TRANSPORTATION RESEARCH
CIRCULAR

Number 482 February 1998

# Future Aviation Activities
# 10th International Workshop

TRANSPORTATION RESEARCH BOARD / NATIONAL RESEARCH COUNCIL

TRANSPORTATION
RESEARCH
*CIRCULAR*

Number 482, February 1998
ISSN 0097-8515

# FUTURE AVIATION ACTIVITIES
# TENTH INTERNATIONAL WORKSHOP

Sponsored by

Federal Aviation Administration
Committee on Aviation Economics and Forecasting
Committee on Light Commercial and General Aviaiton

## WORKSHOP COMMITTEE

Co-Chairs

Jack P. Wiegand, *Forecast International, DMS,* and
Chair, TRB COMMITTEE ON LIGHT COMMERCIAL AND GENERAL AVIATION

Vicki L. Golich, *California State University, San Marcos*, and
Chair, TRB COMMITTEE ON AVIATION ECONOMICS AND FORECASTING

Panel Leaders

Mark Diamond
*SH&E, Boston*
Joseph P. Schweiterman
*DePaul University*
Tulinda D. Larsen
*SH&E, NY*
Gerald S. McDougall
*Southeast Missouri State University*
Michael D. Wolf
*Textron Lycoming*

David Lawrence
*Aviation Market Research*
Anne Strauss-Wieder
*ASW, Inc.*
George W. Blomme
*Aviation Planning & Technology Systems*
Billie Jones
*Pratt and Whitney*

Joseph A. Breen, TRB Staff Representative

Subscriber category
V aviation

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

## FOREWORD

The Tenth International Workshop on Future Aviation Activities was conducted by the Transportation Research Board on September 15-17, 1997, at the National Academy of Sciences in Washington, D.C. This workshop, the most recent in a biennial series that was initiated in 1979, was carried out under the sponsorship of the Federal Aviation Administration to assist public and private-sector managers and decision makers in forecasting long-term trends and developments in commercial, business, and personal air transport. Topics discussed include the domestic and international macroeconomic outlook, the structure and operating patterns of major and regional U.S. air carriers, expected developments in international aviation, aircraft and engine manufacture, trends in business aviation—including fractional ownership, civil helicopter transport services, and the improving future for personally owned and operated light aircraft. A new addition to this year's workshop was the inclusion of an air cargo panel to discuss this dynamic and expanding element of commercial aviation.

More than 100 participants, drawn from government, industry, academic institutions, and private consulting firms both here and abroad, took part in this three-day meeting. Most came from the United States, but there was substantial representation from Europe, Asia, and foreign firms with offices in the United States.

The program consisted of three major parts: an opening plenary session with presentations on the broad outlook and strategic issues, ten concurrent discussion panels on sectoral trends and problems, and a concluding plenary session in which the findings and forecasts of the discussion panels were presented.

The Transportation Research Board deeply appreciates the gift of time and the thoughtful contributions of the distinguished experts who attended the workshop. Special acknowledgment is due to the workshop co-chairs—Vicki L. Golich of California State University, San Marcos, and Jack P. Wiegand of Forecast International/DMS-for planning and organizing this endeavor and for overseeing preparation of this report.

This report of workshop proceedings represents the individual and collective views of panels and not necessarily those of discussion panel leaders or their organizations, the Federal Aviation Administration, or the Transportation Research Board.

## CONTENTS

## INTRODUCTION

The workshop opened with presentations by three distinguished experts, each of whom provided a thoughtful overview of an important segment of a topic that directly or indirectly affects the future of commercial aviation.

Earl B. Odom, Vice-President–Business Development, Airbus Industries of North America, summarized the global market for passenger aviation. Linda H. Boner, vice-president, Glassman-Oliver Economic Consultants, offered insights into deregulation in the energy field; and Brian P. Clancy, Principal, MergeGlobal, Inc., surveyed an increasingly important element of global aviation–the air cargo industry. Their presentations provided data and inspired lively discussions which are reflected in the panel reports.

# WELCOMING REMARKS

*Louise Maillett*
*Federal Aviation Administration*
*Acting Assistant Administrator*
*For Policy, Planning, International Aviation*

On behalf of FAA I am very pleased to welcome you to the 10th International Workshop on Future Aviation Activities. The fact that we have had this workshop for twenty years is recognition of the importance of your input and of FAA projections to developing a safe and efficient air traffic control system. This is my first time here, but I have known of your efforts and the Forecast Conference for many years. In fact, this coming year we will host the 23rd FAA Forecast Conference, which is truly amazing. In the beginning perhaps one could ask if there was some utility to this conference, but after 23 years and the number and quality of the people who participate, it is clear that it is a very useful mechanism for providing information to the community.

What you do here is an absolutely critical forerunner to that conference. As I characterized it today to our Administrator during our senior staff meeting, this is where the real work comes, and this is where the ground work is laid for the future.

This forecasting activity is an essential component for our planning process. These forecasts are used to determine staffing levels and capital expenditures that are needed to accommodate the growth in aviation. The forecasts are used for short-term budget preparation, for cost-benefit analysis, and for safety analysis throughout the agency.

Because of the sizable investment we are talking about making in the National Airspace System, it is essential that our forecasting techniques produce accurate projections. During the last 10 years, with your help, we've adopted state-of-the-art methods of analyzing trends in air traffic. These have helped to reduce our forecasting errors over time. The inputs that you will provide during the next three days are to be used for developing the forecast that we will formally present in March for the period 1998 to 2009. It is a very, very important effort for FAA and for other parts of the industry.

As a result of the continuing success of the conference, we have worked with other people to capitalize on that effort. In your folders you will see something called *Spend an Aviation Week*. When people come to town for the Forecast Conference or for other conferences, we make every effort to make the best possible use of their time. As you can see, we have several meetings that complement each other and culminate in the Forecast Conference, which will be March 12 and 13th, 1998.

The aviation industry has seen dramatic changes in this decade, and we expect these changes to continue well into the 21st Century. We have restructuring, we have intense competition, we have expanding global alliances, and we have *Open Skies*. These are but a few of the activities or issues that we believe will affect our forecasts. We are also experiencing a resurgence in general aviation sales and activities. We believe that that is something that will continue to happen.

The dynamics and complexity of the system make it essential that we turn to you to make sure that our projections, and what we see in the industry correlates to what you see. And, if it does not, to discuss the factors and come up with some consensus—if we can—of where the industry is going.

As you know from the agenda, the workshop is divided into five broad panels—passenger demand, cargo, airports, aircraft fleets, and general aviation. With the exception of air cargo, these are areas that you have looked at in the past and accurate projections of these variables is essential to the quality of the overall forecast.

Let me ask a couple of questions about what we would like to see from your deliberations. In the air carrier and commuter markets we know there has been rapid growth during the last four years, and we ask: What are the critical variables influencing these markets? How will they change? How will they affect the short and the long term? How will the new aviation tax structure activities—clearly something that was not contemplated last year—affect domestic and international aviation, and what will it do to the forecasts? How will the global alliances and *Open Skies*, a continuing effort, affect their operating costs, their revenues, profits, and passenger fares?

Another of our panels this year is the cargo panel. We last prepared a cargo forecast a long time ago, in 1981. What we would like is your opinion on whether we should get back into this business. If so, what are the benefits to the industry, and to FAA, and again, the same question, what are the variables that we should be looking at in order to forecast cargo accurately?

For the Airports Panel, it really is a question of how airports can accommodate the forecast growth in traffic. What are the environmental and capacity constraints, especially in the large hubs, that we need to consider or review for purposes of our forecast? What are the non-capital alternatives for expanding capacity? There have been recommendations of an increasing Airport Improvement Program (AIP) and a need for infrastructure, but are there any other non-capital alternatives for expanding capacity that could be utilized during the forecast period?

In the Aircraft Fleets Panel, we would like to have the discussion focus on the new aircraft—the possible development of large, 500 to 1,000 seat, commercial aircraft. What will that do to airports, what will that do to operations and to the system? What about the growth of regional jets and the effect on overall activity, and the increased demand for business jets? With new information on aircraft that Airbus and Boeing are considering developing, what might that do to our forecast?

We've been looking for general aviation to stabilize or actually to grow. We are hopeful that the time is at hand, and would like to ask your opinion about whether you think that this is true, and why? With the Revitalization Act in 1994, and Cessna's commitment to begin production, we think that the corner has been turned. As you know, in January of this year, Cessna produced its first single-engine piston aircraft in a very long time. What we see in 1997 is a significant increase in general aviation activities at our facilities. What does that mean? That's what we would like you to consider. Is it a projection that will continue? If so, what are the rates for that growth? If it isn't, what is the rationale for this not to continue? The current general aviation forecast for fleets and hours flown used the growth rates developed by a panel from the 1995 meeting. Are those still valid? These are the kinds of things that we want to know in order to be able to project at our Forecast Conference next March.

We rely upon your efforts over the next couple of days to answer or help to illuminate these types of questions to ensure that we identify and appropriately weight the trends, the new issues, and the economic growth that we forecast. This helps us produce an aviation forecast that hits the mark—as it has in the past. Our record, due in large part to what you have done, has been very, very good, and I would like to be able to say that again next year. So, you have an important task in front of you.

To summarize, the U.S. and the world economies, as well as the aviation industry, have undergone considerable change in recent years. We expect this to continue into the 21st Century. To be sure, these changes have made it difficult to predict aviation activity solely by the use of models. We have recognized that and rely on your knowledge and insights to put bounds on our projections. I appreciate you taking the time to be here and thank you for past and future inputs and for developing innovative ways in which to examine new issues.

In closing, I would especially like to recognize and to thank the two TRB aviation section chairs, Vicki Golich and Jack Wiegand, who managed the planning, development and conduct of this workshop.

# SUMMARY

## AIRLINES

The workshop discussions opened with participants from each airline grouping—domestic, regional, and international—joining the fleets and manufacturers panel to explore issues of common importance and to discover areas where developments affecting one group ought to be considered by others. The issues discussed included (1) determinants and direction of air transport demand and supply, (2) trends in cost and productivity drivers, including the introduction of regional jets (RJs), and (3) opportunities for cost reduction, increased productivity, and improved revenue generation. Once again, the group concurred that national gross domestic product figures tell only part of the story when trying to forecast passenger travel demand; other factors include income distribution, exchange rates, type of travel (business or leisure), sophistication of communication systems, and air service quality. With that in mind, the joint panel agreed that U.S.-domestic and U.S.-international enplanements will increase at a rate of about 4-6 percent annually through the year 2002; real yields will decrease moderately as load factors and carrier capacity remain relatively constant.

Continuing a trend begun two years ago, airlines are reporting healthy profits, which will likely contribute to increased labor costs. The recent resurgence of union strength, the blurring of lines between pilots serving regional and major/international airlines–due to the introduction of the regional jet—and the current shortage of pilots will also affect this cost trend. Other cost drivers—namely fuel, regulations, and taxes—are predicted to remain stable for the foreseeable future. Expansion of electronic and web-based ticketing will also help decrease the costs associated with the travel agent "middle-man." To combat the drop in real yields, airlines will be more aggressive in their marketing efforts as they seek to capture larger shares, thus making up any losses with increased volume.

Overall prospects for airline stability and profitability are optimistic. The trend toward liberalization and privatization around the world will continue. Although this may lead to more rationalization and consolidation in the industry, nothing as dramatic as that which followed the initial economic deregulation in the United States is foreseen.

## U.S. DOMESTIC AVIATION

Turbulence among domestic airlines is on the decline. By refining their revenue-management system, eliminating unprofitable hubs, shifting unprofitable routes to partnered regional airlines, and exercising restraint in adding capacity to their own markets, domestic airlines can look forward to a moderately positive increase in passenger demand in both the short- and the long-term.

Panelists expressed concern about changes in federal policy which could prove detrimental to growth in domestic aviation. In particular, panelists identified a FAA/DOT shift away from industry promotion as a problem. The predominant focus on safety and–almost by definition–accidents in the system may discourage passenger travel. At the time of the workshop, applications for new carriers were down significantly and regulations were up. Panelists also expressed concern regarding the seemingly permissive attitude policymakers held toward some controversial and potentially predatory marketing strategies adopted by majors and targeted at new entrants.

A persistent theme requiring some resolution remains the increasingly blurred distinction between "major" and "regional" airlines. The symbiotic relationship between the two is increasing, as many regionals would simply not exist without a partnership with a major. Frequent flyer programs have merged and code sharing proliferates. With the introduction of RJs, some aircraft are barely distinguishable. The panel encourages FAA to develop a more detailed and sophisticated data bank capable of distinguishing between business and leisure travel and which gathers more comprehensive passenger travel data. Without such information, it is difficult at best to forecast passenger trends.

## INTERNATIONAL AVIATION

Tracking developments in international aviation is also hindered by lack of detailed and comprehensive aggregate and disaggregate data. In the era of transnational alliances, marketing carriers and operating carriers may not be the same, and passengers transition from one carrier to the next unknowingly because they hold a ticket from only one. Simple disaggregated data—by carrier or flag—does not tell a complete enough story. Panelists recommend that traffic data be more comprehensive and transparent in order to facilitate accurate forecasting, particularly in an open skies environment where accurate information is imperative to good corporate decisionmaking.

The four major market areas remain unchanged since the last workshop: U.S.-Canada, U.S.-Atlantic, U.S.-South and Central America, and U.S.-Pacific Rim.

Traffic in all four regions will be affected by the proliferation of Open Skies agreements which are rapidly replacing the more restrictive Bilateral Agreements currently in place. Only the United Kingdom and France are still negotiating the terms of liberalizing transatlantic air travel. Transnational alliances and code sharing arrangements among airlines are still most prevalent in the U.S.-Atlantic market. U.S.-Atlantic enplanements are forecast to grow at 4.8 percent annually through 2002, as real yields decline roughly 0.6 percent, load factors decline to 74 percent, and average aircraft size increases to 246 seats.

In Asia, air traffic will be affected by the terms finally reached in a U.S.-Japan Open Skies agreement. The recent market disruptions caused by currency crises within Asia and health concerns prompted by Hong Kong's "avian flu" are likely to depress traffic growth in the near term. Nevertheless, by the year 2002, panelists forecast U.S.-Pacific traffic to increase by 7.2, while real yield declines by 1 percent annually, load factors remain stable, and aircraft size increases to 338 seats.

South America is expected to follow Central America's precedent in concluding liberalized bilaterals soon, which should help increase traffic by 7 percent annually through 2002. Real yield should decline by 0.5 percent (due largely to the shorter segments in this region compared to the transatlantic and transpacific markets), as load factors and seating capacity remain relatively stable at 65 percent and 184 seats, respectively.

Even in the era of liberalization, international aviation must negotiate political obstacles triggered by both domestic and foreign constituency concerns. Though often these concerns are not directly related to air transport (e.g., other trade and shipping issues, currency stabilization and valuation, even national security goals), they can still hinder or help the negotiation process.

The fairly rapid proliferation of a variety of transnational airline alliances remains the most significant factor affecting international aviation activity. As privatization continues to spread throughout the industry, mergers and acquisitions are likely to follow as a complement to transnational alliances. Alliances allow airlines to take advantage of "economies of density and scope" to increase market share and/or yield. To date, alliance partners have concentrated on revenue generation rather than cost reduction. Recent events suggest that alliances will lead to increased activity at partner hubs, while services to and from secondary gateways will either decrease or grow more slowly.

## REGIONAL AND COMMUTER AVIATION

Regional airlines continue to expand at a rate far in excess of the major/national carriers. Traffic has consistently grown at double-digit rates over the past two decades. The continued success of regional airlines is inextricably tied to that of their major airlines marketing partners. Any change in major airline operating structure affects regional carriers. As a result, the structure of the regional airline industry is continually evolving and becoming increasingly integrated into the systems of the major carriers. Perhaps the most important change in the operating structure of major airlines is the transfer of unprofitable routes to regional partners. Since most regional airlines currently enjoy lower operational costs, they are able to fly most of these routes profitably.

The fundamental character of the regional airline industry has changed considerably in the 1990s. Regional airlines are now sophisticated organizations that operate as extensions of the major carriers' route networks. The regional jet has developed as a significant competitive tool of the regional industry, although turboprops remain the primary aircraft serving the more traditional routes.

The U.S. regional airline fleet has leveled off at approximately 2,000 units. The fleet grew rapidly during the 1980s as the new generation 30-seat turboprop aircraft were introduced. The average size of the aircraft operated by the regional airline industry has been steadily increasing. In 1986 the average regional aircraft carried 19 passenger seats. Today, the average regional aircraft carries 25 passengers. As of this conference, over 700 regional jets were in service, on order, or on option in the United States. As these 50-seat jets enter the fleet and the smaller 19-seat turboprops are retired, the average number of seats per aircraft will continue to increase over the next decade. Through excellent fleet planning and the overall popularity of the regional jet aircraft, the panel agreed the average load factor for regional airlines will continue to increase and is expected to achieve 60 percent by the year 2001. The initial success of the regional jets into the fleets was unprecedented. Concern was expressed at the workshop regarding the regional jet. The participants believe that the regional jets will be a divisive issue between management and labor in both the United States and in Europe because of pilots' concern that current and future jet flying opportunities will be spun off to major carriers' lower cost regional partners as they take delivery of regional jets. Rising labor costs within the major/national air carriers may provide further incentives to codeshare if costs can be reduced by transferring flying to codeshare partners.

As in the case of previous workshops (1993 and 1995) there was some discussion regarding the current definition of "regional carrier" used by FAA. While the line between a regional airline and a major/national airline is becoming blurred, the panelists cited definite characteristics that define a U.S. regional airline. These include:

- Fleet of aircraft each with less than 100 seats.
- Primary mission is to support a larger carrier.

Overall, regional airline traffic is expected to grow over the next few years at a rate slower than in the past.

## BUSINESS AVIATION

The early 1990s were a difficult period for business aviation. The outlook now, however, is brighter; and the market is currently in the midst of a transition period with several new light, medium and heavy jets entering service or in development. In the 1997-2002 period the trend is exceptionally positive. Trends reflect fundamental forces and in business aviation the three fundamental forces are (1) new product introductions, (2) corporate profitability and (3), direct operating and regulatory costs. The panelists concluded that the positives in these three factors far outweigh any negatives that they could speculate about in terms of timing and magnitude of their effect on business aviation. In business aviation there is currently a fourth factor that cannot be ignored by either the manufacturers of business aircraft or operators of business aircraft. This factor is fractional ownership. Fractional ownership will likely expand the business aviation market by bringing new buyers and operators into the business aviation community. One company has signed up more than 700 fractional owners in its program. Of particular significance in the fractional ownership sales activity, is that over two-thirds are to companies that had never previously been involved in business aviation. The long-term effect of this new interest in business aviation is without precedent. In the past year one fractional ownership operator has ordered approximately 170 new aircraft. Most business aircraft manufacturers consider the fractional ownership sector as the most important market to address.

Overall the market for business aircraft is sound. A reason cited by an association representative was, "The business aviation community is doing well primarily because more business people need to travel and business aircraft best meet their transportation needs."

Despite the current upcycle in business aviation, the industry still faces a number of issues that could affect their long-term future and stability. Some of the more pertinent factors are user fees, airport access, local noise regulations, air traffic control standardization (Europe), landing fees, and high-density rules at slot-restricted airports.

## LIGHT AND PERSONAL GENERAL AVIATION

Following the enactment of the General Aviation Revitalization Act by the U.S. Congress in 1994, manufacturers announced plans to produce updated single-engine aircraft. The large number of new models now reaching the market reflect a trend that is expected to continue into the foreseeable future. Deliveries of light and personal general aviation aircraft for the first nine months of 1997 rose by approximately 50 percent over the previous year. Export levels are also encouraging. The industry now appears to be on its way to reversing the downward spiral caused primarily by years of product liability lawsuits.

The panel believes that the future of the light and personal general aviation sector depends on a large and active pilot population. Interest must be generated and programs instituted to dramatically increase pilot starts to ensure that the benefits possible through the Revitalization act are realized.

The expected growth of the economy as a whole is a positive sign. However, if the economy stumbles or the regulatory environment becomes less friendly, the new energized activity could return to its downward trend. Therefore, the industry initiatives to spur flight training activities and industry lobbying efforts to prevent overregulation will be critical to continuing the positive growth trend that has been developed over the past two years.

Overall the general economic growth now being experienced may not be sufficient to revive the market for light and personal general aviation aircraft. Industry must develop programs to attract people to flying. New advanced aircraft must be developed and offered at reasonable initial cost as well as reduced operating costs. Also, better training facilities must be provided.

## VERTICAL FLIGHT

Rotorcraft markets should remain stable during the forecast period, with the fleet growing at an average annual rate of 1.5 percent, partly due to acquisitions of military surplus equipment. Real growth in the near term will be largely taken up by increases in load factors and utilization per aircraft.

Key factors expected to affect long-term growth in the U.S. rotorcraft fleet are the regulatory environment, new technology, and the relationship of aircraft cost to performance.

The impact of stricter operating regulations, noise restrictions, and possible user fees should be minimal on the U.S. fleet size but might stimulate earlier replacement of nonconforming helicopters.

More significant are present and planned technological advances that will tend to stimulate the demand for new equipment. The development of the

Global Positioning System (GPS) will positively impact operating costs and perceived safety and improve the usefulness of rotorcraft in all weather conditions. The civil tilt-rotor is expected to stimulate new demand and to capture market share from small fixed-wing turboprops, particularly in the corporate/executive market, provided that needed improvements are made in airspace management and the landside infrastructure.

While prices of new helicopters continue to rise, the perceived ratio of cost to performance has improved, and replacements of older aircraft are increasing. Additional sales are likely to be stimulated by fractional ownership plans, but at least some of these are at the expense of projected single-owner sales.

## AIR CARGO

The 1997 workshop initiated a new panel focused exclusively on air cargo. With the advent of and the significant and enduring successes of all-cargo carriers such as Federal Express, United Parcel Service, DHL, and Airborne, and with the corresponding change in industrial operations to just-in-time production now so heavily dependent on rapid and reliable delivery systems, workshop planners agreed that a targeted examination of air cargo operations was warranted. Thus the air cargo panel faced a unique mission: to establish a framework for future discussions which would include an assessment of what type of data FAA should collect and analyze.

Panelists concluded that air cargo is critical to domestic and global distribution systems, and is still in its infancy with respect to several challenges which lie ahead. Among the most important is simply understanding the industry and collecting useful data. Currently air cargo is transported primarily by *integrators* who provide door-to-door service, *multinational freight forwarders* who work with airlines to move cargo, and *regional or niche forwarders* who work with airlines and agents to move cargo.

In addition, air cargo must be understood as part of an intermodal system; one panelist noted, "planes generally don't deliver cargo right to the door." Trains, trucks, and vans must be deployed to achieve that goal. Finally, assessment of the air cargo industry must consider the fact that 55 percent of all air cargo still travels in the bellies of commercial air carriers that focus primarily on passenger travel for revenue generation.

## FLEETS AND MANUFACTURERS

Prospects for aircraft and engine manufacturers continue to hold steady with the consensus forecast remaining at roughly 4.9 percent annually for the next twenty years. During this same time period, average load factor is expected to increase from 68 percent to 70 percent.

Persistent questions about forecast accuracy remain regarding uncertainty about linking traffic growth predictions to GDP and forecasting aircraft retirements. In both cases, assumptions must be improved to generate accurate forecasts.

Factors expected to affect traffic—and hence aircraft and engine—demand include congestion and its potential to limit aircraft movements; emerging markets particularly in the Commonwealth of Independent States, Eastern Europe, and mainland China; persistent environmental concerns and concomitant regulations; ability of airlines to sustain the marketing and operations discipline that has lead to record profitability in recent years; and alternatives to travel in the form of communication system sophistication. Intriguingly, panelists concurred that technology is *not* likely to bring significant gains to airframe or engine manufacturers in the short term.

The panel's consensus forecast predicted deliveries of 9,700 aircraft (with 80 seats or more) in the next 15 years. Despite concerns about their ability to forecast retirements accurately, the panel agreed that roughly 4,340 retirements will occur over this same time period. As always, manufacturer activity is dependent upon airline activity and ability to buy.

## AIRPORTS & INFRASTRUCTURE

The airport and infrastructure panel concluded that current unconstrained FAA growth projections are attainable if airport infrastructure proves adequate to accommodate a near doubling of commercial passengers over the next 10 years. This viewpoint can be compromised by several factors, differing growth rates among airports create the potential for capacity constraint choke points within the system, global aircraft fleet size is going to double in the coming 20 years and sizable increases in aircraft handling capacity will be needed in the airspace and at airports, and the large number of new RJs entering the commuter airline fleets and the orders for narrow body 150-seat aircraft by major carriers portend both positive and negative impacts on the commercial air carrier airports.

To keep pace with growth an estimated four to ten billion dollars will be required annually in major infrastructure investment in air traffic control systems and airports over the next decade. Sources of funding must be assured especially since underfunding is a continuing problem for FAA. Short planning horizons and long lead times required for project approval complicate the situation. Although some see privatization as a panacea for airport development, the panel believes that, in general, government ownership of airport facilities will continue in the United States. A majority of the new investment will be required at larger airports, which for the most part are viable

economic entities. The situation is graver for smaller airports lacking a backbone of non-aeronautical revenue. Failure to maintain smaller airports will increase demand on larger airports to accommodate projected traffic. Reliever airports become all the more important as a result.

With regard to environmental issues, the industry has made significant gains but opposition to aircraft noise, traffic and runoff remain a serious threat to infrastructure development. Environmental challenges and compliance will add to aviation system costs. The next generation of very large aircraft will have an impact on facilities at only a few major U.S. gateway airports.

Considerable optimism was expressed that emerging aviation technology, particularly in the air traffic control field, will continue to boost airport productivity, but there is a concern about the ability of FAA to implement new technologies in a timely manner. While reaching no conclusions on the impact of increasing telecommunications usage on reducing airline travel, the panel notes that the issue is real and should be monitored closely.

Air cargo continues to grow, particularly at major hubs, and carries with it special needs and services. The overnight aspect of air cargo movement creates special problems for airports as well as special opportunities. Short-term safety and security issues will not significantly limit airport capacity but will entail further costs to the users of the system in implementing extensive passenger security measures.

# DISCUSSION PANEL REPORTS

Prior to the workshop, FAA circulated a questionnaire to all involved participants. The questionnaire listed the preliminary and assumed values and growth rates for each sector of civil aviation to be incorporated in the forthcoming FAA aviation section forecast scheduled for release in March 1998. The TRB workshop panels were asked to review these figures during their deliberations and, where possible, to offer alternatives and comments for each recommended change. The views of most panels are presented in Attachment A. Not every panel responded directly to the questionnaire, however their assessment and rationale are presented in each panel's discussion report.

## JOINT SESSION: PASSENGER DEMAND AND FLEETS/MANUFACTURERS

*Session Co-Chairs:*
Mark Diamond
SH&E (International Airlines)

Tulinda Larsen
SH&E (Regional Air Carriers)

Gary Ives
Hurel-Dubois Ltd. (Fleets/Manufacturers)

Joseph P. Schwieterman
DePaul University (Domestic Air Carriers)

Billie Jones
Pratt & Whitney (Fleets/Manufacturers)

### Introduction

The Domestic, Regional and International passenger demand panels joined the Fleets/Manufacturers panel on the first day of the workshop in order to discuss issues of common importance.

The combined panels examined six topics related to air service demand and supply:

- Overall air transport demand and supply trends.
- Trends in key airline cost and productivity drivers.
- Opportunities for airline cost reduction and productivity improvement.
- Opportunities for improved revenue generation.
- Impact of regional jets.
- Determinants of passenger demand forecasts

### Overall Air Transport Demand and Supply Trends

The combined group concurred broadly with FAA preliminary forecasts for the 1997-2002 period:

- Enplanements will increase at about 4 percent per year in the U.S. domestic market and about 6 percent per year in the U.S. international market, with Pacific and Latin American traffic growing the most rapidly.
- U.S. domestic and international real yields will continue to drop at about one percent per year or less, more moderate decreases than in prior years.
- Load factor will remain relatively constant, in the high sixties range domestically and low seventies internationally, with the highest loads in the Pacific and lowest in Latin America. Regional carrier load factors will remain below 60 percent.
- U.S. carrier average aircraft seating capacity (excluding regional jets) will grow at the rate of 1-2 seats per year in domestic and international markets.
- The U.S. air carrier and regional fleet will grow at 3-4 percent per year, with widebodies growing faster than narrowbodies.

The projected constant load factors imply that U.S. carrier capacity will increase at the same rate as demand. Although there has been a major increase in aircraft orders in the last two years, many of these aircraft will be used for fleet replacement rather than growth in the short and medium terms, as aging Stage II airplanes are retired by the turn of the century.

Other panel members voiced caution that the influx of new aircraft could lead to overcapacity, particularly if there is an economic downturn over the next several years. However, participants did not expect a repeat of the capacity glut of the early 1990s, when fleets were growing at up to 12 percent per year.

U.S. major carriers currently are in a healthy state overall, having dismantled inefficient hub operations, raised load factors to record levels, and used the resulting improved cash flow to retire debt and replace their fleets. Currently, large U.S. hub carriers have costs per unit sold (cost per RPM) only slightly higher than the highly efficient carrier Southwest.

*Longer Term Trends*

The group noted that leisure travel has been growing

faster than business travel in the mature U.S. market since the late 1980s as real yields have dropped. The increase in discretionary travel has, in turn, resulted in greater seasonal differences in traffic flows.

## Trends in Key Airline Cost and Productivity Drivers

### *Labor*

U.S. carrier labor costs are not expected to increase significantly in the short term, as airlines have negotiated relatively favorable long-term contracts. However, over the longer term, labor costs likely will increase as a proportion of operating costs, with unions having become more powerful in the wake of the 1997 UPS strike. The current pilot shortage will also place upward pressure on flight crew costs. Even small increases in crew costs could have a significant impact on airlines, as pilots account for roughly 30 percent of the total labor costs of U.S. carriers.

Regional jets (RJs) will continue to be a divisive issue between management and labor in both the United States and Europe, with pilots concerned that current and future jet flying opportunities will be spun off to major carriers' lower cost regional partners as they take delivery of RJs.

Rising labor costs may provide further incentive for carriers to code-share or franchise–unions willing—if costs can be reduced by transferring flying to a code-share partner.

### *Fuel*

In the long term, fuel prices are projected to remain flat. The fuel price increases of 1996 were considered to be a blip, not part of a rising trend.

### *Regulations and Taxation*

Additional costs for safety and environmental regulations are expected in both the United States and Europe, but not at a higher rate than in prior years. There will be increased airport charges and uncapped Passenger Facility Charges (PFC's) levied against U.S. airlines to offset reduced FAA Airport Improvement Program (AIP) funds.

It was noted that new European airport and navigation charges are disproportionately burdening operators of smaller aircraft in Europe, with fixed runway charges being levied in London without regard to aircraft size or weight. New fixed per-passenger tariffs in Europe also are heavily affecting low cost operators, with the taxes representing up to 25 percent of a discount fare between London and Brussels.

## Opportunities for Cost Reduction and Productivity Improvement

Since the early 1990s, airlines in the United States and abroad have radically restructured their operations to reduce costs. However, with real yields continuing to drop and margins still low compared to other industries, productivity improvements remain critical. The panel concluded that future cost reductions are likely to be relatively small, but enough such reductions could be obtained over the next five years to match the projected five percent decrease in real yield on U.S. domestic and international routes.

Cost reduction opportunities were thought to be higher for non-U.S. airlines, since U.S. carriers have already realized extensive cost savings over the last half-decade. Panel members noted, however, that a larger proportion of non-U.S. carriers' operating costs are fixed, such as landing and overflight charges, and therefore beyond the capability of the airlines to cut.

*Distribution* now represents the greatest area of opportunity for airline cost reduction. These costs, including ticketing, computer reservation system (CRS) and travel agency fees, typically represent 12-14 percent of carriers' overall operating costs.

Airlines are starting to take steps to reduce distribution costs by capping travel agency commissions, offering direct ticket purchasing over the Internet, and providing automatic electronic ticketing ("E-tickets") or ticketless travel.

Such direct ticket sales not only avoid CRS and travel agency fees, they also reduce telecommunications and revenue accounting expenditures, and permit airlines to realize cash from ticket sales earlier.

*Fleet commonality* offers efficiency advantages by decreasing crew and maintenance training requirements, reducing spares purchases and inventory, and offering substantial aircraft purchase discounts. Manufacturers and airlines have recognized the advantages of fleet commonality at least since the early 1980s; however, many U.S. and foreign airline fleets still consist, unnecessarily, of many different aircraft types.

*Larger aircraft* will provide additional productivity improvements from lower seat-mile costs. The Passenger Demand and Fleets/Manufacturers panels concurred with FAA preliminary forecasts that average jet aircraft seating capacity (excluding RJs) will increase over the next five years on U.S. domestic and international routes.

However, the group cautioned that the current massive orders of RJs in the U.S. may bring overall U.S. aircraft size down and decrease productivity —particularly if RJ's are used to replace larger jet aircraft, rather than substituting for turboprops or developing new routes.

*Free Flight* and *Global Positioning Systems (GPS)*, just starting to be introduced, will reduce aircraft operating

costs by offering more direct long-haul routings and decreasing spacing requirements.

*Outsourcing* functions such as maintenance, catering and revenue accounting may provide additional cost savings for carriers. Several large European carriers have successfully outsourced their revenue accounting functions to specialized third party providers in Asia. Maintenance outsourcing continues to be a growing activity worldwide, but will remain problematic for major U.S. carriers holding strong labor contracts.

*Alliances* have the potential to reduce purchasing costs by bringing greater volume and purchasing power to supply contracts. Additional savings could result from sharing resources such as sales forces, reservations personnel, maintenance facilities, terminal space and so forth. The International Airlines panel later noted, however, that global marketing alliances generally have not yet realized significant cost efficiencies. The panel concluded that equity stakes between carriers or purpose-designed joint ventures may be prerequisites for meaningful cost reductions.

### Opportunities for Improved Revenue Generation

*Alternative Distribution Channels*

Technological improvements in distribution may also have a positive effect on revenue generation in the coming years, although the primary impetus behind alternative distribution channels such as the Internet and electronic ticketing has been to reduce costs.

Airlines are starting to set up sites on the Internet to sell discount tickets (American Airlines "NetSAAvers" and USAirways' "E-SAVERS," for example). These "cyber-fares" offer deep discounts to sell off perishable seat inventory at the last minute.

Other airlines, including American, Lufthansa, Cathay Pacific and Canadian have offered fare auctions on the Internet, selling seats to the highest bidder. The philosophy behind such auctions again is to sell off seat inventory that would otherwise go unsold. Fare auctions offer an additional advantage to airlines by providing market intelligence on consumer willingness to pay that can be useful for future pricing decisions.

Currently, Internet ticketing is limited mostly to weekend travel. Airlines so far have resisted extending Internet ticketing to weekday flights to avoid diluting business traveler fares.

"Cyber-fares" have the potential to stimulate travel demand by making low fares and seat availability information more accessible and transparent to the end consumer. However, the increased demand would come at the expense of yield. Since U.S. carriers already are operating at very high load factors, it is questionable how much stimulated demand could be accommodated in the short- to medium-term.

Internet ticketing is likely to increase as a share of total distribution activity, with some long-range estimates projecting that up to half of all air travel sold will be via the Internet. The role of travel agencies will not disappear; and they are still expected to be widely used for corporate travel and will continue to sell inclusive travel packages to leisure travelers in Europe. Furthermore, travel agencies themselves are beginning to branch out into Internet ticket sales.

### Impact of RJs

The joint panels noted the increasing importance that regional jets are likely to have in the U.S. and overseas air transport markets in the future. As of September 1997, over 700 regional jets were in service, on order or on option in the United States.

Fifty-seat RJs have trip costs one-half to two-thirds lower than 737s, and can turn a profit with loads of only 25-27 passengers. They are expected to strengthen hubs and open up new point-to-point route opportunities.

With a vast number of RJs entering the U.S. fleet over the next few years, the regional airline share of U.S. domestic passenger traffic will continue to increase.

### Determinants of Passenger Demand Forecasts

The panels discussed some of the main economic determinants of traffic growth, and noted that GDP, although a primary driver is by itself insufficiently explanatory. Other important determinants that should be considered include population, age distribution, income distribution, immigration trends, exchange rates, quality of air service, and competing transport modes.

## DOMESTIC AVIATION

*Panel leader:*

Joseph P. Schwieterman
DePaul University

*Panelists:*

Martin E. Dresner
University of Maryland, College Park

Robert E. Dunn
R. E. Dunn, Inc

Charles H. Moles
Federal Aviation Administration

Francis P. Mulvey
U.S. General Accounting Office

John W. Fischer
Library of Congress

William Nesbit
Aviation Consulting Services

Samuel C. Keiter
Kurth and Company Inc.

Eric I. Nordling
Atlantic Coast Airlines

Philip M. Martin
Independent Consultant

Stephen E. Still
Airline Planning Group

## Introduction

Although domestic airlines appear to be on a stable growth trajectory, concerns about federal policy, airport user fees, and business-travel demand loom ominously on the horizon. Not only do these issues raise important questions about future profitability, they suggest that the existing rate of expansion will be difficult to sustain.

The panel of experts, representing domestic air carriers, agencies, consultants, and academics, considered the assumptions behind FAA forecasts and emerging issues affecting air travel demand. They evaluated the evolving character of the industry since the previous panel gathering in 1995.

On the whole, panel members are bullish about the short- and long-term outlook for domestic aviation. Major carriers, such as American, Continental, Delta, Northwest, and United, have made important strides in bringing stability to the marketplace. These carriers have refined their revenue-management systems, eliminated unprofitable hubs, and exercised restraint in adding new capacity to their markets.

Interpreted broadly, these developments suggest that the industry will be able to expand without risking a repeat of the cataclysmic 1990-1993 period, when carriers were ravaged by cyclical price cutting and significant excess capacity.

Nevertheless, the panel urged moderation in making long-range traffic projections. For reasons summarized below, panel members believe that both traffic growth rates and yield reductions embedded in FAA forecasts, while reasonable, are marginally too high.

## The Evolving Marketplace

The panel identified several developments—none of which were fully anticipated at the previous gathering in 1995—as hallmarks of the evolving marketplace:

(1) the sharp reversal of federal policy on several aviation issues,
(2) surging interest in regional jets, and
(3) the stabilization of passenger yields.

These developments, considered separately below, portend significant change to the quality of service to small and mid-size airports, the prices that certain travelers pay, and the distribution of traffic among various classes of carriers.

### *Federal Policy*

The progression of federal policy since 1995 has unexpected and largely unfavorable consequences for domestic airlines. The burden of these policies is likely to be borne primarily by start-up carriers and buyers of discount fares.

No longer does FAA accept as its mandate the task of promoting aviation or supporting start-up airlines as a means of enhancing industry competition. To some extent this reversal of policy was caused by the TWA and Valujet crashes and subsequent media attention, which cast the safety record of start-up airlines in an extremely unfavorable light.

The financial effects of negative publicity has been greater and more persistent for newly-created airlines than many anticipated. Applications for new carriers have dropped precipitously over the past several years. Moreover, rules relating to the safety of small aircraft in the wake of recent accidents are emerging as a major barrier to sustaining service to small communities through the Essential Air Service program.

Second, the Federal Government is gradually raising the tax burden on carriers through a modified user fee system (approved by Congress in 1997), heightened fuel taxes, and other mechanisms. The new user-fee (i.e., ticket tax) arrangement, which relies heavily on a fixed fee per passenger enplanement, apparently reflects a more equitable distribution of airport and air traffic control costs. However, it represents an additional financial burden to the industry in general—and is likely have an especially damaging effect on start-up carriers in the years to come.

Finally, the Federal Government has developed a permissive attitude with respect to controversial marketing strategies of major airlines—strategies that often have the appearance of being predatory. Examples include the aggressive matching of discount fares, travel agent overrides, and frequent flyer promotion bonuses to lure traffic from start-up carriers.

Along with ongoing competitive problems arising from exclusive lease agreements at major airports and slot controls, the tolerance of the Federal Government toward the above market practices can create significant entry barriers for low-cost competitors. It also prevents these carriers from successfully prosecuting predatory pricing complaints against their larger counterparts.

Among federal institutions, the General Accounting Office has been a vocal critic of the market dominance

of major carriers. Although GAO studies outline practical steps to alleviate the "pockets of pain" that stem from limited competition, little evidence suggests that federal intervention is forthcoming anytime soon.

All of the above policies come at a time when start-up airlines are struggling financially. Although some consolidation is likely, these carriers are not likely to have opportunities to merge with major carriers or receive governmental assistance. Kiwi, Vanguard, Western Pacific and other financially distressed smaller operators appear especially at risk of failure.

The change in federal policy also renders it more difficult for some small and mid-size communities to bring attractively priced service to their airports. As the niche for some start-up carriers grows more precarious, the subsidy offers of local airport authorities to attract these carriers will likely become less effective.

*Regional Jets (RJs)*

A second change of profound importance since 1995 is the rapid deployment of regional jets (50-70 seat planes that are faster and more comfortable than conventional turboprop aircraft) at majors hubs and on thinly traveled nonstop routes. Orders and options by regional airlines are in place for about 700 units. Prevailing public opinion holds that these RJs are destined to revolutionize convenience, frequency and speed in many smaller domestic markets.

Although the panel agrees with this assessment, it believes that significant obstacles will remain to the widespread introduction of these jets. More notably, the use of RJs will continue to be restricted by rules set by labor negotiators relating to aircraft size, scope clauses, and other labor issues. The American Airlines strike in 1997 and other labor-management conflicts failed to resolve all of the open questions about the long-range role for RJs.

Moreover, the demand for RJs is vulnerable to changing public opinion, which holds small commercial aircraft in low regard as to safety. (These opinions tend not to be substantiated by data.) If RJs suffer accidents early in their service life, public support could be severely damaged.

Nevertheless, panel members doubt that the RJ phenomenon carries with it the risk of bringing significant excess capacity to the markets they serve. Not only do these planes, by their very nature, provide only limited capacity, their delivery schedules could be lengthened if orders prove to be excessive.

*Stabilization of yields*

The final recent market development relates to the stability of domestic passenger fares, especially business fares. Although the industry's recovery was well underway by 1995, the strengthening of yield has only recently become a durable feature of the domestic market. In 1996, real yield (i.e., yield adjusted for inflation) rose 1.3 percent while unrestricted fares rose at a substantially faster rate.

Although real yield is likely to fall over the next decade, panel members believe that the 1.1 percent annual reduction in real yield anticipated by FAA is too aggressive. They anticipate more modest change—perhaps a decline half as large as FAA projection.

## Perspectives on Forecasting

Business and leisure travelers are separate components of market demand. They respond differently to macroeconomic variables and technological change, have vastly different price and income elasticity, and choose air services in fundamentally different ways.

Accordingly, forecasts based solely on aggregate industry statistics—such as industry yield, revenue passenger miles (RPMs), and available seat miles (ASMs)—are more fallible than forecasts that consider the underlying trip purpose of airline consumers. Panel members believe that long-range forecasts could be enhanced through a separate evaluation of the business and leisure markets.

In a similar vein, the maturing business-travel market will almost certainly grow more slowly than leisure travel. (Leisure already accounts for a majority of domestic air travel enplanements). The rising share of leisure passengers suggests that: (1) traffic growth may become more closely tied to changes in yield; (2) traffic will tend to become more dependent on the state of the macroeconomy, and; (3) airports will experience vastly different rates of traffic growth depending on the mix of business and leisure traffic.

The growth of leisure traffic also has implications for the competitive mix of carriers. Much of the boom in air travel demand in recent years apparently consists of leisure passengers carried by low-fare airlines, such as Southwest, America West, Reno and American Trans Air, plus the "free" travel generated by frequent flyer programs. Obviously, the continued growth of this market segment depends heavily on the future of low-cost airlines.

The blurred distinction between "major" and "regional" airlines is another issue of fundamental importance in long-range forecasts. The distinction between these carrier groups will become even more ambiguous as large fleets of regiona; jets are deployed. Regional airlines, whose traffic consists almost entirely of business travelers, have captured traffic from their major partners in recent years and are expected to continue to do so in the future. Although this may

represent traffic growth for regional carriers as a class, it does not constitute growth for the domestic air travel market as a whole.

Developing separate forecasts for various segments of the marketplace, however, is hindered by a dearth of reliable data. For example, the Air Transportation Association travel survey has been discontinued, eliminating a valuable source of information on trip purposes. Other comprehensive data bases do not allow for accurate assessments of the number of business and pleasure trips.

## Rethinking Supply and Demand

The panel believes that FAA traffic growth forecasts for 1997-2002, which project 3.9 percent annual growth in enplanements, are marginally too high—even if FAA's anticipated yield decline of 1.1 percent annually comes to fruition. Panel members emphasized that real GDP growth is not expected to rise in upcoming years; a slowdown in the economy—a concern that far more than a hypothetical at the moment—could suppress rates of growth.

Also conspiring to limit traffic growth are passenger load factors, which have reached historical highs. The recent surge in load factors, while partially a function of the creative programs to fill empty seats, to a large extent reflects capacity limitations in important markets during peak periods.

With respect to load factors, consequently, the panel agreed unconditionally with FAA. Load factors will likely remain for the foreseeable future at their current level of approximately 68 percent to 70 percent. Orders for new aircraft will primarily be used to replace older aircraft, especially older B-727 and DC-9 equipment. If traffic growth is interrupted by recession, panel members believed that carriers will further limit capacity growth, avoiding a repeat of the costly price-cutting experience of the early 1990s. They expect ASM growth in domestic aviation to roughly match growth in RPMs.

This has important implications for all travelers. By exercising restraint in expanding capacity airlines while deploying sophisticated yield management systems, domestic airlines will seek to extract even greater revenues from business travelers. Discount fares will continue to be more effectively targeted at discretionary travelers through new distribution systems, such as the Internet.

Accordingly, the promotional efforts of major airlines (including their scheduling decisions) will continue to reflect the dominant role of business travel in generating revenue. These efforts will remain focused on garnering more of the mature business travel market rather than seeking to expand the business market as a whole.

At the same time, the panel anticipated only modest reductions in unit costs. Most of the easy ways to cut expenses or boost productivity (such as through increased aircraft utilization) have been exploited. The panel believed that distribution costs are the best remaining opportunity for immediate expense reduction—a process that appears to be well underway. (Less than two weeks after the panel adjourned, United Airlines announced its controversial 20 percent reduction in commission payments to travel agents.)

In the final analysis, the panel anticipated a future differing sharply from the boom-and-bust character of the industry's recent past. While panel members are more bearish about traffic growth and yield reductions than FAA, they believed that domestic aviation is approaching the twenty-first century on a stable and, ultimately, profitable course.

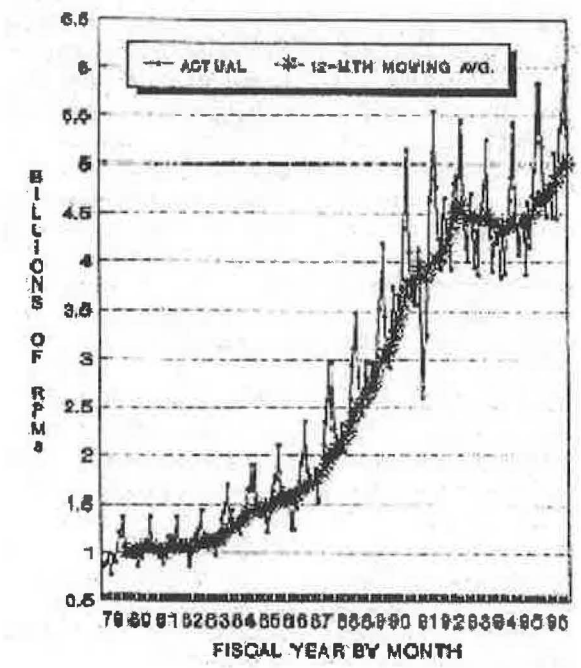


FIGURE 1 Revenue passenger miles.

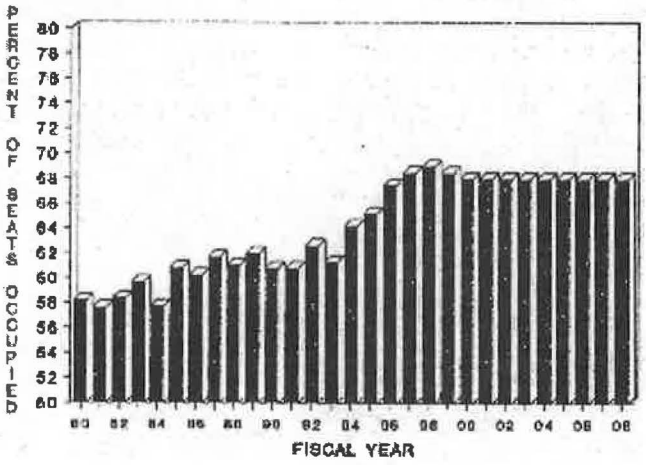


FIGURE 2 U.S. Commercial air carriers passenger load factor: Domestic.

## INTERNATIONAL AIRLINES

*Panel leader:*

Mark Diamond
SH&E

*Panelists:*

Robert L. Bowles
Federal Aviation Administration

Michael Ellis
UK Civil Aviation Authority

Donald L. Fraser
Latinpass

Scott C. Gibson
Economic Strategy Institute

Barry K. Humphreys
Virgin Atlantic Airways

Bilkis Khanam
Transport Canada

Paul V. Mifsud
KLM Royal Dutch Airlines

Adam M. Pilarski
Boeing Commercial Aircraft

John S. Strong
College of William and Mary

Bouke M. Veldman
Strategem

András Zboray Malév
Hungarian Airlines

### Introduction

The International Airlines panel discussed six issues that are significantly affecting international passenger demand and air service planning in the late 1990s:

- International air transport policy (Open Skies);
- Developments in airline alliances;
- Other changes in airline competitive structure (startups and low cost carriers, privatization, mergers, acquisitions and consolidation);
- Network structure (hubs and gateways);
- Aircraft developments (small twins vs. Larger aircraft, superjumbos, ultra-long range aircraft, regional jets); and
- Data needs.

The panel focused primarily, but not exclusively, on air service between the United States and Europe, Latin America, and Asia. For each of these market areas, panel members also projected changes from 1997-2002 in passenger enplanements, yield, load factor, and aircraft size.

### International Air Transport Policy

*U.S. Open Skies Policy to Date*

For the last twenty years, the United States has pursued a policy aimed at liberalizing its international air service agreements. Incremental progress was made through the early 1990s, when the United States began to conclude a large number of Open Skies bilateral agreements with many of its most important international air service trading partners.

The most recent series of liberalized bilateral agreements represents a dramatic break with the narrowly defined agreements of the past. In principle, an Open Skies bilateral between two nations permits any carrier of either country to fly between any gateway points they choose, without restrictions on capacity, service frequency, or fares offered. In most cases, no restrictions are placed on airlines' ability to carry local traffic in intermediate or fifth freedom markets, as well.

For the last several years, the United States has pursued a unique quid pro quo approach in international negotiations: in return for a partner nation accepting Open Skies with the United States, that nation's carriers are permitted to form immunized alliances with U.S. carriers. In such alliances, airlines can not only share codes in computer reservation systems (CRSs), but also jointly set prices and capacity, share sales forces and ultimately share revenue. In effect, the partner carriers are permitted to act as a single merged entity, jointly marketing a common product while effectively immunized from anti-trust prosecution.

Following the U.S.-Netherlands Open Skies agreement in 1993, Northwest and KLM tightened their existing alliance under the immunity provisions. As additional Open Skies agreements were concluded, two other immunized alliances subsequently developed: the Delta/Swissair/Sabena/Austrian grouping, and the Star Alliance of United, Air Canada, Lufthansa, SAS, Thai, and Varig.

The United States has signed more than twenty-five Open Skies agreements to date:

### U.S. Open Skies Partners as of September 1997

*North America*

- Canada

*Latin America & Caribbean*

- Aruba
- Costa Rica
- El Salvador
- Guatemala
- Honduras
- Nicaragua
- Panama

*Europe*

- Austria
- Belgium
- Czech Republic
- Denmark
- Finland
- Germany
- Iceland
- Luxembourg
- Netherlands
- Norway
- Sweden
- Switzerland

*Middle East*

- Jordan

*Asia-Pacific*

- Brunei
- Malaysia
- New Zealand
- Singapore
- Taiwan

These agreements can stimulate passenger demand enormously, illustrated by the 29 percent growth in U.S.-Canadian traffic from 1995 to 1996, following signing of the liberalized U.S.-Canada bilateral.

The U.S. policy has been so successful that relatively few restrictive agreements remain between the United States and its primary international air service partners—most notably, the United Kingdom, France and Japan.

*Projections*

The panel concluded that Open Skies will remain the rule in international air service agreements with the United States for the foreseeable future. For most nations that have not yet signed such agreements, it will be a question of when rather than if.

The pending American Airlines/British Airways immunized alliance, if granted in return for an Open Skies bilateral between the United States and Great Britain, would apply enormous pressure on France and Japan to form similar liberalized agreements with the Untied States. France is already under considerable pressure to accept an Open Skies regime, as it is now surrounded by nations committed to U.S. Open Skies, with powerful alliances threatening to drain off Air France's third, fourth and sixth freedom (direct and connecting) traffic to the United States.

Japan may well be influenced by the recent spate of Open Skies agreements between the United States and other Asian nations, although it is far from certain that Japan will commit to a fully liberalized bilateral with the United States during the next several years. Asia's geography minimizes the potential diversion of Japan-U.S. traffic to carriers in liberalized U.S.-Asia markets, somewhat insulating Japan from pressure to accept an Open Skies agreement. The historically contentious U.S.-Japan aviation relationship will most likely see incremental progress toward liberalization, perhaps with new route rights or new concepts introduced such as limited code-sharing.

Nonetheless, a U.S.-UK Open Skies agreement in conjunction with an American Airlines (AA) and British Airways (BA) alliance would set an additional strong precedent for Japan. The parallels between Japan and the United Kingdom are striking: Narita and Heathrow are both the most constrained gateways in their respective regions, both airfields are severely capacity constrained, and U.S. carriers hold extensive rights to carry "beyond" traffic at each airport.

The AA/BA alliance is not a fait accompli and has attracted a good deal of resistance within the European Commission. However, the panel concluded that even if an agreement is not signed in 1997-1998, a similar U.S.-UK megaalliance, with an accompanying liberalized bilateral environment, would be a virtual certainty within the next half-decade.

Ultimately, as Open Skies between the United States and Europe becomes the norm, national resistance to granting aviation negotiating authority to a supranational body—the European Commission—will diminish. In some future year, the European Union (EU) Commission and the United States may negotiate an air service *treaty*, to replace the current network of U.S.-Europe bilateral agreements. However, if widespread Open Skies agreements are in place, there will be little left for European nations to give away in negotiations with the United States, and thus little danger in transferring negotiating authority to the EU Commission.

South American countries also are expected to develop Open Skies arrangements with the United States over the next several years, following the precedent established in Central America. Chile already has proposed an Open Skies arrangement in advance of its October 1997 talks with the U.S.

*Open Skies Outside the U.S.*

Although the U.S. experience will not necessarily lead immediately to global Open Skies agreements between other nations, regional air transport liberalization is becoming increasingly common worldwide. In particular, liberalized air service relationships have developed within regional trading blocs in recent years, spreading from the European Union to the Andean Pact and Mercosur nations in South America.

## Developments in Airline Alliances

*Developments to Date*

Airline alliances have been common for the last decade, with transborder and intercontinental code-sharing agreements proliferating worldwide. Most of these agreements have been limited in scope, and often confined to a small number of routes with blocked-space purchases of seats and frequent flier program links, but no further strategic cooperation.

After the U.S.-Netherlands Open Skies agreement in 1993, carriers now granted antitrust immunity began entering into significantly more sophisticated alliances, cooperating on the crucial strategic parameters of pricing, capacity, and sales. Such strategic alliances have succeeded by offering a more unified product to travel agents and the end customer, through wide scale code-sharing and linked schedules, shared facilities, coordinated ticketing and handling, common branding, combined frequent flier programs and so forth. The KLM-Northwest alliance has proven to be the model for such alliances, with each airline tailoring its product to present a seamless service offering for passengers.

Such alliances have been enormously lucrative for partner carriers, leading to immediate market share gains that translate directly into added revenue, with little, if any, additional expenditure. Estimates for KLM-Northwest are that each carrier has received from $100 to $175 million in additional annual revenue as a direct result of their alliance (Feldman, Joan, "Alliances: Are We Making Money Yet?," *Air Transport World*, 10/95, page 32).

The KLM-Northwest example also demonstrates that equity exchanges may have little or no impact on the effectiveness or longevity of an alliance. KLM currently is divesting its Northwest equity holdings, but the two partners have committed to an additional 10 years of cooperation.

Immunized alliances capture many of the revenue benefits of mergers and acquisitions, and appear to be replacing the trend toward global carrier consolidation that was widely predicted in the early 1990s. Certainly, alliances are a beneficial alternative to acquisition for ambitious foreign carriers, given the U.S.-mandated limit of 49 percent foreign ownership (25 percent of voting stock), which the panel suggested will remain in force for the foreseeable future. (Foreign ownership limits may, however, come under considerable scrutiny during the next economic downturn if foreign capital becomes the only means available to sustain a failing U.S. carrier.)

There are now three large global strategic alliances of this new type: the KLM-Northwest alliance, the Delta/Swissair grouping and the Star Alliance. In each case, a major U.S. carrier is the backbone of the alliance, bringing strength in behind-gateway traffic feed in the United States. If the AA/BA alliance (with Qantas, Iberia, Canadian Airlines International, Aerolineas Argentinas and Avianca) is concluded, this will represent a fourth dominant global alliance pole.

*Projections*

The panel concluded that sophisticated global alliances will predominate in the future whether or not an AA/BA immunized alliance is agreed to this year. The ultimate number of megaalliances likely will remain limited, although their scope undoubtedly will grow and new large alliances may well be formed. Some major world airlines are still on the sidelines—including Continental, Air France, Singapore Airlines and Cathay Pacific—but are likely to join one or another alliance in the near future. (As of September 1997, Continental was in limited but not immunized alliances with Alitalia and Air France; Singapore was allied with Ansett Australia and Air New Zealand but had not joined an immunized alliance with a U.S. carrier.)

Most carriers worldwide that do not yet belong to alliances will quickly gravitate to one or another grouping, or find themselves at a severe competitive disadvantage as alliances channel off their traffic. From the viewpoint of the incumbent alliance partners, adding more partners is advantageous if those additional participants can extend the scope of the alliance to new city-pair markets or geographic regions.

Alliances will continue to consolidate their strength by employing sophisticated techniques to attract and retain passengers, including coordinated pricing, combined frequent flier programs and travel agency override commissions.

Overall, the panel had mixed views on whether megaalliances would have a detrimental impact on competition. On the one hand, in the new alliance environment, competition by a multitude of air carriers in international origin-destination markets will be replaced by competition between a smaller number of large alliances. Alliance partners will be able to coordinate capacity and prices, but will still face competition from other alliances.

On the other hand, alliances have the potential to raise competitive barriers in certain individual city-pair markets, where the new partners provide the vast majority of direct international air service. To maintain competitive market access, both the EU Commission and the U.S. Government have sought concessions from prospective partner carriers, in the form of reduced service or mandated noncooperation on pricing ("carve-outs"). The U.S. Government also is investigating the proposed American Airlines-TACA code-sharing alliance, which would control nearly 80 percent of U.S.-Central America nonstop service if concluded ("American's Controversial Alliance Strategy," *Avmark Aviation Economist*, April/May 1997, page 6).

*Alliance Implementation Issues*

Although it seems certain that alliances will remain a fixture of the air transportation landscape for the foreseeable future, there is less certainty on precisely how the alliance partners will work together. Numerous issues must be resolved by the partners to ensure alliance effectiveness and longevity.

1. Which carriers will perform the flying? Although economic rationality dictates that international flying be granted to the lowest cost carrier, aircraft availability, union objections, and intangibles such as corporate pride and culture may be more influential in determining which carrier operates on which routes. While KLM has yielded some new transatlantic flying opportunities to Northwest over the last few years, a large share of the Delta alliance transatlantic flying is now performed by Sabena, Swissair and Austrian, although Delta's transatlantic operating costs are lower than its European partners'.

Currently, non-U.S. partner carriers may have an advantage in international alliance flying, as their passengers are not subject to the time-consuming prescreening that FAA requires of U.S. carriers.

2. How will revenue and costs be shared among the carriers? Alliances stand a better chance of succeeding if participants believe that they are treated fairly by their partners, with equitable sharing of revenues, costs, and future market opportunities. Poorly-designed revenue and cost-sharing mechanisms may set up incentives for alliance members to compete with each other in selling, operating, or both.

3. How will carrier services be branded? The panel suggested that branding will be an important issue to be resolved as alliances grow, particularly in regions such as Europe with many national flag carriers. In such an environment, where passengers often have a strong preference to fly on their home country carrier, it may be difficult to adopt a "one product" alliance identity, if that common identity would suppress the national carrier brand.

4. Can alliance partners cooperate with each other to reduce costs? Theoretically, large opportunities exist for alliances to achieve scale economies from rationalizing capacity on overlapping routes, joint purchasing, joint aircraft maintenance, shared facilities, and so forth. However, major alliances to date have focused primarily on revenue gains and have not yet made as much headway in reducing costs.

The panel noted that large integrated alliances may actually lead to *increased* organizational and operational inefficiencies, simply due to the size and complexity of the joint enterprise. Furthermore, the perceived fragility of alliances, with breakups of previous partnerships such as British Airways-United, British Airways-USAir, Continental-SAS, and Delta-Virgin Atlantic, could dissuade alliance partners from engaging in the long-term joint planning and strategic investment required to achieve substantial cost savings.

The panel suggested that equity stakes ultimately would provide a better guarantee than alliances of meaningful cost reductions.

The panel concluded that cost savings are possible through carrier cooperation or joint ventures in areas such as aircraft purchasing or maintenance, but these groupings need not parallel the global marketing alliances established for revenue-generation purposes.

5. Can partner carriers overcome cultural differences to effectively pursue joint strategies? A significant although overlooked implementation issue is how partner carriers' cultures will interact and perform together. The longevity of an alliance ultimately must be based on carriers' ability to work together on a daily basis across all elements of their operations, from ground handling to sales, ticketing, and administering frequent flier programs. Integrating different airlines' existing operating practices may present numerous obstacles.

As alliances grow, these implementation issues are likely to become more acute, particularly as new partners' route networks overlap increasingly with incumbent carriers' systems—setting the stage for conflicts within the alliance on operating decisions, revenue-sharing and the like.

Given these issues, the panel projected that alliance memberships are likely to be fluid in the future, with partners continuing to switch from one alliance to another. However, the structure of a limited number of strong megaalliances will remain.

## Other Changes in Airline Competitive Structure

*Startups and Low-Cost Carriers*

In spite of the primacy of alliances, the panel indicated that there will be a continuing role for niche carriers, including low cost startups and charter carriers.

The panel noted that low-cost carriers have developed a small, but important niche in major air service markets worldwide. Carriers such as Ryanair, Easyjet, Virgin Express, Eurowings and Air One have established themselves in the deregulated intra-European market. The Asia-Pacific and Indian subcontinent regions have seen similar carriers such as Cebu Pacific (Philippines) and Jet Airways (India) commence operations in recent years, and Latin America has had an influx of new entrants, including TAESA (Mexico), Aero-Sur (Bolivia), SAETA (Ecuador) and LAPA (Argentina).

Such carriers generally have been able to capture a low-yield travel market by following the U.S. carrier

Southwest's example: offering point-to-point services that do not rely on hub traffic feed, maximizing aircraft and crew utilization by minimizing ground time, seeking secondary airports farther from major metropolitan areas to avoid congestion and obtain lower landing fees, and selling seats directly to avoid costly CRS and travel agent fees.

In a wet-lease arrangement that may signal an increasing trend, Virgin Express is operating all of Sabena's Brussels-Heathrow and Brussels-Rome flights, and has introduced new Brussels-Gatwick services on behalf of the larger carrier. Similarly, Swissair has spun off a substantial portion of its short-haul flying to its regional partner, Crossair. Both British Airways and Air France have franchised numerous short-haul operations to regional carriers such as Manx and Brit Air. There may yet be other instances in Europe and elsewhere where low-cost or regional airlines take over short-haul flying from established carriers, costing the larger carriers less than if they operated the routes themselves, and freeing them to redeploy their aircraft to more productive routings.

The panel suggested that new startup carriers will continue to develop worldwide. It also indicated that some existing carriers might be able to reinvent themselves as niche carriers offering low-cost service, following the operating patterns of the startups.

The panel also concluded that charter carriers, which cater exclusively to low yield discretionary travelers, will continue to be an important global presence. Charter airlines currently account for 50 percent of European traffic and are expected to maintain this share of the European market in the future. Such carriers, which offer direct service to leisure destinations from non-hub airports such as Luton or Stansted, represent an attractive alternative to leisure travelers seeking to avoid indirect scheduled routings through congested hubs.

*Privatization*

The panel suggested that privatization efforts will continue as air service markets worldwide continue to be liberalized. Currently, many of the major European and Asian carriers have been privatized, while majority shares of virtually all Latin American carriers have been sold off to private interests within the past decade.

**Selected Carriers with Majority Private Ownership, by Region, 1997**

*North America*

- Air Canada
- Canadian Airlines International

*Europe*

- British Airways
- KLM
- Swissair
- Icelandair
- Lufthansa
- Sabena
- Virgin Atlantic
- Lauda Air

*Latin America & Caribbean*

- Aeromexico
- Aeroperu
- LanChile
- Varig
- VASP
- BWIA
- Mexicana
- Aerolineas Argentinas
- Ladeco
- Pluna
- TACA Group
- Air Jamaica

*Asia-Pacific*

- JapanAirlines
- Ansett Australia
- Asiana
- Malaysian Airlines
- Philippine Airlines
- Qantas
- Cathay Pacific
- ANA
- Air New Zealand
- EVA Air

Privatization has demonstrably improved the competitiveness and efficiency of non-U.S. carriers. In the case of Latin America in particular, the improved productivity of privatized carriers has coincided with increased government willingness to liberalize domestic and international air service markets.

Because so many privatizations have occurred already, future privatization activity is likely to slow somewhat. Nonetheless, several important national flag carriers, including Air France, Alitalia and South African Airways, remain candidates for eventual privatization—subject to government willingness to permit private ownership.

*Mergers, Acquisitions and Consolidation*

As indicated, alliances represent an effective alternative to carrier mergers and acquisitions, from a marketing perspective. In spite of this, international carrier acquisitions and consolidations will probably continue to occur for a variety of reasons, particularly involving airlines in poor financial health.

In Europe, the EU Commission has continually indicated its unwillingness to permit further subsidization of ailing carriers, and has met a great deal of resistance toward this practice from healthier, private European carriers. Without subsidies, weaker carriers may of necessity be acquired by others.

In recent years, strong European carriers have acquired smaller or weaker carriers, as evidenced by British Airways' purchases of the French airlines TAT

and Air Liberté. As with alliances, such acquisitions have permitted carriers to expand their geographic networks, marketing presence, and available equipment. Some governments may be reluctant to permit a country's flag carrier to fall to foreign ownership, although Swissair now owns 49.5 percent of the Belgian flag carrier Sabena, and the Brazilian carrier VASP has been seeking to purchase the non-operating Venezuelan flag carrier VIASA.

Equity investments can provide benefits to the acquiring carrier where route authority is limited. In such instances, a carrier may use its equity partner airline as a proxy to maintain or increase access in a given market. American Airlines appears to be following such a strategy with its proposed investment in Aerolineas Argentinas, to solidify its dominance in U.S.-Latin American and intra-Latin American markets.

Some small carriers in a geographic region have banded together with equity stakes to strengthen their competitiveness, and increase the marketing advantages and scale economies that arrive at a certain critical mass. In Latin America, the TACA Group (TACA International of El Salvador, LACSA of Costa Rica, TACA of Honduras, Aviateca of Guatemala, Nica of Nicaragua and COPA of Panama), SAETA Group (SAETA of Ecuador and LAPSA of Paraguay), and the VASP Group (VASP of Brazil, Lloyd Aero Boliviano, and Ecuatoriana) have formed important counterweights to the larger carriers operating in the region. (TACA has only a marketing alliance with COPA, not an equity stake).

Finally, carriers seeking to reduce costs considerably will favor equity acquisitions over non-equity alliances. The TACA Group example illustrates the link between equity stakes and cost efficiency, as the five equity carriers have reduced staff, rationalized aircraft types, centralized distribution functions and engaged in joint purchasing.

The panel projected that Latin American airlines will consolidate further in coming years. There is likely to be a shake-out in the wake of VIASA's recent collapse, with more carriers ceasing operations or being acquired by others.

## Network Structure

### *Hubs and Gateways*

The panel predicted that the new era of alliances will have a dramatic impact on the structure of international flying, with increasing service between large hubs, and an eventual slowing of service growth to and from secondary international gateways.

During the 1980s, with the development of liberalized bilaterals and the entry into service of small twin-aisle aircraft such as the Boeing 767 and Airbus A-310, international flying on thinner routes to and from secondary gateways became politically and technologically feasible. Overseas carriers increased the number of U.S. points they served to broaden their access to the interior U.S. market. Simultaneously, U.S. carriers sought to exploit the feed potential of their hubs by increasing service to more overseas destinations. Finally, carriers on both sides of the Atlantic began to employ small twins on routes that had not been flown previously on a nonstop basis.

As a result, numerous new nonstop international routings were developed to and from secondary gateways, particularly across the Atlantic: Boston-Brussels, Boston-Lisbon, St. Louis-Paris, Atlanta-Munich and others.

The development of megaalliances in the mid-1990s has largely reversed this trend. New transatlantic flying by alliance partners has focused on bridge routes between the carriers' hub gateways in each continent, to attract feed traffic at either end. Since 1991, KLM and Northwest have initiated joint services between KLM's Schiphol hub and Northwest's U.S. hubs in Minneapolis, Detroit and Memphis. Delta has cut back its change-of-gauge services dramatically at Frankfurt since 1995, in favor of increasing services from its JFK, Atlanta and Cincinnati hubs to its partner hubs in Brussels, Zurich and Vienna.

As alliances coalesce, increased hub-hub scheduled services will become more common across the Atlantic and in other long-haul international market areas. The panel did note, however, that there are some practical limits to these developments that may argue for continued scheduled flying to secondary destinations.

- Passengers will continue to demand shortest elapsed-time routings and the fewest connections from origin to destination. Everything else being equal, a passenger traveling from New Orleans to Milan would prefer single connect service over New York/Newark to double-connect service over Memphis and Amsterdam or Atlanta and Zurich.
- Congestion and access problems at the largest gateway hubs, particularly JFK, Heathrow, Schiphol, Frankfurt, Narita and Kansai, will continue to constrain growth of frequencies at these hub airports.

The panel noted that the major European hubs—London, Amsterdam, Paris and Frankfurt—will maintain their dominance. There may be limited development of secondary hubs at Munich and other European cities to relieve congestion at the major hubs, but there will be nothing like the proliferation of regional hubs that occurred in the United States after U.S. deregulation. Secondary hub development will be limited in Europe by the proximity of major cities, a smaller and more concentrated population base and stronger competition from passenger rail.

The panel noted the possibility of cross-border secondary hubs being established in Europe by nonnational European carriers, now that the EU is fully deregulated with complete cabotage rights. The group also noted that a foreign carrier setting up a hub might have a marketing disadvantage given the traveling public's preferences for home carriers. On the other hand, that carrier might be able to circumvent this problem by setting up a cross-border partner or subsidiary, such as a Deutsche BA or a TAT, as the hub carrier.

## Aircraft Developments

*Small Twins vs. Larger Capacity Aircraft*

Passengers continue to demand frequent service on international routes, and liberalized bilaterals have permitted increased service frequencies. Over the last decade, in response, airlines have augmented frequencies on U.S.-Europe and U.S.-Latin America routes by replacing 747's with 757's, 767's and A-310's. The panel projected, however, that over the next several years the small twins will be superseded gradually by larger aircraft in the transatlantic market.

Traffic growth and infrastructure constraints at major international airports will drive aircraft size increases on international routes. However, two other important factors will also underlie the transition to larger aircraft.

- Air carriers will continue to seek productivity improvements as real yields decline, with larger aircraft offering significant cost reduction opportunities. United's 767-300s, 777 s and 747-400s offer direct seat-mile costs that are between 17 and 30 percent lower than its 168-seat 767-200's on transatlantic routes, for example (Source: U.S.DOT Form 41, CY 1996). Long-haul transpacific routes generally will employ the largest and most cost-efficient aircraft available, primarily 747-400 s, to cope with the severe capacity shortages at the key Asian gateways of Tokyo and Osaka, and the low yield environment on transpacific routes outside of Japan. Only in the high yield and shorter-segment U.S.-Latin America market will relatively high frequency service with 757s and 767s continue to predominate.
- The increasing bridge flying by alliance partners between major hub gateways will also increase aircraft size, particularly on transatlantic routes. Hub-hub routings such as Atlanta-Zurich, attract passengers from four distinct origin-destination traffic pools—local gateway-to-gateway (i.e., Atlanta to Zurich), behind (i.e., New Orleans to Zurich), beyond (i.e., Atlanta to Milan), and behind-to-beyond (i.e., New Orleans to Milan)—and therefore warrant larger aircraft to accommodate the demand.

Accordingly, KLM-Northwest have used MD-11 or 747 aircraft on their Detroit-, Memphis-, and Minneapolis-Amsterdam routings, reserving smaller 767s and DC-10 s for non-bridge routes such as Atlanta-, Boston- and Washington-Amsterdam.

*Superjumbos*

Although the panel projected increased overall aircraft size on international routings, they suggested that the market for aircraft larger than the 747-400 will remain limited. Ultimately, the planned Airbus A3XX will serve the largest and most constrained gateway fields such as Heathrow, Narita and Kansai, but may find only limited use elsewhere.

*Ultra-Long Range Aircraft*

New ultra-long range aircraft such as the A-340-8000 and Boeing 777-200X will be placed into service around the turn of the century, offering ranges of 8 to 9 thousand statute miles. Such performance will permit nonstop routings on key transpacific segments such as New York-Hong Kong and San Francisco-Bangkok, bypassing Japan.

The panel agreed that these aircraft will find a niche market, but have a minimal overall impact on the key Tokyo and Osaka gateways. The group projected that Narita and Kansai will remain the primary Asian gateways for transpacific travel, given the high yields and strong demand in the U.S.-Japan market. The panel also noted that the increasing importance of Asia-Japan and intraAsia traffic, which Northwest and United tap into via their extensive fifth freedom rights beyond Japan, will guarantee continued importancefor Tokyo and Osaka. (Asian carriers such as Korean Air, Thai Airways, Malaysia Airlines and Singapore Airlines also benefit from fifth freedom rights beyond Japan to the United States, and thus also have an incentive to continue using Tokyo and Osaka as transpacific gateways.)

*Regional Jets*

The regional jet market is projected to continue growing worldwide as it has in the United States, offering larger capacity, more range, lower seat-mile costs and greater passenger appeal to turboprop operators. Such aircraft will be used to replace turboprops in growing regional markets, add frequencies in existing jet markets, and open up new point-to-point routings in long-range, thin demand regional markets.

The impact of the RJs may be more muted outside

of the United States, given stronger unions (which, as in the United States, object vehemently to routes being spun off from major carriers to low-cost partners with RJ's) and fewer airports, which are by-and-large more capacity-constrained. The panel suggested that the long route distances and limited number of airports in the Far East would preclude the RJs from taking hold there. The panel also noted limiting factors in Europe, including higher fixed charges—particularly navigation and landing fees—that place a disproportionate burden on operators of smaller aircraft.

## Data Needs

The panel noted that the definition of "U.S. carrier traffic" has become blurred, as marketing carriers and operating carriers are no longer one and the same in international alliances:

- Is U.S. carrier traffic purely the number of passengers carried on aircraft belonging to U.S. carriers, or
- does it include passengers purchasing tickets from the U.S. carrier, but flying on an overseas partner carrier's aircraft, or
- does it include passengers purchasing tickets from an overseas partner carrier, but flying on an aircraft belonging to the U.S. carrier?

Current origin-destination and enplanement data collected by the U.S. Government (U.S. DOT Origin-Destination (O&D) Survey, T-100 and INS I-92 data, etc.) and foreign organizations (AEA, IATA, etc.) portrays passengers as belonging to an air carrier when they fly on that carrier's aircraft, regardless of which carrier sells the ticket or shares in the revenue from that sale.

In the alliance era, greater transparency is warranted to determine which carriers are benefiting from traffic flows, regardless of whether or not they actually flew the passengers. Simple breakdowns of traffic by individual operating carrier or carrier nationality no longer have the same relevance as in the past.

An argument may also be made that Open Skies agreements warrant an increased exchange of traffic data between the carriers of each signatory nation, to support open and free competition. Currently, U.S. carriers have full access to origin-destination data of their U.S. competitors but only limited access to foreign competitors' O&D statistics. Similarly, foreign carriers cannot obtain statistics for U.S. carrier traffic in international markets. Although the has required participants in immunized alliances to report O&D data, this information has not been made publicly available.

Rational economic decision-making in free markets depends on the availability of accurate and complete information to all participants in those markets. The panel suggested therefore that the United States and its Open Skies partners establish traffic data reporting and availability requirements for their respective carriers. A practical starting point might be to require some form of cumulative "true" O&D market traffic statistics (summed across all carriers of the partner nations) to be made available to each country's carriers

## Highlights by World Region

For the 1997-2002 period, the panel projected passenger traffic demand, yield, load factor and average aircraft size for the U.S.-Atlantic, U.S.-Pacific and U.S.-Latin America markets.

### *U.S.-Atlantic*

- Enplanements will continue to grow at 4.8 percent per year, slightly slower than prior years due to service consolidation/alliances, but counterbalanced by increased European wealth and declining air fares.
- Intraeuropean traffic growth is expected to remain strong as the European market has completely deregulated, with the addition of unlimited cabotage rights in 1997.
- Real yield will continue to decline at a moderate –0.6 percent annually, with introduction of larger capacity aircraft with lower seat-mile costs.
- Load factor will decline slightly, from 76 percent in 1997 to 73.6 percent in 2002. There is no projected glut of new capacity that will overwhelm demand, but capacity growth on the North Atlantic will slightly outpace traffic growth.
- Average aircraft capacity will grow from 239 to 246 seats between 1997 and 2002, reflecting increasing use of larger twin-aisle aircraft (A-330/340s, 777s, 747s) in lieu of the 767's and A-310's that have dominated the North Atlantic market for the past decade. Increasing hub-hub transatlantic routes and consolidation of the largest hubs in Europe will demand larger aircraft.

Constrained airfields and environmental pressure against airport expansion will further contribute to aircraft size increases and limit frequency growth.

### *U.S.-Pacific*

- The Asia-Pacific region is projected to continue growing at very high rates with enplanements increasing at 7.2 percent annually through 2002, driven by the restoration of Japanese economic growth and the booming PRC economy.
- Intra-Asia travel also is expected to grow

rapidly, with the most rapid growth coming from travel within and to the PRC.

- Real yield will decline at about 1 percent per year, driven by continued economic sluggishness in Japan in the near term, and increasing Asian market liberalization in the longer term.
- Nonetheless, U.S.-Japan yields will remain significantly higher than yields to other Asian points, ensuring a continued high level of services to Narita and Kansai.
- Pacific load factors will remain in the mid-seventies over the 1997-2002 period, declining slightly in the near term, but rebounding to 76 percent by 2002.

The panel noted that average load factors above 75 percent are achievable with aggressive pricing during off-peak seasons.

Intra-Asian load factors may be higher, trending toward the 77-78 percent level.

- Aircraft size across the Pacific will continue to grow as carriers place the largest available equipment in markets characterized by high growth rates, extremely long distances, constrained airfields, and relatively low yields (outside of Japan).

The panel projected that average seats on U.S. aircraft would increase from 328 in 1997 to 338 in 2002.

*U.S.-Latin America*

- Overall, traffic will grow at a very high rate, averaging 6.9 percent per year from 1997-2002, driven by strong economic performance and growth in the newly free-market Latin American economies.

Growth to the Mercosur nations, particularly Chile, Argentina and Brazil, has been the most rapid over the past few years and is expected to continue at a high rate. If the U.S. succeeds in expanding its Open Skies relationships beyond Central America to South America, traffic would grow even more rapidly. In contrast, traffic growth to the Caribbean, Mexico and Venezuela will trail other Latin American markets in the near term, given the current economic and operational difficulties in these areas.

Intra-Latin American growth is expected to be very high, particularly within the liberalized air service environments of the Andean Pact and Mercosur nations. However, intra-Latin American route networks are expected to remain primarily linear, although development of some hub-and-spoke operations in Latin America is not precluded.

U.S. carriers have greatly increased their share of the U.S.-Latin America market in the 1990s. American Airlines now has the largest single presence in the market, leveraging its effective Miami hub. Already strong on fifth freedom intra-Latin American routes, American is solidifying its position in the region via equity purchases and/or and planned alliances with Aerolineas Argentinas, Avianca, the TACA Group, LanChile and TAM.

- Real yields are forecast to decline slightly, at approximately -0.5 percent per year, but will remain considerably higher than either transatlantic or transpacific yields. (Higher yields in the US-Latin America market are partly explained by shorter length-of-haul operations to Central America and Mexico.) Strong traffic growth and American's increasing power in the region will offset increased competition in the liberalized Latin American markets.
- Capacity generally will keep pace with demand growth, with a constant load factor in the 64-65 percent range projected through 2002. High yields in the U.S.-Latin America market allow operations at lower load factors relative to the transatlantic or transpacific markets.
- Average aircraft seating capacity will grow slightly during the next five years from 182 to 184, in line with the wide use of 757 and 767 equipment in U.S.-South American markets, and 737s and A320s to Central America. Passenger demand growth will be accommodated by increasing frequencies, not aircraft capacity.

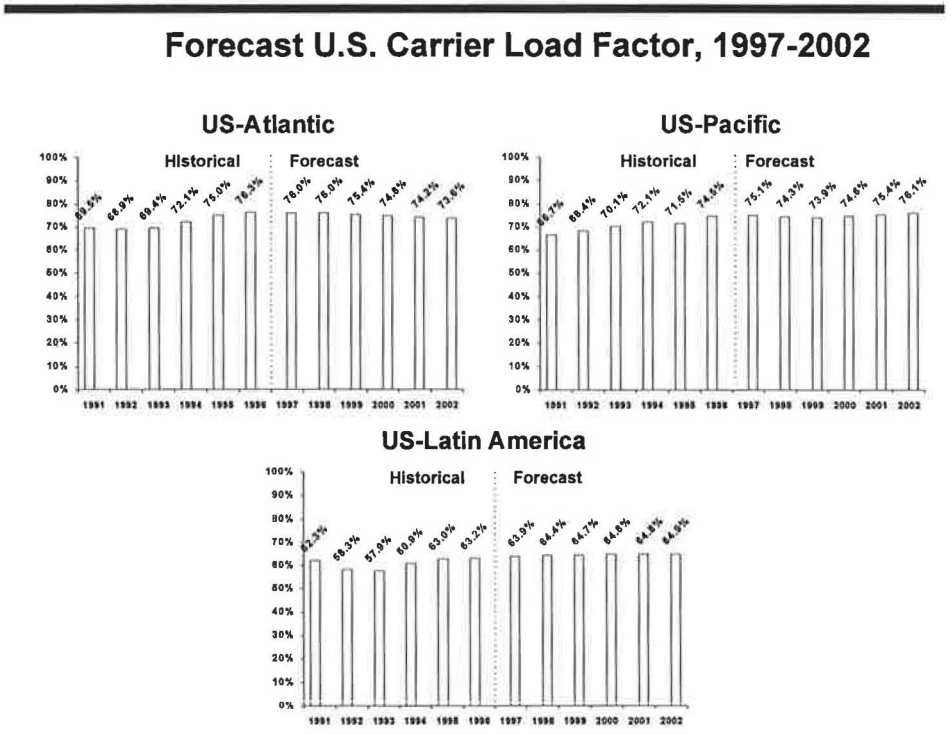


FIGURE 1 Forecasts U.S. carrier load factor, 1997-2002.

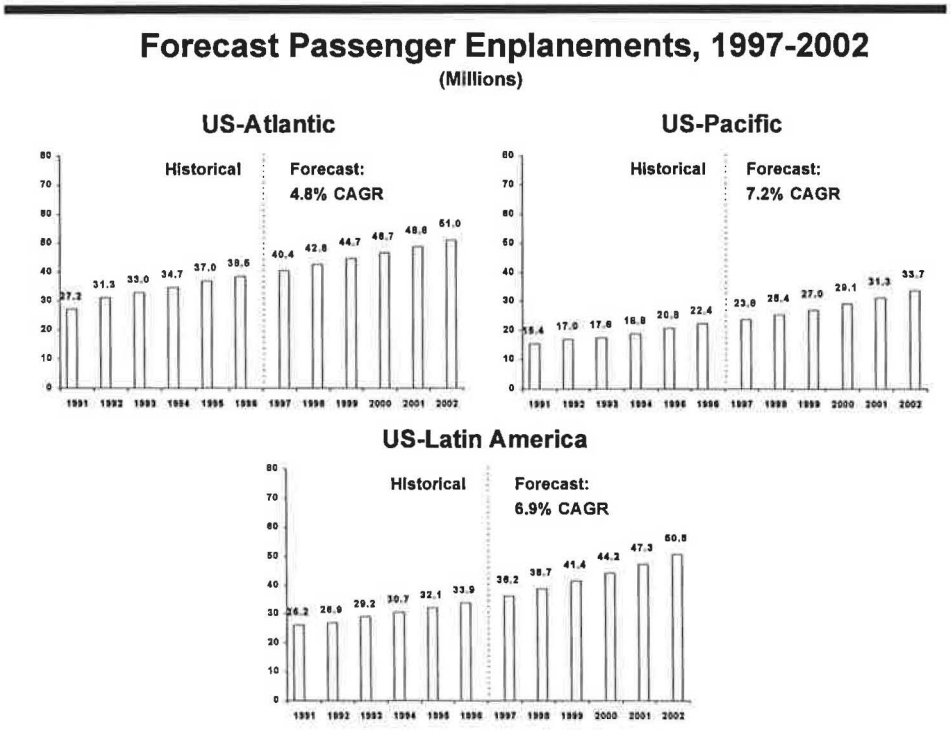


FIGURE 2 Forecast of passenger enplanements, 1997-2002 (millions).

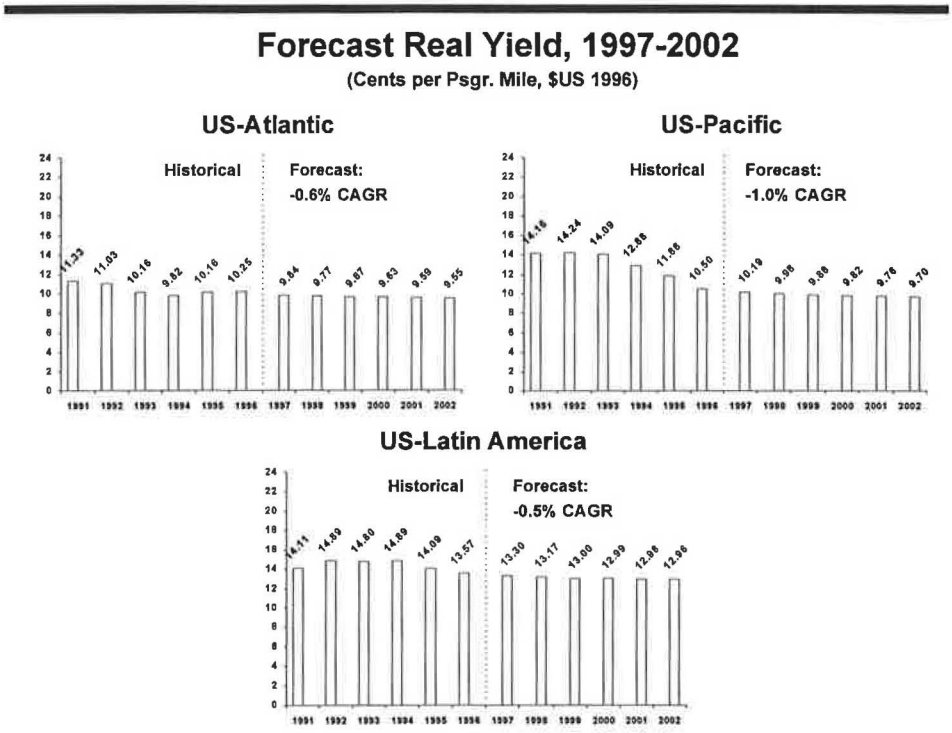


FIGURE 3 Forecast real yield, 1997-2002.

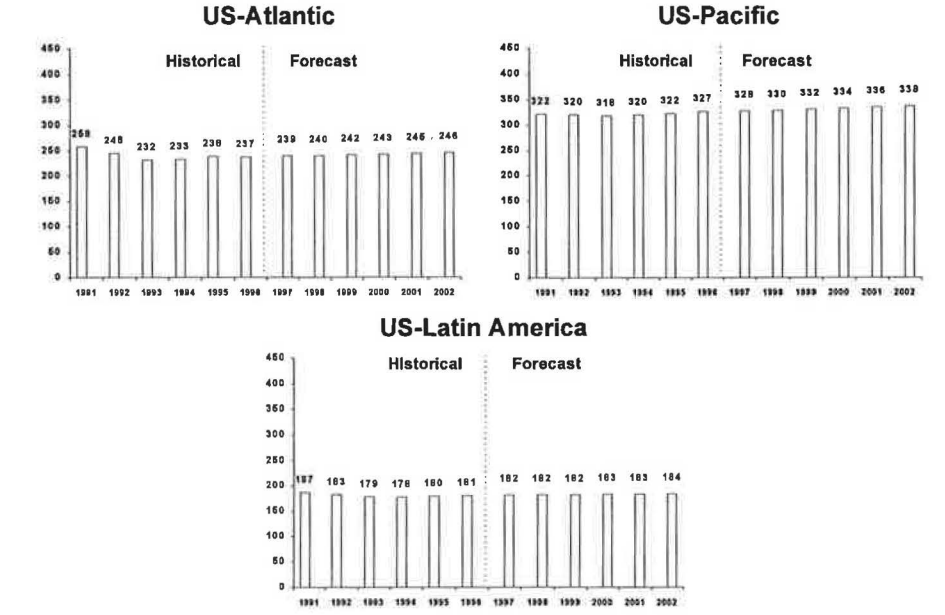


FIGURE 4 Forecast average U.S. carrier aircraft seats, 1997-2002.

## REGIONAL AND COMMUTER AVIATION

*Panel leader:*
Tulinda Larsen
SH&E

*Panelists:*
Douglas Abbey
AvStat Associates, Inc.

Juan Mario Gomez
GE Aircraft Engines

Deborah McElroy
Regional Airline Associates

Charles Moles
FAA

Eric Nordling
Atlantic Coast Airlines

Kenneth Roberts
Roberts Consulting

Derrick Sloan
Industry Canada

Grady Stone
U.S. Airways Express

### Introduction

The panel included representatives from two major regional airlines, a major manufacturer of engines for regional aircraft, the Regional Airline Association, the Federal Aviation Administration, Industry Canada and industry consultants.

The regional airline industry has continued to grow at a faster rate than the larger jet carriers and the panel discussed the factors that will be required to sustain this high rate of growth. New technology RJs are being introduced into the fleets and the panel examined the impact on the characteristics of the regional airline industry.

The primary questions before the panel were the definition of the industry, the outlook for growth, and the anticipated structure of the regional airline industry over the next decade. The panel structured their discussion into four areas:

- Industry definition
- Impact of the regional jet
- Market structure
- Outlook for growth

### Industry Definition

Regional airlines are loosely defined as air carriers that provide regularly scheduled passenger service and have a fleet of aircraft with fewer than 100 seats each. FAA defines the regional airline industry as operators of less than 60-seat aircraft, plus larger turboprops such as the ATR72.

The regional industry was originally known as the commuter airline industry. In the 1960s commuter airlines operated aircraft with less than 30 seats and provided primarily point-to-point service. In the 1970s the larger jet airlines began to use commuter airlines as replacement service to smaller communities. The 1978 Airline Deregulation Act officially recognized the role of the commuter airline industry in providing small community air service and allowed the commuter air carriers to increased the size of the aircraft they operated to 60 seats.

From 1978 to 1984, the government developed the small community air service program known as the Essential Air Service (EAS) program and provided incentives to commuter airlines. These incentives included direct subsidy, loan guarantees, and a mandated cross-subsidy from the longer routes operated by the jet carriers to support the shorter routes operated by the commuter airlines. All of these incentives, except the direct subsidy, expired in 1985 with the sunset of the Civil Aeronautics Board.

During the 1980s, the major carriers were building the current hub network. These carriers used the commuter airlines to expand the hub networks. Extensive marketing agreements emerged between the major carriers and commuters, and the use of the major air carriers two-letter code by the commuter carrier known as code sharing began to expand. Code sharing between major carriers and commuters allowed the commuter airlines to publish flights under the airline designator of the major carrier and to appear in the computer reservations systems as part of the major carrier.

The 1980s were a period of explosive growth for the commuter airline industry and the industry became known as the regional airline industry. Since the early 1980s, the regional airline industry has been in a period of transition. The number of code share agreements increased dramatically, and by 1985 the major carriers began to purchase equity interest in the regional airline partners. In some cases, the major airline fully acquired the regional partners.

As the regional carriers became more a part of the total system of the major jet partner, the major carriers accelerated the transfer of short-haul routes to the regional affiliates. This transferring of jet routes has sustained the regional industry's historic high rate of growth over the past decade.

The fundamental character of the regional airline industry has changed considerably in the 1990s. Regional airlines are now sophisticated companies that operate as extensions of the major carries' route networks. The regional airlines are becoming fully integrated into the overall market strategy of the major carriers. Regional airlines now operate fleets of both turboprop and jet aircraft and the regional jet has developed as a significant competitive tool of the regional industry, although turboprops remain the primary aircraft serving the more traditional markets.

Thus, while the line between a regional airline and a major/national airline is becoming blurred, there are definite characteristics that define a U.S. regional airline. These include:

- Fleet of aircraft each with less than 100 seats and
- Primary mission is to support a larger carrier.

## Impact of the Regional Jet

The 50 seat regional jet has had a significant impact on the regional airline industry. As of this conference, over 700 RJs are on order or option. Regional jets allow regional airlines to expand into longer markets. Traditionally, turboprop aircraft restricted regional airline operations to fewer than 400-mile routes. The regional jets are expanding market opportunities to include up to 1,600-mile routes. Regional jets are used: (1) to replace or supplement the larger jets of the major airlines; (2)to open new markets; and (3) to upgrade traditional regional airline routes currently served by turboprops.

The newest development is the 30-seat jet. Two smaller 30-seat RJs have been launched over the past six months. The Embraer 135 joined the Fairchild Dornier 328Jet in the smaller regional jet market. If these new aircraft prove to be economical to operate, they may create a new market, much as the 50-seat regional jet did in 1995-1996.

All the major U.S. carriers have developed regional jet programs for their affiliated carriers. RJs allow regional airline partners to provide a more desirable pattern of service in specific city pairs. Combining regional jet service with existing major airlines service produces a more competitive service pattern, which fills in the daily flight schedule banks with appropriate aircraft sized to match market demand. The result is increased frequency and feed at lower costs for the major airlines.

Major airlines no longer consider the major and regional services to be divided by segments. Now a combination of different sizes of aircraft operated by each entity can be used to provide the appropriate level and mix of capacity on specific segments throughout the network. The RJs are both larger in overall capacity and fly longer distances. Thus, RJs generate substantially more available seat miles and revenue passenger miles than the turboprops.

Despite the success of the RJs, turboprop aircraft are expected to continue to provide the core services of the regional airline industry. There are currently over 2,000 aircraft in the U.S. regional airline fleet. Less than 10 percent of the fleet are the new technology regional jets. The manufacturers of regional jets have production limitations and can only produce 120 to 180 units per year over the next decade. Sixty percent of the regional airline fleet is still expected to be turboprop powered by the year 2008.

## Market Structure

The basic role of the regional airline industry, which has not changed since its inception, is to provide feeder service for the large commercial jet air carriers. It is the scope of the services that have changed dramatically.

As a result of an intensifying relationship with the major carriers, the regional airline industry has had clear winners and losers. The industry has become more concentrated and the number of regional airlines has declined by more than half 1981—from 250 in 1981 to only 109 in 1997. The top 50 regionals accounted for 99 percent of all the passengers carried by the regional airline industry in 1996. The top 25 regional airlines account for 90 percent and the top 10 regional airlines account for 55 percent of the total.

There are approximately 60 code-sharing agreements between major carriers and regional affiliates. These code-sharing regionals carried 95 percent of the passengers. Of these code-sharing regionals, 18 are owned totally or in part by seven of the larger commercial air carriers and 5 are owned by three larger regionals.

Regional airlines transported 11 percent of all commercial airline passengers in the United States—up from 6 percent in the 1980s. This increase in the share of the total passenger market is a result of the transfer of routes from the major airlines' systems to the regional airline industry.

The transfer of routes from the major airlines to the regional airline industry surged in the 1990s. Major airlines have reduced overall system costs by transferring less profitable routes to the regional affiliates. The major airline is typically serving the market with aircraft of over 100 seats, when the market can be profitably served with a smaller aircraft. There are currently 224 routes operated by major airlines that are under 1,200 miles and average less than a 55 percent load factor. These routes are eligible for transfer to the regional affiliates.

TABLE 1 MAJOR AIRLINE SHORT HAUL
LOW-LOAD FACTOR ROUTES

| Carrier | Number of Markets | Average Passengers Per Flight |
|---|---|---|
| American | 7 | 60 |
| Alaska | 6 | 64 |
| Continental | 21 | 52 |
| Delta | 64 | 63 |
| America West | 16 | 69 |
| Northwest | 36 | 50 |
| TWA | 15 | 52 |
| United | 21 | 60 |
| US Airways | 38 | 57 |
| **Total** | **224** | |

(U.S. DOT T100 2nd Quarter, 1997)

## Outlook for Growth

The panel agreed that the outlook is for continued growth in the U.S. regional airline industry. The transfer of routes from major carriers will continue to be a factor driving the growth in the regional airline industry.

The U.S. regional airline fleet has leveled off at approximately 2,000 units. The fleet grew rapidly during the 1980s as the new generation 30-seat turboprop aircraft were introduced into the market. The fleet size is now leveling off as the older 19-seat and 30-seat turboprop aircraft retire. The average size of the aircraft operated by the regional airline industry has been steadily increasing. In 1986 the average regional aircraft carried 19 passengers. Today, the average regional aircraft carries 25 passengers. As the 50 seat jets enter the fleet and the smaller 19 seat turboprops are retired, the average seat size will continue to increase over the next decade.

Nineteen-seat aircraft have steadily lost market share relative to mid-size turboprops. The role of the 19-seat aircraft is threatened in the United States by the cost impact of the new single safety standard introduced in 1995, and the pressure from the major airlines for cabin service, i.e., stand-up head room.

For these reasons, mid-size (20-39 seat) turboprops are being purchased to replace 19-seat aircraft. Fundamentally, the 19-seat aircraft is becoming economically noncompetitive in scheduled service and will transition to alternative uses. Mid-size turboprop aircraft are expected to continue to serve as the mainstay of the regional airline fleet.

The role of the large turboprops (40-plus seats) is less certain. The larger turboprops face competition from the smaller turboprops and the RJs. The larger turboprop aircraft have had greatest success in Western Europe, where the cost of European airport and air navigation user fees limit the economic viability of aircraft with less than 50-seats.

The most significant growth is expected to be in the regional jet sector of the industry.

The panel agreed that the average load factors for regional airlines will continue to increase and are expected to achieve 60 percent by 2001.

In conclusion, the structure of the regional airline industry is continually evolving and becoming increasingly integrated into the systems of the major carriers. The industry is expected to continue to grow at a faster rate than the major/national carriers.

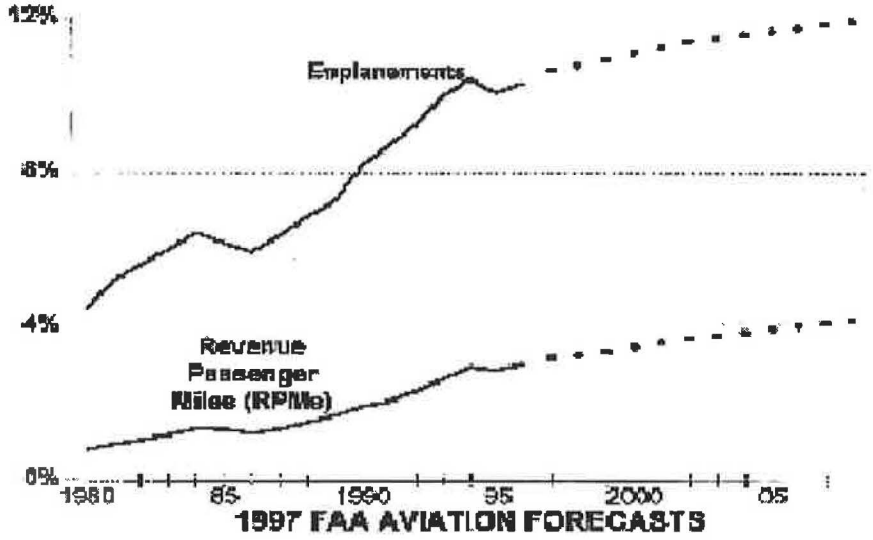


FIGURE 1 Commuter traffic growth: Share of domestic traffic.

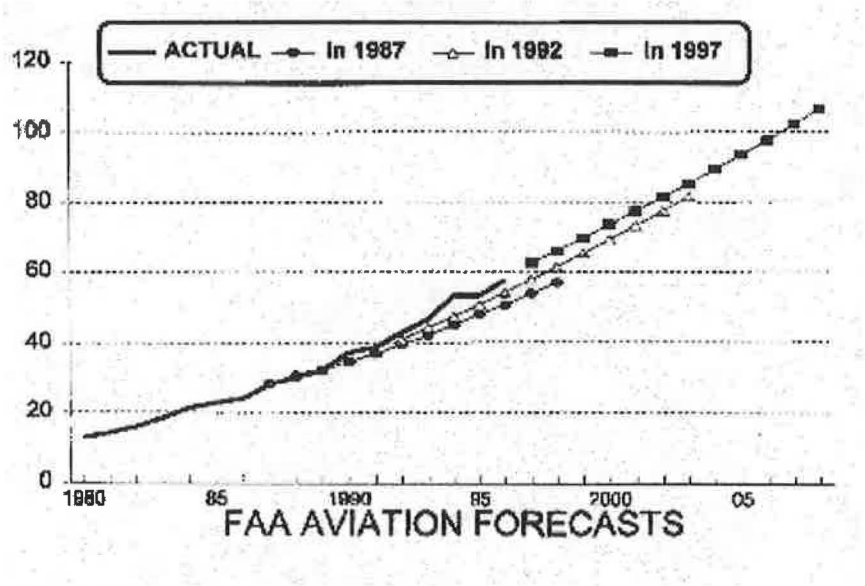


FIGURE 2 Forecasts of enplanements.

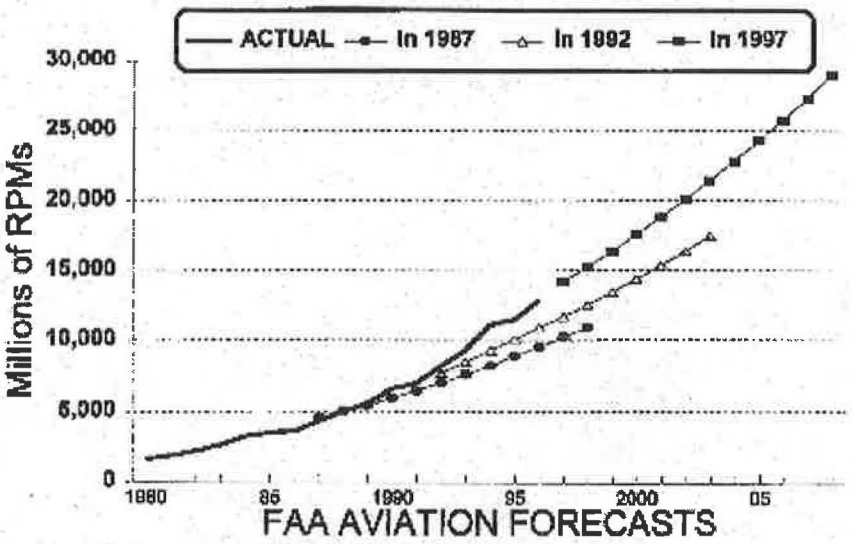


FIGURE 3 Forecasts of RPMs.

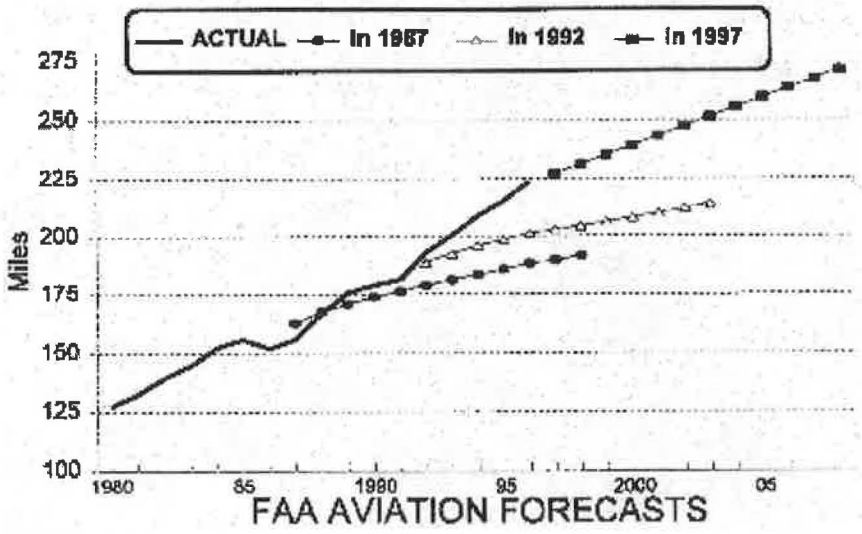


FIGURE 4 Forecasts of average trip length.

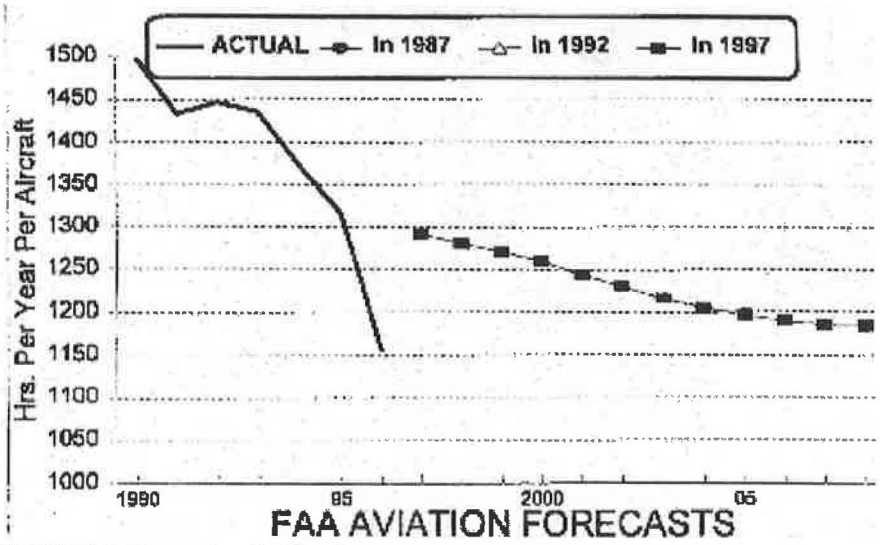


FIGURE 5 Forecasts of utilization.

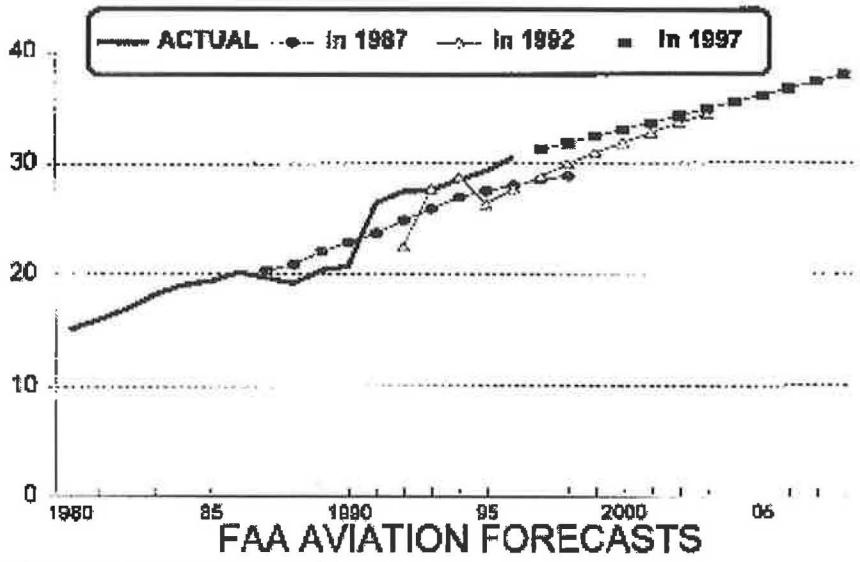


FIGURE 6 Forecasts of seats/aircraft.

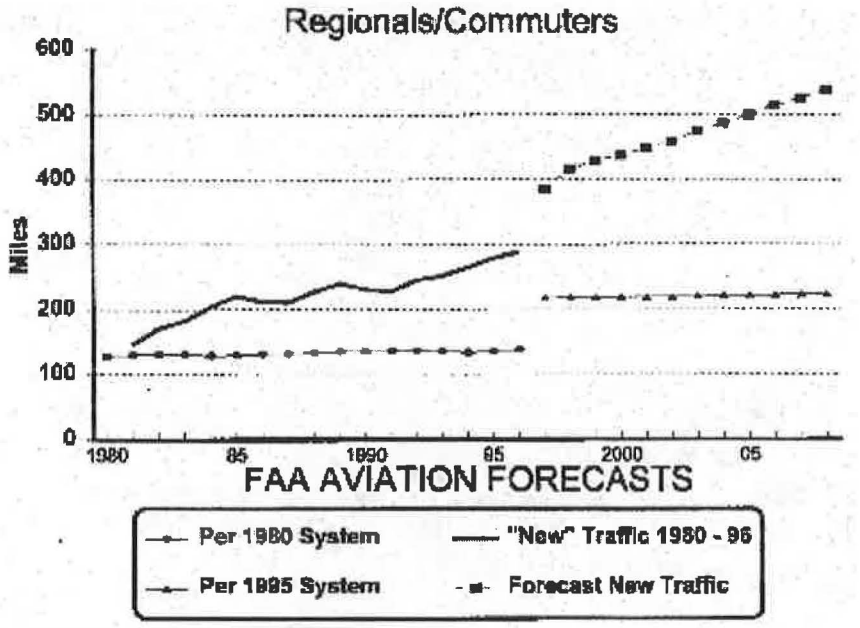


FIGURE 7 Analysis of stage length growth.

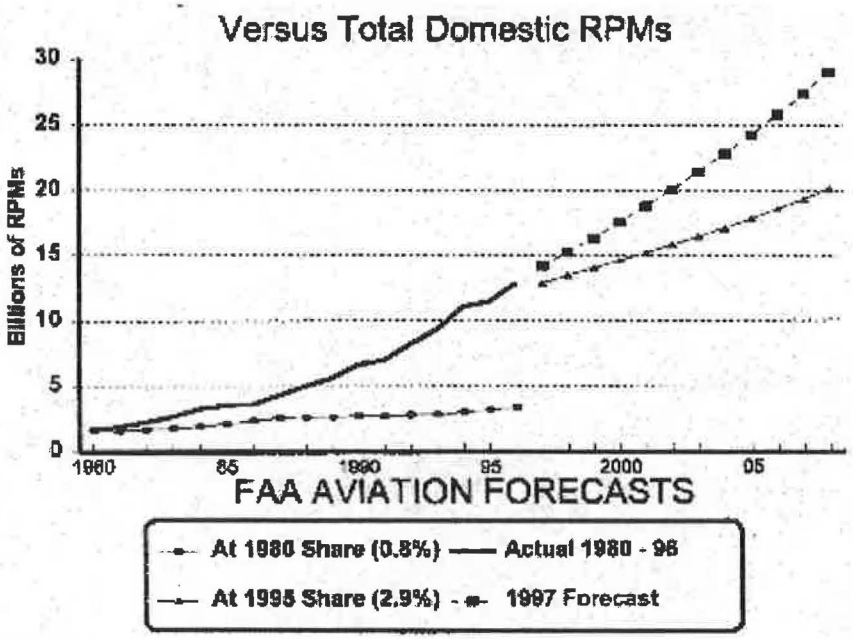


FIGURE 8 Regionals/commuters RPM growth.

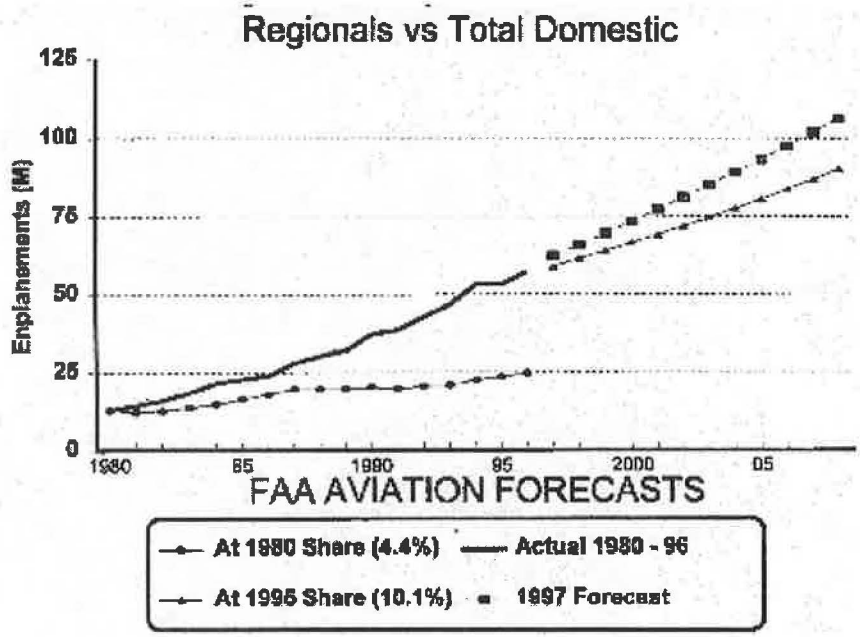


FIGURE 9 Analysis of enplanement growth.

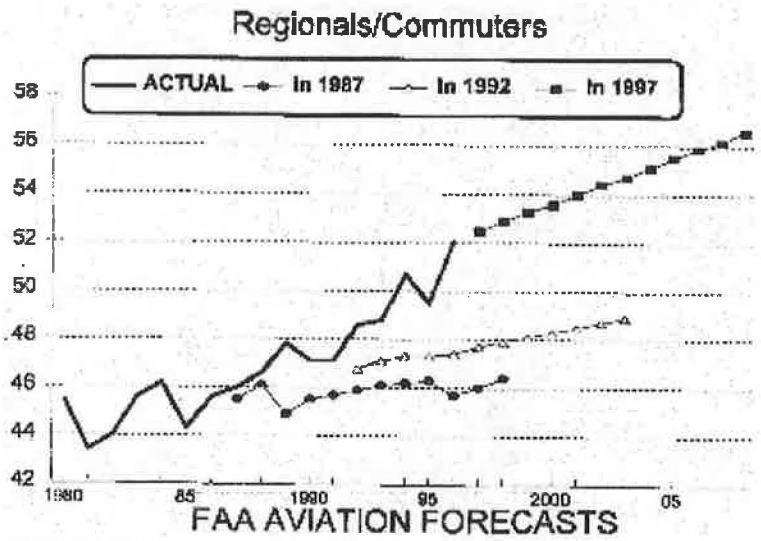


FIGURE 10 Forecasts of Load Factors.

## BUSINESS AVIATION

*Panel Leaders:*
Steven Johnson
Honeywell

Gerald S. McDougall
Southeast Missouri State University

*Panelists:*
Gerald W. Bernstein
BACK Associates

Maureen L. McMaster
Raytheon Aircraft Co.

Michael D. Chase
Gulfstream Aircraft, Inc.

Tri Pham
Pratt & Whitney Canada, Inc.

Jerome Desmazures
Dassault Falcon Jet

Daniel C. Tuerk
Federal Aviation Administration

R. Steven Hines
Cessna Aircraft Company

### Introduction

There are a number of factors now at play in the business aviation sector and their effects suggest business aviation activity will continue to grow over the forecast period 1997-2002. These factors include (1) the impact of new product introductions, (2) the trends in domestic and world economic growth, (3) the creation of new institutions which expand the business aircraft market and promote business aircraft use, and (4) the likelihood of only moderate increases in the cost of operating or using business aviation aircraft. These positive factors are complemented by emerging trends in the light general and personal aviation sector—trends that may increase the likelihood of continued growth of business aviation in the long term.

In particular, the business aviation industry must recognize the efforts to increase piston aviation activity through the reintroduction of single-engine piston aircraft and programs being implemented to increase the private pilot population. (These initiatives are detailed in the next section of this report—*Light General and Personal Aviation.*) Light general aviation activity is an important part of the general aviation hierarchy defined by piston, turboprop, and turbojet aircraft. Some refer to this hierarchy as the aviation food chain since operators tend to migrate from piston aircraft toward turbojet aircraft. The relationship between the general aviation segments may transmit very positive impact to the business aviation sector during the out-years of the forecast period and beyond, as piston activity recovers and the private pilot pool expands.

The aging of the turbine fleet will put downward pressure on fleet utilization, but fleet growth will more then compensate for this, causing total hours flown to increase over the forecast period.

### New Products

Business aviation growth has always been influenced by the research and development undertaken by airframe manufacturers to develop better products to meet the transportation needs of the business community. New products boost sales, revenues, profits, employment, and shareholder returns. Over the forecast period, new products are likely to have an above average positive effect on business aviation activity because of the breadth of new product introductions.

New light jet offerings will expand the small end of the business aviation market, providing trade-up opportunities for firms already involved with business aviation. At the same time, these light turbojet business aircraft provide profitable small firms the chance to take their first step into business aviation aircraft for the purpose of expanding into new geographic markets and increasing productivity and efficiencies while serving existing markets.

At the other extreme, the business aviation industry will feel the full impact of the introduction of very long range business aircraft over the forecast period. While these very long range business aircraft will provide enhanced capabilities and performance to those organizations already utilizing business aircraft to meet their international business travel needs, they also hold the potential for drawing new buyers (operators) into business aviation. This possibility exists because of (1) the increasing demands for very long range executive aircraft, (2) continuing concerns about personal safety, (3) the need for comfort and privacy when involved with business travel, and (4) increasing demands for convenience and time savings when undertaking international business travel.

In between these product end-points, enhancements are being made to the mid-sized, mid-range aircraft that are increasing capabilities and performance. These enhancements are blurring the lines between the traditional light, medium and heavy business jet market segments, but in so doing, providing increased value to business aircraft operators. Additionally, business aviation activity may very well benefit over the forecast period from product innovations that are currently underway.

The business aviation sector may see the introduction of one or more single-engine business turbojet aircraft and an enhanced single-engine turboprop airplane designed for business use. The former has the potential for significantly expanding the

business aviation sector by offering a moderately priced, comfortable, reasonably performing, easy to fly business jet to the successful entrepreneur with growing travel demands.

At the same time, a single-engine business turboprop can provide a contemporary product with good performance and comfort features to those individuals and businesses currently flying older multi-engine piston aircraft or existing, but aging, turboprop aircraft.

## Domestic and World Economic Growth

Unarguably, business aviation has benefited from the modest—on an annual basis—but long and persistent, expansion of the U.S. economy and the relatively good, and improving, health of the world economy. The latter being associated with the expansion of market based economies worldwide. Statistical analyses consistently report a high correlation between corporate profitability and business aviation activity. Additionally, business investment increases when uncertainty is reduced, especially when uncertainty about the economic future is lessened. Moderation and persistence are important ingredients in reducing uncertainty—these create confidence in the future course of economic events and reduce apprehension about economic surprises.

Consensus forecast numbers suggest that moderate real growth with modest inflation will continue for the U.S. economy, at least through 1999-2000. It also appears that the world economy will continue to advance, albeit perhaps unevenly, as European consolidation continues, Asian economies rationalize their financial markets, and Latin America continues to control inflation and increase its reliance on market forces and freer trade policies. The Middle East, an especially important market for longer range business aircraft and a key player in world energy markets, continues to be a wild card in the economic game. Recognizing this, the probability remains high that the U.S. domestic economy and the general condition of the world economy will be a positive influence on business aviation into 2000 and possibly beyond.

## New Institutions

Though it is a simplification of the first order, it is not misleading to say that ten years ago shared ownership was known only to individuals wishing to have access to a condominium in a high-cost resort area. In this case, shared ownership defined a specific time allocation which could be applied only toward a specific housing unit on a first-come, first-served basis.

Today the concept of shared ownership in business aviation—recreated as *fractional* ownership—is providing guaranteed access to a specific type of business aircraft for operators with relatively low travel demands or those wishing to round out the performance capabilities of an existing fleet. By providing guaranteed access at fractional cost, this new business aviation institution has the potential for significantly expanding the business aviation market and, therefore, business aviation activity.

Organizations offering fractional ownership represent a relatively large portion of new business aircraft buyers in terms of units purchased. These fleet-management firms are players in nearly the full spectrum of turbine business aircraft as they acquiring a mix of aircraft ranging from turboprops and the smallest jets to the largest business jets now available.

Furthermore, recent data suggests that 70-75 percent of those participating in fractional ownership plans are new to business aviation—the majority of fractional owners have never owned a business aircraft! Annual growth in fractional ownership since 1990 has exceeded 40 percent. Since the institution of fractional ownership has existed less then a decade in the business aviation sector, there is no reason to believe that the opportunities for expanding business aviation activity through this new aviation institution have been exhausted.

Many believe that fractional ownership will be less sensitive to economic cycles—an effect that could moderate the swings historically seen in business aviation activity. With these kinds of impacts, it is likely that fractional ownership will continue to have a positive influence on unit sales and utilization in the business aircraft segment of general aviation (Appendix B addresses fractional ownership in considerable detail).

## Operating Costs

Business aviation, like any activity, is adversely affected by rising costs. For business aviation it is convenient to divide costs between direct operating costs (e.g., fuel prices and taxes) and regulatory costs (e.g., landing fees or constraints on access). As noted above, the economic outlook provides a rather benign picture for inflation over the forecast period. As such, jet fuel prices should remain relatively constant over the forecast period.

Similarly, since the United States appears to be growing out of its deficit, the pressure to find new taxes or increase existing tax rates (or expand tax bases) is much diminished. As such, fuel costs (the combination of prices and taxes) are not expected to increase dramatically over the near term. As a result, any increases in direct operating costs should be modest—at or below the general rate of inflation.

Future regulatory costs are harder to forecast since they depend, in large part, on political forces rather

then economic forces. Nonetheless, it appears that recent budget action at the federal level will put to rest (for the short term) discussions about increasing landing fees or implementing new operating fees to partially privatize the nation's aviation infrastructure.

There is concern, however, about continuing efforts to reduce or constrain business aviation's access to major U.S. airports. It is important to understand that business aviation is not the source of congestion in the U.S. air traffic control system nor the reason for commercial aircraft delays. Business aviation provides transportation services important to the health and continued growth of corporate America. These services include both access to our major industrial and commercial centers, as well as access to locations not well served by commercial aviation or other transportation modes.

### Summary

While variation will always occur around trends, the outlook for business aviation between 1997-2002 is relatively bright. Trends reflect three fundamental forces in business aviation (1) new product introductions, (2) corporate profitability, and (3) direct operating and regulatory costs. For this review exercise, the positives in these three factors outweigh any negatives that the panel could speculate about in terms of timing and magnitude of their effect on business aviation.

In business aviation, there is a fourth factor that can not be ignored, although its full impact can not be precisely measured. This factor is the emergence of fractional ownership as an institution in business aviation. Fractional ownership will likely expand the business aviation market by bringing new buyers and operators into business aviation.

Taking these four factors into consideration, it is likely that new aircraft sales, fleet growth, and fleet utilization will at least match, if not exceed, the expected real rate of growth in the U.S. economy. The extent to which growth in business aviation exceeds the real rate of economic growth in the United States will be determined, in large part, by the growth in the world economy and the influence of age on fleet utilization.

This is especially so in the turboprop sector. In comparing the turbojet and turboprop sectors of business aviation, it is expected that the turboprop sector will display the least robust growth. New product development is limited in the turboprop sector and the use of the turboprop fleet will be more severely affected by aging aircraft. Nonetheless, there is a viable market for existing turboprop products and new products have the potential for reenergizing certain sectors of the turboprop segment of business aviation.

## LIGHT AND PERSONAL GENERAL AVIATION

*Panel Leader:*
Michael D. Wolf
Textron Lycoming

*Panelists:*

| | |
|---|---|
| Dan Barks<br>Allied Signal Aerospace, Inc. | Molly M. Pearce<br>The New Piper Aircraft, Inc. |
| Don Johnson<br>Aircraft Owners & Pilots Association | Nan Shellabarger<br>Federal Aviation Administration |
| Phillip Michel<br>Cessna Aircraft Company | Edward M. Bolen<br>General Aviation Manufacturers Association |


### Introduction

The panel discussed the state of the light and personal general aviation market and the factors that will influence the market. The industry has been in a steady and unrelenting decline for well over a decade, but the panel felt that it is now in the early stages of a recovery spurred by the General Aviation Revitalization Act of 1994 and a healthy economy. There are industry marketing and product initiatives that will provide the impetus for continued growth. The most critical downside risk is the economy, but regulatory intervention could impact the business if significant changes are made.

### Assumptions

The U. S. economy will continue to grow at a moderate rate and inflation and interest rates will not increase significantly in the next few years. There will be price stability in the general economy and specifically in the area of aviation fuels, and no drastic regulatory or tax changes that would adversely impact the recovery of the industry. Any significant shocks to the industry—causing operating cost increases, reduction in the utility of aircraft or added administrative burden for the use of aircraft—could reverse the improvements made to date. It was also assumed that GA Team 2000, or a similar, major promotional learn-to-fly program will continue throughout the forecast period.

## U. S. Student and Private Pilot Population

*Student Pilots*

There are several industry initiatives that are intended to increase interest in flying and these are expected to rapidly increase the number of student pilot starts, effectively stopping the decline in student pilots that has plagued the industry and threatened its future. These initiatives will eventually increase the private pilot population and later the instrument rated pilot population, too.

The panel took into account:

- The "GA Team 2000" Program;
- Aircraft Owners and Pilots Association's (AOPA) "Mentor Program;"
- Experimental Aircraft Association's (EAA) "Young Eagles" and "Flying Start" Programs; and
- Cessna's Cessna Pilot Center network.

These initiatives are being undertaken by the industry and its pilot population to spur the interest in aviation that has been declining for years. This is the greatest concentration of new initiatives since the late 1970s, when the industry experienced high student pilot levels, robust sales of new aircraft and high fleet utilization.

The student pilot population is expected to grow from 1997 to 1998 by 11.5 percent, and in 1999 by another 7.0 percent, with continued growth expected after that. The student pilot population will grow at an annual rate of 7.0 percent for the period 1997-2002. These increase the student pilot population from about 96,000 in 1996 to 135,000 in 2002.

*Private Pilots*

After a delay as the new student pilots complete their training, the private pilot population will begin to increase and the growth rates are forecast to be 0.9% in 1998, and 4.0% in 1999. For the period 1997-2002, the private pilot population will increase by 4.0% annually which will increase the population of private pilots from 254,000 in 1997 to 309,000 in 2002.

*Instrument Rated Pilots*

The number of instrument rated pilots will also increase, but lag the growth in student starts. This increase will be caused by the increase in aviation interest, by the need for replacement commercial pilots as many of these pilots reach retirement age, and the advent of new technology in the cockpit, such as GPS navigation. Instrument rated pilots numbers will increase by 0.9 percent in 1998, by 1.4 percent in 1999 and for the period 1997-2002 will increase at a 1.9 percent annual rate. This will increase the instrument rated population from 299,000 in 1997 to 328,500 in 2002.

*Commercial Pilots*

The number of commercial pilots will increase at a slower rate and will be stable in 1998, up 1.0% in 1999 and by 0.9% per year for the 1997-2002 period. This will produce commercial pilot populations of 127,800 in 1997 and 133,700 in 2002.

*Pilot Summary*

After a long decline in pilot ranks, industry initiatives and economic strength will produce an increase in pilot training activities. These initiatives will need to be continued for several years to cause the forecasted improvements. The increases may seem modest compared to the effort and new initiatives involved, but the slope of the pilot population curves over time has been negative and stopping that decline requires a significant effort. The student pilot population declined at an annual rate of 4.2 percent from 1990 to 1997 and a forecasted increase of 7.0 percent for 1997 to 2002 shows an 11.2 percentage point change in the rate—a significant accomplishment.

## Flight Activity

*Assumptions*

FAA database on piston powered light and personal aircraft activity is split into three categories. The panel addressed two of these: the single-engine and multi-engine piston fleet. The amateur built experimental (ABE) aircraft were not discussed and are excluded from this report.

Since the last meeting in 1995 market factors that drive flight activity changes are:

- the Cessna single engine start-up program,
- the increase in production by other original equipment manufacturer companies, and
- the increase in the number of new products entering the market.

These are all spurred by the General Aviation Revitalization Act of 1994, which provided limited tort reform for general aviation by enacting an 18-year statute of repose on the products. This has stood up to several tests in the courts and has allowed the

manufacturers to spend more money in research and development and less to defend product liability cases in the courts.

While these changes were anticipated at the 1995 TRB Forecast Workshop, the benefits are now becoming reality, and the industry initiatives over the past two years have evolved from sketchy plans to market place reality.

### Piston-Powered Aircraft Fleet

The piston-powered aircraft fleet is divided into two segments, single-engine and multi-engine aircraft. Fleet age has increased; the average piston aircraft is now 27 years old. With the aircraft population at 129,000 for single-engine and 16,000 for twin-engine, new production will not be sufficient to reduce the average age. However, fleet size should grow—after declining by about 3 percent for the period 1990-1996. Even with the attrition of older aircraft and loss of some aircraft to accidents, the fleet will begin to grow in 1997.

The single engine fleet will grow from 128,848 in 1996 to 129,080 in 1997, 0.4 percent in 1997. The 1998 fleet will grow by 1.2 percent to 130,915 and for 1999 it will grow to 132,486, 1.2 percent increase. For the period 1996 to 2002 the fleet will grow at an annual rate of 0.9 percent to 135,964 in 2002. This growth rate seems relatively modest until one considers the 2.9 percent per year *reduction* that has taken place in the fleet since 1990.

The multi-engine fleet has contracted by an average of 4.6 percent per year since 1990, and aircraft production growth has been limited primarily to single-engine aircraft. This reduction is expected to stop in 1997, with no change in fleet size from 1996. Growth thereafter should increase by 0.3 percent in 1998, and 0.4 percent in 1999. The fleet will stay at 15,937 in 1997 and grow to 15,983 in 1998 and to 16, 050 in 1999. By 2002 the fleet is forecast to increase to 16,314.

### Flight Hours

Piston-powered aircraft hours flown have declined by 4.9 percent for single-engine, and 6.8 percent for multi-engine aircraft from 1990 through 1996. With the improvement in the general aviation environment, caused primarily by tort reform and the improved economy, the flight hours should increase.

Single-engine flight hours were estimated at 16,169 thousand in 1996, and are expected to grow by 0.5 percent in 1997 to 16,250 thousand. 1998 will bring a 1.4 percent growth to 16,484 thousand and by 1999 flight hours will grow by 1.5 percent to 16,728 thousand. For the period 1996-2002 the flight hours for single engine piston aircraft will grow by 1.5 percent per annum to 17,680 thousand.

Multi-engine piston-powered aircraft flew an estimated 2,595 thousand hours in 1996 and this reflects a 6.8 percent annual decline since 1990. In 1997 the figures are expected to show an improvement of 0.2 percent to 2,600 thousand hours and in 1998 to 2,610 thousand for 0.4 percent increase. 1999 estimates are 2,623 thousand hours—a 0.5 percent increase—and the period 1997-2002 will show a 0.5 percent growth rate to 2,681 thousand hours in 2002..

A concern of the panel was that FAA data have shown large fluctuations in flight hours—both up and down—in past years, indicating a possible problem that needs to be explained, validated and/or corrected to ensure that this is an accurate indicator of industry health.

### Summary

The panel was optimistic about growth of the light and personal aircraft market—one direct result of the improved climate provided by the General Aviation Revitalization Act of 1994 and the continuous improvement in the economy. If the economy stumbles or the regulatory environment becomes less friendly, this activity could return to its previous downward trends. Therefore, the industry initiatives to spur flight training activities and industry lobbying efforts to prevent over regulation will be critical to continuing the positive growth trends that have been developed in the past two years.

Overall, this is the most optimistic that industry participants have been in many years, and the panel felt that the upward trends forecasted have been hard-won results of a long battle to turn the industry around.

## VERTICAL FLIGHT

*Panel Leader:*
David Lawrence
Aviation Market Research

*Participants:*

Andrea Aastad
Aastad Company Association

Brandon Battles
Conklin & deDecker Associates

Christine Eberhard
CommuniQuest

David Napier
Aerospace Industries

Martin Rosenstein
Sikorsky Aircraft Corporation

Pierre Herron
Pratt and Whitney Canada

Todd Inskeep
Allison Engine Company

John M. Rodgers
Federal Aviation Administration

John Leverton
R. Dixon Speas Associates

George D. Stamas
Federal Aviation Administration

Leo Mackay, Jr.
Bell Helicopter Textron, Inc.

## Introduction

The session focused initially on scheduled presentations by selected panel members, each of whom stressed key issues that could either constrain or enhance growth of the U.S. civil rotorcraft fleet during the forecast period.

- Inappropriate route assignments and inadequate ground facilities have limited helicopter development in the past. These limitations could become dramatic with the introduction of high-speed, long-range tilt-rotor aircraft in the out-years.
- There is a need for all-weather accessibility to scheduled destinations
- Icing issues are perhaps the most restrictive of the all-weather parameters.
- Noise concerns of communities in the 1980s are now more generalized as airspace concerns.
- While mitigating technology was successfully demonstrated in the Atlanta Olympics Helistar project, explaining these problems and solutions to the public may be beyond the public relations capabilities of the smaller, less sophisticated commercial operators.
- There is a continuing transfer of surplus military equipment to the civil marketplace. One thousand helicopters were surplussed between 1993 and mid-1997, 94 percent of which were UH-1s, OH-58s, and OH-6s. Of the total, 63 percent went to law enforcement agencies, and 40-50 percent of those are believed to be inactive. Of the total reported potential of 3,000 helicopters, at least half are expected to be transferred overseas. Thus, the impact on the U.S. fleet should trail off to zero during the next few years—although it will account for virtually all of the net fleet growth in the early forecast years, as noted below.
- The apparent upturn in helicopter activity in the Gulf of Mexico continues. During the previous five years, flight hours and passenger activity had increased, but operational efficiencies had actually resulted in a decrease in the number of aircraft employed. In 1996, however, only light twin helicopters declined (by 0.8 percent). Single-engine helicopters increased by 3.2 percent, larger aircraft by 4.4 percent, and the total Gulf fleet by 2.7 percent. However, the much publicized extension outward is not yet in evidence and most of the activity still takes place within 150 miles of shore.

The panel then addressed several issues that were posited to influence the fleet forecast.

## Acquisition Costs

While prices of new helicopters continue to rise, the perceived ratio of price to performance has improved to the point where fleet replacements are a growing share of new helicopter purchases, ranging from 40-50 percent in light helicopters to about 70 percent in the intermediates, according to a Pratt and Whitney Canada survey. The EC-120 and B407 were seen as examples of quantum improvements in aircraft performance with only moderate increases in price. It was felt that dramatic increases in price might inhibit further growth, but that decreases would not serve to expand the market. An exception to the relative indifference to price increases is the rapid escalation of spare parts prices, a continuing drag on the market.

The likely introduction of fractional ownership might account for additional sales during the forecast period, but at least some would be at the expense of projected single-owner sales.

## Technology

During the early years of the forecast, present and planned technological advances will stimulate new demand and increase fleet size. Most important among these is the development of the Global Positioning System (GPS), which will positively impact operating costs and perceived safety, and will significantly advance the accessibility of rotorcraft to their destinations under all-weather conditions. GPS will also permit tracking of aircraft through sensitive airspace in communities, thus permitting monitoring and enforcement of Fly Neighborly procedures and other measures to improve further improving helicopters' image and acceptance.

The most obvious new technology is the civil tilt-rotor, which, in the out-years, is expected to stimulate new demand and to capture market share from small fixed-wing turboprops, particularly in the corporate/executive market. The degree to which this potential can be exploited will depend in large part on improvements in airspace management and the landside infrastructure.

## Markets

In FAA's stipulated economic environment, key rotorcraft markets are expected to remain stable. Increased activity in offshore oil still has not translated

into strong helicopter sales, but the potential for growth in Asia and on the Russian mainland still exists. Air medical markets, too, are growing slowly, and seem to show a drift back toward single-engine aircraft as these become more reliable.

### Regulation

The collective impacts of stricter European operating regulations (JAR Ops-3), prospective restrictions on noise, and possible user fees, while a potential factor in worldwide growth, were thought to be minimal on the U.S. fleet size. However, it might stimulate earlier replacement of nonconforming helicopters.

### Comments on FAA Draft Forecast

The vertical flight panel was unable to directly address FAA forecast worksheet because of a significant disparity between FAA's present estimate of the U.S. civil rotorcraft fleet (about 3,600) and that generally accepted by the industry (in excess of 6,000). The key difference seems to be in the respective estimates of *active* aircraft, and this may be related to the survey procedures used to gather the data. The panel did suggest convening a joint FAA-Industry working group to examine the problem.

The panel felt that a 1996 fleet of 6,000 aircraft would grow by 1.7 percent, 2.3 percent and 1.6 percent in 1997, 1998, and 1999 respectively; and by an average annual rate of 1.5 percent between 1996 and 2002. The implicit annual sales would, of course, translate to much higher growth rates if a fleet size of 3,600 were the used as a basis.

The panel projected an increase in hours flown *per aircraft* of between 1 percent and 2 percent per year from 1997 through 1999, and leveling off thereafter. Again, the resultant change in *fleet* flight hours would be substantially greater using industry's, rather than FAA's, estimates of fleet size.

The panel found no basis for challenging FAA estimates of the piston helicopter fleet size or flight hours.

### Suggested Improvements

In view of the disparity between FAA and industry estimates of the present turbine fleet size (3,600 vs. 6,000), the panel suggested that a joint FAA/industry work group be convened to reconcile the data. The key difference appears to be in the respective estimates of active aircraft, and this may be related to the survey procedure used to gather the data.

## AIR CARGO

*Panel Leader:*
Anne Strauss-Wieder
A. Strauss-Wieder, Inc.

*Panelists:*

Magnus Bjorkman
Innova International

Christopher Brehm
Price Waterhouse LLP

John Cammett
Aeroterm

Brian Clancy
MergeGlobal, Inc.

Charles C. Erhard
Washington Dulles
International Airport

Jim Esswein
Federal Express

Pierre Herron
Pratt & Whitney Canada

Daniel Muscatello
Aviation Development
Services, LLC

Morton Plumb
Anchorage International
Airport

Carl Seiberlach
VZM Transystems
Corporation

George Stamos
Federal Aviation
Administration

Pierre Vilain
Louis Berger &
Associates, Inc.

### Introduction

The air cargo panel was a new addition to the workshop, and the group's objectives, therefore, differed from the other workshop panels. Specifically, the discussions held by the panel were geared toward laying a foundation and developing a framework for further discussion of air cargo. The two key questions addressed were:

- What are the key trends and issues in the air cargo industry today?
- Should the FAA resume air cargo forecasting?

This second objective was specifically posed to the panel by FAA to help provide insights into the need for additional or modified data.

The panel included representatives from airport operators and developers, carriers, manufacturers, and consultants to the industry. A wide range of trends and issues were discussed during the panel sessions, and FAA question was fully addressed. However, the panel recognized that these discussions and this summary should be considered only a starting point for more in-depth deliberations.

## Overview of the Industry

To understand air cargo, first it is important to understand the overall freight industry. Freight is a *derived demand*. Freight does not move of its own accord. Rather, goods move in response to the demands of industrial and retail users. These users determine when goods need to arrive, either for production processes or to meet customer demands for products.

The summary below provides an overview of industry trends. Mr. Brian Clancy, MergeGlobal, presented a review of the industry during the plenary session and these trends and their implications were discussed during the panel meetings.

*Growth in the global arena.* Air cargo is a small, but important and growing segment of the goods movement industry. According to MergeGlobal, 22 million metric tons of freight were moved by air in 1996, representing $70 billion in retail revenue. Air cargo is projected to grow rapidly, based on the three forecasts shown below (TABLE 1).

TABLE 1 COMPARATIVE AIR CARGO FORECASTS

| Forecast | Time Period | Average Annual Growth |
|---|---|---|
| Boeing | 1996-2015 | 6.7 percent |
| Douglas Aircraft | 1995-2015 | 7.4 percent |
| MergeGlobal | 1995-2000 | 7.9 percent |

*Source: AirCommerce, Journal of Commerce, December 30, 1996, p. 37.*
*Note: The Boeing forecast has been updated to reflect the information provided in the 1996/1997 World Air Cargo Forecast report.*

*Air cargo uses.* As indicated by Mr. Clancy in his remarks during the opening plenary, users choose to move freight by air for reasons including:

- High value to weight ratio,
- Fragile cargo,
- Perishable cargo (which can be defined as physically perishable such as fresh flowers or economically perishable as in the need to get products on the shelves to meet real-time customer demand),
- Unpredictable demand (both emergency and product life cycle related), and
- Lack of alternative transport mode.

*Means for transporting air cargo.* Cargo is moved in two ways—in the bellies of passenger aircraft and in dedicated all-cargo aircraft. An estimated 55 percent of the world's air cargo capacity or "lift" is belly cargo.

*Domestic air cargo.* Air cargo movement in the U.S. is expected to grow by 5.7 percent annually through 2002 according to MergeGlobal. The Boeing forecast anticipates 5.5 percent growth through 2015. It is important to note that a significant portion of the domestic air cargo indicated by waybills or handled on-airport never enters an aircraft; instead this cargo is exclusively handled by truck. MergeGlobal has estimated that "truck-to-truck" movements may represent up to 20 percent of "air cargo" movements. Boeing estimates that "truck-to-truck" movements may be as high as 10 percent.

*Industry structure.* Three competitive structures currently exist within the world air cargo industry: integrators who provide door-to-door service, multinational freight forwarders who work with airlines to move cargo, and regional or niche forwarders who work with airlines and agents to move cargo. The integrators are increasingly dominating the market. The *1996/1997 World Air Cargo Forecast* estimates that integrators now handle 60 percent of the U.S. domestic air cargo market and may attain a 37 percent share of the world air cargo market by 2015. Examples of integrators include companies such as Federal Express, United Parcel Service, DHL, and Airborne.

In all cases, these companies have extensive and efficient ground systems to expedite the movement of goods door-to-door, as well as electronic tracking systems that allow customers to monitor cargo status. Most experts also agree that the forwarder segments of the market are undergoing a consolidation phase that will eventually lead to fewer—but larger—forwarders who can better compete with the integrators, as well as a group of forwarders who specialize in specific commodities or markets.

The integrator market, itself, is also undergoing

change. This change is driven primarily by a maturation of the just-in-time trends, resulting in a separation of *time definite* and *time critical* cargo. Time definite refers to cargo that must be delivered within a specific time window. However, shippers and suppliers know in advance what this window is and can specify less expensive, slower transport methods. In response to the shift to time definite requirements, integrators now offer second- and third-day delivery services. Time critical cargo is defined as cargo that must be delivered as soon as possible and will remain overnight or same-day service.

The *1996/1997 World Air Cargo Forecast* noted that in 1995, the number of deferred shipments handled by the integrated carriers was roughly equal to the number of overnight shipments. Further, the forecast noted that deferred or time definite shipments have also attracted the attention of the scheduled passenger airlines that can offer this service more easily and competitively than expedited overnight services.

## Key Trends and Issues

- *Air cargo is growing rapidly; however, the industry is still in its infancy.* The panel recognized that air cargo plays a crucial and growing role in goods movement. However, in many respects, it is the youngest of the freight modes. For example, in all the other transportation modes—highway, rail, and maritime—the movement of people and goods have separated. Highways are used by cars and buses for the movement of people; trucks carry freight. Separate trains carry people and goods. In the maritime industry, specialized vessels (including large container vessels) transport freight. However, in the aviation industry, 55 percent of the current capacity is in the bellies of passenger aircraft and is secondary in priority to the movement of passengers. Similarly, it was noted that no standard means for moving air cargo exists. Unlike the maritime industry, there are no standard container sizes; instead container sizes are designed to fit existing space on aircraft. The panel members anticipate that the air cargo industry will go through a maturation process similar to the other modes.
- *Air cargo is important.* Many panel members were concerned about the lack of focus on air cargo. As one panel member noted, "Air cargo has always played second fiddle to passengers. If there was ever a time to focus on air cargo, its now with the growth of international trade."
- *Use of all-cargo aircraft or freighters is increasing.* This conclusion was reached based on two trends observed by the panel: (1) a growing portion of the air cargo market is handled by integrators who used dedicated aircraft and, (2) passenger aircraft are increasingly pushed to go further and faster, limiting the amount of cargo they can carry. Further, gate turnaround for passenger aircraft is decreasing, providing less time to handle cargo.
- *Cargo movement is performed by a wide range of aircraft.* Not all cargo movements are done by older 727 aircraft. Instead, cargo is moved by a full range of aircraft including single-engine planes and the Boeing 747 and even larger aircraft. Examples of smaller aircraft used in cargo movement include the Caravan, ATR 42 and 72, PC 12 and Beech 1900C.
- *Air cargo is part of an intermodal system.* Airplanes do not deliver cargo right to the door. Instead, cargo moved by aircraft is part of an intermodal system that generally relies on trucks to bring goods to and from the airport. Accordingly, airports that handle air cargo must ensure efficient truck access and ground handling facilities in order to remain competitive. Similarly, trucks may be used to substitute for aircraft in the movement of air cargo. The choice of modes depends on length of haul, time requirements, and costs.

Integrated carriers have led the way in intermodal systems by improving the efficiency and connectivity of the ground portions of the move and by offering advanced information systems to customers. These efficiencies, along with a focus on the total trip, have enabled the integrated carriers to increase their market share. Forwarders will need similar improvements to their ground operations and information systems if they are to successfully compete for air cargo in the future.

- *Air cargo doesn't have to flow through the airport nearest its origin or destination.* While proximity to the site of production or market can be a factor in airport selection, it is the *overall cost and time* involved in the transport of a shipment from origin to destination across all modes that are the deciding factors. In some cases, integrators have invested in their own infrastructure assets. For example, Federal Express established its major hub in Memphis, Tennessee. In such cases, carriers may seek to maximize the use of their own assets. In addition, an airport more distant to the origin or destination may offer a wider selection of carriers and routes, providing more options for the forwarders making the airport decision. Finally, certain factors such as landing fees or congestion may encourage carriers to seek and use alternative airports in a particular region.
- *Full service airports are still examining where air cargo fits on-airport.* Many full service airports are reaching capacity decision points; that is, assessing means to handle anticipated increases in passenger movements or accommodating projected growth within land constraints. Accordingly, many airports are analyzing or questioning where air cargo fits in.

This issue is particularly important when it is recognized that a significant amount of air cargo conducted on-airport may be truck movements. Some airports have called for a closer relationship between on-

and off-airport activities and investments so as to maximize efficiencies. Integrated carriers are already doing this through the use of on- and off-airport facilities. In some land constrained locations, a powerful financial incentive exists for them to do this—the lease rate differential between on- and off-airport space can be as high as ten dollars per square foot.

- *Use of all-cargo airports is expected to increase.* As full service airports strive to meet passenger growth projections and the use of freighters increases, the use of dedicated all-cargo airports will increase. This is consistent with the belief that passenger and freight movements may separate in the future, similar to the other transportation modes.

Existing and planned all-cargo airports reflect the same near-symbiotic relationship of on- and off-airport uses as that sought by full-service airports. Specifically, all-cargo airports are usually elements in real estate developments that may also include industrial, commercial, retail, or distribution uses on adjacent properties. Examples include Alliance Airport in Texas and Brownfield Airport in California.

## Assessment of Current Data and Forecasting Situation

In reviewing industry trends and attempting to answer the question posed by FAA, the panel considered the current situation regarding air cargo data and forecasting. These discussions focused on three topics:

- The uses for air cargo data and forecasts,
- The availability of air cargo data, and
- The status of air cargo forecasts.

### *The Uses for Air Cargo Data and Forecasts*

The panel recognized that air cargo data and forecasts are used for different purposes by the various organizations involved in air cargo and the aviation industry. At the federal level, it was noted that data and forecasts were previously obtained and used as part of the regulatory and certification processes. However, in today's deregulated environment, air cargo data and forecasts would be used primarily for capital investment and policy decision-making. At the airport and regional level, data and forecasts, according to panel members, are used for marketing and operational purposes in addition to capital investment and policy decision-making. As one airport manager noted, "I need to know how many cargo planes are coming; when they are coming; what are they going to do once they get here; and what will FAA give me for handling these aircraft." Airport operators and developers also need air cargo data to assess markets to target, including identifying cargo originating in their region but using an airport in another area, commodities, and new origin/destination partners.

Carriers similarly need air cargo data and forecasts for marketing. However, they also need this information to match capacity requirements to demand, both networkwide and region-specific. This includes assessments of the type of aircraft used in certain lanes and ground facility requirements.

The panel also noted that air cargo data bases must include information on how the mode relates to other elements of the distribution system; that is, information on all the modes (truck, air cargo, etc.) involved in the total trip movement from origin to destination.

### *The Availability of Air Cargo Data*

The panel acknowledged that there are many sources for air cargo data. Publicly available sources include the T100, international trade data, the Commodity Flows Survey, Airport Activity Statistics, Traffic by Aircraft Type and Class of Service, and Statement of Operations. However, each source supplies only a small segment of the information needed. Accordingly, various data sources must be matched together. The lack of comprehensive or centralized air cargo data bases, according to the panel, is a problem in the industry.

### *The Status of Air Cargo Forecasts*

Air cargo forecasts are currently being done by several organizations, including Boeing and MergeGlobal that publish their findings. These publications are considered valuable resources for the entire industry. Many airport authorities, carriers, and consultants forecast air cargo for private or internal use. These forecasts may be developed for specific uses; for example, an airport may forecast air cargo for its own region.

## Suggested FAA Role

With this understanding of key industry trends and issues, as well as the current status of air cargo data bases and forecasts, the panel developed the following suggestions regarding FAA's role in these areas:

- *Identify the key questions that need to be answered at the federal and regional/airport level.* Identifying the questions will identify the critical pieces of information needed to answer them. This process provides a starting point for developing the key data sets and their parameters—level of detail, time frame for collection (monthly, yearly or semiannually).
- *Spearhead an effort to develop comprehensive air*

*cargo data bases, primarily through leveraging existing sources*. The panel members felt that FAA was the logical modal agency within the federal government to champion the need for comprehensive data bases and to oversee their formulation. In this regard, the panel acknowledged the range of information already amassed by federal agencies. The panel also recognized that new mandated data collection initiatives would not be popular with either the industry or federal budget organizations. Accordingly, the panel strongly suggested that efforts focus on optimizing the use of existing data bases and collection channels.

- *Convene a forecasting forum to develop a consensus view and report*. The panel suggested that FAA follow an established practice in the economics field. Specifically, it was suggested that FAA regularly invite leading air cargo forecasters to a forum to discuss their findings, assumptions, and methods. The objective of this forum would be to develop a consensus view and forecast, which FAA could publish for industry use. It was hoped by the panel that this format would encourage the participation of a broad range of industry and airport forecasters, including organizations that do not routinely publish their forecasts.
- *Consider undertaking air cargo forecasting at the macro level*. Similar to airport and private industry forecasts, the panel recognized that certain needs and uses for macro-level forecasts exist at the federal level which may not be fully addressed by current air cargo forecasts. The panel, therefore, suggested that FAA consider undertaking its own air cargo forecasting to meet these needs.

### Summary

The air cargo panel at the 1997 workshop faced a unique mission to establish a framework for future discussions and to address a very specific question raised by FAA. The panel concluded that air cargo is an important part of the domestic and global distribution systems, with the use of air cargo growing annually.

The panel also recognized that the industry is still in its infancy, with many changes and challenges facing it as it undergoes the maturation process. These challenges include evolutions in the way goods move (e.g., belly cargo or in all-cargo aircraft); who moves the goods (e.g., integrators or forwarders); where the aircraft will go (e.g., full service airports or all-cargo airports); how the aircraft portion of the move is integrated with ground operations (e.g., intermodal systems); and how cargo is tracked and information is supplied to customers (e.g., electronic data interchange, tagging, and advanced information systems). The outcome of these trends will affect investment, policy, and operational decisions for both the public and private sectors.

Accordingly, good information and forecasts are important, and it appeared to the panel that FAA is the logical federal agency to spearhead efforts in this area. Equally important, since the industry is still evolving, is the need to continue discussions of air cargo on an on-going basis as a means for identifying emerging trends and issues and assessing their implications.

## AIRPORTS AND INFRASTRUCTURE

*Panel Leaders:*

George W. Blomme
Airport Planning & Technology Systems

Gene S. Mercer
Industry Economist

Leonard Ginn
Airports Council International—NA

*Panelists:*

Ted I. Alman
North Carolina Dept. of Transportation

Lloyd McCoomb
Greater Toronto Airports Authority

Paul C. Burnette, Jr.
Virginia Department of Transportation

Paul J. McGraw
Air Transport Association of America

Edward J. Doyle
Innova International Corp.

John J. McIntyre
Executive Jet Aviation

Kenneth I. Flick
Metro. Washington Council of Governments

William C. Spaeth
Metro. Washington Airports Authority

Elmer H. "Moe" Haupt
National Business Aviation Association

Daniel E. Taylor
Federal Aviation Administration

Laurence Kiernan
Federal Aviation Administration

*Participating:*

Linda H. Boner
Glassman-Oliver Econ. Cons., Inc.

Mark C. Pfeifer
GRA

Ken Bunauskas
MergeGlobal

Carl Seiberlich
VZM TransSystems Corporation

## Introduction

The workshop provided a forum for knowledgeable participants to exchange views on passenger traffic forecasts, equipment procurement forecasts and the expected development of the industry's supporting infrastructure. The Airport & Infrastructure panel focused on this final topic, and team essentially acted as futurists, discussing and analyzing social, cultural, political and technological trends and economic statistics to develop alternative future scenarios for the industry forecasts. In this role the panel sought to "think out of the box" and provide early identification of innovations over the next 10 years. Some of the issues considered included:

- Examining various global trends in commercialization and privatization of airports, air traffic control systems, and airlines and their impact on the U.S. scene, where these matters are handled differently.
- How will regional jets, newer larger aircraft, and telecommunications technologies affect airports and future demand forecasts?
- What is the 10-year impact of low-cost carriers on market demand?

Capacity as well as environmental constraints at airports are widely understood throughout the industry, but by discussing the context of these issues within the broader framework of aviation system elements the panel was able to identify some pathmarks to the future.

The size of the global aircraft fleet is going to double in the coming 20 years. With the United States possessing nearly one-half of the global fleet, sizable increases in passenger and cargo traffic as well as aircraft handling capacity will be needed in the airspace system and at airports in the future.

The panel recognized that FAA, passenger, cargo and aircraft activity, forecasts are essentially unconstrained with regard to future airport infrastructure limitations, beyond the extent that such infrastructure constraints have existed in the past. Specifically the panel reviewed the airport passenger demand forecasts and the aircraft activity at FAA facilities forecasts. The panel believed that the unconstrained growth projections by FAA are reasonable demand forecasts and are attainable if airports and related infrastructure, the supply-side of the equation, proves adequate to accommodate a near doubling of commercial passengers over the next 10 to 12 years. Demand is not uniform throughout the national system of airports however. Significantly different growth rates occurring at various airports create the potential for capacity constraint choke points within the system.

The panel examined both positive and negative supply side factors that FAA should consider, that may affect demand-side forecasts in the future. These include factors that could increase system costs due to overall air traffic control handling limitations, congestion delay costs, air traffic or airport capacity constraints, and the resultant higher yields.

The panel focused on infrastructure-related factors which are seen as potential threats to the continued growth of air passenger demand, and those factors which represent opportunities to relax any potential constraints to growth

Airports are faced with unprecedented growth and many are landlocked. Transportation system management options are frequently discussed. Evolutionary changes like e-tickets are occurring now. Other options include actions that airlines can take: spreading peaks pricing peak-hour flights higher using larger aircraft reallocating flights between airports, say from National to Dulles. But all of these options represent real costs to the system. Further could they be implemented to the degree required to stave off airport expansion and further development to some point beyond the forecast time horizon? Many panelists thought not.

## Funding

If a doubling of air traffic demand is to be accommodated over the next decade, major infrastructure investment in the air traffic control system (ATC) and airports will continue to be required. Sources of funding for this infrastructure must be identified and assured. To accommodate the projected demand in a safe and efficient manner in the national system of airports, it is estimated that airport and infrastructure maintenance and expansion will require investments of between four and ten billion dollars annually. Currently the FAA Airport Improvement Program (AIP) provides a significant portion of these requirements. In an era of federal government cutbacks, and greater reliance on state and local government initiatives, the panel felt that future funding for airports might be severely limited.

The large airports where the majority of investment will be required are more viable economic entities than smaller airports, and the potential exists to exploit nonaeronautical revenue sources to assist in meeting funding needs. In addition to AIP entitlement funds, passenger facility charges (PFCs) and traditional revenue bond approaches to financing, other creative financing can be developed for financing aeronautical and nonaeronautical projects.

The situation is far graver for smaller airports where there are few potential nonaeronautical sources of revenue. To be maintained in the national airports system, small nonhub and general aviation airports are

more dependent on government support than larger airports. Any significant loss of government funding support for these airports will likely result in a significant constraint on the demand for aviation, particularly general aviation. FAA has already discontinued set-asides for reliever airports, a potential disservice to large hub operations. Yet, failure to maintain smaller airports will increase demand on larger airports to accommodate projected traffic.

Many small communities are unaware of the value of their airport to their local economy and may be unwilling to approve the necessary investment to maintain it. This is particularly true of privately owned public-use facilities whose owners determine that an airport is not the highest and best use of their property. Once an airport is lost, long lead times and the cost for new airport development severely limits any potential for a replacement facility. The panel had some concern that the elimination of AIP set-aside funding for system planning and reliever airports would negatively affect smaller facilities. The primary funding source for these airports is AIP discretionary funding. Funding cutbacks could lead to some contraction of airports in the national airport system.

If government funding is substantially reduced, FAA might have to reprioritize infrastructure funding and reinstate set-asides for small public-use airports (reliever airports) and system planning. Further, with reduced FAA funding, aeronautical revenues might have to be increased. This will increase the cost of air travel and potentially dampen demand. Systematic reviews should be undertaken by FAA in regard to the costs, benefits and other issues involved in an overall funding shift from FAA to airports, air carriers, and general aviation.

State block grants versus direct federal funding was also discussed. With both facilities development and system planning projects competing for limited state funds, system planning is less likely to be funded. It is important to establish priorities through system planning in order to maintain the national system of airports. In addition the quality of individual state airport organizations varies. Not all have comparable funding or commitment from the State government. As a result these agencies are not uniformly capable of administering funding programs. While state control of funding may continue as a pilot program, it is not a universal cure.

Concern was also expressed about the dangers of some communities diverting aviation revenues to off-airport uses. Such diversion will increase the cost of aviation and decrease demand. It is vital that airport revenues stay on the airports and that investment dollars not be redirected to other activities.

## Environmental Issues

Environmental issues, particularly opposition to aircraft noise, remains a serious threat to infrastructure development and thus to the unconstrained growth of aviation demand. Although the industry has made significant environmental gains in implementing noise abatement programs (e.g. engine retrofits and home insulation programs) and reducing runoff pollution at airports, public pressure will continue for further environmental remedies as activity levels continue to expand. Environmental opposition to industry growth presents an economic threat of escalating costs for the aviation consumers who indirectly must compensate for the costs of noise emission and runoff pollution programs. Environmental opposition, when successful, can result in outright prohibition of airport development. This results in increased cost of air travel as congestion grows, and as more expensive or less convenient alternate airport sites are developed.

Overall, environmental issues will continue to substantially delay airport capacity improvement projects that would help meet projected demand. Environmental issues impact all airports from the smallest general aviation to the largest commercial hub airport. The environmental concerns pose a major constraint on future expansion and growth. They loom as a primary threat to the future of the national airport system. Many federal environmental regulations are viewed as unfunded mandates by airport operators, further exacerbating the funding constraints discussed above.

## General Aviation Issues

The projected growth of general aviation flying, as reflected in the current FAA forecasts, and the rebirth of the small piston engine manufacturing market, is a harbinger of an increased need for general aviation facilities. There may also be some new or revitalized smaller airports adjacent to communities resulting from industrial, commercial, and attendant general population dispersion in the United States.

With a shrinkage of small general aviation airports due to economic and development constraints—especially privately owned public-use airports (POPU) in the system—business and other general aviation aircraft will use larger airports, putting additional strain on capacity. Publicly owned airports are not decreasing in number and will have to pick up the resultant airport system deficiency. Reliever airports become even more important as this shift from privately owned public-use airports continues.

Business aircraft activity now accounts for a major new investment segment in the business aviation industry. The expanding practice of fractional

ownership allows more small business concerns to use private general aviation aircraft for their air travel in a cost-efficient way. This allows interested smaller business concerns ready access to sophisticated high-performance business aircraft through joint ownership. The growth of this program places additional requirements to provide upgraded facilities, particularly at smaller airports where accepting this new service means meeting the increased safety, security, and reliability needs of the industry.

Further information about fractional ownership and impacts on airports and infrastructure is contained in Appendix A.

In terms of FAA forecasting procedures, the panel noted that the 60-seat aircraft break in FAA forecast fields is no longer relevant. Commuter planes are becoming more like air carrier equipment, and air taxis are more akin to general aviation aircraft.

## Airport Privatization

Internationally, the role of government in aviation is changing. In certain countries such as Canada, Mexico, and Australia, the government is getting out of the aviation business, including airports. The panel discussed the Canadian program, which is commercializing larger airports and privatizing smaller airports, as well as privatizing the air traffic control system. With primary reliance on user fees, this method of operating and maintaining the airport network seems to be working well in Canada. Under the Canadian program, the new operators, largely freed of public policy concerns, can adopt a businesslike approach to serving aviation demand. There has been a speed-up in decision making and in the overall ability of airports to respond more quickly to increases in demand. The new operators have worked to reduce airline user fees by developing non-aeronautical revenue sources. They have expanded their marketing staffs to attract new airline services. On the downside, profit-oriented airports can seek to optimize their financial position by delaying investment in airport infrastructure as long as possible.

The program works very well at major commercial facilities in Canada, but has yet to be proven at smaller airports. To what extent will airport privatization occur in the United States? The panel believes that state and local government ownership of airport facilities will continue. Those in favor of privatization see quicker decision making and faster implementation of capacity improvements at airports, but there is the specter of higher financing costs resulting from the generally higher cost of capital acquisition in the private sector. Privatized airports would not necessarily be tax exempt—adding another factor to a complicated formula.

In conclusion, many functions in airport operations in the United States will be outsourced or privatized, but total commercialization and privatization as in Canada will not occur. Over 80 percent of airport workers are presently employed by private firms.

## New Aircraft

### *Regional Jets*

The large number of regional jets entering the commuter airline fleets and the orders for narrow body 150-seat aircraft by the major domestic carriers portend both positive and negative impacts on commercial air carrier airports. The introduction and use of these aircraft needs to be monitored by FAA as well as other segments of the aviation industry in terms of airport facility needs and overall demand forecasting.

The jury is out on the impact of RJs. The substitution of an RJ for a smaller commuter aircraft on a spoke route to a connecting hub airport would offer the promise of better utilization—passenger growth being accommodated with little or no increase in aircraft movements. However, replacing larger domestic air carrier aircraft in longer haul markets with RJs could require more frequencies into the hub airport to accommodate demand. Also, any new direct RJ-served point-to-point markets hub busters bypassing the connecting hub airport will mean new service requirements at smaller commercial airports.

Additionally, what will the fares be on RJs? Could they be higher than existing commuter services? While many panelists believe that the RJs will successfully divert some intercity travel from auto to air, it is too early to know how substantial this will become. If RJs result in reduced service frequencies to smaller communities, a plausible scenario on a variety of accounts, passengers could divert from air to autos to reach major hubs for their air travel connections. In considering RJ operations at airports, some necessary modifications to terminal facilities such as expensive modification of existing jetways to accommodate the five-foot door sill height on the RJs may limit their use. To add further concern and balance to the overall industry optimism for the RJs, if general aviation runways cannot accommodate RJs at major airports, RJs would of necessity have to shift to regular commercial service runways.

Generally the bottom line appears to be that new aircraft orders for narrow body aircraft will, for the most part, replace older narrow body aircraft with little increase in capacity. Hence increased frequencies will be required to meet increased future demand.

*New Large Aircraft*

The panel felt that the next generation of very large aircraft would primarily serve international markets and therefore will only sightly impact facilities at major U.S. gateway airports. Also, new large aircraft could continue the long-standing trend of boosting airport productivity by increasing aircraft size. It was noted, however, that these aircraft will probably find a market only in the largest international airports, particularly in Asia, and will bring their own costs in terms of requiring airport facilities to be modified to accommodate 600-seat aircraft. Designs for the new larger aircraft have raised concerns among air carriers and airports about taxiway-to-runway wing-tip to wing-tip clearances, limitations on adjacent gate use, and in the air, wake vortex and trailing distance separation in the air.

## Technology-General

Considerable optimism was expressed that emerging aviation technology, particularly in the air traffic control field would continue to boost airport productivity and allow more to be done with less. Global positioning systems, tilt-rotor aircraft and improved telecommunications were cited as examples of potential technological advances which could be exploited.

FAA-induced delays, such as radar outage at a major hub and flow control, are evidence of the need for system improvements and timely introduction of new technologies. New advanced avionics holds promise for increasing airport capacity, somewhat relieving airport expansion requirements. How effectively the integration of these technologies is handled is critical to the impact on airport development and system cost.

A concern voiced by members of the airports panel was the ability of FAA to implement new technologies in a timely manner. To many, FAA appears to be financially and institutionally incapable of keeping pace with new technologies. The panel believed that there are technological opportunities available for capacity enhancements to assist in meeting unconstrained demand. Underfunding is an ongoing problem. Further the slow performance of FAA in replacing a 20-year old radar system raises the question of whether the agency would ever be in a position to turn over technology every 5 to 10 years. State DOTs cannot be expected to handle any of the development of these efficiency improvements.

## Safety & Security Issues

The panel believed that short-term safety and security issues will not significantly limit airport capacity, but could entail some further costs to the users of the system in implementing more extensive passenger security measures. Security costs include sophisticated new baggage/passenger screening equipment and the added inconvenience to passengers subjected to more lengthy and inconvenient security procedures. All of this will add to the cost of air travel and work against demand. Cargo and mail security protection costs can also be expected to increase.

Safety is taken as a given. The high standards of airport/aviation safety must continue and there are no major developments foreseen which would alter this commitment. However, the full impact of the TWA 800 accident and the Gore Commission recommendations, when implemented, will have additional impact. The inability of small commuter airports to meet new safety and security measures could eliminate some of these airports from the commercial air service network.

## Terminal Area Forecast

A presentation on FAA Terminal Area Forecasts was provided to the Airports and Infrastructures panel. The graphics for the presentation are in Appendix C. The panel concluded that FAA forecast provides needed tools for planning future airport capacity to meet projected demand. However, input to the forecasts—specifically the quality of operations data as reported on FAA Form 5010, used annually to update all nontower airports flight information—raises questions. A number of options are offered to correct this:

- Develop an operations estimating algorithm to check reliability of reported data based on a more reliable known data base, such as based aircraft;
- Work with the National Association of State Aviation Officials to encourage more extensive use of sampling techniques to estimate non-tower counts that have been successful in a few states such as North Carolina;
- Eliminate actual and forecast estimates for small general aviation facilities and group them into estimated blocks of airports, e.g. 0 to 25,000 operations, then do a more detailed estimate as activity levels are significantly altered.

## Regional Planning Issues

External threats to the aviation industry projections also exist, particularly with regard to critical urban planning issues. Competition for land is removing available development capacity potential for airports. For the

airport and the community it serves, planning protection is inadequate to preserve environmental gains achieved through investments in new technology.

Concern remains about the adequacy of the highway access system to keep pace with the projected development for air travel. If a balance is not retained between the capacity of the airside, terminal, and lanndside components, the bottleneck will shift to lanndside access and result in escalating costs for the air traveler through greater congestion. Unfortunately, these regional planning issues tend to go beyond the immediate control of the industry.

### *Land Use Issues*

Of growing importance to airport capacity is airport landside and off-airport development costs. There will continue to be growing competition for land use in airport environs. Further and continuing investment in highway and sometimes transit access is required to accommodate travelers, airport workers, and cargo shipments. Airport development must be planned and implemented in the context of total transportation planning. The passenger is not interested in getting from airport X to airport Y, but in when he must leave his home/office and when he will arrive at his ultimate destination.

### *Air Cargo*

In reviewing FAA forecasts the panel viewed airports as unified entities comprised of roadways, terminals, aprons, runways, and more, and serving air passengers, air cargo, commercial carriers and private operators. Although not stated directly, this view implies that passengers are the primary clients of airports. Nonetheless, air cargo is showing significant growth—particularly at major hubs—and carries with it special needs and services. The overnight aspect of air cargo movement creates special problems for airports as well as special opportunities. Daytime passenger flights carry cargo as well as luggage, but cargo volume is limited both by capacity and by the need for quick aircraft gate turn-around times.

Cargo adds bulk to the airports—in the size of the parcels, shipments, truck movements, and containerization. Containerization may demand more airport space if trends in intermodal cargo transfer spread beyond ships, rail, and trucks to the air mode as well. As airports look for better property utilization on their land-constrained sites, off-site but near the airport air cargo development becomes more desirable. It too has to compete with other land uses in the airport area. Good road linkages both to the airport and to the regional highway grid are a necessity for such off-terminal sites.

The growth of cargo, and especially the demands of containerized intermodal cargo have to be carefully assessed by airport operators and by FAA in projecting future demand. A paper entitled *Freight Intermodal System* is contained in Apppendix C and provides an introduction to the intermodal cargo concept.

## Telecommunications Issues

Although outside the specific issue of airport and infrastructure planning, the panel believes that as younger people consider their future business options, some will choose the Internet over air travel. While reaching no conclusions on this subject, the panel notes that the issue of telecommunications as an alternative to air travel is real and should be monitored closely for its impact on future forecasts. The impact of telecommunications technology and the ability of this population to maximize use of this technology may affect the frequency of business travel, especially as costs increase.

On one hand the panel saw conducting business on the Internet as a factor reducing demand—business can be conducted on a computer. On the other hand such communication could also generate increased demand for face-to-face contact. Likewise, last-minute air ticket purchases at reduced costs are already a reality on the Internet. This will both fill airline seats and add traffic.

Powerful, user-friendly communication technology tools will be available for computer literate and computer-comfortable managers. The panel cannot quantify how these dynamics may affect the need for routine business travel. Airport infrastructure planners and airlines should consider the future in the context of advancements in communications technology. The airlines have already recognized its importance to certain segments of the traveling public, by providing special amenities including phone, modem, and fax capabilities. In order to encourage the continued use of air transportation, airports can also develop and market facilities, including business centers, to meet travelers' needs. Entire packages of air-hotel-land transportation must be assembled into single purchase packages to meet the specialized needs of specific segments of the passenger population.

## Conclusions

Passenger demand is a function of the economy and the cost of air travel. The panel concluded that there would continue to be a strong demand for air transportation over the next decade.

The general conclusion reached by the panel was that over the short run (the next five years) airports are

not likely to pose a serious constraint on the realization of FAA demand forecasts. However, increasing airport costs--both out-of-pocket and delay-related—could represent a larger share of air carrier costs, and these are generally reflected in the yield assumptions that FAA has issued in the forecasts.

With short planning horizons, long lead times for approval/implementation of airport projects, limited funding resources, and lumpy investments (where projects are funded incrementally) capacity constraints will occur. This will result in higher costs to the industry either in increased user fees or aircraft delays. However, the panel concluded that airports and airlines should cooperate more closely to facilitate passenger and cargo processing and thereby improve customer service.

Over a longer term, it is not clear whether the current airport infrastructure can accommodate the forecasted doubling of aviation demand without severe strain. There are few signals that capacity problems are emerging, but the onset of significant delays occurs very rapidly at individual sites as the system approaches capacity.

In spite of environmental and land use issues, approximately one-third of the 30 largest U.S. airports have new runways in planning or under construction. According to FAA, the current delivery schedule is one runway per year. Given limited AIP funding levels, this delivery rate was considered optimistic by some panelists. It was the panel's feeling that this pace is too slow and could threaten the FAA forecast. Because of the long lead times involved, additional infrastructure projects need to be started now to keep pace with growth. If additional capacity cannot be achieved, costs will rise and some diversion to automobiles or new telecommunications options can be expected.

It was also noted that, following the construction of Denver International Airport, no new U.S. airports have been planned. More attention will likely need to be paid to the aviation infrastructure question in future workshops.

Advanced technology, improved efficiency of airport operations, and the potential increase in size and productivity of new aircraft will offer some relief for accommodating increased passenger demand without airport expansion. Considering the current status of the national system of airports and the estimated costs of new investments required for airport and infrastructure maintenance and development, the panel suggested that FAA carefully review the costs implied by the unconstrained traffic forecast and the resulting potential impact on demand.

Whatever the outcome of specific issues, the panel recognized that airports must be viewed as a system—serving passengers, cargo and aircraft activity—rather than as individual airports. This is critical to understanding airport problems. Airports, rather than ATC, will likely be the cause of system constraints.

## FLEETS AND MANUFACTURERS

*Panel Co-chairs:*

Billie Jones
Pratt and Whitney

Gary Ives
Hurel-Dubois Limited

*Panelists:*

Simon Beech
Lucas Aerospace

John Walsh
Walsh Aviation

Derrick Maple
Smiths Industries Aerospace

Kenneth Holden
GE Capital Aviation Services

Marie Bjornson
Volvo Aero Corporation

Alvin Wang
Pratt & Whitney

Arnold Schwartz
Federal Aviation Administration

Philippe Klinger
SNECMA

Philip Bolt
British Aerospace Asset Management

Martin Wiedra
MTU Munchen

Vernon Thomas
GE Aircraft Engines

Mike Lee
Messier-Dowty,International

Vicki Golich
California State University
San Marcos

### Introduction

The discussions of the Fleets and Manufacturers panel consisted of three parts. First, the entire panel met with panels on Domestic Air Carriers, International Airlines, and Regional and Commuter Airlines. (The report of this joint activity is the first article in this panel discussion series.) Second, a review of the forecasts submitted by each participant prior to the formal conference was compared with a consensus set of figures derived from the data. Third, discussions were held about the forecasting issues identified as key issues and those that were difficult to assess. Additional consideration was given to the issues raised in the joint meeting to determine the points of view expressed by the airline panels.

## Forecasts

The consensus forecast of the panel was that worldwide passenger traffic would grow at an average compound rate of growth of 4.83 percent over the next 20 years. For 5 year periods from 1997-2016, the growth rates projected are 5.38 percent, 4.90 percent, 4.65 percent, and 4.46 percent. The range of forecasts from the ten participants ranged from 4.5 to 5.4 percent (Figure 1). Similarly, the panel forecast U.S. passenger traffic to grow at a compound rate of 3.67 percent for the twenty year period 1997-2016 and 4.07 percent, 3.75 percent, 3.64 percent, and 3.12 percent for the five year periods 1997-2016 (Figure 2). Eight of the firms participated in the U.S. forecast. (The panel did not compile data for US-only operators, therefore FAA forecast worksheets were not completed and submitted.)

The worldwide average load factor was predicted to increase from 68.7 percent in the current five year period to 69.8 percent (Figure 3) in the final five-year period. The resultant effect of the increased load factor is to increase aircraft productivity, reduce the number of additional aircraft required to service the traffic, and increase the opportunity for additional revenues for the airlines.

Deliveries of turboprop and small jet aircraft (fewer than 80 seats) were projected to be 5,800 aircraft (Figure 4) with retirements in the same category as 2,900 (Figure 5) and therefore a net fleet growth of 2,900 aircraft over the twenty year period. For the fifteen-year period, the deliveries were projected to be 4,390, retirements projected at 2,010, and net fleet increase of 2,380.

The world passenger jet fleet deliveries (80 seats and over) were forecast at 13,170 aircraft (Figure 6) with retirements of 5,900 (Figure 7), resulting in a net increase of 7,270 aircraft over the twenty year period (Figure 8). For the fifteen year period, the deliveries were projected to be 9,700, retirements projected at 4,340, and a net fleet increase of 5,360 (Figure 5). The rate of increase of deliveries of aircraft 80 seats and over for the twenty year period averages 658 aircraft which is higher than the average delivery rate for the prior ten year period by 10 percent.

A continuing concern that has been expressed for several years is the difficulty of forecasting aircraft retirements. Although the numbers of Stage I aircraft that have been retired are substantial, the breadth of aircraft types that would be potentially retired in Stage II is much greater. In addition, an aggressive hushkit program has changed most retirement assumptions. Observations were made in the panel discussion sessions about the small potential secondary market for widebody aircraft and the potential shorter operating life for that type. Structural life of all Stage II aircraft is longer than the achieved life of any current aircraft. However, the economic lives of those aircraft are still to be determined.

## Qualitative Issues

Although the projections of deliveries and retirements are the end results of the panel's deliberations, the underlying issues that drive the forecasts are instrumental to the computational process. As shown in the accompanying figures, the assumptions and calculation methodologies of the participants vary substantially. However, the basic economic and operational parameters used for the forecasts are well defined. The panel members expressed concern that economic projections and their relationship with airline traffic failed to reflect actual short-term traffic in a number of cases. They were also concerned with the assumptions that the econometric forecasting firms used to determine trend-line projections. Since the current economic expansion is nearing record length anticipation of cyclical downturns in the next few years weighed heavily in the discussions.

Panelists were asked to rate various issues prior to attending the conference. These issues were in three categories: industry growth, aircraft retirements, and airline changes. In addition, panelists were encouraged to submit other issues of concern, and they responded with 30 suggestions. Tables 1 and 2 display the top five issues which were found to be the most important issues and to be the most difficult issues to forecast in five-year increments.

### *Economic Growth and Aircraft Retirements*

The overriding issue that dominated discussions was the effect of economic growth and the resultant airline traffic in most regions of the world. Relative to U.S. traffic, the panel members were concerned that projections of traffic for the U.S. were substantially lower than actual data for 1996 and for the first two quarters of 1997. Although the data are substantial in the United States due to DOT filing requirements, reports from outside the U.S. are not as robust with detailed data. Similarly, aircraft retirements driven by age or by high numbers of cycles on the airframe were high on the concern list. Although hushkitting has been recognized as an appropriate means of achieving lower standards of noise, the projection of hushkit sales was not widely understood—with the exception of the Pratt & Whitney representatives.

### *Congestion*

One topic that elicited substantial discussion was the effect of continued levels of traffic growth in certain world regions, particularly the United States. While the movement toward smaller RJs would seem to increase

the potential for congestion, the increase in point-to-point operations may actually alleviate some congestion. Additionally, proposed aircraft larger than current B-747s would address the opposite end of the congestion spectrum. Although the panel did not take a position on the need for larger aircraft, it did recognize the issues that the larger aircraft would introduce.

*Emerging Markets*

During previous TRB forecast workshops, concerns have been expressed regarding the development and stability of aviation systems in the Commonwealth of Independent States (CIS), Eastern Europe, the People's Republic of China, and in key high growth economies in Asia. In certain countries continued projections for high economic growth give some cause for concern. Additionally, the replacement of nonwestern aircraft in those systems are hard to project. While substantial movement has been made toward Open Skies in Western Europe, the timing of similar liberalization in Asia is unknown. Over the next decade, the potential for substantial western aircraft deliveries in the CIS and in Asia is enormous—provided that economic and political stability continues.

*Airline Operational Costs and Revenues*

World and U.S. airlines have achieved record profits in the past few years due to the expanding economies coupled with judicious cost controls. Although pressures will increase for higher wages as labor contracts are renegotiated, the airlines have been examining every cost element in their operations. Reduction of direct as well as indirect costs has provided significant savings while innovative means of acquiring aircraft have allowed for substantial fleet renewal. In some cases this has shifted the cost pressures onto the aircraft, engine, and aircraft component suppliers. Yield management has achieved new levels of sophistication resulting in higher realized revenues and record high load factors. Although the panel expressed pleasure in both trends, there was concern expressed about the discipline required by the airlines to continue the trend.

*Alternate Modes of Travel/Communication*

The panel expressed concern about the effects of alternative modes of travel and of communication over the next 20 years. Although some initial studies have been done showing the effects of videoconferencing, there was skepticism about the validity of the data due to the rapid development of communication technologies. Similarly, with the emphasis in Europe toward replacing short-haul air trips with rail and road alternatives, the panel felt that the second decade of our forecast should consider these alternate travel modes for their effect on air travel.

**Summary**

The forecasts for the Fleets and Manufacturers panel were assessed to be pragmatic, based on the projections of economic growth and the retirement models utilized. Although no economic cycle analysis was systematically included in most of the forecasts, the resulting projections of deliveries showed a pronounced variation over time. This resulted from the panel members' concern about another potential boom-and-bust delivery scenario that might result from air carriers' short-term overbuying of equipment. However, the panel members demonstrated their continuing optimism for the aircraft market by enthusiastic discussion of improved forecasting techniques as well as by generating positive forecasts.

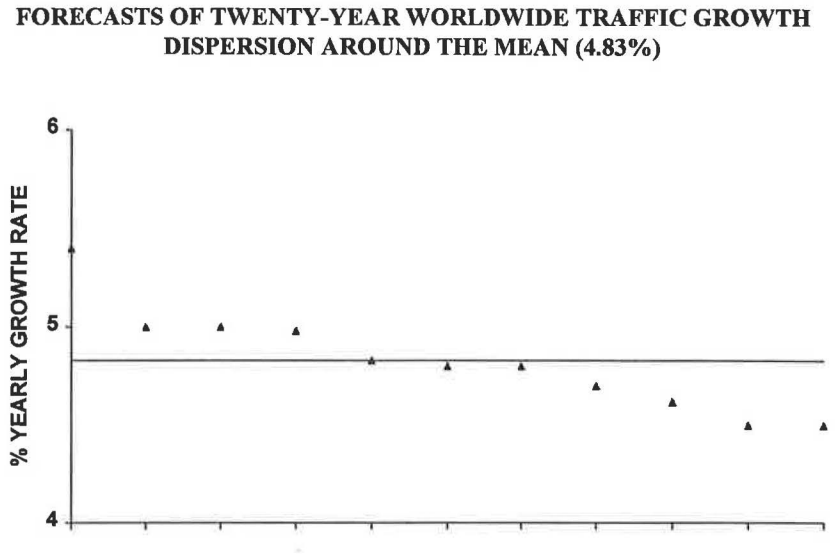


FIGURE 1 Forecasts of twenty-year worldwide traffic growth: Dispersion around the mean (4.83 percent).

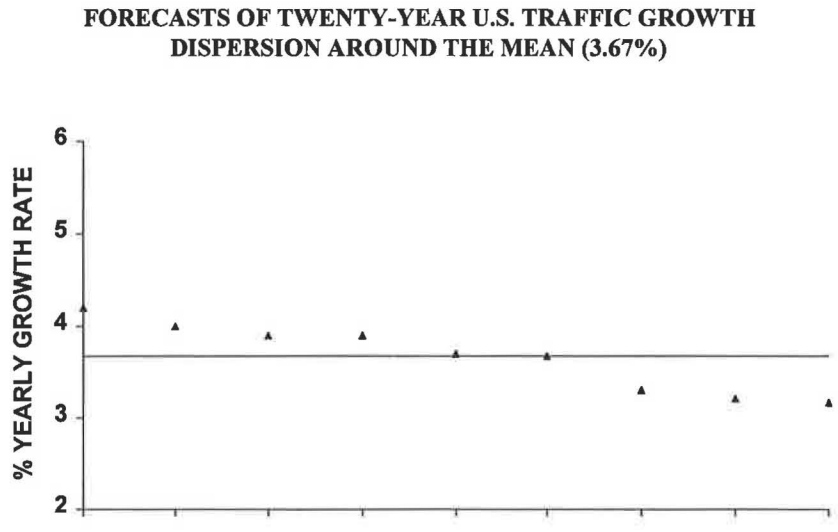


FIGURE 2 Forecasts of twenty-year U.S. traffic growth: Dispersion around the mean (3.67%).

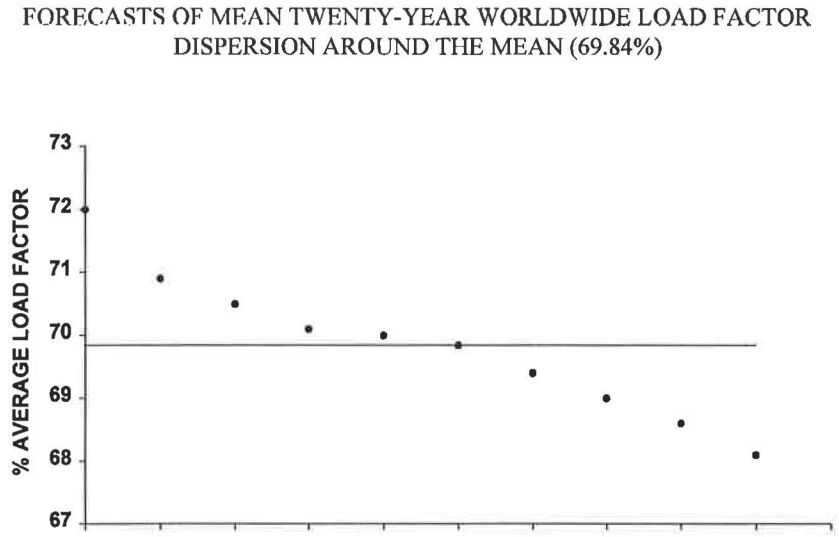


FIGURE 3 Forecasts of mean twenty-year worldwide load factor: Dispersion around the mean (69.84 percent).

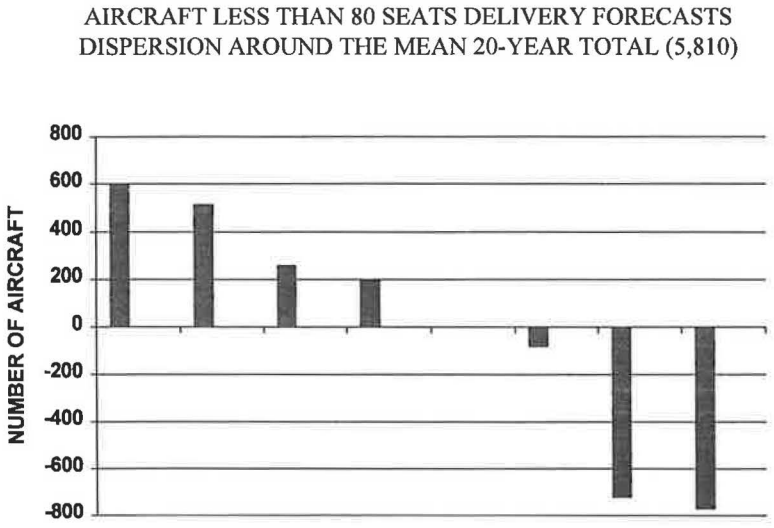


FIGURE 4 Aircraft less than 80 seats delivery forecast: Dispersion around the mean 20-year total (5810).

AIRCRAFT LESS THAN 80 SEATS RETIREMENT FORECASTS
DISPERSION AROUND THE MEAN 20-YEAR TOTAL (2,942)

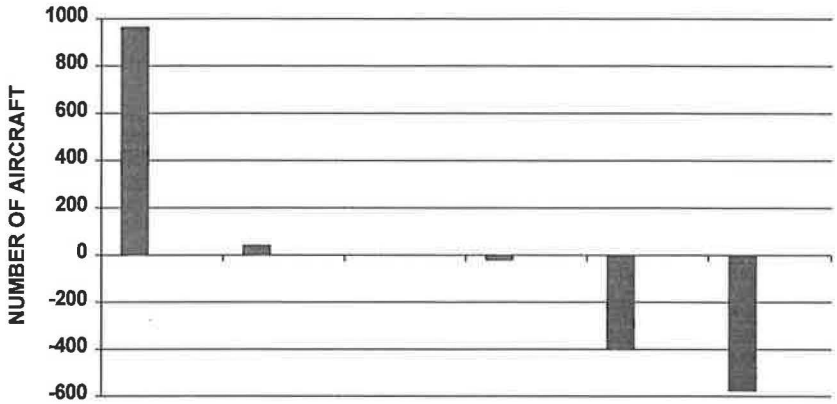


FIGURE 5 Aircraft less than 80 seats retirement forecasts: Dispersion around the mean 20-year total (2,942).

AIRCRAFT GREATER THAN 80 SEATS DELIVERY FORECASTS
DISPERSION AROUND THE MEAN 20-YEAR TOTAL (13,167)

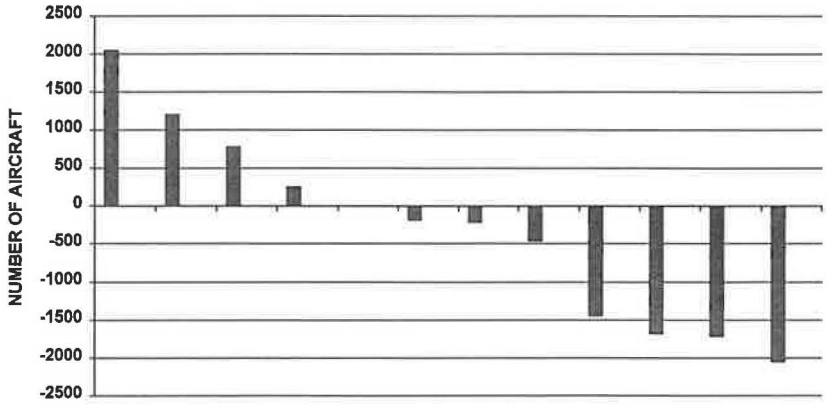


FIGURE 6 Aircraft greater than 80 seats delivery forecasts: Dispersion around the mean 20-year total (13,167).

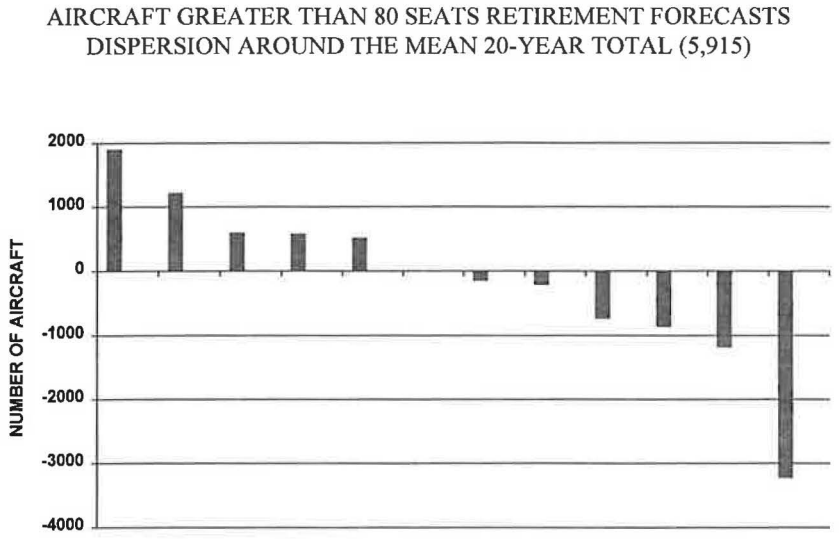


FIGURE 7 Aircraft greater than 80 seats retirement forecasts: Dispersion around the mean 20-year total (5,915).

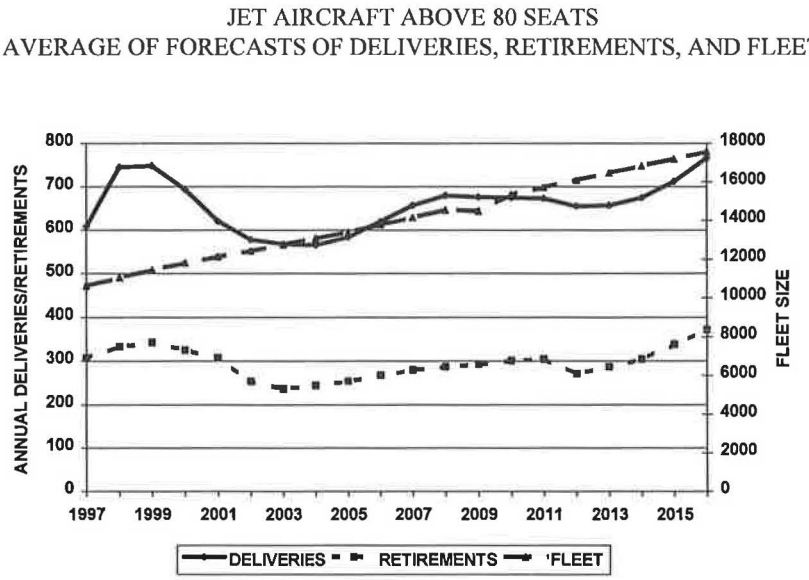


FIGURE 8 Jet aircraft above 80 seats: Average of forecasts of deliveries, retirements and fleet.

Table 1

| DIFFICULT ISSUES TO FORECAST | | |
|---|---|---|
| **First Five Years** | **RAW** | **WEIGHTED** |
| Economic growth and stability, linkage to traffic | 8 | 28 |
| Yield management/pricing policies | 5 | 19 |
| Asian high growth economies - boom or bust | 5 | 18 |
| "Ageing"/high-cycle aircraft concerns | 5 | 15 |
| Re-engining/hush-kitting | 4 | 9 |
| **Second Five Years** | | |
| Eastern Europe, C.I.S., emerging economies | 5 | 18 |
| Economic growth and stability, linkage to traffic | 6 | 17 |
| Hub "fracture" vs."consolidation" in Europe andAsi | 5 | 16 |
| Congestion as a g rowth constraint | 4 | 13 |
| Asian high growth economies - boomor bust | 3 | 10 |
| **Last Ten Years** | | |
| Economic growth and stability, linkage to traffic | 6 | 23 |
| Eastern Europe, C.I.S., emerging economies | 6 | 22 |
| Congestion as a growth constraint | 5 | 15 |
| Alternate modes of transportation, alternate modes o f communication | 6 | 14 |
| Rate of Technology change | 5 | 13 |

TABLE 2

| IMPORTANT ISSUES IN DETERMINING FUTURE AIRCRAFT DELIVERIES | | |
|---|---|---|
| **First Five Years** | **RAW** | **WEIGHTED** |
| Economic growth and stability, linkage to traffic | 9 | 33 |
| Cost of airline operations vs. airline profits | 5 | 17 |
| Availability of/affordability of capital | 4 | 15 |
| "Ageing"/high-cycle aircraft concerns | 4 | 15 |
| Re-engining/hush-kitting | 6 | 13 |
| **Second Five Years** | | |
| Economic growth and stability, linkage to traffic | 7 | 28 |
| Congestion as a growth constraint | 5 | 20 |
| Hub "fracture" vs. "consolidation" in Europe and Asia | 5 | 15 |
| Asian high growth economies - boom or bust | 4 | 15 |
| "Ageing"/high-cycle aircraft concerns | 6 | 13 |
| **Last ten years** | | |
| Congestion as a growth constraint | 9 | 25 |
| Economic growth and stability, linkage to traffic | 5 | 24 |
| Alternate modes of transportation, alternate modes of communication | 6 | 18 |
| Cost of airline operations vs. airline profits | 5 | 17 |
| Hub "fracture" vs. "consolidation" in Europe and Asia | 5 | 10 |

# PASSENGER DEMAND: DOMESTIC

## U. S. DOMESTIC AIR CARRIERS--LARGE

**1. Domestic Passenger Enplanements**

| Enplanements (in Millions) | | | | |
|---|---|---|---|---|
| Actual | | FAA Forecast | | |
| 1996 | 1997e | 1998 | 1999 | 2002 |
| 523.6 | 547.3 | 572.1 | 592.9 | 661.2 |
| Average Annual Growth Rate (%) | | | | |
| 1990-1997 | 1996-97 | 1997-98 | 1998-99 | 1997-2002 |
| 3.7 | 4.5 | 4.5 | 3.6 | 3.9 |
| ***Your Projection*** | | 4.0 | 3.4 | 3.6 |

**Reasons for Changes:**

Feel FAA is marginally too high @ 3.6 for 1999

**2. Domestic Passenger Real Yield in 1996$**

| Passenger Yield in 1996$ (cents) | | | | |
|---|---|---|---|---|
| Actual | | FAA Forecast | | |
| 1996 | 1997e | 1998 | 1999 | 2002 |
| 13.86 | 13.34 | 13.01 | 12.91 | 12.65 |
| Actual Annual Growth Rate (%) | | | | |
| 1990-1997 | 1996-97 | 1997-98 | 1998-99 | 1997-2002 |
| (2.3) | (3.8) | (2.5) | (0.8) | (1.1) |
| ***Your Projection*** | | (2.0) | (0.6) | (0.8) |

**Reasons for Changes:**

**3. Domestic Passenger Load Factor**

| Load Factor (Percent) | | | | |
|---|---|---|---|---|
| Actual | | FAA Forecast | | |
| 1996 | 1997e | 1998 | 1999 | 2002 |
| 67.5 | 68.5 | 69.0 | 68.5 | 68.0 |
| ***Your Projection*** | | 69.0 | 68.5 | 68.0 |
| Actual Annual Growth Rate (Pts) | | | | |
| 1990-1997 | 1996-97 | 1997-98 | 1998-99 | 1997-2002 |
| 1.1 | 1.0 | 0.5 | (0.5) | (0.1) |

**Reasons for Changes:**

Agree!

# PASSENGER DEMAND: INTERNATIONAL

## ATLANTIC ROUTES

**1. Passenger Enplanements (U.S.+ Foreign Flag Carriers)**

| Enplanements (in Millions) | | | | |
|---|---|---|---|---|
| Actual | | FAA Forecast | | |
| 1996 | 1997e | 1998 | 1999 | 2002 |
| 38.5 | 40.4 | 42.5 | 44.6 | 51.4 |
| Average Annual Growth Rate (%) | | | | |
| 1990-1997 | 1996-1997 | 1997-1998 | 1998-1999 | 1997-2002 |
| 4.8 | 4.9 | 5.2 | 4.9 | 4.9 |
| ***Your Projection*** | | 5.4 | 5.0 | 4.8 |

**Reasons for Changes:**

**2. Passenger Real Yield in 1996$ (U.S. Carriers Only)**

| Passenger Yield in 1996$ (cents) | | | | |
|---|---|---|---|---|
| Actual | | FAA Forecast | | |
| 1996 | 1997e | 1998 | 1999 | 2002 |
| 10.25 | 9.84 | 9.79 | 9.74 | 9.60 |
| Average Annual Growth Rate (%) | | | | |
| 1990-1997 | 1996-1997 | 1997-1998 | 1998-1999 | 1997-2002 |
| (2.0) | (4.0) | (0.5) | (0.5) | (0.5) |
| ***Your Projection*** | | (0.8) | (1.0) | (0.6) |

**Reasons for Changes:**

**3. Passenger Load Factor (U.S. Only)**

| Load Factor (Percent) | | | | |
|---|---|---|---|---|
| Actual | | FAA Forecast | | |
| 1996 | 1997e | 1998 | 1999 | 2002 |
| 76.3 | 76.0 | 75.5 | 75.0 | 75.0 |
| ***Your Projection*** | | 76.0 | 75.4 | 73.6 |
| Average Annual Growth Rate (Pts) | | | | |
| 1990-1997 | 1996-1997 | 1997-1998 | 1998-1999 | 1997-2002 |
| 0.9 | (0.3) | (0.5) | (0.5) | (0.2) |

**Reasons for Changes:**

Capacity growth will outpace traffic.

# PASSENGER DEMAND: DOMESTIC

## U.S. AIR CARRIER FLEET

**1. Large Jet Fleet--Narrowbody**

**Reasons for Changes:**

| Number of Aircraft | | | | |
|---|---|---|---|---|
| Actual | | FAA Forecast | | |
| 1996 | 1997e | 1998 | 1999 | 2002 |
| 3,990 | 4,087 | 4,182 | 4,266 | 4,809 |
| ***Your Projection*** | | 4,200 | 4,300 | 4,600 |
| Average Annual Growth Rate (%) | | | | |
| 1990-1997 | 1996-1997 | 1997-1998 | 1998-1999 | 1997-2002 |
| 2.9 | 2.4 | 2.3 | 2.0 | 3.3 |

**2. Large Jet Fleet--Widebody**

**Reasons for Changes:**

| Number of Aircraft | | | | |
|---|---|---|---|---|
| Actual | | FAA Forecast | | |
| 1996 | 1997e | 1998 | 1999 | 2002 |
| 785 | 829 | 887 | 931 | 987 |
| ***Your Projection*** | | 887 | 930 | 980 |
| Average Annual Growth Rate (%) | | | | |
| 1990-1997 | 1996-1997 | 1997-1998 | 1998-1999 | 1997-2002 |
| 3.3 | 5.6 | 7.0 | 5.0 | 3.6 |

**3. Average Seats per Aircraft--Domestic Operations**

**Reasons for Changes:**

| Average Seats/Aircraft | | | | |
|---|---|---|---|---|
| Actual | | FAA Forecast | | |
| 1996 | 1997e | 1998 | 1999 | 2002 |
| 142.0 | 145.2 | 147.2 | 148.2 | 153.2 |
| ***Your Projection*** | | 147.0 | 147.5 | 150.0 |
| Average Annual Change (Seats) | | | | |
| 1990-1997 | 1996-1997 | 1997-1998 | 1998-1999 | 1997-2002 |
| (0.9) | 3.2 | 2.0 | 1.0 | 1.6 |

# PASSENGER DEMAND: INTERNATIONAL

## LATIN AMERICAN ROUTES

**1. Passenger Enplanements (U.S.+ Foreign Flag Carriers)**

| Enplanements (in Millions) | | | | |
|---|---|---|---|---|
| Actual | | FAA Forecast | | |
| 1996 | 1997e | 1998 | 1999 | 2002 |
| 33.9 | 36.2 | 38.7 | 41.1 | 49.5 |
| Average Annual Growth Rate (%) | | | | |
| 1990-1997 | 1996-1997 | 1997-1998 | 1998-1999 | 1997-2002 |
| 4.7 | 6.8 | 6.9 | 6.2 | 6.5 |
| ***Your Projection*** | | 6.8 | 7.0 | 6.9 |

**Reasons for Changes:**

Strong economic performance and growth in newly free-market Latin American economies

**2. Passenger Real Yield in 1996$ (U.S. Carriers Only)**

| Passenger Yield in 1996$ (cents) | | | | |
|---|---|---|---|---|
| Actual | | FAA Forecast | | |
| 1996 | 1997e | 1998 | 1999 | 2002 |
| 13.57 | 13.30 | 13.17 | 13.07 | 12.80 |
| Average Annual Growth Rate (%) | | | | |
| 1990-1997 | 1996-1997 | 1997-1998 | 1998-1999 | 1997-2002 |
| (1.0) | (2.0) | (1.0) | (0.8) | (0.8) |
| ***Your Projection*** | | (1.0) | (1.3) | (0.5) |

**Reasons for Changes:**

Partially explained by shorter length-of-haul operations to Central America and Mexico

**3. Passenger Load Factor (U.S. Carriers Only)**

| Load Factor (Percent) | | | | |
|---|---|---|---|---|
| Actual | | FAA Forecast | | |
| 1996 | 1997e | 1998 | 1999 | 2002 |
| 63.2 | 63.9 | 64.5 | 65.0 | 65.0 |
| ***Your Projection*** | | 64.4 | 64.7 | 64.9 |
| Average Annual Growth Rate (Pts) | | | | |
| 1990-1997 | 1996-1997 | 1997-1998 | 1998-1999 | 1997-2002 |
| 0.2 | 0.7 | 0.6 | 0.5 | 0.2 |

**Reasons for Changes:**

Agree

# PASSENGER DEMAND: INTERNATIONAL

## PACIFIC/FAR EAST ROUTES

**1. Passenger Enplanements (U.S.+ Foreign Flag Carriers)**

| Enplanements (in Millions) | | | | |
|---|---|---|---|---|
| Actual | | FAA Forecast | | |
| 1996 | 1997e | 1998 | 1999 | 2002 |
| 22.4 | 23.8 | 25.5 | 27.3 | 32.8 |
| Average Annual Growth Rate (%) | | | | |
| 1990-1997 | 1996-1997 | 1997-1998 | 1998-1999 | 1997-2002 |
| 6.7 | 6.3 | 7.1 | 7.1 | 6.6 |
| ***Your Projection*** | | 6.6 | 6.6 | 7.2 |

**Reasons for Changes:**

Restoration of Japanese economic growth and booming PRC economy

**2. Passenger Real Yield in 1996$ (U.S. Carriers Only)**

| Passenger Yield in 1996$ (cents) | | | | |
|---|---|---|---|---|
| Actual | | FAA Forecast | | |
| 1996 | 1997e | 1998 | 1999 | 2002 |
| 10.50 | 10.19 | 10.08 | 10.01 | 9.80 |
| Average Annual Growth Rate (%) | | | | |
| 1990-1997 | 1996-1997 | 1997-1998 | 1998-1999 | 1997-2002 |
| (4.1) | (3.0) | (1.1) | (0.7) | (0.8) |
| ***Your Projection*** | | (2.0) | (1.0) | (1.0) |

**Reasons for Changes:**

Near-term Japanese economic sluggishness and increasing Asian market liberalization in the long-term

**3. Passenger Load Factor (U.S. Carriers Only)**

| Load Factor (Percent) | | | | |
|---|---|---|---|---|
| Actual | | FAA Forecast | | |
| 1996 | 1997e | 1998 | 1999 | 2002 |
| 74.5 | 75.1 | 75.0 | 75.0 | 74.0 |
| ***Your Projection*** | | 74.3 | 73.9 | 76.1 |
| Average Annual Growth Rate (Pts) | | | | |
| 1990-1997 | 1996-1997 | 1997-1998 | 1998-1999 | 1997-2002 |
| 0.5 | 0.6 | (0.1) | 0.0 | (0.2) |

**Reasons for Changes:**

Agree

# PASSENGER DEMAND: INTERNATIONAL

## U.S. AIR CARRIER FLEET--Page 1

**1. Large Jet Fleet--Narrowbody**

**Reasons for Changes:**

| Number of Aircraft | | | | |
|---|---|---|---|---|
| Actual | | FAA Forecast | | |
| 1996 | 1997e | 1998 | 1999 | 2002 |
| 3,990 | 4,087 | 4,182 | 4,266 | 4,809 |
| ***Your Projection*** | | -- | -- | -- |
| Average Annual Growth Rate (%) | | | | |
| 1990-1997 | 1996-1997 | 1997-1998 | 1998-1999 | 1997-2002 |
| 2.9 | 2.4 | 2.3 | 2.0 | 3.3 |

**2. Large Jet Fleet--Widebody**

**Reasons for Changes:**

| Number of Aircraft | | | | |
|---|---|---|---|---|
| Actual | | FAA Forecast | | |
| 1996 | 1997e | 1998 | 1999 | 2002 |
| 785 | 829 | 887 | 931 | 987 |
| ***Your Projection*** | | -- | -- | -- |
| Average Annual Growth Rate (%) | | | | |
| 1990-1997 | 1996-1997 | 1997-1998 | 1998-1999 | 1997-2002 |
| 3.3 | 5.6 | 7.0 | 5.0 | 3.6 |

**3. Average Seats per Aircraft--International Atlantic Routes**

**Reasons for Changes:**

| Average Seats/Aircraft | | | | |
|---|---|---|---|---|
| Actual | | FAA Forecast | | |
| 1996 | 1997e | 1998 | 1999 | 2002 |
| 237.2 | 239.2 | 240.5 | 241.5 | 242.5 |
| ***Your Projection*** | | 240 | 242 | 246 |
| Average Annual Change (Seats) | | | | |
| 1990-1997 | 1996-1997 | 1997-1998 | 1998-1999 | 1997-2002 |
| (5.6) | 2.0 | 1.3 | 1.0 | 0.7 |

# PASSENGER DEMAND: INTERNATIONAL

## U.S. AIR CARRIER FLEET--Page 2

**4. Average Seats per Aircraft--International Latin American Routes**

**Reasons for Changes:**

| Average Seats/Aircraft | | | | |
|---|---|---|---|---|
| Actual | | FAA Forecast | | |
| 1996 | 1997e | 1998 | 1999 | 2002 |
| 181.1 | 181.5 | 182.0 | 182.5 | 184.0 |
| ***Your Projection*** | | 182.0 | 182.0 | 184.0 |
| Average Annual Change (Seats) | | | | |
| 1990-1997 | 1996-1997 | 1997-1998 | 1998-1999 | 1997-2002 |
| (1.8) | 0.4 | 0.5 | 0.5 | 0.5 |

**5. Average Seats per Aircraft--International Pacific Routes**

**Reasons for Changes:**

| Average Seats/Aircraft | | | | |
|---|---|---|---|---|
| Actual | | FAA Forecast | | |
| 1996 | 1997e | 1998 | 1999 | 2002 |
| 326.6 | 328.0 | 330.0 | 332.0 | 342.0 |
| ***Your Projection*** | | 330.0 | 332.0 | 338.0 |
| Average Annual Change (Seats) | | | | |
| 1990-1997 | 1996-1997 | 1997-1998 | 1998-1999 | 1997-2002 |
| 1.3 | 1.4 | 2.0 | 2.0 | 2.8 |

# PASSENGER DEMAND: REGIONALS/COMMUTERS

## 298-C CARRIERS

### (Operate only aircraft with less than 60 seats)

**1. Passenger Enplanements**

| Enplanements (in Millions) | | | | |
|---|---|---|---|---|
| Actual | | FAA Forecast | | |
| 1996 | 1997e | 1998 | 1999 | 2002 |
| 32.0 | 39.8 | 42.0 | 44.6 | 52.9 |
| Average Annual Growth Rate (%) | | | | |
| 1990-1997 | 1996-1997 | 1997-1998 | 1998-1999 | 1997-2002 |
| 2.4 | 24.3 | 5.6 | 6.1 | 5.8 |
| ***Your Projection*** | | 6.0 | 6.1 | 6.1 |

**Reasons for Changes:**

**2. Passenger Load Factor**

| Load Factor (Percent) | | | | |
|---|---|---|---|---|
| Actual | | FAA Forecast | | |
| 1996 | 1997e | 1998 | 1999 | 2002 |
| 51.2 | 51.5 | 51.8 | 52.1 | 53.0 |
| ***Your Projection*** | | 53.0 | 54.0 | 55.0 |
| Average Annual Growth Rate (Pts) | | | | |
| 1990-1997 | 1996-1997 | 1997-1998 | 1998-1999 | 1997-2002 |
| 0.6 | 0.3 | 0.3 | 0.3 | 0.3 |

**Reasons for Changes:**

AMR Eagle is already achieving 55%

**3. Average Seats per Aircraft**

| Average Seats/Aircraft | | | | |
|---|---|---|---|---|
| Actual | | FAA Forecast | | |
| 1996 | 1997e | 1998 | 1999 | 2002 |
| 27.8 | 28.0 | 28.5 | 29.0 | 30.5 |
| ***Your Projection*** | | 29.0 | 30.0 | 31.0 |
| Average Annual Growth Rate (Seats) | | | | |
| 1990-1997 | 1996-1997 | 1997-1998 | 1998-1999 | 1997-2002 |
| 0.3 | 0.2 | 0.5 | 0.5 | 0.5 |

**Reasons for Changes:**

Regional Jets fall in this category and 19-seaters are retiring

# PASSENGER DEMAND: REGIONALS/COMMUTERS

## FORM 41 CARRIERS*

**(Operate at least one aircraft with more than 60 seats)**

**1. Passenger Enplanements**

| Enplanements (in Millions) | | | | |
|---|---|---|---|---|
| Actual | | FAA Forecast | | |
| 1996 | 1997e | 1998 | 1999 | 2002 |
| 25.5 | 22.70 | 23.87 | 24.91 | 28.42 |
| Average Annual Growth Rate (%) | | | | |
| 1990-1997 | 1996-1997 | 1997-1998 | 1998-1999 | 1997-2002 |
| 27.8 | (11.0) | 5.2 | 4.4 | 4.6 |
| ***Your Projection*** | | | | |

**Reasons for Changes:**

AGREE

**2. Passenger Load Factor**

| Load Factor (Percent) | | | | |
|---|---|---|---|---|
| Actual | | FAA Forecast | | |
| 1996 | 1997e | 1998 | 1999 | 2002 |
| 53.3 | 54.5 | 55.0 | 55.5 | 57.0 |
| ***Your Projection*** | | | | 60.0 |
| Average Annual Growth Rate (Pts) | | | | |
| 1990-1997 | 1996-1997 | 1997-1998 | 1998-1999 | 1997-2002 |
| 1.2 | 1.2 | 0.5 | 0.5 | 0.5 |

**Reasons for Changes:**

Load factors are already pushing 60%

**3. Average Seats per Aircraft**

| Average Seats/Aircraft | | | | |
|---|---|---|---|---|
| Actual | | FAA Forecast | | |
| 1996 | 1997e | 1998 | 1999 | 2002 |
| 35.0 | 40.0 | 41.0 | 42.0 | 45.0 |
| ***Your Projection*** | | | | 50.0 |
| Average Annual Growth Rate (Seats) | | | | |
| 1990-1997 | 1996-1997 | 1997-1998 | 1998-1999 | 1997-2002 |
| 1.3 | 5.0 | 1.0 | 1.0 | 1.0 |

**Reasons for Changes:**

Continental Express and Mesa Regional Jets will push average seat size up.

* Includes Atlantic Southeast, Continental Express, Executive Airlines, Horizon, Mesa, Simmons, Trans States, and United Feeder Service

# PASSENGER DEMAND: REGIONALS/COMMUTERS

## U.S. REGIONALS/COMMUTERS FLEET

**1. Commuter Fleet (Turboprops & Jets)**

| Aircraft | | | | |
|---|---|---|---|---|
| Actual | | FAA Forecast | | |
| 1996 | 1997e | 1998 | 1999 | 2002 |
| 2,109 | 2,168 | 2,237 | 2,302 | 2,526 |
| ***Your Projection*** | | | | |
| Average Annual Growth Rate (%) | | | | |
| 1990-1997 | 1996-1997 | 1997-1998 | 1998-1999 | 1997-2002 |
| 2.4 | 2.8 | 3.2 | 2.9 | 3.1 |

**Reasons for Changes:**

Regional Jets equal a maximum of 100 per year. Very few turboprop 19-seat aircraft will retire

**2. Average Seats per Aircraft**

| Average Seats/Aircraft | | | | |
|---|---|---|---|---|
| Actual | | FAA Forecast | | |
| 1996 | 1997e | 1998 | 1999 | 2002 |
| 30.5 | 31.2 | 31.8 | 32.4 | 34.2 |
| ***Your Projection*** | | 32 | 34 | 36 |
| Average Annual Growth Rate (Seats) | | | | |
| 1990-1997 | 1996-1997 | 1997-1998 | 1998-1999 | 1997-2002 |
| 1.5 | 0.7 | 0.6 | 0.6 | 0.6 |

**Reasons for Changes:**

# AIRPORTS

## PASSENGER DEMAND

**1. Large U.S. Air Carrier Enplanements--Domestic**

**Reasons for Changes:**

See text of report

| Enplanements (In Millions) | | | | |
|---|---|---|---|---|
| Actual | | FAA Forecast | | |
| 1996 | 1997e | 1998 | 1999 | 2002 |
| 523.6 | 547.3 | 572.1 | 592.9 | 661.2 |
| Average Annual Growth Rate (%) | | | | |
| 1990-1997 | 1996-1997 | 1997-1998 | 1998-1999 | 1997-2002 |
| 3.7 | 4.5 | 4.5 | 3.6 | 3.9 |
| ***Your Projection*** | | | | |

**2. Large U.S. Air Carrier Enplanements--International**

**Reasons for Changes:**

| Enplanements (In Millions) | | | | |
|---|---|---|---|---|
| Actual | | FAA Forecast | | |
| 1996 | 1997e | 1998 | 1999 | 2002 |
| 50.3 | 53.1 | 56.1 | 59.2 | 70.8 |
| Average Annual Growth Rate (%) | | | | |
| 1990-1997 | 1996-1997 | 1997-1998 | 1998-1999 | 1997-2002 |
| 5.2 | 5.6 | 5.6 | 5.5 | 5.9 |
| ***Your Projection*** | | | | |

**3. U.S. Regional/Commuter Enplanements**

**Reasons for Changes:**

| Enplanemts (In Millions) | | | | |
|---|---|---|---|---|
| Actual | | FAA Forecast | | |
| 1996 | 1997e | 1998 | 1999 | 2002 |
| 57.5 | 62.5 | 65.9 | 69.5 | 81.3 |
| | | | | |
| Average Annual Growth Rate (%) | | | | |
| 1990-1997 | 1996-1997 | 1997-1998 | 1998-1999 | 1997-2002 |
| 7.5 | 8.7 | 5.4 | 5.5 | 5.4 |
| ***Your Projection*** | | | | |

# AIRPORTS

## AIRCRAFT ACTIVITY AT FAA FACILITIES

**1. Air Carrier Operations - over 60 seats** **Reasons for Changes:**

| Number of Operations (In Millions) | | | | |
|---|---|---|---|---|
| Actual | | FAA Forecast | | |
| 1996 | 1997e | 1998 | 1999 | 2002 |
| 13.9 | 14.2 | 14.5 | 14.9 | 16.1 |
| Average Annual Growth Rate (%) | | | | |
| 1990-1997 | 1996-1997 | 1997-1998 | 1998-1999 | 1997-2002 |
| 3.7 | 2.2 | 2.1 | 2.7 | 2.5 |
| ***Your Projection*** | | | | |

**2. Regional/Commuter Operations - 60 seats or less** **Reasons for Changes:**

| Number of Operations (In Millions) | | | | |
|---|---|---|---|---|
| Actual | | FAA Forecast | | |
| 1996 | 1997e | 1998 | 1999 | 2002 |
| 10.2 | 10.1 | 10.3 | 10.5 | 11.2 |
| Average Annual Growth Rate (%) | | | | |
| 1990-1997 | 1996-1997 | 1997-1998 | 1998-1999 | 1997-2002 |
| (17.2) | (0.7) | 1.9 | 1.9 | 2.0 |
| ***Your Projection*** | | | | |

**3. General Aviation Operations** **Reasons for Changes:**

| Number of Operations (In Millions) | | | | |
|---|---|---|---|---|
| Actual | | FAA Forecast | | |
| 1996 | 1997e | 1998 | 1999 | 2002 |
| 35.3 | 36.2 | 36.5 | 36.6 | 37.5 |
| Average Annual Growth Rate (%) | | | | |
| 1990-1997 | 1996-1997 | 1997-1998 | 1998-1999 | 1997-2002 |
| (0.6) | 2.6 | 0.8 | 0.3 | 0.7 |
| ***Your Projection*** | | | | |

# GENERAL AVIATION: BUSINESS AIRCRAFT

## TURBOJETS

**1. Fixed Wing Turbojet Aircraft Fleet**

| Turbojets | | | | |
|---|---|---|---|---|
| Actual | FAA Forecast | | | |
| 1996e | 1997 | 1998 | 1999 | 2002 |
| 4,553 | 4,600 | 4,650 | 4,720 | 4,950 |
| ***Your Projection*** | 4,700 | 4,875 | 5,050 | 5,600 |
| Average Annual Growth Rate (%) | | | | |
| 1990-1996 | 1996-1997 | 1997-1998 | 1998-1999 | 1996-2002 |
| 1.8 | 1.0 | 1.1 | 1.5 | 1.4 |
| | 3.5 | 3.5 | 3.5 | 3.5 |

**Reasons for Changes:**

New Models
Economics (positive trend)
Fractional Ownership
Operating/Regulatory cost
increases moderate

**2. Fixed Wing Turbojet Aircraft Hours Flown**

| Hours Flown (in Thousands) | | | | |
|---|---|---|---|---|
| Actual | FAA Forecast | | | |
| 1996e | 1997 | 1998 | 1999 | 2002 |
| 1,487 | 1,515 | 1,545 | 1,590 | 1,750 |
| ***Your Projection*** | 1,530 | 1,575 | 1,625 | 1,775 |
| Average Annual Growth Rate (%) | | | | |
| 1990-1996 | 1996-1997 | 1997-1998 | 1998-1999 | 1996-2002 |
| 1.1 | 1.9 | 2.0 | 2.9 | 2.8 |

**Reasons for Changes:**

Aging Fleets (-)
Fleet Size (+)
Economic growth (+)
Business expansion (+)
Fractional Ownership (+)

# GENERAL AVIATION: BUSINESS AIRCRAFT

## TURBOPROPS

**1. Fixed Wing Turboprop Aircraft Fleet**

| Turboprops | | | | |
|---|---|---|---|---|
| Actual | FAA Forecast | | | |
| 1996e | 1997 | 1998 | 1999 | 2002 |
| 5,457 | 5,457 | 5,500 | 5,560 | 5,820 |
| ***Your Projection*** | | | | |
| Average Annual Growth Rate (%) | | | | |
| 1990-1996 | 1996-1997 | 1997-1998 | 1998-1999 | 1996-2002 |
| 0.5 | 0.0 | 0.8 | 1.1 | 1.1 |

**Reasons for Changes:**

New Products
Economy

**2. Fixed Wing Turboprop Aircraft Hours Flown**

| Hours Flown (in Thousands) | | | | |
|---|---|---|---|---|
| Actual | FAA Forecast | | | |
| 1996e | 1997 | 1998 | 1999 | 2002 |
| 1,503 | 1,508 | 1,525 | 1,550 | 1,650 |
| ***Your Projection*** | | 1,580 | 1,535 | 1,600 |
| Average Annual Growth Rate (%) | | | | |
| 1990-1996 | 1996-1997 | 1997-1998 | 1998-1999 | 1996-2002 |
| (7.0) | 0.3 | 1.1 | 1.6 | 1.6 |
| | | 0.8 | 1.1 | 1.1 |

**Reasons for Changes:**

Economic Growth (+)
Aging Fleet (-)
Net=modest increase

# GENERAL AVIATION: BUSINESS AIRCRAFT

## PILOT POPULATION

**1. Student Pilots**

**Reasons for Changes:**

| Number of Pilots (in Thousands) | | | | |
|---|---|---|---|---|
| Actual | | FAA Forecast | | |
| 1996 | 1997e | 1998 | 1999 | 2002 |
| 94.9 | 94.9 | 96.4 | 98.1 | 103.8 |
| Average Annual Growth Rate (%) | | | | |
| 1990-1997 | 1996-1997 | 1997-1998 | 1998-1999 | 1997-2002 |
| (4.2) | 0.0 | 1.5 | 1.8 | 1.8 |
| ***Your Projection*** | | | | |

**2. Commercial Pilots**

**Reasons for Changes:**

| Number of Pilots (in Thousands) | | | | |
|---|---|---|---|---|
| Actual | | FAA Forecast | | |
| 1996 | 1997e | 1998 | 1999 | 2002 |
| 129.2 | 127.8 | 129.1 | 130.4 | 134.2 |
| Average Annual Growth Rate (%) | | | | |
| 1990-1996 | 1996-1997 | 1997-1998 | 1998-1999 | 1997-2002 |
| (2.4) | (1.0) | 1.0 | 1.0 | 0.9 |
| ***Your Projection*** | | | | |

**3. Instrument Rated Pilots**

**Reasons for Changes:**

| Number of Pilots (in Thousands) | | | | |
|---|---|---|---|---|
| Actual | | FAA Forecast | | |
| 1996e | 1997 | 1998 | 1999 | 2002 |
| 297.9 | 299.0 | 306.5 | 309.6 | 318.0 |
| Average Annual Growth Rate (%) | | | | |
| 1990-1996 | 1996-1997 | 1997-1998 | 1998-1999 | 1997-2002 |
| 0.1 | 0.4 | 2.5 | 1.0 | 1.2 |
| ***Your Projection*** | | | | |

# GENERAL AVIATION: LIGHT AIRCRAFT

## SINGLE ENGINE PISTONS

**1. Single Engine Piston - Fleet**

**Reasons for Changes:**

| Numbers of Aircraft (in Thousands) | | | | |
|---|---|---|---|---|
| Actual | FAA Forecast | | | |
| 1996e | 1997 | 1998 | 1999 | 2002 |
| 132,262 | 132,500 | 134,000 | 135,500 | 139,000 |
| ***Your Projection*** | | | | |
| Average Annual Growth Rate (%) | | | | |
| 1990-1996 | 1996-1997 | 1997-1998 | 1998-1999 | 1996-2002 |
| (2.5) | 0.2 | 1.1 | 1.1 | 0.8 |

**2. Single Engine Piston Hours Flown (Thousands)**

**Reasons for Changes:**

| Hours Flown (In Thousands) | | | | |
|---|---|---|---|---|
| Actual | FAA Forecast | | | |
| 1996e | 1997 | 1998 | 1999 | 2002 |
| 16,577 | 16,660 | 16,900 | 17,150 | 17,800 |
| ***Your Projection*** | | | | |
| Average Annual Growth Rate (%) | | | | |
| 1990-1996 | 1996-1997 | 1997-1998 | 1998-1999 | 1996-2002 |
| (4.5) | 0.5 | 1.4 | 1.5 | 1.2 |

# GENERAL AVIATION: LIGHT AIRCRAFT

## MULTI-ENGINE PISTONS

**1. Multi-Engine Piston Fleet**

**Reasons for Changes:**

| Number of Aircraft | | | | |
|---|---|---|---|---|
| Actual | FAA Forecast | | | |
| 1996e | 1997 | 1998 | 1999 | 2002 |
| 16,652 | 16,652 | 16,700 | 16,770 | 17,050 |
| ***Your Projection*** | | | | |
| Average Annual Growth Rate (%) | | | | |
| 1990-1996 | 1996-1997 | 1997-1998 | 1998-1999 | 1996-2002 |
| (3.9) | 0.0 | 0.3 | 0.4 | 0.4 |

**2. Multi-Engine Piston Hours Flown**

**Reasons for Changes:**

| Hours Flown (In Thousands) | | | | |
|---|---|---|---|---|
| Actual | FAA Forecast | | | |
| 1996e | 1997 | 1998 | 1999 | 2002 |
| 2,515 | 2,520 | 2,530 | 2,545 | 2,600 |
| ***Your Projection*** | | | | |
| Average Annual Growth Rate (%) | | | | |
| 1990-1996 | 1996-1997 | 1997-1998 | 1998-1999 | 1996-2002 |
| (7.2) | 0.2 | 0.4 | 0.6 | 0.6 |

# GENERAL AVIATION: LIGHT AIRCRAFT

## PILOT POPULATION

**1. Student Pilots**

**Reasons for Changes:**

See text

| Number of Pilots (in Thousands) | | | | |
|---|---|---|---|---|
| Actual | | FAA Forecast | | |
| 1996 | 1997e | 1998 | 1999 | 2002 |
| 94.9 | 94.9 | 96.4 | 98.1 | 103.8 |
| Average Annual Growth Rate (%) | | | | |
| 1990-1997 | 1996-1997 | 1997-1998 | 1998-1999 | 1997-2002 |
| (4.2) | 0.0 | 1.5 | 1.8 | 1.8 |
| ***Your Projection*** 1.2 (private pilots) | | 11.5 | 7.0 | 7.0 |

**2. Commercial Pilots**

**Reasons for Changes:**

Agree

| Number of Pilots (in Thousands) | | | | |
|---|---|---|---|---|
| Actual | | FAA Forecast | | |
| 1996 | 1997e | 1998 | 1999 | 2002 |
| 129.2 | 127.8 | 129.1 | 130.4 | 134.2 |
| | | 127.8 | 129.018 | 133.655 |
| Average Annual Growth Rate (%) | | | | |
| 1990-1996 | 1996-1997 | 1997-1998 | 1998-1999 | 1997-2002 |
| (2.4) | (1.0) | 1.0 | 1.0 | 0.9 |
| ***Your Projection*** | | 0 | 1.0 | 0.9 |

**3. Instrument Rated Pilots**

**Reasons for Changes:**

See text

| Number of Pilots (in Thousands) | | | | |
|---|---|---|---|---|
| Actual | | FAA Forecast | | |
| 1996e | 1997 | 1998 | 1999 | 2002 |
| 297.9 | 299.0 | 306.5 | 309.6 | 318.0 |
| Average Annual Growth Rate (%) | | | | |
| 1990-1996 | 1996-1997 | 1997-1998 | 1998-1999 | 1997-2002 |
| 0.1 | 0.4 | 2.5 | 1.0 | 1.2 |
| ***Your Projection*** | | 0.9 | 1.4 | 1.9 |
| (Private: | | 0.9 | 4.0 | 4.0) |

# GENERAL AVIATION: VERTICAL AIRCRAFT

## TURBINES

**1. Turbine Rotorcraft Fleet**

**Reasons for Changes:**

See Text

| Number of Aircraft | | | | |
|---|---|---|---|---|
| Actual | FAA Forecast | | | |
| 1996e | 1997 | 1998 | 1999 | 2002 |
| 3,845 | 3,865 | 3,900 | 3,945 | 4,080 |
| ***Your Projection*** | | | | |
| Average Annual Growth Rate (%) | | | | |
| 1990-1996 | 1996-1997 | 1997-1998 | 1998-1999 | 1996-2002 |
| 0.6 | 0.5 | 0.9 | 1.2 | 1.0 |

**2. Turbine Rotorcraft Hours Flown**

**Reasons for Changes:**

| Hours Flown (In Thousands) | | | | |
|---|---|---|---|---|
| Actual | FAA Forecast | | | |
| 1996e | 1997 | 1998 | 1999 | 2002 |
| 1,857 | 1,870 | 1,890 | 1,920 | 2,000 |
| ***Your Projection*** | | | | |
| Average Annual Growth Rate (%) | | | | |
| 1990-1996 | 1996-1997 | 1997-1998 | 1998-1999 | 1996-2002 |
| 3.7 | 0.7 | 1.1 | 1.6 | 1.2 |

# GENERAL AVIATION: VERTICAL AIRCRAFT

## PISTONS

**1. Piston Rotorcraft Fleet**

**Reasons for Changes:**

| Number of Aircraft | | | | |
|---|---|---|---|---|
| Actual | FAA Forecast | | | |
| 1996e | 1997 | 1998 | 1999 | 2002 |
| 1,898 | 1,890 | 1,870 | 1,850 | 1,780 |
| ***Your Projection*** | | | | |
| Average Annual Growth Rate (%) | | | | |
| 1990-1996 | 1996-1997 | 1997-1998 | 1998-1999 | 1996-2002 |
| (8.3) | (0.4) | (1.1) | (1.1) | (1.1) |

**2. Piston Rotorcraft Hours Flown**

**Reasons for Changes:**

| Hours Flown (In Thousands) | | | | |
|---|---|---|---|---|
| Actual | FAA Forecast | | | |
| 1996e | 1997 | 1998 | 1999 | 2002 |
| 333 | 333 | 333 | 333 | 333 |
| ***Your Projection*** | | | | |
| Average Annual Growth Rate (%) | | | | |
| 1990-1996 | 1996-1997 | 1997-1998 | 1998-1999 | 1996-2002 |
| (12.0) | 0.0 | 0.0 | 0.0 | 0.0 |

# GENERAL AVIATION: VERTICAL AIRCRAFT

## PILOT POPULATION

**1. Student Pilots**

**Reasons for Changes:**

| Number of Pilots (in Thousands) | | | | |
|---|---|---|---|---|
| Actual | | FAA Forecast | | |
| 1996 | 1997e | 1998 | 1999 | 2002 |
| 94.9 | 94.9 | 96.4 | 98.1 | 103.8 |
| Average Annual Growth Rate (%) | | | | |
| 1990-1997 | 1996-1997 | 1997-1998 | 1998-1999 | 1997-2002 |
| (4.2) | 0.0 | 1.5 | 1.8 | 1.8 |
| ***Your Projection*** | | | | |

**2. Commercial Pilots**

**Reasons for Changes:**

| Number of Pilots (in Thousands) | | | | |
|---|---|---|---|---|
| Actual | | FAA Forecast | | |
| 1996 | 1997e | 1998 | 1999 | 2002 |
| 129.2 | 127.8 | 129.1 | 130.4 | 134.2 |
| Average Annual Growth Rate (%) | | | | |
| 1990-1996 | 1996-1997 | 1997-1998 | 1998-1999 | 1997-2002 |
| (2.4) | (1.0) | 1.0 | 1.0 | 0.9 |
| ***Your Projection*** | | | | |

**3. Instrument Rated Pilots**

**Reasons for Changes:**

| Number of Pilots (in Thousands) | | | | |
|---|---|---|---|---|
| Actual | | FAA Forecast | | |
| 1996e | 1997 | 1998 | 1999 | 2002 |
| 297.9 | 299.0 | 306.5 | 309.6 | 318.0 |
| Average Annual Growth Rate (%) | | | | |
| 1990-1996 | 1996-1997 | 1997-1998 | 1998-1999 | 1997-2002 |
| 0.1 | 0.4 | 2.5 | 1.0 | 1.2 |
| ***Your Projection*** | | | | |

# FLEETS/MANUFACTURERS: LARGE JETS

(See Text)

## U.S. AIR CARRIER FLEET--Page 1

**1. Large Jet Fleet--Narrowbody**

**Reasons for Changes:**

| Number of Aircraft | | | | |
|---|---|---|---|---|
| Actual | | FAA Forecast | | |
| 1996 | 1997e | 1998 | 1999 | 2002 |
| 3,990 | 4,087 | 4,182 | 4,266 | 4,809 |
| ***Your Projection*** | | | | |
| Average Annual Growth Rate (%) | | | | |
| 1990-1997 | 1996-1997 | 1997-1998 | 1998-1999 | 1997-2002 |
| 2.9 | 2.4 | 2.3 | 2.0 | 3.3 |

**2. Large Jet Fleet--Widebody**

**Reasons for Changes:**

| Number of Aircraft | | | | |
|---|---|---|---|---|
| Actual | | FAA Forecast | | |
| 1996 | 1997e | 1998 | 1999 | 2002 |
| 785 | 829 | 887 | 931 | 987 |
| ***Your Projection*** | | | | |
| Average Annual Growth Rate (%) | | | | |
| 1990-1997 | 1996-1997 | 1997-1998 | 1998-1999 | 1997-2002 |
| 3.3 | 5.6 | 7.0 | 5.0 | 3.6 |

**3. Average Seats per Aircraft--Domestic Operations**

**Reasons for Changes:**

| Average Seats/Aircraft | | | | |
|---|---|---|---|---|
| Actual | | FAA Forecast | | |
| 1996 | 1997e | 1998 | 1999 | 2002 |
| 142.0 | 145.2 | 147.2 | 148.2 | 153.2 |
| ***Your Projection*** | | | | |
| Average Annual Change (Seats) | | | | |
| 1990-1997 | 1996-1997 | 1997-1998 | 1998-1999 | 1997-2002 |
| (0.9) | 3.2 | 2.0 | 1.0 | 1.6 |

# FLEETS/MANUFACTURERS: LARGE JETS

## U.S. AIR CARRIER FLEET--Page 2

**4. Average Seats per Aircraft--International Atlantic Routes**

**Reasons for Changes:**

| Average Seats/Aircraft | | | | |
|---|---|---|---|---|
| Actual | | FAA Forecast | | |
| 1996 | 1997e | 1998 | 1999 | 2002 |
| 237.2 | 239.2 | 240.5 | 241.5 | 242.5 |
| ***Your Projection*** | | | | |
| Average Annual Change (Seats) | | | | |
| 1990-1997 | 1996-1997 | 1997-1998 | 1998-1999 | 1997-2002 |
| (5.6) | 2.0 | 1.3 | 1.0 | 0.7 |

**5. Average Seats per Aircraft--International Latin American Routes**

**Reasons for Changes:**

| Average Seats/Aircraft | | | | |
|---|---|---|---|---|
| Actual | | FAA Forecast | | |
| 1996 | 1997e | 1998 | 1999 | 2002 |
| 181.1 | 181.5 | 182.0 | 182.5 | 184.0 |
| ***Your Projection*** | | | | |
| Average Annual Change (Seats) | | | | |
| 1990-1997 | 1996-1997 | 1997-1998 | 1998-1999 | 1997-2002 |
| (1.8) | 0.4 | 0.5 | 0.5 | 0.5 |

**6. Average Seats per Aircraft--International Pacific Routes**

**Reasons for Changes:**

| Average Seats/Aircraft | | | | |
|---|---|---|---|---|
| Actual | | FAA Forecast | | |
| 1996 | 1997e | 1998 | 1999 | 2002 |
| 326.6 | 328.0 | 330.0 | 332.0 | 342.0 |
| ***Your Projection*** | | | | |
| Average Annual Change (Seats) | | | | |
| 1990-1997 | 1996-1997 | 1997-1998 | 1998-1999 | 1997-2002 |
| 1.3 | 1.4 | 2.0 | 2.0 | 2.8 |

# FLEETS/MANUFACTURERS: LARGE JETS

## U. S. DOMESTIC AIR CARRIERS--LARGE

**1. Domestic Passenger Enplanements**

**Reasons for Changes:**

| Enplanements (in Millions) | | | | |
|---|---|---|---|---|
| Actual | | FAA Forecast | | |
| 1996 | 1997e | 1998 | 1999 | 2002 |
| 523.6 | 547.3 | 572.1 | 592.9 | 661.2 |
| Average Annual Growth Rate (%) | | | | |
| 1990-1997 | 1996-97 | 1997-98 | 1998-99 | 1997-2002 |
| 3.7 | 4.5 | 4.5 | 3.6 | 3.9 |
| ***Your Projection*** | | | | |

**2. Domestic Passenger Real Yield in 1996$**

**Reasons for Changes:**

| Passenger Yield in 1996$ (cents) | | | | |
|---|---|---|---|---|
| Actual | | FAA Forecast | | |
| 1996 | 1997e | 1998 | 1999 | 2002 |
| 13.86 | 13.34 | 13.01 | 12.91 | 12.65 |
| Actual Annual Growth Rate (%) | | | | |
| 1990-1997 | 1996-97 | 1997-98 | 1998-99 | 1997-2002 |
| (2.3) | (3.8) | (2.5) | (0.8) | (1.1) |
| ***Your Projection*** | | | | |

**3. Domestic Passenger Load Factor**

**Reasons for Changes:**

| Load Factor (Percent) | | | | |
|---|---|---|---|---|
| Actual | | FAA Forecast | | |
| 1996 | 1997e | 1998 | 1999 | 2002 |
| 67.5 | 68.5 | 69.0 | 68.5 | 68.0 |
| ***Your Projection*** | | | | |
| Actual Annual Growth Rate (Pts) | | | | |
| 1990-1997 | 1996-97 | 1997-98 | 1998-99 | 1997-2002 |
| 1.1 | 1.0 | 0.5 | (0.5) | (0.1) |

# FLEETS/MANUFACTURERS: LARGE JETS

## ATLANTIC ROUTES

**1. Passenger Enplanements (U.S.+ Foreign Flag Carriers)**

**Reasons for Changes:**

| Enplanements (in Millions) | | | | |
|---|---|---|---|---|
| Actual | | FAA Forecast | | |
| 1996 | 1997e | 1998 | 1999 | 2002 |
| 38.5 | 40.4 | 42.5 | 44.6 | 51.4 |
| Average Annual Growth Rate (%) | | | | |
| 1990-1997 | 1996-1997 | 1997-1998 | 1998-1999 | 1997-2002 |
| 4.8 | 4.9 | 5.2 | 4.9 | 4.9 |
| ***Your Projection*** | | | | |

**2. Passenger Real Yield in 1996$ (U.S. Carriers Only)**

**Reasons for Changes:**

| Passenger Yield in 1996$ (cents) | | | | |
|---|---|---|---|---|
| Actual | | FAA Forecast | | |
| 1996 | 1997e | 1998 | 1999 | 2002 |
| 10.25 | 9.84 | 9.79 | 9.74 | 9.60 |
| Average Annual Growth Rate (%) | | | | |
| 1990-1997 | 1996-1997 | 1997-1998 | 1998-1999 | 1997-2002 |
| (2.0) | (4.0) | (0.5) | (0.5) | (0.5) |
| ***Your Projection*** | | | | |

**3. Passenger Load Factor (U.S. Only)**

**Reasons for Changes:**

| Load Factor (Percent) | | | | |
|---|---|---|---|---|
| Actual | | FAA Forecast | | |
| 1996 | 1997e | 1998 | 1999 | 2002 |
| 76.3 | 76.0 | 75.5 | 75.0 | 75.0 |
| ***Your Projection*** | | | | |
| Average Annual Growth Rate (Pts) | | | | |
| 1990-1997 | 1996-1997 | 1997-1998 | 1998-1999 | 1997-2002 |
| 0.9 | (0.3) | (0.5) | (0.5) | (0.2) |

# FLEETS/MANUFACTURERS: LARGE JETS

## LATIN AMERICAN ROUTES

**1. Passenger Enplanements (U.S.+ Foreign Flag Carriers)**

**Reasons for Changes:**

| Enplanements (in Millions) | | | | |
|---|---|---|---|---|
| Actual | | FAA Forecast | | |
| 1996 | 1997e | 1998 | 1999 | 2002 |
| 33.9 | 36.2 | 38.7 | 41.1 | 49.5 |
| Average Annual Growth Rate (%) | | | | |
| 1990-1997 | 1996-1997 | 1997-1998 | 1998-1999 | 1997-2002 |
| 4.7 | 6.8 | 6.9 | 6.2 | 6.5 |
| ***Your Projection*** | | | | |

**2. Passenger Real Yield in 1996$ (U.S. Carriers Only)**

**Reasons for Changes:**

| Passenger Yield in 1996$ (cents) | | | | |
|---|---|---|---|---|
| Actual | | FAA Forecast | | |
| 1996 | 1997e | 1998 | 1999 | 2002 |
| 13.57 | 13.30 | 13.17 | 13.07 | 12.80 |
| Average Annual Growth Rate (%) | | | | |
| 1990-1997 | 1996-1997 | 1997-1998 | 1998-1999 | 1997-2002 |
| (1.0) | (2.0) | (1.0) | (0.8) | (0.8) |
| ***Your Projection*** | | | | |

**3. Passenger Load Factor (U.S. Carriers Only)**

**Reasons for Changes:**

| Load Factor (Percent) | | | | |
|---|---|---|---|---|
| Actual | | FAA Forecast | | |
| 1996 | 1997e | 1998 | 1999 | 2002 |
| 63.2 | 63.9 | 64.5 | 65.0 | 65.0 |
| ***Your Projection*** | | | | |
| Average Annual Growth Rate (Pts) | | | | |
| 1990-1997 | 1996-1997 | 1997-1998 | 1998-1999 | 1997-2002 |
| 0.2 | 0.7 | 0.6 | 0.5 | 0.2 |

# FLEETS/MANUFACTURERS: LARGE JETS

## PACIFIC/FAR EAST ROUTES

**1. Passenger Enplanements (U.S.+ Foreign Flag Carriers)**

**Reasons for Changes:**

| Enplanements (in Millions) | | | | |
|---|---|---|---|---|
| Actual | | FAA Forecast | | |
| 1996 | 1997e | 1998 | 1999 | 2002 |
| 22.4 | 23.8 | 25.5 | 27.3 | 32.8 |
| Average Annual Growth Rate (%) | | | | |
| 1990-1997 | 1996-1997 | 1997-1998 | 1998-1999 | 1997-2002 |
| 6.7 | 6.3 | 7.1 | 7.1 | 6.6 |
| ***Your Projection*** | | | | |

**2. Passenger Real Yield in 1996$ (U.S. Carriers Only)**

**Reasons for Changes:**

| Passenger Yield in 1996$ (cents) | | | | |
|---|---|---|---|---|
| Actual | | FAA Forecast | | |
| 1996 | 1997e | 1998 | 1999 | 2002 |
| 10.50 | 10.19 | 10.08 | 10.01 | 9.80 |
| Average Annual Growth Rate (%) | | | | |
| 1990-1997 | 1996-1997 | 1997-1998 | 1998-1999 | 1997-2002 |
| (4.1) | (3.0) | (1.1) | (0.7) | (0.8) |
| ***Your Projection*** | | | | |

**3. Passenger Load Factor (U.S. Carriers Only)**

**Reasons for Changes:**

| Load Factor (Percent) | | | | |
|---|---|---|---|---|
| Actual | | FAA Forecast | | |
| 1996 | 1997e | 1998 | 1999 | 2002 |
| 74.5 | 75.1 | 75.0 | 75.0 | 74.0 |
| ***Your Projection*** | | | | |
| Average Annual Growth Rate (Pts) | | | | |
| 1990-1997 | 1996-1997 | 1997-1998 | 1998-1999 | 1997-2002 |
| 0.5 | 0.6 | (0.1) | 0.0 | (0.2) |

# FLEETS/MANUFACTURERS: REGIONAL JETS/TURBOPROPS

## U.S. REGIONALS/COMMUTERS

**1. Commuter Fleet (Turboprops & Jets)**

**Reasons for Changes:**

| Aircraft | | | | |
|---|---|---|---|---|
| Actual | | FAA Forecast | | |
| 1996 | 1997e | 1998 | 1999 | 2002 |
| 2,109 | 2,168 | 2,237 | 2,302 | 2,526 |
| ***Your Projection*** | | | | |
| Average Annual Growth Rate (%) | | | | |
| 1990-1997 | 1996-1997 | 1997-1998 | 1998-1999 | 1997-2002 |
| 2.4 | 2.8 | 3.2 | 2.9 | 3.1 |

**2. Average Seats per Aircraft**

**Reasons for Changes:**

| Average Seats/Aircraft | | | | |
|---|---|---|---|---|
| Actual | | FAA Forecast | | |
| 1996 | 1997e | 1998 | 1999 | 2002 |
| 30.5 | 31.2 | 31.8 | 32.4 | 34.2 |
| ***Your Projection*** | | | | |
| Average Annual Growth Rate (Seats) | | | | |
| 1990-1997 | 1996-1997 | 1997-1998 | 1998-1999 | 1997-2002 |
| 1.5 | 0.7 | 0.6 | 0.6 | 0.6 |

# FLEETS/MANUFACTURERS: REGIONAL JETS/TURBOPROPS

## 298-C CARRIERS

## (Operate only aircraft with less than 60 seats)

**1. Passenger Enplanements**

| Enplanements (in Millions) | | | | |
|---|---|---|---|---|
| Actual | | FAA Forecast | | |
| 1996 | 1997e | 1998 | 1999 | 2002 |
| 32.0 | 39.8 | 42.0 | 44.6 | 52.9 |
| Average Annual Growth Rate (%) | | | | |
| 1990-1997 | 1996-1997 | 1997-1998 | 1998-1999 | 1997-2002 |
| 2.4 | 24.3 | 5.6 | 6.1 | 5.8 |
| ***Your Projection*** | | 6.0 | 6.1 | 6.1 |

**Reasons for Changes:**

**2. Passenger Load Factor**

| Load Factor (Percent) | | | | |
|---|---|---|---|---|
| Actual | | FAA Forecast | | |
| 1996 | 1997e | 1998 | 1999 | 2002 |
| 51.2 | 51.5 | 51.8 | 52.1 | 53.0 |
| ***Your Projection*** | | 53.0 | 54.0 | 55.0 |
| Average Annual Growth Rate (Pts) | | | | |
| 1990-1997 | 1996-1997 | 1997-1998 | 1998-1999 | 1997-2002 |
| 0.6 | 0.3 | 0.3 | 0.3 | 0.3 |

**Reasons for Changes:**

AMR Eagle is already achieving 55%

**3. Average Seats per Aircraft**

| Average Seats/Aircraft | | | | |
|---|---|---|---|---|
| Actual | | FAA Forecast | | |
| 1996 | 1997e | 1998 | 1999 | 2002 |
| 27.8 | 28.0 | 28.5 | 29.0 | 30.5 |
| ***Your Projection*** | | 29.0 | 30.0 | 31.0 |
| Average Annual Growth Rate (Seats) | | | | |
| 1990-1997 | 1996-1997 | 1997-1998 | 1998-1999 | 1997-2002 |
| 0.3 | 0.2 | 0.5 | 0.5 | 0.5 |

**Reasons for Changes:**

Regional Jets fall in this category and 19-seaters are retiring

# FLEETS/MANUFACTURERS: REGIONAL JETS/TURBOPROPS

## FORM 41 CARRIERS*

**(Operate at least one aircraft with more than 60 seats)**

**1. Passenger Enplanements**

| Enplanements (in Millions) | | | | |
|---|---|---|---|---|
| Actual | | FAA Forecast | | |
| 1996 | 1997e | 1998 | 1999 | 2002 |
| 25.5 | 22.70 | 23.87 | 24.91 | 28.42 |
| Average Annual Growth Rate (%) | | | | |
| 1990-1997 | 1996-1997 | 1997-1998 | 1998-1999 | 1997-2002 |
| 27.8 | (11.0) | 5.2 | 4.4 | 4.6 |
| ***Your Projection*** | | | | |

**Reasons for Changes:**

Agree

**2. Passenger Load Factor**

| Load Factor (Percent) | | | | |
|---|---|---|---|---|
| Actual | | FAA Forecast | | |
| 1996 | 1997e | 1998 | 1999 | 2002 |
| 53.3 | 54.5 | 55.0 | 55.5 | 57.0 |
| ***Your Projection*** | | | | 60.0 |
| Average Annual Growth Rate (Pts) | | | | |
| 1990-1997 | 1996-1997 | 1997-1998 | 1998-1999 | 1997-2002 |
| 1.2 | 1.2 | 0.5 | 0.5 | 0.5 |

**Reasons for Changes:**

Load factors are already pushing 60%

**3. Average Seats per Aircraft**

| Average Seats/Aircraft | | | | |
|---|---|---|---|---|
| Actual | | FAA Forecast | | |
| 1996 | 1997e | 1998 | 1999 | 2002 |
| 35.0 | 40.0 | 41.0 | 42.0 | 45.0 |
| ***Your Projection*** | | | | 50.0 |
| Average Annual Growth Rate (Seats) | | | | |
| 1990-1997 | 1996-1997 | 1997-1998 | 1998-1999 | 1997-2002 |
| 1.3 | 5.0 | 1.0 | 1.0 | 1.0 |

**Reasons for Changes:**

Continental Express and Mesa Regional Jets will push average seat size up.

* Includes*Atlantic Southeast,*Continental Express, Executive Airlines, Horizon,
* Mesa, Simmons, Trans States, and United Feeder Service

*=regional jets

# APPENDIX B INFRASTRUCTURE, AIRPORTS AND THE FRACTIONAL OWNERSHIP SCHEME OF THINGS

*John J. McIntyre*
*Executive Jet Aviation*

Over the past thirty years, the idea of fractional ownership of business aircraft has passed from an obscure gleam in the eye of a few visionary entrepreneurs to a phenomenon now accounting for the largest new investment segment in the world's aviation industry. Executive Jet Aviation recently announced purchase orders for over $1 billion worth of state-of-the-art business aircraft over the next five years to support their Net Jets fractional ownership program worldwide.

While this company and its few lately-arrived competitors accommodate an increasingly large share of the business aviation travel in the United States, the idea spreads like a ripple in a mill pond to Europe and Asia. As it spreads, a new body of experience is being formulated by the pilots, dispatchers, service specialists and schedulers who operate and track this new fleet of specialized air transport.

To understand the "take" of this experience on airports and infrastructure as an element of Future Aviation Activities, it is useful to look at the challenges facing the infrastructure over the next decade and then examine the interests of the fractional ownership community at the points of intersection with these challenges.

## THE TEN CHALLENGES

(1) *GLOBAL POLITICAL, CULTURAL AND ECONOMIC LINKAGES* in the emerging "world-neighborhood" forum, solidify and are implemented through the airports of the world. But linkage requires a degree of cooperation and shared value sometimes difficult to assure in a context of underlying tension and mistrust between nations whose fundamental interests frequently diverge. Where linkage is clearly possible, troubling national sovereignty issues are embedded in initiatives addressing customs and immigration streamlining, currency convertibility and free trade, national security airspace and high-altitude/sub-orbital protocols.

(2) *THE PROLIFERATION OF HEAVIER, LARGER AND MORE POWERFUL AIRCRAFT* and their supporting infrastructures introduces a significant cluster of design deficiencies in existing facilities and potential shortcomings in operational protocols and procedures. Anticipated improvements will be required at major operating sites to accommodate increased wheelbase/ wingspan/gross weight runway requirements, terminal facility expansion, wake vortex detection and avoidance, arrival and departure throughput, and the related problems associated with ground transportation on- and off-site.

(3) *UNIFORM TRAVELER SAFETY* standards are difficult to insure over the wide span of differences between industrialized and developing countries. The mechanisms for insuring uniform standards depend critically on cooperative measures taken by governments and international organizations between and among whom there are often significant controversies on other issues. Standardized approach procedures, international terminology standards, equipment performance criteria, collision avoidance/evasion, ground evacuation, crash and fire equipment, and ground traffic surveillance standards need to be addressed cooperatively between states that find cooperation in any arena difficult.

(4) *AVIATION SECURITY* in the face of unlawful interference with civil aviation is difficult to enforce without clear-cut global lines of authority and responsibility between government and industry. Baggage surveillance and clearance causes bottlenecks and delays proportional to the size and value of the target to terrorists. Checked baggage screening, freight/courier/cargo/mail security, off-terminal arrival and departure security, employee and operator documentation and identification all pose thorny jurisdictional and proprietary issues which must be addressed.

(5) *ENVIRONMENTAL CAPACITY CONSTRAINTS*, currently pressing operators to conform to costly but technically non-challenging standards in noise and emission control, are expected to increase as traffic increases over the next decade. These constraints will eventually exceed the current capacity of airports to conform and will almost surely require attention at the manufacturing source, where they become economic constraints. Non-conforming aircraft will face operational restrictions which will similarly affect revenue performance and the ability to travel unrestricted among all airports.

(6) *TRAVEL MARKET EXPANSION* to a mass transit mode will impact regulatory practices to the extent of ending special considerations for airlines and airports, at the same time that consumer choice, airline competition and hub domination introduce new

market-driven pressures on airports. Government regulation initiatives will be available to insure free competition and unrestrained access to all markets, at the same time that airports will need to assert autonomy and avoid conflict of interest between airlines and airports.

(7) *ECONOMIC SURVIVAL AND GROWTH* of the airport infrastructure depends critically on the ability of facilities to generate revenue and invest in growth. Airport landing, baggage handling, throughput, parking and other fees-for-services are legitimate costs-of-doing-business for an industry that must expect some expansion of fee as a component of operating costs. Tax incentives, government shared-ownership and tax support relieve certain financial pressures, but all involve autonomy tradeoffs which affect airport management flexibility.

(8) *EXPEDITING GROUND PROCESSING* at airports to reduce the slow and inefficient processing of passengers and their baggage, moving them between airport portals and airline gates, and processing cargo and general aviation customers is a challenge severely - impacting airport image and consumer acceptance. New technology initiates in ground transportation, machine readable travel documents, customer identification devices, automatic ticketing and other facilitation developments will require coordination, cooperation and joint stakeholding by government, airlines and the airport to reach implied potentials in the real world.

(9) *INCREASING FLIGHT CAPACITY THROUGH TECHNOLOGY* offers significant promise for the future, but the path to increasing capacity on the ground and in the air through navigational aid improvement is replete with important funding, regulation, acceptance, standardization and international cooperation factors. Satellite based navigation and air traffic management holds great promise but will involve enormous expenditures, involve huge technical quality assurance challenges, depend sharply on international cooperation and involve a difficult and lengthy period of transition.

(10) *INTEGRATED AIRPORT SYSTEMS* are developing. Such systems view the airport, its communication and information data bases and structures, its on-facility ground transit system, its off-campus connectors to local population centers, and its web of environmental, safety, security and customer support services as an operating organism. The potential for synergism is enormous, but so are the costs in political, economic and—to some extent-cultural terms. Systemization requires new forms of government/airline/airport/ community interaction, new dimensions in community planning and organization and new approaches to previously compartmented problems now affecting the much broader community at large

## OUR TEN "VITAL" INTERESTS

Fractional ownership succeeds because it makes sense. It provides all of the benefits of individual or corporate ownership with none of its disadvantages, and in nurturing its success over the last three decades, we have accumulated a substantial body of experience from a somewhat specialized viewpoint.

Our viewpoint draws from the perspectives of the General Aviation, Air Carrier, On-Demand Charter and (some would say) Bush Pilot community and from these perspectives, we can identify ten vital interests which drive and ultimately formulate the way we do our business.

The vital interests of the fractional ownership community are deeply imbedded in the various venues of the aviation government/industry relationship. They will be discussed in terms of their impact on Airports and Infrastructure in some detail, but it may be useful to list them at the outset before charting their points of intersection with the broader challenges above:

(1) *SAFETY OF FLIGHT AND GROUND OPERATIONS*, our paramount interest, the overriding mission of management and each employee.

(2) *ZERO SYSTEM-INDUCED FLIGHT AND GROUND DELAY*, no less than our second prime concern after safety.

(3) *ALL-WEATHER SAFE ACCESS TO SUITABLE AIRPORTS* characterizing the kind of flying we do and the kind of system improvement we continue to champion.

(4) *FACILITY UPGRADES AT THE SECOND-TIER, "RELIEVER" AIRPORTS* include those technical initiatives that constitute our version of the AIP.

(5) *BASIC NON-INTRUSIVE ANTI-TERRORIST PROTECTION*, in everyone's interest, no less a value to the more attractive business traveler target.

(6) *REASONABLE, NON-DISCRIMINATORY COST SHARING* needs to sustain and improve the infrastructure, achievable with intelligent dialogue.

(7) *REGULATORY ACKNOWLEDGMENT OF NICHE ISSUES AND PROBLEMS*, so we can operate in the full sunshine of a system which addresses our "differentness".

(8) *FAIRNESS EXEMPTIONS FROM*

*BURDENSOME INTERNATIONAL CONSTRAINTS* instituted as solutions to non-existent or irrelevant problems.

(9) *ACCESS TO RELEVANT POLICY DELIBERATION FORUMS* in our own right, to provide input as stakeholders in policy decision making.

(10) *PROVISIONS FOR ACCESS TO INTEGRATED AIRPORT SYSTEMS* as they are conceptualized, designed and instituted.

*SAFETY OF OPERATIONS* will always be our paramount concern, underlying all aspects of the unique ownership-operator relationship at the core of the fractional concept. We will continue to invest heavily in the safest, most capable and cost-effective equipment that the industry offers, and we expect to prioritize our investment dollar in that order—safety before capability or economy. We are intimately associated with industry initiatives to improve safe flight, and watch closely a spectrum of safety related issues affecting airport installations, particularly the second, third and fourth tier airports.

Innovation is high on our watch-list—autonomous GPS approach technology and increased approach data processing, storage and communication capabilities; advanced flight following, flight direction and flight clearance procedures, especially within the Control Zone; advances in taxiway lighting, design, and traffic control coupled with new parallel runway construction and ramp placement-these are our tomorrow. We are also concerned, however, with a number of airport safety-related issues which affect the general aviation community and with which we must deal on each of our todays.

Ideally, we would like every airport in the United States to be tower equipped with weather service, a low-minimum all-weather approach, adequate runway length and weight bearing capacity to handle any weight class business aircraft, and an obstruction-free visual approach and departure. In the real world, we must deal with far from ideal conditions routinely, rather than as the exception, and to the extent that conditions vary from the ideal, we have our work cut out for us.

Ideally, as well, we would opt for government owned, operated and financed state-of-the-art facilities with all systems in excellent repair staffed by an unhurried, safety-conscious staff primarily concerned with each and every operation as if it were unique. Ideally, we would like to be able to count on an alerted, fully manned, professionally trained crash and rescue organization with the latest equipment.

Ideally, we would like airport owners and operators to invest proactively in their (and our) future, to keep their facilities in good repair, free of Foreign Object Damage, with easily accessed, contaminant-free fuel; with safe, secure, lighted parking; with well-marked, pothole-free taxiways and runways; and with procedures in place to provide immediate safety-related feedback from the transient flight crew to the operator.

Finally, we would like to see greater attention paid to standardizing second and third tier facilities-runway and taxiway lighting, ramp layout, obstruction marking-and far more diligence paid to getting the word out when conditions (as they must, from time to time) depart from the normal. NOTAM notification and dissemination for the short term, temporary approach plate notices for the longer term, and a real effort to repair the broken, standardize the non-standard, and replace the missing.

*ZERO SYSTEM-INDUCED FLIGHT AND GROUND DELAY* has been the Holy Grail of every commercial pilot since Orville Wright. It is axiomatic that as airport traffic density increases, the "system" induces delays. While a certain level of delay is accepted as the cost of getting airplanes to fly safely, to the business flyer-who has invested heavily in a personal aircraft-delay of any origin constitutes counter-productivity. En-route flight delay is rarely, if ever, attributable solely to airport management, although in the management of air traffic density, every pilot has experienced density delays without knowing clearly who to blame. In this light, the business customer is consistently better served at the less dense facility, acknowledging the tradeoff between ground-site convenience and flight management.

To the business aviation operator, this suggests that a cultural change is frequently needed in the mind of his passengers. Frequently, the attractiveness of San Jose or John Wayne or even Stewart or Bradley airports as an effective antidote to the system delay problem at the major hubs needs to be emphasized and demonstrated. As Corporate America becomes increasingly airminded, involvement in airport related issues is inevitable and airport management needs to be receptive to ways to involve this constituency, as discussed below.

To major airport management, its symbiotic partnership with the Part 121 carrier community is the fact-of-life catalyst that has done such a remarkably good lob in generating current levels of airport throughput. Precise (if not split-second) gate and ramp blocks, improvements in ground control surveillance radar, dual runway allocation, and service coordination efforts involving a host of independent contractors have paid off handsomely. Late afternoon departure delays at single-runway Washington National Airport and chronic ramp holds to the gate mazes at St. Louis and Dallas-Ft. Worth are reminders of how far airport design elsewhere has improved.

But to the second and third tier operator, runway and ramp congestion are problems rarely, if ever, encountered. Without as overt and explicit a set of relationships with the Part 91 and Part 135 communities

that join the larger airports with the Part 121 operators, the smaller airport operators can often fail to take steps to eliminate or reduce system delays. In many ways, this is an attitude problem, frequently characterized by a lack of coordination in the response to service requests, a lack of cooperation between component operators, and the feeling that the airport would be a good place to work "if it weren't for the damned airplanes." In its worst characterization, we are unable to find the alert, professional, safety conscious team player we once met daily at our favorite airports.

Where smaller airport managers have gone to some effort to involve the work force, and the community in general, in an attitude adjustment effort ("Airport Days," Zero Defect campaigns, Fly-Ins, Service-With-A-Smile buttons, etc.), we, the users, have noticed differences.

*ALL-WEATHER SAFE ACCESS TO SECONDARY AND TERTIARY AIRPORTS* is a twin-brother interest to the elimination of system delays, and the two are intimately related. Ninety percent of air travelers fly between the largest seventy five airports. As a long term investment agenda, few big-ticket items are more important to us than instrument approach upgrades at the remaining, smaller airports around the country. We need to go into these secondary and tertiary airports because they are closest to the manufacturing sites and research parks and sub-contractor factories our owners cannot reach efficiently on an airliner.

Deurbanization, as a concept, is a new buzz word in the airport location dialogue but it has been an article of faith in the business world for years. Labor, raw material and quality-of-life issues have sparked a massive industrial move to the hinterland, where more and more of our business trips head. Similarly, the aircraft owner vacations at sites in the same hinterland, and buys an aircraft to fly to and from his vacation. To the hinterland, then, we must go, and we need a quality precision approach when we get there. We need the snow cleared in winter, the ice melted, braking action measured, and a clearly enunciated warning when these conditions have not been met. We need adequate drainage year round to eliminate the pooling and the erosion, the hydroplaning and the splash-up that comes with skimping on runway maintenance. Ramp life of reflective runway striping and rubber crack sealant is limited, and poorly striped, cracked, crumbly runways are fairly good indices of neglectful airport management.

With assured access to GPS based approach systems in the first part of the next century, our hope is that there is enough wealth around to allow sharing by the airports most in need of upgrade and improvement. Non-Directional Beacon (NDB) approaches should quickly pass into the closet in which the Red and Blue airways are stacked. We are, however, skeptical of the Wide Area Approach System initiatives we have heard discussed, worried about the application to the mountainous terrain around the places we fly to in ski season.

Visual approach aids are an inexpensive start to tertiary airport upgrades, and given the choice, we could conceivably prefer a reliable, well-maintained VASI with a well-cleared sight line at some locations to an erratic NDB.

We prefer manned towers to do-it-yourself pattern control and we depend critically on accurate, timely, and weather data. As our aircraft grow in size and weight, we expect that tower personnel, and we hope Center personnel, are aware of and sensitive to runway weight limitations.

*FACILITY UPGRADES AT SECONDARY AND TERTIARY AIRPORTS* are urgent needs for the future, then, but the work that goes into these upgrades must be smart work. Hard work alone will not suffice. As a bottom line, we as an industry believe that we need more, better, smaller airports and we would question any unequivocal assertion advocating unmitigated large airport build-out. Fortunately, growth advocates have articulate enemies who quickly point out the likelihood of environmental, economic, traffic and assorted other disasters in the face of uncontrolled expansion.

The airport and facility planner should have some input to the selection, design and configuration of instrument approach and facility improvements but the fact-of-life proceedings by which such decisions are made are often complex tradeoffs involving far more factors than logic would suggest. To the extent that funding and installing a new instrument system is a major political exercise, we would hope that some experience and skill goes into the bureaucratic maneuvering that establishes the timing and precedes the award. Many facility upgrades have cleared bureaucratic logjams and gone operational thanks to the interested concern of a business aircraft patron of the facility involved. In this regard, we may need to educate that part of Corporate America using our services that there is both a real and cultural difference between Teterboro and Newark/LaGuardia, Palwaukee and O'Hare/Midway airports. The difference is now not entirely weighted on the side of the larger airports. The Corporate America business jet owner has a vested stake in doing all he or she can to improve the lot of the Teterboros and the Palwaukees and the cluster of far lesser facilities nationwide that help them minimize system delays by being where they are. The difference between what can be done (at Teterboro) and what needs to be done (at Palwaukee) is a study in the comparative exercise of Corporate influence in pursuit of that vested interest.

The ongoing controversy about America's future in airport infrastructure revolves around the relative funding burden appropriate to the government, the

airlines, business and general aviation and the community. This robust dialogue addresses the redistribution of capital to accommodate the needs of the second tier system and cross-subsidize the capital costs of major second tier airports. These "reliever" airports are of vital importance to us, and their importance is derived from an entirely different calculus than that by which the proponents of reliever cross subsidization compute value. The full system needs funding. Where their own interests are clear, airline shared-funding of capital airport improvements where their own interests are clear is legitimate, but since general aviation will never be able to meet full systems costs, airlines need to be incentivized to invest as well in the full system as a whole and its future adequacy.

*BASIC NON-INTRUSIVE ANTI-TERRORIST PROTECTION* is another "Holy Grail," and we are gratified and assured by efforts of the government and its industry partners to stay ahead of the complex national and international terrorism threat. As a matter of firm company policy, we cooperate to the fullest extent possible in anti-terrorist security initiatives since we must rely on airport management and government agencies to shield our owner-passengers, their aircraft and their belongings from harm or the threat of harm. We need absolute confidence in this shield and we will do whatever is needed to assure others of our complete cooperation. But we need more than assent to policy and cooperation.

We have a particular stake in insuring that our clients are safe from national, sub-national, para-national and domestic terrorist activities while engaged in any activity over which we can exercise either control, direction or assistance. As a group, our clientele represent particularly lucrative targets for the terrorist, regardless of agenda, and for the domestic criminal as well. We face this added burden in all aspects of our operation, and appreciate extra security attention when circumstances require it. We also appreciate extra consideration from airport authorities when client-initiated security precautions must be taken and consideration given to non-standard parking, ground transit and servicing requirements.

*REASONABLE, NON-DISCRIMINATORY COST SHARING* is a fact-of-life requirement in the day and age of rapid and expensive technological change. We, as an industry, are financially supporting the operation and maintenance of the current system as an acknowledged business cost. Re-equipping the system calls for an awesome investment of capital, with acknowledged shared responsibilities, but with honest differences of opinion on the mechanism of allocating these costs. As the debate over allocation shares proceeds within the envelope of acknowledged responsibility, we are encouraged by indications that seem to point away from user fees toward across the board assessments via fuel, aircraft and service point-of-purchase taxation. We believe that a safe system is a system there for all to use without purchase price decision requirements, elective levels of usage or the temptation to cut corners in marginal situations. We believe that a safe system is a system that is funded in such a manner that assures resource allocation by need rather than by political or economic considerations. We fully endorse the idea that as a profitable segment of the industry, we should pay our fair share to maintain, operate and upgrade the system on which we depend. We further endorse the notion that public debt incurred to fund infrastructure is a proper pass-down to future generations, particularly in the case of airports and facilities purchased to generate future income.

At ground level, we favor public investment wherever feasible, and in some cases where conventional wisdom deems it unfeasible. We acknowledge that players in the industry, ourselves included, often have short term interests and objectives that coincide with infrastructure upgrades and when they do, sometimes remarkable things happen at airports. We also acknowledge that we need remarkable things to happen at certain airports where these interests do not yet coincide. To make this happen, we favor a concerted effort to interest states, counties and municipalities in doing what has to be done to at least help acquaint the public with their long term stake in infrastructure.

*REGULATORY ACKNOWLEDGMENT OF NICHE ISSUES AND PROBLEMS* probably needs to begin with the creation of a new Part in Federal Aviation Regulations to provide guidance and regulation to the fractional ownership industry. It has the potential now to soon outgrow the neither-fish-nor-fowl mind-set currently dictating that we always choose the most stringent strictures of Parts 91 and 135 to obey, and throw in a bits and pieces of other parts when at all in doubt. As fractional ownership operators, we may present a fractionated face to the market analyst, but to the federal aviation infrastructure, all of us.in the business are of one mind in seeking a set of regulations tailored to our singular way of going about our business. Beginning with the issue of IRS excise taxation requirements on charter flight revenue, the need for regulatory recognition extends through other unsettled mazes into appropriate runway length restrictions, ceiling and visibility minimums, pilot training and certification frequency, record keeping and ultimately to contractual, ownership and liability definition. As a uniquely configured industry, we acknowledge our responsibilities to conform strictly to legislative and regulatory guidance. As a corollary, however, we feel that legislative and regulatory guidance should recognize the unique configuration of the industry. We are ultimately concerned not that tailored regulation will be

unduly burdensome but that untailored regulation will be so unspecific and discretionary in its strictures as to be unsafely full of cracks, through which one of us one day will fall-in spite of good intentions. Ultimately, it is the never-ending quest for a safer operation which drives our concerns and prompts our dissatisfaction with the current FAR.

*FAIRNESS EXEMPTIONS FROM BURDENSOME INTERNATIONAL CONSTRAINTS* will, we believe, come as the global aviation community begins to recognize and accept the differentness of fractional ownership operations. Some ICAO conventions negotiated after the end of World War II are, as anyone who has read the back of an airline ticket knows, notoriously inappropriate for the beginning of the 21st century. There is also a large cluster of customs, immigration, epidemiological and political conventions and rules that are appropriate to some operations, but not to fractional ownership. Does a fractionally owned Citation II with three holiday passengers en-route to Bimini qualify as a U.S. flag "state aircraft" subject to the same restrictions and eligible for the same privileges as a United 777 with 450 passengers en-route to Frankfurt?

There are legitimate burdens and inconveniences in international travel. International reluctance to recognize the unique status of fractional ownership, however, opens the industry to the futility of almost daily expensive and time consuming exercises in identifying, understanding and complying with written and unwritten laws designed for other purposes. As a sampling, we try to stay "up" on the ins and outs of our government's guidance and direction on things to worry about-but we should not have to worry about tricky customs, capricious taxation, cabotage and/or the implication of cabotage and scrupulous immigration cleanliness, along with policies with names like anti-terrorist, boycott, overflight, air defense, international marking, currency, fumigation, anti-snail, anti-Medfly, anti-pornography, anti-Israeli/Arab, anti-Cuban/U.S., anti-capitalist, ..the list goes on... policies that can make life unnecessarily miserable.

*ACCESS TO RELEVANT POLICY DELIBERATION FORUMS* constitutes the right of passage of fractional ownership operators from financial and volumetric adolescence into full fledged partnership with the rest of greater aviation. We have been bootstrapping steadily—and successfully—in this direction and as a result of the sheer goodness of our cause (some would say lobbying efficiency), we are receiving more and more media and representational attention. The National Business Aviation Association celebrates fifty years of growth in what one trade magazine this month calls "scope and sophistication." Growth provides access, and the entire aviation community is better for the influence wielded by Business Aviation in facility and airport improvement around the country. When I was five or six, playing in the grass at Bendix Field below Hasbrouck Heights, NJ, modern Teterboro would have been impossible to imagine. Enter Business Aviation and the concerted legislative and agency pressure that accomplished its modernization and history was made, at least at Teterboro. As we grow, the future association represented in paradigm today by our Shared Ownership Association may provide us with the same access to policy formulation and design input as does NBAA and the other alphabet groups across the spectrum of the politico-industrial complex.

Fractional owners are growing in numbers, representing an increasingly greater slice of a deurbanizing business community increasingly dependent on access and movement. We hope that as the relevant indices of fractional ownership growth-miles flown, aircraft purchased, passengers embarked- increase, the ability to communicate interests and concerns to relevant policy makers increases as well.

*PROVISIONS FOR ACCESS TO INTEGRATED AIRPORT SYSTEMS* as they are planned is an interest shared by the general aviation community. New ways to manage and integrate air and ground operations, support auxiliary industries, interact with the broader community at large and move air travel access into the urban and suburban population centers offer exciting models for the future. Expensive models, to be sure, and likely to require staggering investments by the airlines, the community, the federal government and other economic stakeholders. Along with the rest of the general aviation community, we have an interest in making sure that the safety and convenience of our ownership is not neglected in the planning process, and that we are afforded the opportunity to contribute to the planning process as we are expected to contribute to the anticipated revenue stream. We fully expect, in return, to contribute our fair, non-discriminatory share of the cost burden and welcome inclusion in the partnerships needed to build for the future.

Fractional ownership is here to stay. We have learned how to make it work, and we welcome a future in which we participate as a fully recognized industrial partner with the rest of the aviation community. We have the same interests in safety, convenience, efficiency, cost effectiveness and growth as the rest of aviation, and our specialized niche market activity contributes in a healthy way to its vibrant growth. Note that our list of interests implies no request for concessions, no appeal for exceptions to policy or rulemaking, and no bid for tax relief. We will pay our way. We will contribute to growth and we will pay our fair share of the costs of growth.

Fractional ownership is here to stay, and it's good to be here.

# APPENDIX C FREIGHT INTERMODAL SYSTEM

*RADM. Carl J. Seiberlich, USN Ret.*
*TranSystems Corporation*

Since the advent of the commercial steamship, the development of the national rail system, and later the application of the internal combustion engine to the truck, the break-bulk method of moving freight through both the national and international transportation systems remained virtually unchanged. Modal operators were paramount with a bill of lading required for each segment of the overall movement. Cargo was rarely visible within the system, with delays and losses as an accepted part of the operation.

The development of the ocean container in 1956 and the attendant twenty-year transition period changed the entire concept of moving freight. The container and flat rack were the only pieces of equipment which were common to the entire system. At the same time, the global economics of business changed both the needs and the expectations of customers. During the past ten years the evolution from containerization, to intermodal systems, to distribution and third-party logistics-providers has been customer driven. The prime needs of the customer involve cost, transit time, on time delivery, and the elimination of lost or damaged cargo. In turn, the providers of services must remain profitable.

To meet customer needs, the modern, intermodal freight system must be viewed as a system rather than a collection of modal entities, and as a process rather than a series of interfaces or events. The most significant change was that the flow of accurate and timely information through the system proved just as important as the movement of freight. In the investment of capital for system development, the priorities established to meet customer requirements must be kept in the forefront. Planning and knowledgeable evaluation before spending are important.

The development of an efficient and affordable intermodal system is a very complex undertaking. There are issues involving vehicles and infrastructure, information systems and other issues such as organizations and management, contracting and procurement and incentives for, and barriers to, innovation.

In the near term, priority must be given to the continued development: (1) of affordable, accurate and compatible Automatic Equipment Identification (AEI) systems to reduce error rate and increase dramatically the flow of information into the system; and (2) to the Electronic Data Interchange (EDI) to ensure that the information exchange among the various transportation providers and users is facilitated. The installation of incompatible systems will reduce efficiency and increase costs.

The Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA) focused attention on the intermodal performance characteristics of the national transportation system. Intermodalism is now being incorporated into the planning process at the federal, state, and regional levels. Communications among MPOs and freight transportation providers continues to improve.

In examining the intermodal system it becomes apparent that all freight is moved, and information generated and introduced into the system, by modal operators. Therefore, if the intermodal system is to operate efficiently the modal operators must understand the intermodal system of which they are a part, and in the final analysis they must make system decisions rather than modal decisions in both planning and implementation.

In viewing the users of the core intermodal system, we find commercial, military, customs and immigration, and hazardous materials agencies with requirements to meet customer needs or regulatory requirements in moving or controlling freight. The transportation and information providers within the system are the modal operators (ship, rail, truck, air, and various terminal and port operators). The relationship among these various entities is complex and in many cases still in the formative stages of development.

If the envisioned intermodal transportation system is to become an efficient reality, all industry, government and military organizations involved must become partners in the ongoing development of the freight system. If properly done, NEXTEA, the reauthorization of ISTEA, can provide great incentives for partnering and cooperation in research and development and education among these groups.

During the past two to three years, dramatic improvements in communication and cooperation have occurred. Efforts to develop effective partnering relationships are under way. The future looks bright, but to meet system needs NEXTEA is essential if the intermodal dream is to be realized.

# APENDIX D PARTICIPANTS

**Andreas Aastad**
President
Aastad Company
22 Brook Lane
Chadds Ford, PA 19317
610/459-9086 Fax 610/459-0509

**Douglas E. Abbey**
President
Avstat Associates, Inc.
2501 K Street, N.W. #6A
Washington, D.C. 20037-2020
202/338-1727 Fax 202/337-1477
avstatdc@aol.com

**Ted I. Alman**
Manager, Aviation Planning
North Carolina Dept. of Transportation
Division of Aviation
P.O. Box 25201
Raleigh, NC 27611
919/571-4904 Fax 919/571-4908

**Drew Alvino**
Executive Jet
625 North Hamilton Road
Columbus, OH 43219
614/239-5500 Fax 614/239-5589

**Dan J. Barks**
OEM Sales Manager
AlliedSignal Aerospace, Inc.
400 Rogers Road
Olathe, KS 66062
913/768-2331 Fax 913/791-1340

**Brandon Battles**
Conklin and de Decker Associates, Inc.
P.O. Box 121184
Arlington, TX 76012
817/277-6403 Fax 817/277-6402

**Simon W. Beech**
Marketing Manager
Lucas Aerospace
Brueton House, New Road
Solihull, W. Mids 891 3TX
England
44-121-627-5760 Fax 44-121-627-5811

**Gerald W. Bernstein**
Vice President
BACK Associates
236 West Portal Avenue, Suite 359
San Francisco, CA 94127
415/242-9296 Fax 415/242-9298
JerryBern@aol.com

**Magnus Bjorkman**
Systems Analyst
Innova International
57 Union Place
Summit, NJ 07901
908/522-0220 Fax 908/522-0230
bjorkman@earlthlink.net

**Marie A. Bjornson**
Market Analyst
Volvo Aero Corporation
46181 Trollhattan,
Sweden
46-520-94516 Fax 46-520-98584
vac.mala@memo.volvo.se

**George W. Blomme**
President
Aviation Planning & Technology Systems Consulting
P.O. Box 934
Rancho Mirage, CA 92270
760/770-7207 Fax 760/770-2924
georgeblomme@msn.com

**Edward Bolen**
President
General Aviation Manufacturing Assn. (GAMA)
1400 K Street, N.W., Suite 801
Washington, DC 20038
202/637-1374 Fax 202/842-4063

**Phillip A. Bolt**
Vice President, Strategy & Market Analysis
British Aerospace Asset Management
1 Bishop Square, St. Albans Road West
Hatfield, Herts AL10 9NE
United Kingdom
44 1707 255567 Fax 44 1707 255507
Phil.Bolt@BAE.co.uk

**Linda Hearne Boner**
Vice President
Glassman-Oliver Economic Consultants, Inc.
1828 L Street, N.W., Suite 405
Washington, DC 20036
202/331-1946 Fax 202/466-3199
lhboner@goeci.com

**Robert L. Bowles**
Manager, Statistics & Forecasts
Federal Aviation Administration
APO-110, Room 935
800 Independence Avenue, S.W.
Washington, D.C. 20591
202/267-3357 Fax 202/267-5370
robert.bowles@faa.dot.gov

**Christopher S. Brehm**
Principal Consultant
Price Waterhouse LLP
1616 N. Fort Myer Drive
Arlington, VA 22209
703/741-1685 Fax 703/741-1903
chris_brehm@notes.pw.com

**Kenneth Bukauskas**
MergeGlobal, Inc.
1100 N. Glebe Road, Suite 720
Arlington, VA 22201
703/276-9100 Fax 703/276-9296

**Paul C. Burnette, Jr.**
Senior Aviation Planner
Virginia Department of Aviation
5702 Gulfstream Road
Richmond Int'l. Airport, VA 23250-2422
804/236-3632 Fax 804/236-3635
burnette@doav.state.va.us

**John W. Cammett**
President
Aeroterm
800 Stuart Graham Blvd., Suite 315
Dorval, Quebec H4Y 1J6
Canada
514/422-1000 Fax 514/422-8222

**Michael D. Chase**
Marketing
Gulfstream Aircraft, Inc.
500 Gulfstream Road
Savannah, GA 31402-2206
Fax 912/965-3424
mike_chase@mhsmail.gulfaero.com

**Brian P. Clancy**
Principal
MergeGlobal, Inc.
Three Ballston Plaza
1100 North Glebe Road, Suite 720
Arlington, VA 22201
703/276-9100 703/276-9296

**Jerome Desmazures**
Market Research Analyst
Dassault Falcon Jet
Teterboro Airport
Little Ferry, NJ 07643
201/541-4580 Fax 201/541-4619
jeromed@compuserve.com

**Mark Diamond**
Consultant
SH&E
Int'l. Air Transport Consultancy
One Main Street
Cambridge, MA 02142
617/225-2800 Fax 617/225-0328

**Edward Doyle**
Vice President
Innova International Corp.
57 Union Place
Summit, NJ 07901
908/522-0220 Fax 908/522-0230
eddoyle@worldnet.att.net

**Martin E. Dresner**
Associate Professor
University of Maryland
College of Business & Management
College Park, MD 20742-1815
301/405-2204 Fax 301/405-0146
mdresner@mbs.umd.edu

**Robert E. Dunn**
President
R.E. Dunn, Inc.
11212 Old Post Road
Potomac, MD 20854
301/299-0613 Fax 301/299-0510

**Christine L. Eberhard**
President
Communiquest
1020 Manhattan Beach Blvd., Suite 109
Manhattan Beach, CA 90266
310/546-5713 Fax 310/546-5714
Communiquest@aol.com

**Michael J. Ellis**
Head of Air Traffic Forecasts
Civil Aviation Authority
Room T419 CAA House
Kingsway, London, WC2B 6TE
United Kingdom
44-71-832-6379 Fax 44-71-260-1153

**Charles C. Erhard**
Manager, Finance & Administrative Div.
Washington Dulles International Airport
Metropolitan Washington Airports Authority
P.O. Box 17045
Washington, DC 20001
703/572-2905 Fax 703/572-8213

**Jim Esswein**
Federal Express
2003 Corporate Avenue
Memphis, TN 38018
901/395-3592 Fax 901/395-5897
jgesswei@fedx.com

**John W. Fischer**
Specialist in Transportation
Congressional Research Service
Library of Congress
Washington, DC 20540-7430
202/707-7766 Fax 202/707-7575
jfis@.loc.gov

**Kenneth I. Flick**
Principal Regional Planner
Metro. Washington Council of Governments
777 N. Capitol St., N.E., Suite 300
Washington, DC 20002-4239
202/962-3295 Fax 202/962-3202

**Stephen Fortune**
MergeGlobal, Inc.
1100 N. Glebe Road, Suite 720
Arlington, VA 22201
703/276-9100 Fax 703/276-9296

**Robert Francis**
Vice-Chairman
National Transportation Safety Board
490 L'Enfant Plaza, S.W.
Washington, DC 20594
202/334-6020

**Donald L. Fraser**
Director of Marketing
Latinpass, Inc.
1600 N.W. leJeune Road, Suite 200
Miami, FL 33126
305/870-7575 Fax 305/870-7576
aichele@IX.netcom.com

**Scott C. Gibson**
Visiting Fellow
Economic Strategy Institute
1401 H Street, N.W., Suite 750
Washington, DC 20005
202/289-1288 Fax 202/289-1319

**Leonard Ginn**
Sr. Vice President, Economic & Assoc. Affairs
Airports Council International-NA
1775 K Street, N.W., Suite 500
Washington, DC 20006
202/293-8500 Fax 202/331-1362

**Vicki L. Golich (Co-Chair)**
Associate Professor, Political Science
California State University, San Marcos
333 S. Twin Oaks Valley Road
San Marcos, CA 92096-0001
760/750-4144 Fax 760/750-3151
vgolich@mailhost1.csusm.edu

**Juan Mario Gomez**
Manager, Sales & Marketing
GE Aircraft Engines
1000 Western Avenue MD 34007
Lynn, MA 01910
617/594-4584 Fax 617/594-5769
juanmario.gomez@ae.ge.com

**Elmer H. (Moe) Haupt**
Sr. Mgr., Airport & Environmental Services
National Business Aviation Association
1200 18th Street, N.W
Washington, DC 20036
202/783-9253 Fax 202/331-8364
mhaupt@NBAA.org

**Pierre Herron**
Market Research Specialist
Pratt & Whitney Canada
1000 Marie-Victorin Blvd.
Longueuil, Quebec J4G 1A1
Canada
514/647-7362 Fax 514/647-3775
pierre.herron@pwc.ca

**R. Steven Hines**
Director, Research & Statistics
Cessna Aircraft Company
P.O. Box 7706
Wichita, KS 67277
316/941-6867 Fax 316/941-8181

**Kenneth John Holden**
Sr. Vice President, Business Development
& Strategy
GE Capital Aviation Services
GPA House, Shannon Airport
Shannon, County Clare Ireland
353-61-706203 Fax 353-61-360279
ken.holden@aviation.capital.ge.com

**Barry K. Humphreys**
Director, External Affairs & Route Development
Virgin Atlantic Airways
The Office, Cranley Business Quarter
Manor Royal
Cranley, N. Sussex RH10 2NU
United Kingdom
44 1293 747065 44 1293 747073
barry.humphreys@fly.virgin.com

**Todd Inskeep**
Manager, Strategic & Business Planning
Allison Engine Company
P.O. Box 420, Speed Code S30A
Indianapolis, IN 46206-0420
317/230-5878 Fax 317/230-6763
Todd.M.Inskeep@allison.com

**Gary Ives**
Hurel-Dubois
13-21, Avenue du Marechal-Juin
92363 Meudon-La-Foret Cedex,
France
33-1-4601-1164 Fax 33-1-4601-1206

**Larry L. Jenney**
Consultant
1112 Neal Drive
Alexandria, VA 22308
703/780-8288

**Don C. Johnson**
Director, Industry and Membership Analysis
Aircraft Owners & Pilots Association
421 Aviation Way
Frederick, MD 21701
301/695-2067 Fax 301/695-2375
don.johnson@aopa.org

**Steve Johnson**
Mgr., Business Planning, & Marketing Support
Honeywell Commercial Aviation Systems
5353 W. Bell Road
Glendale, AZ 85308
602/436-8820 Fax 602/436-8101
steve.johnson@cas.honeywell.com

**Billie Jones**
Manager, Market Planning
Pratt and Whitney
Commercial Engine Business
400 Main Street, M/S 132-23
East Hartford, CT 06108
860/565-6574 Fax 860/565-1403

**Samuel C. Keiter**
Executive Vice President
Kurth and Company, Inc.
4400 MacArthur Blvd., N.W.
Suite 303
Washington, DC 20007
202/342-1691 Fax 202/337-6741

**Bilkis Khanam**
Forecaster, Air Traffic
Transport Canada
330 Sparks Street
Place de Ville, Tower C, 25F1
Ottawa, Ontario K1A 0N5 Canada
613/990-3827 Fax 613/957-3280

**Laurence Kiernan**
Airport Planner
Federal Aviation Administration
800 Independence Avenue, S.W.
Washington, DC 20591
202/267-8784 Fax 202/267-5275
larry.kiernan@faa.dot.gov

**Philippe Klinger**
Market & Aircraft Analysis Manager
SNECMA
site de Villaroche, Bat. 35
77550 Moissy-Cranayel,
France
33-1-60-59-5405 Fax 33-1-60-59-5120

**Tulinda Larsen**
Director, S.H.& E.
90 Park Avenue
New York, NY 10016
212/682-8455 Fax 212/986-1825
teamlarsen@webtv.net

**David Lawrence**
P.O. Box 1439
Fairfield, CT 06430-1439
203/259-9500 Fax 203/259-3800
davlawrenc@aol.com

**Mike D. Lee**
Market Analysis Manager
Messier-Dowty, International
Cheltenham Road
Gloucester, GL2 9QH ENGLAND
44-1452-711537 Fax 44-1452-711140

**John W. Leverton**
Senior Associate
R. Dixon Speas Associates
10668 John Ayres Drive
Fairfax, VA 22032
703/425-4236 Fax 703/425-4236
leverton@erols.com

**Charles Lynch**
Executive Jet
625 North Hamilton Road
Columbus, OH 43219
614/239-5500 Fax 614/239-5589

**Leo S. Mackay, Jr.**
VP, Strategic Planning & Business Development
Bell Helicopter Textron, Inc.
P.O. Box 482
Fort Worth, TX 76101
Fax 817/280-7408 Fax 817/280-8831
lmackay@bellhelicopter.com

**Louise E. Maillett**
Acting Assistant Administrator for Policy,
Planning & International Aviation
Federal Aviation Administration
800 Independence Avenue, S.W.
Washington, D.C. 20591
202/267-3033 202/267-5800

**Derrick J. Maple**
Head of Market Research
Smiths Industries Aerospace
Bishops Cleeve
Cheltenham, Gloucestershire GL52 4SF
England
44-1-242-661480 Fax 44-1-242-661795

**Philip M. Martin**
Independent Consultant
1340 N. Astor Street, #1206
Chicago, IL 60610
312/587-1736
pmartin@xsite.net

**Lloyd A. McCoomb**
Executive Vice President, Airport Development
Greater Toronto Airports Authority
P.O. Box 6031
Toronto, AMF, Ontario L5P 1B2
Canada
905/676-3010 Fax 905/676-7755

**Gerald S. McDougall**
Dean, Donald L. Harrison College of Business
Southeast Missouri State University
One University Plaza
Cape Girardeau, MO 63701-4799
573/651-2112 Fax 573/651-2610
c476bux@semovm.semo.edu

**Deborah C. McElroy**
Vice President
Regional Airline Association
1200 19th Street, N.W., Suite 300
Washington, DC 20036-2422
202/857-1170 Fax 202/429-5113
deborah_mcelroy@SBA.com

**Paul J. McGraw**
Director, Airport Capacity
Air Transport Association of America
1301 Pennsylvania Ave., N.W.
Washington, DC 20004
202/626-4099 Fax 202/626-7193
pmcgraw@air-transport.org

**John J. McIntyre**
Executive Jet Aviation
625 N. Hamilton Road
Columbus, OH 43219
614/239-2061 614/239-5589

**Maureen L. McMaster**
Manager, Marketing Research
Raytheon Aircraft Co.
P.O. Box 85
Wichita, KS 67201-0085
316/676-8309 Fax 316/676-6779

**Gene S. Mercer**
Industry Economist
5578 Yorkshire Street
Springfield, VA 22151
703/978-8705 Fax 703/978-3654

**Phillip M. Michel**
Vice President, Marketing Communications
Cessna Aircraft Company Dept. 597
P.O. Box 7706, 1 Cessna Blvd.
Wichita, KS 67277-7706
316/941-6240 Fax 316/941-6640
pmichel@cessna.textron.com

**Paul V. Mifsud**
Vice President, Gov't. & Legal Affairs, USA
KLM Royal Dutch Airlines
1201 Pennsylvania Ave., N.W., Suite 500
Washington, DC 20004
202/626-6717 Fax 202/626-6616
pmifsud@aol.com

**Charles H. Moles**
Industry Economist
Federal Aviation Administration
800 Independence Avenue, S.W.
Washington, D.C. 20591
202/267-3358 Fax 202/267-5370
Charles.Moles@FAA.DOT.Gov

**Francis P. Mulvey**
Assistant Director
U.S. General Accounting Office
HEHS, Income Security
441 G Street, N.W., Suite 593T
Washington, DC 20548
202/512-3592 Fax 202/512-6826
Mulveyf@hehs.gao.gov

**Daniel B. Muscatello**
Vice President
Aviation Development Services, LLC
11 Wilton Road
Westport, CT 06880
203/291-7800 Fax 203/291-7801

**David H. Napier**
Manager, Economic Data Service
Aerospace Industries Association
1250 Eye Street, N.W., #1200
Washington, DC 20005-3924
202/371-8563 Fax 202/371-8470
napier@aia-aerospace.org

**William Nesbit**
Consultant
Aviation Consulting Services
620 Elmore
Park Ridge, IL 60068
847/698-9662 Fax 847/823-4685

**Eric I. Nordling**
Vice President, Market Planning
Atlantic Coast Airlines
515A Shaw Road
Sterling, VA 20166
703/925-6171 Fax 703/925-6299

**Earl Odom**
Vice President
Business Development & Marketing
Airbus Industrie of North America, Inc.
198 Van Buren Street, Suite 300
Herndon, VA 20170-6335
703/834-3400 Fax 703/834-3340

**Molly Martin Pearce**
Manager, Marketing Programs
The New Piper Aircraft, Inc.
2926 Piper Drive
Vero Beach, FL 32960
561/567-4361 ext. 2834 Fax 561/778-2144
mmpearce@digital.net

**Mark Pfeifer**
GRA, Inc.
1750 K Street, N.W.
Suite 819
Washington, D.C. 20006
202/296-5200 Fax 202/296-5205

**Tri Pham**
Manager, Strategic Planning & Analysis
Pratt & Whitney Canada, Inc. M/S 01CQ1
1000 Boulevard Marie Victorin
Longueuil, Quebec J4G 1A1
Canada
514/647-2503 Fax 514/647-3775
tri.pham@pwc.utc.com

**Adam Pilarski**
Economic Research Department
Boeing Aircraft Company
3855 Lakewood Blvd.
Long Beach, CA 90846-0001
562/593-0288 Fax 562/982-8967

**Morton V. Plumb, Jr.**
Airport Director
Anchorage International Airport
P.O. Box 196960
Anchorage, AK 99519-6960
907/266-2529 Fax 907/243-0663
morton_plumb@dot.state.ak.us

**David E. Raphael**
President & CEO
Marcar Management Institute of America, Inc.
40007 Marsten Avenue
Belmont, CA 94002-1253
650/637-7711 Fax 650/637-7722
dave@marcar.com

**Kenneth E. Roberts**
President
Roberts Consulting
1508 Woodward Court
Brentwood, TN 37027
615/221-4921 Fax 615/221-4921

**John M. Rodgers**
Director, Office of Aviation Policy, Plans and Management Analysis (APO-1)
Federal Aviation Administration
800 Independence Avenue, S.W.
Washington, D.C. 20591
202/267-3274 Fax 202/267-3278

**Martin L. Rosenstein**
Manager, Strategic Planning
Sikorsky Aircraft Corporation
6900 Main Street (MS S102A)
Stratford, CT 06497-9129
203/386-5693 Fax 203/386-7448
MRosenstein@Sikorsky.com

**Carlos D. Souto**
Industrial Counselor
Embassy of Portugal
2125 Kalorama Road, N.W.
Washington, D.C. 20008
202/328-8610 Fax 202/462-3726

**Arnold N. Schwartz**
Economist, Forecast & Statistics Br., APO-110
Federal Aviation Administration
800 Independence Avenue, S.W.
Washington, D.C. 20591
202/267-3306 Fax 202/267-5370

**Joseph P. Schwieterman**
Associate Professor
DePaul University
Public Services Program
243 S. Wabash Avenue, Suite 805
Chicago, IL 60604
312/362-5732 Fax 312/362-5506

**Carl J. Seiberlich**
RADM, U.S. Navy, (Ret.)
VZM/TranSystems
2100 Reston Parkway, Suite 202
Reston, VA 20191
703/758-8800 x1011 Fax 703/758-0299

**Nan Shellabarger**
Manager, Planning Analysis Division
Federal Aviation Administration
APO-100, Room 938
800 Independence Avenue, S.W.
Washington, D.C. 20591
202/267-9954 Fax 202/267-5370
nan.shellabarger@faa.dot.gov

**Derrick R. Sloan**
Chief, Strategic Analysis, Aerospace
Industry Canada
Aerospace & Defense Branch
235 Queen Street
Ottawa, Ontario K1A 0H5 Canada
613/954-3397 Fax 613/998-6703
sloan.derrick@ic.gc.ca

**William C. Spaeth**
Planner
Metro. Washington Airports Authority
Washington National Airport
Washington, DC 20001
703/417-8165 Fax 703/417-8199

**George D. Stamas**
Statistician
Federal Aviation Administration
APO 110, Statistics & Forecasting
800 Independence Avenue, S.W.
Washington, D.C. 20591
202/267-7924 202/267-9636
George.Stamas@faa.dot.gov

**Stephen E. Still**
Senior Partner
Airline Planning Group
10304 Lewis Knolls Drive
Oakton, VA 22124
703/319-0820 Fax 703/319-0820
APG97@aol.com

**Grady B. Stone**
Director, Express Planning
USAirways
2345 Crystal Drive
Arlington, VA 22227
703/872-7060 Fax 703/872-7312
gstone@usairways.com

**Anne Strauss-Wieder**
A. Strauss-Wieder, Inc.
330 South Chestnut Street
Westfield, NJ 07090-1341
908/654-8536 Fax 908/654-8536
76614.2621@compuserve.com

**John S. Strong**
Professor
College of William and Mary
School of Business
Williamsburg, VA 23187
757/221-2864 Fax 757/221-2937
jsstro@dogwood.tyler.wm.edu

**Daniel E. Taylor**
Senior Economist
Forecast & Statistics Br., APO-110
Federal Aviation Administration
800 Independence Avenue, S.W.
Washington, D.C. 20591
202/267-3302 Fax 202/267-5370
Dan.taylor@faa.dot.gov

**Vernon F. Thomas**
Manager, Market Analysis & Mgmt. Info.
GE Aircraft Engines
One Neumann Way MD F87
Cincinnati, OH 45215-6301
513/243-4032 Fax 513/243-5659

**Daniel C. Tuerk**
Economist, Statistics and Forecast Branch
Federal Aviation Administration APO-110
800 Independence Avenue, S.W., Rm. 938
Washington, D.C. 20591
202/267-3351 Fax 202/267-5370
daniel.tuerk@faa.dot.gov

**Bouke M. Veldman**
Managing Director
Stratagem
Herengracht 560
Amsterdam, 1017 CH
The Netherlands
31-20-6250685 Fax 31-20-4207559
J.P.B.Jonker@inter.nl.net

**Pierre Vilain**
Principal Economist
Louis Berger & Associates, Inc.
100 Halsted Street
East Orange, NJ 07019
201/678-1960 Ext 422 Fax 201/Fax 672-4284
pvilain@louisberger.com

**John Walsh**
President
Walsh Aviation
1677 Coventry Place
Annapolis, MD 21401
410/573-9267 Fax 410/573-6587
john_f_walsh@msn.com

**Alvin Wang**
Market Planning
Pratt & Whitney
400 Main Street, M/S 132-23
East Hartford, CT 06106
860/565-6574 Fax 860/565-9522

**Martin Wiedra**
Manager, Market Analysis
MTU Munchen
Dachauer Strasse 665
80995 Munich,
Germany
49-89-1489-3354 Fax 49-89-1489-6336

**Jack P. Wiegand (Co-Chair)**
Managing Director
Forecast International
52 Powderhorn Drive
Wayne, NJ 07470
201/696-1012 Fax 201/696-1343

**Michael D. Wolf**
Textron Lycoming
652 Oliver Street
Williamsport, PA 17701
717/327-7004 Fax 717/327-7007

**Andras Zboray**
Manager, Scheduling & Market Research
Malev Hungarian Airlines
Roosevelt Ter 2
H-1051 Budapest,
Hungary
Fax 011-36 1266 8940

**TRB Staff**

**Joseph Breen**
Senior Program Officer, Aviation
Transportation Research Board, GR326
2101 Constitution Avenue, NW
Washington, DC 20418
202/334-3206 Fax 202/334-2030
jbreen@nas.edu

**Nancy Doten**
Senior Secretary
Transportation Research Board
202/334-3206 Fax 202/334-2030
ndoten@nas.edu