

TRANSPORTATION
RESEARCH

Number 390, February 1992

CIRCULAR



Future Aviation Activities Seventh International Workshop

LIBRARY
TRANSPORTATION RESEARCH BOARD
2101 CONSTITUTION AVE.
WASHINGTON, DC 20418

National Academy of Sciences
September 12-13, 1991
Washington, D.C.

TRANSPORTATION RESEARCH BOARD / NATIONAL RESEARCH COUNCIL

**FUTURE AVIATION ACTIVITIES
SEVENTH INTERNATIONAL WORKSHOP**

**National Academy of Sciences
September 12-13, 1991
Washington, D.C.**

**FEDERAL AVIATION ADMINISTRATION
COMMITTEE ON AVIATION ECONOMICS AND FORECASTING
COMMITTEE ON LIGHT COMMERCIAL AND GENERAL AVIATION**

**WORKSHOP COMMITTEE
Co-Chairmen:**

**John W. Fischer, Congressional Research Service,
and Chairman, Committee on Aviation Economics and Forecasting
Jack Wiegand, Forecast International,
and Chairman, Committee on Light Commercial and General Aviation**

Moderators:

**Gerald Bernstein, SRI International (International Aviation)
Steven Horner, Canadair (Regional Airlines)
Gerald S. McDougall, Wichita State University (Business Aviation)
Richard R. Mudge, Apogee Research, Inc. (Airports)
Paul Steggerda, Honeywell, Inc. (Aircraft and Equipment Manufacturers)
Ronald L. Swanda, General Aviation Manufacturers Assn. (Light General Aviation)
Nawal Taneja, Ohio State University (Major Domestic Airlines)**

**Larry L. Jenney, Senior Program Officer, Aviation,
Transportation Research Board Staff**

Subscriber Category
V aviation

Transportation Research Board
National Research Council
2101 Constitution Avenue, NW
Washington, D.C. 20418

The Transportation Research Board is a unit of the National Research Council, which serves as an independent advisor to the federal government on scientific and technical questions of national importance. The Research Council, jointly administered by the National Academy of Sciences, the National Academy of Engineering, and the Institute of Medicine, brings the resources of the entire scientific and technical community to bear on national problems through its volunteer advisory committees.



Future Aviation Activities

Seventh International Workshop

National Academy of Sciences
September 12-13, 1991
Washington, D.C.

TRANSPORTATION RESEARCH BOARD / NATIONAL RESEARCH COUNCIL

LIBRARY
TRANSPORTATION RESEARCH BOARD
2101 CONSTITUTION AVE.
WASHINGTON, DC 20418

TABLE OF CONTENTS

INTRODUCTION	3
MAJOR FINDINGS	3
PRESENTATIONS	
The Overall Economic Picture	
Nariman Behraves, Oxford Economic Forecasting	6
Financial Conditions and Issues in the Airline Industry	
Edmund S. Greenslet, ESG Aviation Services	10
Airport and Airline Security	
Wilfred A. Jackson, Association of Airport Councils International	16
Ten Years to 2002 in Retrospect	
Robert J.C. Ebdon, British Airways	21
PANEL REPORTS	
Major Domestic Airlines	
Nawal Taneja, Ohio State University	25
Regional Airlines	
Steven Horner, Canadair	28
International Aviation	
Gerald Bernstein, SRI	32
Business Aviation	
Gerald S. McDougall, Wichita State University	37
Light General Aviation	
Ronald L. Swanda, General Aviation Manufacturers Association	43
Aircraft and Equipment Manufacturers	
Paul Steggerda, Honeywell, Inc.	50
Airports	
Richard R. Mudge, Apogee Research, Inc.	53
APPENDICES	
A. Airport Development, Infrastructure, and Air Express Growth	56
B. Participants	59

INTRODUCTION

The Seventh International Workshop on Future Aviation Activities, the latest in a biennial series that began in 1979, was conducted by the Transportation Research Board in Washington, D.C., on September 12-13, 1991. Sponsored by the Federal Aviation Administration, this workshop was intended to provide insights into the long-term outlook for civil aviation for the benefit of managers and decision-makers in the public and private sectors. The topics discussed included the long-term economic outlook, the structure and operations of major and regional domestic carriers, the globalization of commercial aviation, developments in aircraft technology, airport infrastructure, trends in business aviation, the outlook for personally owned and operated aircraft, and the civil use of vertical-lift air vehicles.

The workshop was attended by 105 invited participants drawn from government, industry, academic institutions, and private consulting firms. The majority were from the United States, but there was significant representation from Canada, England, France, the

Netherlands, Switzerland, and several foreign firms with offices in the United States.

The program was divided into three parts: an opening plenary session consisting of presentations by distinguished speakers on the broad outlook, seven concurrent panels on sectoral interests and trends, and a concluding plenary session where panel moderators summarized the findings and conclusions of their group discussions.

The reports of the panel moderators represent the views of panel participants and not necessarily those of the moderator, his organization, the Transportation Research Board, or the Federal Aviation Administration.

The Transportation Research Board is indebted to all who took part for the generous gift of their time and experience, especially to the panel moderators and to the workshop co-chairmen -- John W. Fischer of the Congressional Research Service and Jack P. Wiegand of Forecast International -- who so ably organized the endeavor and prepared this report of the proceedings.

MAJOR FINDINGS

MAJOR DOMESTIC AIRLINES

The panel believed that the U.S. airline industry will continue to consolidate. By the end of the 10-year forecast period the panel expected the industry to consist of four or five very large major carriers, approximately 50 large-regional/small-national carriers, and a few small niche carriers. The surviving large carriers are expected to wield extensive market power. The transformation will be gradual over the 10-year period. However, a continued recessionary environment could hasten this development.

The transformation of the industry will be driven by a number of factors, each with significant implications. Among these factors are 1) the effects of continued industry overcapacity in a period of weak traffic growth, 2) the inability of all but the strongest firms to attract capital. (Access to foreign capital was not viewed as a solution to the capital problems of marginal carriers.), 3) rationalization of airline fares over time. (A high fare regime was viewed as unlikely for a number of reasons.)

The prospect for new entrants into the market is not great. Some small niche markets might be found, but even the best of these presents a large number of operational barriers for would be new entrants. The change in the structure of the industry will not

significantly reduce congestion problems systemwide. The panel also believed that aircraft size will not necessarily increase and that the availability of good used aircraft could lead to a decline in orders for new aircraft.

The transformation process will effect certain airports serving as hubs for marginal airlines. The disappearance of these carriers will reduce traffic at these airports. The disappearance of marginal carriers at airports with significant origin and destination traffic will not necessarily reduce airline activity at these points. Continuing concentration in the industry was viewed as giving airline labor significantly increased leverage. The Federal Government's role in industry oversight is expected to increase over the forecast period.

REGIONAL AIRLINES

Regional airlines are poorly understood by other segments of the air transport industry, the press, the consumer, and the general public. Unfortunately, this disadvantage is magnified in times of uncertainty, such as in the years following airline deregulation and, more recently, in a period of recession and financial difficulty for the air carriers.

After analysis of the issues confronting the industry, the panel concluded that the future of regional aviation is clear, but not altogether positive. For regional airlines the number of competitors, both domestically and internationally, will continue to decline. Regional airlines are expected to continue in an evolutionary process of affiliation, consolidation, and integration. Integration, however, may not be the final phase of evolution. Two major airlines are in the process of reevaluating their relationship with regional carriers because integration of regional airlines with their major partners appears to strip the regional carriers of the benefits of their size. This could lead to divestiture of integrated regional airlines if the major partner determines that continued investment is not worth the level of value added.

For the regional aircraft manufacturers the situation is worse. Regional carriers have a significant amount of overcapacity, and the current period of economic difficulty has brought the issue to a head. Partnerships and consolidation are around the corner. With financing problems and reduction in the number of customers, the airlines will be seeking to purchase in greater volume at lower prices, which could force a spiral of consolidations. The logical outcome will be fewer manufacturers and higher prices, which will result in lower potential sales volume for new aircraft.

Despite these difficulties, the outlook is relatively bright. Regional airlines are, and will continue to be, an economical alternative to large carrier service. This has been shown in the past through the large number of passenger transfers between regional and major carriers. The volume of transfers is expected to increase as the major airlines retire small jets and shift service on routes formerly served by these aircraft to regional carriers. The transfers may increase even more rapidly through the use of innovative regional aircraft with the capability of exploiting new short-haul markets.

The major uncertainty remains the effect of consolidation, which could result in a more stable and perhaps profitable environment for regional and major airlines alike, as well as aircraft manufacturers and equipment suppliers.

INTERNATIONAL AVIATION

The international panel focused on infrastructure issues. Congestion problems were seen as major barriers to airline growth in the near term. Europe has an existing air traffic control problem combined with a long-term problem of airport capacity. In Asian markets the reverse situation exists, i.e. airport capacity problems now and air traffic control problems in the long term.

The issue in other regions such as Latin America is one of inefficient and at times unsafe operational practices.

The panel identified a number of key issues that needed to be addressed as part of any expansion of international aviation infrastructure. 1) There are no technological barriers to system growth and many existing problems could be solved with off-the-shelf technology. 2) Financial problems are major barriers to improving infrastructure in many places. 3) Environmental concerns will be major barriers to system growth. 4) Institutional problems, such as the question of whether international bodies such as ICAO can set standards, were viewed as possible major barriers to infrastructure expansion and coordination.

The panel, although accepting forecasts for system growth made in the plenary session, singled out the following factors that are expected to influence demand for infrastructure. International hub-bypass service was not seen as having a major effect on reducing demand at congested hubs. Teleconferencing will not have a significant impact on airline traffic over the next 10 to 20 years. The effect of high speed rail on the overall system will be negligible. Growth in the air express market, combined with a move to increased daylight operations, could increase congestion problems over and above those foreseen as a result of expected growth in passenger traffic.

BUSINESS AVIATION

Following a period of industry consolidation, production rationalization, and slower domestic growth in utilization of business turbine aircraft, the business aircraft sector is entering another transition phase. New forces are at play, and it is likely that the business aviation industry and the Federal Aviation Administration will have to adjust to changed circumstances.

There is evidence that the U.S. business turbine market is nearing maturity. Significant growth will occur in international markets and fleets, especially in Europe and Latin America over the next 10 years. The Pacific Rim will show modest growth in business turbine aircraft activity over this period. The U.S. domestic fleet will show little growth, and the U.S. market share of the worldwide business fleet will decline over the next 10 years as international markets develop. The United States will continue to be a net supplier of used aircraft.

Nonetheless, there is uncertainty about the status of the existing business turbine aircraft fleet and the availability of high-quality used aircraft for domestic and international use. There appears to be a significant oversupply of used aircraft on the market (approximately

1,100 units), but many appear to have a high number of hours (in excess of 5,000). Others may not actually be available because of softening prices.

Unprecedented development and introduction of new products are expected over the next decade in response to changing demands of the business customer. Corporate owners and operators are looking for aircraft with longer ranges (trans- and intercontinental), higher speeds, and greater interior space. The market position for the new small jets under development is unclear. New products could revitalize some domestic market segments (e.g., business turboprops) and provide a boost to domestic business turbine activity. Domestic fleet growth and utilization, however, will mirror growth in real economic activity.

Because of the increasing importance of international sales, airframe manufacturers will need to evaluate marketing strategies to mesh with social, economic, and institutional differences across diverse foreign markets. The industry and FAA should begin to develop systems for tracking and monitoring business aviation activity in major foreign areas.

Despite the forecasted international growth, the turboprop market is not likely to recover unless 1) new engines can be developed in the \$125,000-\$175,000 range, 2) new manufacturers enter this market segment, 3) there is increased marketing activity, 4) engine and airframe manufacturers coordinate development efforts with realistic product specifications and design, and 5) the single-engine turboprop hits an active market niche. The impact of new small jets on the upper end of the business turboprop market is uncertain, but there is likely to be some leakage from the turboprop market to the new small jets.

LIGHT GENERAL AVIATION

The panel considered the following to be the significant trends for the coming 10 years in light general aviation.

The size of the U.S. piston-powered general aviation airplane fleet will remain relatively constant. Passage of legislation providing product liability reform, or institution of simplified aircraft certification procedures, could cause the fleet to grow at rates equalling U.S. GNP growth.

Flying for personal and instructional purposes will continue to increase. As the current fleet of piston-powered aircraft ages, used aircraft will not be able to adequately satisfy demand. New aircraft sales will be stimulated, bringing additional aircraft into the fleet.

Many of these new aircraft may be factory assembled aircraft designed originally as aircraft kits for owner assembly.

Piston-engine aircraft flying for other than personal or instructional purposes will continue to decline. General aviation business travelers will continue to choose to travel in turbine-powered aircraft.

New aircraft designs will enter the piston-powered general aircraft fleet primarily through the kit-built industry.

Because of increased inspection requirements for older aircraft and better understanding of the affects of aging, future aircraft buyers will be better able to ascertain the true airworthiness condition of used aircraft. The attrition rate for used piston-powered aircraft will increase.

As the general aviation fleet ages, there will be increased demand for retrofit of avionics equipment and other aircraft systems.

The number of airports open for public use will continue to decline, somewhat depressing the growth possibilities for general aviation.

Because of the continuing federal deficit and the surpluses accumulating in the Aviation Trust Fund, small airports will find it increasingly difficult to get federal funding assistance for airport improvements, thus reducing the utility of these airports.

The number of hours flown by the piston-powered airplane fleet will grow at the same rate as GNP.

The number of active general aviation pilots will continue to decline, but the average hours flown by the remaining pilots will increase.

Federal regulations will require more equipment on light general aviation aircraft, especially if those aircraft operate near large metropolitan areas. Even though each additional piece of equipment may have a small incremental cost, the combined effect will increase the cost of flying beyond the means of some operators, especially those that fly for recreation. Pilots who fly relatively few hours per year may become inactive or sell their aircraft.

Mandatory additional recurrence training for pilots will cause relatively inactive pilots to become completely inactive. Those pilots who remain active, however, will be more competent and skilled. Since most accidents involve pilot error, the general aviation accident rate will continue to improve.

AIRCRAFT AND EQUIPMENT MANUFACTURERS

It is likely that 1991 will be the peak delivery year for commercial jet aircraft. Annual deliveries will decline to the level of 500 to 600 by 1996 and remain in that range

through 2005. During this period the average aircraft size, in terms of seats, will grow. A significant market will remain for new 120-seat aircraft to serve new secondary hubs that will be developed during the forecast period.

The size of the total airline fleet is expected to grow from 8,961 at the end of 1990 to an estimated 13,730 in 2005. This 53-percent growth is based on an average world annual traffic increase of 5.2 percent, combined with slow, but steady growth in average aircraft load factor to 67.2 percent in the last five years of the forecast period.

Aircraft retirements are expected to number 4,052 during the forecast period. The majority of these retirements will take place in the class II aircraft group due to the large number of DC-9 and 727-100 aircraft in the present fleet. The forecast, in fact, shows that retirements in the class II group will actually exceed new deliveries of this type aircraft for the forecast period.

The panel felt that moderate long-term growth in the airline industry was likely. It also believed, however, that an element of caution in using this forecast is essential. A number of issues such as overcapacity and the availability of capital for aircraft replacement could have a significant effect this forecast.

AIRPORTS

The airport panel conducted a wide ranging discussion of issues effecting the aviation system in general and airports in particular. Listed below are the major observations resulting from these discussions.

- There is considerable interest in non-capital (new construction) alternatives to deal with capacity problems.

- The economic difficulties of the airline industry will be a continuing problem for airports, but a problem that is not expected to worsen.

- The growing power of airlines in the airline-airport interrelationship is of considerable concern. New mechanisms for negotiating airline-airport agreements, such as regional authorities, might bear further examination.

- Traditional airport planning has a number of shortcomings. Better strategic planning, combined with an expanded view of related issues, i.e. addressing regional and multimodal problems, is required.

- Public understanding of the value of aviation must be increased. Increased public awareness of the benefits of aviation will be a major factor in removing environmental barriers to airport increased activity.

- Financial pressures on airports are increasing with a concomitant increase in financial risk.

- Regulatory burdens placed on airports are increasing and creating new problems for airport operators. These burdens could be reduced through better planning by, and coordination with, government regulators.

PRESENTATIONS

THE OVERALL ECONOMIC PICTURE

Nariman Behravesb

Oxford Economic Forecasting

THE SITUATION TODAY

One has to be very humble when approaching the subject of the economic outlook. Given the events of the past couple of years and certainly the past month, it is fair to say that the age of uncertainty is upon us with a vengeance. Perhaps this age of uncertainty is best epitomized by a story that was actually told by one of its chief protagonists, none other than Mikhail Gorbachev himself.

The story, as he told it at the Conference on European Security in November 1990, is that he, Francois Mitterand, the President of France, and George Bush were commiserating about their bad lot in life.

Mitterand said he really had it tough. He has 100 mistresses. One of them has AIDS. He didn't know which one. Bush said he had it worse than that. He has 100 security guards. One of them is a terrorist. He does not know which one. Gorbachev said he had it far worse than either. He has 100 economists. One of them is smart. He doesn't know which one.

As we look at the economy of the world and the United States, we can say a couple of things at the outset. One is that the United States is going through a recession which is milder than average. The world economy is going through a significant downturn which is also mild, relative to the 1982 or the 1975 experiences.

Both the U.S. and the world economies are expected to recover, but the recovery will be a relatively modest one, again by historical standards. This is small comfort for the airlines and the air transport industry because the unique nature of this particular downturn has hit them with a triple whammy.

The first, of course, the downturn in economic activity reduced traffic. That was a predictable result. But there were two other characteristics of this particular downturn that really hurt the airlines. Oil prices rose, squeezing airline profit margins. Finally, there was the scare factor. The war and all the terrorist threats that went with it clearly scared a lot of people, putting a crimp on travel. We are not yet back to pre-war traffic levels. Thus, the downturn has hurt the airlines very badly even though by historical standards the economic measures suggest that it is a relatively mild downturn.

In the longer run, we can be more optimistic. The world economy will recover, growth will resume, and the airline industry will do well in the decade to come. However, there will be some significant regional differences worldwide that should be borne in mind.

Let us break this down into three sections: first, the recent recession; second, the recovery both in the near term and the longer term for the United States and the world; and finally, the expected effects and the risks for the air transport industry. I do not pretend to be an expert in this area, but there are some obvious and logical consequences of what I am about to say about the economic outlook.

The recent recession in the U.S. economy, has been maybe half as deep as the average post-war recession. Whether measured by GNP, unemployment, or any other measure, it was not a very deep recession. The profile is not the traditional V-shaped downturn but more of a saucer-shaped depression.

There are at least two reasons for this. First this is a recession in which export growth has stayed quite strong and acted as a cushion for many businesses, the aircraft industry being one of them. Second, many U.S. industries, having learned some hard lessons in the 1970s and 1980s, have maintained very tight control over their inventories. This downturn has not been accompanied by the kind of inventory swings seen in past recessions where inventory reductions compounded or worsened the depth of the recession.

It is important to bear in mind that there was a slowdown in the works even before the recession started. On a worldwide basis, for example, growth was about four percent in 1988. This year, it is only about one percent.

In the United States the slowdown started in 1989. Since the second quarter of 1989, we have not had a single quarter of growth above two percent in the United States. That is very low growth, even for the United

States. Thus, the slowing trend had already set in for a variety of reasons. The Federal Reserve had tightened credit because of inflation fears. Further, high debt levels, not only in the government but also in the private sector were constraining spending. Third, there were huge problems in the financial sector, where the shake-out still continues and constrains growth. Finally, because of our trade problem, manufacturing has had to go through a restructuring, which has placed additional constraints on growth.

I could go on, but the point is that there are a number of long-term structural factors that have slowed the U.S. economy. The recession, itself, was probably triggered by the oil shock. The combination of higher oil prices and the scare factor was enough to plunge the country into a recession. However, we were already in a very slow growth period which made the economy very vulnerable to shock. We got a shock, we went into a recession, we are now coming out of that recession. And just to steal some of my thunder from later on, we are going to come back on a slow growth profile. There is nothing that suggests that growth in the U.S. economy will be anything other than modest.

If we look at the world, the picture is similar, but there are some differences. The United States is not the only country to tighten monetary policy; similar steps have also been taken in Germany and Japan. This has had the effect of slowing down growth worldwide. In many major countries, as in the United States, there has been fiscal contraction and very tight budget policies. The major exception to this trend among economically advanced nations is Germany, which I will touch on in a moment.

There is also some special problems worldwide. In Japan, speculation in the stock market had brought about a huge rise in stock values. The recent collapse in stock prices has made Japan more vulnerable. Growth will slow down in Japan, but not enough, so far as I can tell, to bring on a full-fledged recession. In Germany unification has meant higher interest rates, higher inflation, and higher unemployment in what was formerly East Germany. This has imposed costs on Germany that it will have to pay off in the next few years. And, last but not least, there are huge problems in the Soviet Union and Eastern Europe which, if nothing else, add to the uncertainty that we are facing. In Eastern Europe, the recessions are very deep. There have been reductions in output of 5 to 15 percent.

THE COMING RECOVERY

As we look ahead, we can expect a modest recovery, especially in the United States. However, we still have a lot of old problems: high debt levels both in the private and public sectors, turmoil in the financial markets, and the restructuring of the economy toward more export-led growth.

The Near Term

Many people are wondering if, indeed, there is going to be a recovery. There are a number of analysts who are concerned about a double-dip recession scenario, where we come out of the recession for a very brief period and then plunge back in before eventually recovering. I am rather skeptical about this scenario for a number of reasons. The most important is that the Federal Reserve seems very committed to getting this recovery on its feet. It has been lowering interest rates and will likely lower them a little more in the next few months. Inflation has come down quite a bit. Inventories are low. Exports are still in good shape. This suggests that the recovery, while modest, is likely to continue.

There are signs now that the U.K. is coming out of its recession. While Germany will go through a difficult period, it is likely to be able to avoid a recession and muddle through its difficulties. It is a powerful and resilient economy, and it will likely not drag down the rest of Europe. Eastern Europe and the Soviet Union have huge problems, and their economies will continue to contract for a while before they start their recoveries.

I am much more optimistic about Japan and Asia. Despite the problems in Japanese financial markets, Japan is an extremely resilient country. Japanese manufacturing has been spared many of the problems that the financial sectors have gone through, and we can be fairly confident that -- although growth will slow down -- Japan will not go through a full-fledged recession. The rest of Asia is growing briskly and continues to be one of the brightest spots in the world economy

The Next Ten Years

Over a longer period, the next 10 years, the picture changes somewhat. The expectation for U.S. is growth to remain relatively modest -- maybe 2.5 percent average annual growth throughout the decade. I am a little more optimistic about growth prospects at the end of the decade. Productivity could be higher in the United States, both in manufacturing and services.

The way to characterize European prospects is, on the one hand, promising in terms of what could happen but also fraught with risks, most of which relate to absorbing and reintegrating Eastern Europe and the Soviet Union into the Western European structure. The liberalization process that has occurred in Eastern Europe and now more recently in the Soviet Union has forced the hand of the European Community to broaden its base and perhaps become less protectionist. The long-term prospects for Germany are very bright. Even the long-run (10-year) prospects for Eastern Europe look good. In 10 years' time, countries like Hungary, Czechoslovakia, and Poland will be in reasonably good shape. The Soviet Union has a much longer road to go and many more problems than the other former Soviet Bloc countries.

Throughout the next decade we will see very fast growth in Japan and Southeast Asia. Other regions, like the Middle East, will probably do fairly well.

What does all this mean for the air transport industry? The expected economic growth worldwide is certainly consistent with something close to a doubling of traffic in the next decade. Clearly, there will be regional differences. In Europe traffic may only grow by about four percent annually. In Asia we could see annual growth as high as eight percent.

RISKS AND PROBLEMS

I have spoken about the age of uncertainty and the moderately optimistic outlook for the U.S. and world economy. Now I want to focus on risks, both short-term and long-term.

Economic Uncertainty

In the short run it is possible, although not very likely, that recovery in the United States could falter for a number of reasons. If growth outside the United States slows down and our exports to the rest of the world with it, the U.S. recovery could be in jeopardy for the next year. The restructuring of manufacturing and the shake-out in various financial industries could prove to be too painful and could have a ripple effect throughout the economy. The financial crises and the credit crunch could spread. Any of these factors could bring about an end to economic recovery and trigger a double dip.

In Japan a financial collapse, while unlikely, is not out of the realm of possibility. In Germany it is always possible that unification could derail. And last, but again by no means least, the problems in the Soviet Union -- economic and political -- could easily spread to the rest of Europe, bringing an untold set of problems.

Shortage of Capital

In the longer run, there are two more risks that would have important ramifications for the airline aircraft manufacturing industries. First is the concern that has been expressed recently about a worldwide capital shortage. The restructuring of Eastern Europe, the rebuilding of Kuwait, and the capital demands in the Third World suggest that there will be pressures on the supply of capital. Right now, capital shortage is not of great concern, but it is certainly possible as we enter the middle of the decade that shortage of capital could exert upward pressure on real and nominal interest rates, which in turn could create financing problems for the airlines.

Protectionism

The other long-term risk is much more troubling because it already has created friction worldwide and could continue to be a source of difficulties. I refer to trade frictions. Here, everybody is to blame. The Europeans in certain industries have a fortress mentality. They are unabashedly willing to subsidize industries, including the aircraft industry. Europeans are quite willing to condone forms of protection for what they call national and European champion industries. Agriculture is one of the most flagrant examples.

Japan is just as much to blame. The Japanese have a rather mercantile mentality, and they seem unwilling to give up on their export drive. I will not belabor the point here. I am not a Japan basher; but on the other hand, I think there is a lot the Japanese could do to further the process of multilateral trade. The United States is also clearly not blameless, in that we have turned away from being a champion of free trade to what I call a sulker, a whiner, and a little bit of a spoilsport. We tend to say that because we are not able to sell our goods the way we used to, we are going to take our ball and go home. That is a very dangerous position for us to take.

Trading Blocks

There is a tendency these days to say that it is okay for the world to coalesce in the trading blocks. This is wrong, especially from the perspective of the airline and aircraft manufacturing industries.

If the world does form trading blocks, one implication would be that Boeing would not be able to sell as effectively in Europe or Japan. I doubt Boeing would be terribly happy with that. The same could be said about airline expansions. If we move toward a world of

megacarriers, the future growth of United, Delta, or American Airlines would be heavily constrained by the formation of trading blocks.

It would be a mistake, both for U.S. multinationals and European and Japanese industries to acquiesce to trading blocks. The erection of barriers and creation of spheres of influence would limit trade growth, and with it economic growth.

Other Risks

Finally, just a few words on the inherent risks to the air transportation industry. Clearly, trade frictions are high on the list because they could create serious problems for airlines and the airplane manufacturers. Financing problems resulting from a capital shortage are also risks that could arise in the 1990s.

One other area of concern that I have not mentioned due to lack of time is environmental issues, not only in the United States, but also in Europe and maybe eventually in Asia as well. Noise pollution and air pollution could create serious problems and challenges for the aviation industry.

In addition to the external risks enumerated above, commercial aviation also faces the internal risk of congestion of airports, airways, and air traffic control facilities that could constrain growth as severely as any of the economic factors I have mentioned.

QUESTIONS AND ANSWERS

Question: Would you comment on the effects of the 1986 tax law changes on the economy?

Dr. Behraves: I did not like the 1986 tax law changes, and I will tell you why. At a time when we wanted to restructure the national economy toward investment and exports and away from consumption, the tax incentives had exactly the opposite effect.

However, I also have to say that the effect was not large. There is very little evidence that changes in tax law were even remotely responsible for the current recession. The new tax laws clearly had an effect on investment in 1986 and 1987, but by 1988 investment was very strong. Even in 1989 it was strong. Thus, while I have problems with the tax law as long-term policy, it was not a driving force behind the recession.

Question: I find your economic forecast conservative. An annual GNP growth rate of 2.5 percent would be the lowest in 30 or 40 years. Please explain your assumptions.

Dr. Behravesh: My assumed GNP growth rate is about 2.25 to 2.5 percent. Three driving forces underlying this assumption are labor force growth, productivity growth, and the price of petroleum. Labor force growth is slowing down, largely for demographic reasons. There may be some pick-up in productivity growth. The key is what is going to happen to the services industry as a result of restructuring. I also expect that the price of oil will increase at a rate higher than inflation -- from the present \$22 per barrel to perhaps \$30 or even \$35 by the end of the decade.

Question: Most economists seem to focus on the depth of the U.S. recession rather than its length. We have had six quarters of negative growth and two quarters of slow growth before that. Combining that with the six months that you expect for an upturn, we will have had two and one half years of substandard growth. Is that mild in comparison to previous downturns?

Dr. Behravesh: The answer has to be no at some level. It may help to approach your question in a different way by comparing the unemployment rate now with that which we would have in a condition of "full employment". Our actual unemployment rate has been above the full employment rate, but it has not spiked as it did in past recessions. Still, it has been above the full employment rate and is likely to remain there for some time. The reason is very clear. The Federal Reserve Board has engineered such an outcome in an attempt to get inflation down. It has been a very clear policy goal of the Federal Reserve Board to keep growth low in an attempt to hold inflation down, and they have met with some success.

But to answer your question, you are absolutely right. We have been operating at a level well below our potential for some time, and I expect we will, in some average sense, continue to do so for several months to come.

FINANCIAL CONDITIONS AND ISSUES IN THE AIRLINE INDUSTRY

Edmund S. Greenslet
ESG Aviation Services

I am going to pick up some of the ideas expressed by the previous speaker about the broad economic scale. My intent is to relate these remarks more closely to the industry that we all pay a lot of attention to and that we are all here to discuss -- the airlines and the aircraft manufacturing industry.

I do not think there is a better place to start than to observe that, if this is a mild recession, you certainly cannot tell it by looking at the airline industry. In fact, the economic state of the airline industry is by a wide margin the worst it has ever been.

Go back to the early 1980s, the most recent recession period. The operating margin for the world's airlines at the trough of that recession was a shortfall of 1.4 percent in operating revenue. The operating loss for the world's airlines last year was 3.3 percent of revenue, more than twice the margin of loss in a recession that was arguably substantially milder. Not only was the 1980 recession milder but so was the rise in fuel price. Everybody loves to talk about the fuel price factor, and most airline managements were delighted to have fuel price go up because it gave them something to point the finger at and say don't blame me for all these lousy results, look at what happened to fuel.

Fuel in 1990 went up, but it came back down again early in 1991. Even while it was going up, it was nothing like the early 1980s and the mid-1970s. Those fuel price increases were order of magnitude greater than the fuel price increase of late 1990, and yet the devastation on the earnings front was substantially greater.

This suggests that there might be more to this story than meets the eye. It might also suggest that airline managements are not being totally candid when they point to higher fuel cost as the causative force. As recently as yesterday, Bob Crandall blamed fuel price along with a couple of other things for the reduction in American Airlines' capital spending plans. We will get back to this point a little later.

WHERE THE INDUSTRY IS TODAY

I want to walk through the recent results and cite some of the contributing causes that were of no small moment in bringing us to the present situation. Then I will examine some of the consequences. The handout that you just received (table 1) displays key economic indicators that I will refer to as we go along.

Obviously fuel played a role. Nobody denies that. The jump in fuel prices did hurt financial results severely in the fourth quarter of 1990. But I must point out that during 1989 and 1990, all costs other than fuel were increasing more rapidly than revenue. This is true on a world basis, as well as in the United States. If we take the fuel factor out, neutralize it completely, we still find excessive growth of overall operating expenses that exceeded the growth in revenue by a significant margin.

TABLE 1 WORLD AIRLINE OPERATING RESULTS AND CAPITAL REQUIREMENTS*

Year	International Civil Aviation Organization data (ex USSR)					AIRLINE MONITOR Projections for:			AIRLINE MONITOR Protected Capital Needs for:				% of Net Internal Funds Required - Cash Flow	
	Revenue	Pct. Chg.	Expenses	Pct. Chg.	Oper. Ratio	Net Income	Net Profit Margin	Depreciation	Cash Flow (Dep+Inc)	New Aircraft Delivered	Ground & other Equip.	Total Capital Needs		
Forecast:														
1999	486,616	11.0	462,285	11.0	24,331	12,165	2.5	24,331	36,496	56,235	6,748	62,983	172.6	26,487
1998	438,393	11.0	416,473	11.0	21,920	10,960	2.5	21,920	32,879	53,566	6,428	59,994	182.5	27,114
1997	394,949	11.0	375,201	11.0	19,747	9,874	2.5	19,747	29,621	49,976	5,997	55,973	189.0	26,352
1996	355,810	11.0	338,019	11.0	17,790	8,895	2.5	17,790	26,686	43,963	5,276	49,239	184.5	22,553
1995	320,549	11.0	304,522	11.6	16,027	8,014	2.5	16,027	24,041	41,819	5,018	46,837	194.8	22,796
1994	288,783	11.0	272,900	11.6	15,883	7,942	2.8	14,439	22,381	42,456	5,061	47,234	211.0	24,853
1993	260,165	13.0	244,555	10.6	15,610	7,805	3.0	13,008	20,813	42,456	5,095	47,551	228.5	26,738
1992	230,234	14.0	221,025	10.0	9,209	4,605	2.0	11,512	16,116	46,837	5,620	52,457	325.5	36,341
1991	201,960	2.0	200,950	0.2	1,010	(2,990)	(1.5)	10,098	7,108	41,131	4,936	46,067	648.1	38,959
History														
1990	198,000	10.6	200,500	17.1	(2,500)	(6,500)	(3.3)	9,900	3,400	28,916	4,337	33,253	978.0	29,853
1989	179,000	7.7	171,200	9.7	7,800	3,700	2.1	8,950	12,650	21,716	3,257	24,973	197.4	12,323
1988	166,200	13.1	156,000	11.6	10,200	5,000	3.0	8,310	13,310	17,437	2,616	20,053	150.7	6,743
1987	147,000	18.0	139,800	16.5	7,200	2,500	1.7	7,350	9,850	13,641	2,046	15,687	159.3	5,837
1986	124,600	11.1	120,000	11.0	4,600	1,500	1.2	6,230	7,730	13,279	1,992	15,271	197.6	7,541
1985	112,200	6.5	108,100	7.8	4,100	2,100	1.9	5,610	7,710	11,279	1,692	12,971	168.2	5,261
1984	105,400	8.7	100,300	5.6	5,100	2,000	1.9	5,270	7,270	8,433	1,265	9,698	133.4	2,428
1983	97,000	4.0	95,000	1.7	2,000	(700)	(0.7)	4,850	4,150	10,124	1,519	11,643	280.5	7,493
1982	93,240	0.3	93,400	(0.3)	(160)	(1,300)	(1.4)	4,662	3,362	8,281	1,242	9,523	283.3	6,161
1981	92,992	6.1	93,684	6.1	(692)	(1,150)	(1.2)	4,650	3,500	12,147	1,822	13,969	399.2	10,469
1980	87,676	23.9	88,310	26.1	(634)	(919)	(1.0)	4,384	3,465	11,244	1,687	12,931	373.2	9,466
1979	70,755	20.4	70,019	25.7	736	588	0.8	3,538	4,126	8,808	1,321	10,129	245.5	6,003
Summary Totals:														
1991-1999	2,977,459	10.5	2,835,931	9.7	141,528	67,269	2.3	148,873	216,142	418,156	50,179	468,335	216.7	252,193
1990-1999	3,175,459	10.5	3,036,431	10.4	139,028	60,769	1.9	158,773	219,542	447,072	54,516	501,588	228.5	282,046
1980-1989	1,205,308	9.7	1,165,794	9.4	39,514	12,731	1.1	60,265	72,996	127,581	19,137	146,718	201.0	73,722

* Actual results in millions of dollars through 1990, projections for 1991 to 1999.

The point is that earnings were going down in any event. Earnings went down from 1988 to 1989. Earnings were going down in 1990, long before Desert Shield and Desert Storm began. The fuel factor simply came in as the *coup de grace*. Coming late in the year, too late to be offset by any operational or price changes to recover those costs, it put the kiss of death on the year. The fact is the conditions were already present to produce a lousy earnings year for the industry, and that is what we had.

Traffic growth was slowing down, and this may indeed relate to sluggish economic growth during preceding two years. Certainly there is some evidence of that in world and U.S. traffic growth. For the past three years, through the end of this year (including projections for the last four months) U.S. domestic traffic growth will have increased only 0.7 percent over a three-year period. This comes awfully close to stagnation. The world's growth has slowed down considerably. It slowed from 11 percent in 1987 to 7 percent and then to 5 percent by 1989. As things stand today, with four months of the year to go, 1991 will almost assuredly be a down year in world airline traffic. This has never happened before. Never in the history of this industry has traffic on a worldwide basis declined from the previous year. I can remember. I have been in this business long enough to recall when the trend of uninterrupted growth stopped in the United States a decade ago. 1981 was the first year U.S. traffic ever declined. 1991 will be the first year that world traffic declines. Whatever the causes, and they were many, and we will keep probing for them, the fact is that airline traffic growth has been slowing down for the past five years.

Interestingly enough, load factors have not declined appreciably. In other words, capacity was trimmed back in concert with the traffic slowdown. Expenses were not tailored so well. Unit costs obviously were going up, but we really get to the meat and potatoes of this thing when we look at yield. The yield increase through this whole period has been inadequate. For several years yield was going up in nominal terms, something on the order of six percent -- in real terms about one or two percent. The yield increase dropped off in 1990, and probably will again in 1991 to something over two percent in nominal terms, which amounts to a negative figure in real terms.

Down in real terms is not bad, as that is one of the main drivers of traffic growth long term. Reduced real yield has long been one of the major sources of improved traffic trends in the airline industry. But combined with the kind of cost management we see, the result is inadequate profits.

These costs are reflective of excessive optimism on the part of airline managements, not only in this country but throughout the world. Some of that same optimism

is reflected on the order books of Boeing, Airbus, and McDonnell Douglas. It was also reflected in the rate of expansion of employment and the infrastructure of the airlines. The words of Bob Crandall yesterday may signal a slowdown, if not a halt, in the plans of one of the more aggressive companies. Whether it proves to be a harbinger of things to come we will find out. I hope so because this optimism has been in part responsible for the decline in yield. Part of being aggressive is trying to build a traffic base in the face of a slowing economy. One way to do that is to offer more attractive prices.

The fact that it has not worked particularly well up to this point has not prevented the industry from continuing the practice aggressively. Thus, the picture is slowing traffic and inadequate yield growth, both putting pressure on the revenue stream over the last two years. At the same time, the continued expansion mentality on the part of management caused overall costs to rise at an excessive rate. Even before fuel prices went up, rising costs led quite naturally to the decline in earnings. The decline became a disaster when the rise in fuel price hit.

Let me move to a slightly less tangible but no less significant element of this whole equation -- the consolidation that has been going on in the U.S. industry. Here we are starting to talk about something that has implications for the world as well as for the United States. I do not suggest that there was any grand strategy, Machiavellian or otherwise, on the part of the management of the three giant U.S. companies. But I do think their own reading (or misreading) of their long-term best interest produced the consequences we face today.

Aggressive growth was part of the original plan. Crandall was its greatest spokesman, the others followed along. That, in itself, put pressure on those not able to match the capital spending stream of the giant airlines. As we faced the crisis of late 1990, something unexpected occurred. The fuel increase, which always in the past had been accompanied by a dramatic improvement in the price of the product, did not happen.

Airlines increased prices, you recall, in response to the fuel price increase. They actually announced price increases in the full fares. But in the end, none of it came through. All of it was dissipated in more and more aggressive discounting to match with relentless consistency every discount fare proposed by every troubled airline trying, however it could, to raise some form of operating capital to survive for another day, week, or month. The giants gave them absolutely no breathing room. They sat right on top of their fares, and they kept the pressure on. Not only did they keep it on, they intensified it. The statistics on yield indicate that the

number of people using discount fares has now soared to 96.5 percent of all travellers. It cannot go much farther.

The percentage of discount fares had hovered around 90 percent for a long time. In 1991 it just exploded. What does this mean? Somebody out there is offering discount fares to more people, particularly the business traveller. Think about it. Those last few percentage points at the margin can only come from one place. It comes from business travellers making late or last-minute travel decisions. That is about all that is left in the full fare category anyway. What is happening is that airlines are making more and more discounts of some kind available to business travellers.

More is going on than can be accounted for by the actions of a Midway, America West, Continental, or someone like that. Discounting has been enthusiastically supported and sustained by the large carriers because they could, to put it brutally, smell blood in the water. They saw their competitors in trouble, and they were not going to give them an inch.

It worked. We have five airlines in bankruptcy, one is liquidated. The others may have to combine with each other or with somebody in order to survive. Two of the remaining airlines that are not in bankruptcy are shrinking in size. One has sold a major piece of its assets. With these sales the major point of the whole game has been accomplished. To return to what I said earlier, domestic traffic has not been growing for three years. But in that time Delta is up 22 percent and American is up 17 percent. United is only up two percent, but that is a different story. What the giants have done is to grow by taking market share away from the weaker players. This process can go only so far, and it has probably gone about as far as it can go.

THE OVERSEAS STRATEGY

If the major airlines were going to continue on an aggressive expansion track, they had to find a new place to expand. The domestic market was saturated, both as a result of maturity and as a consequence of the geographical spread of the companies involved. Airlines did not really have more niches to go into; and if they were going to keep growing, they had to find new opportunities. These opportunities were overseas.

The only problem was that the overseas routes were owned by someone else. In effect, the stronger airlines sized up the situation and siezed the opportunity. You shake the tree hard enough and the apples you want fall off. Then you pick them up and put them in your pocket.

I am being grossly simplistic, but this is effectively what happened. The conditions were created to cause these international assets to fall into the hands of the dominant airlines. The only significant international asset not controlled by the big three is the Pacific Division of Northwest, and that is probably not available. The only other operation of any consequence is the South American Division of Pan Am, but to all intents and purposes that is now part of Delta.

Having now achieved the control of the assets that give the opportunity to grow in the decade of the 1990s by expanding overseas business, the time has come, I believe, for the giants to stop shaking the tree. What does that mean? It means that the pressure on the weak players no longer serves any great purpose, and it actually could hurt the big three more than it could help them. The one imperative that follows from the growth strategies pursued by these companies is the need to invest.

What you have before you (table 1) is a world operating statement through the 1990s as I perceive it. The investment figures are taken directly from a forecast that I made for the commercial aircraft market, plus a factor added for investment in ground equipment. From this we deduce how much annual capital spending will be required for the world industry. It comes out to about \$468 billion for the nine years, 1991 through 1999. The amount that is needed from external capital is shown on the log scale chart. (Figure 1)

There is a slight dip in the spending stream as a consequence of the shortfall in cash flow last year and this year. It is nowhere near as bad as in the early 1980's, and it will recover faster. But for all that, it is not possible for American Airlines or any other airline to invest at the rate they plan on the basis of the cash flow figures for 1990 and 1991. It just will not wash. You cannot get there from here. Either the cash flow will have to improve, or the capital spending stream will decline. Crandall said as much yesterday. Basically he said that, if earnings are not better, American Airlines will have to spend less. By my estimate this means a \$500 million cut in a \$21 billion five-year plan.

It is interesting, that \$21 billion five-year plan. The estimates I have made for the major airlines show that American, without resorting to external capital, will be able to spend \$43 billion on new equipment between 1991 and 1999. American's five year plan called for \$21 billion. I estimate American will need more than double that amount for nine years.

Moreover, Delta and United will both have to spend at the rate of \$40 billion. The total is \$123 billion of supportable capital spending over nine years. That is just over 25 percent of the total world airline capital

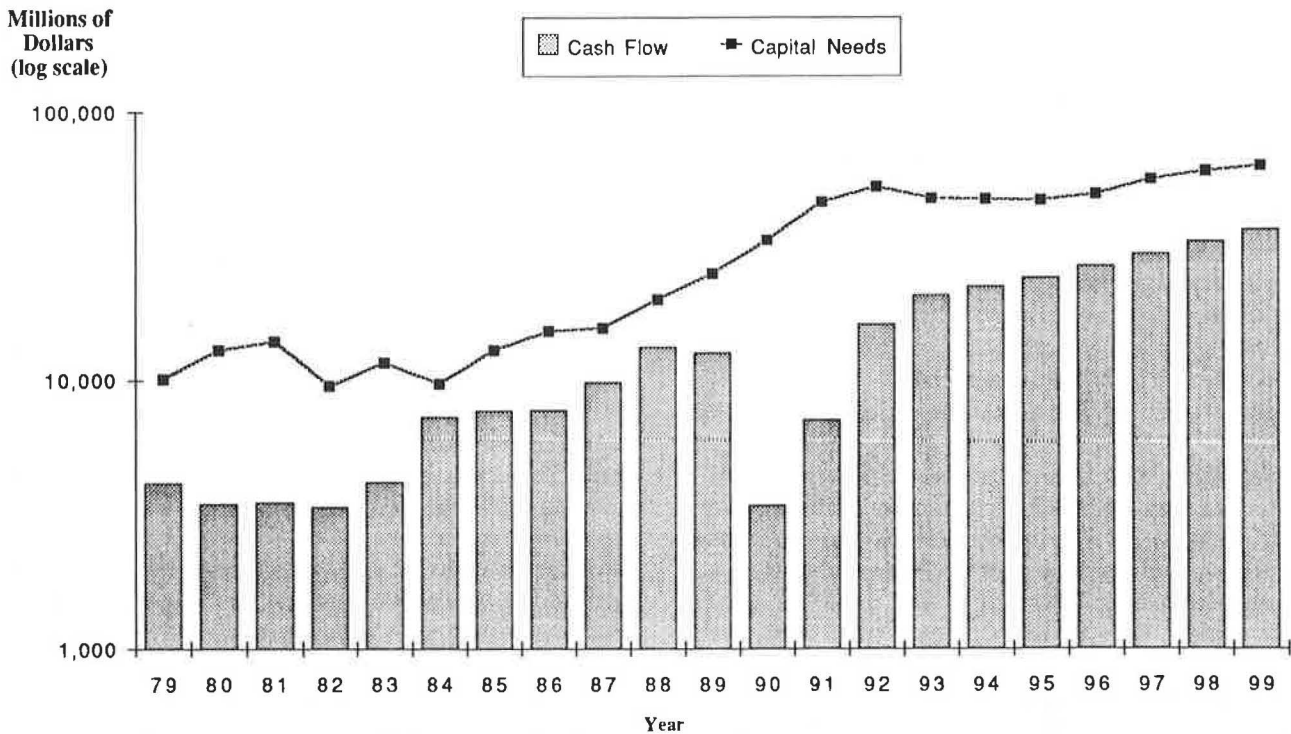


FIGURE 1 Cash flow of ICAO Airlines vs. capital requirements (actual through 1990 and estimates through 1999)

spending for the nine years shown in Table 1. These three companies last year accounted for 18.5 percent of the world's airline traffic. Those of you who are economists and financial analysts will readily agree that the driver of market share is capital investment. If investment in new assets is at a certain rate, market share will tend to move toward that rate. If an airline is investing 25 percent of the world's capital expenditures by all airlines, sooner or later its market share will get awfully close to 25 percent.

This means that if the industry grows, somewhere around 5.5 percent annually through 1999, the big three U.S. carriers will grow at a compound rate of 9.2 percent. Most of that growth will be in international markets. Having acquired those markets, they intend to exploit them. However, they cannot exploit them if they don't spend that capital; and they cannot spend that capital if they don't have a cash flow to support it.

A LOOK AHEAD

The need, I suggest, will be the mother of the event. Yields will go up because those who are in a position to control these markets will not be as obsessed as they

have been with matching every price that any small airline throws into the market. It does not matter what price Midway offers; they cannot hurt United. And they never could, and yet United has been matching them right down the line. That will stop, and we will see a significant shift in yield.

There will not necessarily be a price increase. What the airlines will do is tighten up and change the discount mechanism that forms the bulk of the price structure. In the process yields will go up, cash flows will improve, and capital spending will take place.

The recent yield strategy has been a tactic in an ongoing long-term market strategy. This tactic has fulfilled probably the wildest dreams of its creators. Now it will change because continuing to use it threatens the strategy. If the strategy of growth is threatened by the inability to spend, then airlines are going to change the tactics that inhibit spending. What we will see over the decade of the 1990s, and this is reflected in the forecasts in table 1, is a slightly better overall rate of return in the airline business on average. The aggressive growth plans of the U.S. carriers will put pressure on the international carriers, particularly in Europe. However, it will not be a type of competition characterized by price wars.

The infrastructure friction between Europe and the United States is greater, and the Europeans do not have the ability to use price as it is used in the U.S. domestic market. The competition will be much more involved with control of traffic flow. The big three U.S. carriers with their domestic base intact and their cash flow engine operating will, as a consequence, force major readjustments in the European airline scene. Europe has never had the U.S. style of competition that they are now experiencing in their markets. London is getting it full bore today. Lufthansa is screaming about Delta's rights in Frankfurt. They never screamed about Pan Am's rights in Frankfurt. The reason is simple. Delta's rights in Frankfurt are a threat; Pan Am's never were. Delta can do something with these rights; Pan Am could not.

This will be a force more powerful than government friction, and it will change the aviation scene in Europe. The change may be reluctant, and it may be resisted vigorously, but I do not see how it can be avoided.

So, this is the picture as I see it. The biggest event of the last six to nine months has been the transfer of international assets from the weak airlines to the strong. Nothing will color the 1990s more than this.

QUESTIONS AND ANSWERS

Question: A big part of the profitability improvements that you show is based on a 1992-1993 reduction of growth in airline expenses. Do you attribute that entirely to the yield management by the discount fare structure, or do you see any other structural changes in airline expenses such as British Airways recent move away from vertical integration of all of its internal products and services such as the engine repair?

Mr. Greenslet: I did not dwell on that, but expenses must be more tightly controlled in the next couple of years. It does not have to do with yield directly, but radical surgery on expenses as a reaction to 1990 will help. From that point on, it is a revenue-driven recovery, not an expense-controlled recovery. It is a jump in the revenue stream that relates to yield. Producing enough revenue in the recovery side of the cycle to boost earnings is the first step. Then it is a matter of managing yield to stay in a favorable position through the decade.

Question: A two part question. First, do you see this yield improvement taking place before the demise of Midway, America West, and others? Second, will the majors continue to sit on the weaker airlines until they are not a problem any more?

Mr. Greenslet: It is hard to say exactly when they will start to ease up. I believe they will begin very soon, perhaps by early 1992. Crandall basically signalled the change yesterday. He was sending a message, not so much to Midway and others like them, but to United and Delta. What he said in effect was we have the world in our hands, and it is up to us either to make it or to screw it up. If we continue down this track, we are not going to achieve what we want. It is not in the power of Midway or anyone like them to prevent us. We are not going to wake up one morning and find that yields are up 10 percent just like that. It is going to be a slow process that will start by the first of the year.

Question: The second part of the question. With improved yields or higher prices, will there be new entrants in the last part of this decade?

Mr. Greenslet: No. There is no room in this country for a new entrant. There are no niches meaningful enough for them to serve. When I say there will be higher prices, it is going to be hard for the consumer to recognize them because the fares may not change a whole lot. The consumer will get a discount fare that is just a little bit higher than the discount fare available before. If consumers are very sharp, they will notice they are paying more, but the airlines are going to do their best to obscure it.

Question: I would like to go back to the earlier presentation on economics. I do not really agree with the 2.5 percent growth rate for the U.S. economy. However, on a per capita basis, it suggests incomes rising only about 1.5 percent per year. If you think yields are going to go up significantly, how do you reconcile that with the continued growth of traffic?

Mr. Greenslet: I am not sure domestic traffic will grow. It has been static for three years. Domestic U.S. traffic growth might not be more than three to four percent.

Question: The same problems affect international operations. Last year U.S. airlines lost over \$400 million on international services. It is not that much better than the domestic picture.

Mr. Greenslet: Last year increased fuel cost was a big part of that loss. But the traffic growth potential, particularly for the carriers that will be doing the investing and expanding, has been substantial. They all have had very healthy traffic growth through all of this time. Over time the yield improvement required is not necessarily going to be more than the inflation rate.

We are not talking about real yield necessarily going up much if at all. Real yields may be flat. But that would be equivalent to a nominal yield increase of four percent or so at most unless we have a much more radical improvement in the long-term inflation rate than we presently are counting on.

So on the domestic side, yield increase of three percent and traffic of three percent means a six percent growth in revenue. As an industry average, this may be all one can get. American, Delta, and United, might do better than that for a period of time.

Passenger revenue has a long history of growing in proportion to increases in GNP and disposable personal income except in the 1980s when it flattened out and actually declined. There was some small recovery toward the end of the 1980s and into the 1990s but not much. During the 1980s while the airlines were working out strategies to deal with deregulation, there were great price advantages to the consumer, and the airline industry stopped growing for the first time. It has not resumed since. There is some slight evidence that growth might resume, but it is not certain. The 1990s could continue a trend that could truly be described as a mature industry, i.e., an industry that is not an increasing as a share of either GNP or consumer spending.

AIRPORT AND AIRLINE SECURITY

Wilfred A. Jackson

Association of Airport Councils International

We are going to shift gears. We are not going to talk about the economics of airlines but something that has an economic impact on the airline, and certainly on the travelling public, you and me and all those who buy tickets. I want to speak about security.

Security is something that airline presidents do not like to talk about. Certainly when the security chief of an airline comes to the president with another expense, the president sometimes gets somewhat upset because security is not a profit center. There is nothing that he can do in this area to increase his bottom line. All it does is drain cash flow even more than some other parts of his endeavor, such fuel and labor costs.

OVERVIEW OF SECURITY

Passenger Screening

Back in the 1960s and 1970s civil aviation was plagued by hijackings. It was sometimes known as the homesick Cuban period. A number of Cubans had come to this

country and found that the easiest way to get back to their own country was to hijack an airplane. It was pretty easy to do. Very few airplanes were ever hijacked using a real, live weapon such as a pistol. Most of them were hijacked more by threat than by actual violence.

But the Federal Aviation Administration came to the fore, and several measures were taken. Sky marshals were put on airplanes, and this tended to deter hijacking somewhat. FAA also established the pre-board screening program that we all live with today.

The passenger screening became the responsibility of the air carrier, on the rationale that anything that goes on board an airplane should be the responsibility of the owner and operator of the aircraft. Initially, the FAA and the Federal Government bought the equipment used for passenger screening. Later, as the responsibility flowed over to the air carriers, it became their responsibility to furnish the necessary equipment.

As the passenger screening required by FAA became more and more prevalent throughout the country equipment had to be put into terminals in several places. A single pre-board screening site was never going to be adequate at most airports. One of the difficulties experienced with installing pre-board screening facilities was that the air terminals were not built to accommodate them. As an example, here close to home, look at Dulles Airport. I have lived in this area for approximately 20 years, and I am not sure that the people at Dulles have yet determined where would be the best place to locate the pre-board screening. At present, in order to go to the main restaurant, you have to go through pre-board screening. If you happen to have a lot of change in your pocket, you have to remove it in order to get to the restaurant.

The new terminals being built today around the country are planned with the requirement for pre-board screening in mind. All of the terminals built since the mid-1970s, I would venture to say, have been designed to accommodate pre-board screening, but it still remains an expense to the air carrier.

Screening Airline and Airport Personnel

In the 1980s, we had some other developments in the field of aviation security. We had terrorists who used explosive devices on aircraft. We also had one individual, a former employee of PSA airlines, bypass the screening point by using his airport identification, get on board with a weapon, and destroy the aircraft. He destroyed it by first killing his former boss, then the crew of the aircraft, and consequently everyone on board including himself.

The outgrowth of those two new threats have cost a great deal of money, and I am not altogether sure whether we have really enhanced the security of our airports and civil aviation to any great extent as a result. After the PSA incident, Congress decided that what we needed was more security. The Secretary of Transportation decided in 1988 that what should be done was to have a secure access control system installed at each primary commercial service airport. This meant that 274 airports needed to install equipment and set up procedures to monitor access to aircraft servicing and maintenance facilities.

Initially, FAA said these systems should be in place within a year. We in the industry told them that there is no way to do it in one year even if the equipment were sitting on the ramp ready to install. This was followed by a change to FAR 107, designated FAR 107.14, Access to Secure Areas of Airports. This regulatory requirement is going to cost something in the vicinity of \$1 billion before it is fulfilled. I was talking to the director of security at Chicago O'Hare just yesterday, and he informed me that their price tag is hovering someplace around \$50 million just for that one airport. New York Kennedy claims that their system is currently estimated to cost of \$55 million, and they expect the cost to go up.

These systems are supposed to do several things, one of which is to deny access to secure ramps and working areas for anyone whose authority changes, such as an employee who has been fired or transferred or who has resigned or retired. If the person was authorized access to secure areas, it must be rescinded immediately. The only way for a large airport to do this is with a computer-based access system, which is what most airports are putting in.

Anti-Terrorism

The second threat that has emerged is explosives on board aircraft. Bombs have caused great numbers of casualties and enormous damage. As examples, in 1985 an Air India flight from Toronto to Great Britain was brought down by an explosive device. In 1986 a TWA aircraft was not brought down, but it did sustain severe damage from an explosive device placed on board, and several people died. Probably the most famous of these incidents occurred in 1988, when Pan Am 103 exploded in midair and came down in Lockerby, Scotland. In 1989, not more than three months later, a UTA aircraft out of Africa inbound to Paris was also destroyed by an explosive device.

ACCOMPLISHMENTS

As a consequence there have been several security measures required by FAA and put in place by airlines and airports that have made the security system better and aircraft more secure and more likely to arrive at their destination unharmed. But have we really done everything that could be done or should be done?

In the past nine years, 1980 to 1989, the number of attempted hijackings in the United States decreased from 21 to 10. The number of actual hijackings decreased from 2 to 0. That is certainly a remarkable improvement.

Worldwide hijackings have been reduced from 38 to 16 in the same period. Just recently I read in the Aviation Daily that there have been 38 airplane hijackings averted between 1980 and 1990 because of the screening devices now used at airports. These have detected 28,459 weapons, an average of eight daily or one for every 293 passengers!

To me it is staggering that so many people would attempt to take weapons onto airplanes. In most cases they claim that it is really an innocent gesture. They did not really intend to use this 44 magnum or to be surreptitious, even though it weighs 14 pounds and causes a huge bulge in their pocket. According to the same article, one out of every 746 weapons detected were in the possession of an individual who had an intent to use it.

Weapons have been found on some very strange people, such as a judge in Baltimore who said he always carried a weapon for self protection. He was caught and arrested, much to his indignation. However, we also find that weapons are being carried by a lot of little old ladies for a variety of reasons. They do not seem to understand that they cannot take them on the airplane even though they carry them in their pocketbook only to protect themselves in the parking lot.

RECENT SECURITY IMPROVEMENTS

What is being done to improve present security measures and to perfect new, more effective methods to detect weapons and explosive devices? Airports and airlines are working very diligently to identify everyone who is in secure working areas or out on the airside of the airport. Typically, every person in the secure area must wear a badge that not only serves as identification but also as the key that opens doors and access portals through which the employee must pass.

One of the problems is the number of people at the airports who are not employees of the airport or the airline. Airport security officers must identify these individuals and make sure that they are, in fact, where they are authorized to be -- and more importantly, that they are not where they are not supposed to be. An example is the difficulty that has been experienced with Customs agents. The Customs Service for some time has believed that their agents are properly identified by their uniform and badge. Airport ID devices are not to be worn on their outer clothing when they are in the ramp area but to be carried on their person. Customs agents also do not believe they should show identification or otherwise identify themselves to anyone except a law enforcement officer.

This causes difficulty for persons working on the ramp, who are responsible for identifying anyone in their vicinity. Certainly if they work for an air carrier and they are around their own airplanes, they want to know who is that person approaching them. Simply because the person is wearing a light blue shirt and darker blue trousers does not mean he or she is a customs agent. Anyone could buy such a uniform at any clothing store.

We need to close these loopholes; and to do that, we need to seek and obtain support from the Federal Aviation Administration and from all who work at airports.

The FAA is emphasizing intelligence gathering on terrorists and hijackers. This approach works well against larger groups and organizations. It does not work particularly well, however, for small groups or for individuals who have a grudge because they have been fired by an airline and are seeking revenge by bringing down one of their aircraft by planting dynamite or some other kind of explosive device on board.

We need to do more in the field of intelligence, and certainly we need the assistance of all the intelligence gathering agencies of the United States. This is beyond the capability of the air carrier. It is certainly beyond the capability of the airport community.

FAA is also encouraging the development of automated detection devices. As a matter of fact, I presently sit on a National Academy of Science committee that is looking at just this technology for FAA.

How can we devise a system that would clear everyone and everything going on board an aircraft? The general concept envisions that passengers would come to some central location at a terminal with all their baggage. They would go through a screening of their person as well as all carry-on items and bags or parcels to be checked. Everything going through the system would be screened. The first-level security system would

immediately clear 90 percent of everything checked. The remaining 10 percent would proceed through the next tier of the system, and so on down the line. Each element would clear 90 percent and leave 10 percent to be checked at the next station or phase.

This would result in perhaps one bag in 200 or 300 being opened for inspection, as opposed to the much larger number of bags that are now being opened. We expect this system to be totally automated. With present screening systems we have humans involved, and they are sometimes not as thorough or reliable as we would like them to be. Boredom and fatigue are common problems for security personnel looking at a television or an x-ray machine and monitor. Critical items may pass through.

RESPONSIBILITY FOR SECURITY

There is a debate about who should have responsibility for security at an airport. Should it continue to be the airlines who are responsible for pre-board screening or should it be the airport management? One of the common problems at any large airport is inconsistency. BWI, for example, has five different concourses -- five different screening points operated and controlled by five different carriers. Each carrier has its own procedures and requirements. Even though they fall within the parameters and the overall guidance established by FAA, they operate in different ways. I might add that each manager for each carrier responsible for these screening points has different ideas and approaches to security. Some managers are more interested in security than others, and they have a vast variety of methods and procedures. Certainly the thoroughness of one is not necessarily the thoroughness of all.

For this reason it might be argued that the airport operator, who is a single entity, should have the responsibility, the total responsibility, for all security measures at the facility, including all the screening points. This raises interesting questions. First, who would then have financial responsibility? Who would buy the equipment, and who would have the pecuniary liability if the security system failed and an airplane was brought down? As it is now, it is the responsibility of the air carrier. Would it then become the responsibility of the airport? This is an issue that will have to be settled. Parenthetically, it should be noted that in Europe security systems are operated by the airport authority and have been for a number of years.

One of our largest airports, San Francisco, now wants to assume, as an experiment, responsibility for security of the international building. That would include

the two new TNA machines that the FAA expects to install there in the coming months. The outcome of this experiment will be most telling, and it will probably have a long-term effect on how airport security is handled in this country, if not worldwide.

FUTURE DIRECTIONS

One question always come up. What are we doing about articles that go in the belly of a passenger airplane? As I mentioned earlier, statistics show that hijackings are down to zero. Hijacking attempts are approaching zero, and we hope that they will be at zero very shortly. It is very, very difficult to get on board an airplane today with any kind of a weapon.

But what about the baggage compartment? Every passenger aircraft carries not only baggage but a large amount of cargo in the belly. That cargo consists of packages, small freight, and mail. During Desert Storm the Postal Service refused to give the airlines packages heavier than 16 ounces. There were a great deal of gnashing of teeth and moaning by the airlines because this represented loss of a large percentage of their mail income and they wanted to keep that kind of business. By the same token, it made the travelling public feel a great deal better to know that large packages were no longer being carried in the belly of the airplane.

Maybe we should concentrate on making air cargo more secure before it is loaded on the airplane rather than denying such cargo on aircraft in the first place. The concern also extends to checked baggage. You and your carry-on articles are screened when you go on the airplane, but your suitcase that you check is not. In international traffic, it has been a requirement for some time that the air carrier have a baggage-passenger match to assure that before the baggage goes on the airplane, the passenger who brought it is also on board. Because there are not too many people with suicidal tendencies, this is thought to be an effective procedure to keep explosive devices off aircraft.

If the airlines do not want to carry out a baggage-passenger match, they should at least x-ray the bags; and many carriers have chosen to do that. But I would point out that x-raying a large suitcase of a traveller going to Switzerland for two weeks is a very difficult thing to do. Certainly it is difficult to determine if something in that bag is, in fact, an explosive device shaped like a hair dryer, a cassette player, a radio, an electric shaver, or any other innocuous personal item. Maybe an x-ray is not the best way to do it. We need to be more sophisticated and employ advanced technology to check those bags. Moreover, we need to check the bag in the presence of the owner.

What about the security of aircraft refuelers and the security of the fuel itself? Very few airports are doing anything to secure their fuel supply. Fuel farms are usually located on the edge of the airport so that they are immediately accessible by the land vehicles that deliver fuel and by a number of organizations that draw fuel from them. As another example, have you ever seen a catering truck checked by security forces on an airport? I have not. Catering trucks come and go. They are just a part of the team, and no one ever checks them.

But most important of all, no one is checking the employee -- not the employee who works around the airplane, not the employee of the airport operator, not the employee of the refueler caterer. Once the employee has an ID badge, all that is asked is that he show it. The employee is free to come and go freely. I suggest that before very many years have passed, we are going to have to make a change here.

I also see that we are going to have to change the overall construction of airports. They will have to have a number of built-in funnels and checkpoints. All incoming cargo will have to go through a screening funnel. Every employee who enters the secure working ramp area and gets close to an airplane will have to be screened, either individually or at least on a random basis. Employees will come through an area where they will have to use their identification badges to gain admittance; and, once admitted, some will be selectively taken aside and screened. Lunch buckets will be looked at, as will anything employees might be carrying. Random screening must take place frequently enough to cause trepidation about trying to carry weapons or any forbidden material into the airport.

Without screening of this sort our fears about the work force are well grounded. Though employees are checked once when they are hired, they may go bad. FAA and Congress have mandated a 10-year background investigation of new hires for criminal activities. It is, however, going to be done only once, even if the individual is with the company for 35 years. A new employee may be clean on the day he or she is hired, but goodness knows what might happen afterward.

With the PSA incident, it was a former employee. Who can say that the next incident will not be a current employee? In the PSA incident, the man was fired on a Tuesday, and he did his deed on a Wednesday. He could just as well done his deed on Monday knowing that he was going to be fired on Tuesday.

The long and the short of airport and airline security both for today and for the coming decades is screening, screening, and more screening. We will have to do it as efficiently and effectively as possible. We will have to do

it at the expense of the travelling public. It will not be an expense that airports or air carriers alone can support. Obviously it will have to come from the ticket price that the passenger pays.

As indicated by other speakers this morning, the air carriers will get into a better financial position in the years to come. The cost of security will be a part of the bottom line that the Bob Crandalls of the world will not be happy about, but it is something that they must face squarely. This is not just a U.S. problem; it is worldwide.

As a matter of fact, in Tel Aviv today, 23 percent of the operating costs of Ben Gurion Airport goes for security. In the United States, the percentage is something less than 10 percent. I do not expect our costs to go as high as those of Tel Aviv, which may be the upper limit.

To summarize, we have more secure airports and airlines than we had 10 or 15 years ago, but we still have some way to go to make them as secure as I personally want and you would like them to be.

QUESTIONS AND ANSWERS

Question: Would you care to comment on the likely influence of legal responsibility, i.e., litigation or the prospect of litigation, as it might affect the transfer of responsibility for screening passengers from airlines to airports.

Mr. Jackson: Legal responsibility is a major question that will have to be answered before any such transfer takes place. I am not suggesting in any way that airport operators are in favor of accepting responsibility for security. They oppose it for a variety of reasons, and liability is certainly a major one. They are not in favor of having the larger work force and greater expense that maintaining security would require. As I mentioned in my earlier remarks, the liability issue will have to be ruled upon and limits of responsibility will have to be drawn. What they are doing in Europe could be a pattern for us to follow. They have been doing it this way for some years, and it seems to work.

In passing, what is often referred to as the El Al system is not really their system, but that of Israeli security at Ben Gurion Airport. Israeli security is responsible for the system. They train all the people --

El Al as well as airport personnel at two airports.

Question: You suggested the future design of airport terminal buildings would be funnel-oriented, but at Hartsfield Airport in Atlanta, they have a central checkpoint that all passengers go through to one of four concourses. The cost is covered by the terminal corporation, and I think the liability is distributed in proportion to the shares that the airlines hold in the terminal corporation. Is that similar to what they do in Europe?

Mr. Jackson: For example, the British Airport Authority has six airports, and it is totally responsible for the screening and the security operation at all of them. I am not altogether clear about how financial responsibility and legal liability are distributed.

Question: In Atlanta, the city of Atlanta does not have any direct responsibility. It lies with the airlines consortium in the terminal corporation.

Mr. Jackson: Whether responsibility for security should go in that direction or whether it should go solely to the airport operator (whoever that may be) is an open question. But in my opinion there are a number of advantages to having one party with operational oversight responsibility for all the screening points at an airport.

At Atlanta there is one central entry building, from which passengers go by electric train and moving sidewalk to a number of other terminal buildings where the jet bridges are located. Atlanta is one of the few airports that are so designed. The new Denver airport is following the same pattern of one central entry building with one central screening point from which passengers will go to various terminal buildings.

One thing they are not doing in Atlanta, however, is screening each piece of baggage as it comes in. Passengers are still permitted to check baggage at the curb. Bags are then funneled down into the baggage make-up rooms without being screened. This is for domestic baggage only. Passengers must take international baggage into the terminal and personally check it. They cannot check it at the curb. This procedure has been required for several years by FAA regulation.

10 YEARS TO 2002 IN RETROSPECT*

Robert J.C. Ebdon
British Airways

What all the wise men promised has not happened, and what all the damned fools said would happen has come to pass. (Lord Melbourne, 1890)

It is good to be asked to make a valedictory speech on my birthday, just after my retirement following over 40 years in the business. It has been suggested that I ruminates over the past 10 years which have seen some of the greatest changes in the regulation and organization of air services since the Chicago Convention in 1944 -- changes probably greater than in any other 10 year period.

1992

Remember 1992. The world was emerging from recession. Germany was united. Eastern Europe was bankrupt, but looking to a democratic future away from the power of the Soviet Union. The Soviet Union was looking increasingly fragile as the various Republics sought greater autonomy. The so-called third world was feeling crushed under the twin pressures of debt and internal strife. The Middle East was then, as now, a powder keg with the Iraq-inspired Gulf War just behind us but the aftermath very much with us.

In this environment the airline industry was suffering one of its worst periods economically. Probably the only area of the world where air transport was buoyant was in the Far East/Pacific region, and even there recession was having its effect. Within the United States the private-enterprise US Airlines were having to react to the economic pressures. The gradual demise of the once great PanAm and TWA was accelerated, and they vanished without trace in the early 1990s.

The US industry emerged from the economic recession, and with the completion of the deregulation process in the early 1990s the US market was reduced to three dominant airlines and some lesser players.

It is difficult to appreciate that in 1992 the European Community States acted separately in international aviation matters, that each of the then 12 members had their own national airline or airlines, and that the majority of these were either wholly or substantially government-owned. Moreover, each of these 12 European States had their own bilateral agreement with the United States with varying degrees of freedom for the airlines of the two sides to operate across the Atlantic.

THE EC MARKET "COMPLETE"

Yang Chu, weeping at the crossroads, said "Isn't it here that you take a half step wrong and wake up a thousand miles astray?" (Confucian Hsun-tzu)

1993 saw the completion of the internal European Community market in aviation when, for the first time, the full force of the Treaty of Rome applied at least to intra-European Community air services and Community airlines. This meant that at last the regulated duopolies which had grown up over the years since the Chicago Convention were thrown open to competitive market pressures. No longer were national, flag-bearing airlines given privileged status in the carriage of traffic to and from their own homeland under the patronage of their national governments. Any airline which satisfied safety and fitness criteria and could be defined as a "Community airline" was free to operate on any route within the Community.

At the same time real force was given to the Treaty of Rome provisions outlawing discrimination against Community corporations or individuals on the basis of their nationality. There could no longer be such a thing as a French or a German or an Italian or a British airline. They were all Community airlines, and ownership was open to any Community national who could secure a stakeholding provided he was not debarred from such a holding by law as unfit.

There was a brief hiatus in 1993 as Community airlines absorbed the full implications of the changes that had been thrust upon them. Most of the States had been resistant in one way or another to this idea of opening up Europe to the full forces of the marketplace,

*The date of this presentation happened to fall on Mr. Ebdon's birthday, and he chose to give his view of the future as if he were speaking 10 years hence on the occasion of his retirement. He began by cautioning that his remarks were "a personal flight of fancy" that did not necessarily represent the anticipations of British Airways.

The British, Dutch, and Irish were in the forefront of the move to liberalize Europe from the constraints of the old system in the interests of the travelling public. It was perhaps therefore a surprise that the first airlines to react to this new system were not the supposedly pro-liberal British, Dutch, or Irish but the supposedly reactionary German and French. The two governments concerned announced their intention to sell off their holdings in Air France and Lufthansa, and the two airlines passed into private hands as a unified airline based on the huge Franco-German markets which they had dominated for so long.

Perhaps it was equally surprising that the European Commission permitted this merger to go through unscathed on the grounds that a merged enterprise in private hands would strengthen European aviation for the forthcoming global battle for a share of the world aviation market.

As if in reaction to the threat from the center of Europe, British Airways, which had long had continental hub ambitions, finally consummated its long engagement with Sabena and the Brussels hub. At the same time this new airline established an increased presence in Berlin - - by then the capital of Germany -- to take advantage of the vastly improved airport infrastructure that had been developed since the unification of Germany. Not content with its new-found presence in the heartland of Europe, this enterprise expanded into a hub at Milan in order to develop strategic hub opportunities astride Europe. This operation was to come up against the combined strength of the merged Iberia and Alitalia Airlines, and the scene was set for the emergence of three preeminent European international airlines. It is a matter of history that SAS later took advantage of the enlarged Europe to combine the airlines of Scandinavia and Finland with Austrian Airlines based in Vienna and their shareholdings in the relatively small British carrier, British Midland. However, this enterprise has not so far proved to be as significant a player as the big European three. Close cooperation with Swissair, which has been a feature of SAS over many decades, may signal yet another merger.

THE DEMISE OF BILATERAL AGREEMENTS

All government is evil...The best government is that which governs least. (John L O'Sullivan, 1837)

These concentrations in the mid-1990s in Europe were presented to the regulators as virtual *faits accomplis*; and, as had occurred earlier in the United States after the 1978 Deregulation Act, the regulatory authorities did little to prevent what many had seen as inevitable.

This concentration of the Community industry put irresistible strains on the worldwide bilateral system, within which the concept of substantial ownership and effective control in national hands had long been seen as a barrier to cross-border mergers. With the catalyst of the European Community and the inexorable pressures of competition, a few short years saw the death knell of the nationality provisions in bilateral agreements worldwide. This is still working its way out in some parts of the world, but the ownership of airlines is coming to be seen as unimportant compared with the need to open up markets for the interests of the consumer in developed parts of the world. There is a continued perception of the need to protect indigenous industries in the less developed world, but ownership is now seen as less significant.

THE EUROPEAN COMMUNITY AND THE UNITED STATES

The completion of the European Market and the trend towards Europe-based megacarriers, together with the maturing of US deregulation, created the climate in which a head-on clash between the European Community and the United States seemed inevitable. For some time European airlines and their governments had been concerned that the European market was open to exploitation by US airlines in a way which was not reciprocated within the United States. The concept of cabotage was fiercely protected by jingoistic legislators in the United States and by organized labor.

The argument had always been on two fronts. First, the US market was too valuable to give away, and nobody had anything worth trading. Second, US airlines provided part of the US Government's strategic defense. Even those in the industry like Robert Crandall, president of American Airlines, who advocated changing the law that prevented trading in domestic traffic rights by US administrators, at the same time argued that access to the US market should only be granted in exchange for equivalent opportunities. This contrasted with his attitude on the international front where he sought to ignore the balance of opportunities argument in favor of free and open competition in the interest of the customer. The question of free and open competition in favor of the customer on domestic routes was never fully addressed by the US administration until US airlines found themselves starved for capital, and they began to look at the rest of the world for their capital needs.

Thus, the stage was set for the battle of the giants. The European Community on the one side and the United States on the other lined up for what could have been a war of attrition. Fortunately, as so often happens, the regulators were outflanked by the workings of the marketplace, and the historic merger of American Airlines and British Airways totally undermined the concept of national cabotage.

Protection is not a principle, but an expedient.
(Disraeli 1845)

The emergence of British American Airlines as a fully merged company with shares openly available on the stock markets of the world showed how outmoded was the concept of national cabotage, and the Community and the US Government signed the first truly "open skies" agreement. Under this arrangement European and US-based airlines -- with whatever nationality of ownership -- are free to operate within the United States, within the European Community, and between the United States and the European Community free of bureaucratic intervention.

MERGER MANIA

The latter part of the 1990s could be characterized as merger mania although many parts of the world still remain unaffected.

We have seen and are still seeing world aviation transform into a genuine multinational industry with government involvement concerned primarily with infrastructure and safety questions, striving for sane continued protection of jobs, and balance of payments rather than the old-fashioned idea of national and government ownership.

It is early yet, but it seems inevitable that the next 10 years will see still further concentrations and upheavals in the airline industry as the international market becomes more and more open and competitive.

THE CUSTOMER

If you open that Pandora's box, you never know what Trojan 'orse will jump out. (Ernest Bevin)

When the US Government proposed deregulating the US domestic market, one of the great debates was

whether the customer (passenger and shipper) would benefit. The early expectation by the founding fathers of deregulation (like Alfred Kahn) believed that this so-called deregulation would result in the emergence of a large number of competing airlines fighting for the customer's business -- with resultant pressure on costs, improvement in efficiency, and benefit to the customer. Initially it appeared to work in this way. New airlines emerged and submerged; and in the end, as we have seen, the US industry consolidated into a small number of large players with their associated feeder airlines and niche operators. The same thing happened in the European Community.

It is a matter of fact that airlines, throughout the decades since modern aviation began, have failed to generate the funds necessary to support their operation - - including the replacement of assets and investment in necessary computer technology. Airlines throughout the world have been supported by government subsidy, both open and hidden, and there were those who believed that aviation was not an industry which could be left to the vagaries of the marketplace.

The marketplace is proving to be made of sterner stuff. Faced with ever increasing subsidy bills and increasing customer dissatisfaction, governments throughout the world have become increasingly unwilling to underwrite the debts of their chosen flag carriers. Privatization became the "in" thing, but private capital is no more willing than government to invest in loss-making enterprises. A shake-out became inevitable.

We now see, 10 years after the completion of the European Market, few airlines in the developed world remaining in government hands. Those in private hands are forming the alliances and mergers which must inevitably result in a concentration of the world air transport industry into a smaller and more rational number of competing enterprises, as is the norm in most other industries.

At last the air transport industry appears to be coming of age. At last a more rationally organized international industry appears to be capable of earning profits adequate to fund its operation and replace its assets without being underwritten by government subsidy or guarantees.

Those who believe in the free enterprise system also believe that by this means the customer -- whether passenger or shipper -- will benefit in the long run from a more efficient and consumer-responsive industry. It requires that governments stand aside and stop meddling in the affairs of the industry except to the extent necessary to counter any continuing tendency of other governments to interfere in the free play of the marketplace.

INFRASTRUCTURE

Any consideration of the last 10 years would be incomplete without addressing the problem of the infrastructure. It seems inevitable that the air transport industry will be bedevilled with shortage of airport facilities and inadequate ground access to airports and that successful airports will find demand tending to outstrip supply. Concerns about the impact on the environment have meant that airline customers have had to accept less than optimum provision in congested areas as planning authorities have had to balance the advantages to the community of adequate air transport service and the disadvantages to the environment which they inevitably produce.

It is fortunate indeed that the concentration of the industry in the United States and Europe has relieved the strain on scarce resources at the key airports, which otherwise might have encouraged the regulation-minded governments to interfere. This has resulted in the use of larger aircraft that make less demand on runways and air traffic control. Once again the marketplace itself has produced solutions to what looked like an intractable problem in the early 1990s.

ENVOI

Problems are still with us. Governments continue to have a significant role in ensuring that there are facilities adequate for the needs of the traveller and shipper. The last decade has been one of upheaval in the structure of the industry, particularly in the area of ownership and control of airlines and the involvement of governments in their day-to-day regulation. This conflict between the regulation-minded official and the free market proponent is likely to remain with us, but I believe that the lessons learned over the past decade will ensure that we never again find ourselves in a period when the Granny in Whitehall in London or on the Hill in Washington believes that he or she is better at anticipating the customers' needs than the marketplace itself.

*You ask me what it is I do. Well actually you know,
I'm partly a liaison man and partly PRO.
Essentially, I integrate the current export drive.
And basically I'm viable from ten o'clock till five.
(Sir John Betjeman, Executive)*

PANEL REPORTS

MAJOR DOMESTIC AIRLINES

Panel Moderator

Nawal K. Taneja

John W. Drake
Purdue University

Richard Marchi
Massachusetts Port Authority

Steve Regulinski
United Airlines

John Fisher
Ohio State University

Peter G. McGlade
Southwest Airlines

Don Schenk
Airline Capital Assoc., Inc.

Marilyn Hoppe
America West Airlines

Charles Moles
Federal Aviation Administration

Paul Thomas
Douglas Aircraft Co.

Mark Kiehl
Northwest Airlines

Scott D. Nason
American Airlines

Mr. Alan Youngberg
Ernst & Young

Juan C. O'Callahan
Juan O'Callahan Research

MAJOR TRENDS AFFECTING THE FUTURE STRUCTURE OF THE DOMESTIC AIRLINE INDUSTRY

Transformation to Significantly Fewer Carriers

The U.S. airline industry will undergo significant transformation during the next ten years. Panel members agreed there will be a transformation from an industry of about nine major carriers (excluding all-cargo airlines), about fifteen national carriers, and about 150 regional carriers to an industry of four or five very large major carriers, about 50 large-regional/small-national carriers, and a few very small niche carriers. The surviving majors will have enormous financial reserves to fund continued growth and vast marketing resources to attract passengers and cargo. Most of the survivors will have extensive domestic and international route networks. However, one of the surviving major airlines could well be a very large niche carrier providing high-frequency, low-fare, domestic service primarily over a linear network of short-haul routes. All of the surviving large-regional/small-nationals will be closely affiliated with one of the large majors.

Two related forces will drive the transformation process. First, domestic enplanements have been flat for several years, but the carriers who will survive the transformation process have expanded their domestic market shares. The survivors are growing in a stagnant market by enticing passengers to switch from weaker carriers who lack the requisite marketing resources to those that offer appealing services in a competitive environment. The survivors' superior marketing

programs are expected to strengthen passenger preferences resulting in a continuing shift of market share to the detriment of the marginal airlines.

Domestic airlines have added hundreds of new aircraft to their fleets in the past few years. While many have been replacements for aging aircraft that have been retired, some have been to enlarge their fleets. Because domestic enplanements have been flat during this period, the result has been excess capacity that has been a major contributor to the industry's dismal financial performance. Traffic is weak, fares cannot be raised because of excess capacity, and mounting losses are a drain on every airline's financial reserves. The carriers who survive the industry's transformation will have the financial resources to withstand the industry's latest downturn. However, weaker carriers, with limited financial reserves, will be forced out of business due to the industry's inability to implement a profitable fare structure in an environment of excess capacity.

The Transformation Process

The first step in the transformation of the industry will be the demise of one or more major carriers currently operating under the protection of Chapter 11 of the Federal Bankruptcy Code. Based on the prevailing forecasts of lackluster recovery in the U.S. economy, most panel members agreed at least one major airline will stop operating or be consolidated with another large carrier within the next twelve months. However, the panel members also agreed that the industry's transformation will be affected by several factors that could prolong the process as much as ten years.

Upturn of Passenger Demand

A rise in passenger demand is one factor which might prolong the transformation process. Some marginal airlines, whose eventual demise appears inevitable, might receive a temporary boost in traffic resulting from the failure of weaker competitors. The resultant increase in traffic might be enough to sustain some marginal carriers for a brief period. Likewise, the inevitable recovery in the business cycle will provide a much-needed traffic stimulant, thereby prolonging the existence of some marginal carriers.

Although the industry's transformation might take as long as ten years to accomplish, the demise of individual carriers probably will occur much faster than the prolonged failures of Eastern and Braniff, and Pan Am's extended liquidation. Specifically, at least one of the majors operating under the protection of Federal bankruptcy law is not expected to survive and probably will cease operating or be acquired in the very near future. In addition, as other majors seek protection from creditors under the bankruptcy code, creditor committees are expected to become more aggressive in seeking quicker settlements of claims.

Availability of Foreign Capital

An inflow of capital from foreign sources is a second factor which could aid ailing carriers and prolong the transformation of the industry. At least one panel member noted there is a great deal of foreign capital which could flow to U.S. airlines if the DOT ownership limits are liberalized. However, other panel members expressed doubts about the amount of foreign capital that might be invested in marginal U.S. carriers. Panel members noted foreign investors might be reluctant to invest due to uncertainties about both economic and operational prospects.

From an economic perspective, poor historical returns on airline equities could discourage many prospective foreign investors. Furthermore, large foreign carriers who have participated in strategic alliances generally have been disappointed by the results of the alliances, and the alliances have not had much impact on the industry. Therefore, foreign carriers might be very reluctant to commit financial resources to partnerships with marginal U.S. airlines.

From an operational perspective, marginal carriers lack sufficient resources to appeal to a large foreign flag carrier considering a U.S. investment. A large foreign-flag carrier with sufficient financial resources to prop up an ailing U.S. carrier probably could not find a single U.S. carrier with a route network that would provide the desired level of feed traffic at all of the foreign flag carrier's U.S. gateways. For example, a

foreign flag carrier with bilateral rights to serve many U.S. gateways (e.g., Atlanta, Chicago, Detroit, New York, Orlando, and Washington) would have to purchase several U.S. airlines to realize the desired level of feeder operations at each. It appears unlikely a foreign carrier would be willing to commit the financial resources needed to keep a marginal carrier afloat.

Airline fares

A third factor prolonging the demise of weaker carriers will be the return of price rationality. Most panel members agreed airline fares will, in the long run, become more rational. Future fares will more closely reflect the cost of providing service, including a reasonable return on investment. Panel members also noted price rationality will return because of the declining presence and influence of irrational cash-flow discounters.

Although panel members expect to see more rational pricing of airline services, they do not expect airline fares to become excessively high. Panel members noted six constraints on future price increases. First, air travel demand is relatively elastic and excessively high fares would result in declining revenues. Indeed, panel members agreed fare rationality will be a significant contributor to the continuation of stagnant growth in domestic passenger enplanements. Second, the increasing economic clout of large corporate travel departments will prevent business air fares from becoming too high. Third, the increasing presence of low-fare survivors will exert significant competition in several key markets. Fourth, near-term overcapacity will encourage airlines to engage in discount pricing to fill surplus airline seats. Fifth, the surviving major carriers will have extensive domestic route networks linking nearly every major city pair either with direct or connecting service. Consequently, the surviving carriers will compete with each other in nearly every city pair, and the battle for market share will preclude unreasonably high fares. Sixth, surviving carriers might be reluctant to raise prices for fear of raising the ire of Congress.

Prospects for New Entrants

With the anticipated transformation of the industry, niche markets will exist for new entrants. However, the majority of market niches probably will be too small and fragmented to support a carrier of any size. The panel members agreed that one large niche market does exist, but it is unlikely any carrier will be able to exploit it.

There appears to be substantial demand for low-fare service in the high-density, short-haul markets of the northeastern United States. The experience of People

Express demonstrated that additional travel in many northeastern air service markets could be stimulated with the introduction of high-frequency, low-fare service. However, it will be difficult for any carrier to provide such service because the region's high infrastructure costs and congestion are not conducive to the development of low-cost, high-frequency service.

Higher operating costs, including the cost of acquiring slots and gates, in the major northeastern metropolitan areas create higher costs per enplanement, and higher costs per enplanement are especially onerous for low-cost, low-fare carriers. Moreover, airport and airway congestion and the resultant delays prevent quick turnarounds and decrease aircraft utilization. Based on the higher cost of operation and the prospect of significantly higher ground times, it seems unlikely there will be a carrier that can exploit fully the low-fare, high-frequency niche in the northeastern region. Similarly, a low-fare carrier might not be able to establish a significant market presence at the new Denver airport, or any new airport, because of the relatively high facility charges and resultant higher cost per enplanement.

Congestion and Delay

The transformation of the industry probably will not reduce congestion and delays at many of the nation's largest airports. Panel members agreed that economies of scale and marketing leverage will entice the surviving carriers to expand their hub-and-spoke networks by funnelling more flights through existing hub airports. Competing airlines will attempt to increase market share and to stimulate demand by increasing frequency between their hubs and the outlying spokes. Consequently, congestion and delays at the existing hub airports of the surviving carriers will not decrease.

Aircraft size

The surviving carriers probably will not increase substantially the size of the average aircraft in their fleets. The panel members put forth four arguments why the size of the average airplane in the surviving carriers' fleets will not increase significantly. First, the fleets of the surviving carriers are relatively new, and there will be no economic incentive for the carriers to modernize their fleets. Second, the surviving carriers will be competing with each other by offering increased frequency through their hubs, and to attract profitable loads with higher frequency the airlines will continue to operate moderate-sized airplanes. Third, passenger demand to fill very large aircraft exists in relatively few city-pair markets and then only at certain times of the day (e.g., Chicago to San Francisco at 5:00 p.m.).

Airplanes with the capacity to accommodate peak demand tend to be underutilized at other times. Therefore, airlines add flight sections rather than substitute larger aircraft.

The industry's transformation also will affect aircraft manufacturers. The demise of marginal carriers will result in a glut of used aircraft, some of which, the surviving carriers could add to their fleets. Consequently, with these alternative used aircraft available and the likely oligopolistic tendencies of the remaining carriers, manufacturers could experience a decline in their order books.

Government Actions

Panel members expected governments to become involved in a number of new issues. For example, local governments will become more involved in air transportation issues, such as hearings on the award of international route authority. At the State and Federal levels, governments will become more involved in the mediation of disputes between airport users and neighbors. The Federal Government will be asked to assume a greater role in landside development to reduce airport congestion.

RESULTS OF THE TRANSFORMATION OF THE DOMESTIC AIRLINE INDUSTRY

Impact on Airports

Airport operations will be disrupted at the airport hubs of marginal carriers, who will not survive. At some airports that are now airline hubs, the failure of the hubbing carrier will result in a drastic reduction in service as the airport reverts from a hub role to that of a spoke on the survivors' route networks. It appears that the airports most vulnerable to the severe service curtailments are those that are now hubs of marginal carriers with hub status based on their geographic location (e.g., a good location for connecting traffic flowing from the northeastern states to Florida).

Hub airports of marginal carriers with relatively large origin and destination traffic bases might not lose their hub status after the marginal carrier fails. A surviving carrier could open a replacement hub operation at a large O&D airport after the demise of the marginal carrier. In addition, a few entirely new hub operations (e.g. Orlando) might be opened by one or more of the surviving carriers. Nevertheless, it appears that the transformation of the industry will result in a net reduction in the number of airline hubs.

The number of new-entrant niche carriers and their long-term prospects in the transformed industry will depend largely on the new entrants' ability to gain high-volume, low-cost access to secondary airports near large metropolitan areas. In addition, the introduction of high-frequency, low-fare service in the northeastern United States will also depend on prospective carriers' abilities to obtain sufficient landing slots at underutilized secondary airports. Physical expansion of existing hub airports will probably have little impact on increasing competition because the surviving carriers will be adding frequency as rapidly as the existing hub airports can be expanded.

Although the panel foresaw no change in the recent pattern of flat growth in domestic enplanements, they agreed that enormous pressure will be placed on government to continue to expand the domestic infrastructure. Congestion and delay will decrease at the hub airports of failed carriers but will worsen at the hub airports of the surviving carriers. Moreover, there is likely to be pressure to improve and expand the facilities at secondary airports to provide opportunities for new-entrant niche carriers. Therefore, there will be continuing need to obtain funding for major capacity enhancements. However, the proposed passenger facility

charges, which are expected to provide a significant new source of funding for airport development, could be a problem for carriers who provide short-haul, low-fare service. The PFC represents a much larger percentage of the ticket price for low-fare carriers, and in some markets the PFC can be enough to make the price of air service uncompetitive with other transportation modes.

Impact on Labor

The transformation of the airline industry will result in significantly greater economic and political clout for organized labor. For example, the Strike Replacement Bill could enhance the economic leverage of labor. With little threat of nonunion, new-entrant competition, the surviving carriers are less likely to adopt hard-line bargaining positions with their unions. Moreover, with fewer carriers providing the Nation's airlift capabilities, a work stoppage at any one of the survivors would cripple a very significant share of the nation's air transportation network. This could lead the Federal Government to invoke the provisions of the Railway Labor Act or possibly to enact new legislation specifically tailored to the airline industry.

REGIONAL AIRLINES

Panel Moderator

Steven Horner
Canadair, Bombardier, Inc.

Doug Abbey
AVSTAT Associates

Gerald Kolasinski
Hamilton Standard

James Murphy
AMR Eagle, Inc.

Eric Christensen
Skywest Airlines

Tulinda Larsen
Simat, Hellieson & Eichner

Grady Stone
Dornier Aviation

Kathryn Creedy
Global Airline Enterprises

Claude Lazon
Pratt & Whitney Canada

Richard Van Balen
Fokker Aircraft, USA

Frederick P. Dibble
SAAB Aircraft of America, Inc.

Deborah McElroy
Regional Airline Association

Ed White
Allied-Signal Aerospace Company

Kenneth Jernigan
Barklays Bank plc

Neil Meehan
Meehan & Associates

REGIONAL AVIATION PANEL

INTRODUCTION

The regional aviation panel was comprised of a wide range of industry experts that included domestic regional

airlines, representatives from aircraft and equipment manufacturers, and consultants specializing in regional aviation. The panel spent time primarily on issues that will affect the regional aviation segment of air transportation over the coming decade and beyond. Issues of concern in the short term were only addressed with regard to their long-term effect on the industry.

In general, it was determined that regional airlines are consistently poorly understood by all segments of the air transport industry (including, but not limited to, larger airlines, legislative and regulatory bodies, manufacturers, financing agencies, the general public, the press, and the consumer). Unfortunately, this disadvantage is magnified in a time of uncertainty -- and the aviation business has rarely experienced certain times.

The panel addressed factors that currently affect, or have the potential to affect, regional aviation, specifically:

- Major partners
- Economics
- Regulation
- Demographics
- Capacity
- Competition
- General industry structure
- Available aircraft
- Political and public attention
- Industry consolidation
- New technology

LONG-TERM IMPACTS ON REGIONAL AVIATION

Major Airlines

The issue of major partners is significant. For this reason, the regional aviation group met initially with the panel on domestic major airlines. Together, the two panels addressed the long-term potential of each of the major U.S. airlines and, from the regional perspective, how this would flow down to the regional aviation environment. Because of the existing relationships between major and regional airlines, issues that affect major airlines equally affect regional aviation. In brief, the panels agreed that, in a relatively short time, American, United, and Delta would be the only major airlines in the United States. There is an outside possibility that Northwest and/or USAir will continue, but not in their current form. As for national airlines, all of the carriers in this group are almost certain to be absorbed. The only exception could be Southwest Airlines, which has proven its long-term survivability and competitiveness. This airline, in fact, could potentially triple in size within five to ten years. The continuing consolidation of major airlines will significantly affect regional aviation and is likely to result in further consolidation of regional airlines with the majors by means of partnerships and mergers -- a process that is perhaps only 50 percent complete at this time.

Demographics

Demographics are of special interest to aviation, particularly regional aviation. For example, maturation of the U.S. air travel market could be offset by increasing global ties to other nations, producing greater demand for international air transportation. Domestically, changes in how people travel, particularly the market share captured by various forms of ground transportation which compete with short-haul air transportation, is of special concern. Of note are the proposed high-speed rail projects in Florida, Texas, and Canada.

Changes in the geographical distribution of the U.S. population will be important for regional aviation. Changes in population distribution from East to South and West have benefited the airlines with primary operations in the West. The growing importance of edge cities, those communities that develop on the fringes of larger metropolitan areas, can be directly related to the success of satellite airports such as Oakland, Ontario, and Orange County in California or Stewart and White Plains in New York.

Regional/Major Airline Partnerships

Having a regional partner has become a valuable -- perhaps necessary -- marketing attribute for a major carrier. Just as frequent flyer programs and revenue management have spread throughout the industry, partnerships between regionals and majors will continue to evolve.

The process began in the early 1980s (or the late 1960s if one credits USAir with the creation of the concept), with what can be called the *affiliation* phase. This phase involved the creation of partnerships between major and regional airlines for the purpose of expanding the presence of the major into smaller markets, providing feed to connecting hubs in many cases. This phase generally led to the loss of the regional airline's identity in favor of some new designation suggesting close association with the major. The second phase, *consolidation*, really represented two occurrences: consolidation of regional airlines and acquisition of regional airlines by major airlines. This phase tended to occur as a result of financial problems in the regional partners (sometimes as a result of the partnership) or because the major airline wanted to have greater control over this business segment. The third phase, *integration*, is relatively recent. Only two major airlines (Continental and American) have moved to this phase. It involves the basic disappearance of the owned entity as a separate operational airline. In both cases the regional airlines --

from a planning, management, training, purchasing, and administrative standpoint -- have become part of the major airline itself. Despite this trend, neither Continental or American are satisfied with the performance of their owned partners and are evaluating options to improve these operations. The underlying goal is that value clearly must be added in order for the partnership to be worthwhile. But what is value?

Transborder Opportunities

The panel saw opportunities for regional aviation if there were a relaxation of air service agreements with Canada and Mexico. Canada especially has a great deal of traffic potential, primarily due to the current lack of North-South access routes across the border and the recent free-trade agreement which should increase traffic growth rates between Canada and the United States. Mexico, holds much longer-term potential. The panel agreed that the level of per capita income in Mexico remains much too low to support a rapid increase in air service. However, near the end of the decade when business ties between the countries have expanded, demand for regional transborder air services will grow.

Financing Capital Expenditures

One of the most troublesome issues discussed by the panel was the ability of regional airlines to finance capital expenditures. While this is not exclusively a regional airline problem, it is compounded in this segment of the industry by the lack of banks that focus on or target regional airlines, let alone understand them. The short-term market for airline credit is poor. This is likely to change only if the performance of the airlines improves. Compounding the problem is the requirement for greater numbers of larger, faster, more expensive aircraft, and the tightening of credit as a result of the recession.

Healthy major airlines are rare. Those that can finance regional aircraft for their partner are only likely to do so at the expense of the manufacturer's profitability by buying in large volume at extremely low prices. Regional aircraft purchases without the support of partners will have to rely on the support of the aircraft manufacturer until the capital market again becomes accessible to regional aviation on a large scale. The effect of this on the manufacturing industry could be significant. At least 10 companies offer products in the regional aircraft segment, compared to only three in the large aircraft segment. This has led to an unprofitable environment of oversupply and uneconomical pricing --

a situation that is likely to place some regional aircraft manufacturers in extremely precarious positions. Already Embraer, DeHavilland, and recently British Aerospace, have either experienced problems or are reevaluating their business strategies in the regional aircraft arena.

Clearly, this situation affects growth potential of the regional aviation industry. The lack of capital equipment at economical prices may affect the demand for capital equipment and impact the industry's future.

Small Transport Aircraft Economics

The economics of small transport aircraft continue to be difficult. As major airlines are squeezed into larger aircraft, regional airlines are beginning to feel pressures that may result in a large-scale reduction of the 19-seat aircraft category by mainline regional carriers. Several factors are at play: a general growth trend, increasing operating costs, additional regulatory requirements, and marginal traffic volume in certain markets.

Increasing regulatory pressure is significant for the future of regional aviation. Recent regulations designed to increase passenger safety may present difficulties for the regional aviation industry. While all segments of regional aviation are dedicated to providing the safest passenger transportation available, the economic effect of such requirements must be understood by the industry, the regulators, and the legislators. Some of the regulations that are making the economics of small transport aircraft increasingly difficult are:

- Safety equipment (cockpit voice and flight data recorders, TCAS, ground proximity warning, etc.)
- Changes in passenger weight allowance
- Aging aircraft
- Security (positive passenger/bag checks)
- Handicapped access
- Exit row seating
- Passenger facility charges
- Peak-hour pricing
- Pro-competition legislation
- High-density slots

In conjunction with this regulatory pressure, regional airlines are under increasing pressure from their major airline partners to improve service through new, more efficient aircraft that provide better passenger comfort, performance, and baggage capacity.

While these goals are individually desirable, the combination may be economically unreasonable for an industry that operates on a very thin profit margin.

Service to Small Communities

Because of the cost of providing service to small and scattered markets, many regional airlines have pulled out of the Essential Air Service (EAS) program in order to use their assets in markets which hold greater potential. New, very small regional carriers have emerged to take their place, and these are beginning to form a nationwide network of EAS services. Continuing pressure on costs and movement to larger aircraft will lead to continuation in this service shift.

Congestion and Capacity

The issue of capacity will continue to affect regional aviation. Managers of system capacity are moving toward economic pricing of airway and airspace. These actions have two purposes: to earn better revenue by pricing assets according to their economic use and to decrease demand by revising the pricing structure. In many cases, capacity pricing measures have a more severe effect on regional aviation than on other segments of air transportation. Passenger Facility Charges (PFCs), peak hour pricing, and slot controls threaten the economics of service with small transport aircraft. The panel raised the question of whether the policy goal should be to provide service or to limit it.

Understanding Regional Aviation

The public and political leaders often lack a balanced understanding of small transport operations. Despite a safety record matching that of major air carriers, regional aviation is often perceived as risky by politicians and the media. This compounds the concern of the general public about flying on smaller aircraft. 1990 was the safest year in the history of regional aviation. But this fact will quickly be forgotten because 1991 has already become the unsafest year in the history of regional aviation. The industry as a whole feels frustration over the lack of understanding of the industry by not only the public, but all segments of the air transportation industry.

New Aircraft Programs

There is continuing debate on high-speed jet vs. turboprop regional aircraft. One of the difficulties encountered when evaluating new technology is the often myopic view of those who would be directly affected. In aviation, it is difficult to determine how technology will impact the industry. Aircraft attributes are a perfect

example of this. An example from outside the field of regional aviation can be used to illustrate the point. Tokyo has become a large trans-Pacific hub over the past 20 years. While this is strongly related to Tokyo's population and economic position, and specifically its geography, it is perhaps more significant that the range of the B-747, until recently, was basically limited, to the great-circle distance between the United States and Japan. The airlines adapted to the capabilities of the aircraft available. The same can be said about future regional aircraft development where the capabilities of new high-speed aircraft will influence the route structure of the airlines and allow them to offer improved service to the customer.

New high-speed regional aircraft, whether powered by jet or turboprop engines, do not fit neatly into the current mix of small, slow, turboprop and large, fast, jet aircraft. High-speed regional will not gain wide acceptance until experience proves that they can be blended into the fleet operationally and that their increased speed provides economic advantages that outweigh their higher cost in securing short- and medium-haul markets.

FUTURE STRUCTURE OF THE INDUSTRY

Regional Airlines

Since the panel represented both regional airlines and regional aviation manufacturers, it was appropriate to address the future structure of each.

The number of competitors, both domestically and internationally will continue to decline through the evolutionary process of affiliation, consolidation, and integration. Integration, however, may not be the final phase of the process. Two major airlines are reevaluating the advantages of integrating regional carriers into their operations. Neither has attained the benefits that were projected. The integration of regional airlines into their major partners appears to strip the regional carriers of the benefits of their size, replacing them with the disadvantages of the major airline: bureaucracy, politics, complex structure, and big airline mentality. As a result the integrated regional appears to implode under the weight of the major and has great difficulty providing the same benefits at the same cost levels. This could lead to a divestiture of integrated regional airlines if the major partner determines the continued investment is not worth the level of value added.

How this new phase in the evolution process would take place is hard to determine, particularly in the midst of a recession, which makes the situation look worse perhaps than it actually is. Compounding the problem is the level of investment that the major airlines have made in their integrated partners to rationalize their fleets. Divestiture has a high price. Who would buy these airlines at a price which would even come close to covering the investment of the major airline? The panel agreed that the model for regional airline partnerships is the Delta Air Lines/Delta Connection program. This program provides the regional with the identity of the major, and through 20-percent ownership by Delta, the stability of a relationship with a major airline. Delta enjoys all of the benefits of a regional partner, but at virtually no cost; and its ownership position ensures a limited level of control.

Regional Aircraft Manufacturers

The situation worse for the regional aircraft manufacturing sector, where there is a significant amount of overcapacity. The economic environment is forcing the issue. Partnerships and consolidations now under consideration by several regional aircraft manufacturers could reshape the industry. The logical outcome will be fewer competitive manufacturers and higher prices which will result in lower potential volume.

There is a close relationship between the success of regional airlines and regional aircraft manufacturers. The owned regional airlines, supported by their major partners, have been negotiating aircraft purchases at unprofitable prices for the manufacturers due to the competitive environment. These low-priced assets have allowed the airlines to expand at a rate and cost that would not otherwise have been possible. A change in this scenario, one which raises unit price, may result in reduced demand for regional aircraft.

The Outlook

Despite these problems and issues, the outlook is relatively bright. Regional airlines are, and will continue to be, an economical alternative to large carrier service. This has been shown in the past through the large number of passenger transfers between regional and major carriers. The volume of transfers is expected to increase as the major airlines retire small jets and shift service on routes formerly served by these aircraft to regional partners. The transfers may increase even more rapidly through the use of innovative regional aircraft designed to exploit new short-haul markets.

The major uncertainty remains the effect of consolidation, which could result in a more stable and perhaps profitable environment for regional and major airlines alike, as well as for aircraft manufacturers and equipment suppliers.

INTERNATIONAL AVIATION

Panel Moderator
Gerald W. Bernstein
SRI International

Joan Bauerlein
Federal Aviation Administration

John Mathewson
Federal Aviation Administration

Addison Schonland
CIC Research, Inc.

Robert Bowles
Federal Aviation Administration

William R. Nesbit
Aviation Consulting Services

Grant Wilson
Air Canada

Vicki L. Golich
The Pennsylvania State University

David E. Raphael
Marcar Management Institute

Thomas S. Windmuller
International Air Transport Assn.

Steven McBrien
The MITRE Corporation

John Ross
Transport Canada

Earl Wolfe
American Airlines

FUTURE AVIATION ACTIVITIES INTERNATIONAL AVIATION PANEL

INTRODUCTION

The panel chose to accept Dr. Behravesh's forecast of 5 to 8 percent average annual growth in international air travel. Rather than debate the accuracy of this generally

accepted growth rate, the panel focused attention on the ability of international airport and airspace systems to accommodate growth at this pace. If problems are already apparent in Europe and Asia, what must be done (or what issues must be resolved) to accept the doubling of traffic in the 10 years (more or less) implied by the forecast?

The discussion of the ability of airport and air traffic infrastructure to respond to the forecast growth concentrated on three topics:

- Dimensions of the congestion problem
- Key issues to be managed
- Selected influences on demand.

DIMENSIONS OF THE CONGESTION PROBLEM

Europe

Congestion at Europe's airports (measured by flights delayed over 15 minutes) has risen sharply since the mid-1980s (Figure 1). Currently, approximately 25 percent of all flights are delayed by 15 or more minutes. The cost and disruptions to passengers and airlines are significant.

These delays arise from a variety of reasons, including inadequate air traffic control (ATC) system capacity, antiquated ATC practices, and cost-saving operational responses to these problems (such as gate holds, which increase gate occupancy times). If nothing is done, 11 of Europe's 27 major airports (large hubs in U.S. jargon) will be capacity constrained by 1995, increasing to 16 by 2000. At the same time, the forecast traffic growth could lead to a fourfold increase in congested airway intersections by 2000. Well before then, possibly as early as 1995, Europe's ATC system will exhibit even more serious congestion effects than today if nothing is done to improve it.

Fortunately, parts of this problem have attracted political attention and received remedial action. The European Civil Aviation Conference (ECAC), made up of the transport ministers of 22 states, has endorsed a plan, "Strategies for the 1990s", designed to harmonize the disparate national ATC systems and thus improve capacity. ECAC has also endorsed an airway restructuring program that will lead to further capacity increases.

Europe's main long-term problem is on the ground; only one new airport (Munich) is under construction, and only two others are even being discussed (Spata in Athens and Oslo). Many airports can increase capacity through improved operating efficiencies (Table 1), but several major urban areas (e.g., London and Frankfurt) will still be short of capacity. Efforts must begin now on the 10-year process for new runways and/or airports to serve these regions.

Asia

In a way, capacity problems in Asia are almost the reverse of those in Europe. In recognition of the high growth rates and the national importance of civil aviation, 11 new airports or major expansion projects are under way. However, airspace problems, which require multinational coordination to resolve, are prevalent. North Pacific routes are considered saturated, as are the routes over the South China Sea where aircraft are forced on a single route between the Hong Kong/Taiwan region and the Singapore/Australia region. Routes crossing the India/Pakistan border are likewise inadequate for the flow from Europe to the southern Asia/Pacific region.

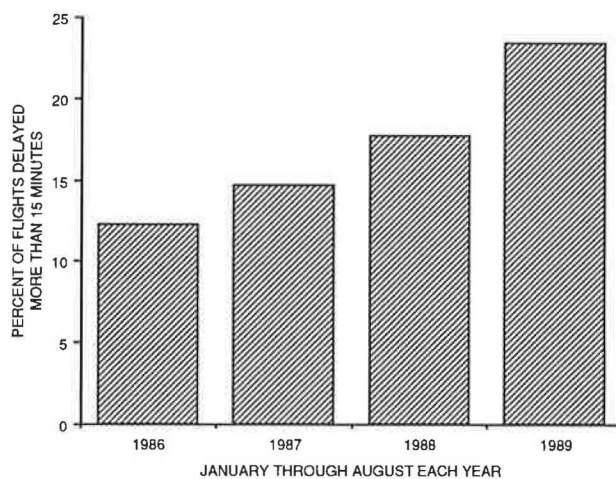


FIGURE 1 The proportion of delayed flights in Europe.

TABLE 1 POSSIBLE CAPACITY ENHANCEMENTS THROUGH IMPROVED UTILIZATION

Single Runway		Parallel Runways		Converging or Intersecting Runways	
Airport	Mvts/hr	Airport	Mvts/hr	Airport	Mvts/hr
London-Gatwick	41	London-Heathrow	72	Zurich	60
Manchester	39	Munich 2*	72	Stockholm	57
Düsseldorf	35	Paris-CDG	72	Istanbul	40
Geneva	35	Amsterdam	70	Hamburg	36
Munich-Riem	34	Paris-Orly†	66	Vienna	35
Milan-Linate	32	Frankfurt‡	60	Madrid	30
Athens	30	Copenhagen	60	Barcelona	28
Marseille	28	Rome	50	Dublin	25
London-Stansted	20	Brussels†	45		
		Milan-Malpensa	30		
		Palma de Mallorca	30		

* Opens 1992

† Near-parallel runways.

‡ Frankfurt can schedule 64 movements per hour in a single hour but only 120 movements per hour in any two consecutive hours.

If Soviet airspace and airports are opened, several benefits are possible. More northerly tracks over the north Pacific through Soviet airspace would enable users to avoid the jetstream and shorten distance by 200 or more nautical miles. The combined effect could be as much as a 1-hour flying time reduction. Soviet airports, such as Vladivostok, could provide alternatives to congested Narita for refueling stops.

A conference of Asian Transport Ministers is being sought by the International Air Transport Association and other interested parties for spring 1992. It is hoped that such a meeting will lead to a committed search for solutions to airway problems.

Latin America

The problems through Central and South America are not those of infrastructure availability but those of inefficient and, at times unsafe, operational practices. Improvements here can be sought through improving controller skill levels.

KEY ISSUES TO BE MANAGED TO MAINTAIN AND EXPAND AVIATION INFRASTRUCTURE

The possible solutions are technological, financial, environmental, and institutional. Prospects in each area are quite distinct.

Technological

No technological barriers exist to resolving any of the airspace problems -- the necessary technology is available virtually "off-the-shelf." Air traffic management over oceanic regions (and Russia east of the Urals) can be provided by the proposed Future Air Navigation Systems (FANS) being discussed by the International Civil Aviation Organization (ICAO). FANS provides satellite-based navigation, surveillance, and communication using the U.S. Global Positioning System (GPS) or Soviet Global Orbiting Navigation Satellite System (GLONASS). FANS has institutional problems that are tied to ICAO; those will be discussed shortly.

Automated dependent surveillance and automated en-route ATC enhancements could expand airway capacities. In terminal areas, runway incursion detection systems and independent parallel operations like those being demonstrated at Raleigh-Durham could enhance safety and capacity.

Environmental

Environmental concerns include noise, emissions, waste, and toxic materials from airport operations. The need for aviation interests to establish a dialog with environmental interest groups, to replace the present rhetoric, was discussed. Little hope was expressed for the ability to establish a dialog with more radical opponents; however, local, issue-oriented environmentalists ("NIMBY" -- Not In My Back Yard) and concerned, rational environmentalists could be engaged in productive evaluations of airport benefits (employment) and cost (noise, emission) trade-offs.

Computer models can provide analyses to support discussion of environmental issues. Although their absolute accuracy is doubtful, they could provide helpful insights if the models tested benefits and costs of alternative developments with a range of weightings (reflecting the values of diverse community groups such as housewives and businesses). The well-accepted use of risk analysis techniques in Vancouver was cited as an example of a quantitative approach to evaluating the inevitable trade-offs.

Financial

In 10 years, it is entirely possible that financial problems will be as prevalent as environmental problems are today. The need for tens of billions of dollars for infrastructure enhancements will compete in constrained capital markets with the hundreds of billions of dollars required for new aircraft. The airport and ATC expenditures needed to accommodate the forecast growth are likely to be stalled (as they frequently have been) if government sources are relied upon. Public-private cooperation will be needed. Recent revenue bond funding for long-delayed radars in Greece is an example of how such cooperation can provide necessary enhancements.

Institutional

The institutional dimension involves international, multinational, national, and labor elements. Concern was expressed about ICAO's ability to sustain its role as the international standard-setting body. While the panel generally agreed on the need for international standards and a body to focus such efforts, examples of ICAO's recent failures were numerous. After years of effort by an ICAO planning group, action on Europe's ATC problems did not gain momentum until ECAC took action. The United States FAA and Europe's Joint Aviation Authority (JAA) have established cooperative measures that make ICAO almost irrelevant for establishing certification standards. This cooperation is beginning to extend into aircraft maintenance and operations standard-setting.

It appears that regional bodies, (such as ECAC) and national civil aviation organizations (such as the U.S. FAA) have a greater ability to implement improvements. The harmonization and route restructuring endorsed by ECAC was previously discussed, while the replication of the Raleigh-Durham high-scan-rate radar system as a way to increase capacity on closely spaced parallel runways at other locations in the United States is expected. While it is gratifying to find governments implementing capacity enhancements, the possible elimination of international planning and standard-setting is worrisome.

Labor problems include union relations and personnel recruitment. Greater flexibility in manpower scheduling without the civil service restrictions that bind many ATC workforces could enhance utilization. Increasing controller recruitment would also help. For example, the U.K. and French air traffic services each hires approximately 50 to 100 controllers annually -- as compared with over 2,000 by the U.S. FAA.

Institutional and political changes do not occur on their own, and the panel was encouraged to note the formation of the Air Transport Action Group (ATAG) in Europe by IATA and other parties such as consumer groups, chambers of commerce, and travel organizations that benefit from an efficient aviation system. ATAG enables organizations with an interest in resolving congestion problems to effectively coordinate political action.

SELECTED INFLUENCES ON DEMAND

Although the panel accepted the demand forecasts as representative of likely growth, they identified four specific influences that could shape the future.

International Hub-Bypass Service

The potential growth of nonhub-nonhub (or small hub-small hub) transoceanic services could contribute to reducing large hub congestion. However, travel survey data suggest that such service probably would not obtain the traffic volume necessary to operate economically. It appears that a large hub is needed at one or the other end of the trip. While this kind of service has grown significantly, future opportunities for reducing traffic demand at large hubs with bypass service are not likely to be so dramatic.

Teleconferencing

Ten years ago, aviation forecasters were anticipating a mild reduction in air travel as a result of teleconferencing in the 10 to 20-year future. We are continuing to await its impact. The panel did not expect teleconferencing to have a significant influence during the 1990s.

High-Speed Rail

Possible reductions in air travel demand arising from high-speed rail service are likely in Europe (and in a few selected domestic city pairs in Asia). The scale of this reduction is expected to be slight systemwide -- causing

a 4- to 5-percent reduction over 20 years in Europe according to two studies. While high-speed rail service may reduce demand by over 50 percent on selected routes, the highly dispersed pattern of European air travel is such that the systemwide impact of high-speed rail is expected to be almost negligible. Indeed, the argument was advanced that the planned installation of high-speed rail stations in the lower level of several European air terminals could help expand feed to airports.

Air Express Growth

In the United States, over the past decade air express has grown from a small activity to a revenue-ton mile volume almost equal to that of air cargo. If forecast growth rates of air express (as high as 26 percent average annual growth rate in the Asia/Pacific region) are achieved, the daytime operations of these dedicated freighter aircraft win increase demand on airport (runway and ramp) capacity over and above the already high passenger growth forecasts.

CONCLUSIONS

The panel viewed the prospects for sustained high international air travel demand as excellent. Prospects for timely provision of the airport and airspace infrastructure to support this growth are far less certain. Sustained action by the aviation community and allied interests will be required to obtain the necessary investments. For the decade of the 1990s, the panel was cautiously optimistic.

BUSINESS AVIATION

Panel Moderator
Gerald S. McDougall
Wichita State University

Ralph A. Aceti
Canadair Challenger

Robert Hollander
Falcon Jet Corporation

Regina VanDuzee
COMSIS

Mark Bobbi
Forecast International

Steve Johnson
Honeywell, Inc.

James Veatch
Federal Aviation Administration

William Follette
Honeywell, Inc.

John Masters
AC Flyer Magazine

Robert W. Yatzeck
Federal Aviation Administration

Steven R. Hines
Cessna Aircraft Co.

Frank Mastin
Learjet Incorporated

Karl Zaeske
Rockwell International

Frank Nel
Pratt & Whitney Canada

INTRODUCTION

The 1980s were a time of adjustment for business aviation. Costs and prices rose. Markets for turbine-powered aircraft became thinner as a result of slower economic growth, recessionary pressures on corporate earnings and profits, and increased merger and takeover activity. Growth in the active U.S. business aircraft fleet and the use of the fleet slowed as an increasing number of business turbine-powered aircraft left the country to be placed in operation overseas.

In response to these market changes, aircraft manufacturers consolidated operations and rationalized product lines around the new economics of business aviation. Except for specialty aircraft, the manufacture of piston aircraft nearly ceased. The production of turboprop aircraft consolidated with one viable U.S. manufacturer (Beech) producing five different turboprop models. Shipments of new business jets stabilized around 260 units per year, which seems to be a level that can sustain minimally profitable operations for the surviving manufacturers.

Business aviation is now entering another transition period. New forces are at play, and it is likely that the business aviation industry will have to adjust once again to changed circumstances. The panel identified the following as major forces that will shape business aviation in the coming decade: (1) a maturing U.S. domestic market, (2) uncertainty about the fleet of used business aircraft and the linkages between market segments, (3) increasing importance of foreign markets, (4) the level of new product development, and (5) changing expectations among corporate buyers and other operators of business aircraft.

BUSINESS AVIATION FORECAST

As a context for discussion of the forces that will affect business aviation, the panel developed an overview forecast of new aircraft shipments, the business aircraft fleet, and flight hours through 2001. The shipment forecast is for worldwide shipments, while the fleet size and fleet hour forecasts are for the U.S. domestic fleet of active aircraft. The values for fleet size and fleet hours are preliminary estimates that are likely to be revised downward when the results of the 1990 FAA General Aviation Activity and Avionics Survey are reported. For this reason, 1989 values were used as base points for forecasts of fleet size and fleet hours. 1990 is the base value for aircraft shipments.

Annual shipments of new business jet aircraft worldwide are expected to increase from approximately 262 units in 1990 to approximately 317 units by 2001. (Table 1) This corresponds to an average annual growth rate of 1.7 percent over the coming decade. The U.S. domestic jet fleet was forecasted to grow at an average annual rate of 1.9 percent, reaching just over 5,500 by 2001. Total jet fleet hours were expected to increase at an average annual rate of 1.6 percent over the forecast period. The forecasts for fleet size and fleet hours suggest a slight decline in average jet hours flown.

The turboprop forecasts show greater strength over the forecast period. (Table 2) Annual shipments of new business turboprop aircraft worldwide are expected to increase from 144 units in 1990 to approximately 339 units in the year 2001. This corresponds to an average annual growth rate of 8 percent, which is much more optimistic than the jet aircraft forecast. Growth at this rate would be quite a departure from recent trends, and

the shipments forecasted for 2001 (if realized) would reposition the turboprop segment to where it was in 1975.

There was general agreement among the panelists that the turboprop forecast presented here requires that several conditions be met. The single-engine business turboprops currently under development must hit a particularly active market niche. Engine and airframe manufacturers would have to cooperate in developing engine specifications and design and production techniques that reduce engine development and fabrication costs. More manufacturers would have to enter the market. Marketing efforts would have to be expanded and intensified. The development of new markets in eastern Europe and the former Soviet republics might also be of great significance.

TABLE 1 BUSINESS JET AIRCRAFT FORECASTS*

YEAR	SHIPMENTS WORLDWIDE	U.S. FLEET	U.S. FLEET HOURS(000)
1970	107	950	474
1971	61	991	481
1972	193	1123	592
1973	258	1406	703
1974	252	1579	806
1975	262	1776	874
1976	253	1938	1000
1977	335	2277	1165
1978	336	2480	1197
1979	395	2653	1259
1980	461	2992	1332
1981	573	3171	1387
1982	431	3996	1611
1983	257	3898	1473
1984	262	4320	1566
1985	239	4375	1622
1986	206	4480	1654
1987	221	4338	1528
1988	260	4187	1678
1989	252	4402	1654
1990	262	4441	1685
1991	267	4526	1707
1992	306	4647	1743
1993	291	4748	1773
1994	284	4837	1801
1995	293	4931	1830
1996	301	5029	1860
1997	298	5120	1887
1998	307	5216	1916
1999	315	5316	1947
2000	312	5410	1976
2001	317	5504	2005

*Historical data 1970 to 1989 (1990 for shipments) forecasts thereafter

TABLE 2 BUSINESS TURBOPROP AIRCRAFT FORECASTS

YEAR	SHIPMENTS WORLDWIDE	U.S. FLEET	U.S. FLEET HOURS(000)
1970	162	1458	970
1971	137	1492	958
1972	241	1509	1042
1973	309	1865	1126
1974	305	2120	1247
1975	338	2519	1326
1976	373	2436	1267
1977	484	2790	1429
1978	567	2980	1431
1979	659	3379	1649
1980	804	3834	1845
1981	899	4428	1785
1982	412	4890	1770
1983	242	5167	1649
1984	204	5433	1873
1985	215	5078	1617
1986	124	5169	1550
1987	124	4973	1689
1988	117	4857	1542
1989	108	5662	2071
1990	144	5745	1899
1991	75	5806	1913
1992	105	5884	1920
1993	297	6066	1950
1994	226	6208	1971
1995	189	6330	1987
1996	235	6476	2009
1997	277	6644	2038
1998	263	6804	2063
1999	308	6988	2092
2000	348	7193	2127
2001	339	7392	2160

*Historical data 1970 to 1989 (1990 for shipments) forecasts thereafter.

The domestic business turboprop fleet was forecasted to increase to 7,392 aircraft by 2001, corresponding to an average annual growth rate of 2.2 percent. Total turboprop hours were forecasted to increase more slowly, 0.35 percent annually, reflecting a decline in turboprop utilization.

The accuracy of the business jet and turboprop forecasts will also depend on major market drivers: corporate performance measured by profits and retained earnings, new product developments and how they match with market niches, prices and price-performance differentials among business aircraft market segments, fleet characteristics including age of aircraft and the extent of overcapacity in the turbine-powered aircraft fleet, the continued development of foreign markets, and the regulatory environment.

A MATURING U.S. MARKET

The current growth profile for the domestic business turbine fleet suggests that the U.S. business aircraft market is maturing. Figure 1 shows the U.S. business aircraft fleet for the years 1965 to 1990, using a logarithmic scale. The slope of the curves represents the percentage of change. It is evident that overall growth in both the turboprop and jet domestic fleets stopped in 1985, even though certain segments continued to grow. The shape of this curve, representing a declining growth rate over time, is consistent with the traditional market concept of product life cycle and the hypothesis that markets eventually mature and become saturated.

Additional evidence is provided in Figure 2, which incorporates a graph of the U.S. multi-engine piston aircraft fleet that exhibits a similar flattening of the growth curve. It appears that the multi-engine piston market matured around 1980 and began to shrink around 1985, the same year that the jet and turboprop markets reached maturity. The multi-engine piston fleet curve could be the precursor of the turbine-powered fleet curve.

A third piece of evidence indicating a maturing U.S. domestic market for business turbine aircraft is the size of the domestic retail fleet and the number of aircraft owners in the 1984-1991 period. (Figure 3) The number of aircraft exceeds the number of owners, suggesting an average retail fleet size of approximately 1.5 aircraft. The turboprop retail fleet and the number of turboprop owners peaked around 1986 and have declined since. The retail jet fleet and the number of retail owners have increased steadily over the 1984-1991 period, but at a diminishing rate.

If, in fact, the U.S. market for business jet and turboprop aircraft is maturing, there are significant implications for aircraft manufacturers and suppliers, who must realize that a mature market is a more price-sensitive market. Sales of new and used aircraft will depend more heavily on changes in prices and interest rates. Growth in shipments and the domestic business fleet will be influenced by the introduction of new products and the extent to which they meet consumer preferences, especially in the international market.

There would also be repercussions for the Federal Aviation Administration in the form of need for flight services, demand on the air traffic control system, and airport capacity. FAA may need to reevaluate its forecasts of business aviation activity, facilities requirements, and controller workload, taking into consideration the maturation of the U.S. business aircraft market, the increasing importance of foreign markets, and the flow of business aircraft from the domestic fleet.

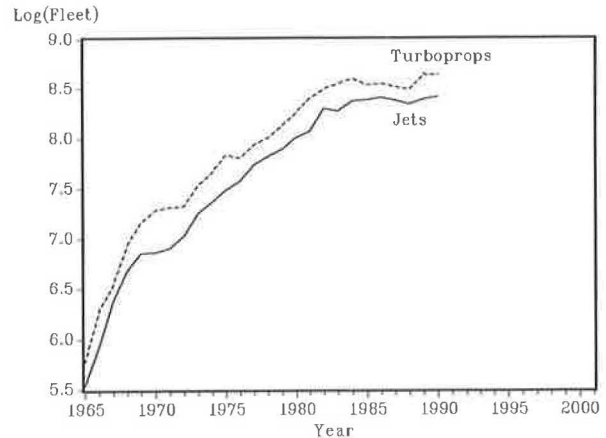


FIGURE 1 U.S. turbine-powered aircraft fleet.

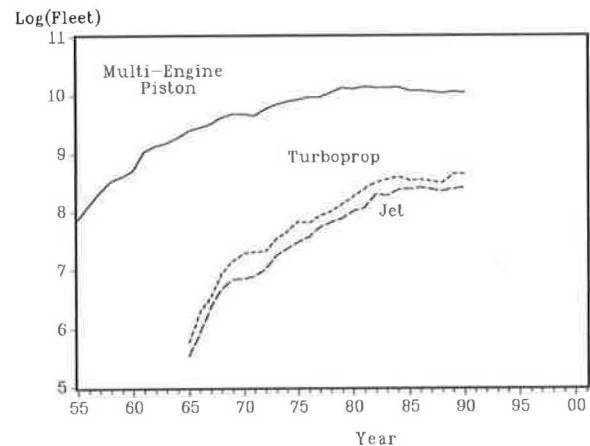


FIGURE 2 U.S. business aircraft fleet (turbine-powered and multi-engine piston).

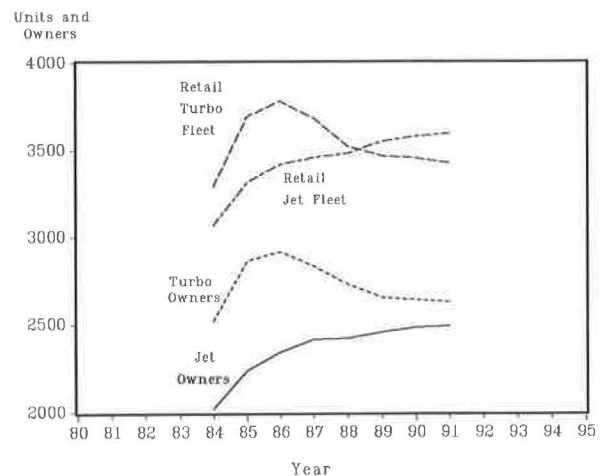


FIGURE 3 Domestic retail aircraft and owners.

The turbine forecasts developed by the panel indicate continued growth in shipments, fleet size, and fleet hours. On the surface, this is contrary to the hypothesis that the U.S. turbine market has matured. It is likely that the overview forecast can be realized only if the business aircraft industry avoids real price increases and successfully develops and introduces new products that appeal to changing buyer preferences for executive air travel. The new products must encourage current owners and operators to trade up and trade in, and at the same time entice new buyers of jet and turboprop aircraft into the market.

THE WORLDWIDE MARKET FOR USED BUSINESS AIRCRAFT

The most recent data show that the major growth in business aviation is taking place outside of North America. This is consistent with the hypothesis that the U.S. domestic market has matured. Worldwide, the turbine-powered aircraft fleet increased 2.6 percent from 1990 to 1991. However, this growth was not evenly distributed geographically. The North American turbine-powered aircraft fleet showed virtually no growth, while the European and South American fleets grew 9.6 and 11.3 percent, respectively. (Table 3)

TABLE 3 GROWTH IN WORLDWIDE BUSINESS FLEET

REGION	PERCENTAGE CHANGE 1990-1991		
	JETS	TURBOPROPS	TOTAL
Worldwide	3.9	1.5	2.6
North America	1.0	-1.0	0.
Europe	13.0	6.4	9.6
South America	13.6	10.3	11.3
Central America	10.3	2.7	7.0
Asia	2.6	3.6	3.0
Africa	6.2	7.0	6.7
Oceania	2.2	-4.0	-2.0

Four-year trends confirm the increasing importance of Europe, South America, and Central America, with commensurate decline in the North American fleet. In 1988 the North American fleet accounted for about 73 percent of the world's business aircraft. By 1991 the North American share had declined to 68 percent. On the other hand, shares increased from 10.9 to 13 percent in Europe, 5.9 to 7.3 percent in South America, and 3 to 3.6 percent in Central America. The remaining regions maintained market share at their 1988 levels. In large part, the growth rates in areas outside the United

States reflect the increasing globalization of business and trade.

The pattern is clear; business jet and turboprop aircraft have been leaving the North American fleet and going to Europe and Latin America. The United States has been a net supplier of used aircraft to the rest of the world, which has led to attrition of the domestic business aircraft fleet at the rate of roughly 0.5 percent annually since 1972.

Can the United States continue to be a supplier of used aircraft to the rest of the world? The answer is yes. Sales of new turbine-powered aircraft to those who presently own airplanes will continue. However, the U.S. fleet will not grow appreciably because somewhere in the daisy chain of trade-ins an airplane will not be resold in this country but be shipped overseas. There is some evidence suggesting a significant overhang of used aircraft on the world market, and presumably these are aircraft that are or were formerly registered in the United States.

Figure 4 shows the average number of aircraft for sale and the total number of aircraft sold, from the fourth quarter of 1989 through the first quarter of 1991. In 1989 the worldwide used turbine aircraft market was close to equilibrium. By the first quarter of 1991, after a three-year period of rising used aircraft prices, a significant excess supply of used turbine-powered aircraft had developed. Over this six-quarter period the number of available aircraft increased by nearly 70 percent while the number of aircraft sold per quarter declined 38 percent. By the first quarter of 1991 quantity supplied (i.e., available) exceeded actual sales by 1,176 units. This overhang suggests an abundant supply of turbine-powered aircraft to support growth in international fleets. Real used aircraft prices will have to retreat, however, to clear the market.

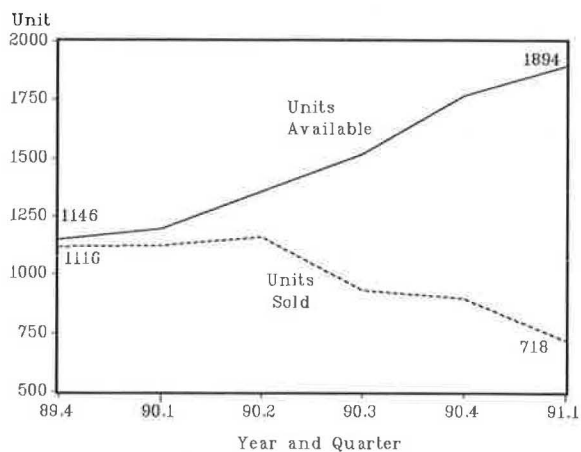


FIGURE 4 Worldwide turbine-powered aircraft market.

Because the U.S. fleet dominates the world fleet, the demand-supply gap in the world market raises questions that deserve further investigation and research. How many turbine aircraft are really active and available? Perhaps the FAA should consider tracking aircraft that have very low use rates by means of the General Aviation Activity and Avionics Survey to obtain a better measure of business aviation activity. What is happening to buyer views about airframe and engine times? At what point do the owners of unmarketable business aircraft simply park them but not take them off the U.S. registry? While there is some market evidence suggesting that jet and turboprop aircraft become unsalable when airframe and engine times reach 4,800-5,200 hours, the acceptance threshold is increasing as the availability of low-time aircraft diminishes and more of the fleet has over 5,000 accumulated hours. 10,000 hours may become the next threshold.

Will foreign markets continue to expand and absorb business aircraft released from the U.S. fleet? These aircraft can provide better service and efficiency than the relatively older aircraft now common in foreign fleets. Moreover, aircraft sold on the world market tend to be dollar-denominated assets, providing foreign buyers with a relatively liquid capital investment. The panel raised the question whether the excess supply of used aircraft means that prices for used aircraft will soon fall. Many operators and owners may be reluctant to place used aircraft on the market because they were purchased during the recent speculative period when used-aircraft prices were rising.

Perhaps most important from the perspective of business aircraft manufacturers, will the outflow of used aircraft from the U.S. fleet, in conjunction with replacement the aging fleet, create a significant increase in the demand for new turbine-powered aircraft? Will current owners of multi-engine piston aircraft move into the used turboprop market for replacements? Given the dearth of turboprop production, will current owners and operators of top-end turboprop aircraft move into entry-level jets? How does the increasingly important foreign market affect the trade-up linkages between piston, turboprop, and jet business aircraft in the U.S. market?

Certain events must take place in the used-aircraft market for continued growth in the market for new aircraft. Trade-up linkages must be established between piston, turboprop and jet markets. The business aircraft industry must identify new customers in the United States. Analysis of shipments, fleet growth, and attrition suggests that the turbine industry must capture nearly 600 new jet owners and 500 new turboprop owners over the next decade. Low growth in the U.S. fleet means that sales of new aircraft will result in the export of used

aircraft. If foreign fleets are going to absorb the outflow of used aircraft from the U.S. fleet, the foreign jet fleet must increase by approximately 70 percent and the turboprop fleet by 50 percent over the next 10 years. Worldwide, the industry will have to find almost 1,500 new jet customers -- either first-time aircraft owners or from among the 4,900 present owners and operators of turboprop aircraft. At the same time, the industry must have a net increase of 1,100 new turboprop customers to sustain the forecasted growth in this market segment. The increase in jet owners is likely to come from turboprop owners, and the new turboprop owners are likely to come from current owners of piston aircraft.

CHANGING BUSINESS PREFERENCES AND NEW PRODUCT DEVELOPMENT

Unprecedented new product development is under way among aircraft and engine manufacturers and avionics suppliers. New single-engine turboprop aircraft (e.g., the Pilatus PC-12 and TBM 700) may soon enter the business aviation market. New entry-level jets, such as the Swearingen Jet and CitationJet now under development, will be comparable in price to currently produced turboprop aircraft. New medium-sized business jets (the Citation X and Lear 60) are being developed, and it is becoming increasingly difficult to distinguish between the new larger medium jets and the present large jets, as performance improves in the medium business jet category. To the extent that these new products are successful, modest expansion of the domestic fleet and continued growth of the overseas market for U.S.-made business aircraft can be expected.

A critical point discussed by the panel was how well these new products will meet the changing preferences of corporate buyers and operators. Corporate executives and corporate flight departments are looking for increased comfort (cabin volume, stand-up room), increased range (transcontinental and intercontinental), improved speed (exceeding Mach 0.8), and lower operating costs. Many of the new products expected on the market during the mid-1990s are designed to meet these buyer preferences. Further advances, however, probably depend on the ability of engine manufacturers to develop new engines with enhanced performance characteristics.

Next generation jet aircraft available sometime after 1995 can be expected to have cruise ranges of 4,300 to 5,500 nautical miles, cruise speeds in the Mach 0.83-0.87 range, and cabin volumes exceeding 1200 cubic feet. The next generation of engines will have 20 percent more airflow per sq. ft. and 10 percent greater thrust-to-weight

ratio. Along with these improvements, the next generation of engines will be of simpler design (up to 30-40 percent fewer parts), and hence less costly to fabricate. They will also have lower cost of operation and maintenance. All of these engine enhancements will improve the opportunities for airframe manufacturers to develop turbine aircraft to meet future market demands for longer range, higher speed, and more comfortable business aircraft.

CONCLUSIONS

The panel concluded that 1991-1992 will be another transition period for business aviation activity. Domestic sales, fleet growth, and fleet utilization will likely reflect the characteristics of a maturing market and a slow economy: market saturation causing slow growth and both factors bringing increased sensitivity to prices. Changes in business aviation activity in the United States, spurred by new product introductions, will mirror real economic growth.

Overseas sales and expansion of foreign fleets will drive industry expansion through the beginning of the 21st century. Europe, Central America (including Mexico), and South America have the greatest market potential, while very modest growth in business aviation activity is expected in Asia. Expansion of foreign fleet

operations depends on continued growth in the world economy, investments in new technology, rationalization and reorganization of fragmented air traffic control systems, and continued favorable international trade conditions.

If the overseas market potential is realized, shipments of new jet and turboprop aircraft will grow in the United States, Europe, and Latin America. As new jet aircraft are introduced, used business jet aircraft will become available to support expansion of jet fleets overseas. Further, as U.S. turboprop operators shift to jets, market, turboprop aircraft will be released to accommodate trade-up by multi-engine piston aircraft operators and expansion of foreign turboprop business fleets.

In light of this forecast, FAA may wish to reexamine its forecast for domestic business aviation activity. Because international markets are expected to play a pivotal role for the business aviation industry in the 21st century, FAA may also wish to initiate study of the international flow of new and used turbine aircraft and changes in fleet activity in key foreign countries or regions. In addition to tracking the U.S. fleet, FAA should consider gathering information on the worldwide fleet. This may involve collating and reporting information collected by counterpart organizations in major foreign countries. A better understanding of business aviation activity worldwide would improve FAA's ability to forecast changes in U.S. business aviation.

LIGHT GENERAL AVIATION

Panel Moderator
Ronald L. Swanda
 General Aviation Manufacturers Association

Fletcher Aldridge
 Aircraft Bluebook & Marketline

Paul Fiduccia
 Sports Aircraft Mnfctrs. Assn.

Paul McDuffee
 Embry-Riddle Aeronautical Univ.

Andrew Chase
 Booz Allen & Hamilton, Inc.

Thomas Henry
 Federal Aviation Administration

Charles Schuck
 Experimental Aircraft Association

Harold M. Collins, Jr.
 Nat'l Agricultural Aircraft Assn.

Frank Jensen
 Helicopter Assn. International

Audrey Smerkanich
 U.S. Department of Commerce

Chris Corich
 Port of Portland

Don C. Johnson
 Aircraft Owners & Pilots Assn.

Dan K. Walker
 Allied-Signal Aerospace

The panel examined the current and future status of light general aviation aircraft, defined as fixed-wing aircraft, powered by single or multiple piston engines and weighing less than 12,500 lbs.

Findings are derived mainly from the panel's analysis of the U.S. light general aviation fleet. As 75 percent of all of the world's light general aviation aircraft are operated in the United States, the status of light general aviation in this country is probably representative of its status worldwide.

INFRASTRUCTURE AND ENVIRONMENTAL FACTORS

Airports

As Figure 1 illustrates, the number of U.S. airports open for public use declined 5 percent from 1983 to 1990. Most of the decline occurred in privately owned, public-use airports, which account for 24 percent of all U.S. public-use airports. These airports are used almost exclusively by light general aviation.

Aircraft Noise

The major environmental problem in aviation is public objection to aircraft noise. Communities neighboring on airports often seek relief by limiting the number of aircraft operations or by instituting bans on flights at certain times of day or night. These measures are aimed chiefly at larger aircraft certificated under federal Stage 2 noise standards. Small propeller-driven airplanes, which predominate in the light general aviation fleet, certificated to a different standard in recognition of their

generally lower noise levels. For these reasons, outright bans on light general aviation airplanes because of noise are rare and not expected to increase in the foreseeable future.

Airport Access

Although access to existing major airports is a significant factor influencing light general aviation, a more important factor is the total number of general aviation and reliever airports. Given an adequate alternative, general aviation aircraft will not operate at congested major airports. As Figure 2 indicates, the percent of general aviation traffic at the 22 busiest major airports has been consistently declining. Much of the remaining general aviation traffic operates during non-peak hours or on non-interfering short runways. Air traffic delays are generally not caused by general aviation traffic at major airports. Bans on general aviation operations at major airports appear unlikely.

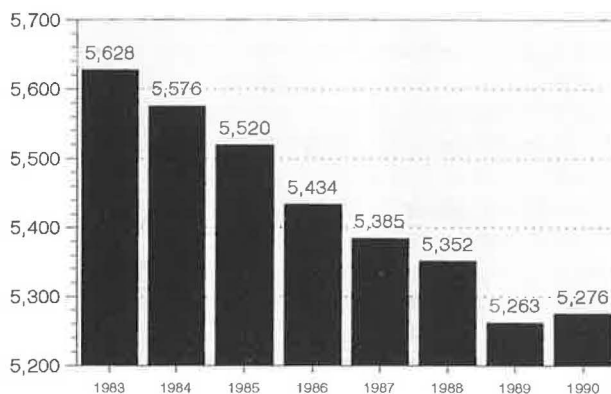


FIGURE 1 U.S. public-use airports.

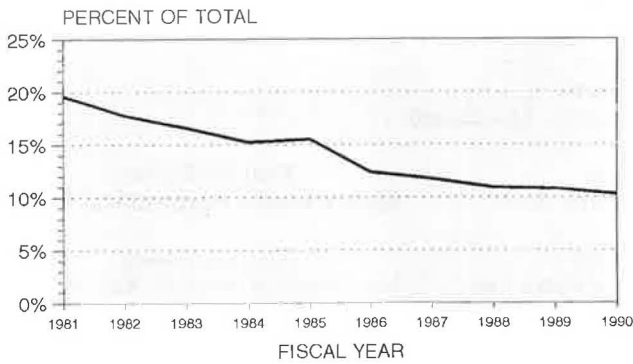


FIGURE 2 General aviation operations at the busiest 22 U.S. airports.

LEGAL AND REGULATORY FACTORS

Product Liability

The tort system within the United States, especially as it affects manufacturer's product liability costs, is one of the most significant factors influencing light general aviation.

Paid product liability claims incurred by the industry have risen from \$24 million to over \$210 million in the past decade, even though the general aviation safety record has shown steady improvement since 1946. (As Figure 3 illustrates, 1989 and 1990 were the best years for general aviation safety in history.) These costs result in higher prices, putting the purchase and operation of a new general aviation aircraft beyond the means of many businesses and private owners.

As general aviation manufacturers are primarily or wholly self-insured, the burden of awards, settlements, and defense costs falls directly on the manufacturers, and ultimately, the consumer. These product liability problems have had far-reaching consequences. Product liability costs have contributed to the decline of new piston-engine aircraft sales from 16,000 units in 1978 to an estimated 620 units in 1991. (Figure 4) The single largest cost of building a small aircraft -- larger than material or labor -- is product liability. Entire aircraft model lines have been discontinued and factories closed.

Low production rates of new aircraft have increased the average age of U.S. general aviation to 25 years. One quarter of the general aviation fleet is more than 33 years old. Employment by aircraft manufacturers had declined by more than 65 percent. Innovation in general aviation products has slowed as manufacturers have become reluctant to introduce new technology. The U.S. general aviation manufacturing industry could lose its position as the world's leading supplier of light general aviation airplanes.

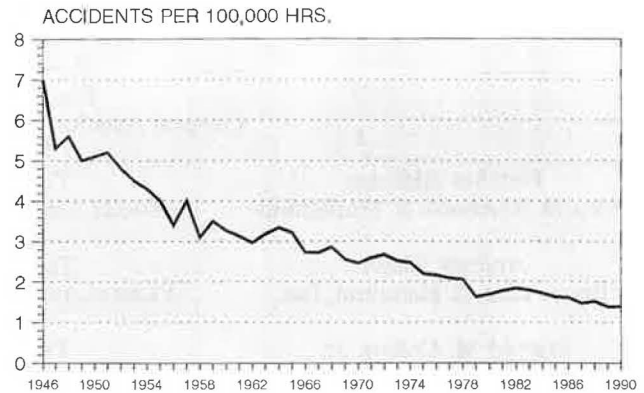


FIGURE 3 General aviation safety record.

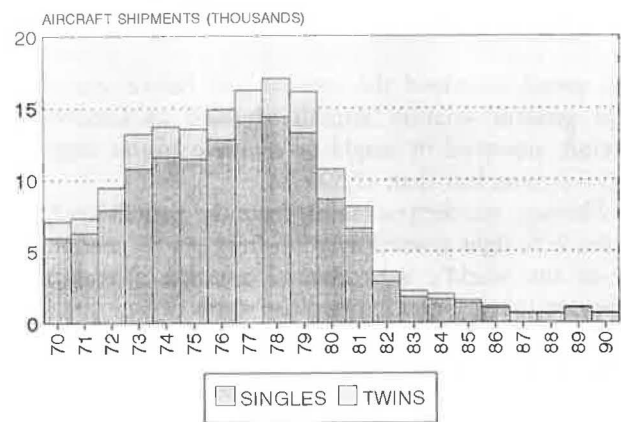


FIGURE 4 Shipments of new piston-powered aircraft.

Without legislative or judicial relief the product liability system will severely restrict growth of the light general aviation fleet.

Airspace Use

The airspace in the United States is becoming more complex, congested, and highly regulated. The Federal Aviation Administration (FAA), in the interest of safety, has placed several new requirements on aircraft operators. Aircraft operating within 30 miles of the main airport inside a Terminal Control Area (TCA) must now have altitude-encoding transponders, even if they are not within the TCA. TCAs are currently located at the 26 busiest airports, and their number is expected to grow. Regulated airspace known as Airport Radar Service Areas (ARSA's) now surround nearly 150 midsize airports, requiring pilots to establish radio contact before entering the airspace. FAA recently relaxed some of these restrictions by allowing "cut-outs" from TCA and ARSA airspace wherein general aviation operators can fly without special clearance.

Equipment Requirements

Operators of piston-powered airplanes, especially those that operate older, less sophisticated aircraft primarily for recreation, are very price sensitive. Even the slightest increase in operating expense or the need for additional aircraft equipment may cause the operator to reduce the annual hours flown or to stop flying completely. This current regulatory environment is believed by some to be a significant factor in the decline in flight hours and activity levels in the general aviation fleet over the last decade. At the same time, this regulatory environment has probably made a significant contribution to general aviation's improving safety record.

Pilot Training

Higher standards of pilot training, especially recurrent training, are under consideration. Currently, many insurance companies will not insure pilots unless they agree to additional or recurrent training. While these equipment and operating requirements may increase safety, they also increase the cost of flying to some degree and may decrease the perceived utility of general aviation.

Aircraft Maintenance

General aviation is a fleet of older aircraft. Twenty-five percent of U.S. general aviation aircraft are more than 33 years old. As with any piece of capital equipment, older general aviation aircraft may reach a point where the maintenance required to keep the aircraft airworthy is prohibitively expensive. To uphold safety, the FAA may find it necessary to prescribe additional maintenance inspections for older general aviation aircraft. A small number of these inspections may uncover major discrepancies that would be relatively expensive to repair. The result of these additional inspections, therefore, could be increased retirement of older general aviation aircraft.

ECONOMIC FACTORS

Although shipments of new aircraft have declined in recent years, the 1990 fleet of 187,773 active general aviation piston-engine aircraft remains a significant provider of transportation in the U.S. economy. In 1990, for instance, general aviation transported approximately 120 million passengers and flew nearly 35 million hours. As such, general aviation is affected by changes in U.S. Gross National Product, expendable income, interest rates, corporate profits, inflation rates, business

confidence, and the overseas value of the dollar.

Since 1980, however, external factors, such as product liability laws, have changed and obscured the traditional relationship between general aviation and the economy. The general aviation industry has restructured since 1980, but not to the point where it operates independently of the U.S. economy. More research is needed to shed light these current relationships.

FUTURE STATUS OF LIGHT GENERAL AVIATION

Fleet Size

Figure 5 shows the number of active rotorcraft and piston-engine aircraft in the U.S. general aviation fleet. This fleet grew rapidly in the late 1970s, primarily because of the introduction of many new models of aircraft, a healthy demand for flight training, low real interest rates, and a robust economy. Since 1980, however, the size of the U.S. piston-powered fleet has remained relatively constant.

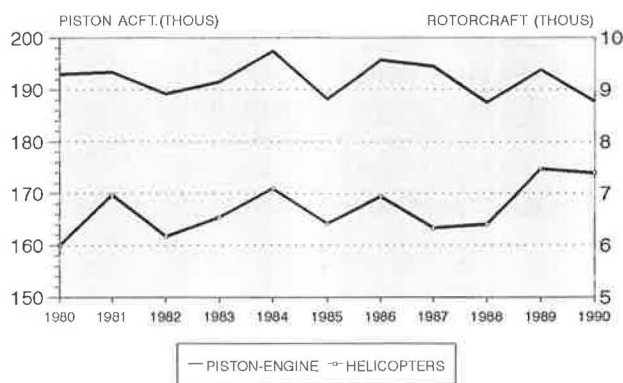


FIGURE 5 U.S. light general aviation fleet (active piston-engine and rotorcraft).

Product liability problems have caused Cessna Aircraft Company, which at one time produced half of all the world's new piston-engine airplanes, to halt production completely. Piper Aircraft Company declared bankruptcy in 1991 and effectively ceased production of all aircraft. It seems unlikely that the U.S. piston airplane fleet will grow with two major manufacturers completely withdrawn from piston airplane production.

Although foreign manufacturers have been exporting piston-powered aircraft to the United States for several years, they have not yet taken the markets abandoned by U.S. manufacturers. While new single-engine piston aircraft imports tripled in 1990 compared to 1985 levels, imports are still relatively modest at only 100 aircraft per year. (Figure 6) No foreign manufacturer is currently marketing a two-seat training aircraft in the United States. Manufacturers from Korea, France, Germany, and others, however, have announced their intentions to export increasing numbers of light general aviation aircraft. One French manufacturer recently announced plans to move assembly of its aircraft from France to the United States. Yet another company announced plans to purchase Piper Aircraft Company and produce aircraft in Canada. It is therefore unclear whether offshore manufacturers will produce aircraft in sufficient quantities to affect the size of the U.S. piston-powered fleet.

Hours Flown

The number of hours flown by the U.S. piston-engine fleet peaked at 37.3 million hours in 1979 and has declined every year since. There are, however, significant differences in the activity of each component of the piston-engine aircraft fleet.

Figure 7 breaksout the total hours flown by piston-engine aircraft into three components: personal use, instructional use, and all other uses (which primarily includes business and executive transportation). Personal hours flown in the piston-engine aircraft fleet gradually increased from a low of 8.0 million hours in 1985 to an all-time high of 10.5 million hours in 1987. This increase is most likely attributable to relatively stable aircraft operating costs, increased expendable income for consumers, and the increased utility of general aviation travel as commercial airfares and congestion at major airports increased.

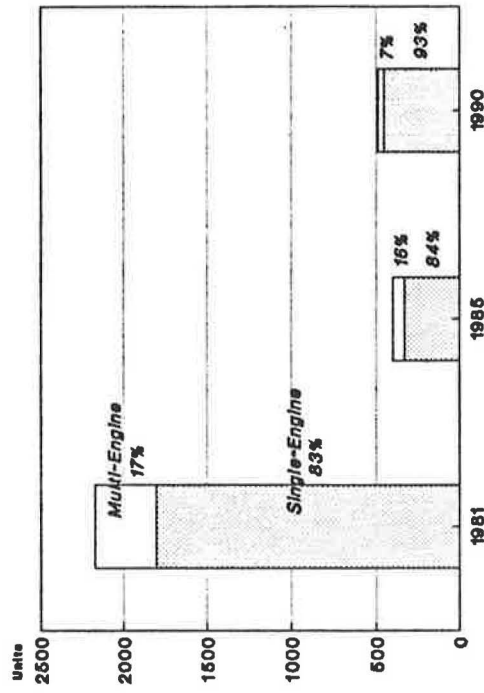
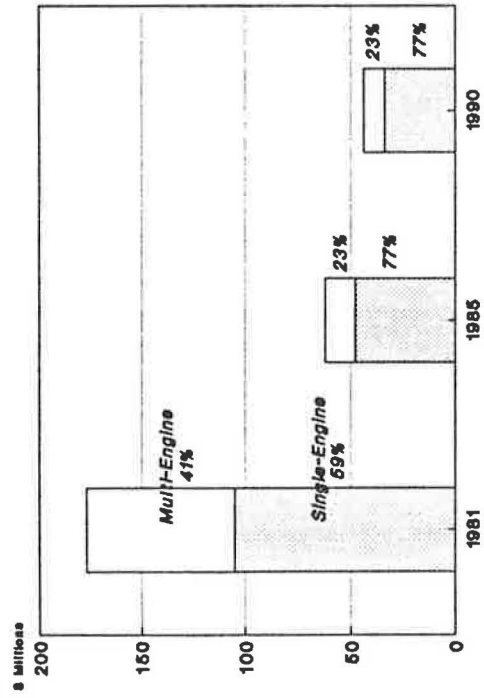
The steady decline in the "All Other" (primarily business travel) category of piston-engine aircraft flight hours is surprising. One explanation is that businesses are not willing to use older, air-worn aircraft in their business. Since the average piston-engine aircraft now is 33 years old, businesses may be turning to the newer, used turbine aircraft fleet for their transportation needs. The cost of purchasing a used turbine aircraft is now relatively low, which may have brought the cost of turbine aircraft into the range of small business owners. Another explanation for the decline in piston-engine aircraft business travel is that, since businesses use aircraft as productivity tools, they may not be satisfied with the cruise speeds offered by most piston-engine powered aircraft.

Hours flown in instructional use peaked at 6.3 million hours in 1979 and then hit a low of 4.1 million hours in 1985. Since 1985, instructional-use hours have gradually risen to 7.4 million hours in 1990, a record high. Figure 8, however, illustrates that during this recent period of increased training activity, the number of students starting pilot training has actually been relatively stable.

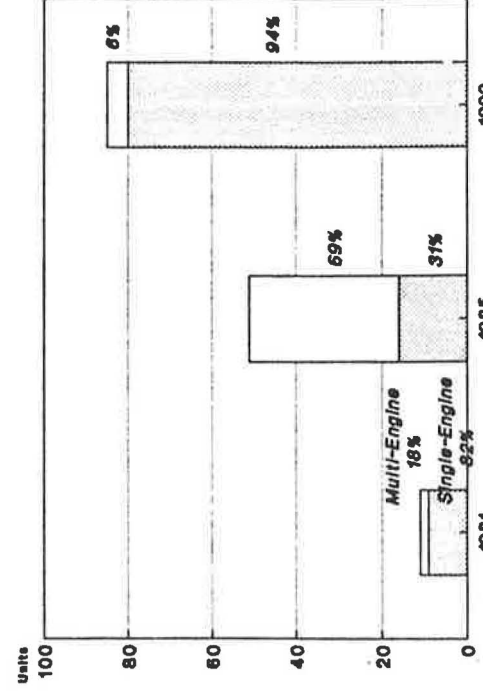
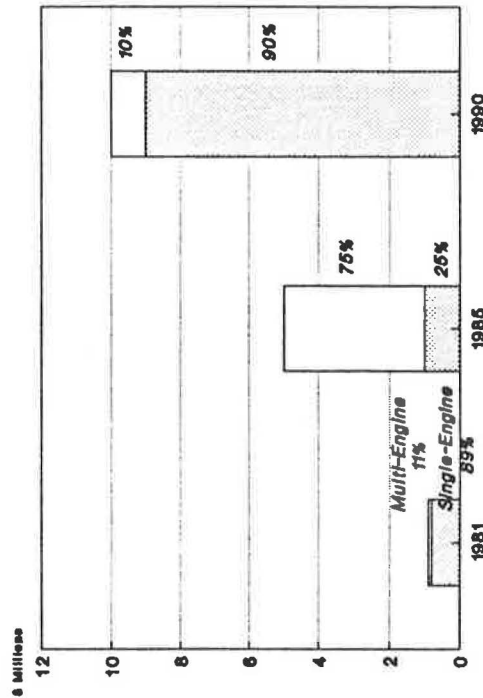
One explanation for this seeming contradiction is that students entering pilot training today are doing so to start a career, and they are more likely to complete a fuller curriculum than those who want to fly for recreational purposes. This explanation is corroborated by the increased enrollments of students at universities offering education for aviation careers.

Another factor giving rise to increased instructional hours is pilot recurrence and upgrade training. The number of pilots receiving an original Commercial or Airline Transport Pilot certificates increased (by 84 percent) to 23,513 in 1990, compared to only 12,801 original issuances in 1984. New instrument ratings also increased (by 107 percent) to 22,528 in 1990 compared to 10,845 in 1984. All these programs involve significant training time, but no additional pilots are created in the process.

Exports:



Imports:



Source: U.S. Department of Commerce: Bureau of the Census; ITA, Office of Aerospace. AMS, 09/09/91.

FIGURE 6 U.S. trade in piston-engine aircraft.

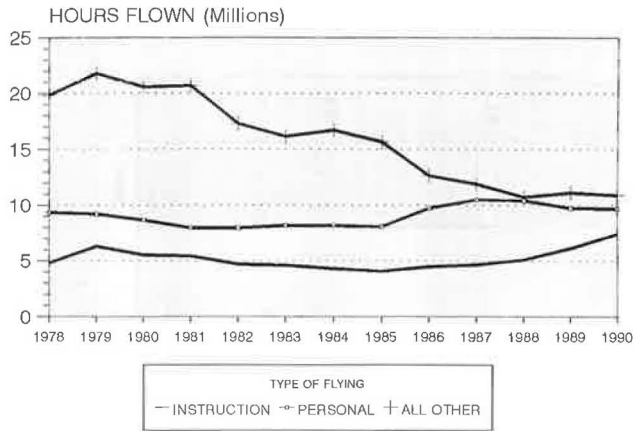


FIGURE 7 Piston-engine aircraft flight hours.

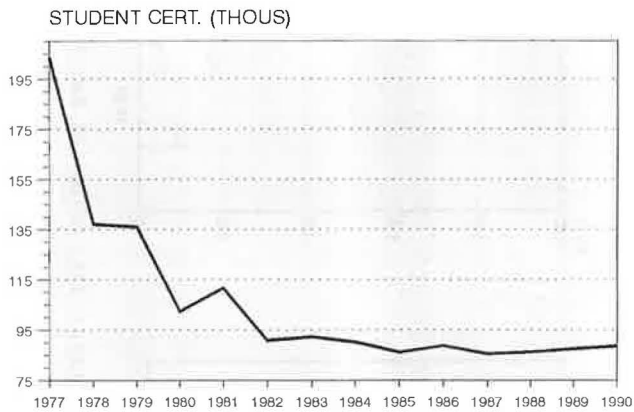


FIGURE 8 New student pilots.

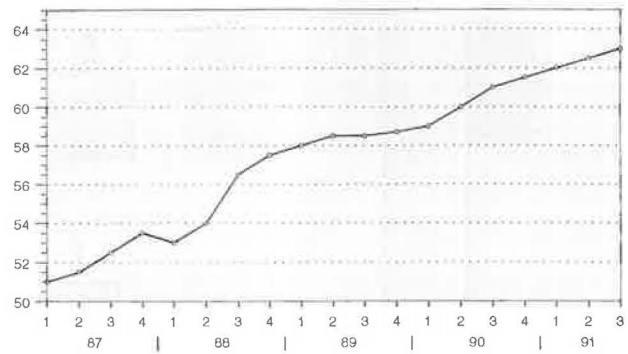
Used Aircraft Prices

One measure of activity in the general aviation fleet is the price of used aircraft. Despite recent downturns in the economy, there has not been a sell-off of used aircraft. Figure 9 shows indices of prices for used piston-powered single-engine and multi-engine aircraft. The strength demonstrated in these measures indicates a solid consumer interest in aviation, despite temporary economic troubles and a lack of new aircraft.

Kit Aircraft Industry

The kit aircraft industry has its origins in the homebuilt aircraft movement created by the Experimental Aircraft Association. Kit aircraft are not type certificated, but receive experimental, amateur-built category airworthiness certificates. Originally, experimental amateur-built aircraft were new designs and restorations or major modifications of old aircraft produced by an individual and generally flown only local-day-VFR.

PRICE INDEX (single-engine piston aircraft)



PRICE INDEX (multi-engine piston aircraft)

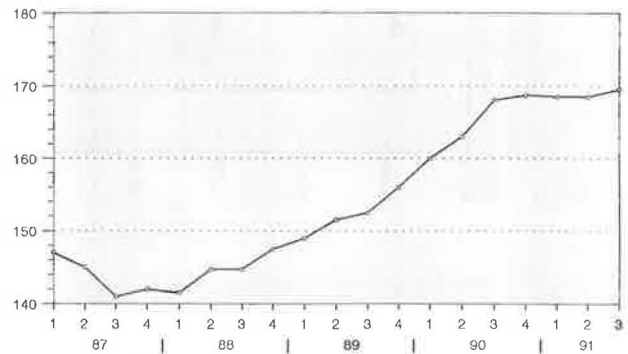


FIGURE 9 Used aircraft prices.

Kit aircraft are the latest step in this evolution. Typically, the designer builds one or more prototypes, performs engineering analyses and ground and flight tests to refine the design, and then markets kits. The kit purchaser must perform a majority of the work to complete the aircraft, often investing 2000 or more hours of work, and several years, in the construction process. For this reason, it is the builder's name, not that of the company supplying the kit, that goes on the aircraft data plate.

The importance of the kit aircraft industry has grown in recent years as more aircraft kits are shipped and more aircraft being completed. Last year (1990), there were over twice as many kit aircraft than production piston single-engine airplanes shipped. For airplanes with base prices under \$100,000, there were far more kit airplanes completed and certificated in 1990 than type-certificated airplanes produced by U.S. or foreign manufacturers.

Another significant change in the kit industry is the increasing sophistication of kit aircraft, in terms of the analysis and testing of the design, the aircraft's materials, the manufacturing processes employed, and aircraft performance. More kit aircraft appear to be built primarily to be flown, rather than for the pleasure of building them, because they are the best single-engine airplanes flying.

In fact, a significant amount of the innovation in U.S. personal airplanes is occurring in the kit industry because of the relative ease with which a kit manufacturer may make design improvements compared to a type-certificated aircraft manufacturer. In addition, some believe that kit aircraft production may be the only practical way, in the current regulatory and legal environment, for a new company to produce an affordable personal aircraft of new design.

Kit aircraft certifications (the number of kits completed and receiving airworthiness certificates) were 13,807 as of June 1, 1991. Based on the number of new airworthiness certificates issued in the first six months of 1991, over 700 amateur-built, experimental aircraft will

be certificated in 1991, up from about 400 in each 1989 and 1990. All of these aircraft are priced under \$100,000.

Kit manufacturers believe that the current aircraft certification system imposes burdens on personal aircraft that are not necessary to maintain an appropriate level of safety. This system creates an economic barrier to the production of new personal aircraft designs and major modifications of existing designs.

The high certification burdens for new designs of personal aircraft have had several consequences. Virtually no really new U.S. personal aircraft designs have been certificated in many years. Virtually all new U.S. personal aircraft designs are amateur-built, experimental aircraft. Most new personal aircraft designs are foreign, and U.S. manufacturers face increased European competition now, and even more on the horizon.

If solutions to the problems inhibiting the production of affordable personal aircraft can be found, the downward spiral of the personal-use, new-aircraft industry could be reversed, and the size of the general aviation piston-powered aircraft fleet would increase.

AIRCRAFT AND EQUIPMENT MANUFACTURE

Panel Moderator

Paul Steggerda
Honeywell, Inc.

Philip Bolt
British Aerospace

Robert Chomick
Pratt & Whitney

Vernon F. Thomas
General Electric Aircraft Engines

Brent D. Bowen
The Wichita State University

Mr. Eugene S. Mercer
Federal Aviation Administration

Thomas Vild
Aerospace Management
Consultant

Alain Buttaud
SNECMA

Gerry Pronk
Fokker Aircraft B.V.

Hugh Walsh
U.S. Department of Commerce

Steven Charters
Rolls-Royce, Ltd.

Len Theroux
International Aero Engines

John F. Walsh
Rohr Industries, Inc.

Paul Thomas
Douglas Aircraft Company

The focus of this panel was on developing a 15-year forecast (1991-2005) of aircraft deliveries in the commercial jet transport market. A part of this effort revolved around forecasting traffic growth, load factor projections, and retirement of aircraft from the fleet. The panel also reached consensus on issues that were considered the most difficult to forecast and those issues that would have a significant impact in the forecast period.

The participants were asked to submit their forecasts in advance, and the results were analyzed during the workshop meeting. Divergent viewpoints were discussed, and adjustments were made to reach a consensus forecast.

TRAFFIC GROWTH AND LOAD FACTORS

The results of the traffic projections developed by the panel for the 15-year forecast period are shown in Table 1. There was a significant range of growth projections. The average worldwide traffic growth came out to 5.2 percent, with the highest growth in the Far East and the U.S. average at 4.5 percent. Load factors were projected to average 66.2 percent worldwide and to increase in each of the five-year segments. (Table 2) The panel felt this increase would result primarily from more efficient scheduling and yield management.

Table 2 also shows traffic growth and load factor broken out in five-year segments and indicates a gradual decline in the rate of traffic growth in 2001-2005 due primarily to the maturity of the market.

**TABLE 1 TRAFFIC GROWTH ASSUMPTIONS
1991-2005**

	AVERAGE ANNUAL GROWTH OF REVENUE PASSENGER MILES (%)		
	LOW	AVERAGE	HIGH
U.S.	2.7	4.5	5.8
NON-U.S.	5.0	5.9	7.0
WORLD TOTAL	3.7	5.2	6.5
WORLD LOAD FACTOR	63.1	66.2	67.8

**TABLE 2 TRAFFIC GROWTH ASSUMPTIONS
1991-2005, AVERAGE BY FIVE-YEAR PERIODS**

	AVERAGE ANNUAL GROWTH OF REVENUE PASSENGER MILES (%)		
	1991/95	1996/00	2001/05
U.S.	4.1	4.8	4.2
NON-U.S.	6.3	6.0	5.4
WORLD TOTAL	5.4	5.4	4.8
WORLD LOAD FACTOR	65.1	66.3	67.2

PASSENGER AIRCRAFT DELIVERIES

To develop a consistent set of assumptions for the deliveries and retirement forecast, a set of matrices was used to classify aircraft types into three categories. (Tables 3 and 4)

TABLE 3 AIRCRAFT CLASSIFICATIONS FOR FORECASTS OF NEW DELIVERIES

CLASS II SHORT-RANGE AIRCRAFT 70 TO 120 SEATS	
<ul style="list-style-type: none"> • BAe NRA • BAe RJ 70 • BAe 146-200/300 • B737-500 	<ul style="list-style-type: none"> • DAA 100 • FOKKER 100 • FOKKER 80 • MD87/MD95

CLASS III MEDIUM-RANGE AIRCRAFT 120 TO 350+ SEATS	
<ul style="list-style-type: none"> • A300-600 • A310-200 • A320 • A321-100 • A330 • A319 	<ul style="list-style-type: none"> • B737-300/400 • B757 • B767-100/200/300 • FOKKER 130 • MD80s • MD90-30

CLASS IV LONG-RANGE AIRCRAFT 150+ SEATS	
<ul style="list-style-type: none"> • A310-300 • A330ER • A330 STRETCH • A340 • A340 STRETCH • A350/2000 • B747-200/300/400 	<ul style="list-style-type: none"> • B767-200ER • B767-300ER • B777 • B787 • MD11 • MD11 STRETCH • MD12

TABLE 4 AIRCRAFT CLASSIFICATIONS FOR RETIREMENT FORECASTS

CLASS II SHORT-RANGE AIRCRAFT 70 TO 120 SEATS	
<ul style="list-style-type: none"> • BAC 1-11 • B727-100 • B737-100/200 • CARAVELLE 	<ul style="list-style-type: none"> • CONVAIR 880 • DC9 • FOKKER 28 • TRIDENT 1/2

CLASS III MEDIUM-RANGE AIRCRAFT 120 TO 350+ SEATS	
<ul style="list-style-type: none"> • A300-B2/B4 • B707-120/220 • B720 • B727-200 • DC8-10/20 	<ul style="list-style-type: none"> • DC8-61 • DC10-10/15 • L1011-1 • MERCURE • TRIDENT 3

CLASS IV LONG-RANGE AIRCRAFT 150+ SEATS	
<ul style="list-style-type: none"> • B707-320/420 • B747 SP • COMET • CONCORDE • CONVAIR 990 	<ul style="list-style-type: none"> • DC8-30/40/50 • DC8-62/63 • DC10-30/40 • L1011-100/200/500 • VC10

The panel's forecast for aircraft deliveries in the period 1991-2005 (average, low, and high values) are shown in Table 5. The panel felt that during this 15-year span the size of aircraft would grow. The move to larger aircraft would satisfy the problem of limited slot availability that will occur during the forecast period at a growing number of airports. There will, however, be an everpresent need for aircraft with fewer than 120 seats as new secondary hubs develop and as other markets are served.

Table 6 lists average annual new passenger aircraft deliveries. 1991 represents the delivery peak year at close to 800 aircraft, followed by a gradual decline to the 500 to 600 range in 1996 and for the 10-year period thereafter. This forecast is at variance with what the aircraft manufacturers' order books and the existing backlog suggest. If the existing record high aircraft backlog is delivered to airlines as presently scheduled, a severe overcapacity will occur in the industry and not correct itself until 2000. But realistically will the airlines allow this to happen? Will they maintain that overcapacity in their fleets? The aircraft delivery history is full of peaks and troughs, and with the projected overcapacity it is hard to forecast as to how this situation will be addressed.

TABLE 5 NEW PASSENGER AIRCRAFT DELIVERIES BY CLASS 1991-2005

	ESTIMATED TOTAL DELIVERIES		
	LOW	AVERAGE	HIGH
CLASS II*	720	1419	2556
CLASS III	4083	4890	5922
CLASS IV	1339	2512	2991

*See Table 3 for class definitions.

TABLE 6 NEW PASSENGER AIRCRAFT AVERAGE ANNUAL DELIVERIES 1991-2005

1991	782	1999	569
1992	710	2000	556
1993	649	2001	543
1994	608	2002	537
1995	594	2003	546
1996	546	2004	543
1997	542	2005	538
1998	552		
		15-YEAR TOTAL	8821

PASSENGER AIRCRAFT RETIREMENT

The result of the panel's forecast for retirement aircraft from the world passenger aircraft fleet by class of aircraft as shown in Table 7. Class II aircraft (short/medium range aircraft with less than 120 seats) have the highest average level of retirements. The forecast shows that retirement of Class II aircraft is expected to exceed deliveries for the forecast period. This is attributed to the relative high number of DC-9's and 727-100's in the current worldwide fleet.

The panel's consensus forecast of annual aircraft retirements (Table 8) reflects the advent of Stage 3 noise legislation and concerns about aging aircraft that have risen over the last few years. Aircraft retirement is generally fairly constant throughout the forecast period, with a low of 228 aircraft in 2002-2005 and a high of 349 aircraft in 1993. The past five years have seen very few actual aircraft retirements, but -- for of the reasons stated above as well as the general economic atmosphere the airline industry at present -- the panel felt that this retirement forecast was appropriate. However, it should be pointed out that aircraft retirements are among the hardest and most challenging to forecast.

TABLE 7 PASSENGER AIRCRAFT RETIREMENTS BY CLASS 1991-2005

	ESTIMATED TOTAL RETIREMENTS		
	LOW	AVERAGE	HIGH
CLASS II*	1692	2058	3415
CLASS III	262	1350	2142
CLASS IV	302	633	1073

* See Table 4 for class definitions.

TABLE 8 PASSENGER AIRCRAFT AVERAGE ANNUAL RETIREMENTS 1991-2005

1991	313	1999	258
1992	342	2000	244
1993	349	2001	231
1994	318	2002	228
1995	294	2003	228
1996	250	2004	239
1997	252	2005	236
1998	263		
		15-YEAR TOTAL	4052

The fleet size in 2005 as a result of the forecasted deliveries and retirements is:

World Jet Passenger Fleet* 8,961
 Estimated Average Deliveries 8,821
 Estimated Average Retirement 4,052
 Estimated Total in Year 2005 13,730
 * In December 1990

This represents a 53 percent growth in fleet size over the next 15 years that is consistent with the traffic growth and load factor forecasts previously presented.

FORECAST ISSUES

Two sets of forecast issues were identified by the panel. One set consists of issues that have historically been considered in the preparation of aviation forecasts:

- Airport congestion,
- Yield management,
- Aging/high cycle aircraft,
- Oil/fuel price trend,
- Globalization of airlines.

A second set of forecasting issues arise because of the current state of the airline industry:

- Rescheduling of aircraft deliveries,
- Ability of leasing companies to place aircraft,
- Buying new vs. used aircraft,
- Availability and affordability of capital,
- Airline overcapacity,
- Restructuring and consolidation of airlines,
- Economic growth.

AIRPORTS

Panel Moderator

Richard R. Mudge
 Apogee Research, Inc.

Michael Bell
 Kemper Securities Group, Inc.

Bruce Carter
 Springfield Airport Authority

Blair Conrad
 Huntsville-Madison County
 Airport Authority

Ron Erdmann
 U.S. Department of Commerce

Richard L. Harris
 Dean Witter Public Finance

George Howard
 Association of Airport Councils
 International

John Kari
 Metropolitan Council,
 Minneapolis-St Paul

Lloyd McCoomb
 Toronto Lester B. Pearson
 National Airport

Richard de Neufville
 Massachusetts Institute of
 Technology

Ken Scott
 Norfolk International Airport

John J. Smith
 Federal Aviation Administration

Tim Ward
 The Perot Group

Robert T. Williams
 Boeing Defense & Space Group,
 Helicopters Division

AIRPORTS

The airport panel began with five presentations by panel members. The authors and topics were:

- Michael Bell¹ from Kemper Securities speaking about airport finance with particular emphasis on the problems faced by airports in implementing passenger facility charges (PFCs).

· John Kari, Senior Transportation Analyst with the Metropolitan Council of the Twin Cities, who discussed an innovative approach to strategic airport planning that depends, in part, on active public involvement in the early stages of analysis.

· Tim Ward of the Perot Group who described recent developments at Alliance Airport, the Nation's most ambitious private airport. His major message

¹ Mr. Bell has since been appointed Chief Financial Officer for the City of Atlanta.

was that airport-related economic development does not happen automatically but depends on the right location, good facilities, and effective marketing.

- Bruce Carter, Manager of the Springfield, Illinois, Airport, talked about the special market development problems faced by many small commercial airports in a world dominated by megacarriers.

- Robert Williams from Boeing Helicopters provided a brief presentation on the market potential for tiltrotor aircraft.

The panel's wide ranging debate identified nine current or emerging trends that will affect the ability of the Nation's airports to help meet long-term demand for air service. These nine trends are interrelated.

LONG-TERM SHORTFALL IN AIRPORT CAPACITY

The panel spent limited time discussing airport capacity problems, in part because this is talked about at virtually every airport meeting. Also, the topic appears to have less urgency today given the weakness of the airline industry. Indeed, a few airports suddenly find themselves with excess capacity. Witness Atlanta's Hartsfield, which has 40 empty gates since the failure of Eastern Airlines.

Even so, a fair number of airports do have capacity problems in the near term. Given the practical problems in making a significant increase of physical capacity, the growing interest in non-capital alternatives was highlighted, including what some call "de-marketing." In other words, higher prices are a natural result of any capacity-constrained system. In the case of aviation, these prices can be imposed either by the airlines or by the airports themselves. Until recently U.S. airports have not had the legal authority or ability to implement true market pricing. A recent ruling by the U.S. Department of Transportation appears to permit this possibility.

CONTINUED WEAK AIRLINE INDUSTRY

The airline industry is currently exhibiting financial and operational weakness, and perhaps reduced competition. As a result, many airports face new financial uncertainty. In particular, fares are likely to increase (at least relative to the trends of recent years) while the extent and quality of service in many markets is likely to decline somewhat. Both effects could generate additional

complaints from the travelling public. These problems, in turn, create difficulties in developing long-term airport plans in general and financial plans in particular.

As a possible remedy for reduced competition, some advocate encouraging foreign entry, either through increased joint ownership of U.S. airlines or through an "open skies" policy that would allow foreign carriers to provide some domestic service. In general, however, the panel did not see as much doom and gloom in the future of the domestic airline industry as expressed by some of the other panels. The feeling seemed to be that, while the competitive situation was unlikely to improve in the near future, it was also unlikely to become significantly worse.

LACK OF COMPETITIVE BALANCE BETWEEN AIRPORTS AND AIRLINES

A closely related problem concerns the balance of power between airports and airlines. In other words, how can innocent public servants negotiate with 800-pound gorillas? Negotiations between airports and airlines have become much more strained than in the past and may worsen. Implementing PFCs provides a recent example of the kind of power struggle that must be resolved.

There was some discussion of radical ideas to increase the power or influence of the airports, perhaps through regional associations. Favorable comments were expressed about the Port Authority of New York and New Jersey. Mention was made of the Australian National Airport Board which negotiates with the airlines on behalf of all commercial airports. Such multi-airport associations were held out as one possible way to help restore "balance" to the airport's lost negotiating power.

GROWTH IN INTERNATIONAL TRAFFIC

International traffic is the fastest growing part of the airline business -- despite somewhat limited promotion by most communities and airports. Gateway airports face serious operational problems, including peak arrival congestion on runways, baggage screening, and delays in customs, immigration, and related inspections. These problems divert management attention from other issues and cost money. Now that more and more airlines overfly traditional ports of entry, these problems are no longer restricted to only a handful of airports.

LACK OF EFFECTIVE LONG-RANGE PLANNING

There was a strong sense that the traditional approach to airport master planning is not all that fruitful, in that many communities spend time deferring to public opposition rather than implementing programs. Early public involvement is important, even though it creates the risk of losing some control over the planning progress. A number of panelists suggested that for certain types of planning -- strategic additions to present capacity or building new airports -- the airport authority may be the wrong public-sector agency to take the lead. Other agencies with broader regional constituencies may be more productive in developing positive public involvement.

The need for strategic thinking was discussed intensively. It was felt that a willingness to think more flexibly and to consider the uncertainty involved in long-term planning would help provide a framework for master planning as well as helping to develop a public consensus for action.

There was a belief that larger airports should think regionally. Concern was expressed about the tendency for the airports within a region to see themselves as direct competitors -- Chicago being a good example.

There is also a need for multimodal planning, particularly for ground access. The absence of workshop attendees with a background in highways or transit was pointed out as symptomatic of this lack of attention. Access is an increasingly severe problem, and it needs to be given more serious attention.

Concern was expressed that many cities planned by syllogism -- almost exactly the opposite of master planning. Often local boosters say look at what Hartsfield did for Atlanta or how wonderful DFW has been for Dallas-Fort Worth and seek to build a major airport in a place that is still developing its local economic base. Concern was expressed that some of these projects are overly ambitious and might fail.

LACK OF PUBLIC UNDERSTANDING OF AVIATION

The public does not appear to appreciate the economic and social value of aviation. This is a standard complaint, and one likely to increase in importance as we become a part of the larger global economy. There also continues to be skepticism in a broad segment of the public about airports and whether or not they speak the truth when they go out and talk to the public.

CONTINUED SENSITIVITY TO NOISE AND RELATED ENVIRONMENTAL IMPACTS

Public misperception about the role of airports is clearly evident in the continued concern about environmental matters. The need for environmental impact statements

and related processes slow down planning and implementation. The negative noise impact of aircraft overflights will always be there, and the move toward Stage 3 aircraft will not eliminate the noise problem. For example, airlines are likely to take advantage of the extra power of many Stage 3 aircraft by having them fan out across the city. This will not decrease complaints, and the aviation industry runs the risk of telling the public that Stage 3 aircraft will take care of the problem, just don't mind those heavy objects flying over your head. The noise problem will continue to hinder the ability of airports to expand and therefore limit the growth potential for the aviation industry in general.

NEW AIRPORT FINANCE BURDENS

Financial pressures on airports have increased, in part due to the airlines' economic situation and in part because regulatory constraints also increase the financial burden on airports. The corollary of increasing airline financial risk is that airports and communities must now share these financial risks. The state of Minnesota, for example, recently invested some \$700 million in Northwest Airlines. Denver, is building a new airport based in part on a guarantee from an airline in bankruptcy and a financial package that puts the City of Denver only 10 years away from the need to find \$230 million a year to pay off their airport financing bonds.

Some communities are confronted with a shift in financial risk that could mean placing greater reliance on general obligation bonds to finance airport investments instead of relying solely on revenue bonds issued by the airport authority.

INCREASING REGULATORY BURDEN

A growing list of regulatory problems face airports. Federal airport security regulations are an example. The goals are unquestionable, but the cost of the measures required to attain them appear to many airport operators to be out of line with the benefits gained. The same can be said of the growing number of new environmental regulations: air quality, storm water drainage, and leaking underground storage tanks.

Some federal airport regulations may be a bit out of date. For example, many FAA grant assurances restrict the ability of airports to organize regional alliances or to develop industrial activities as part of the airport complex. These restrictions have built up over a number of years, and perhaps now is a good time to look at them anew. One participant suggested a need to reexamine the Airport Improvement Program because it may no longer provide the incentives that encourage good planning or good investment.

APPENDICES

APPENDIX A

GLOBAL AIR CARGO AND AIR EXPRESS GROWTH

David E. Raphael,
 Marcar Management Institute

SUMMARY

By the end of this century, the global air cargo industry will have doubled, and the air express sector of the industry will have increased almost fourfold. The business of delivering time-sensitive packages by air on a global basis, which emerged over the past four decades, has reached a new phase of development that will extend to 2000. The challenges are more complex, the capital costs more significant, and the stakes more substantial than at any point in the short history of the industry. This expansion of air cargo and air express will have significant implications for air carriers, shippers, government agencies, and airports on a global basis.

The air express industry has moved through a series of developmental phases. The first phase (1948 to 1967) was a period in which traditional freight forwarders dominated the air cargo industry. In the second phase (1968 to 1981) the express package industry emerged. The third, and competitive phase (1982 to 1987) consisted of two subphases: a period of market growth and then a period of market maturity. The current phase that began in 1988 is one of major uncertainty. The industry may experience further saturation with falling rates of growth, or a period of moderate growth, or a phase of new growth and expansion. Four key parameters are critical to the outcome: economic growth in major trading nations, the competitive structure of the industry, decisions made by governments especially postal authorities in major U.S., European, and Asian markets, and management decisions made air express carriers regarding new aircraft, routes, alliances, services, and differentiation from their competitors.

FORECASTS

Econometric and Market Assumptions

1. During 1990-2000 real economic growth in the United States will average 2.7 percent, in West Germany 2.7 percent, Japan 3.9 percent, Western Europe 3 percent, and Asia and Pacific Region 6 percent.

2. Inflation rates will be moderate during the period with annual gross domestic product deflators averaging 4 percent for the United States, 2 percent for West Germany, 3 percent for Japan, 6 percent for Western Europe, and 9 percent for Asia and the Pacific.

3. Oil prices will rise moderately faster than inflation during the period, not exceeding \$25 per barrel (1990 US \$) by 2000.

4. International cargo growth is expected to outpace that of domestic shipments, and continuing increases are expected in the average length of haul during the forecast period.

5. Air cargo yields will fall 1 percent per year in real terms.

6. Voice mail, facsimile, electronic mail, and other types of electronic transmission are assumed, on a net basis, to have a stimulating effect on express air cargo overall. While some substitution may take place, the increasing use of electronic communications will stimulate the demand for express shipment of letters, packages, and parts.

7. Regulatory conditions are assumed to be more accommodating than at present. Governmental postal authorities are assumed to be more liberal in terms of granting private firms greater freedom in the United States, Western Europe, and subsequently in Asia. This is likely to emerge during the mid-1990s as the general trend toward privatization and liberalization in communications, finance, and industry ownership advances in several key nations.

Scenario Conditions

Saturation

Key assumptions of the saturation scenario include restrictive regulations concerning customs and government monopolies of postal activities, which will have an inhibiting effect on the growth of the market. Labor relations will become problematic in that unionization expands among pilots and personnel working in express hub, sort, and station activities.

Work-to-rule will replace the entrepreneurial spirit that has become critical in achieving the gains of the past decades. Below average economic conditions will unfold during the forecast period, with real growth in North America and Western Europe dropping one percentage point below the economic potential for each region, which ranges between 2.5 and 3.5 percent annually. Management will focus on survival of the firm and make sharp reductions in plant and labor force. Market projections for global express volumes (in revenue tonne kilometers) indicate lower growth rates, on the order of -2 to +6 percent annually.

Business as Usual

In the business-as-usual scenario, government actions will follow the present course of monopoly in postal operations with moderate liberalization in key markets. Economic growth will follow the long-term trend. Managers of express firms will focus on business as usual, with strong cost-cutting policies that lack clearly defined strategic direction for their firms. Managers, in this scenario, will emphasize short-term goals and focus on solving immediate problems with little effort devoted to understanding new customer needs. Market projections are for growth of revenue tonne kilometers in the range of 7 to 11 percent annually.

New Growth

Important changes to liberalize postal and customs policies will be made by major governments around the world. There will be growing acceptance of greater freedom in express markets and privatization of large portions of postal authorities in the Economic Community during the mid-1990s and during the latter 1990s in the Asia-Pacific region. Labor peace is the norm, in this scenario. Employees of the express industry will receive more recognition and reward for their efforts, be given more autonomy through decentralized general management structures, and be empowered to provide improved levels of customer service and profitability. Macroeconomic conditions will be generally favorable during the period, with no major economic downturn for major trading nations. Senior managers of express firms will redefine their companies by developing a new mind set -- to lead customers rather than follow them, to create new competitive services that add value to their customers business, to energize employees by

reward-sharing policies, to commit to programs that provide long-term-learning and loyalty, and to articulate strategic directions clearly.

As a result, air cargo shipments are projected to grow to 150 billion revenue tonne kilometers by 2000, compared to 78 billion in 1990. Air express will expand to 30 billion tonne kilometers in the same period, up from 8.5 billion in 1990. Detailed projections of growth by region in this scenario are shown in Figures 1 and 2.

IMPLICATIONS FOR AIRPORTS

A number of key airports will be affected by growth in air cargo and express delivery services. They include Atlanta, Boston, Chicago, Dallas, Dayton, Denver, Detroit, Fort Lauderdale, Houston, Indianapolis, Los Angeles, Memphis, Minneapolis, New York, Newark, Oakland, Philadelphia, Phoenix, Portland, Salt Lake City, San Francisco, San Jose, Seattle, and Washington, D.C. International airports that will be similarly affected include Brussels, Frankfurt, London, Zurich, Hong Kong, Tokyo, Osaka, Seoul, Taipei, and Montreal.

A growing amount of the pressure on airports will come from the rapid expansion of air express service over the coming decade. Air express markets are growing faster than the air freight, charter, or mail segments throughout the world. The problem could become especially acute in the United States where domestic air express shipments are now nearly equal to domestic air freight shipments on a revenue tonne-kilometer basis. (Figure 3)

In 1988, an estimated 60 percent of air express operations were between 10pm and 7am. However, the percentage of night operations is falling as many carriers provide second-day and third-day services, thus shifting more of their activity to daytime hours and adding to the burden on runways and airport facilities used by passenger operations.

As air express grows, operators are considering a number of new services including special warehouses with the capability of handling overnight express delivery of parts and subassemblies to manufacturers, new customs-processing facilities, maintenance and repair facilities, and hub and sort facilities at airports. These innovations will compete with passenger carriers for scarce land on the airport property.

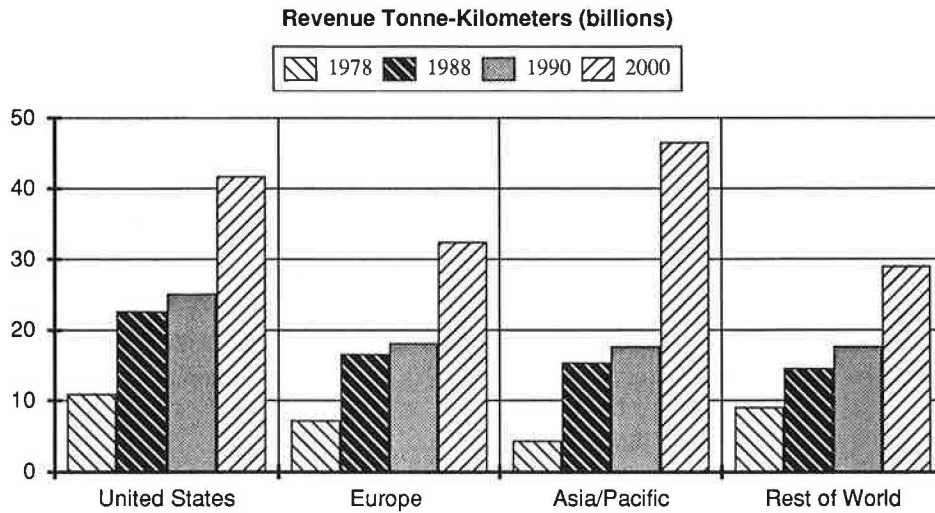


FIGURE 1 Air freight, mail, charter and express markets, by region, 1978-2000 (historical to 1990 - Boeing and ICAO; forecasts - Marcar). (Billions of Tonne-Kilometers)

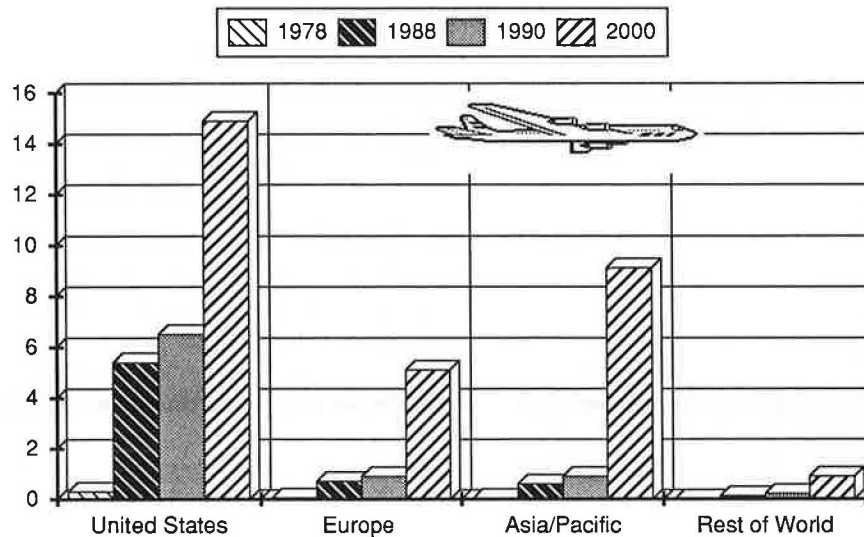
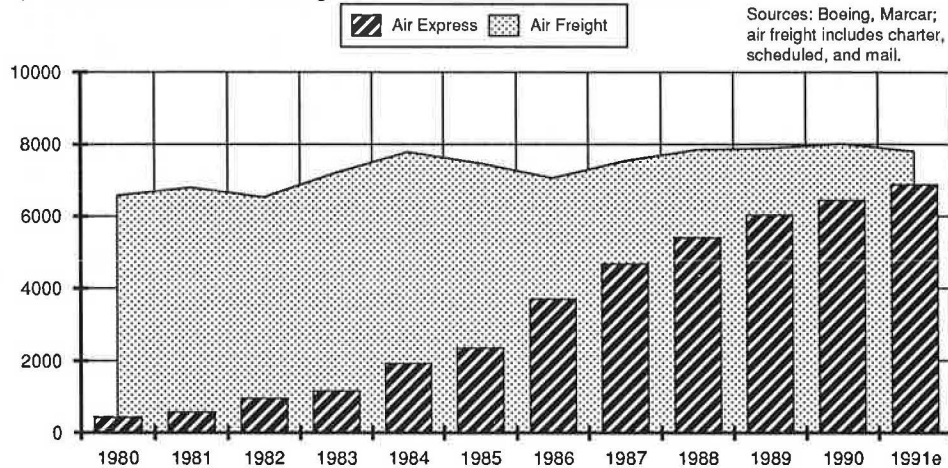


FIGURE 2 Air express markets by region, 1978-2000 (historical to 1990 - Boeing and ICAO; forecasts - Marcar).



Sources: Boeing, Marcar; air freight includes charter, scheduled, and mail.

FIGURE 3 Comparison of U.S. domestic air express and air freight markets (millions RTKs) (Marcar).

APPENDIX B

PARTICIPANTS

		KEY		
DCM Domestic Carrier, Majors			BAV Business Aviation	
DCR Domestic Carrier, Regional			LGA Light General Aviation	
INT International			M - Prefix for Moderators	
APT Airports			SPK Speaker	
MFG Manufacturers			CHM Co-Chairman	
Doug Abbey AVSTAT Associates 2501 K Street NW #6 Washington, DC 20078 202/338-1717 DCR	Mark Bobbi Forecast International 22 Commerce Road Newton, CT 06470-1643 203/426-0800 BAV		Steven Charters Market Strategy & Planning Rolls-Royce, Ltd. P.O. Box 31, Derby DE2 8BJ ENGLAND 44-332-242-424 MFG	
Ralph A. Aceti Director, Marketing Services Canadair Challenger 8 Griffin Road North Windsor, CT 06095 203/ 688-3012 BAV	Philip Bolt Market Evaluation Manager British Aerospace, Filton House P.O. Box 77 Bristol, BS99 7AR ENGLAND 0272-364691 FAX 272-364988 MFG		Andrew Chase Senior Associate Booz Allen & Hamilton, Inc. 4330 East West Hwy., 8 South Bethesda, MD 20814 (301) 907-4042 LGA	
Fletcher Aldridge Editor Aircraft Bluebook & Marketline P.O. Box 12901 Overland Park, KS 66212 913/541-6656 800/654-6776 LGA	Brent D. Bowen Associate Director National Institute for Aviation Research The Wichita State University Wichita, Kansas 64208-1595 316/689-3678 FAX 316/689-3175 MFG		Robert Chomick Pratt & Whitney 400 Main Street East Hartford, CT 06108 203/756-6947 MFG	
Joan Bauerlein Director, Int'l Aviation, Room 935F Federal Aviation Administration 800 Independence Avenue, S.W. Washington, DC 20591 202/267-2313 INT	Robert Bowles Forecast Branch Office of Policy and Plans, (APO-110) Federal Aviation Administration 800 Independence Avenue, S.W. Washington, D.C. 20591 202/267-3359 INT		Eric Christensen Vice President-Planning Skywest Airlines 50 East 100 South St. George, UT 84770 801/628-2655 DCR	
Nariman Behravesh Oxford Economic Forecasting 300 E. Lancaster Avenue, Suite 209 Wynnewood, PA 19096 215/642-7900 SPK	Alain Buttaud Market and Aircraft Analysis Manager Direction du Marche Civile SNECMA 104, Avenue du President Kennedy 75016 Paris, FRANCE FAX 011-33-1-44-145554 MFG		Harold M. Collins, Jr. Executive Director National Agricultural Aircraft Assn. 1005 E Street S.E. Washington, DC 20003 (202) 546-5722 LGA	
Michael Bell Senior Vice President Kemper Securities Group, Inc. Suite 400, 333 W. Wacker Drive Chicago, IL 60606 312/553-8870 FAX 312/553-6115 APT			Blair Conrad Executive Director Huntsville-Madison County Airport Authority, Box 20008 1000 Glenn Hearn Blvd. Huntsville, AL 35824 205/772-9395 APT	
Gerald W. Bernstein Manager, Aerospace Ind. Prog. SRI International 333 Ravenswood Avenue Menlo Park, CA 94025 415/859-4730 FAX 415/859-5890 M-INT	Bruce Carter Airport Manager Springfield Airport Authority Capital Airport Springfield, IL 62707 217/788-1060 FAX 217/788-8056 APT		Chris Corich Manager, General Aviation Airports Port of Portland 700 N.E. Airport Way Portland, OR 97218 503/335-1125 FAX 503/335-1124 LGA	

Kathryn Creedy
Global Airline Enterprises
6529 Old Carriage Lane
Alexandria, VA 22310
703/550-8011
DCR

Richard de Neufville
Chairman, Technlgy. & Policy Program
Center for Transportation Studies
Massachusetts Institute of Technology
Room E40-251
Cambridge, MA 02139
617/253-7694 FAX 617/253-7140
APT

Frederick P. Dibble
SAAB Aircraft of America, Inc.
21300 Ridgetop Circle
Sterling, VA 22170
703/406-4217
DCR

John W. Drake
Professor of Air Transportation
Purdue University
School of Aeronautics & Astronautics
313 Grissom Hall
West Lafayette, IN 47906
DCM

Robert Ebdon
Commercial and Government Affairs
Speedbird House (S-234)
British Airways PLC
Heathrow Airport
Hounslow, Middlesex
England TW6 2JA
01-759-5511 FAX 011-4481-562-2512
SPK

Ron Erdmann
U.S. Travel and Tourism Administration
Office of Research, Rm. 1868
U.S. Department of Commerce
14th & Constitution Ave., N.W.
Washington, D. C. 20230
202/377-3811
APT

Paul Fiduccia
SAMA
1400 L Street, N.W.
Washington, D.C. 20005-3502
202/371-5950
LGA

John W. Fischer
Head, Industry Analysis and
Transportation
Congressional Research Service
Economics Division
Library of Congress
Washington, D. C. 20540
202/707-7766 FAX 202/707-7338
CHM

John Fisher
Ohio State University
Department of Aviation
2160 West Case Road
Columbus, OH 43220
614/292-5460
DCM

William Follette
Honeywell, Inc.
21111 N. 19th Avenue
MS 2H 2802
Phoenix, AZ 85036
602/436-2957
BAV

Vicki L. Golich
Assistant Professor
Department of Political Science
Penn State University
107 Burrowes Building
University Park, PA 16802
814/865-7515
INT

Edmund S. Greenslet
EGS Aviation Services
P.O. Box 1781
Ponte Verde Beach, FL 32004
904/249-4215
SPK

Richard L. Harris
Managing Director, Public Finance
Dean Witter
101 California Street
San Francisco, CA 94111
415/955-6331
APT

John F. Hennigan, Jr.
Deputy Director
Office of Aviation Policy & Plans
Federal Aviation Administration
800 Independence Avenue, S. W.
Washington, D. C. 20591
202/267-3276 FAX 202/267-3324
UNASSIGNED

Thomas Henry
Aviation Forecasts Branch
Federal Aviation Administration (APO-
110)
800 Independence Avenue, S.W.
Washington, D.C. 20591
(202) 267-3357
LGA

Steven R. Hines
Manager, Marketing Research
Cessna Aircraft Co.
Citation Marketing Library
P.O. Box 7706
Wichita, KS 67277
316-946-6867
BAV

Robert Hollander
Falcon Jet Corporation
E. 15 Midland Avenue
Paramus, NJ 07653
201/967-4501
BAV

Marilyn Hoppe
Vice President
Pricing and Revenue Management
America West Airlines
4000 E. Sky Harbor Blvd.
Phoenix, AZ 85034
602/693-5744
DCM

Steven Horner
Manager, Market Research and
Airline Analysis
Regional Jet Division
Canadair, Bombardier Inc.
P.O. Box 6087, Station A
Montreal, Quebec H3C 3G9
CANADA
514/744-1511 FAX 514/744-6586
M-DCR

George Howard
President
Airport Operators Council International
1220 19th Street, N.W. Suite 200
Washington, D.C. 20006
202/293-8500
APT

Wilfred A. Jackson
Director
Security and Facilitation Dept.
Airport Operators Council
International
1220 19th Street, N.W., Suite 200
Washington, D.C. 20036
202/293-8500
SPK

Frank Jensen
President
Helicopter Association International
1619 Duke Street
Alexandria, VA 22314-3408
(703) 683-4646
LGA

Kenneth Jernigan
Director, Aerospace Team
Barklays Bank plc
222 Broadway
New York, NY 10038
212-412-2926 FAX 212/412-7571
DCR

Don C. Johnson
Aircraft Owners & Pilots Association
421 Aviation Way
Frederick Airport
Frederick, MD 21701
(301) 695-2000
LGA

Steve Johnson
Business Planning Manager
Bus and Commuter Aviation Sys Div
Honeywell, Inc.
Box 29000
Phoenix, AZ 85038-9000
602/436-8820
BAV

John Kari
Metropolitan Council
Mears Park Centre
230 E. 5th Street
St. Paul, MN 55101
612/291-6548 FAX 612/291-6550
APT

Mark Kiehl
Director of Forecasting and
Competitive Analysis
Northwest Airlines
Department A-6030
Minneapolis-St. Paul Int'l Airport
St. Paul, MN 55111
612/726-7205
DCM

Gerald Kolasinski
Hamilton Standard Div., UTC
Mail Stop 1-3-B15
1 Hamilton Road
Windsor Locks, CT 06096
203/654-2786 FAX 203/654-2686
DCR

Tulinda Larsen
Director
Simat, Helliessen & Eichner
90 Park Avenue
New York, NY 10016
212-682-8455
DCR

Claude Lazon
Manager Strategic Planning
and Forecasting
Pratt & Whitney Canada
1000 Blvd. Marie Victorin
Longueuil PQ Canada J4G 1A1
514/647-3961 FAX 514/679-1145
DCR

Richard Marchi
Director, Aviation Planning
and Policy Analysis
Massachusetts Port Authority
Transportation Bldg, 10 Park Plaza
Boston, MA 02116
617/973-3500
DCM

John Masters
AC Flyer Magazine
7205 Corporate Center Drive
Suite 301
Miami, FL 33126
1-800-327-2052 FAX 305/592-0294
BAV

Frank Mastin
Director, Marketing Programs
Learjet Incorporated
P.O. Box 7707, Mail Stop 21
Wichita, KS 67277
316/946-2872
BAV

Steven McBrien
MITRE Corporation
7525 Colshire Dr.
McLean, VA 22102
703/883-7605
INT

Lloyd McCoomb
General Manager
Major Crown Projects
Toronto Lester B. Pearson Nat. Airport
P.O. Box 6003
Toronto AMF Ontario
CANADA L5P 1B5
416/676-5090 FAX 416/676-3555
APT

Gerald S. McDougall
Associate Professor of Economics
Wichita State University
Box 13
Wichita, KS 67208
316/689-3012
M-BAV

Mr. Paul McDuffee
Chairman, Flight Technology
Embry-Riddle Aeronautical University
Daytona Beach Regional Airport
Daytona Beach, FL 32114
FAX 904/226-6011
LGA

Deborah McElroy
Vice President
Regional Airline Association
1101 Connecticut Avenue, N.W.
Suite 700
Washington, D.C. 20036
202/857-1170
DCR

Peter G. McGlade
Director, Schedule Planning
Southwest Airlines
P.O. Box 36611
Love Field
Dallas, TX 75235
214/903-4121
DCM

Neil Meehan
Meehan & Associates
333 Clay Street
Suite 4040
Houston, TX 77002
713-658-9594
DCR

Eugene S. Mercer
Manager, Forecast Branch (APO 110)
Office of Aviation Policy and Plans
Federal Aviation Administration
800 Independence Avenue S. W.
Washington, DC 20591
202/267-3357
MFG

Charles Moles
Forecast Branch
Office of Policy and Plans (APO-110)
Federal Aviation Administration
800 Independence Ave., S.W.
Washington, D.C. 20591
202/267-3358
DCM

Richard R. Mudge
President
Apogee Research Inc.
4350 East-West Highway, Ste. 600
Bethesda, MD 20814
301/652-8444
M-APT

James Murphy
Vice President, Planning
AMR Eagle, Inc.
MD 5494 P.O. Box 619616
DFW Airport, TX 75261-9616
817/967-2510
DCR

Scott D. Nason
Vice President
Operations Planning and Performance
American Airlines
MD-5424 CP5
DFW Airport, TX 75261-9616
817/967-1501
DCM

Frank Nel
Pratt & Whitney Canada
1000 Blvd. Marie Victorin
Longueuil PQ Canada
J4G 1A1
514/647-7814 FAX 514/679-1145
BAV

William R. Nesbit
President
Aviation Consulting Services
P.O. Box 246
620 Elmore Avenue
Park Ridge, IL 60068
708/698-9662
INT

Juan C. O'Callahan
Principal
Juan O'Callahan Research
135 Fairview Avenue
Stamford, CT 06902
203/359-3917 FAX 203/325-4730
DCM

Gerry Pronk
 Manager, Marketing Strategy
 Fokker Aircraft B.V.
 P.O. Box 12222
 1100 A-E Amsterdam-Zuidoost
 Amsterdam 110 BA
 NETHERLANDS
 011-31-20-564-7872
 MFG

David E. Raphael
 President
 Marcar Management Institute
 10 Scenic Way, Suite 214
 San Mateo, CA 94403
 415/571-6116 FAX 415/574-3392
 INT

Steve Regulinski
 Director Operations Research
 United Airlines
 EXOEB
 P.O. Box 66100
 Chicago, IL 60666
 708/952-4213
 DCM

John M. Rodgers
 Director, Office of Aviation
 Policy and Plans, APO-1
 Federal Aviation Administration
 800 Independence Ave., S.W.
 Washington, D.C. 20591
 202/267-3274
 UNASSIGNED

John Ross
 Acting Chief, Aviation Forecasts
 Transport Canada
 Tower C, Place de Ville
 Ottawa, Ontario K1A 0N8
 CANADA
 INT

Rudy Ruana
 Jeppesen-Sanderson, Inc.
 1725 K Street, N. W.
 Washington, D.C. 20005
 202/331-7727
 LGA

Don Schenk
 Airline Capital Associates, Inc.
 575 Fifth Avenue, 21st Floor
 New York, NY 10017
 212/808-4420
 DCM

Addison Schonland
 Manager, New Business Development
 CIC Research, Inc.
 1215 Cushman Avenue
 San Diego, CA 92110-3904
 619/296-8844
 INT

Charles Schuck
 Washington Representative
 Experimental Aircraft Association
 708 MacArthur Avenue, N. E.
 Vienna, VA 22180
 703/281-2169 FAX 703/242-8682
 LGA

Ken Scott
 Executive Director
 Norfolk Airport Authority
 Norfolk International Airport
 Norfolk, VA 23518-5897
 804/857-3351 FAX 804/857-3265
 APT

Audrey Smerkanich
 Office of Aerospace
 U.S. Department of Commerce
 Washington, D.C. 20230
 202/377-4222
 LGA

John J. Smith
 Forecast Branch
 Office of Policy and Plans (APO-110)
 Federal Aviation Administration
 800 Independence Ave., S.W.
 Washington, D.C. 20591
 202/267-3306
 APT

Paul Steggerda
 Manager, Business Planning
 Honeywell, Inc.
 P.O. Box 21111, Mail Stop 2H28B2
 Phoenix, AZ 85036
 602/436-1263
 M-MFG

Grady Stone
 Marketing Analyst
 Dornier Aviation
 22455 Davis Drive
 Suite 100
 Sterling, VA 22170
 703/444-8300
 DCR

Ronald L. Swanda
 Director of Airport & Airway
 Operations
 General Aviation Manufacturers
 Association
 1400 K Street, N.W., Suite 801
 Washington, D.C. 20005
 202/393-1500 FAX 202/842-4063
 M-LGA

Nawal K. Taneja
 Professor
 Ohio State University
 Department of Aviation
 2160 West Case Road
 Columbus, OH 43220
 614/292-5460
 M-DCM

Len Theroux
 International Aero Engines
 Corporate Center II
 628 Hebren Avenue
 Glastonbury, CT 06033-2595
 203/652-1800
 MFG

Paul Thomas
 Economic Research Group
 Mail Stop 7-81
 Douglas Aircraft Co.
 3855 Lakewood Blvd.
 Long Beach, CA 90846-0001
 213/593-6003
 DCM

Vernon F. Thomas
 General Electric Aircraft Engines
 Airline Marketing Division
 1 Neumann Way
 Cincinnati, OH 45215
 513/243-4032 FAX 513/243-5659
 MFG

Richard Van Balen
 Vice President-Market Development
 Fokker Aircraft, USA
 1199 North Fairfax Street
 Alexandria, VA 22314
 703/838-0100
 DCR

Regina VanDuzee
 COMSIS
 8737 Colesville Road
 Suite 1100
 Silver Spring, MD 20910
 301/588-0800
 BAV

James Veatch
 Industry Economist, Forecast Branch
 Office of Policy and Plans (APO 110)
 Federal Aviation Administration
 800 Independence Avenue, S.W.
 Washington, DC 20591
 202/267-3355
 BAV

Nicole Verrier
 British Aerospace, Inc.
 P.O. Box 17414
 Dulles International Airport
 Washington, D. C. 20041-0414
 703/478-9420 FAX 703/478-9436
 DCR

Thomas Vild
 Aerospace Management Consultant
 26 Forest Drive
 Chagrin Falls, Ohio 44022
 216/543-7430 FAX 216/543-7430
 MFG

Dan K. Walker
 Director, Domestic Marketing
 Allied-Signal Aerospace
 Bendix/King Division
 General Aviation Avionics Division
 400 North Rogers Road
 Olathe, KS 66062
 (913) 782-0400 Ext. 2333
 LGA

John F. Walsh
 Director, Market Planning & Proposals
 Rohr Industries, Inc.
 P.O. Box 878, Mail Zone 19B
 Chula Vista, CA 92012-0878
 619/691-2906
 MFG

Hugh Walsh
 Lead Aerospace Analyst
 U.S. Department of Commerce
 Office of Aerospace
 Room 2124
 Washington, D.C. 20230
 202/377-4222
 MFG

Tim Ward
 The Perot Group
 2250 Alliance Blvd.
 Fort Worth, TX 76177
 817/837-1000
 APT

Ed White
 Director, New Product Development
 Allied-Signal Aerospace Company
 Garrett Engine Division, Dept. 35-30
 Mail Stop 301-2H
 111 South 34th Street
 P.O. Box 5217
 Phoenix, AZ 85010
 602/231-4611
 DCR

Jack P. Wiegand
 Forecast International
 22 Commerce Road
 Newtown, CT 06470
 203/426-0800 FAX 203/426-1964
 CHM

Robert T. Williams
 Boeing Defense & Space Group
 Helicopters Division
 P.O. Box 16858
 Philadelphia, PA 19142-0858
 (215) 591-5083
 APT

Grant Wilson
 Manager, Aeronautical Services
 AIR CANADA, Base 19
 Dorval International Airport
 Montreal, Quebec H4Y 1C2
 CANADA
 INT

Thomas S. Windmuller
 Infrastructure Action Group
 IATA Centre
 Route De L'Aéroport 33
 P.O. Box 672
 CH-1215 Geneva 15 Airport
 SWITZERLAND
 INT

Earl Wolfe
 American Airlines Flight Academy
 P.O. Box 619617
 DFW Airport, TX 75261-9617
 INT

Robert W. Yatzek
 Manager, Planning Division (APP-400)
 Federal Aviation Administration
 800 Independence Ave., S.W.
 Washington, D.C. 20591
 202/267-3451
 BAV

Alan Youngberg
 Director, Aviation Consulting
 Ernst & Young
 1200 19th St., N.W., Suite 400
 Washington, D.C. 20036
 202/862-9328
 DCM

Karl Zaeske
 Rockwell International
 Collins Commercial Avionics
 Mail Station MS-107-153
 400 Collins Road
 Cedar Rapids, Iowa 52498
 319/395-1817
 BAV