



Continued International Cooperation in Aerospace

A Requirement For Success



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The commercial transport industry is crucial to the U.S. national economy. In addition to being a major U.S. exporter, the industry plays a key role in maintaining the production base necessary for national security and in driving technology development. A domestic commercial aerospace industry is also important to the national economies of many other countries around the world.

A huge investment is required to support a viable commercial transport industry—for research, product development and production. In fact, the cost of commercial transport manufacture is so high that few manufacturers—or countries, for that matter—can support it alone. As a result, many cooperative international programs have developed in the aerospace industry. Such international cooperation is very attractive to aerospace manufacturers because it allows sharing of costs and risks, and provides market access.

The enormous importance of the aerospace industry to national economies, coupled with the level of investment required, has spawned international trade in the civil aircraft sector that is among the most open in the world. From the perspective of American manufacturers, however, open trade cannot be taken for granted. Free trade in the global aerospace market depends on fair competition—that is, competition without government intervention, such as unfair trade barriers or trade-distortive subsidization of a domestic industry. The General Agreement on Tariffs and Trade (GATT) establishes the multilateral disciplines that can promote such a world trading environment. The U.S. and its trading partners must bolster the GATT. Barriers to efforts supporting the GATT and clarifying its interpretation could lead to serious deterioration of the world economy.

Today, international cooperation is more significant in the aerospace industry than in most other U.S. industries. Expanding international cooperation plays an important role in facilitating aerospace trade by increasing the efficiency of the global industry and overcoming some of the barriers encountered in a nationalistic trading environment. Other industries are beginning to face circumstances—similar to those which exist in aerospace—that will encourage international cooperation and necessitate an open, fair trading environment.





International Trade Flows In Aerospace

The volume of world trade in aerospace products is enormous. Few other industry sectors generate anywhere near the volume that aerospace does. According to the United Nations in 1984 (the last year for which figures are available), total free world exports of civil aircraft, engines and parts were \$25.0 billion. The United States, Great Britain, the Federal Republic of Germany, France, Canada and Italy are all major exporters of civil aerospace products. However, many other countries worldwide are beginning to develop aerospace production capabilities.

Aerospace exports are vital to the United States. In 1986, when the U.S. trade deficit approached a record \$170 billion, aerospace exports accounted for nine percent of all U.S. merchandise exports and provided a trade surplus of \$11.8 billion. This balance included exports of \$19.7 billion or 19.1 percent of industry sales.

Exports are particularly important in the commercial transport sector. In 1986, exports of civil products, principally complete commercial transports and aircraft and engine parts, amounted to 75 percent of U.S. aerospace exports (\$14.8 billion). Exports accounted for about 60 percent of commercial transport sales. *Figure 1* shows U.S. exports and imports of commercial transport aircraft, engines and parts.

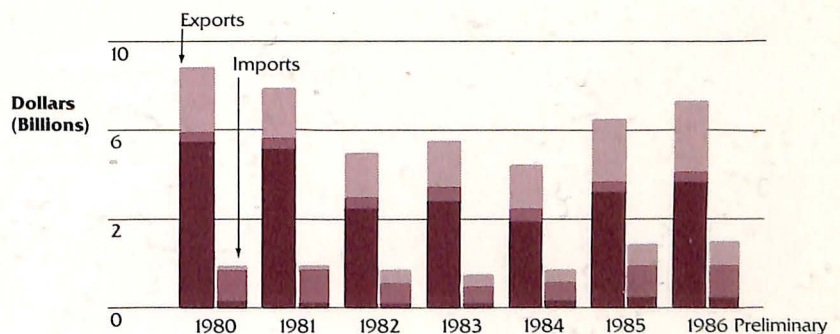
Figure 1

U.S. Export and Import Deliveries of the Commercial Jet Transport Industry

(Includes Airframes, Engines, Sub-Assemblies, Spares and Accessories)

- Other
- Engines (Separately)
- Completed Jetliners

| Annual Surplus (Billions) | 7.8 | 7.0 | 4.3 | 4.9 | 3.9 | 5.0 | 5.7 |
|---------------------------|-----|-----|-----|-----|-----|-----|-----|
| 14 | | | | | | | |



Note: In constant 1978 dollars using aerospace composite price deflator (1982=100 converted to 1978 base year).
 (*) Aircraft and aircraft engine parts - estimate based on transport share of complete aircraft and engine categories.

U.S. imports of aerospace products have risen even more dramatically than exports in recent years. U.S. imports of all aerospace products exceeded \$1 billion for the first time in 1979, but by 1986 they amounted to \$7.9 billion. Civil aircraft and aircraft and engine parts and equipment make up the largest share of foreign sales into the U.S. market. *Figures 2 and 3* show U.S. aerospace exports by destination and imports by origin.

Figures 2 and 3

**U.S. Exports of Aerospace Products[®]
By Major Countries of Destination**

Calendar Years 1982-1986
(Millions of Dollars)

| Major Countries of Destination | 1982 | 1983 | 1984 | 1985 | 1986 |
|--------------------------------|-------|-------|-------|---------|---------|
| Australia | \$312 | \$390 | \$445 | \$1,034 | \$1,327 |
| Belgium Luxembourg | 213 | 281 | 247 | 216 | 345 |
| Canada | 909 | 1,014 | 1,121 | 964 | 1,005 |
| Egypt | 163 | 94 | 292 | 102 | 98 |
| France | 1,182 | 1,190 | 1,011 | 1,014 | 1,480 |
| Germany, West | 910 | 594 | 651 | 967 | 1,282 |
| Israel | 237 | 430 | 444 | 333 | 304 |
| Italy | 253 | 323 | 469 | 725 | 533 |
| Japan | 1,094 | 1,540 | 1,305 | 1,792 | 2,209 |
| Korea, South | 275 | 274 | 382 | 536 | 301 |
| Netherlands | 302 | 401 | 331 | 217 | 625 |
| Saudi Arabia | 525 | 380 | 419 | 687 | 670 |
| Singapore | 178 | 549 | 691 | 641 | 529 |
| Taiwan | 391 | 266 | 264 | 358 | 238 |
| United Kingdom | 736 | 1,087 | 1,276 | 1,566 | 1,301 |

Source: U.S. Department of Commerce, International Trade Administration.

[®] Includes all civil products, f.a.s. basis; excludes military products, which are not reported by country of destination.

**U.S. Imports of Aerospace Products[®]
By Major Countries of Origin**

Calendar Years 1982-1986
(Millions of Dollars)

| Major Countries of Origin | 1982 | 1983 | 1984 | 1985 | 1986 |
|---------------------------|---------|---------|---------|---------|---------|
| Canada | \$1,200 | \$1,018 | \$1,397 | \$1,552 | \$1,905 |
| France | 827 | 726 | 1,109 | 1,673 | 2,007 |
| Germany, West | 97 | 124 | 121 | 229 | 315 |
| Israel | 126 | 73 | 142 | 132 | 211 |
| Italy | 124 | 113 | 143 | 138 | 221 |
| Japan | 200 | 177 | 173 | 185 | 272 |
| Netherlands | 109 | 49 | 124 | 219 | 275 |
| Singapore | 30 | 36 | 100 | 114 | 121 |
| United Kingdom | 1,122 | 933 | 1,163 | 1,562 | 1,898 |

Source: U.S. Department of Commerce, International Trade Administration.

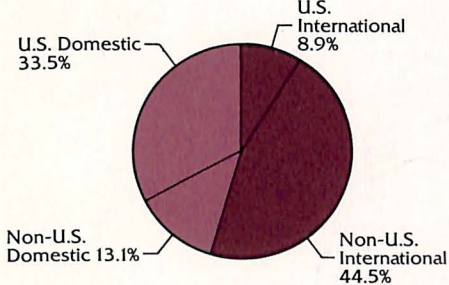
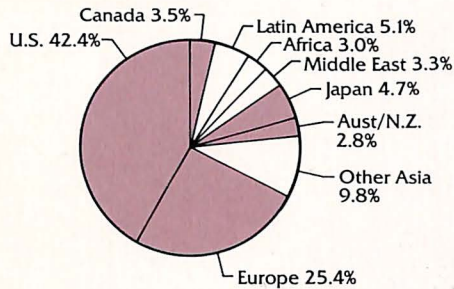
[®] Includes civil and military products; c.i.f. basis

Figure 5

Airline Market Shares by Geographic Area

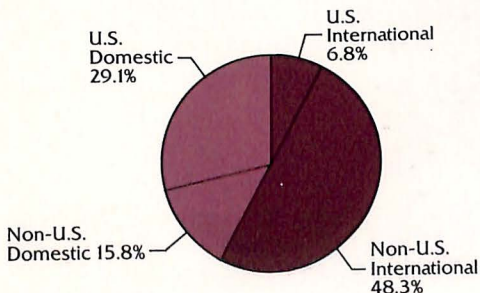
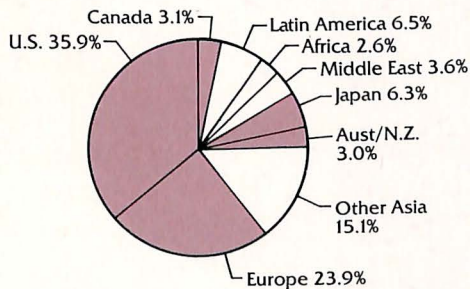
1985 RPMs: 828 Billion

- OECD Countries 78.8%
- World Domestic 46.6%
- World International 53.4%



2000 RPMs: 1800 Billion

- OECD Countries 72.2%
- World Domestic 44.9%
- World International 55.1%



Source: Boeing Commercial Airplane Company

Paradoxically, the U.S. represents the largest single market for aerospace products and yet has an aerospace industry that is export-oriented, indeed, export-dependent. Further examination of aerospace trade flows shows that this dichotomy exists in other major aerospace supplier nations. The European Economic Community (EEC) (excluding Spain and Portugal for which figures are not available) had a positive aerospace trade balance of 1452.2 (MIO ECU) (or about \$ 1.1 billion) in 1985. About 30 percent of EEC aerospace exports, \$2.2 billion, are destined for the United States and 45 percent of imports, \$2.8 billion, are from the United States.

In 1985, about 30 percent of EEC aerospace turnover (production net of change in backlog—roughly equivalent to sales) was exported. There was a slightly heavier dependence on exports in the civil sector (40 percent) than in military production (27 percent).

Market projections for airline passenger travel and other civil aerospace customers show strong growth in many markets worldwide for the foreseeable future. Figures 4 and 5 show total projected growth and geographic distribution of the market. This growth, particularly that projected for less developed nations, indicates the potential for trade in the international civil aerospace industry.

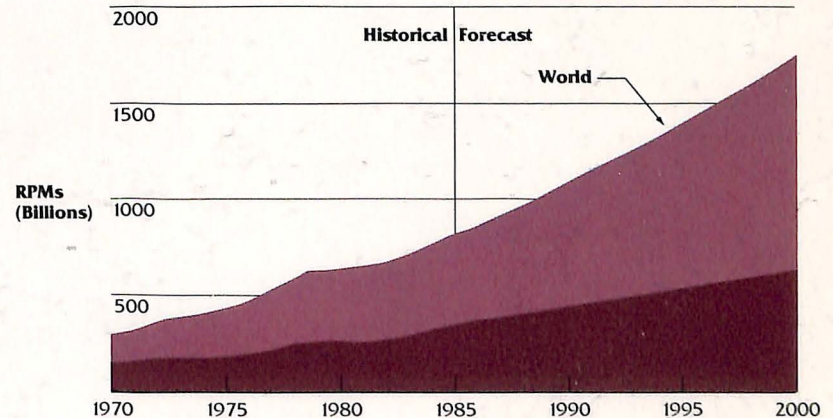
Figure 4

World Revenue Passenger - Miles

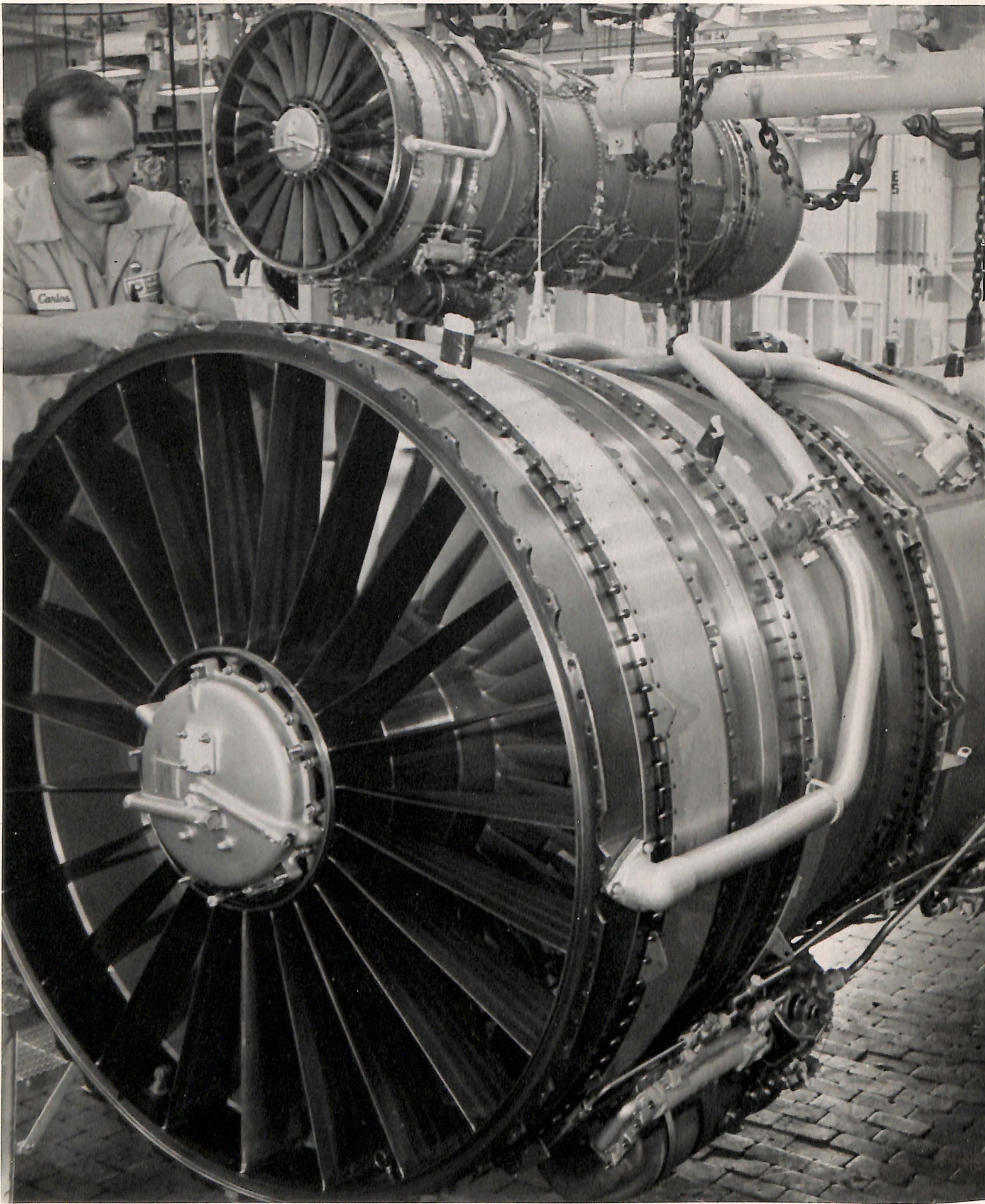
All Services

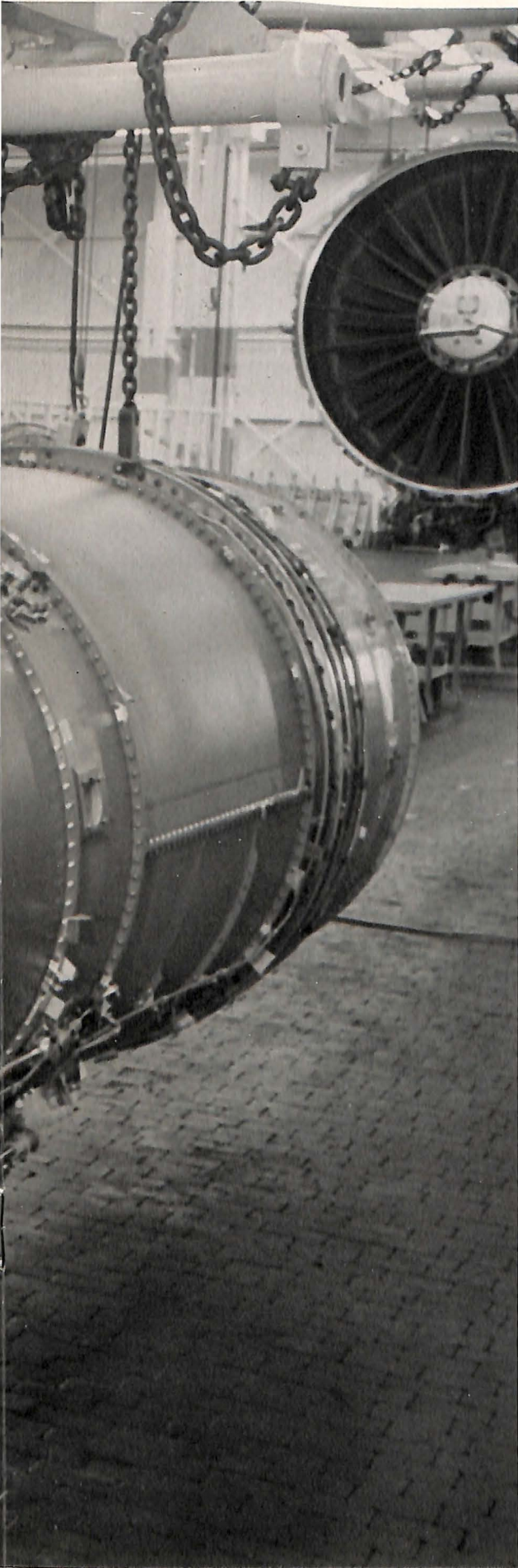
- Non-U.S. Airlines
- U.S. Airlines

| | Average Annual Growth Rates | | | |
|----------|-----------------------------|-----------|-----------|-----------|
| | 1970-1985 | 1985-1990 | 1990-2000 | 1985-2000 |
| U.S. | 5.4 | 5.0 | 3.7 | 4.2 |
| Non-U.S. | 8.9 | 6.6 | 5.8 | 6.1 |
| World | 7.2 | 5.9 | 5.0 | 5.3 |



Note: Excludes USSR and non-ICAO nations, but includes Peoples Republic of China and Taiwan.
Source: Boeing Commercial Airplane Company





Aerospace Production And Trade

The total volume of world aerospace trade demonstrated by the preceding statistics is composed of several different types of trade flows. The first type of trade involves the sale of final products, in this case complete aircraft and engines, or replacement parts to customers such as airlines, repair facilities and leasing companies. The second type of trade involves shipment of intermediate products between suppliers and prime manufacturers. Many forms of international cooperation including subcontracting, licensed production, joint ventures and co-production—which have developed in the aerospace industry—contribute to this latter type of trade. Trade in intermediate products is likely to continue to grow in this industry because these international arrangements are attractive for a number of reasons to both companies and countries.

The development of aerospace products, whether airframe, engine or component, often involves very high costs and risks. For example, a new airframe may involve \$3 billion in non-recurring development cost, while a new engine may cost more than \$1 billion. International cooperation allows the pooling of resources for programs that would be too large for any single manufacturer. International cooperation effectively reduces the risks involved for any one manufacturer and allows a number of different nations to participate in a market segment that can support only a very limited number of products.

For some firms, international cooperation can also provide an efficient basis for market participation through specialization in a product or through product support including marketing, repair and modification activities, and logistic support.

Achievement of the benefits of cooperation—not only for major airframe and engine producers but also for producers of subassemblies and components—is closely tied to an open, fair trading environment. The domestic markets of most nations are not large enough to sustain sufficient production runs to efficiently support the manufacture of complete aircraft or engines. Similarly, few domestic markets can justify the manufacture of many components or subassemblies. With fair international competition, on a commercial basis, suppliers can market to prime manufacturers in different countries and can specialize in specific product types. Specialization captures the economies of scale and drives down the cost of aerospace products. The resulting efficiency is also clearly beneficial to airlines, governments and other customers who must live within budget constraints. The rise in this kind of product specialization in aerospace can be seen from the growing level of intra-industry trade among the industrialized nations.

Firms also undertake international joint ventures as a means of gaining market access in participating countries. Joint ventures with manufacturers located in countries with large domestic markets, such as the United States, are particularly attractive. International cooperation is one way to alleviate the pressures of nationalism or regionalism that sometimes influence sales campaigns. In the absence of cooperative arrangements, nationalistic pressures can cause aircraft or subassembly purchase decisions to be made for political rather than technical or cost reasons—a practice that is detrimental to an international industry.



Importance Of Aerospace Trade To National Economics

National economies benefit from the increased trade in aerospace products. For the developed nation with existing aerospace production capabilities, trade and cooperation—to the extent it contributes to trade—offer expanding markets which can support further technology development. Export sales increase the number of aircraft of a given model produced and lower the average cost of research and other non-recurring costs. The additional income generated can be used to support continuing research for future models. New aircraft models compete in the world market because of their improved safety, efficiency and comfort—rather than strictly on the basis of cost per seat—so new technology can help maintain an industry's vitality, even when it is facing competition from less developed nations with lower wage rates. Aerospace exports are also a source of national prestige and maintain industrial capacity needed for national security.

Market projections for civil aircraft are strong for less developed areas of the world, but countries in those regions have their own national development agendas and may insist on sharing in the benefits of aircraft production and sales. Cooperative business arrangements provide immediate access to markets for the products of the developing nation—both intermediate aerospace goods and other types of products. This generates income which can be used to purchase transportation equipment for the infrastructure critical to the nation's overall development needs. International cooperation is also an efficient means of developing domestic technical capabilities. Through licensing or other cooperative arrangements, development efforts are channeled into areas that are immediately useful. Careful planning of related international cooperative efforts can quickly raise the general level of a developing nation's technology.



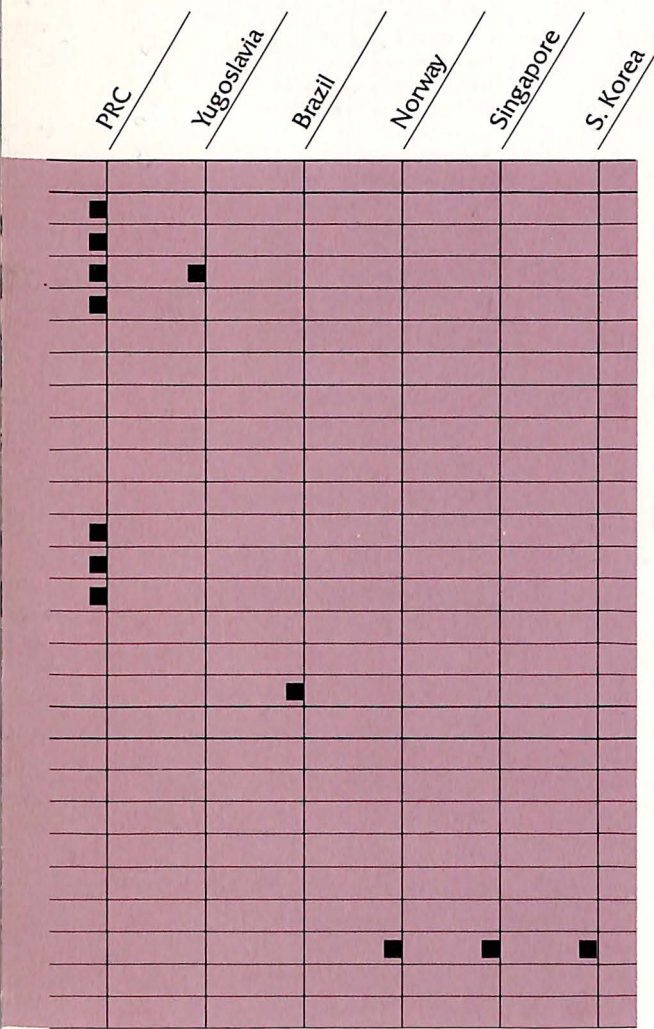
Figure 6

International Cooperation in Commercial Aircraft

Participating Nations

| Major Programs | U.S. | U.K. | France | W. Germany | Japan | Canada | Benelux | Spain | Italy | Sweden | Netherlands | Australia | Indonesia |
|-----------------------|------|------|--------|------------|-------|--------|---------|-------|-------|--------|-------------|-----------|-----------|
| Airframes | | | | | | | | | | | | | |
| DC-9/MD-80 | ■ | | | ■ | ■ | ■ | | ■ | ■ | ■ | | ■ | |
| DC-10/MD-11 | ■ | ■ | | | ■ | ■ | | ■ | ■ | ■ | | | |
| B-737 | ■ | ■ | | | ■ | ■ | | | | | | ■ | ■ |
| B-747 | ■ | ■ | | | ■ | ■ | ■ | | | | | ■ | |
| B-757 | ■ | ■ | | | | | | ■ | | | | ■ | |
| B-767 | ■ | | | | ■ | ■ | | | ■ | | | | |
| B-777 | ■ | ■ | | | ■ | | | | | ■ | | ■ | |
| A300/310 | | ■ | ■ | ■ | | | ■ | ■ | | | ■ | ■ | |
| A320 | | ■ | ■ | ■ | | | ■ | ■ | | | | | |
| F-100 | | ■ | | ■ | | | | | | | ■ | | |
| BAe 146 | ■ | ■ | | | | | | | | ■ | | | |
| DHC-8 | ■ | ■ | | | | ■ | | | | | | | |
| ATR-42 | | | ■ | | | | | | ■ | | | | |
| SAAB-340 [®] | ■ | | | | | | | | | ■ | | | |
| CN-235 | | | | | | | | ■ | | | | | ■ |
| Brasilia | ■ | | | | | | | | | | | | |
| Engines | | | | | | | | | | | | | |
| RB-168 | ■ | ■ | | | | | | | | | | | |
| Olympus | | ■ | ■ | | | | | | | | | | |
| CFM-56 | ■ | | ■ | | | | | | | | | | |
| CF6-80C | ■ | | ■ | ■ | | | | | ■ | ■ | | | |
| V-2500 | ■ | ■ | | ■ | ■ | | | | ■ | | | | |
| PW-2037 | ■ | | | ■ | | | | | ■ | | | | |
| PW-4000 | ■ | | | ■ | | | ■ | | ■ | | | | |
| GE-UDF | ■ | | ■ | | | | | | | | | | |
| JT8D-200 | ■ | | | ■ | ■ | | | | | ■ | | | |

[®] U.S. participated in development but has since reduced its participation to major subcontractor.



The magnitude of the economic benefits of trade and cooperation to manufacturing firms and participating nations have led to significant internationalization of the aerospace industry. *Figure 6* gives examples of the extent to which international cooperation already exists in the aerospace industry. In fact, as this figure indicates, there are no major civil aircraft or engine programs in the free world today that are developed and produced by a single country.

While international cooperation began earlier in the aerospace industry than in other industries, the significant factors that both encourage and necessitate cooperation and open, fair trade are not unique to aerospace. The U.S. and its trading partners—both developed and less developed—must rejuvenate efforts to expand free and fair trade and bolster the General Agreement on Tariffs and Trade that establishes multilateral disciplines on the world trading environment.



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