NATIONAL BENEFITS OF AEROSPACE EXPORTS

AEROSPACE INDUSTRIES ASSOCIATION OF AMERICA, INC.

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The mission of the Aerospace Research Center is to engage in research, analyses and advanced studies designed to bring perspective to the issues, problems and policies which affect the industry and, due to its broad involvement in our society, affect the nation itself. The objectives of the Center's studies are to improve understanding of complex subject matter, to contribute to the search for more effective government-industry relationships and to expand knowledge of aerospace capabilities that contribute to the social, technological and economic well being of the nation.

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FOREWORD

The United States aerospace industry is one of the nation's primary manufacturing exporters and is distinguishable in several important respects from other trade-involved U.S. sectors such as automobile and steel. Nonetheless, there is a real possibility that the industry could yet be undercut—technologically and competitively—in world markets, as were those other basic U.S. industries. Because high technology is one of the United States' largest remaining areas of competitive advantage in world trade, significant declines in aerospace trade—notably aircraft trade, the largest component of industry exports—would have serious implications for the economy and the nation as a whole.

As a cornerstone of America's—and the world's—transportation system, the U.S. aerospace industry has some characteristics which set it apart from industrial sectors such as steel, automobiles, and textiles:

First, aircraft—which make up over 90 percent of aerospace exports—are very expensive, a 747 today costing approximately $85 million and a DC-10 $60 million. Purchase of five planes, plus spare parts and equipment, can require an investment of a half billion dollars or more. Moreover, the useful life of these products can extend beyond 20 years.

Second, the industry occupies an important position at the core of America's industrial base, underpinning national security. The ability to build complex weapons systems, combined with standing plant and equipment convertible to defense needs, is essential to the capacity of the United States to respond in a defense emergency.

Third, the aerospace industry has a unique partnership with the U.S. government. A healthy aerospace industry contributes to the defense industry and keeps alive key technologies in a wide range of civilian industries.

Fourth, the aerospace industry requires strong vertical integration of technology within its companies to provide technically superior products and services. At the same time, it draws heavily on other sectors, forcing developments in a widely diversified horizontal array of industries from power plants to avionics, from microchips to miniaturized pumps and valves, from computer-controlled machine tools to advanced composite materials.

In 1982, the aerospace industry employed over 1.2 million workers, 600,000 in aircraft production, who in turn paid taxes and purchased goods and services throughout the economy. In addition, the industry is one of the largest exporters of manufactured goods, helping offset negative trade balances in other areas, such as automobiles and other consumer goods.

Ultimately, two factors will determine the quality and volume of production needed to help the aircraft segment, and the industry overall, to maintain or enhance its position in both the domestic and world economies. One factor is research and development (R&D), needed to insure a continued supply of innovative, appropriate, affordable and maintainable aircraft and related equipment and services for both domestic and foreign customers. The other is open trading opportunities to permit production of sufficient numbers of aircraft to keep the industry healthy, productive and price competitive.

While this report concentrates on trade, the reliance of the aerospace industry on R&D cannot be overstated. Research and development conducted by the aerospace industry has advanced the state of the art in aerodynamics, propulsion, and navigation and in some unrelated industries as well.

In 1981, the largest aerospace firms spent $6.43 billion for new plant and equipment and $3.2 billion for research and development of new products, processes and materials. Over 4 percent of every aerospace dollar is destined for R&D spending, compared to 2.0 percent for all manufacturing. *Business Week* has reported that R&D spending as percent of sales for major aerospace companies in 1981 was exceeded only by leading firms in the pharmaceutical and computer industries.[1]

[1] "R&D Scoreboard, 1981," *Business Week*, No. 2746, July 5, 1982, pp. 55-72.

In addition to enriching the economy as a whole, R&D benefits domestic producers by giving them a competitive edge worldwide. State-of-the-art civil aircraft are faster, safer, more fuel efficient and more comfortable than older airplanes, illustrating the all-important link between R&D and trade potential.

There has been reduced emphasis on R&D funding in the United States during the past decade. Recently, however, the current Administration has shown signs of recognizing some problems in the R&D area. A lengthy study performed by the Office of Science and Technology Policy (OSTP) in 1982, under the direction of Presidential Science Advisor George A. Keyworth, concluded that a superior aeronautics capability is a unique and vital national asset—and that foreign challenge to this capability deserves serious national attention.[2] The Keyworth study singled out six aviation-related goals which should be given high priority: (1) maintenance of a superior military aeronautical capability, (2) efficient use of the national aerospace system and vehicles and facilities required thereunder, (3) maintenance of an environment in which civil aviation services and manufacturing can flourish, (4) assurance that the U.S. aeronautical industry has access to, and is able to compete fairly in, domestic and international markets, consistent with U.S. export policies, (5) timely provision of a proven technology base to support development of future aircraft, and (6) timely provision of a proven technology base for a safe, efficient and environmentally compatible air transportation system.

Research and development incentives and disincentives were outside the scope of the Keyworth study. Nonetheless, they must be addressed as the United States seeks to strengthen its technological base in aerospace and other areas. There is an increasingly apparent need to review antitrust strictures for their impact on joint R&D ventures and other forays into international commerce. Changes in the law could help the United States keep pace with the changing international economic structure without undermining the efficiencies created by competition. There is also need to explore tax and other incentives favoring R&D and innovation, with attention to the relative emphasis of the entire economy on R&D—specifically, the direct and capital costs of R&D, the cost and quality of technical education, and the vertical and horizontal transfer of technology after it is developed—with a view toward increasing R&D expenditures substantially.

Some of the aircraft industry's problems are related to the current difficulties created by worldwide recession. The world's airlines have serious financial problems, which when combined with high interest rates, have impeded their ability to purchase new aircraft. Corporate and private purchasers of general aviation aircraft and helicopters have been affected as well by poor economic conditions and tight money. Foreign customers have also experienced a loss of purchasing power from currency problems. Moreover, foreign aircraft manufacturers, enjoying the full support of their home governments, have been becoming much more competitive.

In all, the confluence of these factors is having a substantial impact on the U.S. industry at a time when it has invested billions in development of new-generation aircraft. The United States must recognize this fact and respond appropriately to preserve the strength of a vital, but potentially vulnerable, industry which lies at the core of its transportation system and defense capabilities.

CONCLUSIONS

In order to compete in an increasingly aggressive world trading environment, the United States must build on its competitive strengths, among them high technology exports. Aerospace products are a major component of that high technology advantage; the industry exports about a third of its product and the benefits to the U.S. economy, both direct and indirect, are significant. Whether measurable, as in the case of Gross National Product, taxes, or jobs, or much less tangible—national prestige, and the presence of research and production facilities and a skilled labor force in case of national emergency, or spinoffs into the consumer market—these benefits touch the lives of every man, woman and child in the United States.

As foreign aircraft producers gain competitive strength, it becomes especially important to assess the returns from exports and to consider and take steps to strengthen the network of practices and policies that must assist aerospace, and other industries, to maintain their place in the market. These policies should avoid and defuse the easy answer of protectionism but allow strong innovative U.S. industries to fulfill their potential and keep on growing.

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[2]Executive Office of the President, Office of Science and Technology Policy, *Aeronautical Research and Technology Policy*, November 1982.

WORLD TRADE ENVIRONMENT AND THE U.S. TRADE POSITION

U.S. trade in aircraft and related products and services is inextricably linked to worldwide economic fluctuations and trends. During the period from 1960 to 1980, world trade grew at a rate nearly ten times that of world income. Since 1980, however, international trade has declined and when coupled with high unemployment, high interest rates and other negative economic conditions, this decline has led to friction among trading partners that threatens both the foundations of free trade and the world financial system.

International trade has become enormously important to the world's economies. The Gross National Product of the world was $12.2 trillion in 1980 (see Figure 1); world trade totalled $2 trillion. Trade has grown at a much faster rate than GNP—20 percent a year for trade from 1970 to 1980 against 3.8 percent a year for GNP. Table 1 presents free world exports and percentage changes in these from year to year. This growth in trade ebbed markedly in 1981 and continued to decline in 1982.

In 1980, international trade comprised 15 percent of the world GNP, up from 3 percent in 1965 and 9 percent in 1975. During the past decade, in each of the major trading nations, imports and exports made up a substantial portion of GNP. Table 2 shows that the ratio of exports to GNP in 1981 varied from over one fourth in Germany or Canada to less than 8 percent in the United States. For all of these countries, however, the 1981-1982 decline in world trade has had serious consequences.

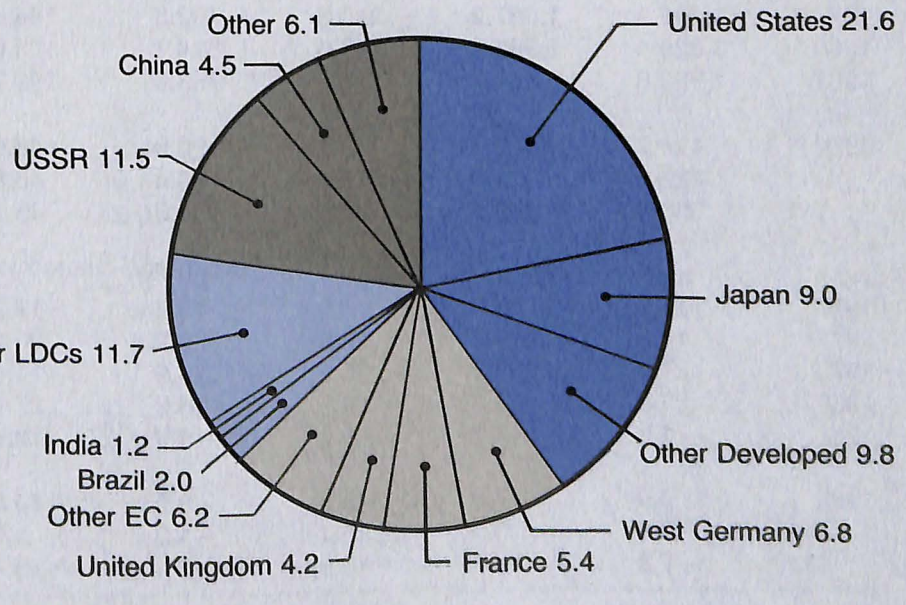
FIGURE 1

WORLD GROSS NATIONAL PRODUCT, 1980

Total GNP: 12,200 Billion 1980 US $

PERCENTAGE

Communist Countries	22.1
Developed Countries	63.0
European Community	22.6
Less Developed Countries	14.9



1970-1980
Annual Growth/GNP—3.8 percent
Annual Growth/Trade—20 percent

Source: Central Intelligence Agency, Directorate of Intelligence, *Handbook of Economic Statistics, 1982*, September 1982.

For many developing nations, the situation has reached crisis proportion. Accumulated debt and related service costs on loans to purchase OPEC oil, capital equipment and other development needs have produced near default conditions in a long list of countries. A severe strain was placed on the international monetary system in 1982 when Mexico approached default; many other nations are in extremely straitened circumstances as well. For developing countries, the cost of repaying loans is now approaching 25 percent of the total export value of their goods and services. Such heavy repayment requirements against future export earnings, combined with International Monetary Fund-imposed restrictive measures accompanying debt restructuring, forces a curb on domestic expansion through deficit-oriented government stimulation. Export expansion for many countries, therefore, has become critical for financial solvency. Meanwhile, these developing countries are providing financial and other incentives to their exporting industries, and imposing restraints on imports through such means as quotas, product embargoes and discriminatory standards. The combined effects of these actions could prevent an early end to world recession.

U.S. Trade Position

The United States has been far from immune to trade-related dislocations, having experienced heavy deficits since 1975. The worst deficit was in 1982, over $36 billion, and some forecasters expect that to more than double in 1983.

The U.S. dollar is stronger now than since the mid-60's. Ironically, a strong dollar hurts the United

TABLE 1

FREE-WORLD EXPORTS

Period	Free-world total	Developed Countries				Developing Countries		
		Total	United States & Canada	Western Europe	Other	Total	OPEC	Other
				Value in billions of dollars				
1970	281.8	227.6	60.0	138.9	28.7	54.3	17.4	36.9
1976	900.8	652.1	155.6	405.2	91.3	248.7	133.8	114.9
1977	1,023.5	740.3	164.8	467.9	107.6	283.3	146.9	136.4
1978	1,175.4	884.5	192.2	562.9	129.4	291.5	142.8	148.7
1979	1,492.8	1,087.2	240.3	702.8	144.1	405.8	212.2	193.6
1980	1,829.4	1,286.8	288.5	814.7	183.6	541.9	297.9	244.0
1981	1,793.8	1,264.7	306.4	758.6	199.7	530.9	273.1	257.8
1982 1	424.7	309.7	72.8	190.9	46.0	115.1	57.9	57.2
11	422.9	311.0	75.8	188.4	46.8	113.1	52.6	60.5
111	389.5	278.5	67.5	165.8	45.2	111.0	54.9	56.0
				Percentage change from preceding year and quarter				
1977	13.6	13.5	5.9	15.5	17.9	13.9	9.8	18.7
1978	14.8	19.5	16.6	20.3	20.3	2.9	−2.8	9.0
1979	27.0	22.9	25.0	24.9	11.4	39.2	48.6	30.2
1980	22.5	18.4	20.1	15.9	27.4	33.5	40.4	26.0
1981	−1.9	−1.7	6.2	−6.9	8.8	−2.0	−8.3	5.7
1982 1	−9.0	−7.8	−5.5	−8.0	−10.5	−12.1	−12.4	−11.7
11	−0.4	0.4	4.1	−1.3	1.7	−1.7	−9.2	5.8
111	−7.9	−10.5	−10.9	−12.0	−3.4	−1.9	4.4	−7.4

Source: United States Department of Commerce, International Trade Administration *International Economic Indicators*, Volume IX, Number 1, March, 1983.

States in some respects, inhibiting the sale of U.S. products on world markets, enhancing the advantage of competitors in all markets and encouraging the import of foreign-made products into U.S. markets. This disadvantage is proving particularly hard on industries that sell significant portions of their output abroad. Before the current recession was fully underway, U.S. industry sold an average of 14 percent of its output in foreign markets. For many producers export sales were very important to their continued existence. Oil field equipment manufacturers, for example, exported over 50 percent of output, as did producers of commercial jet transports. Other American industries were also extremely dependent on export markets, e.g., computers, turbines, and construction machinery (over 25 percent of output exported), and producers of certain farm products, notably soybeans and wheat (60 and 40 percent, respectively).[1]

Over the past decade, the growth in exports of U.S. manufactured goods led the rise in imports. Manufac-

[1]U.S. Department of Commerce, International Trade Administration, *U.S. Competitiveness in the International Economy*, October 1981, p. 9.

TABLE 2

RATIOS OF MERCHANDISE EXPORTS AND IMPORTS TO GROSS NATIONAL PRODUCT AND PRODUCTION

Period	United States	France[1]	West Germany	Italy	United Kingdom	Japan	Canada
			Exports as Percent of GNP				
1970	4.3	12.8	18.5	14.2	15.8	9.5	19.6
1976	6.6	16.2	22.8	20.0	20.8	12.0	20.1
1977	6.2	16.9	22.8	21.1	23.1	11.7	21.3
1978	6.5	16.6	22.1	21.4	22.6	10.1	23.1
1979	7.4	17.5	22.6	22.1	22.2	10.3	25.1
1980	8.2	17.7	23.5	19.7	22.1	12.5	26.1
1981	7.8	18.6	25.6	21.8	20.5	13.5	25.3
1982	6.8		26.8				
	Seasonally Adjusted[3]						
1982: I	7.3	18.2	27.4	23.0	20.3	13.7	23.8
II	7.0	17.2	27.0	21.8	20.6	13.9	25.2
III	6.8	17.9	26.2	20.2	20.1	13.4	25.4
IV	6.1						
			Imports as Percent of GNP[2]				
1970	4.3	13.5	16.1	16.1	17.7	9.2	16.3
1976	7.7	18.3	19.8	23.3	25.1	11.6	19.6
1977	8.4	18.3	19.6	22.4	25.7	10.4	20.3
1978	8.6	17.2	18.9	21.5	24.7	8.3	21.7
1979	9.2	18.7	20.9	23.9	25.1	11.1	24.0
1980	9.8	20.6	22.9	25.1	23.0	13.6	23.7
1981	9.3	21.1	23.8	26.2	20.6	12.7	23.9
1982	8.3		23.6				
	Seasonally Adjusted[3]						
1982: I	8.7	21.1	24.4	27.9	21.2	13.9	20.2
II	8.1	21.1	23.7	25.4	21.8	12.9	19.9
III	8.6						
IV	7.9						

Source: United States Department of Commerce, International Trade Administration *International Economic Indicators*, Volume IX, Number 1, March, 1982.

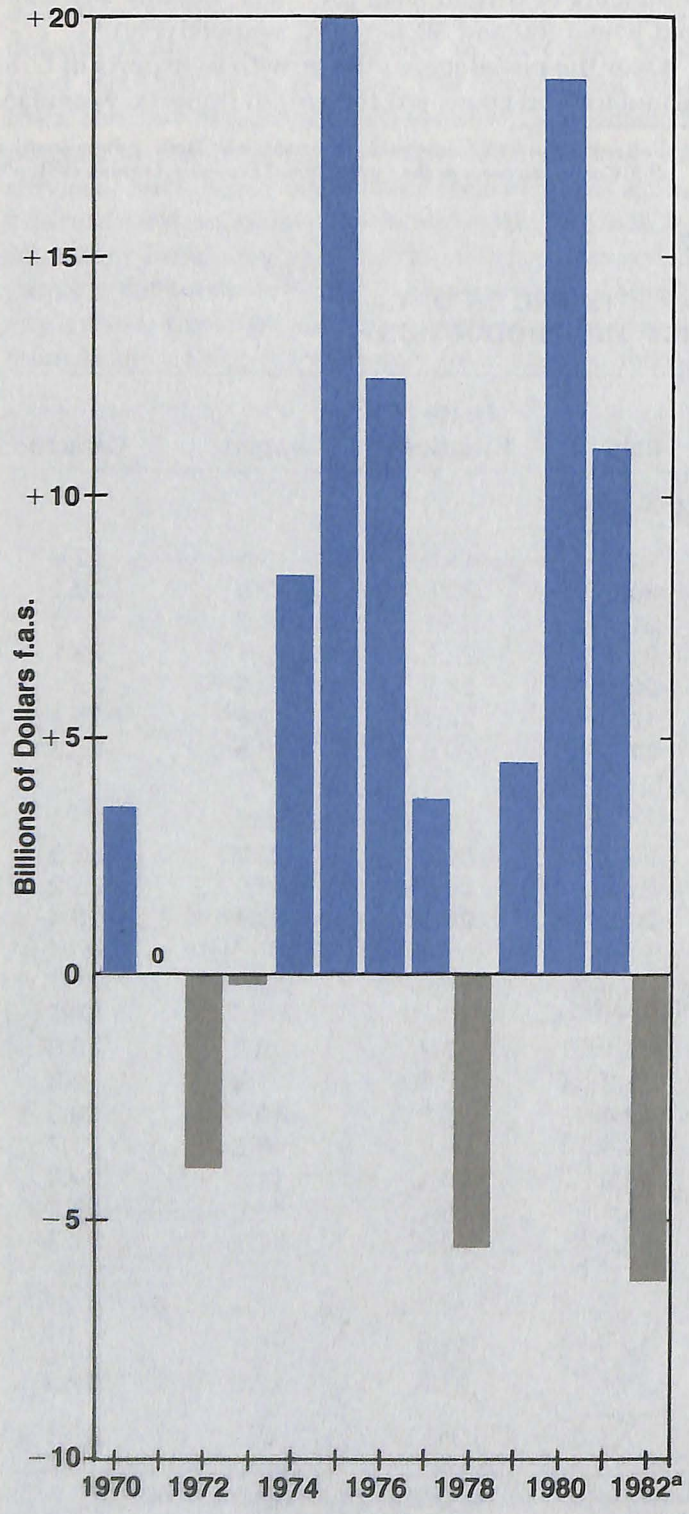
1 Quarterly data are ratios of imports to gross domestic product.

2 Imports c.i.f. except Canada, which is f.o.b.

3 Except for Japan.

FIGURE 2

U.S. BALANCE IN MANUFACTURED GOODS TRADE (1970-1982)



Source: U.S. Department of Commerce, *Current International Trade Position of the United States*, November 1982.
a January – September at annual rate.

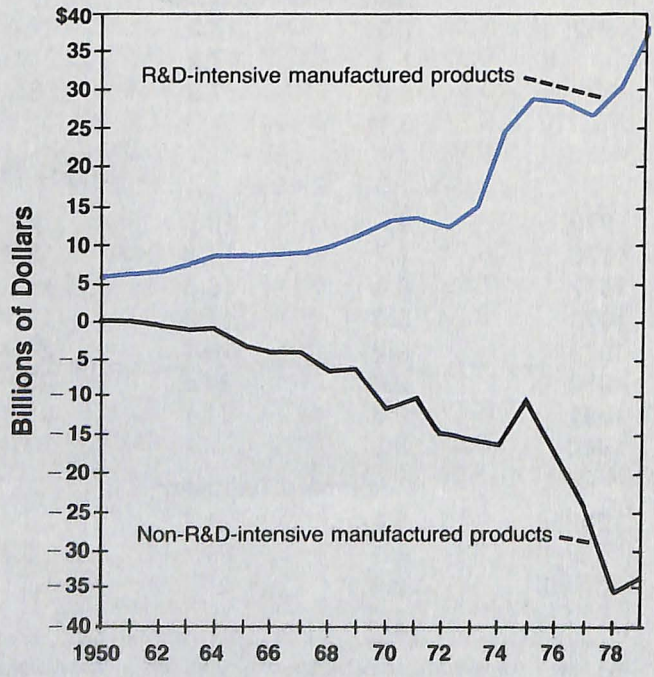
tured goods exports grew some 15 percent faster than imports, increasing five-fold between 1970 and 1980 to almost $150 billion out of $221 billion total exports. Trade balances in manufactured goods have been fluctuating widely from year to year (see Figure 2). Imports have grown rapidly in a number of product areas.

The heaviest and most sustained trade deficits thus far have been limited to automotive and consumer goods. U.S. producers still enjoy a competitive advantage in capital equipment, high technology and agricultural products. Trade surpluses still exist for industries such as aircraft, power generating equipment, computers, and scientific and technical measuring and controlling apparatus. Some chemicals and inorganic fertilizers also provide trade surpluses.

Figure 3 illustrates the importance of high technology industries by showing the divergence in trade balances of R&D-intensive (high technology) and non-R&D-intensive goods. Efforts to strengthen the U.S. competitive advantage in these areas of trade surplus will be the key to improving the United States' overall position in world trade in the future.

FIGURE 3

U.S. TRADE BALANCE IN R&D-INTENSIVE AND NON-R&D-INTENSIVE MANUFACTURED PRODUCT GROUPS



Source: Report of the National Science Board, National Science Foundation, *Science Indicators, 1980.*

THE STRUCTURE AND FUTURE OF FOREIGN TRADE IN THE AEROSPACE SECTOR

The aerospace industry provides a provocative case study of the dynamics—the promises and pitfalls—of maintaining a high technology competitive advantage.

U.S. aerospace exports are largely civil products and, primarily, aircraft. The "split" between civil and military exports varies substantially from year to year depending on the foreign military sales objectives of the current administration, the health of the world's airlines and the world economy generally (see Figure 4). In 1981, military export sales were less than one fourth of total aerospace exports. Examination of the civil sector of aerospace exports shows that 65 percent of the total was completed aircraft, primarily commercial jet transports (Figure 5).

U.S. trade in aerospace products has increased dramatically in the last decade. Figure 6 shows this growth in both imports and exports as beginning in 1970. Through the early 1960's, the aerospace trade surplus showed only slow growth, increasing from $1.7 billion in 1960 to $2.1 billion in 1967.

After 1967, however, the picture brightened considerably. While the total U.S. merchandise trade balance dropped to a 1981 deficit of more than $30 billion, the aerospace surplus climbed rapidly to $13.1 billion. In 1981, at $17.6 billion, aerospace exports were nearly two and a half times their value four years earlier (Table 3.)

In 1982, the aerospace trade surplus fell to $11.2 billion. While this still indicates a very substantial contribution to the U.S. economy, a decline of this magnitude—about 20 percent when adjusted for inflation—must be seen as a warning. While such a

FIGURE 4

CIVIL AND MILITARY AEROSPACE EXPORTS PERCENTAGE BREAKDOWN 1971-1982

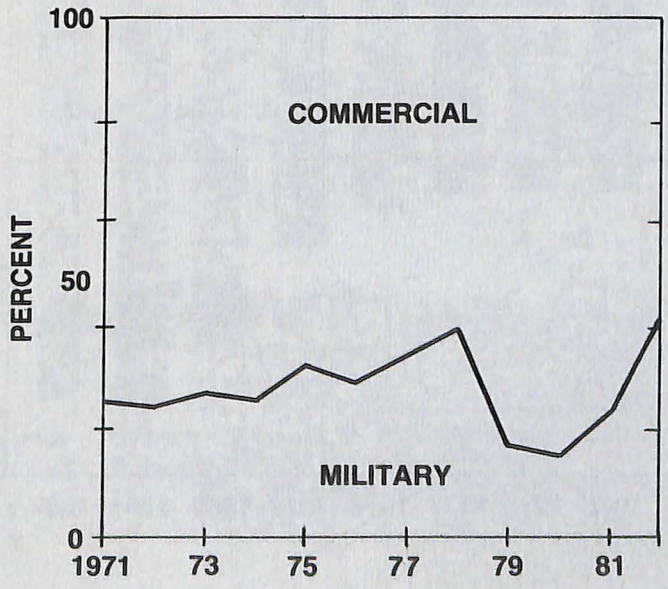
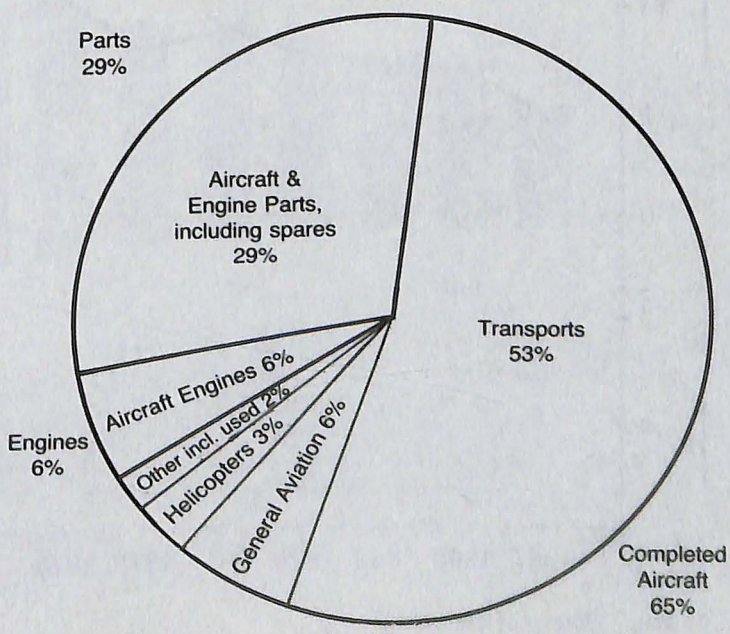


FIGURE 5

RELATIVE VALUE OF CIVIL AEROSPACE EXPORTS 1981



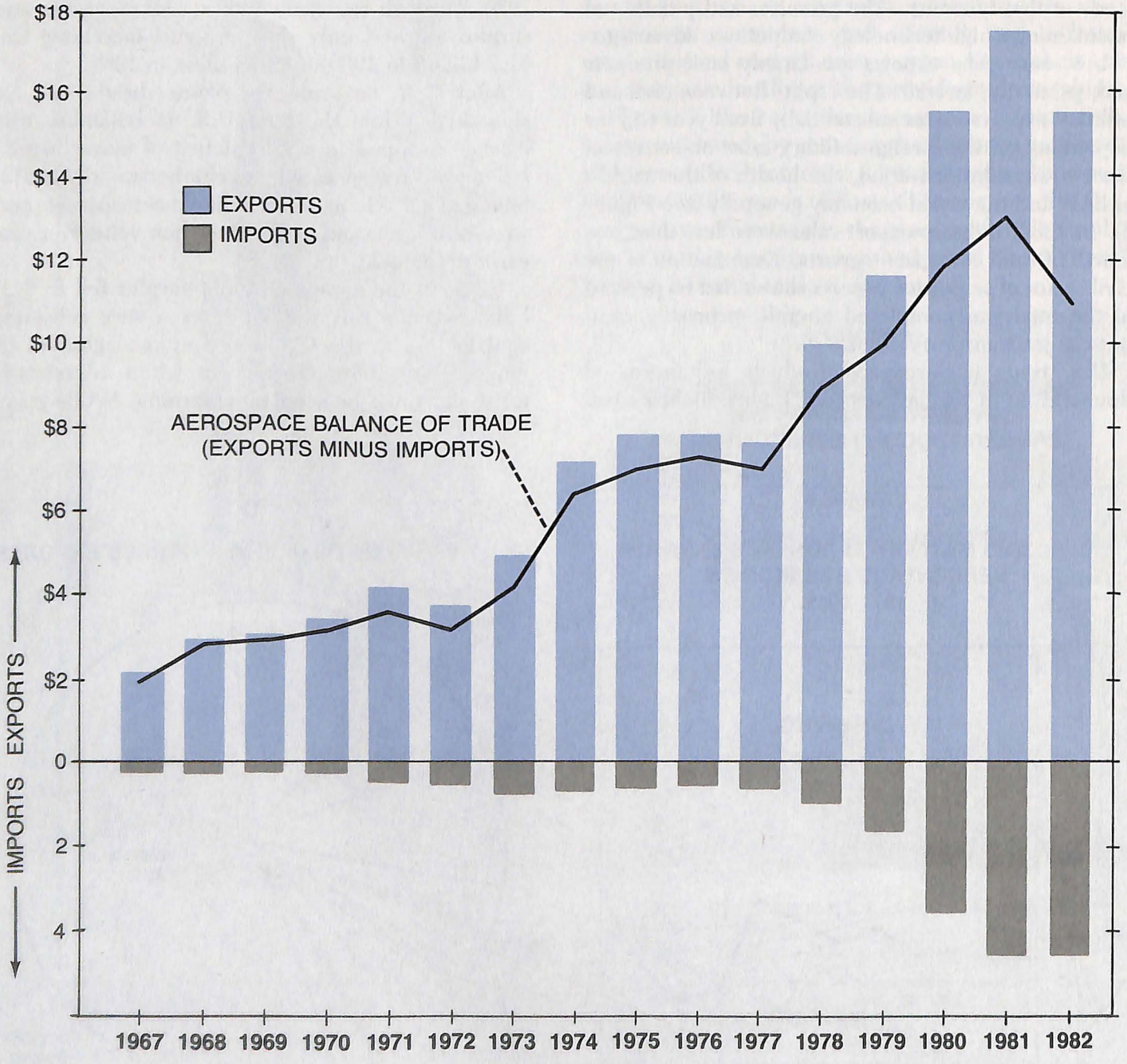
Note: Figures may not add to 100 percent due to rounding.

decline reflects in part a cyclical downturn in major industry segments, the strength of the dollar and high U.S. interest rates, the extent to which it also reflects market in-roads by foreign manufacturers is cause for concern. Losses of market share have become common in older U.S. basic industries such as steel and automobiles; similar losses of competitiveness may have begun to occur in high technology areas.

While they do not yet rival exports in magnitude, aerospace imports are of particular concern because their growth rate has been steeper than that of exports since 1976. The strongest import gains have been

FIGURE 6

AEROSPACE EXPORTS, IMPORTS, AND TRADE BALANCE
(Billions of Current Dollars)



Source: Bureau of the Census

TABLE 3

EXPORTS OF U.S. AEROSPACE PRODUCTS
Calendar Years 1978-1982
(Millions of Dollars)

	1978	1979	1980	1981	1982
TOTAL	$10,001	$11,747	$15,506	$17,634	$15,603
TOTAL CIVIL	$ 6,018	$ 9,772	$13,248	$13,312	$ 9,608
Complete Aircraft-TOTAL	3,625	6,177	8,256	8,613	4,848
Transports	2,558	4,998	6,727	7,180	3,834
General Aviation	496	650	739	790	517
Helicopters	156	207	299	346	206
Other, including used	415	322	491	297	291
Aircraft Engines—TOTAL	277	375	556	784	763
Jet & Gas Turbines	231	323	514	739	721
Piston	46	52	42	45	42
Aircraft & Engine Parts incl. spares-TOTAL	2,116	3,220	4,436	3,915	3,997
Aircraft Parts & Accessories	1,472	2,412	3,296	2,960	2,857
Aircraft Engine Parts	644	808	1,140	955	1,140
TOTAL MILITARY	$ 3,983	$ 1,975	$ 2,258	$ 4,322	$ 5,995
Complete Aircraft-TOTAL	2,243	838	949	1,712	2,388
Fighters & Fighter Bombers	1,707	494	449	1,006	1,473
Transports	232	162	231	158	341
Helicopters	82	61	88	177	156
Other, including used	222	121	181	371	418
Aircraft Engines—TOTAL	61	67	63	83	140
Jet & Gas Turbines	59	61	58	78	136
Piston	2	6	5	5	4
Aircraft & Engine Parts incl. spares-TOTAL	1,044	467	497	1,971	2,341
Aircraft Parts & Accessories	912	326	369	1,475	1,845
Aircraft Engine Parts	132	141	128	496	496
Guided Missiles, Rockets & Parts-TOTAL	635	603	749	556	1,126
Guided Missiles & Rockets	335	292	327	213	716
Missile & Rocket Parts	273	279	393	313	378
Missile & Rocket Engines	3	7	13	4	8
Missile & Rocket Parts	24	25	16	26	24

Source: Bureau of the Census, "U.S. Exports Schedule B, Commodity by Commodity," Report FT446 (Annually).
1 All fixed-wing aircraft under 33,000 pounds
2 Includes aircraft exported under Military Assistance Programs and Foreign Military Sales.

made in aircraft parts, engines and engine parts and completed civil general aviation aircraft and helicopters. Table 4 shows U.S. imports of aerospace products from 1978 to 1982.

The continuing ability of the aerospace industry to contribute a large trade surplus to the total U.S. trade balance will depend on the size of future markets, primarily in civilian sectors, and on the ability of U.S.

TABLE 4

U.S. IMPORTS OF AEROSPACE PRODUCTS
Calendar Years 1978-1982
(Millions of Dollars)

	1978	1979	1980	1981	1982
TOTAL	$943.1	$1,624.3	$3,553.6	$4,500.4	$4,430.3
TOTAL AIRCRAFT	291.8	512.1	975.1	1,379.7	1,159.2
Civil Aircraft-TOTAL	284.5	508.6	969.1	1,336.2	1,128.3
Transports	58.1	199.8	285.5	195.5	93.7
General Aviation[1]	146.8	260.4	495.8	913.0	837.7
Helicopters	28.0	21.6	53.9	105.4	84.9
Other, including used	51.6	26.8	133.9	122.3	112.0
Military Aircraft	4.9	1.5	4.0	41.4	27.9
Gliders, Balloons & Airships	2.4	2.0	2.0	2.1	3.0
Civil	NA	NA	1.8	1.9	2.9
Military	NA	NA	0.2	0.2	0.1
TOTAL AIRCRAFT ENGINES & PARTS	283.0	547.0	1,097.4	1,465.0	1,318.5
Piston, Civil	1.6	4.0	11.0	5.1	10.4
Pist. Engs. & Parts, Military			1.1	0.1	0.4
Piston Eng. Parts, Civil			8.3	7.2	4.2
Turbine, Civil	281.4	324.2	720.3	1,040.6	787.0
Turbine, Military			27.5	7.6	15.6
Turbine Eng. Parts, Civil	NA		295.1	354.4	454.3
Turbine Eng. Parts., Military	NA	218.8	34.1	50.0	46.6
TOTAL OTHER	368.3	565.2	1,481.1	1,655.7	1,952.6
Aircraft Parts, Civil	NA	NA	198.5	229.6	301.3
Non-Specified Parts, Civil	368.2	564.5	679.1	714.2	720.2
Aircraft Parts, Military			121.4	426.8	574.7
Other Parts, Military			136.8	64.8	26.0
Aircraft, Engs. & Parts Previously Exported from U.S.	NA	NA	345.2	220.0	330.2
Other	0.1	0.7	0.1	0.3	0.2

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

Note: Import classifications were revised as of 1980 data, with the total number of categories increased, and most former categories divided into military and civil items. Also effective 1980, import data include two new commodity groupings: civil aircraft parts and aerospace products previously exported from the U.S.

1 All fixed-wing aircraft under 33,000 pounds

NA Not available.

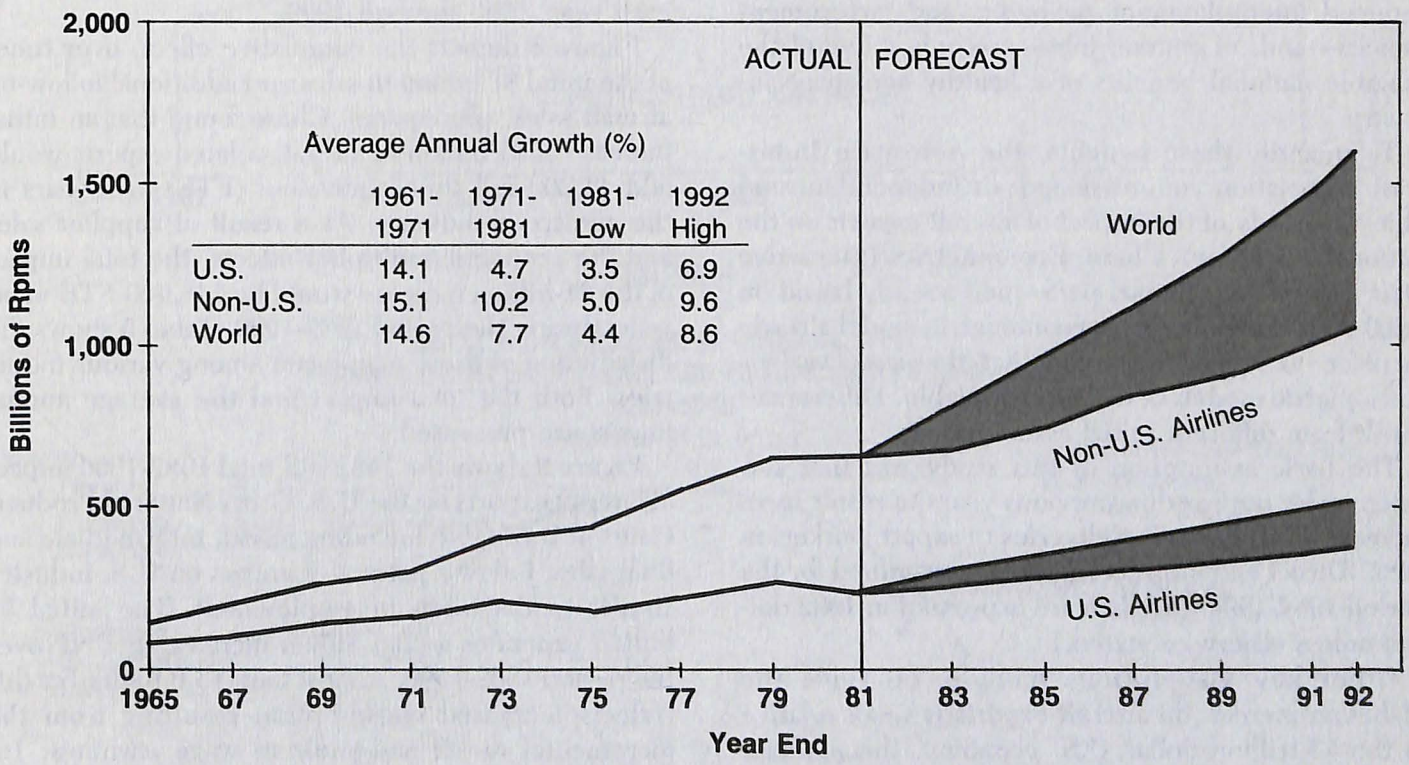
aerospace manufacturers to compete effectively in the face of stiffening foreign competition.

Despite the current worldwide recession, and particularly the malaise in the airline industry, the longer term outlook for commercial aircraft exports is one of greatly expanded markets. Though forecasts vary somewhat, the industry generally agrees that commercial traffic will continue to grow. Figure 7 illustrates the history of traffic growth and projects the range of growth in the 1981-1992 time period. It is significant that even the more conservative estimates show a doubling of revenue passenger miles (RPMs) during this period, which would indicate a strong need for additional equipment.

The questions are: Who will provide the additional equipment, the U.S. manufacturers or their foreign rivals? And with a growing foreign market share, what will be the impact of an erosion of U.S. export sales on the economy as a whole?

FIGURE 7

HISTORY AND FORECAST OF AIRLINE TRAFFIC GROWTH
—WORLD REVENUE PASSENGER MILES-ALL SERVICES—



Source: Boeing Commercial Airplane Company, "Current Market Outlook," October 1982.
NOTE: Excludes USSR and non-ICAO nations, but includes Taiwan and all charter carriers.

THE BENEFITS OF THE AIRCRAFT INDUSTRY TO THE U.S. ECONOMY

The stakes in maintaining America's high technology competitiveness are high in terms of economic growth, employment and national security. The aircraft industry, for example, exports nearly 30 percent of its output and must continue to do so to remain viable. Increased federal, state and local tax receipts, reduced unemployment payments and government deficits—and, of course, jobs—are only a few of the tangible national benefits of a healthy aerospace industry.

To quantify these benefits, the Aerospace Industries Association commissioned an independent and objective study of the impact of aircraft exports on the national economy. Chase Econometrics/Interactive Data Corportion (Chase) performed a study based on a 200 sector inter-industry econometric model already in place. It should be noted that there are various econometric models of this type available. Differences result from different initial assumptions.

The basic assumption of this study was that sufficient sales occurred in previous years to result in an increase of $1 billion in deliveries to export markets in 1982. Direct and indirect effects are examined for the period 1982-1990. (All data are expressed in 1982 dollars unless otherwise stated.)

Other key assumptions include: (a) since the $1-billion increase in aircraft exports is small relative to the $3-trillion dollar U.S. economy, the increase would have no significant impact on the general price level in the United States; (b) the increase in aircraft exports would have no effect on the level of federal, state and local government expenditures for goods and services; and (c) the initial export of $1 billion in aircraft will lead to further follow-on fleet and spare parts sales.

A characteristic of the commercial aircraft industry is that once an airline places an initial order for a particular aircraft model, it tends to expand its fleet or replace individual aircraft with the same model through the life of the model, usually about 20 years. Available data indicate that the ratio of the value of follow-on sales—for fleet expansion and replacement—to the initial sale is generally 3 to 1 over a 20-year period. The bulk of these sales occur in the first 10 years. It was assumed that follow-on sales would follow this pattern and incremental exports of 1 percent per year for spare parts could be expected for each year, 1983 through 1990.

Figure 8 depicts the cumulative effect, over time, of the inital $1 billion in sales and additional follow-on aircraft sales, plus spares. Chase found that an initial increase of $1 billion in aircraft-related exports would add 44,200 full time equivalent (FTE) man-years in the aerospace industry. As a result of supplier sales and the economic multiplier effects, the total impact of the $1-billion increase would be 148,400 FTE man-years during the period 1982-1990. Table 5 shows the distribution of these man-years among various industries. Both the total impact and the average annual impact are presented.

Figure 9 shows the 1982 and total 1982-1990 impact of aircraft exports on the U.S. Gross National Product. Gains in U.S. GNP including initial, intermediate and final sales, follow a pattern of impact on U.S. industry similar to that seen in employment. The initial $1 billion generates a $6.5 billion increase in GNP over the period 1982-1990. Almost half ($3.0 billion) of this reflects increased consumption resulting from the incremental direct and indirect wage earnings. Investment increases $1.0 billion; the remaining GNP increase is due to a $2.4 billion increase in net exports. The total growth in aircraft exports is $3.3 billion. The $900 million increase in imports reflects the demand created for foreign-made aircraft components and unrelated products, such as consumer goods.

An increase in exports has a positive impact on government tax revenues through personal and corporate income taxes, social security receipts, state and local receipts. Unemployment compensation payments and government interest expense are reduced. The first-year impact on government budgets, excluding interest, is an increase of $400 million. Table 6

FIGURE 8

TOTAL AIRCRAFT EXPORTS
INITIAL PLUS CUMULATIVE OVER TIME FROM $1 BILLION IN SALES
AND ADDITIONAL FOLLOW-ON AIRCRAFT SALES, PLUS SPARES

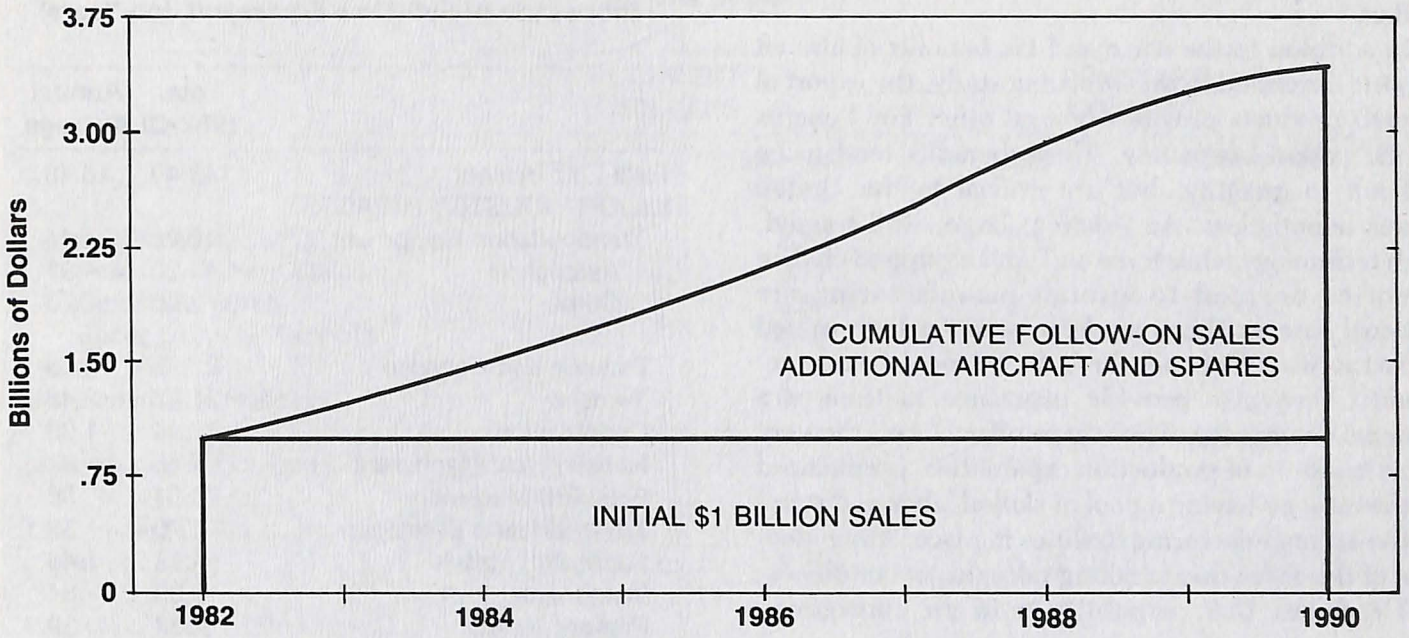
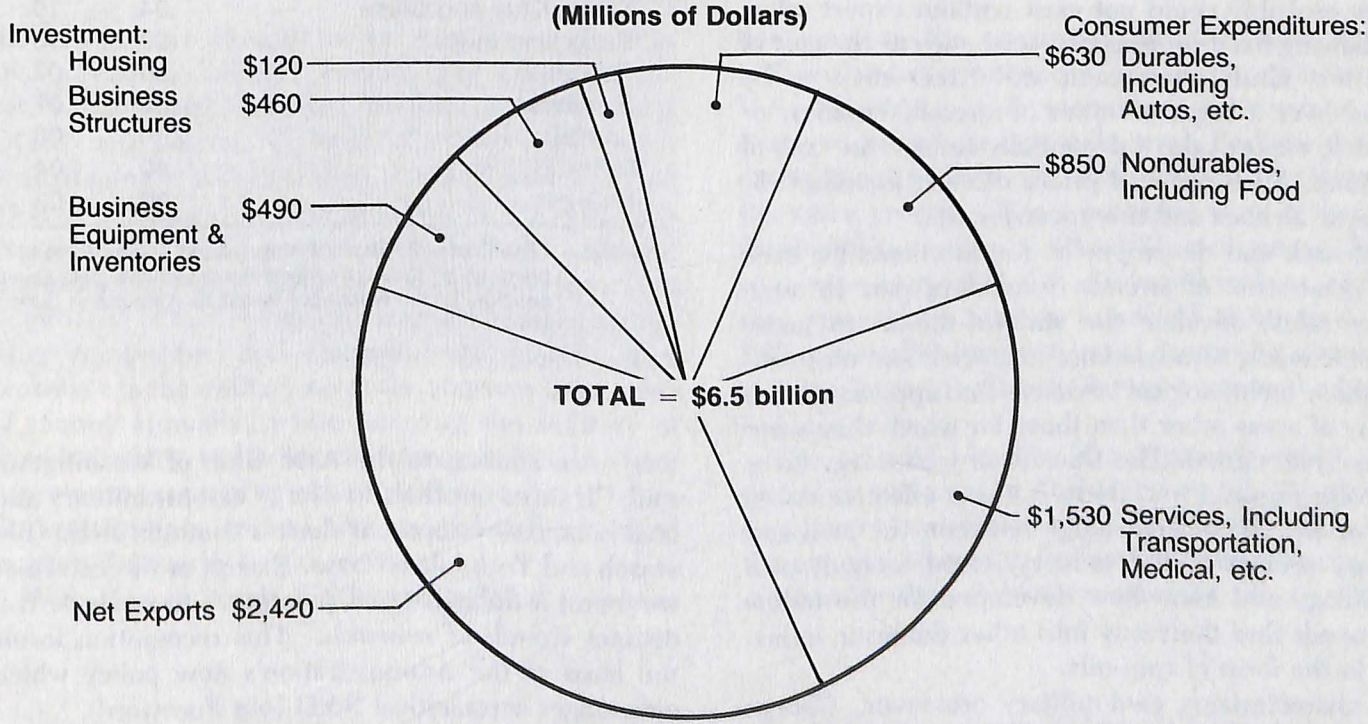


FIGURE 9

IMPACT ON REAL ECONOMIC ACTIVITY
FROM A $1 BILLION INCREASE IN AIRCRAFT EXPORTS
1982-1990
(Millions of Dollars)



Source: "The Economic Impacts of Increased Aircraft Exports" prepared by Chase Econometrics/Interactive Data Corporation, for the Aerospace Industries Association, June 1982.

presents the cumulative effect for the nine-year period in both current year and constant 1982 dollars. Over the nine-year period, the total reduction in the federal deficit, including interest expense, would be $3.7 billion in current dollars or $2.4 billion in 1982 dollars.

In addition to the wage and tax benefits of aircraft exports described in the foregoing study, the export of aircraft products provides several other key benefits to the national economy. These benefits tend to be difficult to quantify, but are crucial to the United States nonetheless. An existing, large, well trained, high technology labor force and well equipped civilian factories devoted to aircraft manufacturing are national assets. These workers produce high-valued export items which aid our U.S. balance of trade accounts; they also provide insurance in time of a national emergency. The "surge-effect," i.e., the very rapid build-up of production capabilities, is enhanced immensely by having a pool of skilled labor and state-of-the-art manufacturing facilities in place. Any reduction of this force due to falling sales (export or domestic) reduces U.S. capabilities in an emergency situation.

Foreign sales of aircraft products also allow the U.S. manufacturer to compete in a much larger market and manufacture a greater number of units. The magnitude of the investment required of the industry is so large and the profit margin so low, that some manufacturers probably could not exist without export sales. By allowing fixed production costs, such as the cost of facilities, land, equipment and R&D costs to be spread over a larger number of aircraft, engines, or missiles, export sales substantially reduce the cost of each unit. Such reduced prices directly benefit U.S. domestic airlines and the government.

Research and development requirements for each new generation of aircraft, funded in part through export sales, advance the state-of-the-art in many areas including aerodynamics, materials and electronics. These technological advances find application in a variety of areas other than those for which they were originally designed. The transfer of technology takes two basic forms. First, there is a cost-effective crossover or sharing of knowledge between the civil and military sectors of the industry. And second, new technology and know-how developed for the industry's needs find their way into other domestic industries in the form of spin-offs.

In characterizing civil/military crossover, George A. Keyworth, Science Advisor to the President and Director of the Office of Science and Technology Policy, in an address to the Aero Club of Washington, said, "It turns out that, to a large extent, military and civil aircraft development share a common R&D (Research and Technology) base. Except at the extremes we found it difficult—and pointless—to separate two distinct strands of research." This recognition forms the basis of the Administration's new policy which encourages aeronautical R&D (see Foreword).

In the past, most R&D crossover may have gone from the military to the civil industry; however, today

TABLE 5

INDUSTRY EMPLOYMENT GAINS FROM A $1 BILLION INCREASE IN AIRCRAFT EXPORTS (Thousands of Full-Time Equivalent Job-Years)

	Total 1982-90	Annual Average
Total Employment	148.40	16.49
MAJOR INDUSTRY IMPACTS		
Transportation Equipment	46.25	5.14
Aerospace	44.20	4.91
Other	2.05	.23
Finance and Services	22.75	2.53
Trade	21.87	2.43
Construction	17.84	1.98
Nonelectrical Machinery	5.46	.61
Electrical Machinery	5.04	.56
Transportation Services	4.70	.52
Fabricated Metals	4.13	.46
Instruments	3.03	.34
Primary Metals	2.88	.32
Food and Beverages	2.28	.25
Publishing	1.92	.21
Communication Services	1.65	.18
Chemicals	1.58	.17
Rubber and Plastics	1.24	.14
Agriculture	1.18	.13
Stone, Clay and Glass	.94	.10
Paper and Pulp	.92	.10
Textiles	.65	.07
Furniture	.59	.07
Lumber	.56	.06
Public Utilities	.40	.04
Mining	.30	.03

Source: "The Economic Impacts of Increased Aircraft Exports" prepared by Chase Econometrics/Interactive Data Corporation, for the Aerospace Industries Association, June 1982.

TABLE 6

IMPACT ON GOVERNMENT RECEIPTS AND EXPENDITURES OF A $1 BILLION INCREASE IN AIRCRAFT EXPORTS (Billions of Dollars)

	CURRENT DOLLARS		CONSTANT DOLLARS	
	1982	1982-1990 TOTAL	1982	1982-1990 TOTAL
Federal Receipts	0.31	2.17	0.31	1.64
Personal Income Taxes	0.11	0.77	0.11	0.58
Corporate Taxes	0.08	0.50	0.08	0.40
Social Security Receipts	0.12	0.90	0.12	0.67
State and Local Receipts	0.04	0.23	0.04	0.18
Unemployment Compensation	−0.05	−0.30	−0.05	−0.24
Total Impact on Government Funds and Spending	0.40	2.70	0.40	2.05
Impact on Federal Deficit (Including Interest Expense)	—	3.70	—	2.40

Source: "The Economic Impacts of Increased Aircraft Exports" prepared by Chase Econometrics/Interactive Data Corporation, for the Aerospace Industries Association, June 1982.
NOTE: Components may not add to totals due to rounding.

the flow is more often in the reverse, especially from civil aircraft to military aircraft. For example, privately funded aircraft such as the McDonnell Douglas DC-10 and Boeing 707 and 747's have been transformed into the KC-10 tanker, the Advanced Warning Aircraft Command System or AWACS (707) and Advanced Airborne Command Post (747). In addition, there is an increasing amount of cross-over, from civil to military, of technology on materials (such as carbon fiber composites) and electronic subsystems. The crossover to the military saves the taxpayer large sums of money annually, while assuring the military of ever-increasing technological advancement. Industry exports are essential in order that these military benefits will continue to be enhanced through increased markets for products and services.

With spinoff, many of the products and processes developed by the aerospace industry—both the aircraft and space components—find application in other U.S. industries. Such technology conversions have even created whole new industries. Perhaps the best examples come from the technologies developed for the space program. These advances were responsible for digital instruments, affordable computers, Teflon cookware, composite skis and tennis rackets, and cardiac pacemakers (among hundreds of other things). Still others offer the prospect of continuing new applications. Exports will help insure continued advances in these areas.

The national benefits of a vigorous, export competitive aerospace industry—and its aircraft component—are varied and provide a vital support for the national economy. Some of the benefits are more measurable than others; nonetheless, all are vital.

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