centers	Nonprofit Institutions
1985						
All Sources—TOTAL	$107,436	$12,495	$78,208	$9,504	$3,529	$3,250
Federal Government	51,276	12,495	26,484	6,003	3,529	2,315
Industry	52,597	—	51,724	538	—	335
Colleges & Universities	2,259	—	—	2,259	—	—
Nonprofit Institutions	1,304	—	—	704	—	600
1986[p]						
All Sources—TOTAL	$114,697	$13,535	$83,562	$10,600	$3,600	$3,400
Federal Government	55,273	13,535	28,988	6,750	3,600	2,400
Industry	55,549	—	54,574	600	—	375
Colleges & Universities	2,500	—	—	2,500	—	—
Nonprofit Institutions	1,375	—	—	750	—	625
1987[E]						
All Sources—TOTAL	$123,050	$15,450	$89,200	$11,150	$3,800	$3,450
Federal Government	60,350	15,450	31,700	7,000	3,800	2,400
Industry	58,570	—	57,500	670	—	400
Colleges & Universities	2,700	—	—	2,700	—	—
Nonprofit Institutions	1,430	—	—	780	—	650
1988[E]						
All Sources—TOTAL	$131,600	$16,400	$95,950	$11,725	$4,000	$3,525
Federal Government	64,550	16,400	34,500	7,250	4,000	2,400
Industry	62,625	—	61,450	750	—	425
Colleges & Universities	2,900	—	—	2,900	—	—
Nonprofit Institutions	1,525	—	—	825	—	700

Source: National Science Foundation.
a Source/performer detail not available by industry.
p Preliminary.
E Estimate.

ESTIMATED SOURCES OF FUNDS FOR R&D BY BROAD INDUSTRIAL CLASSES, 1988[a]

(Millions of Current Dollars)

	Federal Funds	Industry Funds	Total Funds	% Federal
Aerospace	$ 19,103	$ 4,928	$ 24,031	79.49%
Electrical Machine Communications	8,189	12,255	20,444	40.06
Machinery	1,486	10,403	11,889	12.50
Chemicals	287	9,356	9,643	2.98
Autos, Trucks & Parts, & Other Transportation Equipment	2,121	7,117	9,238	22.96
Professional & Scientific Instruments	1,034	5,765	6,799	15.21
Petroleum Products	22	2,431	2,454	0.91
Rubber Products	246	1,272	1,518	16.18
Food & Beverage	0	1,067	1,067	0.00
Paper/Pulp	4	863	867	0.44
Fabricated Metals	49	740	790	6.26
Stone, Clay & Glass	122	650	772	15.80
Nonferrous Metals	218	532	750	29.11
Iron & Steel	219	505	724	30.28
Textiles	0	166	166	0.00
Other Manufacturing	36	1,371	1,408	2.59
Total Manufacturing	$ 33,137	$ 59,422	$ 92,559	35.80
Nonmanufacturing	1,536	1,707	3,243	47.36
TOTAL	34,673	61,129	95,802	36.19

Source: Battelle Memorial Institute.
a Battelle data, derived from the National Science Foundation and McGraw-Hill surveys.

RESEARCH AND DEVELOPMENT FUNDS AS PERCENT OF NET SALES ALL MANUFACTURING INDUSTRIES AND THE AEROSPACE INDUSTRY

Calendar Years 1981-1986

Year	All Manufacturing Industries[a]		Aerospace Industry[b]	
	Total R&D Funds as Percent of Net Sales	Company R&D Funds as Percent of Net Sales	Total R&D Funds as Percent of Net Sales	Company R&D Funds as Percent of Net Sales
1981	3.1%	2.2%	16.0%	4.6%
1982	3.8	2.6	17.7	5.0
1983	3.9	2.6	16.2	4.0
1984	3.8	2.6	16.9	4.0
1985[r]	4.4	2.9	16.9	3.9
1986	4.7	3.1	15.7	4.0

Source: National Science Foundation.

a Includes all manufacturing industries known to conduct or finance research and development.

b Companies classified in SIC codes 372 and 376, having as their principal activity the manufacture of aircraft, guided missiles, space vehicles, and parts.

r Revised.

R&D EXPENDITURES BY STATE BY INDUSTRY, 1985

(Dollars in millions)

	Total, all states	California	New York	Michigan	New Jersey	Massachusetts	Pennsylvania	Texas	Illinois	Ohio	All other states
Total, all industries	$78,208	$17,760	$7,019	$5,975	$5,547	$4,173	$3,570	$3,492	$3,231	$2,847	$24,594
Aircraft & missiles	17,619	9,953	413	114	58	274	300	531	328	60	5,583
Electrical equipment	17,080	1,920	1,503	60	2,878	1,940	1,325	869	1,072	692	4,821
Machinery	10,870	1,237	NA	127	244	954	255	413	632	190	NA
Chemicals & allied products	8,667	383	1,154	607	1,322	125	716	250	514	571	3,025
Motor vehicles	7,058	NA	232	4,796	NA	NA	NA	NA	NA	NA	671
Instruments	5,430	1,061	NA	NA	333	559	252	169	92	52	NA
Petroleum refining	NA	442	81	NA	NA	NA	119	535	NA	NA	276
Food & tobacco products	NA	65	114	36	109	NA	NA	12	140	19	503
Rubber products	1,147	257	NA	NA	NA	NA	NA	10	NA	533	259
Primary metals	NA	59	41	70	NA	NA	190	NA	NA	74	169
Nonmanufacturing	2,851	1,079	147	58	29	103	40	82	32	75	1,206
All other industries	3,018	NA	166	68	63	110	252	43	175	258	1,525

Source: National Science Foundation, Division of Science Resources Studies

NOTE: NA indicates that data are unavailable because of Census Bureau restrictions on the publication of data that would reveal the operations of individual companies.

Total R&D funds data are unavailable for the petroleum refining, food & tobacco products, and primary metals industries because of restrictions on publishing data showing Federal R&D support to these industries. The amount of companies' own funds spent by each of these industries in 1985 was: petroleum refining, $2.106 billion; food & tobacco products, $1.042 billion; and primary metals, $758 million.

FUNDS FOR INDUSTRIAL RESEARCH AND DEVELOPMENT IN THE AEROSPACE INDUSTRY

By Type of Research and Funding Source
Calendar Years 1963-1985[a]
(Millions of Dollars)

Year	TOTAL AERO-SPACE	Basic Research			Applied Research			Development		
		Total	Federal Funds	Com-pany Funds	Total	Federal Funds	Com-pany Funds	Total	Federal Funds	Com-pany Funds
1963	$ 4,712	$ 59	$31	$28	$ 735	$ 585	$ 150	$ 3,917	$3,634	$ 283
1964	5,078	67	34	34	766	607	159	4,244	3,948	296
1965	5,148	71	41	30	735	563	172	4,342	3,921	421
1966	5,526	69	36	33	773	563	210	4,685	4,162	523
1967	5,669	71	33	38	726	490	236	4,871	4,071	800
1968	5,765	68	26	42	677	426	251	5,021	4,145	876
1969	5,882	65	24	41	597	347	250	5,220	4,216	1,004
1970	5,219	63	20	43	565	352	213	4,591	3,718	873
1971	4,881	54	37	17	461	279	182	4,365	3,583	782
1972	4,950	60	44	16	451	267	184	4,438	3,722	716
1973	5,052	50	21	29	512	308	204	4,491	3,633	858
1974	5,278	51	19	32	609	360	249	4,617	3,735	882
1975	5,713	54	17	37	614	381	233	5,044	4,119	925
1976	6,339	54	21	33	666	365	301	5,619	4,521	1,098
1977[a]	7,033	56	25	31	753	419	334	6,223	5,017	1,206
1979	8,041	86	44	42	880	499	381	7,076	5,314	1,762
1981	11,968	131	60	71	1,484	897	587	10,353	7,738	2,615
1983	13,853	146	NA	NA	3,466	NA	NA	10,241	7,668	2,573
1984	16,033	247	NA	NA	3,067	NA	NA	12,718	9,870	2,848
1985	17,619	304	162	142	3,785	2,776	1,009	13,530	10,483	3,047

Source: National Science Foundation, plus estimates by AIA to adjust originally-published breakouts by Research Type and Funding Source to NSF's revised totals.
NOTE: Detail may not add to totals because of rounding.
a Break-outs by Research Type and Funding Source available only for odd-numbered years after 1977.
NA Not available.
r Revised.

FEDERAL AERONAUTICS RESEARCH AND DEVELOPMENT

Fiscal Years 1970-1988
(Millions of Dollars)

Year	TOTAL	NASA[a]	DOD[b]	DOT[c]
BUDGET AUTHORITY				
1970	$1,882	$199	$1,641	$ 42
1971	1,990	210	1,707	73
1972	2,295	236	1,964	95
1973	2,187	313	1,799	75
1974	2,030	278	1,678	74
1975	2,015	314	1,627	74
1976	2,351	325	1,941	85
Tr. Qtr.	584	83	480	22
1977	2,727	378	2,256	93
1978	3,338	437	2,807	94
1979	2,850	519	2,240	91
1980	2,991	560	2,336	95
1981	3,286	526	2,653	106
1982	3,581	516	2,984	81
1983	3,871	547	3,221	103
1984	4,087	600	3,224	263
1985	4,355	648	3,422	265
1986	6,660	601	4,927	1,132
1987[E]	6,817	698	5,173	946
1988[E]	9,234	725	7,009	1,500
OUTLAYS				
1982[d]	$3,309	$563	$2,657	$ 89
1983	3,554	563	2,920	71
1984	3,727	586	2,995	146
1985	4,010	643	3,101	266
1986	6,071	648	4,373	1,050
1987[E]	6,526	622	4,867	1,037
1988[E]	7,707	683	5,923	1,101

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

a Research and Development, Construction of Facilities, Research and Program Management.

b Research, Development, Testing and Evaluation of aircraft and related equipment.

c Federal Aviation Administration Research, Engineering and Development, and Facilities, Engineering and Development.

d First year outlays data available.

E Estimate. Latest year reflects Administration's budget proposal.

FEDERAL OUTLAYS FOR CONDUCT OF RESEARCH AND DEVELOPMENT

Fiscal Years 1975-1989
(Millions of Dollars)

Year	TOTAL	DOD	NASA	Energy[a]	Other
CURRENT DOLLARS					
1975	$19,525	$ 9,341	$3,266	$2,277	$ 4,641
1976	20,233	9,329	3,521	2,225	5,158
1977	22,462	10,176	3,763	3,181	5,342
1978	24,532	10,726	3,833	3,925	6,048
1979	26,578	11,454	4,064	4,413	6,648
1980	30,351	13,451	4,711	4,698	7,492
1981	34,252	15,720	5,279	5,121	8,132
1982	34,509	18,201	3,220	4,974	8,114
1983	36,560	21,057	2,538	4,771	8,193
1984	40,518	23,583	3,539	4,702	8,694
1985	45,244	27,878	2,970	4,900	9,496
1986	51,576	33,292	3,432	4,705	10,147
1987	52,862	34,581	3,250	4,682	10,349
1988[E]	54,162	33,776	3,962	4,941	11,483
1989[E]	59,314	37,023	4,820	5,082	12,389
CONSTANT DOLLARS (1982 = 100)[b]					
1975	$33,945	$16,240	$5,678	$3,959	$ 8,068
1976	32,592	15,027	5,672	3,584	8,309
1977	33,510	15,181	5,614	4,746	7,970
1978	34,205	14,955	5,344	5,473	8,433
1979	34,118	14,703	5,217	5,665	8,534
1980	35,817	15,873	5,559	5,544	8,841
1981	36,743	16,863	5,663	5,493	8,723
1982	34,509	18,201	3,220	4,974	8,114
1983[r]	35,076	20,202	2,435	4,577	7,861
1984[r]	37,451	21,798	3,271	4,346	8,036
1985[r]	40,509	24,960	2,659	4,387	8,502
1986[r]	44,903	28,985	2,988	4,096	8,834
1987	44,806	29,311	2,755	3,968	8,772
1988[E]	44,268	27,606	3,238	4,038	9,385
1989[E]	46,704	29,152	3,795	4,002	9,755

Source: "The Budget of the United States Government, Special Analyses, (Annually).
NOTE: Detail may not add to totals because of rounding.
a Energy research and development programs transferred from AEC to ERDA with 1974 reorganization and to Dept. of Energy in 1977.
b Based on Fiscal Year GNP implicit price deflator.
E Estimate. Latest year reflects Administration's budget proposal.
r Revised.

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

Fiscal Years 1987-1989
(Millions of Dollars)

	1987	1988[E]	1989[E]
TOTAL—APPROPRIATIONS FOR RDT&E	$35,941	$37,263	$38,157
BY APPROPRIATION			
Army	$ 4,699	$ 4,671	$ 5,031
Navy	9,292	9,513	9,216
Air Force	15,051	15,165	14,932
Defense Agencies	6,768	7,662	8,668
Director of Test & Evaluation, Defense	120	182	167
Director of Operational Test & Evaluation, Defense	11	70	143
BY RESEARCH CATEGORIES			
Research	$ 894	$ 901	$ 916
Exploratory Development	2,343	2,392	2,361
Advanced Development	10,426	12,446	11,174
Engineering Development	9,341	9,641	11,587
Management and Support	2,943	2,514	2,560
Operational Systems Development	9,995	9,370	9,558
RECAP OF BUDGET ACTIVITIES			
Technology Base	$ 3,237	$ 3,294	$ 3,277
Advanced Technology Development	5,032	5,434	6,507
Strategic Programs	7,703	7,391	6,525
Tactical Programs	11,032	12,212	13,093
Intelligence and Communications	4,702	4,882	4,470
Defensewide Mission Support	4,236	4,051	4,285
RECAP OF FYDP PROGRAMS			
Strategic Forces	$ 1,147	$ 832	$ 697
General Purpose Forces	2,192	1,763	2,012
Intelligence and Communications	6,362	6,245	6,205
Airlift/Sealift	97	27	13
Guard and Reserve	37	60	83
Research and Development (FYDP Program 6)	25,946	27,894	28,599
Central Supply and Maintenance	151	177	217
Training, Medical and Other	4	—	—
Support of Other Nations	'	4	4
Special Operations Forces	*(a)*	262	327

Source: Department of Defense Budget, "R,D,T&E Programs (R-1)" (Annually).
NOTE Detail may not add to totals because of rounding.
a Less than $1 million.
E Estimate. Latest year reflects Administration's budget proposal.

DEPARTMENT OF DEFENSE
OUTLAYS FOR RESEARCH, DEVELOPMENT, TEST AND EVALUATION

Fiscal Years 1971-1989
(Millions of Dollars)

Year	TOTAL, All RDT&E Functions	Air Force	Navy	Army	Other
1971	$ 7,303	$ 2,809	$2,405	$1,569	$ 520
1972	7,881	3,205	2,427	1,779	470
1973	8,157	3,362	2,404	1,912	479
1974	8,582	3,240	2,623	2,190	529
1975	8,866	3,308	3,021	1,964	573
1976	8,923	3,338	3,215	1,842	528
Tr. Qtr.	2,203	830	778	437	161
1977	9,795	3,618	3,481	2,069	627
1978	10,508	3,626	3,825	2,342	715
1979	11,152	4,080	3,826	2,409	837
1980	13,127	5,017	4,382	2,707	1,021
1981	15,278	6,341	4,783	2,958	1,196
1982	17,729	7,794	5,240	3,230	1,465
1983	20,554	9,182	5,854	3,658	1,861
1984	23,117	10,353	6,662	3,812	2,289
1985	27,103	11,573	8,054	3,950	3,526
1986	32,283	13,417	9,667	3,984	5,215
1987	33,596	13,347	9,176	4,721	6,352
1988[E]	33,126	12,905	8,339	4,539	7,343
1989[E]	36,295	14,242	8,803	4,802	8,448

Source: Department of Defense Budget (Annually).
E Estimate. Latest year reflects Administration's budget proposal.

DEPARTMENT OF DEFENSE
PRIME CONTRACT AWARDS
FOR RESEARCH, DEVELOPMENT, TEST AND EVALUATION

Fiscal Years 1983-1987
(Millions of Dollars)

Program Categories	1983	1984	1985	1986	1987
TOTAL—RDT&E	$16,301	$18,277	$18,938	$19,812	$21,809
Research	763	957	1,142	1,664	1,730
Exploratory Development	1,261	1,246	1,716	1,494	1,524
Other Development	13,915	15,616	15,432	15,870	17,964
Management & Support	362	459	648	784	592
Aircraft—TOTAL	$ 2,072	$ 2,316	$ 2,304	$ 3,160	$ 3,561
Research	36	95	130	591	437
Exploratory Development	152	142	139	106	103
Other Development	1,879	2,074	2,025	2,449	3,007
Management & Support	6	4	9	14	14
Missile and Space Systems—TOTAL	6,444	7,296	7,119	6,873	7,943
Research	34	14	23	22	64
Exploratory Development	239	224	385	325	356
Other Development	6,097	6,937	6,583	6,401	7,401
Management & Support	73	120	127	125	122
Electronics & Communications Equipment—TOTAL	4,681	4,644	4,718	4,515	4,637
Research	76	95	126	122	162
Exploratory Development	404	397	394	325	280
Other Development	4,127	4,042	4,083	3,983	4,117
Management & Support	75	111	115	86	79
All Other—TOTAL[a]	3,104	4,021	4,797	5,264	5,668
Research	617	753	863	930	1,067
Exploratory Development	466	483	798	738	785
Other Development	1,812	2,561	2,741	3,037	3,439
Management & Support	208	224	397	559	377

Source: Department of Defense, "Prime Contract Awards by Service Category and Federal Supply Classification" (Annually).
NOTE: Detail may not add to totals because of rounding.
a "All Other" includes ships, tank-automotive, weapons, ammunition, services, and other.

DEPARTMENT OF DEFENSE
NET VALUE OF PRIME CONTRACT AWARDS OVER $25,000[a] FOR RESEARCH, DEVELOPMENT, TEST & EVALUATION

By Region and Type of Contractor
Fiscal Year 1987

REGION	TOTAL	Type of Contractor		
		Educational Institutions	Other Non-Profit Institutions[a]	Business Firms
TOTAL—Millions of Dollars ...	$21,392	$1,475	$1,218	$18,698
New England	$ 2,687	$ 475	$ 498	$ 1,715
Middle Atlantic	2,515	148	27	2,340
East North Central	813	73	81	659
West North Central	935	13	3	919
South Atlantic	2,726	451	140	2,136
East South Central	490	21	6	463
West South Central	1,098	58	11	1,029
Mountain	2,396	66	2	2,328
Pacific[b]	7,732	171	452	7,109
PERCENT OF TOTAL	100.0%	100.0%	100.0%	100.0%
New England	12.6%	32.2%	40.8%	9.2%
Middle Atlantic	11.8	10.0	2.2	12.5
East North Central	3.8	5.0	6.6	3.5
West North Central	4.4	0.9	0.2	4.9
South Atlantic	12.7	30.5	11.5	11.4
East South Central	2.3	1.4	0.5	2.5
West South Central	5.1	3.9	0.9	5.5
Mountain	11.2	4.5	0.1	12.5
Pacific[b]	36.1	11.6	37.1	38.0

Source: Department of Defense, "Prime Contract Awards by Region and State" (Annually).
NOTE: Detail may not add to totals because of rounding.
a Includes contracts with other government agencies.
b Includes Alaska and Hawaii.

MISSILE PROGRAMS
RESEARCH, DEVELOPMENT, TEST AND EVALUATION[a]

By Agency, Type and Model
Fiscal Years 1987, 1988 and 1989
(Millions of Dollars)

Agency, Type and Model	1987	1988[E]	1989[E]
AIR FORCE			
ALCM	$ 0.7	$ 3.6	$ 1.0
AMRAAM[b]	41.6	48.4	13.6
*ASMS	150.0	133.6	152.0
Peacekeeper (M-X)	290.0	36.0	40.0
*Small ICBM in Hard Mobile Basing	763.5	682.3	200.0
*SRAM II	65.5	174.3	231.5
NAVY			
*AAAM	$ —	$ 16.6	$ 30.4
*AEGIS ER	29.2	63.6	100.7
Harm[b]	3.6	6.0	—
Harpoon	19.0	31.9	22.6
Hawk[e]	1.7	1.3	5.7
Penguin	16.7	14.5	4.1
RAM	22.8	12.6	8.6
Sidewinder[b]	23.3	19.5	21.3
Standard	73.5	93.0	152.8
Tomahawk	77.3	70.5	60.3
Trident II	1,567.3	1,042.8	573.3
VLA	39.2	40.4	30.3
ARMY			
*Advanced Anti-Tank Weapon System	$ 42.6	$ 33.6	$ 134.6
ATACMS	76.3	101.3	84.6
Chaparral	9.4	1.5	—
Laser Hellfire[c]	9.2	21.1	10.6
LOS-F-H	23.6	99.0	49.8
Patriot	21.7	18.3	23.1
STINGER	1.0	3.0	—
TOW 2[d]	4.8	18.9	20.3

Source: "Program Acquisition Costs by Weapon System," Department of Defense Budget (Annually).
NOTE: See Missile Programs Chapter for missile program procurement authorization data.
E Estimate. Latest year reflects Administration's budget proposal.
a Total Obligational Authority.
b Navy and Air Force funding.
c Army and Navy funding.
d Army and Marine Corps funding.
e Marine Corps funding.
g Navy and Marine Corps funding.
* Programs in R&D only.

MILITARY AIRCRAFT PROGRAMS
RESEARCH, DEVELOPMENT, TEST AND EVALUATION[a]

By Agency, Type and Model
Fiscal Years 1987, 1988 and 1989
(Millions of Dollars)

Agency, Type and Model	1987	1988[E]	1989[E]
AIR FORCE			
AC-130U	$ 51.7	$ 67.3	$ 64.7
*Advanced Tactical Fighter	261.3	498.1	702.3
*Aircraft Engine Component Improvement Program[b]	110.3	90.7	94.5
C-17	615.7	1,115.6	961.1
F-15 C/D/E	153.3	105.6	89.1
F-16 Multimission Fighter (Falcon)	53.7	25.4	26.5
KC-135 Re-engining/modern	0.4	4.0	3.2
LANTIRN (Night Precision Attack)	37.9	19.8	4.7
MC-130H Combat Talon[b]	11.9	9.4	21.6
TR-1/U-2	20.5	69.7	102.2
NAVY			
A-6 Intruder	$189.7	$ 215.5	$ 1.4
AH-1W Sea Cobra	1.0	13.1	12.0
AV-8B	41.8	36.7	39.2
CH/MH-53E Super Stallion	3.6	9.6	9.0
E-2C Hawkeye	32.8	21.1	23.1
E-6A	76.1	35.7	—
EA-6B Prowler	50.1	65.6	26.6
F-14 A/D Tomcat	278.7	164.0	167.7
F/A-18 Hornet	30.0	11.9	13.2
Joint Services Adv. Vert. Lift Aircraft (V-22)[b]	421.4	465.7	306.7
*LRAACA	—	1.8	69.1
*National Aerospace Plane	110.0	183.0	245.0
P-3C/G Orion	53.1	96.0	150.7
SH-60B Seahawk (LAMPS MK-III)	18.6	18.4	6.1
SH-60F CV ASW	36.0	—	—
T-45 Training System	134.2	94.6	87.8
ARMY			
AH-64 Attack Helicopter	$ —	$ 18.4	$ 4.8
*LHX Army Helicopter	100.9	130.0	180.9
RPVs	65.2	—	—
UH-60A Black Hawk	—	15.0	41.0

Source: "Program Acquisition Costs by Weapon System," Department of Defense Budget (Annually).
NOTE: See Aircraft Production Chapter for aircraft program procurement authorization data.

a Total Obligational Authority.
b Air Force and Navy funding.
c Air Force, Navy and Marine Corps funding.
d Army, Navy and Air Force funding.
E Estimate. Latest year reflects Administration's budget proposal.
* Programs in R&D only.

Foreign Trade

In a year when the United States as a whole experienced its 12th consecutive international merchandise trade deficit, the U.S. aerospace industry posted new records for export volume and trade balance.

In 1987, aerospace exports amounted to $23.9 billion and represented almost 10 percent of the total U.S. export volume in dollar value terms.

U.S. imports of aerospace products also reached a new record level. In rounded-off figures, 1987 imports of $7.9 billion were the same as the recorded level of 1986 but the exact 1987 figure was $3 million higher.

The resulting $16 billion aerospace trade balance for 1987 topped the prior record (1981) by almost $3 billion and the 1986 figure by $3.2 billion.

The $23.9 billion in aerospace exports represented a gain of more than 15 percent above the previous record $20.7 billion of 1986. The composition of the aerospace export volume was roughly two-thirds civil products. In 1986, the civil/military export ratio was 71 percent civil, 29 percent military.

Civil exports increased from $14.8 billion in 1986 to $16.2 billion in 1987, sparked by the third straight annual increase in sales of civil aircraft, predominantly transport aircraft. Transport sales to foreign customers accounted for $6.4 billion, up from $6.3 billion.

A breakdown of the civil exports categories shows sales of complete aircraft totaling $7.6 billion (up from $7.4 billion in 1986); aircraft and engine parts $7.2 billion (up from $6.5 billion); and aircraft engines $1.3 billion (up from $1.0 billion).

Exports of general aviation aircraft, which had declined sharply in earlier years, continued the rallying upturn initiated in 1986. Sales for 1987 totaled $327 million, which compared with $243 million in 1986 and $191 million in 1985. Helicopter exports, however, dipped to $239 million from the previous year's $277 million.

At $7.7 billion, military aerospace exports reached an all-time high; the 1987 figure compared with $5.9 billion in 1986. The increase spread across the board: export sales of complete aircraft amounted to $3.6 billion (up from

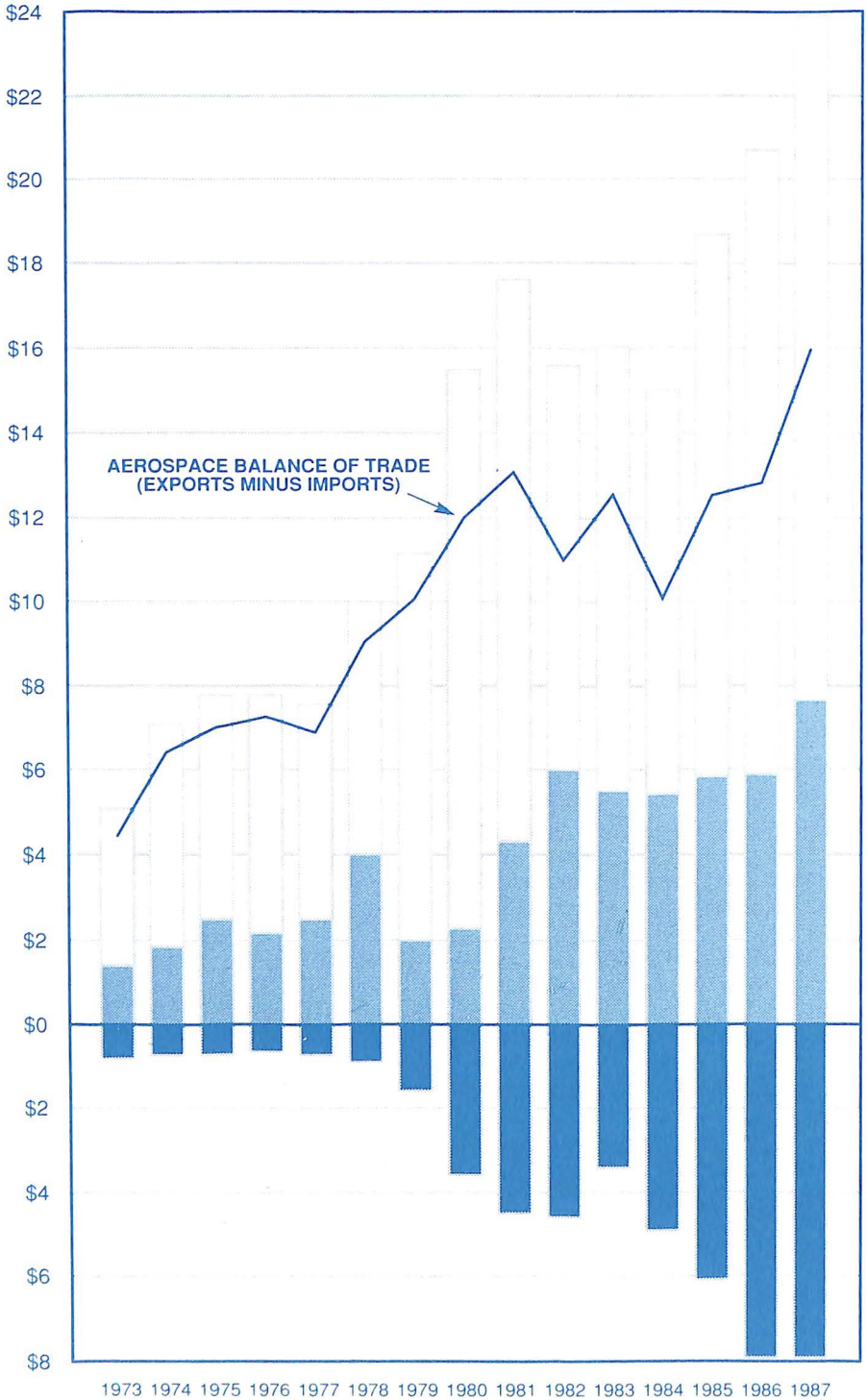
$2.5 billion); sales of aircraft and engine parts totaled $3.1 billion (up from $2.6 billion); sales of missiles, rockets and parts accounted for $848 million (up from $657 million); and sales of complete aircraft engines came to $161 million (up from $111 million).

Civil products, at $6.4 billion, accounted for more than 80 percent of the aerospace import volume. The breakdown shows only minor changes from the previous year: aircraft and engine parts $3.3 billion (up $39 million); complete aircraft $2.0 billion (down $12 million); and complete aircraft engines $1.1 billion (down $16 million). Military imports of $1.5 billion consisted almost entirely of aircraft and engine parts ($1.3 billion, up from $1.2 billion).

The principal customer nations for U.S. aerospace exports in 1987 were Japan, which bought products with a total value of $2.3 billion; the United Kingdom, $2.3 billion; France, $1.4 billion; West Germany, $1.3 billion; and Australia, $1.0 billion.

The United Kingdom led the list of countries of origin for U.S. aerospace imports with a total value of $2.0 billion. Next were France, just under $2 billion; Canada, $1.8 billion; West Germany, $347 million; and Japan, $319 million. □

AEROSPACE EXPORTS, IMPORTS AND TRADE BALANCE



Source: Aerospace Industries Association

U.S. TOTAL AND AEROSPACE FOREIGN TRADE[a]

Calendar Years 1963-1987
(Millions of Dollars)

Year	Total U.S. Merchandise Trade			Aerospace		
	Trade Balance	Exports	Imports	Trade Balance	Exports	Imports
1963	$ 6,061	$ 23,062	$ 17,001	$ 1,532	$ 1,627	$ 95
1964	7,555	26,156	18,601	1,518	1,608	90
1965	5,875	27,127	21,252	1,459	1,618	159
1966	4,524	29,884	25,360	1,370	1,673	303
1967	4,409	31,142	26,733	1,961	2,248	287
1968	1,133	34,199	33,066	2,661	2,994	333
1969	1,599	37,462	35,863	2,831	3,138	307
1970	2,834	42,590	39,756	3,097	3,405	308
1971	(2,024)[b]	43,492	45,516	3,830	4,203	373
1972	(6,351)	48,959	55,310	3,230	3,795	565
1973	1,222	70,246	69,024	4,360	5,142	782
1974	(2,996)	97,144	100,140	6,350	7,095	745
1975	9,630	106,561	96,931	7,045	7,792	747
1976	(7,786)	113,666	121,452	7,267	7,843	576
1977	(28,970)	119,006	147,976	6,850	7,581	731
1978	(33,541)	141,228	174,769	9,058	10,001	943
1979	(30,272)	178,798	209,070	10,123	11,747	1,624
1980	(27,336)	216,672	244,008	11,952	15,506	3,554
1981	(30,051)	228,961	259,012	13,134	17,634	4,500
1982	(35,182)	207,158	242,340	11,035	15,603	4,568
1983	(60,710)	195,969	256,679	12,619	16,065	3,446
1984	(110,932)	212,057	322,989	10,082	15,008	4,926
1985	(136,627)	206,925	343,552	12,592	18,724	6,132
1986	(162,281)	206,376	368,657	12,802[r]	20,704[r]	7,902
1987	(158,207)	243,859	402,066	16,019	23,924	7,905

Source: Bureau of the Census, "Highlights of U.S. Export and Import Trade," Report FT990 (Monthly); "U.S. Exports, Schedule B, Commodity by Country," Report FT446 (Annually); "U.S. Imports for Consumption and General Imports, TSUSA Commodity and Country of Origin," Report FT 246 (Annually).

a Total U.S. and aerospace foreign trade are reported as (1) exports of domestic merchandise, including Department of Defense shipments, f.a.s. (= free alongside ship) basis, not seasonally adjusted, (2) imports for consumption, customs value basis, not seasonally adjusted, and (3) the difference (surplus or deficit) between exports and imports.

b First U.S. trade deficit since 1888.

r Revised.

U.S. EXPORTS OF AEROSPACE PRODUCTS[a] BY MAJOR COUNTRIES OF DESTINATION

Calendar Years 1983-1987
(Millions of Dollars)

Major Countries of Destination	1983	1984	1985	1986	1987
Australia	$ 390	$ 445	$1,034	$1,327	$1,036
Belgium/Luxembourg	281	247	216	345	373
Brazil	280	154	407	451	912
Canada	1,014	1,121	964	1,005	1,103
China	267	128	678	334	528
France	1,190	1,011	1,014	1,480	1,382
Germany, West	594	651	967	1,282	1,274
Hong Kong	121	110	140	266	351
Israel	430	444	333	304	487
Italy	323	469	725	533	455
Japan	1,540	1,305	1,792	2,209	2,313
Korea, South	274	382	536	301	343
Netherlands	401	331	217	625	565
Saudi Arabia	380	419	687	670	221
Singapore	549	691	641	529	498
Spain	147	93	115	204	447
Sweden	98	156	463	419	307
Taiwan	266	264	358	238	153
United Kingdom	1,087	1,276	1,566	1,301	2,297

Source: U.S. Department of Commerce, International Trade Administration.
a Includes all civil products, f.a.s. basis; excludes military products, which are not reported by country of destination.

U.S. IMPORTS OF AEROSPACE PRODUCTS[a] BY MAJOR COUNTRIES OF ORIGIN

Calendar Years 1983-1987
(Millions of Dollars)

Major Countries of Origin	1983	1984	1985	1986	1987
Canada	$1,018	$1,397	$1,552	$1,905	$1,821
France	726	1,109	1,673	2,007	1,974
Germany, West	124	121	229	315	347
Israel	73	142	132	211	208
Italy	113	143	138	221	266
Japan	177	173	185	272	319
Netherlands	49	124	219	275	127
Singapore	36	100	114	121	115
Sweden	10	33	183	244	278
United Kingdom	933	1,163	,562	1,898	2,004

Source: U.S. Department of Commerce, International Trade Administration.
a Includes civil and military products, c.i.f. basis.

U.S. IMPORTS OF AEROSPACE PRODUCTS

Calendar Years 1983-1987
(Millions of Dollars)

Aerospace Imports	1983	1984	1985	1986	1987
TOTAL	$3,446	$4,926	$6,132	$7,902	$7,905
TOTAL CIVIL	$2,927	$3,787	$4,984	$6,398	$6,409
Complete Aircraft—TOTAL	$ 924	$1,301	$1,502	$2,050	$2,038
Transports	188	270	599	742	551
General Aviation	542	612	673	1,053	1,337
Helicopters	90	51	45	63	79
Other, Including Used Aircraft, & Gliders, Balloons, & Airships	104	368	185	192	70
Aircraft Engines—TOTAL	617	750	1,019	1,133	1,117
Turbine Engines	602	738	1,011	1,114	1,110
Piston Engines	15	12	8	19	7
Aircraft and Engine Parts—TOTAL	1,386	1,736	2,463	3,215	3,254
Aircraft Parts and Accessories	267	320	381	594	659
Turbine Engine Parts	452	561	851	1,053	1,058
Piston Engine Parts	5	6	14	12	19
Spacecraft Parts, & Other Parts & Accessories	662	849	1,217	1,556	1,519
TOTAL MILITARY	$ 519	$1,139	$1,148	$1,504	$1,496
Complete Aircraft—TOTAL	$ 3	$ 14	$ 20	$ 35	$ 33
Aircraft Engines—TOTAL	4	124	217	286	199
Turbine Engines	3	123	215	283	196
Piston Engines Including Parts	1	1	2	3	3
Aircraft and Engine Parts—TOTAL	512	1,001	911	1,183	1,265
Aircraft Parts	442	632	493	690	699
Turbine Engine Parts	52	163	228	317	370
Other Parts & Accessories	18	206	190	176	196

Source: Bureau of the Census, "U.S. Imports for Consumption and General Imports, TSUSA Commodity and Country of Origin," Report FT 246 (Annually).
NOTE: Detail may not add to totals because of rounding.

U.S. IMPORTS OF COMPLETE AIRCRAFT

Calendar Years 1983-1987

Aircraft Imports	1983	1984	1985	1986	1987
TOTAL NUMBER OF AIRCRAFT	693	995	1,241	797	816
Civil Aircraft—TOTAL	679	951	1,166	742	630
New Complete Aircraft:					
Helicopters	100	61	60	87	98
General Aviation:					
Single-Engine	6	21	46	71	41
Multi-Engine Under 4400 lbs	18	33	8	18	1
Multi-Engine 4400-10,000 lbs	52	58	46	58	81
Multi-Engine, Turbojet/Turbofan, 10,000-33,000 lbs	86	61	54	63	76
Multi-Engine, Other, Including Turboshaft, 10,000-33,000 lbs		34	49	87	79
Transports (Multi-Engine, Over 33,000 lbs)	7	12	29	36	22
Other Civil Aircraft:					
Used or Rebuilt	181	223	246	141	115
Aircraft Previously Exported from U.S.	NA	NA	NA	NA	NA
Gliders	229	448	628	181	117
Balloons & Airships	NA	NA	NA	NA	NA
Military Aircraft—TOTAL	14	44	75	55	186
New Complete Aircraft	7	43	66	47	123
Gliders	7	1	9	8	63
Balloons & Airships	NA	NA	NA	NA	NA

(Continued on next page)

U.S. IMPORTS OF COMPLETE AIRCRAFT (Continued)

Aircraft Imports	1983	1984	1985	1986	1987
TOTAL VALUE OF AIRCRAFT (Millions of Dollars)	$926.8	$1,314.6	$1,522.0	$2,084.5	$2,070.4
Civil Aircraft—TOTAL	$923.8	$1,300.5	$1,501.6	$2,049.6	$2,037.7
New Complete Aircraft:					
Helicopters	89.5	51.3	44.7	62.6	79.3
General Aviation:					
Single-Engine	0.4	1.5	7.5	8.1	3.1
Multi-Engine Under 4400 lbs	2.5	4.2	1.5	1.5	0.3
Multi-Engine 4400-10,000 lbs	72.6	100.1	95.1	134.9	206.7
Multi-Engine, Turbojet/Turbofan, 10,000-33,000 lbs	466.4	343.8	313.1	433.5	677.3
Multi-Engine, Other, Including Turboshaft, 10,000-33,000 lbs		162.1	255.6	475.5	449.8
Transports (Multi-Engine, Over 33,000 lbs)	188.0	269.7	598.8	741.8	551.1
Other Civil Aircraft:					
Used or Rebuilt	72.8	351.8	177.2r	189.0	60.7
Aircraft Previously Exported from U.S.	27.9	8.8	—	—	8.0
Gliders	3.5	3.6	3.8	1.7	0.6
Balloons & Airships	0.2	3.6	4.4	0.9	0.9
Military Aircraft—TOTAL	3.0	14.1	20.4	34.9	32.7
New Complete Aircraft	2.7	14.0	19.4	34.0	29.8
Gliders	0.2	(a)	0.2	0.8	1.3
Balloons & Airships	0.1	0.1	0.8	0.1	1.6

Source: Bureau of the Census, "U.S. Imports for Consumption and General Imports, TSUSA Commodity and Country of Origin," Report FT 246 (Annually).
NA Not available.
a Less than $50,000.
r Revised.

TOTAL U.S. EXPORTS AND EXPORTS OF AEROSPACE PRODUCTS

Calendar Years 1963-1987
(Millions of Dollars)

Year	TOTAL Exports[a] of U.S. Merchandise	Exports of Aerospace Products				
		TOTAL	Percent of Total U.S. Exports	Civil		Military
				Total	Trans-ports	
1963	$ 23,062	$ 1,627	7.1%	$ 732	$ 191	$ 895
1964	26,156	1,608	6.1	764	211	844
1965	27,127	1,618	6.0	854	353	764
1966	29,884	1,673	5.0	1,035	421	638
1967	31,142	2,248	7.2	1,380	611	868
1968	34,199	2,994	8.8	2,289	1,200	705
1969	37,462	3,138	8.4	2,027	947	1,111
1970	42,590	3,405	8.0	2,516	1,283	889
1971	43,492	4,203	9.7	3,080	1,567	1,123
1972	48,959	3,795	7.8	2,954	1,119	841
1973	70,246	5,142	7.3	3,788	1,664	1,354
1974	97,144	7,095	7.3	5,273	2,655	1,822
1975	106,561	7,792	7.3	5,324	2,397	2,468
1976	113,666	7,843	6.9	5,677	2,468	2,166
1977	119,006	7,581	6.4	5,049	1,936	2,532
1978	141,228	10,001	7.1	6,018	2,558	3,983
1979	178,798	11,747	6.6	9,772	4,998	1,975
1980	216,672	15,506	7.2	13,248	6,727	2,258
1981	228,961	17,634	7.7	13,312	7,180	4,322
1982	207,158	15,603	7.5	9,608	3,834	5,995
1983	195,969	16,065	8.2	10,595	4,683	5,470
1984	212,057	15,008	7.1	9,659	3,195	5,350
1985	206,925	18,724	9.0	12,919	5,518	5,805
1986[r]	206,376	20,704	10.0	14,834	6,276	5,870
1987	243,859	23,924	9.8	16,183	6,377	7,741

Source: Bureau of the Census, "U.S. Exports, Schedule B, Commodity by Country," Report FT 446 (Annually); "Highlights of U.S. Export and Import Trade," Report FT 990 (Monthly).

NOTE Detail may not add to totals because of rounding.

a Exports of domestic merchandise including DOD shipments.

r Revised.

U.S. EXPORTS OF AEROSPACE PRODUCTS

Calendar Years 1983-1987
(Millions of Dollars)

Aerospace Exports	1983	1984	1985	1986	1987
TOTAL	$16,065	$15,008	$18,724	$20,704[r]	$23,924
TOTAL CIVIL	$10,595	$ 9,659	$12,919	$14,833	$16,183
Complete Aircraft—TOTAL	$ 5,691	$ 4,147	$ 6,694	$7,365	$ 7,649
Transports	4,683	3,195	5,518	6,276	6,377
General Aviation[a]	356	268	191	243	327
Helicopters	232	234	210	277	239
Other, Including Used	420	450	775	569	706
Aircraft Engines—TOTAL	950	1,057	923	987	1,326
Turbine Engines	914	1,021	880	944	1,269
Piston Engines	36	36	43	43	57
Aircraft and Engine Parts Incl. Spares—TOTAL	3,954	4,455	5,302	6,481	7,208
Aircraft Parts & Accessories	2,742	3,094	3,610	4,394	4,752
Aircraft Engine Parts	1,212	1,361	1,692	2,087	2,456
TOTAL MILITARY	$ 5,470	$ 5,350	$5,805	$5,871[r]	$ 7,741
Complete Aircraft—TOTAL[b]	$ 1,845	$ 1,581	$ 2,011	$ 2,479[r]	$ 3,590
Fighters & Fighter Bombers	1,379	977	1,352	1,016	1,986
Transports	112	85	101	1,133[r]	1,324
Helicopters	62	83	117	123	81
Other, Including Used	292	436	441	207	200
Aircraft Engines—TOTAL	172	141	146	111	161
Turbine Engines	162	125	144	108	157
Piston Engines	10	16	2	3	4
Aircraft and Engine Parts Incl. Spares—TOTAL	2,459	2,666	2,823	2,624	3,142
Aircraft Parts & Accessories	2,058	2,241	2,302	2,148	2,500
Aircraft Engine Parts	401	425	521	476	642
Guided Missiles, Rockets, & Parts—TOTAL	994	962	825	657	848
Guided Missiles & Rockets	443	288	404	303	353
Missile & Rocket Parts	499	646	387	321	456
Missile & Rocket Engines	28	16	14	17	21
Missile & Rocket Engine Parts	24	12	20	16	18

Source: Bureau of the Census, "U.S. Exports, Schedule B, Commodity by Country," Report FT 446 (Annually).
a All fixed-wing aircraft under 33,000 pounds.
b Includes aircraft exported under Military Assistance Programs and Foreign Military Sales.
r Revised.

U.S. EXPORTS OF CIVIL AIRCRAFT

Calendar Years 1983-1987

Civil Aircraft Exports	1983	1984	1985	1986	1987
TOTAL NUMBER OF AIRCRAFT	1,088	1,045	1,050	1,327	1,929
Helicopters—TOTAL	216	233	137	210	281
Under 2200 lbs	141	155	68	104	129
Over 2200 lbs	75	78	69	106	152
General Aviation—TOTAL	519	425	484	464	509
Single-Engine	279	271	334	270	307
Multi-Engine, Under 4400 lbs	106	53	66	63	51
Multi-Engine, 4400-10,000 lbs	112	83	65	93	127
Multi-Engine, 10,000-33,000 lbs	22	18	19	38	24
Transports—TOTAL	129	83	152	159	170
Passenger Aircraft, Over 33,000 lbs	122	77	140	149	160
Cargo Aircraft, Over 33,000 lbs	2	3	6	2	4
Other, Over 33,000 lbs, Incl. Pass./Cargo Combi	5	3	6	8	6
Other Aircraft—TOTAL	224	304	277	494	969
Used or Rebuilt Aircraft	224	304	277	494	969
Other Aircraft, Including Balloons, Gliders & Kites	NA	NA	NA	NA	NA
TOTAL VALUE (Millions of Dollars)	$5,691	$4,147	$6,694	$7,366	$7,649
Helicopters—TOTAL	$ 232	$ 234	$ 210	$ 277	$ 239
Under 2200 lbs	35	45	18	29	33
Over 2200 lbs	197	189	192	248	206
General Aviation—TOTAL	356	268	191	243	327
Single-Engine	23	34	48	28	28
Multi-Engine, Under 4400 lbs	21	13	14	13	8
Multi-Engine, 4400-10,000 lbs	155	99	85	133	219
Multi-Engine, 10,000-33,000 lbs	157	122	44	69	72
Transports—TOTAL	4,683	3,195	5,518	6,276	6,377
Passenger Aircraft, Over 33,000 lbs	4,415	2,998	4,643	5,352	5,635
Cargo Aircraft, Over 33,000 lbs	37	62	334	186	208
Other, Over 33,000 lbs, Incl. Pass./Cargo Combi	231	135	541	738	534
Other Aircraft—TOTAL	420	450	775	569	706
Used or Rebuilt	298	293	333	501	563
Other, Including Balloons, Gliders & Kites	122	157	442	68	143

Source: Bureau of the Census, "U.S. Exports, Schedule B, Commodity by Country," Report FT446 (Annually).
NA Not available.

U.S. EXPORTS OF CIVIL HELICOPTERS

Calendar Years 1983-1987

Region of Destination	1983	1984	1985	1986	1987
TOTAL NUMBER EXPORTED ...	216	233	137	210	281
Canada & Greenland	16	8	12	12	16
Latin America & Caribbean	38	32	25	39	58
Europe	51	89	18	45	105
Middle East	48	12	6	26	16
Asia	44	62	51	54	47
Oceania	8	25	18	19	32
Africa	11	5	7	15	7
TOTAL VALUE (Millions of Dollars)	$232.1	$233.8	$209.8	$277.3	$239.1
Canada & Greenland	$ 9.7	$ 4.1	$ 5.0	$ 3.2	$ 7.3
Latin America & Caribbean	47.0	42.0	19.0	24.4	68.0
Europe	50.7	52.8	5.4	25.6	41.5
Middle East	48.6	16.3	24.5	78.7	61.3
Asia	59.2	107.5	141.1	125.7	48.4
Oceania	1.1	9.3	9.5	7.8	8.6
Africa	15.8	1.8	5.3	11.9	4.0

Source: Bureau of the Census, "U.S. Exports, Schedule B, Commodity by Country," Report FT446 (Annually).

U.S. IMPORTS OF CIVIL HELICOPTERS

Calendar Years 1983-1987

Country of Origin	1983	1984	1985	1986	1987
TOTAL NUMBER IMPORTED	100	61	60	87	98
Canada	—	—	—	—	32
France	46	13	13	21	29
Germany	48	16	35	55	33
Italy	1	30	8	8	4
United Kingdom	5	2	4	3	—
TOTAL VALUE (Millions of Dollars)	$ 89.5	$51.3	$44.7	$62.6	$ 79.3
Canada	$ —	$ —	$ —	$ —	$ 18.9
France	39.6	14.9	13.7	10.8	24.0
Germany	35.8	9.7	19.9	43.9	31.2
Italy	0.8	19.2	3.9	5.7	5.2
United Kingdom	13.3	7.5	7.2	2.2	—

Source: Bureau of the Census, "U.S. Imports for Consumption and General Imports, TSUSA Commodity and Country of Origin," Report FT246 (Annually).

U.S. EXPORTS OF GENERAL AVIATION AIRCRAFT[a]

Calendar Years 1983-1987

Region of Destination	1983	1984	1985	1986	1987
TOTAL NUMBER EXPORTED ...	519	425	484	464	509
Canada & Greenland	43	49	44	50	32
Latin America & Caribbean	204	108	175	166	97
Europe	102	113	111	146	226
Middle East	13	10	33	8	1
Asia	30	47	55	42	69
Oceania	43	62	49	33	41
Africa	84	36	17	19	43
TOTAL VALUE (Millions of Dollars)	$356.0	$267.8	$191.1	$243.1	$327.3
Canada & Greenland	$ 13.6	$ 23.7	$ 15.1	$ 10.5	$ 17.2
Latin America & Caribbean	66.0	33.3	44.0	48.6	51.5
Europe	92.9	60.6	57.2	92.6	150.6
Middle East	86.2	62.2	3.9	6.8	0.1
Asia	31.4	48.1	40.4	48.8	60.9
Oceania	16.1	8.6	19.4	16.7	3.3
Africa	49.8	31.3	11.1	19.0	43.7

Source: Bureau of the Census, "U.S. Exports, Schedule B, Commodity by Country," Report FT446 (Annually).
a All fixed-wing aircraft under 33,000 pounds.

U.S. IMPORTS OF GENERAL AVIATION AIRCRAFT

Calendar Years 1983-1987

Country of Origin	1983	1984	1985	1986	1987
TOTAL NUMBER IMPORTED	162	207	203	297	278
Brazil	15	14	10	13	20
Canada	38	27	26	34	34
France	19	30	49	99	76
Israel	9	24	9	13	8
Japan	17	15	8	10	12
Netherlands	—	3	6	10	—
United Kingdom	36	53	58	79	80
Other	28	41	37	39	48
TOTAL VALUE (Millions of Dollars)	$541.9	$611.7	$672.7	$1,053.5	$1,337.0
Brazil	$ 26.9	$ 23.9	$ 26.3	$ 62.8	$ 97.8
Canada	208.4	159.6	173.1	229.8	209.6
France	104.3	95.7	83.9	196.1	510.5
Israel	31.7	85.2	33.0	54.8	30.7
Japan	16.2	14.8	7.7	8.6	12.6
Netherlands	—	18.2	35.0	56.9	—
United Kingdom	137.0	198.1	200.7	297.9	301.9
Other	17.4	16.2	113.0	146.6	173.9

Source: Bureau of the Census, "U.S. Imports for Consumption and General Imports, TSUSA Commodity and Country of Origin," Report FT246 (Annually).

U.S. EXPORTS OF COMMERCIAL TRANSPORT AIRCRAFT

33,000 Pounds and Over Airframe Weight
Calendar Years 1983-1987

Region of Destination	1983	1984	1985	1986	1987
TOTAL NUMBER EXPORTED	129	83	152	159	170
Canada	8	6	4	2	—
Latin America & Caribbean	8	3	4	9	20
Europe	57	34	72	69	88
Middle East	10	9	8	11	7
Asia	30	23	49	35	40
Oceania	4	2	7	30	8
Africa	12	6	8	3	7
TOTAL VALUE (Millions of Dollars)	$4,683	$3,195	$5,518	$6,276	$6,377
Canada	$ 280	$ 265	$ 84	$ 46	$ —
Latin America & Caribbean	304	69	234	343	725
Europe	1,785	1,008	2,050	2,284	2,753
Middle East	291	242	438	613	185
Asia	1,464	1,165	2,124	1,957	2,263
Oceania	180	137	437	927	289
Africa	379	309	151	104	162

Source: Bureau of the Census, "U.S. Exports, Schedule B, Commodity by Country," Report FT446 (Annually).

U.S. EXPORTS OF MILITARY AIRCRAFT[a]

Calendar Years 1983-1987

	1983	1984	1985	1986	1987
TOTAL NUMBER OF AIRCRAFT	936	381	313	409[r]	500
Fighters & Fighter Bombers	93	110	91	68	122
Transports	15	6	6	15[r]	106
Helicopters	55	32	38	45	39
New Aircraft, NEC	124	227	141	271	218
Used or Rebuilt Aircraft	649	6	37	10	15
Airships, Balloons, Gliders, etc.	NA	NA	NA	NA	NA
TOTAL VALUE (Millions of Dollars)	$1,845	$1,581	$2,011	$2,479[r]	$3,590
Fighters & Fighter Bombers	$1,378	$ 977	$1,352	$1,016	$1,986
Transports	112	85	101	1,133[r]	1,324
Helicopters	62	83	117	123	81
New Aircraft, NEC	248	410	357	178	135
Used or Rebuilt Aircraft	22	6	59	6	6
Airships, Balloons, Gliders, etc.	23	20	25	23	59

Source: Bureau of the Census, "U.S. Exports, Schedule B, Commodity by Country," Report FT446 (Annually).
NEC Not elsewhere classified.
NA Not available
a Includes aircraft exported under Military Assistance Programs and Foreign Military Sales.
r Revised.

U.S. EXPORTS OF AIRCRAFT ENGINES

Calendar Years 1985-1987
(Millions of Dollars)

	1985		1986		1987	
	Number	Value	Number	Value	Number	Value
TOTAL	6,577	$1,069	4,582	$1,098	5,820	$1,486
Turbine Engines-New	1,942	$ 699	801	$ 630	1,004	$ 779
Civil	1,748	570	702	531	877	654
Military	194	129	99	99	127	125
Turbine Engines-Used	619	325	676	422	1,578	646
Civil	569	310	640	413	1,513	614
Military	50	15	36	9	65	32
Piston Engines	4,016	45	3,105	46	3,238	61
Civil, New, Under 500 HP	854	11	851	13	946	13
Civil, New, Over 500 HP	1,688	8	695	9	295	16
Civil, Used	1,402	24	1,415	21	1,747	28
Military	72	2	144	3	250	4

Source: Bureau of the Census, "U.S. Exports, Schedule B, Commodity by Country," Report FT446 (Annually).

U.S. IMPORTS OF TURBINE AIRCRAFT ENGINES[a]

Calendar Years 1985-1987
(Millions of Dollars)

	1985		1986		1987	
	Number	Value	Number	Value	Number	Value
Turbine Engines	2,010	$1,226	2,274	$1,397	$2,136	$1,306
Civil	1,760	1,011	1,829	1,114	1,656	1,110
Military	250	215	445	283	480	196

Source: Bureau of the Census, "U.S. Imports for Consumption and General Imports, TSUSA Commodity and Country of Origin," Report FT246 (Annually).

a New and used.

EXPORT-IMPORT BANK LENDING AUTHORITY AND GROSS AUTHORIZATIONS SUMMARY

Fiscal Years 1979-1988
(Millions of Dollars)

LOANS[a]

Year	Lending Authority[c]	Authorizations Summary				
		TOTAL Direct Loans[a]	Regular Loans			Discount Loans, Medium Term, and Small Business Credits
			Total Regular Loans[a]	Direct Credits	CFF[b] & Relending	
1979	$3,750	$4,475	$3,825	$3,725	$100	$ 650
1980	4,001	4,578	4,087	4,045	42	491
1981	5,461	5,431	5,079	5,045	34	352
1982	4,400	3,516	3,104	3,104	(*b*)	412
1983	4,400	845	685	685	(*b*)	160
1984	3,865	1,465	1,122	1,122	(*b*)	343
1985	3,865	659	320	320	(*b*)	339
1986	1,059	578	371	371	(*b*)	207
1987	680	599	332	332	—	267
1988[E]	693	NA	NA	NA	—	NA

GUARANTEES AND INSURANCE

Year	Lending Authority	Authorizations Summary		
		TOTAL Guarantees and Insurance	Guarantees	Insurance
1979	$ (*d*)	$5,016	$ 908	$4,108
1980	(*d*)	8,032	2,510	5,522
1981	8,059	7,416	1,506	5,910
1982	9,220	5,832	727	5,105
1983	9,000	8,525	1,741	6,784
1984	10,000	7,151	1,333	5,818
1985	10,000	7,850	1,320	6,530
1986	11,484[f]	5,508	1,128	4,380
1987	11,355	7,958	1,514	6,444
1988[E]	14,602	NA	NA	NA

Source: Export-Import Bank of the United States.
NOTE: Detail may not add to totals because of rounding.
a Discount Loans excluded from loan lending authority limitation until FY 1981. Comparable authorization data for 1980 and prior years are therefore listed under Total Regular Loans, which include Direct Credits, CFF and Relending Loans. For 1981 and subsequent years, compare TOTAL Direct Loans authorization data with Lending Authority, both of which include Discount Loans. The value of Loans may exceed Lending Authority because of the inclusion in Loans of the full amount of Certificates of Loan Participation (COLPs), portions of which are subsequently sold to commercial banks.
b CFF (Cooperative Financing Facility) program discontinued after 1981.
c Effective 1981, lending authority includes discount loans as well as direct loans.
d Limitation for Guarantees and Insurance began in 1981.
E Estimate. Latest year represents Administration's budget proposal.
f Includes $1,800 million proposed I-MATCH Program, which would replace direct lending and would allow an estimated $100 million in commercial loan interest buy-down.
NA Not available.

EXPORT-IMPORT BANK
TOTAL AUTHORIZATIONS OF LOANS AND GUARANTEES AND AUTHORIZATIONS IN SUPPORT OF AIRCRAFT EXPORTS[r]

Fiscal Years 1978-1987
(Millions of Dollars)

Year	TOTAL AUTHORIZATIONS	Authorizations in Support of Aircraft Exports			
		TOTAL	Percent of TOTAL Authorizations	Commercial Jet Aircraft[a]	Other Aircraft[b]
LOANS[c]					
1978	$3,425	$ 237.8	6.9%	$ 189.5	$ 48.3
1979	4,475	1,469.4	32.8	1,399.4	70.0
1980	4,578	1,743.3	38.1	1,692.6	50.7
1981	5,431	2,576.6	47.4	2,550.3	26.3
1982	3,516	263.9	7.5	199.1	64.8
1983	845	396.7	46.9	383.8	12.9
1984	1,465	608.0	41.5	531.8	76.2
1985	659	39.7	6.0	15.2	24.5
1986	578	54.6	9.4	46.3	8.3
1987	599	12.1	2.0	—	12.1
GUARANTEES[d]					
1978	$ 589	$ 97.6	16.6%	$ 77.2	$ 20.4
1979	908	261.4	28.8	239.3	22.1
1980	2,510	1,131.9	45.1	1,088.1	43.8
1981	1,506	562.6	37.4	533.4	29.2
1982	727	104.2	14.3	78.4	25.8
1983	1,741	629.6	36.2	601.3	28.3
1984	1,333	355.5	26.7	293.5	62.0
1985	1,320	322.4	24.4	290.0	32.4
1986	1,128	329.2	29.2	277.4	51.8
1987	1,514	808.3	53.4	768.1	40.2

Source: Export-Import Bank of the United States.

a Includes complete aircraft, related engines and parts, and retrofits.

b Includes business aircraft, general aviation aircraft, helicopters, and related goods and services. Data revised to include Discount Loans.

c Loans are commitments for financing by the Export-Import Bank to foreign buyers of U.S. equipment and services, including Direct Credits, loans authorized under the Cooperative Financing Facility (CFF), (until the termination of the CFF program in 1981), and Discount Loans, which are made by the Export-Import Bank to commercial banks and which subsequently may be guaranteed by the Export-Import Bank, in which case the value of the loans is also included with Guarantees.

d Guarantees by the Export-Import Bank provide assurances of repayment of principal and interest on loans made by private lending institutions, such as commercial banks, for major export transactions. Excludes insurance.

r Revised to include Discount Loans and corrected data.

EXPORT-IMPORT BANK
SUMMARY OF COMMERCIAL JET AIRCRAFT AUTHORIZATIONS FOR LOANS[a] AND GUARANTEES[b]

Fiscal Years 1957-1987
(Values in Millions of Dollars)

Year	No. of Jet Aircraft[c]		Export Value[c]		No. of New Commitments		Gross Authorizations	
	Loans	Guarantees	Loans	Guarantees	Loans	Guarantees	Loans	Guarantees
New Authorizations:								
1957[d]-1969	377	76	$ 3,023	$ 538	115	76	$ 1,717	$ 385
1970	142	1	1,749	3	44	38	598	79
1971	126	9	1,539	40	58	49	481	363
1972	145	2	1,334	9	44	29	475	183
1973	129	4	1,729	25	60	23	690	191
1974	189	—	2,195	—	79	22	895	133
1975	136	1	2,070	5	64	10	691	64
1976	77	6	1,017	139	34	11	398	87
Tr. Qtr.	15	5	219	182	6	3	94	59
1977	31	25	330	902	16	14	138	294
1978	29	5	479	253	18	5	189	77
1979	118	7	2,938	317	35	10	1,399	239
1980	136	21	3,975	901	36	24	1,693	1,088
1981	121	18	4,568	637	26	17	2,550	533
1982	11	6	441	113	5	2	199	78
1983	21	9	779	619	3	4	384	601
1984	37	8	1,023	327	7	4	532	294
1985	—	14	19	481	1	5	13	289
1986	3	14	74	451	1	9	46	277
1987	—	32	22	1,449	5	14	12	808
Cumulative New Authorizations[r]	1,843	262	29,522	7,396	657	369	13,194	6,123
Transfers, Reversals, & Participation	—	—	(8)	8	4	—	(140)	(20)
Cumulative Gross Authorizations (net of Adjustments)[r]	1,843	262	29,514	7,400	661	369	13,054	6,103

Source: Export-Import Bank of the United States.
NOTE: Detail may not add to totals because of rounding.

a Loans are commitments for direct financing by the Export-Import Bank to foreign buyers of U.S. equipment and services, including Direct Credits and loans authorized under the Cooperative Financing Facility (CFF) until the termination of the CFF program in 1981, but excluding Discount Loans, which are made by the Export-Import Bank to commercial banks and which subsequently may be guaranteed by the Export-Import Bank, in which case the value of the loans is included with Guarantees.

b Guarantees by the Export-Import Bank provide assurances of repayment of principal and interest on loans made by private lending institutions, such as commercial banks, for major export transactions.

c For Export-Import Bank commitments including both loan and guarantee authorization, number of aircraft and export value reported under "Loans."

d First year of commercial jet aircraft authorizations.

r Revised.

EXPORT-IMPORT BANK AUTHORIZATIONS OF LOANS AND GUARANTEES IN SUPPORT OF EXPORTS OF COMMERCIAL JET AIRCRAFT

Fiscal Years 1985-1987
(Values in Millions of Dollars)

Customer (Country/Airline)	Number and Aircraft Model or Related Product	Export Value	Authorization				
			Loans (Direct Credits)				Guarantees
			Amount	Percent Coverage[a]	Interest Rate	Repayment Terms[b]	Amount
FY 1987							
TOTALS	32 aircraft	$1,411	$ 7	—	—	—	$768
Brazil/VARIG	6 X 767	324	—	—	—	—	275
Israel/El Al	2 X 757	59	—	—	—	—	50
Japan/All Nippon	15 X 767	857	—	—	—	—	300
Mauritius/Air Mauritius	2 X 767	5	—	—	—	—	5
Mauritius/ Air Marritius	spare parts for 2 X 767	16	7	42.5	9.10%	20-S	7
Nepal/Royal Nepal Airlines	2 X 757	76	—	—	—	—	64
Yugoslavia/Jugoslovenski Aerotransport	2 X 737	53	—	—	—	—	45
Yugoslavia/Aviogenex	2 x 737	18	—	—	—	—	14
Yugoslavia/Aviogenex	1 X 737	19	—	—	—	—	15
FY 1986							
TOTALS	16 aircraft	$ 525.5	$ 46.3	—	—	—	$277.4
Brazil/Ministry of Aeronautics	tools for engine overhaul	6.9	—	—	—	—	5.9
Chile/Lan-Chile, S.A.	2 X 767	96.2	—	—	—	—	40.0
Finland/Finnair	3 X MD-87	74.2	46.3	62.5	8.40	20-S	—
Gabon/Air Gabon	1 X 100-30	22.7	—	—	—	—	19.3
Jamaica/Air Jamaica	engines	4.3	—	—	—	—	3.6
Yugoslavia/Inex Adria Airways	engines	2.2	—	—	—	—	1.9
Yugoslavia/Boeing	2 X 737	69.9	—	—	—	—	59.4
Yugoslavia/McDonnell Douglas	1 x MD-82	21.8	—	—	—	—	18.6
Zimbabwe/Boeing	3 X 737	66.2	—	—	—	—	56.2
Japan/All Nippon Airways	4 X 767	161.1	—	—	—	—	72.5

(Continued on next page)

EXPORT-IMPORT BANK
LOAN AND GUARANTEE AUTHORIZATIONS (Continued)

Customer (Country/Airline)	Number and Aircraft Model or Related Product	Export Value	Authorization				
			Loans (Direct Credits)				Guarantees
			Amount	Percent Coverage[a]	Interest Rate	Repayment Terms[b]	Amount
FY 1985							
TOTALS	14 aircraft	$ 500.7	$ 12.6	—	—	—	$288.9
Morocco/Royal Air Maroc	—	—	—	—	—	—	(1.1) (c)
Japan/All Nippon	8 X 767	297.8	—	—	—	—	134.0
Airways	engines	19.4	12.6	65.0	12.00	20-S	—
Yugoslavia/Jugoslovenski	2 X 737	60.8	—	—	—	—	51.7
Aerotransport Yugoslavia/ Inex Adria Aviopromet	1 X DC-9	22.4	—	—	—	—	19.0
Brazil/Viacao Aerea Sao Paulo	engines	25.1	—	—	—	—	21.4
Mexico/Aironaves De Mexico	3 X DC-9	75.2	—	—	—	—	63.9

Source: Aerospace Industries Association, based on data from the Export-Import Bank of the United States.
NOTE: For definitions of Loans and Guarantees, see Export-Import Bank tables on previous pages.
a Amount of loan as percent of export value.
b Number of payments and frequency (S=semi-annual)
c Reflects change from Exim guaranteed financing to non guaranteed financing.

Employment

The aerospace industry employment curve continued on the upward curve in evidence since 1983 but probably peaked in 1987. Aerospace Industries Association projected an employment decline of indefinite proportions, beginning in 1988, as the industry noted the first impacts of four consecutive negligible to negative growth defense budgets.

Aerospace employment averaged 1,309,000 in 1987, according to AIA estimates. That represented an increase of 4.6 percent over the previous year's average of 1,251,000.

In 1987, aerospace employment amounted to 6.8 percent of the total employment in all U.S. manufacturing industries, up from the previous year's 6.6 percent. It also represented 11.6 percent of total employment among U.S. companies producing durable goods; that figure compares with 11.1 percent in 1986.

As is traditional, more than half of the 1987 aerospace work force was employed by the segment of the industry manufacturing aircraft, engines and parts. Employment in that category totaled 692,000, up from 673,000 in 1986. Employment among companies engaged in fabrication of missiles and space systems averaged 210,000, up from 190,000. In the catch-all category that embraces all other aerospace R&D/manufacture, employment averaged 407,000, compared with 389,000 in the previous year.

The number of aerospace production workers increased across the board. There was a gain of 16,000, to a total of 344,000 in aircraft, engine and parts production workers; an increase of 4,000 (to 68,000) in missiles/space; and a gain of 1,000 (to 33,000) in the "other" category. The total increase in production workers was 23,000, to a total of 446,000.

The aerospace payroll for 1987 amounted to $34.0 billion, up 5.7 percent over the $32.2 billion paid in 1986; both figures include lump sum wage payments made by many aerospace firms in lieu of general wage or cost of living increases. The aerospace payroll represented seven percent of combined payroll outlays by all U.S. manufacturing industries.

Payments to production workers accounted for $13.2 billion or almost 40 percent of the total. Average hourly earnings for aerospace production workers—again including

lump sum payments—came to $13.32 in 1987, up from $12.88 in 1986. Average weekly earnings amounted to $565.64, up from $550.16. The average work week for production employees was 42.5 hours, down from 42.7.

As is customary, the Pacific region dominated in a geographic breakdown of aerospace employment at yearend 1987. Pacific area companies employed 40.3 percent of the total work force. Next, in order, were New England (14.8 percent); Middle Atlantic (10.2 percent); South Atlantic (8.2 percent); West North Central (7.3 percent); Mountain (6.9 percent); South Central (6.8 percent); and East North Central (5.5 percent). In comparison with the previous year's relative rankings, New England supplanted Middle Atlantic as No. 2 and South Atlantic moved ahead of West North Central into fourth place.

The Pacific region also led in all categories in a breakdown by product group. Pacific companies employed 62.2 percent of all workers engaged in civil aircraft manufacture. New England was second with 14.9 percent and West North Central third with 10.2 percent.

Employment in production of military aircraft was more evenly spread: Pacific 23.5 percent, New England 16.8 percent, South Central 13.3 percent, West North Central 12.4 percent, East North Central 11.9 percent and Middle Atlantic 11.7 percent.

In missile production, Pacific area employment amounted to 43.4 percent, New England 22.4 percent and South Atlantic 12.3 percent. The same three areas led in space equipment fabrication, Pacific with 59.4 percent, New England 18.6 percent and South Atlantic 12 percent. □

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

Calendar Years 1977-1987
(Thousands of Employees)

Year	All Manufacturing Industries	Durable Goods Industries	Aerospace Industry[a]		
			TOTAL	As Percent of	
				All Manufacturing	Durable Goods
1977	19,682	11,597	820	4.2%	7.1%
1978	20,505	12,274	901	4.4	7.3
1979	21,040	12,760	1,034	4.9	8.1
1980	20,285	12,187	1,108	5.5	9.1
1981	20,170	12,109	1,115	5.5	9.2
1982	18,781	11,039	1,063	5.6	9.6
1983	18,434	10,732	1,043	5.6	9.7
1984	19,378	11,505	1,084	5.6	9.4
1985	19,260	11,490	1,180	6.1	10.3
1986[r]	18,994	11,244	1,251	6.6	11.1
1987	19,112	11,237	1,309	6.8	11.6

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

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

a AIA employment data for 1977-1986 were substantially revised in 1987 to better account for aerospace industry related employment.

r Revised.

ANNUAL PAYROLL
AEROSPACE INDUSTRY AND ALL MANUFACTURING INDUSTRIES[d]

Calendar Years 1977-1987
(Millions of Dollars)

Year	All Manufacturing Industries[b]	Aerospace[a]			Aerospace As Percent of All Manufacturing
		TOTAL	Production Workers	Other	
1977	266,000	$11,127	$ 4,445	$ 6,682	4.2%
1978	299,200	13,356	5,442	7,914	4.5
1979	333,900	16,830	7,184	9,646	5.0
1980	354,600	19,969	8,509	11,460	5.6
1981	385,300	22,113	9,046	13,067	5.7
1982	382,900	23,071	8,938	14,133	6.0
1983	397,400	23,243	8,948	14,295	5.8
1984[r]	439,100	26,114	9,694	16,420	5.9
1985[r]	460,900	30,370	10,807	19,563	6.6
1986[r]	470,500[r]	32,087	11,991	20,096	6.8
1987	484,000	33,817	12,905	20,912	7.0

AEROSPACE—INCLUDING LUMP-SUM PAYMENTS[c]

Year	TOTAL	Production Workers	Other	Aerospace As Percent of All Manufacturing
1984[r]	$26,171	$ 9,751	$16,420	6.0%
1985[r]	30,451	10,888	19,563	6.6
1986[r]	32,197	12,101	20,096	6.8
1987	34,030	13,118	20,912	7.0

Source: Manufacturing Payroll from Bureau of Economic Analysis, "Survey of Current Business;" Aerospace Payroll from Aerospace Industries Association estimates.

a Based on AIA estimates of annual average employment and earnings for the aerospace industry; derived from BLS data (see Glossary, "Aerospace Employment" and "Aerospace Payroll").

b See Glossary, "Payroll, All Manufacturing."

c Many aerospace manufacturers have included lump-sum payments in labor settlements since late 1983 in lieu of general wage increases and/or cost of living adjustments. These payments are included in a separate wage series for SIC 3721 (Airframes) by the Bureau of Labor Statistics and are included in the totals for production workers and all aerospace by AIA.

d Aerospace employment data covering the period 1977 to 1986 were revised in 1987. As a result, aerospace payroll data over the period have been adjusted to reflect the revised employment figures.

r Revised.

EMPLOYMENT IN THE AEROSPACE INDUSTRY[a]

Calendar Years 1977-1987
(Annual Average, Thousands of Employees)

Year	TOTAL	Aircraft, Engines, & Parts (SIC 372)	Missiles & Space Vehicles (SIC 376)	Other
TOTAL EMPLOYMENT				
1977	820	482	83	255
1978	901	527	93	280
1979	1,034	611	102	321
1980	1,108	652	111	345
1981	1,115	646	123	347
1982	1,063	601	131	330
1983	1,043	578	141	324
1984	1,084	593	154	337
1985	1,180	636	177	367
1986r	1,251	673	190	389
1987	1,309	692	210	407
PRODUCTION WORKERS				
1977	295	247	26	22
1978	329	275	29	25
1979	394	332	33	29
1980	421	355	35	31
1981	410	343	37	31
1982	373	305	40	28
1983	354	283	46	26
1984	363	285	52	27
1985	393	303	61	29
1986	423	328	64	32
1987	446	344	68	33

Source: Aerospace Industries Association, derived from "Employment and Earnings" (Monthly), Bureau of Labor Statistics.
NOTE AIA employment data for 1977-1986 were substantially revised in 1987 to better account for aerospace industry related employment.
a See Glossary for detailed explanation of "Aerospace Employment."
b Communications, navigation, flight control, and displays (aerospace-related portions of SICs 3662, 381, & 382).
r Revised.

EMPLOYMENT IN THE AIRCRAFT, ENGINES, AND PARTS INDUSTRY[a]

Calendar Years 1977-1987
(Annual Average, Thousands of Employees)

Year	TOTAL (SIC 372)	Airframes (SIC 3721)	Engines and Parts (SIC 3724)	Other Parts & Equipment (SIC 3728)
TOTAL EMPLOYMENT				
1977	481.7	270.4	120.9	90.4
1978	527.2	288.3	133.5	105.5
1979	610.8	333.2	151.6	126.1
1980	652.3	349.3	162.9	140.1
1981	645.5	344.2	162.5	138.8
1982	601.1	319.9	148.8	132.3
1983	578.3	304.7	140.1	133.6
1984	592.7	306.1	140.2	146.4
1985	635.8	325.6	147.5	162.7
1986	674.8	339.0	153.1	182.8
1987	692.1	357.1	155.7	179.2
PRODUCTION WORKERS				
1977	246.8	124.4	66.6	55.8
1978	275.4	133.9	75.3	66.2
1979	332.1	165.9	86.4	79.8
1980	354.6	173.7	93.0	88.0
1981	343.0	167.0	92.4	83.6
1982	305.4	144.7	84.2	76.6
1983	282.5	131.5	74.7	76.3
1984	284.6	128.2	73.0	83.5
1985	303.8	135.5	74.8	93.6
1986	330.9	146.6	78.4	105.9
1987	344.1	159.6	79.1	105.3

Source: Bureau of Labor Statistics, "Employment and Earnings" (Monthly).
NOTE: Detail may not add to totals because of rounding.
a See Glossary for detailed explanation of "Aerospace Employment."

AEROSPACE INDUSTRY EMPLOYMENT BY OCCUPATIONAL CLASSIFICATION

As of December 1977-1988
(Thousands of Employees)

Year	TOTAL[a]	Production Workers	Scientists & Engineers	Technicians	Others
1977[b]	665	280	139	46	200
1978	720	337	130	50	203
1979	842	396	146	56	244
1980	902	414	158	62	268
1981	900	399	156	69	276
1982	831	367	151	59	254
1983[b]	830	351	156	66	257
1984	850	364	160	67	259
1985	939	392	175	67	305
1986	967	446	178	66	277
1987[p]	972	440	183	68	281
1988[E]	971	434	187	69	281

Source: Aerospace Industries Association, based on company reports and data from the Bureau of Labor Statistics.
NOTE AIA employment data for 1977-1987 were substantially revised in 1987 to better account for aerospace industry related employment and are not comparable to previously published figures. Totals for employment by occupational classification reflect only companies in sics 372, 376, 3662, 381 and 382. As a result, they do not match the totals for aerospace employment by product group which include other industries with employment related to aerospace.

a End-of-year totals differ from annual averages appearing in other tables.
b Industry strike during this period.
E Estimate.
p Preliminary

GEOGRAPHIC DISTRIBUTION OF AEROSPACE EMPLOYMENT[a] BY OCCUPATIONAL CLASSIFICATION AND PRODUCT GROUP

As of December 1987

PERCENT DISTRIBUTION BY OCCUPATION

Region	TOTAL	Production Workers	Scientists & Engineers	Technicians	All Others
TOTAL	100.0%	100.0%	100.0%	100.0%	100.0%
New England	14.8%	19.2%	10.1%	10.9%	14.1%
Middle Atlantic	10.2	8.5	14.0	7.2	10.3
East North Central	5.5	7.0	4.1	4.4	5.1
West North Central	7.3	9.0	6.8	5.9	6.3
South Atlantic	8.2	7.6	7.3	6.9	9.5
South Central	6.8	7.7	5.9	4.5	6.9
Mountain	6.9	5.9	8.1	8.0	6.9
Pacific	40.3	35.1	43.7	52.2	40.9

PERCENT DISTRIBUTION BY PRODUCT GROUP

Region	Total	Aircraft		Missiles	Space	Other	
		Civil	Military			Aero	Non-Aero
TOTAL	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100%
New England	14.6%	14.9%	16.8%	22.4%	18.6%	13.3%	9.1%
Middle Atlantic	9.9	1.9	11.7	0.3		18.9	
East North Central	5.4	10.2	11.9	0.2	0.6	3.1	12.7
West North Central	8.0		12.4	3.7		6.7	
South Atlantic	8.8	2.2	8.1	12.3	12.0	10.7	10.1
South Central	7.1	4.9	13.3	0.9	2.6	5.0	6.2
Mountain	6.7	3.7	2.3	16.8	6.8	42.3	1.5
Pacific	39.5	62.2	23.5	43.4	59.4		60.4

Source: Aerospace Industries Association, company reports.
NOTE: Data for two regions are combined where employment for one region within a product group represented three or fewer companies.
a Employment in 40 surveyed aerospace manufacturing companies representing approximately two-thirds of total industry employment.

TOTAL EMPLOYMENT AND SCIENTISTS & ENGINEERS IN COMMERCIAL TRANSPORT AIRCRAFT & HELICOPTER MANUFACTURING ESTABLISHMENTS[b]

As of December 1977-1988

Year	Commercial Transport Aircraft		Helicopters	
	Total	Scientists & Engineers	Total	Scientists & Engineers
1977[a]	55,900	8,100	21,100	3,500
1978	58,700	8,700	24,200	3,300
1979	99,800	12,900	27,500	3,000
1980	106,500	13,700	29,800	3,200
1981	84,000	12,000	28,000	3,000
1982	69,800	11,100	26,600	3,100
1983[a]	48,200	8,400	27,600	3,500
1984	57,600	9,300	31,300	3,800
1985	58,700	10,000	34,200	4,300
1986	79,100	12,900	37,300	4,000
1987[p]	86,200	13,700	38,300	4,300
1988[E]	88,100	14,000	37,500	4,100

Source: Aerospace Industries Association, company reports.
NOTE: AIA employment data for 1977-1987 were substantially revised in 1987 to better account for aerospace industry related employment.

E Estimate.
a Industry strike during this period.
b Includes only establishments identified as prime manufacturers of commercial transport aircraft and of civil and military helicopters. Excluses subcontractors and propulsion manufacturers.
p Preliminary.

AVERAGE HOURLY EARNINGS IN THE AEROSPACE INDUSTRY

Production Workers Only
Calendar Years 1973-1987

Year	TOTAL[a]	Aircraft (SIC 372)				Guided Missiles, Space Vehicles & Parts (SIC 376)
		TOTAL	Airframes (SIC 3721)	Engines & Parts (SIC 3724)	Other Parts & Equipment (SIC 3728)	
AVERAGE HOURLY EARNINGS[b]						
1973	$ 4.99	$ 4.99	$ 5.09	$ 5.04	$ 4.70	$ 5.02
1974	5.43	5.42	5.58	5.41	5.05	5.48
1975	6.00	6.00	6.21	6.04	5.47	6.02
1976	6.44	6.44	6.63	6.46	5.95	6.48
1977	6.93	6.92	7.07	7.05	6.44	7.04
1978	7.54	7.54	7.70	7.80	6.93	7.56
1979	8.26	8.26	8.50	8.53	7.48	8.25
1980	9.27	9.28	9.66	9.42	8.40	9.22
1981	10.29	10.31	10.74	10.41	9.35	10.06
1982	11.20	11.23	11.85	11.16	10.18[r]	10.96[r]
1983	11.79	11.82	12.58	11.61	10.73	11.61
1984[r]	12.24	12.32	12.91	12.40	11.37	11.82
1985[r]	12.54	12.62	13.18	12.85	11.63	12.14
1986	12.76	12.87	13.48	13.08	11.91	12.20
1987	13.09	13.19	13.74	13.33	12.26	12.60
AVERAGE HOURLY EARNINGS INCLUDING LUMP-SUM WAGE PAYMENTS[c]						
1984[r]	$12.58	$12.72	$13.11	$12.40	$11.37	$ 11.88
1985[r]	12.93	13.10	13.40	12.85	11.63	12.06
1986	12.88	13.02	13.80	13.08	11.91	12.15
1987	13.32	13.46	14.32	13.33	12.26	12.60

Source: Aerospace Industries Association, derived from "Employment and Earnings" (Monthly), Bureau of Labor Statistics.
a TOTAL column is a weighted average based on BLS employment data.
b Includes overtime premiums.
c *Many aerospace manufacturers have included lump-sum payments in labor settlements since late 1983 in lieu of general wage increases and/or cost of living adjustments. These payments are included in SIC 3721 as well as the totals for SIC 372 and for all aerospace.*
r Revised.

AVERAGE WEEKLY EARNINGS IN THE AEROSPACE INDUSTRY

Production Workers Only
Calendar Years 1973-1987

Year	TOTAL[a]	Aircraft (SIC 372)				Guided Missiles, Space Vehicles & Parts (SIC 376)
		TOTAL	Airframes (SIC 3721)	Engines & Parts (SIC 3724)	Other Parts & Equipment (SIC 3728)	
AVERAGE WEEKLY EARNINGS[b]						
1973	$202.95	$202.10	$199.53	$209.66	$199.75	$211.34
1974	221.10	220.59	222.08	221.81	213.62	226.32
1975	247.53	247.80	255.85	247.04	228.65	245.01
1976	263.31	263.40	273.16	259.69	245.74	262.44
1977	289.76	289.95	296.23	291.87	273.70	287.94
1978	318.05	318.19	324.17	325.26	298.68	316.76
1979	350.64	351.05	359.55	360.82	322.39	346.50
1980	388.71	389.76	403.79	393.76	357.84	378.02
1981	424.31	425.80	443.56	421.61	396.44	410.45
1982	459.99	461.55	484.67	454.21	426.54	448.26
1983	486.10	486.98	526.73	476.01	452.81	480.65
1984[r]	513.55	516.21	531.89	523.28	485.50	496.44
1985[r]	528.82	532.56	546.97	542.27	504.74	517.44
1986[r]	545.13	550.84	567.51	561.13	520.47	517.28
1987	556.42	560.58	579.83	566.53	525.95	535.50
AVERAGE WEEKLY EARNINGS INCLUDING LUMP-SUM PAYMENTS[c]						
1984[r]	$516.19	$519.79	$540.13	$523.28	$485.50	$496.44
1985[r]	533.63	536.88	556.10	542.27	504.74	517.74
1986[r]	550.16	556.91	580.98	561.13	520.47	517.28
1987	565.64	571.63	604.30	566.53	525.95	535.50

Source: Aerospace Industries Association, derived from "Employment and Earnings" (Monthly), Bureau of Labor Statistics.
a TOTAL column is a weighted average based on BLS employment data.
b Includes overtime premiums.
c Many aerospace manufacturers have included lump-sum payments in labor settlements since late 1983 in lieu of general wage increases and/or cost of living adjustments. These payments are included in SIC 3721 as well as the totals for SIC 372 and for all aerospace.
r Revised.

AVERAGE HOURS IN THE AEROSPACE INDUSTRY

Production Workers Only
Calendar Years 1973-1987

AVERAGE WEEKLY HOURS

Year	TOTAL[a]	Aircraft (SIC 372)				Guided Missiles, Space Vehicles & Parts (SIC 376)
		TOTAL	Airframes (SIC 3721)	Engines & Parts (SIC 3724)	Other Parts & Equipment (SIC 3728)	
1973	40.6	40.5	39.2	41.6	42.5	42.1
1974	40.8	40.7	39.8	41.0	42.3	41.3
1975	41.2	41.3	41.2	40.9	41.8	40.7
1976	40.9	40.9	41.2	40.2	41.3	40.5
1977	41.8	41.9	41.9	41.4	42.5	40.9
1978	42.2	42.2	42.1	41.7	43.1	41.9
1979	42.5	42.5	42.3	42.3	43.1	42.0
1980	41.9	42.0	41.8	41.8	42.6	41.0
1981	41.3	41.3	41.3	40.5	42.4	40.8
1982	41.1	41.1	40.9	40.7	41.9	40.8
1983	41.2	41.2	40.8	41.8	42.2	41.4
1984	41.9	41.9	41.2	42.2	42.7	42.0
1985	42.2	42.2	41.5	42.2	43.4	42.3
1986	42.7	42.8	42.1	42.9	43.7	42.4
1987	42.5	42.5	42.2	42.5	42.9	42.4

AVERAGE WEEKLY OVERTIME HOURS

Year	TOTAL[a]	Aircraft, Engines, and Parts	Guided Missiles, Space Vehicles, and Parts
1973	3.2	3.3	2.7
1974	3.3	3.3	3.0
1975	3.0	3.0	3.3
1976	2.7	2.7	2.7
1977	3.5	3.5	3.2
1978	4.4	4.4	4.1
1979	4.7	4.7	4.4
1980	4.1	4.2	3.6
1981	3.5	3.5	3.2
1982	3.2	3.2	3.1
1983	3.1	3.1	3.3
1984	3.9	4.0	3.3
1985	4.5	4.5	4.6
1986	4.8	4.9	4.4
1987	4.8	4.9	4.2

Source: Aerospace Industries Association, derived from "Employment and Earnings" (Monthly), Bureau of Labor Statistics.
a TOTAL column is a weighted average based on BLS employment data.

OCCUPATIONAL INJURY AND ILLNESS INCIDENCE RATES[a] ALL MANUFACTURING AND AEROSPACE INDUSTRIES

Calendar Years 1982-1986

	1982	1983	1984	1985	1986
All Manufacturing:					
Total Cases	10.2	9.7	10.6	10.4	10.6
Lost Workday Cases	4.4	4.7	4.7	4.6	4.7
Nonfatal Cases without Lost Workdays	5.8	5.5	5.9	5.8	5.9
Lost Workdays	75.0	70.4	77.9	80.2	85.2
Aircraft and Parts (SIC 372):					
Total Cases	6.0	5.0	5.8	6.4	7.0
Lost Workday Cases	2.3	1.9	2.2	2.5	2.6
Nonfatal Cases without Lost Workdays	3.6	3.0	3.6	3.9	4.4
Lost Workdays	36.9	33.0	35.3	43.1	43.8
Aircraft (SIC 3721):					
Total Cases	4.8	3.8	4.5	5.4	6.6
Lost Workday Cases	1.7	1.4	1.6	2.0	2.1
Nonfatal Cases without Lost Workdays	3.1	2.4	2.9	3.5	4.5
Lost Workdays	29.5	24.6	28.3	35.8	38.3
Aircraft Engines and Parts (SIC 3724):					
Total Cases	6.6	4.6	5.3	5.2	5.4
Lost Workday Cases	3.3	2.5	2.8	2.7	2.8
Nonfatal Cases without Lost Workdays	3.3	2.1	2.5	2.5	2.6
Lost Workdays	51.5	45.6	45.9	52.0	48.0
Aircraft Parts (SIC 3728):					
Total Cases	8.1	8.0	8.9	9.4	9.0
Lost Workday Cases	2.8	2.6	2.9	3.4	3.3
Nonfatal Cases without Lost Workdays	5.3	5.4	6.1	6.0	5.7
Lost Workdays	39.1	39.0	40.0	50.1	50.1
Guided Missiles, Space Vehicles & Parts SIC 376):					
Total Cases	2.7	2.3	2.7	2.8	3.1
Lost Workday Cases	1.2	1.1	1.2	1.2	1.5
Nonfatal Cases without Lost Workdays	1.5	1.2	1.5	1.5	1.6
Lost Workdays	19.1	19.4	21.0	23.1	28.3
Guided Missiles & Space Vehicles (SIC 3761):					
Total Cases	2.1	2.1	2.5	2.5	2.8
Lost Workday Cases	0.9	1.1	1.1	1.2	1.4
Nonfatal Cases without Lost Workdays	1.2	1.0	1.3	1.3	1.4
Lost Workdays	16.3	19.4	20.0	23.0	29.5
Space Propulsion Units & Parts (SIC 3764):					
Total Cases	3.9	2.8	3.3	4.1	4.8
Lost Workday Cases	1.9	1.3	1.5	1.7	1.7
Nonfatal Cases without Lost Workdays	1.9	1.5	1.8	2.4	3.1
Lost Workdays	28.7	19.5	25.0	27.8	29.2
Other Space Vehicle Equipment (SIC 3769):					
Total Cases	5.4	3.1	3.2	3.1	3.1
Lost Workday Cases	1.6	1.0	0.9	1.1	1.3
Nonfatal Cases without Lost Workdays	3.8	2.0	2.3	2.0	1.8
Lost Workdays	26.7	19.7	22.1	20.6	21.0

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

a Defined as the number of injuries and illnesses per 100 full-time workers. Separate incidence rates also available for occupational injuries only.

FEDERAL CIVILIAN EMPLOYMENT[a] IN THE DEPARTMENT OF DEFENSE

Fiscal Years 1965-1989

Year	TOTAL	Civil Functions[b]	Military Functions[c]
1965	1,004,570	29,902	974,668
1966	1,083,288	30,290	1,052,998
1967	1,225,637	31,980	1,193,657
1968	1,288,130	32,062	1,256,068
1969	1,257,091	31,214	1,225,877
1970	1,159,935	30,293	1,129,642
1971	1,092,804	30,063	1,062,741
1972	1,040,147	30,585	1,009,562
1973	987,281	29,971	957,310
1974	1,002,850	29,072	973,778
1975	983,790	29,069	954,721
1976	951,034	28,648	922,386
1977	940,549	28,912	911,637
1978	933,071	28,962	904,109
1979	914,582	28,592	885,990
1980	907,700	27,700	880,000
1981	981,400	34,400	947,000
1982	1,009,344	31,263	978,081
1983	1,015,779	30,973	984,806
1984	1,040,213	28,681	1,011,532
1985	1,065,551	28,681	1,036,870
1986	1,069,863	28,511	1,041,352
1987	1,059,516	28,199	1,031,317
1988[E]	1,057,036	28,227	1,028,809
1989[E]	1,045,627	28,615	1,017,012

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

a Full-time equivalent civilian employment.

b Data are estimated for portions of Civil Functions.

c Section 904 of the 1982 Defense Authorization Act (Public Law 97-86) exempts the Department of Defense from full-time equivalent controls. Data shown are estimated civilian employment for military functions and military assistance.

E Estimate.

EMPLOYMENT IN NATIONAL AERONAUTICS AND SPACE ADMINISTRATION PROGRAMS

End of Fiscal Years 1960-1989

Year	TOTAL	NASA Employees	Contractor Employees[a]
1960	46,768	10,268	36,500
1961	74,577	17,077	57,500
1962	137,656	22,156	115,500
1963	246,304	27,904	218,400
1964	379,084	31,984	347,100
1965	409,900	33,200	376,700
1966	393,924	33,924	360,000
1967	306,926	33,726	273,200
1968	267,871	32,471	235,400
1969	218,345	31,745	186,600
1970	160,850	31,350	129,500
1971	143,578	29,478	114,100
1972	138,800	27,500	111,300
1973	134,850	26,850	108,000
1974	125,220	25,020	100,200
1975	127,733	24,333	103,400
1976	130,739	24,039	108,000
1977	124,136	23,636	100,500
1978	124,637	23,237	101,400
1979	131,931	22,831	109,100
1980	135,613	22,613	113,000
1981	133,473	21,873	111,600
1982	127,952	21,652	106,300
1983	129,246	22,246	107,000
1984	162,080	22,080	140,000
1985	131,993	21,993	110,000
1986	154,800	21,800	133,000
1987	165,312	22,312	143,000
1988[E]	172,425	22,425	150,000
1989[E]	212,950	22,950	190,000

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

a Includes estimates of manpower for hardware and related contracts, as well as actual work-years for support service contracts. Increase in FY 1984 caused by change in estimating methodology to reflect more accurately the mix of support and development contractors.

E Estimate.

AEROSPACE INDUSTRY WORK STOPPAGES[a]

Calendar Years 1978-1987

Year[b]	Number of Strikes[c]	Number of Workers Involved	Work-Days Idle in Year
1978	17	13,700	741,200
1979	12	6,600	103,400
1980	17	4,400	92,900
1981	12	6,100	188,900
1982	4	11,900	45,200
1983	2	8,700	404,100
1984	4	14,600	188,200
1985	4	19,700	289,800
1986	—	—	—
1987	—	—	—

Source: Department of Labor, Bureau of Labor Statistics, Division of Wages and Industry Relations.
a Based on SIC 372 of the 1967 Code, which includes missile and space propulsion units and parts and missile and space vehicle equipment not elsewhere classified, but which excludes complete guided missiles and space vehicles.
b Effective 1982, data not available for work stoppages involving fewer than 1,000 employees.
c Strikes beginning during calendar year.

EMPLOYMENT AND COST OF R&D SCIENTISTS AND ENGINEERS ALL INDUSTRIES AND AEROSPACE INDUSTRY

1973-1987

Year	Employment[a]			Cost per R&D Scientist and Engineer[d]	
	All Industries[b] (Thousands)	Aerospace[c] (Thousands)	Aerospace as a Percent of All Industries	All Industries[b]	Aerospace[c]
1973	357.7	72.1	20.2%	$ 59,200	$ 70,800
1974	360.0	70.6	19.6	63,300	76,400
1975	363.3	67.5	18.6	66,500	85,100
1976	364.4	66.9	18.4	72,200	91,300
1977	382.8	72.0	18.8	75,800	91,300
1978	404.4	82.0	20.3	80,400	89,400
1979	423.9	86.5	20.4	87,400	93,300
1980	450.6	85.9	19.1	94,900	101,600
1981	487.8	95.2	19.5	103,900	128,400
1982	509.8	91.1	17.9	112,400	146,400
1983	522.1	95.5	18.3	118,900	144,300
1984	544.5	96.5	17.7	129,700	158,400
1985	560.2	103.8	18.5	137,800	169,800
1986[r]	583.6	107.2	18.4	138,100	162,000
1987	584.5	93.3	16.0	NA	NA

Source: National Science Foundation.
a Employment as of January. Scientists and engineers working less than full time have been included in terms of their full time equivalent number.
b All manufacturing industries and those non-manufacturing industries known to conduct or finance research and development.
c SIC codes 372 and 376.
d The arithmetic mean of the numbers of R&D scientists and engineers reported for January in two consecutive years, divided into the total R&D expenditures of each industry during the earlier year.
NA Not available.
r Revised.

Finance

The aerospace industry recorded a record net profit after taxes of $4.6 billion in 1987, reversing a downward trend in evidence for the two prior years. The figure compares with the previous high, experienced in 1984, of $3.6 billion. Comparison with 1986 is not entirely valid because of accounting procedures in that year occasioned by the Tax Reform Act of 1986.

Despite the gain, 1987 aerospace profits were below the averages for all U.S. manufacturing corporations when profit is expressed as a percentage of sales or assets. As a percentage of sales, the aerospace rate was 4.1 percent, the all-industry average 4.9 percent. As a percentage of assets, it was 4.4 percent for aerospace, 5.6 percent for all manufacturing.

The picture is slightly different when profit is expressed as a percentage of equity. Aerospace, at 14.6 percent, topped the all-industry average of 12.8 percent.

The aerospace industry's balance sheet for 1987 showed an increase in total assets to $106.9 billion, up from $102.4 billion in 1986. Net working capital dipped from $9.7 billion in 1986 to $9.5 billion in 1987.

Aerospace expenditures for new plant and equipment amounted to $3.6 billion in 1987, down from $3.8 billion but above the $3.4 billion average for the period 1980-86. Estimated plant and equipment outlays for 1988 are the same as for 1987, $3.6 billion.

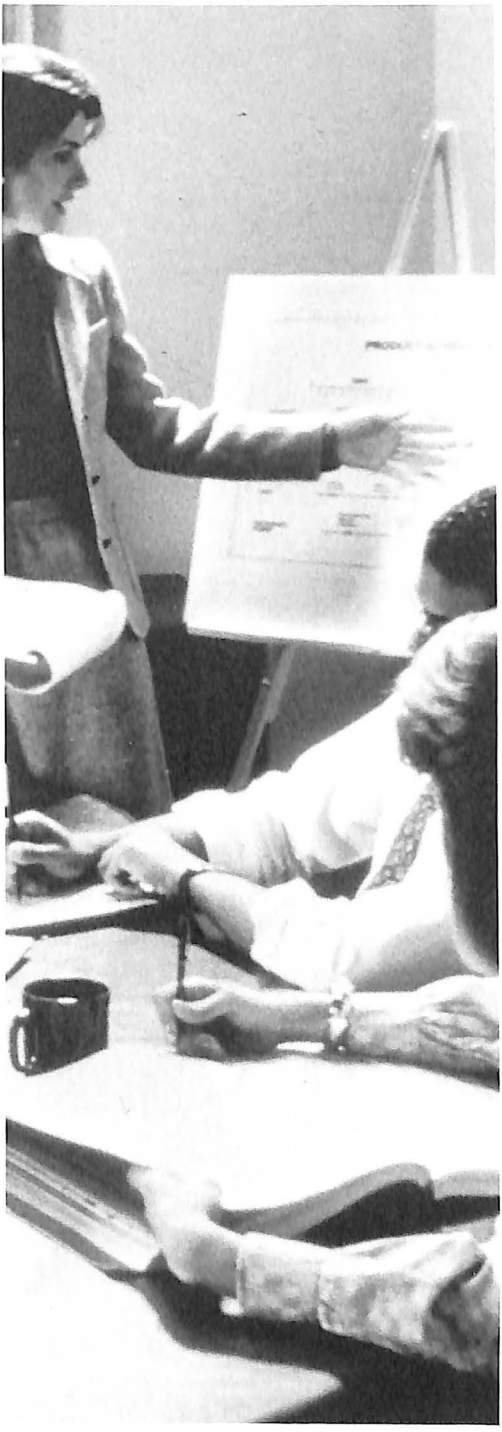
In Fiscal Year 1987, McDonnell Douglas Corporation displaced General Dynamics Corporation as leading contractor to the Department of Defense in terms of contract dollar value. McDonnell Douglas won contracts with an aggregate value of $7.7 billion. General Dynamics was second with $7 billion, General Electric Company third with $5.8 billion.

Rounding out the top 10 were Lockheed Corporation, $5.6 billion; General Motors Corporation, $4.1 billion; Raytheon Company, $3.8 billion; Martin Marietta Corporation, $3.7 billion; United Technologies Corporation, $3.6 billion; The Boeing Company, $3.5 billion; and Grumman Corporation, $3.4 billion.

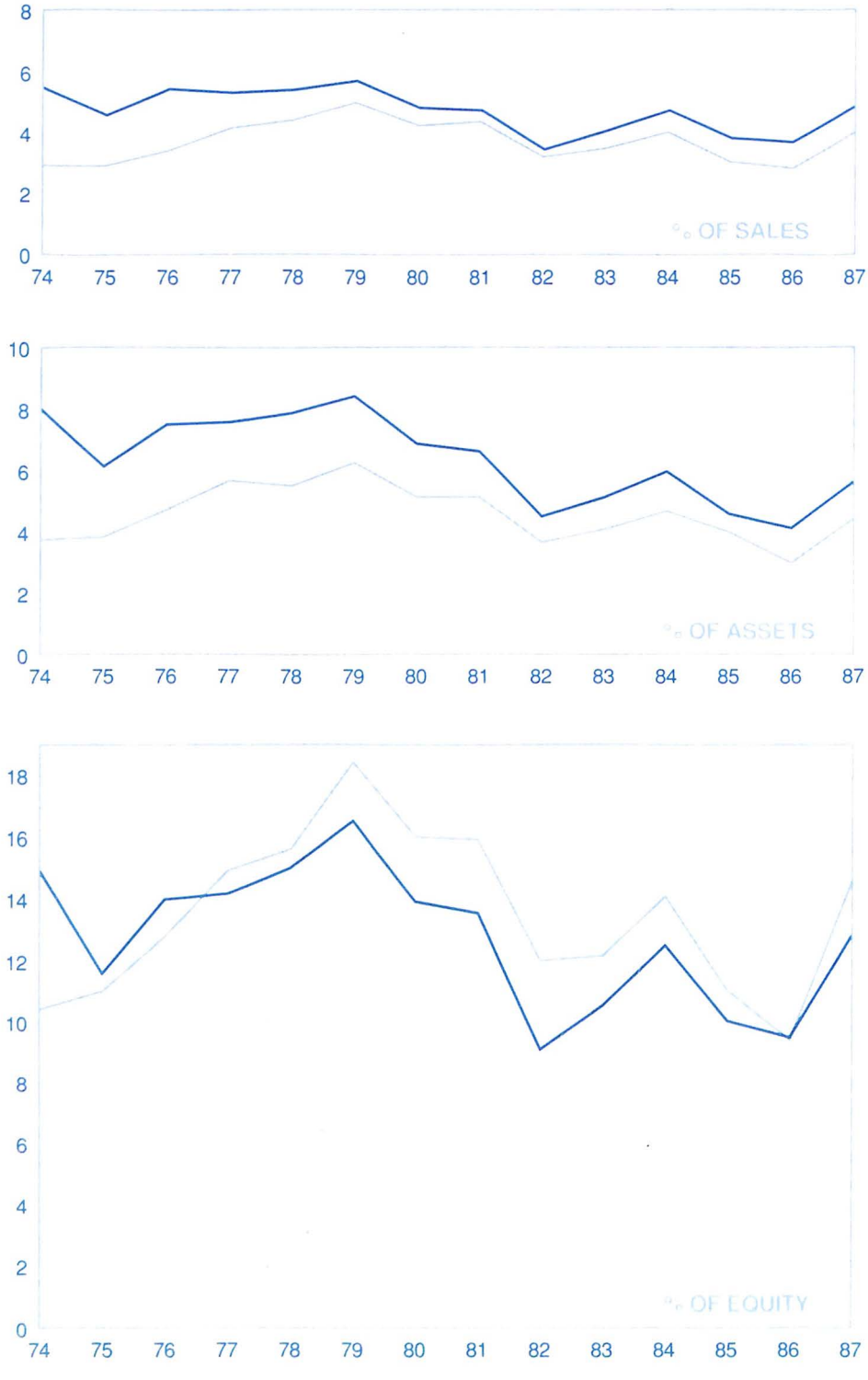
Perennial leader Rockwell International Corporation topped the list of NASA contract

awards in FY 1987 with $1.6 billion. Martin Marietta Corporation and Lockheed Space Operations Company were virtually tied for second at $326 million and $323 million respectively. In fourth and fifth places were Morton Thiokol Inc. ($286 million) and McDonnell Douglas Corporation ($285 million).

The rest of the top 10 included General Electric Company ($225 million); USBI Booster Production Company ($183 million); The Boeing Company ($175 million); United Technologies Corporation ($166 million); and Lockheed Engineering & Management Company ($163 million). □



NET PROFIT AFTER TAXES



Source: Aerospace Industries Association

NET PROFIT AFTER TAXES AS A PERCENT OF SALES, ASSETS, AND EQUITY FOR ALL MANUFACTURING CORPORATIONS AND THE AEROSPACE INDUSTRY[a]

Calendar Years 1973-1987

PERCENT OF SALES

Year	All Manufacturing Corporations	Non-Durable Goods	Durable Goods	Aerospace Industry
1973	4.7%	5.0%	4.5%	2.9%
1974	5.5	6.4	4.7	2.9
1975	4.6	5.1	4.1	2.9
1976	5.4	5.5	5.2	3.4
1977	5.3	5.3	5.3	4.2
1978	5.4	5.4	5.5	4.4
1979	5.7	6.1	5.2	5.0
1980	4.8	5.6	4.0	4.3
1981	4.7	5.1	4.3	4.4
1982	3.5	4.6	2.4	3.3
1983	4.1	4.9	3.1	3.5
1984	4.7	4.8	4.4	4.1
1985	3.8	4.1	3.4	3.1
1986r	3.7	4.6	2.9	2.8
1987	4.9	5.2	4.5	4.1

PERCENT OF ASSETS[b] AND EQUITY[b]

Year	Percent of Assets		Percent of Equity	
	All Manufacturing	Aerospace Industry	All Manufacturing	Aerospace Industry
1973	6.5%	2.4%	12.8%	10.3%
1974	8.0	3.7	14.9	10.4
1975	6.2	3.8	11.6	11.0
1976	7.5	4.7	14.0	12.8
1977	7.6	5.7	14.2	14.9
1978	7.8	5.5	15.0	15.7
1979	8.4	6.3	16.5	18.4
1980	6.9	5.2	13.9	16.0
1981	6.7	5.2	13.6	15.9
1982	4.5	3.7	9.2	12.0
1983	5.2	4.1	10.6	12.2
1984	5.9	4.7	12.5	14.1
1985	4.6	3.5	10.1	11.1
1986	4.2	3.0	9.5	9.4
1987	5.6	4.4	12.8	14.6

Source: Bureau of the Census, "Quarterly Financial Report for Manufacturing, Mining and Trade Corporations."

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

b Average of four quarters.

r Revised.

INCOME STATEMENT AND OPERATING RATIOS FOR AEROSPACE COMPANIES[a]

Calendar Years 1984-1987
(Millions of Dollars)

INCOME STATEMENT	1984	1985	1986	1987
Net Sales, Receipts, Operating Revenues	$88,728	$105,853	$111,580	$110,902
Less: Depreciation, Depletion & Amortization of Property, Plant and Equipment	2,502	3,083	3,411	3,636
Less: All Other Operating Costs & Expenses, Including Selling Costs & General & Administrative Expenses	80,695	97,752	102,568	101,053
Income (or Loss) from Operations	$ 5,531	$ 5,018	$ 5,600	$ 6,303
Net Non-Operating Income (Expense)	37	679	(264)	499
Income (or Loss) before Income Taxes (=Total Income)	$ 5,567	$ 5,696	$ 5,337	$ 6,801
Less: Provision for Current & Deferred Domestic Income Taxes	1,928	2,422	2,243	2,219
Income (or Loss) after Income Taxes (=Net Profit)	$ 3,639	$ 3,274	$ 3,093	$ 4,582
Cash Dividends Charged to Retained Earnings	1,124	1,871	1,432	1,457
Net Income Retained in Business	$ 2,516	$ 1,403	$ 1,661	$ 3,125
Retained Earnings at Beginning of Year[b]	17,705	20,558	20,475	22,128
Adjustments to Retained Earnings[c]	31	(1,452)	(414)	(493)
Retained Earnings at End of Year[d]	$20,252	$ 20,509	$ 21,722	$ 24,882
OPERATING RATIOS				
Income before Taxes as Percent of Net Sales	6.3%	5.4%	4.8%	6.1%
Provision for Current & Deferred Domestic Income Taxes as Percent of Income before Taxes (Total Income)	34.6	42.5	42.0	32.6
Income after Taxes (Net Profit) as Percent of Net Sales	4.1	3.1	2.8	4.1
Income after Taxes (Net Profit) as Percent of Stockholders' Equity[e]	14.1	11.1	9.4	14.6
Income after Taxes (Net Profit) as Percent of Total Assets[e]	4.7	3.5	3.0	4.4

Source: Bureau of the Census, "Quarterly Financial Report for Manufacturing, Mining, and Trade Corporations."
NOTE: Detail may not add to totals because of rounding.

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

b Beginning-of-year retained earnings for any particular year do not equal end-of-year retained earnings for the previous year because of rotation of small companies in survey sample.

c Other direct credits (or charges) to retained earnings (net), including stock and other non-cash dividends, etc.

d Retained Earnings at End of Year CALCULATED AS Retained Earnings at Beginning of Year PLUS Income (Loss) after Income Taxes MINUS Cash Dividends Charged to Retained Earnings PLUS Adjustments to Retained Earnings.

e Average of four quarters.

BALANCE SHEET FOR AEROSPACE COMPANIES[a]

December 31, 1984-1987
(Millions of Dollars)

	1984	1985	1986	1987
Assets:				
Current Assets				
Cash	$ 2,184	$ 5,300	$ 4,524	$ 3,592
Securities, Com'l Paper & Other Short-term Financial Investments	2,904	937	2,352	2,365
Total Cash and U.S. Gov't and Other Securities	$ 5,089	$ 6,236	$ 6,876	$ 5,956
Receivables (Total)	10,165	12,126	13,077	15,576
Inventories (Gross)	37,569	38,967	41,028	44,812
Other Current Assets	1,266	1,623	1,582	1,612
Total Current Assets	$54,088	$58,952	$ 62,562	$ 67,957
Net Plant, Property & Equipment	15,773	19,454	22,103	22,017
Other Non-Current Assets	10,235	15,161	17,748	16,882
Total Assets	$80,096	$93,567	$102,414	$106,856
Liabilities:				
Current Liabilities				
Short Term Loans	$ 1,680	$ 2,480	$ 1,547	$ 1,551
Trade Accts. & Notes Payable	6,672	8,148	8,926	9,706
Income Taxes Accrued	4,378	5,033	5,723	6,393
Installments Due on Long Term Debts	614	518	545	591
Other Current Liabilities	31,014	33,828	36,162	40,262
Total Current Liabilities	$44,359	$50,007	$ 52,903	$ 58,502
Long Term Debt	4,818	7,844	10,915	10,855
Other Non-Current Liabilities	4,302	6,020	5,701	5,807
Total Liabilities	$53,478	$63,871	$ 69,520	$ 75,164
Stockholders' Equity:				
Capital Stock	$ 6,366	$ 9,188	$ 11,172	$ 6,810
Retained Earnings	20,252	20,509	21,722	24,882
Total Stockholders' Equity	$26,618	$29,696	$ 32,894	$ 31,692
Total Liabilities & Stockholders' Equity	$80,096	$93,567	$102,414	$106,856
Net Working Capital	$ 9,730	$ 8,945	$ 9,659	$ 9,455

Source: Bureau of the Census, "Quarterly Financial Report for Manufacturing, Mining and Trade Corporations."
NOTE: Detail may not add to totals because of rounding.
a Based on sample of corporate entities classified in SIC codes 372 and 376, having as their principal activity the manufacture of aircraft, guided missiles, space vehicles and propulsion and parts.

NEW PLANT AND EQUIPMENT EXPENDITURES

Calendar Years 1964-1988
(Billions of Dollars)

Year	All Industries	All Manufacturing Industries	Durable Goods	Aerospace[a]	
				Current Dollars	Constant Dollars 1982 = 100[b]
1964	$ 51.26	$ 21.23	$10.98	$0.41	$1.23
1965	59.52	25.41	13.49	0.53	1.58
1966	70.40	31.37	17.23	1.17	3.38
1967	72.75	32.25	17.83	1.25	3.50
1968	76.42	32.34	17.93	1.23	3.29
1969	85.74	36.27	19.97	1.29	3.30
1970	91.91	36.99	19.80	0.88	2.17
1971	92.91	33.60	16.78	0.63	1.48
1972	103.40	35.42	18.22	0.68	1.57
1973	120.03	42.35	22.63	0.79	1.77
1974	139.67	52.48	26.77	1.21	2.46
1975	142.42	53.66	25.37	1.19	2.12
1976	158.44	58.53	27.50	1.02	1.70
1977	184.82	67.48	32.77	1.14	1.77
1978	217.76	78.58	39.46	1.76	2.50
1979	254.96	95.92	48.50	2.70	3.49
1980	282.80	112.33	55.36	3.57	4.25
1981	315.22	126.54	59.81	3.36	3.62
1982	310.58	120.68	55.35	3.41	3.41
1983	304.78	116.20	53.08	2.91	3.06
1984	354.44	138.82	66.24	3.57	3.79
1985	387.13	153.48	73.27	3.45	3.74
1986[r]	379.47	142.69	69.14	3.80	4.08
1987	388.60	145.46	70.91	3.55	3.82
1988[E]	422.96	159.68	75.75	3.60	3.65

Source: U.S. Department of Commerce, Bureau of Economic Analysis (BEA), Quarterly Report.

a Data are company-based (not establishment- or product-based), and represent corporate entities whose principal activity falls in SIC Codes 372 and 376.

b Aerospace constant dollars based on BEA's industry deflator for historical data, and Durable Goods deflator for current year estimates.

E Estimate.

r Revised

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION MAJOR CONTRACTORS

Fiscal Years 1983-1987
By rank according to net value of NASA prime contracts awarded during last fiscal year
(Millions of Dollars)

Company	1983	1984	1985	1986	1987
TOTAL PROCUREMENTS	$6,797	$7,354	$8,298	$8,180	$8,610
Awards to Business Firms	5,586	5,967	6,653	6,356	6,541
% of TOTAL PROCUREMENTS	82%	81%	80%	78%	76%
Rockwell International Corp.	$1,568	$1,402	$1,345	$1,156	$1,610
Martin Marrietta Corp.	466	428	483	427	326
Lockheed Space Operations Co.	19	301	551	559	323
Morton Thiokol Inc.	268	322	334	320	286
McDonnell Douglas Corp.	237	200	194	266	285
General Electric Co.[b]	142	112	145	207	225
USBI Booster Production Co.	115	197	207	196	183
Boeing Co.	44	44	69	113	175
United Technologies Corp.	116	118	110	97	166
Lockheed Engrg. & Mgmt. Co. Inc.	101	105	125	124	163
Allied Bendix Aerospace	137	163	150	138	142
EG&G Florida Inc.	68	109	108	117	131
TRW Inc.	49	82	103	85	124
Ford Aerospace & Communications	107	106	120	208	120
Lockheed Missiles & Space Co.	96	102	137	121	108
Computer Sciences Corp.	147	89	102	96	90
Contel Corp.	(a)	(a)	(a)	69	81
IBM Corp.	116	134	124	94	72
Pan American World Serv. Inc.	36	40	49	47	60
Orbital Sciences Corp.	(a)	(a)	(a)	(a)	42
Teledyne Industries Inc.	47	52	46	48	38
Planning Research Corp.	57	57	65	51	37
Perkin Elmer Corp.	70	79	64	24	35
Raytheon Service Co.	21	28	25	28	32
BAMSI Inc.	(a)	6	13	19	31
Northrop Services Inc.	29	32	39	41	30
Boeing Technical Operat. Inc.	86	25	39	36	27
Unisys Corp.[c]	27	25	25	18	27
Sverdrup Technology Inc.	(a)	8	7	15	27
Aerojet General Corp.	4	(a)	10	20	26

Source: National Aeronautics and Space Administration, "NASA Annual Procurement Report," (Annually).
a Not in list of major contractors for indicated year(s).
b Includes awards previously reported for RCA Corp.
c Includes awards previously reported for Sperry Corp.

DEPARTMENT OF DEFENSE MAJOR CONTRACTORS

Fiscal Years 1983-1987
Listed by rank according to net value of prime contracts awarded during last fiscal year
(Millions of Dollars)

Company	1983	1984	1985	1986	1987
TOTAL CONTRACTS	$128,242	$133,571	$150,674	$145,742	$142,483
McDonnell Douglas Corp.	$ 6,143	$ 7,684	$ 8,857	$ 6,586	$ 7,715
General Dynamics Corp.	6,818	5,952	7,440	8,013	$ 7,041
General Electric Co.	4,518	4,514	5,891	6,847	5,802
Lockheed Corp.	4,006	4,967	5,082	4,896	5,574
General Motors Corp.[b]	4,133	4,250	5,165	5,069	4,082
Raytheon Co.	2,728	3,093	2,999	4,052	3,820
Martin Marrietta Corp.	2,272	2,261	2,717	2,935	3,726
United Technologies Corp.	3,867	3,207	3,906	3,527	3,587
Boeing Co.	4,423	4,654	5,458	3,556	3,547
Grumman Corp.	2,298	2,419	2,733	2,967	3,393
Unisys Corp.[c]	1,362	1,880	1,909	1,897	2,268
Rockwell International Corp.	4,545	6,219	6,264	5,590	2,238
Tenneco Inc.	3,762	749	1,250	477	2,053
Litton Industries Inc.	2,169	2,441	1,528	1,663	2,035
Honeywell Inc.	1,114	1,354	1,908	1,846	2,008
IBM Corp.	1,421	1,572	1,783	1,359	1,822
Westinghouse Electric Corp.	1,778	1,944	1,941	1,713	1,684
Textron Inc.	672	805	1,920	1,671	1,546
GTE Corp.	674	708	611	1,041	1,475
LTV Corp.	1,343	1,655	1,585	1,445	1,308
TRW Inc.	1,137	983	1,079	1,053	1,135
Texas Instruments Inc.	467	956	1,426	1,435	1,109
Northrop Corp.	847	882	1,195	742	1,068
ITT Corp.	603	1,140	1,503	799	995
Allied Signal Inc.	778	759	1,348	1,043	943
Gencorp Inc.	607	697	566	643	874
Singer Co.	650	561	752	871	814
FMC Corp.	1,236	1,157	831	863	744
Gibbons Green Van Amerorgen[d]	*(a)*	*(a)*	*(a)*	465	721
Morton Thiokol Inc.	281	469	318	236	706

Source: Department of Defense, "100 Companies Receiving the Largest Dollar Volume of Prime Contract Awards," (Annually).

a Not in top 100 companies for indicated year(s).
b Includes amounts previously reported for Hughes Aircraft Co.
c Includes amounts previously reported for Sperry and Burroughs Corporations
d Includes amounts previously reported for Bath Iron Works Corp.

DEPARTMENT OF DEFENSE
PRIME CONTRACT AWARDS OVER $25,000
FOR SELECTED MAJOR MILITARY HARD GOODS

By Geographic Region
Fiscal Years 1985, 1986 and 1987

Program and Region	Millions of Dollars			Percent of Program Total		
	1985	1986	1987	1985	1986	1987
AIRCRAFT—TOTAL ..	$38,449	$35,281	$29,478	100.0%	100.0%	100.0%
New England	4,633	3,578	3,470	12.0	10.1	11.8
Middle Atlantic	4,577	4,463	3,765	11.9	12.6	12.8
East North Central	4,105	4,202	3,059	10.7	11.9	10.4
West North Central ...	6,737	5,015	4,820	17.5	14.2	16.4
South Atlantic	4,461	4,398	4,448	11.6	12.5	15.1
East South Central ...	455	392	352	1.2	1.1	1.2
West South Central ...	4,118	4,898	4,027	10.7	13.9	13.7
Mountain	564	766	1,394	1.5	2.2	4.7
Pacific[a]	8,801	7,659	4,145	22.9	21.5	14.1
MISSILE & SPACE SYSTEMS—TOTAL ..	$21,510	$21,510	$21,631	100.0%	100.0%	100.0%
New England	3,158	3,950	3,443	15.4	18.4	15.8
Middle Atlantic	1,090	1,036	1,262	5.3	4.8	5.8
East North Central	166	173	193	0.8	0.8	0.9
West North Central ...	1,306	1,264	1,209	6.4	5.9	5.6
South Atlantic	2,072	1,863	1,424	10.1	8.7	6.6
East South Central ...	317	615	627	1.6	2.9	2.9
West South Central ...	1,570	1,977	1,516	7.7	9.2	7.0
Mountain	1,973	2,469	3,588	9.6	11.5	16.6
Pacific[a]	8,824	8,162	8,390	43.1	37.9	38.8
ELECTRONICS & COMMUNICATIONS EQUIPMENT—TOTAL	$23,161	$21,050	$23,886	100.0%	100.0%	100.0%
New England	1,988	2,135	2,819	8.6	10.1	11.8
Middle Atlantic	5,242	4,373	4,281	22.6	20.8	17.9
East North Central	1,215	1,715	1,715	5.8	7.2	7.2
West North Central ...	1,623	1,502	1,489	7.0	7.1	6.2
South Atlantic	4,841	5,192	6,345	20.9	24.7	26.6
East South Central ...	153	126	136	0.7	0.6	0.6
West South Central ...	1,272	963	926	5.5	4.6	3.9
Mountain	842	847	1,042	3.6	4.0	4.4
Pacific[a]	5,592	4,697	5,134	24.1	22.3	21.5

Source: Department of Defense, "Prime Contract Awards by Region and State" (Annually).
NOTE: Detail may not add to totals because of rounding.
a Includes Alaska and Hawaii.

Glossary

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

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

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

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

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

Aerospace Sales: the AIA estimate of aerospace industry sales, developed by summing DOD expenditures for aircraft, missiles, and space-related procurement and RDT&E; NASA expenditures for research and development, and space flight control and data communications; outlays for space activities by other U.S. Government departments and agencies; commercial sales of space-related products; net domestic and export sales of civil aircraft, engines, and parts; FMS and commercial exports of military aircraft, missiles, propulsion, and related parts; and sales of related products and services, including electronics, software, and ground support equipment, plus sales of non-aerospace products which are produced in aerospace-manufacturing establishments and which use technology, processes, and materials derived from the aerospace industry. See also Related Products and Services.

Air Carriers: the commercial system of air transportation, consisting of domestic and international scheduled and charter service.

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 Agreement (Agreement on Trade in Civil Aircraft): negotiated in the Tokyo Round of the Multilateral Trade Negotiations, and implemented January 1, 1980, providing for elimination of tariff and nontariff trade barriers in the civil aircraft sector.

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

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

Airlines: see **Air Carriers.**

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

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

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

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

Avionics: Communications, navigation, flight controls, and displays.

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

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

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

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

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

Constant Dollars, see **Deflator.**

Deflator: index used to convert a price level to one comparable with the price level at a different time, offsetting the effect of inflation. The base period, which equals 100, is usually specified as either a given fiscal or calendar year. **Constant Dollars** are calculated by dividing current ('then-year') dollars by appropriate price deflator, and multiplying by 100.

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

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

DOD: Department of Defense.

DOE: Department of Energy.

DOT: Department of Transportation.

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

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

Average Hourly Earnings: on a "gross" basis, reflecting not only changes in basic hourly 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 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 were nuclear energy, fossil energy, solar and geothermal energy, conservation through increased efficiency and environmental controls. Most of these functions were 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.

Export-Import Bank of the United States (Eximbank): created in 1934, and established as an independent U.S. Government Agency in 1945, Eximbank is designed ". . . to aid in financing and to facilitate exports . . ." Eximbank receives no appropriations from the U.S. Congress. It is directed by statute to (1) offer financing that is competitive with that offered exporters of other countries by their official export credit institutions, (2) determine that the transactions supported provide for a reasonable assurance of repayment, (3) supplement,

but not compete with private sources of export financing, and (4) take into account the effect of its activities on small business, the domestic economy, and U.S. employment.

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 and are designated by the year in which they end. A three month **Transition Quarter** from July 1 through September 30, 1976, belongs to neither fiscal year.

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

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

FY: see **Fiscal Year.**

General Agreement on Tariff 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 air carriers.

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

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

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

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

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

Imports: classified as "general imports" or "imports for consumption." This volume refers generally to "imports for consumption," which are entries for immediate consumption plus merchandise withdrawn from bonded storage warehouses for consumption. Data are compiled from Import Entries filed with U.S. Customs officials, and are in general based on the market value or price in the foreign country at the time of exportation of such merchandise, including the cost of containers and coverings, as well as other charges and expenses incidental to placing the merchandise in condition, packed and ready for shipment to the United States, but excluding import duties, insurance, freight and other charges incidental to arrival of the goods in the United States. The foreign values of imported merchandise are converted into U.S. currency at the rate of exchange prevailing on the day the merchandise is shipped to the United States.

Income:

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

Net Income (Before Income Taxes): Net Operating Income plus or minus **"Other Income and Expenses."**

Other Income and Expenses: 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.

Lump-Sum Wage Payment: a one time payment given in lieu of general wage increases and/or cost of living adjustments in labor settlements.

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.

NASA: National Aeronautics and Space Administration.

NATO: North Atlantic Treaty Organization.

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

Non-Aerospace Products and Services: products and services other than aircraft, missiles, space vehicles, and related propulsion and parts, produced or performed by establishments whose principal business is the development and/or manufacture of aerospace products.

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.**

Orders, Net New: the sales value of new orders (supported by legal documents) minus cancellations during the period.

Other Aerospace Products and Services: all conversions, modifications, site activation, and other aerospace products (including drones) and services, plus research and development under contract, defined as basic and applied research in the sciences and in engineering, and design and development of prototype products and processes.

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

Payroll, All Manufacturing: includes the gross earning 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: systematic study directed toward fuller scientific knowledge or understanding of the subject studied. Research is classified as either **basic** or **applied** according to the objectives of the sponsoring agency.

Basic Research: with the objective of gaining fuller knowledge or understanding of the fundamental aspects of phenomena and of observable facts without specific applications toward processes or products in mind.

Applied Research: with the objective of gaining knowledge or understanding necessary for determining the means by which a recognized and specific need may be met.

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.

Independent Research and Development (IR&D): a term devised by the Department of Defense and used by Federal agencies to differentiate between a contractor's research and development technical effort performed under a contract, grant, or other arrangement (R&D) and that which is self-initiated and self-funded (IR&D).

Industrial Research and Development: research and development work performed within company facilities, funded by company or Federal funds, and excluding company-financed research and development contracted to outside organizations such as research institutions, universities and colleges, or other non-profit organizations.

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

Related Products and Services: Sales of electronics, software, and ground equipment in support of aerospace products, plus sales by aerospace manufacturing establishments of systems and equipment which are generally derived from the industry's aerospace technological expertise in design, materials, and processes, but which are intended for applications other than flight.

Research: see **R&D.**

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, including dealer's commission, if any, which have passed through the sales account.

Satellite: a body that revolves around a larger body, such as the moon revolving around the earth, or a man-made object revolving about any body such as the sun, earth, or moon.

SIC (Standard Industrial Classification): a system developed by the U.S. Government to define the industrial composition of the economy, facilitating comparability of statistics. See **Aerospace Industry** for explanation of SIC codes applicable to the aerospace industry.

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 "Quarterly Financial Report for Manufacturing, Mining and Trade Corporations," compiled by the Bureau of the Census.

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 (Tr. Qtr.): the three-month interval from July 1, 1976 to September 30, 1976. See **Fiscal Year.**

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

U.K.: United Kingdom.
U.S.: United States of America.
USA: United States Army, an agency of the U.S. Department of Defense.
USAF: United States Air Force, an agency of the U.S. Department of Defense.
USN: United States Navy, an agency of the U.S. Department of Defense.
USSR: Union of Soviet Socialist Republics.
Utility Aircraft: an aircraft designed for general purpose flying.

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

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Aerojet General
Aeronca, Inc.,
A Fleet Aerospace Company
Allied-Signal Aerospace Company
Aluminum Company of America
Argo-Tech Corporation
B.H. Aircraft Company, Inc.
The Boeing Company
Celion Carbon Fibers
A Division of BASF Structural Materials, Inc.
Chrysler Technologies Corporation
Colt Industries Inc.
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Menasco Inc.
Delavan Corporation
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Honeywell Inc.
IBM Corporation
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The Interlake Corporation
ISC Defense & Space Group, Inc.
ISC Marquardt
ISC Defense Systems
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ISC Datacom/Microwave
ITT Defense Technology Corporation
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Lockheed Corporation
The LTV Corporation
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