PART II FORECASTING REGIONAL AIRLINE ACTIVITY

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BACKGROUND

Since economic deregulation of the U.S. air transportation industry in 1979, the regional airline sector has shown continued strong growth. This growth, pushed by an evolution in marketing and ownership arrangements with the major airlines, combined with the availability of modern, new technology aircraft, has positioned the regional airlines as important elements in the national air transportation industry.

The regional airlines have grown, as measured by passenger enplanements, at an average annual rate of just over 10 percent since 1979. This represents an increase in market share of total domestic enplanements from 4 percent in 1979 to an estimated 8.5 percent in 1990. To put this into perspective, the U.S. airlines will enplane approximately 460 million domestic passengers in 1990. The regionals will account for an estimated 39 million of those passengers.

The growth of the regionals through the 1980s occurred for many reasons. National economic development and demographic shifts were important elements underlying this growth. But two other factors have contributed more than anything else: development of new aircraft specifically designed for this market and the shift from small independent regional airlines (i.e. air taxis) to large regional airlines closely affiliated with the major airlines.

In the late 1970s, several airframe manufacturers saw gaps in market coverage for aircraft seating between 19-65 seats. The industry at the time was making do with general aviation type small aircraft or larger turboprop aircraft originally developed in the 1950s. The core technologies for engines, avionics, and airframes had advanced to the point where developing fast, reliable, cost-effective aircraft for the emerging regional airlines was possible. Once these modern aircraft became available in the mid-eighties, the U.S. regionals ordered them in large numbers.

The transition from small independently operated air taxis occurred in several steps. First was development of interline baggage and ticketing agreements between the air taxi commuter operators and the major airlines. When the competitive advantages of providing additional passenger service at little or no extra cost to the major airline became apparent, the relationships were then formalized into an exclusive marketing and operations coordination program called code-sharing. The evolutionary cycle has continued with many of the major airlines consolidating control of their regional airline partners through equity positions or outright ownership. This vertical integration has served as a traffic stimulus in many markets through increased service levels provided to small and medium-sized communities.

Continuation of the regional airlines development cycle will occur as the major air carriers transition into a more consolidated industry. The extent of the development will be contingent on many different elements: technology, energy resources, infrastructure (airport) capacity, economic development, and others. This workshop brought together experienced individuals to share not only their understanding of the development cycle but how they approach analyzing the direction of this complex industry for the future.

FORECAST METHODOLOGIES

Charles Moles, Federal Aviation Administration

The Federal Aviation Administration (FAA) is responsible for forecasting the regional aircraft fleet mix and passenger enplanements. These provide a basis for allocating resources in response to changes in the regional airline environment that affect facilities planning and future staffing requirements.

FAA's regional aviation forecasting process is not overly complicated. It relies on a data set developed primarily from the 298-C filings by commuter air carriers. Additional data are also included on air carriers like Westair and Aspen that operate as commuters. FAA does not include operations of primarily jet carriers like Air Wisconsin, Presidential, or Altair. The operating definition of what constitutes a regional airline is based on seat size. Currently the Department of Transportation classification of 60 seats and below is used. This allows for the inclusion of the new small jets (less than 60 seats); but it has not been resolved how to deal with the British Aerospace ATP and Aerospatiale-Aeritalia ATR 72, both having between 60 and 70 seats. Additional data are obtained from the Regional Airline Association and the FAA's Utilization and Reliability reporting system.

The FAA forecasting model is an econometric model using Gross National Product (GNP), an oil and gas deflator, and the Consumer Price Index (CPI) as the major input variables. Historical trends in revenue passenger miles, available seat miles, and passenger enplanements (obtained from commuter airline filings) are integrated into the forecast model. The forecast assumptions are then developed based on analysts' opinions and experience and used to drive the model. The results are evaluated in light of other industry forecasts, professional judgment, and expertise. This evaluation process may lead to additional iterations with revised assumptions and/or modifications to the model. Once the output is finalized, the results are used in the decision-making system to allocate resources.

Stephen Martin, Massachusetts Port Authority

Over the last few years severe congestion has developed at Boston's Logan Airport, which consistently ranks among the airports showing the greatest delays. The airport's capacity fluctuates due to the constantly changing wind conditions. Although we have three runways, they intersect and have different hourly capacity limits. Therefore, the airport's capacity can range anywhere from 45 to 110 movements per hour depending on weather conditions. In addition the effective capacity is difficult to determine because we experience unfavorable weather conditions about 30 percent of the time. To help optimize the capacity and minimize the delays we have been working with the National Oceanic and Atmospheric Administration data on hourly wind conditions over the past ten years. This has helped, but it is not a panacea.

Boston's airport is slightly different from most other congested airports in that only 8 percent of the passengers are connecting passengers. However, operations by regional airlines account for 40 percent of the flights at Logan, and half of the passengers using regional airlines are connecting. Yet regional carriers move only 5 percent of Logan's passengers.

I believe that Massport's attempts to address these congestion issues provide a good case study of data needs and shortfalls that affect the regional airline segment of the industry.

Over the past year and a half, Massport has tried different ways to alleviate congestion. Traditionally, Logan has had a 100 percent weight-based landing fee with no peak hour pricing. We then moved to a 33 percent weight-based fee, the rest being made up using a flat operating fee. Next we decided to look at a cost-based fee as a way of alleviating congestion. Before implementing it, however, we wanted to assess the impact of various price structures. First, we measured the impact on a per-passenger and/or per flight basis. To accomplish this, we needed to find out what tickets actually sold for—not just the full fare or the discount fare, but what people were really paying, not only those flying in and out of Boston but also connecting passengers.

Second, we wanted to quantify how much of a reduction in demand would be experienced on a market-by-market basis. For example, there were 40 daily flights between Boston and Hyannis with an average size of 19 seats. On the other end of the spectrum was Laconia, NH, which only had three flights a day with a nine-seat aircraft. What we found was that, of the cities on the higher end, 70-80 percent of the passengers came from markets where jet service had once been provided. Deregulation caused the jet operators to abandon many of these markets, and the demand was met by the smaller turboprops operating with greater flight frequencies. In certain markets formerly served by two jet flights a day, the demand was met with 25 turboprop flights.

In an effort to assess whether an airline could replace a smaller aircraft operating at higher frequency with a larger aircraft serving the same market with lower frequency, we developed a special data base to track the aircraft in service. We believe that, because of the flexibility in pricing fares, the supply of aircraft determines to a great extent the demand for air service. Too much capacity causes fares to drop and demand to increase. It becomes a circular problem where demand creates supply, which in turn creates demand, and so on. In the regional markets it is a little more difficult to assess; but by analyzing operations by market we found that it was possible to substitute bigger aircraft at reduced frequency in the larger regional markets, thereby reducing the incremental cost associated with replacing the weight-based fee with the operational-based fee.

This fee structure was in effect for six months until terminated by a court action. The good news is that this was enough time for us to test our initial calculations. It was heartening to see that the actual effects were very close to what we had forecasted they would be. In terms of traffic growth at the regional level, we found that during the trial period passenger traffic was flat from the like period the year before. Before implementation of the fee, traffic had been growing moderately (3 to 5 percent annually), although exogenous factors, such as the New England economic slump and the strike at Eastern Air Lines, probably contributed to the decline in growth rate.

The lesson we learned was that meticulous study of individual markets yielded the best results. Perhaps FAA does not need that level of detail, but I do feel an individual case study using some sort of bottom-up approach is the best way to evaluate data collection needs. Perhaps some efficiency can be gained by concentrating on the biggest markets. This would require a stratified forecast. For commuter markets, perhaps the way to go about data collection might be to use the classic 80-20 rule, eliminating those 80 percent of the routes that generate 20 percent of the traffic.

William Spaeth, Metropolitan Washington Airports Authority

The Metropolitan Washington Airports Authority (MWAA) operates two completely different airports--Washington National and Washington Dulles International.

Washington National is a purely domestic origin-and-destination airport. It is slot-constrained to an hourly limit of 37 air carrier slots and 13 commuter slots which are limited to aircraft that carry fewer than 55 passengers. The commuter slots are divided into 11 regular commuter slots and two STOL slots. The airport operates under a curfew system that was put in place before the Stage III aircraft noise rules came out. Between 10 p.m. and 7 a.m., only quiet aircraft complying with strict local noise abatement levels may operate. There are not many flights into National after 10 p.m.

Washington Dulles International Airport is very different in that it has a wide variety of traffic. Twelve percent of the traffic is international, and the airport serves as a hub for United Airlines. There are plans to add two more runways, which will increase capacity to 130-140 IFR operations per hour, and eventually to construct six midfield terminals, which will have a capacity for 40 million passengers. The airport is connected to the I-95 Interstate by a dedicated roadway, and there are proposals to extend the Metro line out there.

When WMAA authority does a forecast, it is primarily concerned with facilities planning and how operations are going to affect those facilities. Commuter forecasts are especially important in assessing airfield, ramp parking, and terminals.

The problem is defining just what a commuter, or regional, airline really is. In our analysis, we consider the size of the aircraft, whether it is a turboprop or a jet, and whether it is operated by a code-sharing or an independent carrier. Commuter slots were created largely for noise considerations and have very little reflection on the industry. Furthermore, the ATC system at National categorizes any turboprop aircraft as an air taxi, whereas at Dulles there is a distinction between air taxis and regionals. This has caused some confusion in the past, but it is slowly being cleared up.

We see some interesting characteristics in the regional carriers using the Washington airports. At National, approximately 40 percent of aircraft enplanements were connections during the 1970s. During the 1980s connecting traffic almost completely disappeared. We believe this is because most of the connecting traffic that used to come to National is now going to Dulles and Baltimore/Washington International. The code-sharing carriers at National are flying origin and destination passengers, and not connecting passengers as they do at most airports.

It is also interesting to note that code-sharing carriers have virtually all of the regional airline traffic. What happens with regional traffic at National, however, is that the aircraft tend to be fairly large, and they have some unusual roles. For example, all of Pan Am's and most of American's code-sharing traffic is going into JFK as feed to international flights. We find that the larger carriers do not want separate check-in and baggage-claim facilities for the code-sharing regionals. Nevertheless, we have to plan for the possibility that some of the code-sharing arrangements between regionals and majors might break up.

MWAA is expecting that traffic at National will grow from its present 16 million passengers to nearly 19 million by the turn of the century. Because of slot limitations, this can be accomplished only by using larger aircraft. It is planned that, when improvements are completed, National will be able to accommodate 767-size aircraft. The passenger cap of 16 million passengers was removed when the airports reverted from Federal Government to MWAA administration.

Dulles is completely different from National. Enplanements have grown enormously, especially connecting traffic, as a result of airline hubbing at Dulles. After some intense competition, United has become dominant. Commuter activity at the airport is almost entirely dominated by United Express. I should note that United Express Air Wisconsin figures are included in the air carrier statistics. We expect that the Dulles hub will grow about 4 to 5 percent per year, with commuter traffic increasing at about the same rate.

Dulles really does not act as a reliever for National. Even today, about 40 percent of the passengers who fly into Dulles end up in downtown Washington. Presumably they would still prefer to go to National if the option were available, since it is so much closer.

John Mason, Air Wisconsin

An airline has a slightly different perspective on forecasting than a manufacturer. We are in the day-to-day fight of trying to fill our airplanes with passengers. Our forecasting method is not overly complicated. We tend to take a fairly conservative approach.

To assess the potential of a proposed new service, we do a market forecast. First, we try to define the universe of data that is available. We also look at what aircraft would be available in our fleet and identify those constraints that could influence our decision.

The data we typically compile include origin and destination data from the DOT traffic records. We find these fairly reliable for the larger cities, but for some smaller cities where other carriers have been less than diligent in their reporting of passenger traffic, the data are not as reliable. Other quantifiable data we include are: airport history before deregulation, demographic trends, competitive service levels, and destinations. We also analyze data on changes in the mix of business and pleasure travel, promotional history, and fare levels. These data can give a fair picture of the market base.

Other factors that can influence our decision to penetrate a new market can come from our partner, United Airlines. As Air Wisconsin, we have the ability to penetrate new markets and expand as we determine; but as United Express, we are fairly well controlled. Their plans have a strong impact on ours. We have also found that the predominance of a particular CRS system can make a difference in some markets, as can a strong, competitive frequent flyer program.

If this new market is to serve Chicago O'Hare, we must consider the slot limitations and determine the impact of alternative service scenarios utilizing those slots.

An important step once the market analysis is completed is to compare all the factors with those of other markets of similar size that we serve. From this comparison, based on our experience in the various markets, we can estimate the expected traffic levels if we were to enter that market.

We must also look at how this service would affect aircraft utilization and cost structure. Expected schedule-completion factors must be included in this analysis. At Air Wisconsin, we aim for 97 percent plus on flight completions; if we fall below this target, we notice an impact on advanced bookings several months out.

Over the past three to five years we have not been putting much effort into macroforecasting. We do, however, review our total system on an annual basis in addition to quarterly and monthly updates. Most of what we do in this area is to assess future bookings and seasonal influences. We then include industry projections. The final step is to do a reality check: Is this forecast a plausible view of the future, given past experience and present business conditions?

Bouke Veldman, Fokker Aircraft

Historically, Fokker used a traditional top-down forecasting approach that took into account the various economic parameters normally used in forecasting models. Recently, we have been developing a bottom-up approach in which we look at each airline and assess its individual requirements. This method has an additional application for our sales managers. By analyzing the carriers in this way we can help them identify opportunities.

Another, more basic result of this current bottom-up forecast, and one that is more germane to my department, is to assess the market for a new aircraft between 50 and 100 seats. Using existing data is fairly straightforward because one can do an OAG analysis of existing routes and equipment. The problem comes in

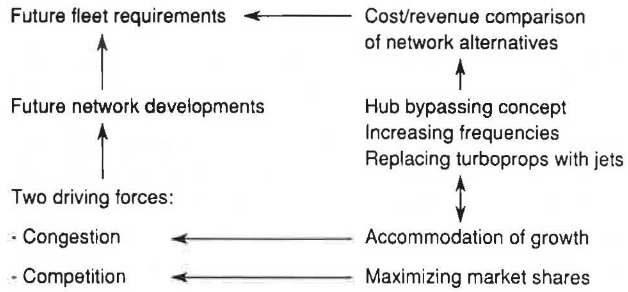


FIGURE 12 Hub-Bypass Forecast Methodology

trying to figure out future network requirements and opportunities.

In assessing the market for a new aircraft, we break the new opportunities into three groups:

- Hub bypass or raiding
- Increased frequencies
- Turboprop replacement

I will focus on the methodology for quantifying the first group. We define a hub by the number of non-stop flights out of that city, not necessarily how much one carrier serves that hub. Generally speaking this is a minimum of 35 cities in the United States and 30 cities in Europe and Asia. This presentation is about Europe because the U.S. study, while complete, is not ready for presentation.

To do a hub-bypass analysis one needs a very large and powerful computer, like the IBM mainframe that Fokker has in Amsterdam. The data base is too large and complex to be handled effectively in any other manner.

In Europe, we have identified 32 hubs (50 in the U.S. and 32 in Asia). To quantify the hub-bypass possibilities, we have had to become a bit subjective in our thinking. You should appreciate that the level of information available on the U.S. market is not available on the European market. Therefore, we have to look at aircraft seat miles (ASM) generated and make some assumptions about load factors in order to derive passenger demand.

Hub bypass is defined as a flight from point A to point B without having to change planes in an intermediate point C. Some of the possibilities include trips between two hubs that bypass an intermediary hub, flights between a hub and a non-hub city that bypass the intermediary hub, the reverse situation, or flying between two points that are not hub cities.

As an example, we decided to consider the possibility of flying between Hamburg (HAM) and Rome (FCO), which is not presently a direct-service route. Normally, a passenger taking this flight would be forced to go through Frankfurt (FRA) and change planes, which adds about one hour to the flight time.

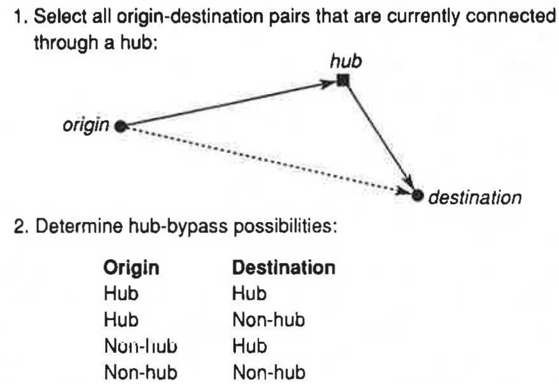


FIGURE 13 Hub-Bypass Concept

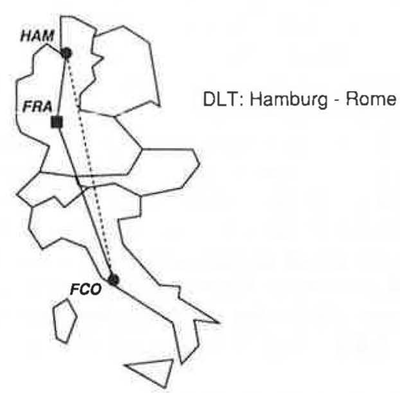


FIGURE 14 Example of New Route Formed by Hub Bypass

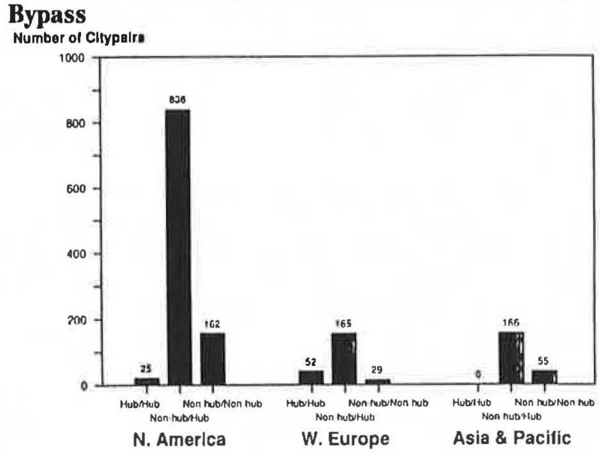


FIGURE 15 New Routes of Less than 1200 nm per Region in 2004

In calculating the potential for new direct service between city pairs we examined only those routes of

1,200 nm or less. To determine hub-bypass possibilities we concentrated on cities, not airports—selecting city pairs that were more than 100 nm apart and where a hub-spoke service route would be less than 1.5 times the length of the direct nonstop route and the flight legs from origin to hub and hub to destination would form an angle greater than 45 degrees.

For example, the distance between Hamburg and Rome with a change of planes in London exceeded the distance from Hamburg to Rome multiplied by 1.5 and

3. Determine **realistic** hub-bypass possibilities

- Origin and destination are considered as city-codes
- Distance between origin and destination > 100 nm
- Distance between origin and destination via hub < 1.5x Distance between origin and destination non-stop
- Angle of direction between origin and destination via hub > 45°

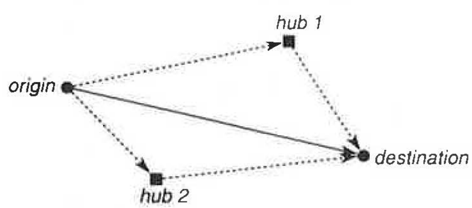
FIGURE 16 Hub-Bypass Criteria

was therefore rejected as a hub-bypass candidate. In another example, because the angle of flying between Hamburg and Rome with a change of planes in Copenhagen was less than 45 degrees, this option was also rejected.

To estimate traffic, the total number of seats coming into a hub, in this case within Europe, was calculated. The available seats on the origin city is a percentage of this total. We then applied that factor to the percentage of seats going to the final destination and to come up with the traffic flow between the two points.

Going back to the Hamburg-Rome example, we found several options, which would be the case for most city pairs. In most instances the destination could be reached via more than one hub. So to calculate

Potential origin-destination route by-passing more than one hub



- In most cases the destination can be reached via more than one hub. This means that the potential of available seats on the origin-destination route comes from ALL existing routes within the region.

FIGURE 17 Example of Multiple Hub Bypass

fully the real flow one must calculate everything. You begin to see why a big computer is needed for this method.

Having done this, we needed to correct for true origin and destination flows, because not all passengers at a hub are connecting. In the United States almost 39 percent of passengers connect at airports. This has been growing since 1980, when it was 32 percent. Furthermore, between larger cities, there are fewer connecting passengers than between smaller cities. In hub-to-hub markets in the United States, for example, we calculated on the basis of historical data that the average for connecting traffic is likely to be 20 percent in 2004. In hub-to-nonhub markets the average is closer to 75 percent. In Europe, the average is 28 percent connecting passengers, but higher at larger hubs. Using these figures, we came up with the connecting percentages for the United States, Europe, and Asia, adjusting the figures in each region, especially Europe and Asia, for the effects of deregulation.

We then added an expected traffic growth between 1989 and 2004 averaging 5 percent annually in Western Europe, 2.8 percent in North America, and 5.75 percent in Asia and the Pacific.

Having determined traffic, we then began the process of selecting routes. In selecting the routes, we chose only those city pairs in which there was enough demand to allow for 400 weekly available seats. Stated another way, this would allow for two daily flights (one each way), five days a week, using an aircraft with a minimum capacity of 40 seats.

This approach has been successful, as you can see by the newspaper clipping announcing DLT's order for the regional jet in which Hamburg-Rome was cited as an intended route. In fact, our analysis showed that there were five routes from Hamburg not presently served that could be accommodated in this same manner.

Using this method, we have identified several new routes, the vast majority of which are in the United States. Furthermore, the indications are that the average distance of the city pairs (around 750 miles) implies a requirement for jet equipment rather than turboprop equipment.

Unfortunately the effects of these new routes on congestion are likely to be minimal, because so many of the possible routes would be feeding into existing hubs, rather than rerouting traffic away from them. This requires then further analysis on the impact of increased frequency and cost-revenue comparisons. As you can see, it is a very complex problem.

Josef Simmerl, Dornier GmbH.

Dornier uses a simple forecasting model for turboprops. We do not consider the smallest commuter segment (6 to 14 seats) because Dornier does not manufacturer any aircraft smaller than the 15-19 seat class. However, we do a large number of airline studies, which are used in our sales campaigns, and serve as the basis for our work.

One of our exercises is to segment the market into large and small commuter airlines. This is primarily a tool used for sales forecasts. The basis of the information is the JP Airline Fleets, which we now have on tape. We find this data to be useful and accurate. We use the OAG schedule tapes for additional insight. We try to forecast growth demand in North America, Europe, and the rest of the world. Because we do not know actual total passenger figures in Europe and parts of Asia, we take the actual seats supplied and convert into passenger miles by using actual load factor data or assumptions. Then we make a trend analysis and forecast growth demand. We split the aircraft market into three segments: 15-19 seats, 20-39 seats, and 40-70 seats. Our forecasts look out 15 to 20 years in five-year intervals.

We do not count every aircraft. If an aircraft is already 30 years old, we take it out on the assumption that if it has not been replaced by a larger aircraft by now, it never will be. If you look at the replacement cycle of aircraft, you will see that the replacement cycle for turboprops is about 25 years. Our replacement assumptions are that 50 to 75 percent of current 19-seat aircraft will be replaced by larger aircraft based on an analysis of trends in market volumes by seats and by size category. We see some unnatural peaks early in the cycle but do not expect that to recur, and therefore we apply judgment and smooth out the peaks.

We see the non-airline side of the market as significant. This includes aircraft used in military, cargo, government and utility roles. Data on non-military aircraft movements is much too optimistic, as high as a 50-percent overstatement in some cases. We therefore have to back up our forecasts with field experience and familiarity with the market.

Marian Thompson, British Aerospace, Inc.

British Aerospace develops forecasts for production planning, determining production mix, assessing new aircraft opportunities, and supporting sales campaigns. At this time we focus on the macroeconomic side of the forecast. In looking at specific markets, such as the regional jet, our forecasting procedure works on an on-going basis using a traditional approach.

Generally, we start with historical trends in ASM to establish the overall market. We define our segment of the market as between 12 and 130 seats including turboprops and jets. This allows us to translate traffic into RPM for each of the market segments. The forecast is then subjected to comparison with the quantitative economic picture. GNP is important because, if there is no economy, there is no traffic; but we do use various other quantitative measures. In this step of the forecast process, so much depends on the relationships between the different market sectors when trying to establish future traffic and fleets. We look at the relationships between the groups and apply a lot of careful judgment.

What we see in the regional airline industry is that traditional barriers are coming down, largely because of the regional jet, which has a tendency to blur the edge between the regional and the major airlines. This is especially true in the United States, where the distinction has always been greatest. The jet is part of the natural progression which was started by the interrelationships between regional and major airlines. As the regionals mature, they look for ways to grow within their feeder role. As this process unfolds, I would say that the biggest need will be for good consistent reporting of quantitative data.

Karl Zaeske, Rockwell International - Collins Avionics

Collins is in the business of supplying avionics for business and commercial aircraft. We use our short-term forecasts to as inputs to production planning. Longer-term forecasts are used for strategic positioning, product planning, and resource allocations. As an original equipment manufacturer we use input data from airframe and engine manufacturers, government sources, and our own sales and marketing personnel. We also analyze data from numerous other outside sources.

- Short-term
  - Market viability customer potential
  - Direct input to production plan process
  - Order, backlog and delivery projection system
  - OEM viability and capacity assessment
  - 3 scenario monthly 3 year production forecast process
- Long-range
  - Product market growth assessment by sector, OEM
  - New opportunity selection process
  - Capital and manning plan
  - Corporate commitment rationalization
  - Structural and demand measurement market study (continuous effort)

FIGURE 18 Regional Markets: Forecast Objectives and Approach

The short-term forecast methodology is driven by the order rates, backlog, projected deliveries and projected backlog. These are analyzed in a historical context as well as an industry structural context. This requires a bottom-up approach segmenting the markets by operator and aircraft type. We also segment the overall market by geographic region. Where are the aircraft scheduled to go? Are they for replacement or growth? What are the particular operating characteristics of each airline? We analyze the OAG data tapes to determine scheduled utilization for block hours, cycles, and sector length. This part of the analysis is also important for our planning of avionics spares support. In this short-term forecast it is essential to monitor constantly the business environment of each operator in the data base. Mergers, dissolutions, new competitive moves, and changes in affiliation are just some of the operator structural changes that can influence order and delivery schedules. Operating revenues, expenses, and profits also provide insight into the viability of the order backlog on an individual, group or geographic region basis.

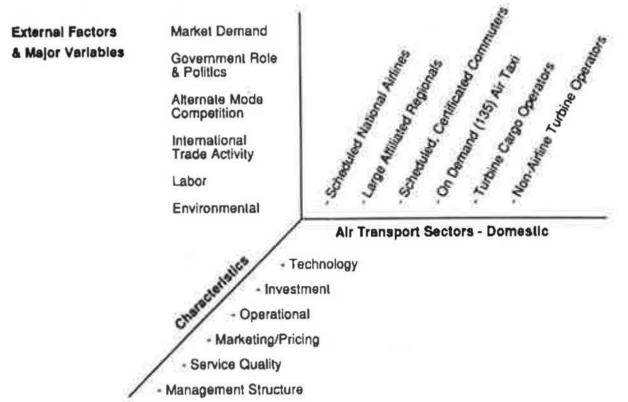
The long-range forecast requires careful analysis of fundamental exogenous factors. To develop the traffic growth estimates, we utilize several outside economic forecasting services that produce alternate scenarios. We also watch regulatory authorities for developments that would force premature obsolescence or increased avionics sophistication. The long-term financial characteristics of each market sector are monitored for signs that indicate an ability or lack of ability to meet the increasing demands for capital or cash flow to acquire the equipment needed for growth.

A very important element in our forecast is the analysis of fleet trends and aircraft flows between various geographic regions and operator segments. We track the free world's aircraft up to 110 seats. The data are stratified by region, size, and operator type (scheduled, non-scheduled, freight, etc.). We also maintain a complete history by model and serial number for each aircraft. This helps provide an understanding of changes that occur in the existing fleet over time.

Aircraft replacement will account for almost 30 percent of the seats required to meet expected demand by 1998. What are the factors that will cause aircraft retirements from the active fleet? Is it age (i.e., airframe life)? Has the aircraft become too costly to operate because of maintenance requirements? Or has marketplace competition forced the operators to acquire newer equipment? We look very hard at the underlying causes to see how they could affect the fleet characteristics in out-years.

We also track new aircraft programs: first, for potential as a customer, and second, to see how the introduction of that new aircraft would affect current product markets; but also for major changes in real productivity. A cost-effective increase in productivity can influence the number of aircraft in the fleet required in the future.

The development of a total market forecast such as ours requires linking all these various elements together. The interactions between elements are studied, and the relationships are quantified where possible. Critical judgments based on historical experience are applied where necessary to test the process at intermediate points. This type of forecast cannot be made into a linear model because of the many interrelationships involved.



Source: Adapted from Research Needs Related to Intermodal Freight Transportation, Transportation Research Board, Circuar 338, October 1988

FIGURE 19 Taxonomy of Air Transportation System

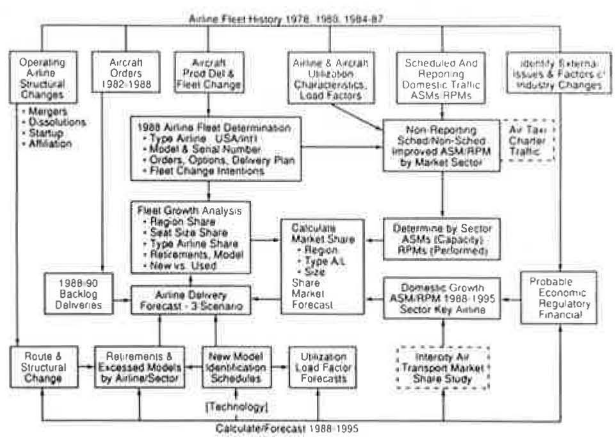


FIGURE 20 World Regional and Commuter Aircraft Forecast Process

Joe Torchetti, Pratt & Whitney of Canada

When we are asked to prepare a forecast, the first thing that must be understood is what will be the use of the forecast. Our market sector is any aircraft under 100 seats: business jets and turboprops, utility aircraft, and regional airliners. It takes five years to develop a new aircraft turbine engine. It is not enough to have just a good near-term understanding of what other airframe and engine manufacturers are currently producing. We must focus on the short-term as well as the long-term aspects of production in addition to positioning new development programs years out.

We look at the market from several different angles. Each is an integral part of the process and must be reconciled with the others. Supply and demand over the long term should balance. The forecast process for the U.S. regional airlines tends to be iterative. We proceed under the basic assumption that the airlines are rational. We begin by taking a top-down approach to forecast demand for air travel. This is driven mainly by economic factors. We then test various assumptions for productivity, aircraft seating capacity, traffic or market patterns, and load factors to arrive at a projected fleet requirement. As an example of this method, our model shows that U.S. regional airline passenger enplanements should reach 90 million by 2000. Critical judgment indicates that the market is maturing somewhat from the high growth rates of the past few years. This means that the growth rates will slow as the market reaches about 8 percent of total U.S. domestic enplanements.

- Top down demand
- Supply side: operators
  - Factors
  - Changes
- Supply side: Manufacturers
- Bottom up demand
  - Gaps

FIGURE 21 Forecasting Considerations

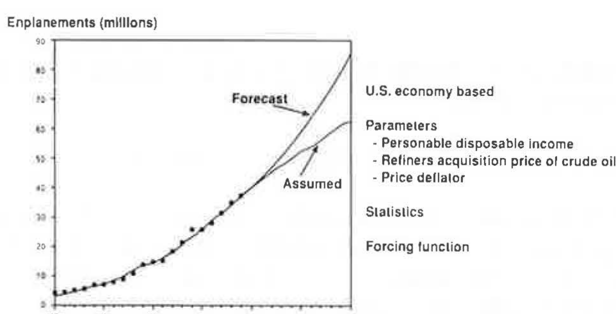


FIGURE 22 Passenger Enplanement Model for U.S. Regional Airlines

To understand the market it is necessary to develop a good historical perspective based on trends. We utilize the OAG data extensively to see how aircraft under 100 seats are used in scheduled service.

The regional airline marketplace has been in constant change since deregulation. Structural issues that have an impact on the operators are studied. Many of these issues are not easily or directly quantified into terms of demand, but the identification of these issues can reflect back into the forecast in the judgmental decisions or assumptions made during the process.

The manufacturing sector of the aviation industry has had a large impact on the growth of the regional airlines. New aircraft and engines were the key to the expansion of the middle and late 1980s that continues into the early 1990s. From a longer term perspective we watch technological developments in airframes and powerplants. How they affect productivity and costs are key factors. In the near term we carefully track production, orders and options, and customer deliveries as a means to determine capacity. The supply of new aircraft can drive traffic growth because of increased seating, higher utilization, and development of new routes. We track the utilization of each aircraft type to further improve our forecast.

Finally, we use the bottom-up approach to close the loop. We look in detail at each airline. We analyze their fleet utilization patterns, retirement plans, new aircraft orders, options, and delivery schedules. Historical trends in ASM, RPM, and enplanements are examined. Airline finances are also studied for trends.

- Current fleet
  - Retirement rates
- Traffic
  - ASM
  - RPM
  - Growth
- Orders & options
- Gap fleet mix

FIGURE 23 Bottom-Up Approach to Airline Fleet Planning

This method of analyzing the market from the top down and bottom up allows us to identify market gaps for new products and estimate the timing and size of the potential opportunity.

ECONOMIC AND STRUCTURAL FACTORS AFFECTING LONG-TERM FORECASTS

The discussions on events or conditions that would affect the long term forecast centered on three main areas: economic factors, aircraft fleet development, and airline industry structure.

Economic Factors

A major driver of any aviation forecast is economic assumptions and the influence or weight assigned to each in the forecast. Most of the participants focused on aggregate indicators such as GNP, consumer spending, net income, and disposable income as useful in determining the trends and turning points of the forecasts. Several forecasters indicated that they also used an energy cost element based on the price of oil. Interest rates were also mentioned as influencing the demand for capital equipment such as aircraft.

In predicting the direction of the economy, most participants agreed that a slowdown or recession should be included in any forecast for the near term. The timing and the severity, however, were subject to debate, with the time frame indicated ranging from "We're already in it" and late 1990 to midyear 1991 and early 1992. The estimated severity ranged from flat to a strong correction. Although there was diversity in the near-term environment, estimates of the long-term outlook for the economy showed considerable consistency. Over the long run, participants felt the fundamental strength of the U.S. economy would be good and that it would allow for further expansion of regional air services.

A concern was expressed by several workshop participants about the availability of capital for equipment purchases, with competition coming from demand for rebuilding Eastern Europe and expected large purchases of new aircraft by the major airlines of the world. Would this cause pressure on interest rates and would the portfolios of the major lending institutions be dominated by large aircraft? These were seen as factors to be watched for indications of upward pressure on money rates for regional airliner acquisitions.

Aircraft Fleet Development

The U.S. regional airline fleet has almost doubled since 1978. The number of seats in scheduled service has increased 233 percent over the same time. Several of the workshop participants felt that a major element of near-term growth would be new aircraft delivery schedules and older aircraft retirements. The assertion was that through the use of aggressive yield management programs, the airlines were creating demand by offering seats in the marketplace—a capacity-driven growth scenario. By carefully following aircraft orders and deliveries and analyzing the productivity characteristics of individual aircraft types it would be possible to establish the in-service fleet at a near-term point (1-3 years) and thereby estimate passenger traffic levels. It was agreed that careful tracking of the scheduled fleet replacement was a key element for developing accurate forecasts. Essential elements of the fleet to be tracked were

- Current in-service fleet,
- Movements into and out of the fleet by older aircraft,
- New aircraft delivery schedules,
- Order backlog and option commitments, and
- Productivity characteristics of all aircraft:
  - Block hours flown or scheduled,
  - Typical stage lengths,
  - Departure rates, and
  - Seating configuration.

Airline Industry Structure

The discussion of structural issues centered around two areas: the physical infrastructure of the airport and airways system and the future composition of the U.S. airline industry as related to the regional airlines.

Most participants felt that the rapid growth of the air transport system was outstripping the investment in and the development of airport and airway system capacity. The capacity limitations that are beginning to appear will force many airport operators to rationalize access by developing pricing structures based on some form of resource cost allocation. This could force regional airlines to cut back service levels at some communities in the short term or to shift their marketing strategy from smaller aircraft operating at higher frequencies to larger aircraft and lower frequencies. Access to the airports will not be the only constraint facing regional airlines in the near future. Ramp space and gate access were seen as potentially limiting at some of the more congested airports.

An additional element that could constrain expansion at some airports is the growing community resistance to the increased noise generated by the higher traffic levels. Several workshop participants noted that community concern about the environment and aircraft noise would put additional pressure on airlines and airport operators to restrict operations of all types. The affect on regional airlines could be particularly severe due to their higher frequency of operations.

On the positive side, development of more direct origin-destination service to bypass the congested hub airports was identified by several participants as an avenue for growth in some markets. As regional passenger flows into and out of hubs are better understood by the major airlines through the use of their computer reservations systems, viable point-to-point or hub-bypass markets will emerge. In addition to helping alleviate congestion and saving the traveler time, regional airlines will also be able to charge a premium fare for this time-saving and convenient service.

The future composition of the major U.S. airlines will directly affect the development of their respective regional affiliates. Continued consolidation of the industry will provide increasing vertical integration not only in the services offered to the public but also in airline operations. The regional airlines will further integrate their development in several ways. The regional airlines affiliated with the strongest major air carriers will continue to grow at above-average rates as they gain market share in existing markets and expand into new markets. They will increase the sophistication of their planning and operations by tying directly into the massive data systems of their major affiliate or owner. Economies of scale will allow them to generate the cash flow necessary to continue to acquire new, efficient equipment and thereby further increase their competitive position through cost reductions.

SUMMARY

As with any industry that has undergone a period of rapid change and growth, the public agencies, airframe and component manufacturers and the airlines themselves must adapt to these changes in planning for the future. The future is not a clear, simple picture for the regional airline industry. It is a complex series of interactions between the economy, demographics, technology, natural resources, and infrastructure capacity. Change is the constant. Some will be rational and paced; some will be fast, even instantaneous. Planning for the future in this environment requires continuously assessing events and long-term trends and developing methods for weighing their impact on the U.S. regional air transport industry.