FORECASTING AVIATION ACTIVITY BY AIRPORT

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INTRODUCTION

The Federal Aviation Administration (FAA) has a responsibility to review aviation forecasts that are submitted to the agency in conjunction with airport planning, including airport master plans and environmental studies. FAA reviews such forecasts with the objective of including them in its Terminal Area Forecast (TAF) and the National Plan of Integrated Airport Systems (NPIAS). In addition, aviation activity forecasts are an important input to benefit-cost analyses associated with airport development, and FAA reviews these analyses when federal funding requests are submitted.

The purpose of this document is to provide guidance to individuals who prepare and review airport forecasts. Airport planners may apply the methods contained herein to develop aviation forecasts for an airport. Alternatively, planners may use the airport forecasts contained in the TAF for planning purposes.

As stated in FAA Order 5090.3C, *Field Formulation of the National Plan of Integrated Airport Systems (NPIAS),* dated December 4, 2000, forecasts should be:

- Realistic
- Based on the latest available data
- Reflect the current conditions at the airport
- Supported by information in the study
- Provide an adequate justification for the airport planning and development.

The FAA Office of Aviation Policy and Plans (APO) is the organization tasked with conducting forecast reviews. APO's role in this process is described in FAA Order 5090.3C, Chapter 2 and in the *Airport Improvement Program (AIP) Handbook*, Order 5100.38A, Change 1, Chapter 4 (dated December 20, 1999). From time to time, APO is asked to provide general guidance concerning what is required in the development of aviation forecasts, as well as information on appropriate techniques for forecasting. This document provides such guidance. Some guidance on the subject was incorporated into a recent APO publication, *FAA Airport Benefit-Cost Analysis Guidance* (December 1999). In addition, the FAA has an Advisory Circular on Airport Master Plans, AC 150/5070-6A, dated June 1985, which includes a chapter on aviation forecasts. The following discussion is meant to supplement, not replace, material in these publications.

The guidance covers the following key steps required for forecasting:

1. Identify aviation activity parameters and measures to forecast
2. Collect and review previous airport forecasts
3. Gather data
    - Determine data requirements
    - Identify data sources
    - Collect and evaluate historical and forecast data
4. Select forecast methods
5. Apply forecast methods and evaluate results
6. Summarize and document results
7. Compare airport planning forecast results with TAF

The guidance covers forecasting techniques generally, but does not provide a detailed technical discussion on specific forecasting methods. A bibliography is attached so that the reader can obtain additional information on specific forecasting methods.

APPLICABILITY OF DOCUMENT

This document is intended to assist individuals who prepare airport forecasts as well as those who review the forecasts. Application of the techniques contained in this report will help to promote consistency in the development of aviation forecasts. Preparers of airport forecasts differ in their depth of understanding and expertise regarding forecasting and analytical procedures as well as in their level of experience.

The depth of analysis required in preparing airport forecasts will vary depending on the type of airport, the volume of service at the airport, and the end use of the forecast. Small general aviation airports typically require operation and based aircraft forecasts. Major commercial airports require more extensive forecasting efforts, including projection of commercial service. These differences in depth of analysis, as reflected in the forecast elements to be included, are discussed in Step 1, Identify Aviation Activity Parameters and Measures to Forecast.

All individuals engaged in the production of forecasts, regardless of level of experience, are encouraged to complete the templates referred to in Steps 6 and 7 and provided in the appendices. Completion of Appendix B, Template for Summarizing and Documenting Airport Planning Forecasts, and Appendix C, Template for Comparing Airport Planning and TAF Forecasts, will facilitate the review and approval of forecasts submitted to FAA. The step-by-step guidance presented in the document will be most valuable for those preparers with less experience.

AVIATION FORECASTING BACKGROUND

Forecast methods used to project airport activity should reflect the underlying causal relationships that drive aviation activity. Aviation activity levels result from the interaction of demand and supply factors. The demand for aviation is largely a function of demographic and economic activity. Supply factors that influence activity levels include cost, competition, and regulations.

The forecast methods discussed in Step 4 should be selected and applied in order to measure the underlying causal relationships. Typically, passenger enplanements can be modeled as a function of variables such as real personal income and real yield (as a measure of fares). The number of commercial operations, in turn, is a function of passenger enplanements as well as operational factors (including average load factors and average seats per aircraft). General aviation activity is largely determined by local population and income levels, the cost of flying, and the number of based aircraft at the airport.

The projections of aviation activity that result from applying appropriate forecast methods and relationships need to be evaluated by the forecaster before they are finalized. While the forecast methods provide a means for developing quantifiable results, aviation forecasters must use their professional judgement to determine what is reasonable. As discussed in Step 5, evaluation of forecast results is an essential part of the forecast process. The following sections discuss the basic steps for forecasting aviation activity by airport.

STEP 1. IDENTIFY AVIATION ACTIVITY PARAMETERS AND MEASURES TO FORECAST

The parameters that must be forecast are determined by the level and type of aviation activity expected at the airport, as well as the nature of planning being done. Generally, the most important activity forecast for airfield planning is the level and type of aviation demand generated at the airport (as measured by aircraft operations), because it is this demand that defines the runway and taxiway requirements. Runway and taxiway improvements are one of the dominant categories of airport improvement funding provided through the FAA. If the airport is served by commercial air carriers, another important activity measure is the level of commercial passenger enplanements because it helps to determine the size of the terminal, the number of gates, and other important elements of airport infrastructure. Some aviation planning is conducted on a regional basis and would include both regional demand and the distribution of demand among airports in the region. Other planning efforts may require detailed analysis of enplanements and aircraft movements by city-pair. Planning for a hub airport could involve detailed network analysis of the hub and spoke system of service.

Table 1 shows the forecast elements that are usually required for airport planning. A description of the basic activity measures is provided in Appendix A.

Table 1
Airport Planning Forecast Elements

Required	Included where Appropriate
Annual Passenger Enplanements	
Air Carrier (Domestic & International)* Commuter	On-demand Air Taxi General Aviation Helicopter
Operational Factors	
Average Seats/Aircraft ** Average Load Factor **	GA Operations per Based Aircraft
Annual Itinerant Aircraft Operations	
Air Carrier Commuter and Air Taxi General Aviation (GA) Military	Domestic vs. International Operations Annual Instrument Approaches IFR & VFR Operations Helicopter Operations
Annual Local Aircraft Operations	
General Aviation Military	Touch and Go Operations
Other	
Number of Based Aircraft by Type Aircraft Operations by Type (Fleet Mix)	Peak Hour Operations by Aircraft Type Peak Hour Passenger Enplanements Air Cargo Air Mail

Notes: * International should be separated only when direct international service is provided.
** Estimate separately for air carrier and commuter.

Passenger enplanements, operational factors, and operations represent the logical progression for developing forecasts of commercial activity. Even though the primary forecast need may be aircraft operations, the forecast for commercial airports should begin by projecting air carrier and commuter enplanements and then apply forecasts of average seats per aircraft and average load factor by category in order to develop air carrier and commuter operations.

Practical considerations dictate the level of detail and effort that should go into airport planning forecasts. For example, a general aviation airport where the only issue for development is the need for a runway extension should concentrate on aircraft operations and general aviation fleet characteristics. In the case of major facilities, like large and medium hub airports, additional forecast elements may be required (for example, hourly passenger flows). Determining what is required in an airport planning forecast is typically straightforward - any activity that creates a facility need at the airport in question should be forecast.

As a general rule, airport plans for GA airports require operations and based aircraft forecasts. Airports with commercial air carrier service must include passenger forecasts. Instrument operations and instrument approaches need to be forecast where such information is needed for planning or upgrading of navigational aids and landing systems. Since instrument operations are related to provision of air traffic control in a region, as well as at an airport, the sponsor or its consultant should coordinate any forecasts with FAA regional air traffic managers through the FAA Airports District Office (ADO).

Forecasts of commercial activity should provide projections of average aircraft size and average load factor for air carrier and commuter operations. If international service is provided (or expected to be provided) at the airport, it should be forecast separately. Examples of special activity forecast elements that may be appropriate in certain cases include cargo/mail traffic, air taxi/sightseeing, fixed base operator activity (GA), helicopter activity, and activity by type of aircraft to forecast noise exposure.

Special forecasts may be needed when they are associated with an airport plan that results in application for significant federal funding. The additional forecast elements are typically derived from basic operation and passenger forecasts. Examples of derived forecast elements are:

- Peak hour/busy hour activity—passengers and aircraft operations
- Operations by hour of day
- Average aircraft delay projections

Hourly aircraft activity and passenger movement data are extremely important in airport planning and design, since annual traffic demand cannot be easily converted into a description of facility needs. Delay estimates generally require detailed simulation modeling.

STEP 2. COLLECT AND REVIEW PREVIOUS AIRPORT FORECASTS

The next step after determining what elements should be forecast is to collect and review previous forecasts developed for the airport. The latest FAA Terminal Area Forecast (TAF) for the airport should be obtained. The TAF is updated annually in December and is available at *http://www.apo.data.faa.gov*. If appropriate, regional planning authorities and/or State aviation authorities should be contacted to determine whether they sponsored forecasts of air transportation demand that included the airport.

Review of forecasts can provide important information about the previous economic outlook and air transportation demand projections. In addition, the reviews can be used to obtain historic data relevant to the current forecasting effort. Previous projections of aviation activity need to be assessed to determine if they are out of date.

STEP 3. GATHER DATA

A. DETERMINE DATA REQUIREMENTS

This step expands on the efforts of Steps 1 and 2 so that the analyst obtains all relevant available data that can potentially be used to prepare the forecasts. The data to be gathered will depend on the parameters to be forecast as well as data available from previous airport forecasts. Consideration has to be given to the number of years of historical data to be collected.

Significant effort should be made to establish accurate baseline data from which to forecast. As noted in FAA AC 150/5070-6A, *"In many cases, more accurate and useful forecasts can be obtained through extra efforts on improving the data base than on more sophisticated forecast methods."* If the base year estimate of operations is inaccurate, the accuracy of the forecasts is diminished. The following discussion of data and data sources should assist the analyst in gathering both aviation and socioeconomic data.

B. IDENTIFY DATA SOURCES

Historical Aviation Data

The U.S. Department of Transportation (U.S. DOT) and the FAA have established the definitions for aviation activity measures. (These definitions are included in Appendix A.) The sources of data are briefly discussed below.

Operations

The FAA's Air Traffic Activity Data System (ATADS) is the official source of historical air traffic activity for FAA Air Route Traffic Control Centers (ARTCCs) and FAA and Contract Towered Airports, as well as counts of services provided by FAA Flight Service Stations. The ATADS can be accessed at the FAA APO website at *www.apo.data.faa.gov.* Monthly and annual counts of aircraft operations and instrument operations by user category are available at the facility, state, regional, and national levels. A glossary of air traffic terms is included in the ATADS database.

Information on operations is also directly available through accessing the TAF at the FAA APO website. (After accessing the website, click on TAF, Query Data, and define the report needed to access the TAF history as well as the forecast.) Data are available by facility, by state, or by region. Historical tower data are incorporated into the TAF by fiscal year up to the last year available before publication of the TAF.

Activity at non-towered airports is included in the TAF, based on estimates filed with FAA Airports District Offices on FAA Form 5010. Any alternative sources of information on operations at non-towered airports used in an airport plan must be clearly identified and explained. There are several approaches available to count aviation activity at non-towered airports including video review and other forms of human counting, and pneumatic, electromagnetic, or acoustical machine counts. If such counts are done as part of the planning process, they should be documented and explained. In addition, for airports with active flying schools, operations counts associated with this activity may be obtained from the schools.

Passengers

The basic sources of historical revenue passenger data are U.S. DOT statistics including the T-100 for US domestic and international enplanements, form 298-C and T-1 for some commuter enplanements, and the Origin-Destination Ticket Sample data (DB-1). The T-100 provides enplanements while the DB-1 database is a 10 percent sample that (when expanded) provides estimates of origin-destination "local" passenger counts. The differences between originating passengers and transferring passengers are particularly important in developing forecasts for air carrier hubs. (Air taxi passengers should not be added to commuter enplanements, but should be separately identified. A supplemental source of information on air taxi passengers is FAA's annual survey of air taxi/commercial operators who report their nonscheduled activity on Form 1800-31. This data is available at *www.faa.gov/arp/pdf/v3a.pdf.* Data provided by air taxi/commercial operators is reported voluntarily, and may be incomplete.)

U.S. DOT's Bureau of Transportation Statistics (BTS) maintains the passenger databases. Information on the passenger databases can be obtained from the BTS Office of Airline Information website at *http://webcentral.bts.gov/oai/sources*. This website contains information on U.S. DOT reports and databases as well as commercial organizations that are data service providers of U.S. DOT data. An alternative source of passenger data is airport authority reports since airlines typically also provide data directly to the airports. A number of airports also maintain websites that report their latest aviation activity.

Based Aircraft

Based aircraft history can best be obtained from the TAF, which incorporates data available from Form 5010. Analysts should attempt to verify the Form 5010 number of based aircraft. This can be done by discussion with the airport authority or fixed base operator(s). If airport plans use based aircraft data from sources other than Form 5010, any significant variations must be documented. An additional source of based aircraft information is commercial organizations that have taken the FAA Form 5010 data and made it available over the internet. Two examples are GCR & Associates at *www.gcr1.com/5010WEB* and AirNav at *www.airnav.com*. One shortcoming of the Form 5010 data is that it only gives the latest available information.

Fleet Mix

Fleet mix information requires the analyst to disaggregate estimates of total activity by specific aircraft type, or aircraft grouping. Judgment and the type of analysis determine the level of detail required. For example, if part of the planning process requires running delay models or noise contours, the air carrier forecast may need to be disaggregated by aircraft type, for both the base and forecast years.

The basic sources of data for air carrier fleet mix are the *Official Airline Guide* and T-100 data. The *Official Airline Guide* is only available from commercial sources. The source of data for general aviation fleet mix is locally available data from airport operators, or a simple survey of based aircraft owners or those offering tie-down, hangar, and other aircraft facilities.

Peak Hour Activity

An additional measure of airport activity is hourly peaking. Hourly peaking can be defined in different ways. The typical approach is to develop "design hour" flows of passengers and aircraft. The design hour is the estimate of the peak hour of the average day of the busiest month. An alternative definition of the design hour, appropriate for large airports that have several busy months, is the peak hour that occurs about 10 percent of the days of the year. The peak hour is developed first for operations, then passengers in the peak hour can be estimated using actual data from the T-100, or estimates based on average aircraft size and load factor. Hourly data for operations can be obtained from the *Official Airline Guide* and from the local FAA tower. If a tower does not exist, peak hour estimates can be developed by analyzing the relationship between annual operations and peak hour operations, using base data available from one or more relevant towered airports.

Specialized Databases

There are two specialized databases that contain delay and proprietary airline information. The databases require users to obtain a registered user name and password. These databases are available for a limited number of the busiest U.S. airports, and include:

- Aviation System Performance Metrics (ASPM)
- OPSNET

These databases are usually needed only for planning efforts at the largest airports where special circumstances and challenges exist.

FAA Aviation Forecasts

The Terminal Area Forecast

The Terminal Area Forecast (TAF) is a detailed FAA forecast planning database that APO produces each year covering airports in the National Plan of Integrated Airport Systems (NPIAS). The TAF is prepared to assist the FAA in meeting its planning, budgeting, and staffing requirements. The TAF contains both historical and forecast data. The TAF forecasts are made at the individual airport level and are based in part on the national FAA Aviation Forecast. The TAF assumes an unconstrained demand for aviation services (i.e., an airport's forecast is developed independent of the ability of the airport and the air traffic control system to supply the capacity required to meet the demand.)

In 1999, the TAF included 290 FAA towered airports, 161 Federal contract tower airports, 180 radar approach control facilities and almost 3,000 non-towered airports. Data in the TAF are presented on a U.S. Government fiscal year basis (October through September), and generally cover 10 years of history and 15 or more years of forecast. The TAF is available on the internet at two locations. A copy of the TAF database and Windows95-based TAF model are located at *http://api.hq.faa.gov/apo_pubs.htm.* A download version of the TAF publication is available at this address. In addition, the TAF data can be directly accessed at *http://www.apo.data.faa.gov.* This JAVA-based model allows for accessing and printing historical and forecast aviation data by individual airport, state, or FAA region. Worksheet formats may also be downloaded.

The TAF summary report for each airport includes the following basic elements as appropriate:

1. Passenger Enplanements – Air Carrier, Commuter, and Total
2. Itinerant Aircraft Operations – Air Carrier, Air Taxi plus Commuter, General Aviation, Military, and Total
3. Local Aircraft Operations – General Aviation, Military, and Total
4. Total Operations – Itinerant plus Local
5. Total Instrument Operations
6. Based General Aviation Aircraft

Other FAA Forecasts

In addition to the TAF, FAA publishes two major forecasts that may be helpful in developing airport forecasts: *FAA Aerospace Forecasts* and *FAA Long Range Aerospace Forecasts*. These may be accessed most readily in download formats at *http://api.hq.faa.gov/apo_pubs.htm.* (This website contains additional information of interest, including Airport Benefit-Cost Analysis Guidance, Civil Airman Statistics, and General Aviation and Air Taxi Activity and Avionics Survey information.)

FAA Aerospace Forecasts is a forecast of national level U.S. aviation demand. This publication provides a 12-year outlook and is updated each year in March.[1] It is the official FAA view of the immediate future for aviation. The publication includes aggregate level forecasts of the following:

- Passenger enplanements, revenue passenger miles, fleet, and hours flown for large air carriers and regional/commuters
- Cargo revenue ton miles and cargo fleet for large air carriers
- Fleet, hours flown, and pilots for general aviation
- Activity forecasts for FAA and contract towers by major user category

FAA Long Range Aerospace Forecasts is a long-range forecast that extends the 12-year forecast to a longer time horizon, typically for a period of 25 years.[2] This forecast contains projections of aircraft fleet and hours, air carrier and regional/commuter passenger enplanements, air cargo freight revenue ton-miles, pilots, and FAA workload measures.

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[1] See, for example, *FAA Aerospace Forecasts, Fiscal Years 2001-2012,* FAA, March 2001, Washington, D.C.

[2] *FAA Long Range Aerospace Forecasts Fiscal Years 2015, 2020 and 2025* (June 2000).

Socioeconomic Data

Whatever method is used to forecast aviation demand, it is usually helpful to incorporate an analysis of local and regional socioeconomic data. This includes historical and forecast data on such variables as population, income, and employment. Those developing airport planning forecasts should use recognized sources of socioeconomic data including local, regional, state, and federal planning organizations. The list below is comprised of recognized sources for detailed regional forecasts or database information. The list below, which includes internet addresses, is not exhaustive.

- U.S. Department of Commerce, Washington, DC. Several organizations provide economic data, including projections.
  - US Census (*www.census.gov*)
  - Bureau of Economic Analysis (*www.bea.doc.gov*) Note: BEA formerly developed regional forecasts of economic activity, but no longer produces such forecasts.
- DRI McGraw-Hill, Inc. Subsidiary of Standard and Poors. (*www.dri.mcgraw-hill.com*)
- NPA Data Services, Inc., Arlington, VA. Detailed history and forecast data are available on county and regional levels. Contact Nestor Terleckyj at 703-978-8400 or visit website. (*www.npadata.com*)
- Regional Financial Associates, West Chester, PA. (*www.rfa.com*)
- WEFA, Inc. Eddystone, PA. (*www.wefa.com*)
- Woods and Poole. (*www.woodsandpoole.com*)

C. COLLECT AND EVALUATE HISTORICAL AND FORECAST DATA

Once the data needs and data sources are identified, the analyst should collect and evaluate all relevant historical and forecast data. Evaluation is an important component of step 3. The analyst should review data series to determine their reasonableness. Data must also be evaluated to determine if anomalies or errors might be present that could affect the outcome of the aviation forecasts. For example, a key time series like enplanements might be affected by unusual factors. An extraordinary event (such as the Olympic Games) could cause a non-recurring traffic peak. Unusual weather occurrences could also affect traffic. Another time series that should be evaluated is based aircraft, which can fluctuate considerably, especially at smaller airports. Historic general aviation operations levels at non-towered airports should be evaluated for their reasonableness by calculating the number of annual GA operations per based aircraft. Guidelines for annual operations per based aircraft are provided in FAA Order 5090.3C, Chapter 3.

The results of data evaluation may require the modification of data in a time series, or restrict the usefulness of some data. If FAA data are questioned or modified, the analyst should clearly describe the situation.

STEP 4. SELECT FORECAST METHODS

The next step in preparing an airport forecast is to select appropriate methods to develop the forecast. While there are several acceptable techniques and procedures for forecasting aviation activity at a specific airport, most forecasts utilize basic techniques such as regression or share analysis. The following discussion is an overview of the majority of forecast methods that apply to aviation demand forecasting. The discussion is not all-inclusive, and additional techniques might be acceptable. A forecast effort could involve a number of different techniques.

A. REGRESSION AND TREND ANALYSIS

Econometric analysis is a generic reference to the use of mathematical and statistical methods in the field of economics. One important and frequently used statistical method in this type of approach is regression analysis.

In regression analysis, the value being estimated (or forecast)—the dependent variable—is related to other variables—the independent or explanatory variables—that "explain" the estimated value. An example of a regression equation is to estimate passenger enplanements as a function of economic variables (e.g., income and fares). The relationship is estimated using historic data for the independent and dependent variables. The explanatory power of the equation is measured by the R^2 statistic (called the coefficient of determination). An R^2 of 0 indicates that there is no statistical relationship between changes in the independent and dependent variables. R^2 values near 1.0 mean that there is a very strong statistical relationship. Forecasts of the independent variables are used in the regression equation to calculate forecast values for the dependent variable.

One major advantage of using a regression equation is that if the independent variables are more readily projected than the forecast or dependent variable, then it is relatively easy to derive a forecast. Forecasts of the independent variable may be available. For example, forecasts of regional income are usually readily available. Obviously, if the independent variable is difficult to forecast or if projections are not available, a good historical regression "fit" may be without value for forecasting purposes.

Fortunately, there is a considerable literature available on the application of regression analysis to air transportation. Most regression models for aviation demand use gross economic measures like income, population, and employment. If regression is used, it should be restricted to simple models with independent variables for which reliable forecasts are available.

The basic type of regression equation used for forecasting is a linear form. Nonlinear regression equations may also be used, such as logarithmic form.

Trend analysis relies on projecting historic trends into the future. In trend analysis, a regression equation is used with time as the independent variable. It is one of the fundamental techniques used to analyze and forecast aviation activity. While it is frequently used as a back-up or expedient technique, it is highly valuable because it is relatively simple to apply. Sometimes trend analysis can be used as a reasonable method of projecting variables that would be very complicated (and costly) to project by other means.

B. SHARE ANALYSIS

Share analysis is a relatively easy method to use, and can be applied to any measure for which a reliable higher-level (i.e., larger aggregate) forecast is available. Historical shares are calculated and used as a basis for projecting future shares. This approach is a "top-down" method of forecasting since forecasts of larger aggregates are used to derive forecasts for smaller areas (e.g., airports). A typical example where this may be appropriate is an airport's percentage share of national enplanements. An airport might historically have a relatively constant 0.22 percentage share of U.S. domestic enplanements. Perhaps the share has shown little variation over the period being measured (e.g., ranged between 0.21 percent and 0.23 percent of the national total). Given no expected structural changes in air service, it may be acceptable to extrapolate the historic share. In the example, the historic share could be multiplied by the FAA's national domestic enplanement forecast to obtain the airport's enplanement forecast. In this case, the airport forecast growth rate would be the same as the national forecast growth rate.

Of course, share analysis could be used even if there is not a constant historic share. For example, a community may have an increasing share of national domestic enplanements. If this increasing share is correlated closely to the community's share of national employment, income, or population, then a forecast of the correlated variable might be a basis for projecting future shares. Another example of share analysis is to forecast an airport's based aircraft as a share of total based aircraft in the local region. The total number of based aircraft in the region can be forecast by correlating it with local economic activity.

Share analysis should not be misused. One cannot necessarily assume, for example, a constant share such that future enplanements for an airport will grow at the average rate of growth shown in the FAA national forecast. The national rate of growth is made up of those airports that are growing fast, those that are growing slowly, and those that are not growing at all. The analyst must project an appropriate local share of enplanements, in light of historical enplanement trends. The forecast values resulting from the share analysis should be compared to historic values for the parameter.

The share approach is efficient, and can sometimes yield better results than searching for complex relationships between local enplanements and a number of independent variables. It has weaknesses, however. Use of the share approach requires that a higher-level forecast is available, and there may be judgment required to estimate future shares.

The share approach may be helpful in forecasting other aviation variables in addition to enplanements. For example, if the local average aircraft size is historically 80 percent of the national level, 80 percent of the national forecast for this variable could be used as the forecast local average aircraft size.

C. OTHER TECHNIQUES

Exponential Smoothing

Exponential smoothing is a statistical technique that may be valuable, especially in producing short-term forecasts. This technique produces a forecast based on a time series analysis of observations in which the most weight is given to the most recent observation and decreasing weights are given to earlier observations. This method would give more weight to the latest trends and conditions at the airport (e.g., new carrier hubbing at the airport). One advantage of exponential smoothing is that forecasts can be generated quickly.

Comparison with Other Airports

The forecast technique using comparison with other airports can be valuable. In this technique the analyst compares the airport to be forecast with other airports of relative size and relevant characteristics. One particular use of this technique is in projecting airport enplanement growth after a major change such as the addition of the first low-fare carrier. In this case, analogy can be made to growth rates achieved at similar airports after they obtained initial low-fare carrier service. It may also be appropriate to compare airport forecasts to statewide forecasts that are available, or established forecasts for other airports in the same region.

Survey Techniques

Surveys and analyses based on surveys can be important in developing airport forecasts. An example of the importance of surveys is when the spatial distribution of passenger trip ends must be estimated. Such information is needed to support ground transportation planning or airport access needs. It is also crucial when considering a new airport or airport relocation. These surveys are specifically aimed at establishing the travel patterns of air travelers – where they originate or terminate their trip in a region, their trip purpose, and relevant socioeconomic characteristics of the traveler. Examples of survey techniques include questionnaires given to travelers, data collected from travel agents, and license plate surveys at airport parking lots.

Cohort Analysis

Cohort analysis is used to disaggregate a larger group in order to study the components (cohorts) separately. In aviation, applications are possible in several areas, including passengers, cargo shipments, and general aviation users. It is not normally used in airport planning projects but could be used for special applications. It makes sense, for example, if one is forecasting passengers for a city like Las Vegas to disaggregate the historical flow of passengers into major groups, say individuals going to Las

Vegas to gamble, those on business, those attending a convention, and local residents on personal travel. If the analyst can establish a time series or even a good "snapshot" of each of these cohorts, a separate analysis can be made of the likely factors that underlie the passenger demand of the separate cohorts.

Another example of cohort analysis involves general aviation. General aviation is a complex entity that is best understood when it is disaggregated into its parts. This is true at both the national level and airport level. The FAA surveys GA aircraft owners to determine usage patterns of aircraft. Utilization, measured by number of hours per aircraft and operations per aircraft, varies significantly by the purpose for which the aircraft is used. An instructional airplane can generate hundreds of operations a month at an airport, if fully utilized, especially when considering touch and go operations. An aircraft used for personal use might be used only a few times a month.

When forecasting GA for an airport plan, speculation is inappropriate. For example, statements that a new instructional program (i.e., flight school) is expected must be backed up by significant evidence. It would be considered significant if a college or university has firm plans to introduce a new flight education program. An unsubstantiated rumor that a commercial training company is coming to an airport is not considered "significant evidence."

Choice and Distribution Models

In some forecasting analyses, it is important to analyze regional aviation demand (or even regional transportation demand) and distribute the demand between or among alternate aviation facilities. This can occur especially in the situation where an airport(s) in the region may be opening or closing during the forecast period. The important elements in this technique are an adequate database, and knowledge of the structure of traveler choices. The data requirements for estimating a choice model can be extensive.

Consider the case of a new proposed commercial service airport in a metropolitan area. The factors that are relevant to airport choice must be identified and modeled. Most modern economic studies of transportation demand use the so-called "full price of travel" framework, which is designed to represent the economic value that consumers place on the various characteristics of the travel choices available to them. In the context of airport choice, the full price of travel may depend on economic characteristics related to the airports themselves (e.g., cost of airport access, type, and availability of air services at each airport, and their cost) as well as attributes that are specific to individual consumers (e.g., income and trip purpose).

A significant amount of literature on various statistical approaches to choice modeling has developed over the years, and the decision of which model to use and how to estimate it must be considered carefully by the analyst. An important assumption of many choice models is that the overall size of the market is fixed. If a new alternative is introduced, such models can explain how the allocation of demand across alternatives changes, but cannot explain how the level of overall demand responds. To assess such impacts, it is often useful to develop a separate analysis to account for induced demand.