

Economic Issues for Aviation Operations

5

By many measures, U.S. aviation industries are world leaders, and each industry contributes positively to the U.S. international balance of payments and has significant world market shares (see table 5-1). However, industry finances, employment, and international competition have become crucial issues for the future of U.S. aviation. Congress must now, and in the coming decade, struggle with difficult and often conflicting trade, finance, and other economic policies important to the long-term fiscal health and competitiveness of U.S. aviation. U.S. regulatory and infrastructure decisions, and the research programs that underpin them, will likely have growing implications for U.S. industry economics and competitiveness.

THE U.S. AIRLINE INDUSTRY

The nation's largest carriers increasingly rely on global markets to sustain growth in revenue. In an attempt to offer passengers the most extensive route system, many of the world's carriers have been expanding since the late 1980s—via strategic alliances, marketing agreements, or route acquisitions. The expansion of low-cost, short-haul domestic service offered by startup as well as existing carriers is prompting some of the largest U.S. carriers to concentrate on serving international and long-haul routes and/or to restructure their operations in order to compete with the low-cost carriers.

State of the Industry

International markets have become more and more important to U.S. airlines. Growth in international passenger service by U.S. airlines outpaced both the rise in gross domestic product and the rapid



TABLE 5-1: Selected Economic Indicators for U.S. Civil Aviation Industries, 1992

Industry	Revenue (\$ billions)	U.S. market share (% of world revenue)	U.S. balance of payments (\$ billions)	Employment (thousands)
Civil aircraft manufacturing				
<i>Civil transports</i>	\$288	79%	\$204	1103
<i>Rotorcraft</i>	0.3^b	46^c	-01	2.1^d
<i>General aviation</i>	1.8	60^e	-0.8	213
Air traffic control equipment ^f	1.5	40	0.4	4.4
Airline service	77.9	37	6.4 ^g	5404
Air traffic control service ^h				
<i>FM air traffic control</i>	N/A	46 ⁱ	NA	319

^a Revenue, market share, and balance of payments calculations based on the value of delivered products for 1992. Does not include figures for separate engines and parts.

^b Excludes production by foreign licensees.

^c Excludes production of piston-powered rotorcraft.

^d Employment calculated by multiplying the total number of employees for each of the three major U.S. turbine rotorcraft manufacturers by their respective civil to total revenue ratios.

^e Department of Commerce estimate based on industry data.

^f All figures based on OTA survey of U.S. ATC equipment manufacturers.

^g Balance of payments for international air service represents the difference between airfares paid to U.S. carriers by international visitors traveling to the United States and fares paid to foreign earners by Americans traveling abroad.

^h ATC service is not a commercial industry in the United States. It is shown here for comparative purposes.

ⁱ The cost of developing and operating the U.S. ATC system was approximately \$6 billion, based on OTA analysis of the 1992 FAA budget for ATC operations, facilities and equipment, and research, engineering, and development.

^j In 1992, FAA handled about 46 percent of all commercial aircraft departures in the world, based on FAA and Boeing data.

KEY: NA = not applicable.

SOURCES: Data compiled from Aerospace Industries Association of America, *Aerospace Industry Review*; Air Transport Association of America, *ATC Market Report*; Bell Helicopter Textron, Boeing, Bureau of Economic Analysts, Federal Aviation Administration; General Aviation Manufacturers Association, *Interavia Aerospace World*; International Civil Aviation Organization; Office of Management and Budget, Office of Technology Assessment, U.S. Travel and Tourism Administration; and World Jet Airplane Inventory.

expansion of U.S. domestic traffic in the decade following deregulation (1979 to 1989).] Although domestic airline traffic increases have slowed markedly since 1988, the growth in international markets continues to climb (see figure 5-1).²

Most recent forecasts of the industry's performance indicate that total U.S. air traffic will continue to grow through 2010, albeit at lower levels

than in the past. Federal Aviation Administration (FAA) forecasts indicate that passenger traffic will increase at a 3.5-percent annual pace in domestic markets and a 6.6-percent annual rate on international routes during the 12 years from 1993 to 2004.³ If this forecast holds, international travel will account for one-third of U.S. airline passenger-miles by 2004.⁴

¹ International air travel markets remain regulated. During this period, average annual growth rates were gross domestic product 2.5 percent, domestic traffic 4.6 percent, and international traffic 6.8 percent.

² In 1991, however, international traffic suffered a 2 percent drop in growth due to the U.S. economic recession and the Persian Gulf War. The average annual growth rate for international traffic carried by U.S. airlines since 1987 is 10.3 percent.

³ U.S. Department of Transportation, Federal Aviation Administration, *FAA Aviation Forecasts, Fiscal Years 1993-2004* (Washington, DC: February 1993), pp. III-38 -111-40.

⁴ *Ibid.*, p. 1X-12.

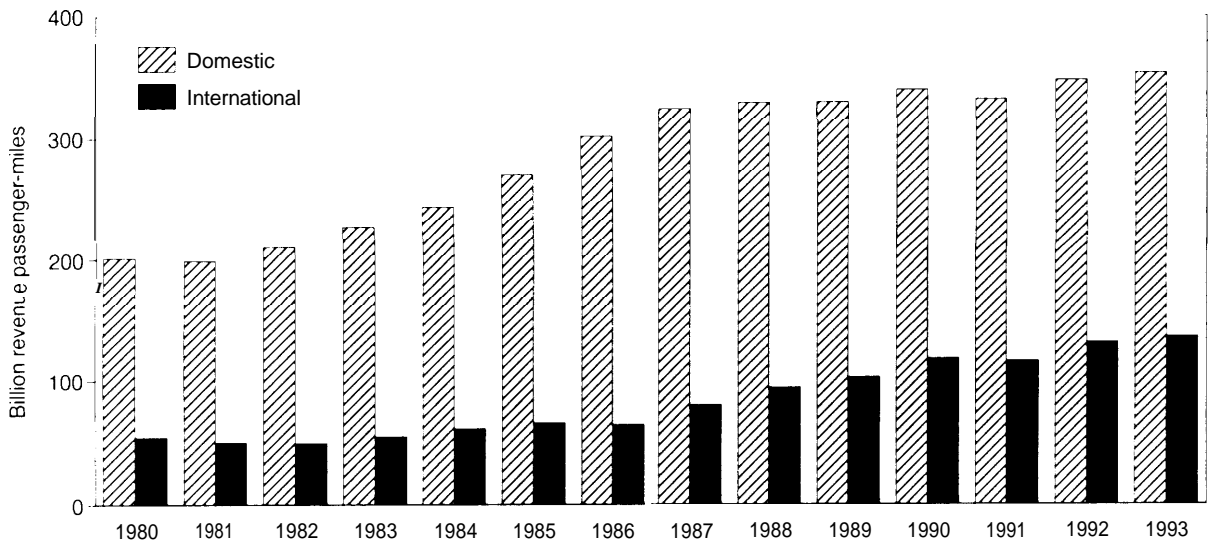


Advances in telecommunications technology especially satellite and digital communications, permit airlines to offer new in-flight passenger services

Carrier Fleet Forecast

The total U.S. air carrier fleet is projected to increase from a 1992 inventory of 4,206 large jets to more than 5,700 such aircraft in 2004.⁵ At the same time, expectations are that the distribution of the fleet by aircraft type will change significantly during this period. The category that is forecast to experience the largest growth in terms of number of aircraft is two-engine narrow-body aircraft, growing from 52 percent of the fleet to 67 percent.⁶ Two-engine wide-body aircraft are projected to have the fastest annual growth rate, with fleet size more than doubling during this period.⁷ Due to the Aviation Safety and Capacity Expansion Act of 1990, X Stage 2 aircraft (comprising 41 percent of the U.S. fleet in 1992)⁹ will be virtually eliminated by the year 2000.

FIGURE 5-1: U.S. Scheduled Airline Traffic



SOURCE Office of Technology Assessment 1994 Data compiled from the Air Transport Association of America

⁵Ibid., p. IX- 17.

⁶Examples of two-engine narrow-body aircraft include the B-737, B-757, MD-80, and A320. Ibid., p. III-41.

⁷Examples of two-engine wide-body aircraft include the B-767 and the A300. I bid., p. IX 17

⁸Public Law 101-508.

⁹Federal Aviation Administration, op.cit., footnote 3, pp. 111-40-111-43.

The change in the distribution of the world's airline fleet mirrors that of the U.S. fleet. The two categories that are forecast to grow the fastest in terms of number of aircraft are those with between 171 and 240 seats, which are expected to increase from 13 percent of the 1992 fleet to 19 percent of the 2010 fleet, and aircraft with more than 350 seats, which are forecast to increase from 9 to 19 percent of the world fleet.¹⁰

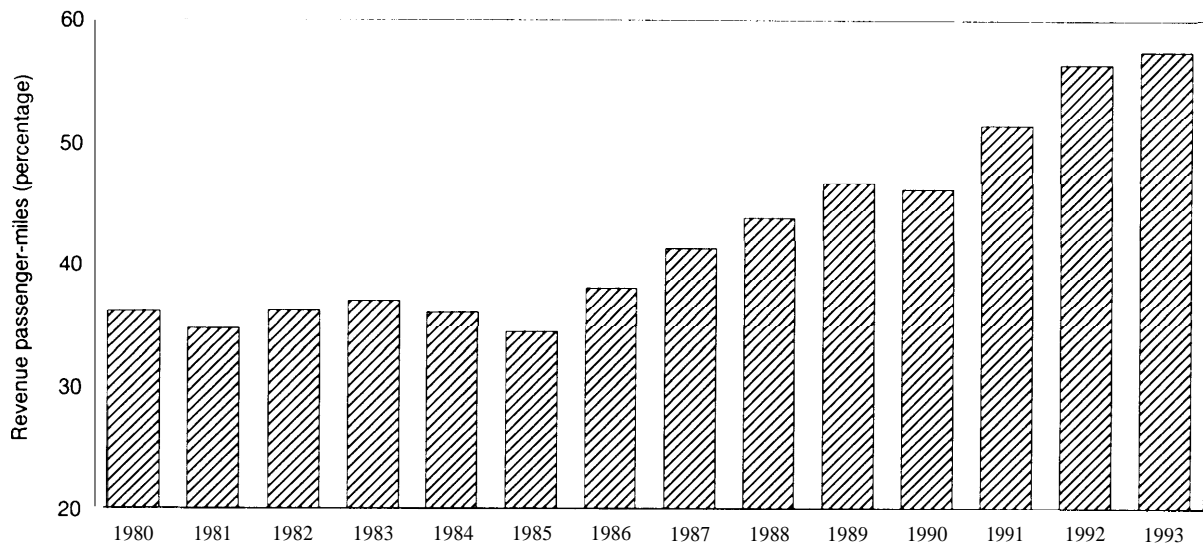
Airline Competition

Opinions vary about the number of domestic U.S. airlines that will exist in the 21st century and the extent to which they will continue to compete. The passage of the Airline Deregulation Act of 1978 resulted in huge growth in the number of

competing airlines, followed by consolidation of the entire industry. The industry reached a peak of 123 carriers, including cargo and charter airlines, in February 1984.¹¹ By the end of 1991, however, there were only 58 U.S. carriers.¹² From 1985 to 1987, there were 12 mergers involving major or national carriers. This and the large number of airline bankruptcies resulted in fewer firms controlling more of the industry's traffic than in the period preceding deregulation. The market share in terms of traffic (by revenue passenger-miles) of American Airlines, United Airlines, and Delta Air Lines increased from 34 percent in 1985 to 57 percent in 1993 (see figure 5-2).

The industry can be expected to remain competitive through the foreseeable future, assuming

FIGURE 5-2: Industry Market Share of American, Delta, and United—Domestic and International Service



NOTE Since 1987, American Airlines, United Airlines, and Delta Air Lines have been the leading carriers. In 1980, United ranked first, American fourth, and Delta fifth.

SOURCE Office of Technology Assessment, 1994. Data compiled from the Air Transport Association of America.

¹⁰Boeing Commercial Airplane Group, 1993 *Current Market Outlook* (Seattle, WA: March 1993), p. 3.9.

¹¹U.S. Department of Transportation, Federal Aviation Administration, *FAA Aviation Forecasts, Fiscal Years 1989-2000* (Washington, DC: March 1989), p. 53.

¹²U.S. Department of Transportation, Federal Aviation Administration, *FAA Aviation Forecasts, Fiscal Years 1992-2003* (Washington, DC: February 1992), p. 27.

the current trend toward consolidation does not change dramatically. The Transportation Research Board concluded in 1991 that at least five major carriers would be necessary for a competitive industry.¹³ Other economists believe that three to five major airlines with several regional airlines would provide a sufficient level of competition.¹⁴

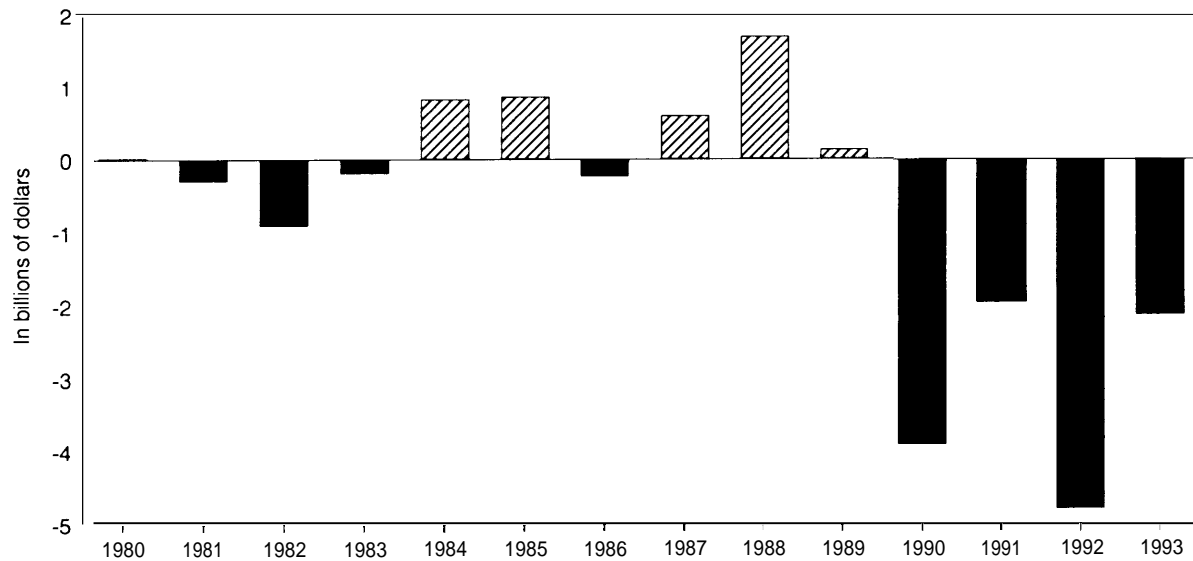
The Financial Condition of the Industry

No carrier—with the notable exception of Southwest Airlines—was unscathed by the recession of

the early 1990s. U.S. airlines lost \$12.8 billion from 1990 to 1993,¹⁵ three airlines ceased operations,¹⁶ and three others filed for Chapter 11 bankruptcy¹⁷ (see figure 5-3).

Following two years of profits (1987 and 1988), the industry experienced a downturn in profitability in the second half of 1989. The slow growth in both domestic and international air travel during 1990 and 1991—when the U.S. economy entered a recession—and the increase in jet fuel prices following the Iraqi invasion of Kuwait

FIGURE 5-3: Net Profit of U.S. Scheduled Airlines



NOTE Of the airlines net loss in 1990 and 1991 approximately \$2 billion was recurred by Eastern Airlines and Pan Am World Airways Of the 1992 net loss approximately \$2 billion was due to accounting adjustments related to retiree benefits

SOURCE Off Ice of Technology Assessment, 1994 Data compiled from the Air Transport Association of America

¹³National Research Council, Transportation Research Board, *Winds of Change: Domestic Air Transport Since Deregulation*, Special Report 230 (Washington, DC: 1991), p. 3. The Transportation Research Board did not explicitly define competition, beyond indicating that it meant competition in a domestic context. According to economic theory, the U.S. airline industry, to remain competitive, would require enough carriers such that no one carrier or coalition of carriers exercises a high degree of market control; i.e., no carrier could dictate fares in any of its markets without losing passengers to other airlines.

¹⁴Peter Passell, "Waiting Out the Airline Shakeout," *The New York Times*, May 22, 1992, p. D1.

¹⁵Of the airlines' 1992 net loss, approximately \$2 billion was due to accounting adjustments related to retiree benefits

¹⁶Eastern Air Lines, Pan Am World Airways, and Midway Airlines.

¹⁷Continental Airlines, America West Airlines, and TWA.

SOUTHWEST AIRLINES



Southwest remained profitable in the early 1990s, while the rest of the U.S. airline industry lost over \$ 12 billion

in August 1990 were the main factors behind the industry's losses during this period.¹⁸ Following the start of the Persian Gulf War, discounted fares offered by U.S. airlines caused systemwide yields to fall, further contributing to the airlines' losses.¹⁹ The economic recession caused heavier than usual reductions in high-yield business travel, possibly indicating a systemic change in the demand for such travel. Airline forecasters believe that increased use of facsimile machines and videoconferences replaced some business trips and may cut into future business travel.²⁰

Due to cost and personnel reductions, higher prices absent the deep discounting of the summer of 1992, and a gradual increase in economic growth since 1992, U.S. airlines posted narrower losses in 1993 than in the previous year. In response to the industry's losses between 1990 and 1992, airlines engaged in a substantial effort to re-



AT&T

Videoconferences may substitute for some growth in future business travel,

duce costs by closing hubs and the feeder routes that serve them, negotiating significant wage and benefit concessions from their unions, and laying off employees.

Adding to the financial pressure on the largest airlines is the recent introduction of low-cost, point-to-point, jet service by new domestic carriers. In the 12-month period preceding July 1993, over a dozen passenger airlines began operations. As of 1993 the new startups had less than a 2-percent share of the domestic market, but some analysts forecast that they could reach an 8-percent share by the end of 1994.²¹ Southwest Airlines, which has successfully provided this type of service in the southwestern United States since the 1970s, expanded its service to the east coast in 1993. The major airlines—with higher operating costs on the short-haul routes—have responded

¹⁸After growing by 5.9 percent in 1990, total traffic fell by 1.6 percent in 1991. Federal Aviation Administration, *op.cit.*, footnote 3, p. ix-13.

¹⁹*Ibid.*, pp. 27-58.

²⁰James Ott, "Modest World Airline Traffic Growth Seen for '92, Bigger Hike Eyed for '93," *Aviation Week and Space Technology*, Mar. 16, 1992, p. 61.

²¹James S. Hirsch, "Takeoff Is Bumpy for Start-Up Airlines as They Try To Grab a Piece of the Sky," *The Wall Street Journal*, July 1, 1993, p. B1.

by transferring money-losing routes to their regional affiliates, most of which are not part of the corporate entity, or by pulling out of markets. Several of the larger carriers—including United, Delta, and USAir—have plans to create low-cost airlines-within-an-airline to compete with the newer carriers on short-haul routes.²² Continental Airlines introduced CALite, a low-price, quick turn-around service, in October 1993 to compete with Southwest.²³

Employment

Despite the loss of three carriers and the filing for Chapter 11 bankruptcy by three others between 1990 and 1992, airline industry employment has remained fairly steady since peaking in 1990 at 546,000.²⁴ Approximately one-half of the employment loss experienced in 1991—2 percent—

was regained in 1992. In fact, 1991 was the only year in which employment and air traffic dropped since 1983. Thus, the loss of an individual airline will not—in and of itself—result in a decline in the overall number of jobs in the industry: for the most part, only a drop in the demand for air travel will significantly affect employment.²⁵ The impact of layoffs, however, should not be minimized; employees who are laid off may be forced to relocate to find other airline jobs—sometimes lower paying ones than they held previously.

Capital investment

In such an uncertain economic climate, only the industry's healthiest airlines can be assured of obtaining the necessary financing to expand their fleets and replace their older aircraft with those that meet Stage 3 noise requirements, the most de-



AIR TRANSPORT ASSOCIATION

Some new commercial aircraft were stored in desert facilities as financially strapped airlines deferred orders in the early 1990s

²²In July 1994, UAL Corp.—United's parent company—agreed to sell a majority stake in the airline (55 percent of its equity) to its machinists and pilots unions in exchange for approximately \$4.9 billion in wage and work-rule concessions over six years. This transaction opens the way for the airline to create a separate low-fare, short-haul carrier. James Ott, "Vote Sets UAL on New Course," *Aviation Week & Space Technology*, July 18, 1994, p. 20.

²³Robert L. Rose and Susan Carey, "The Frugal Skies: Money-Losing Routes Prompt Big Carriers To Mull Radical Steps," *The Wall Street Journal*, Oct. 19, 1993, p. A 1.

²⁴Air Transport Association, *Air Transport 1992* (Washington, DC: June 1992)

²⁵In a not unlikely scenario, the demand for air travel could decline during an economic recession. The resulting loss in revenue could cause one or more carriers to go bankrupt and employees to be laid off. But in this set of circumstances, it is still the traffic loss—and not the carriers that ceased to operate—that caused employment to drop.

manding ones. To help control costs, airlines are retiring older planes and deferring new aircraft orders. Each of the nation's three largest carriers has cut back its capital spending plans: American by \$8 billion between 1991 and 1995, United by \$6.7 billion between 1992 and 1995, and Delta by \$6 billion between 1992 and 1995.²⁶ As of June 1993, firm orders for the industry stood at 696 aircraft, requiring an estimated \$39 billion.²⁷ Because of the difficulty in raising money through issues of stock, the top three airlines have increased their amount of long-term debt to finance recent property and equipment acquisitions.

International Developments

Due to fewer intra-Europe airline flight restrictions and the increasing share of passenger traffic expected to come from the Pacific Rim, many international airlines are forming (or considering) alliances large enough to compete on a global scale.²⁸ For example, in early 1993, the United States approved a \$300-million investment by British Airways in USAir and allowed the two airlines to form a code-sharing alliance²⁹ that links

USAir's domestic service to British Airways' international destinations.³⁰ This type of agreement—where two airlines offer seamless service through the sharing of aircraft and crews—is one type of strategic alliance.³¹

The current limits set by federal law on foreign investment in U.S. airlines restrict ownership to 25 percent of an airline's voting stock and require decisionmaking control to remain in the hands of the airline's U.S. owners.³² In 1991, the U.S. Department of Transportation (DOT) announced that it would interpret this law to allow a foreign investor to hold up to 49 percent of an airline's total stock (voting and nonvoting). In addition, DOT has proposed allowing foreign investments in as much as 49 percent of a U.S. airline voting stock. DOT sees this proposal as a way of giving financially troubled U.S. airlines access to needed capital.³³

The 1992 agreement between Northwest Airlines and KLM Royal Dutch Airlines to operate as one airline (KLM has a 20-percent common stock investment in Northwest's parent company, Wings Holdings) through the joint scheduling of

²⁶ Anthony L. Velocci, Jr., "Big Three Cuts To Reduce Debt Downgrade Effects," *AviationWeek & Space Technology*, Mar. 22, 1993, p. 38.

²⁷ Richard Crum, Economic and Data Analyst, Air Transport Association of America, personal communication, Nov. 5, 1993.

²⁸ In June 1992, the European Community, now the European Union (EU), approved the third and final package of airline liberalization measures that went into effect on January 1, 1993. The agreement gives EU airlines freedom to set fares on intra-EU flights; establishes limited rights of cabotage in which EU airlines will be allowed to pick up passengers and freight in another EU country and continue to another point within that country with certain restrictions; and sets up common licensing criteria for any airline operating within EU territory. Carol A. Shifrin, "EC Ministers Approve Liberalization, But 'Safeguards' May Slow Competition," *AviationWeek & Space Technology*, June 29, 1992, pp. 21-22.

Because the European Union's third package of liberalization measures allowed national governments to retain significant control over their domestic aviation markets and to restrict competition within their markets at least until 1997, the EU cannot be considered an open air travel market as of 1993. For more information, see U.S. Congress, General Accounting Office, *International Aviation: Measures by European Community Could Limit U.S. Airlines' Ability To Compete Abroad*, GAO/RCED-93-64 (Washington, DC: April 1993), pp. 22-34.

²⁹ A code-sharing alliance is an agreement between two airlines to use the same code in computer reservations systems, allowing them to jointly serve the same route.

³⁰ The \$300-million investment is the first of three planned stages of investment by British Airways that would bring the total investment in USAir to \$750 million after five years. Bruce Ingersoll, "U.S. Approves British Air Stake in USAir Group," *The Wall Street Journal*, Mar. 16, 1993, p. A3.

³¹ Gellman Research Associates, Inc., "Airline Strategic Alliances: Definition and a Case for Caution" *Transportation Advisor*, vol. 3, No. 1, January 1993, pp. 1-4.

³² See U.S. Congress, General Accounting Office, *Airline Competition: Impact of Changing Foreign Investment and Control Limits on U.S. Airline*, GAO/RCED-93-7 (Washington, DC: December 1992).

³³ As of 1994, the current administration has under way a complete review of the United States' international aviation policy.

their flights as well as cooperating on pricing, purchasing, and marketing can also be termed a strategic alliance.³⁴ Other U.S. carriers have established alliances that are closer to marketing agreements—the offering of joint services, such as limited code-sharing, that does not involve the sharing of assets: United with Lufthansa German Airlines, Delta with both Swissair and Singapore Airlines, and Continental Airlines with SAS.³⁵

The deal between British Airways and USAir could have several consequences for both U.S. and foreign airlines. It could encourage other foreign airlines to invest in U.S. airlines, which would provide the investing airline a direct link to U.S. passengers destined for Europe or Asia while possibly strengthening the balance sheet of the U.S. airline. The agreement could also encourage the liberalization of future bilateral aviation treaties involving the United States. The United States linked its approval of the investment by British Airways to the negotiation of a more liberal bilateral agreement with Britain. Because the agreement between British Airways and USAir provides British Airways with feeder traffic from USAir's routes, other U.S. carriers are demanding that the bilateral treaty currently under negotiation between the United States and Britain give them access to a greater number of British destinations. A new treaty containing such liberalized provisions could form the basis for other treaties the United States establishes under DOT's Open Skies policy, which is designed to remove many of the international market and capacity constraints contained in current bilateral.

Working against the possibility of the opening of future bilateral treaties is the threat from several foreign countries to renounce their current pacts and negotiate more restrictive agreements so that



British Airways has invested in USAir and the services of the two airlines are coordinated

their carriers will not have to compete to the same extent against the lower cost U.S. airlines. Both France and Japan are considering placing more restrictions on the number of routes and flights in their bilateral agreements with the United States; the issue of beyond rights—allowing U.S. carriers to pickup passengers in those countries and fly to other destinations—is particularly contentious.³⁶ However, the recently agreed to 1993 aviation treaty between the United States and Germany preserves the current liberal agreement in effect, gradually moves the two countries toward a full Open Skies regime—allowing unlimited flights free of government restrictions—in four years, and allows an increasing number of code-sharing opportunities between international carriers.³⁷

Factors Affecting the International Success of the U.S. Airline Industry

As the share of air traffic originating in international markets increases, the ability of U.S. carriers to compete in the international arena becomes

³⁴The United States granted tentative approval to this agreement in November 1992. Brett Pulley and Bruce Ingersoll, "U.S. Gives Tentative Clearance to KLM, Northwest To Start Integrating Service," *The Wall Street Journal*, Nov. 17, 1992, p. A3.

³⁵Gellman Research Associates, Inc., op. cit., footnote 31, pp. 1-4.

³⁶Bruce Ingersoll, "Unclear for Takeoff, Big U.S. Airlines Fly Into Foreign Barriers Over Expansion Plans," *The Wall Street Journal*, May 14, 1993, p. A1.

³⁷Jeffrey Lenorovitz, "Lufthansa, United To Link Efforts," *Aviation Week & Space Technology*, Oct. 4, 1993, pp. 22-23.

more important to their economic growth. Heightened competition with foreign airlines has made operating under different safety and environmental regulations an issue for U.S. carriers. But while the absence of common regulations affects the balance of international competition, it is not an overriding concern. International trade policy, including bilateral aviation agreements and airport facilities and service issues³⁸ that influence the ability of carriers to access foreign markets, is the most significant factor affecting the international competitiveness of U.S. airlines, according to industry officials.³⁹ Table 5-2 presents U.S. airline views on how trade policy, international differences in operating regulations, FAA's air traffic system management, technology innovation, and other federal policies can affect the international competitiveness of U.S. carriers—both overseas and in the U.S. market.

The success of U.S. airlines in international markets can be measured by a number of different indicators: the market share of U.S. airlines versus foreign airlines in overseas markets, the U.S. international balance of payments for airline services, and a comparison of labor productivity between U.S. and foreign carriers. Reliance on any single measure can result in an inaccurate assessment of an industry's competitiveness. For instance, the U.S. airline industry contributed positively to the U.S. international balance of payments over

the five years from 1988 through 1992.⁴¹ In 1992, according to the Bureau of Economic Analysis (BEA), the industry contributed a surplus of \$6.4 billion out of a total balance for services of \$61 billion (see table 5-3). BEA's count seems to overstate the balance for air service. It is more likely that the 1992 U.S. balance was between \$2.5 billion and \$3 billion.⁴² However, this trend alone may not be proof that the U.S. airline industry is a stronger competitor in international markets than foreign airlines. One explanation for the change in the balance of payments for air service since 1985 is the effect the fall in the value of the dollar had on the attractiveness of travel to the United States in general and travel on U.S. airlines for international travelers. An examination of the different measures of competitiveness show that U.S. airlines are strongly positioned to compete in international markets (see table 5-4).

FAA Safety, Security and Environmental Regulations

The Federal Aviation Administration is responsible for regulating the operations of commercial aircraft, including: approving flight procedures, determining equipment requirements, and overseeing flight crew training.⁴³ Prior to the issuance of a new safety rule, FAA performs a cost-benefit analysis to determine if the estimated benefits of a regulation outweigh its estimated costs. Despite

³⁸These international access issues include landing and other user fees, terminal space, passenger and cargo handling, and customs and visa requirements. U.S. airline industry concerns are with the unfair or discriminatory practices in certain countries that favor national airlines over U.S. and other outside earners.

³⁹OTA survey of seven senior representatives of U.S. airlines, spring 1993.

⁴⁰A more comprehensive definition of *competitiveness* is contained in the 1985 report of the President Commission on Industrial Competitiveness: "Competitiveness is the degree to which a nation can, under free and fair market conditions, produce goods and services that meet the test of international markets while simultaneously maintaining or expanding the real incomes of its citizens."

⁴¹Balance of payments for international air service represents the difference between airfares paid to U.S. carriers by international visitors traveling to the United States and fares paid to foreign carriers by Americans traveling abroad.

⁴²Based on data from BEA and DOT, and OTA analysis. The National Research Council has raised questions concerning the accuracy of the passenger survey data on which BEA relies for its estimates of airfares paid by U.S. and foreign travelers. They have suggested that the survey data be checked for consistency with actual data on airfares. For more information, see National Research Council, Panel on Foreign Trade Statistics, Committee on National Statistics, *Behind the Numbers: U.S. Trade in the World Economy* (Washington, DC: National Academy Press, 1992), pp. 140-146.

⁴³For more information on FAA regulation of commercial aircraft, see U.S. Congress, Office of Technology Assessment, *Safe Skies for Tomorrow: Aviation Safety in a Competitive Environment, OTA-SET-381* (Washington, DC: U.S. Government Printing Office, July 1988), pp. 56-57.

TABLE 5-2: Industry Ranking of Factors Affecting the International Economics and Competitiveness of U.S. Airlines^a

Factor	Description	Example
1. International trade policy		
Bilateral aviation agreement	Defines the markets and air service constraints in which an air carrier must operate	Routes, the number of carriers that may operate each route, the number of flights, and the method for gaining approval for fare changes
Airport facilities and service issues	Affect the ability of carriers to compete in foreign markets, such as airport access, ground handling, and ticket counter space	To provide access for foreign earners, DOT has expropriated slots from U S carriers at slot-controlled airports Foreign governments rarely help U S carriers obtain airport access
2. FAA operating regulations	Complying with FM rules, many of which do not apply to foreign carriers, can result in higher operating costs for U.S. airlines	The modification of 14 proposed or existing rules could result in a 3.5-percent increase in enplanements on U S carriers annually ^{b,c}
3. U.S. tax policy	Aviation ticket taxes, alternative minimum tax, lack of investment tax credit	Returning user fees to the levels that existed prior to the Budget Reconciliation of 1990 could result in a 1-percent increase in enplanements annually ^b
4. Non-FAA regulations	Agriculture, environment, immigration, worker safety, and pension benefits	Fines for inadmissible passengers (INS), aircraft inspection fees (USDA), and passenger manifests (DOT, proposed).
5. Domestic airport and ATC infrastructure	A more efficient system would reduce airline operating costs on domestic legs and generate feed traffic for international flights	United Airlines has estimated it could save over \$600 million per year in lower direct operating costs if an advanced air traffic management system were fully implemented ^d
6. Commercial technology	Not a major factor, since in most cases aircraft, communications, and cabin service technologies are available to any airline	Technologies that are more difficult to emulate, such as computer reservation systems and pricing management systems, confer a degree of competitive advantage for U S carriers

^aThese conclusions are based on a 1993 survey of senior representatives of U.S. airlines with international service, specifically five passenger airlines, one cargo airline, and an executive from the Air Transport Association.

^bThe WEF Group, *The Potential Impact of Selected Airline Tax and Regulatory Changes on the U.S. Economy*, submitted to the Air Transport Association of America, May 1992.

^cThis aggregate result includes five non-FAA regulations.

^dEdwin A. Thomas, United Airlines, personal communication, June 29, 1994.

KEY: ATC = air traffic control; DOT = Department of Transportation; FAA = Federal Aviation Administration; INS = Immigration and Naturalization Service; USDA = Department of Agriculture.

SOURCE: Office of Technology Assessment, 1994.

TABLE 5-3: U.S. Balance of Payments for Merchandise Trade and Services (\$ billions)

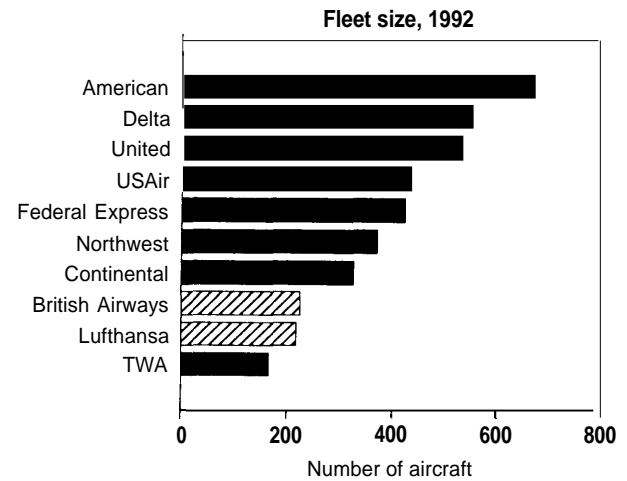
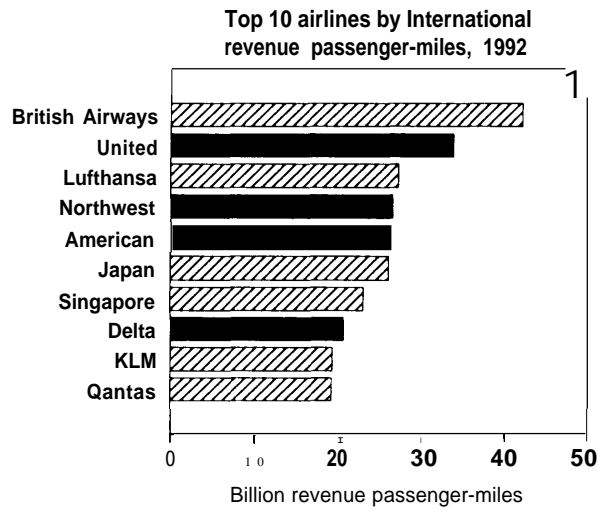
Category	1987	1988	1989	1990	1991	1992	1993
Merchandise trade^a	(\$1 596)	(\$127 0)	(\$1 152)	(\$109 0)	(\$74 1)	(\$96 1)	(\$132 6)
Civilian aircraft, engines, and parts	9.8	13.3	17.0	21.7	24.9	25.1	21.4
Private services	128	197	329	390	525	60.2	591
International air service^b	-- (0.3)	1.2	-- 24	4.8	5.8	6.4	5.1

^aExcludes military transfers.

^bBalance of payments for international air service represents the difference between airfares paid to U.S. carriers by international visitors traveling to the United States and fares paid to foreign carriers by Americans traveling abroad.

SOURCE: U.S. Department of Commerce, Bureau of Economic Analysis, Balance of Payments Division, 1994.

TABLE 5-4: U.S. Airline Industry's Position in International Markets



Market share-international passenger traffic

U S airlines are among the world's largest airlines in terms of scheduled passenger traffic carried on international routes, three U S airlines were ranked in the top five in 1992. When total traffic (domestic and international) is counted, U S airlines held four of the five top slots.

The market share (in terms of passengers) of U S carriers for international travel to and from the United States remained above 51 percent from 1988 through 1991.

Unit costs and productivity

U S carriers' operating costs are 30 to 50 percent lower than those of most European and Japanese carriers, according to a 1993 study.^a Another study concluded that overall productivity of the European airline industry was 28 percent lower than that of U S airlines in 1989. The relative productivity levels of the major personnel functions varied from 46 percent lower for marketing (European versus U S airlines) to 11 percent lower for airport handling.^b (Labor productivity rates are one of the determinants of unit labor costs, i.e., labor costs per available seat-mile.)

For most of the 1980s, international service has been more profitable for U S airlines than domestic service. Since 1989, though, the annual operating profit margin for domestic service has been better.^c

^a Mercer Management Consulting, Inc., 'Update on the Global Airline Industry,' unpublished report, Apr 27, 1993, p 21.

^b The six major functions were cockpit crew, cabin attendants, airport handling, maintenance and overhaul, ticketing, sales, and promotion; and other personnel.

^c McKinsey Global Institute *Service Sector Productivity* (Washington, DC, October 1992), pp 2A-4, 2A-8.

^d A host of variables considered to lie behind the U S advantage in unit labor costs, including deregulation of the market and the relative lack of protective work rules in the United States.

^e Operating profit margin is defined as operating profit (operating revenues minus operating expenses) as a percentage of operating revenues.

^f From 1990 to 1992, however, the operating profit margin for domestic service was negative.

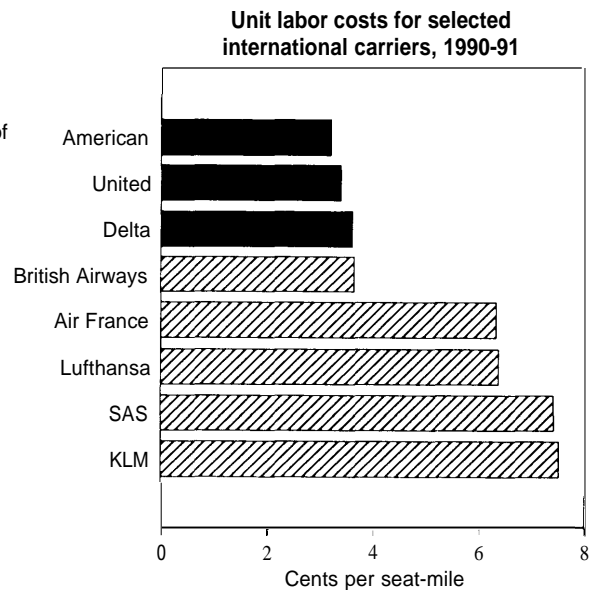
KEY BA = British Airways, JAL = Japan Air Lines, KLM = Royal Dutch Airlines, SAS = Scandinavian Airlines System

SOURCES: Office of Technology Assessment, 1994, based on data compiled from Global Aviation Associates, Ltd., International Air Transport Association, Air Transport Association of America, U S Travel and Tourism Administration, Volpe National Transportation Systems Center, and U S General Accounting Office.

Fleet size-capacity

U S carriers have the world's six largest fleets. Each of the three largest U S airlines—American, Delta, and United—has a fleet more than twice the size of British Airways.^f

U S carriers offer almost one-half of the total seating capacity available in the North Atlantic market. In July 1993, four U S airlines were ranked among the top five international airlines by capacity share.



this analysis and other parts of the federal regulatory review process instituted during the 1980s to control the burden of regulations, new rules continue to generate opposition from those within industry who question their impact on costs.⁴⁴

Historically, regulation was concerned with economic issues, such as entry into markets by individual firms, the prices they charged, and the selection of products or services offered. Starting in the 1960s, though, federal regulation broadened its scope to include social objectives. Social regulation was intended to improve consumer protection, workplace safety, and environmental quality and to eliminate discrimination.⁴⁵

The justification used by government for both social and economic regulation is that it corrects market failures that occur when either adequate competition does not exist in an industry, or market forces are not sufficient to allocate social resources efficiently. A typical example of market failure is externalizing the cost of pollution, or not accounting for its effect on a community when pricing transportation equipment or the operation of stationary pollution sources.

Effect of operating regulations on airline economics in general

Compliance with a new regulation can affect a company in several ways. In the case of the airline industry, each carrier should be able to pass along part of the resulting cost increase to the consumer

in the form of higher ticket prices. But, because higher ticket prices will cause aggregate passenger demand to fall, the resulting increase in revenue may not fully offset the increased cost of complying with a new regulation.⁴⁶ Thus profits are likely to drop. Any part of the cost increase not passed along would most likely result in lower profits as well.⁴⁷

There is an extensive literature that attempts to describe the cost of federal government regulation. One study estimated the cost of regulation to businesses and individuals for consumer safety and health (of which FAA regulations are a subset), worker safety, and other nonenvironmental social regulation at \$32 billion in 1990.⁴⁸

Estimating the cost of implementing a given regulation is a difficult exercise. Cost estimates often rely on traffic forecasts, and these are subject to question. But in addition to the inherent uncertainties in forecasts of changes in airline industry operations, discrepancies between FAA's and industry's estimates arise due to differing economic assumptions as well as a certain amount of bias. The airline industry, unlike FAA, does not discount its estimates of future costs.⁴⁹ Also, industry factors projected inflation into their cost estimates. FAA, in accordance with guidance from the Office of Management and Budget, does not adjust for inflation. The result of these two differences alone is that for a typical regulatory forecast of costs over a 15-year time horizon, industry es-

⁴⁴For more information on the FAA rulemaking process, see *ibid.*, pp. 59-60.

⁴⁵Congressional Quarterly, *Federal Regulatory Directory* (Washington, DC:1990), pp. 1-7.

⁴⁶The extent to which revenues rise after ticket prices increase depends on the price elasticity of demand for air transportation. Only in the unlikely case in which passenger demand is completely unresponsive to changes in price (i.e., price elasticity of demand equals zero) would airlines be able to fully recoup the cost of a new regulation through increased fares.

This analysis assumes that airlines will not be able to significantly cut their (flying) operating costs by decreasing capacity in response to the lower passenger demand. Including in the analysis any incremental drop in variable labor and passenger service costs associated with lower demand should not affect the conclusion. In the long run, airlines will have more flexibility to lower their operating costs by decreasing system-wide capacity.

⁴⁷Overtime, carriers may become more efficient as they adapt to new requirements. Thus, they may be able to absorb some of the regulatory cost increase without attempting to raise prices and/or suffer a loss in profits.

⁴⁸Robert W. Hahn and Thomas D. Hopkins, "Regulation Deregulation: Looking Backward Looking Forward." *The American Enterprise*, July-August 1992, p. 72.

⁴⁹Discounting is an accounting methodology that accounts for the time value of money so that expenditure that occur at different times can be compared.

timates will be approximately two times higher than FAA's.⁵⁰ Because of the political consequences of rulemakings, it is often in the best interest of the airline industry to bias its cost estimates on the high end. FAA is often forced to balance these high estimates against lower ones from other industry constituents. For instance, in estimating the purchase cost of equipment using newly developed technology, forecasts of costs from a potential manufacturer will likely be lower than those provided by the airlines.

Despite industry's claim that the burden of federal regulation is a significant cause of the airlines' current financial difficulties, virtually no analysis on this topic has been done in either the private sector, the federal government, or academia. The estimate of the cost of FAA-imposed technical regulations by the National Commission To Ensure a Strong Competitive Airline Industry (Airline Commission) was the first federal effort to quantify the regulatory burden in a formal manner.⁵¹

According to the Airline Commission, 16 major aviation safety and security rules have added \$2 billion in total costs to airlines since 1984.⁵² In addition, other regulatory actions by FAA have imposed costs on the airlines: between \$1.5 billion and \$4.5 billion for U.S. airlines to convert to an all Stage 3 fleet by the end of 1999 in response to the Aviation Safety and Capacity Expansion Act of 1990;⁵³ \$900 million to comply with airworthiness directives from 1989 through 1992;

and \$200 million for heightened security during the Persian Gulf crisis.⁵⁴

FAA regulations and international competitiveness

The regulatory burden on the U.S. airline industry only affects U.S. carriers' ability to compete internationally when it creates an "unlevel playing field"; that is, the same rules are not being followed by foreign carriers. Foreign carriers implement a large proportion of U.S. airline safety regulations voluntarily because of safety and economic considerations, although many of these safety regulations are not required of foreign carriers under international treaty or U.S. law.⁵⁵ Representatives of the International Air Transport Association stated that a comparison of the regulatory operating environment among countries will show that the similarities greatly outnumber the differences. Until recently, FAA rules were implemented by most foreign airlines as if they were the international standard. Differences in international regulations affect aircraft manufacturers as well. (See box 5-1.)

Nonetheless, according to American Airlines, rules requiring U.S. carriers to follow FAA security procedures at foreign airports cost the airline \$50 million per year more than foreign carriers are spending at the same airports.⁵⁶ Besides the direct cost associated with these rules, industry representatives say they adversely affect marketing due to the earlier airport arrival times they require and

⁵⁰Paul Larson, Manager, Regulation and Organizational Analysis Division, Office of Aviation Policy, Plans, and Management Analysis, Federal Aviation Administration, letter to OTA, Aug. 25, 1993.

⁵¹National Commission To Ensure a Strong Competitive Airline Industry, *Change, Challenge and Competition*, A Report to the President and Congress (Washington, DC: U.S. Government Printing Office, August 1993), p. 10.

In 1993, an FAA contractor began an effort to create an automated database of costs and benefits of past regulations. Ward Keech, Manager, Aircraft Regulatory Analysis Branch, Office of Aviation Policy, Plans, and Management Analysis, Federal Aviation Administration, personal communication, Oct. 28, 1993.

⁵²This value represents a simple aggregation of FAA's original cost estimates for individual rules (in current year dollars).

⁵³Public Law 101-508.

⁵⁴Based on the Airline Commission report and FAA analysis.

⁵⁵4 CFR 129 is the federal safety regulation governing the operation within the United States of foreign air carriers authorized by DOT.

⁵⁶Robert W. Baker, Executive Vice President, Operations, American Airlines, comment at OTA advisory panel meeting, Sept. 15, 1992.

BOX 5-1: International Harmonization of Aircraft Certification Standards¹

The Federal Aviation Administration has established minimum standards for the design and manufacture of commercial transport aircraft produced in or imported into the United States to certify them as safe. In 1970 a number of European civil aviation authorities created the Joint Aviation Authorities (JAA) to develop common aircraft design regulations. By 1988, JAA had eliminated most of the differences among its members. Although JAA is not a statutory authority, the European Union required its member countries, as of 1992, to adopt all of JAA's existing rules, including its certification code.

Because a non-uniform system of certifying aircraft designs results in an increase in manufacturers' costs and an inefficient use of resources, FAA and JAA initiated an effort in 1983 to harmonize (resolve) the differences in their standards, interpretations, and procedures. Over the following nine years, however, limited progress was made in eliminating unnecessary duplication on specific certification projects. The General Accounting Office (GAO) found that of the 267 differences in either wording or interpretation between the two sets of regulations that existed in 1980, 87 percent still remained in 1992. In response to aircraft manufacturers' criticism of their harmonization efforts, FAA and JAA began drafting a strategic plan in 1992 to eliminate regulatory differences within established time frames. Additionally, the two groups also began working on a proposal for a cooperative and concurrent approach in which FAA and JAA specialists would work together during the certification process.

Differences between FAA's and JAA's code may continue to arise as the result of the longer timeline to implement new rules in the United States, as well as from the possibility of changes being incorporated into a proposed FAA rule during the rulemaking process. Also, FAA's use of issue papers that contain new requirements for manufacturers could hinder the harmonization process if they appear late in the certification process and differ from JAA's requirements. GAO found that FAA used issue papers to impose additional requirements faster than the rulemaking process allows.

Estimates vary regarding the additional costs borne by aircraft manufacturers as a result of inefficiency in the certification process. The Aerospace Industries Association of America estimated that eliminating regulatory differences and duplication of activities would save U.S. aircraft manufacturers between \$800 million and \$1 billion between 1992 and 2002.

One source of additional costs are design changes imposed by either FAA or JAA late in the certification process as a result of differences in the interpretation of identical regulations. To meet more conservative interpretations of rules by JAA concerning derivative aircraft and the segregation of electrical wiring, for example, Boeing created



U.S. manufacturers supply annually over half of the world market for large commercial aircraft.

(continued)

¹This box is based on U.S. Congress General Accounting Office, *Aircraft Certification: Limited Progress on Developing International Design Standards* GAO/RCE-92-179 (Washington, DC, August 1992).

²GAO relied on FAA's determination of the number of differences that existed in 1980.

BOX 5-1: International Harmonization of Aircraft Certification Standards (Cont'd.)

a second design for the 747-400 and also agreed to retrofit aircraft it had already exported to Europe. These design changes increased Boeing's production costs by \$60 million to \$90 million for the estimated number of 747-400 aircraft they would sell to members of JAA.

Another source of added costs are duplicate certification tests (including flight tests and other analyses) that add little to the safety of the aircraft and waste resources of both the regulating organizations and the manufacturers. Due to its past experience of conducting 90 foreign certification analyses to export 12 separate aircraft designs, Boeing has budgeted approximately \$30 million for JAA certification of the new 777 aircraft after FAA completes its review.

These additional costs are often passed directly to airlines when they purchase new aircraft. In addition, airlines must spend millions of dollars modifying aircraft to obtain foreign certifications.³

³ Kenneth M Mead, Director, Transportation Issues, Resources, Community, and Economic Development Division, U.S. General Accounting Office, "State of the Airline Industry Strategies for Addressing Financial and Competition Problems," testimony at hearings before the House Committee on Appropriations, Subcommittee on Transportation and Related Agencies, Mar 10, 1993.

the perception they create that U.S. airlines are more likely than foreign airlines to be targets of terrorism.⁵⁷ According to FAA's Associate Administrator for Regulation and Certification, international differences in operating regulations are more costly than disparities in airworthiness rules, and the economic burden falls mostly on the airlines.⁵⁸

AIR TRAFFIC CONTROL EQUIPMENT MANUFACTURING

The need to replace obsolete equipment in Western Europe, along with likely economic growth in Eastern Europe and Asia, is expected to result in a fast-growing worldwide market in air traffic control (ATC) equipment.⁵⁹ Due to cutbacks in

U.S. military spending, defense contractors have entered the marketplace. U.S. companies are well positioned to compete successfully for a portion of the ATC equipment market. Airport automation systems for baggage handling, security, and terminal management are a related and possibly faster growing market.⁶⁰

During the next decade, the international market for ATC equipment is expected to expand faster than the markets for air travel and commercial aircraft combined. Foreign ATC sales are projected to grow at a 10 percent annual rate. Meanwhile, opportunities exist not only for ATC equipment manufacturers, but possibly for providers of air traffic communications, navigation, and surveillance services.⁶¹

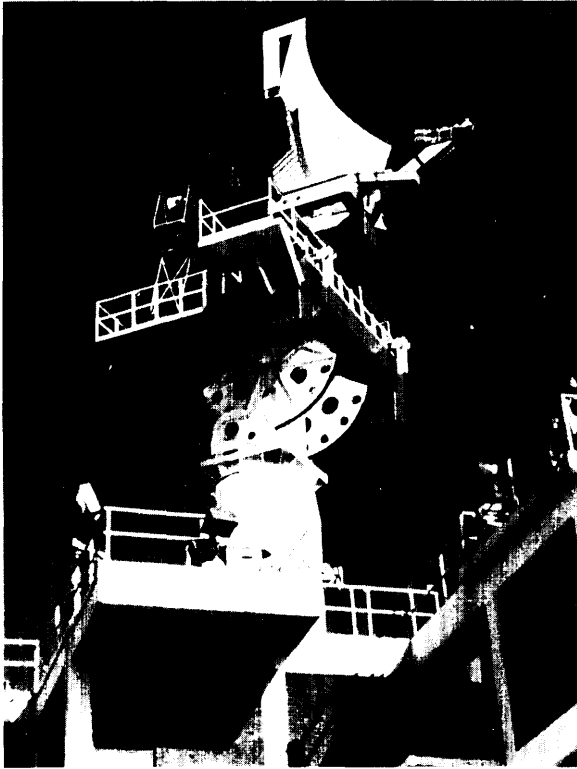
⁵⁷ Office of Technology Assessment, based on a survey of senior representatives of the U.S. airline industry, 1993.

⁵⁸ Anthony Broderick, FAA Associate Administrator for Regulation and Certification, comment at OTA workshop, June 9, 1992.

⁵⁹ For the purpose of this section, *air traffic control equipment* is defined as the various components of ground-based equipment (radars, sensors, computer hardware and software, landing systems, and communications equipment) that enable an organization to provide commercial ATC services. This definition excludes onboard aircraft avionics.

⁶⁰ David Hughes, "ATC, Airport Upgrades Poised for New Growth," *Aviation Week & Space Technology*, Apr. 5, 1993, pp. 40-43.

⁶¹ ATC service is a governmental function throughout the world, rather than a commercial industry; FAA is responsible for ATC services for the United States. One economist estimates that the United States provides ATC services for one-third to one-half less cost than for similar traffic levels and airspace coverage than European agencies. Richard Golaszewski, Gellman Research Associates, Inc., "Improving Air Traffic Control in Europe," *34th Air Traffic Control Association Fall Conference Proceedings*, Oct. 30- Nov. 2, 1989 (Arlington, VA: Air Traffic Control Association, 1989), pp. 508-515.



The Westinghouse ASR-9 airport surveillance radar developed for FAA is also sold to foreign countries

State of the Industry

While hard to estimate, the ATC equipment market—globally and nationally—is only about 1 or 2 percent of the size of the civil aircraft and equipment market. The federal government does not track trade and production data separately for the ATC equipment industry; ATC equipment is a

small part of the Department of Commerce's Standard Industrial Code SIC 3812: search, detection, navigation, guidance, aeronautical, and nautical systems instruments and equipment. A study by the consulting firm DRI/McGraw-Hill calculated worldwide ATC sales by both U.S. and foreign companies as \$6.3 billion in 1992, projected to grow at a 9-percent annual rate over the following decade.⁶² Even those ATC manufacturing executives surveyed by OTA⁶³ who thought that DRI/McGraw-Hill's estimates were reasonable noted the uncertain availability of funds in Eastern Europe, the Commonwealth of Independent States, and China as a factor that could reduce the size of the market in the future. In addition, the DRI/McGraw-Hill estimate includes aircraft avionics; several respondents thought that the DRI/McGraw-Hill estimate overstated the true size of the worldwide ATC market by two to five times. Of the world market (including the United States), the consensus of the surveyed executives was that the U.S. share is close to 40 percent, or \$2.7 billion if the DRI/McGraw-Hill estimate was correct.⁶⁴

OTA's survey of seven firms in the civil ATC market can also be used to estimate the size of the U.S. ATC industry. Total employment was 4,400 in 1992 and revenue was approximately \$1.2 billion for the seven firms. OTA estimates that revenue for the entire U.S. ATC industry in 1992 was between \$1.2 billion and \$1.9 billion—or slightly over one-half of the DRI/McGraw-Hill number.⁶⁵ Based on U.S. firms' foreign revenues, the United

⁶²"Worldwide ATC Market Expected To Grow More Than 9% Annually," *ATC Market Report*, vol. 1, No. 12, Dec. 3, 1992, pp. 1-2.

⁶³The following firms were surveyed: IBM Corp., Westinghouse Electric Corp., Hughes Aircraft Co., Paramax Systems Corp., Raytheon Co., Martin Marietta Corp., Allied Signal Co., Textron, Inc., Wilcox Electric, Inc., Hazeltine Corp., and ITT Gilfillan.

⁶⁴This estimate—that the U.S. worldwide market share is 40 percent—was originally provided by Ed Hazelwood, Editor, *ATC Market Report*.

⁶⁵Since the primary customer for ATC equipment in the United States, FAA, does not purchase any foreign-made equipment, FAA outlays for ATC equipment can be used as a proxy for the domestic share of U.S. industry revenues. In 1992, FAA spent \$1.6 billion on ATC equipment and services. Herman Tharrington, Special Assistant to the FAA Associate Administrator for NAS Development, verified that FAA does not purchase ATC equipment from foreign-based manufacturers. It should be noted that some of FAA's ATC equipment contracts are with U.S. subsidiaries of foreign-owned corporations; i.e., Wilcox Electric, Inc. and Cardion, Inc. The Department of Defense purchases a small amount of ATC equipment less than \$100 million per year—for use in the National Airspace System and, occasionally, an airport authority will sell

States had a 1992 balance of trade surplus in ATC equipment of approximately \$300 million to \$475 million.⁶⁶

Both the DRI/McGraw-Hill study and an independent forecast by Raytheon, an ATC equipment manufacturer with significant foreign sales, project the international market to grow at almost a 10-percent annual rate.⁶⁷ However, even if the foreign contracts awarded to U.S. firms grow at this rate, their profits may not increase as quickly, since foreign contracts often require firms to subcontract out a significant share of the work to local firms. Still, industry forecasts project that the world market for ATC equipment will grow faster than the markets for commercial aircraft and airline service. According to Boeing, the transport aircraft market, as measured by the value of annual deliveries, is not expected to grow from 1993 through 2005 while passenger travel will increase around 5 or 6 percent per year during this period.⁶⁸

U.S. Trade Policy for ATC Equipment

To penetrate foreign markets, countries that produce ATC equipment require government attention to a greater extent than even commercial aircraft manufacturers. In virtually all cases, the ATC equipment is sold to national governments, while aircraft sales are made to airlines, which may or may not be government-owned.

In this context, home government subsidies enable foreign ATC manufacturers (some of which are state-owned) to outbid U.S. companies for equipment contracts—either through lower

prices, loan guarantees, or other attractive financing, or by selling equipment as part of a foreign aid package. Unfortunately, the General Agreement on Tariffs and Trade (GATT)—under which international ATC equipment sales are covered—does not effectively deal with government subsidies. Although GATT contains rules regarding subsidies, they do not directly address a multilateral trading situation (e.g., U.S. and European firms competing for a contract award from a developing country). If the playing field regarding subsidies could be leveled for multilateral trade through GATT—as it is for bilateral trade—U.S. firms would become stronger competitors in the global market.

The European Union is defining an ATC technology plan for Europe with a goal of ensuring that European industry does not fall behind the United States in this technology area. If Europe succeeds at consolidating its ATC system and equipment manufacturing industries, then U.S. suppliers will have fewer opportunities in Europe and greater competition in developing-country markets.⁶⁹ Moreover, Eurocontrol⁷⁰ claims not to be bound by aviation bilateral agreements and provides favored status to European companies bidding on its research and development contracts.⁷¹

CONCLUSIONS

The future of U.S. aviation is global. U.S. aviation manufacturers and service providers are strong international competitors. They are world leaders in

⁶⁶OTA's survey indicated that 25 percent of ATC manufacturers' revenue was from foreign customers. This figure was used to estimate the U.S. balance of trade in ATC manufacturing.

⁶⁷The forecast by Raytheon did not state a specific time horizon. See David Hughes, "Raytheon Stresses ATC Overseas Market," *Aviation Week & Space Technology*, Mar. 1, 1993, p. 54. The surveyed executives were split as to whether DRI/McGraw-Hill's forecast growth for the entire world market, 9 percent annually, was accurate or too high.

⁶⁸Boeing, *1993 Current Market Outlook* (Seattle, WA: 1993), p. 1.5.

⁶⁹Gellman Research Associates, inc., "Cooperation and Coordination in Federal Aviation Research," OTA contractor report, Aug. 27, 1992, p. 34.

⁷⁰A supranational air traffic management organization in Western Europe (see ch.2)

⁷¹James L. Crook, Vice President for Operations, Air Traffic Control Association, Inc., personal communication, June 30, 1994.

delivering high value and quality aircraft, ATC equipment, and airline and ATC services. However, further market opportunities exist, especially in the fast-growing ATC markets. The international market for ATC equipment is expected to grow at a higher rate than either the market for commercial aircraft or air travel during the next decade.

Safety, environmental, and ATC standards are becoming increasingly important to U.S. aviation industry economics. International differences in these regulations impose a cost burden on U.S. industries. While good progress is being made in harmonizing European and U.S. safety standards for aircraft design, it will take more than a decade to completely harmonize operating regulations.