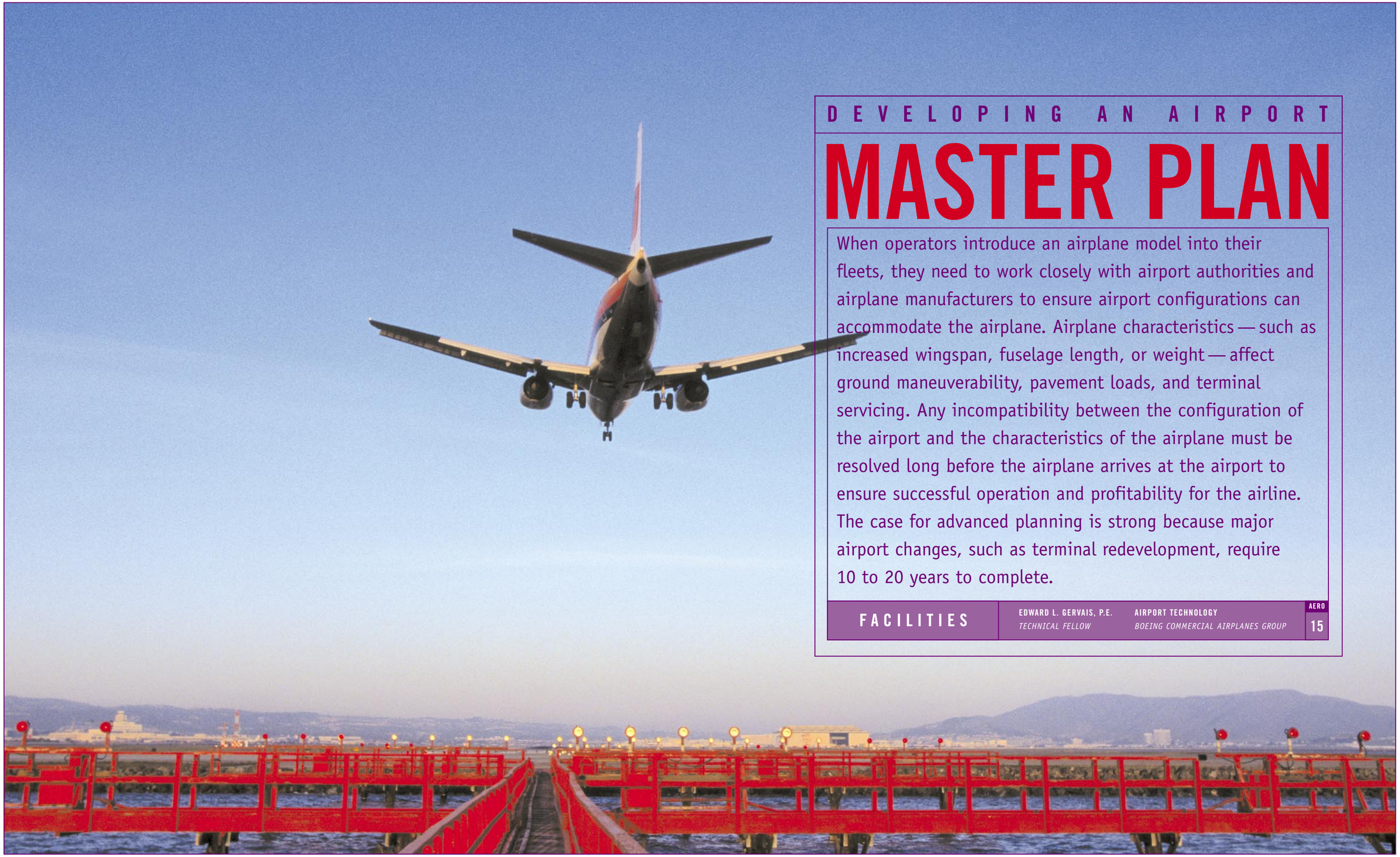

DEVELOPING AN AIRPORT

MASTER PLAN

When operators introduce an airplane model into their fleets, they need to work closely with airport authorities and airplane manufacturers to ensure airport configurations can accommodate the airplane. Airplane characteristics — such as increased wingspan, fuselage length, or weight — affect ground maneuverability, pavement loads, and terminal servicing. Any incompatibility between the configuration of the airport and the characteristics of the airplane must be resolved long before the airplane arrives at the airport to ensure successful operation and profitability for the airline. The case for advanced planning is strong because major airport changes, such as terminal redevelopment, require 10 to 20 years to complete.

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An airport master plan combines aviation growth projections with future airplane capabilities to create a detailed plan and schedule for a given airport. It defines both the immediate and long-term needs of an airport facility in logical growth increments that include airport configuration, uses, and costs. An effective plan maximizes the development potential of the facility and allows for the appropriate budgeting and timing for engineering, design, and construction.

In developing an airport master plan, airports, airlines, and airplane manufacturers should consider the following factors to ensure safe and efficient airplane operations:

1. Aviation industry forecasts and growth projections.
2. General airport planning guidelines.
3. Specific airplane requirements.
4. Airport terminal requirements.

1 AVIATION INDUSTRY FORECASTS AND GROWTH PROJECTIONS

Forecasts are available from a variety of sources, with multiple sources being the preference of most major airports. (See table 1 for information on how to obtain copies of the following documents.)

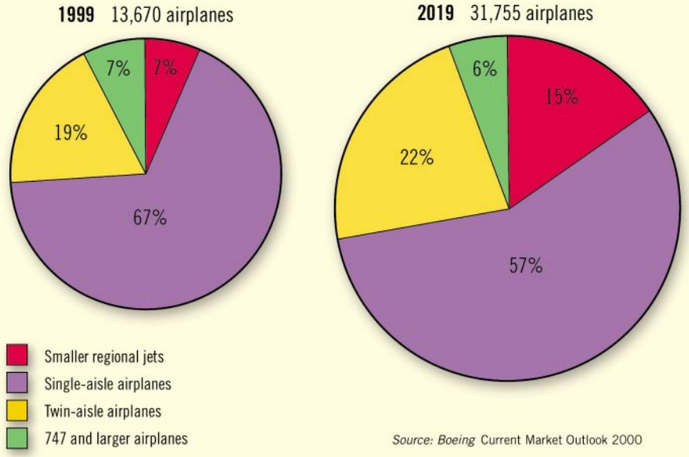
- The International Civil Aviation Organization (ICAO) publishes annual traffic summaries for the entire world. The data can be sorted by state, region, or major markets such as trans-Pacific or trans-Atlantic.
- The International Air Transport Association (IATA) produces traffic summaries and provides its own forecast specialists on a case-by-case or market-by-market basis.
- The International Coordinating Council of the Aerospace Industries Association (ICCAIA) offers the *Conventional Takeoff and Landing (CTOL) Future Trends* document. It outlines commercial airplane attributes that have had an impact on airport planning from the 1950s to the present.
- The Boeing Company annual *Current Market Outlook* forecasts worldwide air travel growth and new-airplane demand (fig. 1). It can be used for almost all forecast functions, including those of minor-market, single-runway airports, for which forecasts of the single-aisle airplane fleet are critical.

These documents are used primarily for passenger, cargo, and movement forecasts. Passenger forecasting involves the number of passengers who will use a given airport. It is measured in the thousands or millions of people who will go through an airport monthly or annually.

Cargo forecasting predicts freighter traffic for a given airport or region. It is measured by the tons of cargo annually transported through an airport.

Movement forecasts involve one or more of the following items: peak-hour operations, the number of airplanes based at an airport, the typical mix of airplanes, gate usage, regional and local economic forecasts and demographic studies, and unique phenomena (e.g., hosting the Olympic Games when millions of passengers are expected during a relatively short period of time).

FIGURE 1 THE WORLD FLEET WILL MORE THAN DOUBLE BY THE YEAR 2019



2 GENERAL AIRPORT PLANNING GUIDELINES

In addition to forecast data, airport planning requires general information on the commercial airplane fleet that is expected to serve a given locale during a reasonable period of time, say the next 10 to 20 years.

Both ICAO and the U.S. Federal Aviation Administration (FAA) have developed guidelines on the physical space required to accommodate all sizes of airplanes, based on wingspan, wheel base, and gear track (the distance between the outer edges of the right and left extremities of the landing gear). These documents give the planner basic guidance on runway and taxiway widths and shoulder requirements, minimum runway-to-taxiway and taxiway-to-taxiway separation distances, and taxiway-to-taxilane separations.

In the United States, the primary source for these planning tasks is FAA Advisory Circular AC 150/5300-13, *Airport Design*. Outside the United States, most airports rely on ICAO *Annex 14 International Standards and Recommended Practices for Aerodromes* and ICAO *Airport Design Manuals (ADM) for Runways* (ADM Part 1), *Taxiways and Parking Aprons* (ADM Part 2), and *Pavements* (ADM Part 3). (See table 1.)

3 SPECIFIC AIRPLANE REQUIREMENTS

Space for parking, gate usage, ground operations, and runways is best measured against the needs of the specific airplanes being accommodated rather than the general FAA or ICAO guidelines mentioned above. It is at this point in the planning process that airplane manufacturers work most closely with airport planners and the airlines.

For example, Boeing produces airport-planning manuals, titled *Airplane Characteristics for Airport Planning*, for all Boeing- and Douglas-designed commercial airplanes (table 1). These manuals describe specific airplane characteristics, such as dimensions, performance, ground maneuvering, terminal servicing, jet-engine wake and noise, and pavement requirements.

In 1968, a standard format for airplane-specific information was developed through the ICCAIA. Called National Aerospace Standard (NAS) 3601, it includes sections on basic airplane field-length requirements, performance, typical interiors, pavement requirements, and jet blast attributes. NAS 3601 documents, such as the Boeing *Airplane Characteristics for Airport Planning* manuals, now are a basic requirement for any transport-category airplane having maximum takeoff weights of 35,000 lb (15,875 kg) or more.

Airlines, airports, and airplane manufacturers together walk a fine line, balancing the desire for increased airplane capacity, range, and operating economy with the need for airport improvements and modifications.

No matter where an airport is in the spectrum of traffic, larger commercial airplanes are on the horizon. The introduction of the 717 and 737 at smaller airports served by regional transports such as F-100s and Avions de Transport Regional could create the need for longer runways and stronger pavements. At the top end, airports served by twin-aisle airplanes such as the 767 and MD-11 may need upgrading to adequately deal with the 747-400 and the 777.

For example, the introduction of the 777-200 in 1995 presented airports with several issues in terms of airplane size and pavement load.

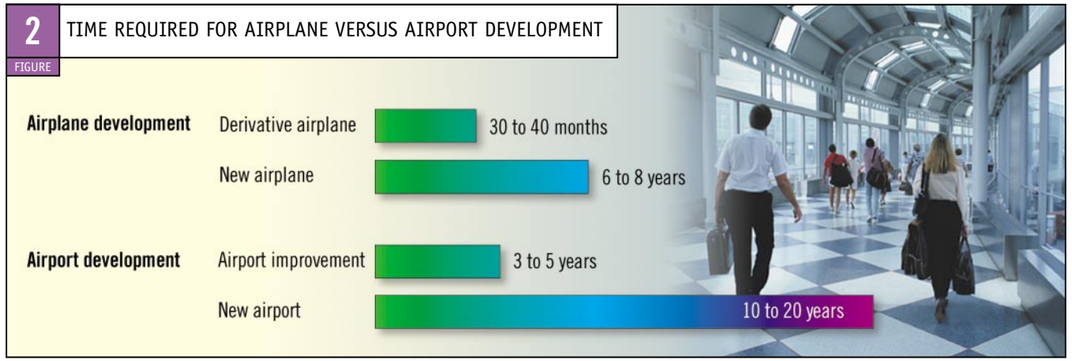
With a wingspan of 200 ft (61 m) and an overall length of 210 ft (64 m), the 777 needed to occupy 747 gates at most airports. In many cases, these gates were available because the 777 flew routes served by the 747. Airports without 747 services made gate adjustments to accommodate the 777 or reconfigured terminals. A few airports used remote parking locations and shuttled passengers to and from check-in areas or departure lounges.

Pavement loading was another issue facing airports served by the 777. Before the inception of the 777 in 1989, there was no universally accepted pavement design for a six-wheeled (triple-tandem) main landing gear configuration (see "Pavement Loading," April–June 1997 *Airliner,* p. 25). In fact, most airports that were in the initial design stages in the early 1990s identified the 747 or the 767, but not the 777, as the critical airplane to govern pavement design.

One explanation for this is that the development and implementation of a typical airport master plan can take 20 years to accomplish if the required changes are major, and 10 to 14 years if the changes are minor. In either case, the lead time required at the airport level far exceeded the time needed to introduce the 777 (fig. 2). It took eight years to design, produce, and deliver the 777.

2 TIME REQUIRED FOR AIRPLANE VERSUS AIRPORT DEVELOPMENT

FIGURE



To deal with this situation, an airport master plan must effectively combine forecast data with future airplane capabilities to create a detailed plan and timeline that indicate how existing facilities should be changed, renovated, or completely rebuilt to accommodate the predicted growth.

4 AIRPORT TERMINAL REQUIREMENTS

An airport master plan also must address the airport structure itself. This includes terminal layouts, passenger and baggage hold areas, baggage handling, and baggage claim. The primary industry source for these requirements is the IATA *Airport Development Reference Manual* (table 1). It details airline needs not only for major hubs but provides guidance to smaller airports that have remote parking stands or relatively few contact gates. The IATA manual discusses passenger queuing at check-in counters, terminal passenger displays, and check-in computers. The FAA also publishes a terminal-requirements manual, Advisory Circular AC 150/5360-13, *Planning and Design Guidelines for Airport Terminal Facilities* (table 1).

1 AIRPORT PLANNING RESOURCES

TABLE

Boeing *Airplane Characteristics for Airport Planning*	www.boeing.com/assocproducts/aircompat/
Boeing *Current Market Outlook*	www.boeing.com/commercial/cmo/index.html
FAA Advisory Circular AC 150/5300-13, *Airport Design,* and Advisory Circular AC 150/5360-13, *Planning and Design Guidelines for Airport Terminal Facilities*	www.faa.gov/arp/150acs.htm
IATA *Airport Development Reference Manual*	www.iata.org/index.asp
ICAO traffic summaries; *Annex 14 International Standards and Recommended Practices for Aerodromes;* and *Airport Design Manuals (ADM) for Runways* (ADM Part 1), *Taxiways and Parking Aprons* (ADM Part 2), and *Pavements* (ADM Part 3)	www.icao.int/cgi/goto.pl?icao/en/sales.htm or ICAO Document Sales 999 University St. Montreal, Quebec, Canada H3C 5H7
ICCAIA *Conventional Takeoff and Landing (CTOL) Future Trends*	Aerospace Industries Association 1250 Eye St. N.W., Suite 1200 Washington, DC 20005 USA

For more information on airport planning, contact Boeing Airport Technology.
Phone: 425-237-0126 ■ Fax: 425-237-0860 ■ E-mail: AirportTechnology@boeing.com
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SUMMARY

With the right resources and data, planners can create a specific, detailed airport master plan that provides an overall view of how to improve or change a given airport to accommodate envisioned growth. Prudent planners look to the airplane manufacturers and local and regional airlines in deciding what the master plan should encompass. When airport planners and their consultants work with airplane manufacturers and the airlines, the resulting master plans are better, more accurate instruments of needed change.