CHAPTER 3

DEMAND FORECASTING TECHNIQUES

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1. INTRODUCTION TO FORECASTING

Cargo forecasts are important to airports for many reasons including master planning and budgeting. Airports that accurately forecast their future traffic will better anticipate the needs of their customers, and thus will be in a better position to develop to their full potential. This chapter provides insight into how to best plan for increased cargo activity.

The forecast prepared for a master plan or similar study should represent market-driven demand for air cargo service. To the extent possible demand forecasts should be unconstrained and as such not take facility constraints or other outside limiting factors into consideration. In other words, for purposes of estimating future demand, forecasts should assume facilities can be provided to meet demand. After determining what facilities are needed to accommodate the forecast aviation activity, alternatives can be identified and evaluated in order to provide any physical improvements.

Forecasts provide critical input to airport management and planning. Cargo forecasting is not just a theoretical exercise. It must consider underlying market forces based on market assessments and economic theory, as well as an airport's physical capabilities and constraints. Every airport is unique and while every cargo operation has some common elements, the translation from best practices to planning metrics will require a careful review of current and past activities.

It is important to remember that air cargo is a high-volume, low margin business that is driven by time, service, and cost control. The physical planning extends beyond the parameters of the on-airport buildings to a wide range of business and regulatory interests both on- and off-airport.

Forecasting is an inherently uncertain activity simply because past experience can be only a hint about future performance. Thus, even the most sophisticated forecasters find that the actual results are often higher or lower than their predictions. The purpose of this guide is to describe techniques for forecasting air cargo activity for individual airports that can help define and minimize the range of uncertainty, or "forecast error."

The best source of *customized* inputs to a forecast derives from a detailed market assessment. Carriers, their business partners, and all of the supporting entities in the air cargo community (including federal agencies) can provide meaningful input to ensure that the forecast is anchored in reality and adds clarity to the planning requirements.

Reliable forecasts provide critical input to airport management and planning. Although forecasting is a challenging task, the production of more dependable traffic forecasts can be guided by a set of principles that have been judged to be effective. These principles of forecasting are:

- It is essential to understand the issues and events driving the forecasts and to communicate with users regarding the nature of the forecasts and their application
- Sound judgment is always an integral part of the forecasting process; however, impartiality should be maintained through the process
- Use the most reliable and current data – A correct and solid traffic base is essential. If not available, different data sources should be consulted to establish the best possible estimates
- Use the most appropriate forecasting methodology and technique. Different traffic component forecasts require different forecasting technique(s) due to data availability and completeness as well as the forecast requirements such as the level of details

- Consistent assumptions should be applied through the forecasting process, both for input variables and forecast adjustments, to ensure internal and external consistency
- Uncertainties surrounding the forecasts should be identified and dealt with, not ignored

Forecasting is as much about common sense as it is about math. You cannot forecast effectively without using your judgment. Even the simplest trend analysis --that is, traffic grew by 5% last year, so the forecast calls for 5% growth this year --entails a judgment about whether it is reasonable to assume that past performance will be repeated. At the other extreme, complex econometric models, with dozens of independent variables, basically extrapolate observed historical relationships into the future. The problem is, and always will be, that the world keeps changing, often faster than the historical numbers can keep up. Therefore it falls to the forecaster to make educated guesses about the future development of key factors, -such as economic growth, currency rates and fuel prices, which influence air cargo traffic growth.

The forecaster should also consider the use of the Planning Activity Level (PAL) concept. This approach reflects that the need for any necessary improvements will not be driven by a set point in time but rather by the arrival of future demand levels. Therefore, while a master plan forecast might tie forecast demand levels to specific years for the purpose of providing context, forecasts are rarely able to predict exactly when activity levels will be reached. Rather, forecasts are most useful in predicting future trends. The actual realization of predicted activity levels will likely differ from the forecast in terms of what year that activity occurs. The PALs represent activity based milestones that can be used to make future expansion and development decisions, focusing on specific volumes of activity that trigger the expansion requirement, rather than the timing identified in the forecast. The FAA's guidance on master plans supports the concept of PALs, stating "…planners should identify what demand levels will trigger the need for expansion or improvement of a specific facility. In this way, the sponsor can monitor the growth trends and expand the airport as demand warrants".[1]

Typically, at least two forecast scenarios are developed to provide a range of potential future activity levels. The baseline forecast represents a continuation of the airport's current role in the region and in the national transportation system. The baseline forecast represents the most likely scenario and will be used for future planning. An alternative scenario(s) can be used as a sensitivity analysis to assess the ability of the airport to respond to optimistic demand factors that depart from the baseline forecast.

The following sections will provide an understanding and familiarity about the need for air cargo forecasting, the elements that are incorporated, data sources, and forecasting techniques and models. Periodic updates of the forecast ensure that the planning recommendations remain consistent with the characteristics of the actual activity and reasonable expectations of future activity levels.

2. IMPORTANCE OF AIR CARGO FORECASTING

While it is sometimes difficult to predict an exact activity level for a specific time in the future, properly preparing a forecast is a necessity in today's business environment. Traffic forecasts are important in understanding an airport's demand growth, assessing market risk, and predicting financial gains/losses to develop management strategy. Often, forecasting is mandated in master plans to secure funding for future capital improvement projects, particularly under federal grants and bond issuances. Airports that accurately

[1] FAA Advisory Circular 150/5070-6B, *Airport Master Plans*, page 48

forecast their future traffic will better anticipate the needs of their customers, and thus will be in a better position to develop to their full potential.

a. Market Demand

The air cargo industry has experienced many changes since the turn of the century. The general U.S. economic downturn that began in 2000 adversely affected U.S. air cargo activity. After the terrorist attacks of September 11, 2001, cargo activity in the U.S. was immediately impacted. Critical impacts included an increased use of trucks, an escalation of insurance costs, consolidation among smaller firms, failure of many small cargo airlines and smaller support firms, higher security costs, longer processing time because of security, and increased available freighter capacity which drove down rates. The cargo industry recovered by 2003 and posted strong growth for several years.

Growth in U.S. air cargo activity began to slow down in 2006 as the price of oil surged to record high levels (ultimately peaking above $140 per barrel in July 2008), causing shipping by other modes to become more attractive. While oil prices declined significantly in the fourth quarter of 2008, economic activity deteriorated in late 2008 and the resulting global recession that followed limited the positive impact of the lower oil prices.

While China remains as the cargo demand giant for many other countries, emerging trade patterns in recent decades (i.e., the Middle East and Latin America) present new opportunities. Although airports will continue to market for further expansion in Asia, a forecast should also consider and highlight the opportunities in emerging markets that are available to them.

Evolving carrier route structures and increased passenger aircraft capacity also add to the demand dynamics. A number of carriers have shifted from dedicated freighters to passenger aircraft. Freight forwarders have also taken advantage of this shift as they capitalize on underutilized belly capacity. The diversion of international passenger routes to various secondary airports and improved ground infrastructures will continue to pull cargo volume away from mature gateways.

Despite the introduction of new international routes from various airports, not all airports will receive air cargo in high volumes. Domestically, the two major integrators (FedEx and UPS) will continue to drive cargo routing patterns. While some airports have benefitted as regional hubs in the integrators' networks in the past, other airports will continue to serve local metropolitan areas, often as drop centers, connecting to air services at other airports.

In stimulating local air cargo activity, airports geographically positioned for freight have developed trucking drop centers located near major highways to efficiently pull air traffic away from gateway airports. Marketing these routings as cheaper alternatives for shipping freight, airports have provided drop centers near major gateways for freight to be transported to the alternative airport at no additional cost to freight forwarders. While these drop center facilities continue to expand at alternative airports, volume that has been diverted remains limited.

While airports continue to develop, redevelop, and expand to adapt to anticipated air cargo growth, the forecaster must understand the revolving changes and trends in the industry to accurately assess potential capacity and infrastructure needs.

b. Facility and Infrastructure Demand

The global economic slowdown resulted in cargo volume dropping at most airports, making facilities demand forecasting much more difficult. Adding to the complexities are modal shifts, airport accessibility, regulatory and security compliance issues, fuel pricing, environmental issues, changing aircraft configurations, and shifts in supply chain business strategies.

Air cargo growth patterns often combine one or more countervailing trends. For example, international freighter services have continued to concentrate at the major U.S. gateways for efficiency and cost purposes. At the same time, shifts in business and supply chain locations have created a need for new facilities at secondary gateways. A forecast plays a fundamental part in emphasizing demand growth; it also needs to align demand with the infrastructure and facility requirements. Within these requirements are desires for newly built air cargo facilities, easier airport access, warehousing sorting and storage space, smoother customs policies, secure airside access, and shorter taxi-time.

While some airports continue to market vacant facilities to new cargo tenants, other airports have converted such excess facilities to alternative uses. In some cases, logistics providers have taken leases on such vacancies and converted them to office and trucking distribution facilities.

As costs continue to dictate business directions, many forwarders have decided to relocate their distribution facilities to off-airport locations. Developers can own off-airport property rather than leasing from the airport, thus allowing for long-term financing and residual property value. Additionally, off-airport property construction costs are often cheaper and the facilities more quickly developed. The less strict security requirements of off-airport property also provide another key benefit to off-airport real estate. Under the Transportation Security Administration's (TSA) Certified Cargo Screening Program (CCSP), the 100 percent screening requirement can be met by allowing off-airport facilities to certify and screen cargo.

The elements of doing business are constantly changing and business decisions will evolve to achieve optimal financial efficiency and influence facility development. It is key that forecasts reflect industry changes and allow airports to adjust facility development, modernization, and lease agreements to demand, and thereby become successful. It will enable management to change operations at the appropriate time to attain the greatest benefits and prevent losses.

3. ELEMENTS OF AIR CARGO FORECASTING

Future levels of air cargo traffic and related activity for a particular airport (or system of airports) will be affected by various demand and supply elements as they apply for a specified forecast period. An air cargo forecast requires some understanding of how these factors determined activity levels in the past and how changes in those factors may affect the future. Trend forecasts implicitly assume that past trends in demand and supply elements will continue into the future, while econometric forecasting attempts to explicitly measure the influence of specific factors. In either case, it is important that a forecaster be cognizant of how demand and supply characteristics produce an aggregate level of cargo and aircraft traffic.

Air cargo markets combine cargo flow demand with the available air cargo service supply sector to create airport activity levels. In simple terms, cargo flow demand for a particular airport is an aggregation of all the various shipments that transit that airport, each with a unique timing, origin and destination points, commodity type, packaging, shipment size and service requirements (e.g., desired transit time or perishability). Air cargo services (supply) encompass the available routing options for those shipments and typically should include that of competing airports and modes of transportation. Air cargo services include airport-to-airport transportation as well as supporting ground services (e.g., trucking, handling and storage), and can be compared in terms of cost, transit time and level of service. The air cargo supply sector also includes on- and off-airport facilities and infrastructure (e.g., runways and access roads).

This section will describe the key elements that can be used to describe and measure cargo demand, service supply, and the resulting airport cargo activity.

a. Air Cargo Demand

The demand for air cargo services is driven by the highly diverse needs of shippers and consignees including the overnight delivery of a document, time-sensitive items such as the transport of donor organs to hospitals, or the managed distribution of components and products for multi-national high tech manufacturers. Some key characteristics that can be used to describe air cargo demand are:

Origin/Destination

Most air shipments do not originate or terminate at an airport, so industrial and demographic location patterns drive flow patterns. The origin and destination of a shipment determine the range and cost of routing and service options that may be available.

Commodity

Commodity type affects both the desirability of, and requirements for, air services. Key characteristics include perishability (time or physical), value, weight, and physical dimensions. There are thousands of distinct commodities that move in air trade markets, each with distinct shipment characteristics.

Desired Level of Service

The optimal level of air cargo service typically involves a trade-off between the cost and the quality of service as determined by transit time, reliability and security (including maintaining perishable goods), often compared to the same characteristics for available surface options.

Shipment size

For the most part, air shipments are small and typically must be consolidated into pallets or containers for handling to and from the aircraft. Larger sized shipments may require special handling or aircraft types, but are also more susceptible to diversion to another mode of transport.

Cargo demand for an airport is primarily determined by the location and volume of air commodity production, consumption and/or distribution[2] within that airport's catchment area (or market hinterland). The demand for any particular airport is also affected by the location and competitiveness of alternative airports or modes of transport. The domestic and international catchment areas for an airport differ as follows:

U.S. Domestic

The integrated carriers (FedEx and UPS) dominate the handling of domestic air cargo shipments and therefore the domestic catchment area is determined by the ability to meet next-day morning delivery schedules for those carriers. The size and scope for any particular airport's catchment area is primarily based on the location of alternative airports and relative drive times to the primary pickup/delivery areas.

International

[2] Some outbound items may be produced outside of an airport's catchment area and trucked to a distribution center where the air shipment would originate with a similar pattern for inbound commodities.

U.S. international air trade is dominated by a few large gateway airports that draw cargo from large regional markets via both truck and air connecting services. Primary gateways also attract cargo based on their proximately to particular world regions. For example, Los Angeles (LAX) will attract cargo bound for Asia from the U.S. East Coast, and New York Kennedy (JFK) will similarly handle Europe-bound traffic from the West Coast. There are advantages of direct service to smaller gateway airports, particularly for traffic from a more constrained primary area as defined by same day pickup/delivery time by truck (typically 50 to 100 miles from the airport, depending on the location of other gateway airports).

Within an airport's catchment area, the key demand factors that would affect cargo forecasts are general economic trends as well as specific regional demographic and industrial trends including:

Regional Demographics

The demand for inbound air shipments is affected by population and income levels (as is outbound demand for shipments generated by individuals).

Regional Employment and Production

Demand for outbound air services is determined by air commodity production volumes within a region, which also affects inbound demand to the extent that machinery, parts and components are shipped in by air in support of that production.

Regional Industrial Location Patterns

Industries make location and expansion decisions based on a variety of cost and efficiency factors. Accordingly, future growth in particular air cargo movements depends on non-transport factors that drive those decisions.

Shifts in Commodity Demand

Economic, industrial and demographic factors affecting the destination markets that trade with a particular regional market will also affect future air cargo growth.

Shifts in Distribution Practices and Patterns

The importance of logistics in both manufacturing and final product distribution drives intermediate demand for air and other cargo transportation. The development of regional distribution centers serving large geographical areas has created new air cargo for some airports based not on local demand, but on the efficiency of transferring cargo to satisfy other regions' demands.

The impact of demand on air cargo forecasts for an airport can typically be measured using general economic forecasts in concert with some consideration of trends in commodity and origin/destination mix. But it is also important to consider some of the other factors, especially for markets that are highly dependent on a single industry that may relocate, a commodity that may lose popularity or suffer environmental problems, or a foreign economy that may experience extreme variations.

b. Air Cargo Services and Other Supply Factors

Air cargo service providers include airlines, airports and support service firms. Airlines provide the air transport segment of air shipments, but may also provide ground handling or pickup/delivery services. Air carriers are primarily categorized as either (1) direct airport-to-airport carriers that mostly concentrate on air transport (including both passenger and freighter aircraft operators), or (2) integrated all-cargo carriers who maintain single entity responsibility for shipments on a door-to-door basis (and therefore supply most of the ground support services). Airports facilitate the transfer and handling of air cargo by providing infrastructure, facilities and support services. Other firms provide services to the airline or the shipper/consignee including:

- Freight forwarders act as agents for the shipper or consignee in managing, providing or securing air, ground, and other handling services;
- Customs brokers are primarily responsible for marshaling inbound international shipments through local customs and inspection requirements and may also handle ground services at the destination airport;
- Trucking firms assist in the transportation between the airport and origin/destination points when not directly provided by the airline or forwarder; and
- Specialized service firms including warehousing, airport ground handlers, and third-party logistics (3PL) or distribution firms.

Some of the service factors that will influence cargo forecasting include:

- Unlike other modes, air cargo flight capacity is significantly affected by passenger demand and service patterns, particularly for international markets. Future shifts and growth in passenger services will drive cargo routing patterns.
- The emergence of the U.S. integrated carriers has resulted in a significant decline in the need for general all-cargo and passenger capacity in the U.S. domestic market, and has also affected the express segment of international cargo markets. Future changes in how integrated carriers structure and operate their networks will greatly affect routing patterns, particularly for their hub and gateway airports.
- General all-cargo freighter service typically provides flight capacity on routes where passenger flights cannot satisfy demand either in terms of capacity or capabilities (e.g., oversized shipments). While limited in the U.S. domestic market, non-integrated freighters continue to have a strong role in the international market, and shifts in the use and routing of freighters greatly affects traffic levels particularly for smaller secondary gateways. Freighter capacity may also be the first to be reduced in a downturn, adversely affecting certain airports.
- The pattern of air cargo routings is affected by the range and payload characteristics of both passenger and freighter aircraft and future fleet trends should be considered in forecasts.
- Another aircraft-related factor is the level of future fuel prices that will not only affect operating costs, but will drive many fleet decisions. Fuel price increases disproportionately affect air relative to other modes often leading to increased rates and mode shifts.
- Increased post-9/11 security has affected the air cargo market significantly based on the reduced ability to handle cargo on passenger flights, and time/cost impacts from increased screening and security review. This is particularly true in the U.S. domestic market where trucking services have significantly less restrictions.

- Air cargo routing patterns are not driven entirely by cost and time factors as experienced by the shipper, but also depend on internal efficiency strategies for the airline and forwarder industries. The concentration of international air cargo at a limited number of U.S. gateways is partially caused by airlines wanting to use common airports for their passenger and freighter flights or by efficiencies related to airline partnerships. Forwarders also have a major influence on routing decisions as their gateway systems concentrate international traffic at a limited number of airports based on internal efficiency and profitability.

- International regulation may also affect cargo service and routing patterns as a limited number of U.S. markets are still controlled by bilateral agreements that limit carrier entry and routes. The availability of federal agencies for clearance may also impact decisions on the routing of international freight.

- On the environmental side, the key issues are noise and emissions. Future noise and emissions restrictions could affect the ability to use certain airports or the cost of operating all-cargo fleets, many of which are heavily populated with the older aircraft targeted by the regulations.

In terms of cargo forecasting, the most important supply consideration is whether existing patterns and trends can be expected to continue, or whether some of the key supply factors should be incorporated into the forecast process.

c. Airport Traffic and Other Activity

The airport traffic and activity levels that are measured and forecast are based on the interaction between air cargo demand and supply patterns, the details of which are not easily discerned from airport-level statistics. Traffic patterns reflect the underlying demand for shipping between various geographic regions, the type of commodities involved, and the way individual providers tailor their services to meet demand.

In terms of forecasting, the key activity measures include:

- Shipment weight and value
- Number and capacity of aircraft operations by category (passenger, all-cargo, integrator), type (passenger, freighter) or aircraft size category.
- On- and off-airport truck activity
- On- and off-airport facility/infrastructure utilization.

For short-term forecasts or those for relatively stable markets, it may be possible to forecast one of those statistics (e.g., traffic tons) and apply ratios for any others that are required. However, such simple assumptions may obscure fundamental shifts in the demand and supply sectors and lead to inaccurate or unreasonable forecasts.

4. AIR CARGO DATA SOURCES

This section discusses the various sources of data that can be useful in forecasting cargo demand.

a. General Sources for Traffic and Activity

Data sources include:

- Individual airport statistics

- Airline industry sources (Airports Council International (ACI), International Air Transport Association (IATA) and Airlines for America (A4A; formerly known as Air Transport Association of America))
- U.S. Department of Transportation (DOT) aviation statistics (Form 41/T-100)
- Flight schedule data (Official Airline Guide (OAG) and other)

The level of detail available from airports varies but typically includes carrier-level totals for enplaned and deplaned tonnage and the number of flights on a monthly basis. Airports collect this information directly from the airlines so there may be additional information available internally.

ACI collects domestic and international traffic statistics (freight and mail) from member airports that are roughly equivalent to statistics produced by individual airports. The ACI data does not include any details on commodity, airline or routing. IATA also collects international freight statistics from its member airlines that is available in aggregate form by region and airline. Detailed international data collected through the IATA billing system (CASS) is available to submitting airlines and forwarders only.

The U.S. DOT T-100 statistics provide airport-to-airport traffic statistics by airline, service type (cargo/passenger and scheduled/non-scheduled) and aircraft type (all-cargo, passenger, and combi) on a monthly basis. The data covers both U.S. and foreign carriers and includes flights, capacity, and freight and mail weight by direction. The data is available in two primary sets. The segment data covers all onboard traffic moving on non-stop flights between two airports and includes details on service and aircraft type (including capacity and flights). The market data covers all on-flight traffic between two airports based on the airports where the cargo is enplaned and deplaned[3]. The release of international data occurs approximately six months after the measured time period (with domestic data released after three months).

Current and historical scheduled flight data can be used to profile cargo and passenger flight schedules by carrier, aircraft type/capacity, and origin/destination market, but often does not include the integrated carriers and may exclude some international cargo flights as well.

b. International Cargo Flow Sources

The primary source of U.S. international air trade data is the U.S. Bureau of the Census commodity series that provides weight and value for air imports and exports (based on mode to/from the point of entry/exit) by commodity (10-digit harmonized schedule with concordances to other codes), foreign country of origin/destination, and U.S. Customs District of entry or unlading (for imports) or Customs District of exit (for exports). In recent years, port-level detail (for unlading or exit) has been made available, although there is some suppression to protect the identity of integrated carriers.

Export data with additional origin detail is available in the U.S. Bureau of the Census state of export series in two primary formats:

- Commodity: State of origin by destination country by commodity (6-digit Harmonized Schedule (HS) or 3-digit North American Industry Classification System (NAICS) code)

- Port of Exit: State of origin by destination country by airport of exit

[3] This distinction only affects traffic that moves on a multi-stop flight. For traffic on a flight from A to C that stops at B, the segment data would show the traffic for the A-B and B-C airport pairs, while the market data would register the traffic on the A-C airport pair. Note that the data is collected based on airlines' flight numbering system and a one-stop flight that changes its number at the intermediate stop will show up for two separate market pairings.

To the extent that foreign-to-foreign cargo flows are of interest, some countries maintain similar trade statistics (although few with air-specific data) and there are also air-specific traffic statistics (e.g., IATA and Seabury).

c. Domestic Cargo Flow Sources

The data available for U.S. domestic traffic is extremely limited, particularly in regard to commodity detail and include:

- Commodity Flow Survey (CFS) data – provides some highly aggregated data, commodity and other details that are mostly obscured for air traffic by confidentiality restrictions; distinguishing domestic vs. international is also a problem.

- Transearch/Freight Analysis Framework (FAF) – Weight and value by origin/destination region and commodity group is available for Air and truck mode. FAF is derived from the CFS, provides international flow statistics and includes long-term forecasts.

d. Other Sources

Other sources include:

Commercial Airline Fleet Databases

Detailed world fleet databases (e.g., ACAS or BACK) provide statistics on individual aircraft's historical patterns of ownership and use. This data source can be used to identify and describe the current fleets of cargo carriers by aircraft type/capacity, and then track the historical use of those aircraft in terms of annual block hours.

U.S. Carrier Form 41/T-100 U.S. DOT Financial Statistics

U.S. carriers file operating and financial statistics with the U.S. DOT identified by aircraft type and domestic/international use. These statistics can be used to profile aircraft operating costs and profitability at the aggregate market level (U.S. domestic and general world region).

Cargo Forecasts

A review of benchmark industry trends, regional market data, and shipping patterns will increase the reliability of a cargo forecast. Several forecasts including the FAA Terminal Area Forecast, FAA Aerospace Forecast, Boeing Current Market Outlook and the Airbus Global Market Forecast are reasonable forecasts that can be used as benchmark data and are discussed below.

FAA Terminal Area Forecast

The FAA publishes its own forecasts annually for each U.S. airport. The Terminal Area Forecast (TAF) system is the official forecast of aviation activity at FAA facilities. These forecasts are prepared to meet the budget and planning needs of FAA and provide information for use by state and local authorities, the aviation industry, and the public. The TAF includes enplanement and aircraft operations forecasts for: FAA towered airports, federally contracted towered airports, and nonfederal towered and non-towered airports. Detailed forecasts are prepared for the major users of the National Aviation System including: large air carriers, air taxi/commuters, general aviation, and military. The TAF includes forecasts for active airports in the National Plan of Integrated Airport System (NPIAS).

FAA Aerospace Forecast

The FAA Aerospace Forecast can be used as a tool to look at the FAA's overall expected outlook of the air cargo industry and the FAA's projected domestic and international growth in terms of revenue ton miles on a system-wide basis.

International Market Forecasts (Boeing/Airbus/Other)

At a macro level, institutional forecasts such as those made by Boeing and Airbus are helpful in considering international volume growth, but should only be applied as a means of comparison to airport-specific forecasts, rather than used as a rote source for growth rates. The Boeing Current Market Outlook and the Airbus Global Market Forecast can also be consulted for their assumptions and freighter fleet growth projections. The use of these consensus forecast cargo growth rates and an outlook of future aircraft orders can be used as a metric to better understand the potential growth and prospect of cargo operations in the future. These forecasts include an inherent bias for future aircraft demand.

Regional/National Economic Forecasts

Historically, air cargo activity tracks with gross domestic product (GDP). An example of a dependable national economic forecast would be the Congressional Budget Office's Budget and Economic Outlook.

Cargo Carriers, Brokers, Freight Forwarders

Depending on the scope of the forecast and the nature of the activity at the subject airport, the best source for both historical data and an idea of future plans will be the companies handling and transporting the cargo. Carriers, their business partners and all the supporting entities in the air cargo community can provide meaningful input to ensure that the forecast is anchored in reality and adds clarity to the planning requirements.

5. FORECASTING TECHNIQUES AND MODELS

Forecasting methods range from applying simple growth rates to market-specific detailed modeling. This chapter demonstrates appropriate techniques for users.

a. Collecting and Understanding the Data

Forecasting aviation demand is not an exact science where the same approach can be applied at all airports. Each airport presents its own unique set of variables that need to be considered.

In order to project aviation demand, many factors need to be analyzed including current aviation industry and cargo trends (particularly those appropriate to the airport), catchment area socio-economic data, historical air service and cargo traffic trends, benchmark data, and competing air services at alternate airports.

i. Current Aviation Industry and Cargo Trends

A review of industry trends, regional market data, and shipping patterns will supplement the forecast. As the airline industry undergoes major changes, the basic ingredients of an airport's successful air cargo operation have remained essentially intact. However, as airports mature, regional growth and evolving dynamics in goods movement may negatively impact the region's ability to meet the needs of the air cargo industry, and eventually force operations to shift to alternate facilities or modes. The challenges create opportunities to be explored regarding more efficient utilization of existing airport assets, as well as the development of new facilities and infrastructure, and enable airports to review financing options.

ii. Catchment Area Socio-economic Data

Catchment area is the area and population from which a facility or region attracts business. The catchment area is determined by the level and type of air services offered at an airport relative to competing airports. It is also influenced by connecting road networks.

The intrinsic links between the level of aviation activity and economic growth in the catchment area are well documented. Simply put, growth in population, income, employment, and business activity in the catchment area typically lead to increased demand for cargo traffic. For example, an increase in population drives an increase in the consumption of products, many of which are transported by air. As a result, an increase in population can lead to an increase in air cargo demand. The same holds true for personal income and employment. Economic output (gross domestic or regional product) has been found to have a high degree of correlation to air cargo traffic. This is because as economic output grows, the amount of raw materials and finished goods that must be transported also increases.

iii. Historical Air Service and Cargo Traffic Trends

Historical data factors show how an airport's traffic has evolved and will serve as the starting point for the development of comprehensive forecasts. A review of recent trends also identifies those factors, which have, or in the future might, influence future traffic volumes. It is suggested that at least the same number of years of historical data be used as the time horizon of the forecast. Evaluating a longer historical time frame can make it easier to distinguish true trends from short-term aberrations, and thus enhances the accuracy of the projected relationships between independent and dependent variables. The historical analysis of aviation activity is one of the key factors in developing assumptions underlying the forecast. However, the forecast assumptions should also be based on broader industry trends, economic analysis, and review of peer forecasts such as those published by the FAA, Boeing, and Airbus.

iv. Benchmark Data

Benchmark data and growth trends for a similar airport(s) can provide a guide for what level of growth an airport can expect in the future. It is important to benchmark to airports with a similar role (cargo hub vs. non-hub vs. international gateway, domestic vs. international cargo, freighter vs. belly cargo) and/or geographical location (West Coast vs. Midwest vs. East Coast). A review of historical growth trends, markets served, and aircraft size at benchmark airports can be useful in identifying factors that will influence future growth in cargo volumes.

Benchmarking can be particularly useful when an airport's role in the cargo market is changing. For example, when an airport loses its hub cargo carrier it can be useful to look at other airports without cargo hubs to see what type of growth trends can be expected. Conversely, if a forecast is considering the establishment of a cargo hub at an airport, the evaluation of historical cargo volumes after the creation of a cargo hub at a benchmark airport can provide invaluable data on potential future cargo demand.

v. Competing Air Services

In order to forecast air cargo demand at an airport, it is first important to identify other competing airports that exist within the region and determine an airport's historical market share of air cargo. It is necessary to understand the level of cargo currently being transported through nearby airports, the role of these airports, and whether or not the competing airports can accommodate future growth. The proximity of an international gateway or cargo hub to an airport can be an influential force in determining the cargo volumes that can be expected at a particular airport. Capacity constraints at a nearby hub can mean opportunities for an airport with excess capacity.

b. Benchmarking Analysis

Analysis of the data collected is the next step of the forecasting process. The data collection results should be analyzed to determine whether there are any gaps between the airport's records and those that have been gathered for benchmarking purposes. From this information, strategic planning can be employed to make improvements to the airport's data reporting processes.

If the performance of the selected benchmarks is superior, it is important to understand the reasons why in order to determine whether there are problem areas, whether the benchmarks used were not the best comparisons, and to provide input into subsequent modification and improvement.

This analysis can be conducted within various time frames, depending on whether an airport is looking for short-term or long-term trends. For example, an airport would normally select a short-term time frame if it was considering a new route, and a long-term time frame if considering facility development.

c. Common Forecasting Techniques

There are many forecasting techniques ranging from applying simple growth rates to market specific detailed modeling. The most appropriate forecasting methodology is typically determined based on the available data. The most common techniques include a simple growth rate model, time series, and an econometric approach. These models can be specified at the individual airport level, at a multi-airport level, or at a regional/national level. The models can also be combined with a market share forecast.

Each of these techniques has its own set of advantages and drawbacks, and they may be used independently or in combination. No one approach is always the best. The following sections demonstrate appropriate forecasting techniques for various uses.

i. Simple Growth Rate Model

The simple growth rate model does not rely on an analysis of historical data. It merely applies an externally produced growth rate to a single cargo statistic such as tonnage transported. The growth rate used could come from sources such as the FAA Aerospace Forecast or the Boeing/Airbus annual forecast. The simple growth rate model assumes that the broader base of the external forecast growth rate will apply to the subject airport.

ii. Time Series

Time series analysis projects historical trends into the future using time as the primary independent variable. As time series forecasts are one-variable models, they require only the data for the variable to be forecast.

Frequently while forecasting, the forecaster has observations on only a single data series and has to develop forecasts without being able to include other explanatory variables. In such a case only the past values of this single variable are available for modeling and forecasting.

In general, time series data can be described by trends, seasonal effects and cyclical effects. The first step in putting together a time series forecast is to analyze a time series of historical data for the specific airport or market in order to determine the growth trend. The easiest procedure for isolating the trend in a time series is to plot the historical data in graphic form on an x and y axis. The traffic data is plotted on the vertical (y) axis. Time, the independent variable, is plotted on the horizontal (x) axis. It is then possible to draw a curve or trend line which minimizes the total distance of the plotted points. In simple forecasts, it is possible to extend this line into the future to estimate future traffic. Growth rates, positive or negative, can be calculated from the slope of the line. Generally, expressing growth in terms of CAGR (compound average growth rate) is recommended. Growth rates can then be applied to the base year (or last year in the time series in order to project traffic into the future). Many popular computer software programs, such as Microsoft Excel, automate the process of developing the historical trendline.

The primary drawback to this technique is that it fails to take into account how the economic, demographic, and industry factors that existed during the historical period are likely to be different in the future.

The time series technique is useful for the following situations:

- When detailed data is not available
- When the financial and technical resources required for a more rigorous forecast are not available
- When the anticipated growth is expected to be relatively stable
- When the operating and economic environment is expected to be relatively stable.
- For short term forecasts (less than 5 years)

iii. Econometric

Econometric analysis is a form of multivariate analysis utilizing the relationship between the dependent variable (i.e., cargo traffic) and a set of independent economic, demographic, and operational variables (i.e., price, personal income).

Economic forecasting is used to show how predicted changes in the independent variables would affect future cargo traffic. The following steps are used when developing an econometric forecast:

1. Specify independent variables for testing
2. Data collection
3. Select a statistical model
4. Determine the model's ability to accurately predict historical values.
5. Use model to derive forecast traffic values
6. Evaluate results in context of historical traffic patterns
7. Compare with benchmarks (i.e., FAA Aerospace Forecast and TAF)

Specify Independent Variables

Prior to selecting a model, a forecaster must determine what independent variables should be considered in the forecast. Proper independent variables can be selected by determining which factors are likely to have the greatest effect on traffic growth. Typically, these variables include:

- Population
- Economic output (gross domestic or regional product)
- Personal income (total or per capita)
- Employment
- Similar statistics for destination markets

Data Collection

Once the forecaster specifies the independent variables, credible data (historical and forecast) for each of the variables must be collected, including the dependent variable cargo traffic. The data should be collected as a time series. Historical cargo traffic can typically be provided by the airport. Economic data sets, including forecasts, can be obtained from a number of sources such as the Bureau of Labor Statistics, U.S. Census Bureau, the National Bureau of Economic Research, or independent institutions such as Woods & Poole Economics.

Select a Statistical Model

Once data for each of the independent and dependent variables is collected, the forecaster must determine which model best describes the relationship between the dependent and independent variables. Typically, one of the following models are used:

$$Linear: \; Y = \beta_0 + \beta_1 x_1 + \beta_2 x_2$$
$$Multiplicative: \; \log(Y) = \log(\beta_0) + \beta_1 \log(x_1) + \beta_2 \log(x_2)$$
$$Linear - Log: \; Y = \log(\beta_0) + \beta_1 \log(x_1) + \beta_2 \log(x_2)$$

For each model, there is a single set of constant coefficients (β) which provides a best fit of the equation to the data.

Determine Model's Ability to Accurately Predict Historical Values

Once the forecaster determines the model to be used, the forecaster should apply the data to the specified model. It is then possible to determine whether the model is accurately assessing each of the variable's relationship to cargo traffic. This is done by entering the independent variables into the model and determining if the resultant is in close proximity to the historical dependent values. Should the resultants not reflect the historical values, the forecaster should choose a different model. If no model results in accurate historical results, one or more of the independent variables should be removed from the model.

Use Model to Derive Forecast Traffic Values

By entering the predicted values for the independent variables in the model, the forecaster will derive the forecasted cargo traffic.

Evaluate Results in Context of Historical Traffic Patterns

Once the results are developed, they should be compared to historical traffic patterns to ensure reasonability. For example, if there is a close relationship with the independent variables, the future independent variables should have the same type of pattern.

Compare with Benchmark Forecasts

As a final step to ensure reasonability, benchmark forecasts can be used as a comparison to confirm the projected growth is realistic.

iv. Market Share Forecasts

Market share forecasts project airport activity as a percentage of a larger, more readily available aggregate forecast (i.e., state, regional or national level forecast).

This approach involves a review of recent forecast results in terms of annual growth rates and determining which can best be applied over the forecast horizon. A market share forecast is prepared when compiling growth rates and the outlooks of national forecasts, such as the FAA Aerospace Forecast, the Boeing Current Market Outlook, and the Airbus Global Market Forecast. This type of forecast is developed by applying these collected consensus growth rates used in these forecasts to historical data.

Stakeholder input is then taken into account for consideration of factors that might not be present in prior forecasts, such as changes in market behavior due to the economy. Special consideration must be given to the state of the industry during the forecast, as well as additional due diligence to fully understand the airport's current and potential future role in order to fine-tune each airport forecast.

6. EXAMPLE FORECAST

This section presents an example forecast for which a single approach did not yield reasonable results. As a result, a combination approach was applied, using trend analysis, industry forecasts, and an econometric regression approach. This example illustrates the need for professional judgment in the forecasting process.

Airport Cargo Forecast

This air cargo tonnage forecast was conducted using several sources of economic and traffic data such as Boeing World Air Cargo Forecast 2008-2009, Airbus Global Market Forecast 2009-2028, the Federal Aviation Administration (FAA) Aerospace Forecasts 2010-2030, the International Monetary Fund (IMF), and Moody's Economy.com.

A linear regression against the Real Gross Domestic Product (GDP) was used as a basis for the air cargo tonnage forecast at the Airport. Although this methodology provided reasonable results in the long term, near-term trends appeared to be underestimated and more reflective of a mature market. As a result, a two-step process was used to develop the cargo tonnage forecast:

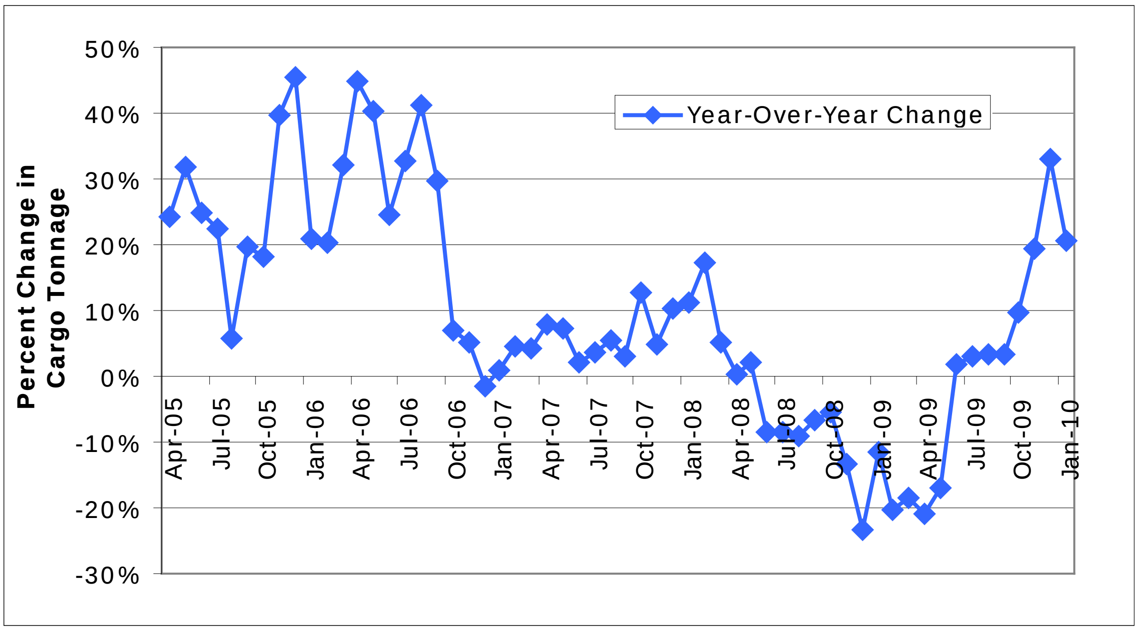
- A near-term approach considered recent trends in air cargo tonnage at the Airport which provided the opportunity to incorporate a more appropriate year-to-year estimate of the impact of the current economic crisis and subsequent recovery on cargo traffic levels.

- Air cargo tonnage was correlated to the Real GDP from 1998 through 2010. This statistical relationship was used as a long-term approach (2010-2030). The long-term approach also focuses on the major forecast trends for the air cargo industry provided by Boeing and Airbus.

Near-Term Forecast

According to tonnage records provided by the airport, Airport cargo volumes were down 10.3 percent in 2009. The months of December 2008 through May 2009 saw air cargo volumes at the airport drop 13 to 23 percent compared to the same months a year before. After a period of somewhat stable cargo tonnage levels (June 2009 through September 2009), air cargo volumes at the airport increased sharply, showing growth of 19 to 33 percent in November 2009 through January 2010 compared to the same months a year earlier.

MONTHLY AIR CARGO TRENDS



Sources: Airport records; Consultant analysis

Year-over-year growth in air cargo tonnage at the airport from 1998 through 2010 was compared to the growth in Real GDP over the same time period. From 1999 through 2010, air cargo tonnage at the airport grew 2.0 times faster than GDP. Cargo tonnage growth at the airport was affected by the current economic crisis as reflected in years 2009 and 2010. If the past two years were excluded, air cargo volumes at the airport would appear to have grown 2.5 times stronger than GDP.

GDP multipliers at the airport were also compared to benchmark airports. Air cargo data for two similar airports were analyzed from 2000 through 2008 and compared to growth in Real GDP over the same time period. The average GDP multiplier over the past nine years was estimated at 2.1 for cargo tonnage at both benchmark airports.

Based on these analyses, it was assumed that a multiplier of about 2.1 would be appropriate in 2011 as air cargo volumes at the airport would continue to recover from the recent economic downturn. The GDP multiplier is expected to decrease through the recovery period to about 1.6 by 2015.

Long-Term Forecast

A statistical regression analysis was conducted between cargo tonnage back to 1998 and Real GDP. Overall, this forecast expects Real GDP to grow 7.1 percent per annum from 2010 through 2030. The air cargo tonnage forecast derived from the regression analysis shows an average growth of 8.4 percent per annum through 2030, resulting in a long-term GDP multiplier of about 1.2.

Therefore, as the airport's cargo market becomes more mature, it was assumed that the GDP multiplier would continue to decrease from 1.6 in 2015 to 1.1 by 2018. It is expected that the multiplier would slightly decrease to 1.0 by 2026 and remain constant through the remainder of the forecast period.

Air Cargo Tonnage Forecast Summary

As a result of the forecasting process, air cargo volumes were expected to grow 9.1 percent annually from 170,900 tons in 2010 to 975,700 tons in 2030.

AIR CARGO TONNAGE FORECAST

YEAR	AIR CARGO TONNAGE	ANNUAL % CHANGE	REAL GDP	ANNUAL % CHANGE	GDP MULTIPLIER
Actual					
1998	44,549		17,188		
1999	43,745	-1.8%	18,223	6.0%	-0.3
2000	52,152	19.2%	19,520	7.1%	2.7
2001	58,026	11.3%	20,307	4.0%	2.8
2002	68,481	18.0%	21,367	5.2%	3.5
2003	87,143	27.3%	22,171	3.8%	7.2
2004	94,203	8.1%	24,027	8.4%	1.0
2005	112,374	19.3%	26,016	8.3%	2.3
2006	140,922	25.4%	28,420	9.2%	2.8
2007	165,488	17.4%	31,189	9.7%	1.8
2008	177,712	7.4%	34,023	9.1%	0.8
2009	159,386	-10.3%	36,094	6.1%	-1.7
2010	170,900	7.2%	38,412	6.4%	1.1
Forecast					
2015	326,600	12.9%	56,216	8.6%	1.5
2020	528,600	7.7%	84,180	7.0%	1.1
2025	744,000	6.7%	114,985	6.1%	1.1
2030	975,700	5.2%	150,799	5.2%	1.0
CAGR					
1998-2010	11.9%		6.9%		
2010-2020	12.0%		8.2%		
2020-2030	6.3%		6.0%		
2010-2030	9.1%		7.1%		

CAGR = Compound Annual Growth Rate
Sources: Airport records; IMF; Moody's; Consultant analysis.

Air Cargo Tonnage By Segment

Airbus and Boeing forecasts were reviewed in order to segment the air cargo tonnage forecast into domestic and international categories. For purpose of this forecast, it was assumed that the dedicated cargo freighters would continue to drive growth in domestic cargo tonnage at the airport in line with the Boeing growth rate. Therefore, domestic cargo tonnage was expected to grow 10 percent annually through 2030. International air cargo volumes would grow at a slower rate of 8.4 percent per year.

As a result of the increase in express freight volumes at the airport, domestic belly cargo tonnage was expected to account for a decreasing share of total domestic cargo volumes at the airport. Accounting for about 73 percent of total domestic air cargo tonnage in 2010, domestic belly tonnage share was expected to decrease to about 60 percent by 2030. Both domestic and international belly cargo tonnage was assumed to benefit from the robust growth in domestic and international passenger movements forecast. Therefore, international belly tonnage was expected to grow at a stronger pace than international freighter tonnage. International freighter tonnage was, however, assumed to remain at about a third of international cargo tonnage as combination carriers were expected to continue to deploy all-cargo flights in and out of the airport.

AIR CARGO TONNAGE FORECAST BY SEGMENT

	YEAR					CAGR
SEGMENT	**2010**	**2015**	**2020**	**2025**	**2030**	**2010-2030**
Domestic						
Belly	49,636	94,700	151,800	211,800	275,200	8.9%
All-Cargo	18,358	40,500	76,400	123,400	183,400	12.2%
Total	67,994	135,200	228,200	335,200	458,600	10.0%
International						
Belly	69,461	131,000	209,100	289,400	372,300	8.8%
All-Cargo	33,444	60,400	91,300	119,400	144,800	7.6%
Total	102,906	191,400	300,400	408,800	517,100	8.4%
Total						
Belly	119,097	225,700	360,900	501,200	647,500	8.8%
All-Cargo	51,803	100,900	167,700	242,800	328,200	9.7%

CAGR = Compound Annual Growth Rate
Sources: Airport records; Consultant analysis.

Freighter Movements Forecast

All-cargo tonnage was forecast to grow 9.7 percent per annum from 51,803 metric tons in 2010 to 328,200 tons in 2030. Over this period, all-cargo carriers were expected to increase available capacity and load factors as a response to increasing demand. However, some of the cargo carriers at the airport operate on multi-stop itineraries, stopping at the airport to unload and load only a portion of their overall tonnage. Therefore, it was assumed that the carriers currently operating on multi-stop itineraries would not materially change their operational practices over the forecast period. The forecast projected some increase in tonnage per flight and load factors to account for a portion of the routes that were operated on a non-stop basis.

The following carrier specific assumptions were considered in the development of the cargo movements forecast:

- The six all-cargo carriers would compose the main core of all-cargo traffic at the airport over the forecast period.

- The largest domestic all-cargo carrier at the airport accounted for 39 percent of all-cargo tonnage and 51 percent of all-cargo movements in 2010, using mainly Boeing B757 and B737 aircraft. This carrier was expected to remain the largest domestic all-cargo carrier at the airport over the forecast period. The airline would continue using Boeing B737 but would focus most of its growth on the larger Boeing B757 aircraft.

- A cargo carrier that specializes in express freight with service to its hub currently operated ATR-72 aircraft at the airport (Code C)[4]. Based on current fleet plans, it was assumed that the airline would continue to use primarily Code C aircraft at the airport with the addition of some Code D aircraft such as the Airbus A310. Destination focus was expected to remain on round-trips to its hub.

- A regional carrier recently switched to all-cargo activity using Boeing B737-200 aircraft. The airline was expected to increase its frequency at the airport using Code C aircraft composed of Boeing B737-200 and ATR-42 aircraft.

- In addition to these three carriers, new entrants would likely emerge in the domestic market focusing on express freight services in line with Airbus and Boeing forecasts. The new domestic all-cargo carriers were assumed to focus on point-to-point service using small Code C aircraft such as the ATRs.

- Current international all-cargo carriers operated mainly non-stop service using Code E aircraft. It was assumed that these airlines would continue to deploy Code E aircraft between their hubs and the airport over the forecast period. Asia and Europe would remain the main trade partners at the airport; however, cargo flows to and from Middle East were expected to grow faster than these two regions. Code F aircraft such as Boeing B747-800 were assumed to be deployed starting around 2020. Code E aircraft such as the Airbus A330 would progressively replace aging Airbus A300s and A310s.

As a result of these assumptions, all-cargo movements were expected to increase from 3,621 movements in 2010 to 19,960 movements in 2030, averaging growth of 8.9 percent per annum. Tonnage per movement was forecast to grow from 14.3 in 2010 to 16.4 by 2030. International all-cargo movements would grow at a slower rate than domestic all-cargo traffic due to the use of larger aircraft over the forecast period.

[4] ICAO Aerodrome reference code is defined in ICAO Aerodrome Design and Operations Manual –page 17: http://legacy.icao.int/fsix/_Library/Manual%20Aerodrome%20Stds.pdf

FREIGHTER MOVEMENTS FORECAST BY SEGMENT

SEGMENT	YEAR 2010	2015	2020	2025	2030	CAGR 2010-2030
Domestic						
Tonnage	18,358	40,500	76,400	123,400	183,400	12.2%
Movements	2,615	5,060	8,490	12,340	16,670	9.7%
Tonnage per Movement	7.0	8.0	9.0	10.0	11.0	
International						
Tonnage	33,444	60,400	91,300	119,400	144,800	7.6%
Movements	1,006	1,590	2,280	2,840	3,290	6.1%
Tonnage per Movement	33.2	38.0	40.0	42.0	44.0	
Total						
Tonnage	51,803	100,900	167,700	242,800	328,200	9.7%
Movements	3,621	6,650	10,770	15,180	19,960	8.9%

CAGR = Compound Annual Growth Rate
Sources: Airport records; Consultant analysis.

Code C and Code D aircraft would constitute most of the growth in domestic all-cargo traffic at the airport. Code E aircraft would be introduced in 2020 to account for about 4.0 percent of domestic all-cargo movements by 2030. On the international side, Code E aircraft would account for an increasing share of international all-cargo movements from 81.5 percent in 2010 to 86 percent in 2030, progressively replacing Code D aircraft. To respond to increasing cargo tonnage levels, Code F aircraft would be deployed starting in 2020 and would account for about 10 percent of international all-cargo movements by 2030.

FREIGHTER FLEET MIX FORECAST

AIRCRAFT CODE	YEAR 2010	2015	2020	2025	2030	CAGR 2010-2030
Domestic						
Code C	1,009	2,330	3,740	5,180	6,340	9.6%
Code D	1,606	2,730	4,640	6,910	9,660	9.4%
Code E	-	-	110	250	670	n.a.
Total	2,615	5,060	8,490	12,340	16,670	9.7%
International						
Code D	186	320	320	320	320	2.8%
Code E	820	1,270	1,910	2,370	2,640	6.0%
Code F	-	-	50	150	330	n.a.
Total	1,006	1,590	2,280	2,840	3,290	6.1%
Total	3,621	6,650	10,770	15,180	19,960	8.9%

CAGR = Compound Annual Growth Rate
Sources: Airport records; Consultant analysis.

7. CONCLUSION

Cargo forecasts are important in understanding an airport's demand growth, assessing market risk, and predicting financial gains/losses to develop management strategy. Often, forecasting is mandated in master plans to secure funding for future capital improvement projects, particularly under federal grants and bond issuances. Airports that accurately forecast their future traffic will better anticipate the needs of their customers, and thus will be in a better position to develop to their full potential.

Forecasting cargo demand is not an exact science where the same approach can be applied at all airports. Each airport presents its own unique set of variables that need to be considered. A variety of forecasting approaches were presented in this guide. Each of these techniques has its own set of advantages and drawbacks, and they may be used independently or in combination. No one approach is always the best. The application of professional judgment is critical.

Because forecasting cargo demand is an inherently uncertain activity, the use of PALs and continuous monitoring of actual cargo activity can be critical. The use of PALs reflects that the timing of any necessary improvements will not be driven by a set point in time but rather by the timing and arrival of future demand levels. The actual realization of predicted activity levels will likely differ from the forecast in terms of what year that activity occurs. The PALs represent activity based milestones that can be used to make future expansion and development decisions, focusing on specific volumes of activity that trigger the expansion requirement, rather than the timing identified in the forecast.

Reliable forecasts provide critical input to airport management and planning. Although forecasting is a challenging task, the application of the principles in this guide can allow for the production of more dependable and useful cargo forecasts. It is important, however, to remember that forecasting is a tool, and that it remains the responsibility of management to review the end products with a critical eye and check against the airport's core strategies and beliefs.