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11th International Workshop

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11th INTERNATIONAL WORKSHOP

Sponsored by

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

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FOREWORD

The Eleventh International Workshop on Future Aviation Activities was conducted by the Transportation Research Board on September 15–17, 1999, 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 and 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. After a successful introduction in the 1997 workshop, the air cargo panel has become an important and growing element of this workshop.

More than 100 participants, drawn from government, industry, academic institutions, and private consulting firms both here and abroad, took part in this 3-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, nine 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 the workshop co-chairs—Professors Vicki L. Golich of California State University, San Marcos, and Gerald S. McDougall, Dean of Business, Southeast Missouri State University—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.

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The workshop opened with a welcome by John M. Rodgers, Director of the FAA's Office of Aviation Policy and Plans. This welcome was followed by three distinguished plenary speakers. Randall Malin, Principal, Malin & Associates, provided exceptional insights into the industry on the basis of his years of executive experience and recent participation in a National Research Council study on competitive practices among airlines. William Swelbar, GKMG Consulting Services, Inc., followed and offered a creative view of the potential for competitive alliances among regional airlines. The final plenary speaker was William D. Hammers, Optimal Solutions, Inc., who addressed web-based forecasting as it applies to NASA's innovative proposal to develop the Small Aircraft Transportation System (SATS). [Note: NASA recently redesignated this system the Smart Aircraft Transportation System.]

By addressing the current issues facing major and regional airlines and the general aviation community, the plenary speakers provided thoughtful insights to the panel members, who were then charged with looking into the future and comparing their outlook with that of the FAA. Each individual was assigned to one of nine panels. These panels addressed the following areas: domestic, regional, and international airlines; business aviation; light and personal general aviation; vertical flight; air cargo operations; airports and infrastructure; and fleets and manufacturers.

WELCOME

John M. Rodgers
Director, Office of Aviation Policy and Plans
Federal Aviation Administration

I have always been interested in better forecasting. Before starting my 26 years with the FAA, I was with a consulting company for several years and before that with Black & Decker Manufacturing. Reminiscing about my time at Black & Decker Manufacturing, I was just out of college and was employed in market research. I was not a forecaster. The forecasting group was housed in adjacent office space. I frequently looked covetously over at the forecasting group, and I mentioned to Phil Dolan, who was both my supervisor and mentor, my interest in forecasting. He was very kind, but also very sage, saying, "Well, that is very good, but if you decide you really want to be a forecaster, just make sure you can run faster than the numbers catch up with you." That was my introduction to one philosophical approach to forecasting. It is important to remember that there are limitations to forecasting.

Later on, when I was working with the consulting company performing transportation-related projects, I was sitting in my office one morning and my secretary asked if I would take a phone call from someone who was interested in potential employment. I agreed. The caller was a lady who explained that her acquaintance had suggested that she really should seek employment in forecasting. I asked, "Did you have training in quantitative subjects; are you an industry expert?" She said, "No, I get premonitions—visions—about what is going to happen." So, trying to be polite, I said, "That is very, very interesting—could you give me some insight on what is going to happen to the prime rate over the next month?" She wasn't quite sure what the prime rate was, so I explained it to her. Upon hearing my explanation, she said, "No, I really don't forecast small events like that. I only do big events, like whether a meteor is going to hit or whether there is going to be an assassination." I thanked her, but I explained that the nature of our business was such that in general we didn't have a lot of call for that kind of information.

Again, this story illustrates a point—small things, like the interest rate, can actually have a big impact on events. That is why we spend a lot of time working with financial numbers. That is why we are asking you to help us try to ascertain what is going to happen in the future.

On behalf of the FAA, I would like to welcome you to the Eleventh International Workshop on Future Aviation Activities. I tried to see if there was an acronym for that, but it's a tongue twister and there isn't an acronym. This workshop recognizes the importance of your input to forecast projections in developing a safe and efficient air traffic control system. I might add that I believe this is a win-win situation as the FAA finds out what our workload is going to be, and I hope through this sharing that you will go back to your respective occupations with additional insight that will benefit you in your work.

This coming year, we will host the 25th FAA Aviation Forecast Conference. After 24 successful years and continued strong support from the aviation industry, it is clear that this conference is very important to the aviation community. What you are doing here in this particular activity today is the forerunner to the conference. It is an important part of our preparation. This is where a major element of the groundwork is laid for the forecasts that will be presented next March.

Talking about the conference that we are going to have next March, we are changing our format a little bit. We are combining the commercial and general aviation (GA) conferences. You may, if you have your pocket planner, want to note the time and place of that coming conference. It is going to be March 8–9 at the Washington, D.C., Convention Center.

Herb Kelleher, Chairman, President and CEO of Southwest Airlines, has agreed to be our luncheon speaker. He has addressed the group before, and, frankly, as I think most of us know, he is very effective as a speaker both because of his insight and because of his bon mots and good humor.

Forecasting activity is an essential component of the FAA's planning process. Forecasts are used to determine staffing levels and capital expenditures that are needed to accommodate growth in aviation. The forecasts are also used by our agency in preparing our budgets and conducting cost/benefit analyses of both investment and potential rules, in analyzing what we think trust fund income will be, and finally in looking at things like accident rates for safety analysis purposes.

Because of the sizeable investment that we are making in the national air space system, it is essential that our forecasts produce accurate results. We are called to task by the users of these forecasts and by our congressional overseers to be accountable. During the last ten years, with your help, we have adopted state-of-the-art methods of analyzing trends in air traffic. These methods and your insight have, in fact, helped us reduce forecast errors. The input that you are going to be providing over the next three days will be used in developing the forecasts that we present in March. Again, this is a very important activity to my office and to the FAA.

As we all know, the aviation industry has seen dramatic changes in the past decade. Frankly, I expect that these changes will continue. There has been, first, major restructuring. Second, there has been intense economic market competition. Third, there have been expanding global alliances. Fourth, we have negotiated a large number of open skies agreements. These activities and issues, I think, will affect our forecasts.

I am happy to say that over the past three or four years we have also experienced a tremendous resurgence in GA activity and sales. Again, this will certainly affect forecasts of the FAA workload. I know a few of you may dispute the importance of GA activity levels to FAA workload, but the reality is that GA is our largest customer in terms of activity counts.

The dynamics and complexity of our aviation system make it essential that we verify our projections with you to make certain that they reflect what you think is going to occur in the industry. If there are differences between our projections and your opinions, and I suspect there will be in some cases, what we need to do is to discuss these differences openly over the next several days. What we would like to achieve, if possible, is a consensus of where the industry is heading.

Talking a little bit about the format of the conference here today, there are nine panels, and each of you will participate in one of these panels. I am lucky—I get to walk around and go to more than one. There are three panels on passenger demand—domestic, international, and regional; one on airports; a panel on aircraft fleets and manufacturers; one for GA; one for business aviation; one for vertical flight; and one for air cargo. What we would like each of these panels to do is to help us make certain that we have accurate projections of the variables that affect each of the panel categories.

To provide focus, I will recite some questions that enter my mind when I think about the coming forecasts and also are of great interest to the FAA's forecasters.

First, during the past five years, I think we are all aware that there has been a very rapid rate of growth and major structural changes in the air carrier and commuter markets. How will global alliances and open skies agreements affect future air carrier operating costs and revenues? Will we continue to see low cost carriers entering the market? Will we see mergers among the majors and less or more competition? Will we open domestic routes to international carriers? Will there be continuing increases in airline productivity and lower real fares? How will regional jets affect the market?

Let's talk about airports. How will airports accommodate forecast traffic growth? What are the environmental and capacity constraints, especially in the large hubs, that we will need to consider and review for purposes of our forecasts? What are the noncapital alternatives for expanding airport capacity? There have been recommendations for increasing investment in airports, but are there any other choices?

For the aircraft fleet panel, what will be the impact of regional jets and their effect on overall activity? How will regional jets affect hubbing and point-to-point service? Will airport capacity constraints, both domestically and internationally, significantly increase the demand for larger aircraft? What will the development of super-jumbo commercial aircraft do to airport operations and the air traffic control system?

As I said earlier, we have seen a tremendous surge in GA growth. Has GA turned the corner? Clearly, resurgence is evidenced by increased GA activity at FAA facilities, an increasingly large fleet size, record shipments, and billings of a fixed-wing aircraft. Do you think these trends will continue? If so, what are the expected rates of growth? The current FAA aviation forecast for the GA fleet and hours flown is based upon growth rates that were established in this conference two years ago in 1997. Are these rates still valid?

Again, I want to emphasize that for GA forecasting, we are very dependent on the input we get from this forecast conference. It is not our only source of forecasting information. But because of the wide amplitude that we have seen in GA activity over a 20-year period, we are very dependent on your insight in helping us forecast for the future. At the 10th workshop—the last workshop—you recommended that the FAA resume its forecasting of the demand for cargo services. In fact, we did this, and last March we published the first cargo forecast that we have made in over 12 years. We are hoping to build in future years on these cargo forecasts and are open to your suggestions that you might make today about ways that we can do this, about new directions.

We rely on your efforts to answer and illuminate all the questions that I have just posed. This helps us improve the accuracy of our forecasts. Our record is relatively good, due in part to what you have contributed. So you have an important task in front of you.

To summarize, the U.S. and world economies, as well as the aviation industry, have undergone considerable change in the past several years. It is difficult to predict aviation activity only using statistical models. We recognize this and rely on the information and insights that we will get from this activity. I, and the members of my office and the FAA, appreciate the time that you have taken to be here, and I thank you for your inputs, both past and present.

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

COMPETITIVE PRACTICES: TRENDS TO WATCH

Randall Malin
Principal, Malin & Associates

The focus of this workshop is to identify long-term trends and developments affecting the future of air transportation. If you have worked on the commercial side during the past 20 years, you know that rapid and substantive change has been the norm. You also know that "long-term" often means next week. To be a forecaster in the airline industry, as I once was, requires a strong sense of humility, because the future so often follows neither the trend lines nor conventional wisdom. Thus, it is with both humility and presumption that I stand before you to share some developments and trends that I believe deserve your close attention as you try to figure out what the future holds. What are my qualifications for occupying this podium? I am neither an economist nor a futurist; I am just a former airline person. However, I have been both a participant in and a student of this industry for nearly 40 years, and maybe that is worth something. I must confess at the outset that I do not have many answers today, but I do have many questions for you to ponder. My comments will focus on four subjects: airplanes, pricing, alliances, and government policy.

Airplanes

Conventional wisdom holds that as time goes by, airplanes get bigger and they fly farther. And in recent weeks we have seen the rollout of the 767-400 and continued speculation about whether Airbus will build the A-3XX. You will not be surprised to learn that during the first 20 years of deregulation, the average stage length for U.S. airlines increased by 40 percent, from 503 to 703 miles. However, you may not have noticed what has happened to average seats per plane-mile during the same period. From 1978 to 1988 this indicator of average aircraft size increased from 146 seats per mile to 163—about what you would have expected. But in the past 10 years the average seats per mile fell back from 163 to 150. What caused this significant reversal in the trend line? What does it say for the future? Have the airlines lost sight of the relationship between plane-mile cost and seat-mile cost, namely, that as aircraft get larger, plane-mile costs go up, but seat-mile costs go down. Don't they realize that the combination of slot control, air traffic congestion, and the lower seat-mile costs of large aircraft mandate the use of bigger and bigger equipment? Or have they rediscovered the importance of frequency in preference to capacity? Are they now choosing fighters rather than bombers? If so, how long will this last? Recently British Airways announced its intention to replace its 747s with 777s in an effort to increase yield and lower costs. Does BA's decision signify the end of the airline industry's 25-year pursuit of revenue and market share? Will increased emphasis now be placed on profitability? Is BA the harbinger of an industry trend or merely an isolated exception? How do you reconcile BA's intentions with the reality of slot control at so many of the international airports it serves?

In August, United scheduled 21 daily nonstop roundtrips between Washington Dulles and Los Angeles and San Francisco. Just five of those roundtrips were flown with 747, 777, or 757 equipment. The other 16 roundtrips, or 76 percent of the total, were flown with A-320s and A-319s. Whatever happened to the old rule that once an airline has five or six flights in a long-haul market, it should increase the size of its aircraft rather than continue to add frequency?

Today's most interesting airplane development is, of course, the RJ—the regional jet. The plethora of RJ orders is reminiscent of the late 1980s, when Boeing had a five-year waiting list for its 757s and 737s. Is the RJ going to revolutionize the U.S. marketplace by bringing back linear routings and overflying the hubs? If so, what happens to the hubs? Or is the RJ merely a replacement for the consumer-unfriendly turboprops that have characterized the regional carriers' fleets? Will the pilots' unions find a way out of the mutually exclusive positions of demanding scope clauses at the majors while simultaneously trying to represent the best interests of their regional airline membership?

Will the regional carriers find the siren call of nonhub flying so attractive that they will be willing to cut the umbilical cord that now keeps them tightly tied to their major airline partners? Will they be frustrated to discover that slot control and/or lack of gates preclude service to the very destinations that medium-sized cities desire? Nonstop access to New York LaGuardia, Washington National, and Los Angeles is always at the top of these cities' wish lists. Will the price-conscious consumer be disappointed to learn that, despite the hype, the RJ is not a low seat-mile cost airplane making $69 fares possible throughout the country?

Is the current emphasis on smaller airplanes a real change in direction or merely a blip in a long-term trend line? And what is its significance for air traffic control, airport managers, airline fleet planners, and the airframe and engine manufacturers?

Pricing

Airline pricing in a deregulated marketplace is always complex and often irrational. Thus it defies generalizations. Nonetheless, I will plunge ahead. Let me start with my pet peeve. That is the use of yields as surrogates for prices by economists, by Wall Street, by the U.S. Department of Transportation (DOT), and, I'm sorry to say, by the airlines, which obviously know better. How many times have you and I been taught never to use averages to reach sweeping conclusions? But that is exactly what we do when we use yields for a city-pair, an airport, or even an entire nation to prove that things are either wonderful or horrible. Please remember four warnings as you track yield trends. First, prices are set on great circle mileage, but yields are calculated using actual miles flown. Thus, the more circuity in the routing, the lower the yield. Second, air travel is segmented into two primary categories—the price-sensitive discretionary traveler chasing discount fares and the time-sensitive business traveler who is usually stuck with walk-up prices. There are no yield data today, nor will there be tomorrow, that can identify the varying proportion of discretionary versus business traffic that is included in the average.

The third warning stems from the DOT requirement that passengers using frequent flyer miles be included in the traffic and revenue statistics. Thus, as free travel increases as a percent of total, there is an accompanying downward pressure on yields. My fourth warning relates to negotiated fares for corporations, which we call the "managed" market. These corporate discounts are increasingly being established on a net basis, that is, without inclusion of travel agent commissions and overrides in the price. Think what impact this accelerating development has on reported yields. I'll now step down from my soapbox with a quiet plea to please be careful about the conclusions you draw from yields.

One universally accepted principle in the airline business is that the discretionary market is elastic and the business market is inelastic. It is this belief that underlies the Saturday night stay requirement that has been the hallmark of market segmentation since SuperSaver was introduced in 1977. Let's roll the clock back 22 years to the introduction of SuperSaver. This event was, of course, the development that unlocked discretionary travel in the U.S. market. It was also the development that allowed airlines to accommodate business and vacation travelers on the same airplane rather than on separate aircraft as is the case in Europe and much of the rest of the world.

In April 1977 the unrestricted walk-up, roundtrip coach fare in transcontinental markets was $412. The new low SuperSaver fares were set at $227 for midweek travel and $268 for the weekend. These prices represented discounts of 45 percent and 35 percent, respectively. Look how we have progressed in 22 years. Depending on the time of the year and the sale du jour, you can find a transcontinental roundtrip fare between $300 and $400. The roundtrip walk-up fare is now over $2,000 in some markets. When SuperSaver was introduced, the walk-up fare was less than twice the discount fare. Now, depending on the time of the year, it can be five or more times the discount fare. A large part of this increased spread between walk-up and discretionary pricing has taken place during the 1990s. It raises the question of just how far the airlines can push the inelastic portion of the market. Is there a point at which the fare differential becomes so absurd that business travel stagnates or declines—even without an economic recession? Are we beginning to see signs of this phenomenon in the most recent airline earnings reports?

I suggest that you monitor a little-noticed but important development with regard to fare regulations. This is the class-action lawsuit against airlines that prohibits travel agents from issuing hidden-city and back-to-back tickets. Without going into a lot of detail, these are the techniques used by business travelers to access low fares by buying one or more discount tickets and then throwing away unneeded coupons. Ending the airline prohibition of this practice was included in one of the consumer protection bills introduced in Congress earlier this year. Think of what could happen to the price of both walk-up and discount travel should the courts, or the Congress, or the DOT decide that passengers have a right to buy a ticket and then discard any part that they choose not to use. Think about it: what other industry dictates what consumers can do with a product or service once they have paid for it?

In a well-publicized development, the airlines are embracing the Internet with great enthusiasm. This action follows their success in reducing distribution costs by both cutting and capping travel agent commissions. Now they are taking their cost-reduction efforts a step further by trying to persuade passengers to book online at their proprietary websites. They are even offering special low fares that are only available at these sites. These actions have broken the long-held promise that the ticket price is the same whether purchased from a travel agent or from the airline directly. The airlines naturally aspire to shift as many passengers as possible to their websites, thereby saving both commissions and their own reservations costs. However, there is an obvious major impediment. Airline pricing is extremely complex and the average traveler cannot be expected to comprehend all the rules and restrictions. That is one of the big reasons they turn to travel agents. Could fare simplification be the key to getting 25 to 50 percent of bookings on airline websites? Are airlines analyzing whether distribution costs saved from online booking can outweigh the revenue maximization benefits derived from complex fare structures and sophisticated yield management systems? If you are an airline manager with responsibility for both revenues and costs—not just revenues—you should be asking yourself these questions.

Alliances

Is there anything else going on in the airline world today besides alliances? I sometimes think Aviation Daily should be renamed Code Share Daily! We are, of course, at the lemming stage with alliances. Conventional wisdom and Wall Street decree that every carrier has to be in one or die. Is it a trend or just a fad? No one knows. What we do know, however, is that it is a lot easier for a CEO to enter into an alliance than it is for the marketing department to make it work. There is little question that a properly structured, bilateral, end-on-end alliance can mean significant financial revenue benefit to the partners—just look at Northwest and KLM. What is not at all clear yet is whether multilateral, worldwide alliances can offer the proverbial win-win result for more than two participants. What is clear, however, is that alliances—no matter what the benefits—are not a panacea for an airline that is suffering from uneconomic labor contracts or a bad fleet mix. In this regard it is somewhat pathetic to see the Greek government putting such a high priority on finding an alliance that will accept Olympic. That hardly seems the number one problem to be addressed.

We have all read the various press releases detailing the incremental revenue accruing to alliance participants. What we haven't seen yet is a press release that states: "Our alliance hasn't produced any new revenue." Or one that says: "We have lost millions of dollars in revenue to other carriers' alliances." The new joint fares offered by alliance partners have undoubtedly generated some new traffic for the industry, but how much? Isn't it likely that most of the so-called incremental revenue is coming at the expense of other carriers? Won't these losers now have to join an alliance strictly for defensive reasons?

It looks like there will be just four or five global alliances, each with five or more members. Is it reasonable to expect that each one of them, and each airline in each alliance, will be a winner? This is a key question because to be a participant in an alliance means that an airline must surrender some part of its sovereignty for the greater good of the alliance. I am not talking about coordinating frequent flier programs, operating at contiguous gates, or achieving the Holy Grail of "seamless connectivity." I am talking about the hard things—for instance, reallocating the aircraft resources of the alliance by having carriers pull down capacity in certain markets and increase it in others. How are such decisions going to be made? Will it be by unanimous or majority vote? Or will the big guys simply tell the little guys this is the way it is going to be? The governance issues with a bilateral alliance are challenging, to say the least. The governance issues in a multilateral alliance are truly mind-boggling.

Before an airline enters an alliance, it should be confident regarding the benefits that will accrue to it—from both an offensive and a defensive standpoint. And it should also be certain that it may not want to switch alliances in the future. The current situation facing Air Canada and the Star Alliance ought to make a number of carriers pause before committing too much of their autonomy to an alliance.

The continued evolution of alliances is something you need to monitor very closely as you assess the future. Are they going to be the cornerstone of the global airline market, or are they going to be little more than super frequent flier programs? There are two critical developments that could have a major impact on the future of alliances. First, what happens if DOT reverses itself on the subject of antitrust immunity? Second, what is the future of the alliance movement if governments change the current rules regarding foreign ownership? These two issues fall into the area of government policy, so let us move on to that.

Government Policy

I must tell you that the Transportation Research Board committee on which I recently served had major concerns regarding the way DOT has traded antitrust immunity for open skies agreements. We were not at all convinced that such a quid pro quo was in the best interest of the consumer. Does anyone other than American Airlines and British Airways believe that giving these two carriers immunity to set prices, schedules, and commissions in the New York-London market is a pro-competitive step—even if Heathrow is opened up somewhat?

With cross-border mergers and acquisitions taking place in so many industries, how long will it be before the prohibitions on foreign ownership of airlines are lifted—in the U.S. and throughout the world? Will the concept of flag carriers survive in the European Union, or will we see the type of consolidation that has taken place in the U.S. marketplace? Does the recently announced quasi-merger between Alitalia and KLM become the model for the future? And is a similar arrangement between Northwest and Continental in the offing? Will the ultimate shape of alliances mean that two or more carriers merge their general office, sales, reservations, and airport customer service functions but leave the pilots, flight attendants, and mechanics in separate operating companies?

Another key policy issue is slots. Few, if any, new airports will be built in major cities in our lifetimes. Nor will we see many new runways at most congested airports. This means that airport access restrictions will continue to be a challenge facing airlines and governments, even if all air traffic control constraints were to magically disappear. What are aviation authorities going to do to ensure that slots are assigned to those airlines that will use them to benefit the greatest number of consumers? In the U.S. slots are being hoarded and underutilized in order to protect grandfathered slot holders from competition. When I last checked, commuters were flying 31 percent of the slots at LaGuardia, substantially more than the 23 percent they have been allocated under the High Density Rule. Our TRB committee felt very strongly that it was past time for Congress and DOT to abandon the 30-year-old slot program and to replace it with a congestion pricing approach that promotes maximum competition at restricted-access airports.

A current hot policy issue in the U.S. is the one of controlling "predatory behavior"—the usual charge being an incumbent carrier flooding the market with low-fare seats in order to drive out a new entrant. Our committee didn't question that there had been some instances of aggressive behavior against new entrants. However, we had difficulty buying into the excessively regulatory solution being proposed by DOT. In fact, we could not reach agreement on whether DOT should be dealing with alleged predatory practices at all. In my opinion—and I stress that this is not the committee's view—if DOT really wants to do something to level the playing field for new entrants, it should not try to regulate the pricing and scheduling responses of the incumbents. Rather it should focus its attention on frequent flier programs, commission overrides, gate access, slots, and the misuse of CRS information to discipline travel agents.

DOT tends to define the consumer as the price-sensitive discretionary traveler. It issues many statements touting the benefits to the economy from the spread of low-fare carriers. What it is actually talking about is the unique phenomenon known as Southwest. Southwest is everybody's darling, and rightfully so. It is like the Energizer bunny—it just keeps going, and going, and going. There are two developments to watch. First, will any new entrant be able to replicate Southwest's record of success—either in the U.S. or in Europe? Second, will the current airline-within-an-airline experiments at Delta, United, and US Airways be able to compete with Southwest, or will these experiments go the way of the B scale? Is the airline-within-an-airline concept the only solution to competing with Southwest? If so, how great a percent of the big carrier's operation can it become?

I cannot close without highlighting one other development to watch: the high-speed train. Just imagine the impact a bullet train could have on the problems of congested airspace, restricted airports, and scarce gates in the Boston-New York-Washington corridor. But don't hold your breath. After nearly 40 years of waiting for the bullet train, I have decided to take the Shuttle!

PROPOSITION RJ

William Swelbar
GKMG Consulting Services, Inc.

It is a real pleasure for me to have been invited to speak with you this morning regarding a study that we made, the report of which was published in May 1999 as Proposition RJ: An Alliance to Enhance Airline Competition.

There is an awful lot of speculation out there as to why it is that we did this. As you heard in my biography earlier, much of my career has been spent working on behalf of labor. As a consultant, that should be very important. As a result of this study, I'm not sure I'm on any labor group's "A" list to be doing work in the future. And it is a sacrifice that I feel very strongly about. One of the reasons is that much of my work with labor has been done when an airline has been in a distress situation. We've worked as advisors to labor during those negotiations. But I've never understood how it is that you can be sitting at a negotiating table, taking money out of your pocket, and in return you are probably getting stock or some flavor of equity and then in the other room there is a group of lawyers writing scope language that limits your ability to compete, and therefore somehow that artificially affects the risk/reward ratio.

It is the regional jets and competition and the networks that have access to them, and the networks that don't, that I think is really the issue. While scope clauses are written for a lot of good reasons, they are hindering a company's ability to compete when the competition has access to this tool and your carrier does not. I think you have to ask the question, Have I not put more jobs in jeopardy long-term by having this limiting language than by allowing my company to have a sufficient number in order to meet the competition head-on?

In May 1999, just before the RAA convention and just before we released our report, an editorial appeared in Airline Business entitled "Time to Talk About the Scope Clause." Karen Walker really got focused on the subject very quickly, and this whole issue questioning labor-management issues she called taboo—one that has been avoided in the past. But it is time to talk about it. It does have an effect on all of the things that Randy talked about earlier—whether it be the regional jet and how it is going to be used in the future, and certainly alliances, labor is a player, and they have a lot of concerns on where it is that those jobs are going to be and who is going to do the flying, and all those rightful questions. I think any of us doing any forecasting have to recognize that labor is, indeed, a force. They are a lot of bright people and they have issues that we need to listen to and will certainly affect the ultimate outcome.

Most of labor's recent response to our study has been that we are a solution looking for a problem. I think it is a clever statement and we agree that there is a solution to this and that there is a problem. Any time we have picked up the press in the last few months and with many of the actions by Atlantic Coast just in the last couple of weeks, it certainly underscores the issue of the constraints that they face as a company and how it is that they are choosing to deal with them as a corporate entity.

Since 1992, the number of city pairs and the numbers of cities receiving regional jet service have grown at a tremendous pace, as evidenced by the slope of the curve in Figure 1. I think we can all expect that this trend will continue into the future and certainly there have been changes since the report was released in May.

But despite the fact that the slope of the growth line is steep, the regional jet accounts for less than 6 percent of all airline departures and about 3 percent of the seats that operate in the domestic system today—not significant, despite all the growth (Figure 2).

This is where we begin to define the "have" and the "have-not" networks. When I talk about "have" and "have-not" networks, the "have" networks are those that have significant access to regional jets and very few limitations in their respective scope clauses. The "have" networks for purposes of our discussion are Delta, Continental, and America West. Throughout the study, we are really talking about the major network carriers. As we would expect, the "have" networks operate about two-thirds of the service out there today in terms of cities and city pairs and departures (Figure 3).

Historically, and in a very short summary, I will try to catch up from May when we released the report. RJ flying is hub concentrated (Figure 4). The way we have approached this analysis is that this trend and this hub concentration will continue into the future. Part of the reason for looking at this that way—and there are some pieces that we can agree with and some we can disagree with—is that we were trying to take 15 years of labor sensitivity and to appreciate where it is that labor would be most comfortable in seeing regional jets used versus a lot of point-to-point flying. A lot of the questions that Randy Malin posed fall under how point-to-point flying is going to evolve, while appreciating that it is going to be something that will make some of the labor groups very uncomfortable. We really have taken a hub-oriented focus.

So what has happened since the release of the report? The idea is to take a look at the expansion in service and at those services that have been hub-directed (Figure 5). Of the services that have been introduced since May, 95 percent are still directed toward the hub. There is one exception—US Airways. Only 11 percent of its segments have been directed toward the hubs. The remainder of that service is going to LaGuardia Airport. They have really chosen to do something very different with the regional jets that they now have access to.

Also shown in Figure 5 are the new markets, where it is that regional jets have exited and have been redeployed in other markets—markets where we have witnessed increased frequency and where we have seen frequency decrease. So the focus here has been, as expected, on new markets and increased frequency in existing markets, confirming the historical deployment shown earlier.

Figure 5 is shown for a reason I'll just be honest about. We took a lot of abuse on this, that all this airplane is going to do is to be used in big markets. That is what it does. It serves big markets—hubs. Markets referred to in the study were based on the FAA definition of a non-hub, a small-hub, and a medium-hub market. When you take a look at the cities that are receiving regional jet service, it is the small- and the non-hub markets that have benefited. They have really seen the quality of their access to the air transportation system improved as a result of this airplane.

Lo and behold, even in the small-hub markets, we see city pairs where we have RJs competing with RJs. I think a lot of the idea is that the market can only sustain one service or multiple frequencies to one hub, and that doesn't seem to be the case, at least on the basis of analysis of the data today. These are markets that have seen growth, that the consumer chooses to use. They like the regional jet and it is now an alternative for them. Again, we have seen growth, and I think the competition reflects that the regional jet can be profitably used in smaller and medium-sized markets (Figures 6 and 7).

The big issue for labor today as regional jets come into the system is whether they take flying away. What our analysis shows is that the strong majority use of the regional jet has been to add new service and to replace the turboprop and that there has not been a significant loss of mainline flying (Figure 8). Just what has been the mission of the airplane? Thirty percent have been to start new service and the mainline naturally benefits at the hub.

An example that we used in the study is an announcement that Delta made in April, in which the mainline was going to be taken out of shorter-haul routes—Daytona Beach, Melbourne, and Tallahassee in Florida and Albany, Georgia, and Montgomery, Alabama—they dropped frequency. At the same time, those aircraft were redeployed and the mainline pilots benefited from longer-haul flying to points in the West—San Francisco, Los Angeles, Denver, and San Antonio. The net benefit to the Delta mainline pilot was a gain of 10.5 block hours per day. A gain in block hours creates net new pilot jobs as manpower requirements are dictated by flying time (Figure 9).

When Atlantic Coast got its first regional jets and announced service from Dulles to Nashville, we saw a tremendous stimulation of international demand using the Washington Dulles gateway. In fact, number of passengers went from 500 a year to over 3,500 with the initial introduction of the airplane. The folks in Nashville had access to a new gateway and a carrier that held a fairly insignificant presence in that city (Figure 10).

Where do these airplanes operate? They operate in local markets that, for the most part, have fewer than 100 passengers per day each way (PDEW). These are not markets where the mainline can put a 737 in three times a day and be competitive or economic. There has been much discussion of this airplane's replacing the mainline jet—and it's true. A lot of the markets where the regional jet is flying today are those markets that were dropped by the mainline during the last recession and the Gulf War, when we saw the systems weaned for the most part. Today the airplanes are properly sized to go back, reenter those markets, and enjoy the benefits at their respective hubs (Figure 11). Figure 12 shows what happens if there is reduced mainline frequency or the mainline jet service has been supplemented by a regional jet once a day. For example, go back to the Delta example where they dropped frequency to Melbourne, Florida. The fact is that the mainline financial performance in that particular city pair tends to improve and accrue benefits to the mainline carrier. Delta's numbers, for example, would look significantly better going from three frequencies to two in certain markets and not really skip a beat in terms of revenue and traffic generation.

Another way to look at this, as Delta cited in its press release with Atlantic Coast, is to look at Cincinnati. Comair is the carrier that has used this airplane the longest and gives us the best empirical look at what has happened. The Delta mainline pilot is correct when he or she says that our flying is not growing at Cincinnati. What Comair has done is to augment the rapid expansion of flying at Cincinnati by Delta mainline by bringing the regional jets on board. Today, that hub is well protected by regional jet service and is, in fact, the only city that can actually state that it has jet service to every point served nonstop from that hub.

While Delta mainline may not have continued to add services to Cincinnati, what it was enabled to do was begin to redeploy and redirect those assets to do other things. You really saw Cincinnati and Delta's mainline service stop growing at Cincinnati in 1996—the same time that they were negotiating a new pilot agreement—the agreement where they negotiated Delta Express and began to focus their energies elsewhere. While Cincinnati is flat, Delta Express added 36,500 block hours of flying to the Delta system, and the Atlanta hub grew by 53,000 block hours—a significant amount—despite the fact that Delta Express was specifically designed to overfly the Atlanta hub. This is where you do see growth in the system. It may not be at Cincinnati, but those assets are able to be redeployed as this network is secured by use of the regional jet. That is a competitive benefit that accrues directly to Delta and then gives them advantage over their competition (Figure 13).

As Comair began to bring the RJs on board to support Delta's network, we found that 3,300 new PDEWs were brought to Cincinnati by the Comair system in new markets or markets where the regional jet replaced the turboprop. You bring 3,300 new passengers a day and these are passengers who now connect to longer-haul mainline services. It is a definite benefit. The average hub stimulation in markets where Comair operates regional jets is 57 percent.

Again, to restate the basic concept, in those spoke cities where the regional jet operates, Delta's assets can be redeployed and used on other parts of the network. You really saw Delta's presence increased at those spokes. Passengers were either redirected to Atlanta or were put into the Delta Express system. We found an increase of almost 10,000 new PDEWs generated as a result of the redeployment of those specific assets.

This is how we approached this study. We modeled every carrier network, every hub, in order to make our determination of the number of regional jet opportunities for each specific hub for each network. I think it is important for this group that I discuss the criteria we used for markets: only spoke-to-hub routes, stage lengths of 900 miles or less, circuity of 140 percent or less, markets with reported network PDEWs of 100 or more, partner or mainline network connections only (no regional-to-regional connections assumed), modest stimulation of markets where there was minimal competition, and markets with no nonstop jet service, with turboprop service, or with less than twice-weekly jet service.

Regarding each of the assumptions made, there is a sensitivity to labor in every one. The idea was not to replace mainline jets. The idea was to make each network stronger and make it competitive vis-à-vis, in Delta's case, United, or in US Airways' case, Continental or Delta—those carriers that do not have unlimited or reasonable access to match the opportunities in their system.

A major question for labor should be competition and how does that translate into jobs? Does it make sense to write language that limits my carrier's ability to compete? If I bring more people to my hub, I need more 757s, I need more 737s to carry people to their ultimate destination. So what we did is take a look at those networks where we saw the greatest number of opportunities. What we found, in terms of decreasing order and based on the potential number to feed to that hub each day, was as follows: United currently limited to 65 regional jet units; US Airways currently limited to 30; Northwest currently limited to 54; Delta, unlimited; and American, unlimited on the lower end but some limits on the higher end in terms of seating capacity (Figure 14).

The point is that, at present, United and US Airways are significantly scope-clause constrained. Over the long term, a large number of opportunities can accrue to those carriers. If they don't get there, someone is going to, and will benefit at the others' expense.

To illustrate this, we looked at the hub and we looked at market sizes. Again, our view shows some sensitivity to labor. We see the greatest number of opportunities accruing to the regional jet aircraft at 50 seats or less. I know I have an esteemed colleague or two in this room who have some different views on regional jet aircraft that have larger configurations, and those views are correct. But what opportunities I think are obtainable in the U.S. in the near or medium term, and considering labor, are going to be found in smaller-size jets.

With Delta, we still see a tremendous opportunity to build Cincinnati. What we know is that Comair is contemplating a very large order for airplanes in the 37-seat category, and I think that is exactly what this analysis says—that there is still a way to continue to grow there. There are other constraints that you will have to discuss as to whether you can continue to build Cincinnati to this level. However, the fact of the matter is there are still a number of market opportunities that can accrue to the Delta network (Figure 15).

When we analyzed the Northwest network, Memphis was the number one regional jet opportunity among U.S. carrier hubs. Prior to the release of our study, Northwest had just completed its contentious pilot negotiations, gained access to 54 regional jet units, and announced that 42 of those 54 units were going to be used to build its Memphis hub. We think that there is tremendous opportunity for Northwest. This summer it added a fourth connecting bank, which I think says that Northwest is focused on doing some buildup of that tertiary hub (Figure 16).

When we did this study, we anticipated that USAirways probably had some terrific opportunities available, but I had no idea that there were so many. In terms of adding new cities or seeing city pairs improve by use of the regional jet, we estimated 268 new route opportunities available to the US Airways network. Remember that I said earlier they were constrained to 30. So there is a significant number of opportunities available to US Airways today that it cannot satisfy as a result of these scope-clause constraints (Figure 17).

It is my understanding that US Airways and its pilots are meeting outside of normal negotiations, or Section 6 negotiations, with the regional jet issue being front and center in those negotiations. It is a fairly significant event when you have scope negotiations outside of normal negotiations. US Airways has asked its pilots for 422 regional jets of all flavors, meaning from 30 seats to 90 seats—a large number.

I think that the issues at United are really underscored by Atlantic Coast Airline's recent decision to do business with Delta. The United system is limited to 65 units today. There are more than 65 opportunities available to United at Washington Dulles alone, but those 65 opportunities don't just accrue to Atlantic Coast; they accrue to Sky West, Air Wisconsin, and other carriers in the United network. Therefore, Atlantic Coast found a partner that had no limits and where they could, as a company, enjoy the benefits that the regional jet brings to it and will now work for two partners, not just one. United and its pilots are in negotiations today. For United, we estimated 232 opportunities to that network and United has asked its pilots for 284 (Figure 18).

This scope issue is not a big one. It is a carrier-to-carrier, network-to-network issue that hasn't been quantified. It has been talked about, but it hasn't been quantified and made public. We have not provided qualitative, anecdotal evidence. Based on our assumptions, we estimate some 800 market opportunities that cannot be satisfied given the current scope-clause constraints (Figure 19).

Those that are unconstrained, of course, can order all the jets they want, but those three networks are not going to satisfy all of the issues that are important to consumers and cities in all regions of the country—it cannot happen because of the geographic bias of our hub system.

You have three carriers that are unconstrained—Delta, Continental, and America West. The point is that they can continue to add regional jets without limits, and the fact of the matter is that each one of their respective hubs becomes stronger against the competition every day, and those hubs very much overlap the competition.

Figure 20 represents the whole issue of feed. If the unconstrained carriers continue to add, who gets hurt? We see US Airways getting hurt, specifically the Pittsburgh hub. We see United being number two, with Dulles losing the greatest number of opportunities. This was just a very simple matrix that said the first guy in takes away the opportunity from a potential competitor. We know there is competition at these spokes, but the fact of the matter is there is a benefit that accrues to the first competitor in.

When you lose that feed, somehow it converts to jobs. What our analysis shows is that the most potential job loss is to the United pilots, primarily because they fly bigger equipment, and secondly to US Airways (Figure 21).

To carry the argument further, if the next currently constrained carrier expands the RJ limit and begins to add more regional jets, who would get hurt? The matrix in Figure 22 shows how the respective networks overlap.

Finally, we close with how this idea started and the fact that our effort has been funded partially by a group of airports. We went out to visit carriers to present market opportunities. What we heard a number of times is, Yes, the service certainly can support a regional jet. The problem is we only have access to so many. So you may get one; or you may not get one. Communities want them. It is not very complicated. Fargo, ND, where we saw United add service to both Denver and Chicago hubs, opened up a number of new markets and, more important, helped to compete with the monopoly service received by Northwest over its Minneapolis hub (Figure 23).

If you look at the service that Northwest offered over the Minneapolis hub on this monopoly service prior to entry, it offered service to 115 on-line city pairs. When they added Denver, we saw 40 new city pairs added. So now Fargo has access to 155. By the time to you add Chicago to the mix, the number grows to 201 on-line city pairs (Figure 24). The consumer in Fargo definitely benefited from the addition of these two services.

But, more important, of the original 115 monopoly city pairs, 80 now receive competitive service and that is really the issue in the longer term. I am not going to make any wide-ranging prediction on price because we all know, as Randy Malin said, that the regional jet is not the panacea for price, but competition is good, and this technology that enables hub and network competition should not be constrained.

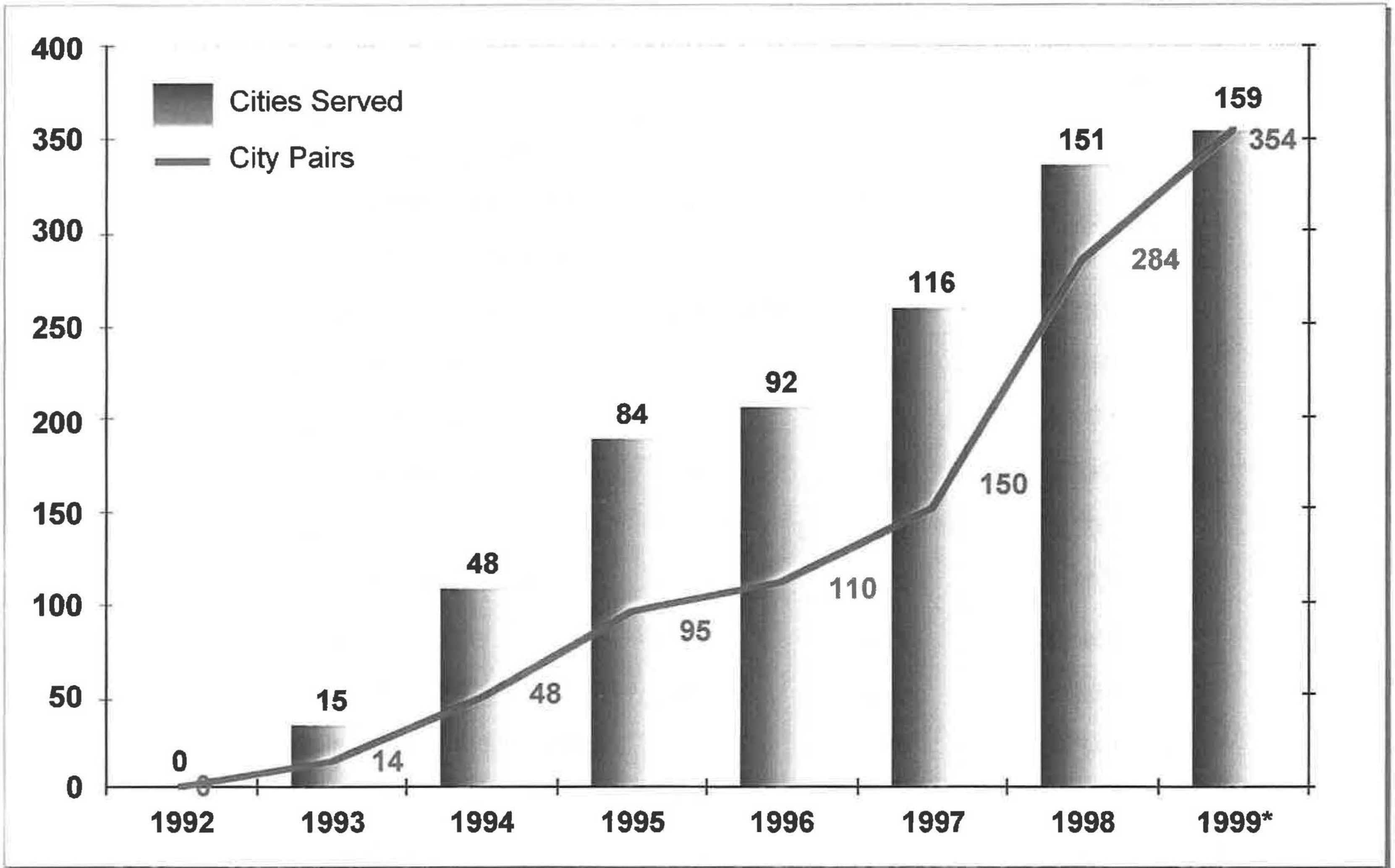


FIGURE 1 U.S. cities served by RJ aircraft [source: Official Airline Guide (OAG), North American Edition, 2Q'99].

Carrier	Code-Share Partners	Daily RJ Departures	Daily RJ Seats
Air Wisconsin	UA	22	1,100
American Eagle	AA	175	8,742
Atlantic Coast Airlines	UA	109	5,470
Atlantic Southeast Airlines	DL	155	7,764
Comair	DL	537	26,865
Continental Express	CO	212	10,603
Mesa Airlines	US/HP	144	7,203
Mesaba Airlines	NW	144	12,240
Midway Airlines		72	3,634
Skywest Airlines	DL	79	3,949
Trans States Airlines	UA/TW/DL	30	1,487
Total Daily RJ Departures		1,679	89,057
Total Daily Domestic Departures		30,454	2,882,139
Daily RJ Departures as % of Daily Domestic Departures		5.9%	3.1%

FIGURE 2 Airline departures and domestic seats accounted for by RJs (source: OAG, North American Edition, 2Q'99).

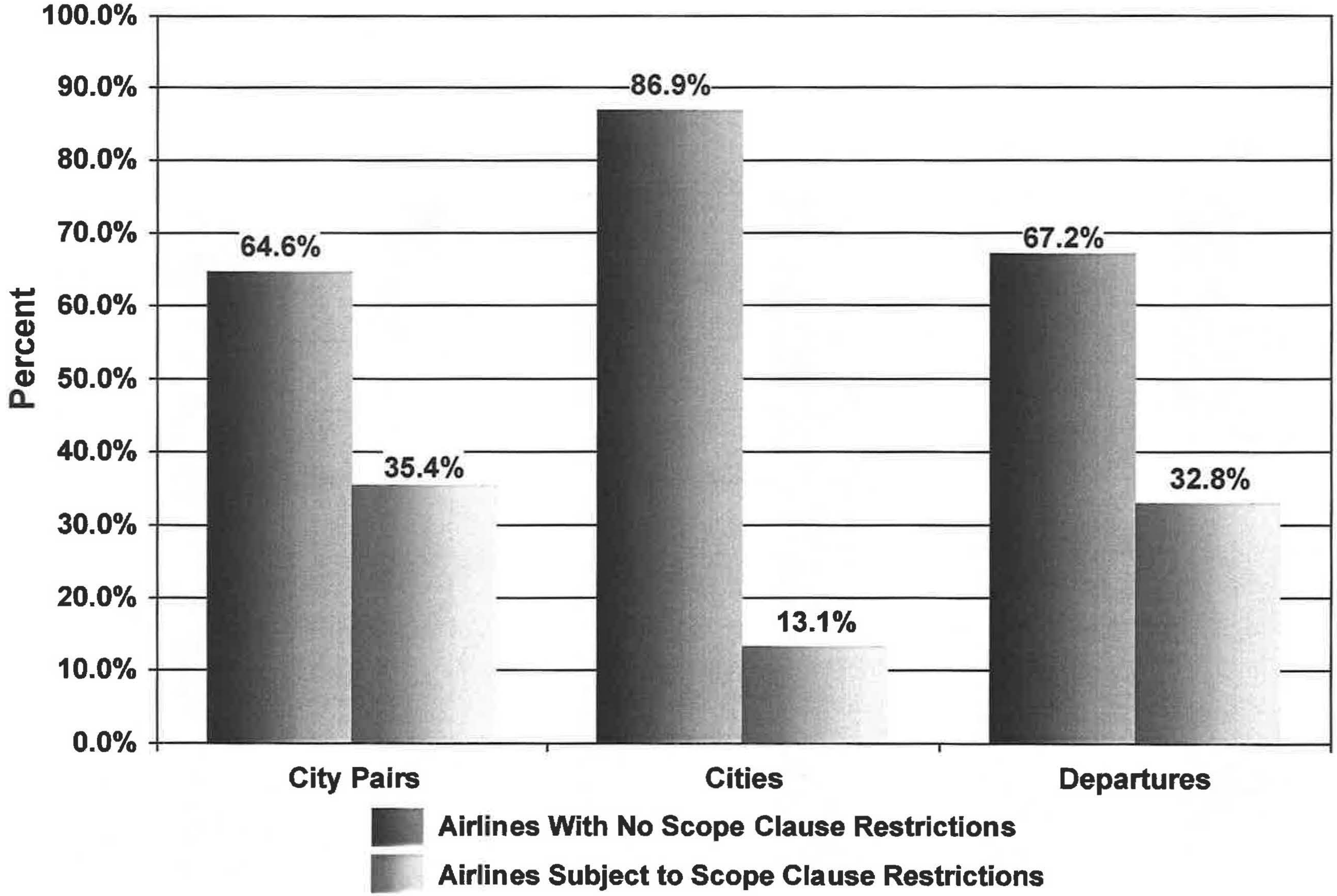


FIGURE 3 Carriers deploying RJ service: "have" and "have not" networks (source: GKMG analysis of OAG 2Q'99).

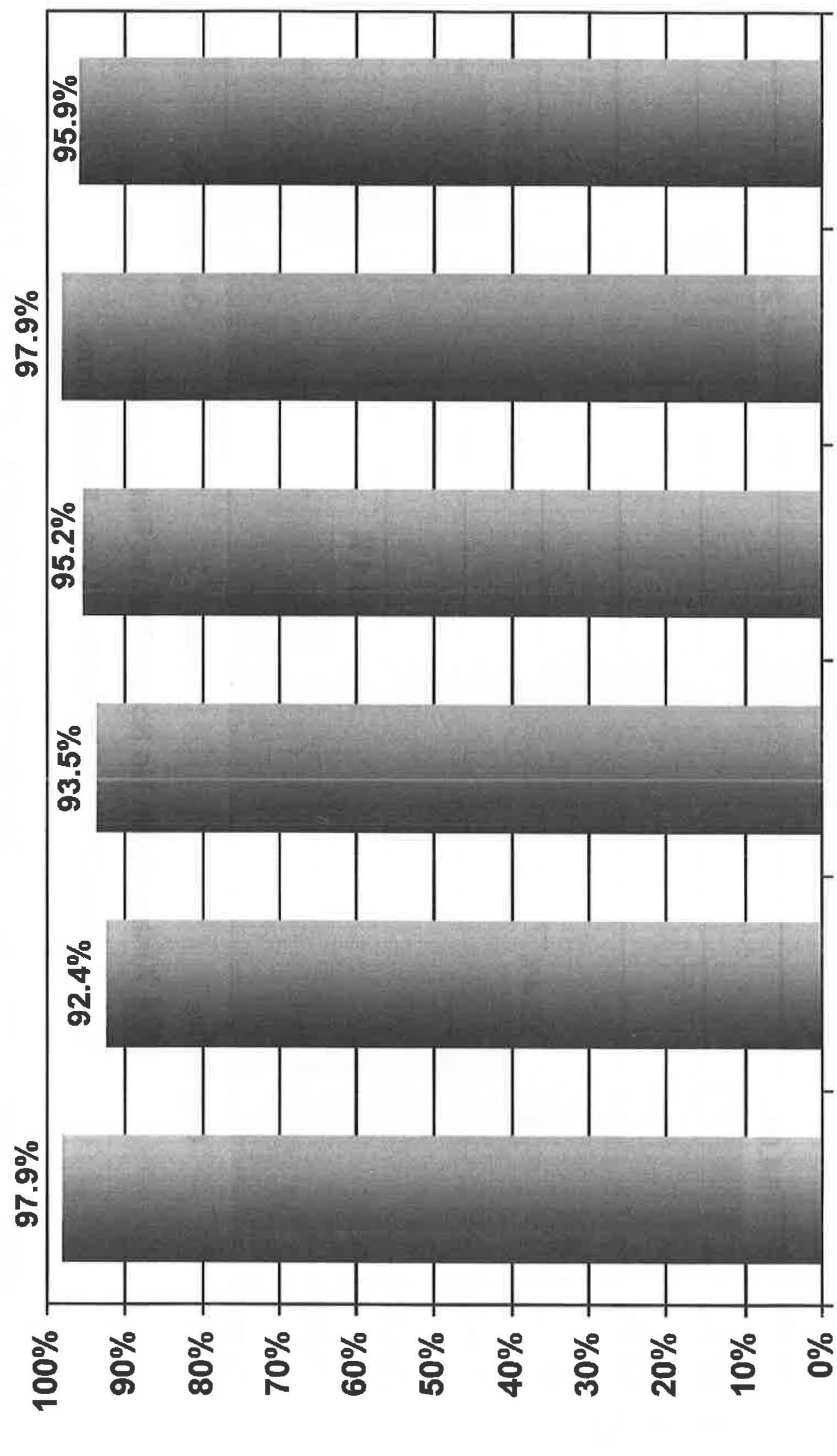


FIGURE 4 Hub flying by RJs (source: GKMG analysis of OAG 2Q'99).

	Percent of changes in RJ flying involving Hubs	Type of change in segments served			
		New	Exit	Increased Frequency	Decreased Frequency
America West	100%	8	2	4	—
Continental	100	35	6	24	—
Delta	88	22	14	43	19
Sub-Total Unconstrained		65	22	71	19
Sub-Total Percent		37%	12%	40%	11%
American	95%	10	10	16	2
Northwest	100	9	6	26	6
TWA	—	—	—	—	—
United	100	—	2	12	8
US Airways	11	23	—	10	12
Sub-Total Unconstrained		42	18	64	28
Sub-Total Percent		28%	28%	42%	18%

FIGURE 5 Developments since release of GKMG report in May 1999 (source: GKMG analysis of 3Q'99 regional jet schedules as compared with those in 2Q'99).

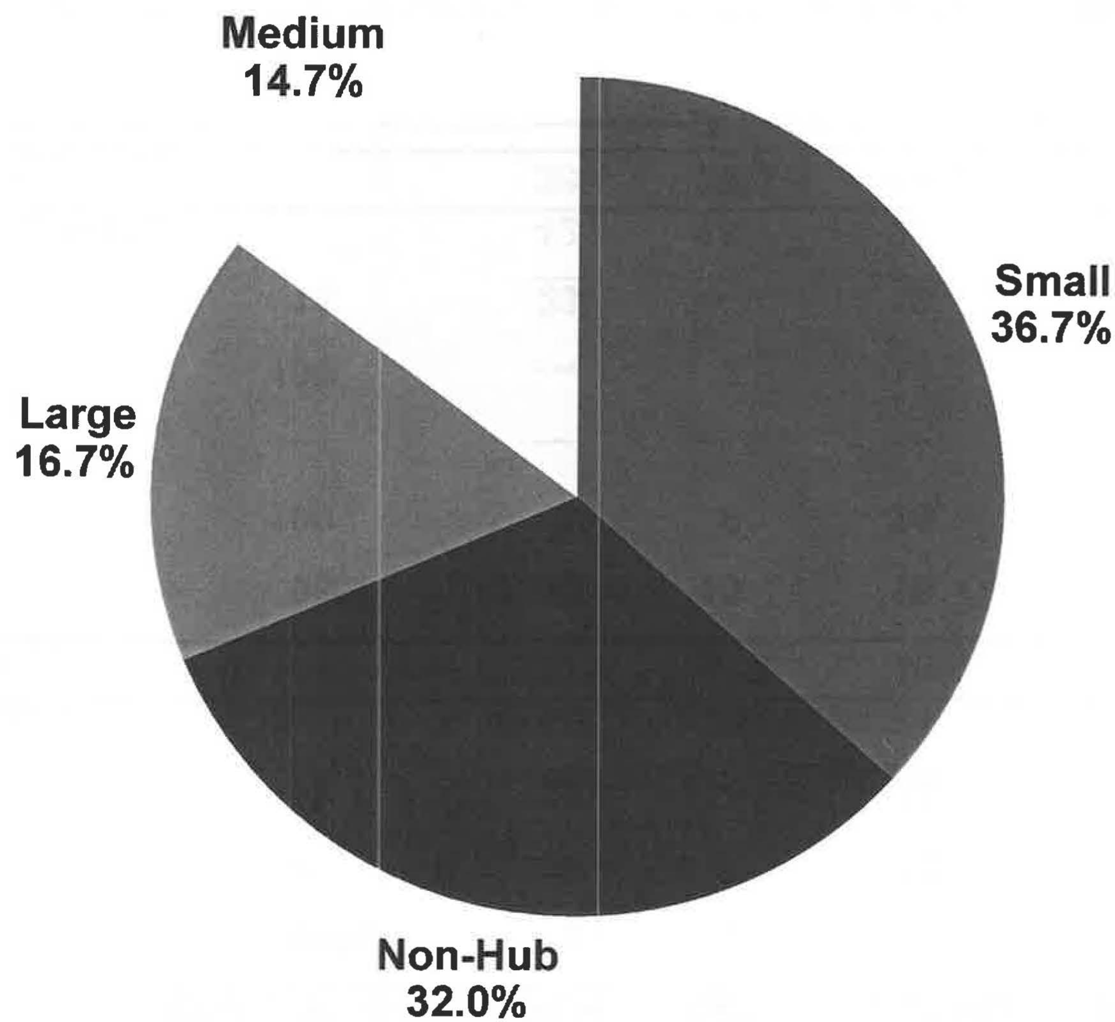


FIGURE 6 Percent of airports with RJ service grouped by airport size (as defined by DOT on basis of share of U.S. enplanements) (OAG, 3Q'99).

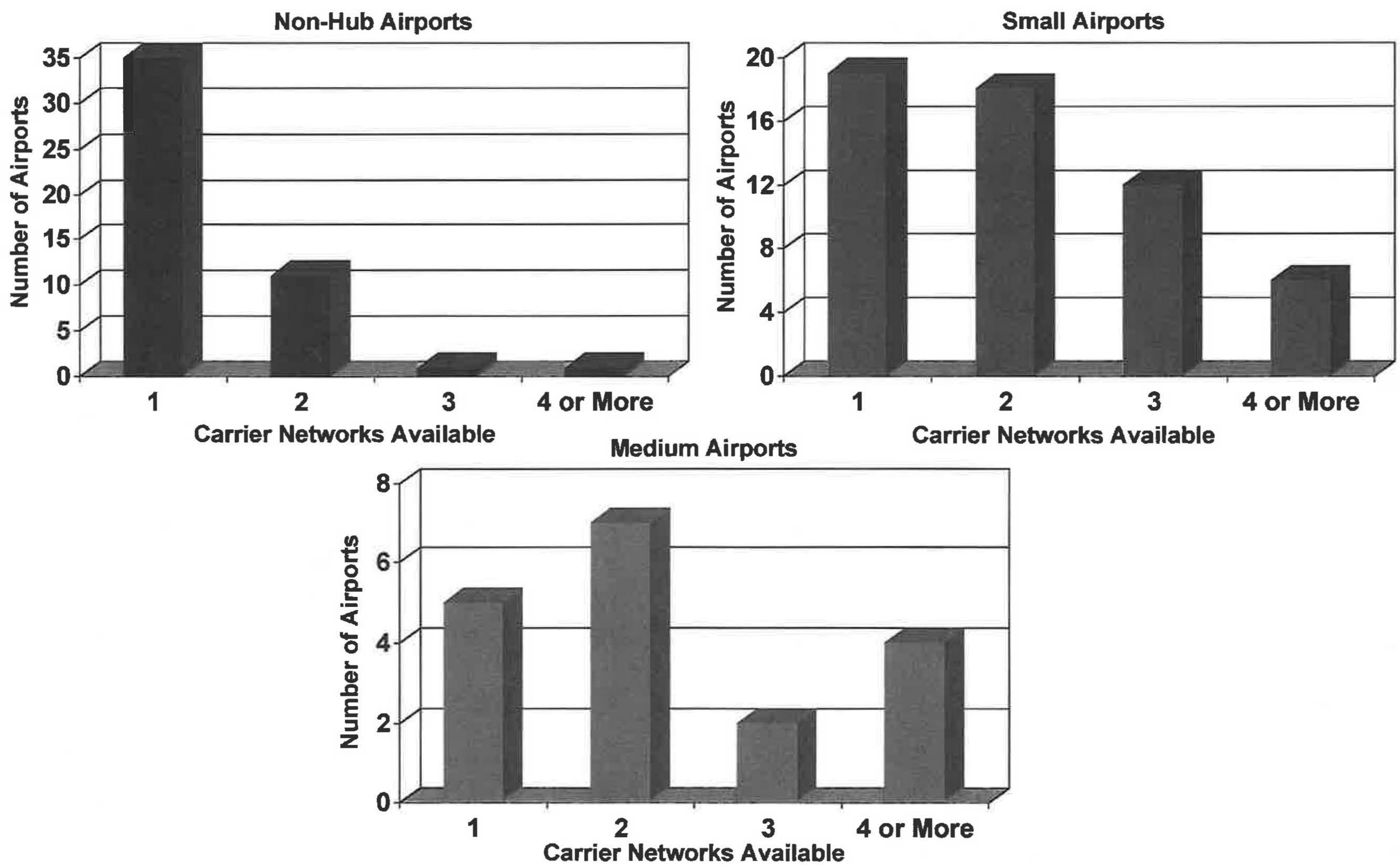
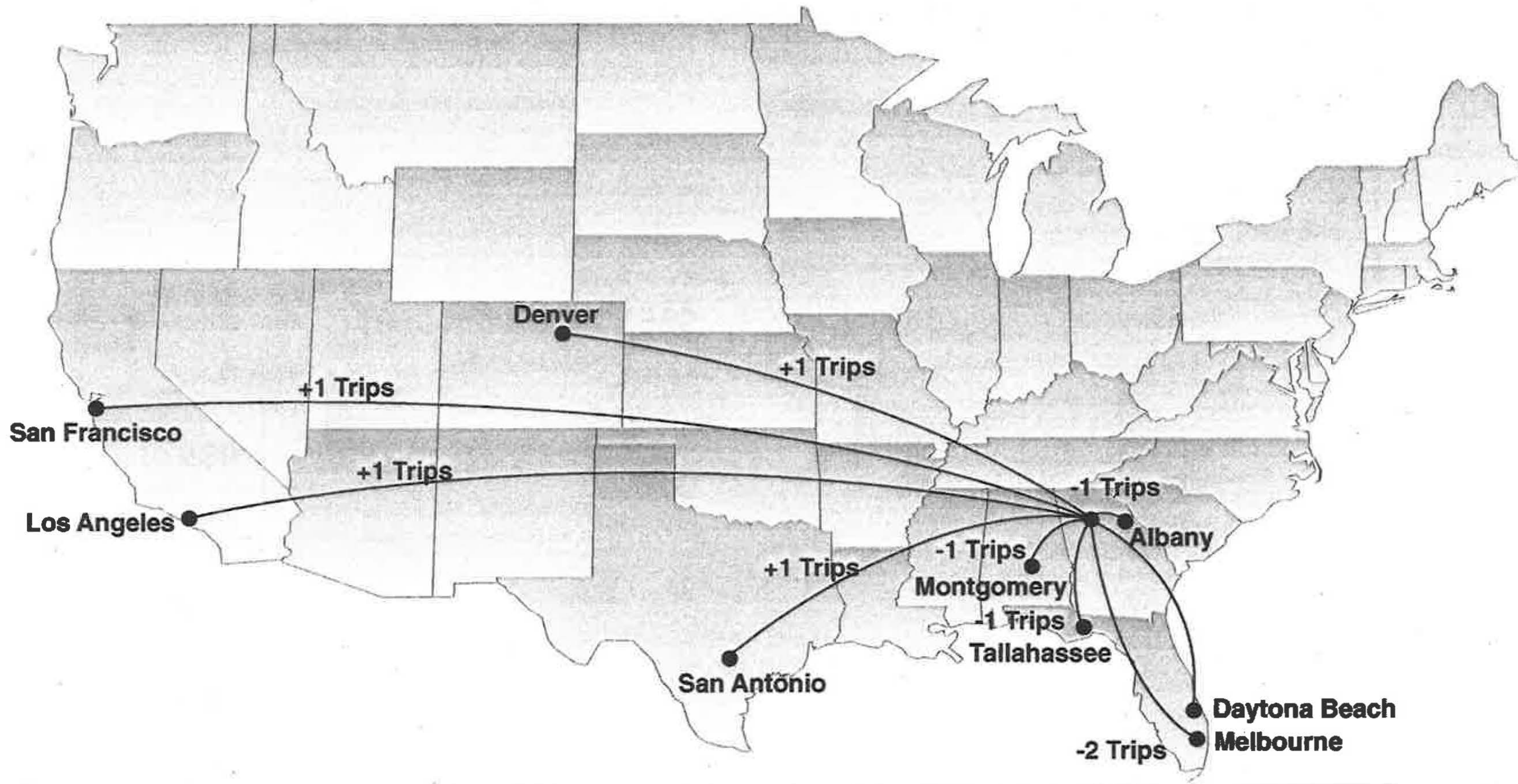


FIGURE 7 Carrier competition via RJs at spoke markets.

Carrier	New Service	Replace Turboprop Service	Supplement Turboprop Service	Supplement Jet Service	Supplement Turboprop and Jet Service	Replace Turboprop and Jet Service	Replace Jet Service
American	36%	14%	45%	5%	0%	0%	0%
America West	46	-	15	31	0	0	8
Continental	37	-	15	24	4	0	20
Delta							
ASA	14	4	57	11	7	0	7
Comair	27	12	21	20	7	2	11
Skywest	12	4	8	30	12	0	34
Northwest	15	0	2	39	42	0	2
United							
Atlantic Coast	46	13	25	8	8	0	0
Air Wisconsin	100	0	0	0	0	0	0
TransStates	72	0	14	0	14	0	0
US Airways	50	0	39	0	0	0	11
TOTAL	30%	6%	21%	23%	10%	1%	9%

FIGURE 8 New flying created and mainline operations replaced by RJs (source: GKMG analysis of OAG 2Q'99).



Summary

Trips Lost to Mainline	7	Trips Granted to Mainline	4	Difference 10.9	Mainline Block Hours Granted by Mainline
Block Hours Lost	16.3	Block Hours Granted	27.2		

FIGURE 9 Significant jet block hour gains due to service adjustments using RJs.

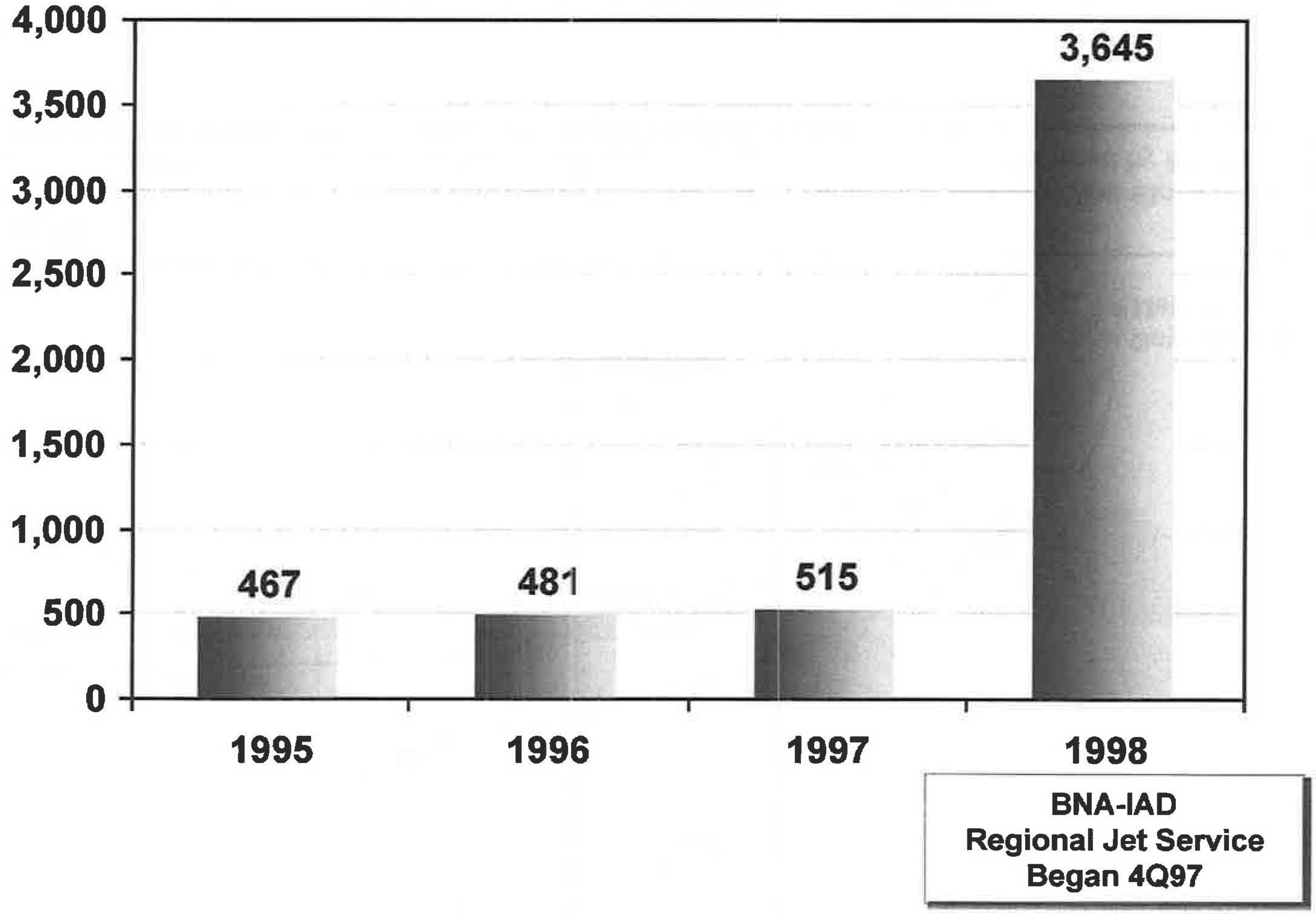


FIGURE 10 Benefit to mainline operator's international service from use of RJs: Nashville passengers using United via Dulles to Europe, third quarter, 1998 (source: DOT, databank OD1A).

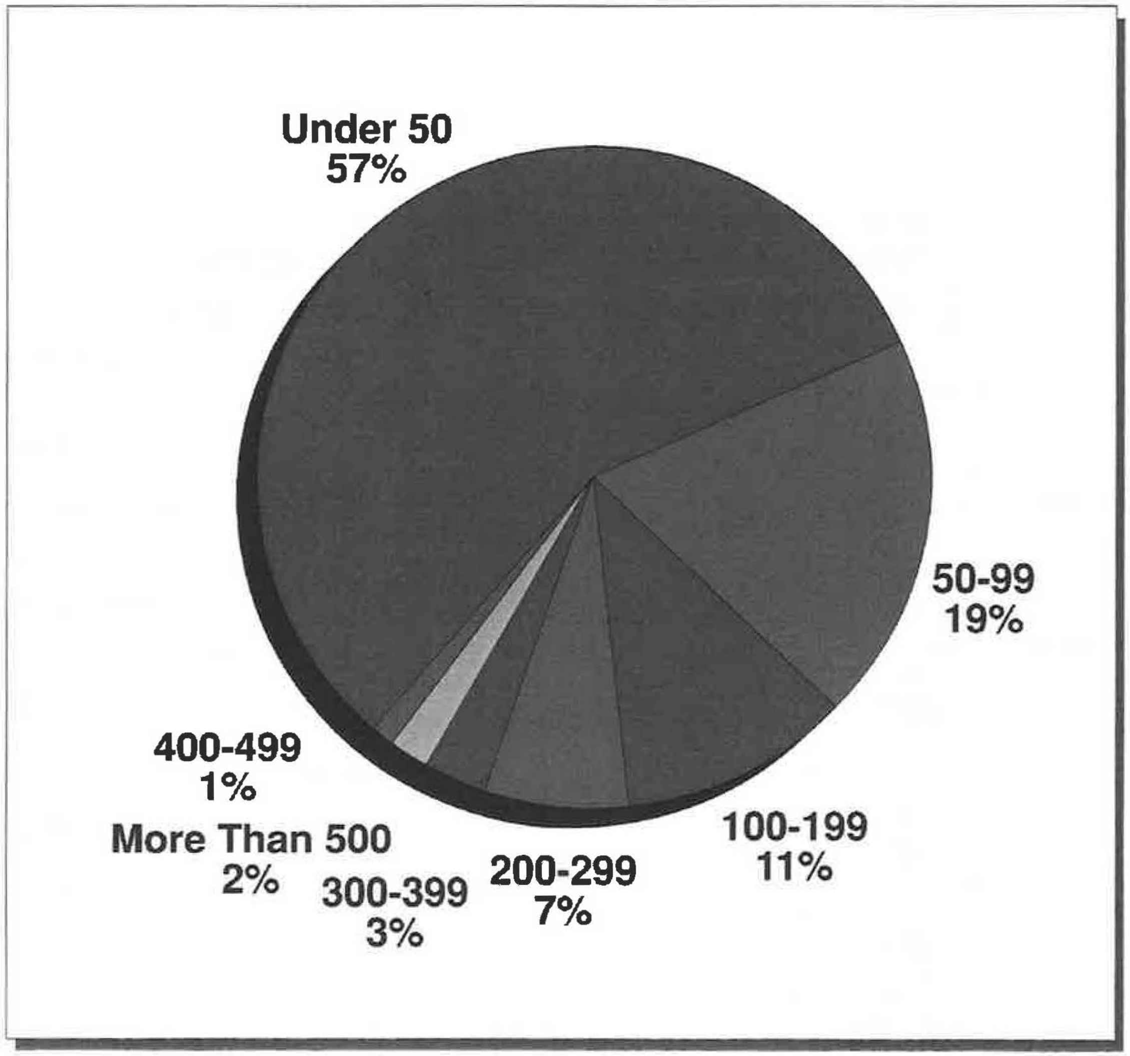


FIGURE 11 Operation of RJs in city-pair markets too small to sustain mainline jet operations (source: DOT OD1A adjusted for regional/commuter carrier participation for city-pairs receiving RJ service).

	Local Market PDEWS	Mainline Load Factor	Local Market Yield
New Service	↑	NM	NM
Supplement Jet Service	↑	↑	↑
Supplement Turboprop Service	↑	NM	↑
Supplement Both Jet and Turboprop Service	↑	↑	↑
Replace Jet Service	↑	NM	↑

Note: NM is Not Meaningful

Regional Jet Service Enhances the Profitability of the Mainline Network

FIGURE 12 Stimulation of markets and strengthening of remaining mainline markets by RJ service (source: GKMG analysis of DOT databank OD1A as adjusted, Schedule 298C, Carrier T3 Reports and Carrier T-100 Reports).

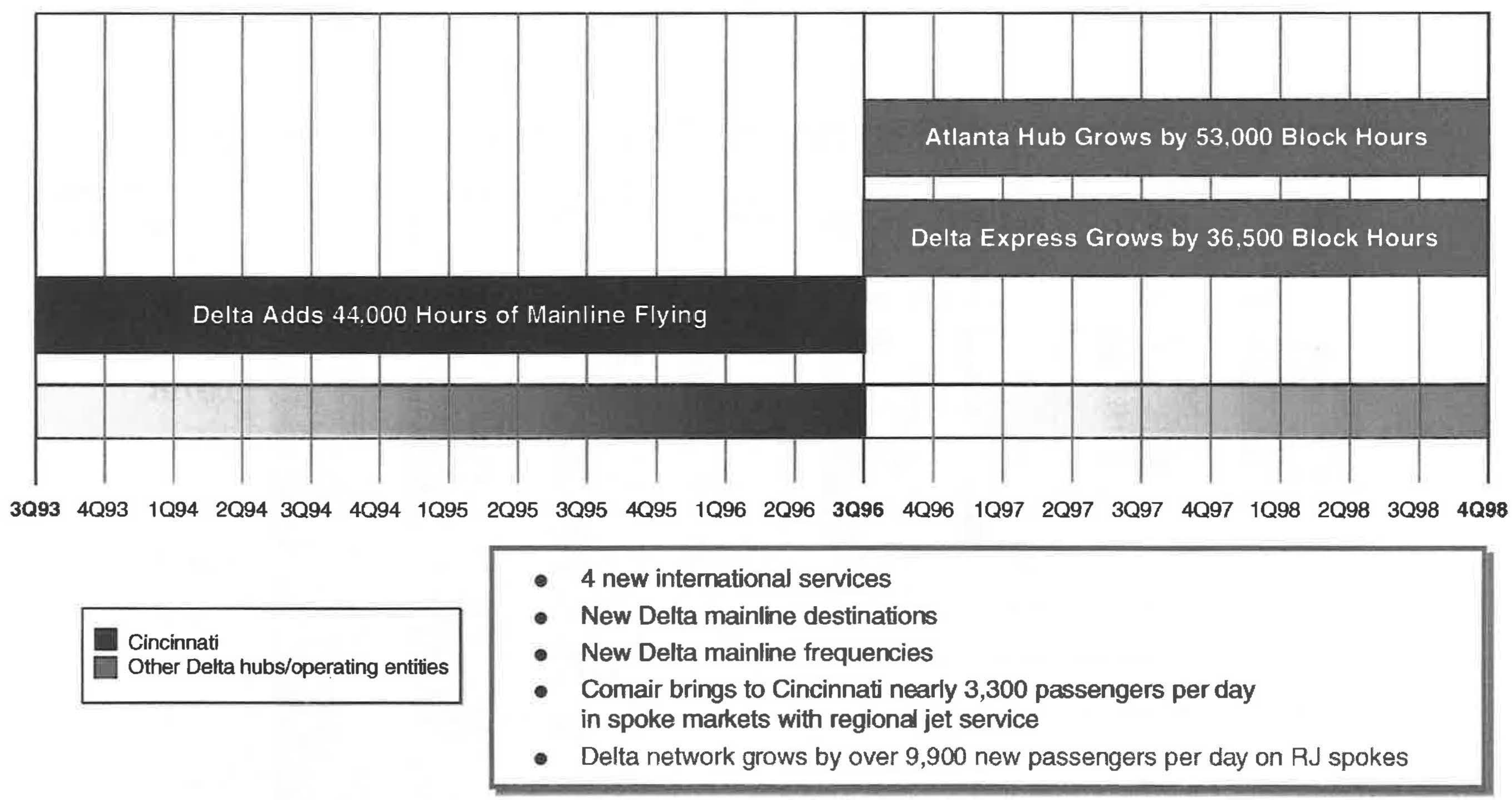
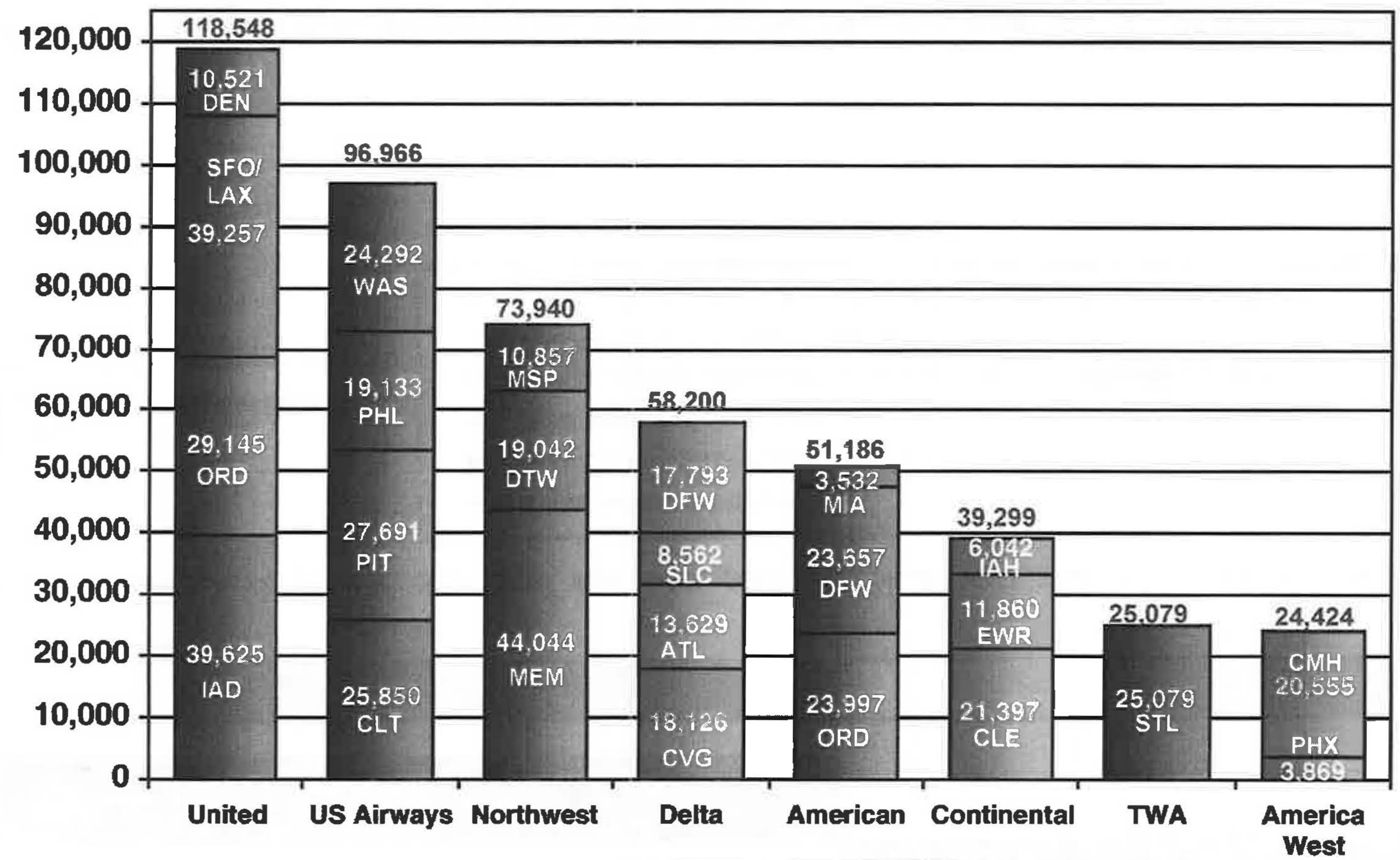


FIGURE 13 Effect of RJ service on Delta mainline growth in Cincinnati and reallocation of assets to Delta Express, Atlanta hub growth, and international operations (source: GKMG analysis of Carrier T-100 Reports).



Domestic	116,991	95,755	72,577	57,466	49,733	38,549	24,599	23,399
International	1,577	1,211	1,363	734	1,453	750	480	25

"Scope Clause Constrained" Airlines   "Scope Clause Unconstrained" Airlines

FIGURE 14 Traffic pools available to carrier networks and their respective hubs through introduction of RJ service.

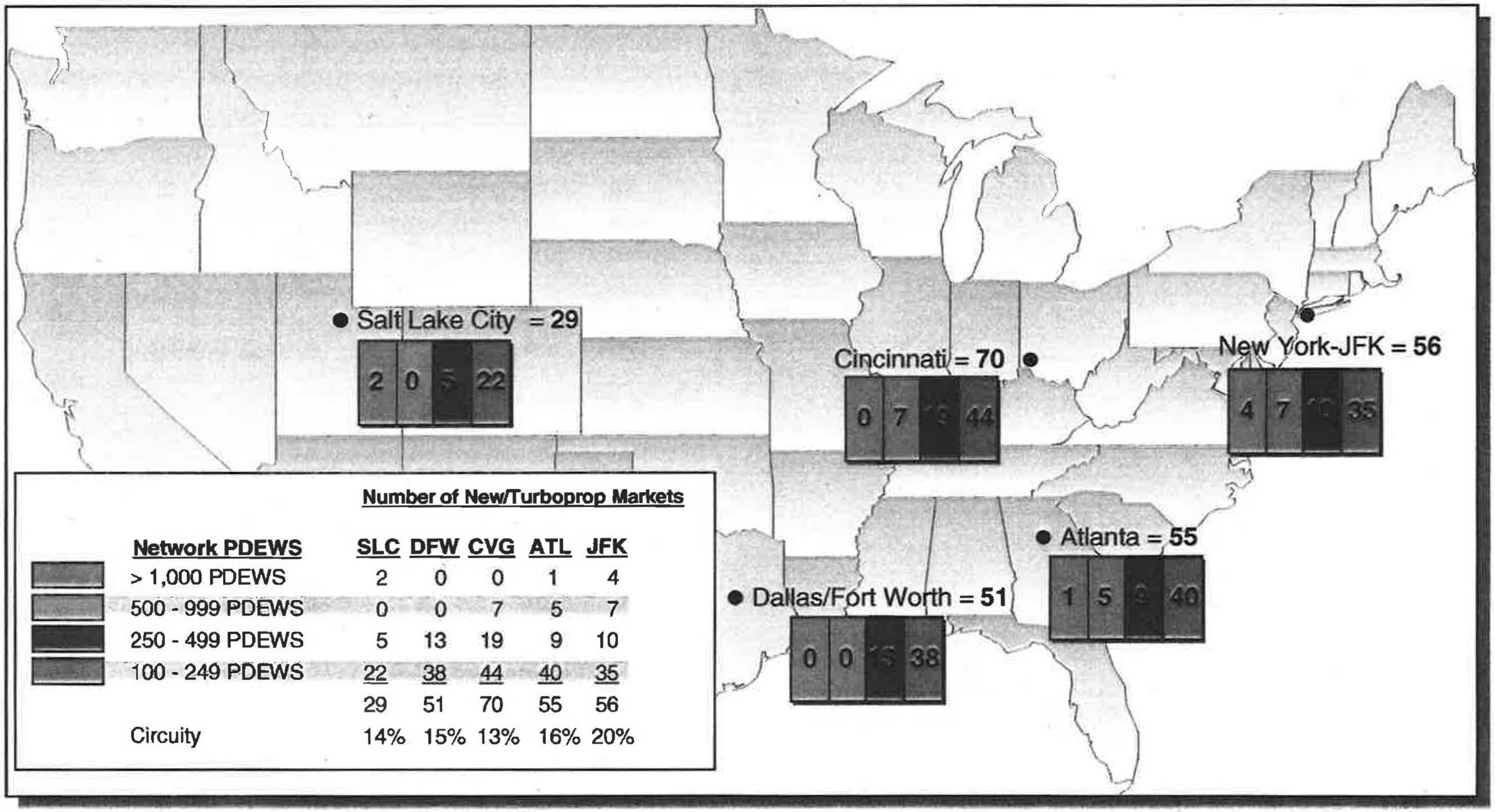


FIGURE 15 Delta RJ city-pair market opportunities.

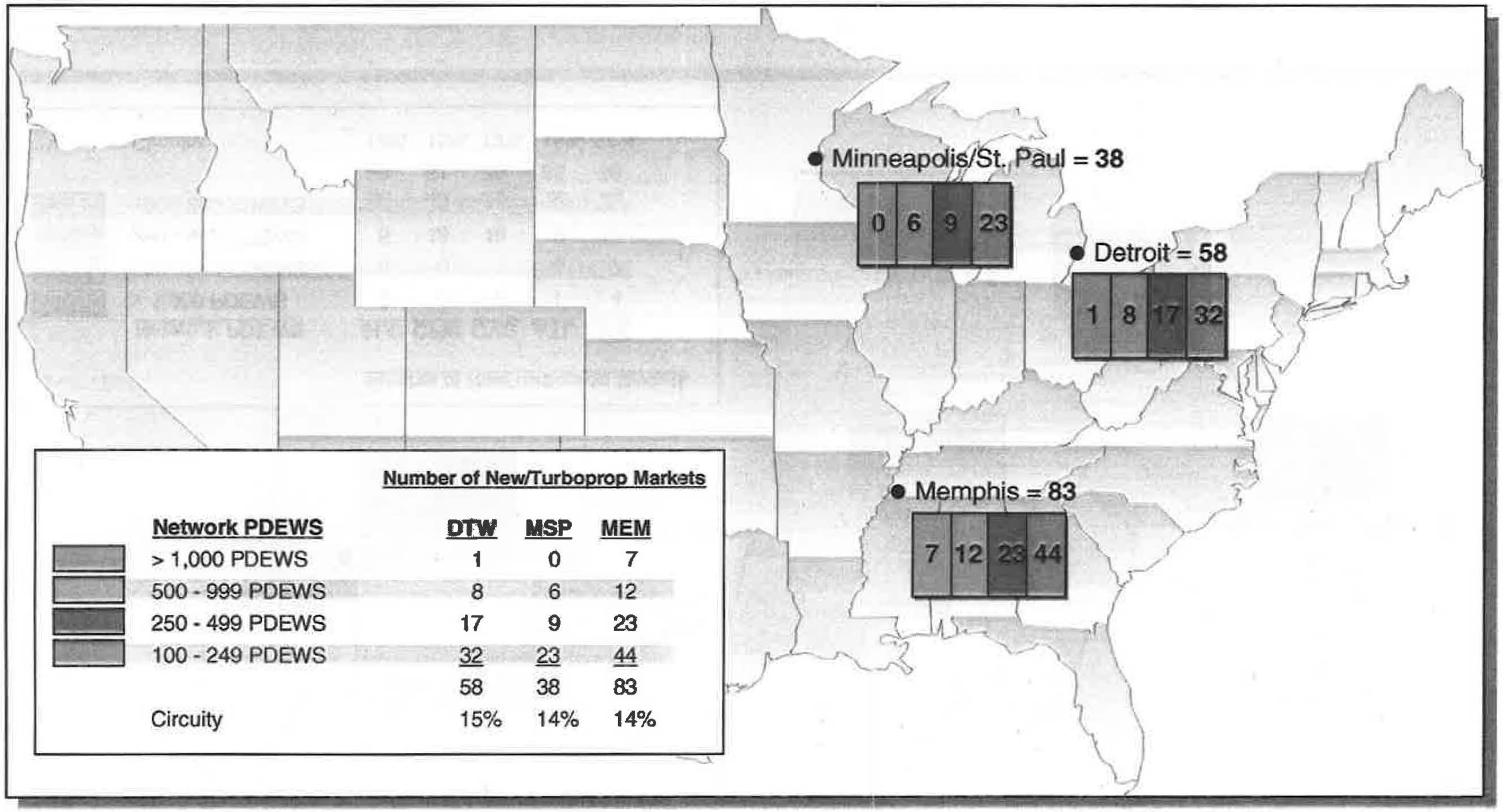


FIGURE 16 Northwest RJ city-pair market opportunities.

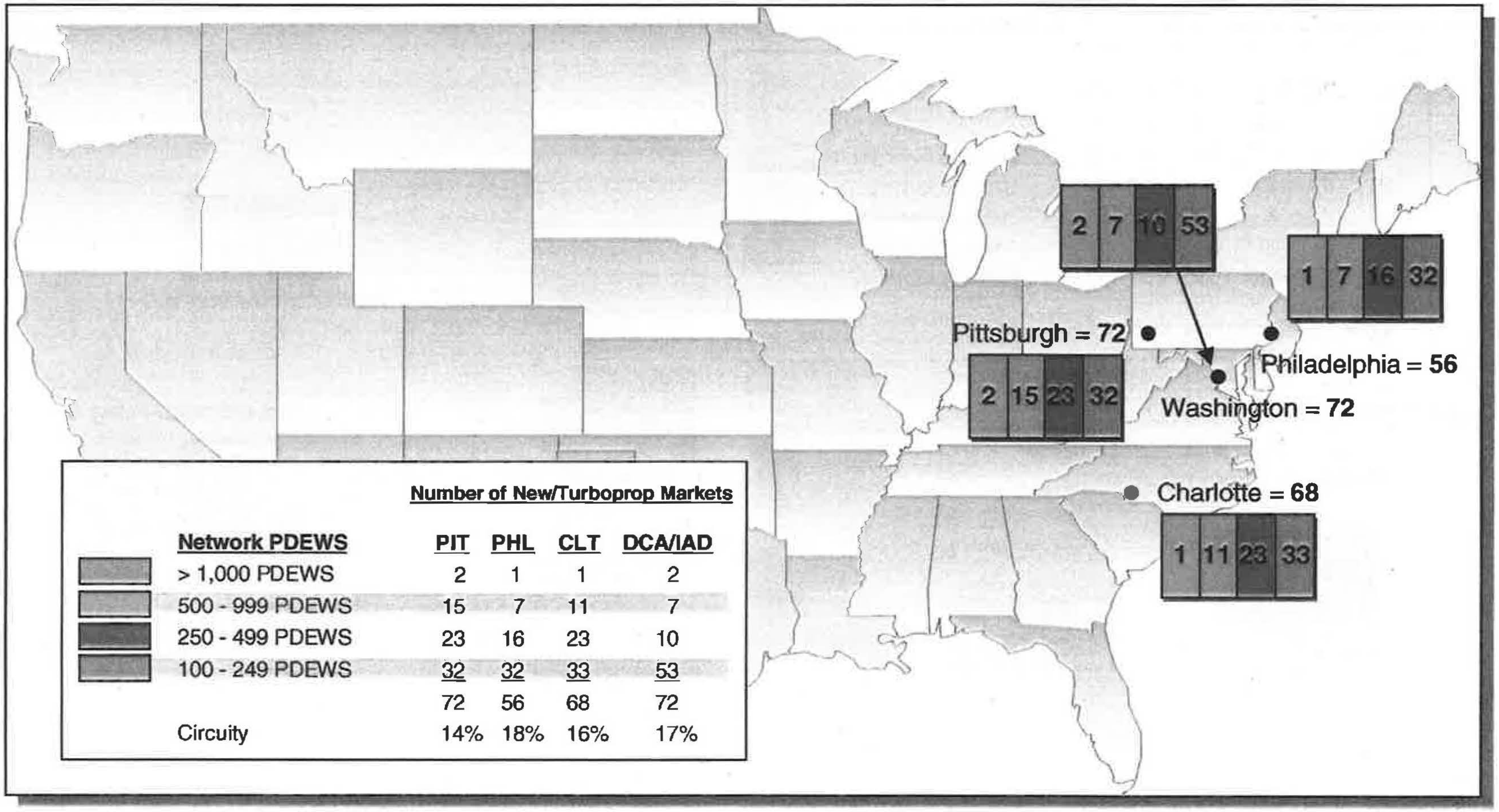


FIGURE 17 US Airways RJ city-pair market opportunities.

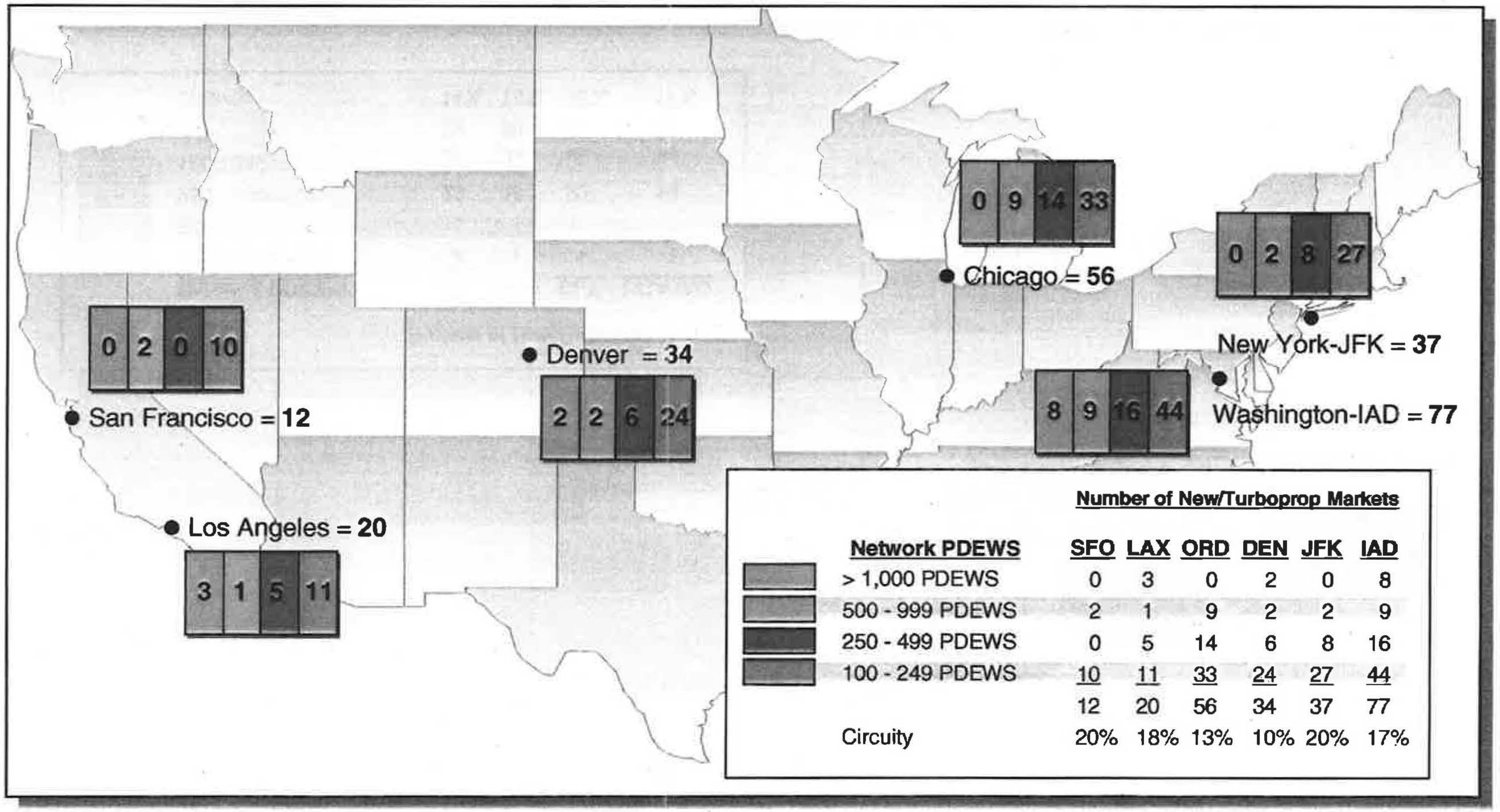


FIGURE 18 United RJ city-pair market opportunities.

Carrier	New RJ Market Opportunities	Scope Clause Limit on RJ Aircraft	RJs in Service	Unobtainable Market Opportunities
America West	65	-	10	0
Continental	146	-	41	0
Delta	261	-	104	0
American	171	67	25	(129)
Northwest*	179	54	25	(114)
TWA	126	30	-	(126)
United*	236	65	23	(194)
US Airways	268	35	12	(245)
Total	1,452	251	240	(808)

"Scope Clause Constrained" Airlines

*Excludes NW's AVRO 85 and UA's Bae-146s which are exempt in respective pilot agreements

FIGURE 19 Unobtainable market opportunities to major airline networks.

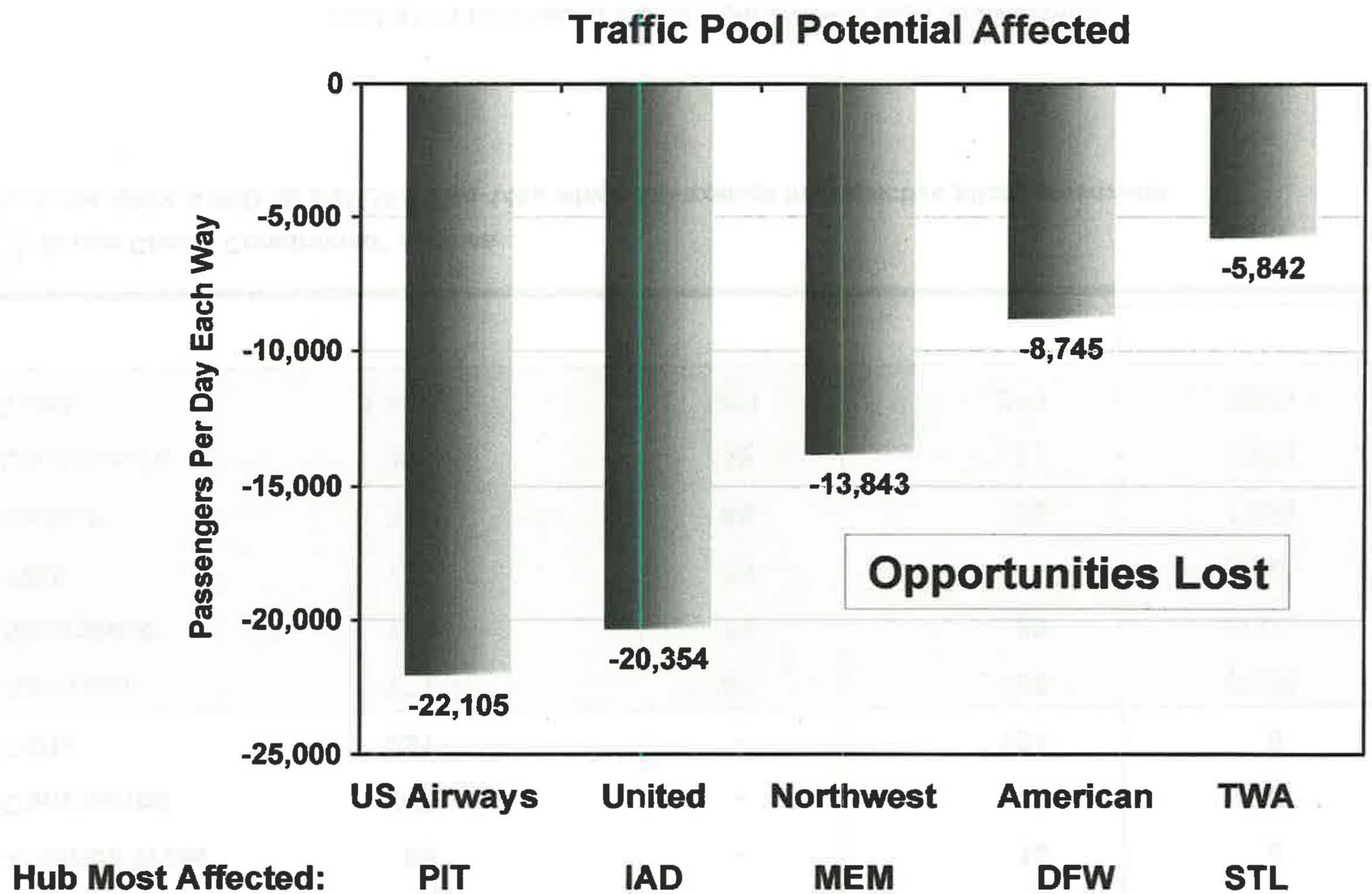


FIGURE 20 Diminished RJ traffic pools available to scope-clause-constrained airlines because of continued RJ growth by Delta, Continental, and America West.

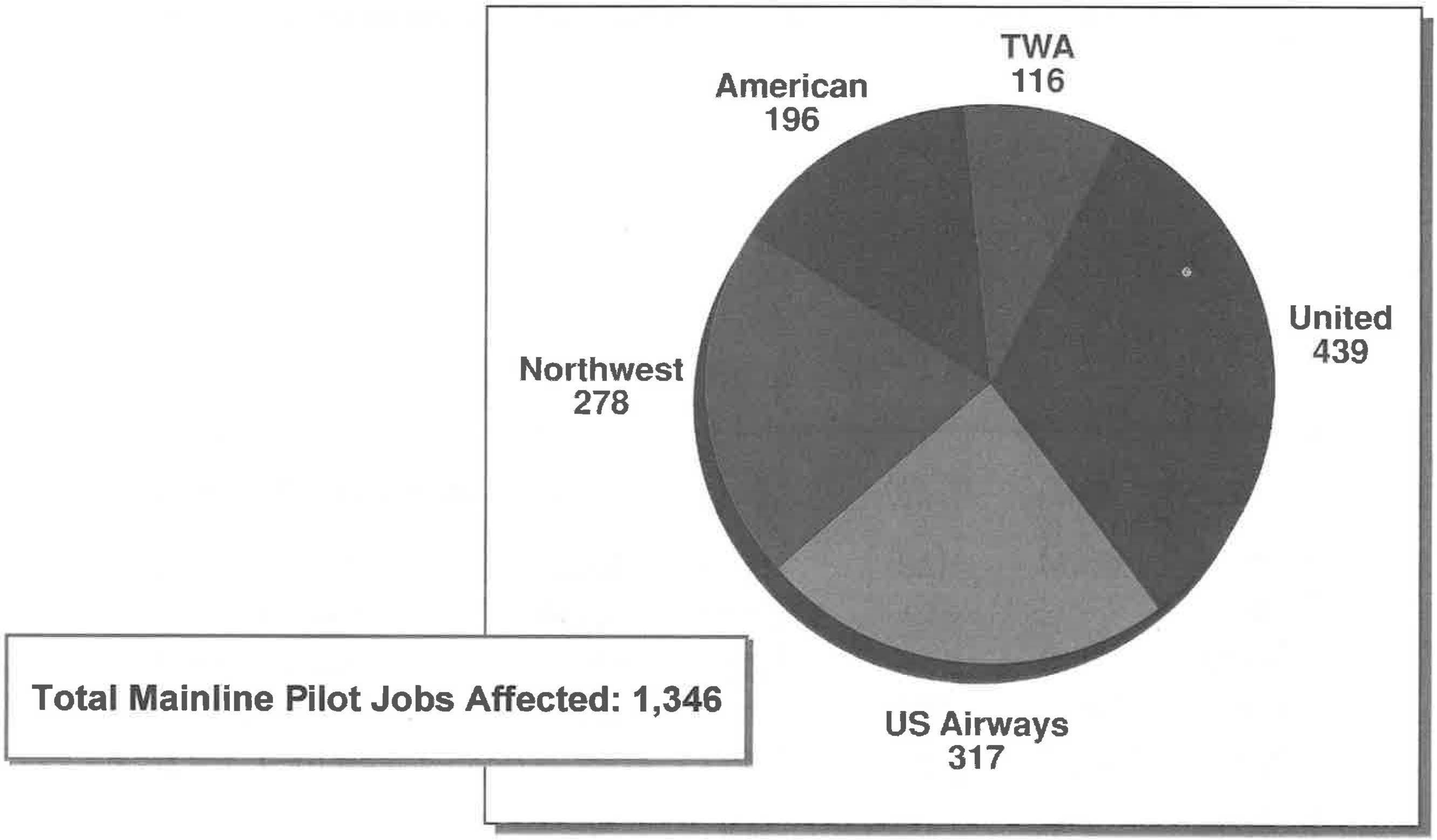


FIGURE 21 Effect on mainline pilots' jobs because of continued improvement in competitive positions of scope-clause-unconstrained Delta, Continental, and America West.

	Competitor Pilot Jobs Impacted				
	AA	NW	TW	UA	US
If AA grows:	--	(145)	(73)	(204)	(153)
If NW grows:	(136)	--	(72)	(200)	(144)
If TW grows:	(105)	(146)	--	(246)	(112)
If UA grows:	(139)	(153)	(114)	--	(86)
If US grows:	(109)	(206)	(87)	(158)	--
Average Exposure:	(122)	(163)	(87)	(202)	(124)

FIGURE 22 Effect on competitor pilot jobs by change from restricted carrier to scope-clause-unconstrained carrier.

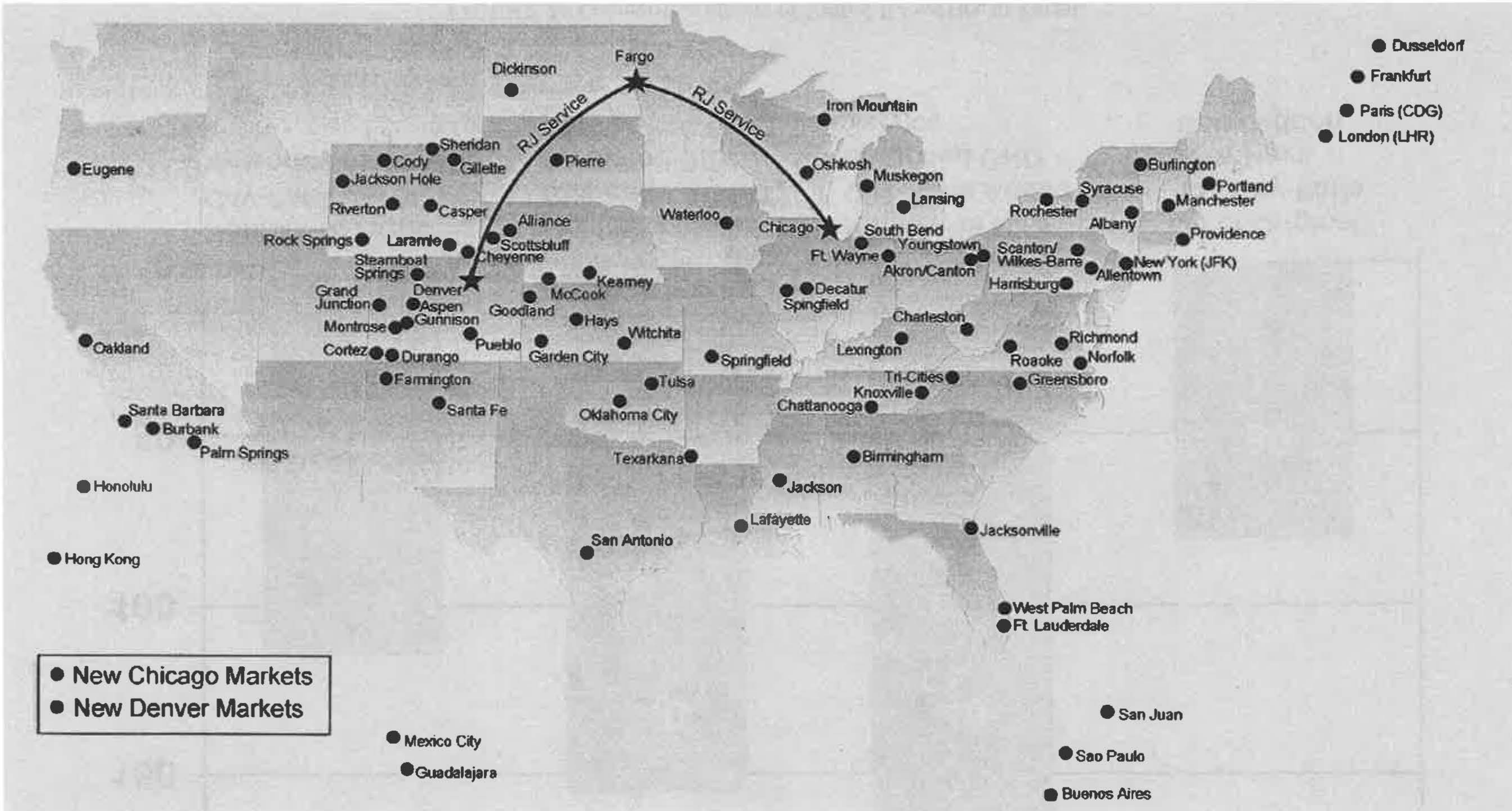


FIGURE 23 New markets opened as result of United RJ service at Fargo, ND.

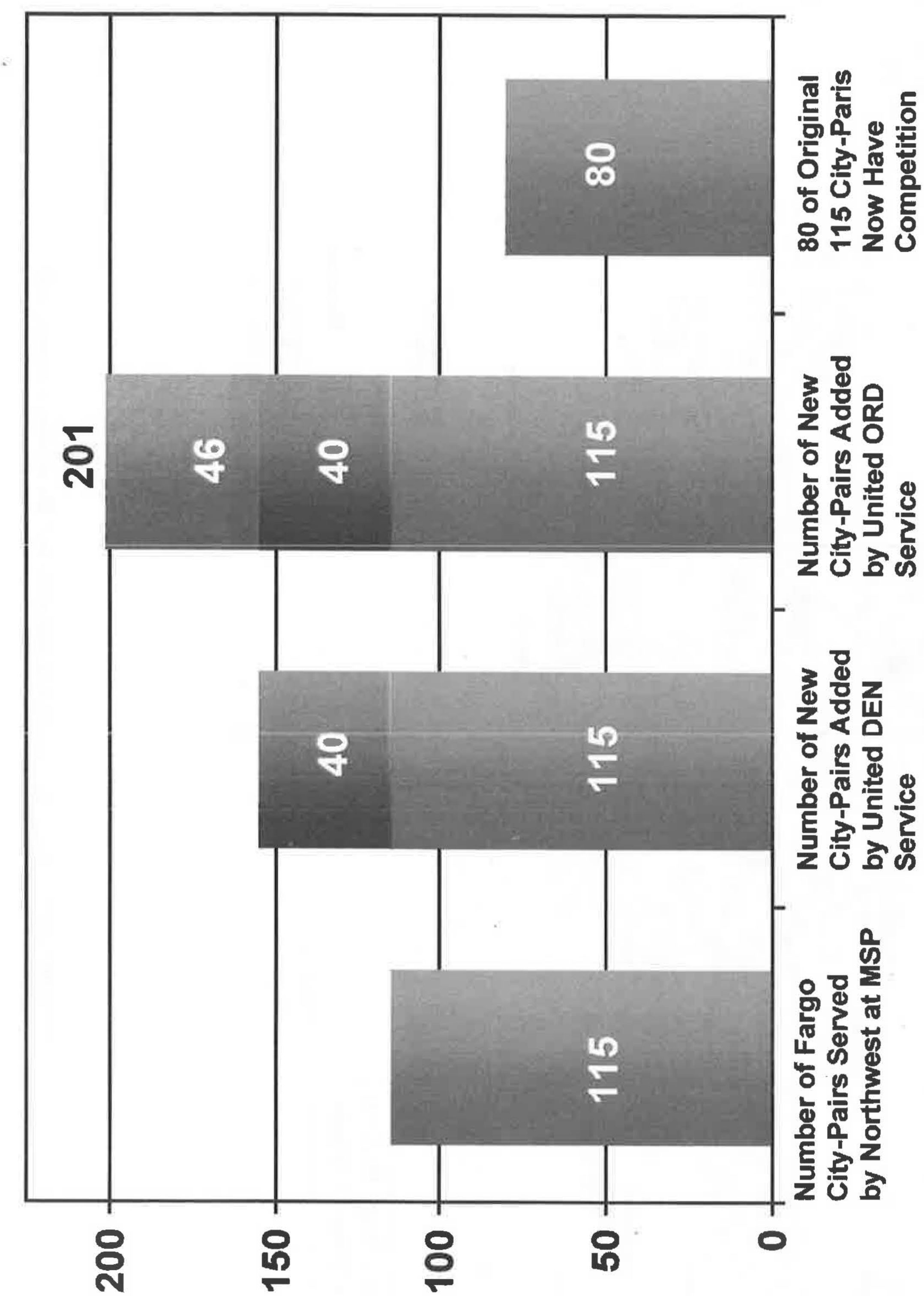


FIGURE 24 Competitive effects of United RJ service at Fargo.

WEB-BASED FORECASTING: SMALL AIRCRAFT TRANSPORTATION SYSTEM

William D. Hammers
Optimal Solutions, Inc.

I am going to talk about the part of aviation that hasn't been mentioned so far—the general aviation (GA) world—and in particular the Small Aircraft Transportation System (SATS) [since renamed the Smart Aircraft Transportation System]. It is a current initiative that follows the GA revitalization effort that was started several years ago. The Piston Engine Aircraft Revitalization Committee (PEARC) Study by the General Aviation Manufacturers Association (GAMA) was an important early initiative. Its purpose was to determine the customer requirements for learning how to fly GA aircraft and to project the market demand for small aircraft based upon meeting the customer requirements. The PEARC Study is useful today because it provides a baseline for the SATS program data analysis effort.

The SATS website at http://sats.nasa.gov contains information about the program, so I'm not going to talk in depth about the defining characteristics of SATS or the impact of SATS on the future of our nation. Rather, I am going to talk about forecasting customer demand and customer acceptance by collecting actual responses from SATS customers to survey questions presented to them.

On the SATS site, you will find the information shown in Figure 1. Note in these statements the phrases "affordable infrastructure," "significant economic development," "significant economic impact," and "affordable means." These words imply to estimators and forecasters that data have to be gathered to further quantify these phrases. So my effort has been focused on collecting data from the future customers of SATS that will determine the impact of SATS on the transportation infrastructure and the economic development of our states.

NASA, in partnership with FAA, the states, and industry, leads the National General Aviation Roadmap strategy, which guides national investments toward an "InterState Skyway" capability. These investments take the form of focused and base research and technology programs. The SATS program provides for investments in showcase demonstrations of key technologies for vehicles and airports/airspace infrastructure. There are two major emphases in SATS. One is on the key technologies that will enable air vehicles to meet a goal of portal-to-portal transportation at four times highway speeds, and the other is on the air transportation infrastructure required to meet this portal-to-portal goal.

The investigation into the required air transportation infrastructure at the state level is just beginning. Two initial SATS states have been designated—Florida and Virginia. In addition, there is a list of other states that are now beginning to discuss ways that they might develop their transportation infrastructures to support this new system.

The investigation into the key vehicle-related technologies required to meet the SATS goal was launched in 1994 by the Advanced General Aviation Transport Experiments (AGATE) consortium and the General Aviation Propulsion (GAP) program, and a great deal of information has been derived from these initiatives. The investigation that I'm going to discuss today—the vehicle- and engine-related initiatives of AGATE and GAP, as described in Figure 2—will play a key role in the development and deployment of SATS.

AGATE is managed by an alliance consisting of NASA, FAA, research universities, and selected GA industry partners, and it is headquartered at the NASA Langley Research Center. The alliance is charged with defining vehicles and flight training specifications that would fit within the system and support the needs of the traveling public. The GAP program, located at NASA's Glenn Research Center, develops engine technologies that will meet the reliability, efficiency, quietness, speed, and cost goals of the program. These two initiatives are providing the leadership and resources to define the technology roadmap to meet the vehicle, engine, and training requirements of SATS.

The goals of AGATE, those related to vehicles, are quite aggressive. To meet them, the work was divided into technical work packages aligned with the systems of the aircraft. Two additional work package teams, Program Analysis and Systems Assurance, have broad interactions throughout the technical AGATE work packages. I work with the Program Analysis Work Package team (Figure 3). The Program Analysis Technical Council (PATC) directs and leverages the program investments in market analyses, metrics database development, program impact analyses, and portfolio analyses. Their principal products are the volume forecasts for use by the AGATE management team for modeling GA aircraft systems and for trying to reach the volume-driven cost goals. The PATC members listed in Figure 3 are responsible for the results that I am going to present this morning. Their marketing experience and skills were a tremendous help in the definition and construction of a web-based survey that we are using to collect customer information for AGATE and the GAP program.

PATC developed two data collection efforts—a large-scale effort and a small-scale effort. The latter effort is the personal presentation of the AGATE cockpit concept demonstrator to a small, but representative sample of the total GA market. Personal interaction during the presentation allows for evaluation of the advantages and disadvantages of the proposed AGATE initiatives. In addition, individual written assessments of the program are collected through the personal administration of the same survey instrument used in the large-scale data collection effort. The small-scale data collection initiative gathers information that is used to improve both the survey instrument and the analysis of the large survey data set.

The large-scale data collection effort is the main focus of the program analysis activity. It uses the resources of the World Wide Web (the Internet) to gather data from both the existing and latent GA markets. Data are collected by an interactive, dynamic survey instrument located on a server at the National Institute of Aviation Research (NIAR) on the campus of Wichita State University, Wichita, Kansas.

The survey can be accessed from multiple websites by an active link to the NIAR server from each of the cooperating sites. A new Internet domain was created to house the survey and related information on the NIAR server. The site name, Advanced Personal Air Transportation System, at http://apats.org, was chosen to convey to the user a new direction in GA. A link to the AGATE home page was established and it provides a source of valuable information about AGATE to all visitors to the new site. A link to the survey site is also on the AGATE home page, and it provides a valuable source for Internet users with interest in GA activities.

Multiple additional websites, with an active link to the NIAR server, encourage visitors to their site to complete the survey. Because of the large number of sites linked to the NIAR server survey, and the exploding use of the Internet, a large number of surveys have been completed. The surveys provide important information about both the existing GA market and the additional market provided by an increasing demand for travel.

There are several advantages to web-based applications, as shown in Figure 4. The survey was rapidly developed and deployed on the web. In six weeks, we had six iterations of the survey reviewed by PATC, with each version better than the previous one. Because the survey was online, the peer review by Research Triangle Institute was completed very quickly, letting us activate the survey on the web just three months after the start of the project. I should note that we did use key questions from the PEARC survey so that we can compare the web-based survey results with the results obtained by traditional survey methods. This will help us uncover any bias in the web-based survey.

It is a dynamic survey, so branching to succeeding questions is determined in real time by the answers provided by the respondent to current questions. This is not visible to the respondent; it is happening seamlessly in the program code of the survey. Another big advantage to the web-based survey is that it is threaded. We know attention spans on surveys are limited and attention spans on the web are very limited. We developed this survey so that nobody spends more than 10 minutes completing it. In the survey itself, there are over 100 questions, so how is this accomplished? Well, again, using the technology of the web, when you enter the survey, you are assigned two random numbers. These random numbers determine sets of questions that you receive. The survey contains cost questions that have three different cost values associated with each question, but you will only see one from this collection of questions. We reduce the set of questions per user from literally 115 to 120 down to no more than about 30, yet from the volume of survey traffic that we get on the Internet, we still build a statistically valid sample for each question.

Finally, the survey is updateable in real time. If we determine that we are asking a question that needs to be changed, we can immediately change it in the survey, and the survey is ready for the next participant. Each survey is automatically given a date stamp with the day, hour, and minute it was completed so we know from each survey response date which set of questions was being answered. This allows for the data analysis of both the old and new questions.

I want to present some of the information contained in the survey data, but before we get to survey results, let's look at the survey activity to date. I will just point out a few things illustrated by Figure 5. These data were compiled on September 5, 1999. The number of users to date is 43,109, which tells us how many people have been on the survey site. If someone visits the site, he or she doesn't have to take the survey, but I can tell you that about 4,300 surveys have been completed. This says that we have a survey completion rate of about 10 percent, which is phenomenal when compared with the completion rate of paper surveys mailed to a randomly selected sample of participants.

Also note that the traffic is not only from the domestic market in the United States, but it is in fact truly international in scope with almost 10 percent of the visitors to the site coming from outside the United States. The average time spent on the site is almost 7 minutes. This is a long time, for an average, if you are looking at it from a web perspective, because the attention span there is very short for many people.

Now let's look at some of the preliminary observations that are coming from the AGATE survey. Figure 6 shows the survey activity over time. Initially, we were hooking up to search engines and we were getting all the links from other sites—Embry Riddle, for example, has a link to the survey site; the travel agents site has a link; AOPA; and various other sites. The first bump is when AOPA introduced the site to their members via a link. Activity slowed down over the holiday season but then picked up dramatically when AVWEB published an article about our site and survey. The article generated tremendous response from the owners and pilots of GA aircraft. This was very beneficial to our data collection effort because the AGATE survey focuses on the vehicle. It has vehicle-related questions and we need people who are familiar with airplane system technology and the associated cost of that technology. We have been able to sustain an increase in the number of surveys, and we now have approximately 4,300 surveys completed.

Let's look at the distribution of people who have taken the survey and their interest in piloting an aircraft. Figure 7 shows that the "would like to become a pilot" sector of the latent market is 11 percent of the total sample. The remainder of the latent market are those who chose to travel in an advanced light aircraft, but not to become a pilot. These people are captured in the "not interested in piloting a plane" sector and make up 2 percent of the total. Note that former pilots make up 4 percent of the total respondents, and the remainder, 83 percent, are current pilots.

One of the cost demand curves that we generate on a regular basis is shown in Figure 8. The values have been removed from the cost axis and the identification of the marked data points has been removed from the curve because the data are proprietary to AGATE. However, the graph does illustrate a typical reasonable cost curve generated by the survey data. The favorable responses at each cost value are shown on the vertical axis. Note that percentage in agreement with the reasonableness of the cost decreases with the increase in the cost of the airplane feature. This information is useful to the manufacturers of equipment related to the AGATE airplane features to show them what they can expect in terms of market acceptance for each cost value.

In the ranking of the benefits of the AGATE airplane by the current and former pilot population, the pilots were asked to indicate the most important benefit of the AGATE aircraft (their first choice), the second most important benefit, and the third most important benefit. This ranking showed that the most important benefits are affordability, increased safety, and increased reliability. These three benefits must accrue before GA will revitalize itself as an industry. Airplanes must become more affordable, safer, and more reliable. Speed is next in the pilots' ranking, followed by ease of use, utility, and cabin comfort. The weighted score is calculated by the formula in Figure 9, where F indicates a first choice, S is a second choice, and T is a third choice of the benefit.

Which feature of the AGATE airplanes that we are considering is the most important to the pilots? Figure 9 shows the overall winner—the graphical pilot interface. Note that a graphical pilot interface makes the aircraft safer and more reliable to fly in more environments. The graphical pilot interface is followed by advanced turbine engines, advanced piston engines, datalink communications, free flight, crashworthiness, etc.

One important result that has emerged from this study is that not only do people travel frequently today, but also there is a large pent-up demand for additional travel. This conclusion is drawn from the responses to three questions that ask how many additional trips of more than 2 hours' travel time by automobile and less than 1000 miles the survey participant would take if they were (a) cheaper, (b) faster, or (c) cheaper and faster than commercial air travel. Pent-up demand for travel exists no matter how the data are grouped. The charts in Figures 10-13 represent the responses of people who are frequent travelers, not pilots, but who would be willing to travel in advanced light aircraft—in other words, the traveling latent market.

One further note before the charts are presented. Because the survey is threaded, a latent market survey participant will only receive one of the three questions listed above.

Figure 10 gives the response to the number of additional trips survey participants would take if they were cheaper than commercial air travel. Only 1 percent of the survey respondents would not take any additional trips under this condition, but 62 percent say they would take at least 6 extra trips, with 28 percent saying they would take more than 10 extra trips.

Figure 11 shows the information gleaned from responses to the question, "How many extra trips would you take if they were three times faster than by automobile?" Again, 1 percent of the population would take no extra trips if they were three times faster than travel by automobile. But now fully 50 percent of the respondents say that they would take more than 10 such extra trips. This is consistent throughout the data sectors that we have analyzed—people want to travel faster. They want to go portal-to-portal faster than we can travel today. So cost is a factor in determining the number of extra trips a person would take, but not as big a factor as increasing the speed of taking the trip.

Now, one-third of the latent market who completed the survey were asked, "How many additional trips (more than 2 hours but less than 1000 miles away) would you make each year if you could travel three times faster than by automobile and it were less expensive than a commercial flight?" You see the data are consistent with the previous chart—51 percent say they would take six or more such trips a year and 49 percent say they would take more than 10 such extra trips (Figure 12).

The large number of extra trips that people would take if they were cheaper than commercial air travel and three times faster than travel by automobile bodes well for the economic viability of SATS. One should remember that this pent-up demand for travel is dependent upon achieving the benefits of the AGATE aircraft: affordable, safe, reliable, fast, and comfortable transportation that is easy to use. Also note that in Figure 12 there is widespread acceptance by the latent market of travelling in an advanced light aircraft, not necessarily piloting, in order to satisfy the pent-up demand for travel.

Figure 13 is my last chart and I chose it because it represents a shift in survey responses from the results in the PEARC Study relative to the benefits of flying. The PEARC Study asked survey participants to rank the benefits of flying. In the PEARC Study, the majority of the respondents said that "enjoyment" was the reason they wanted to fly in a GA airplane. In the current survey, the majority of the survey participants say that the greatest benefit of learning how to fly is the ability to travel. This reinforces the point that I made earlier about the pent-up demand for travel within the latent market.

In the SATS program we are expanding the AGATE survey to include SATS-related questions. The level of difficulty of the SATS effort is an order of magnitude larger than the AGATE work because it represents an expansion of the vehicle analysis to the system that will contain the vehicle as one part.

Potential customer input is important to the success of any new system because it drives the market analysis, which then yields an estimate of the return on investment and the economic viability of the system. So if you have not taken the AGATE survey yet, I encourage you to go to the site and complete it.

SATS is:

- **An integrated transportation system approach to safety for small aircraft, underutilized airspace, and small landing facilities.**
- **Affordable infrastructure for highly accurate instrument approaches to virtually all runway ends and helipads in the nation.**
- **Scheduled as well as on-demand point-to-point air transportation services (including very small economical jets) between 5,400 public use landing facilities.**
- **Safe accessibility by air to 90% more destinations throughout the nation.**
- **Economic development for suburban, rural, and remote America, enabled by the SATS transportation innovation.**
- **An exportable transportation innovation of significant economic impact for the nation's balance of trade.**
- **An affordable means to close the 21st century gap between transportation demand and supply.**

FIGURE 1 SATS goals.

Developing Vehicle Technologies

Two major partnerships, AGATE and GAP, were developed by NASA and the FAA to explore the future role of aviation in personal transportation systems.

The Advanced General Aviation Transport Experiments (AGATE) Consortium is a government- industry-university partnership that supports the revitalization of the U.S. general aviation industry. It was founded in 1994 to produce the industry standards and certification methods for aircraft, flight training systems, and airspace infrastructure for next generation single pilot, 4-6 place, near all-weather light planes.

The General Aviation Propulsion (GAP) program was established by NASA in partnership with the FAA and the U.S. aviation industry to develop technologies and manufacturing processes for revolutionary, low-cost, environmentally-compliant propulsion systems and to flight-demonstrate these propulsion systems on advanced light aircraft.

FIGURE 2 AGATE and GAP.

AGATE Program Analysis Technical Council

Bruce Holmes, NASA, Chairperson

Members:

James Coyne, NATA	Chris Ode, Kestrel Aircraft
Paul Fiduccia, SAMA	Lance Neibauer, Lancair
Bob Gavinsky, Stoddard-Hamilton Aircraft	Michael R. Smith, Global Aircraft
Charles R. Lynch, Executive Jet	Robert J. Stewart, Global Aircraft
James Griswold, Aerospace Consultant	George Rourk, Williams International
Tom Shea, Cirrus Design	Ron Swanda, GAMA
Bruce Landsberg, AOPA	Robert A. Wright, FAA
Alan Goodnight, Cessna Aircraft Company	Russ Smith, Rayethon Aircraft
Robin Sova, FAA	Mike Wolf, Lycoming
Ron Wilkinson, Teledyne Continental Motors	Dave Ellis, Wichita State University
Mike Humphreys, Kestrel Aircraft	Bill Hammers, Optimal Solutions, Inc.

FIGURE 3 Program analysis team.

Survey Instrument

Survey Development:

- Constructed by the Program Analysis Technical Council
- Improved through five iterations of the draft survey
- Peer review of site and survey by Research Triangle Institute
- Activated on the Web on June 1, 1998
- Benchmarked with PEARC 1995 survey questions

Web Based Survey Characteristics:

- Rapid Development and Distribution
- Dynamic
- Threaded
- Updateable

FIGURE 4 Data collection instrument.

Survey Site (http://apats.org) Statistics

This Report was Generated	Monday September 06, 1999
Timeframe	05/15/98 - 09/05/99
Number of Hits for Home Page	25,446
Number of Successful Hits for Entire Site	557,205
Number of User Sessions	43,109
User Sessions from United States	57. 18%
International User Sessions	9.6%
User Sessions of Unknown Origin	33.19%
Average Number of Hits Per Day	1,163
Average Number of User Sessions Per Day	89
Average User Session Length	00:06:51

FIGURE 5 Survey activity to date.

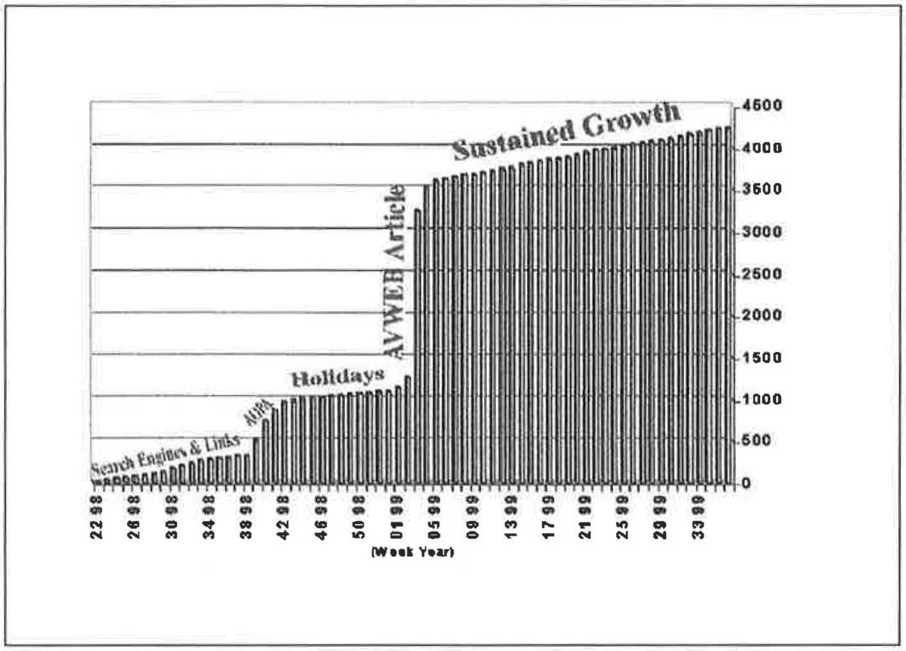


FIGURE 6 Survey activity: cumulative number of surveys.

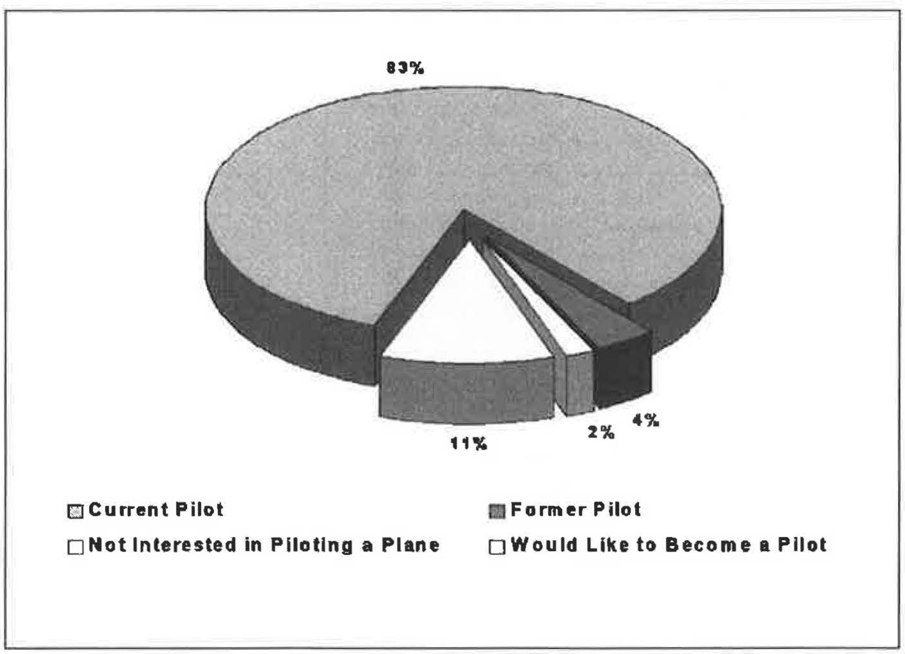


FIGURE 7 Pilot demographics: pilot status.

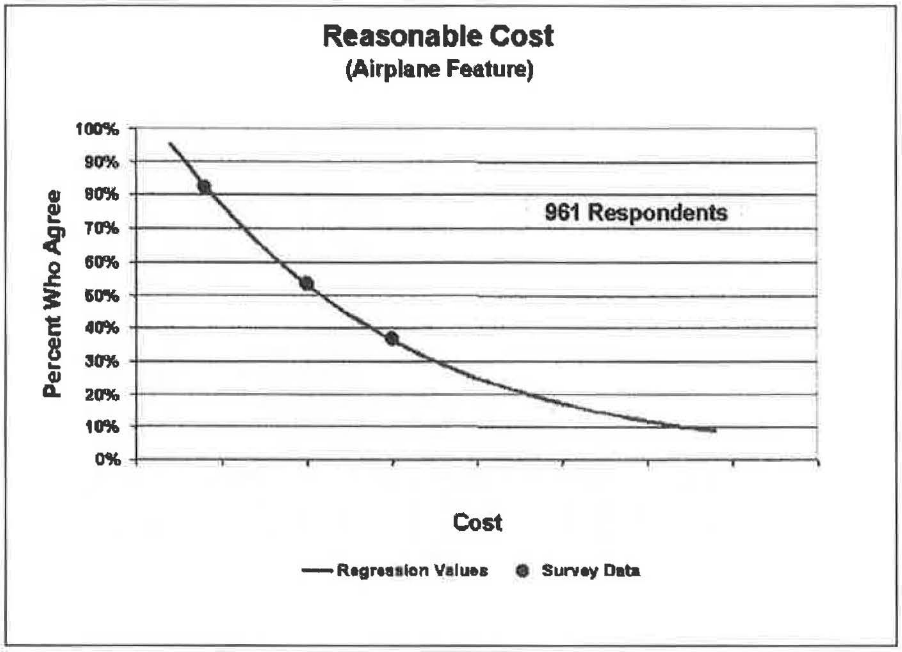


FIGURE 8 Cost curve.

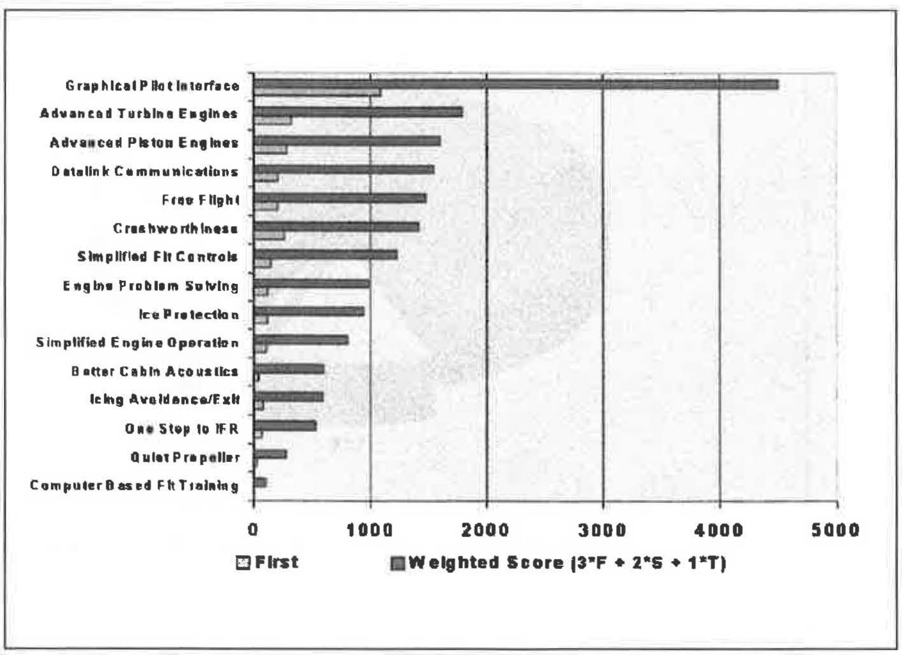


FIGURE 9 Features ranking: pilot ranking of AGATE features.

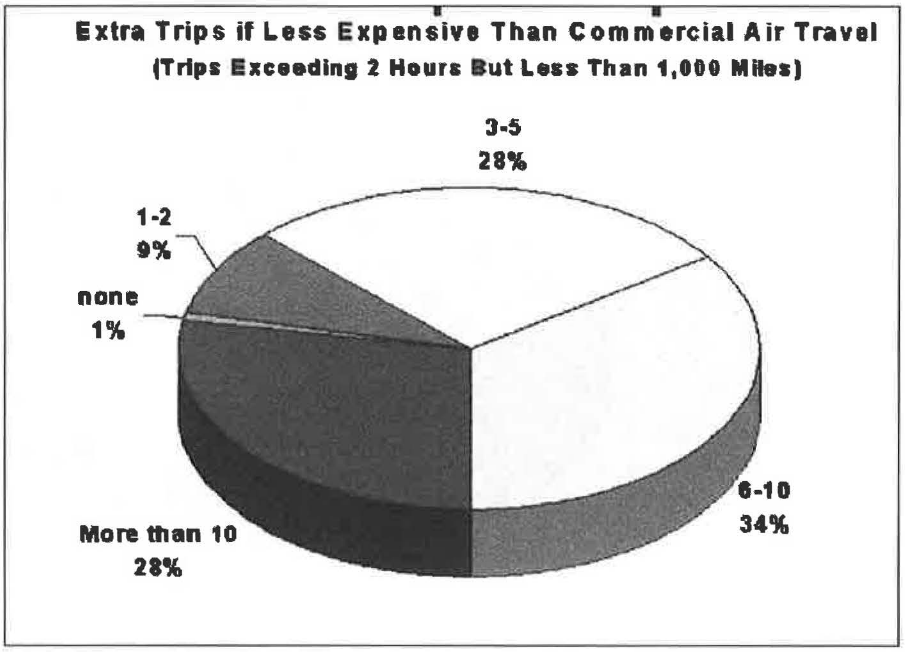


FIGURE 10 Number of extra trips survey participants would take if they were less expensive than commercial air travel.

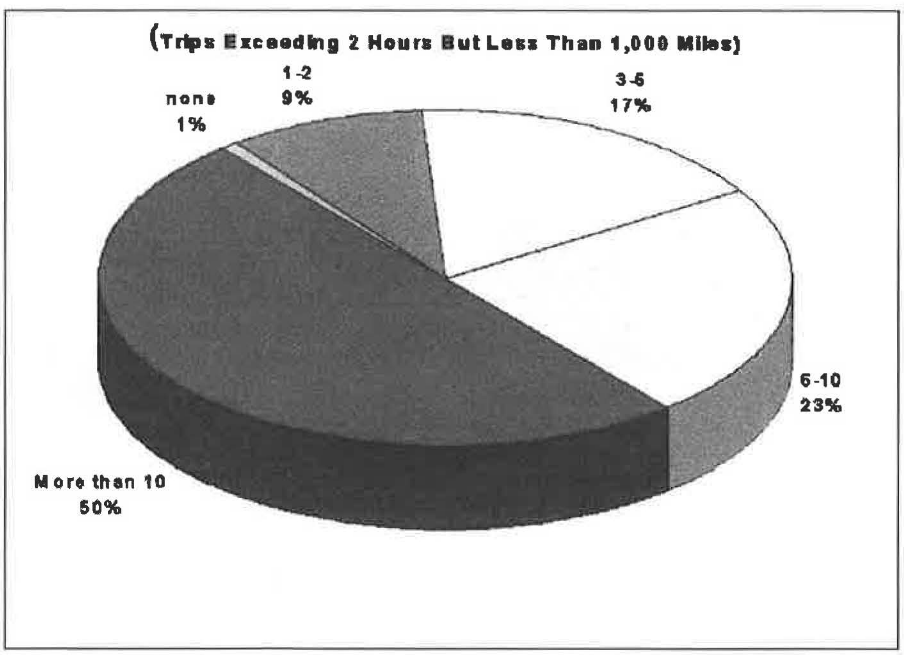


FIGURE 11 Number of extra trips survey participants would take if they were three times faster than by automobile.

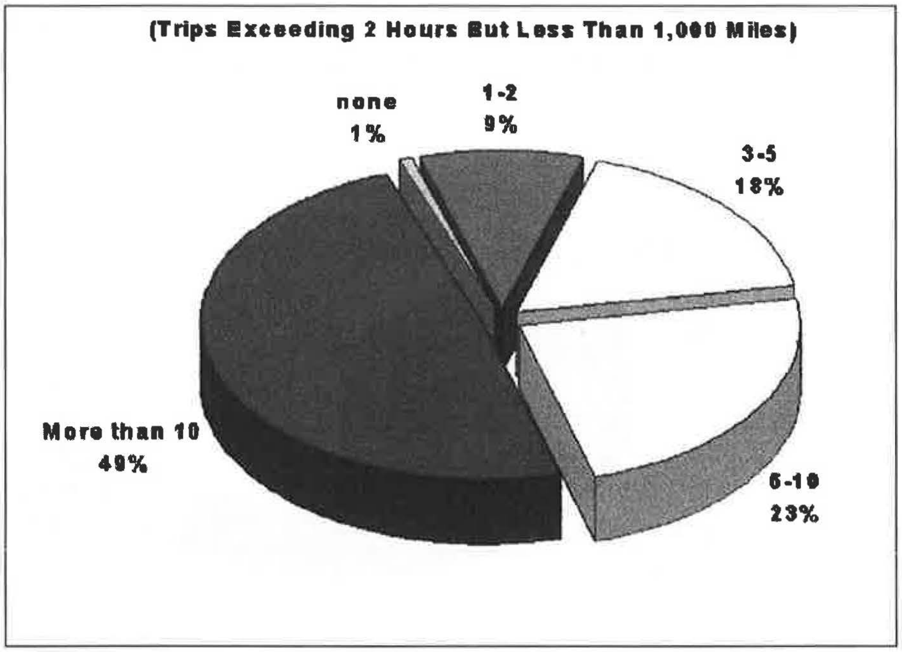


FIGURE 12 Number of extra trips survey participants would take if they were three times faster than by automobile travel and less expensive than commercial air travel.

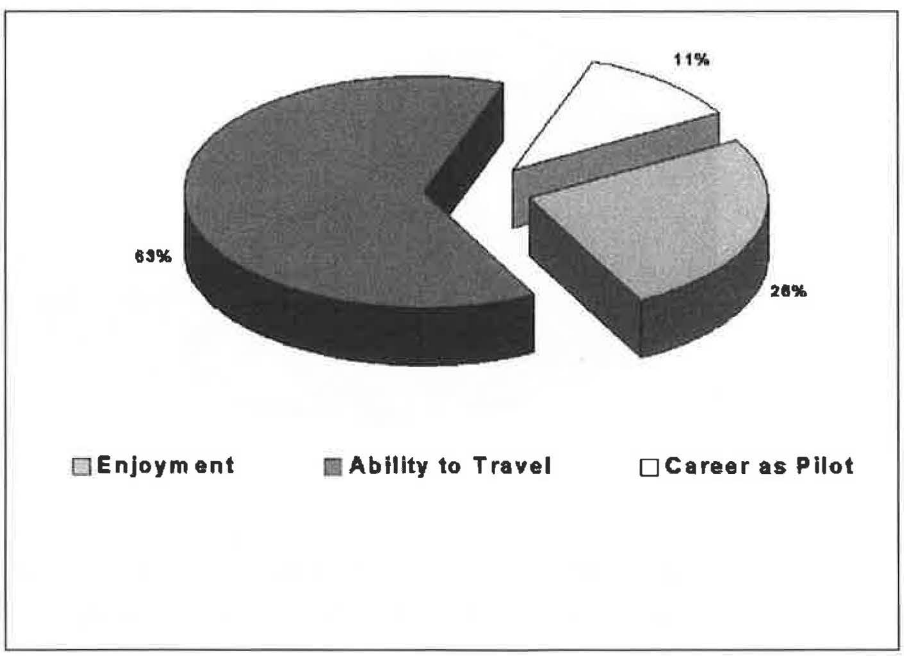


FIGURE 13 Reasons for flying (potential pilots).

SUMMARY

INTRODUCTION

The opening plenary session introduced workshop participants to a diverse set of complex conditions and interdependencies that influence the growth and development of our aviation world. Whether one speaks about commercial airline operations, cargo operations, business aviation, or personal flying, it is evident that economic, environmental, and regulatory influences have the potential for great good or great grief as we move into the next century. Regardless of sector, macro-level factors are intertwined with competitive forces that encourage mergers, strategic alliances that cut across borders and people, and the development of new institutions to meet market realities. These responses are challenging traditional methods of doing business and governing such an important public good as our airway system. Clearly, the plenary speakers informed workshop participants that all segments of aviation are moving faster than public policy and our current ability to anticipate the future.

THE AIRLINES

Following the plenary session, members of the domestic, regional, and international airline panels joined the fleets and manufacturers panel to (a) identify common variables likely to influence future activities of each; (b) consider whether or not some traditionally employed variables should be eschewed from future analyses; and (c) consider the use of new variables—perhaps employed by only one or a few panels in the past or genuinely new—in workshop analyses. The presentations and subsequent discussion noted common variables that remain market structured (e.g., reservation systems, regional jets, opportunities for cost reduction, increased productivity, and improved revenue generation), public policy (e.g., environmental, safety, and economic regulation), and the state of the economy [e.g., gross domestic product, income distribution, exchange rates, travel type (business or leisure), sophistication of communication systems, labor and fuel costs, and air service quality]. Variables that seem to exert less influence on trends in aviation include aircraft size (in the case of international aviation) and passenger yield (because of more sophisticated tools to reduce excess capacity and to disperse fares more effectively). Finally, the variables that once seemed to affect only a few forecasts but now are considered to be more widely prevalent include airline alliance behavior, physical infrastructure, technological innovation, and liberalization, including cabotage and foreign ownership of U.S. airlines.

Continuing a trend now four years in the making, airlines have recorded healthy profits. This is just beginning to result in pressures for increased labor costs as contracts signed during tougher times conclude and new contracts must be negotiated. Resurgent union strength, the impact of regional jets on pilot compensation, and the continued shortage of pilots will also affect this cost trend. Fuel costs, regulations, and taxes are predicted to remain relatively stable for the foreseeable future. Increasingly sophisticated use of electronic and web-based communications should boost airline profitability by reducing travel agent costs and creating travel demand through greater contact.

Overall prospects for airline stability and profitability are optimistic. The trend toward liberalization and privatization around the world will continue, leading to more rationalization and consolidation in the industry.

DOMESTIC AIRLINES

Domestic airlines appear to have settled into a core of majors that are consolidating through local and international alliance partnerships and a steady presence of low-cost carriers (e.g., Southwest) on the "competitive fringe." Key trends in the economy, technological innovation, and public policy do not seem likely to trigger radical adjustments to the current airline plan.

Panelists see the relaxation of foreign ownership rules as inevitable and predict that cabotage will thereby become moot; significantly, panelists were not alarmed in any way by this prediction; rather they simply viewed this as an important situation to be managed. Likewise, the introduction of the regional jet—and its concomitant labor unrest—was no longer viewed as a disturbing or disruptive trend; rather it was seen as another mechanism that would help domestic airlines manage their passenger yield more effectively. The concern for FAA forecasts is to consider devaluing "passenger yield" as a measure of air travel pricing. The blurring boundaries between regional and domestic carriers exacerbated by the regional jet require more changes in FAA forecasting assumptions: the old parameters defining majors and regionals—namely, aircraft size and range—are no longer viable. So the FAA will need to rethink how they want to cast these factors.

The greatest concern articulated by these panelists related to capacity shortages caused by infrastructural limitations: airport and air traffic control capacity will continue to constrain domestic travel. According to these panelists, the FAA should also pay attention to persistent pilot shortages and the impact of environmental opposition to new or expanded airports.

REGIONAL AIRLINES

The regional airline industry is expected to continue to grow at rates exceeding those of the major airlines. The growth will primarily be from new and larger markets made possible by the introduction of regional jets. However, there are several key issues that will affect the regional airline industry. These include labor relations, consolidation, slots, and small community air service.

INTERNATIONAL AIRLINES

Tracking developments in international aviation is still hindered by lack of detailed and comprehensive aggregate and disaggregate data. 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 decision making. 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 is predicted to grow steadily, but not aggressively; panel predictions were for a five-year growth of 4.7 percent on U.S.-transatlantic routes, 5.0 percent on U.S.-Asia travel, 6.0 percent for U.S.-Latin American travel, and 3.6 percent for U.S.-Canada travel.

Much like their domestic airline colleagues, international airline panelists did not predict dramatic changes in market structure; rather they foresee a period of stabilizing international airline alliances and a managed transition to a more liberal market for global air transport. Panelists registered their greatest concern for uncertainty in the areas of environmental regulatory action, infrastructure capacity, and safety, including reducing terrorist activities. They predict that Airbus Industrie's decision to pursue the building of the new large aircraft (A3XX) will affect manufacturers more than airlines (which will simply have a choice of Boeing or Airbus aircraft once the A3XX is available).

BUSINESS AVIATION

The panel members quickly agreed that the resurgence in business aviation (the development, production, and utilization of business jet and business turboprop aircraft) can be traced to the impressive level of research and development that the industry undertook to bring new and derivative products to the market, a growing economy that fueled the demand for business turbine aircraft, the introduction of fractional ownership that allowed new operators to act on their demand for business air travel, and a benign regulatory environment. The business turbine industry also benefited from the inability of the commercial air travel industry to balance the efficiencies of the hub system with increasing expectations for superior customer service.

Looking ahead to the next five years, it is expected that business aviation will show considerable strength if a number of key elements remain in place. First and foremost, the U.S. economy must continue on the modest growth path that has described the 1990s. Second, it is important that the regulatory environment remain supportive, avoiding unneeded constraints on access to airways or airports, more stringent certification requirements, or unwarranted limitations on operating business turbine aircraft under fractional ownership. It is also important that the second wave of research and development, which is now under way, in fact, bring to the marketplace aircraft that meet price and performance requirements.

Using a very straightforward framework linking the production of new business turbine aircraft with fleet size and hours flown (recognizing the influence of exports, imports, and attrition), the participants concluded that the production of new business turbine aircraft will reach a new sustainable rate (i.e., a natural rate) of production of 800 units, with 600 of these units in the jet segment. The net flow of business aircraft into the domestic fleet will generate average annual fleet growth of nearly 4 percent, with the business jet fleet growing at an annual rate of 6.4 percent. Total business turbine hours are expected to grow at an average annual rate of 5.6 percent over the 1999-2004 period, with business jet hours growing at an 8.5 percent rate.

LIGHT AND PERSONAL GENERAL AVIATION

It appears that the light and personal segment of general aviation (i.e., piston-driven aircraft) will continue a revival that started with the reintroduction of piston production by Cessna Aircraft Company in the mid-1990s. In regard to single-engine piston aircraft, the panel expects domestic original equipment manufacturers (OEMs) to produce 1,500 units in 1999, and production will continue to grow from this level at an average annual rate of approximately 5 to 8 percent over the forecast period (1999-2004). This growth path assumes that (a) the U.S. economy will continue to show modest growth despite a slight slowdown predicted toward the middle of the forecast window, (b) there will be no new regulations increasing costs of certification or minimum required piloting skills, and (c) the flight school infrastructure will continue to improve and the number of new pilots will show substantial growth.

Believing that 25 percent of new domestic production will be exported, the panel expects fleet growth to be slightly less than 1 percent per year in the single-engine segment, resulting in a fleet size approaching 150,000 single-engine aircraft in the year 2004. Piston-hours from this segment of general aviation is expected to grow 2.5 percent per year, however, because of an expected increase in student pilots and the number of aircraft used for flight training. Aircraft in flight training show higher utilization rates and student pilots fly more hours than the typical licensed single-engine pilot.

The panel expects less strength from the multiengine piston segment, with flat production, no growth in fleet size, and very modest growth in hours flown. The growth in fleet hours (averaging less than 1 percent per year) will reflect an increase in the number of pilots flying multi-engine aircraft. With a stable fleet, this will cause the utilization rate (hours per aircraft) to increase.

VERTICAL FLIGHT

The immediate future for the vertical flight segment is tied to (a) conditions in the oil and gas, the air medical, and the utilities industries; (b) law enforcement practices; (c) the introduction of fractional ownership; and possibly (d) a resurgence of interest in vertical flight among scheduled airlines.

In regard to turbine helicopters, the original equipment manufacturers estimate the current U.S. fleet to number approximately 6,600 aircraft. The domestic fleet should grow approximately 2 percent a year over the first half of the forecast period (1999-2001) and then growth will slow to approximately 1 percent per year between 2001 and 2004. Turbine utilization rates (hours per aircraft) are expected to stay at the current norm—515 hours per year.

The piston fleet numbers about 4,500 aircraft, a number substantially higher than that often reported. This segment of the vertical fleet is expected to grow at 2 percent per year over most of the forecast period, with the utilization rate remaining constant at around 250 hours per year—a rate that is half that observed with turbine helicopters.

This outlook for vertical flight reflects a slight downturn in demand from the air medical industry due to restructuring of health care in response to regulatory changes, rather flat conditions expected within the oil and gas industry, the diminished availability of military surplus equipment for law enforcement, expected growth in corporate not-for-hire use, and continuing strength in utility operations, which is the largest application of civil helicopter operations.

AIR CARGO

The inclusion of air cargo as a discrete panel in 1999 vindicates the decision to create a new panel at the 1997 workshop; the same factors affecting passenger travel influence changes in cargo transport, but in many instances in a significantly different way. For example, expansion of web-based communications has dramatically increased cargo carriage because of the need to transport the products purchased from warehouse to household. Environmental concerns, however, are similarly negative in impact, with noise of primary worry, but emissions not far behind.

Panelists were most concerned about the need for air cargo data to be improved and refined so that they could be more helpful to both industry and governmental decision makers. In particular, panelists recommended that the FAA distinguish between express and general air freight data, include more international air cargo movements (the current U.S.-centered data do not capture a comprehensive enough picture of the industry), and distinguish among world geographic regions to paint a more accurate picture of the type of cargo flown (and thus the impact on air cargo carriers).

The primary separation between all-cargo and belly-cargo carriers remains meaningful and may be important for passenger airline managers.

Again, panelists concluded that air cargo is critical to domestic and global distribution systems and is still in its infancy with respect to several challenges that lie ahead. To that end, panelists urged the creation of industry working groups to share data and recommended that relevant government organizations and agencies participate in these groups.

AIRPORTS AND INFRASTRUCTURE

Regardless of segment (commercial, regional, cargo, business, vertical flight), it is difficult to understate the importance of developing and maintaining our nation's airports and infrastructure to ensure an efficient air travel industry. In this regard, the panel was charged to examine the trends that will drive aviation demand and to provide an estimate of the direction and effects of these trends. FAA forecast methodologies were examined, factors influencing the growth of aviation in the United States were identified, and ways for improving the presentation of FAA forecasts were discussed.

In regard to methodology, the panel raised questions about the quality of input data, the credibility assigned to the output forecast, the usefulness of forecasts because of time lags between preparation of airport master plans and the preparation of environmental documentation required with airport development, and the need to consider supply factors to supplement the traditional emphasis on demand factors. A number of suggestions were offered by the panel: the FAA should (a) develop a cargo forecast, (b) publish origin-destination survey data, (c) move from hub forecasts to a "top 40" forecast, and (d) consider ways for gauging peak-hour demand, an element of particular importance to terminal design.

The panel was divided on the issue of system gridlock: is it imminent or not? There was agreement that it would be useful to have better information on where supply and demand imbalances exist. In regard to demands being placed on the system, the panel expects the continued growth of the regional jet segment to be of significance. International air traffic will continue to be one of the more volatile segments, and some interior mega-hubs (e.g., Atlanta) will begin to feel the impact of this as carriers avoid the primary gateways when they serve newer transoceanic markets. The panel noted that general aviation is at risk of being priced out or squeezed out of larger metropolitan areas.

Participants noted that a regulatory twist is under way: air quality may be overtaking noise as the major environmental concern. Nonetheless, issues with noise will continue to grow as more aircraft are put into service. However, the panelists agreed that air quality issues would negatively affect the pace of airport development and therefore influence the availability of capacity to accommodate the forecast growth seen in commercial, cargo, and business aviation.

FLEETS AND MANUFACTURERS

Aircraft and engine manufacturers expect to grow steadily on the basis of worldwide passenger traffic growth of roughly 4.8 percent per annum over the next 20 years. Factors affecting aircraft and engine manufacturers have not changed much in the last several years, and they parallel those identified by passenger and cargo airlines, namely, infrastructure constraints, concerns about environmental regulations, and the balance of managing yield by offering greater frequency or by consolidating services. Again, 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 14,450 aircraft (of 75 seats and over) deliveries over the next 20 years. Despite concerns about their ability to forecast retirements accurately, the panel agreed that roughly 6,400 retirements will occur over this same time period, resulting in a net fleet increase of 8,050. As always, manufacturer activity is dependent upon airline activity and ability to buy.

Prior to this workshop, the FAA circulated a questionnaire to all invited participants. The questionnaire listed the preliminary and assumed values and growth rates for each sector of civil aviation to be incorporated into the forthcoming FAA aviation forecast scheduled for release in March 2000. 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 Appendix A. Not every panel responded directly to the questionnaire; however, their assessment and rationale are presented in their individual panel reports.

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Introduction

Forecasts of domestic air travel growth are the product of myriad assumptions relating to the structure of the marketplace, the direction of public policy, and the state of the national economy. Some variables instrumental to such forecasts, including available seat-miles (ASMs) and average aircraft size, generally move in relatively consistent patterns; others, such as fuel prices and the gross national product, tend to defy accurate prediction more than a year or two in advance. Integrating these many factors into a single forecast requires both reliable data and recognition of the probable sources of error.

A panel of academics, consultants, industry managers, and government officials evaluated the many economic, technological, and policy issues poised to affect the expansion and performance of domestic air travel over the next five years. The group also considered the implicit and explicit assumptions behind FAA forecasts and offered an analytical assessment of these projections.

On the whole, the panel found the FAA's forecasts to be consistent with prevailing opinions in the aviation field as well as with widely circulated research on air transportation. Although the panel was somewhat more bullish about the probable growth in passenger enplanements and rises in load factors than the FAA, these differences to a large extent reflected contrasting assumptions about the probable state of the macroeconomy rather than diverging views about the character of the air travel marketplace.

Market Structure Considerations

The panel does not anticipate dramatic industry consolidation in the form of merger or buyout activity over the next five years. Nevertheless, it concurs with the widely held prevailing view that international alliances are poised to profoundly affect nearly all aspects of market performance. These changes will likely come in the form of equity and code sharing, coordinated decision making, and the integration of certain maintenance and marketing activities within these alliances.

The panel believes that established major carriers, with the probable exception of Southwest Airlines, will ultimately assimilate themselves into three or four major alliances. Two of these alliances, Star Alliance (dominated by United and Lufthansa) and the One World Alliance (dominated by American and British Airways), have already established formal marketing identities. The others remain more embryonic in form but appear to be evolving from the Northwest-Continental-KLM-Alitalia partnership and the Delta-Air France-Aero Mexico partnership. While these alliances at present have relatively little impact on domestic market share, their tightening grip on the marketing decisions of both large and small carriers may result in a form of de facto consolidation, which could affect both prices and capacity decisions.

Among the most notable developments from alliances anticipated by the panel are renewed calls for fewer restrictions on foreign ownership of U.S. airlines, which may prove especially significant for "second tier" domestic carriers such as TWA and US Airways. Another likely outcome will be political pressure to allow cabotage, which would give foreign carriers the opportunity to serve markets within the continental United States. Such liberalization may be inevitable as the government continues its push for open skies agreements around the globe, prompting foreign carriers to seek expansion opportunities in the United States in return.

Against the backdrop of these alliances, the panel expects the domestic marketplace to experience an expanding competitive fringe—that segment of the market occupied by start-up airlines as well as established low-cost carriers such as Southwest. Concern about the precarious financial condition of start-up carriers appears to have lessened substantially since the last FAA-TRB workshop two years ago, partially because of the resilience of the U.S. economy. An infusion of venture capital—an occurrence little expected among industry observers during the middle 1990s—is enhancing the ability of start-up carriers to acquire new aircraft and expand their presence in markets previously dominated by major carriers. It is also facilitating the expansion efforts of nascent operators such as National Airways and JetBlue.

Although the growth of Airtran, Frontier, Spirit, Vanguard, and other start-ups will likely be affected by worsening capacity shortages at major airports, most notably at Boston Logan, Chicago O'Hare, New York LaGuardia, and Washington National, these carriers will continue to take advantage of air travelers' demonstrated willingness to travel secondary airports around such cities. The panel believes that industry analysts have tended to underestimate the significance of this practice in the past and that it will likely continue—if not accelerate—in the years ahead. The recent expansion of Southwest Airlines in Islip, NY, and Manchester, NH, and the exponential growth of Chicago's Midway Airport exemplify how once-underutilized airports can mitigate regional capacity shortages.

The panel anticipates that federal policy will affect industry yields only modestly (or perhaps not at all), despite continuing discussion about federal guidelines to establish a clearer definition for predatory pricing. Nevertheless, the group considers it noteworthy that the U.S. Department of Transportation (DOT) appears prepared to continue awarding slots to start-up carriers at critical airports as these slots become available. There is also growing pressure on Congress to begin a gradual phase-out of the High Density Rule limiting the number of takeoffs and landings at O'Hare, National, and LaGuardia.

Passenger Yield

Perhaps the most important implication of the continued expansion of start-up airlines is the downward pressure it places on passenger yields. Nevertheless, the panel projects a slightly more moderate decline in yield than those reflected in the FAA forecasts. It anticipates a decline in yield of 1.7 percent during the current year—a drop marginally less than the FAA estimate of 2.2 percent (Table 1). During 2000–2001, the panel expects a yield decline of 1.8 percent, an amount similarly below the FAA estimate. Overall, between 1999 and 2004, however, the panel anticipates a decline of 1.6 percent, a decline more precipitous than those forecast by the FAA.

Among the factors most responsible for the disparity between the FAA and panel numbers are concerns about the potential effects of a substantial rise in the price of jet fuel and differing assumptions about the state of the macroeconomy. Still, panelists agreed with the assertion that the dynamism of the marketplace would continue to place downward pressure on yield well into the new millennium.

The panel warns that passenger yield will become an increasingly misleading measure of the price of air travel in the years ahead. Yield estimates do not encompass many sources of revenue, such as those generated through "affinity" relationships with credit card companies, hotel companies, and other partners in frequent flyer programs, revenues that appear to be growing as a proportion of total revenues. To an increasing extent, yield numbers understate the carrier's actual revenue from flight operations.

Another concern about the relevance of yield estimates relates to the industry's growing ability to liquidate excess capacity at sharply discounted prices only a few days (or hours) before a flight's departure—a process facilitated by the Internet and other forms of electronic marketing. The evidence remains unclear as to whether this represents predominately new traffic or whether it constitutes merely a change in the way in which existing passengers (especially those who are highly sensitive to price) are buying seats. Still another complicating factor is the proliferation of regional jets, which tend to increase yield by providing nonstop service that is attractive to business flyers at a relatively high cost per seat-mile flown. Unlike most other markets, therefore, routes served by regional jets are likely to see substantial increases in both the number of passengers and the average fare.

Finally, yield numbers fail to provide information about the growing dispersion of fares in the domestic market. As shown in Figure 1, there is substantially more variation in the prices paid by travelers in markets with high average fares (those with average fares to $200 or more) than in those with low average fares (those with average fares of $60 or less). (Figure 1 limits its sample to citypairs with travel distances to 250 miles or less.) The tighter distribution of prices in low-fare markets reflects the simplified fare structures of low-fare airlines, which tend to equalize the prices paid by various segments of the market.

Load Factors

The unprecedented rise in passenger load factors during the late 1990s has profound implications for the performance of the domestic air system. During 1998, domestic load factors exceeded 70 percent for the first time in commercial aviation history. During 1999, they remain near this historic level, despite a relatively sharp rise in industry capacity. The comparatively crowded conditions that exist on aircraft in today's marketplace may well be largely responsible for prevailing consumer perceptions that air travel is diminishing in quality—concerns leading to congressional calls for a "Passenger Bill of Rights," which may drive up industry costs.

The panel identified two industry developments (in addition to the strength of the U.S. economy) as essential to understanding the rise in load factors. First, carriers are demonstrating a greater willingness and ability to adjust their capacity sharply in response to evolving competitive issues as well as shifts in demand. Many carriers are offering high-frequency service on long-haul routes with smaller aircraft. A notable example of this is the Chicago–Los Angeles market, where United Airlines currently operates 18 trips in each direction on certain days, including nearly simultaneous departures of Boeing 737s during the peak period. Similarly, the introduction of regional jets on routes historically served by larger equipment is helping carriers more closely align capacity to market demand.

The second factor responsible for rising load factors is more speculative. As previously stated, carriers are becoming more adept at disposing of their empty seats through Internet sites and other marketing arrangements. The recent flurry of media attention to web pages selling weekend excursion tickets at dramatic discounts and the emergence of entities such as Priceline.com (a vendor that allows customers to "name their own price") illustrate the significance of these new forms of distribution.

After considering the effects of these and other market forces, the panel expects a perceptible rise in load factors over the next several years. In this respect, the panel's assessment differs notably from FAA's, which anticipates a modest decline in load factors until they stabilize at about 69.2 percent. Although the panel projected that industry load factors would fall 0.2 point during the current year, it anticipates a rise of about 1.0 point during 2000. Further into the future, between 2001 and 2004, the panel anticipates load factors in excess of 71 percent. It should be noted, however, that some of the disparity between the panel and the FAA numbers reflects the agency's practice of making forecasts in accordance with the Office of Management and Budget's macroeconomic projections, which call for a significant slowdown in the rate of economic growth during 2000 and 2001.

Adding to the uncertainty in load factor forecasts are initiatives, such as the one under way at United Airlines, to reduce the number of seats in the front section of the coach cabin to accommodate full-fare passengers. Whether this development, as well as the expansion of business class, will ultimately prove significant to load factors remains to be seen.

Average Aircraft Size

Major carriers over the past several years have steadily reduced the average size of their domestic fleets, as measured by the number of seats per airplane. This trend is partially attributable to the redeployment of widebody aircraft (most notably the DC-10 and Boeing 747) to international routes and the expanding proportion of smaller planes, such as regional jets and Boeing 737s. This trend is heralded by DOT estimates showing that the average number of seats per plane declined from 151.7 to 142.2 between 1990 and 1998. Such a dramatic decline occurred despite a substantial rise in the average length of passenger trips, which grew from roughly 730 miles to more than 800 miles over the period. During the early years of deregulation, the industry responded to longer stage lengths by moving toward larger aircraft sizes. During the 1990s, however, this has not been the case.

The panel urged forecasters to recognize the limitations of the data used to measure average aircraft size. The most significant problem is attributable to the inclusion of certain regional carriers in the calculations, thus leading to overstatements of the extent to which fleet sizes have declined. (This data problem has recently been to a large extent corrected.) Another concern is that the distinction between major airlines and their regional partners is becoming blurred as equity-sharing arrangements, codesharing, and regional jets proliferate.

TABLE 1 COMPARISON OF FORECASTS: DOMESTIC AIR TRAVEL

	Actual	Predicted					
	1990–1999	1999-2000		2000-2001		1999-2004	
		FAA	Panel	FAA	Panel	FAA	Panel
Real Yield (% chg)	-2.0	-2.2	-1.7	-2.2	-1.8	-1.4	-1.6
Load Factors (pts/yr)	1.0	-0.3	-0.2	-0.4	1.0	-0.1	0.3
Seats per Aircraft	-1.1	0.4	0.3	0.4	0.3	0.4	0.3
Enplanements (% chg)	3.3	2.3	2.5	2.3	2.4	3.2	2.6

After taking these various factors into account, the panel arrived at the same conclusion as the FAA and predicted that the trend toward small aircraft sizes would reverse itself over the next five years. This change in direction, the panel believes, will not come in the form of a dramatic rise in the number of widebody aircraft. Rather, it will occur largely as a result of the practice of replacing older planes with larger versions of the same model (as well as the exclusion of regional carriers from the calculations). Overall, the panel expected the average aircraft size in domestic fleets to rise 0.3 seat per aircraft annual through 2004.

Passenger Enplanements

Forecasts of passenger enplanements must be consistent with expected declines in real yield and rates of economic growth. Although certain segments of the business market may grow sluggishly or even decline in the years ahead, the overall size of the business market is likely to grow at a rate similar to that of the gross national product. The distinction between business and pleasure travel, however, will become less discernible as business travelers become more price sensitive and place greater emphasis on multiple-purpose trips, such as those involving out-of-town conventions held at leisure-oriented destinations. The exponential growth of business-related travel to Orlando and Las Vegas is illustrative of the strength of the market for mixed-purpose trips.

As a general rule, the panel concluded, air travel is more of a complement to electronic forms of communication, such as e-mail and Internet-based commerce, than a substitute for it. Online commerce appears to be vastly expanding the interaction between geographically dispersed business and consumers through the country. Demographic and socioeconomic trends, such as the aging of the population, the growing proportion of citizens with a college education, and the rapid population growth of cities in temperate regions, also appear favorable for the growth of air travel.

The panel projected that enplanements would grow 2.5 percent during 1999, 2.4 percent during 2000, and 2.6 percent over the entire period between 1999 and 2004—estimates similar to FAA forecasts. Much of this growth will come as a result of the stimulatory effects of low fares introduced to the market by start-up airlines as well as by Southwest. While one of these carriers now serves the vast majority of major airports, they still have abundant expansion opportunities, especially along the Eastern Seaboard.

The specter of capacity shortages at major airports (as well as air traffic control concerns) will markedly affect the rates of growth in individual citypairs. Nevertheless, recent history suggests that these issues will not substantially affect the overall rate of traffic growth. Such a conclusion reflects not only the availability of capacity at secondary airports, but also emerging technological and managerial innovations—developments that are allowing existing airports to accommodate far more passengers than seemed possible only a decade ago.

The panel's deliberations and the FAA forecasts point toward a dynamic and efficiently functioning market for air travel, provided that the industry can overcome vexing constraints to expansion. As the new millennium unfolds, the industry's ability to resolve problems relating to pilot shortages, air traffic control problems, and rising environmental opposition to new airports will have enormous implications for American mobility.

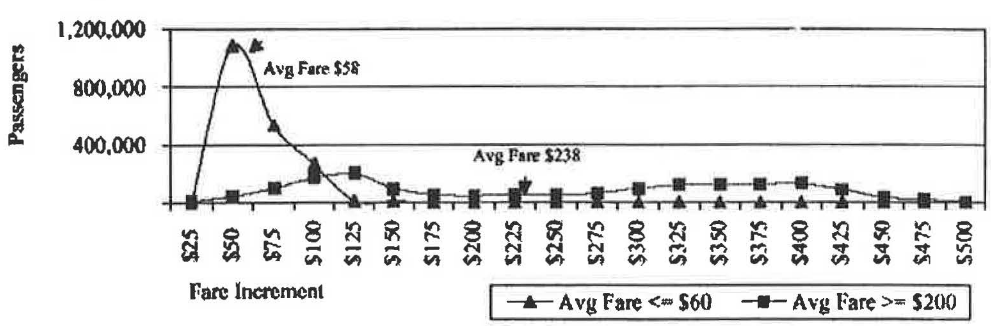

FIGURE 1 Passengers over fare increments: markets with average fare of $200 or more versus those with average fare of $60 or less; 250 miles or less.

REGIONAL AIRLINES

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Introduction

The regional airline industry is expected to continue to grow at rates exceeding those of the major airlines. The growth will primarily be from new and larger markets made possible by the introduction of regional jets. However, there are several key issues that will affect the regional airline industry. These include labor relations, consolidation, slots, and small community air service.

Labor Relations

Labor relations is expected to be a major issue for the industry over the next decade. Regional airlines operating regional jets are in effect providing the major airlines an in-house "C" scale, or lower pilot wage scale, operation. Thus, scope clauses will be the major area of negotiation between the major airlines and their pilots.

The panel forecasts that the scope clauses will be relaxed to increase the number of 50-seat and smaller regional jets but retain the 70-seat limitation. Tight limits are expected to be imposed upon 70-plus-seat regional jets. The long-term trend will be to merge work forces, and ultimately scope clauses will be negotiated away.

The cost impact of imposing pilot pay scales used by the larger airlines is expected to not be dramatic since the pay scale for pilots is weight and productivity driven. Regional jets are much lighter and have fewer seats than the mainline jets. However, imposing larger airline contracts on regional flight attendants and other union groups would result in significant increases in cost.

The panel noted that the National Mediation Board's docket contains largely regional airline cases. There are a large number of open contracts. The issues are now becoming more than wages and include benefits.

A concept that is gaining popularity is the flowthrough of regional airline pilots into the major airlines' network. Regional pilots generally do not receive seniority numbers in the major airline systems, but are offered opportunities to move up into the major airline in an orderly progression.

While the panel found that there was no problem at the moment, there is a severe training issue that could have a significant effect on the future. When regional pilots leave for the major airlines, two weeks' notice is typical. The regional airlines have a four-week training cycle. Flight cancellations would be due to lack of training, not to a shortage of pilots. The cost of hiring, recruiting, and training is escalating. In addition, the FAA has issued new interpretations of reserve rest time that are projected to increase the need for pilots by 20 percent.

Consolidation

The panel forecasts increased consolidation in the regional airline industry. The major airlines will continue to absorb the code-sharing partners. The panel expects more majors to purchase feeder partners like Delta purchasing ASA. Regionals are used by major airlines not only to increase markets served, but also to be politically convenient. The majors use regionals for local politics and to serve markets that are not otherwise economic.

The barriers to entry for a new tier of regional airlines are too high to allow for the growth of a new level of regionals. The power of the code share with frequent flyer programs and overall marketing costs make it extremely difficult for new independent regional airlines to begin operations with 19- to 30-seat aircraft.

The only potential for new entry is with smaller aircraft, such as Cape Air. Cape Air has created a niche with single-engine, single-pilot operations in Cape Cod. Cape Air provides very high frequency service in less-than-200-mile markets.

Slots

The panel found that there is no safety reason for the imposition of slots. The Regional Airline Association directly advocates the elimination of slots by DOT. Slots are expected to be eliminated at O'Hare and JFK airports within five years. It is expected to take longer for slots to be eliminated at LaGuardia and Reagan Washington National airports. Once slots are eliminated, it will be the job of the airlines to handle congestion.

Small Community Air Service

Small community air service will suffer losses due to 19-seat aircraft retirement. The program is expected to be rationalized and to include fewer communities. Funding is expected to stay at $50 million. Some small and medium-sized communities will benefit from the less-than-50-seat micro regional jets.

INTERNATIONAL AIRLINES

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Introduction

The International Airlines panel identified and discussed 15 issues that are expected to influence the growth of international air travel to and from the U.S. during the next five to ten years. These issues were grouped into the following five major categories (in descending order of importance):

- Demand influences,
- Industry structure,
- Regulatory environment,
- Physical infrastructure, and
- Technology.

Following this review and discussion of issues, the panel reviewed and suggested revisions to the draft forecast parameters submitted by the FAA for the U.S.-Atlantic, -Pacific, -Latin American, and -Canadian transborder markets.

Demand Influences

Macroeconomic Factors

The panel anticipates a slowdown in the U.S. economy during the period 2000 to 2001. Although many forecasts indicate that it should be mild, the panel is concerned that there is significant potential for it to be more serious (possibly a recession). Either a slowdown or a recession would adversely effect the export-dependent recovery in Asia and, to a lesser extent, Europe.

Continental Europe is in the process of recovering from its recession, with the U.K. beginning its recovery. The forecast U.S. slowdown will mildly delay the return to a strong economy throughout the region and will slow the growth of commercial airline traffic. The panel concurs with the FAA's forecast of an average annual growth rate (AAGR) of 4.7 percent in passenger enplanements on U.S.-transatlantic routes over the next five years.

In Asia, Japan is the major influence on regional air travel. It is expected that the U.S. slowdown will undermine the recovery that has recently begun in Japan, delaying the return of strong air travel growth to and from that country. The Chinese market remains one waiting to be proved. The panel anticipates slower growth in traffic to and from China. South Korea is improving, but political instability in North Korea reduces stability throughout the region. Australia and New Zealand appear to offer stable growth prospects throughout the forecast period. The panel believes the FAA's forecast of an AAGR of 6.1 percent in passenger enplanements over the next five years is high in such circumstances. A 5.0 percent AAGR forecast over the next five years is suggested.

Recent Latin American traffic increases are perceived to benefit from a variety of stimuli, including deregulation and privatization; benefits from these sources are expected to continue through the forecast period. Nonetheless, with a slowdown in the U.S., the FAA's 6.7 percent AAGR forecast of passenger enplanements over the next five years is perceived to be aggressive. A 6.0 percent AAGR forecast is suggested.

The Canadian economy has been showing healthy (3 percent) growth this past year; annual growth in the order of 2.6 percent is expected over the next decade. A combination of this forecast economic growth, increases in real disposable income, continued (but declining) benefits of the open skies agreement with the U.S., and Canada's attractiveness as a destination market for U.S. travelers (because of the favorable exchange rate) is expected to sustain transborder traffic growth. The panel concurs with the FAA forecast of 3.6 percent AAGR in passenger enplanements over the next five years.

Microeconomic Factors

Opportunities are perceived for continued cost reduction, resulting in lower fares and traffic stimulation. Alliances provide an opportunity for cost savings by allowing the domestic (or larger) partner at each end to undertake sales and traffic support, as well as combined purchasing for the allied airlines. Inefficiencies introduced by alliances are seen as minor compared with the benefits obtained by eliminating these duplications. Slow but steady progress is expected in the reduction of distribution (travel agency) costs to airlines.

Sharp increases in fuel and labor costs are not anticipated in the next five years. Moderate fuel price increases are likely. These will adversely affect all airlines, but U.S. airlines to a greater extent since they currently have lower unit fuel costs. A fuel tax for environmental purposes could emerge in Europe during the next five to ten years.

Aircraft Size

The trend in the 1990s toward smaller average aircraft size in the transatlantic market is expected to reverse itself as more B777s enter the market. A slow growth (about 1.5 percent per year) in average aircraft size is expected in Atlantic markets over the next five years. Replacement of older B747s, DC-10s and MD-11s with B777s and B747s is the major trend foreseen for the Pacific; the net effect will be no change in average aircraft size. Latin American routes are expected to experience very slow growth (0.7 percent per year) in average aircraft size due to the lack of significant infrastructure constraints, the ability to meet increased demand primarily with frequency, and the higher growth expected in the longer-haul (larger aircraft) routes.

Safety and Political Turmoil

Political instability is expected to continue in various parts of the world. Major events like the Gulf War and terrorist attacks can and will have adverse short-term effects. Such events are not expected to affect the underlying growth of demand.

Negative safety perceptions may affect selected national markets but are unlikely to affect as a whole any of the four major regions reviewed.

Industry Structure

Alliances

Alliances have become a part of airline life and are expected to remain through the forecast period. It is recognized that alliances in various forms have come and gone in the past, so although the panel expects the current trend to continue, it does recognize a vulnerability of this structure to changes in the regulatory environment.

The current alliance structure includes the following:

- Star Alliance—built around United, Lufthansa, Air Canada, SAS, Thai, VARIG, and ANA;
- OneWorld—built around American, BA, Canadian, Cathay Pacific, and QANTAS;
- Wings—built around Northwest, KLM, and Alitalia; and
- (Unnamed)—built around Delta and Air France.

A total of four or five alliances are expected to compete during the next five years. As the alliance structure matures, participation in one is seen more as a defensive move (to preserve a competitive position) than as a move to attract new traffic. The stimulative effect of alliances on traffic is seen to be slight—some cost saving is expected and traveler convenience (measured as the number of two-stop or on-line destinations available) is improved.

Competition

In Europe, it is expected that some national airlines will be allowed to fail. Sabena, Olympic, and TAP are possibilities. Open skies and European Commission (EC) competition rules will accelerate mergers among European carriers. The panel does not see similar trends in the Pacific over the next five years.

Low-Cost Carriers

Low-cost airlines are not seen as serious contenders in the larger international markets. Carriers with mixed fare classes are seen to have pricing flexibility (in combining high- and low-fare passengers) that will enable them to constrain the effects of low-cost carriers that would need to charge passengers equal shares of total costs. The panel does not foresee any significant downward pressure on yields from such carriers in either the Atlantic or Pacific market.

Regulatory Environment

Open Skies

U.S.-U.K. traffic makes up about 40 percent of the total U.S. transatlantic traffic volume, so an improvement in the U.S.-U.K. bilateral would set a tone for the few remaining (non-open-skies) countries in Europe. In parallel to possible negotiations of this bilateral, the European Commission is seen as slowly moving toward exercising its authority to negotiate external traffic rights for European Union (EU) member states. The panel perceives the likelihood of an EU-

North America common aviation area across the Atlantic in the next five to ten years. Within the late part of this same time frame, some aviation issues might be moved into the WTO process. Either of these latter two developments would put pressure on other regions to liberalize air service.

Ownership

In the EU, 49 percent of airline ownership can be freely traded. The remaining 51 percent can be traded within the EU countries. The U.S. restriction on foreign ownership of a U.S. airline to less than 25 percent is seen as an invalid and anachronistic labor issue. Greater flexibility in the U.S. could lead to changes in the ownership relationships of alliance partners.

Environmental Regulations

Environmental issues are the dominant concern of European governments and airlines, just as safety is the dominant concern of the FAA and U.S. airlines. This concern with the environment will lead increasingly to stringent environmental regulations in Europe. The panel anticipates that there will be a sustained move to a Stage 4 noise standard within the next five years led by European governments.

The panel's major concern is that the U.S.-European dispute over hushkit-equipped aircraft may lead to a trade war. In addition to widespread adverse economic impacts, an aviation casualty in such a war would be the Concorde. Once withdrawn, the Concorde would not be returned to service.

Regional Blocks

There is a possibility that the EU will develop its own (unilateral) rules for aircraft noise and emissions. The U.S. already unilaterally develops standards in the form of safety oversight, security classifications, and crew age-60 rules, which apply to non-U.S. airlines. For a period of time, the Pacific trials of GPS-based navigation systems were conducted multilaterally by the U.S., Australia, Micronesia, and Japan; these were ahead of ICAO's FANS efforts. All these regional-focused activities are seen as disruptive to the standardization of international air transportation regulations and a threat to ICAO's standard-setting role.

It was commented that during the 1980s, the U.S. tended to advance its aviation agenda on a unilateral basis, whereas European nations argued for instituting any changes through the global, cooperative ICAO process. In the 1990s, European nations and the EU appeared to be advancing their aviation agenda on a regional basis, and the U.S. is now arguing for instituting changes through the ICAO process.

Physical Infrastructure

Airports

The London and Frankfurt markets in the Atlantic region and Tokyo in the Pacific region are seen as the major problem areas for traffic congestion over the next five years. However, the emergence of increased point-to-point routing over the North Atlantic should ease the problem there. The traffic-mitigating effects of the recession in Asia and prospects of a slow recovery in Japan suggest that physical airport congestion in Asia, political considerations apart, will not affect the overall regional forecast.

Airspace

Concern is expressed at the inability of the Pacific en-route system to accommodate further increase in demand. Proposed navigation improvements are significantly behind schedule (for political and budgetary reasons, not technological ones). The expected U.S. economic slowdown and a slow economic recovery in major Asian markets will probably defer this problem until beyond the five years evaluated. If not remedied, airspace limitations are likely to be a constraint on trans-Pacific traffic growth within the next ten years. Similar constraints are not anticipated in Atlantic markets.

Technology

New Large Aircraft (A3XX)

In the Atlantic markets, it is not anticipated that conditions will demand the introduction of larger aircraft such as the A3XX until near the end of the next decade.

Customer demand for increased point-to-point service and the lack of major congestion points in the airport and airway system (see separate discussion above) mitigate the need for such an aircraft during the next five years in the Atlantic. Where airport constraints do occur, actions by airport authorities to increase average aircraft size on domestic routes or to encourage passengers to use nonaviation modes of travel for shorter trips are expected to provide sufficient capacity for international flights.

In Pacific markets, slow growth in demand will delay the need for such an aircraft for at least five years. Excess capacity exists in many Asian nations due to recent airport construction; even Tokyo Narita will see some benefit through a slight extension to its (still delayed) second runway.

Mixed concerns were expressed with safety and operational problems of such an aircraft. It is not known how the public would react to a fatal accident involving 700 passengers in a single aircraft (recognizing that similar concerns were expressed about Boeing 747s when they were introduced). It was also noted that the complexities of the boarding process for such large aircraft would have to be addressed.

Supersonic Aircraft

New designs of supersonic aircraft are not anticipated to be operational within the next ten years. Too many environmental problems remain to be overcome.

Communications Substitution

As yet there is no credible evidence that increased communications connectivity (such as through the Internet, videoconferencing, and teleconferencing) has adversely effected air travel. If anything, the panel believes that increased communications connectivity tends to stimulate air transportation demand by facilitating geographically diverse business contacts and meeting arrangements.

Discussion Panel Report
BUSINESS AVIATION

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Introduction

The 1999-2004 outlook for business aviation (here business aviation refers to turbine-powered, fixed-wing, general aviation aircraft) is strong if certain key conditions remain unchanged. First and foremost, it is important that the U.S. economy avoid a recession. For purposes of this discussion, the panel was comfortable retaining the assumption that the U.S. economy will soften slightly around 2001-2002, with real growth in gross domestic product falling within the range of 1.8 to 2.0 percent. Nonetheless, the forecast assumes that a recession will be avoided during the forecast period. In regard to other regions of the world, the panel believes that Asia, Europe, and South America will be modest "pluses" for the business aviation industry. Asia will continue efforts to correct monetary imbalances and implement fiscal policies to further stimulate growth, Western Europe will continue to benefit from economic integration and improved world competitiveness, and South America will constrain the distorting influences of inflation. All regions will benefit from more market-oriented policies that spur economic activity.

Second, the panel assumes that the regulatory environment affecting business aviation will not change dramatically over the next five years. Specifically, the panel's forecast assumes that there will be no attempt to constrain business aviation activity by imposing user fees or limiting access to airports and airspace. It is assumed that noise and emissions requirements on business turbine aircraft will remain within the bounds prescribed by current rules and regulations affecting the forecast period. And the panel assumes that the further development of fractional ownership will not be inhibited by more stringent certification requirements or unwarranted regulations constraining the use of aircraft operating under fractional ownership.

Third, the panel recognizes the influence of new product development on business aviation activity. In part, the robust conditions observed over 1998 and 1999 reflect the unprecedented product development that occurred over the preceding five years and that resulted in the introduction of approximately 15 new and derivative business turbine aircraft. An almost equal number of new and derivative aircraft has been announced for the forecast period. The panel assumes that these product announcements will enter the market and live up to their billing in regard to price, performance, and availability.

Fourth, the panel assumes that fractional ownership will continue to grow and bring new operators into business aviation while providing current operators with efficient and effective ways to manage fleet resources. Current information on fractional ownership suggests that 60 to 70 percent of those purchasing a fractional share today do not currently own a business aircraft. The remaining portion of fractional buyers are operating business aircraft but wish to refine the composition of their current fleet so that they can better satisfy their demand for business travel.

In addition to these key assumptions, the panel assumes that 75 percent of new turbine production will enter the U.S. fleet. This capture rate is slightly higher than the historic rate, but the upward adjustment reflects the expected continued strength of the U.S. economy and the dominant role the U.S. fleet plays in the world fleet. The panel believes that 0.5 percent is an appropriate attrition rate for the business jet fleet and that a 1.0 percent attrition rate is applicable to the business turboprop fleet. The difference in the attrition rates reflects differences in fleet aging and net exports in used aircraft. On average, net exports (U.S. exports of used aircraft minus U.S. imports of used aircraft) of business jet aircraft are expected to balance out over the forecast period, with year-to-year variation reflecting the impact of economic conditions on the international flow of this dollar-denominated mobile asset. It should be noted that approximately 100 business jet aircraft will enter the U.S. fleet from the world fleet over 1999, a flow that the panel believes will reverse itself during the forecast period. As such, attrition from the U.S. jet fleet will reflect retirements and writeoffs and average approximately 30 jet aircraft per year. In contrast, the panel believes that there will be a modest flow of business turboprop aircraft from the U.S. fleet to the world fleet over the forecast period. If this is added to the influence of retirements and writeoffs, it can be expected that approximately 60 business turboprop aircraft will leave the U.S. fleet annually. The panel also assumes that market conditions will support the continued delivery of 600 new jet units per year worldwide, on average. Given the maturity of the turboprop segment of business aviation, the panel assumes that annual worldwide deliveries of new turboprop aircraft will average 200 units, a number that includes some nonbusiness turboprop aircraft (e.g., the Cessna Caravan) picked up in fleet counts. As an aside, it should be noted that the introduction of new engine technologies could have a dramatic impact on the turboprop segment of business aviation after 2004. However, because this possibility is still speculative, the panel did not factor this into out-year assumptions about deliveries (e.g., deliveries in 2003 and 2004 could be delayed in anticipation of entrance of substantially new products into the market in 2005).

1999-2004 Forecast

The panel framed its discussion around a straightforward heuristic model of business aviation activity. By definition, the U.S. fleet in any year is the sum of new production flowing into the fleet, the fleet size carried over from the previous year, and attrition of existing aircraft during the current year. As noted above, attrition includes net exports, retirements (which includes units temporarily taken out of the active fleet), and writeoffs. New production depends on economic growth and corporate profitability, new product development and introduction, and new aircraft prices. Total fleet hours is influenced by a number of factors including the level of economic activity, operating costs, fleet size, and the composition of users (i.e., the proportion of aircraft under fractional ownership). The panel considered all of these factors in its discussion and incorporated their influences into its forecast numbers.

The panel believes that market conditions will sustain a delivery rate of approximately 600 new business jet units per year on average. Assuming that 75 percent of new production flows into the U.S. jet fleet, 450 new business jet aircraft will enter the U.S. jet fleet annually over the forecast period. Given the expected annual rate of turboprop production (200 units), it is also expected that 150 new turboprop aircraft will enter the U.S. turboprop fleet annually. At the same time, the existing jet fleet will shrink approximately 0.5 percent on average due primarily to retirements and writeoffs. For forecast purposes the panel sets attrition from the U.S. business jet fleet at 30 jet units per year. At the same time the turboprop fleet will shrink approximately 1.0 percent per year, i.e., 60 units per year. As noted above, the higher attrition from the turboprop fleet reflects a larger number of retirements due to fleet aging and a modest level anticipated for net exports. Of course, there will be year-to-year variation around these mean values reflecting the randomness associated with writeoffs and normal variation in exchange rates and other economic influences affecting the international flow of used aircraft.

With these projected inflows and outflows the panel expects the business jet fleet to grow by approximately 420 aircraft per year and the turboprop fleet to grow by approximately 90 aircraft per year over the forecast period. Of course, these linear increases reflect movement toward the mean, when in fact there will be year-to-year variation around these trend values because of year-to-year deviations from the panel's assumed conditions and the natural variability observed in the behavior of owners and operators of business turbine aircraft related to their own peculiar circumstances.

Given the estimated sizes of the 1999 jet and turboprop fleets, forecast fleet sizes for 2000 through 2004 are summarized in Table 1. Year-to-year details are provided in Table 2. Given the estimated size of the 1999 business jet fleet (5,770 aircraft) it is forecast that the U.S. business jet fleet will number 7,870 business aircraft (numbers have been rounded in calculations) by 2004. This increase in the business jet fleet corresponds to an average annual growth rate of 6.4 percent in the business jet fleet. This growth rate is significantly higher than recent historic growth rates and higher than that forecast just a few years ago looking forward to the year 2000. This upward adjustment is warranted, however, by changed industry conditions. The higher rate of growth in the business jet fleet reflects a significant increase in the perceived sustainable annual rate of production for business jet aircraft (increasing from approximately 350 to 400 units per year to 600 units per year) associated with the strong domestic economy, a shift from commercial air travel to business air travel by some groups, unprecedented development of new and derivative models that continues to increase the value (benefits over costs) of owning a business jet, and the impact of fractional ownership on the business turbine market. In combination, these influences have moved the business jet market to a new, sustainable level. Necessarily, the greater inflow of new jet aircraft into the jet fleet boosts fleet growth, and this is reflected in the panel's forecast numbers.

With a 1999 turboprop fleet of 5,780 aircraft, it is expected that the U.S. turboprop fleet will number 6,230 aircraft by the year 2004. This corresponds to an average annual growth rate of 1.4 percent, a value consistent with the maturity of this segment of the business aviation industry when the domestic economy is expected to display modest real growth. As noted above, it is possible that the growth in the turboprop fleet could show some softening in

2003 and 2004 as new purchases are delayed in response to the introduction of new models incorporating significant improvements in engine technology. The forecast numbers do not factor this in, however, because of the uncertainty about the timing of any introductions that may be linked to advances in engine technologies. Regardless, the panel believes that the business turboprop fleet will show modest growth over the forecast period.

Forecasts for total flight hours for the jet and turboprop fleets are summarized in Table 3. Given the assumptions about fundamental background conditions (e.g., growing national economies, a stable regulatory environment, and no significant changes in operating costs) total hours are driven by the forecast growth in fleet size and, in the case of business jets, the change in fleet composition toward fractional ownership. First, consider the operation of the turboprop fleet. Total turboprop hours is expected to increase from approximately 1.7 million in 1999 to slightly more than 1.8 million hours in 2004. This increase corresponds to an average annual growth rate in total fleet hours of 1.4 percent. The slightly lower growth in turboprop fleet hours compared with the growth in fleet size is consistent with the aging of the business turboprop fleet. Older aircraft have lower utilization rates less than newer aircraft. Overall, the panel expects the turboprop utilization rate (hours per aircraft) to average 190 to 195 hours over the forecast period, with the possibility that the impact of aging will be balanced by a general increase in the demand for business air travel associated with expanding economic activity.

In regard to business jet aircraft, the panel anticipates 1999 fleet hours to be approximately 2.1 million. This level of activity is slightly higher than some estimates of 1999 fleet hours, but the panel members believe previously reported estimates did not adequately reflect the influence of fractional ownership on aircraft utilization. For example, the typical business jet aircraft in a corporate fleet flies approximately 330 hours per year, whereas a jet aircraft operated under fractional ownership will fly approximately 1,200 hours per year. In 1999 there were approximately 250 business jet aircraft operating under fractional ownership. The panel adjusted previous estimates for this impact to derive the base year (1999) value of 2.1 million hours.

The number of aircraft operating under fractional ownership is expected to increase by approximately 80 aircraft per year over the forecast period. This means that there will be approximately 650 jet aircraft (8.0 percent of the business jet fleet) operating under fractional ownership by 2004. Because of the increasing presence of "fractional flying," the panel expects total fleet hours to increase at a rate exceeding the growth rate in the business jet fleet; that is, this shift in fleet composition will have a discernible impact on total jet fleet hours. By the year 2004, total business jet fleet hours is forecast to reach 3.2 million, with nearly 25 percent of this total attributable to aircraft operating under fractional ownership. This total increase in total jet fleet hours corresponds to an average annual increase of 8.5 percent, a rate substantially higher than the growth rate in fleet size. With the shift toward fractional ownership and the more intense use of fractional jets this brings, the average jet utilization rate (hours per aircraft) is forecast to increase from the historic corporate utilization rate of 330 hours per year to approximately 400 hours per year.

Summary

Business aviation has experienced a resurgence over the past five years because (a) the results from research and development resulted in new and derivative products that increased value to the customer; (b) the commercial air travel industry did not figure out (and has not figured out) how to balance the efficiencies of a hub system with a customer focus on service and convenience; (c) a growing economy created the desire for and capacity to purchase business turbine aircraft; (d) new institutions improved the business case for acquiring business turbine aircraft, thereby bringing new operators into the industry; and (e) the regulatory environment avoided unwarranted constraints on the acquisition and operation of business turbine aircraft while enhancing the capacity and safety of the nation's airspace. Given the momentum in the business aviation market; persistent competitive pressures that ensure continued research and development by original equipment, avionics, and engine manufacturers; and reasonable assumptions about economic and regulatory trends over the next five years, it is expected that business aviation in the United States will continue showing considerable strength and solidify its role in the nation's air transportation system. The U.S. economy shows no sign of moving into a recession, and other national and regional economies around the world appear to be improving their economic performance. The unprecedented research and development that spurred growth over the latter part of the 1990s is expected to continue through the early years of the new millennium. If announced plans are achieved, the business aviation industry will have introduced approximately 30 new and derivative turbojet aircraft by the end of 2004. The safety record for business aviation continues to improve within the current regulatory environment, and this record should mitigate any arguments for further regulatory intrusion purporting to protect the businessperson operating business turbine aircraft. The competitive forces that created fractional ownership and added a substantial number of new owner-operators to the business aviation industry and improved the efficiency of current fleet operations will continue to extend the benefits of business turbine aircraft into unserved and underserved markets.

Taken together, these factors support a robust forecast for business aviation. The business jet fleet is expected to grow at an average annual rate of 6.4 percent for the 1999-2004 period resulting in a jet fleet approaching 7,900 aircraft. Total jet hours is expected to grow at an average annual rate of 8.5 percent and will exceed 3.1 million hours by 2004. Over the forecast period, the turboprop fleet will grow modestly, increasing at an average annual rate of 1.5 percent. Fleet hours will also expand, but at a slightly lower rate (1.4 percent) because of the effect of age on utilization. By the end of the forecast period turboprop hours will exceed 1.8 million. Overall, the forecasts for these measures of business flying speak to the increasing role that business aviation plays in maintaining our nation's competitiveness in a global economy.

TABLE 1. FIXED-WING TURBINE AIRCRAFT FLEET

Turbojets					
Actual			**Forecast**		
1990	1998	1999*	2000	2001	2004
4,100	5,468	5,770	6,190	6,610	7,870
	Average Annual Growth Rate (Percent)				
	1990-99	1998-1999	1999-00	2000-01	1999-04
	3.9	5.5	7.3	6.8	6.4
Turboprops					
Actual			**Forecast**		
1990	1998	1999*	2000	2001	2004
5,300	5,700	5,780	5,870	5,960	6,230
	Average Annual Growth Rate (Percent)				
	1990-99	1998-1999	1999-00	2000-01	1999-04
	1.0	1.4	1.6	1.5	1.5

* Increase in aircraft for 1998-1999 reflects the increase of fractional ownership on aircraft utilization.

TABLE 2 TURBINE FORECAST DETAIL

FIXED-WING TURBINE AIRCRAFT FLEET

Turbojet Fleet					
1999*	**2000**	**2001**	**2002**	**2003**	**2004**
5,770	6,190	6,610	7,030	7,450	7,870
Turboprop Fleet					
1999*	**2000**	**2001**	**2002**	**2003**	**2004**
5,780	5,870	5,960	6,050	6,140	6,230

FIXED-WING TURBINE AIRCRAFT HOURS FLOWN

Turbojet Hours (000s)					
1999*	**2000**	**2001**	**2002**	**2003**	**2004**
2,100	2,320	2,540	2,750	2,950	3,160
Turboprop Hours (000s)					
1999*	**2000**	**2001**	**2002**	**2003**	**2004**
1,690	1,720	1,750	1,770	1,800	1,820

*Increase in aircraft and hours for 1998-1999 reflects the increase of fractional ownership on aircraft utilization.

TABLE 3. FIXED-WING TURBINE AIRCRAFT HOURS FLOWN

Turbojets					
Actual			**Forecast**		
1990	1998	1999*	2000	2001	2004
1,396	1,801	2,100	2,330	2,540	3,160
	Average Annual Growth Rate (Percent)				
	1990-99	1998-1999	1999-00	2000-01	1999-04
	3.9	16.6	10.9	9.0	8.5
Turboprops					
Actual			**Forecast**		
1990	1998	1999*	2000	2001	2004
2,319	1,675	1,690	1,720	1,750	1,820
	Average Annual Growth Rate (Percent)				
	1990-99	1998-1999	1999-00	2000-01	1999-04
	(3.4)	1.4	1.7	1.7	1.4

*Increase in hours for 1998-1999 reflects the increase of fractional ownership on aircraft utilization.

Discussion Panel Report
LIGHT AND PERSONAL GENERAL AVIATION

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Assumptions

1. There will be a slight U.S. economic downturn in the years 2000 through 2002 in terms of GDP. Inflation, however, will remain low—below 3 percent.
2. No "negative" regulations will be implemented, such as increased demands on certification and piloting skills.
3. International demand will equal 25 percent of total demand.
4. No new OEMs will enter the single-engine piston market.
5. The flight school infrastructure will be improved. As an industry, we will become more efficient at keeping consumers interested in aviation. More flight schools will be added in the United States and "learn-to-fly" promotional activity will continue from GAMA and Cessna.

Forecasts

1. Single Engine Piston Fleet
See Table 1.

Reasons for changes:

• Attrition is estimated at 500 units per year.

• New production is estimated at 1,500 (United States only) in 1999. This number is estimated to grow by 5 percent in years 2000–2002 and then to grow by 8 percent in 2003 and 2004. The increase in growth is attributed to new product introductions from Cessna and Piper, combined with full production being achieved by Cirrus and Lancair in the out-years.

Factors to consider:

• 100LL fuel could be eliminated, causing a higher attrition rate.

• Airworthy directives could be issued on a large number of these 20-plus-year-old aircraft, causing owners to "retire" their airplanes rather than incur the cost to keep them flying.

2. SEP Aircraft Hours Flown
See Table 2.

Reasons for changes:

• The panel believed that there would be a shift in the type of people flying single-engine piston aircraft in the forecast period. Specifically, it was believed that there would be an increase in student pilots and therefore an increase in the number of aircraft being used for flight training. The panel's estimate puts the hours-per-year-per-aircraft at 145—a number very similar to the GAMA estimates.

Factors to consider:

• If student starts do not increase appreciably, utilization could remain flat.

3. Multi-Engine Piston Fleet
See Table 3.

Reasons for changes:

• The supply of multiengine piston aircraft is expected to stay flat throughout the forecast period. There will be some attrition, however, but that attrition is forecast to equal production. Therefore, the panel recommends holding the fleet size static.

4. MEP Aircraft Hours Flown
See Table 4.

Reasons for no change:

• While the supply of multiengine piston fleet is expected to stay flat throughout the forecast period, the number of pilots flying them is forecast to increase. Because of that, there will be more demand per aircraft, causing higher utilization.

Factors to consider:

If student starts do not increase appreciably, utilization could remain flat.

Reasons for changes:

• Two variables were used to derive this forecast: new students and a "carryover" factor of existing student pilots. Through August 1999, student starts are up more than 12 percent. If this trend continues, the student pilot population should continue to see strong year-to-year growth—the panel estimated 8 percent annually. Add to this a 50 percent carryover factor and the average annual growth reaches 8 percent by 2004.

5. Student Pilots

See Table 5.

Factors to consider:

• If GAMA and Cessna stop promoting learning-to-fly, then growth in student pilots could fall back to pre-1998 levels. In addition, the industry should do all it can to increase the number of Certified Flight Instructors. Last, if the FAA increases air-space complexity, there could be a decline in student starts.

6. Private Pilots

See Table 6.

Reasons for changes:

• In short, if the student pilot population grows as forecast, then the number of private pilots will increase too. Historically, 41 percent of student pilots moved on to become private pilots. Moreover, the panel estimated an attrition rate of 10 percent per year of the current pilot "stock." These two variables were used to derive the forecast.

7. Commercial Pilots

See Table 7.

Reasons for changes:

• The number of commercial pilots is directly related to the number of private pilots. Historically, there have been two private pilots to every one commercial pilot. The panel used this relationship to derive the commercial pilot forecast.

8. Instrument-Related Topics

See Table 8.

Reasons for changes:

• The number of instrument pilots is directly related to the total number of student, private, and commercial pilots. Historically, instrument rated pilots have equaled 67 percent of the total. The panel used this relationship to derive the instrument pilot forecast.

TABLE 1 Single Engine Piston Fleet

Single Engine Piston Fleet					
	98 act.	**99e**	**00**	**01**	**04**
FAA Forecast	141,718	143,419	144,662	145,915	150,236
Recommendation		142,718	143,793	144,947	149,084
		98-99	**99-00**	**00-01**	**99-04**
Recommended Annual Growth		0.7%	0.8%	0.8%	0.8%

TABLE 2 SEP Aircraft Hours Flown

SEP Aircraft Hours Flown (in thousands)					
	98 act.	99e	00	01	04
FAA Forecast	18,633	18,912	19,265	19,625	20,454
Recommendation		18,784	19,131	19,591	21,658
		98-99	99-00	00-01	99-04
Recommended Annual Growth		0.8%	1.8%	2.4%	2.5%

TABLE 3 Multi-Engine Piston Fleet

Multi Engine Piston Fleet					
	98 act.	99e	00	01	04
FAA Forecast	16,065	16,129	16,219	16,310	16,566
Recommendation		16,065	16,065	16,065	16,065
		98-99	99-00	00-01	99-04
Recommended Annual Growth		0.0%	0.0%	0.0%	0.0%

TABLE 4 MEP Aircraft Hours Flown

MEP Aircraft Hours Flown (in thousands)					
	98 act.	99e	00	01	04
FAA Forecast	2,411	2,423	2,438	2,453	2,499
Recommendation		2,423	2,438	2,453	2,499
		98-99	99-00	00-01	99-04
Recommended Annual Growth		0.5%	0.6%	0.6%	0.6%

TABLE 5 Student Pilots

Student Pilots (in thousands)					
	98 act.	99e	00	01	04
FAA Forecast	97.7	101.2	104.7	108.2	117.5
Recommendation		104.0	110.1	118.9	149.8
		98-99	99-00	00-01	99-04
Recommended Annual Growth		6.4%	5.9%	8.0%	8.0%

TABLE 6 Private Pilots

Private Pilots (in thousands)	98 act.	99e	00	01	04
FAA Forecast	247.2	250.9	257.2	263.6	280.6
Recommendation		249.7	255.5	264.5	297.7
		98-99	99-00	00-01	99-04
Recommended Annual Growth		1.0%	2.3%	3.5%	3.2%

TABLE 7 Commercial Pilots

Commercial Pilots (in thousands)	98 act.	99e	00	01	04
FAA Forecast	122.1	122.1	123.0	124.0	126.3
Recommendation		124.8	127.7	131.5	148.8
		98-99	99-00	00-01	99-04
Recommended Annual Growth		2.2%	2.3%	3.0%	3.4%

TABLE 8 Instrument-Related Pilots

Instrument Rated Pilots (in thousands)	98 act.	99e	00	01	04
FAA Forecast	300.2	304.4	311.4	318.5	334.0
Recommendation		307.3	317.1	329.2	379.3
		98-99	99-00	00-01	99-04
Recommended Annual Growth		2.4%	3.2%	3.8%	4.0%

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1. Impact of the following activity on growth of helicopters:
   a. Oil and gas industry:
      Worldwide fleet of about 1200 offshore helicopters will remain constant in the next few years. Helicopter fleet of about 600 turbines is expected to decrease in the Gulf of Mexico. The North Sea fleet will also see a reduction. However, the fleet is expected to increase in other areas such as South America, Africa, and Asia.
   b. Air medical industry:
      1) U.S. helicopter fleet has grown to about 400 units but is expected to decline in the next several years due to redundant operations in many major metropolitan areas. Hospital management is increasingly aware and concerned about cost.
      2) However, the industry is experiencing growth with single engine helicopters in a areas not served by majors, which may offset the decline expected in major metropolitan areas.
   c. Law enforcement:
      1) The U.S. helicopter fleet consists of about 1200 turbine helicopters of which about 50 percent are registered military surplus. The ease of acquiring military surplus equipment led to a major expansion over the last five years, which will result in growth of activity in regularly certified helicopters in the future.
      2) Fleet growth in the U.S. was 2.7 percent in 1998 or 32 units net including only 4 net military surplus helicopters. Availability or military surplus equipment is now negligible and no longer a major factor in law enforcement growth.
   d. Scheduled commercial airlines:
      Sikorsky indicates a recent resurgence of activity, but the market is still a relatively minor application in the worldwide market and the U.S.
   e. Fractional ownership operations:
      Both Bell and Sikorsky are experimenting with programs, but there are problems not experienced in fixed-wing, such as typically short stage lengths and the need for a large back-up fleet.
   f. Utility operations:
      1) Currently the largest application in civil helicopter operations, this activity constitutes more than 50 percent of the U.S. fleet. Agriculture work is down slightly, but other applications such as electrical, fire support, offshore oil support, etc., are up.
      2) Growth of utility fleet is expected to match the industry growth of about 2 percent overthe next few years.
   g. Corporate/private (not for hire):
      1) Roughly 12 percent of the U.S. turbine fleet, this application is showing positive growth. In 1997 sales of new and used turbine helicopters amounted to 12.8 percent of the 884 units sold to U.S. operators. In 1998, the percentage grew to 18.3 or 790 units. In the first eight months of 1999, growth is 17.3 percent or 603 units, which is about 26 percent of 904 units annualized.
      2) Growth of the corporate/private fleet is expected to exceed 10 percent for the next few years depending upon the overall U.S. economy.

2. Manufacturer's perspective:
   a. The overview presentation made it clear that OEMs acknowledge the importance of cost in industry growth, but generally the manufacturers are expecting continued growth of demand for new turbine helicopters.
   b. The majority of Eurocopter's 1998 and 1999 and anticipated year 2000 sales are of newly introduced products including the EC135, EC155, EC145 and the EC120. Worldwide unit sales amount to about 40 percent of the commercial market.

c. Sikorsky has developed a new analytical framework to solve for minimum operating cost, including the cost of failures and downtime. They see commercial growth in S-76 sales and forecasting 250 units for the S-92.
d. MDH has reduced the 902's selling price by 20 percent and concurrently significantly reduced its cycle time. The company is optimistic with new management and its line of turbine helicopters.
e. Bell Helicopter's share of the worldwide commercial market is also about 40 percent. Bell is experiencing growth in its product line, particularly with the 407.
f. Bell/Agusta's tilt rotor program may capture a larger share of the corporate/private twin engine market for executive transport, which is now at about 150 units. It may also affect the fixed wing turboprop market.

3. Outlook for piston helicopter demand:
   a. Delivery of new piston helicopters to U.S. operators in terms of units is approaching delivery of new turbine helicopters. In 1998, there were 109 new pistons compared with about 140 new turbines. In 1999 through August YTD deliveries of new pistons totaled 98 to U.S. operators compared with about 99 turbines.
   b. Today Robinson Helicopters dominates the new piston helicopter market with about 84 percent of total new sales through August 1999. Part of the reason is an expanding general aviation market (corporate/private), which for pistons is about 36 percent of piston sales compared with turbines, which total about 18 percent.

4. Regulation/legislation:
   A potential obstacle to growth of helicopters is the failure to consider rotorcraft requirements and unique capabilities when seeking consensus in rule making (e.g., the new rules on pilot reserve time may force small operators into prohibitive operating costs).
   Problems:
   a. Recent NPRM was checked with airlines but not with the Helicopter Association International (HAI).
   b. It will be essential to preserve the present infrastructure without further limits that would make some heliports obsolete; new heliport design guide could be a problem.
   c. The HAI's surveys indicate that the costs of regulation compliance are now 11 to 12 percent of total operating costs and are expected to increase. These, plus rising salaries and the costs of contracted maintenance, have offset much of the gain in aircraft productivity. Fifty percent of the commercial operators surveyed are at or below break-even.
   d. Regulations modeled after the excessively limiting JAR-Ops 3 JAA regulations could also tend to limit growth of the industry.

5. Forecast worksheets:
   a. Turbine helicopters
      1) The OEM community estimates the U.S. turbine helicopter fleet at about 6600 units. Customer Service Departments support the following:

Agusta	88 units
American Eurocopter	1100 units
Bell Helicopter Textron	4000 units
MD Helicopters	1244 units
Sikorsky (excluding S58T & S55T)	180 units
Total U.S. fleet	6612 units

      2) The helicopter panel believes that the OEM fleet estimate is about right. Growth is estimated at 2 percent annually for the next two years, then 1 percent annually for the next three years.
      3) Studies conducted by Conklin & Dedecker estimate turbine helicopter flight hours per aircraft at about 515. This level has been relatively stable for the past 5 years.
   b. Piston helicopters:
      1) The helicopter panel believes that the U.S. piston helicopter fleet is about 4500 units—about twice the FAA estimate.
      2) Growth of the piston fleet through August 1999 is 1.8 percent, which is expected to be at least 2.5 percent by year end. Growth for the next two years is estimated at 2 percent, with that percentage declining as the fleet grows in later years.
      3) The panel estimates flight hours per helicopter at about one-half of the turbine or about 250 hours per aircraft.
   c. Pilots:
      No information was readily available at the meeting, but the panel is looking into this question further and expects to recommend an estimate in the near future.

The helicopter panel is concerned that a low FAA estimate of the U.S. helicopter fleet adversely affects the position of the helicopter industry, particularly in regulatory matters. The lack of FAA representation on the helicopter panel of the current TRB/FAA workshop tended to feed the panel's concerns.

AIR CARGO

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Introduction

The panel review of FAA's draft air cargo forecast was mixed. Specifically, the panel determined that FAA's forecast was too low for international freight/express revenue ton-miles (RTMs) and the widebody fleet. The FAA forecast was too high for domestic freight/express RTMs and international mail RTMs. The FAA forecast was on target for domestic mail RTMs and the narrowbody fleet.

General Trends and Issues

The panel sees a continuing growth in the air cargo industry. The panel also expects this growth to continue at a faster rate than that for the commercial air passenger industry. The panel sees favorable worldwide economic growth that will facilitate air cargo industry growth. There are, however, several key issues that will affect the industry both in the short and the long term.

Environmental issues will have a major impact on the air cargo industry over the next decade. In general, the panel sees strong potential for increasing restrictions on aircraft noise and emissions that will affect business costs and operations. Some airports, particularly in Europe, have established penalties or credits to encourage the use of quieter and cleaner aircraft. In addition, ICAO has been tasked by national governments at the recent Kyoto conference to establish a baseline for worldwide aircraft emissions and to determine how to assess nations for their contribution to these emissions. There is strong potential that all or part of these costs will be passed on to carriers, including cargo carriers. The movement to Stage III and the potential requirement for Stage IV aircraft will affect the air cargo market, including the market for new or refitted cargo aircraft.

Capacity issues will also continue to play a key role in the air cargo industry. Slots and capacity restrictions at airports already limit air cargo operations. These restrictions, unless addressed, will have an increasingly negative effect on operations as the cargo market expands. This, in turn, will limit growth through lost opportunities. Some major airports, in particular, have limited potential for expansion. As a result, the panel sees the emerging and continued development of "cargo" airports that have significantly greater air cargo presence than usual and an increasing interest by communities to establish primarily cargo airports—often in less convenient locations.

Concerning Data Used for FAA Forecasts

The panel generally understood the limitations on the data available to the FAA in making its forecasts, as well as those on staff and funding. The panel did, however, see some opportunities to improve the information presented by the FAA. The panel also recognized the need for the industry to establish working groups among air cargo entities to develop information and data that would be helpful in their forecasting and trend analysis. The panel did not find it necessary for the government to perform this function, but did see a need for the government to facilitate these efforts and to participate as group members.

Data Improvements for FAA Forecasts

Concerning suggestions for data improvements, the panel saw a need for the FAA to distinguish between the express and general air freight businesses. This distinction is important because the trends in these two types of air cargo businesses are very different, including the fact that express business is growing more rapidly than air freight business.

The panel also noted that FAA's current data are very "United States–centered" and therefore do not account for some air cargo movements. FAA's data, for example, include information on U.S.-to-U.S. and U.S.-to-international destinations, but does not include international-to-U.S. destinations. The panel recognized that accurate and comprehensive international air freight data are not available from published sources. Such information is very valuable for capacity planning in the express industry.

The current FAA cargo forecast does not address world geographic distinctions. Geographic distinctions are important because the flow of cargo, type of cargo, and market growth differ across regions. The Latin American air cargo market, for example, has grown more quickly than the European market over the last decade. The panel noted the clear distinction between passenger and cargo markets. Simply stated, passengers generally make round trips and cargo doesn't. Examining cargo movement by direction, therefore, provides a much clearer picture of the air cargo industry. In addition, the panel noted that the "to and from" directional tonnage depends on whether it is a national or international shipment.

Industry Working Groups To Obtain Critical Data for Forecasts

The panel recognized that it would be helpful to establish industry working groups to share data that would be useful in making forecasts. The panel did not find it necessary for the government to perform this function, but did see a need for the government to facilitate these efforts and to participate as group members to contribute their expertise and knowledge. The panel also recognized that this effort would address the suggestions made in 1997 by the previous air cargo panel concerning the need to develop air cargo databases and convene a forecasting forum to discuss data findings, assumptions, and methods.

Panel members discussed ongoing consideration by some cargo carriers to establish an industry working group. This group, for example, may include FedEx, UPS, Airborne, and DHL. These companies would share and aggregate proprietary shipment and weight data by region. This would enable them to develop a better understanding of market trends and potential that would be useful in their business planning.

While panel members said that they did not want to have the government perform the functions of such working groups, they did suggest government participation and recognition. Government participation, including participation by analysts from the FAA, the U.S. Departments of Transportation and Commerce, ICAO, and IATA, for example, would both benefit the working group and provide both national and international perspectives. The panel also believed that recognition by these government entities would both indicate the importance of the group and help to further recognize the importance of the air cargo industry to national and world economies.

Finally, the panel would consider industry working groups as fulfilling the suggestions made by the previous air cargo panel in 1997. The previous panel had suggested that FAA spearhead an effort to develop comprehensive air cargo databases and convene a forecasting forum to develop a consensus view and report for industry use. The forum was to provide a vehicle for forecasters to discuss their findings, assumptions, and methods. The panel strongly believed that the FAA should provide greater focus on air cargo by having a separate break-out session for air cargo at its annual forecast conference. The FAA should also provide the opportunity for an informal discussion group to meet and exchange ideas and discuss important air cargo issues as part of the conference.

FAA's Issues Concerning Air Cargo

FAA requested that the panel discuss several key issues related to growth and financial factors in the air cargo industry.

Growth of All-Cargo and Belly-Cargo Carriers

The panel suggested that for the domestic market all-cargo carriers would grow relatively faster than belly-cargo carriers. However, there was some discussion that there is no universally accepted definition of what constitutes the all-cargo carrier segment. For the international market it was mentioned that the relative trend cannot be generalized and depends on what region of the world is being considered. It was also noted that the future growth for the market shares of the belly-cargo segment is tied to the outlook for the passenger market. For example, with high passenger load factors there may be less room for belly cargo. However, if there is sufficient expansion of passenger carrier operations, this could provide additional capacity to accommodate cargo activity. There is also potential competition from so-called fast cargo ships on the North Atlantic.

Potential for All-Cargo Carriers To Expand into Passenger Market

UPS confirmed that they do operate charter flights. These operations are usually Thursday through Monday. This has been on an experimental basis and has recently grown. UPS, however, does not intend at this time to expand into the scheduled passenger market. The panel was not aware of other efforts by all-cargo carriers to move into the passenger market.

Financial Factors Affecting All-Cargo Activity

The panel had reached consensus that real yield will continue to decline in the near term. Unit costs have a tendency to rise because of factors outside the control of the carriers. These costs include fuel costs, capital costs, handling and landing fees, airport charges, and labor costs. Also, fees for air traffic services may be more costly than existing regimes such as taxes as nations, including the U.S., move to fee-based assessments for providing air traffic services. These factors may have an impact on profitability, particularly for all-cargo carriers. Belly carriers, however, can spread the cost of these factors to their passenger segment.

Domestic Air Cargo RTMs: U.S. Commercial Carriers

1. Domestic freight/express

	1999-00	2001-01	1994-04
FAA forecast	4.9	5.0	5.5
Panel projection	3.9	4.0	4.5

Reasons for changes:

• Domestic cargo growth has not exceeded GDP growth in recent years.

• The GDP forecast used by FAA shows slower GDP growth.

Factors to consider:

• Domestic air cargo growth is inversely related to imports, and import growth is expected to be high.

• The impact of e-commerce will not be as great on air cargo as projected by some analysts because it mainly moves by truck.

• The centralization of distribution centers will affect RTMs without affecting actual tonnage.

• The "conventional" views of how to look at the economy, such as business cycles, may be changing.

2. Domestic mail

	1999-00	2001-01	1994-04
FAA forecast	3.3	3.3	3.6
Panel projection	OK	OK	OK

Reasons for changes:
Not applicable.

Factors to consider:

• Some domestic mail carried on contracted U.S. commercial carriers for the USPS is not being reported.

• The USPS should have these data.

International Air Cargo RTMs:
U.S. Commercial Carriers

1. International freight/express

	1999-00	2001-01	1994-04
FAA forecast	6.9	7.5	7.3
Panel projection	OK	OK	7.5-7.6

Reasons for changes:

• The panel was more optimistic for a strong international market, especially for express.

Factors to consider:

• The continued strengthening and stabilization of the Asian and Latin American economies.

• A general increase in market opportunities:

a) Increased 5th-freedom opportunities with additional open skies agreements. For example, there may soon be an open skies cargo agreement with Hong Kong that will provide great opportunities.

b) Growth and development of the China/U.S. market.

c) Decreased costs for cargo carriers from global airline alliances.

2. International mail

	1999-00	2001-01	1994-04
FAA forecast	3.1	3.5	3.5
Panel projection	2.7	3.0	3.0

Reasons for changes:

• The panel does not see the international mail market to be as strong as the projection.

Factors to consider:

• It is now much cheaper to fax documents than in the recent past because of cheaper telephone rates and other telecommunications innovations.

• The international mail market faces increasing competition from Internet use for delivering personal and business mail as well non-document-type products.

• The USPS is aggressively working to build its international market, which would move projections up if the USPS is successful.

Air Cargo Tonnage:
U.S. International Tonnage by Region

The panel determined that forecasts by regions would be useful information and encourages the FAA to pursue providing this information. In additional, the panel would encourage the FAA to use more comprehensive econometric models. These could include export/import trade data, exchange rates, and industrial production and consumption data.

Jet Fleets and Manufacturers: U.S. Air Carrier Large Cargo Aircraft

Note: This category of analysis was proposed by the FAA to be added, and the panel endorses this addition.

1. Large cargo aircraft—narrowbody

	1999-00	2001-01	1994-04
FAA forecast	2.0	1.7	1.4
Panel projection	OK	OK	OK

Reasons for changes:
Not applicable.

Factors to consider:

• Aging aircraft, upgrading to widebody aircraft, and noise restrictions may affect the market for this aircraft.

• Lack of commonality among containers is a problem.

2. Large cargo aircraft—widebody

	1999-00	2001-01	1994-04
FAA forecast	8.8	7.5	5.8
Panel projection	OK	OK	7.5-8.0

Reasons for changes:

• The panel is more optimistic that widebody aircraft growth will continue.

• There is a strong market for converted widebody passenger aircraft.

Factors to consider:

• Watch for continued less belly capacity for passenger aircraft if the passenger market remains strong, leading to an increase in widebody cargo aircraft to accommodate this "spill" from belly cargo.

• Previous industry fleet forecasts, such as those provided by Boeing, have underestimated growth.

• The profitability of all-cargo operations may affect the number of aircraft.

• Demand for all-cargo aircraft may vary by region because of increasing use of the Boeing 777 for passenger use, which increases belly space available for cargo.

Discussion Panel Report
AIRPORTS AND INFRASTRUCTURE

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Introduction

The Airports and Infrastructure Panel was charged with examining, in a broad, comprehensive manner, the trends that will drive aviation demand over the next several years and providing an estimate of the direction and effects of these trends, drawing on the broad and diverse expertise represented on the panel. In this regard this panel differed from other panels in the workshop, which focused primarily on specific portions of the FAA forecast. The panel devoted itself to analyzing the FAA forecast methodology, discussed possible changes or improvements to the way the forecast is presented, and reviewed a wide range of factors that will influence the growth of aviation in the U.S. over the next several years.

FAA Forecast

The panel opened its discussions by devoting a significant amount of attention to the FAA forecast. Although it is well recognized that the FAA's purpose in developing aviation forecasts is as an aid in determining FAA workload requirements, the panel wished to explore their utility to those involved in airport planning and the preparation of environmental documentation in support of airport development projects. A question was raised about whether the FAA could issue its forecast as a range rather than as exact numbers. In the view of some, the present FAA forecast has credibility problems. Providing the forecast in terms of a range may be more credible. For example, a probability distribution could be assigned to the forecast numbers. It might be useful to identify a confidence band around a central forecast. Or it might be more effective for scenarios to be used, possibly two per airport. Perhaps a narrative could accompany the forecast describing underlying characteristics and assumptions.

Because of the time lag between preparation of an airport master plan and the preparation of environmental documentation in support of airport development, a different forecast is often in effect at the time of environmental processing than was used in preparation of the airport master plan. This creates problems in satisfactory completion of the environmental work. Because actual aviation activity seldom agrees with the forecast, publication of the forecast as a range would help maintain the validity of the forecast over the time required to complete environmental documentation.

Panelists then turned to consideration of the extent to which capacity constraints affect the level of demand. The FAA forecast has historically been demand based and not constrained by availability of supply. The forecasting of demand without consideration of supply is problematic in the view of some panelists since it is known that supply affects demand. Is an optimum market solution consistent with a demand-driven planning process? The forecasts don't indicate the appropriate response to demand.

The panel discussed the quality of the FAA forecast and offered suggestions on how quality can be maintained and improved. The quality of a forecast is dependent upon the quality of the underlying data. As factors influencing the growth of aviation change, the old forecasting techniques may no longer be satisfactory. The changing characteristics of the aviation world suggest that the current means of forecasting may not be of the highest quality and that, over time, the FAA will have to account for these changes to improve the quality of the forecast. The FAA should consider investing more resources in more comprehensive data collection. Some organizations such as the National Business Aircraft Association (NBAA) collect data that may be useful to the FAA in developing the general aviation forecast. The use of the air traffic organization's Enhanced Traffic Management System (ETMS) may be helpful in developing the general aviation forecast. The International Air Transport Association does a survey that includes airport data that may be helpful to the FAA. There is also a need to develop a good method for counting or estimating operations at nontowered airports. However, the panelists recognized the current budget constraints that limit the FAA's forecasting capabilities.

The panel concluded its discussion of the FAA forecast by offering a wish list of actions the FAA could take with respect to the forecast that would assist airport planners in carrying out their airport system planning and development responsibilities. These included the following:

- Because air cargo is an increasingly important segment of aviation, the FAA should develop cargo forecasts;
- The FAA should publish the origin-destination survey data it collects for the top 40 airports, at least in summary form;
- In lieu of hub forecasts, the FAA has focused on developing forecasts for the top 40 airports in recent years—FAA may want to consider returning to performing hub forecasts;
- Perhaps the general aviation portion of the FAA forecast should differentiate between business and recreational activity; and
- There is a need to be able to derive peak-hour demand from national forecasts, particularly for terminal design.

System Capacity

The panel next focused on the topic of system capacity. The discussion revealed that panelists were divided in opinion on whether or not gridlock in the aviation system is imminent in spite of increasing delays. Some observed that, judging by their actions, the airlines apparently think not. There is no sign that airlines will utilize capacity more effectively as they continue the trend toward the use of smaller aircraft at congested large hub airports. It was noted that a countervailing factor is the planned addition of new runways at half of the large hub airports in the U.S. The increasing complexity of environmental documentation review processes and litigation could delay construction of at least some of these.

There was consensus among the panelists that it may be useful to know where supply and demand imbalances exist—where annual operations at a particular airport are approaching or exceeding that airport's estimated annual service volume. This could take the form of a narrative discussion in the forecast document in which airports are identified where capacity limitations inhibit realizing unconstrained forecast demand.

Some concern was expressed, on the other hand, that federal intervention and education, though well intentioned, may cause more harm than good by focusing attention on the perceived demand-capacity imbalance. However, a number of panelists felt that congestion must be affecting demand. There is probably latent demand that would become apparent if congestion could be alleviated. Adding to the complexity of this issue is the fact that at hubbing airports such as Chicago O'Hare, airlines sacrifice connecting traffic to other airports as origin-destination demand increases.

Regional Jets

There was general agreement among panelists that regional jets will figure prominently in the growth of aviation over the next several years. Discussion centered on whether the growth in regional jet commuter activity would be accommodated primarily at existing hubs or if regional jets will begin to serve other airports by overflying hubs, for example. There was general agreement that regional jets are probably going to be a factor in higher growth at underutilized medium-sized and small hub airports with implications for U.S. commuter/air taxi enplanement forecasts. The issue of possible reuse of existing turboprops on new routes was mentioned.

International Aviation

Turning to the influence of international aviation on air traffic growth, the panel observed that transoceanic traffic is a very volatile segment of aviation because mergers, interline agreements, and code sharing can affect transfers and therefore the airports at which transfers occur. Some 70 to 80 percent of transoceanic travel is transfer traffic. There was agreement that alliances among air carriers are primarily a defensive measure that may bring about some small savings but little in added revenue.

New large aircraft may become viable for Atlantic and Pacific transoceanic traffic in about 10 years.

Los Angeles and New York will continue to be primary gateways for newer transoceanic markets, but as particular routes mature, the carriers serving those routes will increasingly overfly the coastal airports in favor of the interior megahubs such as Atlanta, Chicago, Dallas–Fort Worth, and, ultimately, Denver. Spillover from these hubs will increase traffic at other airports.

General Aviation

Some length of time was devoted to general aviation activity and general aviation airports. Concern was expressed that airspace congestion in parts of the country is a constraint on the growth of general aviation. General aviation is at risk of being priced out or squeezed out of access to larger metropolitan areas. However, most general aviation pilots are satisfied with being able to access a metropolitan area via a reliever airport.

On the plus side, it appears that fractional ownership of general aviation aircraft will have a positive effect on the growth of general aviation. Fifteen percent of new aircraft deliveries are for fractionally owned aircraft. Most of this growth will be experienced at relievers and larger general aviation airports.

There was some speculation about the demand on the airport system that may result from the Small Aircraft Transportation System and whether the tiltrotor aircraft will receive widespread civil use, with no consensus reached.

With respect to general aviation airports, there was some support for the idea that FAA design standards for these airports may be excessive and that there may be a need to reevaluate design criteria for general aviation airports.

Finally, there was agreement that a way should be found to keep privately owned airports a viable part of the system because too many of them are closing. All-weather capabilities will also need to be developed at more airports. It is recognized that the FAA is limited in how supportive it may be in this area in that most airports threatened with closure are not in the National Plan of Integrated Airport Systems and therefore not eligible to receive federal financial assistance.

Cargo

The panel discussed the increasing importance of the air cargo segment of aviation. The panel believes that there is a need to develop a cargo forecast on an airport-by-airport basis and that integrated carrier activity should be forecast separately from commercial air carrier activity. It was observed that the continued growth of air cargo has implications for noise concerns and airport landside planning and development. Another factor is that the trend away from one-day service to two- or three-day service may favor commercial carriers over integrated carriers such as FedEx and UPS.

Environmental Concerns

Noise may be of increasing concern as more aircraft are put into service to handle passenger growth, mitigating the effect of Stage 3 conversions of existing equipment to some degree. However, it appears that air quality is fast overtaking noise as a major concern in the environmental assessment process for proposed projects at many locations. In some cases, air quality compliance considerations will either curtail or stretch out the pace of airport development. Increases in analysis requirements, review time, and probable litigation all combine to stretch out environmental approval schedules. The location of an airport in an air quality nonattainment area certainly presents that airport with a major constraint on expansion. The operation of more sophisticated general aviation aircraft (turbojets) is also causing environmental problems.

New Technology

Although little time was devoted to discussion of the effect of new technology on the growth of aviation, it was observed that teleconferencing (or video conferencing) may replace a certain amount of business travel. Video conferencing via the Internet may eventually become a factor. However, not much research in this area has been reported by the aviation industry. Changing technologies can also increase airside capacity by reducing the separation requirements for arriving and departing aircraft, but these may be slow to be realized.

Conclusions

A number of factors could change or impede realization of projected demand levels:

- Degree to which airfield capacity will be a constraint;
- Effect of compliance with noise, air quality, and other environmental regulations;
- Role of regional jet service—whether it will be primarily on hub-and-spoke routes or direct and the effect that scope clauses will have on its use;
- Effect that changing influences in international aviation such as code sharing, global airlines, and new large aircraft may have on airport usage, causing increased international traffic at large inland transfer hubs; and
- Degree to which general aviation growth will be affected positively on the one hand by fractional ownership and negatively on the other hand by difficulties in protecting existing general aviation airports and restricting access to major metropolitan areas.

A variety of steps could be taken to improve the utility of FAA forecasts for airport planners:

- Presentation of forecast values as a central forecast with a range rather than a single number;
- Publication of information gathered on origin-destination versus transfer traffic at major airports; and
- Development of cargo forecasts on an airport-by-airport basis.

Discussion Panel Report

FLEETS AND MANUFACTURERS

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Introduction

Prior to the Fleets and Manufacturers Panel meeting, the participants submitted their forecasts to the co-chairs for comparison and production of a consensus set of results. In addition, qualitative issues of importance to forecasting in the short and medium term were identified and prioritized prior to the meeting. Additional points were raised and discussed during the presentation of the consensus results in the panel meeting.

Forecasts

The consensus forecast of the panel was that worldwide passenger traffic would grow by 4.8 percent per annum over the next 20 years. The range of views from the panelists ranged from 4.4 to 5.1 percent pa (Figure 1). In terms of regional growth, the consensus showed an overall reduction in the share of North American traffic from 36 percent in 1998 to 29 percent in 2018.

Worldwide capacity as measured by available seat kilometers (ASKs) is expected to rise by 4.6 percent pa over the next 20 years, thereby driving an increase in load factor of 0.2 percent pa from 70.2 percent in 1998 to 72.1 percent in 20 years.

Freight traffic is forecast to rise by an average of 6.6 percent pa over the next 20 years.

Deliveries of turboprops and regional jets of 75 seats and fewer (Class I) are projected to be 6,000 aircraft, with retirements of 3,100 and hence an increase in the global fleet of 2,900 aircraft to 7,800 in 2018 (Figure 2).

The world passenger jet fleet deliveries (75 seats and above) are forecast to be 14,450, with 6,400 retirements, resulting in a net fleet increase of 8,050 aircraft and reaching 19,600 by 2018 (Figures 3, 4, and 5).

Addition of the jet freighter fleet, turboprop and regional jet fleet, and larger passenger aircraft gives a total fleet size of 29,700 aircraft in 2018 compared with 18,540 today.

Qualitative Issues

Several qualitative issues that will drive the fleet of jet and turboprop aircraft in the short or long term were discussed. In the short term Stage 2 noise regulations in the United States and Europe are driving a peak in retirements that is being matched by a peak in new aircraft deliveries. The quantity of hushkitted aircraft that are retained in the fleet is an important driver that could increase fleet size over that required to meet demand.

The impact of alliances was discussed, and it was agreed that it was not a big driver on overall fleet size but could have implications on the mix of aircraft purchased by aligned versus nonaligned carriers. In the longer term, alliances could have a great effect on the shape of the industry by driving down the cost base and allowing fares to be further reduced and load factors increased.

Asian traffic was recognized as being well into recovery, but it was considered that it would take more time for yields to improve and that this was needed before Asian carriers started ordering new aircraft again.

The group recognized that aircraft production was forecast to be reduced over the coming years, but a key question that the industry faces is whether the forecast decline in supply will match or exceed demand.

The U.S. economy was recognized as a key driver for economies in Europe and Asia and therefore any downturn in the U.S. economy would have global impacts. No economic downturn had been included in the forecasts of the group.

Future environmental legislation was considered by the group as something that could have a fundamental effect on passenger traffic and hence fleet needs but is at this time not quantifiable.

Further noise regulations will also have an as yet unquantifiable effect on the fleet.

The explosive growth of regional jets in the United States could have a serious effect on airport congestion and further exacerbate the shortage of cockpit crew.

A key driver in forecasting future fleet needs is the level of infrastructure congestion and whether this is accepted as a constraint or whether solutions will be found.

A further factor that was discussed is the balance between offering more frequency and more direct services versus the lower cost benefits of consolidation of services.

Comments on FAA Forecast

The U.S. fleet of narrowbody aircraft in 2004 is believed to be about 100 aircraft too low because of the expected retention of more hushkitted aircraft in the fleet.

The large-cargo aircraft fleet could be higher because of increased express freight traffic.

The forecast of the regional and commuter fleet is also believed to be about 100 aircraft too low, given that Embraer and Bombardier are delivering approximately 200 regional jets per annum, of which about 70 percent are destined for the U.S. market.

The turboprop fleet is believed to be around 150 aircraft too high in 2004 as the panel expects greater substitution of services by regional jets.

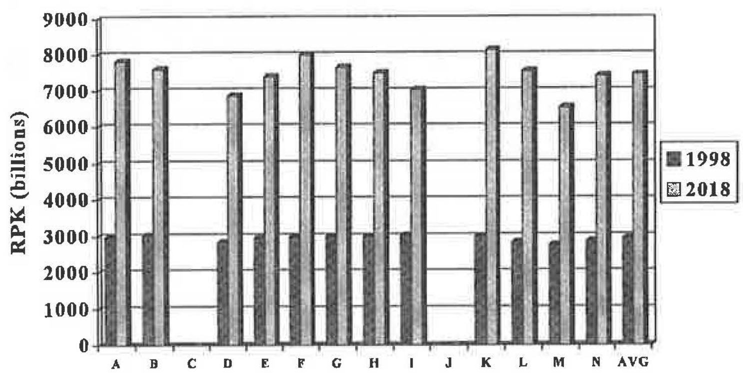

FIGURE 1 Worldwide revenue passenger kilometer forecast.

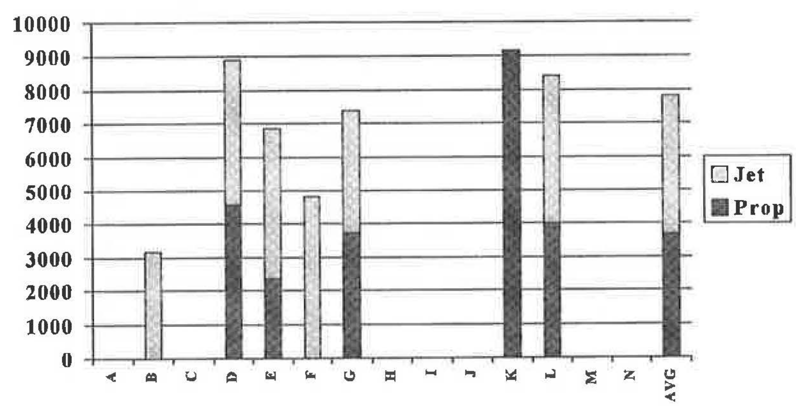

FIGURE 2 Class I aircraft: 2018 fleet size.

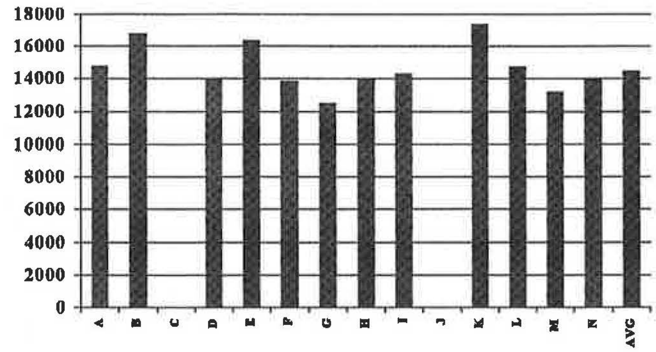

FIGURE 3 Class II/III/IV aircraft: cumulative deliveries 1999 to 2018.

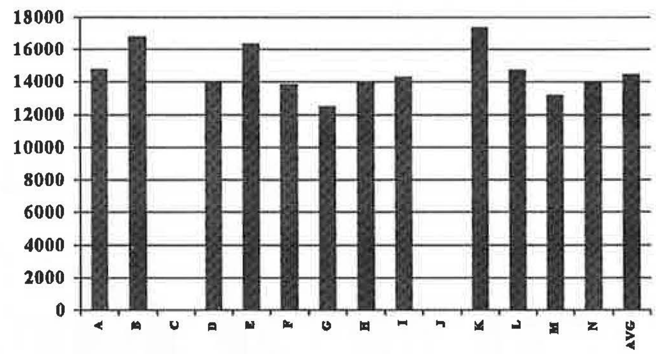

FIGURE 4 Class II/III/IV aircraft: cumulative retirements 1999 to 2018.

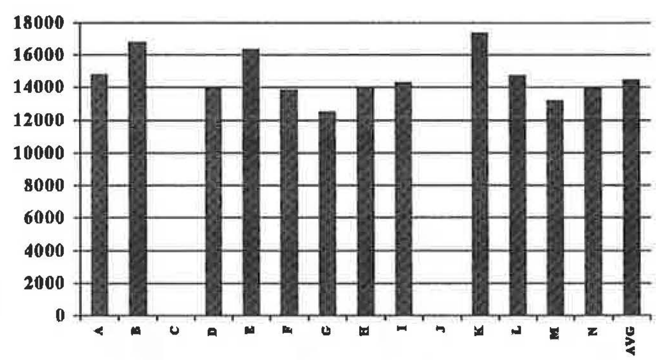

FIGURE 5 Class II/III/IV aircraft: 2018 fleet size.

APPENDIX A: PARTICIPANTS

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PASSENGER DEMAND: DOMESTIC

U.S. DOMESTIC AIR CARRIERS--LARGE

1. Domestic Passenger Enplanements

Enplanements (in millions)					
Actual			FAA Forecast		
1990	1998	1999e	2000	2001	2004
424.1	554.6	567.9	581.0	594.5	663.7

	Average Annual Growth Rate (percent)				
	1990-99	1998-99	1999-00	2000-01	1999-04
	3.3	2.4	2.3	2.3	3.2
Your Projection:			2.5	2.4	2.6

Reasons for Changes:

Factors to Consider:

2. Domestic Passenger Yield in 1999$

Passenger Yield in 1999$ (cents)					
Actual			FAA Forecast		
1990	1998	1999e	2000	2001	2004
16.61	14.18	13.90	13.59	13.29	12.98

	Average Annual Growth Rate (percent)				
	1990-99	1998-99	1999-00	2000-01	1999-04
	(2.0)	(2.0)	(2.2)	(2.2)	(1.4)
Your Projection:			(1.7)	(1.8)	(1.6)

Reasons for Changes:

Factors to Consider:

3. Domestic Passenger Load Factor

Domestic Load Factor (percent)					
Actual			FAA Forecast		
1990	1998	1999e	2000	2001	2004
60.8	70.1	69.8	69.5	69.1	69.2

	Average Annual Growth Rate (points)				
	1990-99	1998-99	1999-00	2000-01	1999-04
	1.0	(0.3)	(0.3)	(0.4)	(0.1)
Your Projection:			(0.2)	(1.0)	(0.3)

Reasons for Changes:

Factors to Consider:

PASSENGER DEMAND: DOMESTIC

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

1. Large Jet Passenger Aircraft (Excluding Regional Jets)

Number of Aircraft					
Actual			FAA Forecast		
1990	1998	1999e	2000	2001	2004
3,722	4,087	4,130	4,176	4,245	4,606
		Your Projection:			

Average Annual Growth Rate (percent)				
1990-99	1998-99	1999-00	2000-01	1999-04
1.2	1.1	1.1	1.7	2.2

Reasons for Change

Factors to Consider:

2. Average Seats Per Aircraft--Domestic Operations

Average Seats/Aircraft					
Actual			FAA Forecast		
1990	1998	1999e	2000	2001	2004
151.7	142.2	141.8	142.2	142.6	143.7

Average Annual Growth Rate (percent)				
1990-99	1998-99	1999-00	2000-01	1999-04
(1.1)	(0.4)	0.4	0.4	0.4
Your Projection:				

Reasons for Change

Factors to Consider:

PASSENGER DEMAND: DOMESTIC

U.S. AIR CARRIER PASSENGER FLEET: Page 2

1. Large Jet Passenger Fleet--Narrowbody (Excl. Regional Jets)

Number of Aircraft					
Actual			FAA Forecast		
1990	1998	1999e	2000	2001	2004
3,080	3,406	3,431	3,449	3,489	3,783
		Your Projection:			

Average Annual Growth Rate (percent)				
1990-99	1998-99	1999-00	2000-01	1999-04
1.2	0.7	0.5	1.2	2.0

Reasons for Change

Factors to Consider:

2. Large Jet Passenger Fleet--Widebody (Excl. Regional Jets)

Number of Aircraft					
Actual			FAA Forecast		
1990	1998	1999e	2000	2001	2004
633	681	699	727	756	823
		Your Projection:			

Average Annual Growth Rate (percent)				
1990-99	1998-99	1999-00	2000-01	1999-04
1.1	2.6	4.0	4.0	3.3

Reasons for Change

Factors to Consider:

3. Regionals Jets (U.S. Carriers Only)

Number of Aircraft					
Actual			FAA Forecast		
1993	1998	1999e	2000	2001	2004
9	206	321	412	519	838
		Your Projection:			

Average Annual Growth Rate (percent)				
1993-99	1998-99	1999-00	2000-01	1999-04
81.4	55.8	28.3	26.0	21.2

Reasons for Change

Factors to Consider:

PASSENGER DEMAND: INTERNATIONAL

ATLANTIC ROUTES

1. Passengers (U.S. and Foreign Flag)

Passengers (in millions)					
Actual			FAA Forecast		
1990	1998	1999e	2000	2001	2004
29.0	47.1	50.3	53.1	55.5	63.2
	Average Annual Growth Rate (percent)				
	1990-99	1998-99	1999-00	2000-01	1999-04
	6.3	6.8	5.6	4.5	4.7
Your Projection:			5.6	4.5	4.7

Reasons for Change

Factors to Consider:
U.S. Economic slowdown-depth & duration
European recovery
No unusual stimulation effects

2. Passenger Yield in 1999$ (U.S. Carriers Only)

Passenger Yield in 1999$ (cents)					
Actual			FAA Forecast		
1990	1998	1999e	2000	2001	2004
11.97	10.14	9.90	9.68	9.47	9.27
	Average Annual Growth Rate (percent)				
	1990-99	1998-99	1999-00	2000-01	1999-04
	(2.1)	(2.4)	(2.2)	(2.2)	(1.3)
Your Projection:			(2.2)	(2.2)	(1.3)

Reasons for Change

Factors to Consider:
Excess capacity; US--Europe
Move of aircraft from Pacific to Atlantic.
Push for profitability following 2000/2001 slowdown.

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

Domestic Load Factor (percent)					
Actual			FAA Forecast		
1990	1998	1999e	2000	2001	2004
69.8	78.9	78.7	78.4	78.5	78.5
	Average Annual Growth Rate (points)				
	1990-99	1998-99	1999-00	2000-01	1999-04
	1.0	(0.2)	(0.3)	0.1	(0.0)
Your Projection:					

Reasons for Change

Factors to Consider:
Deliveries of new A330/340, B-767/777. Aircraft movement between Pacific & Atlantic routes. Aircraft parked by US airlines. Airlines can balance capacity with demand.

PASSENGER DEMAND: INTERNATIONAL

PACIFIC ROUTES

1. Passengers (U.S. and Foreign Flag)

Passengers (in millions)					
Actual			FAA Forecast		
1990	1998	1999e	2000	2001	2004
15.1	23.1	23.3	24.0	25.7	31.4

	Average Annual Growth Rate (percent)				
	1990-99	1998-99	1999-00	2000-01	1999-04
	4.9	0.9*	3.0	7.1	6.1
Your Projection:			3.0	3.0	5.0

*final figure may be higher

Reasons for Change

Factors to Consider:
U.S. economic slowdown will delay stronger Asian recovery until after 2001.

2. Passenger Yield in 1999$ (U.S. Carriers Only)

Passenger Yield in 1999$ (cents)					
Actual			FAA Forecast		
1990	1998	1999e	2000	2001	2004
14.47	9.25	8.97	8.78	8.71	8.53

	Average Annual Growth Rate (percent)				
	1990-99	1998-99	1999-00	2000-01	1999-04
	(5.2)	(3.0)	(2.1)	(0.8)	(1.0)
Your Projection:			(2.1)	(0.8)	(1.0)

Reasons for Change

Factors to Consider:
Airline need for profits

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

Domestic Load Factor (percent)					
Actual			FAA Forecast		
1990	1998	1999e	2000	2001	2004
71.4	72.8	72.8	73.0	73.2	74.0

	Average Annual Growth Rate (points)				
	1990-99	1998-99	1999-00	2000-01	1999-04
	0.2	0.0	0.2	0.2	0.2
Your Projection:			0.2*	(0.3)	0.1

*aircraft moved to Atlantic

Reasons for Change

Factors to Consider:
Capacity growth through new deliveries will exceed traffic growth during economic slowdown but traffic will catch up.

PASSENGER DEMAND: INTERNATIONAL

LATIN AMERICAN ROUTES

1. Passengers (U.S. and Foreign Flag)

Passengers (in millions)					
Actual			FAA Forecast		
1990	1998	1999e	2000	2001	2004
26.3	37.2	39.2	41.5	44.2	54.1
	Average Annual Growth Rate (percent)				
	1990-99	1998-99	1999-00	2000-01	1999-04
	4.5	5.4	5.9	6.5	6.7
Your Projection:			5.9	6.0	6.2

Reasons for Change

Factors to Consider:
U.S. economic slowdown

2. Passenger Yield in 1999$ (U.S. Carriers Only)

Passenger Yield in 1999$ (cents)					
Actual			FAA Forecast		
1990	1998	1999e	2000	2001	2004
15.04	13.61	13.30	13.00	12.71	12.41
	Average Annual Growth Rate (percent)				
	1990-99	1998-99	1999-00	2000-01	1999-04
	(1.4)	(2.3)	(2.3)	(2.2)	(1.4)
Your Projection:			(2.3)	(2.2)	(2.0)

Reasons for Change

Factors to Consider:
Prioritization of Latin American carriers will improve their competitiveness.

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

Domestic Load Factor (percent)					
Actual			FAA Forecast		
1990	1998	1999e	2000	2001	2004
62.3	62.8	62.8	62.8	63.1	64.5
	Average Annual Growth Rate (points)				
	1990-99	1998-99	1999-00	2000-01	1999-04
	0.1	0.0	0.0	0.3	0.3
Your Projection:			0.0	0.2	0.3

Reasons for Change

Factors to Consider:
Economy and aircraft deliveries

PASSENGER DEMAND: INTERNATIONAL

U.S./CANADA TRANSBORDER

1. Passengers (U.S. and Foreign Flag)

Passengers (in millions)					
Actual			FAA Forecast		
1990	1998	1999e	2000	2001	2004
13.7	18.7	19.4	20.0	20.7	23.1
	Average Annual Growth Rate (percent)				
	1990-99	1998-99	1999-00	2000-01	1999-04
	3.9	3.7	3.1	3.5	3.6
Your Projection:			3.1	3.5	3.6

Reasons for Change

Factors to Consider:

Canada--US exchange rate: Canada remains desirable destination and favorable Canadian economic factors.

PASSENGER DEMAND: INTERNATIONAL

AVERAGE SEATS PER AIRCRAFT

1. Atlantic Routes

Average Seats/Aircraft					
Actual			FAA Forecast		
1990	1998	1999e	2000	2001	2004
278.6	228.4	229.2	230.7	232.2	236.7
	Average Annual Growth Rate (seats)				
	1990-99	1998-99	1999-00	2000-01	1999-04
	(5.5)	0.8	1.5	1.5	1.5
Your Projection:			1.5	1.5	1.5

Reasons for Change

Factors to Consider:
DC-10s and B-767s replaced by B-777s.

2. Pacific Routes

Average Seats/Aircraft					
Actual			FAA Forecast		
1990	1998	1999e	2000	2001	2004
318.6	318.2	317.5	318.9	320.2	326.2
	Average Annual Growth Rate (seats)				
	1990-99	1998-99	1999-00	2000-01	1999-04
	(0.1)	(0.7)	1.4	1.3	1.7
Your Projection:			0	0	0

Reasons for Change

Factors to Consider:
Replacement of DC-10/MD-11 with B-777 does not significantly change average size

3. Latin American Routes

Average Seats/Aircraft					
Actual			FAA Forecast		
1990	1998	1999e	2000	2001	2004
194.0	177.7	177.3	177.9	178.0	181.0
	Average Annual Growth Rate (seats)				
	1990-99	1998-99	1999-00	2000-01	1999-04
	(1.9)	(0.4)	0.6	0.1	0.7
Your Projection:			0.6	0.6	0.7

Reasons for Change

Factors to Consider:
Growth in longer haul markets requires larger aircraft to deliver the range.

PASSENGER DEMAND:REGIONALS/COMMUTERS

U.S. REGIONAL/COMMUTER INDUSTRY

1. Passenger Enplanements

Enplanements (in millions)					
Actual			FAA Forecast		
1990	1998	1999e	2000	2001	2004
37.7	66.1	71.0	74.9	78.7	92.6
	Average Annual Growth Rate (percent)				
	1990-99	1998-99	1999-00	2000-01	2001-04
	7.3	7.4	5.5	5.1	5.5
Your Projection:			8.0	7.4	5.5

Reasons for Changes:

-known aircraft deliveries and firm orders
-capacity constraints pull down growth beyond 2001

Factors to Consider:

2. Passenger Trip Length

Passenger Trip Length					
Actual			FAA Forecast		
1990	1998	1999e	2000	2001	2004
179.6	241.8	246.9	252.2	257.6	273.7
	Average Annual Growth Rate (miles)				
	1990-99	1998-99	1999-00	2000-01	2001-04
	7.5	5.1	5.3	5.4	5.4
Your Projection:			0	0	8

miles

Reasons for Changes:

-elimination 19-seats
-new jet routes

Factors to Consider:

3. Passenger Load Factor

Load Factor (percent)					
Actual			FAA Forecast		
1990	1998	1999e	2000	2001	2004
47.5	56.5	56.8	57.2	57.5	58.4
	Average Annual Growth Rate (points)				
	1990-99	1998-99	1999-00	2000-01	2001-04
	1.0	0.3	0.4	0.3	0.3
Your Projection:			0.4	0.3	0.3

Reasons for Changes:

Factors to Consider:

PASSENGER DEMAND: REGIONALS/COMMUTERS

U.S. REGIONALS/COMMUTERS (Reporting on BTS Form 298C)

1. Passenger Enplanements

Enplanements (in millions)					
Actual			FAA Forecast		
1990	1998	1999e	2000	2001	2004
24.0	35.7	35.3	37.1	38.9	45.3
	Average Annual Growth Rate (percent)				
	1990-99	1998-99	1999-00	2000-01	1999-04
	4.4	(1.1)	5.1	4.9	5.1
	Your Projection:				

Reasons for Changes:

Factors to Consider:

2. Passenger Trip Length

Passenger Trip Length					
Actual			FAA Forecast		
1990	1998	1999e	2000	2001	2004
174.0	245.9	253.9	259.1	264.3	280.1
	Average Annual Growth Rate (miles)				
	1990-99	1998-99	1999-00	2000-01	1999-04
	8.0	8.0	5.2	5.2	5.2
	Your Projection:				

Reasons for Changes:

Factors to Consider:

3. Passenger Load Factor

Load Factor (percent)					
Actual			FAA Forecast		
1990	1998	1999e	2000	2001	2004
45.9	55.1	55.1	55.4	55.7	56.6
	Average Annual Growth Rate (points)				
	1990-99	1998-99	1999-00	2000-01	1999-04
	1.0	0.0	0.3	0.3	0.3
	Your Projection:				

Reasons for Changes:

Factors to Consider:

PASSENGER DEMAND: REGIONALS/COMMUTERS

U.S. REGIONALS/COMMUTERS (Reporting on BTS Form 41)

1. Passenger Enplanements

Enplanements (in millions)					
Actual			FAA Forecast		
1990	1998	1999e	2000	2001	2004
13.7	30.4	35.7	37.8	39.8	47.3
	Average Annual Growth Rate (percent)				
	1990-99	1998-99	1999-00	2000-01	1999-04
	11.2	17.4	5.9	5.3	5.8
	Your Projection:				

Reasons for Changes:

Factors to Consider:

2. Passenger Trip Length

Passenger Trip Length					
Actual			FAA Forecast		
1990	1998	1999e	2000	2001	2004
184.1	237.0	240.0	245.5	251.0	267.5
	Average Annual Growth Rate (miles)				
	1990-99	1998-99	1999-00	2000-01	1999-04
	6.2	3.0	5.5	5.5	5.5
	Your Projection:				

Reasons for Changes:

Factors to Consider:

3. Passenger Load Factor

Load Factor (percent)					
Actual			FAA Forecast		
1990	1998	1999e	2000	2001	2004
49.6	58.4	58.8	59.1	59.4	60.3
	Average Annual Growth Rate (points)				
	1990-99	1998-99	1999-00	2000-01	1999-04
	1.9	0.4	0.3	0.3	0.3
	Your Projection:				

Reasons for Changes:

Factors to Consider:

PASSENGER DEMAND: REGIONALS/COMMUTERS

U.S. REGIONAL/COMMUTER PASSENGER AIRCRAFT

1. Regional/Commuter Passenger Fleet (Turboprops & Jets)

Aircraft					
Actual			FAA Forecast		
1990	1998	1999e	2000	2001	2004
1,819	2,039	2,094	2,171	2,262	2,485
	Your Projection:				2,314

Average Annual Growth Rate (percent)				
1990-99	1998-99	1999-00	2000-01	1999-04
1.6	2.7	3.7	4.2	3.5

Reasons for Changes:

Factors to Consider:

2. Average Seats Per Aircraft

Average Seats/Aircraft					
Actual			FAA Forecast		
1990	1998	1999e	2000	2001	2004
26.5	33.1	34.2	35.2	36.2	38.5

Average Annual Growth Rate (seats)				
1990-99	1998-99	1999-00	2000-01	1999-04
0.9	1.1	1.0	1.0	0.9
Your Projection:		1.5	1.0	0.9

Reasons for Changes:

Factors to Consider:

-Retirement of 19 seats

- Delivery of 50+ seats
- Potential large delivery of microjets beyond 2000

PASSENGER DEMAND: REGIONALS/COMMUTERS

U.S. REGIONAL/COMMUTER PASSENGER AIRCRAFT

1. Regional Jets

Aircraft					
Actual			FAA Forecast		
1993	1998	1999e	2000	2001	2004
9	206	321	412	519	838
	Your Projection:		460	630	1100

Average Annual Growth Rate (percent)				
1990-99	1998-99	1999-00	2000-01	1999-04
81.4	55.8	28.3	26.0	21.2

Reasons for Changes:

Factors to Consider:

Orders and production

2. Turboprops

Aircraft					
Actual			FAA Forecast		
1990	1998	1999e	2000	2001	2004
1819	1833	1773	1759	1743	1647
	Your Projection:				1314

Average Annual Growth Rate (percent)				
1990-99	1998-99	1999-00	2000-01	1999-04
(0.3)	(3.3)	(0.8)	(0.9)	(1.5)

Jets (not included) Mesa 36 RJ85
ZW 18-146
Horizon 22 F-28

Turbo-prop: less than 20 seats

Reasons for Changes:

All Jet:
ASA Amer Eagle
Comair
ACA
MEAA
CoExp

Factors to Consider:

Assume Alaska

FLEETS/MANUFACTURERS:JETS

U. S. AIR CARRIER JET FLEET

1. Large Passenger Aircraft

Number of Aircraft					
Actual			FAA Forecast		
1990	1998	1999e	2000	2001	2004
3,722	4,087	4,130	4,176	4,245	4,606
		Your Projection			

Average Annual Growth Rate (percent)				
1990-99	1998-99	1999-00	2000-01	1999-04
1.2	1.1	1.1	1.7	2.2

Reasons for Changes:

Factors to Consider:

2. Large Cargo Aircraft

Number of Aircraft					
Actual			FAA Forecast		
1990	1998	1999e	2000	2001	2004
528	943	982	1,022	1,058	1,128
		Your Projection			

Average Annual Growth Rate (percent)				
1990-99	1998-99	1999-00	2000-01	1999-04
7.1	4.1	4.1	3.5	2.8

Reasons for Changes:

Factors to Consider:

3. Regional Jets

Number of Aircraft					
Actual			FAA Forecast		
1993	1998	1999e	2000	2001	2004
9	206	321	412	519	838
		Your Projection			*

Average Annual Growth Rate (percent)				
1993-99	1998-99	1999-00	2000-01	1999-04
81.4	55.8	28.3	26.0	21.2

Reasons for Changes:

Factors to Consider:

FAA estimate could be 100+/- low as Embraer & Bombardier are delivering approx 200 Regional Jets per annum--70% of which are destined for the US market.

FLEETS/MANUFACTIRERS: JETS

U.S. AIR CARRIER LARGE PASSENGER AIRCRAFT

1. Large Passenger Aircraft--Narrowbody

Number of Aircraft					
Actual			FAA Forecast		
1990	1998	1999e	2000	2001	2004
3,080	3,406	3,431	3,449	3,489	3,783
		Your Projection			*

Average Annual Growth Rate (percent)				
1990-99	1998-99	1999-00	2000-01	1999-04
1.2	0.7	0.5	1.2	2.0

Reasons for Change

Factors to Consider:

*May be about 100 aircraft too low as more hushkitted aircraft could be retained in the fleet.

2. Large Passenger Aircraft--Widebody

Number of Aircraft					
Actual			FAA Forecast		
1990	1998	1999e	2000	2001	2004
633	681	699	727	756	823
		Your Projection			

Average Annual Growth Rate (percent)				
1990-99	1998-99	1999-00	2000-01	1999-04
1.1	2.6	4.0	4.0	3.3

Reasons for Change

Factors to Consider:

3. Large Passeger Aircraft--Average Seats Per Aircraft

Average Number of Seats					
Actual			FAA Forecast		
1990	1998	1999e	2000	2001	2004
169.0	158.4	158.4	159.1	159.9	162.3
		Your Projection			

Average Annual Growth Rate (seats)				
1990-99	1998-99	1999-00	2000-01	1999-04
(1.2)	0.0	0.7	0.8	0.8

Reasons for Change

Factors to Consider:

FLEETS/MANUFACTURERS:REGIONAL JETS/TURBOPROPS

U.S. REGIONAL/COMMUTER PASSENGER AIRCRAFT

1. Regional/Commuter Passenger Fleet (Turboprops* & Jets)

Aircraft					
Actual			FAA Forecast		
1990	1998	1999e	2000	2001	2004
1,819	2,039	2,094	2,171	2,262	2,485
		Your Projection:			*

Average Annual Growth Rate (percent)				
1990-99	1998-99	1999-00	2000-01	1999-04
1.6	2.7	3.7	4.2	3.5

Reasons for Changes:

Factors to Consider:

*turboprop fleet may be 150 aircraft too high as the panel expects greater substitution of services by Regional Jets.

2. Average Seats Per Aircraft

Average Seats/Aircraft					
Actual			FAA Forecast		
1990	1998	1999e	2000	2001	2004
26.5	33.1	34.2	35.2	36.2	38.5

Average Annual Growth Rate (seats)				
1990-99	1998-99	1999-00	2000-01	1999-04
0.9	1.1	1.0	1.0	0.9
Your Projection:				

Reasons for Changes:

Factors to Consider:

FLEETS/MANUFACTURERS: REGIONAL JETS/ TURBOPROPS

U.S. REGIONAL/COMMUTER PASSENGER AIRCRAFT

1. Regional Jets

Aircraft					
Actual			FAA Forecast		
1993	1998	1999e	2000	2001	2004
9	206	321	412	519	838
		Your Projection:			

Average Annual Growth Rate (percent)				
1990-99	1998-99	1999-00	2000-01	1999-04
81.4	55.8	28.3	26.0	21.2

Reasons for Changes:

Factors to Consider:

2. Turboprops

Aircraft					
Actual			FAA Forecast		
1990	1998	1999e	2000	2001	2004
1819	1833	1773	1759	1743	1647
		Your Projection:			

Average Annual Growth Rate (percent)				
1990-99	1998-99	1999-00	2000-01	1999-04
(0.3)	(3.3)	(0.8)	(0.9)	(1.5)

Reasons for Changes:

Factors to Consider:

FLEETS/MANUFACTURERS: JETS

U.S. AIR CARRIER LARGE CARGO AIRCRAFT

1. Large Cargo Aircraft--Narrowbody

Number of Aircraft					
Actual			FAA Forecast		
1990	1998	1999e	2000	2001	2004
633	712	719	732	743	764
		Your Projection			

Average Annual Growth Rate (percent)				
1990-99	1998-99	1999-00	2000-01	1999-04
1.4	1.0	1.8	1.5	1.2

Reasons for Change

Factors to Consider:

2. Large Cargo Aircraft--Widebody

Number of Aircraft					
Actual			FAA Forecast		
1990	1998	1999e	2000	2001	2004
58	231	263	290	315	364
		Your Projection			

Average Annual Growth Rate (percent)				
1990-99	1998-99	1999-00	2000-01	1999-04
18.3	13.9	10.3	8.6	6.7

Reasons for Change

Factors to Consider:

GENERAL AVIATION: VERTICAL AIRCRAFT

TURBINES

1. Turbine Rotorcraft Fleet

Turbine Rotorcraft					
Actual			FAA Forecast		
1990	1998	1999e	2000	2001	2004
3,700	4,589	4,631	4,668	4,710	4,852

	Average Annual Growth Rate (percent)				
	1990-99	1998-99	1999-00	2000-01	1999-04
	2.5	0.9	0.8	0.9	0.9
Your Projection:					

Reasons for Changes:

Factors to Consider:

2. Turbine Rotorcraft Hours Flown

Hours Flown (in Thousands)					
Actual			FAA Forecast		
1990	1998	1999e	2000	2001	2004
1,493	1,790	1,819	1,846	1,874	1,960

	Average Annual Growth Rate (percent)				
	1990-99	1998-99	1999-00	2000-01	1999-04
	2.2	1.6	1.5	1.5	1.5
Your Projection:					

Reasons for Changes:

Factors to Consider:

GENERAL AVIATION: VERTICAL AIRCRAFT

PISTONS

1. Piston Rotorcraft Fleet

Piston Rotorcraft					
Actual			FAA Forecast		
1990	1998	1999e	2000	2001	2004
3,200	2,259	2,259	2,259	2,259	2,259
	Average Annual Growth Rate (percent)				
	1990-99	1998-99	1999-00	2000-01	1999-04
	(3.8)	0.0	0.0	0.0	0.0
	Your Projection:				

Reasons for Changes:

Factors to Consider:

2. Piston Rotorcraft Hours Flown

Hours Flown (in Thousands)					
Actual			FAA Forecast		
1990	1998	1999e	2000	2001	2004
716	348	352	356	361	373
	Average Annual Growth Rate (percent)				
	1990-99	1998-99	1999-00	2000-01	1999-04
	(7.6)	1.1	1.1	1.4	1.2
	Your Projection:				

Reasons for Changes:

Factors to Consider:

GENERAL AVIATION: VERTICAL AIRCRAFT

PILOT POPULATION

1. Student Pilots

Number of Pilots (in Thousands)					
Actual			FAA Forecast		
1990	1998	1999e	2000	2001	2004
128.7	97.7	101.2	104.7	108.2	117.5
	Average Annual Growth Rate (percent)				
	1990-99	1998-99	1999-00	2000-01	1999-04
	(2.6)	3.6	3.5	3.3	3.0
Your Projection:					

Reasons for Changes:

Factors to Consider:

2. Private Pilots

Number of Pilots (in Thousands)					
Actual			FAA Forecast		
1990	1998	1999e	2000	2001	2004
299.1	247.2	250.9	257.2	203.6	280.6
	Average Annual Growth Rate (percent)				
	1990-99	1998-99	1999-00	2000-01	1999-04
	(1.9)	1.5	2.5	(20.8)	2.3
Your Projection:					

Reasons for Changes:

Factors to Consider:

3. Commercial Pilots

Number of Pilots (in Thousands)					
Actual			FAA Forecast		
1990	1998	1999e	2000	2001	2004
149.7	122.1	122.1	123.0	124.0	126.3
	Average Annual Growth Rate (percent)				
	1990-99	1998-99	1999-00	2000-01	1999-04
	(2.2)	0.0	0.7	0.8	0.7
Your Projection:					

Reasons for Changes:

Factors to Consider:

GENERAL AVIATION: VERTICAL AIRCRAFT

PILOT POPULATION--page 2

4. Helicopter Only

Number of Pilots (in Thousands)					
Actual			FAA Forecast		
1990	1998	1999e	2000	2001	2004
7.2	7.0	7.0	7.0	7.1	7.2
	Average Annual Growth Rate (percent)				
	1990-99	1998-99	1999-00	2000-01	1999-04
	(0.3)	0.6	0.6	0.6	0.6
Your Projection:					

Reasons for Changes:

Factors to Consider:

5. Instrument Rated Pilots

Number of Pilots (in Thousands)					
Actual			FAA Forecast		
1990	1998	1999e	2000	2001	2004
297.1	300.2	304.4	311.4	318.5	334.0
	Average Annual Growth Rate (percent)				
	1990-99	1998-99	1999-00	2000-01	1999-04
	0.3	1.4	2.3	2.3	1.9
Your Projection:					

Reasons for Changes:

Factors to Consider:

GENERAL AVIATION: LIGHT AIRCRAFT

SINGLE ENGINE PISTONS

1. Single Engine Piston Fleet

Single Engine Piston					
Actual			FAA Forecast		
1990	1998	1999e	2000	2001	2004
154,000	141,718	143,419	144,662	145,915	150,236
	Average Annual Growth Rate (percent)				
	1990-99	1998-99	1999-00	2000-01	1999-04
	(0.8)	1.2	0.9	0.9	0.9
Your Projection:			0.8	0.8	0.8

Reasons for Changes:

Factors to Consider:

2. Single Engine Piston Aircraft Hours Flown

Hours Flown (in Thousands)					
Actual			FAA Forecast		
1990	1998	1999e	2000	2001	2004
21,883	18,633	18,912	19,265	19,625	20,454
	Average Annual Growth Rate (percent)				
	1990-99	1998-99	1999-00	2000-01	1999-04
	(1.6)	1.5	1.9	1.9	1.6
Your Projection:			1.8	2.4	2.5

Reasons for Changes:

Factors to Consider:

GENERAL AVIATION: LIGHT AIRCRAFT

MULTI-ENGINE PISTONS

1. Multi-Engine Piston Fleet

Multi-Engine Piston					
Actual			FAA Forecast		
1990	1998	1999e	2000	2001	2004
21,100	16,065	16,129	16,219	16,310	16,566
	Average Annual Growth Rate (percent)				
	1990-99	1998-99	1999-00	2000-01	1999-04
	(2.9)	0.4	0.6	0.6	0.5
Your Projection:			0.0	0.0	0.0

Reasons for Changes:

Factors to Consider:

2. Multi-Engine Piston Aircraft Hours Flown

Hours Flown (in Thousands)					
Actual			FAA Forecast		
1990	1998	1999e	2000	2001	2004
3,897	2,411	2,423	2,438	2,453	2,499
	Average Annual Growth Rate (percent)				
	1990-99	1998-99	1999-00	2000-01	1999-04
	(5.1)	0.5	0.6	0.6	0.6
Your Projection:					

Reasons for Changes:

Factors to Consider:

GENERAL AVIATION: LIGHT AIRCRAFT

PILOT POPULATION

1. Student Pilots

Number of Pilots (in Thousands)					
Actual			FAA Forecast		
1990	1998	1999e	2000	2001	2004
128.7	97.7	101.2	104.7	108.2	117.5
	Average Annual Growth Rate (percent)				
	1990-99	1998-99	1999-00	2000-01	1999-04
	(2.6)	3.6	3.5	3.3	3.0
Your Projection:			5.9	8.0	8.0

Reasons for Changes:

Factors to Consider:

2. Private Pilots

Number of Pilots (in Thousands)					
Actual			FAA Forecast		
1990	1998	1999e	2000	2001	2004
299.1	247.2	250.9	257.2	203.6	280.6
	Average Annual Growth Rate (percent)				
	1990-99	1998-99	1999-00	2000-01	1999-04
	(1.9)	1.5	2.5	(20.8)	2.3
Your Projection:			2.3	3.5	3.2

Reasons for Changes:

Factors to Consider:

3. Commercial Pilots

Number of Pilots (in Thousands)					
Actual			FAA Forecast		
1990	1998	1999e	2000	2001	2004
149.7	122.1	122.1	123.0	124.0	126.3
	Average Annual Growth Rate (percent)				
	1990-99	1998-99	1999-00	2000-01	1999-04
	(2.2)	0.0	0.7	0.8	0.7
Your Projection:			2.3	3.0	3.4

Reasons for Changes:

Factors to Consider:

GENERAL AVIATION: LIGHT AIRCRAFT

PILOT POPULATION--page 2

4. Instrument Rated Pilots

Number of Pilots (in Thousands)					
Actual			FAA Forecast		
1990	1998	1999e	2000	2001	2004
297.1	300.2	304.4	311.4	318.5	334.0
	Average Annual Growth Rate (percent)				
	1990-99	1998-99	1999-00	2000-01	1999-04
	0.3	1.4	2.3	2.3	1.9
Your Projection:			3.2	3.8	4.0

Reasons for Changes:

Factors to Consider:

GENERAL AVIATION: BUSINESS AIRCRAFT

TURBOJETS

1. Fixed Wing Turbojet Aircraft Fleet

Turbojets					
Actual			FAA Forecast		
1990	1998	1999e	2000	2001	2004
4,100	5,468	5,770	6,071	6,356	7,160
	Average Annual Growth Rate (percent)				
	1990-99	1998-99	1999-00	2000-01	1999-04
	3.9	5.5	5.2	4.7	4.4
Your Projection:					

Reasons for Changes:

Factors to Consider:

2. Fixed Wing Turbojet Aircraft Hours Flown

Hours Flown (in Thousands)					
Actual			FAA Forecast		
1990	1998	1999e	2000	2001	2004
1,396	1,801	1,909	2,018	2,123	2,428
	Average Annual Growth Rate (percent)				
	1990-99	1998-99	1999-00	2000-01	1999-04
	3.5	6.0	5.7	5.2	4.9
Your Projection:					

Reasons for Changes:

Factors to Consider:

GENERAL AVIATION: BUSINESS AIRCRAFT

TURBOPROPS

1. Fixed Wing Turboprop Aircraft Fleet

Turboprops					
Actual			FAA Forecast		
1990	1998	1999e	2000	2001	2004
5,300	5,700	5,779	5,857	5,935	6,161
	Average Annual Growth Rate (percent)				
	1990-99	1998-99	1999-00	2000-01	1999-04
	1.0	1.4	1.3	1.3	1.3
Your Projection:					

Reasons for Changes:

Factors to Consider:

2. Fixed Wing Turboprop Aircraft Hours Flown

Hours Flown (in Thousands)					
Actual			FAA Forecast		
1990	1998	1999e	2000	2001	2004
2,319	1,675	1,699	1,721	1,745	1,811
	Average Annual Growth Rate (percent)				
	1990-99	1998-99	1999-00	2000-01	1999-04
	(3.4)	1.4	1.3	1.4	1.3
Your Projection:					

Reasons for Changes:

Factors to Consider:

GENERAL AVIATION: BUSINESS AIRCRAFT

PILOT POPULATION

1. Student Pilots

Number of Pilots (in Thousands)					
Actual			FAA Forecast		
1990	1998	1999e	2000	2001	2004
128.7	97.7	101.2	104.7	108.2	117.5
	Average Annual Growth Rate (percent)				
	1990-99	1998-99	1999-00	2000-01	1999-04
	(2.6)	3.6	3.5	3.3	3.0
Your Projection:					

Reasons for Changes:

Factors to Consider:

2. Private Pilots

Number of Pilots (in Thousands)					
Actual			FAA Forecast		
1990	1998	1999e	2000	2001	2004
299.1	247.2	250.9	257.2	203.6	280.6
	Average Annual Growth Rate (percent)				
	1990-99	1998-99	1999-00	2000-01	1999-04
	(1.9)	1.5	2.5	(20.8)	2.3
Your Projection:					

Reasons for Changes:

Factors to Consider:

3. Commercial Pilots

Number of Pilots (in Thousands)					
Actual			FAA Forecast		
1990	1998	1999e	2000	2001	2004
149.7	122.1	122.1	123.0	124.0	126.3
	Average Annual Growth Rate (percent)				
	1990-99	1998-99	1999-00	2000-01	1999-04
	(2.2)	0.0	0.7	0.8	0.7
Your Projection:					

Reasons for Changes:

Factors to Consider:

GENERAL AVIATION: BUSINESS AIRCRAFT

PILOT POPULATION--page 2

4. Instrument Rated Pilots

Number of Pilots (in Thousands)					
Actual			FAA Forecast		
1990	1998	1999e	2000	2001	2004
297.1	300.2	304.4	311.4	318.5	334.0
	Average Annual Growth Rate (percent)				
	1990-99	1998-99	1999-00	2000-01	1999-04
	0.3	1.4	2.3	2.3	1.9
Your Projection:					

Reasons for Changes:

Factors to Consider:

AIRPORTS AND INFRASTRUCTURE

COMMERCIAL PASSENGER DEMAND

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

Enplanements (in millions)					
Actual			FAA Forecast		
1990	1998	1999e	2000	2001	2004
456.6	590.2	603.2	618.1	633.4	657.5

	Average Annual Growth Rate (percent)				
	1990-99	1998-99	1999-00	2000-01	1999-04
	3.1	2.2	2.5	2.5	1.7
Your Projection:					

Reasons for Changes:

Factors to Consider:

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

Enplanements (in millions)					
Actual			FAA Forecast		
1990	1998	1999e	2000	2001	2004
41.3	53.1	56.0	58.8	62.4	66.2

	Average Annual Growth Rate (percent)				
	1990-99	1998-99	1999-00	2000-01	1999-04
	3.4	5.5	5.0	6.1	3.4
Your Projection:					

Reasons for Changes:

Factors to Consider:

3. U.S. Commuter/Air Taxi Enplanements

Enplanements (in millions)					
Actual			FAA Forecast		
1990	1998	1999e	2000	2001	2004
37.2	66.1	71.0	74.9	78.7	92.6

	Average Annual Growth Rate (points)				
	1990-99	1998-99	1999-00	2000-01	1999-04
	7.4	7.4	5.5	5.1	5.5
Your Projection:					

Reasons for Changes:

Factors to Consider:

AIRPORTS AND INFRASTRUCTURE

ENPLANEMENTS BY HUB SIZE

1. Large Hub Enplanements

Enplanements (in millions)					
Actual			FAA Forecast		
1990	1998	1999e	2000	2001	2004
329.8	442.9	467.3	485.6	506.9	570.9
	Average Annual Growth Rate (percent)				
	1990-99	1998-99	1999-00	2000-01	1999-04
	3.9	5.5	3.9	4.4	4.1
Your Projection:					

Reasons for Changes:

Factors to Consider:

2. Medium Hub Enplanements

Enplanements (in millions)					
Actual			FAA Forecast		
1990	1998	1999e	2000	2001	2004
106.7	142.2	148.0	154.4	160.8	180.8
	Average Annual Growth Rate (percent)				
	1990-99	1998-99	1999-00	2000-01	1999-04
	3.7	4.1	4.3	4.2	4.1
Your Projection:					

Reasons for Changes:

Factors to Consider:

3. Small Hub Enplanements

Enplanements (in millions)					
Actual			FAA Forecast		
1990	1998	1999e	2000	2001	2004
38.2	44.6	45.7	47.1	48.4	52.5
	Average Annual Growth Rate (points)				
	1990-99	1998-99	1999-00	2000-01	1999-04
	2.0	2.4	3.1	2.7	2.8
Your Projection:					

Reasons for Changes:

Factors to Consider:

AIRPORTS AND INFRASTRUCTURE

AIRCRAFT OPERATIONS BY USER GROUP

1. Air Carrier Operations - 60 seats plus

Operations (in millions)					
Actual			FAA Forecast		
1990	1998	1999e	2000	2001	2004
12.9	14.3	14.6	15.0	15.3	16.8
	Average Annual Growth Rate (percent)				
	1990-99	1998-99	1999-00	2000-01	1999-04
	1.4	2.4	2.4	2.5	2.8
Your Projection:					

Reasons for Changes:

Factors to Consider:

2. Regional/Commuter Operations - Less than 60 Seats

Operations (in millions)					
Actual			FAA Forecast		
1990	1998	1999e	2000	2001	2004
8.8	10.2	10.4	10.6	10.8	11.6
	Average Annual Growth Rate (percent)				
	1990-99	1998-99	1999-00	2000-01	1999-04
	1.9	2.2	1.7	1.7	2.2
Your Projection:					

Reasons for Changes:

Factors to Consider:

3. General Aviation Operations

Operations (in millions)					
Actual			FAA Forecast		
1990	1998	1999e	2000	2001	2004
39.0	38.1	38.7	39.4	40.1	41.9
	Average Annual Growth Rate (points)				
	1990-99	1998-99	1999-00	2000-01	1999-04
	-0.1	1.6	1.9	1.8	1.6
Your Projection:					

Reasons for Changes:

Factors to Consider:

AIRPORTS AND INFRASTRUCTURE

AIRCRAFT OPERATIONS BY HUB SIZE

1. Large Hub - Total Operations

Operations (in millions)						
Actual			FAA Forecast			
1990	1998	1999e	2000	2001	2004	
12.2	13.9	14.2	14.6	14.9	16.1	
	Average Annual Growth Rate (percent)					
	1990-99	1998-99	1999-00	2000-01	1999-04	
	1.7	2.7	2.6	2.1	2.5	
	Your Projection:					

Reasons for Changes:

Factors to Consider:

2. Medium Hubs - Total Operations

Operations (in millions)						
Actual			FAA Forecast			
1990	1998	1999e	2000	2001	2004	
9.0	9.3	9.5	9.7	9.9	10.5	
	Average Annual Growth Rate (percent)					
	1990-99	1998-99	1999-00	2000-01	1999-04	
	0.6	2.0	2.2	2.0	2.0	
	Your Projection:					

Reasons for Changes:

Factors to Consider:

3. Small Hubs - Total Operations

Operations (in millions)						
Actual			FAA Forecast			
1990	1998	1999e	2000	2001	2004	
9.2	8.9	9.2	9.3	9.4	9.8	
	Average Annual Growth Rate (points)					
	1990-99	1998-99	1999-00	2000-01	1999-04	
	-0.1	2.7	1.5	1.4	1.4	
	Your Projection:					

Reasons for Changes:

Factors to Consider:

AIR CARGO: DOMESTIC REVENUE TON MILES

U.S. COMMERCIAL AIR CARRIERS

1. Domestic Freight/Express

Revenue Ton Miles (Millions)					
Actual			FAA Forecast		
1990	1998	1999e	2000	2001	2004
7,532.5	11,735.4	12,345.4	12,950.6	13,597.7	16,129.5

	Average Annual Growth Rate (percent)				
	1990-99	1998-99	1999-00	2000-01	1999-04
	5.6	5.2	4.9	5.0	5.5
Your Projection:					

Reasons for Changes:

Factors to Consider:

2. Domestic Mail

Revenue Ton Miles (Millions)					
Actual			FAA Forecast		
1990	1998	1999e	2000	2001	2004
1,477.5	2,301.0	2,381.7	2,459.5	2,540.4	2,836.8

	Average Annual Growth Rate (percent)				
	1990-99	1998-99	1999-00	2000-01	1999-04
	5.4	3.5	3.3	3.3	3.6
Your Projection:					

Reasons for Changes:

Factors to Consider:

AIR CARGO: INTERNATIONAL REVENUE TON MILES

U.S. COMMERCIAL AIR CARRIERS

1. International Freight/Express

Revenue Ton Miles (Millions)					
Actual			FAA Forecast		
1990	1998	1999e	2000	2001	2004
6,770.3	13,954.0	14,783.6	15,798.0	16,977.2	21,031.8
	Average Annual Growth Rate (percent)				
	1990-99	1998-99	1999-00	2000-01	1999-04
	9.1	5.9	6.9	7.5	7.3
Your Projection:			6.9	7.5	7.5-7.6

Reasons for Changes:

Factors to Consider:

2. International Mail

Revenue Ton Miles (Millions)					
Actual			FAA Forecast		
1990	1998	1999e	2000	2001	2004
502.9	529.3	543.0	559.6	579.0	645.5
	Average Annual Growth Rate (percent)				
	1990-99	1998-99	1999-00	2000-01	1999-04
	0.9	2.6	3.1	3.5	3.5
Your Projection:			2.7	3.0	3.0

Reasons for Changes:

Factors to Consider:

AIR CARGO: TONNAGE

U.S. INTERNATIONAL TONNAGE BY REGION

1. Atlantic Region:
Freight / Mail Tons (U.S. + Foreign Flag Carriers)

Tons (Thousands)					
Actual			FAA Forecast		
1990	1996	1997	2000	2001	2004
1,869.2	2,546.5	2,803.9			
	Average Annual Growth Rate (percent)				
	1990-97	1996-97	1997-00	2000-01	1997-04
	6.0	10.1			
	Your Projection:				

Reasons for Changes:

Factors to Consider:

2. Latin American Region:
Freight / Mail Tons (U.S. + Foreign Flag Carriers)

Tons (Thousands)					
Actual			FAA Forecast		
1990	1996	1997	2000	2001	2004
951.6	1,726.1	1,977.4			
	Average Annual Growth Rate (percent)				
	1990-97	1996-97	1997-00	2000-01	1997-04
	11.0	14.6			
	Your Projection:				

Reasons for Changes:

Factors to Consider:

AIR CARGO: TONNAGE

U.S. INTERNATIONAL TONNAGE BY REGION

3. Pacific Region:

Freight / Mail Tons (U.S. + Foreign Flag Carriers)

Tons (Thousands)					
Actual			FAA Forecast		
1990	1996	1997	2000	2001	2004
1,476.4	2,265.0	2,461.9			
	Average Annual Growth Rate (percent)				
	1990-97	1996-97	1997-00	2000-01	1997-04
	7.6	8.7			
Your Projection:					

Reasons for Changes:

Factors to Consider:

4. Canada:

Freight / Mail Tons (U.S. + Foreign Flag Carriers)

Tons (Thousands)					
Actual			FAA Forecast		
1990	1996	1997	2000	2001	2004
185.8	234.6	228.1			
	Average Annual Growth Rate (percent)				
	1990-97	1996-97	1997-00	2000-01	1997-04
	3.0	(2.8)			
Your Projection:					

Reasons for Changes:

Factors to Consider:

APPENDIX B: PARTICIPANTS

Participant Key		**REG**	Regional Aviation
AIRP	Airports & Infrastructure	**DOM**	Domestic Aviation
M	Panel Moderator	**SPK**	Speaker
BUS	Business Aviation	**GEN**	Light Personal & General
MFG	Fleets & Manufacturers	**VFL**	Vertical Flight
CARGO-	Air Cargo	**INT**	International Aviation

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