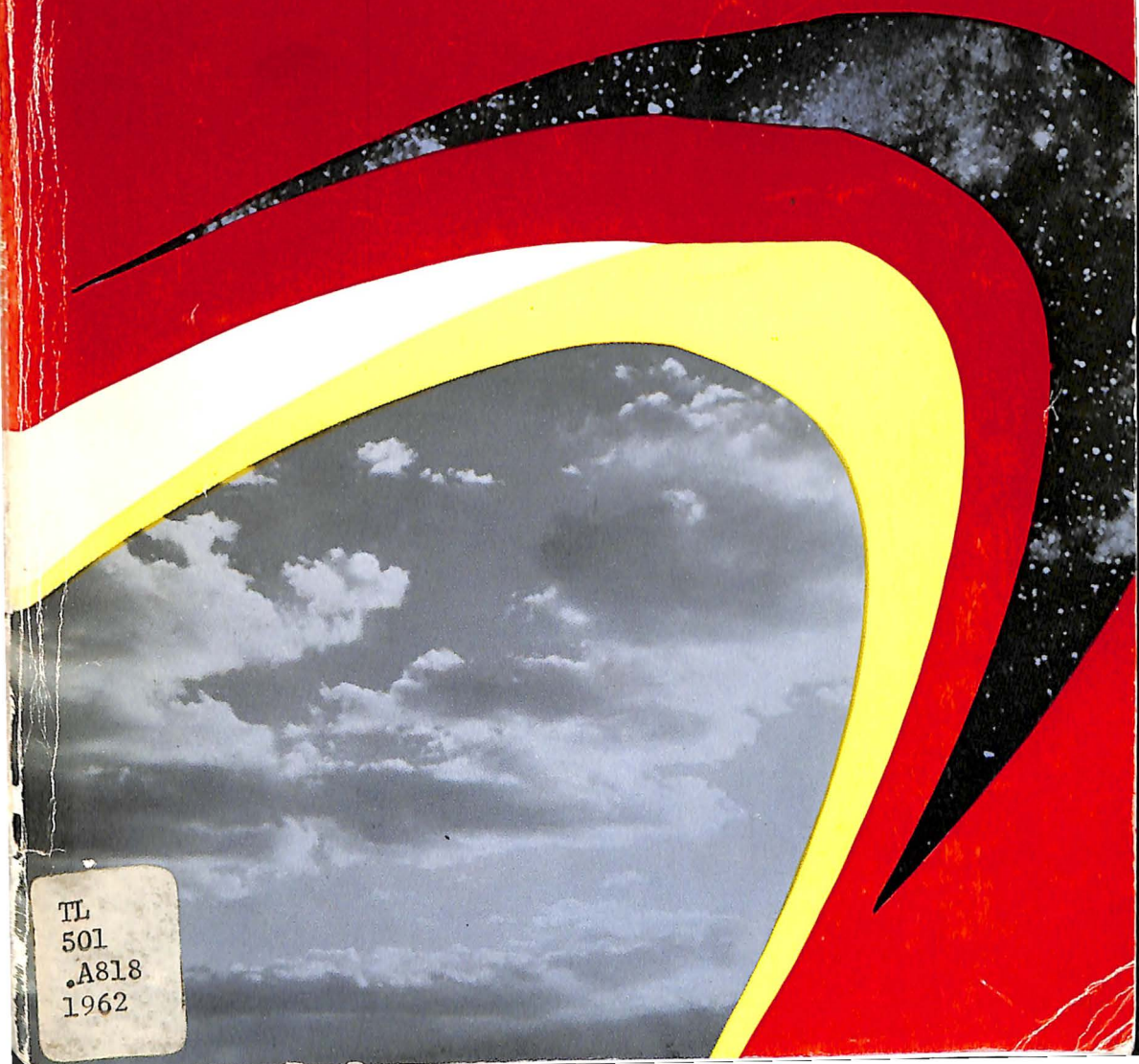
AEROSPACE FACTS AND FIGURES 1962



AEROSPACE INDUSTRIES ASSOCIATION OF AMERICA, INC.

AEROSPACE FACTS AND FIGURES 1962

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AEROSPACE FACTS AND FIGURES, 1962

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FOREWORD

Even though the United States has attained the strongest military posture it has ever had in peacetime and has reached a degree of progress in space flight which demonstrates the definite capability of achievement of its planned goals, neither this Nation nor this industry can rest on these technological laurels.

The ever-broadening demands for technological breakthroughs required to assure leadership in the exploration of space, the ever-increasing importance of qualitative superiority in weapons as the major element of our national security, and the increasingly keen competition for the world's civil aviation market require the utmost dedication, not only of all elements of industry but of governmental organizations as well.

Today the aerospace industry continues in the difficult stage of transition from serial production of aircraft to a low-volume production of highly diversified and sophisticated products. Because of the great technical complexity of modern-day aerospace weapons and civil airliners and their enormous costs, an extraordinary premium has been placed on our industry's technical and managerial capabilities necessary to keep pace with the scientific, tech-

nical and productive capabilities of its laboratories and plants. Management has responded to this challenge with characteristic vigor. But even the most prescient managerial techniques can never create time. The industry's pool of scientific and technical talent and the finest facilities are simply a potential. The best possible management and use of time available is a prime requirement.

Aerospace Facts and Figures—1962, chronicles statistically and textually this industry's efforts in research, development, test and production of aircraft, missiles, spacecraft and propulsion systems. Users of this work will note in the pages of this book the effects of the radical changes on the nature and composition of the aerospace industry. This document is not necessarily a work of original research; rather, it is a compilation of facts gathered from hundreds of sources during the past year which have been considered of importance and interest.

This tenth edition, as those in the past, is designed to serve as a standard reference work of value to legislators, administrators, and managers in Government and in industry, writers and editors, analysts and students.

GEORGE F. HANNAUM
Vice President
Aerospace Industries Association
June 1962

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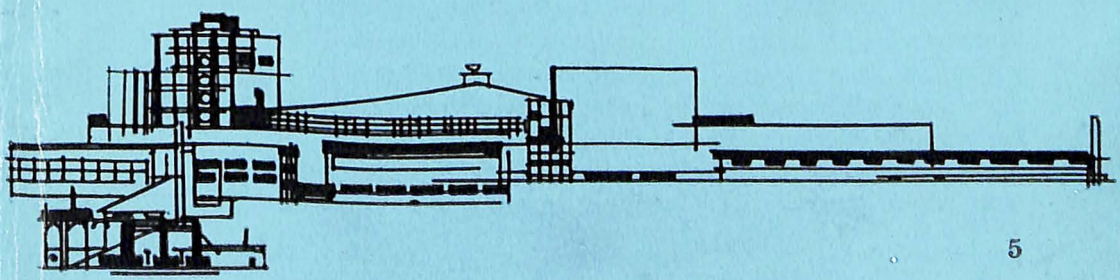
AIRCRAFT PRODUCTION

Despite the increasing emphasis on guided missiles and substantial gains in a broad-front approach to space exploration, procurement and production of high performance aircraft to the military services continued to account for 43.5 per cent of the military procurement and production dollar. However, the production of military aircraft continues to decline. Indicative of the production shift is the fact that in 1953 the aerospace industry delivered 8,978 aircraft to the military services and in 1961 the industry delivered approximately 2,000. In the commercial transport field 206 turbined-powered airliners, for delivery to the world's airlines, rolled off production lines at a rate of nearly one per working day.

Generally speaking, the aerospace industry is changing from an industry geared primarily to quantity production of aircraft to low-volume production of highly diversified and sophisticated flight devices for use both in and beyond earth's atmosphere. Today, more than one-third of the aerospace industry's effort is devoted to research and development activity. Building and maintaining the management capabilities



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

Year	TOTAL	Military	Civil
1909	N.A.	1	N.A.
1910	N.A.	—	N.A
1911	N.A.	11	N.A.
1912	45	16	29
1913	43	14	29
1914	49	15	34
1915	178	26	152
1916	411	142	269
1917	2,148	2,013	135
1918	14,020	13,991	29
1919	780	682	98
1920	328	256	72
1921	437	389	48
1922	263	226	37
1923	743	687	56
1924	377	317	60
1925	789	447	342
1926	1,186	532	654
1927	1,995	621	1,374
1928	4,346	1,219	3,127
1929	6,193	677	5,516
1930	3,437	747	2,690
1931	2,800	812	1,988
1932	1,396	593	803
1933	1,324	466	858

(Continued on next page)

necessary to keep pace with the scientific and technical gains and at the same time to keep these gains allied with the productive capabilities of its laboratories and plants is difficult.

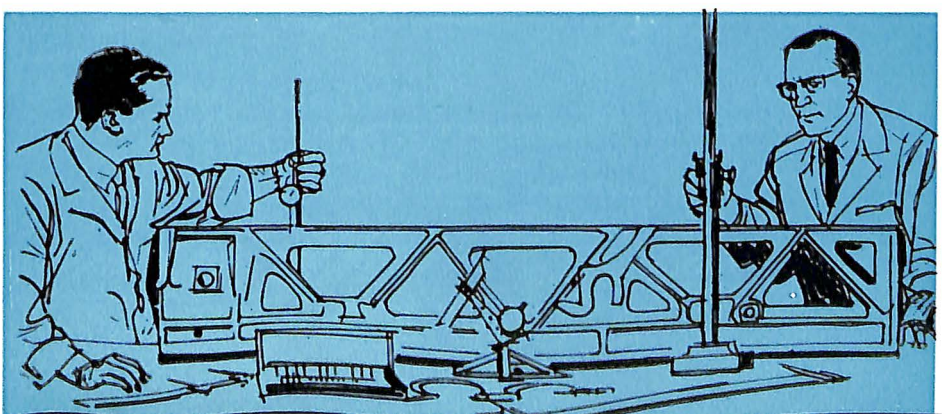
In this regard, a major problem area to the industry is the acquisition of research, development, testing and production facilities required for modern weapons systems. The industry, paradoxically, has an excess of floor space while seeking the means to build new facilities, primarily for research, development and testing.

Funds for new facilities financed from industry must, in the long run, come from earnings. An industry survey conducted in 1962 reveals

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

Year	TOTAL	Military	Civil
1934	1,615	437	1,178
1935	1,710	459	1,251
1936	3,010	1,141	1,869
1937	3,773	949	2,824
1938	3,623	1,800	1,823
1939	5,856	2,195	3,661
1940	12,813	6,028	6,785
1941	26,289	19,445	6,844
1942	47,675	47,675	—
1943	85,433	85,433	—
1944	95,272	95,272	—
1945	48,912	46,865	2,047
1946	36,418	1,417	35,001
1947	17,739	2,122	15,617
1948	9,838	2,536	7,302
1949	6,137	2,592	3,545
1950	6,200	2,680	3,520
1951	7,532	5,055	2,477
1952	10,640	7,131	3,509
1953	13,112	8,978	4,134
1954	11,478	8,089	3,389
1955	11,484	6,664	4,820
1956	12,408	5,203	7,205
1957	11,943	5,198	6,745
1958	10,938	4,078	6,860
1959	11,076	2,834	8,242
1960	10,881[E]	2,700[E]	8,181
1961	9,463[E]	2,000	7,463

N.A.—Not available.
E Estimate.
NOTE: 1950 to date excludes aircraft produced for the Military Assistance Program.
Sources: 1, 2, 3, 12, 17

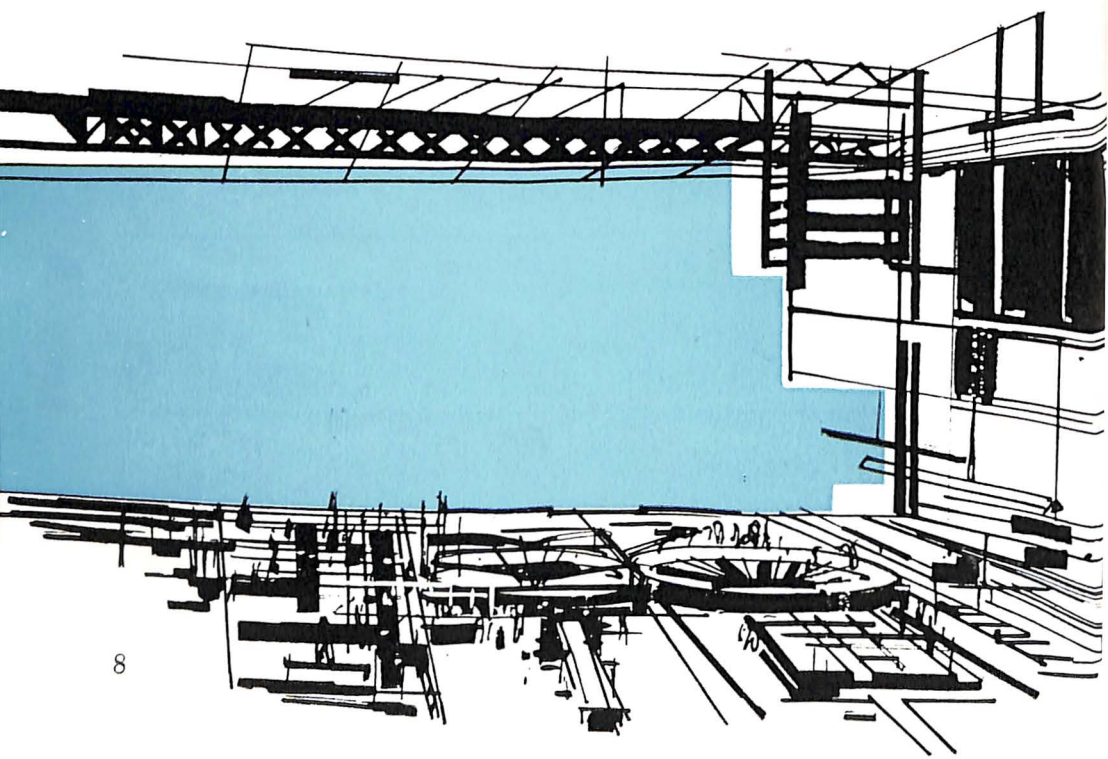


that the aerospace industry currently is reinvesting 70 per cent of its net earnings for facilities, research and development and working capital.

Beginning with 1961, the sales and backlog figures of aerospace companies have been refined and expanded. The refinement exists in a detailed breakdown of what previously was included in "other products and services" into several specific categories. This gives the first publicly available breakdown of sales and backlogs into "missile systems," "military space vehicle systems," etc. Future publications additionally will disclose the trends of sales and backlogs in these categories.

The expansion in coverage brings within the scope of the survey the 64 companies producing, assembling, developing, or having prime system responsibility for complete missiles, space vehicles, and engines or propulsion units for missiles and space vehicles. It represents an expansion in the reporting panel of companies of about one-third from the 48 manufacturers engaged in 1960 in the manufacture of complete aircraft engines and propellors.

The expansion in coverage affects primarily the column previously listed as "other products and services." It has no significant effect on sales and backlog figures reported for "complete aircraft and parts" and "aircraft engines and parts." Separate publication of data on "aircraft propellors and parts" has been discontinued; "other aircraft, space vehi-



AIRFRAME WEIGHT PRODUCTION, 1939 TO DATE

Year	Weight in Millions of Pounds (Excluding Spares)		
	TOTAL	Military	Civil
1939	12.5[E]	10.1	2.4[E]
1940	27.8[b]	23.1	4.7[E]
1941	86.1[E]	81.4	4.7[E]
1942	275.8	275.8	—
1943	654.2	654.2	—
1944	961.1	961.1	—
1945	541.1	539.4	1.7
1946	38.4	12.9	25.5
1947	29.3	11.4	17.9
1948	35.2	25.1	10.1
1949	37.0	30.3	6.7
1950	41.9	35.9	6.0
1951	55.2	50.2	5.0
1952	116.6	107.3	9.3
1953	148.4	138.0	10.4
1954	140.9	130.4	10.5
1955	124.5	114.3	10.2
1956	106.2	90.0	16.2
1957	101.2	79.4	21.8
1958	82.8	66.1	16.7
1959	74.9	51.8	23.1
1960	75.2[E]	47.0[E]	28.2
1961	56.9[E]	35.0[E]	21.9

[E] Estimate.
Sources: 1. 12. 17

cle and missile activities" include a part of the sales and backlog of aircraft propellors.

The shift is shown by the guided missile and space sales of aerospace manufacturers reaching $7.9 billion in 1961, while their aircraft and aircraft engine sales accounted for $5.8 billion. Manufacturers' backlogs declined during the year, reflecting the slower pace of airline reequipping with turbine aircraft and the impact of Federal Government financial methods as missiles and space programs, with their short production runs, replace long-production run aircraft. (see pages 10 and 13).

Production of military aircraft during 1961 continued to drop. An estimated 2000 units were produced in 1961 compared to an estimated 2700 in 1960. No substantial increase in production is expected in 1962

and the more distant future. 206 gas-turbined airliners were delivered during 1961, a decrease from the 241 delivered in 1960. By December 1961, a total of 728 of these luxurious transports had been delivered to both foreign and domestic airlines since deliveries began four years ago.

1961 shipments of utility and executive type aircraft totalled 6,778 units, having a retail value approximating $124,000,000. These ship-

VALUE OF BACKLOG REPORTED BY MANUFACTURERS OF COMPLETE AIRCRAFT, SPACE VEHICLES, MISSILES, AND SELECTED PARTS
1960, 1961

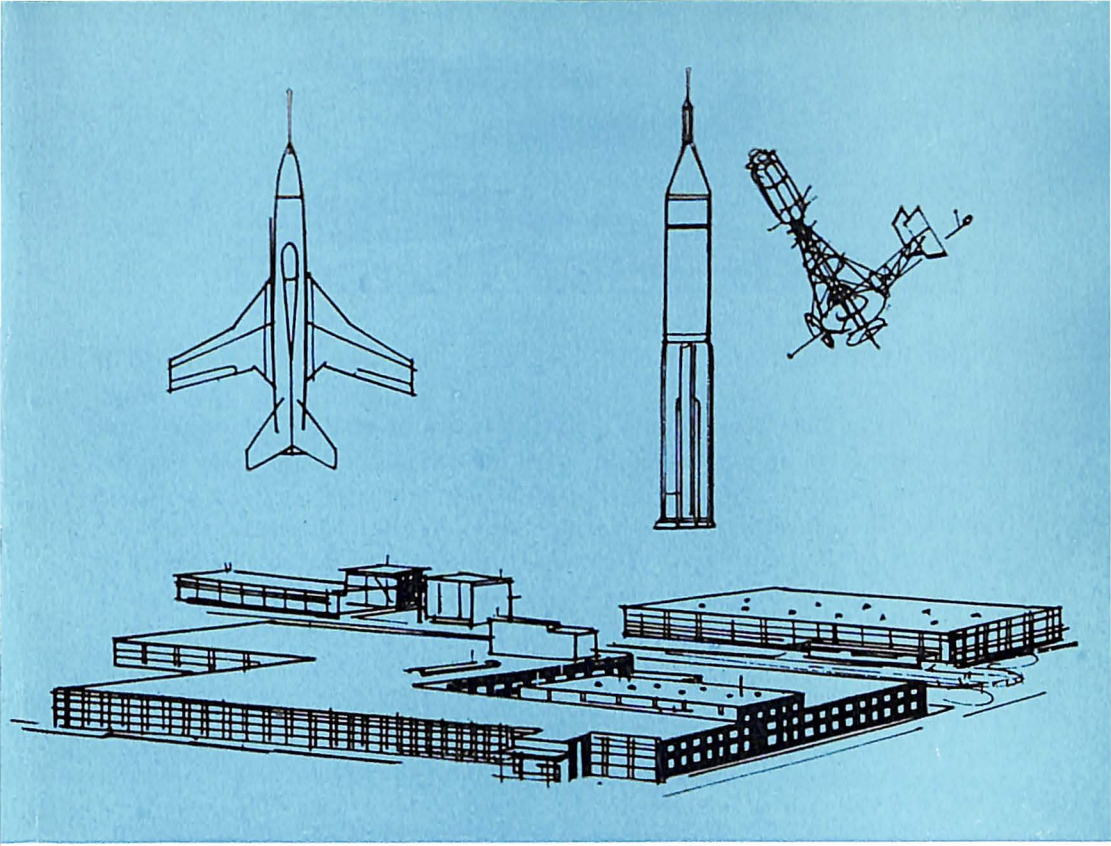
Type of Product or Service	December 31 1960	December 31 1961
TOTAL	$15,321	$13,950
United States Government	12,056	11,045
Other Customers[a]	3,265	2,905
Complete Aircraft and Parts, Total	6,089	5,669
U. S. Government	4,066	3,996
Other Customers	2,023	1,673
Aircraft Engines and Parts, Total	1,566	1,545
U. S. Government	1,161	1,088
Other Customers	405	457
Missile and Space Vehicle Systems, Engines, Propulsion Units and Parts, Total	4,690	3,844
Missile Systems	3,855	2,881
Space Vehicle Systems, U. S. Govt., Military	124	360
Engines and/or Propulsion Units for Missiles and Space Vehicles (including Parts), U. S. Govt., Military	467	368
Space Vehicle Systems and their Engines and/or Propulsion Units, U. S. Govt., Nonmilitary	244	235
Other Aircraft, Space Vehicle and Missile Activities, Total[b]	2,049	1,783
U. S. Government	1,495	1,382
Other Customers	554	401
All Other Products and Services, Total[c]	927	1,109
U. S. Government	765	935
Other Customers	162	174

[a] Includes some reported values, primarily those associated with subcontracts, shown under "Missile and space vehicle systems, engines, propulsion units and parts," even though such values were reported as U. S. Government orders.

[b] Includes all conversions; modifications; site activations; other aerospace products (including drones) and services not included above; and receipts for applied research and development on items such as drones, etc. Receipts for other applied research are included with figures for the respective reporting categories.

[c] Includes all nonaircraft, nonspace vehicles, and nonmissile products and services; and all basic research.

Source: 13

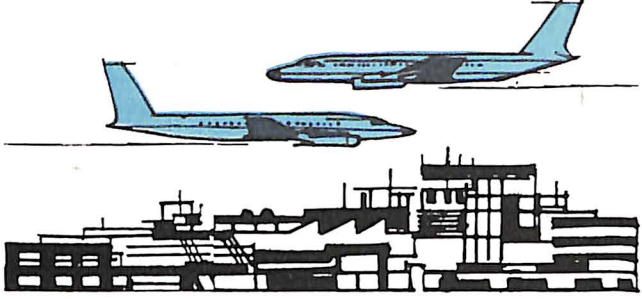


ments were somewhat less than 1960, when 7,588 aircraft, valued at approximately $150,000,000 were reported. The drop resulted from the general business slump which still existed in early 1961. However, the industry is recovering and a healthy continuing growth is anticipated in both unit volume and dollar value of utility aircraft sales in the decade ahead.

The dollar value and unit volume of the general aviation industry's sales have more than trebled in the past decade, during which period members of the Association's Utility Airplane Council have produced more than 50,000 aircraft. Indicative of the industry's faith in the future is that during the past year the general aviation segment of the manufacturing industry continued to make substantial capital expenditures—numbering in the millions of dollars—to improve plant equipment, expand floor space, and increase the efficiency of its productivity and customer service.

American business, industry and agriculture have found privately-operated utility and executive aircraft add greatly to their efficiency and productivity. The use of general utility aircraft has become an integral and important part of the national transportation economy.

The production of helicopters increased substantially to 432 com-



mercial craft delivered in 1961, well above the 294 units delivered in 1960.

The year 1961 also marked a change in status of the turbine-powered helicopter from an experimental to an operational vehicle. The turbine-powered 'copter has been introduced into wide use by the military and by the scheduled helicopter airlines. While the military services continue as the major user of rotary-wing aircraft, the commercial helicopter industry has also become big business. Leading the list of services which these highly versatile machines perform are: construction work, oil and mineral exploration, powerline patrol, forestry and short-haul transport.

PRODUCTION AND FACILITIES

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

December 31	Total	Aircraft and Parts	Aircraft Engines and Parts	Aircraft Propellers and Parts	Other Products and Services[a]
1948	$3,104	$2,094	$ 786	$103	$121
1949	3,010	2,013	749	91	157
1950	5,039	3,102	1,470	145	322
1951	12,665	8,126	3,531	241	767
1952	17,653	11,222	5,172	298	961
1953	16,753	11,604	4,080	218	851
1954	14,852	10,639	2,929	187	1,097
1955	15,702	10,673	3,061	130	1,841
1956	18,350	11,744	4,065	191	2,350
1957	14,531	9,236	2,969	158	2,168
1958	13,171	8,095	2,018	69	2,989
1959	12,120	6,650	1,385	57	4,028
1960	12,496	6,132	1,604	55	4,705

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

Source: 13

VALUE OF NET SALES REPORTED BY MANUFACTURERS OF COMPLETE AIRCRAFT, SPACE VEHICLES, MISSILES, AND SELECTED PARTS
1961
(Millions of Dollars)

Type of Product or Service	First Quarter	Second Quarter	Third Quarter	Quarter Fourth	TOTAL
TOTAL	$3,588	$3,875	$3,635	$3,856	$14,954
U. S. Government	2,754	2,913	2,860	3,004	11,531
Other Customers[a]	834	962	775	852	3,423
Complete Aircraft and Parts, Total	1,014	1,150	1,098	1,125	4,387
U. S. Government	648	753	766	778	2,945
Other Customers	366	397	332	347	1,442
Aircraft Engines and Parts, Total	350	371	314	420	1,455
U. S. Government	257	265	212	287	1,021
Other Customers	93	106	102	133	434
Missile and Space Vehicle System, Engines, Propulsion Units and Parts, Total	1,290	1,327	1,283	1,314	5,214
Missile Systems	939	946	901	869	3,655
Space Vehicle Systems, U. S. Govt, Military	128	130	138	155	551
Engines and/or Propulsion Units for Missiles and Space Vehicles (incl. parts) U. S. Govt., Military	191	200	190	215	796
Space Vehicle Systems, their Engines, and/or Propulsion Units, U. G. Govt., Nonmilitary	32	51	54	75	212
Other Aircraft, Space Vehicles and Missile Activities, Total[b]	651	714	638	666	2,669
U. S. Government	415	464	453	466	1,798
Other Customers	236	250	185	200	871
All Others Products and Services, Total[c]	283	313	302	331	1,229
U. S. Government	184	194	192	218	788
Other Customers	99	119	110	113	441

[a] Includes some reported values, primarily those associated with subcontracts, shown under "Missile and space vehicle systems, engines, propulsion units and parts," even though such values were reported as U. S. Government orders.

[b] Includes all conversions; modifications; site activations; other aerospace products (including drones) and services not included above; and receipts for applied research and development on items such as drones, etc. Receipts for other applied research are included with figures for the respective reporting categories.

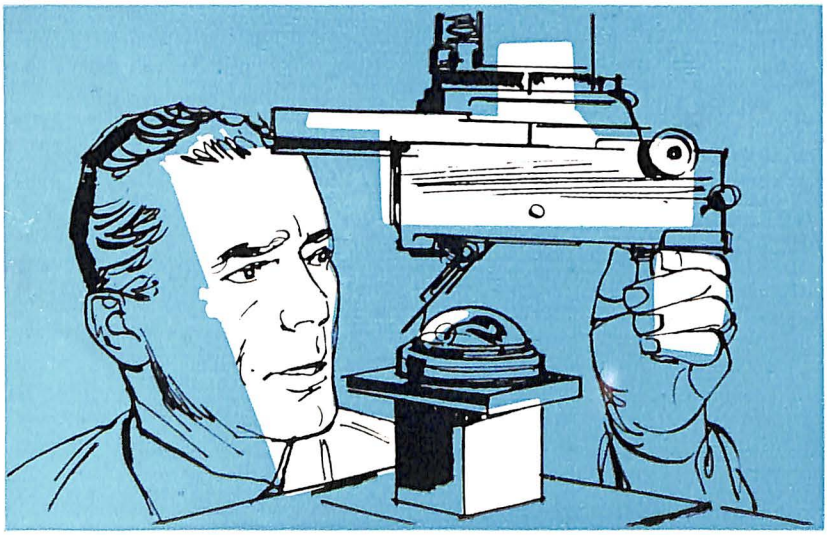
[c] Includes all nonaircraft, nonspace vehicles, and nonmissile products and services; and all basic research.

Source: 13

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

Year	Total	Aircraft and Parts			Aircraft Engines and Parts			Aircraft Propellers and Parts			Other Products and Services[b]
		Total	U.S. Military	Other	Total	U.S. Military	Other	Total	U.S. Military	Other	
1948[a]	$1,158	$ 748	$ 626	$122	$ 265	$ 222	$ 43	$ 48	$ 36	$12	$ 97
1949	1,781	1,098	927	171	508	461	47	62	50	12	113
1950	2,274	1,416	1,255	161	583	519	64	75	62	13	200
1951	3,456	1,883	1,657	226	879	779	100	110	89	21	584
1952	6,497	3,897	3,442	455	1,609	1,440	169	148	122	26	843
1953	8,511	5,179	4,661	518	2,378	2,189	189	203	176	27	751
1954	8,305	5,226	4,626	600	2,062	1,872	190	183	151	32	834
1955	8,470	5,164	4,605	559	1,933	1,728	205	134	112	22	1,239
1956	9,496	5,554	4,740	814	2,035	1,718	317	136	101	35	1,771
1957	11,765	6,772	5,607	1,165	2,527	2,137	390	183	140	43	2,283
1958	11,470	6,319	5,305	1,014	2,179	1,858	321	163	126	37	2,809
1959	11,255	5,458	4,063	1,395	1,676	1,268	408	102	64	38	4,019
1960	10,997	5,099	3,333	1,766	1,330	913	417	98	73	25	4,470

[a] Total for last three quarters of 1948 only.
[b] "Other Products and Services" includes missiles, conversions, modifications, and all other products and services not covered under the first three categories as long as they were produced or performed by manufacturers of complete aircraft, aircraft engines, or propellers.
Source: 13



Value of Production of the Aerospace Industry 1914 to Date (Thousands of Dollars)

Year	Total Value[a]	Part of Total Value Added by Manufacture
1914	$ .8	$ .7
1919	14.4	7.2
1921	6.6	4.2
1923	12.9	9.1
1925	12.5	9.7
1927	21.2	13.6
1929	71.2	43.8
1931	40.3	27.2
1933	26.5	18.5
1935	45.3	31.0
1937	149.7	93.1
1939	279.5	183.2
1940 Jul-Dec	370.0	N.A.
1941	1,804.0	N.A.
1942	5,817.0	N.A.
1943	12,514.0	N.A.
1944	16,047.0	N.A.
1945 Jan-Aug	8,279.0	N.A.

Year	Sales[b]	Total Value[c]	Part of Total Value Added by Manufacture[d]
1947	$ 1,200[E]	N.A.	$ 885
1949	1,781	N.A.	1,202
1950	2,274	N.A.	1,406
1951	3,456	N.A.	2,337
1952	6,497	N.A.	3,728
1953	8,511	N.A.	4,556
1954	8,305	$10,047	4,904
1955	8,470	8,638	4,671
1956	9,496	9,999	5,565
1957	11,765	12,392	6,453
1958	11,470	10,185	5,127
1959	11,255	10,174	4,805
1960	10,997	8,634	4,246

[E] Estimate.
[a] 1914-1939: Value of Products.
1940-1945: Value of Production at August 1943 Unit Cost.
[b] Sales of Manufacturers of Complete Aircraft, Engines, Propellers and Parts. The figures include other products and services such as missiles, conversions and modifications.
[c] 1954-date: Value of work done by the aircraft industry plus value of shipments of the aircraft engines and parts and aircraft propellers and parts industries. Shipments of the aircraft equipment industry not included.
[d] Aircraft, aircraft engines and parts and propeller and parts industries.
Sources: 1, 3, 8, 13

SHIPMENTS OF CIVIL ENGINES
1954 to Date

Manufacturerand Engine Designation[a]	1954	1955	1956	1957	1958	1959	1960	1961
TOTAL	5,358	7,398	11,204	10,817	10,251	12,259	12,159	10,663
Recipro.	5,358	7,398	11,204	10,779	9,736	10,875	10,524	9,669
Jet	—	—	—	38	515	1,384	1,635	994
Allison Division General Motors								
282	—	—	—	—	242	604	576	22
Continental								
205	147	163	87	145	77	16	56	46
246	78	41	22	24	15	23	20	16
252	210	279	627	879	829	1,348	840	828
253	561	811	1,736	811	1,734	953	1,252	987
267	423	500	433	31	36	36	9	12
273	990	1,712	2,524	2,733	2,181	2,816	3,207	850
298	—	—	—	—	—	713	469	86
3E-1	—	—	—	—	—	—	—	1,888
3E-3	—	—	—	—	—	—	—	322
Other	17	12	20	24	23	8	20	70
General Electric								
306	—	—	—	—	—	—	—	70
308	—	—	—	—	18	90	212	—
1E5	—	—	—	—	—	—	66	185
J79-11A	—	—	—	—	—	—	—	69
Lycoming								
223	2	6	7	8	2	8	11	1,241
228	—	—	—	—	—	—	—	12
229	969	127	132	44	95	113	80	17
274	618	2,309	3,011	2,631	2,023	2,021	1,452	1,128
275	213	591	909	842	419	308	271	122
277	—	—	—	—	—	—	—	11
286	—	—	—	—	—	247	294	218
284	—	—	2	250	768	1,044	701	718
295	—	—	—	123	561	906	1,247	728
304	—	—	—	—	—	—	115	—
1E	—	—	—	—	—	—	233	—
1E4	—	—	—	—	—	—	—	122
1E7	—	—	—	—	—	—	—	90
1E11	—	—	—	—	—	—	—	65

(*Continued on next page*)

SHIPMENTS OF CIVIL ENGINES—*Continued*
1954 TO DATE

Manufacturer and Engine Designation[a]	1954	1955	1956	1957	1958	1959	1960	1961
Pratt & Whitney Division								
230	44	26	21	5	6	1	—	—
231, 264	350	157	316	456	315	3	6	—
290	—	—	—	35	232	275	172	145
291	—	—	—	3	23	410	523	46
1E8	—	—	—	—	—	—	63	357
1E9	—	—	—	—	—	—	23	97
XTF10	—	—	—	—	—	—	—	3
Other	—	—	—	—	—	5	—	—
Wright Aeronautical								
243	2	1	—	68	51	6	—	6
259	1	5	23	157	129	202	34	49
272	516	483	315	323	22	—	—	—
287	—	32	576	910	283	26	—	—
289	—	—	—	—	—	24	—	1
Other	—	—	—	—	—	—	—	36

[a] Type certificate number.
Source: 1

FLOOR AREA AVAILABLE IN AEROSPACE FACILITIES,
1939 TO DATE
(Millions of Square Feet)

Date	TOTAL	Airframe	Engine	Propeller
Jan. 1, 1939	9.5	7.5	1.7	.3
Jan. 1, 1940	13.1	9.6	3.0	.5
Jan. 1, 1941	25.5	17.9	6.5	1.1
Jan. 1943	117.1	77.5	31.8	5.2
Dec. 1943	175.0	110.4	54.2	6.8
Dec. 1944	167.4	103.0	54.9	7.9
1947 (estimate)	54.1	39.0	13.5	1.6
1950 (estimate)	63.5	47.5	14.0	2.0
June 30, 1952	122.8	82.3	38.4	2.1
June 30, 1953	135.8	91.1	42.1	2.6
Sept. 30, 1954	127.5	91.0	33.7	2.8
Dec. 31, 1955	131.3	96.5	32.1	2.7
Dec. 31, 1956	138.4	101.5	34.1	2.8
Sept. 30, 1957	141.5	103.5	35.2	2.8
Dec. 31, 1958	137.8	103.1	31.6	3.1
Sept. 30, 1959	126.8	93.6	30.0	3.2
Dec. 31, 1960	148.4[a]	118.4[a]	26.8	3.2
June 30, 1961	152.5[a]	125.5[a]	24.5	2.5

[a] Includes missile and aircraft airframes.
Sources: 1, 3, 17

Aircraft Engine Production, 1917 to Date
(Number of Engines)

Year	Total	Military		Civil	
1917–1919	N.A.	44,453		N.A.	
1926	N.A.	842		N.A.	
1927	N.A.	1,397		N.A.	
1928	3,252	2,620		632	
1929	7,378	1,861		5,517	
1930	3,766	1,841		1,925	
1931	3,776	1,800		1,976	
1932	1,898	1,085		813	
1933	1,980	860		1,120	
1934	2,736	688		2,048	
1935	2,965	991		1,974	
1936	4,237	1,804		2,433	
1937	6,084	1,989		4,095	
1938	N.A.	N.A.		3,800[E]	
1939	11,172	N.A.		N.A.	
1940	30,167[E]	22,667		7,500[E]	
1941	64,681[E]	58,181		6,500[E]	
1942	138,089	138,089		—	
1943	227,116	227,116		—	
		Recipr.	Jet	Recipr.	Jet
1944	256,911	256,789	122	—	—
1945	111,650[E]	108,442	1,208	2,000[E]	—
1946	43,407	1,680	905	40,822	—
1947	20,912	2,683	1,878	16,351	—
1948	14,027	2,495	2,493	9,039	—
1949	11,972	2,981	5,009	3,982	—
1950	13,675	3,122	6,239	4,314	—
1951	20,867	6,471	9,816	4,580	—
1952	31,041	8,731	16,928	5,382	—
1953	40,263	13,365	20,251	6,647	—
1954	26,959	7,868	13,572	5,519	—
1955	21,108	3,875	9,594	7,639	—
1956	21,348	2,663	7,186	11,499	—
1957	21,946	2,429	8,658	10,859	38
1958	18,354	1,452	6,669	10,233	515
1959	17,162	661	3,965	11,152	1,384
1960	18,926[E]	600[E]	5,800[E]	10,891	1,635
1961	16,063[E]	500[E]	4,900[E]	9,669	994

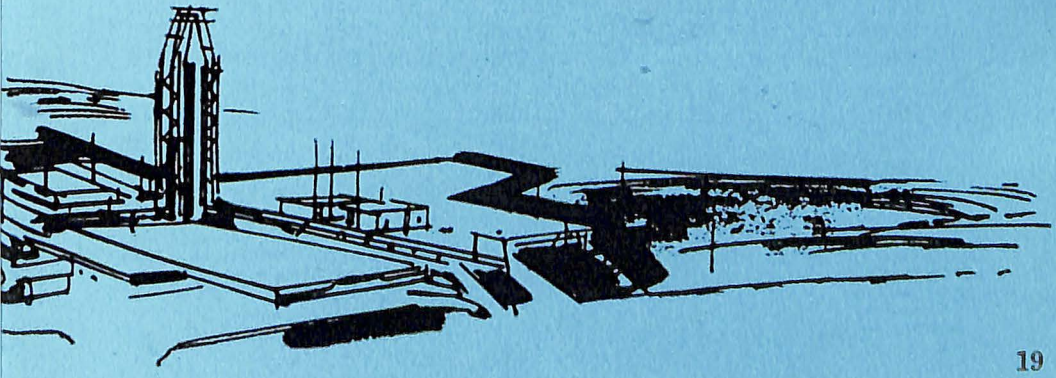
N.A. Not available.
[E] Estimate.
Sources: 1, 3, 12, 17

MISSILES

Missile weapon systems became a billion-dollar Defense Department budget item in 1952. Ten years later these weapons account for almost seven billion procurement dollars per year. In 1952 practically all of the funds expended for missile development and production were in the air defense category. The long range missiles were still only a $1 million budget item. The missiles being built in 1952 were relatively "unsophisticated"; nearly all of them were turned out in aircraft construction plants.

Through 1955, missile development and production proceeded at approximately the same funding level, with emphasis still on defensive weapons, although some short range offensive weapons were being produced.

Missiles, as a major item of development and procurement started in 1956, when total funding topped the $2 billion level. At that time production was begun on intermediate range weapons and development got under way on intercontinental ballistics missiles. In 1957, missile funds almost doubled over the previous years. Missile funds reached the $5



billion mark in fiscal 1958, and for the past four years have been close to $7 billion. The long range missiles now absorb approximately half the total missile money.

This great expansion in a new field had a profound effect on the aerospace industry. The newer missiles, particularly those in the long range categories, were even more complex than the most advanced aircraft, a factor which compounded all the previous problems. To these was

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

Year Ending June 30	ALL MISSILE PROGRAMS	Of this Total		
		Intermediate and Intercontinental Ballistic Missiles	Other Surface to Surface Missiles	All Other Missiles
1946 & prior	$ 72	$ 2	$ 19	$ 51
1947	58	—	20	38
1948	81	—	36	45
1949	98	—	45	53
1950	134	—	65	69
1951	784	1	185	598
1952	1,058	1	239	818
1953	1,166	3	403	760
1954	1,067	14	336	717
1955	1,468	159	398	911
1956	2,281	526	387	1,368
1957	4,506	1,401	603	2,502
1958	5,180	2,150	639	2,391
1959	6,900	2,946	685	3,269
1960	6,718	3,216	534	2,968
1961	8,292	5,458	391	2,443
1962[a]	8,173	5,045	488	2,640
1963[b]	8,302	5,056	545	2,701

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

[a] Preliminary.
[b] Projected.
Source: 17

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

Year Ending June 30	Total Procurement and Production	Guided Missiles	Missiles as Percent of Total
1951	$23,114	$ 424	1.8
1952	29,536	468	1.6
1953	21,117	685	3.2
1954	10,588	569	5.4
1955	7,420	234	3.2
1956	9,795	764	7.8
1957	11,294	2,135	18.9
1958	10,983	2,090	19.0
1959	14,304	3,966	27.7
1960	11,701	2,030	17.3
1961	11,716	2,078	17.7
1962[E]	15,893	2,078	20.5
1963[E]	16,445	4,011	24.4

[E] Estimate
Source: 17, 21

added still another problem—facilities.

Although quite a bit of the productive know-how the industry had acquired in building aircraft was applicable to missilery, manufacturing methods underwent a revolutionary change. Missile parts had to be assembled in dust-free, vibration-free plants under rigid temperature and humidity control. These devices had to be continually tested and retested while they were actually on the production line. Computer-operated tools were required for the high precision machining needed for missile parts.

The industry found that its old aircraft plants were not suitable for conversion to missile manufacture; missile facilities had to be built from the ground up. So, while industry was retiring its old plants for lack of plane production, it had to provide new facilities for missiles, and the funds for the most part had to come from earnings which were on a steady decline.

The current Fiscal Budget contemplates completion of 13 ATLAS Squadrons, and 12 of the 14 TITAN squadrons. Military interest for

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

Year Ending June 30	TOTAL DEFENSE DEPARTMENT	Air Force	Navy	Army
1951	$ 424	$ 121	$130	$173
1952	468	95	119	253
1953	685	N.A.	N.A.	N.A.
1954	569	N.A.	N.A.	N.A.
1955	234	N.A.	N.A.	N.A.
1956	764	N.A.	N.A.	N.A.
1957	2,135	N.A.	N.A.	N.A.
1958	2,090	N.A.	N.A.	N.A.
1959	3,966	N.A.	N.A.	N.A.
1960	2,030	1,256	382	392
1961	2,078	1,173	553	351
1962[E]	3,256	1,805	878	573
1963[E]	4,011	2,500	953	558

[E] Estimate based on 1963 Budget Submission.
Source: 17, 21

the more immediate future is primarily in the solid fuel submarine-based POLARIS and the hardened and possibly the mobile, land-based MINUTEMAN. Pentagon officials will not say at this time how many of the two systems will eventually be purchased, but in any case, the Navy and Air Force, respectively, will continue their efforts to improve further the performance of these weapons with respect to reliability, accuracy, yield, and penetration capabilities. With TITAN I operational, heavy emphasis is being placed on development of the TITAN II weapon system. There will no doubt also be additional requirements for TITAN II boosters in the space program.

Unless research elements of the aerospace industry can achieve a dramatic breakthrough in a solid fuel chemistry—and this is a possibility which should not be excluded—it is difficult to visualize an entirely new strategic ballistic missile development in the near future. Consideration has been given to a mid-range land-based tactical ballistic missile, although there is not yet, however, a firm requirement. There may also develop a future requirement for a surface ship-based ballistic missile—perhaps either POLARIS or some new solid fuel missile, but

DEPARTMENT OF DEFENSE
UNOBLIGATED FUNDS AVAILABLE FOR PROCUREMENT, FEBRUARY 28, 1962
TOTAL AND GUIDED MISSILES
(Millions of Dollars)

	Total Procurement	Guided Missiles	Missiles as Percent of Total
Defense Department	$12,383	$2,295	18.5
Air Force	6,009	1,464	24.4
Navy	4,421	492	11.1
Army	1,953	339	17.4

Source: 20

DEPARTMENT OF DEFENSE
UNPAID OBLIGATIONS, FEBRUARY 28, 1962
TOTAL AND GUIDED MISSILES
(Millions of Dollars)

	Total Procurement	Guided Missiles	Missiles as Percent of Total
Defense Department	$16,664	$3,242	19.5
Air Force	5,332	2,703	50.7
Navy	8,335	883	10.6
Army	2,996	804	26.8

Source: 20

it would have to have a much better cost-effectiveness ratio than the proposed installation of the POLARIS on the nuclear-powered cruiser LONG BEACH. That proposal was entirely too costly in relation to the benefits to be gained and accordingly was dropped from the program.

As this Nation moves into the decade of the 60's, space systems will no doubt assume ever-increasing importance in the defense program. The Defense Department has a host of requirements for orbiting satellites —communications, navigation, weather, warning, reconnaissance, and a device designed to inspect hostile satellites. The Defense Department is also embarking on two new major projects—the Mobile Medium Range Ballistic Missile (MMRBM) mentioned earlier, and Titan III. The latter calls for 120-inch solid propellant stages strapped onto the Titan II, plus an additional new upper stage. DOD has referred to this system as the Standard Space Launch Vehicle (SSLV) and as the workhorse military space booster of the next decade. Its total thrust will be in the two million-pound range.

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

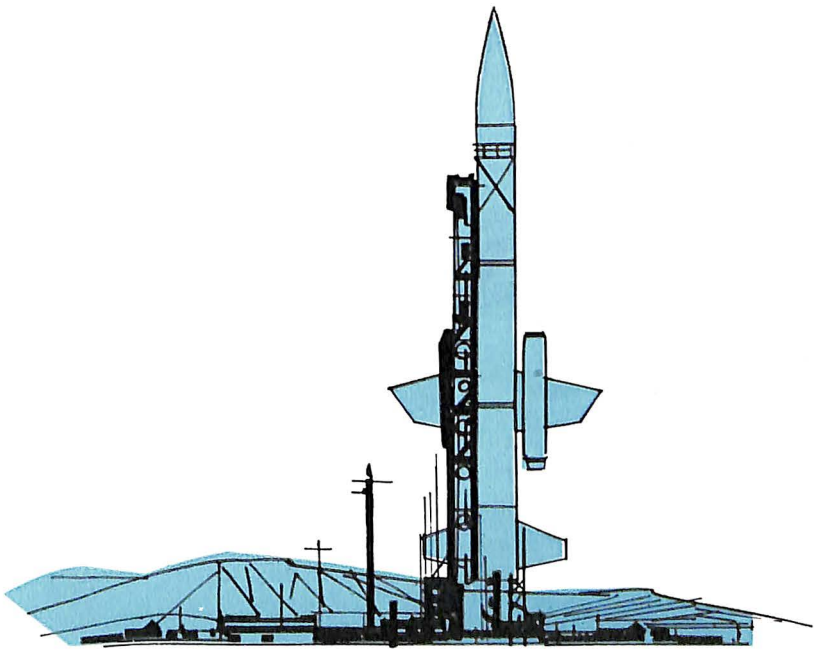
Year Ending June 30	Total Procurement and Production	Guided Missiles	Guided Missiles as Percent of Total
1951	$ 3,976	$ 21	0.5
1952	11,478	169	1.5
1953	17,297	245	1.4
1954	15,957	417	2.6
1955	12,838	604	4.7
1956	12,227	1,005	8.2
1957	13,488	1,855	13.8
1958	14,083	2,434	17.3
1959	14,409	3,337	23.2
1960	13,334	3,027	22.7
1961	13,095	2,972	22.7
1962[E]	14,836	3,523	23.7
1963[E]	15,356	3,899	25.4

[E] Estimate based on 1963 Budget Submission.
Source: 17

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

Year Ending June 30	TOTAL DEFENSE DEPARTMENT	Air Force	Navy	Army
1951	$ 21	$ 16	$ 5	—
1952	169	66	56	$ 46
1953	245	N.A.	N.A.	N.A.
1954	417	N.A.	N.A.	N.A.
1955	604	N.A.	N.A.	N.A.
1956	1,005	N.A.	N.A.	N.A.
1957	1,855	N.A.	N.A.	N.A.
1958	2,434	N.A.	N.A.	N.A.
1959	3,337	N.A.	N.A.	N.A.
1960	3,027	2,021	423	583
1961	2,972	1,922	493	557
1962[E]	3,523	2,370	602	552
1963[E]	3,899	2,446	772	681

[E] Estimate based on 1963 Budget Submission.
Source: 17



amounts allocated to these and similar projects in the future will be even greater. Taken together with the anticipated increases in the budgets of other agencies, particularly NASA, the space program is clearly destined to become a major market for the aerospace industries.

During this fiscal year the Army will proceed with the development, test, and evaluation of the NIKE-ZEUS program at a cost of about one-quarter billion dollars. By the time this phase of the program is completed, the Army will have invested in it a total of about $1.75 billion.

In addition to NIKE-ZEUS, the Defense Department is continuing its efforts to expand the present limited knowledge of the entire problem of detecting, tracking, intercepting, and destroying attacking ballistic missiles. This series of studies, called Project DEFENDER, currently involves expenditures of over $100 million a year.

Guided Missiles Procurement:

The Army is continuing production of the Hawk, Redeye, Pershing, Sergeant, improved Honest John and Little John rockets, as well as anti-tank missiles. The Navy will continue the Sidewinder and Sparrow

GUIDED MISSILES, EMPLOYMENT BY MAJOR INDUSTRIES
August 1961

Industry Title	Number of Establishments	Missile Employment (Thousands)	Per Cent of U.S. Total	Per Cent Change from October 1958[a]
TOTAL—ALL INDUSTRIES	481	565.4	100.0	+ 9.2
Aircraft and Parts	113	140.3	24.8	+ 9.9
Ordnance and Accessories[b]	36	139.6	24.7	+14.2
Electrical Machinery, etc.	132	141.2	25.0	+ 5.0
Miscellaneous Business Services	34	32.7	5.8	+ 3.8
Professional and Scientific Instruments, etc.	33	22.0	3.9	+ 4.9
Federal Government	28	42.8	7.6	+ 9.0
Machinery (except Electrical)	13	8.1	1.4	+16.5
All Others	74	38.7	6.8	N.A.

N.A.—Not available.
[a] Percent change based on establishments reporting in both years.
[b] In this category are listed plants whose major product does not fall into any other industry Many of these plants are owned or operated by aircraft companies.
Source: 32

EMPLOYMENT TRENDS IN REPORTING ESTABLISHMENTS IN 19 MAJOR LABOR MARKET AREAS WITH EMPLOYMENT IN MISSILES OF 5,000 OR MORE AUGUST 1960 AND AUGUST 1961
(Employment in Thousands)

	Missile Employment in Reporting Establishments August 1961	Per Cent Change in Missile Employment Aug. 1960 to Aug. 1961	Missile Employment as % of Manufacturing Employment Aug. 1961
TOTAL, U. S.	565.4	+ 9.2	3.5
TOTAL, 19 Areas	392.9	+10.0	8.5
PER CENT: 19 Areas of U. S. Total	69.5	—	—
Los Angeles-Long Beach, Calif.	127.2	+16.2	16.4
San Jose, Calif.	25.6	+27.3	30.0
San Diego, Calif.	23.1	+28.6	32.4
Philadelphia, Penna.	22.6	n.c.	4.2
New York, N. Y.	22.4	— 2.9	2.0
Baltimore, Md.	20.4	+11.3	10.4
Boston, Mass.	19.2	—10.0	6.6
St. Louis, Mo.	9.0	—14.3	3.7
Paterson-Clifton-Passaic, N. J.	6.9	+12.2	4.4
Minneapolis-St. Paul, Minn.	6.9	— 6.8	4.5
Buffalo, N. Y.	6.3	+22.4	3.8
Newark, N. J.	5.9	— 6.8	2.6
Washington, D. C.	5.4	+ 7.2	15.0
Dallas, Texas	5.2	+ 3.8	5.5

NOTE: Data on Seattle, Wash.; Sacramento, Calif.; Denver, Colo.; Lawrence-Haverhill, Mass.; and Milwaukee, Wisc. are withheld to prevent disclosure of individual firm data.
n.c.—No change.
Source: 32

missiles, Bullpup, Shrike, Subroc and Polaris, and continues the integration of Terrier, Tartar, and Talos into the active fleet. The Air Force will complete procurement of the 13-squadron Atlas ICBM program, the Titan I program, and substantial procurement of the Titan II program, and has commenced the installation and checkout of the Minuteman program. Sky Bolt procurement will be initiated, and sizable procurement of the Bullpup will continue. Sidewinder also will be procured.

Major DOD Research and Development Efforts:

In missiles, a major effort is continued on ballistic missile defense and test of the Nike-Zeus system. Development continues on Minuteman, Sky Bolt and Polaris. Development has been initiated on a new solid-propellant, medium-range ballistic missile. Other development projects

EMPLOYMENT TRENDS IN REPORTING ESTABLISHMENTS WITH MISSILES ACTIVITY, BY REGION AND SELECTED STATES, AUGUST 1960 AND AUGUST 1961
(Employment in Thousands)

Region and Selected States	Number of Reporting Establishments	Missiles Employment		Employment Change % August 1960-August 1961
		Number	Per Cent of Total[a]	
TOTAL	481	565.4	100.0	+ 9.2
Northeast	143	120.6	21.3	— 0.4
Massachusetts	20	37.0	6.5	— 5.6
New York	52	34.7	6.1	+ 2.8
New Jersey	28	23.5	4.2	+ 8.5
Pennsylvania	25	16.7	3.0	—10.8
Connecticut	12	6.6	1.2	+11.3
North Central	83	49.8	8.8	— 7.5
Ohio	21	12.9	2.3	+ 1.2
Missouri	6	11.0	1.9	—12.3
Wisconsin	5	6.9	1.2	+ 8.5
Minnesota	8	6.8	1.2	— 6.8
Michigan	10	5.5	1.0	—32.6
South	80	103.7	18.3	+11.5
Maryland	17	30.5	5.4	+17.3
Florida	11	26.0	4.6	+16.5
Alabama	9	16.2	2.9	+18.0
North Carolina	7	13.0	2.3	+ 3.0
Texas	13	7.7	1.4	— 2.5
Tennessee	3	5.4	1.0	— 6.7
West	175	291.2	51.5	+16.6
California	147	209.0	37.0	+18.4
Utah	8	12.3	2.2	+26.4
Arizona	7	7.5	1.3	+ 9.6
New Mexico	5	6.3	1.1	+ 1.6

[a] Regional items do not add to total due to rounding.
NOTE: Data from Washington and Colorado are withheld to prevent disclosure of individual firm data.
Source: 32

include the Typhon, Subroc and Mauler. In the field of military astronautics, development programs continue on navigation satellites, communication satellites, reconnaissance and early warning satellites, as well as launch vehicles. R&D on very large solid-rocket boosters will continue and an improved multi-purpose space booster system using both solid and storable liquid propellants will be developed.

SALES OF MISSILES AND ENGINES[a], 1961
BY AEROSPACE MANUFACTURERS
(Millions of Dollars)

Period	Missile Systems	Engines[a]
First Quarter	$939	$191
Second Quarter	946	200
Third Quarter	901	190
Fourth Quarter	869	215
TOTAL	$3,655	$796

[a] Includes engines and/or propulsion units for military space vehicles.
Source: 13

DRONES IN PRODUCTION OR DEVELOPMENT

Name and Designation	Service	Prime	Airframe	Power Plant	Guidance
1025	Army	Beech	Beech	McCulloch	Babcock & Summers
KD2B-1	Navy	Beech	Beech	Rocket-dyne	
KD2R-5	Navy	Northrop Ventura	Northrop Ventura	McCulloch	
DSN-3	Navy	Gyrodyne	Gyrodyne	Boeing	
Q-2C/124E	USAF/Navy/ Army	Ryan	Ryan	Conti-nental	Lear
SD-2	Army	Rheem	Aerojet	Lycoming	Sperry Rand
SD-5	Army	Fairchild	Fairchild	Pratt & Whitney	
RP-76/78	Army/Navy	Radioplane	Radioplane	Aerojet	Radioplane
"Roadrunner," "Redhead"	Army	North American	North American	Marquardt	Babcock

Source: 17

U. S. MISSILE & ROCKET PROGRAM

Project	Service	Systems Contractor	Propulsion		Guidance Mfgr.	Status
			Mfgr.	Type		
Surface-to-Air						
BOMARC "A"	AF	Boeing	Aerojet-Marquardt	Liquid	IBM/Westinghouse	Operational
BOMARC "B"	AF	Boeing	Thiokol-Marquardt	Ramjet-Solid	Kearfott-Westinghouse	Operational
HAWK	Army	Raytheon	Aerojet	Solid	Raytheon	Operational
MAULER	Army	General Dynamics	Lockheed	Solid	General Dynamics	Development
NIKE-AJAX	Army	Western Electric	Thiokol	Solid/Liquid	Western Electric	Operational
NIKE-HERCULES	Army	Western Electric	Hercules-Thiokol	Solid	Western Electric	Operational
NIKE-ZEUS	Army	Western Electric	Thiokol	Solid	Bell Telephone	Development
TALOS	USN	Bendix	Navy/Bendix	Solid-Ramjet	Bendix/Sperry	Operational
TARTAR	USN	General Dynamics/Pomona	Aerojet	Solid		Operational
TERRIER	USN	General Dynamics/Pomona		Solid		Operational
TYPHON (medium range)	USN	General Dynamics/Pomona	ABL	Solid	Bendix/Gen. Dynamics	Development
TYPHON (long range)	USN	Bendix	ABL/Bendix	Solid/Ramjet	Bendix/Gen. Dynamics	Development
Air-to-Air						
FALCON	AF	Hughes	Thiokol	Solid	Hughes	Operational
GENIE	AF	Douglas	Aerojet	Solid	Unguided	Operational
SIDEWINDER	USN/AF	USN	USN	Solid	Philco/GE	Operational
SPARROW III	USN	Raytheon	Aerojet	Solid	Raytheon	Operational
Surface-to-Surface						
DAVY CROCKETT (man-carried)	Army	Army				Operational
ENTAC (man-carried)	Army	Nord			Wire-Guided	Operational
JUPITER	AF	Chrysler	North American	Liquid	Ford Instrument	Operational
LITTLE JOHN	Army	Emerson Electric	Hercules Powder	Solid	Unguided	Operational
LACROSSE	Army	Martin	Thiokol	Solid	IT&T	Operational (phase out '62)

U. S. MISSILE & ROCKET PROGRAM—*Continued*

Project	Service	Systems Contractor	Propulsion		Guidance Mfgr.	Status
			Mfgr.	Type		
M-55 (man-carried)	Army	Norris-Thermador				
PERSHING	Army	Martin	Thiokol	Solid	Bendix	Operational (late '62)
REDSTONE	Army	Chrysler	North American	Liquid	Ford Instrument	Operational
SERGEANT	Army	Sperry/Utah	Thiokol	Solid	Sperry	Operational
SHILLELAGH	Army	Ford Aeronutronics				Development
SS-10	Army	Nord/GE			Wire-Guided	Operational
SS-11	Army	Nord/GE				Operational
HONEST JOHN	Army	Douglas-Emerson	Hercules	Solid	Unguided	Operational
ATLAS D E & F	AF	General Dynamics	North American	Liquid	D-GE/ Burroughs E, F, ARMA	Operational
MACE	AF	Martin	Thiokol-Allison	Solid and Turbojet	A.C. Spark Plug	Operational
MINUTEMAN	AF•	Boeing	Thiokol Aerojet	Solid	North American	Operational
THOR	AF	Douglas	North American	Liquid	A.C. Spark Plug	Operational
TITAN I	AF	Martin	Aerojet	Liquid	Bell Tel Labs/Remington Rand	Operational
TITAN II	AF	Martin	Aerojet	Liquid	A.C. Spark Plug	Development
TITAN III (Standardized space launch vehicle)						
POLARIS*	USN	Lockheed	Aerojet	Solid	GE/MIT Hughes	Operational
Air-to-Surface						
BULLPUP	USN/AF	Martin, Maxon Electronics (second source)	USN and Thiokol	Solid and Liquid	Martin Maxon Electronics (second source)	Operational
HOUNDDOG	AF	North American Autonetics	Pratt & Whitney	Turbojet/ Nuclear	North American Autonetics	Operational
SKYBOLT	AF	Douglas	Aerojet	Solid	Northrop	Development
SHRIKE	USN	USN		Solid	Texas Instrument, Inc.	Development
ZUNI	USN	USN	USN	Solid	Unguided	Operational
Surface-to-Underwater (ASW)						
ALPHA	USN	Avco		Solid	Unguided	Operational (on destroyer-escorts)
ASTOR	USN	Westinghouse		Electric/ Torpedo		
ASROC	USN	Minneapolis-Honeywell		Solid/ Torpedo		Operational
SUBROC	USN	Goodyear	Thiokol	Solid	Kearfott	Development
TERNE	USN	Norway-USA Arma		Solid		

* Under Water To Surface.
Source: 17

SPACE PROGRAMS

The twelve-month period following April 1, 1961, was without question the most eventful period in the brief history of American space flight. It was marked by the first U. S. manned orbital space mission, preceded by two piloted suborbital flights, and by new gains in meteorological, communications, navigational and scientific satellites. There was also increased activity in military space research.

The year's effort brought to 70 the number of projects successfully launched by the U. S. since January 31, 1958, when Explorer I went into orbit. The Soviet Union's total reached 17, including two manned orbital flights.

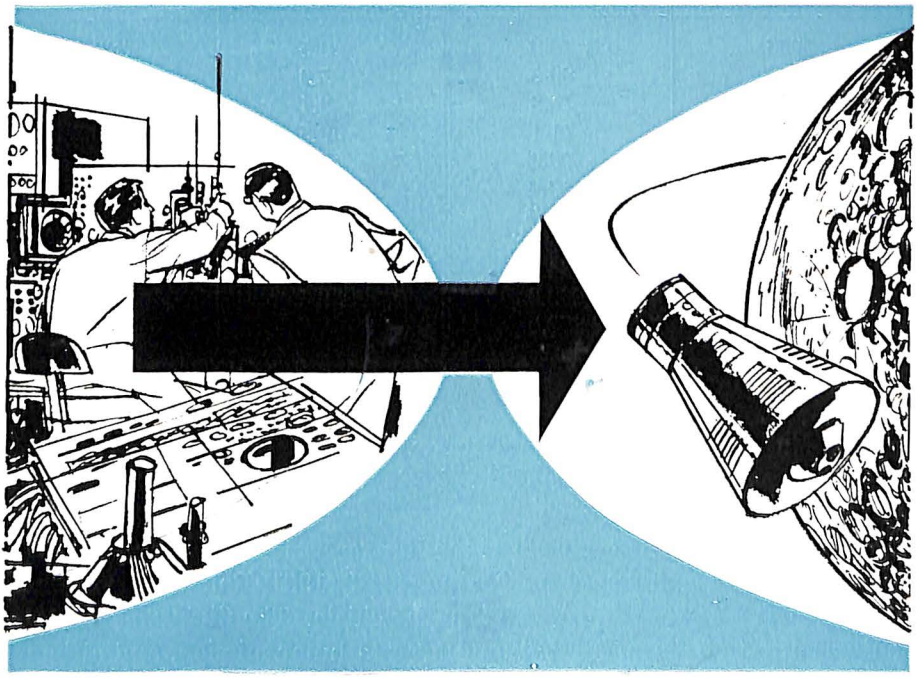
The most dramatic and far-reaching American success of the year occurred on February 20, 1962, when astronaut Lieutenant Colonel John H. Glenn, USMC, was launched into a three-orbit mission in a Mercury capsule. Launched by an Atlas D booster from Cape Canaveral, Fla., the Mercury capsule went into an elliptical orbit with an apogee of 163 miles and a perigee of 100 miles, girdling the globe in 88.5 minutes. Glenn covered approximately 81,000 miles during his four-hour and 56-minute flight. He was weightless for four hours and 45 minutes and experienced a maximum acceleration of eight "G's."

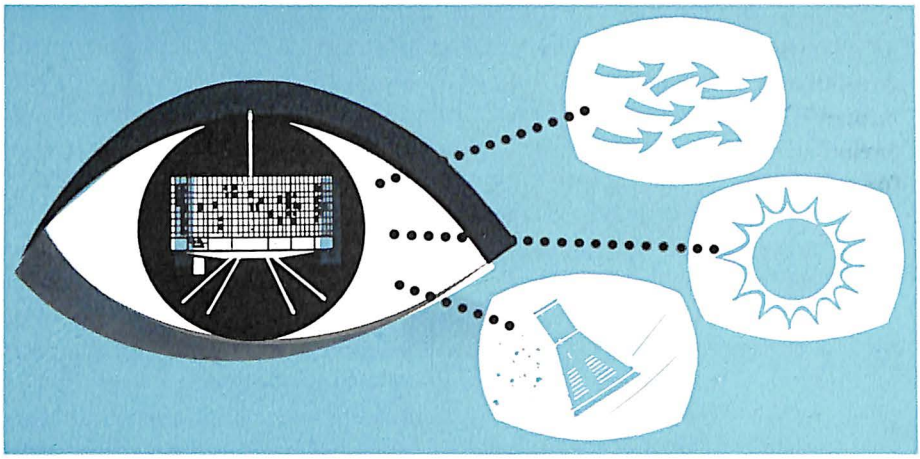
Glenn's mission was the fifth manned space flight during the 12 months after April 1, 1961. The first took place on April 12, 1961, when the USSR launched the spacecraft *Vostok* with Red Air Force Major Yuri Gagarin aboard. Gagarin completed a single orbit mission. On

May 5, U. S. astronaut Commander Alan B. Shepard, Jr., USN, made a successful sub-orbital mission in the Mercury capsule, reaching an altitude of 115 miles and remaining aloft 15 minutes. On July 21, astronaut Captain Virgil Grissom, USAF, completed a similar Redstone-boosted suborbital flight, climbing to 118 miles. The fourth manned spacecraft was launched by the Soviet Union on August 6, 1961. Named Vostok II, it carried Red Air Force Major Gherman Titov into a 17-orbit mission with an apogee of 115 miles a perigee of 110 miles. The spacecraft was recovered on land the following day but Titov parachuted before landing.

In addition to these manned space flight achievements, the 12-month period ending March 31, 1962, saw the successful launch of a number of unmanned spacecraft. These projects included:

TIROS. The National Aeronautics and Space Administration's program aimed toward development of a global weather satellite system for increasing the accuracy of weather forecasting progressed during the 12-month period. There were two new Tiros satellites: Tiros III and Tiros IV, the former launched from the Atlantic Missile Range on July 12, 1961, the latter on February 8, 1962. These two satellites were more advanced than their predecessors in the Tiros series in that they carried two wide-angle TV cameras and an additional infrared experi-





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

Year Ending June 30	TOTAL	Conduct of Research and Development	Increase in Research and Development Plant
1953	$ 78.6	$49.5	$29.1
1954	89.5	47.6	41.9
1955	73.8	43.4	30.4
1956	71.1	50.5	20.6
1957	76.0	55.2	20.8
1958	89.2	72.0	17.2
1959	145.5	114.7	30.8
1960	401.0	346.7	54.3
1961	744.3	487.0	98.2
1962[E]	1,292.0	932.5	149.8
1963[E]	2,252.0	2,012.5	217.8

[E] Estimate.
Source: 24

ment. Both sent back thousands of excellent cloud cover photographs which were put to use by the U. S .Weather Bureau. Both satellites were launched by a Delta vehicle.

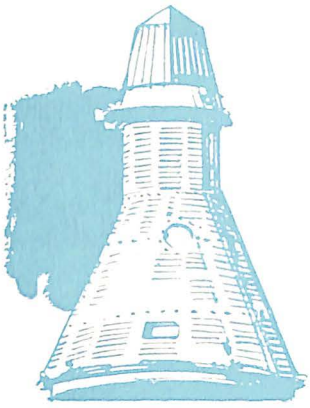
RANGER. The first models of the Ranger series of lunar probes were launched with partial success. On August 23, 1961, Ranger I was placed in earth orbit by an Atlas-Agena launch vehicle. The flight was intended only as a test of the spacecraft and not as a lunar mission, and although

it went into a lower orbit than that programmed, NASA pronounced the test successful. On November 18, 1961, Ranger II was placed in orbit on a similar test. Ranger III, designed to impact the moon, was launched January 26, 1962. Due to an error in injection, the spacecraft failed to impact the moon and went into orbit around the sun, with a solar orbiting period of 406.4 days. The lunar-impacting Ranger spacecraft, designed for "hard" or crash landings on the moon, carry television cameras for

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
OBLIGATIONS FOR
RESEARCH, DEVELOPMENT AND OPERATION
Program and Financing (in thousands of dollars)

	Obligations		
	1961 Actual	1962 Estimate	1963 Estimate
Program by activities:			
1. Manned space flight:			
(a) Spacecraft development and operations	$117,265	$210,036	$876,887
(b) Launch vehicle development	171,919	318,016	747,983
2. Space applications:			
(a) Meteorology	18,126	52,614	51,185
(b) Communications	13,501	51,889	85,377
3. Unmanned investigations in space:			
(a) Spacecraft development and operations	163,199	310,564	467,882
(b) Launch vehicle development	85,721	80,124	75,879
4. Space technology:			
(a) Launch vehicles and spacecraft	40,962	64,196	107,260
(b) Propulsion and space power	121,973	201,410	344,827
5. Aircraft and missile technology	38,810	42,225	52,588
6. Supporting operations	38,648	97,929	158,410
Total direct appropriations to NASA	810,124	1,429,003	2,968,278
Reimbursable from other appropriations:			
1. Space applications:			
(a) Meteorology	—	34,780	40,600
(b) Communications	—	11,106	—
2. Unmanned investigations in space:			
(a) Spacecraft development and operations	138	—	—
3. Space technology:			
(a) Launch vehicles and spacecraft	—	250	—
(b) Propulsion and space power	2	7,100	28,700
4. Aircraft and missile technology	14,900	27,968	23,162

Source: 24



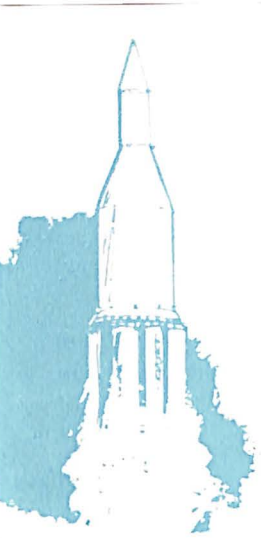
transmission of pictorial lunar data prior to the crash. They also contain a lunar seismometer, designed to survive the impact and transmit data on "moonquakes."

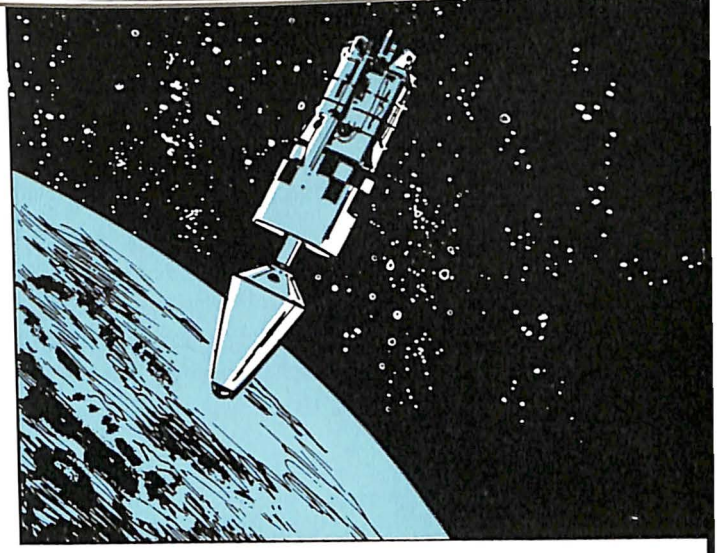
TRANSIT. The Navy-directed Transit program, designed to produce an operational satellite as a navigational aid for submarines, ships and aircraft, scored two new successes. Transit 4A was sent into orbit on June 29, 1961; Transit 4B was successfully launched on November 15, 1961. Launch vehicle for both satellites was the Thor-Able-Star. Each of the Transit satellites carried a secondary or tertiary "passenger"

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
OBLIGATIONS FOR
RESEARCH AND DEVELOPMENT
Program and Financing (in thousands of dollars)

	Obligations		
	1961 Actual	1962 Estimate	1963 Estimate
Program by activities:			
1. Manned space flight	$21,267	$150,680	$675,682
2. Space applications	2,560	6,720[a]	3,175
3. Unmanned investigations in space	13,679	33,187	12,200
4. Space technology	17,753	49,787	85,371
5. Aircraft and missile technology	11,292	5,771	2,182
6. Supporting operations	31,643	28,523	50,123
Total direct	98,194	274,668	828,679

[a] For 1962, an additional $11.1 million will be financed by transfers to NASA from amounts appropriated to other agencies.
Source: 24





satellite. Transit 4A had two passengers: a cosmic radiation experiment named Injun, and an experiment in solar X-ray radiation measurement named Greb III. Transit 4B's passenger was TRAAC, an experiment designed to test the feasibility of spacecraft stabilization utilizing the earth's gravitational field.

EXPLORER. The Explorer series of scientific satellites, originally developed by the Army and later turned over to NASA, added three more successes: Explorer 11, launched by a Juno II vehicle on April 27, 1961; Explorer 12, sent into orbit on August 15, 1961, by a Delta vehicle; and Explorer 13, launched August 25, 1961 by a solid-fuel Scout rocket. Explorer 11 contained a telescope to detect and map high energy gamma rays. This was the first attempt at astronomical observations from an orbiting satellite. Explorer 12 sent back to earth data on solar winds, magnetic fields and energetic particles in space. Explorer 13's assignment was an investigation of micrometeoroid impact and penetration.

DISCOVERER. The Air Force continued to launch and recover its Discoverer satellites, aimed at testing designs and techniques applicable to future military spacecraft. In the year following April 1, 1961, the USAF launched 10 more Discoverers. On five of these launches, the instrument capsule was recovered in mid-air; on two more, recovery was made after impact in the ocean. Recovery of the capsule, which is ejected from orbit, is a prime objective of the Discoverer program. Launch vehicle for the latest Discoverers was the Thor Agena B, Thor serving as the first stage and the 15,000-pound thrust Agena B serving as both second stage and satellite.

MIDAS. There were two additional launches of Midas (Missile Defense Alarm System) satellites. Midas 3 was launched from Point Arguello, Calif., on July 12, 1961, and Midas 4 was launched from the

same site on October 21, 1961. Both were placed in polar orbits and both were launched by the Atlas Agena B vehicle, with the 22-foot Agena being used as the satellite section. The Midas program calls for orbiting satellites containing infrared devices capable of detecting exhaust heat of an intercontinental ballistic missile shortly after launch, thereby providing warning of attack.

SAMOS. The Air Force's Samos (Satellite and Missile Observation System) is highly classified and few details have been released. On September 9, 1961, the third of this series was launched from Point

SELECTED MAJOR NASA CONTRACTORS
(Listed by rank according to net value of NASA prime contracts awarded, July 1, 1960-December 31, 1961)

	July 1, 1960 to Dec. 31, 1961	July 1, 1960 to June 30, 1961	July 1, 1961 to Dec. 31, 1961
U. S. TOTAL, ALL NASA CONTRACTS (in millions)	$754.4	$423.3	$331.1
Company	Per Cent of Total		
North American Aviation	16.3	17.7	14.4
McDonnell Aircraft	10.5	9.9	11.3
Douglas Aircraft	7.0	7.3	6.6
American Telephone and Telegraph[b]	4.5	6.3	2.2
Grumman Aircraft	2.8	2.6	3.0
Ling-Temco-Vought	2.7	2.1[c]	3.5
Chrysler	2.6	3.1	2.0
United Aircraft	2.4	[a]	5.6
Radio Corporation of America	2.1	2.0	2.2
Aerojet-General	2.1	1.5	2.9
General Electric	2.1	2.2	1.9
Hayes International	1.9	2.4	1.2
Bendix	1.7	1.5	2.0
Space Technology Laboratory	1.7	3.1	[a]
Brown Engineering	1.5	1.6	1.3
International Business Machines	0.9	[a]	2.0
Minneapolis-Honeywell	0.6	0.6	0.6
A. Venneri	0.6	0.5	0.7
Calumet & Hecla	0.6	0.5[d]	0.6
Electronics & Missiles Facilities	0.5	[a]	1.2
Rust Engineering	0.5	[a]	1.1
Hughes Aircraft	0.5	[a]	1.1
Lockheed Aircraft	0.4	0.8	[a]
Blount Brothers	0.4	[a]	1.0
Thompson Ramo Wooldridge	0.4	[a]	0.8

[a] Not in list of major contractors for indicated year.
[b] Includes Western Electric.
[c] Chance Vought only.
[d] Flexonics only.
Source: 36

SALES OF SPACE VEHICLE SYSTEMS[a], 1961
BY AEROSPACE MANUFACTURERS
(Millions of Dollars)

Period	Space Vehicle Systems	
	Military	Non-Military
First Quarter	$128	$32
Second Quarter	130	51
Third Quarter	138	54
Fourth Quarter	155	75

[a] Excludes engines and propulsion.
Source: 13

Arguello, Calif., but it failed to orbit. Earlier in the year, however, on January 31, 1961, Samos II was launched into polar orbit. Launch vehicle is an Atlas Agena-A, the latter being both second stage and satellite.

OSO. NASA's *OSO* (Orbiting Solar Observatory) was launched from the Atlantic Missile Range on March 21, 1962. The first attempt to give man a clear look at the sun, undistorted by the layer of atmosphere which surrounds the earth, the 440-pound OSO was launched by a three-stage Delta vehicle. OSO, placed in a near circular orbit 300 miles above earth, contained 13 experiments to measure a broad range of electromagnetic radiation in the ultraviolet x-ray and gamma ray regions. From these measurements, NASA will be able to study the elements in the sun, its composition and the intensity of its radiations.

Of significance to the future of space flight in the United States was the initial funding and the award of first contracts for elements of NASA's national lunar program, aimed at landing men on the moon within the decade, with a tentative target date of 1968. The major manned and unmanned phases of this program are these:

Ranger, a series of spacecraft designed to make a "hard" landing on the moon, sending back TV data prior to the crash landing and seismometer data after impact .

Surveyor, a more advanced lunar spacecraft, designed to "back down" to a "soft" lunar landing on a column of rocket thrust. Surveyor will contain a variety of instruments to telemeter back to earth data on a number of subjects.

MANNED SPACECRAFT LAUNCHINGS

Date	Astronaut	Vehicle	Booster	Flight
USA				
May 5, 1961	Cmdr. Allan B. Shepard, Jr., USN	Mercury-3 ("Freedom-7")	Redstone	Sub-orbital
July 21, 1961	Maj. Virgil I. Grisson, USAF	Mercury-4 ("Liberty Bell-7")	Redstone	Sub-orbital
Feb. 20, 1962	Lt. Col. John H. Glenn, Jr., USMC	Mercury-6 ("Friendship-7")	Atlas	3 Orbits
May 20, 1962	Lt. Comdr. Malcolm Scott Carpenter, USN	Mercury-7 ("Aurora-7")	Atlas	3 Orbits
USSR				
Apr. 12, 1961	Yuri Gagarin	Vostok I		1 orbit
Aug. 7, 1961	Gherman Titov	Vostok II		17 orbits

Source: 36

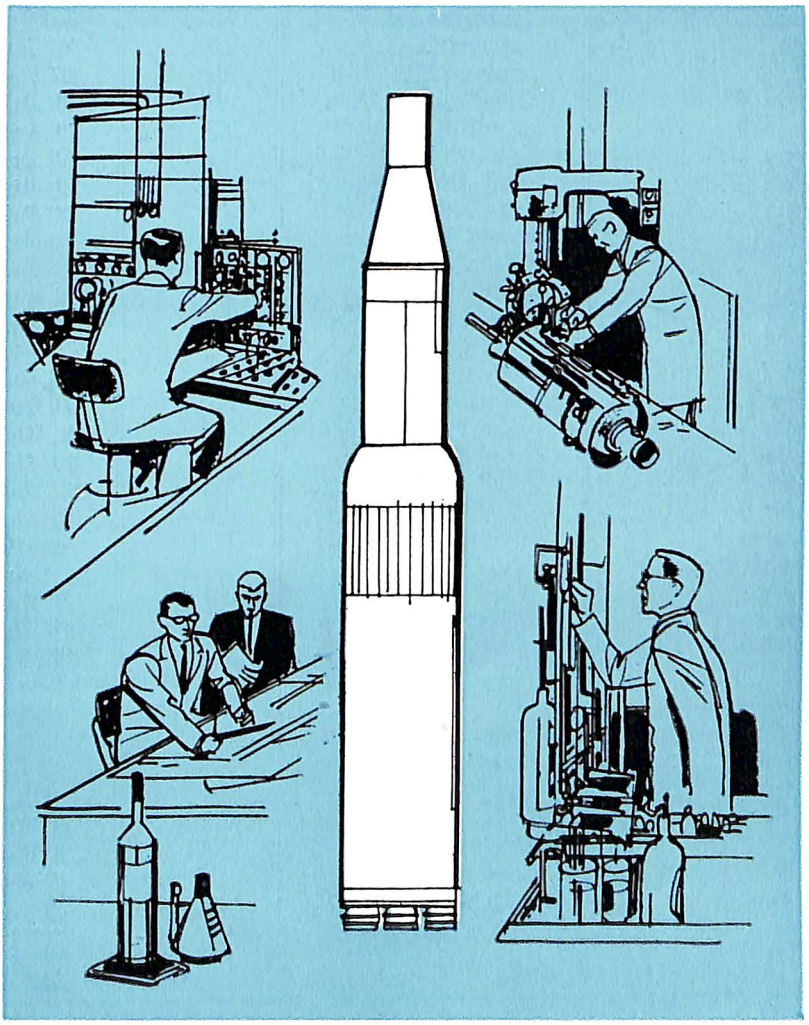
Prospector, a soft landing spacecraft with instrumentation similar to that of Surveyor, but with the added ability to move about on the lunar surface, permitting observations from a number of different areas.

Gemini, a manned follow-on program to Project Mercury, with a two-man capsule capable of remaining in space for longer durations than are possible in the Mercury spacecraft. To be launched in 1963-64, Gemini will also investigate space rendezvous techniques.

Apollo, which calls for landing three men on the moon. The manned lunar landing will be preceded first by a series of earth-orbiting missions in the three-man spacecraft at increasing distances from earth, later by circumlunar missions permitting close-in manned inspection of the moon prior to the lunar landing.

From the industry standpoint, fabrication of space equipment has become more important. The aerospace industry was producing a wide variety of space materiel, including spacecraft launch vehicles, guidance equipment, rocket power plants, reaction controls, environmental equipment and ground items such as tracking communications network components. In mid-1962, fabrication of space equipment has not yet reached significant proportions in terms of the over-all industry workload, but it was on a sharply rising curve. With national appropriations for military and scientific exploration for fiscal 1963 topping the $5 billion mark, and with currently-approved programs indicating substantial increases

in the later years of this decade, space equipment will become a much more important factor in industry operations in the near future. Since spacecraft and components are more complex, and since no mass production is indicated in the immediate future, participation in space programs by aerospace companies will further modify their operations. Continuing trends to shorter production runs, increasing emphasis on research and development, higher reliability, and continuing requirements for new facilities, will combine to increase the rate of change within the aerospace industry.



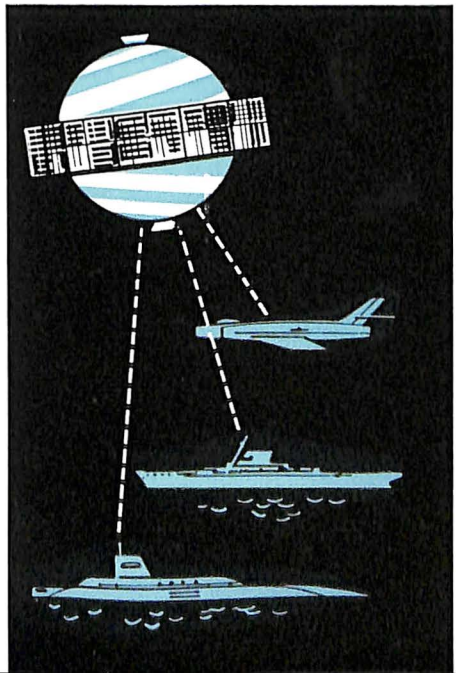
SPACE PROGRAM
OBJECTS IN ORBIT
UNITED STATES AND RUSSIAN LAUNCHINGS
AS OF JUNE 12, 1962

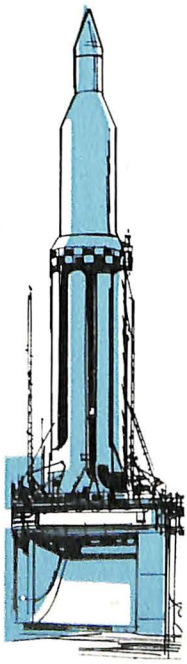
Object	Code Name	Source	Launch
1961 LAUNCHES			
Alpha 1	Samos II	US	31 Jan
Alpha 2	Metal Object	US	31 Jan
Gamma 1	Venus Probe	USSR	12 Feb
Delta 1	Explorer IX	US	16 Feb
Delta 2	Rocket Body	US	16 Feb
Delta 3	None	US	16 Feb
Epsilon 1	Discoverer XX	US	17 Feb
Kappa 1	Explorer X	US	25 Mar
Nu 1	Explorer XI	US	27 Apr
Omicron 1	Transit 4A	US	29 Jun
Omicron 2	Injun-SR-3	US	29 Jun
Omicron 3-45	Metal Objects	US	29 Jun
Omicron 47-89	Metal Objects	US	29 Jun
Rho 1	Tiros III	US	12 Jul
Rho 2	Rocket Body	US	12 Jul
Rho 3	Metal Object	US	12 Jul
Rho 4	Metal Object	US	12 Jul
Sigma 1	Midas III	US	12 Jul
Sigma 3	Metal Object	US	12 Jul
Sigma 4	Metal Object	US	12 Jul
Upsilon 1	Explorer XII	US	16 Aug
A Delta 1	Midas IV	US	21 Oct
A Delta 3	Metal Object	US	21 Oct
A Delta 4	Metal Object	US	21 Oct
A Delta 5		US	21 Oct
A Epsilon 1	Discoverer XXXIV	US	5 Nov
A Eta 1	Transit IV-B	US	15 Nov
A Eta 2	Traac	US	15 Nov
A Eta 3	Rocket Body	US	15 Nov
A Lambda 1		US	22 Dec
1962 LAUNCHES			
Alpha 1	Ranger III	US	26 Jan
Alpha 2	Rocket Body	US	26 Jan
Beta 1	Tiros IV	US	8 Feb
Beta 2	Rocket Body	US	8 Feb
Beta 3	Metal Object	US	8 Feb
Beta 4	Metal Object	US	8 Feb
Zeta 1	OSO 1	US	7 Mar
Zeta 2	Rocket Body	US	7 Mar
Eta 1		US	7 Mar

OBJECTS IN ORBIT—*Continued*

Object	Code Name	Source	Launch
Eta 3		US	7 Mar
Theta 2	Rocket Body	USSR	16 Mar
Iota 1	Cosmos II	USSR	6 Apr
Iota 2	Rocket Body	USSR	6 Apr
Kappa 1		US	9 Apr
Kappa 3		US	9 Apr
Kappa 4		US	9 Apr
Mu 2	Rocket Body	US	23 Apr
Nu 1	Cosmos 3	USSR	24 Apr
Nu 2	Rocket Body	USSR	24 Apr
Xi 2	Rocket Body	USSR	26 Apr
Omicron 1	Ariel	US/UK	26 Apr
Omicron 2	Rocket Body	US/UK	26 Apr
Sigma 1		US	15 May
Sigma 2		US	15 May
Sigma 3		US	15 May
Upsilon 1	Cosmos 5	USSR	28 May
Upsilon 2	Rocket Body	USSR	28 May
Phi 1		US	30 May
Phi 2		US	30 May
Chi 1		US	2 Jun
Chi 2	Oscar II	US	2 Jun
Chi 3		US	2 Jun

Source: 36





DECAYED OBJECTS
FOR PERIOD FROM JANUARY 1, 1961 THROUGH MAY 1, 1962

Code Name	Source	Launch	Decay
1961			
Sputnik VII	USSR	4 Feb	26 Feb 61
Rocket Body	USSR	4 Feb	12-13 Feb 61
None	USSR	4 Feb	17 Mar 61
Rocket Body	USSR	12 Feb	18 Feb 61
Sputnik VIII	USSR	12 Feb	25 Feb 61
None	USSR	12 Feb	13-18 Feb 61
None	US	16 Feb	Prior Jul 61
None	US	17 Feb	30 Mar-2 Apr 61
None	US	17 Feb	20 Apr 61
None	US	17 Feb	31 Oct 61
Discoverer XXI	US	18 Feb	20 Apr 62
Transit 3B & Lofti	US	22 Feb	30 Mar 61
Sputnik IX	USSR	9 Mar	9 Mar 61*
None	USSR	9 Mar	10 Mar 61
None	USSR	9 Mar	10 Mar 61
Sputnik X	USSR	25 Mar	25 Mar 61*
Rocket Body	USSR	25 Mar	26 Mar 61
None	USSR	25 Mar	26 Mar 61
Discoverer XXIII	US	8 Apr	16 Apr 62
None	US	8 Apr	10 Sep 61
Vostok	USSR	12 Apr	12 Apr 61
Rocket Body	USSR	12 Apr	16 Apr 61
Capsule	US	16 Jun	18 Jun 61**
Discoverer XXV	US	16 Jun	12 Jul 61
Metal Object	US	29 Jun	29 Jan 62
Discoverer XXVI	US	7 Jul	5 Dec 61
Capsule	US	8 Jul	9 Jul 61**
Metal Object	US	12 Jul	24 Jul 61
Vostok II	USSR	6 Aug	7 Aug 61
Rocket Body	USSR	6 Aug	9 Aug 61
Ranger 1	US	23 Aug	30 Aug 61
Rocket Body	US	23 Aug	3 Sep 61
Explorer XIII	US	23 Aug	28 Aug 61
Discoverer XXIX	US	30 Aug	10 Sep 61
Capsule	US	30 Aug	4 Sep 61**
Discoverer XXX	US	12 Sep	11 Dec 61
Capsule	US	12 Sep	15 Sep 61**
Metal Object	US	12 Sep	18 Sep 61
Metal Object	US	12 Sep	28 Sep 61
MA-4	US	13 Sep	13 Sep 61**
Rocket Body	US	13 Sep	13 Sep 61
Discoverer XXXI	US	17 Sep	26 Oct 61
Discoverer XXXII	US	13 Oct	13 Nov 61
Capsule	US	13 Oct	14 Oct 61**

Code Name	Source	Launch	Decay
Metal Object	US	13 Oct	25 Oct 61
Metal Object	US	13 Oct	16 Oct 61
	US	21 Oct	5 Dec 61
Metal Object	US	5 Nov	30 Nov 61
Metal Object	US	5 Nov	9 Dec 61
Metal Object	US	5 Nov	10 Dec 61
Metal Object	US	5 Nov	12 Dec 61
Discoverer XXXV	US	15 Nov	3 Dec 61
Capsule	US	15 Nov	16 Nov 61**
Metal Object	US	15 Nov	23 Nov 61
Ranger 2	US	18 Nov	20 Nov 61
MA-5	US	29 Nov	29 Nov 61**
Rocket Body	US	29 Nov	30 Nov 61
Discoverer XXXVI	US	12 Dec	8 Mar 62
Capsule	US	12 Dec	16 Dec 61**
Oscar	US	12 Dec	31 Jan 61
Metal Object	US	12 Dec	20 Dec 61
	US	22 Dec	31 Dec 61
1962			
Rocket Body	US	20 Feb	21 Feb 62
	US	21 Feb	9 Mar 62
Discoverer XXXVIII	US	27 Feb	21 Mar 62
Capsule	US	27 Feb	3 Mar 62**
Rocket Body	US	27 Feb	3 Mar 62
Metal Object	US	27 Feb	3 Mar 62
Metal Object	US	27 Feb	7 Mar 62
	US	7 Mar	31 Mar 62
	US	9 Apr	4 May 62
	US	18 Apr	20 Apr 62
	US	18 Apr	21 Apr 62
	US	18 Apr	21 Apr 62
Ranger IV	US	23 Apr	26 Apr 62*****
Rocket Body	USSR	26 Apr	29 Apr 62
Metal Object	USSR	26 Apr	3 May 62
	US	29 Apr	29 Apr 62
	US	29 Apr	1 May 62

*USSR announced successful re-entry and recovery.
**Successful re-entry and recovery.
*****Hit moon.
Source: 36

RESEARCH AND DEVELOPMENT

The Research, Development, Test and Evaluation (RDT&E) program is divided into six research and development categories by the Department of Defense. *First* is research. This includes all effort directed toward increased knowledge of natural phenomena and solution of problems in the various sciences, but excludes efforts directed to prove the feasibility of solutions of problems of immediate military importance or time-oriented investigations and developments. *Second,* exploratory development, which includes effort directed toward the solution of specific military problems short of major development projects. This may vary from time-oriented applied research to advanced bread-board hardware, study, programming, and planning efforts. It is pointed toward specific military problem areas with a view toward developing possible solutions and determining their characteristics. For example, there are exploratory developments in communications, surveillance and target acquisition, and air mobility in the Army; surveillance, aircraft, and ordnance and missiles in the Navy; and aerospace propulsion, materials, and nonnuclear weapons in the Air Force. The large programs in the Advanced Research Projects Agency such as DEFENDER (advanced anti-ballistic missiles studies) and VELA (detection of nuclear explosions) are also in this category.

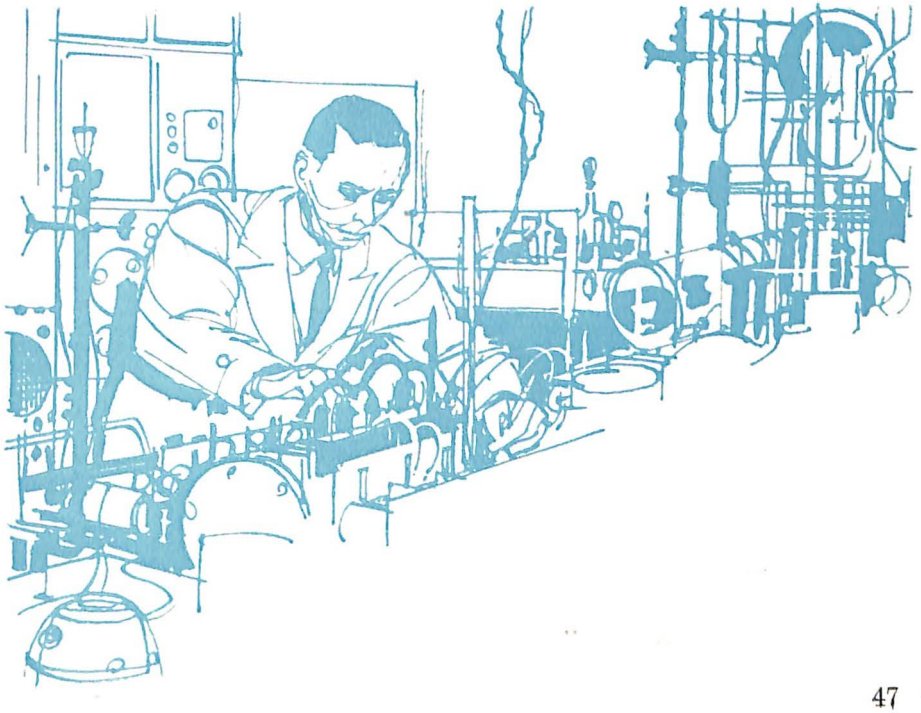
Third, a class called advanced developments, including all projects which have moved into the development of hardware for experi-

mental or engineering testing. Examples are VTOL aircraft, the X-15, experimental hydrofoil, et cetera.

Distribution by type of DOD FY 1963 RDT&E Budget:

Total	*100%*
Research	4
Exploratory Development	15
Advanced Development	14
Engineering Development	21
Operational Systems Development	29
Management and Support	17

The *fourth* category is that of engineering development. There are development programs being engineered for service use but not yet approved for procurement or operation. Examples are MAULER, TYPHON, B-70, NIKE-ZEUS, DYNASOAR, et cetera. *Fifth*, there is a corresponding category, called operational systems developments, which is the R&D effort directed toward development, engineering, and test of systems which have been approved for production and service employment, but otherwise have the same characteristics as engineering development programs, including such things as POLARIS, MINUTEMAN,



FEDERAL EXPENDITURES FOR RESEARCH AND DEVELOPMENT
(Millions of Dollars)

Year Ending June 30	TOTAL	Major National Security	Other
1940	$ 74	$ 26	$ 48
1941	198	144	54
1942	280	211	69
1943	602	472	130
1944	1,377	1,178	199
1945	1,591	1,372	219
1946	918	784	134
1947	898	768	130
1948	853	698	155
1949	1,080	889	191
1950	1,080	871	209
1951	1,298	1,063	235
1952	1,815	1,565	250
1953	3,101	2,832	269
1954	3,148	2,868	280
1955	3,268	2,979	289
1956	3,435	3,104	332
1957	4,460	4,027	433
1958	4,985	4,463	523
1959	5,792	5,048	744
1960	7,742	6,639	1,103
1961	9,291	7,719	1,572
1962[E]	10,244	7,820	2,424
1963[E]	12,365	8,572	3,793

[E] Estimate.
NOTE: Beginning with 1953, the figures include amounts for the research, development, test and evaluation appropriations; the amounts separately identified for development, test and evaluation in the procurement appropriations; and the amounts directly in support of research, development, test and evaluation in the military construction, shipbuilding, and military personnel appropriations. Research and development facilities are also included.
Source: 24

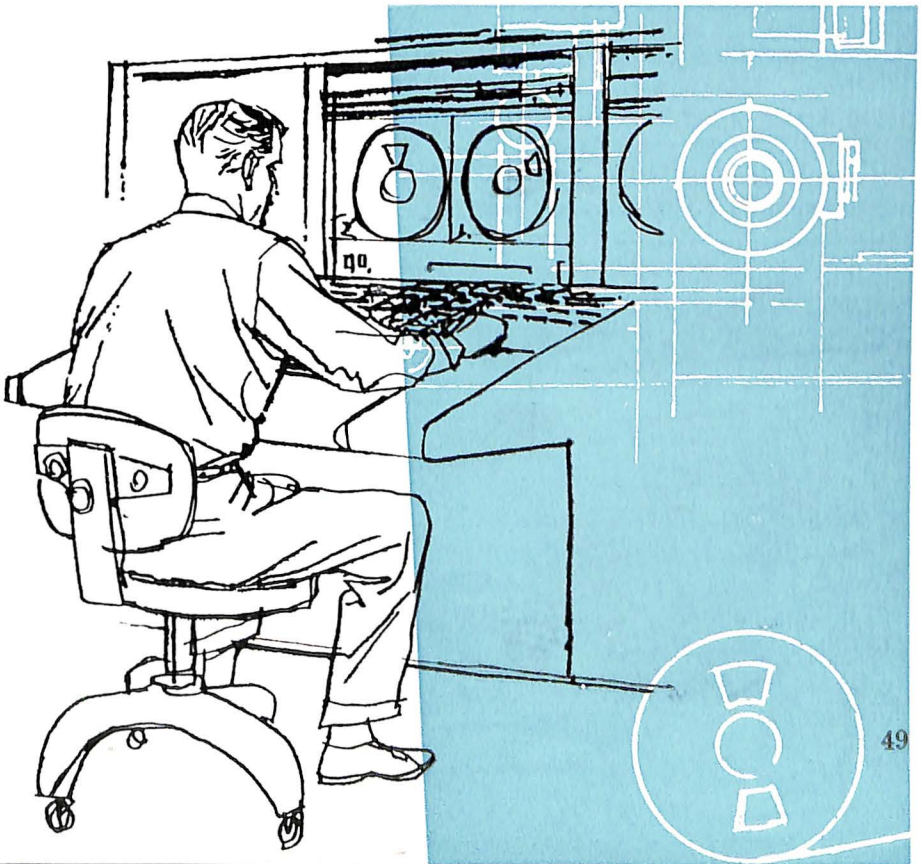
TITAN, et cetera. The *sixth* category is called management and support and includes R&D effort directed toward support of installations or operations required for general R&D use such as test ranges, maintenance support of laboratories, et cetera.

In this era of very complex and very expensive weapons systems, in which these systems are useless if not reliable and impractical if operational makeready takes too long, there are two principles that are followed in

converting new technology into weapon systems. The first is that there are a number of areas of advanced technology and exploratory development which are likely to prove necessary later on for various kinds of systems.

The second principle is that in the absence of the existence of reasonably well proven technology and components, major weapons systems developments are deferred. This is to avoid some of the expensive mistakes that have occurred in the past in trying to develop systems first and the technology on which they rest later. It is also designed to reduce the complexity and increase the reliability of major weapons systems.

Which these are is to some extent a matter of technical judgment. Examples are engine developments for VTOL aircraft, missile-fire control systems for interceptors and new highly reliable electronic components of various kinds. These technologies are pushed and pushed hard; even in the absence of a formally stated military requirement, because later major weapons systems will probably depend on them. Doing this reduces the motive for stating as military requirements things for which no reasonable military case can be currently made, in order to make sure that the technology is developed. By not tying technological development to formal military requirements extravagent claims is divided, and timely component development is assured.



DEPARTMENT OF DEFENSE-MILITARY FUNCTIONS
TOTAL EXPENDITURES, BY APPROPRIATION GROUP
FISCAL YEARS 1954-1963
(Millions of Dollars)

	FY 1954	FY 1955	FY 1956	FY 1957	FY 1958
Military Personnel	11,968	11,442	11,534	11,539	11,572
Active Forces	11,266	10,650	10,526	10,411	10,398
Reserve Forces	315	369	512	613	607
Retired Pay	387	424	495	515	567
Operation and Maintenance	9,462	8,276	8,768	9,734	10,221
Procurement	10,588	7,420	9,795	11,294	10,983
Aircraft	5,041	4,922	6,923	6,559	5,945
Missiles	569	234	764	2,135	2,090
Ships	759	1,150	1,274	1,335	1,723
Astronautics	—	—	—	—	—
Ordnance, Vehicles, & Related Equipment	2,990	527	405	247	90
Electronics and Communications	395	327	215	469	549
Other procurement	835	260	214	549	586
Research, Development, Test, and Evaluation	2,165	1,708	1,828	2,185	2,345
Military Construction	308	882	2,012	1,915	2,085
Civil Defense	—	—	—	—	—
Revolving and Management Funds	100	1,119	—	75	130
TOTAL—New Obligational Availability	34,590	30,847	33,937	36,742	37,337
Transfers from prior year balances	—	—60	—750	—487	—590
TOTAL—New Obligational Authority	34,590	30,787	33,187	36,255	36,747

(*Continued on next page*)

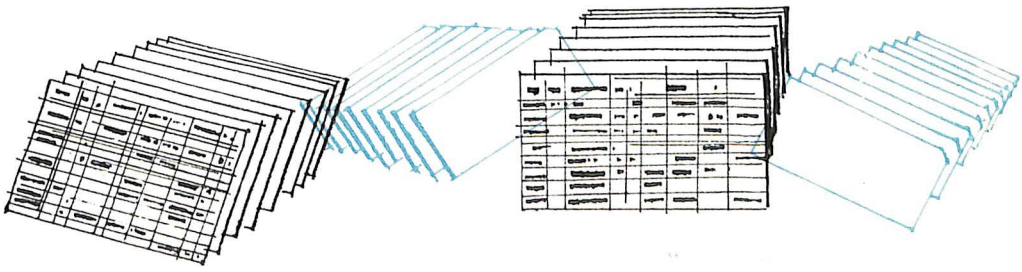
DEPARTMENT OF DEFENSE-MILITARY FUNCTIONS
TOTAL EXPENDITURES, BY APPROPRIATION GROUPS
FISCAL YEARS 1954-1963
(Millions of Dollars)

	FY 1959	FY 1960	FY 1961	FY 1962	FY 1963
Military Personnel	11,993	12,026	12,144	13,488	13,675
Active Forces	10,709	10,637	10,695	11,898	11,978
Reserve Forces	644	674	660	670	668
Retired Pay	640	715	790	920	1,029
Operation and Maintenance	10,187	10,317	10,702	11,870	11,609
Procurement	14,304	11,701	11,716	15,893	16,445
Aircraft	6,167	5,929	4,998	5,795	5,488
Missiles	3,966	2,030	2,078	3,256	4,011
Ships	1,943	1,140	2,246	2,938	2,982
Astronautics	—	—	—	—	—
Ordnance, Vehicles, & Related Equipment	545	703	1,034	1,830	2,004
Electronics and Communications	982	1,179	935	1,375	1,211
Other procurement	701	720	425	697	749
Research, Development, Test, and Evaluation	3,777	5,620	6,033	6,283	6,843
Military Construction	1,385	1,364	1,061	959	1,318
Civil Defense	—	—	—	255	695
Revolving and Management Funds	57	30	30	—	—
TOTAL—New Obligational Availability	41,703	41,058	41,686	48,748	50,585
Transfers from prior year balances	—535	—430	—366	—470	—445
TOTAL—New Obligational Authority	41,168	40,628	41,321	48,278	50,140

NOTE: Changes in the internal classification of accounts within the Department of Defense have made historical comparisons difficult. The Comptroller of the Department of Defense estimate the expenditures by functional title as if the fiscal year 1963 budget structure had been used throughout. The Research, Development, Test and Evaluation figures do not include expenditures for research and development facilities, nor do they include expenditures financed out of procurement and other appropriations.

This table is based on documents for fiscal year 1963 appropriations. Other tables in this chapter with date for 1961 and earlier have not been adjusted to the current budget structure.

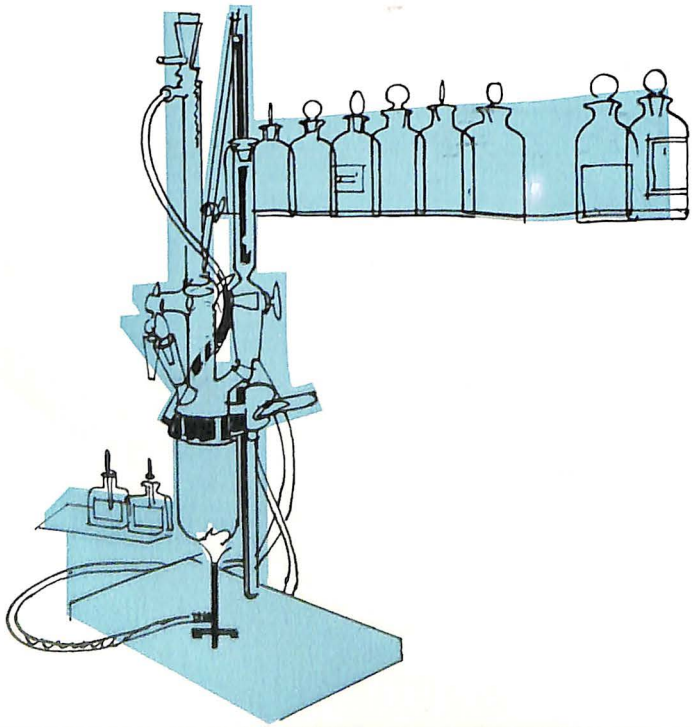
Source: 22



DEPARTMENT OF DEFENSE
EXPENDITURES FROM RESEARCH, DEVELOPMENT, TEST AND EVALUATION APPROPRIATIONS[a]
(Millions of Dollars)

Year Ending June 30	Department of Defense	Air Force	Navy	Army	Other
1951	758	269	327	162	-
1952	1,165	429	448	288	-
1953	1,411	530	499	382	-
1954	1,385	513	476	396	-
1955	1,391	524	467	400	-
1956	1,491	632	449	410	-
1957	1,687	729	523	435	-
1958	1,742	694	569	476	3
1959	2,859	813	798	539	709
1960	3,732	1,089	767	705	1,171
1961	6,131	1,659	1,192	1,082	2,198[b]
1962[E]	6,039	1,950	1,330	1,200	1,559[b]
1963[E]	6,650	3,040	1,380	1,280	950[b]

[E] Estimate.
[a] Adjusted to make data comparable to current appropriation structure. Does not include RDT&E expenditures from other appropriations.
[b] Includes $1 billion or more each year to adjust to current budget structure, leaving 1960 and earlier data not strictly comparable.
Source: 24



DEPARTMENT OF DEFENSE[a]

OBLIGATIONS FOR RESEARCH, DEVELOPMENT, TEST AND EVALUATION

(In Millions)

Purpose, budget title, and program	1961 actual	1962 estimate	1963 estimate
Conduct of research and development:			
Research, development, test, and evaluation:			
Military sciences	$ 620.5	$ 785.5	$ 964.4
Aircraft and related equipment	680.3	630.3	690.9
Missiles and related equipment	3,194.8	2,640.0	2,386.0
Military astronautics and related equipment	608.6	1,058.5	1,327.4
Ships and small craft and related equipment	212.9	211.3	234.4
Ordnance, combat vehicles, and related equipment	168.1	191.1	221.9
Other equipment	443.0	532.7	801.5
Programwide management and support	236.8	239.9	268.4
Emergency fund	—	99.5	150.0
Total, direct obligations, research, development, test, and evaluation	$6,165.0	$6,388.8	$7,044.9
Procurement[b]:			
Aircraft	112.7	71.2	8.2
Missiles	13.4	12.8	—
Ships	40.1	31.0	78.6
Other	3.7	—	—
Total, direct obligations, procurement	169.9	115.0	86.8
Military personnel	205.1	206.1	206.6
Civil Defense	—	15.5	17.0
Total, direct obligations for the conduct of research and development	$6,540.0	$6,725.4	$7,355.3
Research and development facilities	113.1	93.0	106.0
Total, direct obligations for research and development	$6,653.1	$6,818.4	$7,461.3

[a] Includes obligations made by USAF; Navy; Army; Advanced Research Projects Agency; Emergency Fund.

[b] Estimated amounts for items identified as development, test, and evaluation support

Source: 24

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

Program	1961	1962[E]	1963[E]
TOTAL DIRECT OBLIGATIONS	$3,468.3	$3,351.3	$3,644.9
Military sciences	133.2	164.9	169.3
Aircraft and related equipment	566.0	475.4	476.9
Missiles and related equipment	1,958.4	1,442.3	1,270.0
Military astronautics and related equipment	503.3	929.4	1,175.7
Ordnance, combat vehicles, and related equipment	1.3	2.0	0.9
Other equipment	225.0	257.2	469.0
Programwide management and support	81.1	80.1	83.1

[E] Estimate.
Source: 24

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

Program	1961	1962[E]	1963[E]
TOTAL DIRECT OBLIGATIONS	$1,330.1	$1,398.0	$1,470.0
Military sciences	139.4	150.6	164.0
Aircraft and related equipment	82.9	95.6	160.0
Missiles and related equipment	689.7	705.7	670.0
Military astronautics and related equipment	35.9	40.4	51.7
Ships and small craft and related equipment	212.1	210.6	233.0
Ordnance, combat vehicles, and related equipment	76.8	78.2	71.0
Other equipment	41.2	64.5	52.5
Programwide management and support	52.1	52.4	67.8

[E] Estimate.
Source: 24

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

Program	1961	1962[E]	1963[E]
TOTAL DIRECT OBLIGATIONS	$1,163.4	$1,295.0	$1,334.0
Military sciences	159.9	228.0	185.0
Aircraft and related equipment	31.4	59.2	54.0
Missiles and related equipment	546.7	492.0	446.0
Military astronautics and related equipment	55.2	87.0	100.0
Ships and small craft and related equipment	0.8	0.8	1.5
Ordnance, combat vehicles, and related equipment	89.9	111.0	150.0
Other equipment	176.8	211.0	280.0
Programwide management and support	102.7	106.0	117.5

[E] Estimate.
Source: 24

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

Year Ending June 30	TOTAL	Conduct of Research and Development					Increase in Research and Development Plant
		Total	Production and Weapons	Reactor Development	Biology, Medicine, Physics	Isotopes Development	
1954	$274.3	$229.5	$ 96.0	$ 70.6	$ 62.9	...	$ 44.8
1955	289.8	253.4	92.1	95.4	65.9	...	36.4
1956	385.1	335.5	106.4	155.1	74.0	...	49.6
1957	512.2	419.5	90.1	244.8	84.6	...	92.7
1958	637.0	516.1	110.6	289.6	115.9	...	120.9
1959	877.1	699.8	226.0	325.8	143.5	4.4	177.5
1960	986.3	761.7	223.5	361.7	166.8	9.6	224.6
1961	1,104.1	843.0	240.0	399.9	192.4	10.7	261.1
1962[E]	1,323.0	1,049.4	412.2	408.3	215.4	13.5	273.6
1963[E]	1,407.7	1,121.6	393.5	463.2	250.1	14.8	286.1

[e] Estimate
Source: 24

DEPARTMENT OF DEFENSE
UNOBLIGATED FUNDS AVAILABLE FROM
RESEARCH, DEVELOPMENT, TEST AND EVALUATION APPROPRIATIONS
FEBRUARY 28, 1962
TOTAL AND GUIDED MISSILES

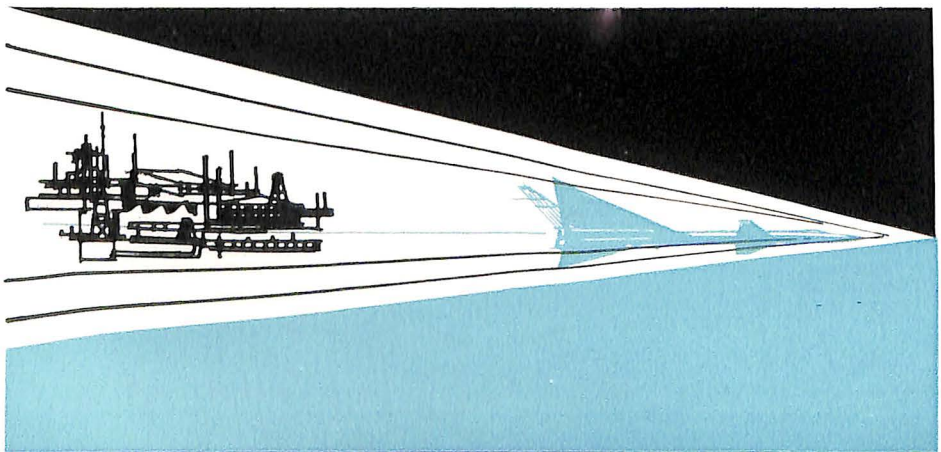
	TOTAL, Research, Development, Test & Evaluation	Guided Missiles	Guided Missiles as Percent of Total
Department of Defense	$2,702	$387	14.3
Air Force	1,540	192	12.5
Navy	454	114	25.1
Army	457	80	17.5
Office of Secretary of Defense	251	—	—

Source: 20

DEPARTMENT OF DEFENSE
UNPAID OBLIGATIONS FROM
RESEARCH, DEVELOPMENT, TEST AND EVALUATION APPROPRIATIONS
FEBRUARY 28, 1962
TOTAL AND GUIDED MISSILES

	TOTAL, Research, Development, Test & Evaluation	Guided Missiles	Guided Missiles as Percent of Total
Department of Defense	$3,093	$1,121	36.2
Air Force	1,017	124	12.2
Navy	956	538	56.3
Army	940	458	48.7
Office of Secretary of Defense	176	—	—

Source: 20



DEPARTMENT OF DEFENSE
UNOBLIGATED FUNDS AVAILABLE FROM
RESEARCH, DEVELOPMENT, TEST AND EVALUATION APPROPRIATIONS
FEBRUARY 28, 1962
TOTAL AND AIRCRAFT

	TOTAL, Research, Development, Test & Evaluation	Aircraft	Aircraft as Percent of Total
Department of Defense	$2,702	$299	11.1
Air Force	1,540	212	13.8
Navy	454	60	13.2
Army	457	28	6.1
Office of Secretary of Defense	251	—	—

Source: 20

DEPARTMENT OF DEFENSE
UNPAID OBLIGATIONS FROM
RESEARCH, DEVELOPMENT, TEST AND EVALUATION APPROPRIATIONS
FEBRUARY 28, 1962
TOTAL AND AIRCRAFT

	TOTAL, Research, Development, Test & Evaluation	Aircraft	Aircraft as Percent of Total
Department of Defense	$3,093	$311	10.1
Air Force	1,017	194	19.1
Navy	960	60	6.3
Army	940	57	6.1
Office of Secretary of Defense	176	—	—

Source: 20

FUNDS FOR INDUSTRIAL RESEARCH AND DEVELOPMENT
ALL INDUSTRIES AND AIRCRAFT INDUSTRY, 1957 TO DATE

Year	Total, All Industries	Aircraft and Parts	Electrical Equipment	Motor Vehicles and Other Transportation Equipment	Machinery	All Other
Total Research and Development Funds						
1957	$ 7,664	$2,540	$1,175	$702	$687	$2,560
1958	8,218	2,498	1,947	849	778	2,146
1959[a]	9,553	3,028	2,240	866	946	2,472
1960	10,497	3,482	2,405	849	993	2,768
Financed by the Federal Government						
1957	3,741	2,210	717	212	260	387
1958	4,636	2,126	1,331	318	316	545
1959[a]	5,610	2,610	1,575	249	404	772
1960	6,125	3,027	1,634	216	384	864
Funds for Basic Research						
1957	241	25	38	8	17	126
1958	295	20	56	6	20	193
1959[a]	345	42	63	9	24	207
1960	382	39	74	9	28	232

[a] Revised
Source: 39

RESEARCH AND DEVELOPMENT IN THE AIRCRAFT INDUSTRY, 1957-1960,
BY FUND SOURCE AND TYPE OF RESEARCH
(Millions of Dollars)

	1957	1958	1959[a]	1960[b]
Funds for R&D Performance, TOTAL	$2,540	$2,498	$3,028	$3,482
Source of funds:				
Federal Government	2,210	2,126	2,610	3,027
Company and other non-Government sources	330	373	418	455
Type of R&D:				
Basic research	25	20	42	39
Applied research and development	2,515	2,478	2,986	3,443

[a] Revised.
[b] Preliminary.
Source: 39

APPLIED RESEARCH AND DEVELOPMENT IN THE AIRCRAFT INDUSTRY BY PRODUCT FIELD, 1958, 1959

Product Field	Amount (Millions of Dollars)	
	1958	1959
Applied Research and Development Funds, TOTAL ...	$2,478	$2,986
Aircraft and Parts	727	956
Atomic energy	84	99
Chemicals	17	13
Electrical and communication equipment and electronic components	327	371
Guided Missiles	1,183	1,324
Machinery	20	97
Other transportation equipment	19	18
Primary metals	67	2
Professional and Scientific instruments	20	16
Other product fields	14	89

Source: 39

INDUSTRIAL RESEARCH AND DEVELOPMENT EXPENDITURES AS PER CENT OF NET SALES AND PER RESEARCH AND DEVELOPMENT SCIENTIST AND ENGINEER

Year	Average, All Industries	Aircraft and Parts	Electrical Equipment	Motor Vehicles and Other Transportation Equipment	Machinery	Industrial Chemicals
Research and Development Funds as a Per Cent of Sales						
1957	3.6	18.3	9.5	2.9	3.4	5.0
1958	3.8	17.7	10.5	4.2	3.6	5.4
1959	4.2	20.8	11.3	3.4	4.2	6.0
R & D Expenditures per R & D Scientist or Engineer						
1957	$33,300	$42,600	$39,600	$48,300	$26,200	$31,300
1958	32,900	39,500	38,300	52,500	27,300	31,700
1959	35,200	41,300	36,700	49,300	32,300	36,000

Source: 39

DEPARTMENT OF DEFENSE
RESEARCH, DEVELOPMENT, TEST, AND EVALUATION
FISCAL YEARS 1961-1963
(Millions of Dollars)

	Expenditures		
	FY 1961	FY 1962	FY 1963
RESEARCH, DEVELOPMENT, TEST, & EVALUATION—TOTAL	$6,131	$6,039	$6,650
Army	1,207	1,231	1,280
Navy	1,435	1,396	1,380
Air Force	3,300	3,183	3,470
Defense Agencies	189	230	520
Military Sciences—Total	507	658	900
Army	154	179	251
Navy	125	145	150
Air Force	106	147	129
Defense Agencies	122	187	370
Aircraft—Total	547	597	579
Army	26	29	21
Navy	90	99	110
Air Force	432	469	448
Missiles—Total	3,025	2,535	2,220
Army	554	548	462
Navy	803	720	665
Air Force	1,668	1,266	1,093
Ships—Navy	209	195	219
Astronautics—Total	518	729	1,038
Army	13	54	85
Navy	14	50	50
Air Force	428	614	904
Defense Agencies	64	12	—
Ordnance, Vehicles & Related Equipment—Total	212	185	182
Army	116	101	108
Navy	84	76	70
Air Force	12	8	4
Other Equipment—Total	561	465	639
Army	254	215	240
Navy	61	58	54
Air Force	246	193	345
Program-Wide Management & Support—Total	551	645	722
Army	91	105	113
Navy	49	52	62
Air Force	408	486	547
Defense Agencies	3	2	—
Emergency Fund	—	30	150

NOTE: All data are adjusted for comparability with FY 1963 appropriation structure.
Source: 18

MANPOWER

The product of the aerospace industry, whether it is designed for spacecraft, missiles or aircraft, becomes more complex each year. At the same time, the demand for product reliability is becoming greater. This has dictated a marked emphasis on research, development and test and consequently has had a dramatic impact on the composition of the industry's work force.

During the years of World War II, when the industry was concentrating on mass production of aircraft and the guided missile was still a vague shadow on the horizon, about nine out of ten industry employes were production line workers. In the post-war years, the growing complexity of aircraft brought about a demand for an increase in the more highly skilled labor categories.

In 1954, just after the Korean war, most military aircraft were of the subsonic variety. The airlines were still flying piston-engine equipment and the only missiles in service or in production were short-range, relatively complicated types. The mass production of World War II had given way to shorter production runs, and, although the aerospace industry products were considerably more complex than their wartime predecessors, the rally revolutionary period of industry change was barely under way.

At that time, hourly production workers constituted 71.6 per cent of the industry work force. This was a considerably lower portion than that of the wartime years, but in 1954, production workers were by far the majority of the total work force.

The demand for technical personnel, in 1954, was already on the upswing. A study by the University of Illinois broke down the per-

FUNDS FOR INDUSTRIAL RESEARCH AND DEVELOPMENT
ALL INDUSTRIES AND AIRCRAFT INDUSTRY, 1957 TO DATE

Year	Total, All Industries	Aircraft and Parts	Electrical Equipment	Motor Vehicles and Other Transportation Equipment	Machinery	All Other
Total Research and Development Funds						
1957	$ 7,664	$2,540	$1,175	$702	$687	$2,560
1958	8,218	2,498	1,947	849	778	2,146
1959[a]	9,553	3,028	2,240	866	946	2,472
1960	10,497	3,482	2,405	849	993	2,768
Financed by the Federal Government						
1957	3,741	2,210	717	212	260	387
1958	4,636	2,126	1,331	318	316	545
1959[a]	5,610	2,610	1,575	249	404	772
1960	6,125	3,027	1,634	216	384	864
Funds for Basic Research						
1957	241	25	38	8	17	126
1958	295	20	56	6	20	193
1959[a]	345	42	63	9	24	207
1960	382	39	74	9	28	232

[a] Revised
Source: 39

RESEARCH AND DEVELOPMENT IN THE AIRCRAFT INDUSTRY, 1957-1960,
BY FUND SOURCE AND TYPE OF RESEARCH
(Millions of Dollars)

	1957	1958	1959[a]	1960[b]
Funds for R&D Performance, TOTAL	$2,540	$2,498	$3,028	$3,482
Source of funds:				
Federal Government	2,210	2,126	2,610	3,027
Company and other non-Government sources	330	373	418	455
Type of R&D:				
Basic research	25	20	42	39
Applied research and development	2,515	2,478	2,986	3,443

[a] Revised.
[b] Preliminary.
Source: 39

APPLIED RESEARCH AND DEVELOPMENT IN THE AIRCRAFT INDUSTRY BY PRODUCT FIELD, 1958, 1959

Product Field	Amount (Millions of Dollars)	
	1958	1959
Applied Research and Development Funds, TOTAL	$2,478	$2,986
Aircraft and Parts	727	956
Atomic energy	84	99
Chemicals	17	13
Electrical and communication equipment and electronic components	327	371
Guided Missiles	1,183	1,324
Machinery	20	97
Other transportation equipment	19	18
Primary metals	67	2
Professional and Scientific instruments	20	16
Other product fields	14	89

Source: 39

INDUSTRIAL RESEARCH AND DEVELOPMENT EXPENDITURES AS PER CENT OF NET SALES AND PER RESEARCH AND DEVELOPMENT SCIENTIST AND ENGINEER

Year	Average, All Industries	Aircraft and Parts	Electrical Equipment	Motor Vehicles and Other Transportation Equipment	Machinery	Industrial Chemicals
Research and Development Funds as a Per Cent of Sales						
1957	3.6	18.3	9.5	2.9	3.4	5.0
1958	3.8	17.7	10.5	4.2	3.6	5.4
1959	4.2	20.8	11.3	3.4	4.2	6.0
R & D Expenditures per R & D Scientist or Engineer						
1957	$33,300	$42,600	$39,600	$48,300	$26,200	$31,300
1958	32,900	39,500	38,300	52,500	27,300	31,700
1959	35,200	41,300	36,700	49,300	32,300	36,000

Source: 39

centage distribution of technical personnel into two categories. First, there were the scientists and engineers, those who held a college degree in engineering, mathematics or the physical sciences. This group, in 1954, made up 13 per cent of the work force.

In addition, there were the semi-technical employes—draftsmen, engineering aides and other sub-professional personnel. This group, in 1954, constituted only three per cent of the industry's total force.

The remainder of the work force was made up of three groups. First, there was the category called "managerial," consisting of supervisory personnel at all levels. This group amounted to eight per cent of the total, while secretarial and stenographic personnel accounted for another two per cent. The final category—10 per cent of the total—was a catch-all lumping together professional positions other than managerial, such as finance and industrial relations, and clerical personnel.

In the five-year period after 1954, the rate of change in the aerospace industry began to accelerate. The era of the supersonic airplane had arrived, and speeds of military aircraft climbed to the Mach 2 level, bringing an attendant increase in complexity.

The changing trend continues today. With advance military aircraft in production, with second-generation missiles either in production or in

advanced development, and with manufacture of space equipment occupying more of industry's attention, the complexity curve continues to rise and the work force continues to change.

For the first time, the ratio of hourly production workers to total employment dropped below half. At the end of 1959, only 48 per cent of the industry's employes were in the production worker category.

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

Year	TOTAL	Salaries	Production Workers	
			Wages	Average Weekly Earnings
1914	$ 196	$ 61	$ 135	$15.45
1919	6,908	2,001	4,907	26.63
1921	3,235	1,033	2,202	30.36
1923	6,160	1,638	4,522	29.97
1925	N.A.	N.A.	4,222	30.06
1927	9,146	2,289	6,857	29.82
1929	31,448	9,524	21,924	28.66
1931	N.A.	N.A.	15,481	30.16
1933	13,824	3,516	10,308	25.36
1935	21,475	6,582	14,893	25.16
1937	46,867	13,514	33,353	26.72
1937[a]	N.A.	N.A.	43,827	27.74
1939	108,286	30,798	77,488	30.56
1947	703,693	227,396	476,297	54.98
1949	956,189	311,821	644,368	63.62
1950	1,132,017	371,773	760,244	68.39
1951	2,102,913	642,821	1,460,092	78.40
1952	3,140,534	1,003,510	2,137,024	81.20
1953	3,941,133	1,301,268	2,639,847	83.80
1954	4,048,811	1,423,511	2,625,300	85.07
1955	4,153,201	1,584,834	2,568,367	89.72
1956	4,882,071	1,937,243	2,944,828	95.99
1957	5,377,000	2,212,000	3,165,000	101.48
1958	4,720,050	2,044,229	2,675,821	103.02
1959	4,693,678	2,045,705	2,647,973	108.82
1960	4,653,495	2,225,351	2,428,144	112.07
1961[E]	4,850,000	2,400,000	2,450,000	117.00

NOTE: This table is based upon Census Bureau data which go back to an earlier period than the other data on compensation which are based on Bureau of Labor Statistics publications.
N.A.—Not available.
[a] This line and all following lines include data for aircraft engine manufacturers which are not available for prior years.
Sources: 10, 11

AIRCRAFT AND TOTAL MANUFACTURING EMPLOYMENT, 1914 TO DATE

Year or Month	Aircraft Employment (in thousands)	Total Manufacturing Employment (in thousands)	Aircraft as Per Cent of Total Manufacturing Employment
1914	0.2	7,514	[a]
1919	4.2	9,837	[a]
1921	2.0	7,557	[a]
1929	18.6	9,660	0.2
1933	9.6	6,558	0.2
1939	62.3	9,722	0.6
Dec. 1941	502.8	14,036	3.5
Nov. 1943	1,458.6	18,074	8.1
Sep. 1945	325.9	13,645	2.4
1948	237.7	15,582	1.5
1950	283.1	15,241	1.9
1953	795.5	17,549	4.5
1954	782.9	16,314	4.8
1955	761.3	16,882	4.5
1956	837.3	17,243	4.9
1957	895.8	17,174	5.2
1958	783.6	15,945	4.9
1959	755.4	16,667	4.5
1960	673.8	16,762	4.0
1961	668.9	16,268	4.1

NOTE: 1914 to 1933 data are from the Census Bureau, 1939 to date the data are from the Bureau of Labor Statistics.
[a] Less than .05 per cent.
Sources: 3, 34

The ratio of hourly production employes to total industry employment has now fallen to slightly more than 40 per cent, or only four out of every ten employes as opposed to the wartime ratio of nine out of ten. Technical personnel, including scientists and engineers with college degrees and the semi-technical group of draftsmen and engineering aides, now account for 25 per cent of the total. In other words, every fourth employe in the industry possesses a technical skill of some kind.

The miscellaneous group of clerks and non-managerial professionals amounts to 20 per cent of the total, while secretarial and stenographic workers take up three per cent. There has been another slight increase in managerial talent, which is up to more than 11 per cent of the total.

This trend toward increasing emphasis on employment of technical personnel and declining numbers of hourly production workers will con-

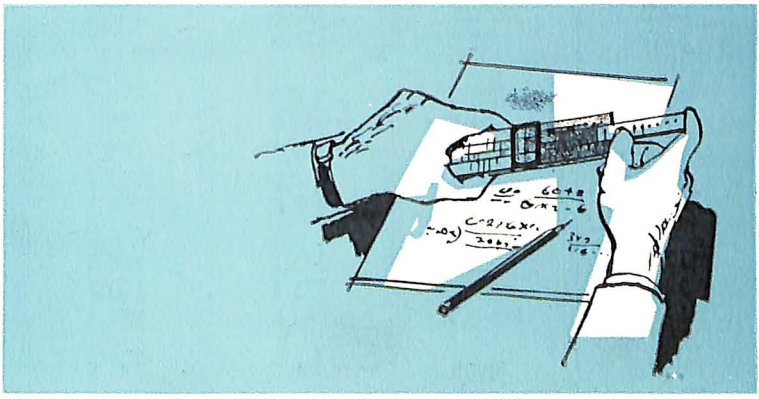
tinue throughout the decade, due to the demands for ever-increasing performance in weapons systems, spacecraft, commercial aircraft and related equipment. There will be slight increases in managerial personnel, secretarial and stenographic help and in the miscellaneous, catch-all category. These three groups combined will probably amount to 38 per cent of the work force by 1965. Of the remaining 62 per cent in that year, 29 per cent will be technical personnel and 33 per cent production workers.

By 1970, the study predicts there will be more technical personnel engaged in aerospace manufacture than hourly production workers. The study indicates that, at the end of the decade, production workers

SCIENTISTS AND ENGINEERS IN THE AIRCRAFT AND PARTS INDUSTRY
1954 TO DATE

Year	TOTAL	Engineers	Metallurgists	Chemists	Physicists	Mathematicians	Other
Total Number Employed							
1954[a]	48,500	41,100	700	1,000	1,200	900	3,500
1957	84,900	66,000	900	1,600	1,900	2,200	12,300
1959	94,900	83,100	1,300	2,600	4,000	3,300	600
1960	101,500	84,400	1,400	2,800	5,500	3,800	3,600
Research and Development							
1954[a]	27,600	22,500	400	700	1,000	800	2,200
1957	56,700	44,800	600	1,100	1,500	1,600	7,200
1959	60,400	51,100	1,000	1,900	3,700	2,500	200
1960	64,600	52,900	1,100	2,000	5,200	3,100	300

[a] Data are on slightly different basis from those for later years.
Source: 39



will account for only 29 per cent of the total work force, while the technical category will reach 32 per cent, a reversal of the ratios estimated for 1965.

According to Bureau of Labor statistics at the end of 1959, there were approximately 755,000 employes on the payrolls of industry companies, a decrease of only 30,000 from the 1954 total, but the composition of this work force had altered markedly.

Latest manpower figures indicate that employment in the aerospace industry of employes engaged in the manufacture of aircraft, missiles, spacecraft, propulsion systems and their components and accessories,

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

Monthly Average for the Year	TOTAL	Aircraft (Airframes)	Aircraft Engines and Parts	Other Aircraft Parts and Equipment
1939	63.2	45.1	11.3	6.8[E]
1940	148.6	101.8	31.4	15.4[E]
1941	347.1	234.6	75.3	37.2[E]
1942	831.7	549.6	192.0	90.1[E]
1943	1,345.6	882.1	314.9	148.6[E]
1944	1,296.6	815.5	339.7	141.4[E]
1945	788.1	489.9	210.9	87.3[E]
1946	237.3	159.0	49.9	28.4[E]
1947	239.3	158.5	50.1	30.7[E]
1948	237.7	158.0	48.6	31.1[E]
1949	264.2	175.3	53.6	35.3[E]
1950	283.1	188.4	57.0	37.7[E]
1951	467.8	313.3	95.0	59.5[E]
1952	670.6	425.9	148.6	96.1[E]
1953	795.5	472.4	191.2	131.9[E]
1954	782.9	470.0	178.2	134.7[E]
1955	761.3	466.6	168.0	126.7[E]
1956	837.3	494.4	194.9	148.0[E]
1957	895.8	519.0	213.2	163.6[E]
1958	783.6	448.5	184.3	150.8
1959	755.4	425.1	182.0	148.3
1960	673.8	371.4	170.5	131.9
1961	668.9	361.5	182.6	124.4
1962				
Feb.	699.9	385.7	191.8	122.4

[E] Estimate.
Source: 34

continued to decline in 1960, for the third consecutive year. Employment at year's end 1961 amounted to 693,900, the highest point in employment during the year. Average employment during the entire year amounted to 668,900.

Because of the high quality of skills demanded in its products, wages of aerospace industry employes are among the highest of all U.S. industry manufacturing employes. The hourly earnings in the aerospace industry continued to increase during 1961, climbing from an annual average of $2.62 in 1959, to $2.70 in 1960, to $2.78 in 1961. Correspond-

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

Monthly Average for the Year	TOTAL	Aircraft (Airframes)	Aircraft Engines and Parts	Other Aircraft Parts and Equipment
1939	49.6	34.8	9.5	5.3[E]
1940	118.0	79.2	26.5	12.3[E]
1941	278.3	183.8	65.0	29.5[E]
1942	674.8	433.9	168.3	72.6[E]
1943	1,090.5	692.1	278.8	119.6[E]
1944	1,016.0	616.3	290.3	109.4[E]
1945	591.0	360.5	164.9	65.6[E]
1946	167.5	113.1	34.0	20.4[E]
1947	176.7	117.4	36.5	22.8[E]
1948	175.2	117.4	34.9	22.9[E]
1949	196.6	132.2	38.6	25.8[E]
1950	209.4	140.4	40.8	28.2[E]
1951	348.4	234.8	66.5	47.1[E]
1952	495.4	315.0	105.5	74.9[E]
1953	586.2	346.8	136.1	103.3[E]
1954	560.2	335.1	121.6	103.5[E]
1955	525.5	322.5	108.5	94.5[E]
1956	561.0	330.3	122.5	108.2[E]
1957	591.4	342.4	132.1	116.9[E]
1958	499.4	287.6	107.5	104.3
1959	462.6	260.8	103.7	98.2
1960	392.5	215.8	94.9	81.9
1961	378.4	199.3	101.8	78.0
1962				
Feb.	395.3	211.8	106.6	76.9

[E] Estimate.
Source: 34

ing average weekly wages have increased from the 1959 annual average of $106.63 to $110.43 in 1960, to $115.09 in 1961. By February 1961, hourly earnings had increased to $2.83 and weekly earnings to $118.29.

The majority of all scientists and engineers employed by the aerospace industry are engaged in research and development work, and the aerospace industry has the highest percentage of research and development technicians among all the industries in the U.S. Sixty-three per cent of the aerospace industry's scientists and engineers are in R&D;

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

Monthly Average for the Year	TOTAL	Aircraft (Airframes)	Aircraft Engines and Parts	Other Aircraft Parts and Equipment
1939	N.A.	N.A.	$ 36.05	N.A.
1940	N.A.	N.A.	37.62	N.A.
1941	N.A.	N.A.	47.78	N.A.
1942	N.A.	N.A.	58.38	N.A.
1943	N.A.	N.A.	59.33	N.A.
1944	N.A.	N.A.	60.75	N.A.
1945	N.A.	N.A.	57.48	N.A.
1946	N.A.	N.A.	54.22	N.A.
1947	$ 54.74	$ 54.13	54.67	N.A.
1948	60.97	60.36	61.52	N.A.
1949	63.34	62.85	63.31	N.A.
1950	68.10	67.15	69.31	N.A.
1951	77.96	75.95	83.07	N.A.
1952	81.27	79.85	84.20	N.A.
1953	83.38	81.99	84.77	N.A.
1954	84.66	85.28	82.62	N.A.
1955	89.21	89.84	86.48	N.A.
1956	95.57	95.11	94.30	N.A.
1957	96.35	95.88	95.65	N.A.
1958	101.25	101.66	99.65	$100.53
1959	106.63	105.86	108.50	106.34
1960	110.43	110.03	112.20	109.45
1961	115.09	114.54	116.90	113.55
1962 Feb.	118.29	118.71	118.82	116.89

N.A.—Not available.
Source: 34

this compares with 61 per cent in the electrical equipment industry, 53 per cent in the professional and scientific instruments industry and 39 per cent each in the chemical and the fabricated metal products industry.

No other industry in modern times has experienced such a rapid transformation of its work force, but the shift in employment is but one example of the widespread changes which have occurred in the aerospace industry in the era of technology. There is no question but that there will be further changes across the board.

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

Monthly Average for the Year	TOTAL	Aircraft (Airframes)	Aircraft Engines and Parts	Other Aircraft Parts and Equipment
1939	N.A.	N.A.	$0.812	N.A.
1940	N.A.	N.A.	0.816	N.A.
1941	N.A.	N.A.	1.008	N.A.
1942	N.A.	N.A.	1.189	N.A.
1943	N.A.	N.A.	1.236	N.A.
1944	N.A.	N.A.	1.287	N.A.
1945	N.A.	N.A.	1.286	N.A.
1946	N.A.	N.A.	1.316	N.A.
1947	$1.372	$1.360	1.384	N.A.
1948	1.487	1.465	1.519	N.A.
1949	1.560	1.548	1.571	N.A.
1950	1.637	1.622	1.662	N.A.
1951	1.78	1.75	1.85	N.A.
1952	1.89	1.87	1.94	N.A.
1953	1.99	1.98	1.99	N.A.
1954	2.07	2.08	2.05	N.A.
1955	2.16	2.17	2.13	N.A.
1956	2.27	2.27	2.24	N.A.
1957	2.35	2.35	2.35	N.A.
1958	2.50	2.51	2.51	$2.44
1959	2.62	2.64	2.64	2.55
1960	2.70	2.71	2.73	2.65
1961	2.78	2.78	2.81	2.71
1962				
Feb.	2.83	2.84	2.86	2.77

N.A.—Not available.
Source: 34

AVERAGE EMPLOYMENT IN THE AIRCRAFT AND PARTS INDUSTRY
BY GEOGRAPHICAL DIVISIONS AND SELECTED STATES—1955 TO 1960[a]

Geographical Divisions and Selected States	1955	1956	1957	1958	1959	1960
TOTAL	745,424	818,107	890,326	782,057	754,533	668,914
New England	66,672	77,848	87,496	76,592	71,462	71,313
Massachusetts	8,977	9,092	9,898	9,161	9,180	8,546
Connecticut	46,269	67,169	75,219	65,037	60,865	61,291
Me., N.H., Vt., R.I.	1,426	1,587	2,379	2,394	1,417	1,476
Middle Atlantic	103,372	103,841	101,039	82,728	74,201	71,554
New York	61,648	59,387	61,211	54,400	48,282	45,159
New Jersey	24,979	27,868	24,993	16,675	15,445	15,458
Pennsylvania	16,745	16,586	14,835	11,653	10,474	10,937
East North Central	121,821	123,489	131,615	103,660	94,851	77,846
Ohio	66,192	66,018	69,954	58,353	60,217	49,997
Indiana	28,554	30,645	31,204	25,508	22,556	18,124
Illinois	14,965	16,956	17,382	10,855	5,271	4,304
Mich., Wisc.	12,110	9,870	13,075	8,944	6,807	5,421
West North Central	64,016	68,684	83,501	74,867	69,306	62,197
Missouri	21,456	23,363	32,225	31,793	30,149	27,420
Kansas	39,308	41,350	47,861	40,710	37,269	33,193
Minn., Iowa., N.D., S.D., Neb.	3,252	3,971	3,415	2,364	1,888	1,584
South Atlantic	49,535	54,496	53,099	49,734	49,380	40,616
Maryland	30,339	33,691	32,072	26,822	23,820	16,228
Del., D.C., Va., W.Va.	408	539	615	590	571	497
N.C., S.C., Ga., Fla.	18,788	20,266	20,412	22,322	24,989	23,891
East South Central (Ky., Tenn., Ala., Miss.)	5,803	7,541	9,016	9,785	8,509	5,303
West South Central (La., Okla., Tex.)	54,003	63,203	66,585	60,756	52,267	44,724
Mountain	6,614	11,101	15,552	16,052	22,196	27,211
Arizona	5,030	7,149	7,743	5,756	6,192	14,164
Mont., Idaho, Wyo., Colo., N.Mex., Utah, Nev.	1,584	3,952	7,809	10,296	16,004	13,047
Pacific	273,588	307,904	342,423	307,883	312,361	268,150
California	234,022	263,020	279,168	240,997	244,670	209,830
Wash., Ore.	39,566	44,884	63,255	66,886	67,691	58,320[b]

NOTE: Corresponding data for the years 1947 through 1954 may be found in "Aerospace Facts and Figures," 1959, 1960 and 1961 editions.

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

[b] Includes Alaska and Hawaii.

Source: 32

TOTAL WAGES PAID IN THE AIRCRAFT AND PARTS INDUSTRY, BY GEOGRAPHICAL DIVISIONS AND SELECTED STATES—1955 TO 1960[a]
In Millions of Dollars

Geographical Divisions and Selected States	1955	1956	1957	1958	1959	1960
TOTAL	$3893.0	$4568.7	$5103.9	$4823.0	$4947.5	$4585.0
New England	333.6	422.9	478.6	434.5	438.3	458.5
Massachusetts	46.6	52.2	56.6	59.2	63.2	63.8
Connecticut	280.7	363.2	410.7	363.3	367.6	386.2
Me., N.H., Vt., R.I.	6.3	7.5	11.3	12.0	7.5	8.5
Middle Atlantic	545.5	577.0	578.9	512.1	490.6	495.1
New York	342.1	351.3	362.1	349.1	333.5	328.8
New Jersey	123.0	143.6	139.7	100.2	96.2	99.6
Pennsylvania	80.4	82.1	77.1	62.8	60.9	66.7
East North Central	644.6	705.9	775.1	651.9	638.6	548.4
Ohio	344.4	373.5	413.4	372.5	407.4	353.6
Indiana	150.2	170.7	179.1	154.1	147.8	125.6
Illinois	83.6	102.1	104.0	70.6	37.8	30.4
Mich., Wisc.	66.4	59.6	78.6	54.7	45.6	38.8
West North Central	309.3	353.3	440.6	418.8	415.8	389.5
Missouri	105.8	125.1	171.8	178.8	186.8	178.1
Kansas	187.2	207.5	249.7	226.2	217.0	200.2
Minn., Iowa, N.D., S.D., Neb.	16.3	20.7	19.1	13.8	12.0	11.2
South Atlantic	247.2	292.4	291.0	298.0	314.5	269.0
Maryland	153.3	181.0	172.2	157.1	146.6	105.1
Del., D.C., Va., W.Va.	1.7	2.4	2.8	3.8	4.3	4.3
N.C., S.C., Ga., Fla.	92.2	109.0	116.0	137.1	163.6	159.6
East South Central (Ky., Tenn., Ala., Miss.)	24.8	33.9	41.6	53.1	45.0	29.6
West South Central (La. Okla., Tex.)	277.4	341.6	369.7	365.2	336.6	299.0
Mountain	34.9	66.8	92.8	107.2	154.3	197.1
Arizona	26.0	41.8	45.1	37.7	44.5	42.3
Mont., Idaho, Wyo., Colo., N.Mex., Utah, Nev.	7.9	25.0	47.7	69.5	109.8	154.8
Pacific	1475.7	1774.9	2035.6	1982.2	2113.8	1898.8
California	1275.7	1532.2	1694.3	1582.3	1693.5	1500.1
Wash., Ore.	100.0	242.7	341.3	399.9	420.3	398.7[b]

NOTE: Corresponding data for the years 1947 through 1954 may be found in "Aerospace Facts and Figures," 1959, 1960 and 1961 editions.

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

[b] Includes Alaska and Hawaii.

Source: 32

WOMEN EMPLOYEES IN THE AIRCRAFT INDUSTRY
1942 TO DATE

Date	Number (thousands)	Per Cent of Total Employment
Jan. 1942	23.1	2.8
Nov. 1943	486.1	33.3
Oct. 1947	28.5	12.3
Sept. 1949	33.3	12.5
Oct. 1950	37.3	11.9
Oct. 1951	86.5	17.0
Oct. 1952	125.7	17.3
Oct. 1953	136.6	16.9
Oct. 1954	121.6	16.0
Oct. 1955	115.8	15.1
Oct. 1956	135.6	15.5
Oct. 1957	132.4	15.3
Oct. 1958	116.3	14.8
Oct. 1959	111.3	15.1
Oct. 1960	100.3	15.3
Oct. 1961	99.1	14.6

Sources: 3, 34

LABOR TURNOVER IN THE AIRCRAFT AND PARTS INDUSTRY, 1958 TO DATE
(Rates per 100 Employees per Year)

Date	TOTAL		Aircraft (Airframes)		Aircraft Engines and Parts		Other Aircraft Parts and Equipment	
	Accessions	Separations	Accessions	Separations	Accessions	Separations	Accessions	Separations
1958	28.3	33.3	26.9	29.8	27.8	35.0	33.8	42.0
1959	27.4	37.9	22.4	36.5	29.1	35.0	39.4	45.0
1960	28.6	39.2	23.4	33.8	35.1	39.5	34.3	53.9
1961	32.6	30.9	31.3	29.3	28.9	24.8	43.2	44.9

Source: 34

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

Year	Aircraft Industry		Aircraft Parts Industry		All Manufacturing	
	Injury-Frequency Rates[a]	Severity Rates[a]	Injury-Frequency Rates[a]	Severity Rates[a]	Injury-Frequency Rates[a]	Severity Rates[a]
1939	12.9	1.9	[b]	[b]	14.9	1.4
1940	15.8	1.3	[b]	[b]	15.3	1.6
1941	10.4	1.4	[b]	[b]	18.1	1.7
1942	11.4	0.7	9.5	0.9	19.9	1.5
1943	9.7	0.7	11.7	0.8	20.0	1.4
1944	8.8	0.6	10.1	0.6	18.4	1.4
1945	9.4	1.2	10.6	1.7	18.6	1.6
1946	5.2	0.8	13.7	2.1	19.9	1.6
1947	4.8	0.7	11.1	0.6	18.8	1.4
1948	4.9	0.8	10.2	0.8	17.2	1.5
1949	4.3	1.0	9.2	1.0	14.5	1.4
1950	4.0	0.9	5.9	0.6	14.7	1.2
1951	4.5	0.6	7.1	0.9	15.5	1.3
1952	3.7	0.3	6.7	0.4	14.3	1.3
1953	3.8	0.6	6.3	0.5	13.4	1.2
1954	3.2	0.7	5.8	0.5	11.9	1.0
1955	2.8	0.3	4.8	0.3	12.1	0.6
1956	2.6	0.2	4.7	0.2	12.0	0.7
1957	2.7	0.3	3.8	0.3	11.1	0.8
1958	2.9	0.3	4.1	0.3	10.9	0.8
1959	2.7	N.A.	4.1	N.A.	11.9	N.A.
1960	2.1	N.A.	4.3	N.A.	11.3	N.A.
1961	2.0	N.A.	4.7	N.A.	11.0	N.A.

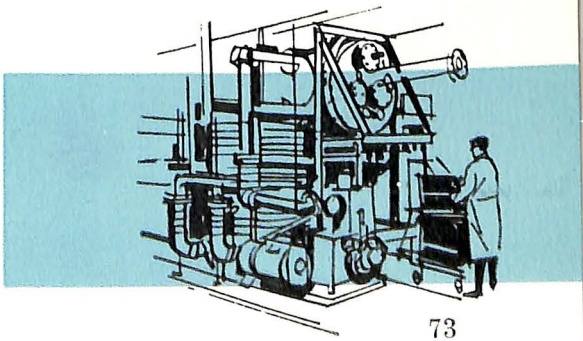
N.A.—Not available.

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

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

[b] Included with "Aircraft."

Source: 35



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

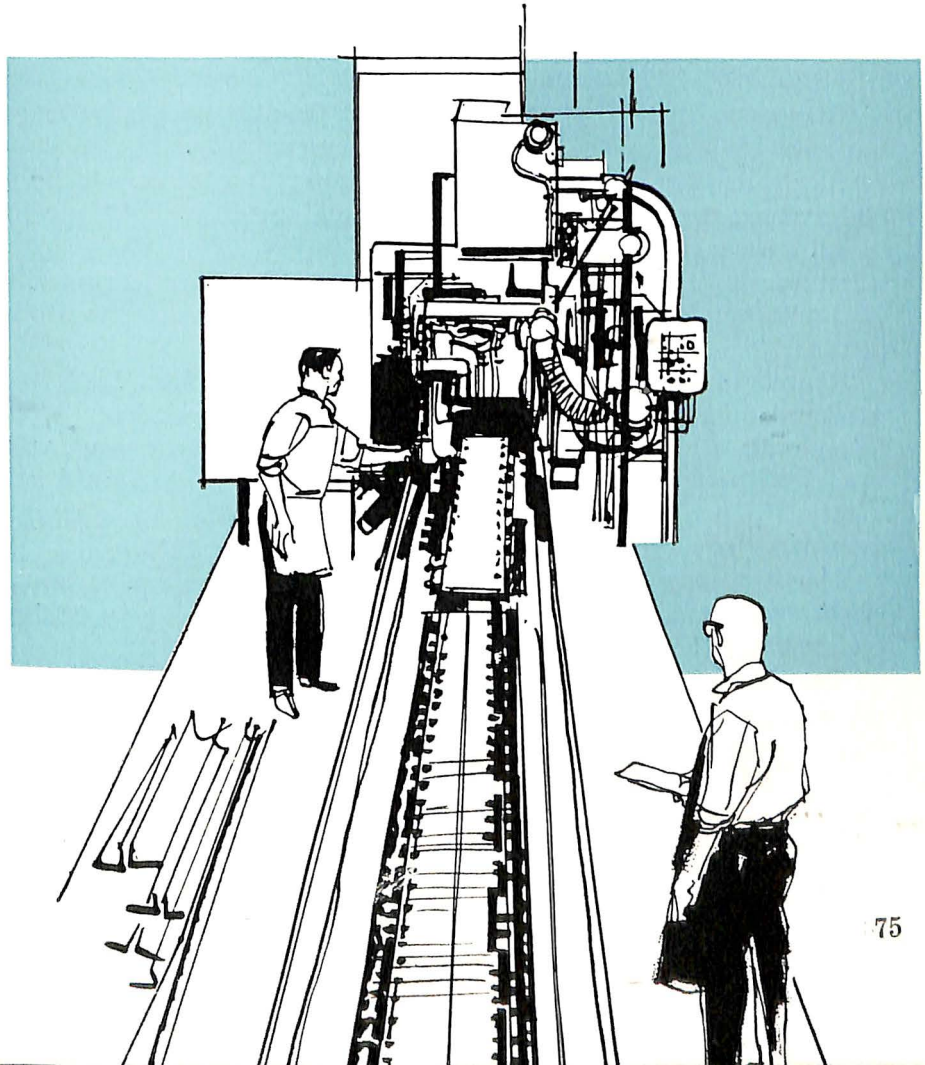
Year	Number of Strikes	Number of Workers Involved	Man-Days Idle in Year
1927–1933	4	1,153	18,965
1934	4	3,207	111,048
1935	1	1,700	6,800
1936	—	—	—
1937	6	9,390	90,964
1938	N.A.	N.A.	N.A.
1939	2	1,263	85,419
1940	3	6,270	36,402
1941	29	28,422	112,549
1942	15	6,584	12,416
1943	60	52,481	130,112
1944	103	189,801	386,371
1945	85	150,200	581,000
1946	15	21,300	557,000
1947	10	3,520	67,900
1948	8	21,400	1,100,000
1949	10	10,300	451,000
1950	18	23,900	145,000
1951	29	48,800	765,000
1952	44	81,000	927,000
1953	31	57,800	1,350,000
1954	11	6,350	171,000
1955	38	48,500	403,000
1956	21	23,100	1,040,000
1957	18	23,200	88,200
1958	20	36,700	308,000
1959	26	21,700	312,000
1960	28	82,400	1,190,000

N.A.—Not available.
Source: 33

WORK STOPPAGES IN SELECTED INDUSTRIES, 1960

Industry	Number of Strikes	Number of Workers Involved	Man-Days Idle in Year
All Manufacturing Corporations	1,598	707,000	11,200,000
AIRCRAFT AND PARTS	28	82,400	1,190,000
Primary Iron and Steel	51	14,500	541,000
Petroleum Refining	2	240	48,200
Motor Vehicles and Equipment	70	81,600	487,000
Electrical Machinery	102	96,600	1,260,000

Source: 33



FINANCE

Once again, in 1961, the earnings rate of the aerospace industry was far below the average for American industry generally.

As a percentage of sales, aerospace earnings amounted only to 1.8 per cent, compared with the average sales-to-earnings ratio of 4.3 per cent for all other manufacturing industries.

Net earnings for the year amounted to $257 million compared to $185 million in 1960; sales totaled nearly 14 billion compared to $13 billion in 1960.

The earnings rate of the aerospace industry has been historically much lower than the rate for other major manufacturing industries. The highest rate achieved by the aerospace industry in recent years was a rate of 3.8 per cent in 1955. It declined steadily since then until it hit a low of 1.4 per cent in 1960. The average for all other manufacturing industries was 5.4 per cent in 1955 and 4.4 per cent in 1960.

Simultaneously, the aerospace industry's net earnings as a percentage of net worth have dropped sharply in the past five years, from 16.7 per cent in 1957 to 9.2 per cent in 1961.

The effect of the low earnings rate is accentuated by the industry's volatile technology. Aggressive research and development programs are the heart of new business. Without such, the United States' goals of defense and space exploration supremacy would be forfeited.

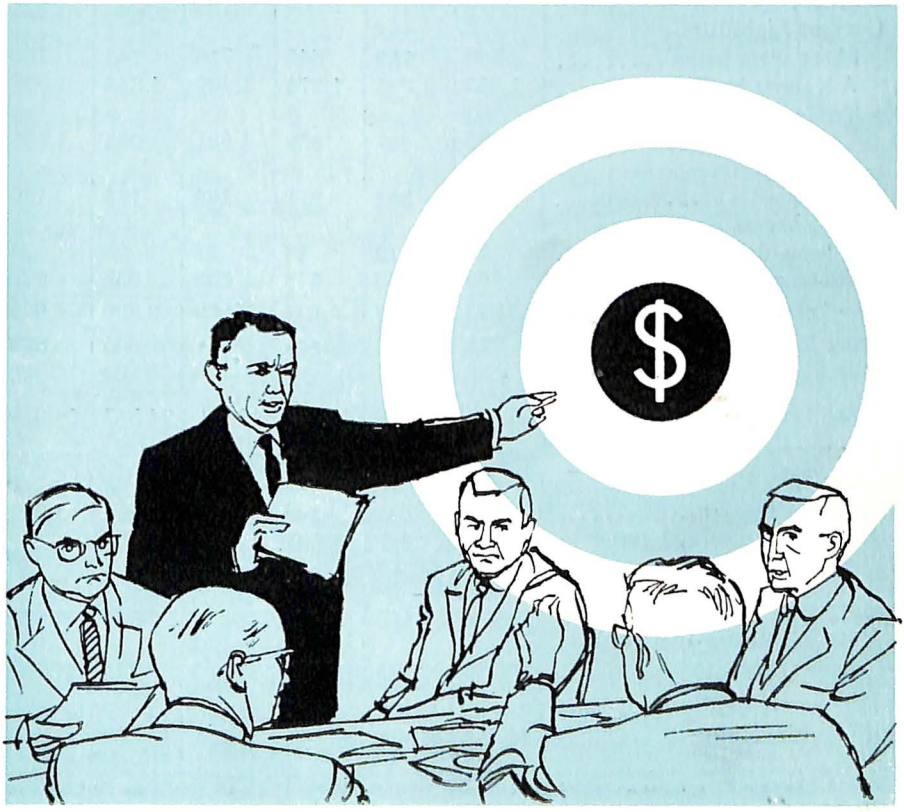
These vigorous R&D programs are the reason the aerospace industry reinvests a higher proportion of its earnings in facilities and equipment than any other manufacturing industry. Funds to support the technical

capability and the necessary facilities and equipment can come only from earnings.

An example of the surging technology of the industry as it affects defense and space products may be seen from the advancements in powered flight in a relatively few years. In the first 45 years, speeds moved from 12 miles an hour to more than 500 miles an hour, a yearly average increase of about 10 miles per hour.

Since then, however, the gains have been many, many times as great. In one-third the time it took to increase aircraft speeds 450 miles an hour, the industry boosted them more than 1,000 miles an hour, and supersonic flight—once considered an impenetrable barrier—is today a routine run.

This same sort of case history can be found in every segment of the aerospace industry. Corporate survival demands quantum jumps. It has been many years since the industry's goal has been as evolutionary as most other industry goals are today—simple product improvement.



BALANCE SHEET COMPARISONS, AEROSPACE COMPANIES
1956 TO DATE
(Millions of Dollars)

	1956	1957	1958	1959	1960	1961
Assets:						
Current Assets						
Cash	$ 433	$ 446	$ 443	$ 358	$ 363	$ 417
U. S. Government Securities	83	49	79	91	102	58
Total Cash and U. S. Govt. Securities	$ 516	$ 495	$ 522	$ 449	$ 465	$ 475
Receivables (total)	1,351	1,558	1,538	1,658	1,718	1,906
Inventories (gross)	3,421	3,593	3,218	3,440	3,425	3,470
Other current assets	53	74	70	104	82	112
Total Current Assets	$5,341	$5,720	$5,348	$5,651	$5,690	$5,693
Total Net Plant	679	974	1,036	1,092	1,195	1,420
Other Non-Current Assets	97	121	120	164	229	305
Total Assets	$6,118	$6,816	$6,503	$6,906	$7,113	$7,688
Liabilities:						
Current Liabilities						
Short term loans	380	759	645	718	745	700
Advances by U.S. Govt.	1,855	1,735	1,374	1,409	1,346	1,308
Trade accounts and notes payable	695	807	852	1,001	955	1,005
Federal income taxes accrued	348	364	277	196	165	186
Instalments due on long term debt	15	19	18	37	25	24
Other current liabilities	700	606	533	538	654	822
Total current liabilities	3,993	4,290	3,699	3,899	3,890	4,045
Long Term Debt	202	253	444	541	645	806
Other Non-Current Liabilities	16	17	20	20	32	28
Total Liabilities	$4,211	$4,560	$4,163	$4,460	$4,567	$4,879
Stockholder's Equity:						
Capital Stock	658	841	902	977	1,154	1,291
Earned Surplus and Reserves	1,249	1,417	1,438	1,468	1,394	1,517
Total Net Worth	$1,907	$2,258	$2,340	$2,445	$2,548	$2,808
Total Liabilities and Stockholders' Equity	$6,118	$6,816	$6,503	$6,906	$7,113	$7,688
Net Working Capital	$1,348	$1,430	$1,649	$1,752	$1,800	$1,918

NOTE: Includes 51 companies which filed reports with the Securities and Exchange Commission. Source: 41.

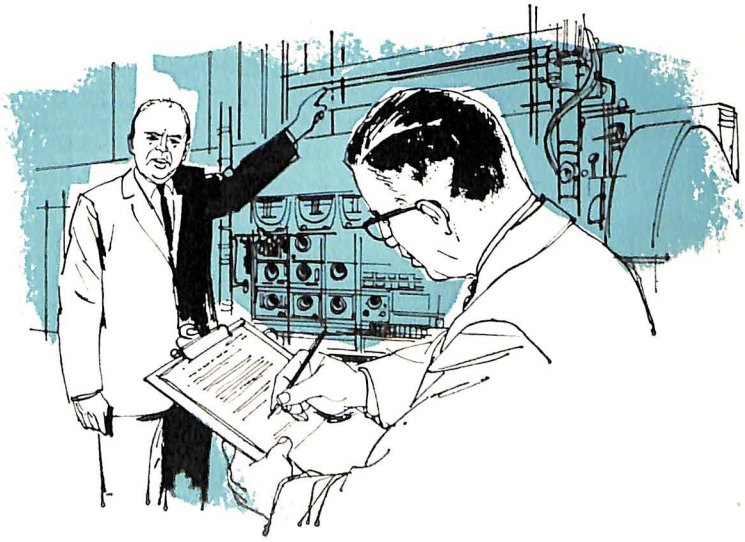
Despite the low earnings rate and the exacting performance of the industry, aerospace industry performance continues to receive the closest scrutiny and aerospace industry earnings the sharpest criticism. The net result has been excessive, stultifying controls which have made the main goal—better defense at less cost—still more difficult to reach.

Even "non-profit" firms, created by the Federal Government to improve technical management capabilities, are paid fees of 10 per cent above their costs. This fee paid to non-profit firms is more than five times the earning rate of the aerospace industry.

INCOME ACCOUNTS, 51 AEROSPACE COMPANIES, 1956 TO DATE
(Millions of Dollars)

	1956	1957	1958	1959	1960	1961
Net Sales	$11,011	$12,868	$12,575	$12,488	$12,974	$13,954
Net Profit from Operations	745	809	664	451	386	570
Total Income before Federal Income Taxes	733	791	636	411	333	521
Provision for Federal Income Taxes	386	414	329	215	148	264
Net Profit after Taxes	347	377	307	196	185	257

Source: 41



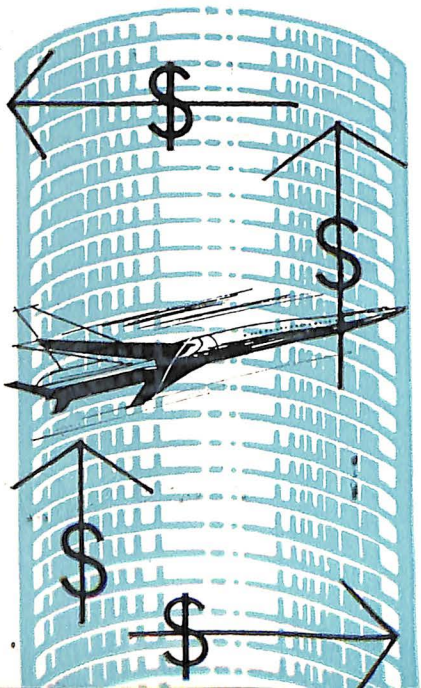
The justification for this "profit" to "non-profit" firms, according to a Government witness testifying before a Congressional committee, is that these organizations must conduct some independent research to "stay healthy."

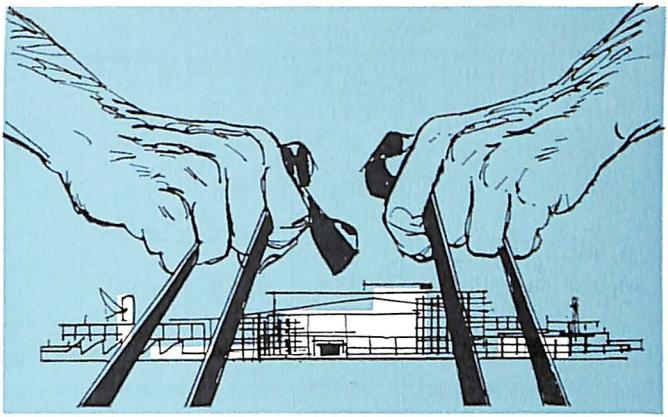
The admonition applies to the aerospace industry, which needs capital for overhead expenses and facilities if it is to continue the Herculean task of meeting the new challenges posed by defense and space exploration requirements.

COMPOSITION OF CURRENT ASSETS, 1956 TO DATE, 51 AEROSPACE COMPANIES
(in Per Cent of Total)

Year	Total Current Assets	Cash and Securities	Inventories	Receivables	Miscellaneous
1956	100.0	9.7	64.1	25.3	0.9
1957	100.0	8.7	62.8	27.2	1.3
1958	100.0	9.7	60.2	28.8	1.3
1959	100.0	8.0	60.8	29.3	1.9
1960	100.0	8.2	60.2	30.2	1.4
1961	100.0	8.0	58.2	32.0	1.8

Source: 41





FINANCIAL RATIOS, 51 AEROSPACE COMPANIES, 1956 TO DATE

Year	Net Federal Taxes as a Per Cent of Total Inome	Net Profit as a Per Cent of Sales
1956	52.3	3.2
1957	52.3	2.9
1958	51.7	2.4
1959	52.3	1.6
1960	44.4	1.4
1961	50.7	1.8

Source: 41

NET INCOME AS A PERCENT OF SALES
(After Taxes)

Industry	1954	1955	1956	1957	1958	1959	1960	1961
Total Manufacturing Corporations	4.5	5.4	5.2	4.8	4.2	4.5	4.4	4.3
AIRCRAFT AND PARTS .	3.4	3.8	3.1	2.9	2.4	1.5	1.4	1.8
Primary Iron and Steel	5.3	7.2	6.7	6.6	5.4	4.8	5.1	4.6
Petroleum Refining ...	10.6	11.1	11.5	10.6	9.5	9.9	9.9	10.1
Motor Vehicles and Equipment	5.3	6.9	5.2	5.4	4.0	5.0	5.9	5.5
Electrical Machinery .	4.5	4.4	3.8	4.2	3.8	4.9	3.5	2.3

Source: 41

SELECTED MAJOR DEFENSE CONTRACTORS
(Listed by rank according to net value of military prime contracts awarded, 1950-1961)

	July 1, 1950 to June 30, 1961	July 1 1960 to June 30, 1961	July 1, 1959 to June 30, 1960	July 1, 1958 to June 30, 1959	July 1, 1957 to June 30, 1958	World War II
U. S. TOTAL, ALL CONTRACTS (in Billions) .	$225.2	$17.3	$15.4	$16.7	$16.2	$193.3[E]
Company	Per Cent of Total					
Boeing Airplane	5.5	4.1	6.5	7.0	13.1	1.5
General Dynamics[a] ..	5.0	8.5	8.2	9.7	8.5	N.A.
General Electric	4.1	3.8	6.3	5.5	4.8	1.9
North American Aviation	3.8	5.2	5.9	6.1	4.0	1.6
General Motors	3.6	1.2	1.4	1.3	1.7	7.9
United Aircraft	3.6	2.7	3.4	3.2	4.1	2.2
Lockheed.....	3.5	5.2	6.9	5.4	4.7	1.9
Douglas	2.9	1.4	2.6	4.1	3.2	2.5
American Telephone and Telegraph	2.3	2.5	3.0	2.9	4.1	1.5
Martin	1.7	3.1	3.9	3.1	2.5	1.3
Republic Aviation ..	1.6	1.3	1.7	1.7	1.6	0.7
Sperry Rand[a]	1.4	1.8	1.9	2.4	2.3	0.9
Curtiss Wright	1.4	0.3	0.5	0.4	1.3	4.1
Hughes Aircraft	1.2	1.5	2.3	3.0	2.9	N.A.
McDonnell	1.2	1.0	1.3	2.4	2.2	N.A.
Bendix	1.2	1.1	1.6	1.6	1.3	1.1
Westinghouse Electric	1.1	1.4	1.7	1.4	1.7	0.8
Grumman Aircraft ..	1.1	1.1	1.6	1.8	1.5	0.8
Radio Corporation of America	1.1	1.7	2.6	1.2	2.4	0.3
International Business Machines	1.0	1.4	1.9	1.7	1.9	N.A.
Other Selected Major Contractors						
Raytheon	0.9	1.3	2.1	2.4	1.5	N.A.
Northrop	0.9	0.7	0.9	0.9	1.7	0.1
General Tire and Rubber	0.6	1.3	1.6	1.2	1.0	N.A.
Ling-Temco-Vought[a]	0.6	0.7	1.3	N.A.	2.4	N.A.
Fairchild	0.4	0.2	0.2	0.2	0.6	0.2
Textron[a]	0.4	0.3	0.4	0.3	0.5	0.7
Thiokol	0.2	0.9	0.9	0.8	0.4	N.A.

N.A.—Not available.
[E] Estimate.
[a] Major change in corporate composition or product.
Sources: 17, 43

MILITARY

A sweeping change of far-reaching significance in military procurement programming has been effected by the Department of Defense during the past year. It has been dictated by the revolution in military technology since the end of World War II.

The great technical complexity of modern-day weapons, their lengthy period of development, their tremendous combat power, and their enormous cost have placed an extraordinary premium on the sound choice of major weapon systems in relation to tasks and missions and this Nation's national security objectives. These choices have become, for the top management of the Defense Department, the key decisions around which much of the defense program revolves. These decisions, considered even singly, have a profound effect upon the composition of the industry —its workforce—and, therefore, the economy of entire industrial areas of the Nation.

The Defense Department has revised its hardware procurement system based upon *nine Program Packages* containing those military programs which are concluded to provide for the overall defense of the United States. These nine "packages" are: *Central War Offensive Forces, General Purpose Forces, Sealift and Airlift, Reserve and National Guard, Research and Development, Service-Wide Support, Classified Projects, and Department of Defense.*

Included in the Central War Offensive Forces program package are a number of general categories—aircraft forces; land-based missile forces; sea-based missile forces; command, control, and communication systems; and headquarters and command support.

SUMMARY OF COMPOSITION OF MAJOR ACTIVE ARMED FORCES
FISCAL YEARS 1961-1963

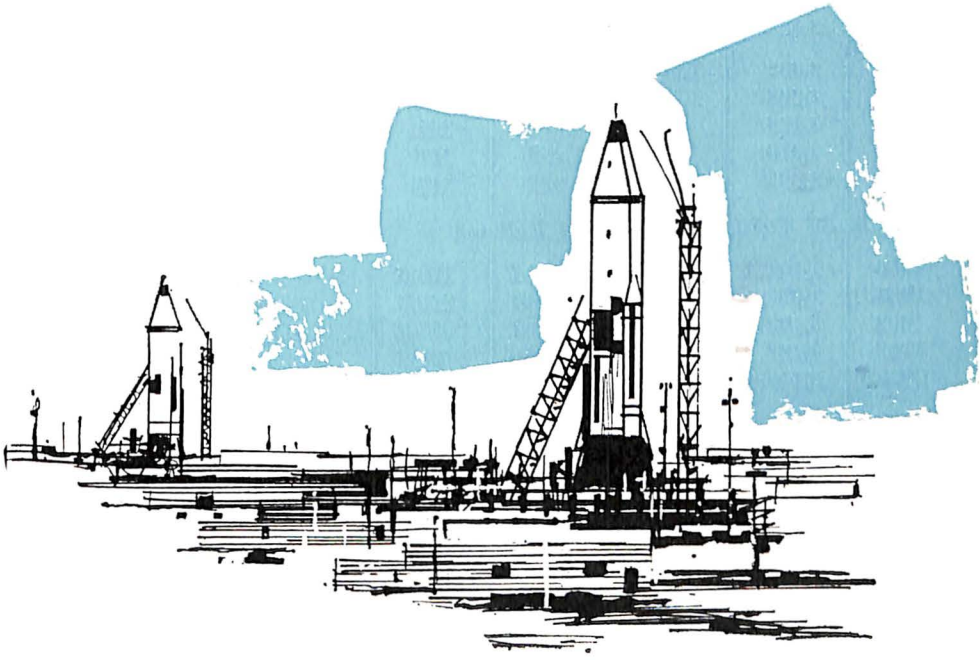
Description	Actual	Estimate	
	June 30, 1961	June 30, 1962	June 30, 1963
Military personnel (in thousands):			
Army	858	1,081	960
Navy	627	666	665
Marine Corps	177	190	190
Air Force	820	888	869
Total, Department of Defense	2,428	2,825	2,684
Military forces:			
Army:			
Divisions	14	16	16
Armored cavalry regiments and combat commands	7	6	6
Brigades	2	1	3
Battle groups (infantry)	8	9	10
Missile commands	4	3	3
Air defense anti-aircraft battalions	77	65	63
Surface-to-surface missile battalions	24	30	33
Helicopter aircraft inventory—active	2,721	2,785	3,039
Fixed-wing aircraft inventory—active	2,843	2,818	2,855
Navy:			
Commissioned ships in fleet	(819)	(898)	(862)
Warships	375	395	383
Other	444	503	479
Attack carrier air groups	17	18	17
Carrier anti-submarine air groups	11	12	11
Patrol and warning squadrons	38	53	35
Marine divisions	3	3	3
Marine air wings	3	3	3
Aircraft inventory—active	8,793	9,297	8,950
Air Force:			
USAF combat wings	(88)	(98)	(86)
Strategic wings	37	37	33
Air defense wings	19	18	17
Tactical wings	32	43	36
USAF combat support flying forces	(119)	(132)	(122)
Air refueling squadrons	65	67	59
MATS air transport squadrons	21	30	26
Other specialized squadrons	33	35	37
Aircraft inventory—active	16,905	16,244	15,449

Parentheses indicate totals of the immediately following items.
Source: 24

Within the aircraft forces, for example, are the B-52's (with HOUND DOG and QUAIL air-to-surface missiles), the B-58's and B-47's (including the reconnaissance version of the B-47), the tankers, and the B-70. Within the missile forces are ATLAS, TITAN, MINUTEMAN, and POLARIS—plus the THOR and JUPITER IRBM's, and the submarine-launched REGULUS missiles. Also included in the Central War Offensive Forces package are the communications link and the command and control systems required for the effective direction of the strategic forces, together with the headquarters and command support associated wih these forces.

The Central War Defensive Forces (or Continental Air Defense Forces) program package is another of the more easily definable program packages supporting a clearly identified major military mission.

The third and largest program package is that for the General Purpose Forces. These are the forces on which the military services must rely to fight local or limited wars, or theater engagements in general war. This package is organized broadly along Service lines; within Services the basic, identifiable combat units form the program elements. Under the Army are almost all its regular combat units and command support elements. They range from the four basic kinds of divisions through the missile groups and commands to tank units, artillery bat-



talions, air defense units for the Army in the field, and aviation companies.

The Navy's list is even longer, embracing all of the combatant ships and support vessels, except for the strategic-missile firing submarines, the radar warning picket ships, and Military Sea Transportation Service (MSTS) ships. All of the Fleets' various aircraft units are also included, except those assigned to the airborne early warning squadrons.

All Marine Corps units are listed under General Purpose Forces, including the Marine Air Wings.

The Air Force General Purpose Forces include principally those units

NUMBER AND FLYAWAY VALUE OF MILITARY AIRCRAFT PRODUCED, 1950 TO DATE
THE DEPARTMENT OF DEFENSE

Year	TYPE OF AIRCRAFT						
	TOTAL	Bomber	Fighter	Transport	Trainer	Helicopter	Other
NUMBER							
1950	2,680	560	1,477	176	351	60	56
1951	5,055	502	1,937	271	558	349	1,438
1952	7,131	1,193	2,117	479	1,363	961	1,018
1953	8,978	1,156	3,958	713	1,510	873	768
1954	8,089	1,806	3,511	626	1,403	373	370
1955	6,664	1,353	3,128	513	1,111	410	149
1956	5,203	1,164	1,916	362	778	644	339
1957	5,198	873	2,073	224	819	659	550
1958	4,078	676	1,482	271	560	641	448
1959	2,834	511	922	215	564	451	171
FLYAWAY VALUE[a] *(Millions of Dollars)*							
1950	1,141.3	546.4	339.7	178.5	47.7	6.3	22.7
1951	1,684.3	690.5	559.1	278.5	78.2	29.6	48.4
1952	3,162.0	1,334.7	751.7	647.9	256.1	101.4	70.2
1953	4,722.9	1,799.2	1,672.5	791.5	253.6	124.4	81.7
1954	5,715.0	2,405.4	2,087.0	854.4	261.3	82.0	24.9
1955	4,927.9	2,013.8	1,907.4	652.7	166.4	169.2	18.4
1956	5,075.3	2,202.9	1,987.4	537.0	115.5	184.6	47.9
1957	5,284.9	2,163.4	2,086.5	676.2	169.5	156.6	32.7
1958	5,365.3	2,157.2	2,106.6	781.9	139.4	156.0	24.2
1959	5,101.0	2,066.1	1,829.5	759.4	216.1	163.1	66.8

NOTE: Aircraft produced for the Military Assistance Program are excluded.
[a] Values are estimated based on unit prices in latest production contracts; values of spares, spare parts, and other support equipment are excluded.
Source: 17

assigned to the Tactical Air Command. The tactical fighters and bombers, tactical reconnaissance aircraft, KB-50 tankers, MATADOR and MACE missiles, and the associated command and control systems and headquarters all fall under this category.

The fourth program package is that for Sealift and Airlift. The troop carrier wings of the Air Force, including theatre airlift, Military Air Transport Service (MATS), and Military Sea Transportation Service (MSTS), make up the essential pieces of this grouping.

The fifth program package is composed of the Reserve and National Guard Forces. The program elements are arranged according to Service

NUMBER AND FLYAWAY VALUE OF AIR FORCE AIRCRAFT PRODUCED, 1950 TO DATE
THE DEPARTMENT OF THE AIR FORCE

Year	TYPE OF AIRCRAFT						
	TOTAL	Bomber	Fighter	Transport	Trainer	Helicopter	Other
NUMBER							
1950	1,668	219	917	169	326	6	31
1951	2,149	152	1,158	240	517	14	68
1952	3,625	399	1,247	454	1,258	49	218
1953	5,674	489	2,862	578	1,381	165	199
1954	5,226	716	2,729	603	998	172	8
1955	4,115	632	2,346	464	578	82	13
1956	2,515	605	1,166	326	354	62	2
1957	2,467	318	1,494	216	343	16	80
1958	1,792	167	906	235	402	2	80
1959	1,230	133	553	215	298	28	3
FLYAWAY VALUE[a] *(Millions of Dollars)*							
1950	763.7	340.7	183.6	174.4	44.4	1.1	19.5
1951	1,220.5	527.6	334.1	255.6	71.0	2.1	30.1
1952	2,379.4	1,023.0	434.3	617.7	239.0	9.7	55.7
1953	3,411.9	1,273.8	1,184.1	626.6	235.2	39.4	52.8
1954	4,236.9	1,663.9	1,621.2	713.9	203.0	30.9	4.0
1955	3,671.8	1,551.3	1,393.0	578.3	104.8	43.3	1.1
1956	3,661.5	1,736.0	1,343.3	511.0	48.1	22.9	0.2
1957	3,829.5	1,622.7	1,478.6	671.4	48.2	4.2	4.4
1958	3,540.3	1,395.7	1,322.9	761.7	55.4	0.5	4.1
1959	3,662.8	1,462.2	1,328.3	759.5	98.8	14.0	0.1

NOTE: Aircraft produced for the Military Assistance Program are excluded.
[a] Values are estimated based on unit prices in latest production contracts; values of spares, spare parts, and other support equipment are excluded.
Source: 17

NUMBER AND FLYAWAY VALUE OF NAVY AIRCRAFT PRODUCED, 1950 TO DATE
THE DEPARTMENT OF THE NAVY

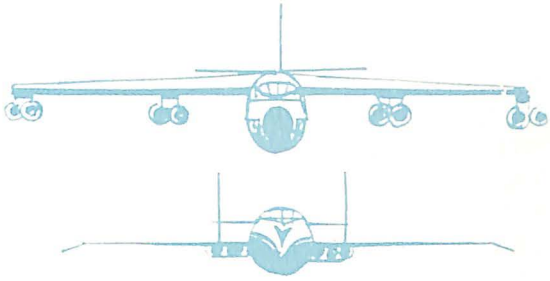
Year	TYPE OF AIRCRAFT						
	TOTAL	Bomber	Fighter	Transport	Trainer	Helicopter	Other
NUMBER							
1950	979	341	560	7	25	39	5
1951	1,374	350	779	31	41	143	30
1952	2,164	794	870	25	105	353	17
1953	2,315	667	1,096	135	129	245	43
1954	2,367	1,090	782	23	405	46	21
1955	2,260	721	782	49	533	128	47
1956	1,966	559	750	36	424	152	45
1957	1,816	555	579	8	476	193	5
1958	1,485	509	576	36	158	204	2
1959	1,117	378	369	—	266	101	3
FLYAWAY VALUE[a] *(Millions of Dollars)*							
1950	376.7	205.7	156.1	4.1	3.3	4.6	2.9
1951	439.5	162.9	225.0	22.9	7.2	21.1	0.4
1952	740.5	311.7	317.4	30.2	17.1	63.9	0.2
1953	1,276.7	525.4	488.4	164.9	18.4	62.5	17.1
1954	1,451.6	741.5	465.8	140.5	58.3	34.3	11.2
1955	1,199.7	462.5	514.4	74.4	61.6	74.4	12.4
1956	1,314.5	466.9	644.1	26.0	67.4	78.0	32.1
1957	1,354.3	540.9	607.9	4.8	121.3	68.3	11.3
1958	1,727.9	761.5	783.7	20.2	84.0	73.9	4.6
1959	1,355.2	603.9	501.2	—	117.3	98.3	34.5

NOTE: Aircraft produced for the Military Assistance Program are excluded.
* Values are estimated based on unit prices in latest production contracts; values of spares, spare parts, and other support equipment are excluded.
Source: 17

and within each Service according to which of the major missions they support. Actually, Reserve and National Guard program elements will be reviewed in the appropriate mission package—Central War Defensive Forces, General Purpose Forces, or Sealift and Airlift.

Program package six includes all of the Department's Research and Development projects not associated with other program elements. Space projects are gathered in a separate group in the R&D program package.

The seventh program package is labelled Service-Wide Support. This is the "all-other" package, containing all the activities not readily allocable to missions, forces, or weapon systems. Some of its major ele-



NUMBER AND FLYAWAY VALUE OF ARMY AIRCRAFT PRODUCED, 1950 TO DATE
THE DEPARTMENT OF THE ARMY

Year	TYPE OF AIRCRAFT						
	TOTAL	Bomber	Fighter	Transport	Trainer	Helicopter	Other
NUMBER							
1950	35	—	—	—	—	15	20
1951	1,532	—	—	—	—	192	1,340
1952	1,342	—	—	—	—	559	783
1953	989	—	—	—	—	463	526
1954	496	—	—	—	—	155	341
1955	289	—	—	—	—	200	89
1956	722	—	—	—	—	430	292
1957	915	—	—	—	—	450	465
1958	801	—	—	—	—	435	366
1959	487	—	—	—	—	322	165
FLYAWAY VALUE[a] *(Millions of Dollars)*							
1950	0.9	—	—	—	—	0.6	0.3
1951	24.3	—	—	—	—	6.4	17.9
1952	42.1	—	—	—	—	27.8	14.3
1953	34.3	—	—	—	—	22.5	11.8
1954	26.5	—	—	—	—	16.8	9.7
1955	56.4	—	—	—	—	51.5	4.9
1956	99.3	—	—	—	—	83.7	15.6
1957	101.1	—	—	—	—	84.1	17.0
1958	97.1	—	—	—	—	81.6	15.5
1959	83.0	—	—	—	—	50.8	32.2

NOTE: Aircraft produced for the Military Assistance Program are excluded.
[a] Values are estimated based on unit prices in latest production contracts; values of spares, spare parts, and other support equipment are excluded.
Source: 17

ments are recruit, technical, and professional training, the overhead of the supply and maintenance systems, medical support, and higher headquarters. The other packages are self-explanatory.

To supply the data for top-level Defense Department decisions, each service is required to submit cradle-to-grave documentation covering each weapon system or other definable program element. The entire cost —acquisition, operation, and support—of the proposed program must be projected over the entire life cycle of the weapon or support system. On all programs, information is required that will show possible trade-offs between cost, schedule and performance. How much would it cost—for example—to speed up the operational date of a missile program by six months? How much, if anything, would be saved if we only hardened

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

Year	Total	Bombers	Fighters	Transports	Trainers	Other[a]
1940	23.1	9.2	5.5	2.5	5.6	.3
1941	81.4	40.9	16.4	3.8	18.1	2.2
1942	275.8	162.5	48.8	18.2	39.3	7.0
1943	654.2	423.0	121.8	55.5	47.1	6.8
1944	961.1	609.2	215.5	113.6	19.1	3.7
1945	539.4	331.1	124.7	75.5	3.4	4.7
1946	12.9	3.9	5.6	2.4	—	1.0
1947	11.4	3.3	4.5	2.5	—	1.1
1948	25.1	13.2	9.2	1.6	.4	.7
1949	30.3	18.0	8.7	2.4	.5	.7
1950	35.9	16.4	10.2	6.7	1.9	.7
1951	50.2	17.0	15.7	11.5	3.1	2.9
1952	107.3	36.7	31.7	24.6	9.5	4.8
1953	138.0	44.1	40.7	36.5	11.3	5.4
1954	130.4	51.8	35.4	31.1	9.6	2.5
1955	114.3	39.9	43.2	20.9	7.4	2.9
1956	90.0	38.6	30.6	13.1	3.3	4.4
1957	79.4	32.7	28.7	9.3	4.2	4.5
1958	66.1	25.2	18.0	15.9	3.1	3.9
1959	51.8	18.6	12.9	14.6	3.5	2.2

NOTE: Data exclude gliders and targets for entire period and experimental aircraft subsequent to 1949.
E Estimate.
[a] "Other" includes helicopter, liaison, observation, utility, search and rescue and basic reconnaissance types; however, reconnaissance versions of bombers and fighters are included with bombers and fighters.
Source: 17

MILITARY AIRCRAFT IN DEVELOPMENT OR PRODUCTION
(FIXED WING)

Designation	Name	Type	Service	Manufacturer
L-23F	Seminole	Utility Transport	Army	Beech
B-52H	Stratofortress	Bomber	USAF	Boeing
C-135A/B	Stratolifter	Cargo	USAF	Boeing
KC-135A/B	Stratotanker	Tanker	USAF	Boeing
F-111A	TFX	Fighter	USAF/ Navy	Unknown
T-37B	—	Trainer	USAF	Cessna
F8U-2NE	Crusader	Fighter	Navy	Chance Vought
B-58A	Hustler	Bomber	USAF	General Dynamics
A4D-2N	Skyhawk	Attack	Navy	Douglas
A4D-5	Skyhawk	Attack	Navy	Douglas
A2F-1,1Q	Intruder	Attack	Navy	Grumman
S2F-3,3S	Tracker	Anti-Sub	Navy	Grumman
W2F-1	Hawkeye	Attack Warning	Navy	Grumman
AO-1	Mohawk	Combat-Surveillance	Army	Grumman
F-104G	Starfighter	Fighter	USAF	Lockheed
C-130B	Hercules	Cargo	USAF	Lockheed
SC-130B	Hercules	Search	Coast Guard	Lockheed
C-130E	Hercules	Cargo	USAF	Lockheed
C-140	Jet Star	Cargo	USAF	Lockheed
C-141A	Super Hercules	Cargo	USAF	Lockheed
GV-1,1U	Hercules	Cargo	Navy	Lockheed
P2V-7	Neptune	Patrol	Navy	Lockheed
P3V-1	Orion	Patrol	Navy	Lockheed
F4H-1,1P	Phantom II	Fighter	Navy	McDonnell
F110, RF110A	Phantom II	Fighter	USAF	McDonnell
A3J-1,2,3	Vigilante	Attack	Navy	North American
RS-70	Valkyrie	Recon/Strike Bomber	USAF	North American
T-39A,B	Saberliner	Trainer	USAF	North American
T-3J-1	Saberliner	Trainer	Navy	North American
T-38A	Talon	Trainer	USAF	Northrop
F-105D	Thunderchief	Fighter	USAF	Republic
AC-1	Caribou	Cargo	Army	DeHavilland
L-28	Helio Courier	Light Support	USAF	Helio

Source: 17

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1945	539.4	331.1	124.7	75.5	3.4	4.7
1946	12.9	3.9	5.6	2.4	—	1.0
1947	11.4	3.3	4.5	2.5	—	1.1
1948	25.1	13.2	9.2	1.6	.4	.7
1949	30.3	18.0	8.7	2.4	.5	.7
1950	35.9	16.4	10.2	6.7	1.9	.7
1951	50.2	17.0	15.7	11.5	3.1	2.9
1952	107.3	36.7	31.7	24.6	9.5	4.8
1953	138.0	44.1	40.7	36.5	11.3	5.4
1954	130.4	51.8	35.4	31.1	9.6	2.5
1955	114.3	39.9	43.2	20.9	7.4	2.9
1956	90.0	38.6	30.6	13.1	3.3	4.4
1957	79.4	32.7	28.7	9.3	4.2	4.5
1958	66.1	25.2	18.0	15.9	3.1	3.9
1959	51.8	18.6	12.9	14.6	3.5	2.2

NOTE: Data exclude gliders and targets for entire period and experimental aircraft subsequent to 1949.
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SC-130B	Hercules	Search	Coast Guard	Lockheed
C-130E	Hercules	Cargo	USAF	Lockheed
C-140	Jet Star	Cargo	USAF	Lockheed
C-141A	Super Hercules	Cargo	USAF	Lockheed
GV-1,1U	Hercules	Cargo	Navy	Lockheed
P2V-7	Neptune	Patrol	Navy	Lockheed
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F4H-1,1P	Phantom II	Fighter	Navy	McDonnell
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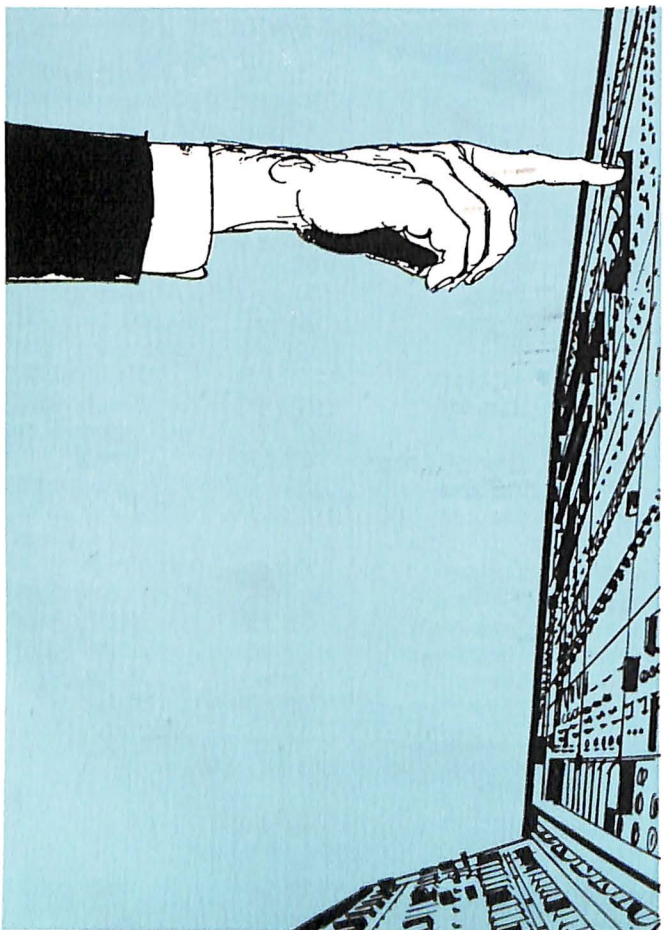
F-105D	Thunderchief	Fighter	USAF	Republic
AC-1	Caribou	Cargo	Army	DeHavilland
L-28	Helio Courier	Light Support	USAF	Helio

Source: 17

the ICBM silos to 100 psi and installed 50 more of them? If we spent X millions of dollars to increase the accuracy of a guidance system by 2%, could we save money by reducing the number of missiles required? When these data are assembled, realistic consideration is given to three primary factors: the mission to be accomplished; the latest estimates on the capabilities of the Soviet Union on its satellites; and the cost-effectiveness relationships among the various alternative means of performing each mission. Combat capabilities can be weighed against the resources required and both may be measured against our national objectives.

The NIKE-ZEUS and the B-70 are two cases in point. And because it costs as much to operate a B-52 wing for five years as it does to procure the aircraft for that wing and more to operate an infantry division for one year than to equip it initially, the Defense Department needs also to know the annual operating cost, as distinct from the initial investment and R&D costs. In fact, for one type of aircraft the Air Force recently estimated that the five-year cost of replenishment spares alone would just about equal the flyaway cost of the aircraft.

While it has long been recognized that the operating costs of missiles—



PRODUCTION OF MILITARY ASSISTANCE AND COAST GUARD AIRCRAFT BY TYPE AND MODEL, CALENDAR YEAR 1959

Military Assistance—Total	141
Bombers	39
P2V-7	10
P5M-2	10
S2F-1	19
Fighters	16
F-100	15
F-104	1
Transports	3
C-130	3
Trainers	50
T-33	50
Other Models	33
SA-16 (UF)	4
H-13	15
H-19	3
H-47	1
HSS-1N	5
U-1	1
L-19	2
L-20	2
U. S. Coast Guard—Total	10
Transport	2
SC-130B	2
Other Models	8
HUL	2
HUS	6

Source: 17

as a per cent of total program costs—are considerably less than aircraft, the extent of this difference has not been shown publicly until recently. For example, according to recent DOD program projections, the cost of operating the 14-wing B-52 force for five years will account for about one-third of its total program cost. In contrast, the cost of operating the 13-squadron ATLAS force for the same period is expected to amount to about one-tenth of the total program cost. A comparison of the F-102

U S. Military Aircraft Engine Acceptances
Calendar Years 1950 to Date

	CY 1959	CY 1958	CY 1957	CY 1956	CY 1955	CY 1954	CY 1953	CY 1952	CY 1951	CY 1950
Total U.S. Military	4,626	8,121	11,087	9,849	13,469	21,440	33,616	25,659	16,287	9,361
Jet	3,421	6,135	8,104	6,532	9,333	13,367	20,181	16,912	9,520	5,589
J-33	—	20	106	95	514	1,188	2,488	2,243	1,800	1,520
J-34	139	99	76	40	—	—	316	1,177	1,442	541
J-44	55	320	181	—	—	—	—	—	—	—
J-48	24	60	214	318	131	496	1,414	1,121	269	4
J-52	36	5	—	—	—	—	—	—	—	—
J-57	1,957	4,000	5,391	3,876	1,918	739	113	75	16	—
J-60	1	—	—	—	—	—	—	—	—	—
J-69	538	652	542	235	32	—	—	—	—	—
J-75	293	209	70	27	—	—	—	—	—	—
J-79	309	460	302	102	2	—	—	—	—	—
J-85	69	32	2	—	—	—	—	—	—	—
J-65	—	137	798	1,135	3,252	3,308	1,331	42	16	—
J-71	—	135	422	507	388	130	54	4	—	—
J-83	—	6	—	—	—	—	—	—	—	—
J-35	—	—	—	—	507	1,300	2,192	4,282	2,220	759
J-40	—	—	—	—	61	51	7	—	—	—
J-46	—	—	—	—	265	515	88	1	—	—
J-47	—	—	—	191	1,871	5,204	12,141	7,967	3,755	2,765
J-73	—	—	—	6	392	436	37	—	—	—
J-42	—	—	—	—	—	—	—	—	—	—
J-67	—	—	—	—	—	—	—	—	2	—
Turbo-Prop	544	534	554	654	261	205	70	16	296	650
T-33	2	—	—	—	—	—	—	—	295	650
T-34	63	103	52	73	87	17	24	2	1	—
T-53	165	40	—	—	—	—	—	—	—	—
T-56	260	371	481	580	165	31	6	—	—	—
T-58	54	20	21	1	—	—	—	—	—	—
T-40	—	—	—	—	2	152	39	14	—	—
T-49	—	—	—	—	7	5	1	—	—	—
Recipro-cating	661	1,452	2,429	2,663	3,875	7,868	13,365	8,731	6,471	3,122
O-435	327	298	217	96	4	—	224	118	—	—
O-480	66	285	230	30	—	—	—	—	—	—
O-470	—	173	143	377	435	477	760	1,187	1,951	122
O-335	—	—	13	137	95	25	528	1,112	600	15
O-526	—	—	4	—	—	—	—	—	—	—
O-525	—	—	9	—	—	—	—	—	—	—
O-425	—	—	—	—	—	—	33	99	—	10
O-190	—	—	—	—	—	—	—	—	—	75
O-205	—	—	—	—	—	—	—	14	—	—
R-1340	—	22	7	—	—	—	—	—	—	—
R-1820	155	506	1,191	1,160	1,035	1,240	1,344	533	205	163
R-3350	113	87	198	547	1,022	1,901	3,511	1,544	681	432
R-1300	—	11	201	77	118	188	1,618	497	290	311
R-2800	—	70	216	239	529	1,052	1,187	486	322	373
R-4360	—	—	—	—	637	2,933	3,910	2,897	2,329	1,601
R-975	—	—	—	—	—	52	250	244	86	17
R-2180	—	—	—	—	—	—	—	—	7	3

Source: 17

and BOMARC produces about the same result—about 21% for the aircraft versus about 8% for the missile.

Research and development costs as a per cent of total program cost, however, present the opposite relationship. In the case of the ATLAS, R&D accounts for well over one-third of total program costs compared with about 5% in the case of the B-52. The comparable figures for the BOMARC and the F-102 are 13% and 3%, respectively.

The reasons for these differences are quite apparent. The aircraft is recoverable; the missile is not. Therefore, the aircraft can be exercised repeatedly in flight while the missile cannot. This in turn means far greater fuel consumption and maintenance costs, including spares, for the aircraft systems as compared with the missile systems.

By the same token, however, it means that a much higher degree of system reliability must be built into the missiles than into the aircraft. There are no crews aboard the missiles to make corrections in flight. Everything must virtually work perfectly if the mission is to be successful. It is this need for high system reliability that in large measure accounts for the fact that research and development is a much greater proportion of total program cost in the case of missiles than in the case of aircraft.

Since the Defense Department will continue to budget and the Congress will continue to appropriate funds in terms of budget categories and appropriations, a "torque converter" has to be provided to permit a ready translation of program data into the traditional budget accounts, and vice versa. The Defense Department has chosen for this purpose a new financial measure termed "total obligational authority." Except for certain Air Force missiles which are at present incrementally funded, total obligational authority or TOA represents the full cost of an annual increment of a program, regardless of the year in which the funds are authorized, appropriated, obligated, or expended. And, beginning in fiscal year 1964, it is expected that the DOD will fund all programs

UNITED STATES AIR FORCE PERSONNEL, 1912 TO DATE

As of June 30	TOTAL	Officers	Cadets	Airmen
1912[a]	51	12	—	39
1914	122	18	—	104
1916	311	63	—	248
1918[b]	195,023	20,708	—	174,315
1920	9,050	969	—	8,081
1922	9,642	958	113	8,571
1924	10,547	884	119	9,544
1926	9,674	954	142	8,578
1928	10,549	1,055	280	9,214
1930	13,531	1,499	378	11,654
1932	15,028	1,659	325	13,044
1934	15,861	1,545	318	13,998
1936	17,233	1,593	328	15,312
1938	21,089	2,179	342	18,568
1940	51,165	3,361	1,894	45,910
1941	152,125	10,611	8,627	132,887
1942	764,415	55,956	50,213	658,246
1943	2,197,114	205,874	99,672	1,891,568
1944	2,372,292	333,401	82,647	1,956,244
1945	2,282,259	381,454	16,764	1,884,041
1946	455,515	81,733	7	373,775
1947	305,827	42,745	53	263,029
1948	387,730	48,957	1,338	337,435
1949	419,347	57,851	1,860	359,636
1950	411,277	57,006	2,186	352,085
1951	788,381	107,099	2,476	678,806
1952	973,474	128,401	6,782	838,291
1953	977,593	130,769	9,157	837,667
1954	947,918	129,752	9,072	809,094
1955	959,946	137,149	4,384	818,413
1956	909,958	142,093	3,256	764,609
1957	919,835	140,563	2,706	776,566
1958	871,156	132,939	2,458	704,562
1959	840,435	131,602	4,271	735,759
1960	814,752	129,689	4,397	680,666
1961	821,151	128,793	2,801	689,557
1962[E]	887,664	137,504	2,970	747,190
1963[E]	868,566	132,891	2,520	733,155

[E] Estimate.
[a] As of November 1.
[b] As of November 11.
Sources: 3, 17

without exception, so that TOA will in all cases truly represent the full cost of an annual increment of a program.

Both the program books, i.e., program elements and resource categories, and the budget books, i.e., the appropriation accounts, will then be kept in terms of total obligational authority programmed and obligations incurred. These two fiscal measures will be the connecting links between the appropriation accounts (budget) and the programs.

UNITED STATES NAVY AND MARINE CORPS AVIATION PERSONNEL, 1941 TO DATE

Year as of June 30	TOTAL	Pilots	Enlisted Aviation Rates	Aviation Ground Officers
1941	23,148	6,300	14,848	2,000
1944	299,968	47,276	228,356	24,336
1950	91,298	12,978	76,349	1,971
1951	162,214	18,287	139,838	4,089
1952	194,730	20,944	168,486	5,300
1953	196,813[c]	22,903	163,673	4,930
1954	179,783[c]	21,316	147,670	4,725
1955	165,243[c]	21,352	133,424	4,885
1956	204,388	23,740	175,588	5,060
1957	212,684	23,101	181,847	7,736
1958	202,884	23,214	172,777	6,893
1959	191,077	22,593	161,931	6,553
1960	182,654	21,808	153,385	7,461
1961	188,707	21,957	158,633	8,117

Sources: 3, 17

UNITED STATES ARMY AVIATORS ON ACTIVE DUTY, 1950 TO DATE

As of June 30	Total Number
1950	1,050
1951	1,372
1952	1,933
1953	2,227
1954	2,528
1955	3,097
1956	4,166
1957	5,050
1958	5,611
1959	5,984
1960	6,365
1961	6,531

Source: 17

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

Fiscal Year	U. S. Air Force		Naval Aviation	
	Total Cash Appropriations	Expenditures	Total Cash Appropriations[a]	Expenditures
1899	$ .05	N.A.	$ —	N.A.
1909	.03	N.A.	—	N.A.
1912	.12	N.A.	.03	N.A.
1913	.10	N.A.	.01	N.A.
1914	.17	N.A.	.01	N.A.
1915	.20	N.A.	.01	N.A.
1916	.80	N.A.	1.0	N.A.
1917	18.7	N.A.	3.8	N.A.
1918	735.0	N.A.	61.5	N.A.
1919	952.3	N.A.	220.4	N.A.
1920	28.1	N.A.	25.7	N.A.
1921	35.1	$ 30.9	20.0	N.A.
1922	25.6	23.1	19.1	$ 14.3
1923	13.1	18.1	14.8	14.2
1924	12.6	11.0	14.7	14.3
1925	13.5	11.7	15.7	15.5
1926	15.9	14.9	18.2	18.1
1927	15.3	16.8	22.4	22.0
1928	21.1	19.4	20.3	19.8
1929	28.9	23.3	32.3	32.1
1930	34.9	28.1	31.6	31.1
1931	38.9	38.7	32.1	31.0
1932	31.9	33.0	31.2	31.7
1933	25.7	22.1	25.4	31.2
1934	31.0	17.6	29.8	15.5
1935	27.9	20.5	32 1	17.2
1936	45.6	32.2	40.8	20.5
1937	59.6	41.3	38.9	27.5
1938	58.9	51.1	51.6	59.8
1939	71.1	83.4	48.2	47.9
1940	186.6	108.5	111.8	50.8
1941	2,173.6	605.9	453.0	193.6
1942	23,049.9	2,555.2	6,190.0	993.1
1943	11,317.4	9,392.4	5,258.0	3,966.4

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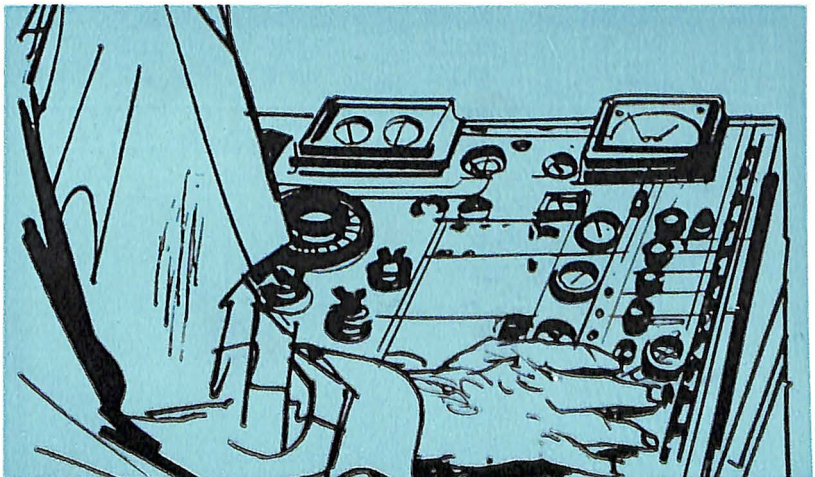
APPROPRIATIONS AND EXPENDITURES FOR MILITARY AVIATION
1899 TO DATE—*Continued*
(Millions of Dollars)

Fiscal Year	U. S. Air Force		Naval Aviation	
	Total Cash Appropriations	Expenditures	Total Cash Appropriations[a]	Expenditures
1944	23,656.0	13,087.7	4,583.7	4,490.1
1945	1,610.7	11,357.4	2,539.6	5,166.0
1946	.5	2,519.4	795.0	1,065.7
1947	1,200.0	854.3	770.8	749.1
1948	608.1 } [b] 829.8 }	1,199.1	906.0	747.9
1949	938.8	1,059.2	588.3	875.1
1950	4,139.4	3,599.9	1,034.7	999.9
1951	15,855.6	6,348.7	3,815.3	1,238.0
1952	22,975.1	12,716.0	5,266.5	2,228.4
1953	22,076.4	15,087.1	4,853.0	3,110.1
1954	11,419.4	15,668.5	2,322.0	3,296.7
1955	11,637.1	16,406.7	2,755.0	2,553.4
1956	15,517.0	16,748.8	1,717.8	2,737.1
1957	17,696.5	18,362.7	2,543.7	3,053.3
1958	17,732.2	18,435.4	2,682.8	3,358.6
1959	18,712.6	19,084.2	2,890.0	3,323.3
1960	18,495.9	19,066.2	1,961.6	2,027.1
1961	17,884.3	19,778.2	2,141.8	2,069.1
1962[E]	19,591.8	20,500.4	2,680.9	2,620.0
1963[E]	19,757.5	19,913.9	3,065.0	2,660.0

NOTE: For details on missiles see separate tables in this and the missiles chapter.
E Estimate.
[a]Includes "Aircraft and Related Procurement" and "Aircraft and Facilities" until 1960. Beginning with 1961 "Procurement of Aircraft and Missiles."
[b]FY 1949 Construction of Aircraft & Related Procurement appropriation enacted in FY 1948.
Sources: 3, 17, 24



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

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

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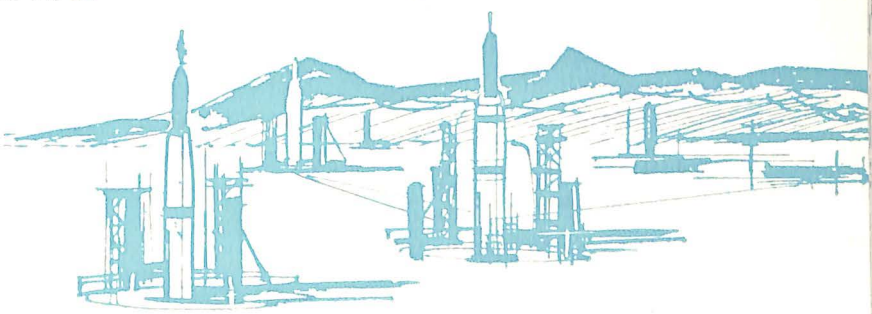
TOTAL FEDERAL EXPENDITURES AND EXPENDITURES FOR MILITARY AIRCRAFT AND GUIDED MISSILES
1922 TO DATE
(Dollar Figures in Millions)

Fiscal Year	Total Federal Expenditures	Total National Security Expenditures[a]	Expenditures for Aircraft and Missiles[b]	Percent Aircraft and Missiles of Total Federal	Percent Aircraft and Missiles of National Security
1947	39,289	14,769	593	1.5	4.0
1948	33,791	11,983	703	2.1	5.9
1949	40,057	13,988	1,248	3.1	8.9
1950	39,617	13,009	1,705	4.3	13.1
1951	44,058	22,444	2,433[c]	5.5	10.8
1952	65,408	45,963	5,057[c]	7.7	11.0
1953	74,120	50,442	8,434[c]	11.4	16.7
1954	67,537	46,986	9,497[c]	14.1	20.2
1955	64,389	40,695	9,408[c]	14.6	23.1
1956	66,224	40,723	8,840[c]	13.3	21.7
1957	68,966	43,360	10,502[c]	15.2	24.2
1958	71,369	44,234	11,227[c]	15.7	25.4
1959	80,342	46,491	11,067[c]	13.8	23.8
1960	76,539	45,691	9,299[c]	12.1	20.4
1961	81,515	47,494	8,870[c]	10.9	18.7
1962[E]	89,075	51,212	9,972[c]	11.2	19.5
1963[E]	92,537	52,690	9,467[c]	10.2	18.0

[E] Estimate.
[a] Includes stockpiling, Mutual Defense, and Atomic Energy.
[b] Includes related items.
[c] Procurement and Production, military functions only.
Sources: 3, 16, 17, 24



DEPARTMENT OF DEFENSE
UNOBLIGATED FUNDS AVAILABLE FOR PROCUREMENT, FEBRUARY 28, 1962
TOTAL AND AIRCRAFT
(Millions of Dollars)

	Total Procurement	Aircraft	Aircraft as Percent of Total
Defense Department	$12,383	$5,020	40.5
Air Force	6,009	3,662	60.9
Navy	4,421	1,288	29.1
Army	1,953	70	3.6

Source: 20

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

Year Ending June 30	Total Procurement and Production	Aircraft	Aircraft as Percent of Total
1951	$23,114	$ 8,686	37.6
1952	29,536	13,471	45.6
1953	21,117	13,948	66.1
1954	10,588	5,041	47.6
1955	7,420	4,922	66.3
1956	9,795	6,923	70.7
1957	11,294	6,559	58.1
1958	10,983	5,945	54.1
1959[a]	14,304	6,167	43.1
1960[a]	11,701	5,929	50.7
1961[a]	11,716	4,998	42.7
1962[a, E]	15,893	5,795	36.5
1963[a, E]	16,445	5,488	33.4

[E] Estimate based on 1963 Budget Submission.
[a] Data are not directly comparable to those for earlier years because of changes in title classifications and in funding.
Source: 17

DEPARTMENT OF DEFENSE
UNPAID OBLIGATIONS, FEBRUARY 28, 1962
TOTAL AND AIRCRAFT
(Millions of Dollars)

	Total Procurement	Aircraft	Aircraft as Percent of Total
Defense Department	$16,664	$5,438	32.6
Air Force	5,332	2,703	50.7
Navy	8,335	2,462	29.5
Army	2,996	274	9.1

Source: 20

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

Year Ending June 30	Total Procurement and Production	Aircraft	Aircraft as Percent of Total
1951	$ 3,976	$2,412	60.7
1952	11,478	4,888	42.2
1953	17,297	8,189	47.3
1954	15,957	9,080	56.9
1955	12,838	8,804	68.6
1956	12,227	7,835	64.1
1957	13,488	8,647	64.1
1958	14,083	8,793	62.4
1959	14,409	7,730	53.6
1960	13,334	6,272	47.0
1961	13,095	5,898	45.0
1962[E]	14,836	6,449	43.5
1963[E]	15,356	5,568	36.3

[E] Estimate based on 1963 Budget Submission.
Source: 17

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

Year Ending June 30	Total Defense Department	Air Force	Navy	Army
1951	$8,686	$ 6,247	$2,304	$135
1952	13,471	10,091	3,335	44
1953	13,948	N.A.	N.A.	N.A.
1954	5,041	N.A.	N.A.	N.A.
1955	4,922	N.A.	N.A.	N.A.
1956	6,923	N.A.	N.A.	N.A.
1957	6,559	N.A.	N.A.	N.A.
1958	5,945	N.A.	N.A.	N.A.
1959	6,167	N.A.	N.A.	N.A.
1960	5,929	4,090	1,739	100
1961	4,998	3,267	1,612	119
1962[E]	5,795	3,723	1,830	243
1963[E]	5,488	3,135	2,135	218

[E] Estimate based on 1963 Budget Submission.
Source: 17

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

Year Ending June 30	Total Defense Department	Air Force	Navy	Army
1951	$2,412	$1,812	$ 594	$ 7
1952	4,888	3,633	1,205	51
1953	8,189	N.A.	N.A.	N.A.
1954	9,080	N.A.	N.A.	N.A.
1955	8,804	N.A.	N.A.	N.A.
1956	7,835	N.A.	N.A.	N.A.
1957	8,647	N.A.	N.A.	N.A.
1958	8,793	N.A.	N.A.	N.A.
1959	7,730	N.A.	N.A.	N.A.
1960	6,272	4,414	1,765	93
1961	5,898	3,926	1,832	141
1962[E]	6,449	4,178	2,104	167
1963[E]	5,568	3,460	1,923	185

[E] Estimate based on 1963 Budget Submission.
Source: 17

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

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

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

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

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

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

New Obligational Authority: Congressional appropriations and reappropriations.

New Obligational Availability: New obligational authority plus transfers.

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

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

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

Sources: 17, 24

AIR TRANSPORTATION

AIRLINE INDUSTRY

U. S. certificated airlines during 1961 continued their extensive program of modernizing their air fleets and facilities for improved service to passengers and shippers. These efforts produced new records in passengers carried and ton-miles of freight cargo and mail.

However, the financial picture of the carriers did not improve. The end result of a record $2 billion in revenues was a $35 million loss for the certificated carriers.

The certificated airlines in 1961 carried more than 58 million passengers, a slight increase over the previous year. This is more than twice the number of passengers carried in 1951. Revenue passenger miles continued to gain in 1961, increasing to 39.8 billion in 1961 compared to 38.9 in 1960. Cargo and mail ton-miles showed impressive increases. Mail ton-miles gained from 250 million in 1960 to 308 in 1961.

The U. S. scheduled airlines in 1961 operated 1,611 air transports, ranging from the venerable DC-3 to turbine-powered transports flying from coast-to-coast in less than 5 hours.

Turbine-powered transports today make up less than one-third of the total certificated airline fleet. However, these planes carried more than 50 per cent of the passengers.

This percentage will continue to grow, of course, as airlines receive more and more of these aircraft. During 1962 and 1963, for example, an

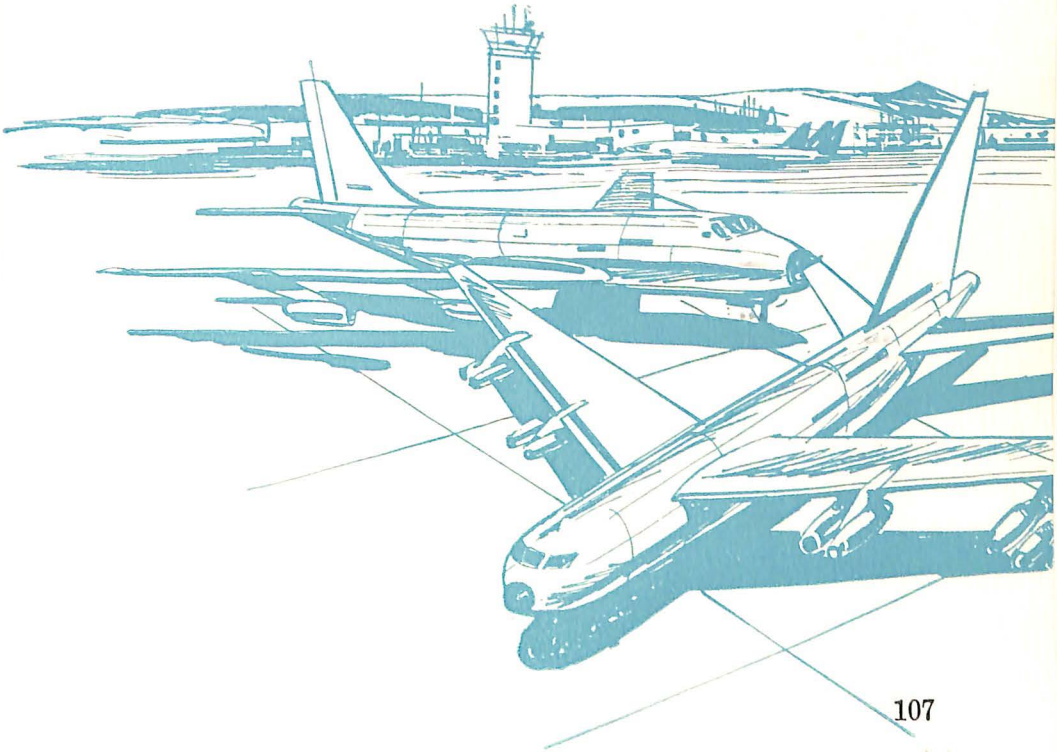
additional 100 new turbojets will be delivered to the Nation's carriers. More will follow in succeeding years.

This not only gives American travelers and shippers the greatest civil air system in the world but immeasurably strengthens our Nation's military capability. The industry's fleet constitutes a tremendous national resource as a force in-being for any emergency. Of these, more than 200 planes are specifically assigned for service with the Civil Reserve Air Fleet, and would be used in global military airlift operations in the event of a national emergency.

Emphasis on safety continued to be a paramount feature of airline development. The safety record of 0.31 fatalities per 100 million passenger-miles was the third lowest in airline history. It also marked the tenth consecutive year that there has been less than one fatality per 100 million passenger-miles.

Safety continues to receive the greatest possible attention. On aircraft maintenance alone, the airlines spent well over a half-billion dollars in 1961, almost a third of total operating expenses. There is no such thing as a deferred expense in the safe maintenance of aircraft; at all times, the highest standards are maintained.

A major problem for the domestic trunklines in 1961, however, was declining load factors. Thus, while passenger-mile volume was at a new



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

Company and Aircraft	1953	1954	1955	1956	1957	1958	1959	1960	1961
TOTAL[a]	209	191	113	206	323	216	262	241	206
Boeing									
707	—	—	—	—	—	7	73	68	11
720	—	—	—	—	—	—	—	24	61
Convair									
340	101	61	14	—	—	—	—	—	—
440	—	—	—	57	79	21	14	5	—
880	—	—	—	—	—	—	—	15	49
Douglas									
DC-6	69	41	14	39	44	65	1	—	—
DC-7	11	48	30	67	123	57	—	—	—
DC-8	—	—	—	—	—	—	21	91	42
Fairchild									
F-27	—	—	—	—	—	25	41	14	8
Lockheed									
1049	28	41	55	43	42	21	5	—	—
1649	—	—	—	—	35	8	—	—	—
Electra	—	—	—	—	—	12	107	24	21
Jet Star	—	—	—	—	—	—	—	—	14

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

peak, the rate of growth was slower than anticipated.

Also significant in the trunk passenger field in 1961 was the fact that low-fare coach traffic, for the first time, exceeded first class traffic, accounting for 57 per cent of total passenger miles. This compares with 49 per cent in 1960 and 43 per cent in 1959. During the late summer months of 1961, the coach percentage was as high as 63 per cent of total.

These two factors—retarded traffic growth and a substantial switch from first class to low-fare coach service—contributed largely to the first loss in 13 years by the trunk carriers.

Plans for the development of a supersonic transport moved ahead. The President's Task Force on National Aviation Goals stated: "The technical feasibility of building and operating a supersonic transport suitable for commercial transportation has been attested to by competent persons, not only in the United States, but in other countries. British and French designers are known to be working diligently on designs for such aircraft. The Soviets, whose moves are perhaps of most significance, are undoubtedly moving aggressively in this direction. The recent flight of a Soviet supersonic bomber in the Tushino air show is an indication of their capabilities.

"Beyond the economic and social justification for the development of a supersonic transport, international prestige considerations argue heavily in favor of going forward with the development of such an aircraft on a timely basis. The loss of this nation's preeminent position in the production and sale of transport aircraft would be a stunning setback. In the light of Russian accomplishments in space technology, it is imperative that the United States must retain its leadership in aviation.

"Finally, a fleet of supersonic transports would represent a significant military asset. The importance of the ability to rush troops and material to remote areas of the world—at speeds afforded by supersonic transport—is obviously desirable."

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

Domestic						International[a]					
Aircraft Make and Model	1941	1958	1959	1960	1961	Aircraft Make and Model	1941	1958	1959	1960	1961
Bell						Armstrong-Whitworth					
B47D,G	..	4	5	5	1	Argosy	..	..	..	..	7
Boeing						Boeing					
247D	27	..	..	..	..	307	3	..	..	..	..
307	5	..	..	..	..	314	8	..	..	..	..
377	..	9	6	..	..	377	..	23	15	3	..
707	..	..	48	62	62	707	..	6	18	29	32
720	..	..	..	22	76	Canadair					
Convair						CL-44	..	..	..	..	9
240	..	76	46	51	46	Convair					
340	..	133	122	117	115	880	..	..	..	..	1
440	..	31	36	31	31	Curtiss					
540	..	..	1	4	5	C-46	..	..	..	..	29
880	..	..	..	14	38	Douglas					
Curtiss						DC-2	3	..	..	..	..
C-46	..	7	7	7	15	DC-3	45	8	14	9	13
Douglas						DC-4	..	27	26	22	23
DC-3	280	307	282	258	237	DC-6	..	83	52	36	43
DC-4	..	31	25	18	2	DC-7	..	38	31	37	42
DC-6	..	271	270	261	217	DC-8	..	..	..	19	24
DC-7	..	214	189	179	173	Lockheed					
DC-8	..	..	18	56	69	10	2	..	..	..	..
Fairchild						18	3	..	..	..	..
F-27	..	10	29	37	44	749	..	..	..	..	7
Lockheed						1049	..	..	..	1	26
10	16	..	..	..	..	Martin					
18	13	7	..	..	..	130	1	..	..	..	..
49, 749	..	109	98	69	62	404	..	..	..	..	5
1049	..	89	86	82	65	Sikorsky					
1649	..	29	28	25	24	S42B	4	..	..	..	..
188	..	..	96	107	122	S43	1	..	..	..	..
Martin						Other[b]	N.A.	N.A.	N.A.	N.A.	1
202	..	26	19	15	17						
404	..	95	85	80	59						
Sikorsky											
S51	..	2	2	2	1						
S55	..	6	5	5	5						
S58	..	5	6	7	7						
S62	..	..	..	1	..						
Sud-Aviation											
Caravelle	..	..	..	..	17						
Vertol											
V44B	..	5	5	5	5						
Vickers											
700, 800	..	80	82	74	70						
Other[b]	N.A.	N.A.	N.A.	N.A.	26						
Total	341	1546	1596	1594	1611[c]	Total	70	185	156	156	262

(Continued on next page)

U. S. Scheduled Airlines—Aircraft in Service by Make and Model—*Continued*

Domestic						International[a]					
Aircraft Make and Model	1941	1958	1959	1960	1961	Aircraft Make and Model	1941	1958	1959	1930	1961
Fixed Wing						Fixed Wing					
4-engine turbojet	..	..	66	154	245	4-engine turbojet	..	6	18	48	57
4-engine turboprop	..	80	178	181	192	4-engine turboprop	..	..	..	..	16
2-engine turboprop	..	10	30	41	49	2-engine turboprop	..	..	..	..	..
2-engine turbojet	..	..	..	..	17	2-engine turbojet	..	..	..	..	..
4-engine piston	5	752	702	634	543	4-engine piston	16	171	124	99	141
2-engine piston	336	682	597	559	520	2-engine piston	54	8	14	9	47
Helicopter						Helicopter					
Piston engine	..	22	23	24	19	Piston engine	..	..	..	..	..
Turbine engine	..	..	..	1	..	Turbine engine	..	..	..	..	..
Other[b]	N.A.	N.A.	N.A.	N.A.	26	Other[b]	N.A.	N.A.	N.A.	N.A.	1
Total	341	1546	1596	1594	1611	Total	70	185	156	156	262

N.A.—Not available.

[a] Excludes certain aircraft in both domestic and international operations; includes all-cargo carriers.

[b] Not identified by make, model, and number and type of engines.

[c] Does not include 4 turboprop, 118 two-engine piston, and 105 4-engine piston powered fixed wing transport aircraft operated by supplemental and commercial U. S. air carriers.

Source: 25

EMPLOYMENT, WAGES, AND AVERAGE ANNUAL EARNINGS IN THE TRANSPORTATION INDUSTRY, 1959

	ALL INDUSTRY	ALL TRANSPORTATION	Air Transportation (Common Carrier)	Railroads	Highway Transportation	Water, Pipeline, and Other Transportation
Full-Time Equivalent Employees (Thousands)	57,664	2,459	167	883	1,064	345
Wages and Salaries (Million Dollars)	$271,310	$14,577	$1,147	$5,499	$5,849	$2,082
Average Annual Earnings per Full Time Employee	$4,705	$5,928	6,868	$6,228	5,497	$6,035

Source: 9

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

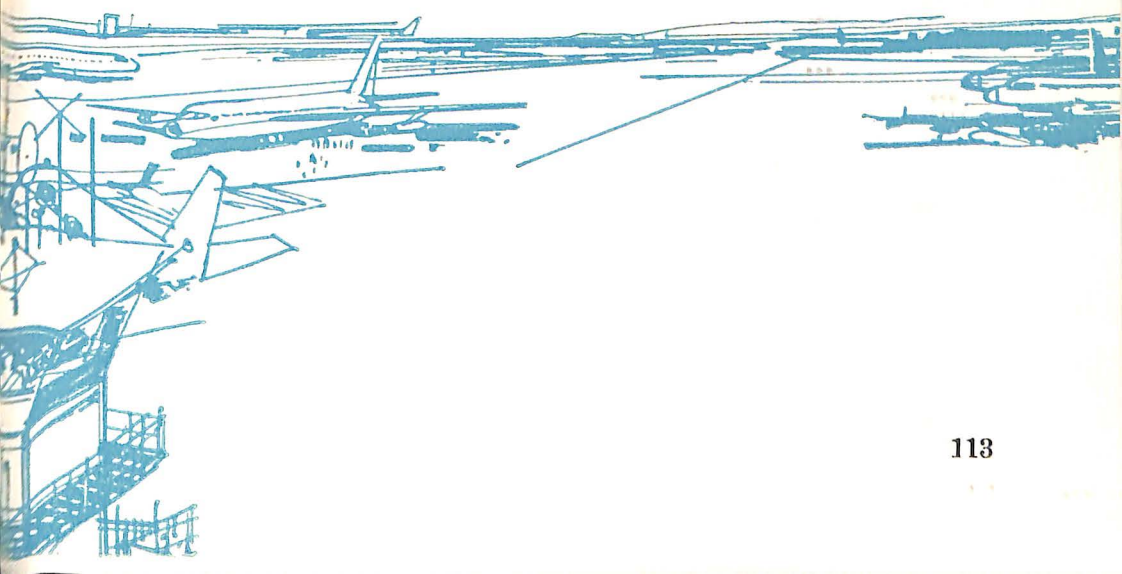
Year	Revenue Miles (Millions) Flown	Passengers Carried (Millions)	Revenue Passenger Miles (Millions)	Cargo Ton-Miles[a] (Millions)	Mail Ton-Miles[b] (Millions)
1949	463	17	8,827	196	66
1951	527	25	13,204	324	92
1953	657	32	18,245	359	106
1955	780	42	24,351	503	150
1956	869	46	27,625	634	160
1957	976	49	31,261	721	169
1958	973	49	31,499	726	185
1959	1,030	56	36,372	853	209
1960	998	58	38,863	880	250
1961	970	58	39,831	1,023	308

[a] Includes freight plus express revenue ton-miles in scheduled and nonscheduled operations.
[b] U. S. mail ton-miles plus foreign mail ton-miles.
Source: 8

U. S. Domestic and International Scheduled Airlines Passenger Service
Selected Years, 1926 to Date

Year	Domestic		International	
	Passengers Carried[a] (Thousands)	Revenue Passenger-Miles Flown[b] (Millions)	Passengers Carried[a] (Thousands)	Revenue Passenger-Miles Flown[b] (Millions)
1926	6	1.3	N.A.	N.A.
1930	385	85.1	33	7.8
1935	679	281.2	111	46.7
1940	2,803	1,052.2	163	99.8
1945	6,541	3,360.3	511	450.1
1950	17,468	8,029.1	1,752	2,214.0
1951	22,711	10,589.7	2,140	2,613.8
1952	25,176	12,559.3	2,391	3,065.0
1953	28,901	14,793.9	2,745	3,450.8
1954	32,529	16,802.4	2,919	3,810.4
1955	38,221	19,852.1	3,488	3,398.9
1956	41,937	22,398.6	4,068	5,226.2
1957	45,162	25,378.8	4,259	5,882.0
1958	44,741	25,375.5	4,428	6,123.9
1959	51,000	29,307.6	4,999	7,064.2
1960	52,377	30,556.6	5,499	8,306.2
1961	52,712	31,062.3	5,699	8,768.5

NOTE: Passenger originations only.
N.A.—Not available.
[a] 1926, 1930: duplicated revenue and non-revenue passengers; 1935, 1940: duplicated revenue passengers; 1945 to date: unduplicated revenue passengers.
[b] 1926, 1930: includes non-revenue passenger-miles.
Source: 8



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

Year	Miles Flown (Millions)	Passengers Carried (Millions)	Passenger-Miles (Millions)	Cargo-Ton-Miles (Millions)	Mail-Ton-Miles (Millions)
1919	1	N.A.	N.A.	N.A.	N.A.
1929	57	N.A.	132	N.A.	N.A.
1934	101	N.A.	405	N.A.	N.A.
1939	185	N.A.	1,262	N.A.	N.A.
1944	257	N.A.	3,412	N.A.	N.A.
1949	840	27	15,000	390	130
1951	1,000	42	22,000	625	160
1953	1,195	52	28,500	710	185
1955	1,420	68	38,000	890	255
1956	1,570	77	44,000	1,015	275
1957	1,760	85	50,500	1,115	295
1958	1,815	87	53,000	1,145	320
1959	1,915	98	60,000	1,315	355
1960	1,930	106	67,500	1,495	415
1961	1,925	112	72,000	1,680	500

N.A.—Not available.
Source: 29

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

1961		1954	
United Air Lines	6,896	Pennsylvania Railroad	3,447
American Airlines	5,964	American Airlines	3,372
Trans World Airlines	4,286	United Air Lines	3,135
Eastern Air Lines	4,007	New York Central System	3,041
Delta Air Lines	2,183	Eastern Air Lines	2,847
Pennsylvania Railroad	1,989	Trans World Airlines	2,611
Atchison, Topeka & Santa Fe Railway System	1,695	Atchison, Topeka & Santa Fe Railway System	1,948
New York Central System	1,182	Union Pacific Railroad Company	1,459
Union Pacific Railroad Company	1,150	Southern Pacific Company	1,342
National Airlines	1,118	New York, New Haven & Hartford Railroad Company	1,274

[a] Excludes commuters and multiple ride passengers.
NOTE: Data do not include foreign operations of the airlines.
Sources: 8, 30

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

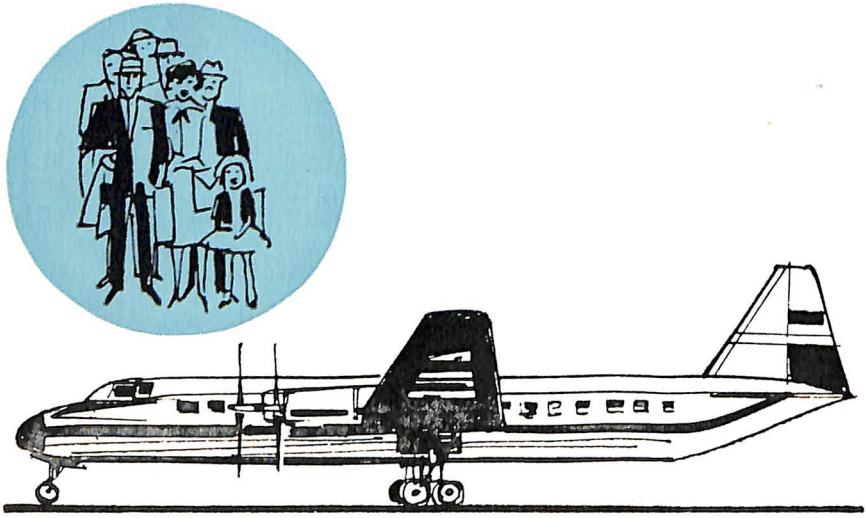
Year	Domestic Air Carriers			Railroads (excluding Commutation)		
	TOTAL	Scheduled	Non-Scheduled	TOTAL	Pullman	Coach
1937	.4	.4	—	21.6	9.2	12.4
1938	.5	.5	—	18.5	8.3	10.2
1939	.7	.7	—	19.6	8.5	11.1
1940	1.1	1.1	—	20.7	8.2	12.5
1941	1.4	1.4	—	26.2	10.1	16.1
1942	1.4	1.4[a]	—	50.0	19.1	30.9
1943	1.6	1.6	—	83.8	25.9	57.9
1944	2.2	2.2	—	91.7	28.3	63.4
1945	3.4	3.4	—	86.7	27.3	59.4
1946	5.9	5.9	—	59.7	20.7	39.0
1947	6.1	6.1	—	41.2	13.5	27.7
1948	6.0	6.0	—	36.5	12.2	24.3
1949	6.9	6.8	.1	30.8	10.5	20.3
1950	8.0	8.0	[a]	26.6	9.2	17.4
1951	10.7	10.6	.1	29.4	9.9	19.5
1952	12.7	12.6	.1	29.1	9.3	19.8
1953	14.9	14.8	.1	27.2	8.2	19.0
1954	16.9	16.8	.1	25.0	7.3	17.7
1955	20.0	19.9	.1	24.2	6.9	17.3
1956	22.5	22.4	.1	23.7	6.6	17.1
1957	25.5	25.4	.1	21.0	5.2	15.9
1958	25.6	25.4	.2	18.4	4.2	14.2
1959	29.5	25.3	.2	17.6	3.8	13.8
1960	30.9	30.6	.3	17.0	3.6	13.4
1961	31.3	31.1	.2	16.2	3.3	12.9

[a] Less than 50 million passenger miles.
Sources: 8, 80

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

Year	AIRLINES		RAILROAD		INTER-CITY BUS
	Domestic Scheduled	Domestic Non-Scheduled	Coach (Excluding Commuter)	Parlor Car and Sleeping Car[a]	
1926	12.0	—	3.35	N.A.	2.96
1937	5.6	—	1.80	N.A.	1.73
1947	5.1	—	2.02	2.74	1.70
1952	5.55	3.20	2.53	3.35	2.02
1953	5.45	3.20	2.53	3.38	2.06
1954	5.39	N.A.	2.50	3.35	2.08
1955	5.35	N.A.	2.47	3.31	2.06
1956	5.32	N.A.	2.56	3.39	2.13
1957	5.30	N.A.	2.71	3.68	2.29
1958	5.63	N.A.	2.76	3.75	2.43
1959	5.87	N.A.	2.77	3.84	2.59
1960	6.08	N.A.	2.80	3.88	2.70
1961	6.08[E]	N.A.	2.86	3.96	2.78[E]

[a] Revenue figures cover railroad passenger tickets only, exclude space charges for parlor and sleeping cars.
N.A.—Not available.
[E] Estimate.
Sources: 1, 3, 25, 30, 37



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

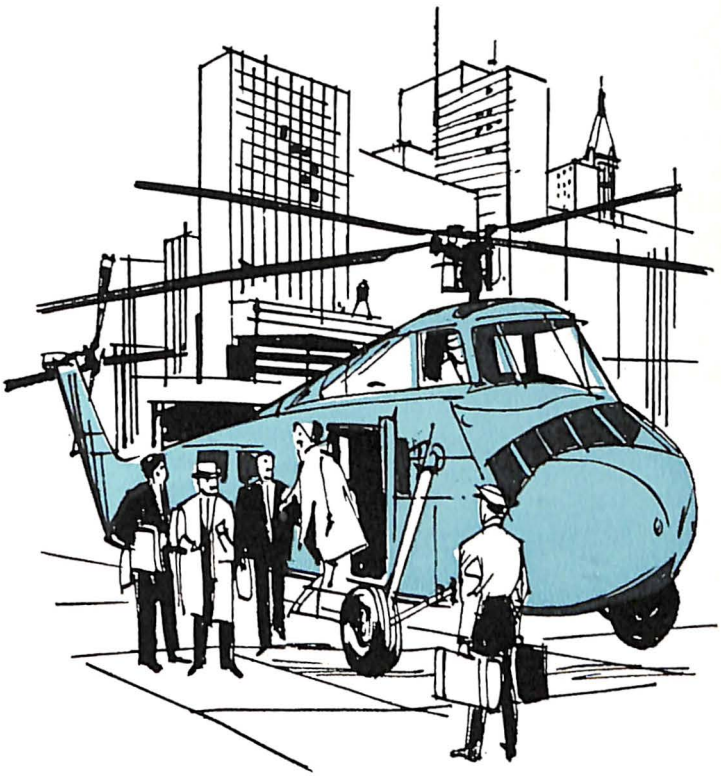
	TOTAL	Domestic Air Carriers	Railroads[a]	Buses
Billions of Passenger-Miles				
1916	35.2	[b]	35.2	[b]
1939	32.9	.7	22.7	9.5
1941	44.4	1.4	29.4	13.6
1944	125.3	2.2	95.7	27.4
1948	76.7[r]	6.0[r]	46.0	24.7
1951	72.3[r]	10.6[r]	35.3	27.4
1954	71.8[r]	16.8[r]	29.4	25.6
1955	73.9[r]	19.9[r]	28.5	25.5
1956	75.8[r]	22.4[r]	28.2	25.2
1957	73.2[r]	25.4[r]	26.3	21.5
1958	69.5[r]	25.4[r]	23.3	20.8
1959	71.8	29.3	22.1	20.4
1960	71.8[r]	30.6[r]	21.3	19.9[r]
1961	71.6[E]	31.3	20.3	20.0[E]
Percent				
1916	100.0	[b]	100.0	[b]
1939	100.0	2.1	69.0	28.9
1941	100.0	3.2	66.2	30.6
1944	100.0	1.8	76.4	21.8
1948	100.0	7.8	60.0[r]	32.2
1951	100.0	14.5[r]	48.1[r]	37.4[r]
1954	100.0	23.4[r]	40.9[r]	35.7
1955	100.0	26.9[r]	38.6[r]	34.5[r]
1956	100.0	29.6[r]	37.2	33.2[r]
1957	100.0	34.7[r]	35.9[r]	29.4
1958	100.0	36.5[r]	33.5[r]	30.0
1959	100.0	40.8	30.8	28.4
1960	100.0	42.6[r]	29.7[r]	27.7[r]
1961	100.0	43.7	28.4	27.9

[r]Revised
[E] Estimate
[a]Includes commutation and electrified divisions of steam railway companies, but excludes electric railways.
[b]Negligible.
Sources: 1, 25, 30, 37

TRANSPORTATION ACCIDENT DEATH RATES
(Deaths per 100,000,000 Passenger-Miles)
1946 TO DATE

Year	Domestic Airlines	Railroads	Buses	Cars and Taxis
Passenger Deaths				
1946	1.2	0.18	0.19	2.5
1947	3.2	0.16	0.21	2.3
1948	1.3	0.13	0.18	2.9
1949	1.3	0.08	0.23	2.7
1950	1.1	0.58	0.18	2.9
1951	1.3	0.43	0.24	3.0
1952	0.35	0.04	0.21	3.0
1953	0.56	0.16	0.18	2.9
1954	0.09	0.08	0.11	2.7
1955	0.76	0.07	0.18	2.7
1956	0.62	0.20	0.16	2.7
1957	0.12	0.07	0.13	2.6
1958	0.43	0.27	0.24	2.3
1959	0.69	0.05	0.17	2.3
1960	1.01	0.16	0.11	2.2
1961	0.38	0.10	0.15	2.2
Total Deaths[a]				
1946	1.8	3.2	1.4	4.0
1947	3.4	3.9	1.4	3.7
1948	1.6	4.0	1.2	3.4
1949	1.5	4.0	1.2	4.0
1950	1.3	4.7	1.1	4.2
1951	1.6	4.2	1.1	4.3
1952	0.5	3.4	1.0	4.2
1953	0.7	3.9	0.95	4.1
1954	0.1	3.4	0.82	3.7
1955	0.9	3.7	0.96	3.7
1956	0.7	3.5	0.84	3.6
1957	0.1	3.5	0.7	3.4
1958	0.5	4.1	0.87	3.2
1959	0.85	3.3	0.95	3.1
1960	1.16	3.6	0.79	3.0
1961	0.42	4.0	0.85	2.9

[a] Includes pedestrians, employees, trespassers, etc.
Source: 38



VERTICAL LIFT AIRCRAFT INDUSTRY

The 1961 edition of the Directory of Heliports/Helistops in the United States, Canada and Puerto Rico (a publication initiated by the Vertical Lift Aircraft Council in 1960) revealed: forty-three states, and the District of Columbia, Canada and Puerto Rico had 487 established heliports/helistops and 16 proposed facilities. Of these 487 established heliports, 434 are ground level and 53 are elevated. In addition, approximately 100 oil rigs in the Gulf of Mexico are equipped with helicopter landing facilities. The 1960 Directory listed 327 heliports/helistops—a 48.9% increase by 1961.

The Directory indicates an increase in the number of hospitals and

motels that have helicopter landing facilities—a trend that stresses the immediate need for city-center heliports.

SUMMARY OF HELIPORTS, BY STATE

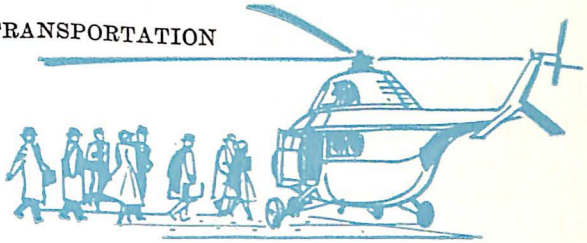
	1961	*1960*		*1961*	*1960*
Alabama	2	2	Missouri	4	4
Alaska	3	1	Montana	10	
Arizona	3		Nebraska	2	
California	89	69	Nevada	8	8
Colorado	4	4	New Hampshire	1	
Connecticut	24	15	New Jersey	18	18
Delaware	2		New York	10	7
District of Columbia	2	2	North Dakota	2	
Florida	16	4	Ohio	14	
Georgia	6	4	Oklahoma	2	
Hawaii	5		Pennsylvania	17	17
Idaho	2	1	Rhode Island	4	1
Illinois	108	107	South Carolina	1	1
Indiana	16	14	Tennessee	7	4
Iowa	1	1	Texas	17	14
Kentucky	2	1	Utah	2	1
Louisiana	21	22	Virginia	4	3
Maine	7		Washington	5	3
Maryland	6	6	West Virginia	1	1
Massachusetts	8	1	Wisconsin	7	
Michigan	11	5	Wyoming	1	1
Minnesota	3	3	Canada	22	11
Mississippi	1	1	Puerto Rico	4	
			Totals	487[a]	327

[a] Excludes approximately 100 oil rig heliports in Gulf of Mexico.
Source: 1

Another Directory published annually by AIA's Vertical Lift Aircraft Council and given wide distribution is the Directory of Helicopter Operators—(Commercial, Executive, Government) and Helicopter Flight Schools in the United States and Canada.

The 1962 Directory shows an increase of 23.9% in the number of operators and an 11.9% increase in the number of helicopters as compared with the 1961 totals. (See chart, page 122.) There are now 85 helicopter flight schools as compared with 55 in 1961.

In view of the increase in the number of executives and companies now operating helicopters as inter-plant and executive transports, an aviation publication conducted a "Round Table" discussion of the benefits



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

Company and Helicopter	1953	1954	1955	1956	1957	1958	1959	1960	1961
TOTAL	111	131	146	268	311	196	291	294	432
Bell									
47 Series .	59	68	84	111	132	99	169[b]	144[b]	177[b]
Brantley									
B-2	—	—	—	—	—	—	15	43	104
Cessna									
CH-1C ..	—	—	—	—	—	—	—	—	14
Hiller									
12 Series .	34	20	16	21	21	12	25	72	99
Hughes									
269-A ...	—	—	—	—	—	—	—	—	19
Omega									
B12-D1 ..	—	—	—	—	—	—	—	—	2
Republic									
Alouette .	—	—	—	—	—	5	15	5	—
Sikorsky									
S-55	18	43	41	52	38	11	4	1	3
S-58	—	—	5	55	60	22	47	9	8
S-61	—	—	—	—	—	—	—	—	1
S-62	—	—	—	—	—	—	—	7	5
Vertol									
H-21	—	—	—	29	60	35	12	—	—
V-33	—	—	—	—	—	—	—	5	—
V-44	—	—	—	—	—	12	5	8	—

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

as well as the problems involved in the corporate use of helicopters. Held during the American Helicopter Society Forum in May in Washington, D. C., participants included representatives of manufacturers, commercial operators, corporate users and the Federal Aviation Agency.

To aid city planners and corporations in the establishment of heliports, the Vertical Lift Aircraft Council authorized a revision of its 1958 publication "Your Heliport Design Guide." Containing an encouraging foreword by President John F. Kennedy, the 1962 edition is scheduled for publication this summer.

SUMMARY OF HELICOPTER OPERATORS AND THE HELICOPTERS OPERATED BY TYPE

	January 1962	*January 1961*	*April 1960*
Commercial Operators	322	265	193
Commercial Helicopters	994	882	705
Executives & Companies	145	106	94
Executive Helicopters	213	173	134
Government Agencies	36	35	31
Government Helicopters	112	124	97
Total Operators	503	406	318
Total Helicopters	1319	1179	936

	January 1962	*January 1961*	*April 1960*
Helicopter Flight Schools	85	55	50

Source: 1

Turbine-powered helicopters now in service with the Military and the scheduled helicopter airlines will result in greatly reduced operating costs and lower passenger fares. The resulting economic "breakthrough" will permit the helicopter to realize its incredible operational versatility.

The Marine and Army helicopters that serve the White House are scheduled to begin operating twin-turbine helicopters in June, 1962.

During the year, two major military design competitions were awarded—The Army LOH and the Tri-Service VTOL.

The Army's LOH "Light Observation Helicopter" competition was established to select a prototype 4-passenger, turbine-powered helicopter as a replacement for the L-19's, H-13's and H-23's. Deliveries of 5 prototypes from each competing company are scheduled to begin in October,

1963. Following extensive tests and evaluation, a production order of several thousand units will be made to one (or more) of the three winning competitors.

The Army now has approximately 2,800 helicopters of different types and approximately an equal number of fixed-wing airplanes. It is reported that by 1970 the proportion will be about 7 to 1—some 7,000 vertical lift aircraft and 1,000 planes.

In another VTOL aircraft area is a contract to develop a tri-service transport. A three-company team will build a tiltwing model sponsored by the three services.

In addition to the Military, one of the major Government users of helicopters is the U. S. Forest Service. Since 1947, helicopters have been used to perform a wide variety of tasks in managing our National Forests, such as range, wildlife, recreation, timber and water. Since the first fire flights 15 years ago, aircraft have become a common sight during

ANNUAL PRODUCTION OF MILITARY HELICOPTERS
1941 to Date

Year	TOTAL[a]	Air Force	Navy	Army[b]
1941	7	7	—	—
1942	—	—	—	—
1943	22	19	3	—
1944	144	120	24	—
1945	275	241	34	—
1946	44	40	4	—
1947	57	36	21	—
1948	153	94	59	—
1949	73	24	43	6
1950	26	6	5	15
1951	360	14	143	192
1952	983	49	353	559
1953	943	165	245	463
1954	431	172	46	155
1955	444	82	128	200
1956	647	62	152	430
1957	689	16	193	450
1958	668	2	204	435
1959	451	28	101	322

[a] The TOTAL column includes, in addition to the aircraft of the Air Force, Navy and Army, aircraft bought by units of the Department of Defense for delivery to foreign countries in the Military Assistance Program, and for delivery to other federal agencies such as the Coast Guard, Federal Aviation Agency, etc.

[b] For the years 1941 through 1947, aircraft for the Army Air Corps are included in the historical series for the Department of the Air Force, which was established in 1947.

Source: 17

HELICOPTERS IN PRODUCTION AND DEVELOPMENT, 1961

Company	Military Symbol		Civil Designation	Number of Places	Present Status
Bell	—		47G-2A	3	Production
	—		47G-3B	3	Production
	HUL-1M	USN	47JM	4	Development
	—		47J-2	4	Production
	HU-1B	USA	204B	9-10	Production
	HU-1D	USA	205	13	Development
	XV-3	USA	200	4	Development
	HO-4	USA	206	—	Development
Boeing-Vertol	VZ-2	USA	B-V 76	1	Development
	—		B-V 107 (prototype)	25	Development
	HRB-1	USMC	B-V 107-II	25-27	Production
	HC-1B	USA	B-V 114	33	Production
Brantley	—		B-2	2	Production
Cessna	—		CH-1C	4	Production
	—		CH-1C (IFR)[a]	4	Development
Gyrodyne	YRON-1	USN	Rotorcycle	1	Production
	XRON-1	USN	Rotorcycle	1	Production
	DSN-1	USN	Model 60	Drone	Production
	DSN-2	USN	Model 61	Drone	Development
	DSN-3	USN	Model 63	Drone	Production
Hiller	—		UH-12E	3	Production
	H-23F	USA	UH-12E4	4	Production
	YROE-1	USMC / USN	—	1	Development
	X-18	USAF	—	2	Test Bed
Hughes Tool, Aircraft Division	YHO-HU	USA	269A	2	Production
Kaman	—		K-16B	—	Development
	HU2K-1	USN	K-20	12	Production/ Development
	H-43B	USAF	K-600-3	12	Production
Omega	—		BS-12D	5	Production
Republic	—		RH-3A	5	Development

(Continued on next page)

HELICOPTERS IN PRODUCTION AND DEVELOPMENT, 1961—*Continued*

Company	Military Symbol		Civil Designation	Number of Places	Present Status
Sikorsky	H-34A,B,C	USA	S-58	20	Production
	HUS-1G	USCG			
	HUS-1,1Z	USMC			
	HSS-1,1N	USN			
	HUS-1A	USN			
	—		S-60	2	Development
	HSS-2	USN	S-61L	31	Production
	—		S-62	12	Production
	—		S-64	5	Production

[a] Instrument Flight Rules.
Source: 1

most fire-fighting operations in our western regions. For fire fighting, the Forest Service now uses *helijumpers*—specially trained men wearing protective clothing who can jump without a parachute from a hovering helicopter to the site of the fire. *Helitack* crews have been organized. In action, they are transported by helicopter to a helispot near the fire for initial attack. Since 1956 *helitankers* have been used to drop retardents on forest fires. In 1961, the Forest Service reports 14,190 helicopter flight hours were flown on fire-fighting missions and 2,381 helicopter hours for other work—such as seeding, timber survey and dam inspection —a total of 16,571 helicopter hours in Forest Service work.

The Forest Service is currently conducting studies to develop new techniques for larger transport helicopters in fire-fighting and logging operations, as well as to determine the feasibility of obtaining a suitable one-man helicopter for the Forest Ranger to replace the automobile in routine day-to-day business.

In the Air Force, helicopters have also proved effective in fire fighting and in airplane crash rescue operations—on and off airports. Crashes often occur in inaccessible areas just a few miles from an airport, and the helicopter can be on the scene in a matter of minutes to begin rescue operations.

The Presidentially-appointed Task Force on National Aviation Goals (Project Horizon) in its report in September, 1961, stated: "valuable experience is being gained in the technical and operational problems of maintaining regular scheduled services at relatively high utilization rates. This experience is of particular interest to the military agencies actively engaged in the development of V/STOL aircraft . . . (and) should be continued where it has been certificated."

HELICOPTER SCHEDULED AIRLINES
Revenue Ton-Mile Traffic Carried
1952 TO DATE
(In Thousands)

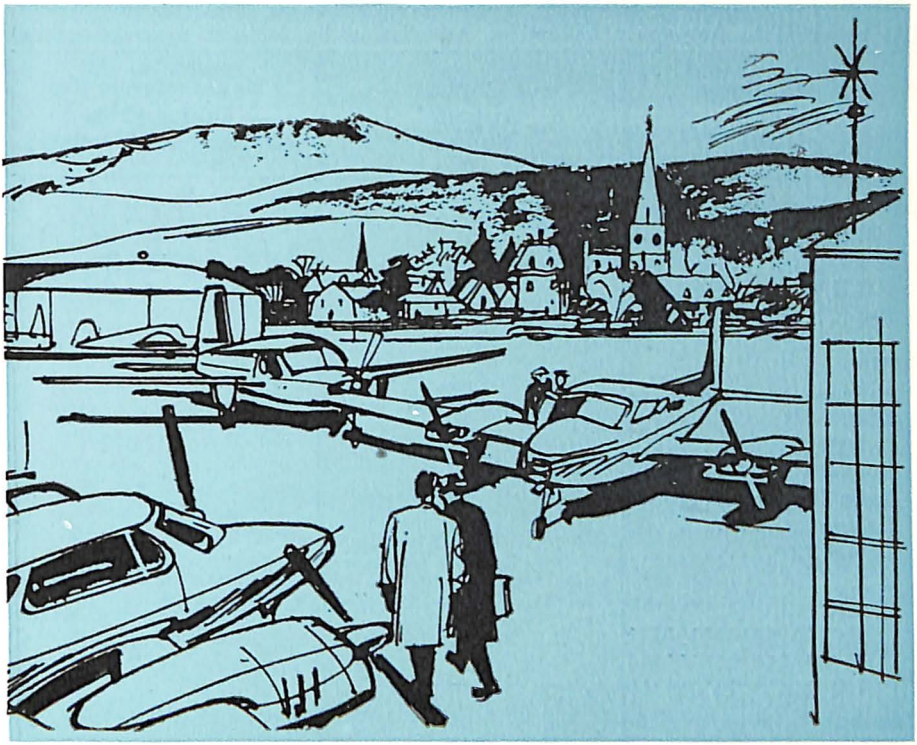
Year	TOTAL TON-MILES	Passenger	U. S. Mail	Express	Freight	Excess Baggage
1952	75	—	75	—	—	—
1953	127	2	125	—	2	—
1954	151	18	116	13	4	—
1955	193	59	97	32	5	—
1956	281	146	91	36	7	1
1957	449	314	91	34	7	3
1958	594	468	84	33	6	3
1959	856	717	87	41	7	4
1960	1,054	911	91	40	7	5
1961	960	818	93	39	6	4

Source: 8

HELICOPTER SCHEDULED AIRLINES
Available Service and Utilization
1952 TO DATE
(In Thousands)

Year	Passengers Carried	Revenue Ton-Miles Flown	Revenue Passenger-Miles Flown	Revenue Plane-Miles Flown
1952	—	75	—	632
1953	1	129	26	1,007
1954	8	152	183	1,074
1955	29	192	628	1,152
1956	64	280	1,585	1,318
1957	153	446	3,275	1,604
1958	230	589	4,885	1,675
1959	366	849	7,477	1,899
1960	490	1,044	9,475	2,219
1961	431	963	8,603	2,156

Source: 8



GENERAL AVIATION

Federal Aviation Agency studies indicate that during 1961 active general aviation aircraft reached an estimated total of 80,500 units, which flew 12,600,000 hours. When it is considered that the entire fleet of active commercial airliners totals only some 2,000 aircraft, which flew less than 4,000,000 hours, the fact that business and private use of civil aviation has come of age becomes readily apparent.

The industry's faith in this future growth is best demonstrated by the continuing substantial capital expenditures it has made during the past several years, and which it continues to make. These already number in the millions of dollars invested to improve plant equipment, expand floor space, and increase productivity. The extensive dealer—distributor organization of the industry has made comparable and continuing improvements in its efforts to increase the number and improve the quality of its customer service outlets.

UTILITY AIRCRAFT, FACTORY SHIPMENTS, 1961
(As reported to Aerospace Industries Association by selected manufacturers)

Manufacturer and Model	Complete Aircraft[a] Number	Manufacturers Net Billing Price (Thousands of Dollars)
Aero Commander		
500 A,B,C	70	
560 F	32	$ 11,047
680 E,F	35	
720	2	
Beech		
18	36	
Queen Air	62	
Debonair	161	37,072
Bonanza	282	
Twin Bonanza	33	
Baron	199	
Travel Air	45	
CallAir		
A-5	11	
A-6	9	163
A-7	2	
Cessna		
150	344	
172	903	
175	126	
180	130	42,266
182	575	
185	293	
210	171	
310	136	
320	68	
Champion		
Traveler	16	
Tri Traveler	27	
Sky Trac	1	690
Challenger	51	
Agricultural	7	
DX'er	5	
Tri Con	1	
Olympia	4	
Lake		
LA-4	9	209
Mooney		
Mark 20	286	3,987

(Continued on next page)

UTILITY AIRCRAFT, FACTORY SHIPMENTS, 1961—*Continued*

Manufacturer and Model	Complete Aircraft[a] Number	Manufacturers Net Billing Price (Thousands of Dollars)
Piper		
Super Cub	199	
Colt	1,173	
Tri Pacer	14	
Apache	74	28,889
Aztec	144	
Comanche 180	178	
Comanche 250	407	
Pawnee	206	
Cherokee 150	227	
Cherokee 160	24	
TOTAL	6,778	$124,323

[a] Excludes aircraft shipped to the military, helicopters and gliders.
NOTE: The totals shown here may vary from FAA figures because they are based on selected reports only.
Source: 1

The dollar value and unit volume of the industry's sales have more than trebbled in the past ten years. General aviation has become the largest user of the Nation's air space, and of its airport, air communication, and air navigation facilities. Despite this great progress, the decade ahead presents an almost unlimited potential, concerning which the Federal Aviation Administrator said: "What is known as general aviation . . . already own and operate three-quarters of the active airplanes in the country"; and, he further stated: "General aviation's share in 10 years should swell 80 or 90 per cent over the sixties."

The greatest percentage of hourly use is in the business flying category which, in 1961, reached an estimated 5,400,000 hours. The recognized utility of privately operated aircraft for business purposes is demonstrated by the fact that business-flying hours approximately doubled in ten years and are estimated to grow a million more hours in the next five years.

Apart from business flying, the largest category of annual hourly use is for personal reasons or for pleasure. This category has grown to slightly over three million hours, an increase of over a million hours in the past decade, and is expected to grow another two million during the next five years.

The Federal Aviation Agency operates about 230 control towers

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

Year	TOTAL	Aero Commander	Beech	Cessna	Champion	Mooney	Piper	All Other Manufacturers
NUMBER OF AIRCRAFT SHIPPED								
1947	15,594	—	1,288	2,390	N.A.	—	3,464	8,452
1948	7,037	—	746	1,631	N.A.	—	1,479	3,181
1949	3,405	—	341	857	N.A.	74	1,278	855
1950	3,386	—	489	1,134	N.A.	51	1,108	604
1951	2,302	—	429	551	N.A.	26	1,081	215
1952	3,058	39	414	1,373	N.A.	49	1,161	22
1953	3,788	69	375	1,434	N.A.	37	1,839	34
1954	3,071	67	579	1,200	N.A.	14	1,191	52
1955	4,434	72	680	1,746	N.A.	32	1,870	34
1956	6,738	154	724	3,235	162	79	2,329	55
1957	6,118	139	788	2,489	217	107	2,300	78
1958	6,414	97	694	2,926	296	160	2,160	79
1959	7,689	148	893	3,588	274	182	2,530	74
1960	7,588	155	962	3,720	248	172	2,313	18
1961	6,778	139	818	2,746	112	286	2,646	31
MANUFACTURERS NET BILLING PRICE (Thousands of Dollars)								
1947	$ 57,929	—	13,405	5,976	N.A.	—	7,697	30,851
1948	32,469	—	10,126	6,768	N.A.	—	3,083	12,492
1949	17,731	—	6,177	4,545	N.A.	133	3,244	3,632
1950	19,157	—	6,516	5,506	N.A.	82	3,092	3,961
1951	16,887	—	7,708	3,573	N.A.	45	3,933	1,628
1952	26,159	2,011	9,848	9,220	N.A.	100	4,891	89
1953	34,458	4,260	9,545	12,094	N.A.	91	8,286	182
1954	43,461	4,517	20,056	10,666	N.A.	31	8,070	121
1955	68,258	5,119	24,893	21,880	N.A.	182	16,008	176
1956	103,791	11,183	28,770	38,570	597	741	23,474	456
1957	99,652	9,914	32,110	30,988	1,045	1,095	23,294	1,206
1958	101,939	6,902	27,072	36,897	1,516	1,868	26,548	1,136
1959	129,876	10,626	35,701	45,703	1,521	2,091	33,134	1,100
1960	151,220	11,917	43,061	56,664	1,492	2,781	35,102	203
1961	124,323	11,047	37,072	42,266	690	3,987	28,889	372

[a] The totals shown here may vary from FAA figures because they are based on reports by selected manufacturers only. FAA totals for all civil aircraft including commercial transport aircraft are shown on page 7.
Source: 1

throughout the country. Naturally, these are at the Nation's larger and busier airports, most of which are served by the airlines. During 1960, FAA recorded almost 26,000,000 movements to and from these airports; more than half—14,800,000—were general aviation movements; 7,100,000 were airlines; and the balance military. However, these counts were recorded only at the FAA-towered airports. General aviation regularly operates to and from more than 6,000 airports while the airlines provide service to less than 600. Thus, general aviation provides air transpotration to thousands of communities in the Nation which have airports but do not receive airline service.

Of course, this simply means that general aviation is increasingly the means to make the entire Nation air accessible. It also emphasizes great community of interest steadily developing with the Nation's scheduled airlines as general aviation feeds increasingly more traffic to and from the off-airlines points.

American utility and executive aircraft receive wide acceptance in export markets. In the five-year period, 1957-1961, the four principal manufacturers exported 5,910 aircraft valued at $103,127,000, figured

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

As of December 31	Certificated Airplane Pilots				Student Pilot Approvals During Year	Certified Civil Flying Schools
	TOTAL PILOTS	Airline Transport	Commercial	Private		
1927	1,572	[a]	N.A.	N.A.	545	—
1930	15,280	[a]	7,843	7,433	18,398	39
1935	14,805	736	7,362	6,707	14,572	24
1940	69,829	1,431	18,791	49,607	110,938	749
1945	296,895	5,815	162,873	128,207	77,188	964
1951	580,574	10,813	197,900	371,861	45,003	1,625
1952	581,218	11,357	193,575	376,286	30,537	1,280
1953	585,974	12,757	195,363	377,854	37,397	1,093
1954	613,695	13,341	201,441	398,913	43,393	1,035
1955	643,201	13,700	211,142	418,359	44,354	902
1956	669,079	15,295	221,096	432,688	45,036	809
1957	702,519	16,900	237,149	448,470	76,850	814
1958	731,078	18,303	245,541	467,234	58,107	847
1959	758,368	19,364	255,377	483,627	67,618	855
1960	783,232	20,985	262,437	499,810	51,465	843

N.A.—Not available.
[a] Airline Transport Rating became effective May 5, 1932.
Sources: 3, 25

at manufacturer's net billing price. During 1961 alone, they exported 1,581 aircraft valued at $29,530,000. American-made aircraft are the greatest percentage of the active fleet of general aircraft throughout the Free World whether it be Europe, the Middle or Far East, Africa, or Central and South America.

The miles flown by general aviation in a year make a most impressive figure: FAA estimates these as 1,645,000,000 during 1960, which is approximately double the miles flown by the airlines during the same period. In flying this impressive number of miles, general aviation consumed about 268,000,000 gallons of gasoline and 4,300,000 gallons of oil.

The pace of the industry's growth can be measured in another way. Some recent industry market research compared the general aircraft manufacturing industry's growth during the ten-year period, 1950-1959, to the "Gross National Product" (GNP). During this period, the general aircraft manufacturing sales dollar volume grew from $19 million (figured at manufacturer's net billing price) to $130 million; or at a rate of 21.2%; during this same ten-year period GNP grew at a rate of 5.4%—from $285 billion to $482 billion.

The general aviation industry provides a wide variety of fine business and utility aircraft to meet every personal business, industrial and agricultural requirement. These range in size from small one- to three-place, and heavier four- to five-place single-engine aircraft, to small twins, seating from four to eight passengers.

Some larger turbine-powered types are now available and others are under development. The general aircraft fleet also includes some

large aircraft privately operated by large corporations, which are essentially identical in size and performance to those used by the airlines. But the greatest number, and over two-thirds of the fleet, used for business purposes are single-engined aircraft, most of which carry four people.

Industry market research discloses the average length of a flying business trip to be about 400 miles or less. Unless flight distance is substantially greater than 400 miles, the block-to-block speed differential

GENERAL AVIATION, HOURS, AND MILES FLOWN, BY TYPE OF FLYING, 1931 TO DATE

Year	Total	Business		Commercial		Instructional		Personal		Other	
		Units	Percent	Units	Percent	Units	Percent	Units	Percent	Units	Percent
HOURS FLOWN, Thousands											
1931	1,083	152	14	281	26	307	28	343	32	—	—
1936	1,059	122	12	245	23	380	36	312	29	—	—
1941	4,460	250	6	511	11	2,816	63	883	20	—	—
1946	9,788	1,068	11	943	10	5,996	61	1,686	17	95	1
1950[b]	9,650	2,750	28	1,500	16	3,000	31	2,300	24	100	1
1951	8,451	2,950	35	1,584	19	1,902	23	1,880	22	135	1
1952	8,186	3,124	38	1,727	21	1,503	18	1,629	20	203	3
1953	8,527	3,626	42	1,649	19	1,248	15	1,846	22	158	2
1954	8,963	3,875	43	1,829	20	1,292	15	1,920	22	47	[a]
1955[b]	9,500	4,300	45	1,950	21	1,275	13	1,975	21	—	—
1956[b]	10,200	4,600	45	2,000	20	1,500	15	2,100	20	—	—
1957	10,938	4,864	45	2,013	18	1,864	17	2,109	19	88	1
1958[b]	11,700	5,300	45	2,200	19	2,000	17	2,200	19	—	—
1959[c]	12,000	5,300	44	2,200	18	1,900	16	2,600	22	—	—
1960	12,203	5,300	44	2,200	18	1,700	14	2,950	24	53	[a]
ESTIMATED MILES FLOWN, Thousands											
1931	94,343	13,391	14	26,489	28	25,323	27	29,140	31	—	—
1936	93,320	11,789	13	24,608	26	30,375	33	26,548	28	—	—
1941	346,303	27,439	8	51,082	15	197,128	57	70,654	20	—	—
1946	874,740	121,530	14	107,935	12	478,825	55	156,555	18	9,795	1
1950	1,061,500	339,700	32	180,500	17	286,600	27	244,100	23	10,600	1
1951	975,480	379,845	39	190,480	20	190,195	19	200,265	21	14,695	1
1952	972,055	419,705	43	217,865	22	144,035	15	165,795	17	24,655	3
1953	1,045,346	499,166	48	209,937	20	120,700	11	196,174	19	19,369	2
1954	1,119,295	552,610	49	226,240	20	124,290	11	209,980	19	6,175	1
1955	1,216,000	627,800	52	245,700	20	120,650	10	221,850	18	—	—
1956	1,315,000	672,000	51	247,000	19	158,000	12	238,000	18	—	—
1957	1,426,285	720,800	51	249,400	17	202,375	14	240,950	17	12,760	1
1958	1,544,000	787,000	51	278,000	18	216,000	14	263,000	17	—	—
1959[c]	1,596,000	798,000	50	279,000	17	205,000	13	314,000	20	—	—
1960	1,645,000	811,000	50	281,000	17	184,000	11	362,000	22	7,000	[a]

[a] Less than .05 per cent.
[b] Estimated. No survey was conducted covering the designated year.
[c] Revised.
Source: 25

U. S. Active Civil Aircraft, by Type and by States
As of January 1, 1961

State	Total active aircraft	Air Carrier (scheduled and irregular)	General Aviation		
			Multi-engine	4-Place and Over Single Engine	All Other
Alabama	783	13	72	352	346
Alaska	1,452	61	71	621	699
Arizona	1,230	2	116	553	599
Arkansas	992	—	76	366	550
California	10,022	138	828	4,500	4,556
Colorado	1,082	48	82	508	444
Connecticut	557	1	52	224	280
Delaware	260	6	59	98	97
District of Columbia	439	147	117	94	81
Florida	2,691	130	340	1,182	1,039
Georgia	1,191	102	72	507	510
Hawaii	101	24	6	21	50
Idaho	748	—	31	386	331
Illinois	4,110	225	377	1,979	1,529
Indiana	2,145	15	203	1,028	899
Iowa	1,698	—	82	853	763
Kansas	1,862	—	154	991	717
Kentucky	633	—	60	331	242
Louisiana	1,268	1	156	514	597
Maine	392	1	13	147	231
Maryland	681	—	56	281	344
Massachusetts	1,017	34	75	387	521
Michigan	2,969	12	295	1,322	1,340
Minnesota	2,221	93	127	838	1,163
Mississippi	870	—	51	285	534
Missouri	1,944	206	163	813	762
Montana	1,054	2	50	478	524
Nebraska	1,291	—	65	541	685
Nevada	466	34	62	215	155
New Hampshire	199	—	19	71	109
New Jersey	1,480	15	159	605	701
New Mexico	909	—	79	546	284
New York	3,699	684	417	1,148	1,450
North Carolina	1,227	21	116	491	599
North Dakota	677	—	8	201	468
Ohio	3,413	1	423	1,546	1,443
Oklahoma	1,693	—	215	777	701
Oregon	1,535	2	147	751	635
Pennsylvania	2,644	—	295	1,105	1,244
Rhode Island	136	2	13	59	62
South Carolina	488	—	35	211	242

U. S. ACTIVE CIVIL AIRCRAFT, BY TYPE AND BY STATES—*Continued*
AS OF JANUARY 1, 1961

State	Total active aircraft	Air Carrier (scheduled and irregular)	General Aviation		
			Multi-engine	4-Place and Over Single Engine	All Other
South Dakota	834	—	14	321	499
Tennessee	905	14	111	406	374
Texas	6,852	133	872	3,127	2,720
Utah	515	—	29	294	192
Vermont	99	—	7	31	61
Virginia	897	—	75	335	487
Washington	1,857	37	56	808	956
West Virginia	396	—	38	192	166
Wisconsin	1,544	—	151	603	790
Wyoming	451	—	25	224	202
TOTAL	78,619	2,204	7,215	34,267	34,933
Puerto Rico	94	7	20	33	34
Virgin Islands	6	—	3	1	2
Other	41	—	5	26	10
TOTAL	141	7	28	60	46
TOTAL	78,760	2,211	7,243	34,327	34,979

Source: 25

betwen planes that fly in the 150-200 mile per hour range to those that fly 300 or more miles per hour is negligible, all factors considered.

Some idea of the advantage of these present aircraft speeds can be gained from an example. At 160 miles per hour, which is a good average speed for a typical small single-engined business aircraft, three to four times the distance can be covered in the same time as could be accomplished by the usual means of surface transportation. The average cross-country speed of an automobile is 35 to 40 miles per hour when you count in the inevitable traffic delays, stops for meals and gasoline. Thus, in a ten-hour day, a small airplane can easily reach out 400 miles in about three hours or less, allow several hours for lunch and for the transaction of business, and still return home the same day. At the end of this same ten-hour period, the automobile would barely have reached its destination, business would have to be postponed until the next day and—unless driving was pushed until late in the evening—return would be on the third day. Of course, for longer stages and transcontinental

transportation there will be increasing need for larger, higher speed aircraft. But this will represent a small percentage of the total market. For long cross-country trips, especially between points which are served by the airlines, this is the area for commercial air transportation, which can be supplemented on either end by company-based aircraft or by the use of air taxis.

Closely related to the potential growth of the general aviation industry and a basic necessity for future growth is an increase in the number of airports to accommodate the steadily mushrooming aircraft population. Though greatly improved air traffic management can increase the capacities of the existing airport system, to a large degree, successful air traffic management begins and ends on the ground and can be greatly aided and improved by steady increase in the size of the Nation's airport population. Years ago those communities without easy access to the railroads did not prosper; and more recently, lack of accessibility to a major highway has had similar consequence. It is only logical for the growing importance of air transportation to have the same effect.

The community airport serves a public purpose just as do streets, highways and public parks. All citizens benefit from the resultant trade and commerce, whether they, themselves, directly use the airport or not. This is exemplified by the present fact that a conveniently located air-

INVENTORY OF CIVIL AIRCRAFT[a], BY YEAR OF MANUFACTURE
AS OF JANUARY 1, 1961

Year of Manufacture	Number	Percent of Total
TOTAL	78,760	100.0
1960	5,131	6.5
1959	6,639	8.4
1958	5,234	6.6
1957	4,485	5.7
1956	5,207	6.6
1955	3,294	4.2
1954	2,059	2.6
1953	2,482	3.2
1952	2,197	2.8
1951	1,251	1.6
Prior to 1951	40,781	51.8

[a] Number of active civil aircraft, commercial transport and utility, recorded with Federal Aviation Agency.
Source: 25

TOTAL AIRCRAFT OPERATIONS[a] IN THE UNITED STATES AT FAA AIR TRAFFIC CONTROL AIRPORT TOWERS
1950 TO DATE
(In Millions)

Year	Total		General Aviation		Air Carriers		Military	
	Number	Per Cent	Number	Per Cent	Number	Per Cent	Number	Per Cent
1950	16.0	100.0	9.6	60.0	4.0	25.0	2.4	15.0
1955	19.5	100.0	8.5	43.6	6.0	30.8	5.0	25.6
1956	22.0	100.0	10.0	45.5	6.5	29.5	5.5	25.0
1957	25.1	100.0	12.1	48.2	7.1	28.3	5.9	23.5
1958	26.6	100.0	14.0	52.6	7.0	26.3	5.6	21.1
1959	26.9	100.0	15.0	55.8	7.4	27.5	4.5	16.7
1960	25.8	100.0	14.8	57.4	7.2	27.9	3.8	14.7

[a] Aircraft operations are all aircraft arrivals and departures, including both instrument flights and visual flights.
Source: 26

CIVIL AIRCRAFT, 1928 TO DATE
Including Air Carrier Aircraft

As of January 1	Total	Active	Inactive
1928	2,740	N.A.	N.A.
1932	10,680	N.A.	N.A.
1935	8,322	N.A.	N.A.
1941	26,013	N.A.	N.A.
1951	92,809	60,921	31,888
1952	88,545	54,039	34,506
1955	92,067	58,994	33,073
1956	85,320	60,432	24,888
1957	87,531	64,688	22,843
1958	93,189	67,153	26,036
1959	98,893	69,718	29,175
1960	105,309	70,747	34,562
1961	111,580	78,760	32,820

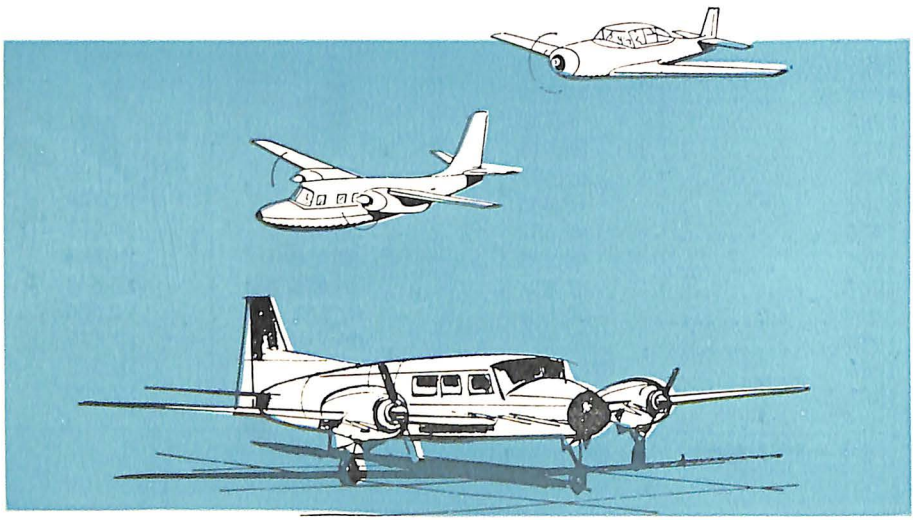
N.A.—Not available.
Source: 25

port has become a fundamental consideration of modern business enterprise in the selection of a new plant or branch office location. These landing facilities, in the majority of the cases, need be no more than one-way strips, sodded or surfaced, depending on the traffic volume and the normal weather of the locality.

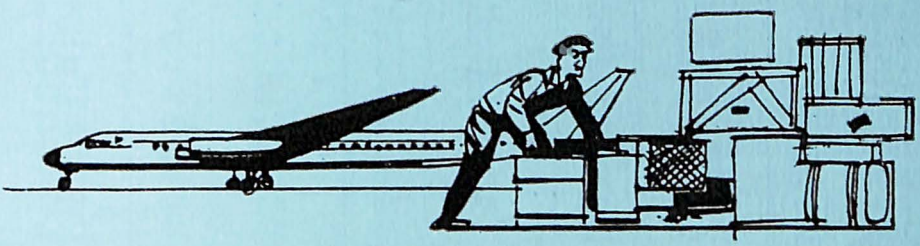
PUBLIC AIRPORTS BY LENGTH OF RUNWAY AND REGION, JANUARY 1, 1961

Region	TOTAL	Airports by Length of Runway (in feet)						
		0-2,999	3,000-3,499	3,500-4,199	4,200-4,999	5,000-5,899	5,900-6,999	7,000- & over
TOTAL	3026	1159	368	459	239	389	114	298
New England	141	58	10	21	10	21	4	17
Middle Atlantic	306	165	42	25	13	34	4	23
East North Central	536	273	80	86	24	37	6	30
West North Central	413	190	55	64	25	29	13	37
South Atlantic	339	108	40	51	32	71	7	30
East South Central	132	39	19	29	14	17	5	9
West South Central	366	104	59	62	45	49	13	34
Mountain	256	25	26	39	36	54	37	39
Pacific	529	197	36	79	38	77	24	78
Other	8	0	1	3	2	0	1	1

Source: 25



EXPORTS



As indicated in the 1961 issue of *Aerospace Facts & Figures*, U. S. aerospace exports during 1961 maintained the plateau attained during 1960. U. S. aerospace exports totaled $1.2 billion during 1961. During 1961 aerospace industry exports accounted for 6% of all U. S. merchandise exports and 11% of aerospace industry total sales. The continued high level export delivery of a wide variety of American manufactured aerospace products provided significant support to economic goals of the U. S. These substantial export sales by U. S. aerospace manufacturers to a large majority of the Free World's political entities proved to be a timely and important factor in bolstering the U. S. imbalance of international payments.

State of the art technical advances made by foreign manufacturers as well as foreign government supported aeronautical industries provided the usual competitive climate of the international aerospace market. In the markets of the future, U. S. aerospace products will confront sophisticated foreign competitors with rising frequency.

The sharp decline of the big jet exports was cushioned by rises in other important categories—utility aircraft up about 17% in value, and the miscellaneous category (including military aircraft and parts) which was up 12%.

EXPORTS OF CIVIL AIRCRAFT, 1948 TO DATE

NEW PASSENGER TRANSPORTS

Year	TOTAL		3,000–14,999 lbs airframe weight		15,000–29,999 lbs airframe weight		30,000 lbs & over airframe weight	
	Number	Value (Millions)	Number	Value (Millions)	Number	Value (Millions)	Number	Value (Millions)
1948	91	$37.4	34	$2.4	14	$4.2	43	$30.8
1949	51	22.2	16	1.3	25	7.6	10	13.4
1950	48	40.4	4	.4	15	6.6	29	33.4
1951	26	13.2	13	1.1	1	[a]	12	12.1
1952	25	18.2	9	.6	1	.6	15	17.0
1953	87	79.2	17	1.3	13	7.5	57	87.0
1954	110	93.0	29	2.0	7	4.0	74	70.4
1955	95	81.2	39	2.5	5	2.4	51	76.3
1956	151	132.9	64	4.7	2	.8	85	124.4
1957	203	179.3	94	7.7	9	6.9	100	164.7
1958	127	146.4	36	3.5	9	5.6	82	137.3
1959	65	107.6	23	2.3	3	1.7	39	103.6
1960	159	480.1	57	6.7	10	9.1	92	464.3
1961	120	266.4	64	7.7	4	3.5	52	255.2

NEW UTILITY, PERSONAL AND LIAISON PLANES

Year	TOTAL		3-Places or less		4-Places and over	
	Number	Value (Millions)	Number	Value (Millions)	Number	Value (Millions)
1948	935	$4.2	552	$1.5	383	$2.7
1949	510	2.8	235	.7	275	2.1
1950	408	2.2	173	.5	235	1.7
1951	540	3.7	237	1.0	303	2.7
1952	815	5.6	551	3.1	264	2.5
1953	776	5.4	370	1.5	406	3.9
1954	529	4.5	223	1.1	306	3.4
1955	749	7.4	296	1.9	453	5.5
1956	966	11.0	340	2.5	626	8.5
1957	1,086	13.1	368	2.5	718	10.6
1958	896	12.1	268	2.2	628	9.9
1959	1,033	14.5	394	3.6	639	10.9
1960	1,528	23.6	374	3.0	1154	20.6
1961	1,646	27.5	582	4.3	1064	23.2

(Continued on next page)

EXPORTS OF CIVIL AIRCRAFT—*Continued*

Year	Rotary Wing Aircraft		Used Aircraft		Other	
	Number	Value (Millions)	Number	Value (Millions)	Number	Value (Millions)
1948	47	$1.9	202	$ .7	.....	.....
1949	31	1.2	252	.6	.....	.....
1950	38	.9	262	.9	.....	.....
1951	28	.9	300	.9	.....	.....
1952	37	1.4	303	1.5	.....	.....
1953	98	4.9	416	1.5	.....	.....
1954	74	4.0	340	1.2	.....	.....
1955	66	4.2	800	37.1	4	.01
1956	55	3.7	534	22.7	1	.002
1957	104	11.9	627	43.2	4	.005
1958	67	9.6	595	35.8	4	4.3
1959	63	8.2	461	20.5	6	2.9
1960	82	7.7	564	25.7	3	.02
1961	119	6.8	495	33.9	81	4.0

[a] Less than $500,000.

Source: 14

Political unrest in several Free World areas continued to be a decided deterrent to U. S. aerospace exports in 1961. However, foreign licensing arrangements and manufacturing of U. S.-developed aerospace equipment and components in overseas areas continued to grow during 1961. However, the proposed U. S. tax structure on foreign-based companies and subsidiaries may well deter this form of business progress in the future. During 1961, U. S. aerospace manufacturers broadened and increased their sales and service activities in major and minor market areas throughout the Free World.

The import of aircraft and aeronautical products to the U. S. more than doubled, from 1960 to 1961. Averaging approximately 70 million dollars a year during the past five years, aerospace imports totaled $151,666,500 in 1961.

Proposed tariff reductions by the U. S., when effective, will tend to stimulate the sale of foreign manufactured aerospace products in the U. S. Forthcoming aerospace tariff reductions by other industrial countries will be helpful to U. S. aerospace export manufacturers providing these reductions are effective on a comparable basis, and scheduled with U. S. tariff reductions.

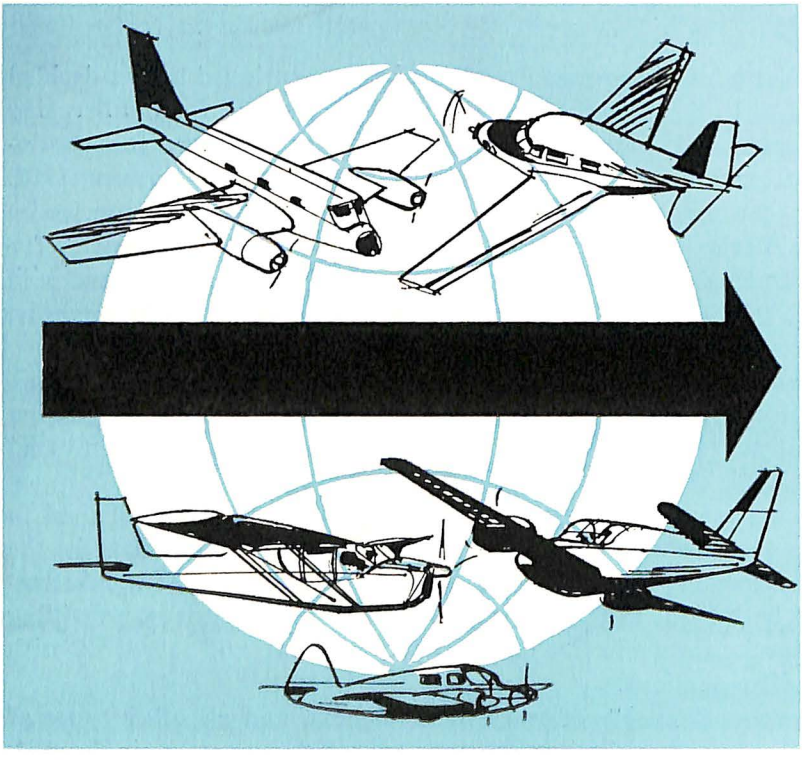
The export financing of trainers, transports, and all other types of military aerospace equipment presents one of the greatest single challenges to the American aerospace industry today.

The outlook for 1962, in evaluating all the many factors, leads to the conclusion that the year-end result should be a little better than 1961—possibly $1.3 billion, especially if jet transports are delivered at the moderately accelerated pace that the predicted improvement in international air traffic promises.

Foreign civil and military aircraft production and export statistics are most often classified as security information and, therefore, only available for release on a very limited basis. The information reported by the following countries is therefore brief and not as thorough as generally desired.

GREAT BRITAIN

1961 was a year of continued technical and commercial progress, and of further rationalization for the British Aircraft Industry. Total dollar value of aerospace exports in 1961 amounted to $417,800,000—compared to $398,400,000 in 1960 and $438,200,000 in 1959. Aero engines and parts exported in 1961 amounted to $232,316,000.



MUTUAL SECURITY PROGRAM, SHIPMENT OF MILITARY AIRCRAFT 1950 TO DATE

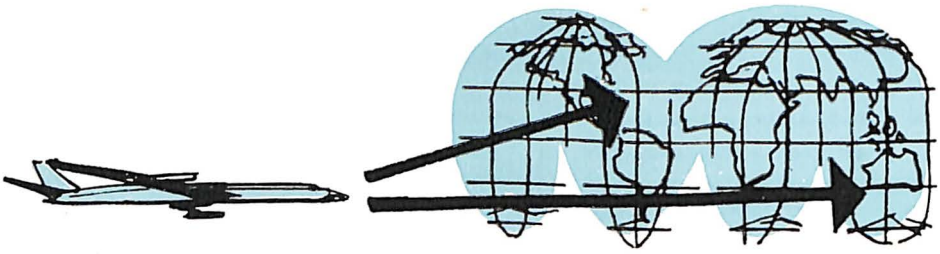
Year Ending September 30	Total	Air Force	Navy
1950	251	818	283
1951	850		
1952	1,317	1,124	193
1953	2,689	2,274	415
1954	1,170	923	247
1955	1,292	1,138	154
1956	2,659	2,580	79
1957	2,182	2,085	97
1958	1,714	1,565	149
1959	620	528	92
1960	355	317	38
1961	483	427	56
TOTAL[a]	15,582	13,779	1,803

[a] October 6, 1949 to September 30, 1961.
Source: 17

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

Year	Number	Value (Thousands of dollars)
1948[b]	660	$326
1949[b]	107	112
1950	247	285
1951	304	509
1952	551	941
1953	347	708
1954	728	1,516
1955	897	2,016
1956	1,371	3,529
1957	1,516	3,860
1958	1,552	4,312
1959	948	2,448
1960	1,464	3,716
1961	1,575	4,399

[a] Under 400 h.p.; data for exports of engines of 400 h.p. and over withheld for "security reasons."
[b] Under 250 hp.
Source: 14



FRANCE

During 1961, France exported aerospace products valued at $341 million, a very significant increase over the $230 million in aerospace equipment exported during 1960. France reported $681 million in total aeronautical sales during 1961. An aircraft labor force of 84,000 during 1961 was a modest increase over recent past years. Substantial airframe and complete aircraft exports (notably Caravelle transports) accounted for $219 million during 1961.

JAPAN

Continued growth in Japan's aerospace industry was evidenced during 1961. Total aeronautical sales during the year reached $75,475,000—a substantial gain over $68 million for 1960 and $41 million during 1959. The Japanese aircraft labor force increased to 20,713 persons during 1961. Japan imported 54 units of new aircraft during 1961 at a total of $26 million. Civil aircraft production during 1961 totaled 38 units of new aircraft at a value of $2 million.

WEST GERMANY

Germany exported 206 units of new and used civil aircraft during 1961 at a value of $5.2 million, against 237 units at a value of $7.4 million during 1960. Germany reported civil aircraft import figures for 1961 as 254 units (new and used) valued at $38 million. Total production and employment figures were not reported.

SWITZERLAND

Switzerland reported civil aircraft production of 18 units valued at $62,790 during 1961. Approximately $23,255 was the value of 6 units of civil aircraft exported during 1961. Switzerland reported the import of approximately 55 units of civil aircraft valued at approximately $146,510 during 1961. The aeronautical manufacturing industry of Switzerland employed 2500 persons in 1961 and the industry was reported as stable.

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

Year	TOTAL	Aircraft[a]	Aircraft Engines	Aircraft Parts, N.E.C.
1955	$32,096	$14,415	$1,265	$16,416
1956	86,790	55,594	2,300	28,896
1957	52,671	15,476	1,639	35,556
1958	78,560	32,715	5,991	39,854
1959	68,066	16,273	7,510	44,283
1960	60,901	6,841	7,388	46,672
1961	151,667	82,821	17,485	51,361

[a] Aircraft includes new and used airplanes, seaplanes, and amphibians.
Source: 15

U. S. EXPORTS OF CIVIL HELICOPTERS
1948 TO DATE

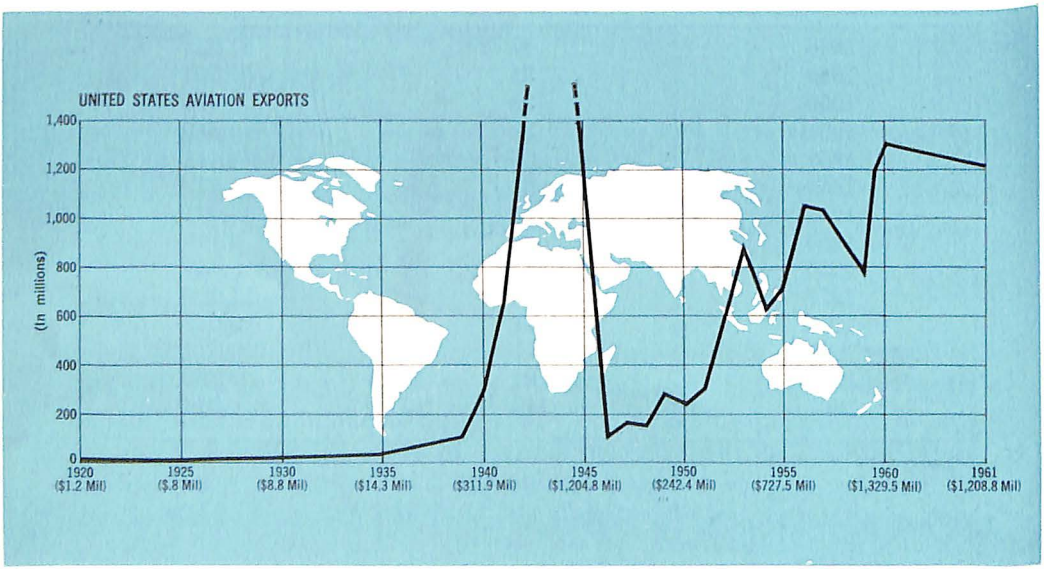
Year	Number	Value in Thousands
1948	47	$1,933
1949	31	1,181
1950	38	984
1951	28	899
1952	37	1,411
1953	98	4,873
1954	74	4,044
1955	66	4,165
1956	55	3,658
1957	104	11,907
1958	67	9,564
1959	63	8,184
1960	82	7,703
1961	119	6,846

Source: 14

U. S. TOTAL EXPORTS AND EXPORTS OF AERONAUTIC PRODUCTS
SELECTED YEARS, 1912 TO DATE
(Millions of Dollars)

Year	Total United States Merchandise	Total Aeronautic Products	Percent of total
1912	$ 2,170.3	$ .1	[a]
1915–1918	22,176.7	31.5	.14
1921	4,378.9	.5	[a]
1929	5,157.1	9.1	.18
1939	3,123.3	117.8	3.8
1946	9,500.2	115.3	1.2
1952	15,025.7	603.2	4.0
1953	15,649.0	880.6	5.6
1954	14,948.1	618.9	4.1
1955	15,418.5	727.5	4.7
1956	18,839.7	1,059.3	5.6
1957	20,850.3	1,028.0	4.9
1958	17,892.7	971.5	5.4
1959	17,566.2	769.5	4.4
1960	20,549.7	1,329.5	6.5
1961	20,874.1	1,208.8	5.8

[a] Less than .05 percent.
Sources: 14, 16



SHIPMENTS TO FOREIGN AIRLINES OF AIRCRAFT AND PARTS (INCLUDING ENGINES) BY U. S. MANUFACTURERS
(As reported to AIA by selected manufacturers)

TOTAL AND DESTINATION	TOTAL VALUE $ 000	AIRCRAFT		PARTS
		Number	Value $ 000	Value $ 000
TOTAL				
1955	111,402	54	80,179	31,230
1956	161,487	91	124,545	36,942
1957	212,736	106	169,882	42,854
1958	181,173	90	144,845	36,328
1959	160,854	41	107,965	52,889
1960	549,379	93	461,907	87,472
1961	351,337	57	264,264	87,073
EUROPE AND AFRICA				
1955	45,208	24	37,650	7,558
1956	102,869	73	95,307	7,562
1957	133,131	70	124,886	8,245
1958	85,411	42	79,884	5,527
1959	42,046	11	32,400	9,646
1960	381,677	73	372,053	9,624
1961	132,346	24	122,600	9,746
NEAR EAST, FAR EAST, MIDDLE EAST				
1955	27,990	15	25,279	2,711
1956	14,748	7	12,551	2,187
1957	20,664	14	17,872	2,792
1958	27,662	14	24,933	2,729
1959	71,050	20	64,548	6,502
1960	50,505	12	45,889	4,616
1961	65,057	18	61,735	3,322
CANADA AND LATIN AMERICA[a]				
1955	38,203	15	17,249	20,954
1956	43,880	11	16,687	27,193
1957	58,941	22	27,124	31,817
1958	68,101	34	40,029	28,072
1959	47,758	10	11,017	36,741
1960	117,197	8	43,965	13,232
1961	153,934	15	79,929	74,005

[a] Includes "not distributed by destination."
Source: 1

UNITED KINGDOM: AERONAUTIC EXPORTS, 1924 TO DATE

Annual Average	Million Dollars	Annual	Million Dollars
1924–1928	$ 5.6	1952	121.6
1929–1933	7.1	1953	182.0
1934–1938	16.3	1954	156.9
1939–1943	33.9	1955	185.3
1944–1948	57.7	1956	292.6
1949–1951	112.3	1957	325.0
		1958	434.2
		1959	438.2
		1960	398.4
		1961	417.8

Source: 42

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

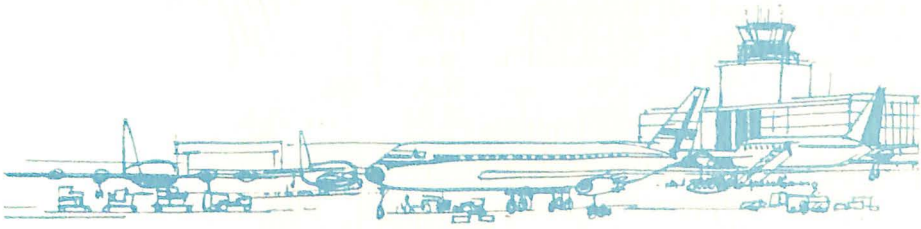
Year	Employment	Value of Production (Million Dollars)
1918	347,112	N.A.
1935	35,890	69.1
1939	355,000	N.A.
1944	1,821,000	N.A.
1948	134,219	455.2
1950	153,600	423.1
1954	238,200[a]	624.0[E]
1955	258,300[a]	N.A.
1956	265,300[a]	N.A.
1957	257,600[b]	N.A.
1958	246,600[b]	N.A.
1959	235,400[b]	N.A.
1960	292,500[b]	N.A.
1961	305,500[a]	N.A.

N.A.—Not available.
E Estimate by official British sources.
[a] As of end of November.
[b] As of end of December.
Sources: 27, 28

CANADA: AIRCRAFT AND PARTS INDUSTRY, 1935 TO DATE

Year	Number of Plants	Average Number of Employees	Gross Selling Value of Products (Millions of Dollars)
1935	7	294	$ .9
1936	7	416	1.3
1937	8	606	1.7
1938	13	1,617	6.9
1939	13	3,596	12.6
1940	19	10,348	24.2
1941	24	26,661	74.0
1942	42	44,886	137.8
1943	45	69,529	223.7
1944	45	79,572	427.0
1945	38	37,812	253.3
1946	16	11,405	36.2
1947	12	9,374	44.3
1948	11	8,049	45.6
1949	14	10,725	61.1
1950	15	10,549	50.2
1951	23	19,198	111.3
1953	43	38,048	398.7
1954	47	35,095	343.0
1955	52	33,036	354.3
1956	52	35,563	354.5
1957	70	41,616	424.4
1958	75	39,932	462.3
1959	78	28,516	327.5
1960	83	27,056	308.2

Sources: 6, 23



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

Year	Manufactured	Exported	Imported
1952	1	–	66
1953	9	–	68
1954	36	7	28
1955	86	–	12
1956	93	6	19
1957	227	2	17
1958	211	27	13
1959	145	16	N.A.
1960	16	–	31
1961	38	–	54

N.A.—Not available.
Source: 31

ESTIMATES OF AERONAUTICAL ACTIVITIES IN OTHER COUNTRIES[a]

Country	Employment (Latest Available Data)	Aeronautical Sales and Trade (Value in Millions of U. S. Dollars)		
		Sales (Total)	Imports (Civil)	Exports (Civil)
Australia	N.A.	N.A.	30	4
France	84,000	680	128	255
Germany	23,000	N.A.	50	7
Japan	20,700	75	26	[b]
Netherlands	5,300	N.A.	56	11
Sweden	8,500	N.A.	35	4
Switzerland	2,500	N.A.	N.A.	N.A.

[a] As compiled and released by each separate country; years may differ for different items.
[b] Negligible.
Source: 1

Public Relations Officials of Member Companies
of the Aerospace Industries Association

Aero Commander, Inc.
Al Balaban
Bethany, Oklahoma

Aerodex, Inc.
Jack Barbee Assc.
Investment Bldg.
Washington, D. C.

Aerojet-General Corp.
George E. Pelletier
P. O. Box 296
Azusa, California

J. J. Lipper
Room 1433, 30 Rockefeller Center
New York City, New York

John Z. Ickes
P. O. Box 1947
Sacramento, California

T. H. Sprague
Room 1050, Bender Building
1120 Connecticut Avenue, N.W.
Washington, D. C.

Space General Corporation (A subsidiary of Aerojet-General)
Warren Northwood
777 Flower Street
Glendale, California

Aeronca Manufacturing Corp.
Knight Goodman
Middletown, Ohio

Aeronutronic Division of
Ford Motor Company
Richard P. Lytle
Ford Road
Newport Beach, California

Allison Division, General Motors Corp.
Roger C. Fleming
Indianapolis 6, Indiana

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Vice President of Public Relations
Pittsburgh 19, Pennsylvania

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John L. Fleming
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Kellogg Division
Fred L .Cogswell
3151 West Fifth Street
Oxnard, California

Raymond Atchley Division
Edward J. Bausch
2339 Cotner Avenue
West Los Angeles, California

Avco Corporation
James J. Cassidy
750 Third Ave.
New York 17, New York

Lycoming Div.
Paul Deegan
Stratford, Connecticut

Electronics & Ordnance & Nashville Divs.
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Cincinnati, Ohio

Research & Advanced Development Div.
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Wilmington, Massachusetts

Avco-Everett Research Laboratory
V. J. Coates
Everett, Massachusetts

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Detroit 2, Michigan

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Mishawaka, Indiana

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Towson, Baltimore 4, Maryland

F. O. Rettberg
The Bendix Corporation
Scintilla Division
Sidney, New York

D. H. Schurz
Bendix Systems Division
Ann Arbor, Michigan

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F. C. Smith
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Cleveland Pneumatic Industries, Inc.
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3781 East 77th Street
Cleveland 5, Ohio

Continental Motors Corp.
N. W. Hopkins
1504 Guardian Bldg.
Detroit 26, Michigan

Cook Electric Company
Harry Thornton
6401 W. Oakton St.
Morton Grove, Ill.

Curtiss-Wright, Corp.
Ronald S. Gall
304 Valley Boulevard
Wood-Ridge, New Jersey

Douglas Aircraft Co., Inc.
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EXPLANATION OF TERMS USED

Note: Terms used in Federal and Military Budgeting and financial accounting are explained on page 105.

Active Aircraft Inventory: The sum of ready aircraft in the basic military aircraft inventory and the inventory of command-support aircraft.

Aerospace Industry: The industry primarily engaged in the production of aircraft, guided missiles, space ships—i.e., all air and space vehicles.

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.

Airframe: The structural components of an airplane, excluding engines, accessories and other parts that may be replaced from time to time.

Airplane: See aircraft.

Backlog: The sales value of orders accepted by aerospace companies, supported by legal documents, that have not yet passed through the sales account.

Decayed Objects: Space craft and components which have been destroyed by friction burning on re-entry into the atmosphere, including unprotected spacecraft returning from orbit and launch vehicle components dropping earthward after attaining high velocities.

Drone: A pilotless airplane piloted by remote control.

Guided Missile: (Official definitions differ). As used in this volume, an unmanned vehicle moving above the surface of the earth whose trajectory or flight path to target is capable of being altered by a mechanism within the vehicle.

Jet Engine: An engine that takes in air from outside and projects a jet of hot gases backward to create thrust, the gases being derived from combustion within the engine.

Military Assistance: A program contributing to the development, maintenance and training of modern military forces, to deter or resist external aggression, combat internal subversion and protect valuable overseas bases in more than 40 countries.

Missiles: See guided missiles.

Natinal Security Expenditures: Military functions of the Department of Defense, military assistance, atomic energy, stockpiling and expansion of defense production.

Reciprocating Engine: An engine in which power is delivered in a back-and-forth movement of a piston or pistons.

Rocket Engine: An engine that projects a jet of hot gases backward to create thrust without taking in air from outside. The gases are derived from combustion of fuels and other materials stored internally.

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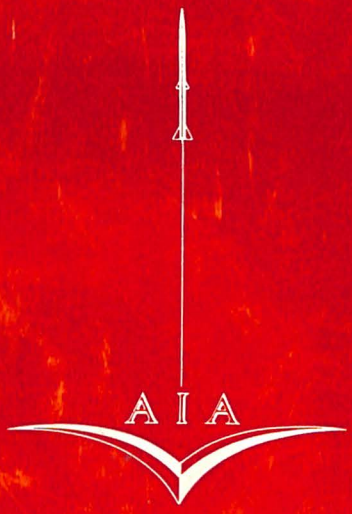

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