$$\ln(RP) = C + C_Y*\ln(Y) + C_{PCIP}*\ln(PCIP) + C_{PP}*\ln(PP) + C_{LFC}*LFC + C_{REC}*REC$$

Building the Forecasts-

The Basic Logic and Assumptions

Predicting how scheduled air services would change and how those changes would impact the region's airport system presented a major challenge to the study. One reason for this is that the models used needed to (a) be sensitive to the factors influencing passenger demand and (b) produce estimates of various trip destinations and types of passenger at reasonable levels of detail. The need for forecasts of other activities at the region's 11 jet passenger airports, such as scheduled cargo and general aviation activities, presented a further challenge. However, the primary focus of this study was scheduled passenger markets for domestic routes, as this activity has the greatest impact on the overall functioning of the regional airport system.

Three Questions - Three Models

In an effort to understand future patterns of domestic passenger activity, the following three major questions presented themselves:

1. What is the magnitude of air passenger travel demand between New England and other major destinations in the United States (the macro demand model)?
2. Where in New England do passengers ultimately begin and end their trips (the passenger allocation model)?
3. What would be the pattern of passenger airport selection in response to changes in schedules, fares and the time required to get to airports (the airport choice model)?

How Many Passengers?

To answer the first question, past travel patterns were used to create a forecast model that compared air travel behavior in three New England "submarkets" to 62 domestic markets around the U.S. The three submarkets were given the names Central, North/West, and Southwest. Working with 20 years of historical value, the study team spent considerable effort to find forecast formulas that provided both a good statistical fit and made common sense. Statistical fit is simply looking back and measuring how well year-to-year changes in key factors, say population and air fares, predicted the number of passengers who flew. Common sense is then applied to ensure that the mathematical formulas that come out of the efforts to find a statistical fit represent our understanding of the basic laws of markets. For example, as prices fall, consumers will usually buy more of a product. Based upon this work, it was determined that the three most important factors affecting increased demand for air travel are increases in population, increases in personal income, and decreases in airfares.[1] Developing separate forecast equations for short, medium, and long distance markets further refined the forecast. Using forecasts of population and income obtained from www.economy.com and predictions of future airfares from a review of FAA and industry forecasts, an overall "macro" forecast of demand was developed that applied these three factors to each of the 62 major domestic markets.

Forecast Scenarios

Every forecast reflects underlying assumptions. These are forecasts in and of themselves of how certain market conditions will change in the future. To address natural uncertainty in the forecasts of these market conditions, it is common to construct "scenarios" reflecting changes in these market conditions. By looking at the effect of variations in those scenarios, we can get an idea how sensitive the forecasts are to changes in underlying market conditions.

In order to identify which scenarios would be of greatest value to this project, a two-day workshop was held with study team participants-agency staff, consultants, and peer group members. The workshop focused on evaluating how future demand for air travel could be affected by a variety of departures from historical trends. These departures, called "trend-breakers," can range from geo-political issues to changes in aircraft technology and telecommunications. After a careful analysis, it was determined that, the bottom line impact of these large but unpredictable events could be simulated by changes in the major drivers of passenger demand - growth in income and changes in airfares.

Based on this, the first scenario represented a continuation of current trends in those drivers. This is called the **Base Case**. In addition, two alternative scenarios were tested: one leading to a higher forecast and one leading to a lower one. In the higher scenario, called the **Enhanced Scenario**, the per capita income growth rate was increased from 1.6% to 2.4%. Airfares were allowed to decline in a manner similar to the base case assumptions with the exception of Boston and the NYC area airports, where it was assumed that high passenger volumes and associated congestion would result in premium pricing, driving average airfares up by 15%. In the lower scenario, called the **Depressed Scenario**, the annual increase in per capita income was lowered from the 1.6% to 0.8% and airfares were held at current levels. This approach also allowed us to measure the sensitivity of the forecast to these two drivers of demand.

$$\ln(RP) = C + C_Y * \ln(Y) + C_{PCI}$$

[1] Yie
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more accurate term.

Adjustments to "Passenger Forecasts"

The method used to develop the forecasts of passenger activity between New England and major domestic markets produced a successful result as defined by its ability to replicate how historically passenger demand changed in reaction to changes in income, population, and fares. But as one member of our Peer Review Panel is fond of saying, these methods "are like trying to drive down the highway by using your rear view mirror."[2] In a review of the initial forecasts, it was noted that the historical period used for model calibration was coincident with a declining price of air travel and an expansion of services. It was further determined that this caused the model to produce average annual growth rates that exceeded longer-term historic experience and that such growth was not sustainable into the future period covered by this study.

Since we already had developed an enhanced scenario to help us understand the impacts of higher-than-anticipated growth, professional judgment was used to modify the model's base case forecast to reflect a more reasonable growth rate of 2.3% that reduced the 2020 forecast from its original 92.8 to 75 million passengers.

What are the Places of Origin of the Passengers?

To answer the second question: concerning where passengers ultimately begin and end their trips, the study conducted simultaneous surveys of passengers at all airports with scheduled airline service. The content of these surveys permitted the data that was collected to be broken down into resident vs. non-resident travelers and business vs. leisure travelers.

An important product of the survey was a profile of passengers that, when combined with demographic data from cities and towns throughout the region, enabled the study to estimate passenger origins by municipality within major markets as well as groups of communities in more rural areas.

Which Airports Will Passengers Use?

Finally, the third question was addressed using the Airport Choice model. Using the data gathered in the 2004 passenger survey, the [illegible] created a model to predict airport choices by passengers. It simulated the frequency of passenger choice of a given airport based upon ground travel times, the availability of non-stop air service, and fares. This model was then applied to estimate the volume of demand that each regional airport would be capable of sustaining. In the process, the model reflected consideration of the minimum market size needed to support airline service in particular markets. The model not only estimated the volume of passengers expected to use one of the 11 airports but also it identified the new types of markets that a given airport might expect to be able be serve in the future.

There is one assumption contained in the airport choice model that deserves special mention here. The underlying mathematics used to create the model try to use available information about fares, non-stop routes, and travel times to airports to explain how passengers used airports at the time of the 2004 survey. What can't be explained by those factors is lumped into a unique airport constant for each airport. Except for

[2]Dr. Richard de Neufville, Professor of Civil and Environmental Engineering and Engineering Systems, Massachusetts Institute of Technology.

the experiments with unconstrained forecasts of Worcester and New Haven, this study generally held these factors constant through time. It may require subsequent surveys to determine whether there is a need and a basis for revising these airport factors to significantly improve our forecasts and understanding of future passenger needs.

Intra-regional and International Passengers, Air Cargo, and General Aviation

The major focus of this study was air passenger service to domestic markets. But in order to understand the ability of the airports to accommodate this demand it was necessary to also forecast the full range of activities that could be expected at these airports. These are as follows:

Intra-regional passengers include passengers traveling between cities in New England. In this study, New York City airports were also viewed as intra-regional trips. International travel involves both trans-oceanic flights as well as Canadian and Caribbean destinations. While Boston's Logan Airport remains the dominant international airport for the region, services to these closer markets are developing at airports throughout the New England system. Air charter flights are common within this market.

Air cargo services have an essential role in the region's economy. Air cargo travels as air freight forwarded in the cargo bays of scheduled passenger flights as well as shipments in dedicated all-cargo aircraft.

General aviation (GA) refers to non-scheduled flights. The most common form of GA is the privately owned single-engine aircraft. However this is a very diverse market and at larger airports, GA operations may be dominated by twin turboprop engine, helicopter and jet aircraft.

Trend analysis was used in developing the forecasts for these additional segments of airport activity. This approach involved the use of a comparative analysis of past growth at each airport as a share of national growth, along with assessments of local developments that could have an impact on the local share of national and regional markets. In addition, national forecasts by the FAA and industry analysts were evaluated and used, as appropriate, to refine our estimates of growth at each of the NERASP airports.

Expanding Expertise Through Peer Review Panels

The forecast models were developed with the assistance of a panel of academic experts in aviation and market analysis. Similarly, a panel of economists reviewed our economic forecasts. While the quality of these forecasts remains the responsibility of the consultant team, both of these panels made significant contributions to improving the forecasts presented in this study.[3]

Forecasts: A Sketch Not A Photograph

Forecasts of air passenger activity should be applied to practical contemporary issues with a considerable amount of judgment. Not only is there significant variation in year-to-year activity but the nature of air travel and how it fits into the lifestyles and work habits of passengers is also constantly evolving. Therefore these estimates should not be considered to be a sharply focused photograph with accurate depiction of small details, but a well-studied sketch of the character of the future, best viewed at a little distance to properly perceive the impression it creates.

[3] Please see acknowledgements on the inside back cover for a list of participants on these panels.