Air Service to Small Communities

February 1982

NTIS order #PB82-186800



Library of Congress Catalog Card Number 80-600060

For sale by the Superintendent of Documents, U.S. Government Printing Office
Washington, D.C. 20402

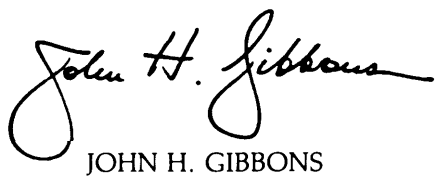
Foreword

In October 1978, OTA undertook an assessment of the impact of advances in air transport technology. In 1980 it issued a report on advanced high-speed aircraft, and in January 1982, published Part 2—The Air Cargo System, a background paper. This is the third report in the series, It draws in part on earlier OTA staff analyses and panel proceedings, and the contributions of these individuals and the organizations they represent formed an important foundation for this report.

Air service to small- and medium-size communities is presently undergoing a rapid and sometimes disruptive transition from a regulated environment to a deregulated, competitive market. Past Government regulation has affected not only the level of service to small communities, but also the aircraft that were (or were not) developed for this market by U.S. manufacturers. Foreign aircraft (many of them government-subsidized) are starting to dominate key segments of the U.S. commuter airline fleet, and several programs have been suggested to assist U.S. aircraft manufacturers, as well as commuter airlines and the small communities they serve.

The future growth of commuter airlines will ultimately depend on their ability to provide convenient and competitive service in short-haul markets. This in turn depends on demographics and general economic conditions, the cost and availability of fuel, and access to the Nation's airport and air traffic control system, as well as the introduction of a new generation of cost-cutting aircraft. The latter, however, depends on the ability of the commuters to pay for new aircraft through profits or financing, both of which—like traffic levels—have been adversely affected by the restrictions imposed as a result of the Professional Air Traffic Controllers Organization strike.

Due to the speed of change in all of these areas, this assessment can provide only a "snapshot" of the current situation. It is hoped, however, that the report may furnish a basis for understanding the changes that are yet to come.



JOHN H. GIBBONS
Director

Air Service to Small Communities Working Group

Jane H. Bartlett
President
Arlington League of Women Voters

David Brewster
Senior Designer
Babcock & Schmid Associates, Inc.

Tulinda Deegan
Director, Government Relations
Commuter Airline Association of America

Marcy Fannon
President
Aviation Service Co.

James Dougherty
Consultant
General Aviation Manufacturers Association

Harry W. Johnson
General Aviation Office
National Aeronautics and Space Administration

David S. Stempler
Chairman, Government Affairs Committee of the Board of Directors
Airline Passenger Association, Inc.

Janet St. Mark
President
SMS Associates

Shirley Ybarra
Vice President
Simat, Helliesen, & Eichner

Supporting Contractors:

Raymond A. Ausrotas
Associate Director
Massachusetts Institute of Technology
Flight Transportation Laboratory

Robert A. Burco
President
Public Policy Research Associates, Inc.

Douglas Cochran
Professor of Management
Arizona State University

John W. Drake
Professor of Air Transportation
Purdue University

Samuel E. Eastman
President
Economic Sciences Corp.

Adib Kanafani
Associate Professor of Transportation Engineering
Institute for Transportation Studies
University of California at Berkeley

NOTE: The working group provided advice and comment throughout the assessment, but the members do not necessarily approve, disapprove, or endorse the report for which OTA assumes full responsibility.

OTA Air Service to Small Communities Project Staff

John Andelin, *Assistant Director, OTA*
Science, Information, and Natural Resources Division

William Mills, *Project Director*

Paul B. Phelps, *Analyst*

Marsha Fenn, *Administrative Assistant*

OTA Publishing Staff

John C. Holmes, *Publishing Officer*

John Bergling Kathie S. Boss Debra M. Datcher Joe Henson

Contents

Chapter *Page*

I. Overview ... ... O 3
Regulation and Service to Small Communities 4
U.S. Commuter Aircraft Industry Competitiveness 5
Further Issues 6

2. Evolution of the Commuter Airline Industry 11
Government Regulation and Industry Structure 11
Trunk Airlines 11
Local Service Airlines 12
Commuter Airlines 12
Technological Evolution 13
The Jet Era 14
Local Service Subsidies and Route-Strengthening 14
Commuter Airline Growth and Fleet 17
Market Opportunities 17
Commuter Aircraft and Fleet Mix 19
Deregulation and Commuter Evolution 20
Provisions for Small Communities 20
Future Role of Commuters 21

3. Air Service Trends 25
Introduction 25
The Role of Commuter Airlines 25
The Impact of Deregulation on Low-Density Air Service 26
Changes in Air Service Patterns 27
State and Regional Air Service Studies 29
EAS, Commuters, and Market Development 31
The EAS Program 31
Reactions to the EAS Program 32

4. Technological Needs and Opportunities 37
Introduction 37
The Commuter Aircraft Fleet 38
Fleet Mix 38
Why Foreign Aircraft? 39
Future Markets, Aircraft and Competitiveness 40
Market Projections 40
Aircraft Exports and U.S. Competitiveness 41
The Small Transport Aircraft Technology Program 42
Proposed NASA Technology-Readiness Program 44

Contents—continued

LIST OF TABLES

Table No. *Page*

1. Points Served by Certificated Carriers: 48 Contiguous States 15
2. Section 406 Subsidy Payments to Carriers, 1954-82 16
3. Changes in Aircraft Departures and Available Seats by Market Size, 1977-80 28
4. Changes in Frequencies by Market Size, 1977-80 28
5. Commuter Aircraft in Joint Passenger/Cargo Operations, 1980 38
6. Turboprop Commuter Aircraft Under Development 42

LIST OF FIGURES

Figure No. *Page*

I. Relative Direct Operating Costs From the DC-3 to the DC-10 13
2. Local Service Airlines Aircraft Fleet Mix 16
3. Commuter Passengers, Cargo, and Mail, 1970-80 18
4. Commuter Airline Fleet by Aircraft Size 19
5. Air Service Changes, October 1977 v. 0ctober 1979 29
6. Air Service Changes, October 1977 v. 0ctober 1980 30
7. STAT Advanced-Technology Commuter Aircraft Configurations 43

Chapter 1

OVERVIEW

Chapter 1
OVERVIEW

Passenger air service to the Nation's small* communities has declined steadily since 1960, as the Civil Aeronautics Board (CAB) allowed first the trunks and then the local service airlines to withdraw from short-haul, low-density markets. Between 1960 and 1978, 187 small- and medium-size cities were dropped from regulated airline routes. In response to concern that deregulation would result in further deterioration, the Airline Deregulation Act of 1978 guaranteed continued scheduled air service for 10 years to any community currently receiving certificated airline service, with direct Federal subsidy if necessary. CAB established the Essential Air Service (EAS) program to implement this guarantee, for which a community becomes eligible when it loses its last certificated carrier.

Even before 1978, the certificated airlines had been replaced in many markets by unregulated, unsubsidized commuter airlines, whose smaller aircraft and lower operating costs were better suited to short-haul, low-density air service. The result in many cases was more frequent and convenient service than had been provided by subsidized local service carriers with large, uneconomical jets. This trend has accelerated since deregulation, as commuters have replaced certificated carriers in over 132 EAS-eligible communities, usually without subsidy. Commuters have also reentered markets previously abandoned by certificated airlines, again without subsidy.

Nevertheless, the changes that have taken place in air service patterns since 1978 suggest that many small- and medium-size cities, and some States and regions, may not have shared equally in the recent improvements in domestic air service. Communities in at least 34 States have appealed their EAS determinations, and some critics feel that the program provides for levels of service that are inadequate to maintain or develop markets in many small communities. More recently, 19 States have joined in a court case challenging CAB's administration of the transitional subsidy program. Congressional supporters of the program, however, point out that it provides greater protection than small communities had before *1978,* and that the cost to the Federal Government of a nationwide "market development" program would be prohibitive.

The future of air service to small communities, both during and after the 10-year transition to full deregulation, will increasingly depend on the survival and health of the commuter airlines. Their future growth, like that of the major airlines, will depend on factors such as U.S. economic growth, inflation and interest rates, and the availability and price of aviation fuels. In the short term, commuter profitability and expansion are constrained by the current economic downturn, the flight restrictions imposed as a result of the Professional Air Traffic Controller Organization (PATCO) strike, and other factors, including the limited availability of some classes of small transport aircraft. In the medium term, some commuters (like the trunks and locals before them) may be tempted to abandon service to small communities in order to compete in denser, more profitable markets; commuter service to small communities may also be constrained by access limitations at congested hub airports or by rising operating costs.

In the longer term, however, many commuter operators doubt that air service to the smallest communities can be continued unless a new generation of commuter aircraft, embodying the full range of cost-cutting technologies now practical, can be put into service. The National Aeronautics and Space Administration (NASA) has identified several areas in which research could lead to improved technology for commuter aircraft. Although these improvements alone would not guarantee profitability, they do offer the prospect of important economic benefits to commuter operators. Some observers, however, doubt that the program would produce results soon enough, or that aerospace firms would apply the NASA results in a whole family of advanced-technology small transports. For the present, U.S. commuter airlines are buying and flying increasing numbers of foreign aircraft, and many observers have expressed concern that U.S. manufacturers may be losing their ability to compete in these key market segments.

*"The term "small" in this report generally refers to communities with populations below 100,000, although some communities in CABs Essential Air Service program are as large as Bakersfield, Calif. (population **233,000),** and many communities of well under 50,000 have scheduled airline service.

REGULATION AND SERVICE TO SMALL COMMUNITIES

The history, structure, and behavior of the commercial air carrier industry have been shaped by three basic factors: aviation technology, the market for air service, and Government regulation. The Civil Aeronautics Act of 1938 created CAB and gave it authority over who could offer air service, where they could offer it, when they could terminate service to a given community, and what fares they could charge. When the original trunk airlines became more profitable and began to acquire larger aircraft after World War II, CAB created a new category of carriers—the local service airlines—to provide federally subsidized air service in low-density markets and small communities. As the locals, too, began adding larger aircraft to their fleets in the late *1950's,* CAB's central concern shifted from protecting the financial viability of the trunks to reducing the total local service subsidy, which had risen from $33 million in *1958* to $62 million in 1961. The Board's response was to strengthen the locals' route structure by allowing them to drop service to the smallest communities and move into more profitable markets that were better suited to their new aircraft. To fill the emerging gap in air service, CAB created a new category of "commuter air carriers, " whose numbers have grown from 12 airlines in 1964 to almost 300 in 1981.

The principal function of the low-density, short-haul air service provided by the commuter airlines has been to provide small- and medium-size communities with access to the Nation's primary air transportation system. This service is particularly vital in areas that are isolated by low population density, long distances, and physical barriers. A number of studies have also shown that scheduled air service is an important factor in nonmetropolitan economic growth and in the ability of small- and medium-size cities to attract the industries needed for their future economic growth. Federal policy has consistently stressed the development of an air transport system that meets the present and future service needs of all regions, and the Airline Deregulation Act of 1978 specified that this would require "the maintenance of a comprehensive and convenient system of continuous scheduled airline service for small communities and for isolated areas, with direct Federal assistance where appropriate, " To guarantee such service, section 419 of the act establishes a subsidy program to be administered by CAB.

Airline deregulation, however, has been a mixed blessing for small communities. Many small cities are enjoying new or improved service, but deregulation has also created new market opportunities that tempt established commuter airlines—like the locals before them—to abandon service to smaller communities. Almost all recent commuter growth has taken place on routes where commuters have begun or expanded service since 1978; existing commuter routes sustained traffic declines, particularly during the 1980 slump, Nonhub airports (the smallest communities) experienced the smallest increase in both departures and available seats in 1979 and the greatest decrease in both measures of air service during the 1980 slump. More flights are available from nonhubs to large hubs, which indicates improved access to the national air transport system; but departures from nonhubs to small hubs and other nonhubs has decreased *20* percent since deregulation, At least 33 nonhubs ineligible for EAS have lost all scheduled air service, although service to EAS points has remained stable since deregulation.

A similar unevenness emerges when service is considered on a State-by-State basis: 13 of the contiguous States experienced a decrease in either departures or available seats between October *1977* and October *1980,* while *16* States plus the District of Columbia have suffered declines in both measures of air service; the Southeast and Midwest have been particularly hard hit. Studies by the North Carolina and New York State departments of transportation found that their small- and medium-size communities were vulnerable to a loss of scheduled air service because of the lack of well-developed commuter net works. These studies also suggested that the EAS levels determined by CAB may be too low to provide adequate or sus-

tainable levels of service. Another study by the Appalachian Regional Commission found that almost half of the communities in its 13-State area have experienced service reductions, including 11 nonhubs that have lost all certificated service; that certificated service is being withdrawn faster than commuter replacement service is being initiated; and that the region's route network is becoming substantially less capable of facilitating intraregional air travel.

These and other studies have raised a number of questions about the adequacy and long-term effects of the EAS program and 419 subsidies, as implemented by CAB. Communities in at least 34 States have appealed their EAS determinations, and CAB faces a legal challenge to its determination for Bakersfield, Calif., in a suit that has been joined by the attorney generals of 19 States and by the National Conference of State Legislatures. In addition, at least **10** medium-size communities have formed an organization to work for changes in CAB policies and EAS determinations. Critics have suggested that the EAS program might permanently depress traffic levels and thereby lead to demands that it be extended beyond its scheduled 1988 sunset. Congressional sources, however, emphasize that EAS is intended only to ensure basic service during the 10-year transition; it is not a market-development program.

U.S. COMMUTER AIRCRAFT INDUSTRY COMPETITIVENESS

The original commuter fleet in the 1960's consisted of single-engine and light-twin aircraft that had low initial costs but few passenger amenities. As the industry grew, the carriers began to operate commuter derivatives of more modern executive aircraft; but CAB still restricted commuters to aircraft of no more than 12,500 lb—between 15 and 19 passengers. This meant that there was little domestic market for larger commuter aircraft, and even when CAB raised the limit to 30 passengers in 1973 many commuters preferred to stay with the smaller aircraft. As a result, no U.S. manufacturer developed a new aircraft in the 20- to 30-seat range, and the new foreign aircraft that were available captured most of the market. Deregulation raised the size limit to 60 seats, and once again those carriers who wanted to up grade their fleets had no modern U.S. option: they could buy the one new foreign aircraft that was available, or settle for older piston or twin-turboprop aircraft—many of them also foreign-made—of the type once flown by the local service airlines.

Commuter airlines have added 1,000 aircraft to their fleets since 1965, and current forecasts indicate a worldwide demand for as many as 8,000 commuter aircraft between 15 and 60 seats by the year 2000, perhaps as many as 2,500 in the United States alone. This represents potential domestic sales of $5 billion to $10 billion in 1980 dollars, and total world sales of $10 billion to $25 billion, for which U.S. firms must compete with foreign manufacturers, many of them government-subsidized. The General Agreement on Trade and Tariffs in 1980 made even the domestic market even more competitive, however, and most U.S. manufacturers have remained reluctant to enter the field with a high-risk, new-technology aircraft. Few of the commuter aircraft currently under development in the world are American, and most of these are either dated designs or derivatives of current-technology executive aircraft. This has in turn raised questions about the loss of the traditional U.S. technology lead and the future competitiveness of the U.S. aircraft industry, not only in capturing a share of the growing foreign market but in holding onto its share of the domestic market as well.

One possible approach to addressing the needs of small communities, commuter airlines, and aircraft manufacturers alike is contained in the Small Transport Aircraft Technology (STAT) program initiated by NASA in 1978. In its first phase, STAT identified technology needs and potential advanced-technology applications in four specific areas: aerodynamics, propulsion, aircraft systems, and structures. The second phase consisted of technology-application

studies by three aircraft manufacturers—Cessna, General Dynamics-Convair, and Lockheed-California—each of whom designed both a current-technology "baseline" aircraft and an advanced-technology aircraft incorporating these potential improvements. These studies indicated that an advanced-technology *30-* to 50-seat commuter aircraft would reduce fuel consumption by 16 to 40 percent and reduce direct operating costs by 16 to 24 percent compared to baseline designs, and would also reduce airframe production costs by as much as 25 percent, while improving reliability and safety and providing passenger comfort (e.g., headroom, cabin noise, and ride quality) equivalent to large jet transports.

The special Commuter Air Transport Subcommittee of the NASA Advisory Council's Aeronautics Advisory Committee recommended in November 1980 that NASA should sponsor a dedicated research and development (R&D) program to bring the necessary technologies to a stage of readiness for commercial development and application. The subcommittee's report outlines three options for a possible STAT technology-readiness program:

. small option (supporting and enabling technology, experimental engineering designs, and small-scale fabrication)—3 years, $18 million;
- medium option (above elements plus large-scale component fabrication, simulation, and wind-tunnel testing)—4 years, $58 million; and
- large option (above elements plus integration, ground and flight testing: and evaluation)—5 to 6 years, $80 million to $135 million.

Some commuter operators and aircraft manufacturers agree that a program along these lines would encourage U.S. firms to develop an advanced-technology commuter aircraft, and that the availability of such aircraft could be very important both for commuter airline profitability and for small communities that might otherwise lose their air service. Others, however, feel that NASA should look also, or instead, at faster or larger or longer range aircraft. One major manufacturer feels that any version of the proposed program would take too long—that foreign manufacturers have already begun to move on some of these technologies, and that NASA should concentrate on a few high-priority areas that will produce quick results for application by U.S. manufacturers. Particular priority has been assigned to new aircraft configurations and efficient turboprop engines.

FURTHER ISSUES

Unresolved issues relating to air service to small communities, commuter airlines, U.S. commuter aircraft industry competitiveness, and the STAT program include the following:

- *Essential air service.* —The EAS determinations made by CAB ensure minimal levels of air service to small- and medium-size communities, but they may not be sufficient to provide "threshhold" levels of service that will permit the development of sustainable passenger traffic and self-supporting future markets. (CAB notes that EAS is not a market-development program.) Will the perceived inadequacies in EAS or 419 programs result in higher subsidies in the future or demands for extension of the programs beyond their scheduled sunset in *1988?* To what extent will potential service inadequacies damage the future economic development of affected communities?
- *State and local capabilities.—Will* the States be able to assume responsibility for necessary monitoring and regulatory functions, particularly if (as has been proposed) airline reporting requirements are reduced or CAB sunset is moved forward to 1982? To what extent can State and local governments or regional associations encourage market development in small communities through promotional and marketing activities, thereby compensating for perceived inadequacies in current EAS determinations

and 419 subsidies? To what extent can State, local, and private loans or direct-financing programs be used to supplement or replace Federal funding for subsidizing the equipment purchases or operating costs of commuter airlines?

- Cornmuter *airline concerns.* —The single most important issue to commuter carriers is the mandatory joint fare program, an arrangement that benefits commuter airlines. They feel that this is vital to their financial viability, particularly in maintaining service to small communities. They also claim that joint fares result in savings for the traveling public when they connect between commuter and other carriers. Eligibility for the Federal Aviation Administration's (FAA) Equipment Loan Guarantee program is another concern: commuters became eligible for equipment loan guarantees following deregulation and received guarantees totaling $15 million in fiscal year *1979* and *$79* million in fiscal year *1980.* The authorization of *$400* million in fiscal year 1981 contained a $100 million set aside for commuters, and for fiscal year 1982 the provisional authorization is for $100 million, all of it set aside for commuter aircraft loans. Other commuter operator concerns include the price and availability of fuel, as well as the availability of low-cost, economical aircraft.
- *Airport capacity and air traffic control,* — Local communities, commuter carriers, and Federal officials alike have expressed concern over the ability of the Nation's airports and air traffic control system to accommodate the future expansion of commuter operations. The loss of small airports, the need to upgrade existing airports with improved navigational and landing aids, and the allocation of landing slots to commuters at major hubs are of particular interest. The restrictions imposed as a result of the PATCO strike have limited commuter access to some hubs, and FAA foresees serious capacity problems at a number of major airports in the mid to late 1980's (and at many of the 30 largest U.S. airports by the end of the century) unless improvements are made in the present airport and airways system. (These and related topics will be addressed in OTA'S forthcoming assessment, The *Airport and Air Traffic Control System.)*
- *U. S. commuter aircraft competitiveness.* — Some foreign governments have erected barriers against imports of whole U.S. aircraft; others subsidize R&D costs and make export loans or incentives available to their manufacturers, who then practice what has been characterized as "predatory financing" in the U.S. market. U.S. firms (and airlines that insist on buying U.S. aircraft) must rely for the most part on private investment and commercial financing at substantially higher rates, and many banks have little familiarity with or confidence in commuter airlines, Recent cutbacks in funding for NASA aeronautics research, the FAA loan guarantee program, and the activities of the Export-Import Bank have aggravated this situation. Some U.S. manufacturers now feel that R&D costs have become so high, and the FAA certification process for new aircraft so onerous, and the technical risks so great, that the development of an aircraft containing the full range of technological improvements would entail unacceptable financial risks.
- Corn *muter-oriented NASA research.* — There is some difference of opinion about whether a NASA technology-readiness R&D program (at any funding level) is in fact the best way, or even an appropriate way, to encourage the eventual production of a *U.S.-manufactured* "economic vehicle" for the commuter airlines. Supporters contend that such a program would encourage U.S. firms by reducing the technical and financial risks or by demonstrating Government support, Some observers, however, think that the program should focus on short-term priorities, while others contend that there is no assurance that the technologies, once developed, will actually be used by U.S. aerospace manufacturers.

Chapter 2

EVOLUTION OF THE COMMUTER AIRLINE INDUSTRY

Chapter 2

EVOLUTION OF THE COMMUTER AIRLINE INDUSTRY

The structure of the U.S. commercial air transportation industry and the level of service it provides to small communities have been influenced by the interplay of three principal forces. The first and by far the strongest of these influences is Government *policy and regulation:* this has largely been reflected in the economic rules and route awards of the Civil Aeronautics Board **(CAB)** and the airworthiness and operational certification rules of the Federal Aviation Administration (FAA). The second influence is the development of *aviation technology:* this affects the cost and performance characteristics of the aircraft used in the air service system. The third influence is the *air transportation market:* this reflects the desire of consumers for air service, its costs, and their ability to pay for it. The purpose of this chapter is to outline the way in which these forces have evolved and are interacting to shape the future of low-density, short-haul air service in this country.

GOVERNMENT REGULATION AND INDUSTRY STRUCTURE'

The Federal Government has exercised regulatory control over commercial aviation since the passage of the Kelly Air Mail Act of 1925, which authorized the Postmaster General to contract with air carriers and compensate them for transporting mail. Since almost no air routes at that time were profitable strictly on the basis of passenger revenues, the authority to award mail contracts gave the Government considerable power to determine which routes would be served, at what levels, and by which air carriers. This regulatory power was expanded when Congress enacted the Air Commerce Act of 1926. This act charged the Secretary of Commerce with the task of promoting air commerce and empowered him to issue and enforce air traffic rules, license pilots, certify the airworthiness of aircraft, establish airways, and operate various aids to air navigation. These responsibilities, which were primarily designed to promote greater safety, were similar to the functions of today's FAA.

The Civil Aeronautics Act of 1938 added economic authority to operational and safety authority, thereby establishing the Federal Government as the economic regulator of the air transportation industry. This act created what is now CAB and required every air carrier to obtain a certificate from CAB authorizing it to serve a specified point or route. An airline that possessed such a certificate was thus a *certificated airline.* This authority gave CAB jurisdiction over who could offer air passenger service, where they could offer it (market entry), and when they could terminate service (market exit). CAB was also charged with approving the fares charged for all routes and for all types of service. One of CAB's first actions was to exempt nonscheduled aircraft operations from economic and safety provisions of the act, thereby establishing a precedent for future regulations that distinguish between scheduled and unscheduled airline services.

Trunk Airlines

At the time of the 1938 act, there were already 16 operating airlines, which immediately received certificates to continue the service they were already providing. These 16 carriers became the first trunk carriers; their number has subsequently fallen to 10 through mergers and

'This chapter draws on the contractor report, "Federal Economic Regulation of Air Service to Small Communities: The Effect on Aircraft Development, " prepared for OTA by Samuel E. Eastman.

acquisitions. * In keeping with the broad and sometimes conflicting objectives of the act, CAB sought both to encourage the development of air service and, at the same time, to protect the economic stability of these trunk carriers. Since its congressional mandate was to promote competition only "to the extent necessary to assure the sound development of an air-transportation system" (sec. 102), CAB often granted different trunks exclusive access to newly authorized routes and, at least initially, refused to issue operating certificates to any new airlines.

World War II had a profound effect on the embryonic commercial aviation system. First of all, it accelerated the advancement of aviation technology and greatly increased the number of aircraft available. The war also accelerated the expansion of the market by whetting the appetite of smaller communities throughout the country for air service. In response to demands for increased air service from chambers of commerce, local governments, and prospective operators, CAB in 1944 established a new category of experimental "feeder airlines."[2]

Local Service Airlines

CAB recognized that this new small-community service would require subsidy, since many small communities could not generate enough ridership to cover costs. The trunks at that time were just on the verge of becoming profitable without dependence on the revenues from airmail contracts, and CAB was reluctant to jeopardize this hopeful trend toward financial self-support.[3] Instead of imposing new complexities on their operations, therefore, it chose to create a new category of air carriers. Between 1944 and 1950, CAB awarded temporary operating certificates to 17 new or existing interstate carriers that were to become the local service airlines, and in 1955 these temporary certificates were made permanent at the insistence of Congress. *

In 1955, the primary difference between the trunk and the local service airlines was in their route structure. The trunks served some small communities, but they concentrated on the longer routes with higher ridership. The local service airlines, on the other hand, were given authority to operate only on low-density routes serving smaller communities, or on heavier routes only where they were required to make intermediate stops at smaller cities. These requirements, imposed by CAB in awarding certificates, were expressly to keep the new locals from competing with the trunks by preventing them from offering comparable service (an intermediate stop can add 30 to 45 minutes to a trip).

Local service operating losses on these low-density routes were compensated by Federal payments under section *406* of the Federal Aviation Act of 1958 ("sec. 406 subsidies"). Later, during the 1960's, as the industry prospered and CAB became more concerned with reducing subsidies, it tried to strengthen the locals by allowing them to withdraw from small communities and offer competitive service in more lucrative markets. This liberalized policy was reversed again during the recession and "route moratorium" of the early 1970's.

Commuter Airlines

At about the same time that the local service airlines were brought into existence, a third category of commercial air service had already begun to take shape as so-called "fixed-base" operators around the country offered various combinations of aircraft maintenance services, sales, rental, brokerage, on-demand air-taxi service, and flying lessons. They varied widely in size and financial stability, although most were small and operated on the ragged edge of success. In 1949, CAB created another experimental category-confirmed in 1952—for "noncertified irregular route" carriers; these regulations (referred to as the part 298 exemption) stated only that such operators could not operate aircraft of

● These 10 carriers are: American Airlines, Eastern Airlines, Trans World Airlines, United Airlines, Braniff Airways, Continental Airlines, Delta Airlines, National Airlines, Northwest Airlines, and Western Airlines.

[3]D. Solar, "The Federal Interest in Local Air Service: A Study in the Evolution of Economic Policy" (Ph. D. thesis, Columbia University, 1963), pp. 29-30.

[2]Civil Aeronautics Board Reports, vol. 6, July 1944 to May *1946, p. 3*

[3]*G. C.* Eads, *The Local Service Airline Experiment* (Washington, D. C.: The Brookings Institution, 1972), p. 84.

more than 12,500 lb takeoff gross weight (originally 10,000 lb), nor could they offer scheduled service between certificated points. This new class of carrier was known as scheduled air taxis or "third-level" carriers, and after 1969, as commuter airlines.

An aircraft of 12,500 lb is about half the size of a DC-3, the early workhorse of the certificated carriers. This weight limitation and the exclusion from certificated points were specifically imposed to protect certificated carriers—primarily local service airlines—from competition by this new class of air carrier.[5] Exemptions were available, but few commuter markets were large enough to support larger aircraft; as a result, very few short-haul aircraft in the *20-* to 50-seat range were bought or flown by commuters until 1973. Such aircraft were in use and in production overseas, however, giving foreign firms a head start when the size limit was later raised. CAB's 1969 size restriction thus seems to have contributed to the present dominance of foreign manufacturers in the domestic *20-* to 50-seat commuter market (see ch. 4).

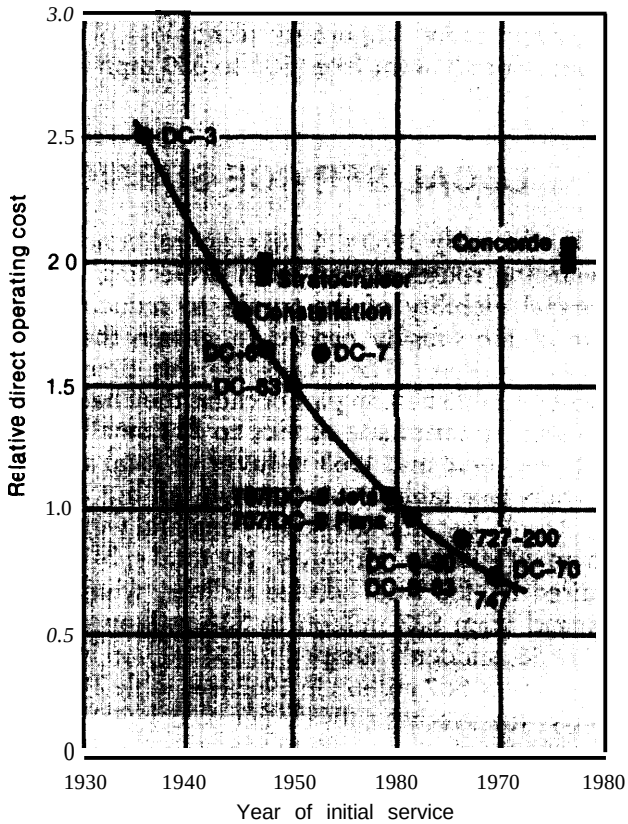
[5]Code of Federal Regulations, title 14, pt. 200 to end, 1971, pp. 364-378.

TECHNOLOGICAL EVOLUTION

During the early sorting out of industry structure and Government regulation, important changes were occurring in aviation technology. The conclusion of World War II made a large number of surplus aircraft available at relatively low prices. The *21-* to 28-seat DC-3 had entered commercial service in 1936, 2 years before the Civil Aeronautics Act. By the end of the war, more than 10,000 had been built, and they had become by far the dominant aircraft in the fleets of both the local service and the trunk airlines. The trunk airlines, however, were ready for larger, faster, and longer range aircraft.

Here again World War II had already primed the pump. Not only had it given a tremendous impetus to the advancement of aircraft technology, but now the Nation's aircraft manufacturers, short on military business, were ready and eager to produce a new generation of commercial transport aircraft: in the late 1940's the DC-4 and the Lockheed Constellation, followed quickly by the DC-6, the Boeing Stratocruiser, and the Convair 240—with more to follow in the 1950's. Compared to the DC-3, these aircraft cut seat-mile operating costs by roughly a third (see fig. 1). They had greater range and essentially doubled both cruise speed and seating capacity. By the late 1940's, the trunks were expanding their fleets and replacing their now outgrown DC-3s with this newer equipment, which was

Figure 1.—Relative Direct Operating Costs From the DC-3 to the DC-10 (current dollars)



SOURCE: R.S. Shevell, "Selection of the Fittest: The Evolution and Future of Transport Aircraft," *Israel Journal of Technology,* Vol. 12, 1974.

tailored to their evolving high-density, longer stage-length route structures.

For the local service airlines, however, the DC-3 was too big, not too small: many of the points they served generated too few passengers to provide break-even loads on a 21- to 28-seat aircraft. Nonetheless, DC-3s were attractive to the local service airlines. First, they had been operated successfully by the trunks and carried with them the image of those more prestigious carriers. Second, they were available at reasonable prices when capital was difficult to raise; removing the locals' experimental status in 1955 and making Government-guaranteed loans available in 1957 also helped with this problem. So, during the **1950's,** the DC-3s moved from the trunk fleets to the local service airlines, and it was only in the last half of that decade that the locals started moving toward larger aircraft.

The Jet Era

The first commercial jet aircraft represented an even more important technological milestone. Speeds went from 300 to 350 mph to 550 mph. Seating capacity increased from *50* to *60* seats to *125* or more. More to the point, direct operating costs per seat-mile dropped another **30** percent from the most modern propeller craft (see fig. 1). Jet equipment revolutionized the operations of the trunks. Their greater size and speed and higher cruising altitude boosted productivity and profitability of the trunks' longer and more heavily traveled routes.

The acquisition of these new jet aircraft gave the trunks a stronger economic incentive to abandon their low-density markets. As the trunk airline fleets evolved more and more toward jets, it would have been natural and efficient for them to modify their route structure by progressively dropping service to small communities on their shorter and more lightly traveled routes, in order to concentrate on the longer, more heavily traveled segments. The trunks were not free to make this adjustment in their route structure without specific permission from CAB, but as it happened CAB was willing to accommodate this shift in trunk route structure in order to strengthen the routes and finances of the local service airlines.

LOCAL SERVICE SUBSIDIES AND ROUTE-STRENGTHENING

By the early 1960's, CAB's central concern in awarding routes shifted from protecting the financial viability of the trunks to reducing the size of the subsidy needed to sustain the local service airlines. The trunks by this time were firmly established, in part because they had been allowed to terminate service to 211 small cities between 1948 and 1963 in favor of local service carriers (see table 1). As a result, all but one of the trunks became self-supporting and were able to go off subsidy. However, the total subsidy required by the local service airlines, which had ranged from $22 million to $33 million during 1954-58, suddenly jumped to $55 million in 1960 and almost $67 million in 1962 (see table 2). Similarly, the average subsidy per passenger, which had declined in the mid-1950's, rose from about $7.60 **per** passenger in 1958 back to nearly $10.00 per **passenger in** 1961. One factor in these increases was the replacement of many of the now-obsolete DC-3s with larger 35- to 60-seat aircraft such as CV-240s and 440s, M-202s and 404s, and F-27s. A far more important factor, however, was the large number of small communities to which the locals were required to provide air service.

The subsidy for each local service carrier was computed on the basis of both its losses on unprofitable service and its overall profitability compared to the industry average. The idea that some of the carrier's losses should be covered through internal cross-subsidy from its profitable routes was implicit in the determination. The exact formula changed from time to time in response to changing conditions, but the principle behind the subsidy determination remained the same: to compensate the carrier for losses above what might be considered a reasonable level of internal cross-subsidization, given the carrier's mix of strong and weak route segments.

Table 1.— Points Served by Certificated Carriers: 48 Contiguous States

	Trunk carriers[b]			Local service carriers[c]			All carriers		
Year[a]	Points authorized	Points suspended	Points served	Points authorized	Points suspended	Points served	Points authorized	Points suspended	Points served
1948	—	—	454	—	—	—		—	—
1955	376	27	349	381	18	363	583	44	539
1956	373	23	350	380	13	367	575	35	540
1957	368	25	343	387	9	378	579	33	546
1958	361	21	340	415	14	401	581	34	547
1959	332	23	309	468	29	439	610	52	558
1960	328	13	315	497	38	459	618	51	567
1961	309	13	296	494	28	466	601	39	562
1962	302	16	286	499	22	477	599	38	561
1963	251	8	243	475	11	464	562	19	543
1964	247	8	239	468	5	463	552	13	539
1965	231	8	223	472	4	468	536	12	524
1966	230	7	223	466	5	461	530	12	518
1967	229	5	224	466	7	459	526	12	514
1968	230	5	225	468	5	463	527	10	517
1969	228	5	223	469	4	465	526	9	517
1970	228	18	210	467	34	433	524	50	474
1971	228	18	210	466	34	432	522	52	470
1972	222	15	207	455	32	423	508	47	461
1973	221	19	202	445	40	405	497	56	441
1974	208	16	192	432	49	383	481	64	417
1975	198	18	180	433	53	380	464	70	394
1978	—	—	—	—	—	—	—	—	380
1980	—	—	—	—	—	—	—	—	248

aAs of December each Year.

[b]Includes points served jointlywlth local service carrlers
cincludes points served jointly with trunk carriers.

SOURCE Civil Aeronautics Board, Offlce of Facilities and Operations

CAB's primary response to the rising cost of subsidy, therefore, was to allow the locals to modify their route structure in an attempt to strengthen their financial performance, a policy change welcomed by the industry. Specifically, CAB allowed locals to replace trunks at some points, relaxed the requirement that the locals stop at every intermediate certificated point on every flight, and became more lenient in permitting the locals to drop service to points that generated less than 5 passengers per day on average. The latter "use it or lose it" policy alone resulted in the elimination of 108 previously subsidized small communities from the local service route map between 1956 and 1968, to be replaced by larger points dropped by the trunks. This route-restructuring increased local service revenues and, after a delay, improved industry profitability. It also allowed CAB to begin reducing subsidy payments: after peaking in 1962 and 1963 at $67 million, total subsidy payments declined to $62 million in *1964* and had fallen to $34 million by 1970.

By the mid-1960's the trunk airlines had moved almost entirely out of low-density air service, the few exceptions being cities that fit well in their route structures or fed "captive" passengers into the longer and heavier traveled routes. There is a marked similarity in the growth pattern of local service airlines: economic and technological forces have driven their evolution in the same direction. For both, there has been a strong economic incentive to move to larger and more modern aircraft that can yield the most profit on the strongest routes. CAB route-strengthening and FAA equipment loan guarantees further reinforced the logic of moving toward larger aircraft, and by the mid-1960's the locals were ready to start acquiring jets. By 1970 more than a third of the local service fleet was jets and nearly all of its piston-powered air-

Table 2.—Section 406 Subsidy Payments to Carriers, 1954-82

Fiscal year	Alaskan	Hawaiian	Helicopter	Regional	Local service	International	Domestic trunkline[a]	Grand total
1954	8,303	689	2,574	—	24,299	18,714	3,822	58,401
1955	7,902	293	2,656	—	22,358	3,757	2,773	39,739
1956	7,619	291	2,735	—	24,122	6,632	1,790	43,189
1957	7,707	216	3,771	·	28,444	6,903	1,572	48,613
1958	8,179	45	4,419	—	32,703	4,911	2,283	52,540
1959	7,337	168	4,860	—	36,450	—	1,201	50,016
1960	8,818	330	4,930	—	51,498	—	—	65,576
1961	9,313	505	5,538	—	56,300	—		71,656
1962	9,058	338	5,781	—	64,835	—		80,010
1963	9,690	520	5,000”	—	67,700	—	—	82,910
1984	9,411	802	4,300	—	65,482	—	2,566	82,561
1965	8,163	995	3,358	—	64,412	—	3,475	77,403
1966	6,509	1,124	1,170	—	58,671[b]	—	3,089	70,563[b]
1967	5,939	567	—	—	55,240[b]	—	2,477	64,223[b]
1968 ...., , .	5,894	—	·	—	47,982	—	1,343	55,219
1969	5,421	789	—	—	40,513	—		46,723
1970	4,898	—	—	—	34,830	—	—	39,726
1971	4,499	—	—	—	55,940	—	—	80,439
1972	4,394	—	—	—	62,160	—		66,554
1973	4,385	—	—	—	60,206	—	—	64,571
1974	4,339	—	—	—	68,619	—	—	72,958
1975	4,345	—	—	1,812	57,563	—	—	63,720
1976	4,360	—	—	4,017	64,658	—		73,035
1977	4,261	—	—	4,391	70,561	—		79,213
1978	3,878	—	—	4,840	69,097	—		77,815
1979	3,427	—	—	5,894	66,132	—	—	75,453
1980	7,993	—	—	9,404	63,387	—	—	80,844
1981	8,409	—	—	8,502	72,897	—		89,568
1982 (estimated).								94,400C

a T$_{run}$kli$_{neaccrua}$1$_{9}$ for 1964-68 $_{re}$fl$_{ec}$t local service operations in the New England area.

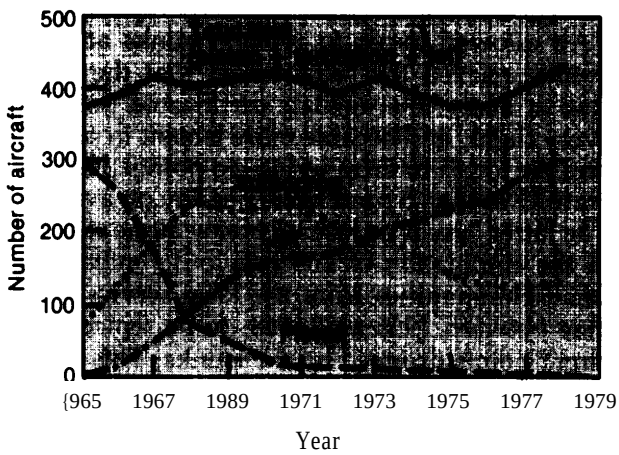
[b]Revised pursuant to order 77-12-106, Dec. 20, 1977, in accordance with provisions of sec. 120 of Public Law 95-163. For this report, fiscal years 1976-80 are considered to be the 12 months ended June 30 of these years.

clf legislative changes t. 406 are adopted, a ceiling of $28 million would be imposed.

craft had been replaced by large turboprops; this transition is illustrated in figure 2.

The transition to larger, faster aircraft had a negative effect on small communities (who needed good short-haul, low-density air service) because it offered local service as well as trunk operators a much more profitable alternative —the ability to supply good long-haul, high-density service. Between 1968 and 1978 an additional 125 cities were suspended or deleted from local service routes, and it was becoming obvious that a major gap in air service was once again emerging. Service to small communities was decreasing and something was needed to fill the role CAB had originally assigned to the local service airlines in 1944. This role was to pass to the commuter airlines.

Figure 2.—Local Service Airlines Aircraft Fleet Mix



SOURCE: National Aeronautics and Space Administration, Small *Transport Aircraft Technology,* fig. 2.

COMMUTER AIRLINE GROWTH AND FLEET

Out of several thousand air-taxi operators in January of 1964, only 12 offered scheduled services, all to noncertificated points. By the end of 1968, there were over 200 scheduled air-taxi operators. This explosive early growth in what has become the commuter airline industry resulted in part from the economic opportunity created by the service gap left by the withdrawing locals. Another important factor was the availability of new aircraft that were small enough to be exempt from CAB economic regulation, yet large enough to carry economic loads in scheduled short-haul operations.

Market Opportunities

Regulatory and economic changes in the 1960's improved the climate for the growth of scheduled air taxis. In 1964, FAA promulgated Federal Aviation Regulation (FAR) part 135, which defined the operational and safety rules of the industry. In 1965, CAB amended its regulations to allow these carriers to transport mail and to provide service between certificated points, often as replacements for trunk or local service airlines. In 1964, American Airlines contracted for Apache Airlines to replace it in serving Douglas, Ariz.; this was the first "air taxi replacement agreement. " In 1967, Allegheny Airlines (now USAir) greatly expanded this concept by contracting its unprofitable points to 12 independent commuter contractors operating under the name "Allegheny Commuter;" this network continues today. CAB officially recognized the commuter industry in 1969, defining a commuter air carrier as an air-taxi operator that either: 1) per forms at least five round trips per week between two or more points and publishes flight schedules that specify the times, days of the week, and origins and destinations of such flights; or *2)* transports mail by air under a current contract with the U.S. Postal Service. [e]By August 1978, 26 commuter airlines were providing replacement service for certificated carriers at 59 points, mostly without direct financial assistance.

'Civil Aeronautics Board, Glossary of *Air Transportation* Terms, 1st cd., February 1977.

The number of passengers on commuter airlines grew at an annual rate of slightly over 13 percent from 1970 to 1979, compared with a 7-percent growth rate for the combined trunk and local service airlines and a 3-percent annual growth rate in real gross national product. Commuter air cargo growth has averaged over 26 percent annually, reflecting the growth of small parcel shipments by Federal Express and other carriers. ' Only mail activity has dropped, as the U.S. Postal Service has deliberately withdrawn patronage. These trends are shown in figure 3. Between 1970 and 1979, the number of aircraft in the commuter fleet grew by 8 percent annually, from 687 to 1350 aircraft.'

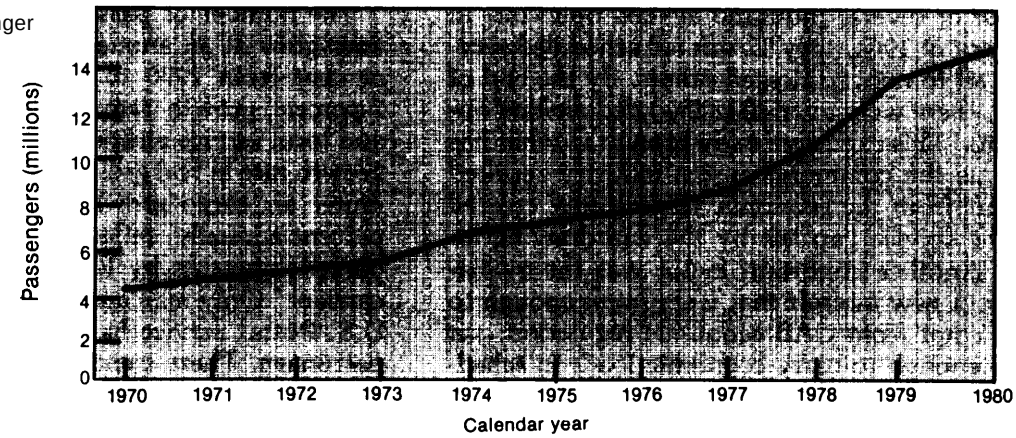
There are a number of reasons for the rapid growth of commuter air service. First, the speed and convenience of air travel are more attractive as incomes rise, and the rising number of businesses moving to smaller communities has also increased the demand for short-haul air service. The number of communities served by commuters, for example, has almost doubled over the past decade. Second, the withdrawal of the local service and trunk airlines from smaller communities results in a faster growth rate for commuter airline ridership than normal growth in the demand for air service would imply. Third, entry into the commuter airline business has been relatively easy: less capital was needed to acquire or lease the smaller aircraft appropriate to this type of service, and until 1978 entry and exit were unregulated. Fourth, integration with the primary air transportation system has been improving in recent years as the trunk and local service airlines, to whose longer routes the commuters customarily feed passengers, have begun to share ticket counters, gate space, baggage handling, and reservation services at reasonable cost. A fifth and perhaps more important reason for commuter growth, however, was the availability of suitable new aircraft in the late 1960's.

'For further information on this subject, see OTA'S forthcoming background paper, *The* Air *Cargo System.*

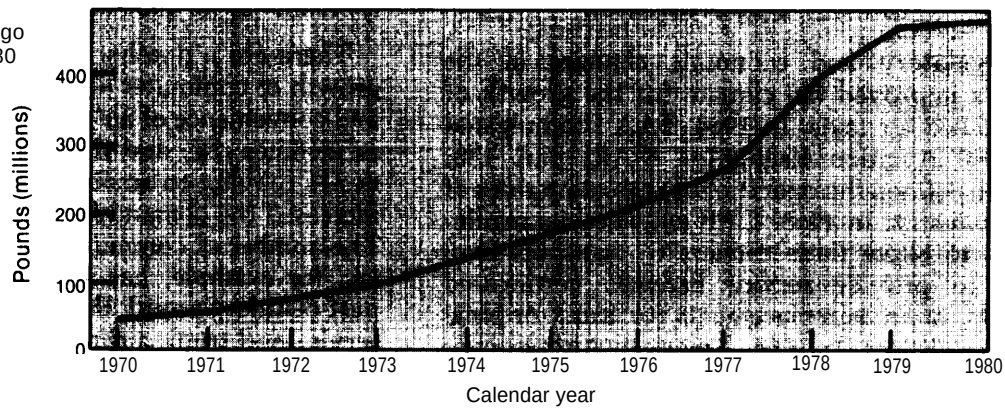
'Commuter Airline Association of America, 1980 *Annual Report* (Washington, D. C.: CAAA, November 1980), p. 116.

Figure 3.–Commuter Passengers, Cargo, and Mail, 1970-80

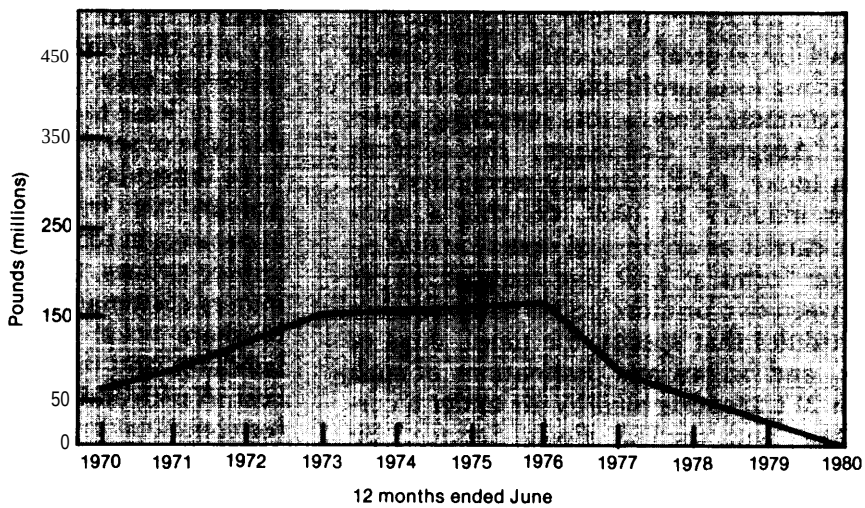
Commuter passenger traffic 1970-80



Commuter cargo activity 1970-80



Commuter mail activity



SOURCE: Passengers and cargo data from Commuter Airline Association of America, 1980 Annual *Report,* Washington, D. C., 1980; mail data from Civil Aeronautics Board, *Commuter Air Carrier Traffic Statistics, 12 Months Ending June 30, 1979,* Washington, D. C., 1979.

Commuter Aircraft and Fleet Mix

In *1964,* Pratt & Whitney of Canada, an engine manufacturer with a history of successful aircraft engines, announced a new turboprop engine, the PT-6, which was highly suitable for aircraft in the 12,500-lb commuter category, A year earlier the Low-Cost Plane Design Committee of the Association of Local Transport Airlines (ALTA), the trade association of the local service airlines, had issued a report calling for a new aircraft designed specifically for low-density air service-a so-called "DC-3 replacement."[9] The availability of an appropriate engine, along with the impetus of the ALTA report, contributed to the development of two new twin-turboprop airplanes in the 15- to 19-seat range that were well suited to commercial low-density markets: the Canadian DHC-6 Twin Otter, made available in 1966 and designed primarily as a general-purpose bush airplane; and the Beech 99, first produced in 1967 for the corporate and air-taxi market. By 1970, commuter operators had purchased 134 of these two aircraft, representing about 75 percent of the over-15-seat aircraft in the commuter fleet. [10]

CAB originally restricted commuter airlines to aircraft smaller than 12,500 lb gross takeoff weight—about 19 passengers—for the express purpose of confining their operations to service that would not compete with the trunk and local service airlines. As the threat of such competition passed, this limitation was changed in 1973 from an aircraft size limitation to a maximum payload limitation—either *30* seats or *7,500* lb of cargo. At that time, however, permission to fly so-passenger aircraft was less significant than it might appear. For one thing, there were no modern aircraft available in this size range that were specifically tailored to the economic and operational requirements of the commuter market. In addition, FAA operating regulations required the addition of a cabin attendant at *20* seats or more, which represented an economic barrier to seating capacities only slightly above this threshold. More importantly, however, few commuter markets in 1973 were large enough to support larger equipment, and internal disputes prevented the commuter airline industry from endorsing a new 30-seat aircraft. " U.S. manufacturers, lacking a firm commitment from the domestic market, decided not to develop any new commuter aircraft.

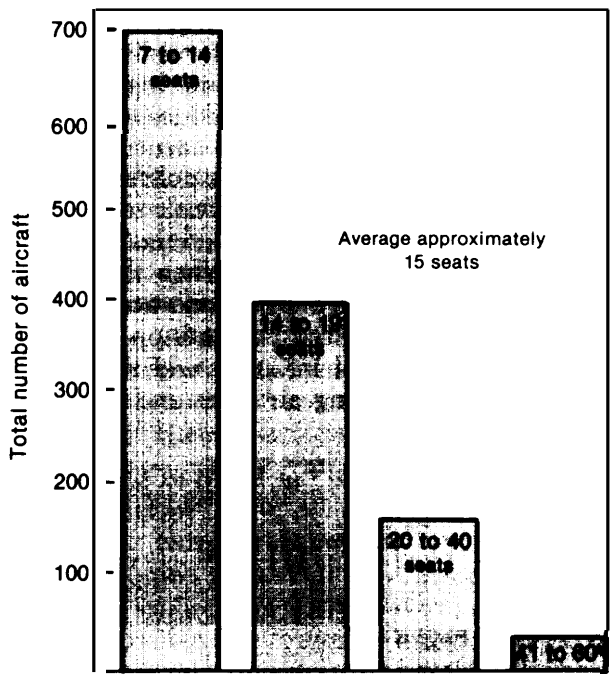
As a result, the commuter airline fleet (fig. 4) remains dominated by small aircraft—not a surprising circumstance, given the industry's regulatory history and the markets it currently serves. Nevertheless, the fleet is shifting toward larger aircraft and—given the new size freedom under the Airline Deregulation Act of 1978 and the higher profit potential of larger aircraft on the higher ridership routes—this shift would probably be even more marked if greater numbers of suitable aircraft were currently available. The real growth of the commuters began in the

[9] Association of Local Transport Airlines, "Recommendations of the Low Cost Plane Design Committee Re: The Development of an Airplane Designed to Provide Economical Short-Haul Operations Over Low-Density Routes, " Feb. 20, 1963.

[10] Eastman, op. cit.

[1] Ken Cardella, president of Cochise Airlines, interview, July 31, 1981.

Figure 4.—Commuter Airline Fleet by Aircraft Size



[a] A few airlines counted as commuters are technically very small regionals, and have been permitted larger aircraft.

SOURCE: Data from Commuter Airline Association of America, 1980 *Annual Report.*

1960's with the advent of new small transport aircraft suitable for short-haul service. The commutes' future, and the future of air service to small communities, seems likely to be equally sensitive to the further evolution of small transport aircraft (see ch. 4).

DEREGULATION AND COMMUTER EVOLUTION

The passage of the Airline Deregulation Act in October 1978 formalized a number of significant changes in Federal policy and regulations aimed at making the air transportation system more efficient. These changes promise to have profound effect on the future of both the airline industry and air service to small communities. In many respects, however, the act has merely accelerated already existing trends in airline route and fleet development and confirmed the process of administrative deregulation that was already in motion at CAB.

In the evolution of the airline industry, all classes of air carriers have tended to acquire larger aircraft and concentrate on their longer and higher density markets. This has usually meant dropping their service to small communities or transferring these short-haul, low-density routes to the next class of airlines. As the industry prospered, CAB became more disposed to authorize competitive service in high-density markets, and CAB's efforts to reduce local service subsidies in the 1960's led to particularly liberal route award policies. These policies in turn had the effect of enabling the locals to go after more lucrative markets and to terminate service to many small communities. When this policy was reversed during the "route moratorium" of the early 1970's, reduced competition (in combination with general inflation and rising fuel costs) led to increasing air fares and declining airline profitability.

Congress considered but failed to pass airline deregulation legislation in 1975. Pressure for regulatory reform continued to grow, however, with an emphasis on increasing competition in order to improve service and reduce fares. In 1977, CAB began to approve fare discounts and gradually relaxed the restraints on market entry and exit. By *1978,* CAB appeared to be firmly committed to deregulation, and in the 3 years since passage CAB has been extremely prompt as well as liberal in approving the new routes and terminations permitted by the act. The current administration has proposed dismantling CAB 27 months early, on September 30, 1982, rather than waiting for the January 1, 1985, date mandated by the legislation.[12]

Provisions for Small Communities

The Airline Deregulation Act of 1978 is far more explicit than its predecessor, the Federal Aviation Act of 1958, in specifying the nature of the desired air transportation system and the means by which this system is to be developed. Where the 1958 act called for "competition to the extent necessary to assure the sound development" of the system, the 1978 act directs CAB to promote "the availability of a variety of . . . services by air carriers" through "maximum reliance on competitive market forces . . . to provide efficiency, innovation, and low prices." Where the earlier act emphasized "sound economic conditions" for existing carriers, the new act calls for "the encouragement of entry into air transportation markets by new air carriers . . . and the continued strengthening of small air carriers so as to assure a more effective, competitive airline industry. " And where the 1958 act simply instructed CAB to "preserve the inherent advantages of . . . [air] transportation," the 1978 act specifically directs CAB to promote "a comprehensive and convenient system of continuous scheduled airline service for small communities and for isolated areas, with direct Federal assistance where appropriate" (sec. 3[a]).

To accomplish this last objective, section 419 of the act guarantees "essential air service"

[12] Carole Shifrin, "Reagan Bill Would End CAB in '82," *Washington Post,* June 25, 1981, p, B1.

(EAS) for at least 10 years to all eligible communities (those receiving certificated service on the date of passage, or whose authorized service had been suspended—a total of 555 communities, 316 of them in the *48* contiguous States). The act directs CAB to determine the level of EAS for each community to establish a new subsidy program (the "419 subsidy") for payments to carriers that provide EAS. Congress defined EAS broadly as a level that "satisfies the needs of the community concerned . . . and ensures access to the Nation's air transportation system. " Subsequent guidelines developed by CAB specify that EAS will consist of a minimum of two well-timed round trips per day (one on weekends) to one or two hubs, with no more than two intermediate stops, using aircraft with two engines and two pilots, with a maximum combined capacity of 160 seats per day (80 outbound and 80 inbound at a 50-percent load factor, or 40 passengers each way).

CAB's EAS standards are clearly near the minimum permitted by the language of the act, and they are viewed by many cities and states as too restrictive to support services at any but the smallest communities (see ch. 2). However, CAB feels that market forces will attract and support air service when demand is above these levels, and that such service should not be subsidized—EAS is not a market-development program. '3 Congressional participants in the development of the act claim that CAB is correct in interpreting the intent of section 419 as a minimum guarantee.

Future Role of Commuters

Responsibility for providing EAS to small communities will increasingly fall to the commuter airlines, particularly after the current section *406* subsidies to local service carriers expire in *1985.* Although eligibility for section 419 subsidies is not limited to commuter airlines, CAB issued a policy statement a month before deregulation indicating that the local service carriers are no longer structured or equipped to serve small- or even some medium-size communities.[14] CAB has also issued several reports indicating that small communities generally receive more frequent and more responsive service from unsubsidized commuters than they had from subsidized locals. [1]5

Nevertheless, some small communities have been unable to attract reliable commuter replacements, and States and regions that lack a well-developed commuter airline network may be vulnerable to a deterioration of service to small communities even before the expiration of section 419 in 1988. Commuter airlines, for their part, sometimes complain that the EAS program is poorly designed, and some operators are unwilling to bid for new EAS communities when they become available (see ch. 4).

It should also be noted that the Airline Deregulation Act did not "deregulate" the commuter carriers as it did the rest of the industry. It did just the opposite—the commuter airlines now operate in a much more constrained regulatory environment than they did before 1978. For example, they must now comply with more stringent reporting requirements and operating regulations; their pilots must hold "airline transport pilot" certificates, the highest level of FAA license; and even their smallest aircraft must now comply with the stricter FAR part 135 safety rules. In addition, although commuters can terminate service to nonsubsidized points on 30 days' notice, on subsidized EAS routes they may not terminate service on less than *90* days' notice to the affected communities and States and CAB. CAB also has the power to require them to continue service (with subsidy) until a replacement carrier can be found. There have already been many cases in which commuters have not wanted to offer (or continue) service in particular markets, even with subsidy, because the subsidy level was too low to provide the profit they

[13]Earlier Civil Aeronautics Board and Department of Transportation studies had shown that points enplaning 17 or more passengers per day would support commuter replacement service without the need for subsidy. Civil Aeronautics Board, Bureau of Domestic Aviation, *A Review* of *the* Office of *Technology Assessment's report entitled, "Air Service to Small Communities, "* October 1981; see also Department of Transportation, Office of Transportation Regulatory Policy, *Air Service to Small Communities,* March 1976.

"Civil Aeronautics Board, *Statement on Improuing Service to Medium and* Small *Communities,* Sept. 18, 1978.

[15] 'See Civil Aeronautics Board, *Aircraft Pressurization and Commuter Airline Operations,* June 1979, app. B.

could make with the same aircraft in an alternative unsubsidized market. About 130 points have had commuter replacements; but 13 points have experienced more than one turnover and *20* points have a second turnover pending.

The act also allows commuters to operate larger aircraft (up to 55 seats, later increased to *60* seats) that would enable them to serve larger markets. Even though the availability of new-technology aircraft in this size range will remain limited until the mid-1980's (see ch. 4), the opportunity to operate larger aircraft on more profitable routes could well tempt successful commuters, in the pattern of their predecessors, to abandon their less lucrative service to smaller communities. This eventuality, and the general outlook for service to small communities, is discussed in chapter 3.

Chapter 3

AIR SERVICE TRENDS

Chapter 3

AIR SERVICE TRENDS

INTRODUCTION

The principal function of the low-density air service provided by commuter airlines has been to provide small- and medium-size communities with access to the Nation's primary air transportation system. This function makes a significant contribution to the primary system, since over 70 percent of the passengers from these "feeder" routes transfer to flights on the longer, denser trunk routes once they arrive at a major hub. The service is even more vital to the communities themselves, particularly in areas where they tend to be isolated by low population density (as in Appalachia), long distances (as in the Southwest), physical barriers (as in Hawaii and the Caribbean), or all three (as in Alaska). Federal policy has consistently stressed the development of an air transport system that meets the diverse service needs, present and future, of all regions of the country. The Airline Deregulation Act of 1978 makes it explicit that such a system will require "the maintenance of a comprehensive and convenient system of continuous scheduled airline service for small communities and for isolated areas, with direct Federal assistance where appropriate. "

A major development that has contributed to the growing need for low-density air service has been the continuing decentralization of population and business. The last decade has seen a historic reversal in demographic trends: rural areas have begun to grow more rapidly than metropolitan areas. At the same time, there is a growing trend toward decentralization in American industry, with more and more businesses locating their new facilities in rural communities, particularly in the Southeast and Southwest. Studies conducted as early as 1957 showed that access to air transportation had a significant influence on the decisions of these "footloose" industries to locate in particular communities.[1] More recent studies by the Economic Development Administration have indicated that proximity to an airport with scheduled airline service is the most important of 16 factors related to urban growth in the nonmetropolitan South, as well as the most reliable indicator in predicting rapid future economic growth in small- and medium-size communities.[2]

The relationship between air service and economic development appears to be causal. Air service attracts new businesses, particularly branch plants of light industries that pay high wages, by providing fast and convenient connections with suppliers, customers, and company headquarters. For many small communities, therefore, the availability of reliable air service is directly related to their chances for economic development.[3] In addition, the evolution of many medium-size cities into regional manufacturing and distribution centers is dependent on the continuation of frequent, reliable service. The degradation of service that has sometimes resulted from the withdrawal of local service carriers from these markets could possibly threaten this evolution (see ch. 2 and below). At issue, then, are three related questions: 1) who will provide this low-density air service; 2) how much service will they provide; and 3) who will pay for developing these markets—the carriers, the communities, or the Federal Government?

The Role of Commuter Airlines

The future of air service to small- and medium-size communities depends increasingly on the ability of the commuter airlines to provide adequate and efficient replacement service in these low-density markets. The rapid growth of the commuters in the *1960's* and 1970's was based in large part on just this kind of capability: the most successful commuters were entre-

[1] T. E. McMillan, Jr., "Why Manufacturers Choose Plant Locations vs. Determinants of Plant Locations, " Land *Economics, vol.* 41, No. 3, August 1965, pp. 239-246.

[2] L. E. Wheat, *Urban Growth in the Nonmetropolitan South* (Lexington, Mass.: D. C. Heath, 1976), pp. 1 and 49-52.

[3] Ibid.

preneurs who replaced certificated carriers on routes for which the commuters' smaller aircraft were more economical. Because the commuters were ineligible for subsidy, their growth came about almost exclusively through private-sector initiatives; and because they could provide more frequent flights with their smaller aircraft, replacement often improved the level of service in a given community.

The commuter airline industry is highly disaggregated, however. There are almost 300 commuter airlines, but the top 10 commuters carry 37 percent of all passengers and the top 50 carry 85 percent; the 5 largest commuters carry twice as many passengers as the 5 next largest. The largest commuters are capable of operating aircraft fleets and providing services comparable or even superior to those provided by the locals before they moved up to jets. Yet the industry also includes many small companies that operate one or two aircraft of less than 10 seats over a small number of routes, serving communities that generate only a few passengers per day. While the largest commuter carriers have relatively sophisticated management and secure financing, the smallest commuters are generally run by one person (who often doubles as chief pilot) and are more likely to be financially shaky. Most observers appear to believe that these "mom and pop" commuters will disappear in the future.

For these and other reasons, the new market opportunities created by the Airline Deregulation Act may be a mixed blessing from the point of view of the small communities themselves. Service may improve in some communities if they fit well in an improved route structure, and the freedom to operate larger aircraft may enable some commuters to improve service throughout their systems. However, the freedom to operate larger aircraft over more profitable routes may tempt the largest commuters to abandon their smaller aircraft and less lucrative routes, and with them their service to small communities. (This temptation can only increase as the local service airlines abandon more and more of their low-density markets as 1985 and the end of the section *406* subsidy program approaches; the present administration has proposed eliminating the *406* subsidy ahead of schedule).

Section 419 of the Airline Deregulation Act was specifically designed by Congress to maintain *essential* air service to small communities during the 10-year transition to a free market. It was not intended to be a market-development program, and this has been the basis for a number of complaints about the Civil Aeronautics Board's (CAB) implementation of the Essential Air Service (EAS) program (see below). Some critics feel that this level of subsidy is inadequate to maintain historical service levels, let alone provide a level of service that will develop the potential demand for air service in these markets. Some commuter airlines have become reluctant to bid for 419 service contracts, and others have filed exit notices or are being held in involuntarily on subsidized markets they would like to drop. In the future, the lack of availability of suitable aircraft, as well as a lack of financing and loan guarantees for their purchase, could also affect the ability of commuters to offer the necessary level of service in these small communities on an economically sustainable basis (see ch. 4).

THE IMPACT OF DEREGULATION ON LOW-DENSITY AIR SERVICE

The existing deficiencies in air service to small communities have resulted from trends inherent in the evolution of the regulated air transport industry, and deregulation seems likely to accelerate these trends (see ch. 2). It is too soon to judge the full impact of airline deregulation, in part because it is a gradual process that will not be completed until 1988 and, more importantly, because of the adverse economic conditions that have affected airline operations generally since 1979. The flight restrictions imposed by the Federal Aviation Administration (FAA) in response to the air controllers' walkout have also constrained commuter growth, particularly for car-

riers operating into the Nation's 22 busiest hub airports. This constraint will persist for 2 or more years if the administration adheres to its present policy with regard to the controllers who went on strike. Most changes in air service patterns, however, have been and will continue to be the result of the commuter airline industry's adaptation to changing market forces in an increasing competitive environment.

Commuter airline passenger traffic has grown at an average rate of over 13 percent since 1970, but in 1979, the first full year of deregulation, it grew by a record rate of almost 27 percent.[4] Commuter carriers entered over 400 new markets during the same year. In 1980, according to Commuter Airline Association of America (CAAA) estimates, **passenger** traffic increased by another 11 percent despite higher fuel costs and a general downturn in the U.S. economy.[5] Continued recession and strike effects have led to predictions of flat or negative growth in 1981 and possible failures for some overextended commuters, but the long-term outlook remains healthy. Preliminary FAA figures project a 7.9-percent growth rate for commuter passenger enplanements through 1993, and other estimates are as high as 10 percent annually.[6] Commuters served 505 airports in the 48 contiguous States in 1980 and provided the only scheduled air service at *292* of these points, including *133* EAS points or 42 percent of the eligible communities.[7] In 1981, they provided the only scheduled service to 187 EAS points (59 percent of eligible communities), and they are expected to be the only airlines serving nearly all the EAS points by 1983.

Within the commuter industry, however, growth has been inconsistent, with carriers serving the same region or market type experiencing very different growth rates. Almost all growth has taken place in markets where commuters have begun new service since deregulation, markets in which they have replaced certificated carriers, or markets in which traffic was previously limited by restrictions on aircraft size.[8] Existing commuter routes, by contrast, sustained traffic declines in *1980* comparable to those experienced by certificated carriers.[9] In general, the 1980-81 slump hit the commuters later than the trunks and locals.[10] In many cases, however, the commuters were less able to sustain these losses; several commuters have failed in 1981, and more failures are likely in the future.

Changes in Air Service Patterns

Overall levels of air service have increased since deregulation, but some small communities and some market categories have not fared well.[11] During the first year of deregulation, airports of all sizes experienced an increase in both aircraft departures and available seats per week (see table 3), but nonhubs—the smallest communities—experienced the smallest increase in both measures of air service. While all hub categories experienced a decrease in both departures and available seats in 1980, nonhubs suffered the greatest losses, and 46 nonhubs (all of them ineligible for EAS) ceased to receive scheduled air service. Thirteen of these points regained service in 1981, but nonhubs as a class have suffered a decrease in departures since 1978. Nonhubs have also experienced a significant decline in available seats since deregulation. To some extent the decline in available seats reflects the smaller aircraft serving these points, and may therefore represent an improvement in system efficiency. This reallocation of resources, on a nationwide scale, was in fact one of the objectives of deregulation; but it should have been accompanied by an increase in departures, not a decrease. Since August 3, 1981, FAA-imposed restrictions have led to further cuts in service from nonhubs to affected large hubs. Some commuters were forced to reduce operations by as much as 20 to 40 per-

[4] "'Growth of Commuter Traffic Figures Vary From 12 to 16%," *Aviation Week and Space Technology,* Mar. 16, 1981, p. 40.

[5] 'Commuter Airline Association of America (CAAA), *1980 Annual Report* (Washington, D. C.: CAAA, November 1980), pp. 7 and 20.

[6] 'Commuters Predict No-Growth Year, " *Aviation Week, Nov.* 9, 1981, pp. 65 and 129.

[7] CAAA, op. cit., pp. 20 and 49.

[8] 'Alan R. Stephen, vice president for operations, CAAA: quoted in *Aviation Week,* op. cit.

[9] CAAA, op. cit., p. 20.

[10] '"Stephen Smith, vice president for government relations, CAAA, private communication, June 22, 1981.

[11] ' 'Material in this and the next two paragraphs is based on two reports prepared by the U.S. General Accounting Office: *The Changing Airline Industry: A Status Report Through 1979* (CED-80-145, Sept. 12, 1980), and *The Changing Airline Industry: A Status Report Through 1980* (CED-81-103, June 1, 1981).

Table 3.—Changes in Aircraft Departures and Available Seats by Market Size, 1977-80 (week of October 1)

		Market type				
		Large hubs	Medium hubs	Small hubs	Nonhubs	Total
Number of communities:	1979[a]	26	33	76	570	705
	1980 [b]	24	36	71	528	659
	1981 [c]	23	37	72	540	672
Departures per week:						
Percentage change:	1977-78 [a]	5.9	6.5	6.4	9.2	6.7
	1978-79 [a]	8.3	6.6	6.7	6.2	7.4
	1979-80 [b]	–5.6	–8.8	–7.2	– 11.7	– 7.6
	1980-81 [c]	5.6	1.7	– 1.1	1.6	3.3
Cumulative change:	1977-79 [a]	14.7	13.5	13.5	16.0	14.6
	1977-79 [b]	14,3	15.1	13.4	14.2	14.3
	1977-80 [b]	7.9	4.9	5.2	0.9	5.6
	1978-81 [c]	11,4	4.1	–0.9	– 2.4	5.6
Available seats per week:						
Percent change:	1977-78 [a]	6.1	3.2	4.6	0.2	5.0
	1978-79 [a]	8.6	4.0	1.5	1.4	6.4
	1979-80 [b]	–6.1	– 10.1	–6.5	– 10.8	– 7.2
	1980-81	NA	NA	NA	NA	NA
Cumulative change:	1977-7P	15.2	7.3	6.2	1.6	11.7
	1977-79 [b]	14,1	6.9	5.0	–0.2	10.6
	1977-80 [b]	7.2	–3.9	– 1.8	– 11.0	2.6
	1978-81	NA	NA	NA	NA	NA

SOURCES: [a]GAO, *The Changing Airline Industry: A Status Report Through 1979* (September 1980).
[b]GAO, *The Changing Airline Industry: A Status Report Through 1980* (June 1981).
[c]CAB, *Report on Airline Service, Fares, Traffic, Load Factors, and Market Shares* (October 1981); reflects service status on August 1 of each year

cent, and others were granted temporary exemptions from their EAS obligations.

When air service is analyzed by city-pair market type, a related and even more striking pattern emerges (see table 4). During the first year of deregulation, service between nonhubs and all larger hubs increased by above-average amounts, indicating the operation of a hub-and-spoke network and an improvement in the smallest communities' access to the national system. Service between nonhubs, however, declined by more than 5 percent. This pattern was repeated in 1980—all market types suffered declines, but the decline was greatest between nonhubs. Service frequency from nonhubs to small hubs and other nonhubs has declined by *20* percent since deregulation, and has increased only to large hubs. In large part this has been due to changes in routing, and although nonhub-to-nonhub service may facilitate intrastate or intraregional travel, most nonhub passengers would prefer more direct access to larger hubs where transfers are possible.

Table 4.—Changes in Frequencies by Market Size, 1977.81 (week of October 1)

	Flights per week		
Market type	Percent change 1977 -79[a]	Percent 1977-80[b]	Percent 1:%:1%
Nonhub to large hub.	*9.0*	–2.3	*0.5*
Nonhub to medium hub. . .	*20.4*	– 1.3	*–7.3*
Nonhub to small hub.	*9.6*	– 11.1	*–21.8*
Nonhub to nonhub.	*–5.3*	– 16.5	*– 19.9*
Small hub to small hub. . . .	1.1	– 10.4	*–0.3*
Small hub to medium hub. .	1.8	–9.6	*–9.5*
Small hub to large hub. . . .	6.4	–1.2	*–4.2*
Medium hub to medium hub	–2.6	– 13.4	*–0.9*
Medium hub to large hub. .	6.3	–3.0	*–6.5*
Large hub to large hub. . . .	6.4	–6.4	*–4.3*
Total*	6.1	–5.6	*–4.9*

● Differences in the percentage change in departures and the market flight frequencies result from two factors The first is that the data bases differ. the departure data Includes foreign flag operations while the market data does not. Secondly, there is a compounding effect which multiplies the number of city pairs resulting from a multistop itinerary A, B, C, and D, There are three aircraft departures-A, B, and C. There are, however, six city pairs: A-B, A-C, A-D, B.C. B.D, C-D

SOURCES [a]GAO, *The* Changing *Airline Industry A Status Report Through 1979* (October 1980); these data reflect hub categories as of October 1, 1979, but do not include communities that lost all scheduled service in the previous 2 years.
[b]GAO, The *Changing Airline Industry A Status Report Through 1980* (June 1980), these data reflect hub categories as of October 1, 1980, but do not include the 46 nonhub communities that lost all scheduled service in the previous year,
[c]CAB *Report on Airline Service, Fares, Traffic, Load Factors, and Market Shares* (October 1981); these data compare service levels and hub categories as of Aug. 1, to eliminate effects of PATCO walkout.

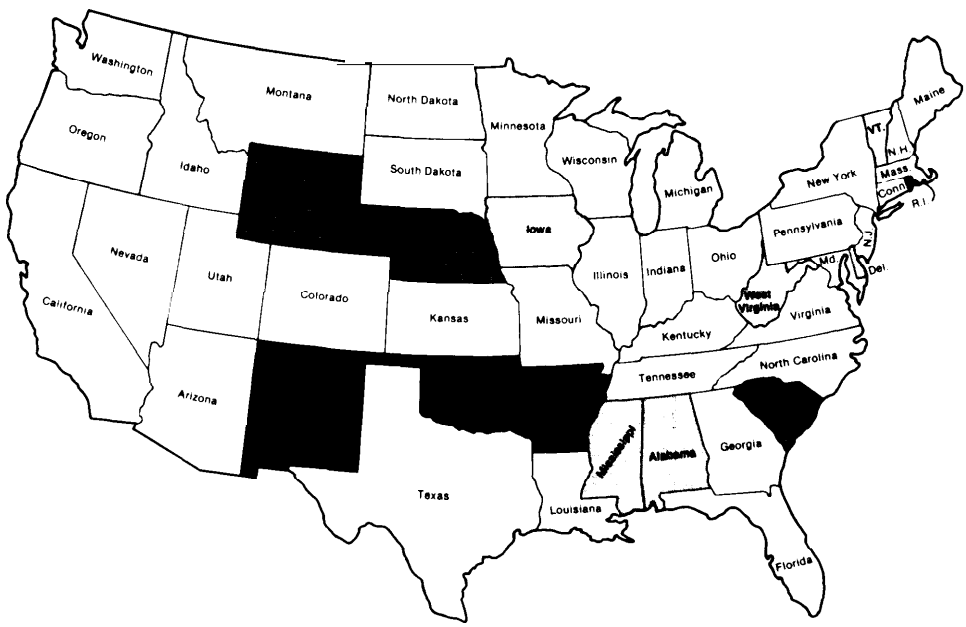
A similar unevenness is also found when service is considered on a State-by-State basis. While the Nation as a whole enjoyed an increase in air service between October 1977 and October 1979, seven States experienced a decrease in either departures or available seats, and six suffered a decrease in both measures of scheduled air service (see fig. *5).* During the 1979-80 slump, on the other hand, only one State—Maryland—experienced an increase in both departures and available seats, while declines elsewhere greatly reduced the earlier gains and in several cases turned gains into losses. Overall between 1977 and 1980, only 19 States enjoyed increases in both departures and available seats. Thirteen States experienced decreases in either departures or available seats, and 16 States plus the District of Columbia suffered declines in both measures of scheduled air service (see fig. *6).* Delaware, Mississippi, Alabama, and Wyoming have been particularly hard hit.

When service is analyzed strictly in terms of the smaller number of communities that qualify for EAS under the Airline Deregulation Act (i.e., those that were certificated on Oct. *24, 1978,* the date of passage), the declines are somewhat smaller but the overall pattern among the States remains the same. At the 132 points where commuters have replaced certificated carriers, traffic actually increased by 2 percent from 1978 to 1980; at nonhubs generally, traffic declined by 8 percent. This suggests that EAS is working, but it also raises questions about the fate of small communities after 1988.

State and Regional Air Service Studies

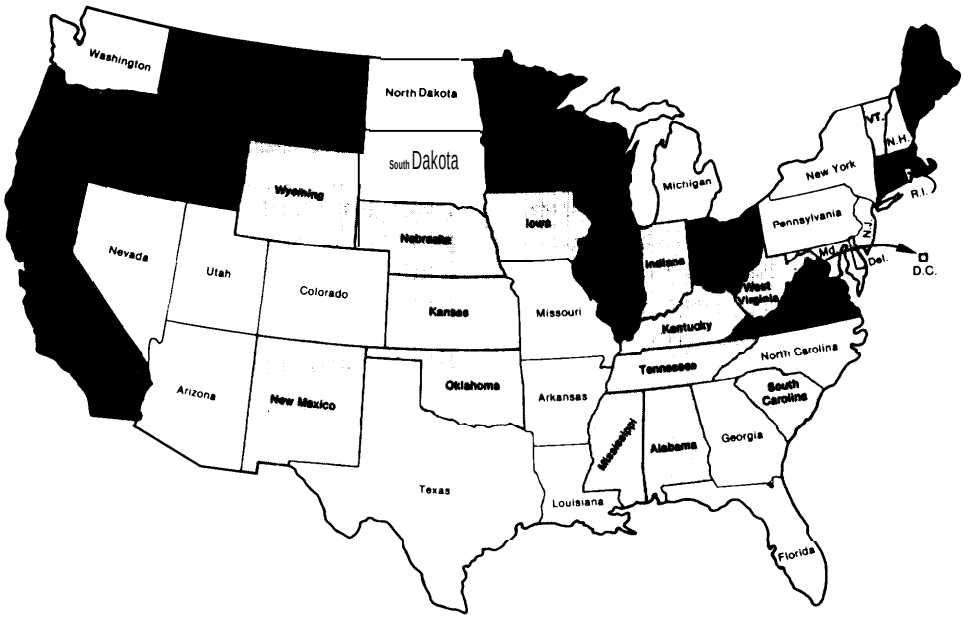
Neither CAB nor FAA routinely monitors service to small communities by State or region, nor do most States keep records of this type. Three major studies of this kind have, however, been conducted since deregulation. The results of these studies raise serious questions about the adequacy of the EAS program, as designed by Congress and implemented by CAB, and about the future of air service to small communities, particularly those that are ineligible for EAS.

Figure 5.—Air Service Changes, October 1977 v. October 1979



SOURCE: Off Ice of Technology Assessment

Figure 6.—Air Service Changes, October 1977 v. October 1980



U decrease in both departures and available seats

_ decrease in elther departures or available seats

SOURCE: Office of Technology Assessment

A study published by the North Carolina Department of Transportation in February 1980 found that many of the State's small communities were reaching a size that could support scheduled air service, but that the absence of a well-developed commuter airline network leaves the State potentially vulnerable to a "void" in small community air service, particularly at noncertificated points. [12]

A more recent study by the New York State Department of Transportation found that the State's small- and medium-size communities had already experienced a 20-percent decline in air traffic in the 10 years before deregulation, largely due to the inability of commuters to fill the voids left by the steady withdrawal of USAir from short-haul markets. In New York's medium-hub communities, deregulation has increased service in long-haul markets but caused a 12-percent decline in service on short-haul routes. Since deregulation the State's nonhubs have suffered extensive service reductions and substantial traffic underdeveloprnent. The study concludes that the EAS levels for its small communities, as determined by CAB, are inadequate to accommodate even the depressed historical demand for air service (which in 1978 was only 54 percent of potential or latent demand), let alone promote traffic development in these markets. The study recommends an expanded State role in monitoring and promoting air service to small communities. [13]

Another analysis will soon be published by the Appalachian Regional Commission, whose region includes West Virginia and parts of 12 other States. The study found that, between October 1978 and October 1980, the region's communities had experienced a substantial deterioration in the quality and quantity of air service, relative to both the Nation as a whole and the

[12] Division of Aviation, North Carolina Department of Transportation, Small *Community Air Service Route and Marketing Study*, February 1980.

[13] Aviation and Rail Planning Unit, New York State Department of Transportation (NYDOT), *Adequacy of Air Service Study*, May 1981.

national average for other small- and medium-size communities:

- of 44 communities receiving scheduled air service, 20 experienced reductions in service levels and 11 of these communities (7 of them EAS points) lost one or more certificated carriers;
- certificated service is being withdrawn faster than commuter service is initiated, resulting in a net decline in service levels;
- traffic decreases at medium and small hubs were 50-percent greater than the national average;
- 20 of the 24 nonhubs experienced traffic declines, 9 of them greater than 25 percent, and 11 nonhubs lost all certificated service (2 more have termination notices pending); and
- despite improvements in service to large hubs, the Appalachian route network is becoming substantially less capable of facilitating intraregional air travel.

Like the New York study, the Appalachian air service study concludes that the future of air service to small communities will depend on the development of successful commuter carriers, and that State and community initiatives may be needed to assist carriers at specific points. These initiatives include both promotional activities and direct financial assistance where section 419 subsidies prove inadequate. [14]

[14] Appalachian Regional Commission, *The Effects of Airline Deregulation Upon Air Service in Appalachia,* working paper, June *1981.*

EAS, COMMUTERS, AND MARKET DEVELOPMENT

It may be too soon to determine how the 10-year transition to full deregulation will affect air service to small communities, particularly in view of the short-term effects of the economic downturn and strike-related flight restrictions. In general, it will depend on the future development of commuter airlines and, in particular, on the ability and willingness of commuters to provide convenient and competitive service in these short-haul, low-density markets. Beyond this, it will depend on a number of other factors that are not entirely within the control of the commuter airlines:

- the ability of State, local, and private groups to attract and promote air service in order to develop self-supporting future markets in small communities;
- the availability and adequacy of financing and loan guarantees for the purchase of additional equipment by commuter airlines; and
- the availability of new-generation aircraft specifically designed for low-cost air service to the small communities.

The EAS Program

Congress, in section 419 of the Airline Deregulation Act, stressed the maintenance of air service to the Nation's small communities. The EAS program implements this provision, but many observers feel that CAB's determinations tend to guarantee only a minimal level of service. In some cases, critics feel, this may have contributed to a net reduction in service and thereby damaged the chances for developing economically viable markets in the future. Congressional comments, on the other hand, stress the unacceptably high cost of a nationwide market-development program and the fiscal inability of the Federal Government to provide more than a minimum guarantee. CAB's EAS determinations are in general geared to maintain service at about 1978 traffic levels.

CAB standards imply that two round trips and 40 passenger enplanements per day constitute "adequate" air service. However, the New York air service study and other sources argue that these levels are inadequate to meet existing

needs and demands and "are not sufficient to stimulate healthy rates of traffic development and sustain increasing levels of service. "[15] Experience at some small communities indicates that six daily round trips to a large hub (or eight to a medium hub) constitute a "threshold" level of service that is needed to develop potential demand and allow self-supporting, economically efficient operations. [16] According to the "threshold" theory, increased frequency may cause short-term losses but is necessary for long-term market development. Conversely, failure to provide a threshold level of service could permanently depress traffic levels in affected communities. This in turn could increase the long-term cost of the 419 subsidies and prolong the need for Federal involvement beyond the 10 years envisioned by Congress in 1978.[17] Ironically, however, this argument is based primarily on the substantial increases in passenger traffic that occurred at some cities where *unsubsidized commuters* replaced locals, before deregulation. Supporters of the EAS program would argue that aggressive marketing will have similar results where latent demand is sufficient, but that such market-development programs do not require and should not receive Federal subsidies.

It has also been suggested that the EAS program's service guarantees are adequate only for the smallest of the eligible cities: by applying its 2-departure, 40-passenger ceiling on a nationwide basis, it is argued, CAB may cause more rather than fewer transitional problems in slightly larger communities. This problem is particularly acute in some small and medium hubs that are also losing service due to adjustments in the trunk or local service route systems. Similarly, because a community qualifies for section 419 only when it loses its last scheduled carrier, severe traffic depression and economic dislocation might occur before the subsidy begins and persist for years even after replacement service is obtained. Finally, it has been suggested that 90 days' notice is often insufficient for a community to find a replacement carrier, let alone for the carrier to acquire the needed equipment, advertise schedules, and actually initiate operations.

In short, although the EAS program guarantees that no eligible small community will lose all air service during the transition to deregulation, the program could allow temporary dislocations and permanent reductions in traffic that might result in a loss of service after 1988.[18] In addition, EAS provides no protection for the many nonhubs that, because they received no certificated service before 1978, are ineligible for protection under section 419. It should be pointed out, however, that regulation did not protect the *level* of service to a community before 1978. CAB permission was required to eliminate the last flight, but the number, time, and destination of flights were decided by airline management on the basis of market demand. In addition, CAB had no authority to protect service to noncertificated points.

Reactions to the EAS Program

CAB data on air service under the EAS program seem to confirm some of the above concerns. Tables 3 and 4 (above) indicate that, collectively, nonhubs and medium hubs have experienced disproportionate service dislocations since deregulation. CAB points out in recent reports that EAS is working in eligible nonhubs: comparing December *1980* to December *1978*, departures declined 8.1 percent for all nonhubs, but only 0.7 percent for the 299 nonhubs covered by the program; and in the 132 cities where commuters have replaced certificated carriers since 1978, departures actually increased by 2 percent. [19] In most cases, commuter replacements required no subsidy; at the few points where 419 subsidies were paid, the cost is only about *35* to *40* percent of the *406* subsidy that had been required by local service carriers.

[15] NYDOT, op. cit., main report, epilogue, p. 2.

[16] Ibid., pp. 7, 19-20.

[17] Joanne Young, "Small Community Air Service: Guaranteed Essential Air Service Under Section 419 of the Federal Aviation Act, " memorandum to Frank Willis, Deputy Assistant Secretary for Policy and International Affairs, U.S. Department of Transportation, June *9, 1981; see* also her article, "Community-Oriented Essential Air Service: What's Best for Commuters?" *Commuter Air,* November 1981, pp. 12-18.

[18] Ibid.

[19] Civil Aeronautics Board, *Report on Air Service at Medium-Size Communities, vol.* 1, July 1981, p. 4; Civil Aeronautics Board, *Developments in the Deregulated Airline industry,* June 1981, p. 33.

However, the 229 nonhubs not covered by EAS experienced a 26.6-percent decline in departures, and this figure does not reflect the **46** ineligible nonhubs that lost all scheduled airline service during 1980 alone. The latter were typically small communities that had previously received service only from a commuter airline and would not have been protected from reduction or loss of service under regulation.

Furthermore, eligible communities from at least 34 different States have already appealed their EAS determination. Such petitions are not unusual, and in many cases they reflect dissatisfaction with the hub to which flights connect, rather than the number of flights. In one instance, however, CAB's rejection of such a petition is being challenged in a court suit involving the EAS determination for Bakersfield, Calif. The State of California has intervened in this case, and 18 other States have filed amicus briefs in support of the suit through their attorneys general; the suit has also been joined by the National Conference of State Legislatures, the Airport Operators Council International, and the Territory of American Samoa .'"

A number of small and medium hubs (particularly in the West and Midwest) have also experienced significant declines in departures, although they were partially offset in the national totals by smaller declines or slight gains at other communities. Louisville, Ky., for instance, experienced a 13.1-percent decrease in flight frequencies between October **1979** and October *1980,* including the loss of service to 11 major destinations. Similar experiences have led many medium-size cities to feel that they are "bearing the brunt of dislocations caused by the [new] route and rate freedoms" under deregulation .21 As a result, at least 10 medium-size cities have formed a coalition called Communities for an Effective Air Transportation System to promote changes in FAA and CAB policy, including provisions for market protection, **12** or even 18 months notice before market exit, replacement fuel allocation guarantees, and a redefinition of EAS in terms of demonstrated historic passenger demand. 22

CAB attributes these transitional dislocations to the withdrawal or rerouting of flights by trunks and locals, and to a short supply of smaller jet aircraft. 23 Congressional supporters of airline deregulation also point out that regulation had resulted in overcapacity in many markets, and that these "dislocations" may often reflect airline decisions to move empty seats from one market to other markets where they can be filled. This reallocation of resources, based on market forces, promotes the efficient use of the resources; and service reductions in smaller markets allow service increases in larger ones—i.e., "dislocations" in one part of the national air transportation system may bring "improvements" elsewhere.

Some commuter carriers, for their part, would often prefer not to provide replacement service under section 419, citing the excessive "hassle" and risks involved as well as the inadequate subsidy payments. One operator has characterized CAB's current *419* program as "overzealous protection of the Treasury at the expense of small community service, " and says that this situation, which gives commuter carriers "no chance of developing real airline business, " will soon lead to a "gradual degeneration of the entire small community system."[24] Market development—providing threshold service with adequate aircraft—can require a more substantial investment than the 419 subsidy provides. Few small commuters have the financial resources to cover these operating losses even in the short term, and the industry as a whole is already financially overextended. Deregulation has removed the regulatory barriers for commuters, but not the financial barriers, and these barriers are particularly severe with fuel prices and interest rates at present levels. However, FAA equipment loan guarantees have been provisionally set at $100 million for fiscal year **1982,** with all

[20] *County of Kern and City of Bakersfield v. CAB* docket Nos. 79-7308 and 80-7099, USCA 9th Circuit.

[21] Joan M. Feldman, "Medium Size Cities Protest Service Cuts Since Airline Deregulation, " *Air Transport World* June 1Q81, pp. 30-32.

[22] Feldman, op. cit.: Civil Aeronautics Board, *Report on Air Service at Medium-Size Communities* vol 1, pp. 10-11.

[23] Civil Aeronautics Board, *Report on Air Service at Medium-Size Communities* vol. 1, pp. 18-19, 21, and 25.

[24] Ken Cardella, president of Cochise Airlines, interview, July 31, 1981.

of the available funds set aside for commuter operators purchasing aircraft of 60 seats or less.

Another major problem—cited by numerous sources as being as important as subsidies or financing in terms of serving the smallest of the communities—relates to the need to develop a new generation of commuter aircraft that incorporates the full range of cost-cutting technologies. Many used aircraft are available, but in many cases they lack the fuel efficiency or performance characteristics needed for short-haul air service. Commuter airlines eagerly await the development of an advanced-technology commuter aircraft, but current conditions put their availability in doubt. This topic is discussed in the next chapter.

Chapter 4

TECHNOLOGICAL NEEDS AND OPPORTUNITIES

Chapter 4

TECHNOLOGICAL NEEDS AND OPPORTUNITIES

INTRODUCTION

The appropriateness of a given aircraft depends on how well it matches the markets it is intended to serve. Commuter airlines typically operate on low-density, short-haul routes that create unique operational requirements: small passenger capacity, short stage length between stops, low-altitude operations, and high frequency of takeoff and landing at both small community airports and crowded major hubs. An additional constraint, since costs per mile increase rapidly as distances decrease, is that the number of seats that have to be filled to cover costs—the break-even load—is larger at short distances than at longer distances for a given fare structure.

Below certain payloads or stage lengths no aircraft can operate profitably. Although these boundaries can be lowered by increasing ticket prices or by reducing operating costs, each of these courses of action have their own limits. Fares per mile already tend to be higher at shorter stage lengths, and beyond a certain point further increases will decrease patronage and cause total revenue to fall rather than rise. Similarly, the turboprops flown by commuters have lower operating costs than the jets flown by trunks and locals; but at a given aircraft size and technological state of the art there is also a limit to cost reductions. At any given time, therefore, there will always be some short-haul markets, especially those enplaning a very small number of passengers, that cannot be self-supporting.

Lowering the break-even load of aircraft through improved technology, however, would make economically self-supporting air service possible at lower traffic levels. Other things being equal, this would mean that smaller communities would be able to support scheduled air service without subsidies.

The need for an "economic vehicle" that would enable commuter airlines to better serve this market segment is described by Fred Bradley of Citibank as follows:

> We are reasonably convinced that there is a large market out there, a lot of people that would fly on the commuter routes. And we've been approached practically daily on financing for this particular group of carriers. But as you go from airline to airline and look at their balance sheets and income statements, as you look at the numbers and analyze these airlines in some depth, which we have, the basic problem is that there really isn't an economic vehicle that will permit this particular group of carriers to operate profitably at this point in the type of business they're in. [1]

Similarly, the New York Department of Transportation has found that many commuters do not have the equipment to serve the State's short-haul markets: some cannot find the right aircraft, others cannot find financing; but in both cases the result is that commuter airlines do not have the means to enter existing and potential markets,[2] Commuter financing problems have been further aggravated by recent reductions in FAA equipment loan guarantees.

---

[1] Fred Bradley, senior vice president, Airline and Aerospace Department, Citibank Corp.; proceedings of the OTA Advanced Air Transport Advisory Panel, Jan. 22, 1980, mimeo, pp. 34-35, 36, 66.

[2] Joseph Civalier, Aviation and Rail Planning Unit, New York State Department of Transportation, interview, June 24, 1981.

THE COMMUTER AIRCRAFT FLEET

When scheduled air-taxi service first developed in the 1950's and early 1960's, the fleet consisted primarily of older twin-engined Beech 18s (first flown in 1937), along with a few light twins and a variety of smaller single-engined aircraft. The low initial costs of these general aviation aircraft was important to carriers who typically operated with marginal financing and were willing to forego expensive passenger amenities in order to hold down their operating costs. As the industry grew and customer expectations rose, the airlines began to operate commuter derivatives of more modern executive aircraft, such as the Piper Chieftain and Cessna *402.*

The development of smaller turboprop engines, suitable for aircraft under 12,500 lb, led to the introduction of two extremely popular commuter aircraft, the 19-seat deHavilland of Canada Twin Otter in 1965 and the 15-seat Beech *99* in 1966 (heavier piston engines had limited earlier commuter payloads to about 10 passengers). The Swearingen Metro, a 19-seat executive derivative introduced in 1969, has sold well, with 100 now in service; this is the only current-technology aircraft presently produced in the United States for the 19-seat commuter market. The 18-seat Brazilian Embraer Bandeirante, introduced in 1972, has also gained considerable popularity with commuter carriers.

When CAB raised the size limit for commuter aircraft from 12,500 lb (about 19 seats) to 30 passengers in June 1972, many carriers preferred to stay with smaller aircraft (which better suited their needs and routes) in order to avoid the additional operating requirements. As a result, the commuter industry could not agree to endorse a 30-seat commuter aircraft and, lacking a firm domestic market, no U.S. manufacturer developed or produced a new aircraft in the 20- to 30-seat size range (see below). A few of the larger commuters did begin to operate larger aircraft on their denser routes, however, and the two foreign aircraft that were available–the French Aerospatiale Nerd 262 and the Shorts Brothers' SD-330, produced in Northern Ireland—captured most of the market.

The Airline Deregulation Act of 1978 raised the capacity limit again, first to 55 and later to 60 passengers, and once again commuter airlines that wanted to upgrade their fleets for high-density markets were forced to turn to foreign manufacturers. The only new commuter aircraft in the 30- to 60-passenger category was the Canadian-made deHavilland Dash 7, a four-engine 50-seat aircraft first flown in 1977; it has been put in service or ordered by a number of large commuters. Most of the commuters that wanted 30- to 60-passenger aircraft, however, had to settle for older, twin-engine planes—many also foreign-made—of the type once flown by the local service airlines: the British Aerospace **I-E-748** and Fokker F-27 (Dutch), both still in production; and two U.S.-built aircraft, the Convair 580/600 and the piston-powered Martin 404, both no longer in production. A few small jet aircraft, primarily Fokker F-28s and British Aerospace 146s, have also been purchased for operations in the densest commuter markets.

Fleet Mix

The current U.S. commuter aircraft fleet, broken down by manufacturer in table 5, is still

Table 5.—Commuter Aircraft in Joint Passenger/Cargo Operations 1980

Manufacturer	Piston single engine	Piston multi-engine	Turboprop	Jet	Helicopter	Total all aircraft
Aerospatiale	—	—	27	–	3	30
Beech	2	38	102	–	–	142
Bntten Norman	—	47	—	—	—	47
Cessna	104	181	—	—	—	285
Convair	—	9	30	–	–	39
DeHavilland	16	35	112	—	–	163
Douglas	—	37	—	—	—	37
Embraer	—	—	27	–	–	27
Fokker/Fairchlld	—	—	19	5	—	24
Grumman	—	28	—	—	—	28
Handley Page	—	—	16	—	—	16
Martin	—	20	—	—	—	20
Piper	53	264	—	—	—	317
Shorts Brothers	—	—	35	–	–	35
Swearingen	—	—	103	—	—	103
Misc. Aircraft	3	9	9	–	5	26
Total all aircraft	178	668	480	5	8	1,339

Miscellaneous aircraft Aero Commander (9), Bell (3), Casa (2), Dornier (1), Hawker Siddley (l), Helio (2). Mooney (l), Nomad (5), Sikorsky (2)

SOURCE 1980 Commuter Airline Association of America Annual Survey

dominated by relatively small aircraft. Piston-powered one- and two-engine aircraft seating less than 10 passengers account for 54 percent of all commuter aircraft. [3] Since deregulation, however, there has been a change in fleet mix: between 1978 and 1980, the number of small piston aircraft declined slightly, while the number of larger turbine aircraft almost doubled and average capacity rose to over 13 seats per plane. Ranked by the total number of available seats in the fleet, 7 of the top 10 aircraft have 15 or more seats and 4 of the top 10 have capacities of 27 or more passengers.[4] More significant is the fleet composition of the top 50 commuter airlines, which carry 87 percent of the industry's passenger traffic: two-thirds of their current fleet have capacities of 15 or more seats, and 60 percent of their orders for new aircraft are for 30 or more seats. [5] Most of these orders are for foreign-made aircraft.

Why Foreign Aircraft?

Commuter airlines cannot find the larger aircraft they want in the United States because American manufacturers have never developed a dedicated aircraft specifically for commuter use. In large part this is a lingering effect of the commuter industry's regulatory history (the Civil Aeronautics Board (CAB) 10,000-lb weight limit for air taxis in 1947, the 12,500-lb limit for commuters in 1969) and the industry's indecision when the limit was raised to 30 seats in 1973. These factors effectively killed the domestic market for commercial aircraft between the largest the commuters were allowed to fly (I9 seats) and the smallest the local service airlines wanted to fly (60 to 75 seats). In addition, the commuter aircraft market was extremely diversified, ranging from the smallest 4-seaters to the 19-seat limit, and was made up of numerous small companies that bought only one or two aircraft apiece. Manufacturers and other observers also cite the costs and uncertainties involved in Federal Aviation Administration (FAA) certification for new-technology aircraft. As a result, the current generation of U.S. aircraft in use by the commuters was developed primarily as passenger derivatives of more lucrative general aviation and business aircraft designs. But as one commuter operator puts it, "Old-generation equipment can't be modified to fit the new needs [and conditions]; we must have a new-technology plane to produce a profit. "[6]

Foreign manufacturers, on the other hand, continued to design and build new dedicated passenger aircraft in the 15- to *20-*, *30-* to 35-, and *50-* to 60-seat ranges for the European and Third World markets, frequently with government subsidies. They consequently had a considerable competitive advantage when CAB raised the commuter size limit to 30 passengers in 1973. U.S. manufacturers, apparently still considering the market too small and/or too risky, did not field a competitor in this size range until 1981—the 37-seat Gulf stream American G1-C, a stretched and refitted 1960's-generation executive aircraft. Similarly, when deregulation raised the commuter capacity limit to 60 passengers in 1978, the only American aircraft in the market were 20-year-old local service aircraft that were no longer in production. Foreign manufacturers, on the other hand, could offer the new 50-seat Dash 7 as well as older but serviceable aircraft like the BAe *HS-748* and Fokker F-27, which had been upgraded over the years and were still in production. One FAA official has put the situation this way:

> The thing that will strike you, if you go around and look at the commuters, is that the equipment that they're using is not built in the United States. With the exception of commuter-type aircraft, we lead the world, but . . . we have darned near by default turned this market over to foreign manufacturers. U.S. manufacturers are busy selling what they can make money on, and they don't think the commuter market is that big. If you go to Beech or Cessna or Piper, any airplane they're going to come up with is going to be a derivative. We're not seeing the utilization of new technology in these aircraft, but just the packaging of existing technology. They're not investing in real R&D—the

[3] Commuter Airline Association of America, *1980 Annual Report (Washington,* D. C.: CAAA, November 1980), p. 121.

[4] Ibid., p. 120.

[5] *Aircraft Convention News, vol. 12, No. 4,* July 1, 1980, p. 40.

[6] Angelo Koukoulis, president of AeroMech, interview, Aug. 4, 1981.

investment is too high for the number of aircraft in the market—so most U.S. commuter aircraft are old planes or modifications of general aviation. That's why commuter airlines are going to foreign airplanes—foreign manufacturers are subsidized in these smaller segments of the market.'

'Charles Foster, Director of the FAA Northwest Region, proceedings of the OTA Advanced Air Transport Advisory Panel, Jan. 22, 1980, pp. 18-19, 47; and interview, Jan. 19, 1981.

FUTURE MARKETS, AIRCRAFT, AND COMPETITIVENESS

In spite of consistently optimistic projections of the potential domestic and international sales of commuter aircraft, most U.S. firms still appear reluctant to enter the market. Of the 15 or more commuter aircraft currently under development in the world, only a few are American and only one of these (Fairchild's SF-340, a joint venture with Sweden's Saab) represents an all-new design. This has in turn raised questions about the loss of the traditional U.S. aerospace technology lead and about the future competitiveness of the U.S. aircraft industry, not only in the international market but in the domestic market as well.

Market Projections

Forecasts of the future demand for light transport aircraft vary, but there is general agreement that considerable demand will in fact develop and that new aircraft in this category will find their initial success and major market with U.S. commuters airlines. The U.S. commuter fleet grew from 361 to 1,333 aircraft between 1965 and 1980, and the number of aircraft in the 21- to 50-seat range has increased 900 percent since *1972;* both trends can be expected to continue.[8] In a 1979 study conducted for the FAA, the Aerospace Corp. surveyed U.S. and foreign engine and aircraft manufacturers and trade associations, and arrived at a consensus 1980-2000 forecast of worldwide markets for 5,398 new aircraft between 15 and 60 seats, with the following breakdown:[9]

- 15 to 19 seats—800 to 3,750 aircraft, average 2,187 (48 percent in the United States);
- 20 to 40 seats—1,527 to 3,000 aircraft, average 1,996 (45 percent in the United States, plus a potential U.S. military market for an additional 200 aircraft);
- 41 to 60 seats—1,026 to 1,500 aircraft, average 1,215 (35 percent in the United States);
- total world market—3,353 to 8,000 aircraft, average 5,398 (44 percent in the United States);
- potential U.S. domestic market—over 2,500 new aircraft.

Whether this market would be large enough to support the development of new commuter aircraft by U.S. firms would depend on the market share they capture. As a rule of thumb, a manufacturer needs to sell at least 200 aircraft of a given model to recover its development costs, although high interest rates may raise the break-even point. In the 20- to 40-seat category, which the Aerospace Corp. report identifies as the principal equipment gap in the U.S. commuter fleet, 200 sales would represent only 13 percent and 30 percent of the lowest estimate of potential world and U.S. markets, respectively. Break-even sales would represent only 22 percent of the average forecast of the U.S. civilian market, and could be achieved through potential U.S. military sales alone.

A more recent report prepared for OTA makes an even more optimistic forecast of a total free-world market by 2000 for 6,250 new U.S.-manufactured commuter aircraft for airline and Government use, with the following breakdown: [10]

- 7 to 14 seats—1,650 aircraft (plus additional sales for corporate and private use);

'CAB Bureau of Domestic Aviation, *Memorandum on the Growth of the Commuter* Carrier *Fleet,* Feb. 10, 1981, pp. i, 4.

'Aerospace Corp., *Light Transport Aircraft Market Forecast,* prepared for the FAA Office of Aviation Policy, ATR-79(4857-03) -2ND, July 1979, p. 15.

[10]John W. Drake, "Estimates of U.S. Production of Light Transports for the U.S. and Foreign Market to the Year 2000," contractor report prepared for OTA, January 1980, p. 34.

- 15 to 19 seats—1,500 aircraft;
- 20 to 40 seats—1,600 aircraft (plus additional sales to the U.S. Government); and
- 41 to 60 seats—1,500 aircraft.

Aircraft Exports and U.S. Competitiveness

Exports of small transport aircraft have been increasingly important to both the industry and the U.S. balance of trade. Piper, Cessna, and Beech (who developed the light twin after World War 11 with almost no foreign competition) have until recently had a virtual world monopoly, and U.S. exports of new aircraft under 33,000 lb (about 50 seats) rose from $64 million in 1971 to $292 million in 1977. In 1979, U.S. general aviation manufacturers alone shipped almost 4,000 aircraft, valued at more than $600 million, to over 100 foreign countries. In the past these sales have been dominated by smaller single-engine, light-twin, and executive aircraft; but an equally large market may soon exist for commuter aircraft. Even the conservative 1980-2000 forecast above shows U.S. manufacturers competing for domestic sales of $5 billion to $10 billion and a total world market worth between $10 billion and $25 billion in 1980 dollars.

These numbers are large enough to constitute a viable market—in fact, a market large enough to attract many competitors, A growing number of developed and developing countries manufacture commuter aircraft in the 15- to 60-passenger range or have plans to do so (see table 6). There will be increasing competition for domestic and foreign sales in all three size categories, including sales tactics that some U.S. manufacturers characterize as "predatory financing. " Canada, for example, is the United States' principal challenger in this market, and the Canadian government has given deHavilland an $85-million loan to finance exports. This in turn allows the manufacturer to offer U.S. buyers up to 100-percent financing on orders for its forthcoming Dash 8 at 8-percent interest, and deHavilland has signed sales options with at least 12 of the 25 largest U.S. commuter airlines. Brazil, in an attempt to reduce its trade imbalance, imposes barriers to the sale of U.S. general aviation aircraft, but Embraer is able to market its Bandeirante and forthcoming Brasilia in the United States without restraints and with 85-percent financing at 8.5-percent interest. [1] A recent agreement to reduce government aircraft export subsidies is restricted to jet aircraft and affects only the United States, France, Great Britain, and West Germany. [2]

Future U.S. competitiveness, particularity in capturing a larger share of the increasingly crowded *30-* to 40-passenger market, will depend on the ability and willingness of American manufacturers to efficiently produce low-cost, reliable aircraft that incorporate the latest cost-cutting and productivity-increasing technologies. Few of the commuter aircraft currently under development for production in the 1980's are American, however, and these tend to be derivatives of current-technology aircraft (see table *6).* Several commuter carriers have expressed concern that these new aircraft may embody many of the same compromises that make the current generation of U.S. aircraft less than optimal for low-density, short-haul operations. Many of these operators feel that a "family" of advanced-technology transport aircraft, spanning the 15- to 60-passenger range and meeting the cost and performance requirements of short-haul operations, will be needed if small communities are to receive good air service and if U.S. manufacturers are to meet foreign competition.

---

[1] *Aviation* Week *and* Space *Technology,* June 8, 1981, p. 103.

[2] 'See Nancy Ross, "4 Countries Reduce Subsidies for Aircraft, " *Washington Post,* Aug. 4, 1981, p. D6; and Clyde H. Farnsworth, "Accord to Limit Jet Export Subsidy, " *New York Times,* Aug. 4, 1981, p. D3.

Table 6.—Turboprop Commuter Aircraft Under Development

Manufacturer/model/comments	Origin	Seats	Speed (mph)	Estimated delivery	Price (millions of 1980 dollars)
Beech C-99 (B-99 derivative)	United States	15	290	Mld-1981	1.015
Dornier 228-100 (advanced-technology wing)	West Germany	15	268	December 1981	NA
BAe Jetstream 31	England	19	265	Mid-1982	1.6
Beech 1900 (Super King Air derivative)	United States	19	303	April 1983	1.6
Dornier 228-200 (advanced-technology wing)	West Germany	19	268	December 1981	1.5
Swearingen Metro III (Metro II derivative)	United States	19	305	1981	1.02
Ahrens 402/404	Puerto Rico	27-30	200	1982	1.7-2.0
Embraer Brasilia 120 (new PW1OO engine)	Brazil	30	345	May 1984	3.2
deHavilland Dash 8 (new PW1OO engine)	Canada	32	300	Mid-1984	4.0
Saab-Fairchild SF-340 (new GE CT7 engine)	Sweden/United States	34	315	Early 1984	3.75
CASA-Nurtanio CN-235 (new GE CT7 engine)	Spain/Indonesia	34-38	NA	Early 1985	NA
Shorts SD-360 (stretched SD-330)	Northern Ireland	36	215	1982	3.4
Gulf stream American GI-C (stretched used GI executive)	United States	37	345	1981	3.0
Commuter Aircraft Corp. CAC-1OO	United States	38-44	305	March 1984	3.0
Aerospatiale-AerItalia ATR-42 (new PW1OO engine)	France/Italy	42-49	300-315	October 1985	5.0

NA Not available.

SOURCE: Office of Technology Assessment

THE SMALL TRANSPORT AIRCRAFT TECHNOLOGY (STAT) PROGRAM

In 1978, the Senate Committee on Commerce, Science, and Transportation asked the National Aeronautics and Space Administration (NASA) to 1) identify technical improvements in commuter aircraft that would increase their operational economics and public acceptance; and 2) to determine whether NASA's aeronautical R&D programs could help aircraft manufacturers solve the technical problems involved in designing and producing an advanced-technology "economic vehicle" for use by commuter airlines.[13] NASA's final report and recommendations will be presented to the Committee in early 1982; preliminary findings are outlined below.

Through interviews with airline operators and engine and aircraft manufacturers, NASA's preliminary studies identified technological needs and opportunities in the following areas:

- Aerodynamics. —Reduce operating costs through improvements in cruise efficiency, second-stage climb performance, and takeoff and landing performance. Potential advanced-technology applications include airfoil and wing design for laminar air flow, new high-lift devices, improved engine/airframe integration, and rear-mounted configurations.
- Propulsion.—Improve engine fuel efficiency, reliability, and maintainability; reduce weight, noise, and initial cost. Potential advanced-technology applications include dual-phase turbines, electronic engine controls, and special materials for engine components, as well as high-efficiency propellers and other results of NASA's ongoing advanced-propfan research.
- Aircraft systems.—Improve safety, handling, and ride quality while reducing pilot workload and maintenance costs. Potential advanced-technology applications include fly-by-wire or fiber-optics controls, gust-load alleviation technologies, low-cost icing protection, and improved navigation and guidance equipment.
- Structures.—Increase strength and reduce both weight and production costs through the use of advanced materials and manufacturing techniques. Potential advanced-technology applications include bonded-aluminum honeycomb, advanced aluminum alloys, and composite materials.

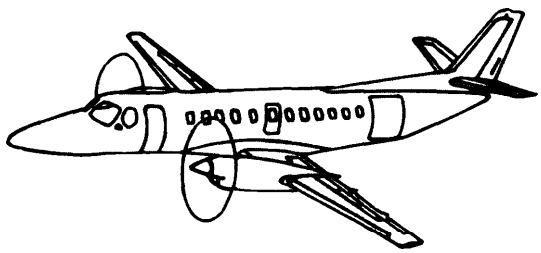
Based on these findings, NASA then commissioned technology-application studies by three aircraft manufacturers—Cessna, General Dy-

'3Smul/ *Transport Aircraft Technology: An Interim Report for the Committee on Commerce, Science, and Transportation* (Washington, D. C.: National Aeronautics and Space Administration, October 1979), p. iii.

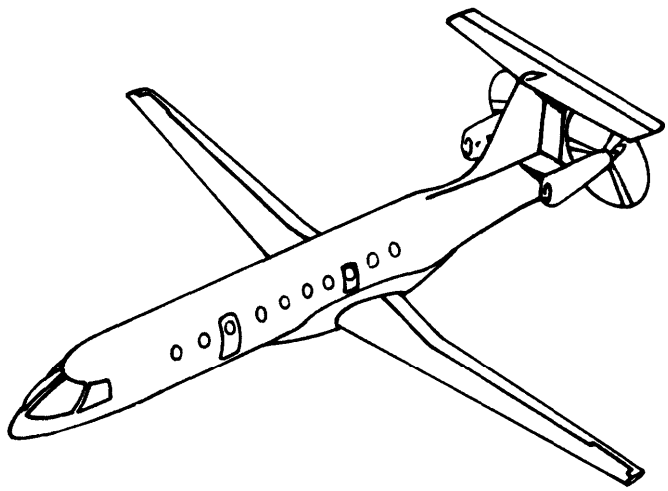
namics-Convair, and Lockheed-California—each of whom designed both a current-technology "base line" aircraft and an advanced-technology commuter aircraft in each size category (see fig. 7). Design goals included a range of 600 nautical miles with full payload, optimization for minimum direct operating costs over a 100-nautical-mile (nmi) stage length, 4,000-ft field capability, and passenger comfort (such as headroom, baggage space, pressurization, cabin noise, and ride quality) equivalent to large jet transports. Results included the following:

- Cessna's 19- and 30-passenger advanced-technology designs would use 38 to 40 percent less fuel on a 100-nmi trip and cut direct operating costs (DOC) by 21 percent (with fuel at $1/gal) compared to its baseline designs. Major improvements include the use of advanced propellers and engines, as well as structural bonding and compos-

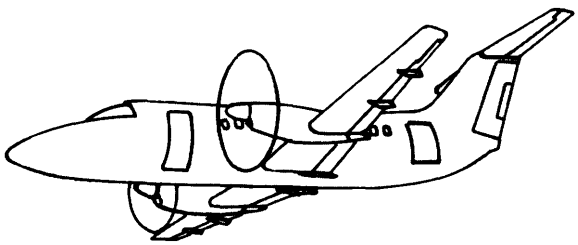
Figure 7.—STAT Advanced-Technology Commuter Aircraft Configurations



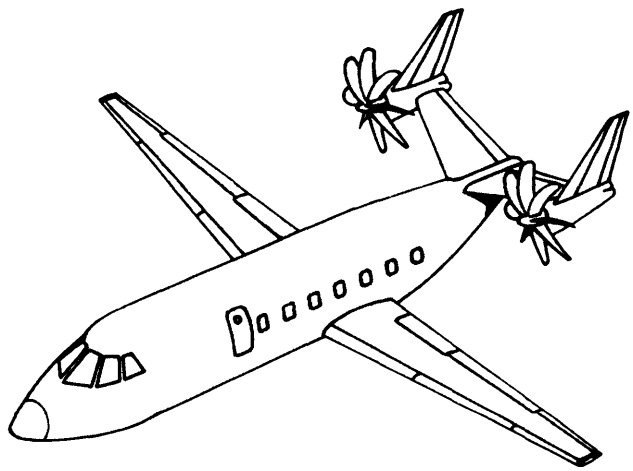
Cessna 19-passenger aircraft



Convair 30-passenger aircraft



Cessna 30-passenger aircraft



Lockheed-California 30-passenger aircraft

SOURCE National Aeronautics and Space Administration

ites that reduced aircraft weight and cost; the configuration is still fairly conventional.

- Convair's 30-passenger advanced-technology design would use 31-percent less fuel and reduce DOC by 24 percent compared to its baseline design on a 100-nmi trip. Major improvements include a new high-lift/low-drag wing design, composite structures, active controls, and improved propellers and engines, as well as a configuration with the engines mounted on pylons at the rear of the fuselage in order to reduce cabin noise and improve wing efficiency.
- Lockheed-California's 30-passenger advanced-technology design would cruise at Mach 0.6, 20 percent faster than the others, but would still save 26 percent on fuel and 16 percent on DOC compared to the company's baseline design on a 100-nmi trip. Major improvements include a high-lift/low-drag wing, active controls, improved propulsion system, and airframe manufacturing techniques that save 25 percent on structural costs compared to conventional aluminum skin-stringer techniques.
- Additional engine studies conducted by Allison, General Electric (GE), and Garrett indicate that opportunities exist to save about 20 percent on fuel and 13 percent on direct operating costs relative to current-generation turboprops, or 12 and 8 percent (respectively) relative to the new generation of fuel-efficient engines to be introduced about 1982 (i.e., GE's CT7 and Pratt & Whitney Canada's PW1OO families). Similar propeller studies by McCauley and Hamilton-Standard indicate that additional improvements of 8 to 17 percent on fuel and 3 to 8 percent on DOC are possible with advanced propeller technology, depending on baseline and configuration. (These engine and propeller results were assumed in the foregoing airframe company results.)

The findings of the STAT program to date indicate that very significant improvements in fuel efficiency, operating costs, and passenger comfort are possible in future commuter aircraft through a combination of technological advances, and that NASA's current large-transport and general aviation activities will contribute to some of the necessary technical improvements. However, not all of the possible spinoffs are directly applicable to commuter aircraft, whose design constraints and operation requirements present significantly different research and technology problems.

Proposed NASA Technology-Readiness Program

The special Commuter Air Transport Subcommittee of the NASA Advisory Council's Aeronautics Advisory Committee recommended in November 1980 that NASA sponsor a dedicated R&D program to bring the necessary specialized technologies to a state of readiness for commercial development and application. The resulting STAT technology-readiness program, as outlined in the draft final report, consists of four major subprograms (each with small, medium, and large options) that would bring their respective technologies to different levels of readiness: [4]

- Propulsion—
  Small: 3 years, $6 million.
  Medium: 4 years, $24 million.
  Large: 5 years, $35 million to $70 million.
- Structures—
  Small: 3 years, $6 million.
  Medium: 4 years, $16 million.
  Large: 6 years, $20 million to $30 million.
- Aerodynamics—
  Small: 3 years, $3 million.
  Medium: 4 years, $7 million;
  Large: 5 years, $10 million to $15 million.
- Systems—
  Small: 3 years, $3 million.
  Medium: 4 years, $11 million.
  Large: 5 years, $15 million to $20 million.
- Total STAT readiness program—
  Small: 3 years, $18 million;

[4] National Aeronautics and Space Administration, Small *Transport Aircraft Technology,* draft report of the Aeronautics Advisory Committee's Ad Hoc Subcommittee on Commuter Air Transport Technology, Dec. 22, 1980. See also Louis J. Williams (NASA-Langley) and Thomas L. Galloway (NASA-Ames), "Design for Supercommuters, " *Astronautics and Aeronautics,* vol. 19, No. 2, February 1981, pp. 20-30.

Medium: 4 years, $58 million;
Large: 5 to 6 years, $80 million to $135 million

The response to these draft proposals from commuter operators, aircraft manufacturers, and aviation officials familiar with the details of the STAT program varies considerably. One successful commuter operator has said that STAT could be very important to marginal cities that might otherwise lose their air service, and that he would like to be able to buy such aircraft from U.S. manufacturers—"It tears you apart to go overseas. "[15] Other commuter operators agree but add that NASA should be looking at faster aircraft (400 mph propfans rather than 300 mph turboprops) optimized for longer routes, since the average commuter stage length has already risen to 120 miles and will probably rise to 200 miles with the end of 406 subsidies.[16]

The Senate Committee on Commerce, Science, and Technology has indicated that NASA should also look at the requirements of low-density, long-haul routes. [17] Small aircraft of this type might be profitable in nonhub-to-nonhub markets, and larger aircraft on routes between medium hubs (see ch. 3). One U. S. firm, DuPont Aerospace, has announced plans for an innovative **30-** to 45-passenger twin-jet for such routes, but other sources think that turboprop or propfan propulsion would be preferable on routes up to 1,000 miles. Another domestic manufacturer contends that the major market opportunity after 1985 will be for larger turboprop aircraft—60 to 100 passengers—on regional routes of up to 850 miles. 'e Several major airlines have also indicated that they might consider buying a larger 150-seat turboprop or propfan, if the technology is successfully demonstrated and the aircraft economically produced.

Other observers, however, point out that time is crucial: initial orders lead to follow-on orders, and markets lost to foreign manufacturers may be irretrievable, They therefore recommend that the STAT program be accelerated or simplified in order to produce short-term results that can be applied quickly by U.S. manufacturers. Particular priority has been given to the aft-mounted engine configuration, for instance. One industry expert has suggested that the quickest, cheapest, and most useful thing NASA could do would be to rear-mount existing turboprop engines on an existing airframe for aerodynamic and cabin-noise tests.[19] A NASA official involved in the STAT program agrees that configuration and aerodynamics are perhaps the highest priority and that such a test-bed aircraft, for checking the tradeoffs with different wings and engine mounts, would be desirable "not too far into the program. "[20] Others stress the need to evaluate the performance of propfan engines on this test-bed aircraft. Gulfstream American, which is eager to stay in the commuter market, has already offered NASA the wind-tunnel models of its G2 and G3 executive jets for use in tests of the aft-mount configuration. Fairchild and Cessna are also interested in the configuration, as are Aerospatiale, Fokker, and Saab among foreign manufacturers.

A far more fundamental question with regard to the proposed STAT readiness program, however, was raised by the chairman of the NASA advisory committee that reviewed it: "would an increased flow of new technology from NASA as a result of conducting research in applicable areas, in fact, be *used* by the U.S. aircraft industry in developing a new commuter aircraft?"[21] Industry representatives have been pessimistic until recently, in part because of market condi-

---

' 'Angelo Koukoulis, president of AeroMech, interview, July 10, 1981.

"Dick Henson, president of Henson Aviation (Allegheny Commuter), interview, June 23, 1981; Ken Cardella, president of Cochise Airlines, interview, June 24, 1981.

"U.S. Senate, Committee on Commerce, Science, and Transportation, "National Aeronautics and Space Administration Act, 1982, " Report No. 97-100, May 15, 1981, p. 37.

"James J. Foody, vice president for aerospace development, and Samuel C. Colwell, director of market planning, Fairchild Industries; interview, June 15, 1981, and private communication, June 17, 1981. See also their "New Horizons for the Turboprop in Airline Service" and "Role of the Turboprop in the Air Transportation System for the 1980's and Onward, " mimeos, n.d.

"James J. Foody, vice president for aerospace development, Fairchild Industries, interview June 15, 1981.

[20]Louis J, Williams, head of the General Aviation and Commuter Technology Office, NASA Langley Research Center, interview, June 26, 1981.

"Robert J. Loewy, chairman of the NASA Aeronautics Advisory Committee, letter to Walter J. Olstad, NASA Acting Associate Director for Aeronautics and Space Technology, Mar. 26, 1981; emphasis his.

tions; but several NASA officials feel that there is every indication that U.S. manufacturers will in fact use the technology once it is brought to sufficient readiness. In a sense they would have to do so, in order to remain competitive in an increasingly crowded market. The initial advantage would accrue to U.S. firms who participate in the NASA research activities, but the results would eventually become available to their foreign competitors, many of whom are already actively pursuing these technologies: Dornier is using advanced-technology wings, composites, and manufacturing techniques in its new 228/100 and 200; Aerospatiale and Aeritalia are applying advanced aerodynamics, active controls, and propellers in their ATR-42; and there are indications that Japanese firms like Mitsubishi may soon begin work on advanced turboprop commuter aircraft.

Beech, Cessna, Fairchild, Gulfstream American, and Lockheed-Georgia have all expressed an interest in the STAT program and a willingness to apply at least some of the technological improvements it might produce. The revolutionary Lear Fan executive propfan, and the recent advances in U.S. business aircraft technology generally, indicate that U.S. firms can and will apply advanced technology aggressively in order to remain competitive in a lucrative market segment. Nevertheless, there are significant barriers to the development of a family of advanced-technology commuter aircraft in the United States. One such barrier is financing the necessary R&D: another is the delay and costs arising from an uncertain FAA certification process; a third is the financial risk inherent in competing with Government-assisted foreign manufacturers. Some observers believe that a well-funded, well-designed STAT program would encourage manufacturers by demonstrating Government support for their attempts to develop and certify new commuter aircraft. These issues, as well as the more specific issue of how to ensure that STAT's advanced technologies will actually be used by U.S. manufacturers, still remain unresolved.

U.S. GOVERNMENT PRINTING OFFICE : 1982 89 - 89-431