Airport Operations

A concise cheat sheet covering key aspects of airport systems, including airport characteristics, classifications, planning, and airfield design. Ideal for students, aviation professionals, and anyone interested in understanding how airports function and evolve.

Introduction to Airport Systems

Historical Development & Growth Drivers

1970s: Development of large-capacity aircraft, supersonic aircraft, automated people movers, centralized deicing, mobile lounges, and moving sidewalks.

1990s: Rise of international mega-carriers, low-cost carriers, European liberalization, long-range twin-engine aircraft, and satellite revolution.

Asian Air Travel Growth Drivers: Massive population, rising income levels, growing middle class, growth of low-cost carriers, and tourism initiatives.

Busiest Domestic Route: New York to Los Angeles (more than 35,000 flights).

Airport Physical Characteristics

Number of Runways: Ranges from 1 to 9.

Runway Length: Ranges from 500 to 16,000 feet.

Geometric Configuration: Parallel or intersecting runways.

Other Factors: Airfield layout, terminal facilities, historical and local influences, altitude (most below 100ft).

Airport Classifications

Hub Airport: Transfer facility with surges of activity. Example: Dubai (Emirates).

Gateway Airport: First point of arrival or last point of departure for international services. Examples: JFK, Los Angeles, Miami.

Airport Network Models

Hub & Spoke Network

A network structure used by most of the world's largest airlines. Depends on connecting passenger traffic to increase loads and revenues. Examples: Denver, Los Angeles, Dubai.

ADV: Consolidates traffic for low-demand O-D markets, requires fewer flights/aircraft, provides operational/cost advantages.

DISADV: Longer turnaround times, uneven use of airport resources, weather disturbances leading to missed connections.

Point-to-Point Network

Does not use a hub, requires a greater number of different aircraft routes to connect cities, provides fewer city pairs, and arrival/departure is not synchronized.

Network Comparison

Hub & Spoke:

- Consolidates traffic.
- Fewer flights.
- Operational advantages.

Point-to-Point:

- More direct routes.
- Greater aircraft route variety.
- Arrival/departure not synchronized.

Airline and Airport Industry Dynamics

Key Drivers

Long-Term Growth: Demand for expansion and improvements, influenced by long-range aircraft, route deregulation, privatization, open skies agreements, and low fuel prices.

Organizational Changes: Economic and political deregulation, technical changes in aircraft and ATC, and privatization trends.

Airline Alliances

Lead to resource sharing, common lounges, greater bargaining power, frequent flyer programs, better connections, and code sharing. Example: Star Alliance (United, Lufthansa).

Technological Changes

Electronic processing of passengers and bags, internet retail, electronic ticketing, bar-coded boarding passes, common-use kiosks, and mobile boarding passes leading to significant savings.

Low-Cost Carriers (LCC)

LCCs drive the development of low-cost airports and influence the competition between low-cost and traditional main airports.

Airport Planning and Design

Airside vs. Landside

Airside:

- 95-80% of airport area.
- Runways, taxiways, aprons.

Landside:

- 5-20% of airport area.
- Terminals, parking, access roads.

Safety requirements are similar in airside (RW/TW dimensions, navigation equipment, RW/TW markings).

Differences exist in airport landside (planning, design, management).

Cultural Differences in Airport Design

Visible cultural differences include design elements like check-in configurations and apron layouts. Invisible cultural differences are related to planning and governance, such as decision-making processes.

Airport Master Plan

Develops the ultimate version of the airport, includes aviation/non-aviation sectors, guidelines for future development, schedules priorities, land use impact/noise compatibility standards.

Problems: Forecast inaccuracies, competition, airline alliance formation, changes in routes/services.

Airfield Design

Classify airfields based on the most critical aircraft to be served. Factors affecting airfield size: number/orientation of runways, geometric configuration, dimensional standards, land for future growth, nature of traffic.

Airfield Layout and Runway Design

Airport Classification Codes

ICAO Code: Code number (1-4) reflects aircraft operating performance (reference field length). Code letter (A-F) reflects aircraft physical dimensions (wingspan/outer main gear wheel span).

FAA Code: Uses aircraft approach speed (1.3 times stall speed at MLW) to determine the first element (A-E), and wingspan/tail height to determine the second element (I-VI).

Runway Length Factors

Weight of critical aircraft on takeoff/landing, stage length, weather, airport location (elevation/obstacles), runway characteristics (slope, surface condition).

Runway Safety Elements

Stopway: Area beyond the takeoff runway, centered on the runway's extended centerline, supports aircraft for aborted takeoff, not used for taxi/landing.

Clearway: Rectangular area from the start of the runway, clear of obstacles at an upward slope of 1.25 degrees.

Runway Safety Area (RSA): Prepared surface for reducing the risk of aircraft damage in case of undershoot/overshoot.