AIRPORT OPERATION

IV B. Tech VII semester (Autonomous IARE R-16)

BY

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Course Outcomes

COs	Course Outcome
CO1	Understand about the commercial airport operations, functions, planning and facilities needed.
CO2	Describe about the procedure of ground handling of baggage and also to know about handling process, equipment's and technologies used
CO3	Explain about airport operation management, pavement management, resource, fire fighting, safety, hazardous materials handling managements.
CO4	Explore the airport terminal services, Air traffic control system, access system, Tele-communication, Meteorology, Aeronautical information system
CO5	Outline the operational administration and performance related to airport monitoring, equipment's and human resource considerations.

UNIT-I

THE AIRPORT AS AN OPERATIONAL SYSTEM

Course Learning Outcomes

CLOs	Course Learning Outcome
CLO1	Remember about the difference between general aviation and commercial airports.
CLO2	Understand the hub and its types used in airport system.
CLO3	Describe airport planning and master plan.
CLO4	Explain about forecasting, design alternatives and land use for the airport operations.

The Airport as a System

Major components of the air transport

- The airport, including its commercial and operational concessionaires, tenants, and partners, plus, for these discussion purposes, the airways control system.

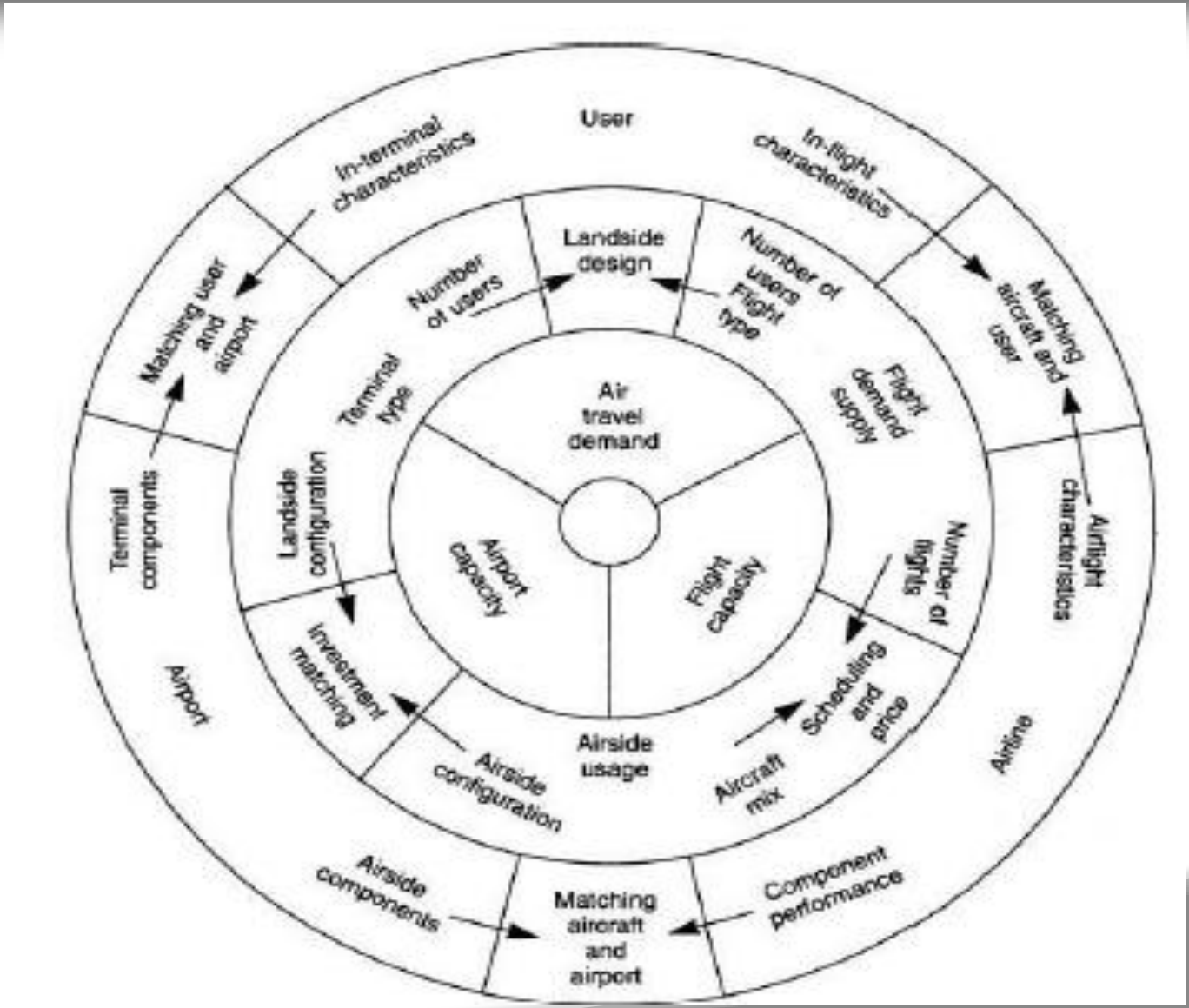
- The airline

- The user

How it can become suboptimal?

- Deficit operations by the airline(s) at the airport
- Unsatisfactory working conditions for airline and airport employees
- Inadequate passenger accommodation (low levels of service [LOS])
- Insufficient flight supply
- Unsafe operations
- High operational costs to users
- Inadequate support facilities for airlines
- High delay levels for airlines and passengers
- Inadequate access facilities
- Sluggish passenger demand

A hierarchy system of airport

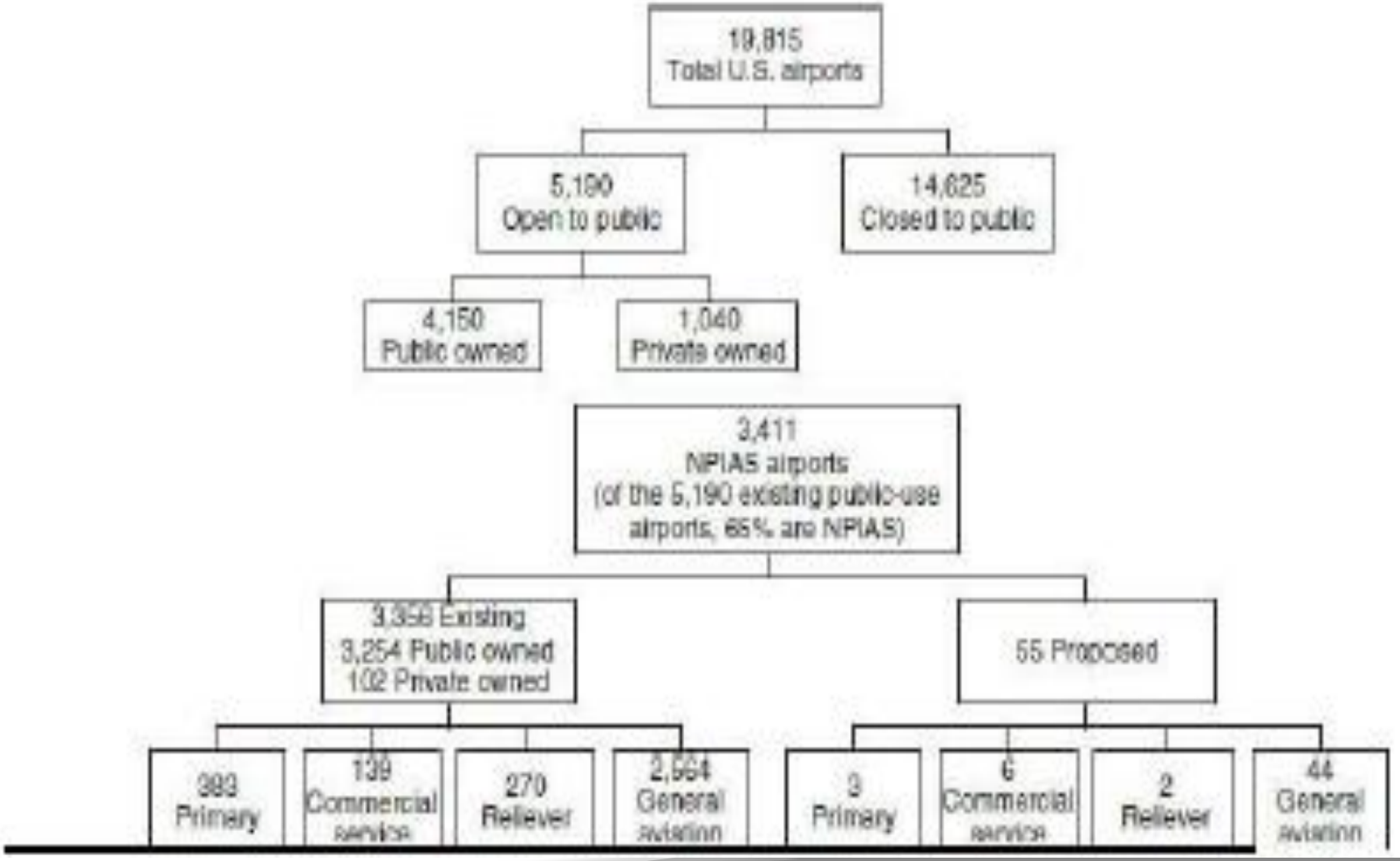


Organizations Affected by a Large Airport

Principal Actor	Associated Organizations
Airport operator	Local authorities and municipalities Central government Concessionaires Suppliers Utilities Police Fire service Ambulance and medical services Air traffic control Meteorology
Airline	Fuel supplies Engineering Catering/duty-free Sanitary services Other airlines and operators
Users	Visitors Meeters and senders
Nonusers	Airport neighbor organizations Local community groups Local chambers of commerce Environmental activist groups Antinoise groups Neighborhood residents

National Airport Systems USA

Classification of National Airport System



Airport Categories

Airport	Hub Type Classification	Percentage of Annual Passenger Boardings	Common Name
Commercial Service Publicly owned airports that have at least 2,500 passenger boardings each calendar year and receive scheduled passenger service	**Primary** Have more than 10,000 passenger boardings each year	**Large** 1% or more	Large hub
		Medium At least 0.25% but less than 1%	Medium hub
		Small At least 0.05% but less than 0.25%	Small hub
		Nonhub More than 10,000 but less than 0.05%*	Nonhub primary
	Nonprimary	**Nonhub** At least 2,500 and no more than 10,000	Nonprimary Commercial service
Nonprimary (except commercial service)			Reliever
			General aviation
Other than passenger classification			Cargo service

The British National Airport System

Gateway International Airports

Airports supplying a wide range and frequency of international services, including intercontinental services and a full range of domestic services.

Regional Airports

Airports catering to the main air traffic demand of individual regions. They are concerned with the provision of a network of short-haul international services (mainly to Scandinavia and other parts of Europe) and a range of charter services and domestic services, including the links with gateway airports.

Local Airports

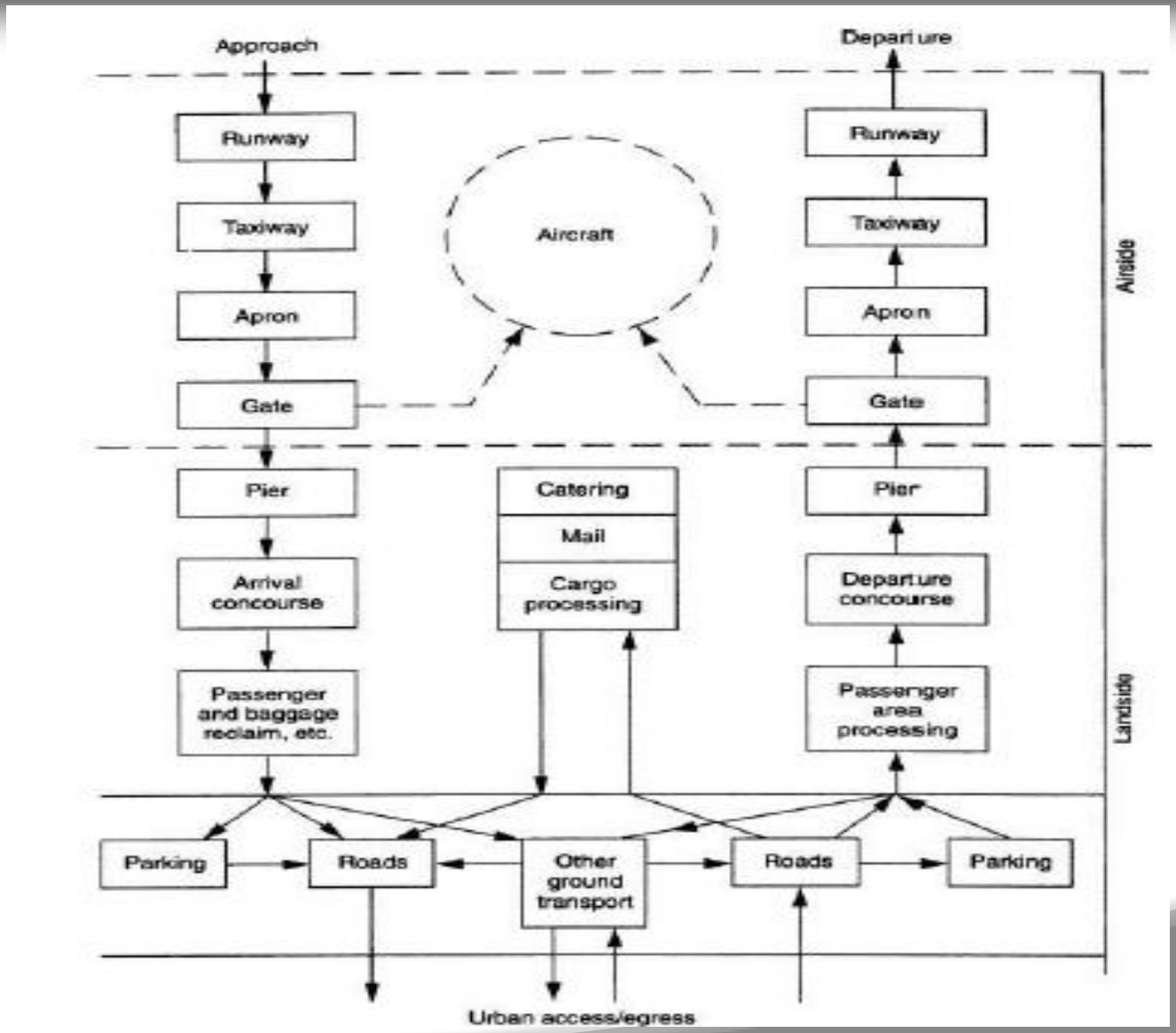
Airports providing third-level services (e.g., scheduled passenger services operated by aircraft with fewer than 25 seats), catering privately for local needs, concentrating on general aviation with some feeder services and some charter flights.

General Aviation Airports

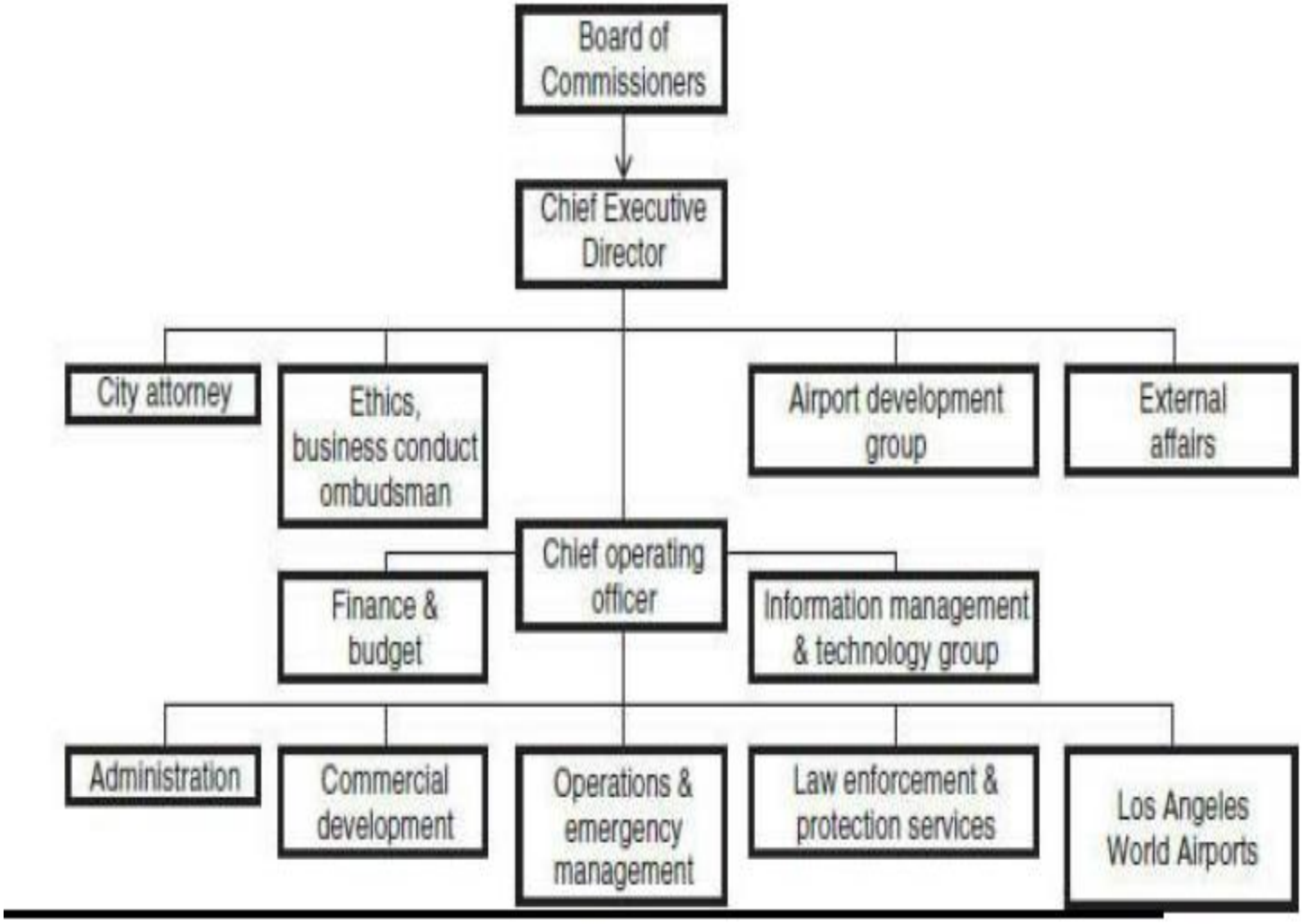
Airports concerned primarily with the provision of general aviation facilities.

Source: CAA

The Function of the Airport

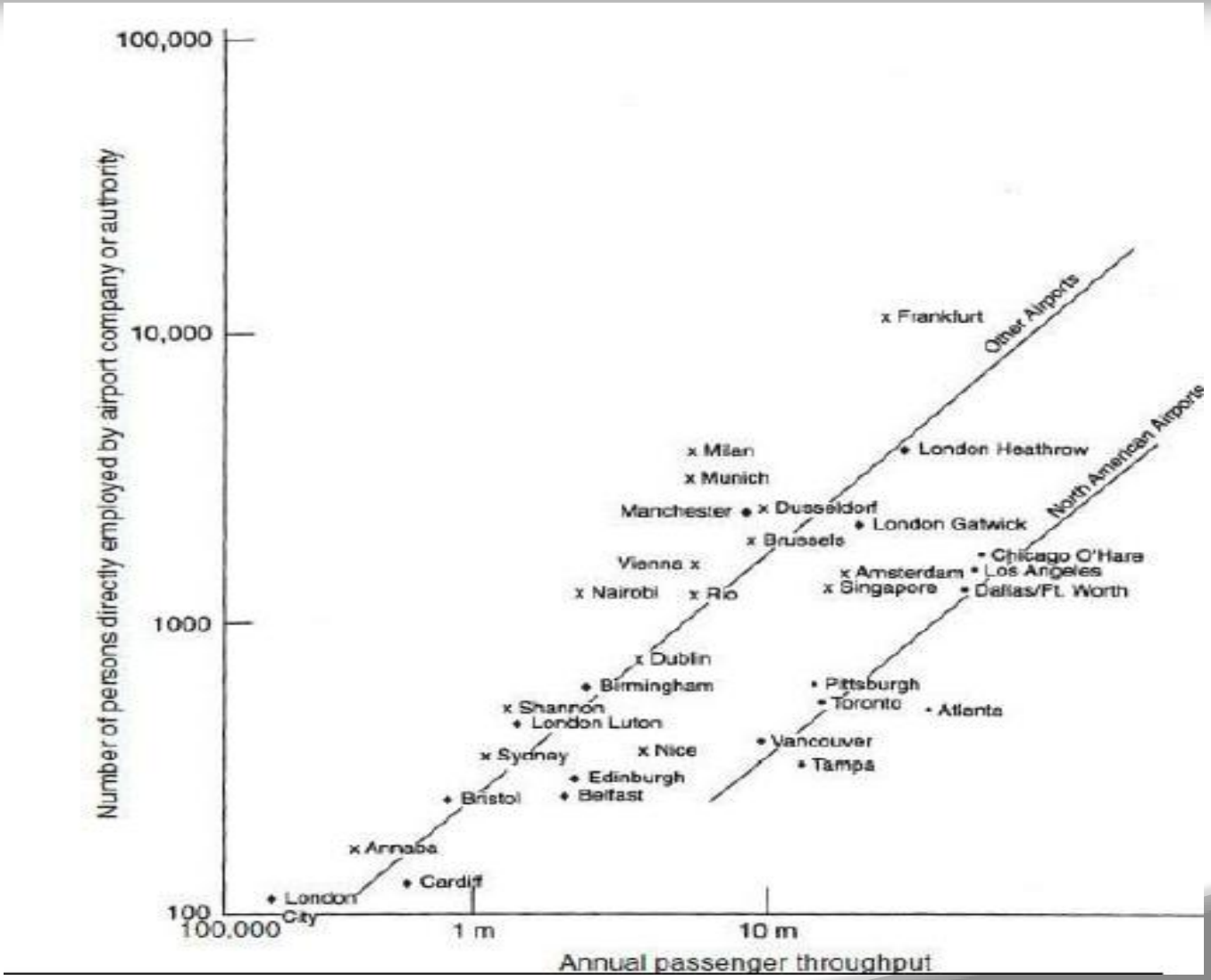


Airport Organizational Structure



Los Angeles World Airports (LAWA), 2011

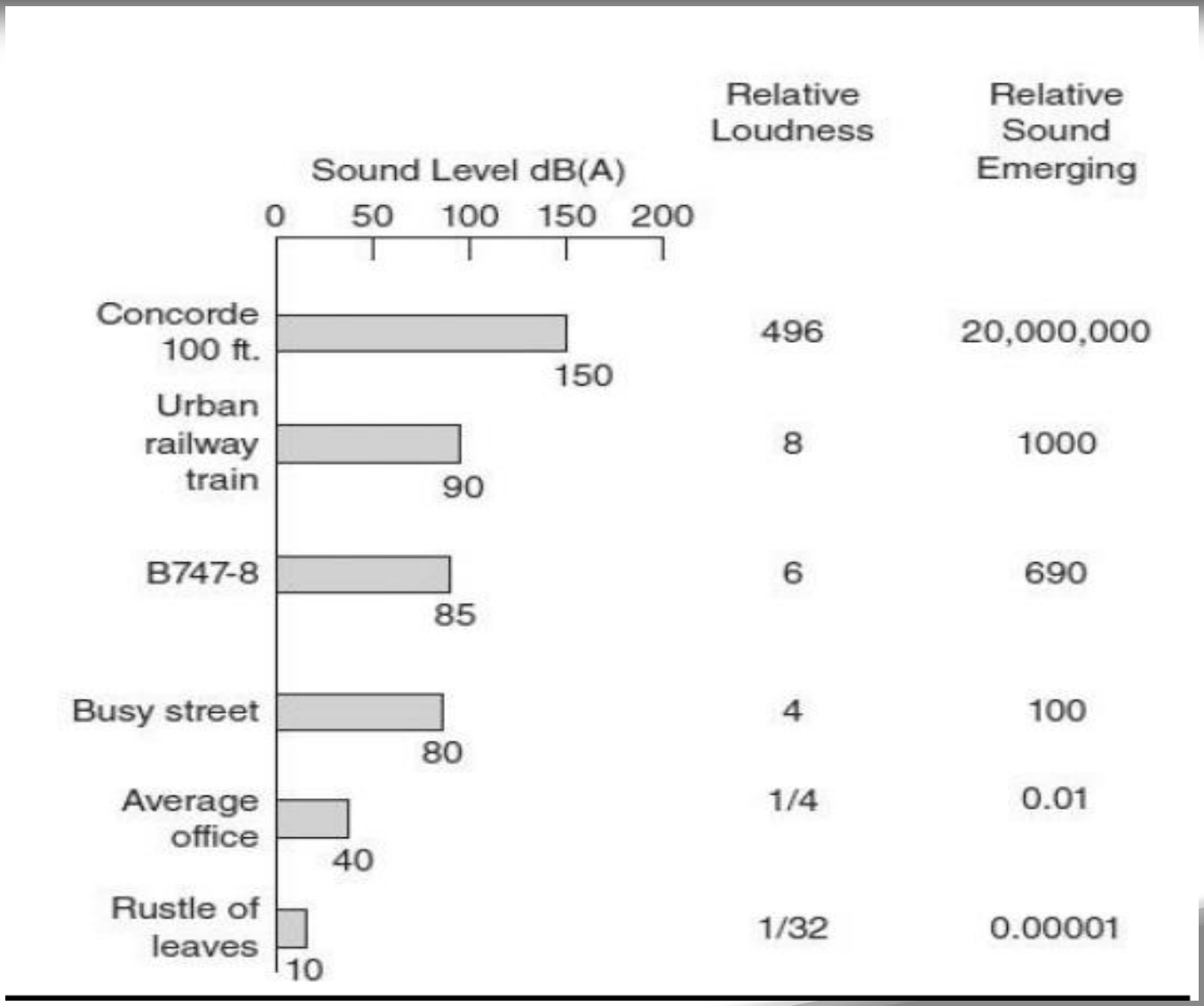
Annual passenger throughput



Airport Noise Control

- Aviation is not the only form of transport that generates noise.
- Automobiles generate it from such sources as the engine, the tires, and the gearbox.
- Railroad trains generate noise aerodynamically and from rail and wheel contact, suspension, and the traction motors.
- Aircraft produce noise from their engines and from the aerodynamic flow of air over the fuselage and wings.
- It is the noise generated by aircraft in and around airports that causes problems.
- **Air mode is the source of the loudest and most disturbing noise**.
- Must have some knowledge of the technical terms used by noise experts.
- The audible spectrum of sound is 20 to 20,000 Hz.
- Maximum sensitivity to sound is perceived around the middle of this range.

Scale of noise and sound.



Aircraft Noise

A simple dB measure is not sufficient to measure the noise related to ears. A new system was introduced. Perceived Noise Level (PNL), a D-weighted summation that is sufficiently complex to warrant computer calculation

Single-Event Measures:

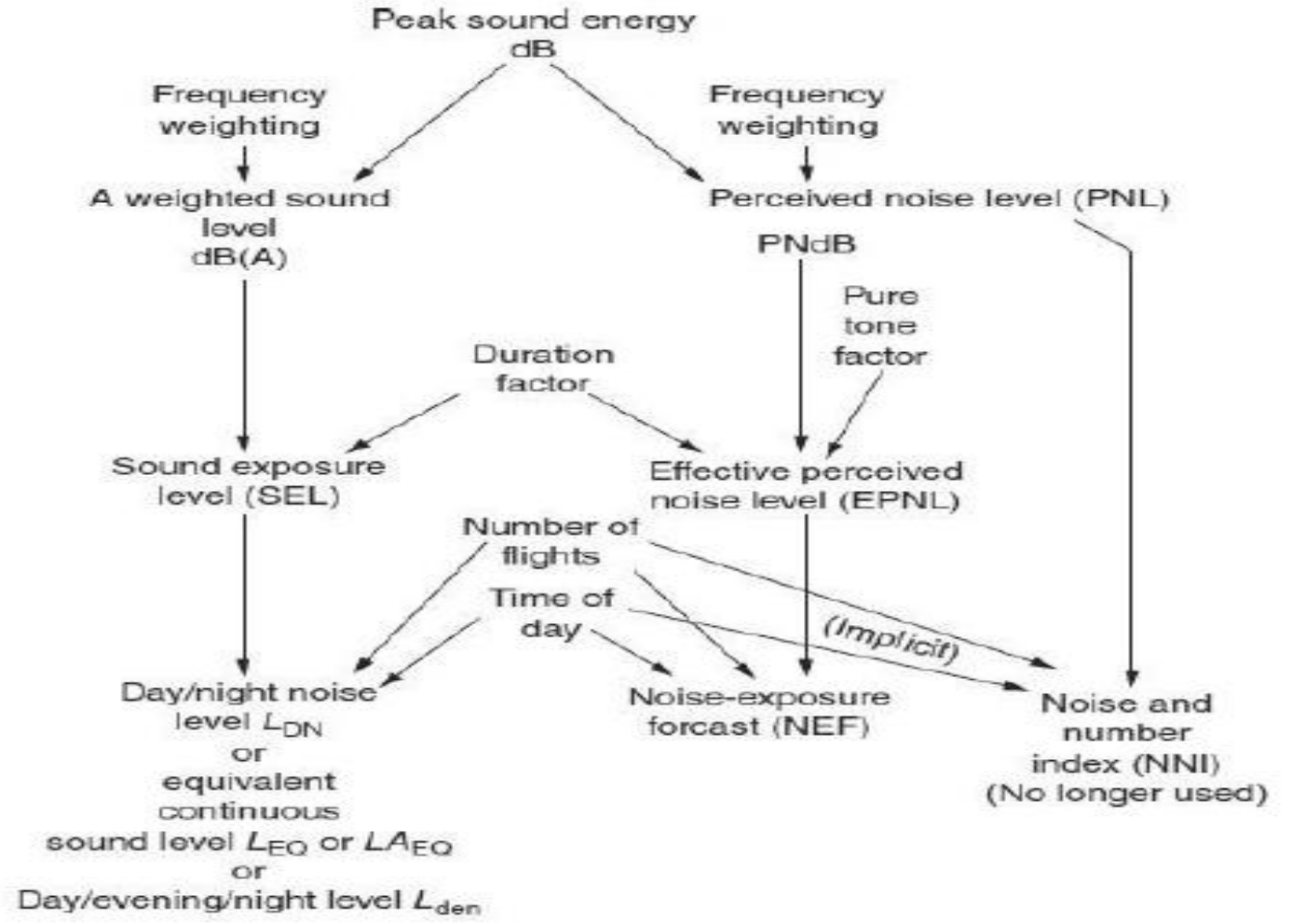
The principal measures of single-event noise used are effective perceived noise level (EPNL or LEPN) and sound exposure level (SEL, sometimes abbreviated to LSE or LAE).

Cumulative-Event Measures

Quantifying such interference requires noise measurements in terms of instantaneous levels, frequency, duration, time of day, and number of repetitions. Many surveys have been carried out to correlate community response to all these factors

Day/Night Average Sound Levels

Relationships among noise measures



Feelings about Noise

Annoyance Category	Feelings About Aircraft Noise
A	*Not annoyed.* Practically unaware of aircraft noise
B	*A little annoyed.* Occasionally disturbed
C	*Moderately annoyed.* Disturbed by vibration; interference with conversation and TV/radio sound, may be awakened at night
D	*Very annoyed.* Considers area poor because of aircarft noise; is sometimes startled and awakened at night
E	*Severly annoyed.* Finds rest and relaxation disturbed and is prevented from going to sleep; considers aircraft noise to be the major disadvantage to the area
F	*Finds noise difficult to tolerate.* Suffers severe disturbance; fells like moving away because of aircraft noise and is likely to complain

Noise-Control Strategies

Quieter Aircraft:

- Low-noise fans with swept stators
- Quieter intake liners, bypass and core stream liners
- Improved nozzle-jet noise suppressors
- Active noise-control fans
- Reduction in airframe noise
- Low-noise inlets
- Low-noise flaps, slats, and gear

Noise-Preferential Runways

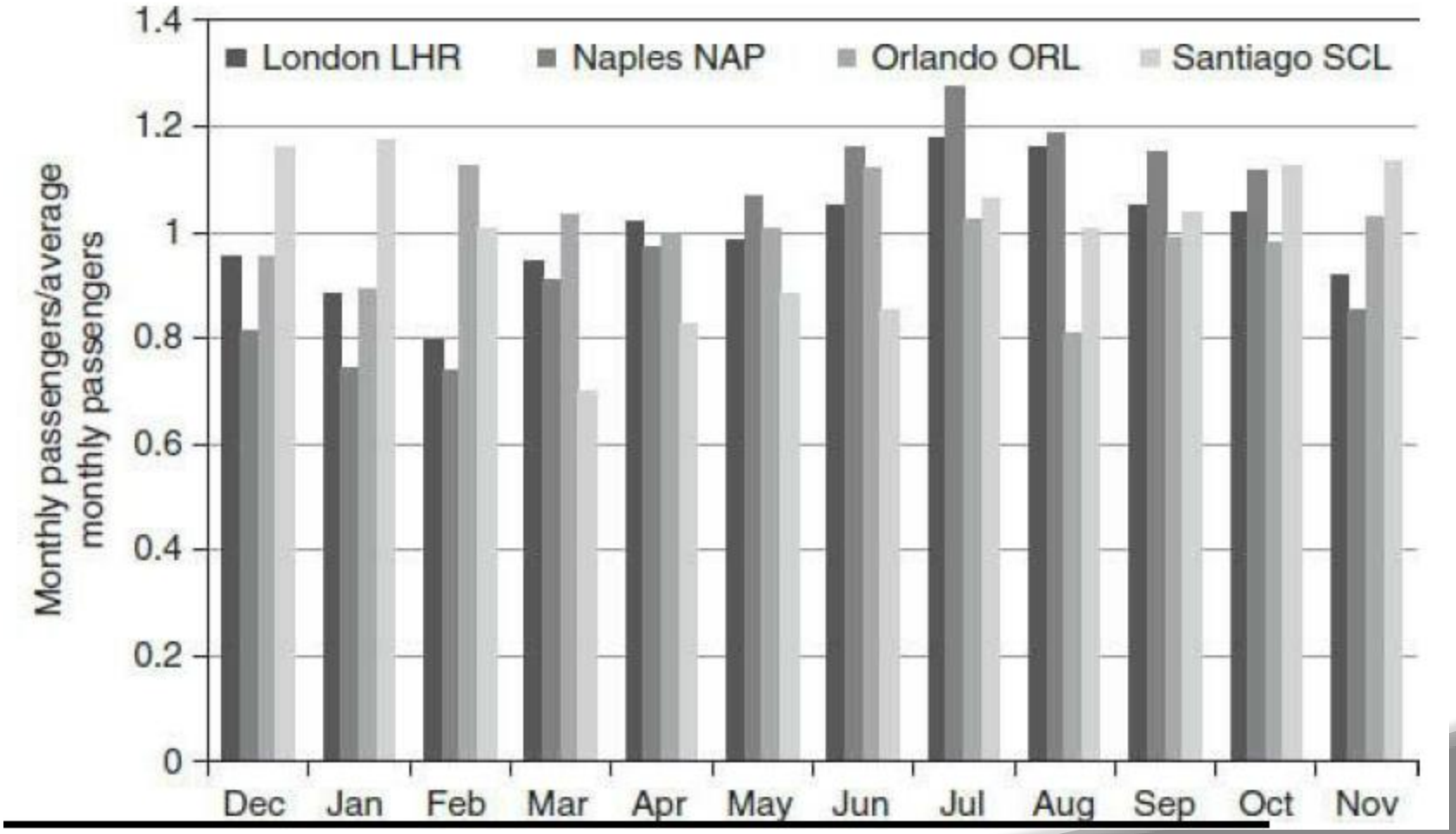
Runway should be well suited to direct noise nuisance away from the heavily populated suburbs.

Nature of Peaks

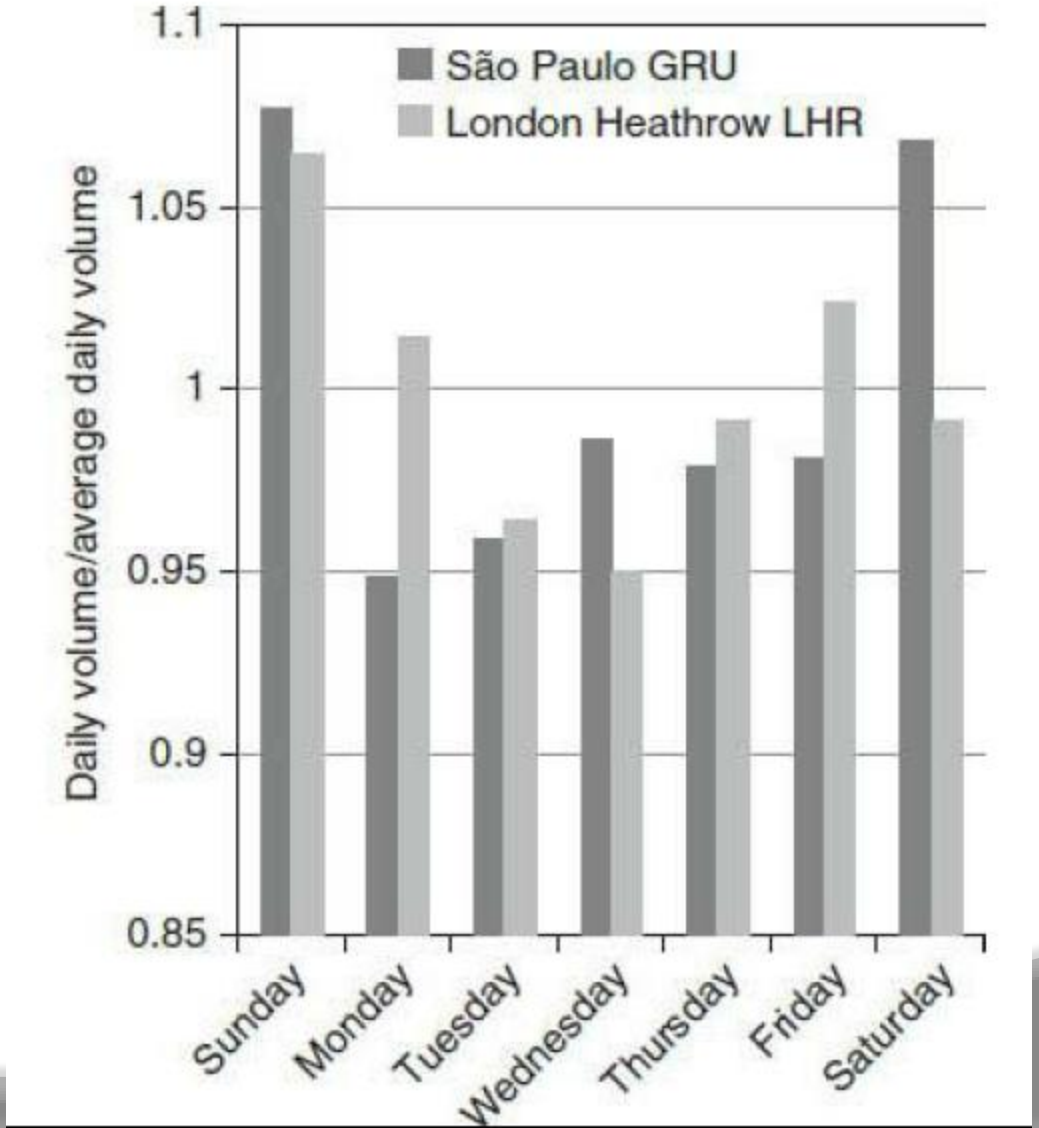
Airport traffic displays peaking characteristics by the month of the year, by the day of the week, and by the hour of the day. The following factors are among the most important affecting peaking characteristics.

- Domestic/international ratio
- Charter and low-cost carrier (LCC)/scheduled ratio.
- Long-haul/short haul.
- Geographic location.
- Nature of catchment area.

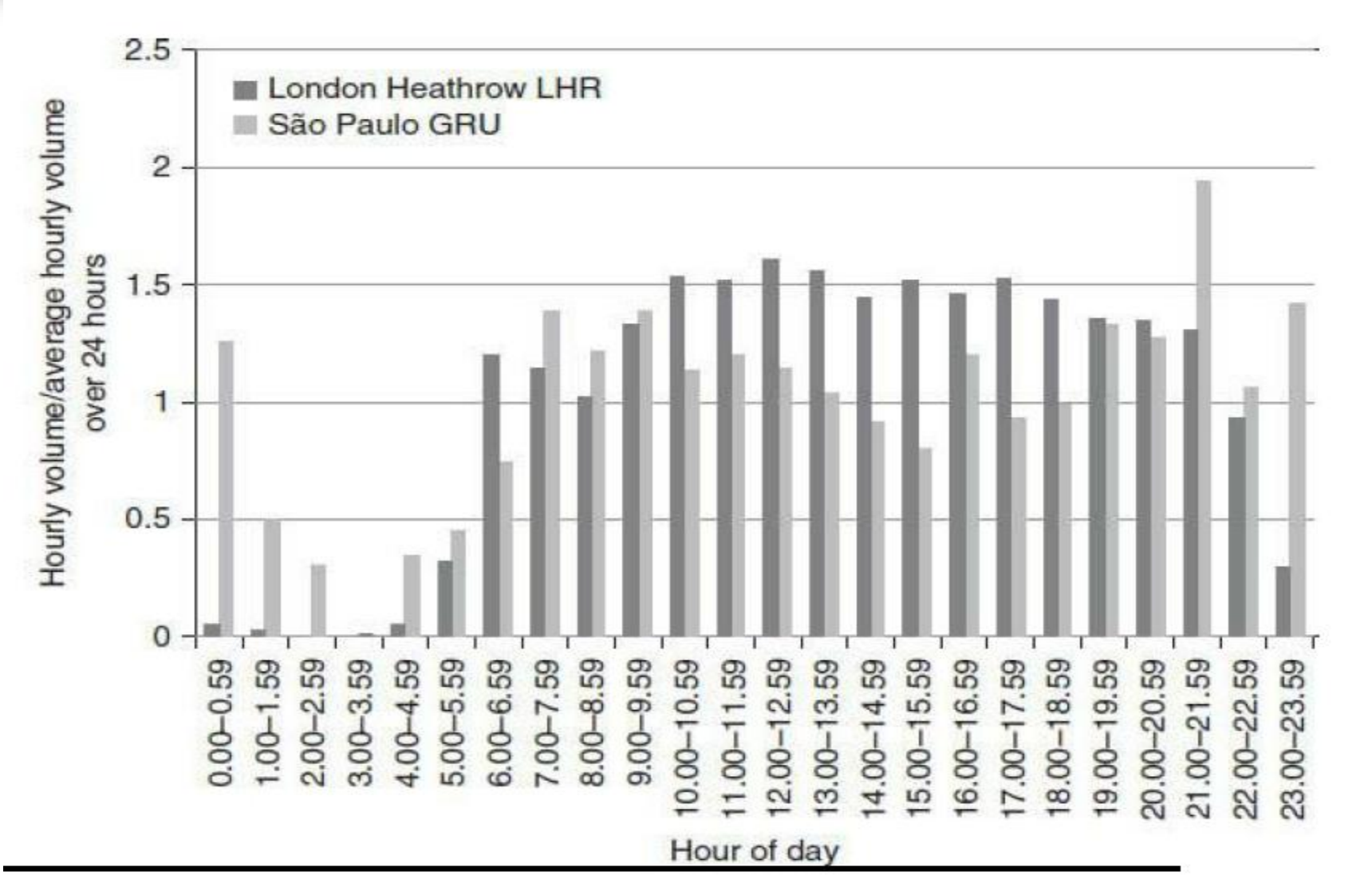
Monthly Variation of Passenger



Weekly variation of passengers Trends

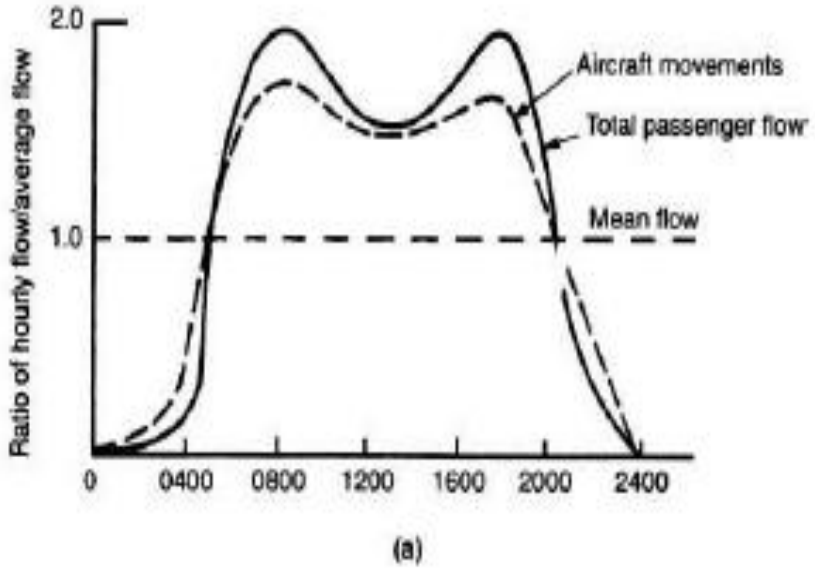


Variation of hourly traffic volume

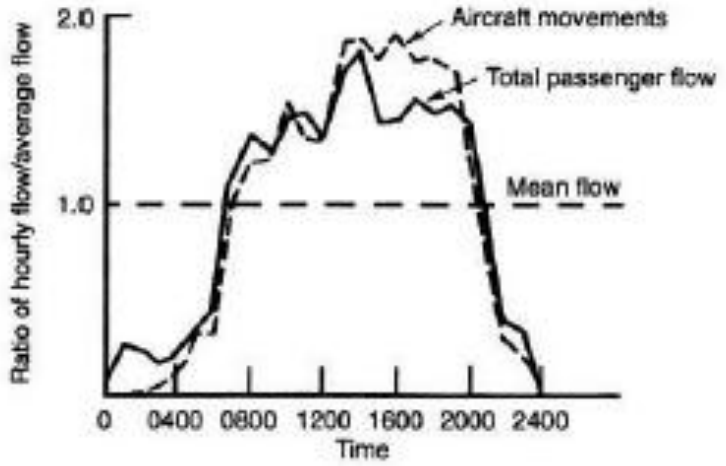


Implications of Variations in Volumes

Demand for peak-hour schedules affects the amount of infrastructure that must be supplied by the airport



Idealized relationship between air carrier movements and passenger flow



Observed relationship between air traffic movements and passenger flow at Chicago O'Hare Airport

Factors and Constraints on Airline Scheduling Policies

Factors

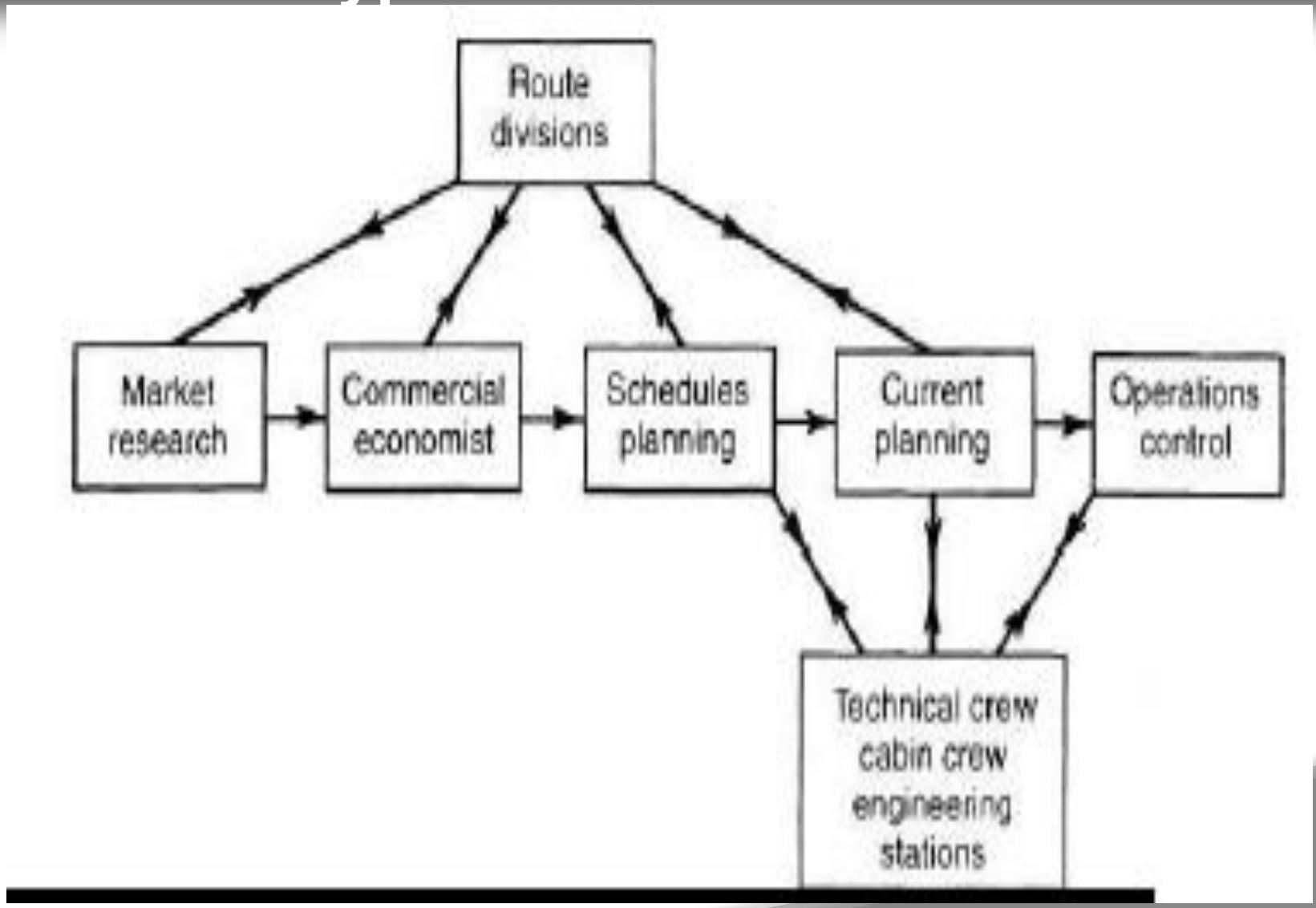
- Utilization and Load Factors
- Reliability
- Long-Haul Scheduling Windows
- Airport (Runway) Slots
- Terminal Constraints
- Long-Haul Crewing Constraints
- Short Haul Convenience
- General Crewing Availability
- Aircraft Availability
- Marketability
- Summer-Winter Variations
- Landing-Fee Pricing Policies

Scheduling Within the Airline

Factors affecting scheduling within airline

- Currently available route capacity
- Aircraft type
- Fare structure (i.e., standby, peak, night, etc.)
- Social need for route and subsidies
- Political considerations (in the case of the flag airline of a country)
- Competition
- Requirements for special events

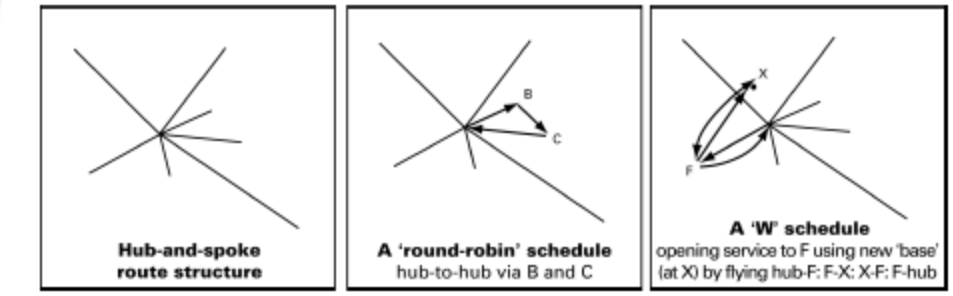
Organization of scheduling within a typical airline



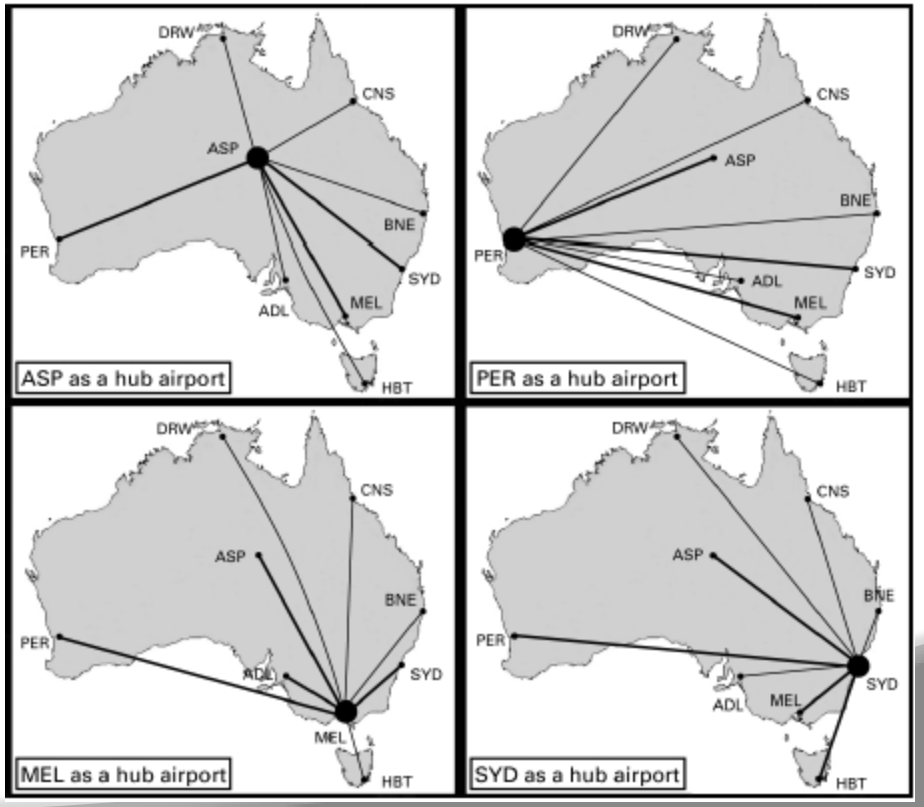
HUBS

- Which provided services both to other major airports also designated as hubs and to smaller airports providing spoke services.
- The airline **Hubbing** system was associated with much greater frequency of services between hubs and from the spoke airports, supposedly accompanied by higher load factors on the aircraft.
- Direct services between smaller Non hub airports generally were abandoned. Some airports operate as hubs for one airline only.
- The hubs are classified in four ways e.g. large hub, medium hub, small hub and non hub as per the operation of the airport activities

HUBS LOCATIONS



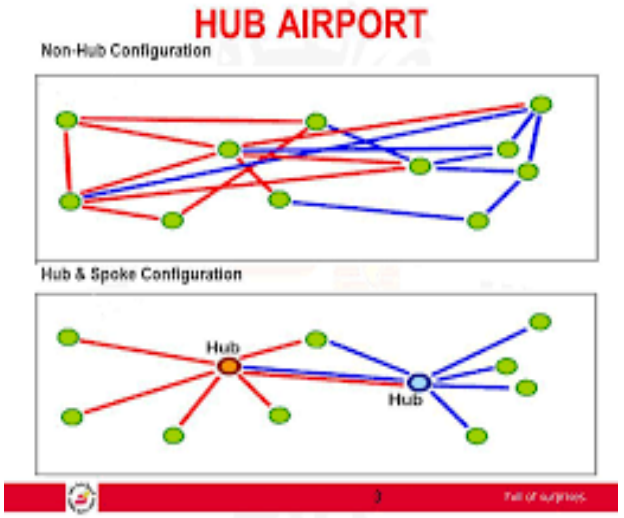
Different Hubbs



Classification of Hubs

FAA has classified the hubs in four types

- **1. Large hubs**
- **2. Medium hubs**
- **3. Small hubs**
- **4. Nonhubs**



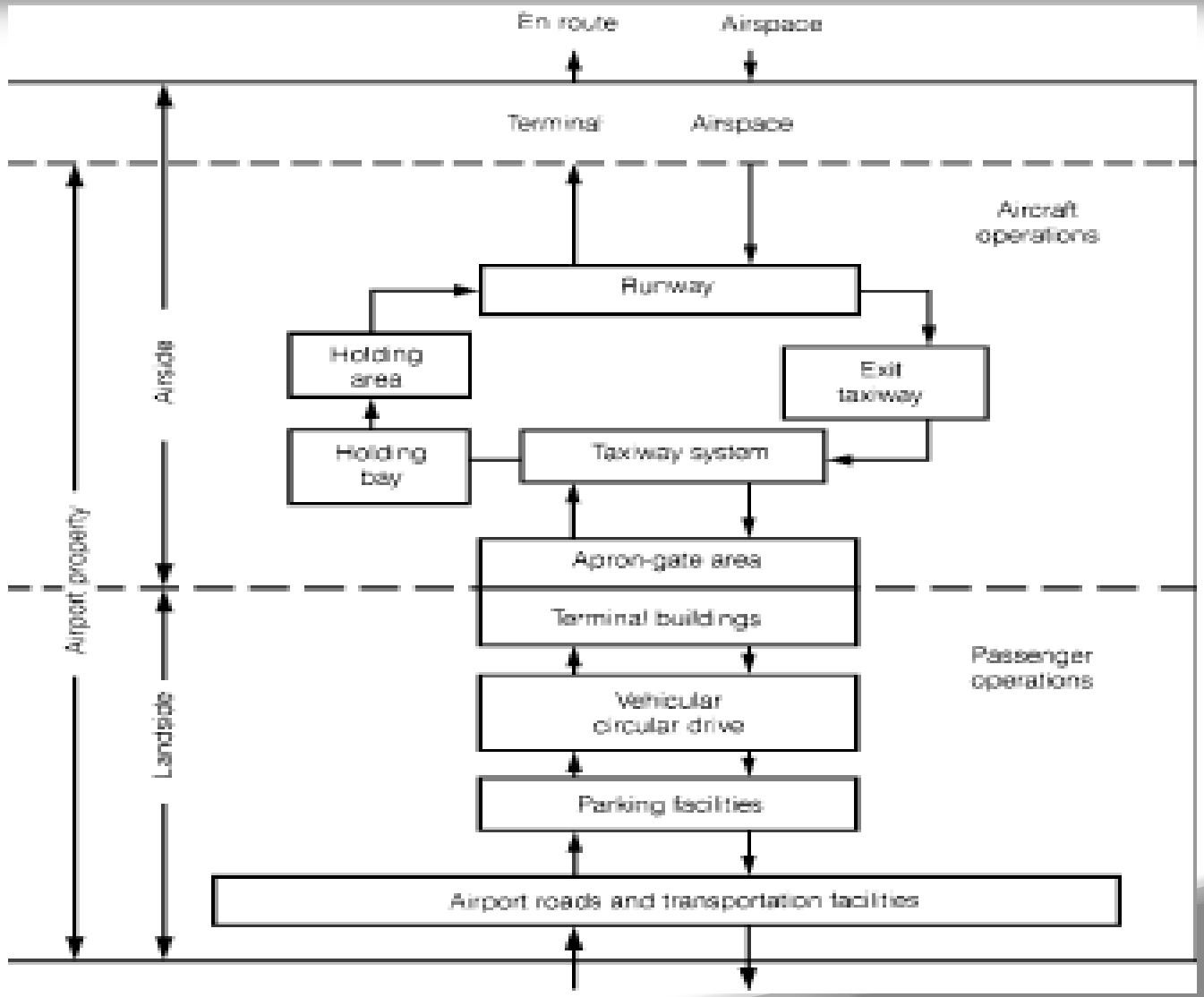
Medium hub

Large hub

Components of an airport

- **Airside of an airport is planned and managed to accommodate the movement** of aircraft around the airport as well as to and from the air. A**irfield component includes all the facilities** located on the physical property of the airport to facilitate aircraft operations.
- **Airspace surrounding an airport is simply the area, off the ground, surrounding** the airport, where aircraft maneuver, after takeoff, prior to landing, or even merely to pass through on the way to another airport.
- **Landside components of an airport are planned and managed to accommodate** the movement of ground-based vehicles, passengers, and cargo. These components are further categorized to reflect the specific users being served.
- **Terminal component is primarily designed to facilitate the movement** of passengers and luggage from the landside to aircraft on the airside.

Components of an Airport



The airport master plan

At the local level, the centerpiece of airport planning is the airport **master plan, a document that charts the proposed evolution of the airport to meet future** needs. The magnitude and sophistication of the master planning effort depends on the size of the airport.

Master planning is a formal and complex process that has evolved to coordinate large construction projects (or perhaps several such projects simultaneously) that can be carried out over a period of up to 20 years

Important master plans

Dublin master plan

Brunei master plan

Objectives of the airport master plan

- The overall objective of the airport master plan is to provide guidelines for future development that will satisfy aviation demand and be compatible with the environment, community development, other modes of transportation, and other airports.

- To provide an effective graphic presentation of the ultimate development of the airport.
- To establish a schedule of priorities and phasing for the various improvements proposed in the plan.

Specific objectives of Master Plan

- To present the pertinent backup information and data that were essential to the development of the master plan.
- To describe the various concepts and alternatives that were considered in the establishment of the proposed plan.
- To provide a concise and descriptive report so that the impact and logic of its recommendations can be clearly understood by the community the airport serves and by those authorities and public agencies that are charged with the approval, promotion, and funding of the improvements

Elements of master plan

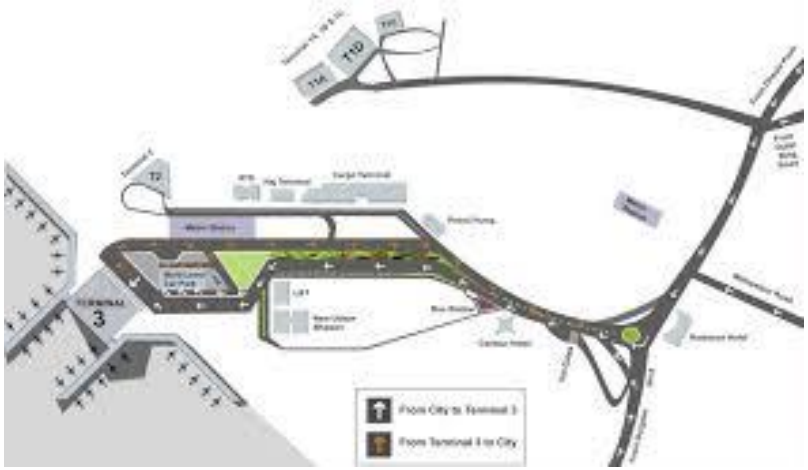
1. **inventory**
2. **Activity forecasts**
3. **Demand/capacity**
4. **Analysis**
5. **Facilities requirements**
6. **Design alternatives**
7. **Financial plans**.

The airport layout plan

The airport layout plan is a graphic presentation to scale of existing and proposed airport facilities and land uses, their locations, and the pertinent clearance and dimensional information required to show conformance with applicable standards. It shows the airport location, clear zones, approach areas, and other environmental features that might influence airport usage and expansion capabilities.

IGI New Delhi Layout plan

Ultimate Airport Development Plan



Information Obtained by Layout Plan

Airport facilities- like runways, taxiways, aprons, blast pads, extended runway safety areas, buildings, NAVAIDs, parking areas, roads, lighting, runway marking, pipelines, fences, major drainage facilities, wind indicators, and beacons.

Prominent natural and man-made features such as trees, streams, ponds, rock outcrops, ditches, railroads, power lines, and towers.

Outline of revenue-producing non-aviation-related property

Areas reserved for existing and future aviation development

Existing topographic contours, Fueling facilities and tie down areas Facilities that are to be phased out.

Airport activities

Tourist visit

Tourist visit

Contd------

- **Airport boundaries and areas** owned or controlled by the sponsor, including aviation easements
- **Airport reference point** with latitude and longitude
- **Elevation of runway ends**, high and low points, and runway intersections
- **True azimuth of runways**
- **North point—true and magnetic**

- **Pertinent dimensional data—**runway and taxiway widths and runway lengths, taxiway-runway-apron clearances, apron dimensions, building clearance lines, clear zones, and parallel runway separation.

Forecasting

From forecasts, the relationships between demand and the capacity of an airport's various facilities can be established and airport requirements can be determined.

Forecasting Methods

1. **Qualitative forecasting**

a. Jury of Executive Opinion
b. Sales Force Composite method
c. Consumer market survey
d. Delphi method

2. Quantitative forecasting

Methods are those that use numerical data and mathematical models to derive numerical forecasts.

a. Time-series or trend analysis models
b. *Causal models*

Causal model

A **causal model** is constructed by finding variables that explain, statistically**,** the changes in the variable to be forecasted. The availability of data on the variables, or more specifically their specific values, is largely determined by the time and resources the planner has available

Time-series models are based on a measure of time (months, quarters, years, etc.) as the independent or explanatory variable

Facilities requirements

- The study of the demand/capacity relationship involves an estimation of the need to expand facilities and the cost of these improvements.
- This type of analysis is done in consultation with the airlines and the general aviation community.
- The analysis is applied to aircraft Operations versus airfield improvements, passager enlacements versus terminal
- Building improvements, cargo tonnage versus cargo facility development, airport access traffic versus access roads and rapid transit facilities, and other improvements as might be appropriate.
- Airspace in the vicinity of the master plan airport is also analyzed.

Design alternatives

When planning for an airport's future, airport planners develop a series of design alternatives to accommodate forecast levels of demand. These design alternatives are then brought to airport management, the local government, the surrounding community, and often the Federal Aviation Administration to reach a consensus on the recommended design alternative.

The design alternatives for airports may include:

- The selection of an airport on a new yet undeveloped site
- The plans for design and operation of the airfield and local airspace
- The plans for design and operation of

Airport operations design alternatives

- Separation of apron vehicles from moving aircraft
- Passenger flow separation in the terminal building
- Passenger flow separation from apron activities
- Concession availability and exposure to public
- Airfield security and prevention of unauthorized
- Air cargo and freight forwarder facilities
- Airport maintenance shops and facilities

Contd------

- Airfield and apron drainage
- Airfield and apron utilities
- Utility plants and heating and air-conditioning systems
- Fire and rescue facilities and equipment

Financial Plan

- The financial plan is an economic evaluation of the entire plan of development.
- It looks at the master plan activity forecasts from the point of view of revenues and expenditures.
- Analyzing the airport's balance sheet over the planning period to ensure that the airport sponsor can afford to proceed.

1. **Economic evaluation**
2. **Break-even need**
3. **Potential airport revenue-** Landing area**,** *Aircraft aprons and parking areas,* Airline terminal buildings, Public parking areas, Cargo buildings, Aviation fuel, *Hangars*

Land use and Environmental planning

Land use planning

1. Land uses on the airport
2. Land uses around the airport

Environmental planning

- For any proposed airport planning project, a review of how such expansion
- would affect the surrounding environment must be performed.
- A detailed environmental statements for all major federal airport development actions significantly affecting the quality of the environment

UNIT-II

GROUND HANDLING AND BAGGAGE HANDLING

Reference: Norman J. Ashford—Airport Operations, McGraw Hill, 3rd Edition, 2013

Course Learning Outcomes

CLOs	Course Learning Outcome
CLO5	Remember ground, passenger and ramp handling procedure.
CLO6	Understand departure, control methods and divisions of responsibilities.
CLO7	Describe baggage handling process and equipment's requires for this purpose.
CLO8	Explain about organization management and performance matrices.

GROUND HANDLING

- The movement of passengers, baggage, and cargo through the terminals and the turnaround of the aircraft on the apron are achieved with the help of those involved in the ground handling activities at the airport (IATA 2012).

- These activities are carried out by some mix of the airport authority, the airlines, and special handling agencies depending on the size of the airport and the operational philosophy adopted by the airport operating authority.

- Ground handling procedures can be classified as either terminal or airside operations

Activities for ground handling

Terminal

- Baggage check
- Baggage handling
- Baggage claim
- Ticketing and check-in
- Passenger loading/unloading
- Transit passenger handling
- Elderly and disabled persons
- Information systems
- Government controls
- Load control
- Security
- Cargo

Airside

- Ramp services
  - Supervision
  - Marshaling
  - Startup
  - Moving/towing aircraft
  - Safety measures
- On-ramp aircraft servicing
  - Repair of faults
  - Fueling
  - Wheel and tire check
  - Ground power supply
  - Deicing
  - Cooling/heating
  - Toilet servicing
  - Potable water
  - Demineralized water

GROUND HANDLING OF BAGGAGE

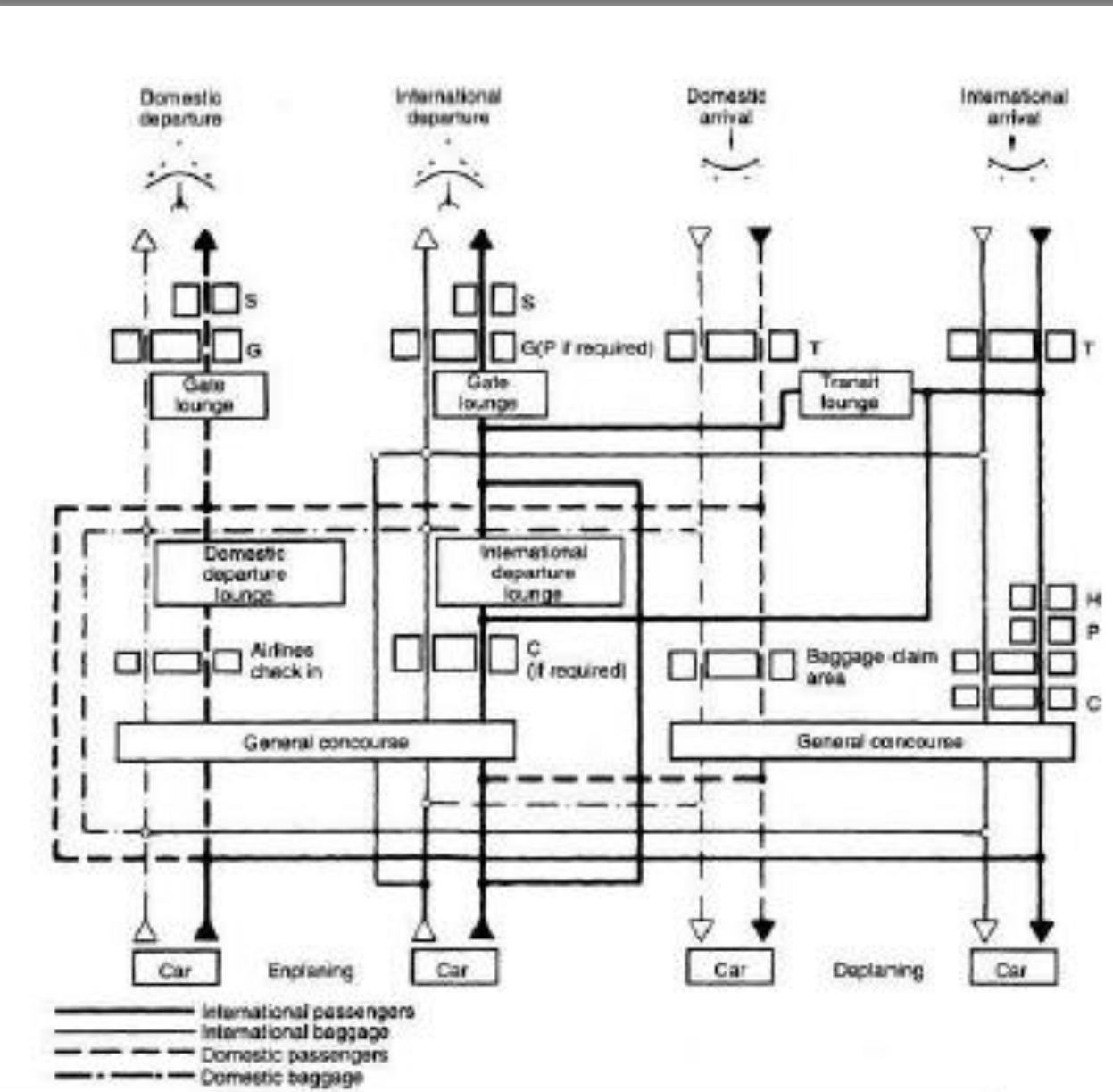


FIGURE: Schematic of the passenger baggage flow system (G = gate control and airline checkin, if required; P = passport control; C = customs control; H = health control, if required; T = transfer checkin; S = security control). (Source: Ashford et al. 2011.)

Cargo Terminals

FIGURE (b) INFRAERO cargo terminal, São Paulo International Airport. (Courtesy of INFRAERO, Brazil.) (c) An ETV. (Courtesy of INFRAERO, Brazil.)

Passenger handling

Passenger handling in the terminal is almost universally entirely an airline function or the function of a handling agent operating on behalf of the airline. Most passenger activities are done by airlines except security, health, customs and immigration which is done by Government authorities.

Airline-designated checkin area.

Computer-assigned CUTE passenger checkin desks

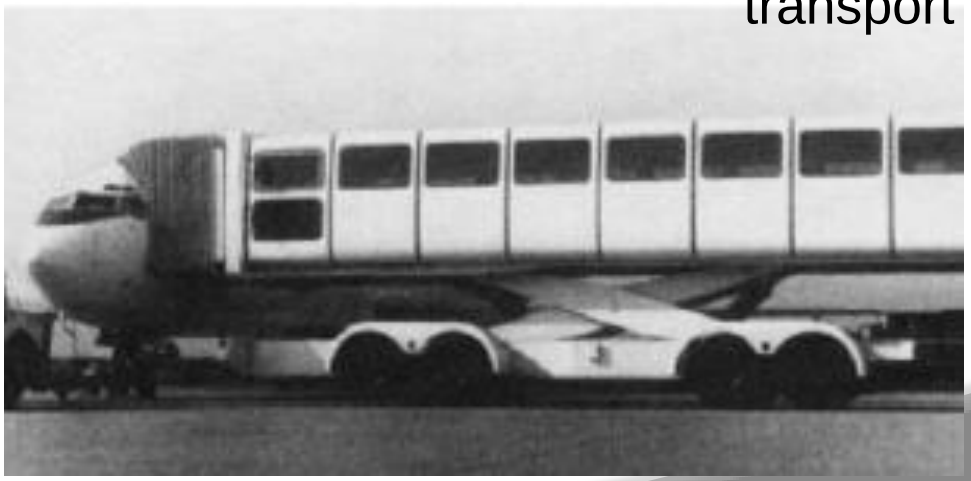
Passenger handling facilities at airport

Airline passenger

Elevating passenger air bridge.

Apron passenger transport

Three-loading-bridge configuration serving an A380



Mobile lounge for passenger transport

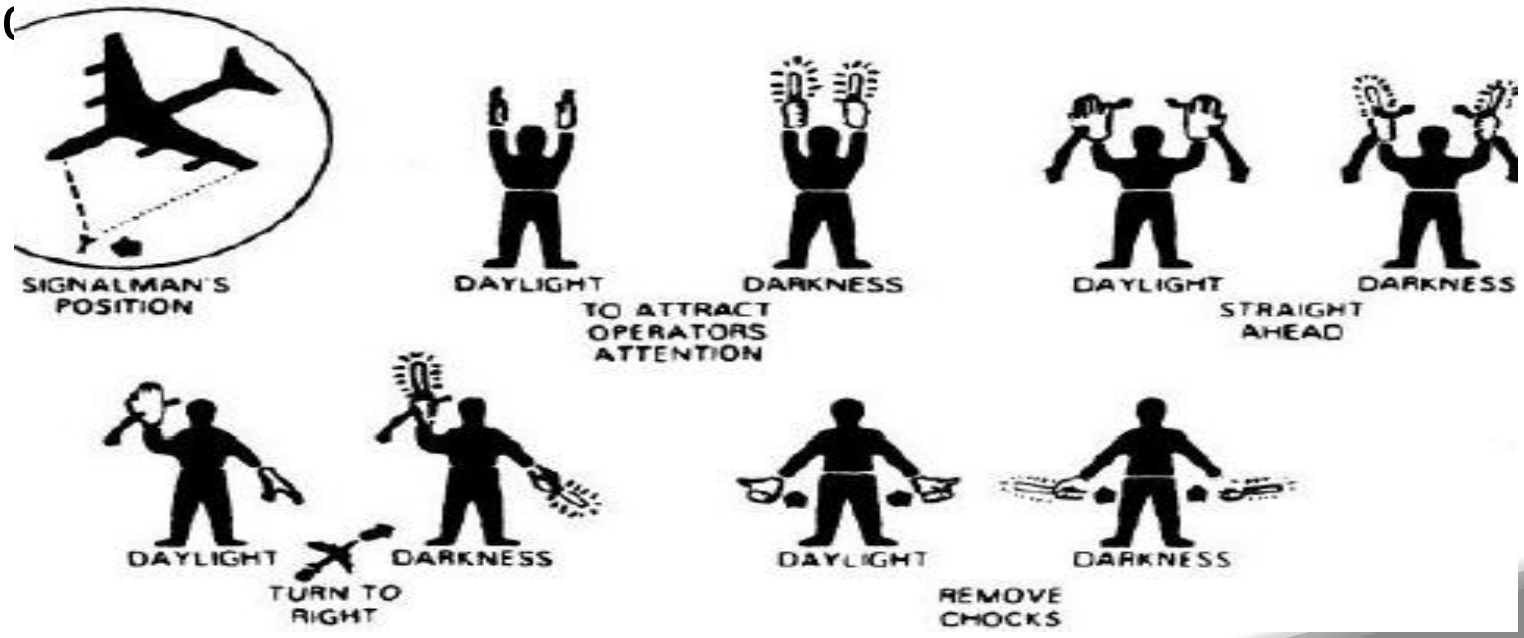
Ramp Handling

During the period that an aircraft is on the ground, either in transit or on turnaround, the apron is a center of considerable activity, the control of the activities called Ramp handling. Examples are

1. Nose in docking
2. Self docking
3. Aircraft parking and information system
4. Docking guidance system

5. **Marshaling**- Marshaling includes the positioning and removal of wheel chocks, landing-gear locks, engine blanking covers, Pitot covers, surface control locks, cockpit steps, and tail steadies.

6. Headsets are provided to permit ground-to-cockpit



Ground signalman marshalling an aircraft

RAMP FACILITIES

The ramp handling process also includes the provision, positioning, and removal of the appropriate equipment for engine starting purposes

Mobile apron engine air-start vehicle.

Aircraft tow tractor

Ramp servicing

Following Servicing are undertaken at ramp;
1.Fault servicing, 2. Fuelling 3. Wheels and tires servicing 4. Ground power supply 5. Deicing and washing 6. Cooling and heating

Fuel Tanker at ramp

Mobile aircraft fuel dispenser

Ramp servicing equipments

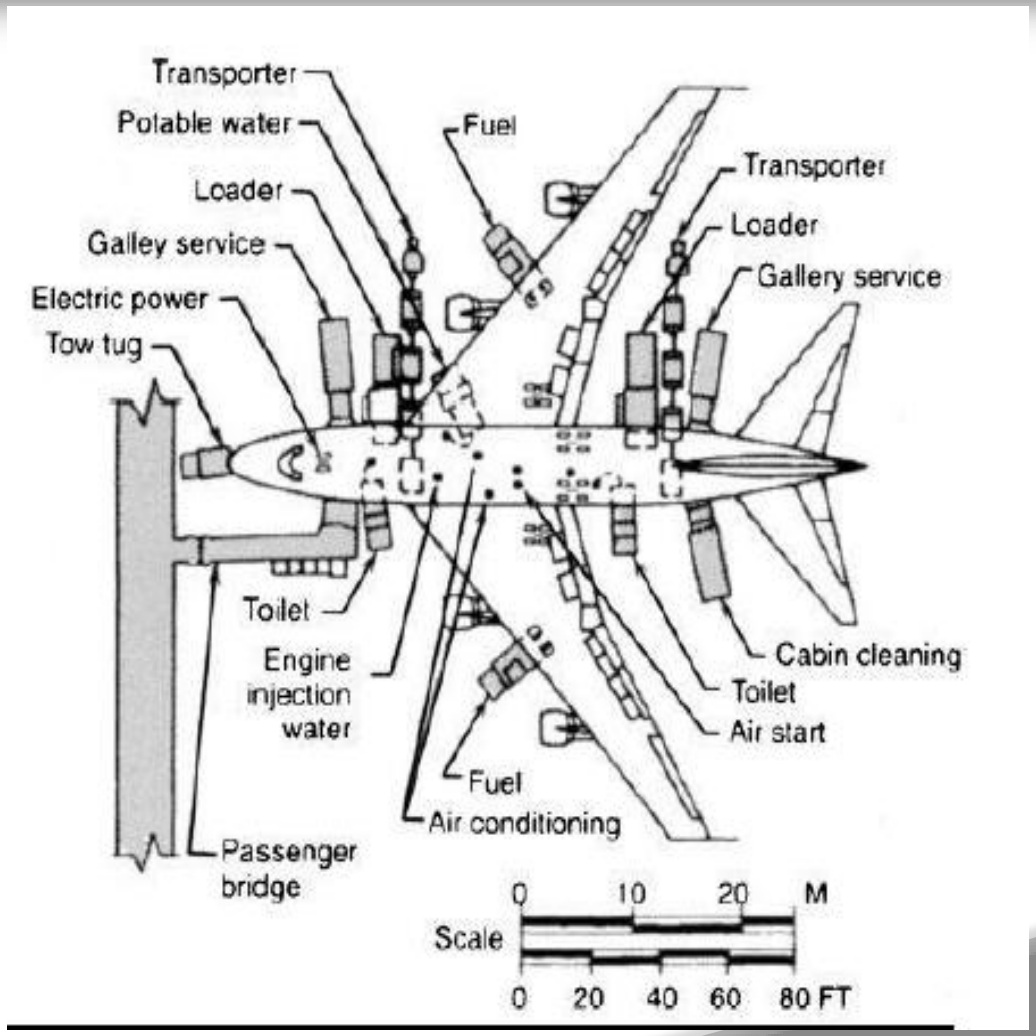
Apron cable electrical supply

Deicing and washing system

Fixed ground cooling unit attached to an air bridge

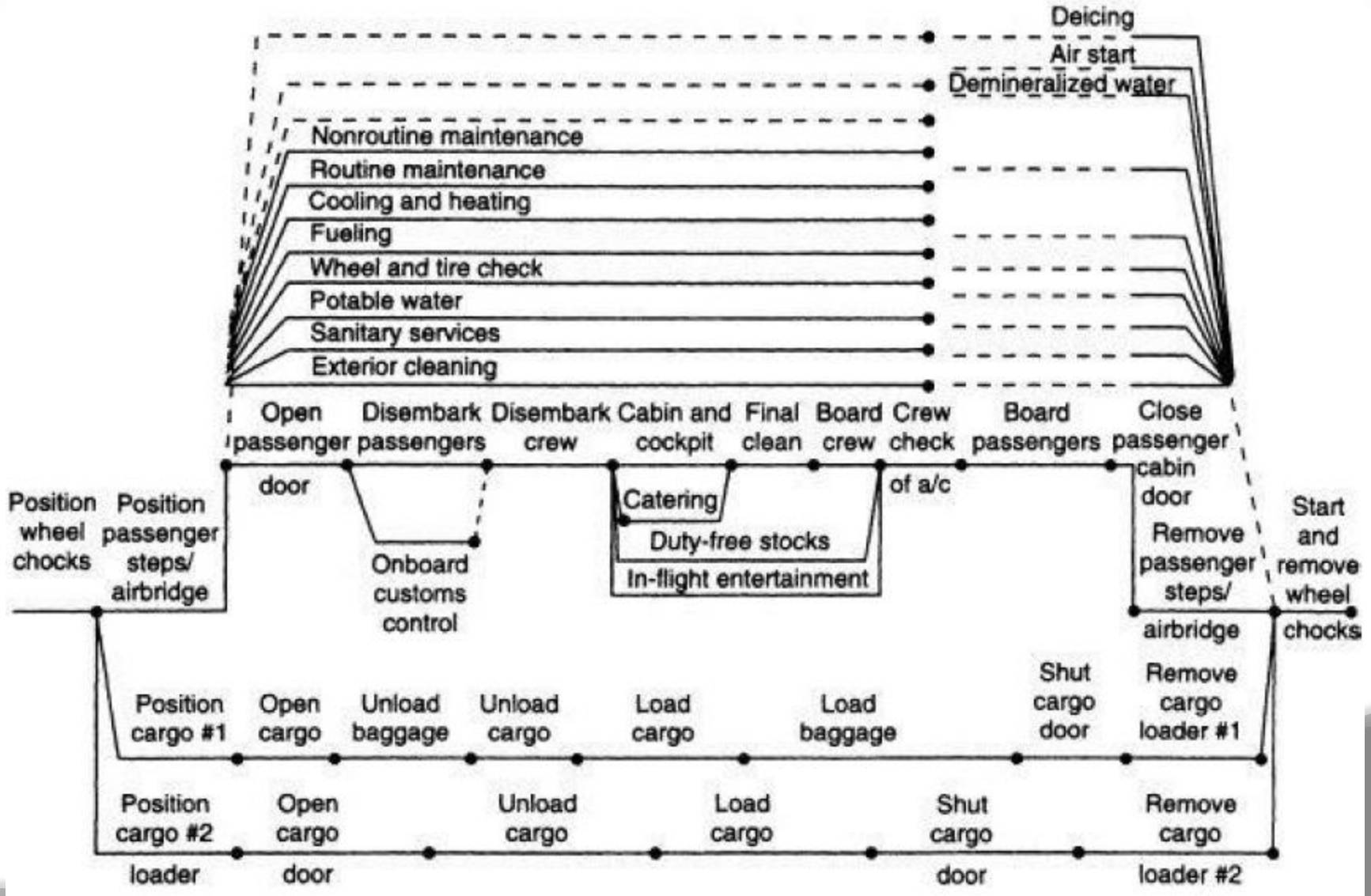
RAMP LAYOUT

- Modern aircraft are very large, complicated, and expensive.
- Therefore, the apron servicing operation is also complicated and consequently time-consuming.
- Unless the ramp servicing procedure can be performed efficiently, with many services being carried out concurrently
- the aircraft will incur long apron turnaround times during which no productive



Ramp layout for servicing a B747SP

Departure control



Division of Ground Handling Responsibilities

- There is no hard-and-fast rule that can be applied to the division of responsibility for ground handling functions at airports. The responsibility varies not only from country to country but also among airports in the same country. Virtually all airport ground handling was carried out by the airlines. Specialist companies are now providing some or all ground handling services at most large and medium sized airports
- On the ramp, functions such as marshaling, steps, loading and unloading of baggage and cargo, and engine starts are carried out by the handling companies.
- Economic advantages of scale could be expected from centralized ground handling operations.
- Routine preventive maintenance also should be less expensive with a smaller proportion of the equipment out of service for repairs.

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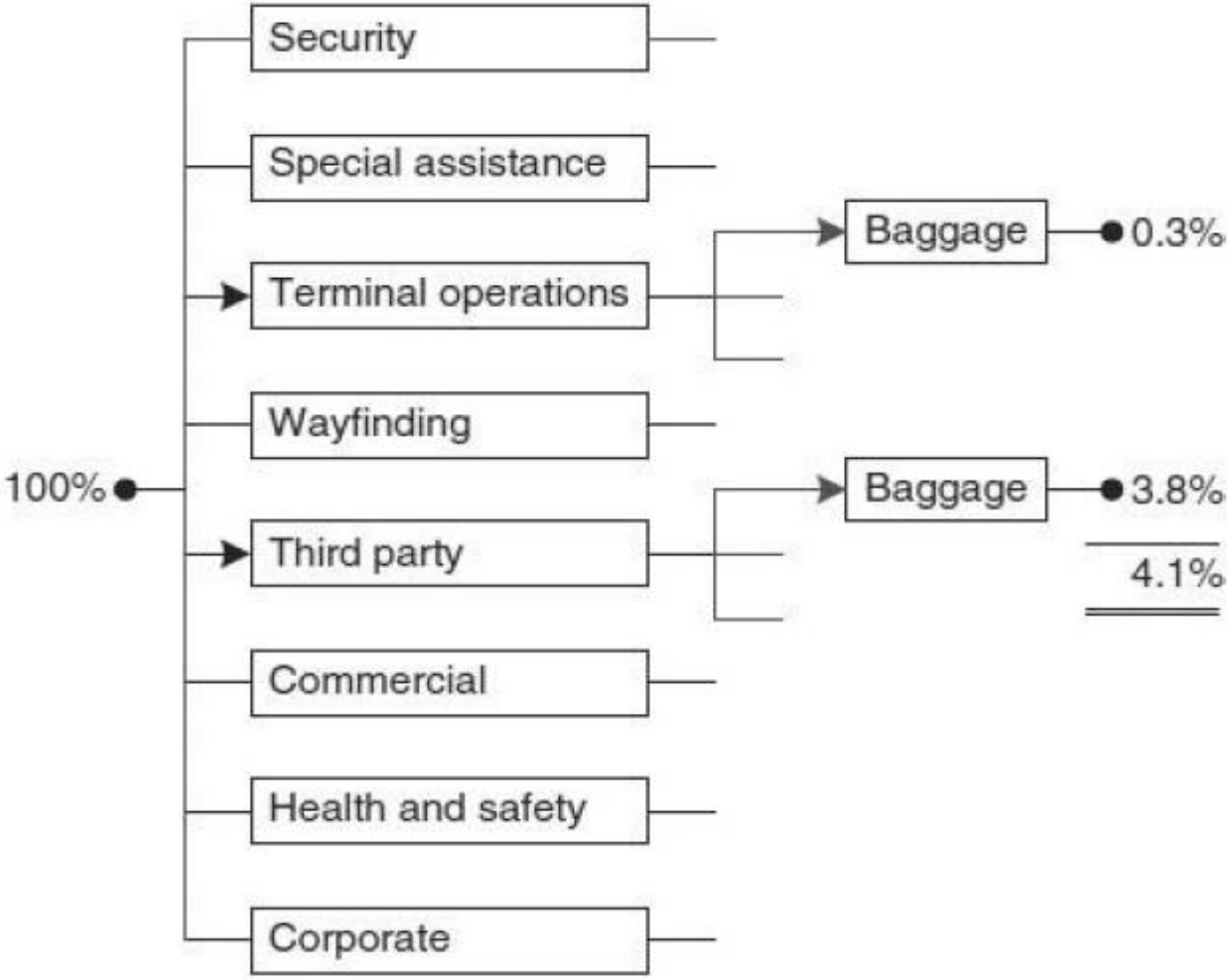
Control of Ground Handling Efficiency

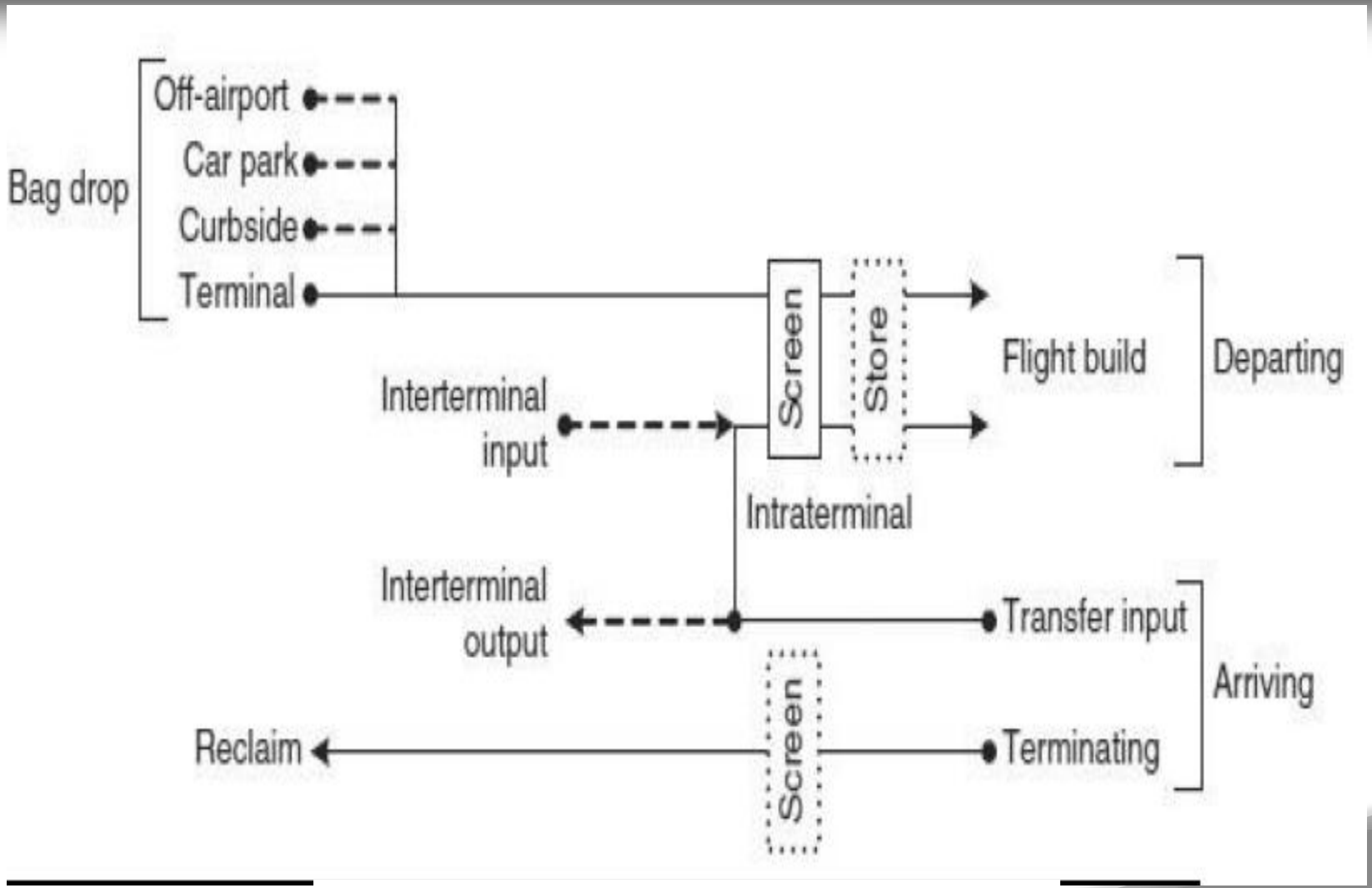
- Ground handling operation requires skilled and dexterous management to ensure that staff and equipment resources are used at a reasonable level of efficiency.
- Airports using only one ground handling organization are also vulnerable to severe industrial action from a relatively small group of workers.
- to be broken into a number of relatively self-sufficient and semiautonomous organizations based on the various parts of a single large terminal or on the individual-unit terminals of a decentralized design

Baggage Handling



Baggage component of customer complaints.

Baggage-Handling Processes

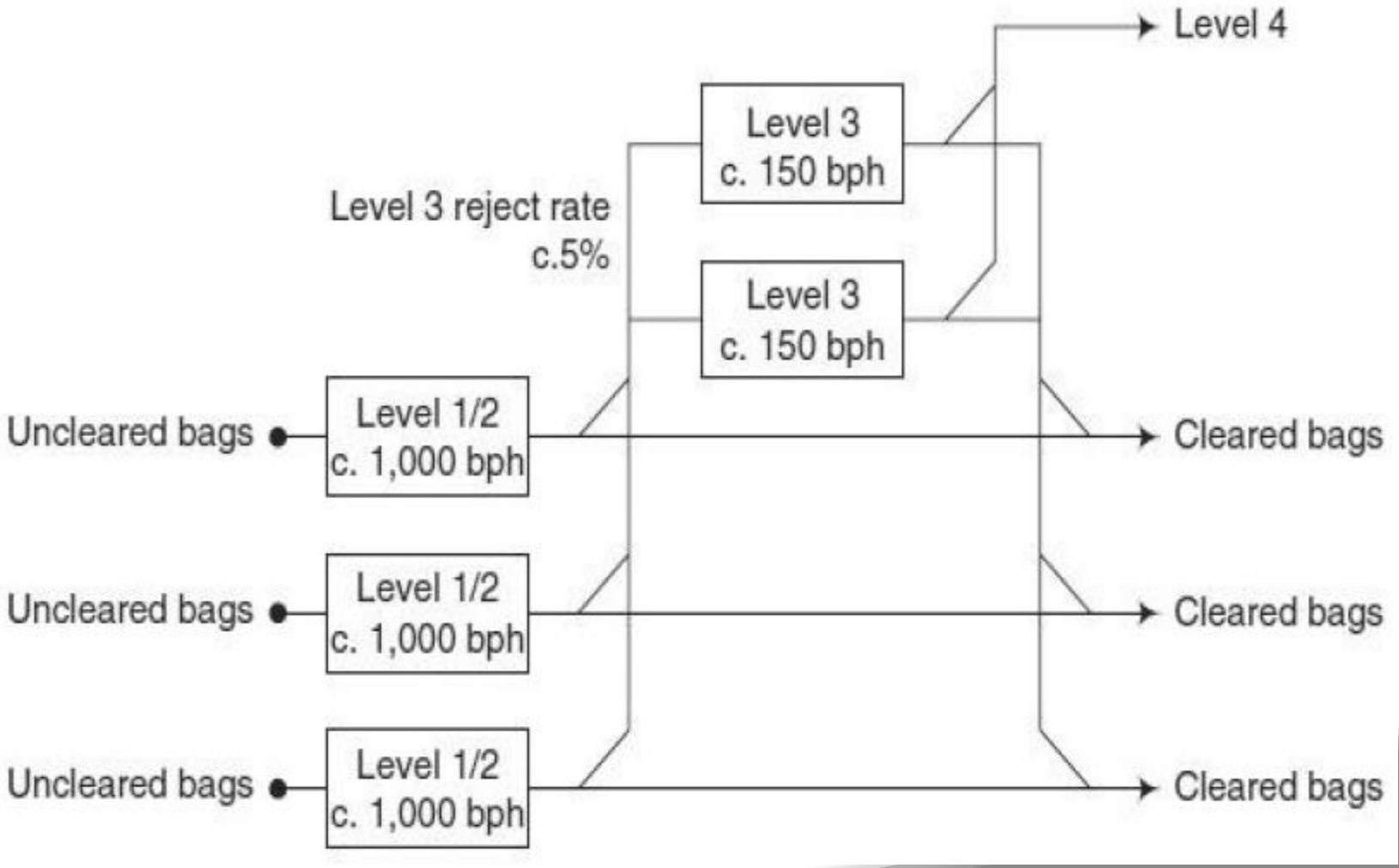


Typical baggage processes.

Staffed bag drop.

Self-service bag drop

Hold Baggage Screening



Flight Build and Aircraft Loading

- Bags that have been processed and sorted ultimately are delivered to outputs where they are loaded either into ULDs or trailers.
- ULDs are containers into which bags and cargo can be loaded.
- The number of makeup positions allocated per flight will depend on the expected volume of baggage, the flight build time, and the number of segregations into which bags have to be sorted.
- This can vary from one or two positions for small aircraft to 10 or more for larger aircraft with complex terminating and transfer products

Loading ULDs onto an aircraft

Equipment, Systems, and Technologies

Baggage-Handling-System Configuration

- The design System of the passenger terminal complex itself can radically affect the configuration of the outbound-baggage system.
- Operate on one or more central bag rooms in the main terminal area
- Concept of baggage makeup area is the remote bag room

Baggage system Elements

Baggage system actually consists of two elements:

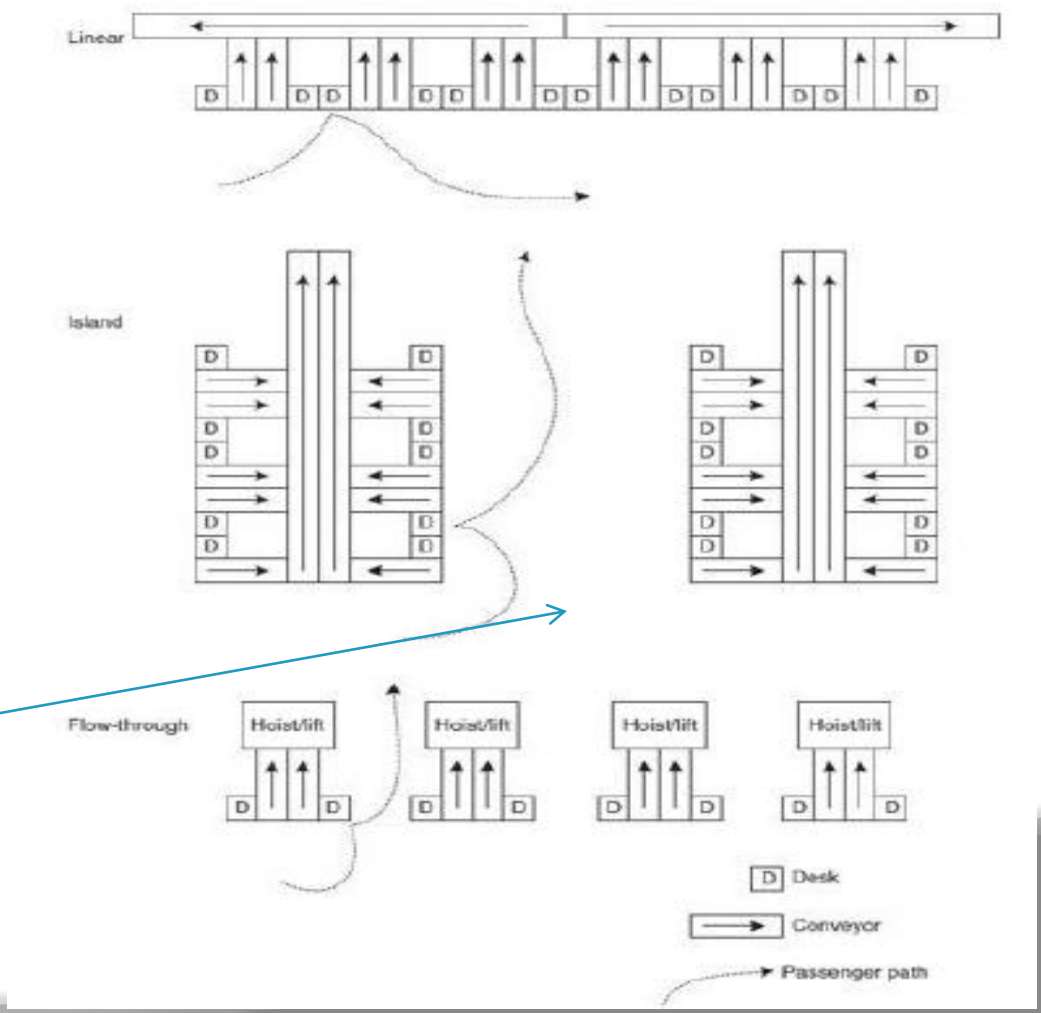
- A bulk, centralized system for dealing with all but the most time-critical of bags (which brings the benefit of economies of scale for staffing and other resources)
- A distributed delivery system to most stands that is used to deliver just the time-critical bags (which brings the benefit of swift delivery right to the aircraft, giving handlers the best chance of loading last-minute bags).

Checkin and Bag Drop

Traditional checkin and bag-drop desks can be arranged in a number of ways

- Linear
- Island
- Flow-through

Checkin desk configurations



Sorting

Once baggage has entered a system (other than the simplest), it has to be sorted. Destinations include screening equipment, manual encoding stations, and bag storage or flight makeup locations

Tilt-tray sorter

Tote-based system

Hold-Baggage Screening

The control authorities build this into their regulations to ensure the best-possible chance of detection of known and potential threats. three standards of x-ray screening equipment have been identified:

1. Standard 1—a single-view technology
2. Standard 2—a multi view technology
3. Standard 3—a computed tomographic technology :

Hold-baggage screening equipment

computed tomographic machine

Bag Storage

There are two types of bag storage system:

- Manual- bags are grouped by hand
- Automated : they simply automate the manual process—accumulating groups of bags in conveyor lanes by flight or build open time. whole lane of bags would have to be released to
- access just one specific bag.

Crane-served bag store

ULD

ULDs that are filled with bags in a baggage makeup facility will be transported to the departure stand on dollies robot-based and semi automated approaches require the baggage-handling system to be able to store, batch, and deliver bags for a single segregation

Tug and dolly train

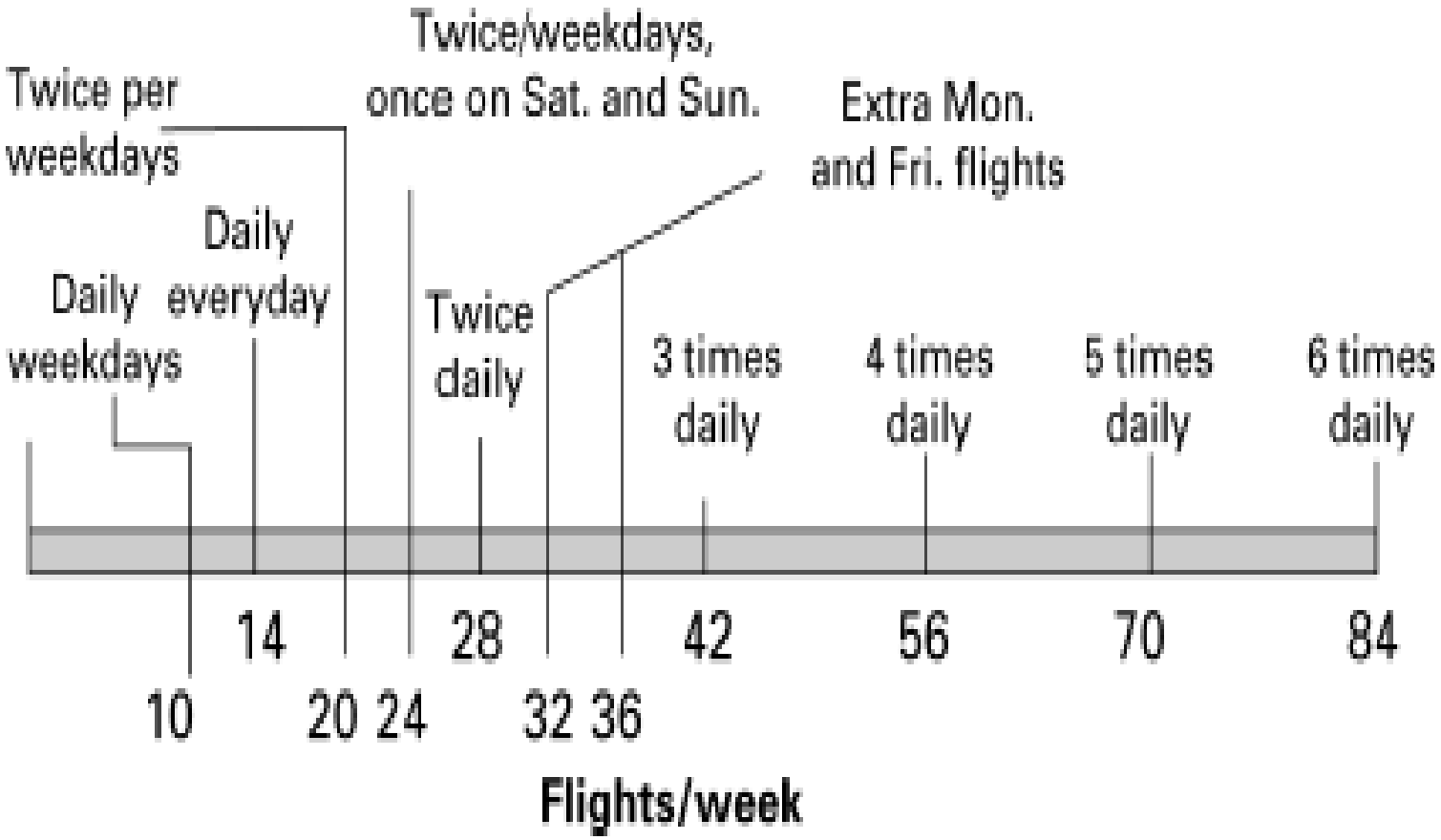
Reclaim

The most common baggage reclaim device is a carousel, of which there are several variants. The two principal choices are:

- Flatbed or inclined
- Direct or indirect infeed(s)

(a) Flatbed reclaim. (b) Inclined reclaim

Daily and weekly schedule



UNIT-III
PASSENGER TERMINAL AND CARGO OPERATIONS

Course Learning Outcomes

CLOs	Course Learning Outcome
CLO9	Remember airport operations and pavement management
CLO10	Understand the aircraft rescue and firefighting system
CLO11	Understand safety aspects like bird and wild life hazards management.
CLO12	Remember the factors affecting the security at commercial and general aviation airport.

Functions of the Passenger Terminal

Three principal transportation functions are carried out within the terminal area

1. **The processing of passengers and baggage**: This includes ticketing, checkin and baggage drop, baggage retrieval, governmental checks, and security arrangements.
2. **Provision for the requirement of a change of movement type:** Function necessitates a holding function, which is much more significant than for all other transport modes.
3. **Facilitating a change of mode:** This basic function of the terminal requires the adequate design and smooth operation of terminal facilities of two mode types.

On the airside, the aircraft must be accommodated, and the interface must be operated in a manner that relates to the requirements of the air vehicle. Equally important is the need to accommodate the passenger requirements for the **landside mode**, which is used to access the airport

Terminal Activities

- It is worth classifying the terminal activities into **five principal component** groups:

- Direct passenger services
- Airline-related passenger services
- Governmental activities
- Non-passenger-related airport authority functions
- Airline functions

Philosophies of Terminal Management

The two extreme positions may be designated as

I. • Airport-dominant

II. • Airline-dominant

- Airport-dominant operations are sometimes called the
- European model, although similar arrangements are found throughout the world.
- which involves high airport-authority staffing levels and high authority equipment costs with concomitant savings to airlines

Factors affecting choice of operational procedure

Philosophy of the airport authority and its governing body

- Local industrial relations
- International and national regulations
- Financial constraints
- Availability of local labor and skills

Direct Passenger Services

Terminal operations that are provided for the convenience of air travelers and are not directly related to the operations of the airlines are normally designated as direct passenger services. Passenger services are divided in two

1) Non commercial services:

Noncommercial activities are usually seen as being entirely necessary services that are provided either free of charge or at some nominal cost.

2) commercial services: Commercial activities, on the other hand, are potentially profitable operations that are either peripheral to the transportation function of the airport.

The following noncommercial activities will be provided

I. Porterage
II. Flight and general airport information
III. Baggage trolleys
IV. Left-luggage lockers and left-luggage rooms2
V. Directional signs
VI. Seating

- Toilets, nurseries, and changing rooms
- Rest rooms
- Post office and telephone areas
- Services for people with restricted mobility and special passengers

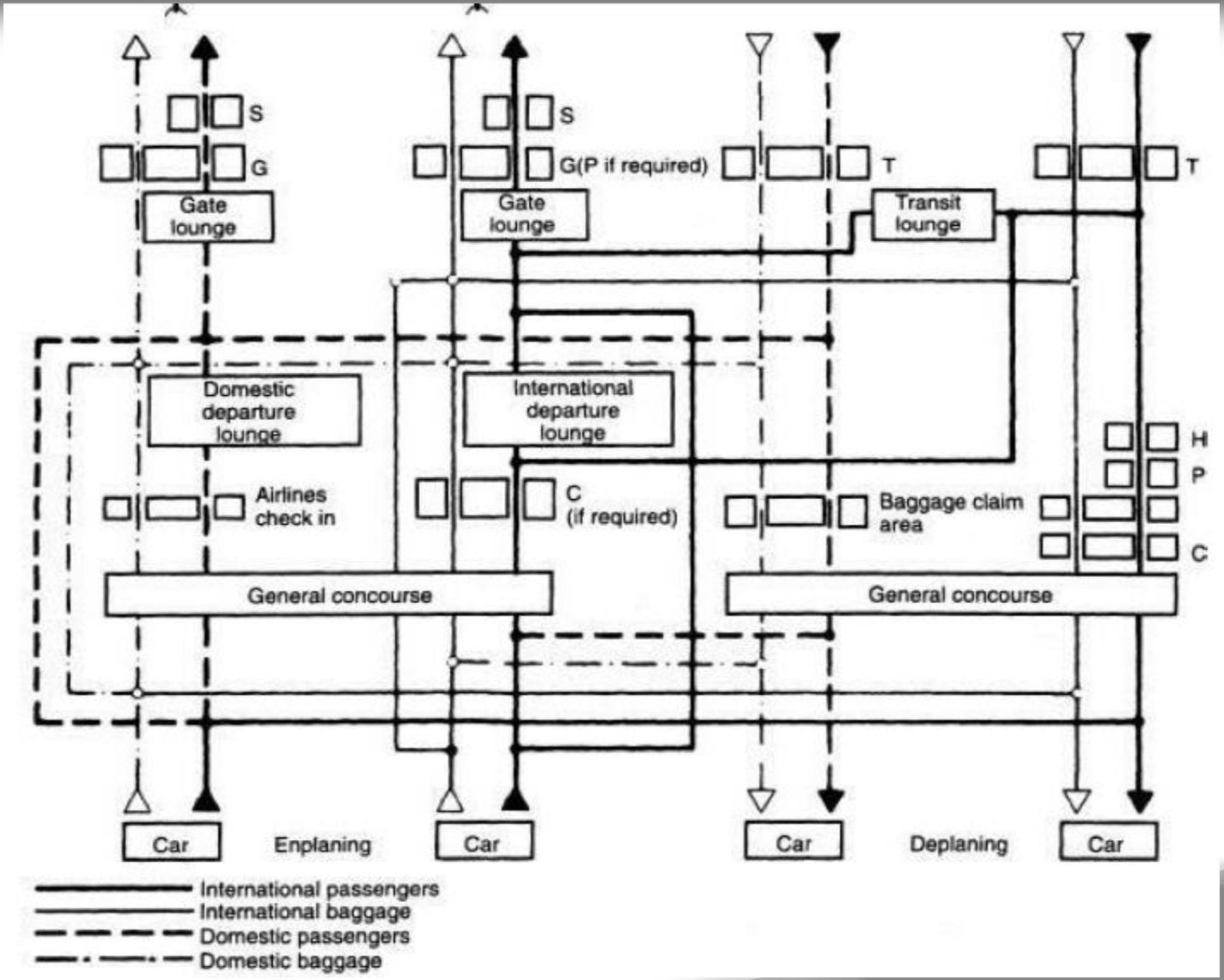
Following commercial activities can be expected

- Car parking
- Restaurants, cafés, and food
- Duty-free and tax-free shops
- Other shops (e.g., book shops, tourist shops, boutiques, etc.)
- Car rental
- Internet service
- Insurance
- Hotel reservations
- Amusement machines, lotteries
- Advertising
- Business-center facilities
- Hairdressers, dry cleaners, and valet services
- Banks and exchange services

Duty-free shops

Advertizing display case

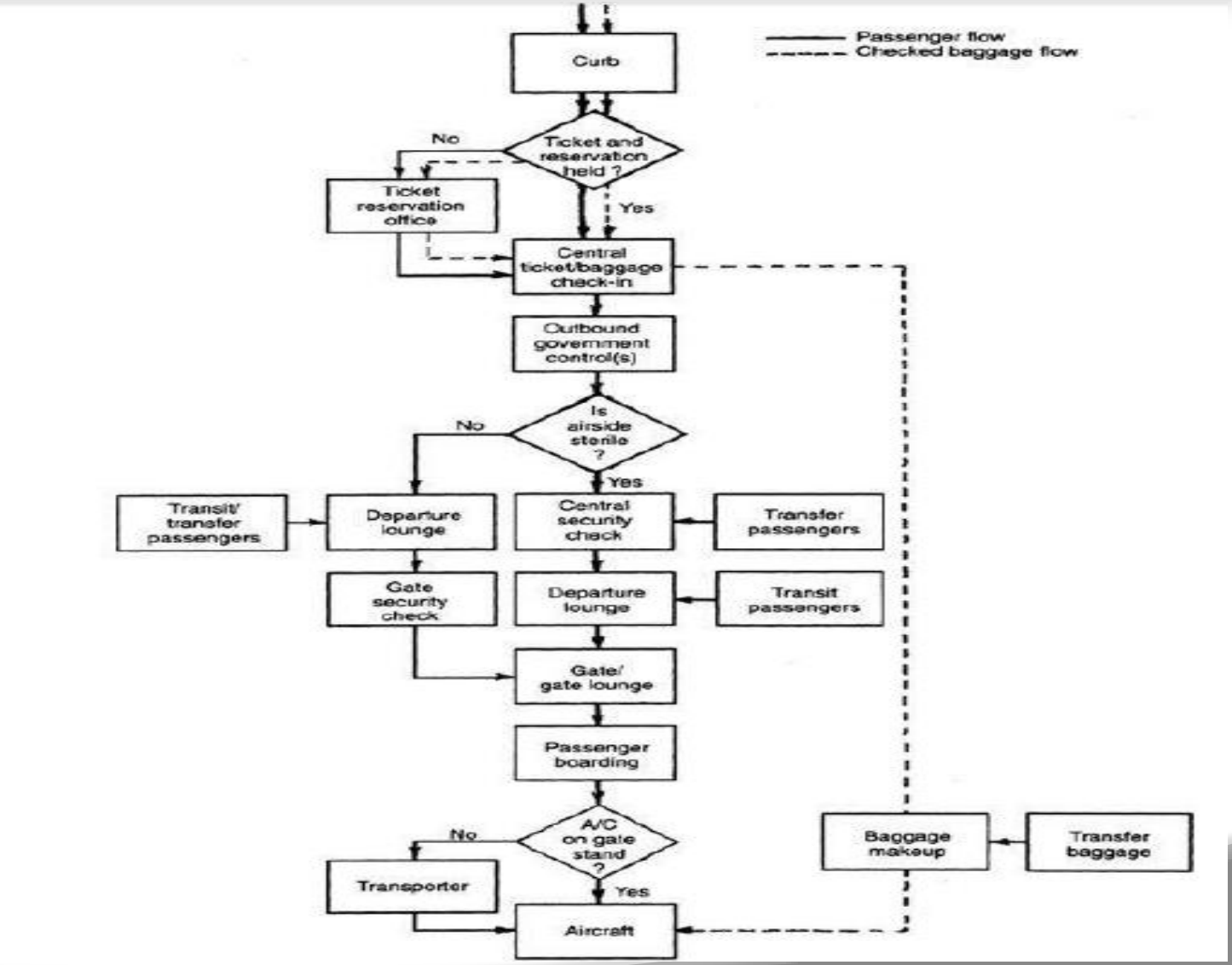
Schematic of the passenger baggage flow system



Decentralized terminals of Dallas–Fort Worth International Airport

Aerial view of Atlanta Hartsfield International Airport

Centralized processing



Terminal Functions

- Transportation planners use the term high-activity centers to describe facilities such as airport terminals that have a high throughput of users.
- The largest passenger airports process well in excess of 10,000 passengers.
- Departing international passengers are likely to spend 1½ to 2 hours in the terminal facility.
- Arriving international passengers spend at least 30
- Minutes.
- Passengers are necessarily engaged in a number of processing activities.
- Likely to use a number of subsidiary facilities put in the airport for their comfort and convenience

Terminal activities into five principal component groups

- ✓ Direct passenger services
- ✓ Airline-related passenger services
- ✓ Governmental activities
- ✓ Non-passenger-related airport authority functions
- ✓ Airline functions

Either directly or indirectly, these functions, were conducted in the passenger terminal area, will involve some responsibility on the part of the terminal manager

Airline-Related Passenger Services

- Airline information services
- Reservations and ticket purchases
- Checkin, baggage checkin, handling of bag drop and storage
- Loading and unloading of baggage at the aircraft
- Baggage delivery and reclaim (reclaim is often under authority control)
- Airline passenger “club” areas, sometimes called commercially important persons (CIP) facilities

Checkin showing area under lease to airline

Designated baggage-delivery system

Airline-Related Operational Functions

1.Flight Dispatch

The main activities associated with this procedure of flight dispatch are

- Flight planning
- Aircraft weight and balance
- Flight-crew briefing
- Flight watch

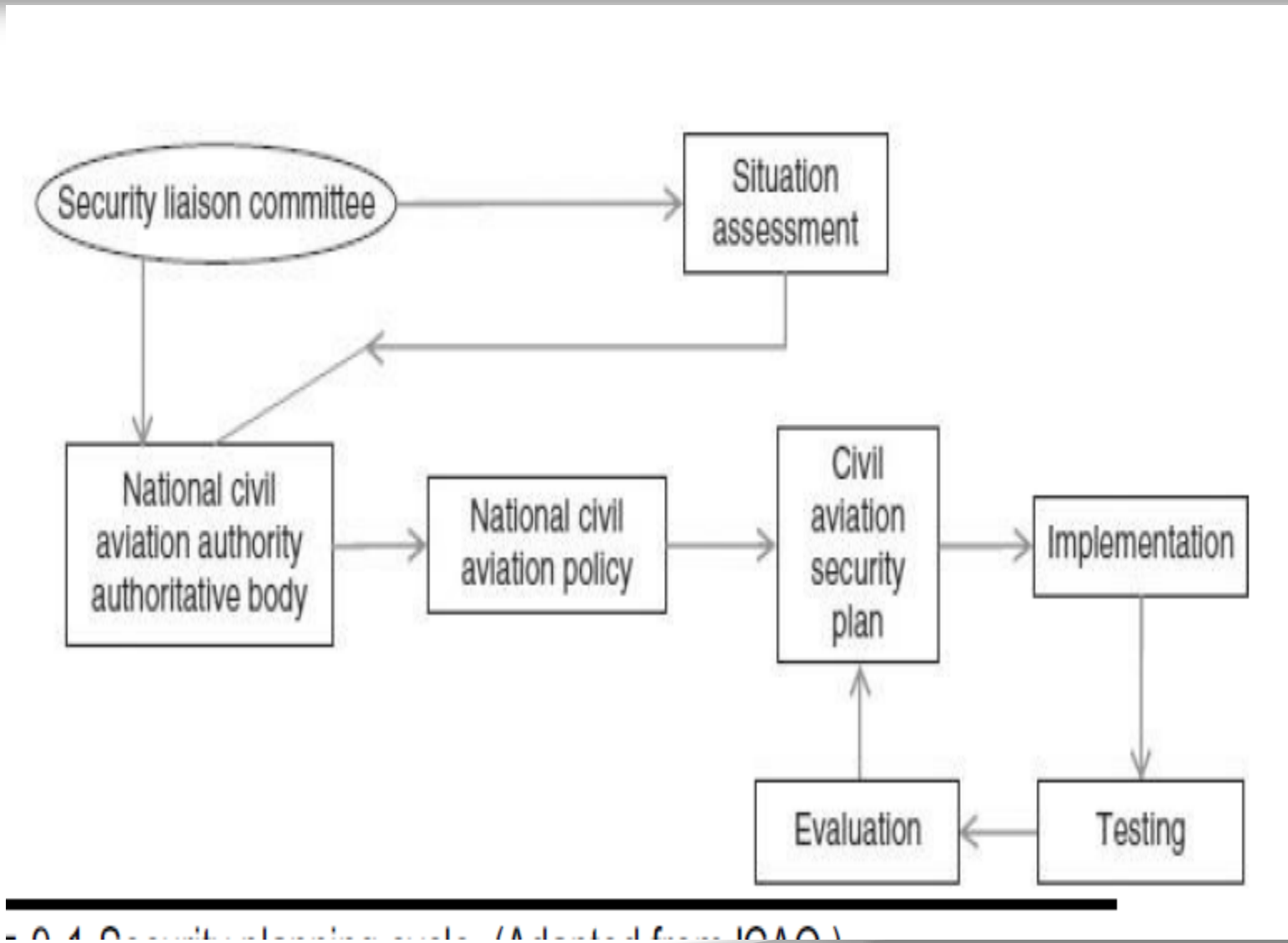
Flight dispatch work is carried out by aircraft dispatchers who work in close cooperation with the aircraft captain.

The airline departments at airports concerned with flight dispatch will need access to airport operations departments, air traffic services, meteorological services, and communications facilities, including email, internet

Airport Security

- Airports, have always been vulnerable to conventional crime such as vandalism, theft, breaking and entering, and even crimes against the person.
- they also have become the focus of terrorism.
- Hijacking usually results in the taking of passengers and crew as hostages.
- there is considerable concern to provide continuous
- protection against the possibility of attacks on civil aviation.
- unpredictable and as unlikely
- as the probability of an aircraft accident, but both have the serious potential for loss of life and injury or damage to property

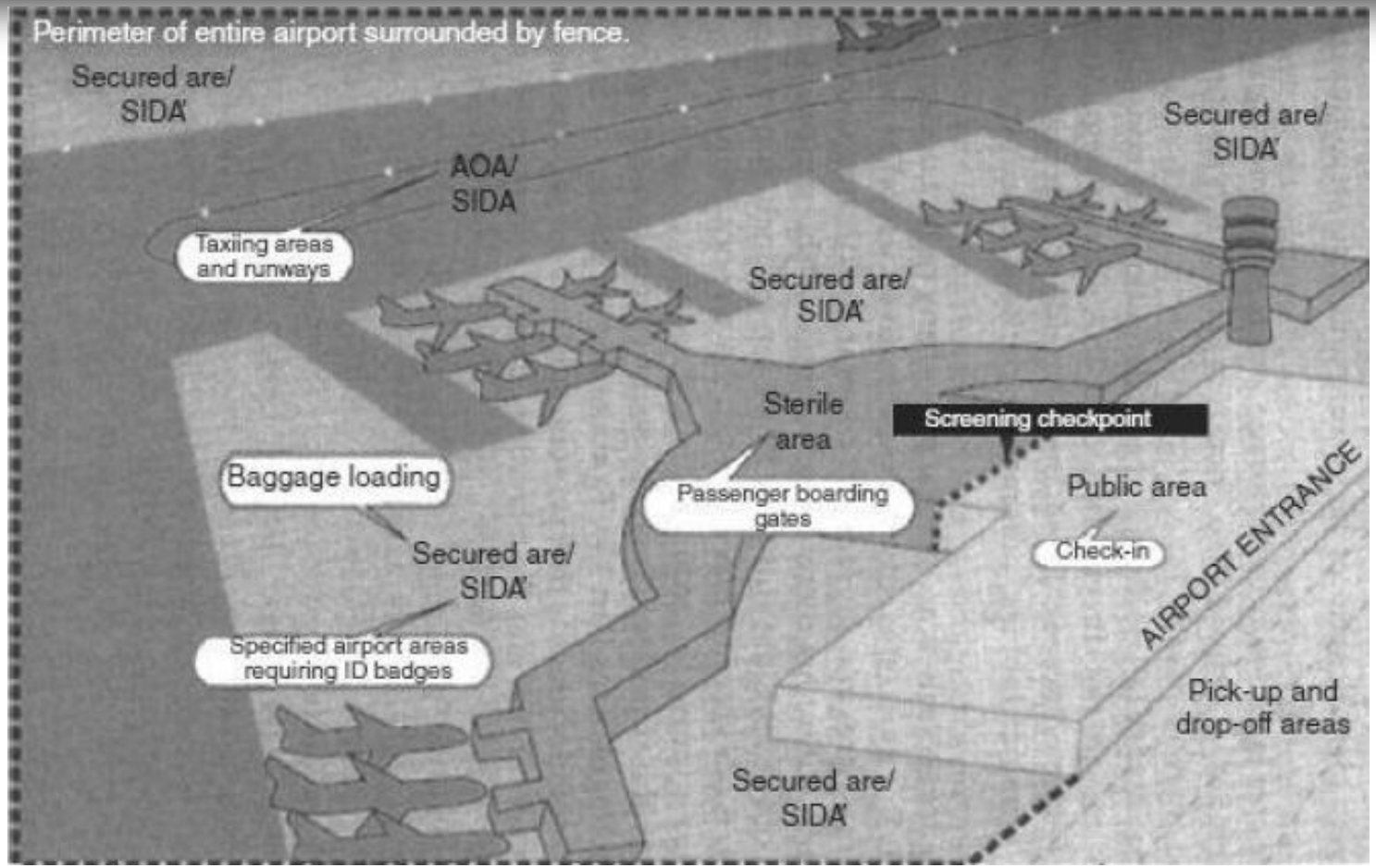
Security planning cycle. (Adapted from ICAO.)



Airport Security Program

- Legislation and sources of regulations
- Airport security committee
- Communications structure and physical description of airport
- Security measures and controls
- Security equipment
- Response to acts of unlawful interference
- Security training
- Quality control

Airport Security Program

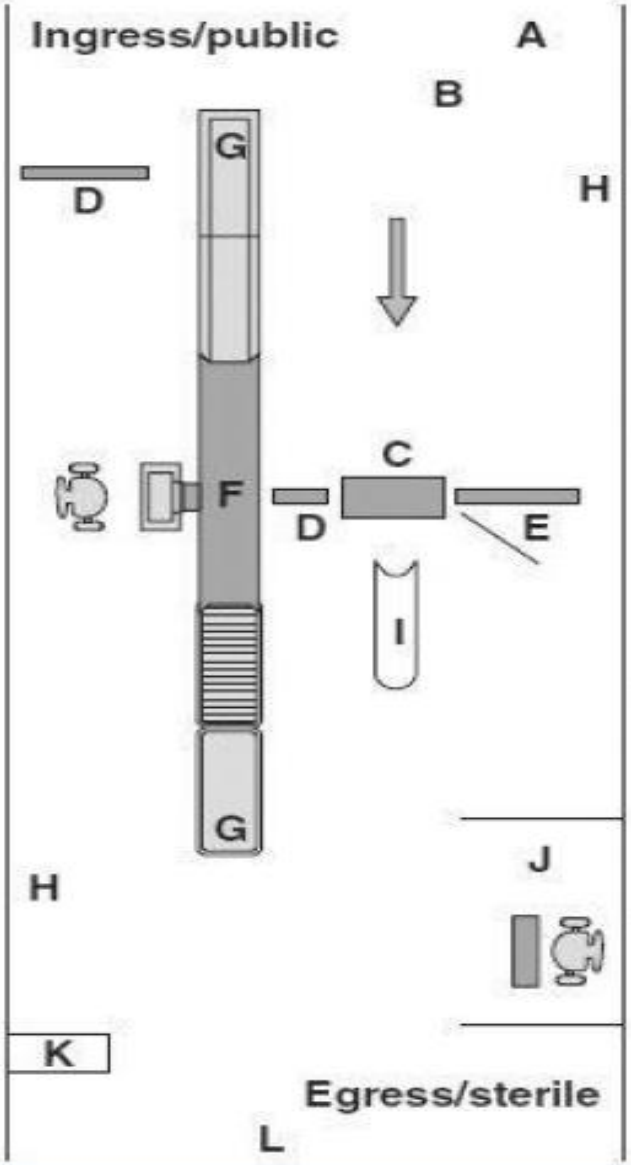


General depictions of the security areas of an airport

Elements of the security

- Compliance with the requirements of criminal history record checks
- Description of the personnel identification system
- Escort procedures for nonemployees requiring escort
- Challenge procedures, • Training programs for personnel
- A description of use and operation of law-enforcement support
- Contingency plans for incidents such as terrorist attacks, bomb threats, civil disturbances, air piracy, and suspicious/ unidentified items
- Procedures for the distribution, storage, and destruction of classified and unclassified security information
- Public advisories
- Incident-management procedures

Security Screening Checkpoint



Legend (letters refer to those within the diagram and the following paragraphs):

A = Prescreening preparation instruction zone
B = Queuing space
C = Walk-through metal detector
D = Non-metallic barrier
E = Non-metallic ADA gate
F = Carry-on baggage X-ray machine
G = Divest & composure tables
H = SSCP adjacent walls/barriers
I = Holding station
J = Wanding station
K = Explosives trace detection (ETD) machine
L = Egress seating area

Other elements (not shown in this diagram):

Explosive trace portal
supplemental x-ray
LEO station
Supervisor station
Private search area
SSCP CCTV coverage
Data connections/cabinet
SSCP lighting
Wireless access point
Exit travel lane
Exit lane station
Exit lane CCTV
Integrated exit lane systems

Walk-through Metal Detector (WTMD).

Explosive trace detector

Whole-body scanner: x-ray backscatter

Freight x-ray machine

Perimeter Control for Operational Areas

a. Fencing
b. Access Gates
c. Security lighting
d. Patrols
e. Closed-circuit-television (CCTV) monitoring
f. Electronic intruder-detection systems

Organization of security

a. Name and title of the official(s) responsible for airport security
b. Organizational details of services responsible for the implementation of security measures, including

I. Airport security officers
II. Central government security officials (if appropriate)
III. Police
IV. Government inspection agencies
V. Airline operators
VI. Tenants
VII. Municipal authorities

Airport security committee

1. Airport manager
2. Airport security chief
3. Representative of the National Aviation Security Agency (if
4. appropriate)
5. Police
6. Military
7. Customs
8. Immigration
9. Air traffic services
10. Fire services
11. Communications representatives
12. Health service
13. Postal service
14. Operators
15. Cargo companies and forwarders
16. Tenants

Security measures at the airport

Boundary fencing, guarded access points, lighting, alarm systems, closed-circuit television, walk-through units, patrols, etc.)

Access movement and control

Identification procedures for persons. Attach the text(s) that regulate the movement of persons at the airport.

a. Specify the access points where access passes are required.
b. Specify the criteria for granting access passes.
c. Describe in detail the format and contents of the various badges, cards, devices, and signs used for identification.
d. Specify the procedures for checking the access pass and the penalties for not complying with the regulations.
e. Specify the procedures to be adopted for the cancellation of an access pass.

Security Equipments used in airport

Security equipment

- Responsibilities for the operation and maintenance of equipment
- Detailed description

a. X-ray equipment
b. Walk-through metal detectors
c. Handheld metal detectors
d. Whole-body imaging devices
e. Explosives detectors
f. Simulation chambers—location, type, and construction
g. Security gates, turnstiles, keys
h. Biometric devices for personal identification

Security control of VIPs

- Security control of VIPs and diplomats

1. National guidelines for special procedures
2. Procedures for VIPs and diplomats
3. Private or semiprivate arrangements for special passengers
4. Measures to limit arrangements to strict minimum
5. Procedures for dealing with diplomatic bags and diplomatic mail

- Security control for certain categories of passengers

1. Staff members, including crew members in uniform
2. Facilities and procedures for disabled passengers
3. Procedures for inadmissible persons, deportees, escorted prisoners

Security control of firearms and weapons

- Security control of firearms and weapons

a. National laws and regulations
b. Carriage of firearms on domestic and foreign aircraft
c. Authorized weapons carriage in the aircraft cabin (e.g., prisoner,escort, VIP escort, sky marshals)

- Protection of the aircraft on the ground

a. Responsibilities and procedures
b. Security measures for aircraft not in service
c. Positioning of aircraft
d. Use of intruder detection devices
e. Preflight security checks
f. Special measures available to operators on request

Contingency plans to respond to acts of unlawful interference

a. Categories

(1) Reception of unlawfully seized aircraft
(2) Bomb threat to an aircraft in flight or on the ground
(3) Bomb threat to a facility on the airport
(4) Ground attacks—ground to air and ground to ground

b. Responsible organizations

(1) Operational command and control
(2) Air traffic services procedures
(3) National aviation security agency (if constituted)
(4) Special services (location day/night)
(5) Explosive ordinance disposal units
(6) Armed intervention teams
(7) Interpreters
(8) Hostage negotiators
(9) Police authority

UNIT-IV
AIRPORT TECHNICAL SERVICES AND ACCESS

Course Learning Outcomes

CLOs	Course Learning Outcome
CLO13	Remember the airport technical services available in any airport.
CLO14	Understand the Tele-communication, meteorology and airport access.
CLO15	Remember the factors affecting airport access and its modes during airport operations.
CLO16	Understand the safety management system and Air Traffic control procedure.

The Scope of Technical Services

- Annex 11: Air Traffic Services
- Annex 10: Aeronautical Telecommunications (including navaids)
- Annex 3: Meteorology Services for International Air Navigation
- Annex 15: Aeronautical Information Services

Runway End Safety Areas (RESA) and Runway Excursion Guidance for Aerodromes," stated that "all Aerodrome Licence Holders are now required to assess the risk of a runway excursion on applicable runways where the RESA does not extend to the recommended distance for the runway code number

EMAS installation at Charleston Airport, West Virginia

Air Traffic Control

Future Air Navigation System (FANS), and while the name implied that its terms of reference were limited to the navigation function, it was charged with developing very wide-ranging operational concepts for ATC

Traditional ATC systems use analogue radio systems for aircraft CNS, and their ground-service methodology is still more tactical

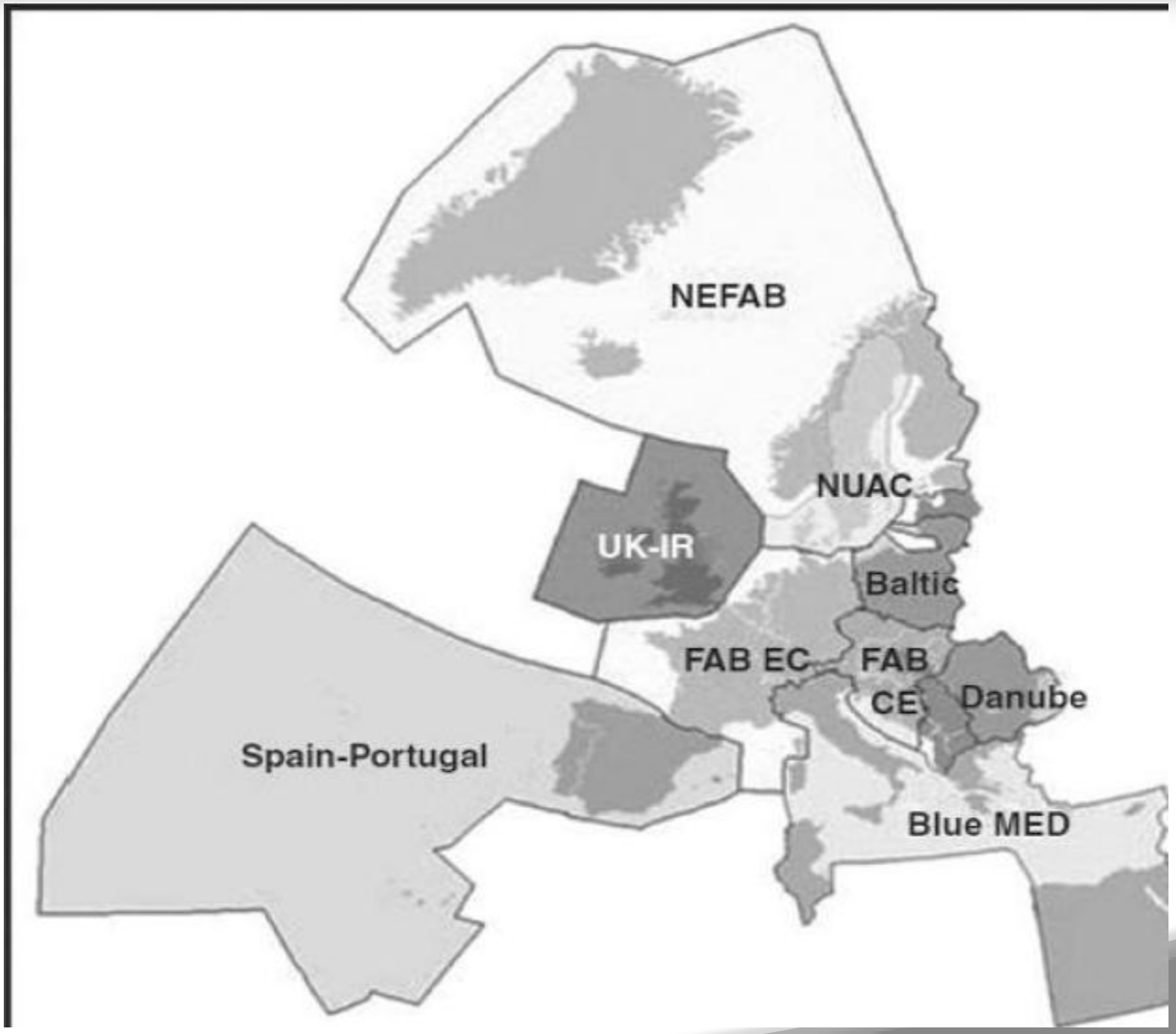
Function of ATC

- The primary purpose of ATC is the prevention of collisions between aircraft in flight and also between aircraft and any obstructions either moving or stationary on an airport.
- Efficient flow has tended to mean using up to the maximum capacity available in airspace, accepting that as the capacity limit is approached there will be an increasing level of delay.
- Central administration and management of air traffic services was vested in a governmental or quasi-governmental Agency.
- This was usually a civilian organization but might be the military authority in some countries.

International ATC Collaboration

- There has been considerable change over time in the way that the air traffic service function has been viewed internationally. Whereas it was always a “national” service, the advantage of imposing pannational service quality attributes has been long recognized.
- Europe in 1960, Eurocontrol was formed as a unit funded by national governments to address the fundamental.
- Air route traffic control centers (ARTCCs)
- One significant change in Europe is the introduction of new airspace regions, each one called a functional airspace block (FAB).

Planned FAB configuration for Europe



Airports can be affected by operational circumstances that affect capacity

- Weather (short term)—passing storm
  Weather (longer term)—snow accumulation
- Incident/accident—blocking runway/taxiway
- Work in progress—adding/servicing infrastructure
- Capacity deficiency in the terminal

General Flight Rules

Visual Flight Rules

- Each flight has to be conducted according to either visual flight rules (VFRs) or instrument flight rules (IFRs). In the case of VFRs, the **flight is conducted on a see-and-be-seen basis** in relation to terrain and other aircraft.
- It is therefore necessary for a pilot to have certain minimum weather conditions known as visual meteorologic conditions (VMCs).
- Anything worse than these conditions is referred to as instrument meteorologic conditions (IMCs).
- The weather criteria for visual flight are intended to provide to pilots an adequate opportunity to see other aircraft or obstructions in time to avoid collisions.

Instrument Flight Rules

- When visibility and/or proximity to clouds are less than the quoted VFR limits (VMC), flight has to be conducted under IFRs.
- Flight under IFRs in controlled airspace, the rules require that ATC must be notified of flight details in advance by what is known as a n ATC flight plan.
- Another of the rules requires that an instrument flight must be conducted at a minimum height of 1,000 feet (300 m) above the highest obstacle within 5 miles (8 km) of the aircraft's position.
- Flights may, of course, be conducted under IFRs outside controlled airspace and therefore not receive a specific level assignment from ATC.

Classes of Airspace

There are several different classes of airspace that relate to the varying level of provision of air traffic services

Class	Type of Flight	Separation Provided	Service Provided	Speed Limitation*	Radio Communication Requirement	Subject to an ATC Clearance
A	IFR only	All aircraft	Air traffic control service	Not applicable	Continuous two-way	Yes
B	IFR	All aircraft	Air traffic control service	Not applicable	Continuous two-way	Yes
	VFR	All aircraft	Air traffic control service	Not applicable	Continuous two-way	Yes
C	IFR	IFR from IFR IFR from VFR	Air traffic control service	Not applicable	Continuous two-way	Yes
	VFR	VFR from IFR	1) Air traffic control service for separation from IFR; 2) VFR/VFR traHic information (and traffic avoidance advice on request)	250 kt IAS below 3,050 m (10,000 ft) AMSL	Continuous two-way	Yes
D	IFR	IFR from IFR	Air traffic control service, traffic information about VFR flights (and traffic avoidance advice on request)	250 kt IAS below 3,050 m (10,000 ft) AMSL	Continuous two-way	Yes
	VFR	Nil	IFR/VFR and VFR/VFR traffic information (and traffic avoidance advice on request)	250 kt IAS below 3,050 m (10,000 ft) AMSL	Continuous two-way	Yes

Separation Minima

The criteria used by ATC to determine the required spacing between aircraft to achieve safety are known as **separation minima.** These are specific criteria relating to vertical or horizontal distances or times established between aircraft. In the vertical plane, IFR aircraft are separated by being required to fly at different altitudes or flight levels3 so that they are 1,000 feet (300 m) apart up to FL290 and 2,000 feet (600 m) apart from FL290 upward.

Horizontal separation is classified into three groups: lateral, longitudinal, and radar. Aircraft are laterally separated if their tracks diverge by a minimum angular amount with reference to a radio navigational aid, for example, 15, 30, or 45 degrees, or if they report over different geographic locations and thereafter they continue to move farther apart.

Telecommunications

The provision and maintenance of suitable aviation communication and navigation equipment and facilities are worldwide requirements. International aeronautical telecommunications services are formally classified
As for civil aviation and, as such, are

- Fixed services
- Mobile services
- Radio navigation services
- Broadcasting services

In the Unites States, there is Aeronautical Radio, Inc. (ARINC), which has progressed from providing airlines with voice communications to a comprehensive data network service, including an aircraft communications addressing and reporting system (ACARS).

CONTD----

ARINC is airline-owned, as also is another airline cooperative effort, the telecommunications network Societe International de Tele-communications Aeronautique (SITA), based in Europe.

Fixed Services

- Distress messages and distress traffic
- Flight safety
- Meteorologic
- Flight regularity
- Aeronautical administration
- Notices to Airmen (NOTAM) distribution
- Reservations
- General aircraft operating agency

Mobile Services

In the context of telecommunications, the term mobile refers to the service being provided for aircraft (moving vehicles), although the facilities provided by the individual government agencies are primarily fixed installations on the ground. Mobile service covers two vital aspects of aircraft movement:

- Communications
- Navigation

The major users of the communications facilities for air/ground and vice versa contact are aircraft, but to a very small extent they also may be used by ground vehicles moving on the airport.

Contd---

Depending on the volume of traffic at a particular airport and any adjoining airports, there may be as many as six or seven different channels used by ATC for various communications purposes. A typical international airport has separate frequencies for each of the following:

- Information service
- Approach control
- Aerodrome
- Ground control
- Clearance delivery
- Helicopters

The channels/frequencies used by ATC serving a particular airport are not necessarily operated from the airport itself.

Radio Navigation Services

- There are internationally agreed standards for radio navigation equipment laid down by ICAO. The technology used is not what ICAO specifies, but rather it is the minimum navigational performance specification (MNPS) of equipment used in certain applications.
- The oldest type of radio aid in use is the non directional beacon (NDB). It is akin to the nautical lighthouse, radiating a non directional signal to which the aircraft receiver can determine a direction relative to the aircraft's heading.
- The NDB is still very widely available, especially as a "locator" beacon for guidance toward precision navigation aids such as ILS.

Contd-----

- The basic short-range navigation aid, found in the vicinity of airports and across almost all populated areas of the world, is the VHF omnidirectional range (VOR) beacon.
- This is usually regarded as accurate to ±1 degree because it is unnecessary to promulgate operations with greater navigation requirements.
- A pilot can select a radial (specified by a number between 1 and 360). The number will correlate with the magnetic directions associated with the beacon's position, and the radio aid guides the crew, or autopilot, to fly to or from the VOR station.
- VOR beacons provide directional guidance only and are usually colocated as ground stations with distance-measuring equipment (DME) that provides an accurate distance from the facility

Satellite Navigation

- Global Positioning System (GPS) is a system synonymous widely in the public domain with the way that satellite navigation has developed, but it was simply the first allen compassing system.
- GPS needed a “constellation” of 18 satellites, 6 spaced in three orbits, with about a 12-hour orbital period, to be fully operational because a user has to be able to receive a signal from at least four satellites at any point in time to determine precise position.

Broadcast Services

- A great deal of information relating to air navigation is required by aircraft in flight or about.
- Such information on weather and airport and radio aids serviceability is of particular importance to depart.
- The telecommunications agency of each country makes available suitable broadcast facilities and is required by international agreement to publish details of the frequencies used and times of broadcasts.
- Automatic Terminal Information Service (ATIS) has for many years been the most common type of broadcast concerned with airport operations.
- It is a recorded broadcast on either the voice facility of a nearby VOR beacon or a discrete radio frequency of its own.
- VOLMET is volume meteorologic information for aircraft in flight and comprises both reports of actual weather conditions at specified airports and also landing forecasts.

- Broadcasts are made via the “mobile” service on both VHF and HF. High frequencies (HF).
- More cost-effective means of serving crew requests for meteorologic data is through digital data links, such as ADS-B and ACARS. are assigned for broadcasts to North Atlantic flights.
- The existing VOLMET will be retained while there is a need for redundancy, and in many scenarios, it is forecast to be retained almost indefinitely.
- Message formats are being retained, and details of the information sent in this way are given in the following section.

Meteorology

Function Aviation meteorologic services are provided by governmental organizations in all ICAO Member States, and their services are organized to conform with ICAO Annex 3. Some countries employ their military to produce aviation-related weather products, but most use the civil meteorologic organization.

Meteorologic Observations and Reports

Meteorologic observations are vital to forecasting, and reports are generated by meteorologic services worldwide. Four types of routine observations of surface weather have been established by ICAO.

- Aviation routine weather report (METAR)
- Aviation selected special weather report (SPECI)
- Local routine met report (met report)
- Local special met report (special)

Aircraft Meteorology Data Relay (AMDAR)

- AMDAR is an initiative by both the World Meteorological Organization (WMO) and ICAO to exploit data available from the sensors used on board most modern airliners.
- The system is intended to automatically relay relevant meteorologic data such as wind direction, speed, temperature, and pressure.
- While intended to supplement sounding data, AMDAR potentially allows for a huge amount of data in critical areas as well as such areas where no soundings are available.

Terminal Airport Forecasts

Terminal airport forecasts (TAFs) are generated for regional and international airports by the meteorologic services of each country. Usually TAFs are provided for airports also providing METARs. They are normally issued four times a day, and the forecasts cover between 9 and 30 hours ahead. They use the same code and terminology as METAR but with a few additional code groups to define time frames and certain data items.

Significant weather forecasts include the following elements:

- Information about tropical cyclones
- Squall lines
- Moderate or severe turbulence
- Moderate or severe icing
- Sand and dust storms
- Cumulonimbus clouds and thunderstorms
- Volcanic ash information on active volcanoes
- Jet streams
- Flight level of the tropopause
- Information about the position of nuclear accidents

SIGMETs/AIRMETs

- Significant meteorologic information (SIGMET) and airmen's meteorologic information (AIRMET) messages are weather advisories directed at pilots concerning phenomena that may jeopardize the flight safety of aircraft flying in the area covered by the advisory.
- SIGMETs advise of severe phenomena such as icing, turbulence, volcanic ash, thunderstorms, and other convective phenomena, as well as mountain waves and
- Radioactive contamination from sea level to FL600.
- SIGMETS are disseminated worldwide, but AIRMETS usually have a lower dissemination range.
- AIRMETs and SIGMETs are published using numbering from 1 for the first message in a day in ascending order until the end of the day.

Aeronautical Information

considerable amount of aeronautical information such as ATC requirements (including airspace restrictions), airport layout, hours of operation, and availability of fuel. The requirement is multiplied many times over if an international flight is involved.

- Aeronautical information service is responsible under
- international agreement for
- The preparation of an aeronautical information publication (AIP)
- The origination of NOTAMs
- The origination of aeronautical information circulars (AICs)

In preparing an AIP, there is a laid-down format

Part 1: GEN, General

Part 2: ENR En route Part 3: AD Aerodrome

Airport Access

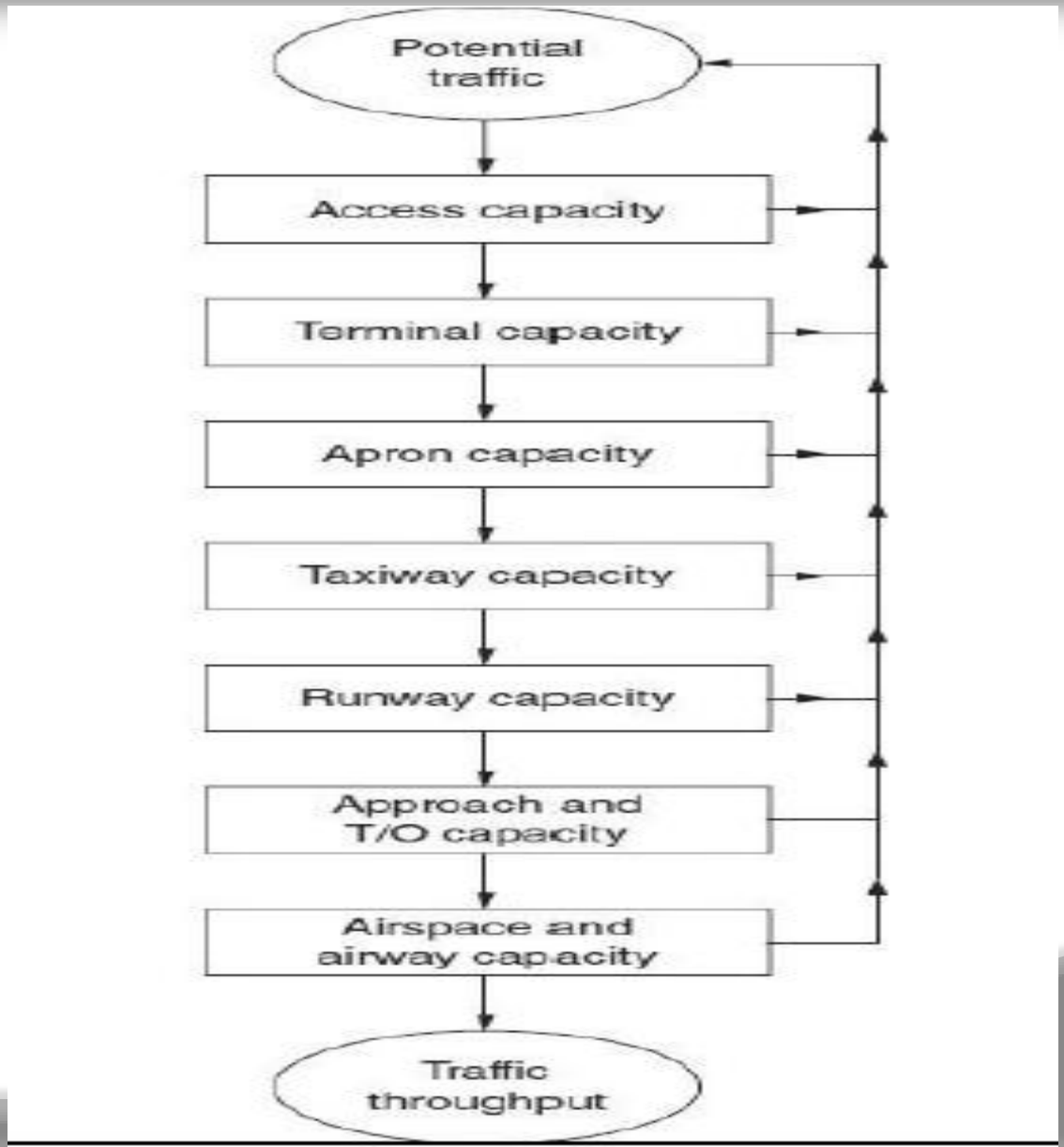
Access as Part of the Airport System

Therefore, the airport administrator has an unavoidable vital interest in the whole area of access and accessibility, perhaps one of the most difficult problem areas to face airport management.

An administration might have to watch severe deterioration in its own operations owing to problems outside the limits of the airport itself, conditions over which the airport operator appears to have less and less direct control.

Next Figure is a conceptualized diagram indicating how potential outbound passengers and freight traffic through an airport will be subject to capacity constraints at the various points in the system

Sequential capacity constraints on outbound airport throughput



Formulations of Access in an Airport

$$MTAO = \frac{365 \times 0.90 \times RCAP \times PPV}{ASOP \times CHTF \times ANPO} \qquad (13.1)$$

$$AEDT = \frac{MTAO \times ASOP \times ANPO}{365 \times PPV} \qquad (13.2)$$

CHTF x AEDT = RCAP x 0.90

AEDT = average number of vehicles entering the central terminal area in the prior six months
ANPO = average number of annual passengers per actual air operation in the prior six months
ASOP = actual number of air operations divided by the proposed number for the prior six months
CHTF = critical-hour traffic factor: the three-hundredth highest hour of vehicular traffic during the prior 12 months divided by the average number of vehicles entering the central terminal area daily
MTAO = Maximum Takeoff and Approach operations
PPV = average number of air passengers per inbound vehicle
RCAP = entering central terminal area roadway capacity in terms of vehicles per hour
0.90 = constant

Access Users and Modal Choice

Airport passengers often, but not always, constitute the majority of persons entering or leaving an airport. Excluding individuals making trips as suppliers to the airport, the airport population can be divided into three categories:

a. Passengers—originating, destined, transit, and transfer
b. Employees—airline, airport, government, concessionaires, and such
c. Visitors—greeters, senders, sightseers

All but the transit and transfer passengers make use of the access system. Table shown next slide lists the spread of breakdowns of airport “populations” that have been found over time by a number of surveys. It can be seen that the range of values is very large

Proportion of Passengers, Workers, Visitors, and Senders/Greeters at Selected Airports

Airport	Passengers	Senders and Greeters	Workers	Visitors
Frankfurt	0.60	0.06	0.29	0.05
Vienna	0.51	0.22	0.19	0.08
Paris	0.62	0.07	0.23	0.08
Amsterdam	0.41	0.23	0.28	0.08
Toronto	0.38	0.54	0.08	Not included
Atlanta	0.39	0.26	0.09	0.26
Los Angeles	0.42	0.46	0.12	Not included
JFK	0.37	0.48	0.15	Not included
Bogota	0.21	0.42	0.36	Negligible
Mexico City	0.35	0.52	0.13	Negligible
Curacao	0.25	0.64	0.08	0.03
Tokyo	0.66	0.11	0.17	0.06
Singapore	0.23	0.61	0.16	Negligible
Melbourne	0.46	0.32	0.14	0.18
U.S. Airports	0.33–0.56	—	0.11–0.16	0.31–0.42 (includes senders and greeters)

Percentages of Airline Passengers with Origin or Destination

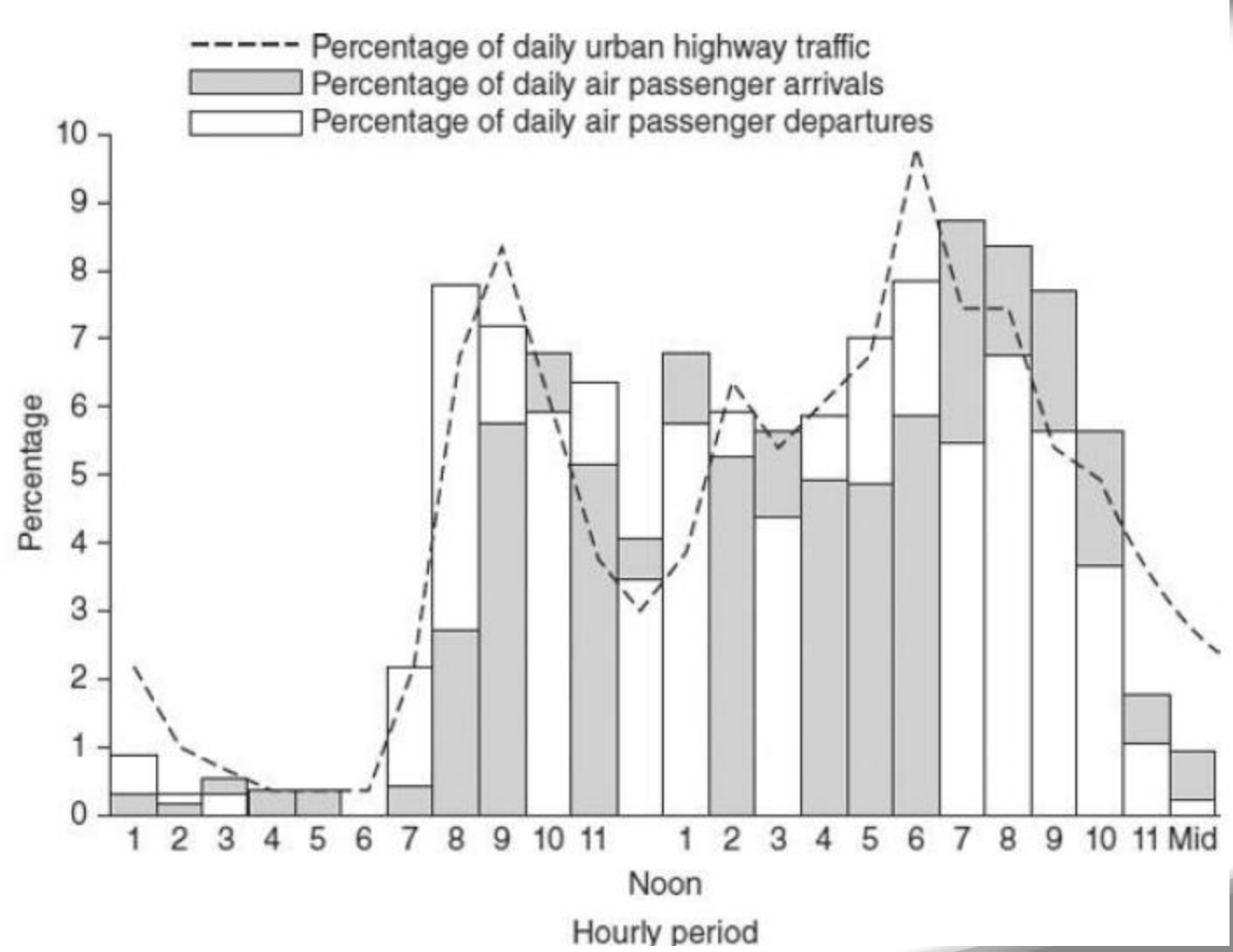
	Distance from Airport to CBD (miles)	Percent of Passengers Oriented to CBD
United States		
New York (LGA)	6.5	46%
New York (JFK)	11.5	32% (to Manhattan)
Atlanta (ATL)	7.5	7%
Chicago O'Hare (ORD)	15.5	14%
Baltimore/Washington	10.0	14% (to central Baltimore)
Reagan Washington National (DCA)	2.0	33% (to central Washington)
Chicago Midway (MDW)	9.0	20%
Philadelphia (PHL)	6.3	14%
Denver (DEN)	7.5	20% (of nonresident business passengers)
United Kingdom		
London Heathrow (LHR)	16	29%
London Gatwick (LGW)	24	21%
Liverpool (LPL)	6	37%
Manchester (MAN)	8	11%
Glasgow (GLA)	6	28%
Birmingham (BHX)	7	25%
Newcastle (NCL)	6	17%

CBT_ Central Business District

Access by Car or Taxi for Selected Airports

	Percent Car or Taxi	Public Transport Available
Oslo	37	Yes (bus and rail)
Hong Kong	40	Yes (bus and rail)
Tokyo Narita	40	Yes (bus and rail)
Geneva	55	Yes (bus and rail)
London Heathrow	58	Yes (bus and rail)
Munich	61	Yes (bus and rail)
Zurich	65	Yes (bus and rail)
London Gatwick	65	Yes (bus and rail)
London Stansted	68	Yes (bus and rail)
Paris Charles de Gaulle	69	Yes (bus and rail)
Frankfurt	70	Yes (bus and rail)
Amsterdam	70	Yes (bus and rail)
Brussels	74	Yes (bus and rail)
Paris Orly	77	Yes (bus and rail)
San Francisco	79	Yes (bus and rail via shuttle)
Boston Logan	82	Yes (bus and rail via shuttle)
Washington Reagan	83	Yes (bus and rail)
Los Angeles	87	Yes (bus and rail via shuttle)
Chicago Midway	88	Yes (bus and rail)
Chicago O'Hare	91	Yes (bus and rail)
Atlanta Hartsfield	92	Yes (bus and rail)
New York JFK	92	Yes (bus and rail via shuttle)

Air passenger traffic patterns in the San Francisco



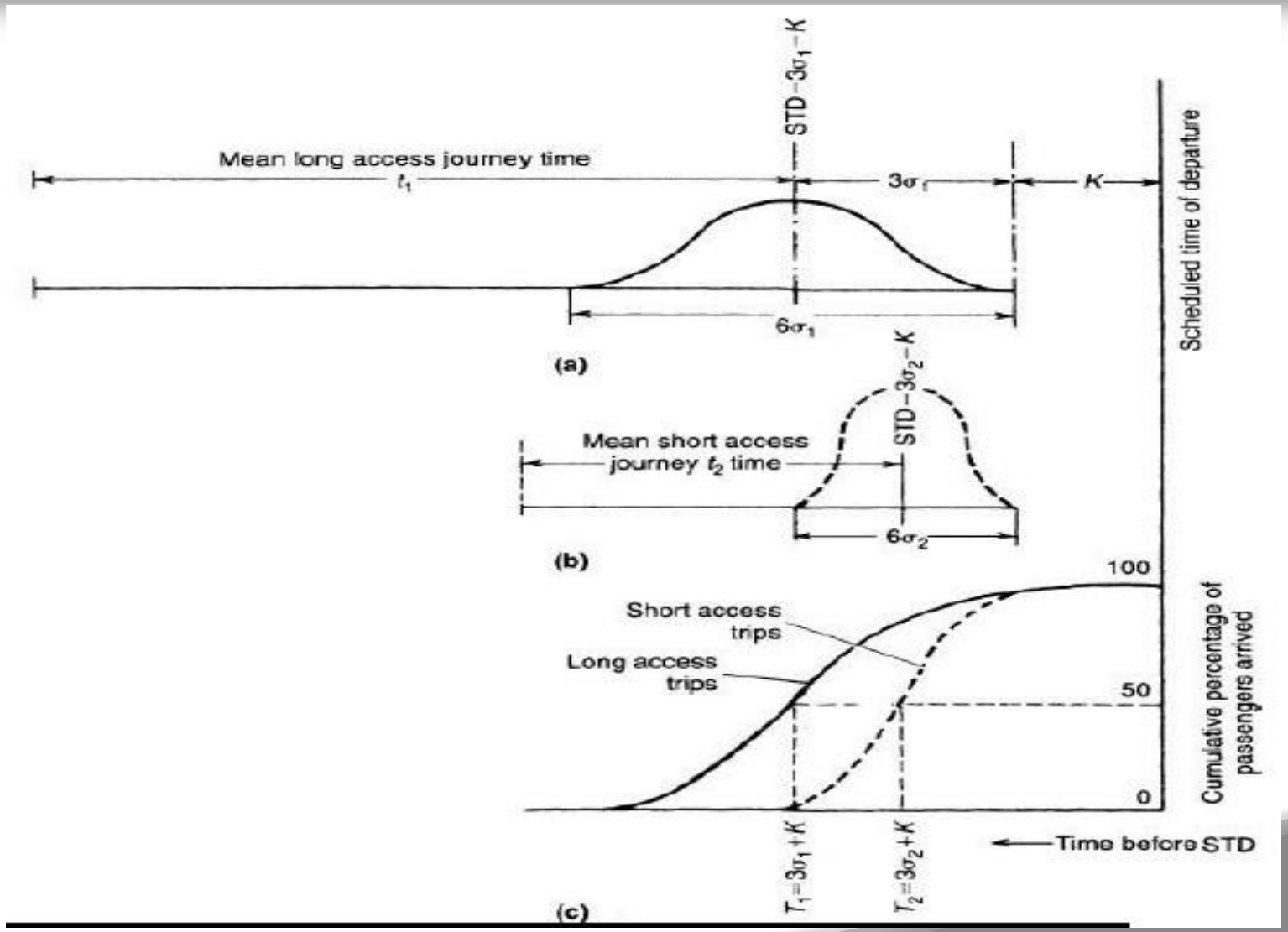
Access Interaction with Passenger Terminal Operation

- Terminal problems can affect the amount of time that the departing passenger spends in the terminal
- Short dwell times in terminals require few facilities.
- Departing passenger who places most demands on the airport terminal system.
- Departing dwell times depend
- Chiefly on the length of access time, reliability of access time, checkin and security search requirements, airline procedures, and the consequences of missing a flight

Length of Access Time

a. It is likely that the amount of time for a particular access journey is a random variable that is normally distributed about its mean value.
b. It is reasonable to assume that the variance of the individual journey time about the mean is in some way proportional to the mean.

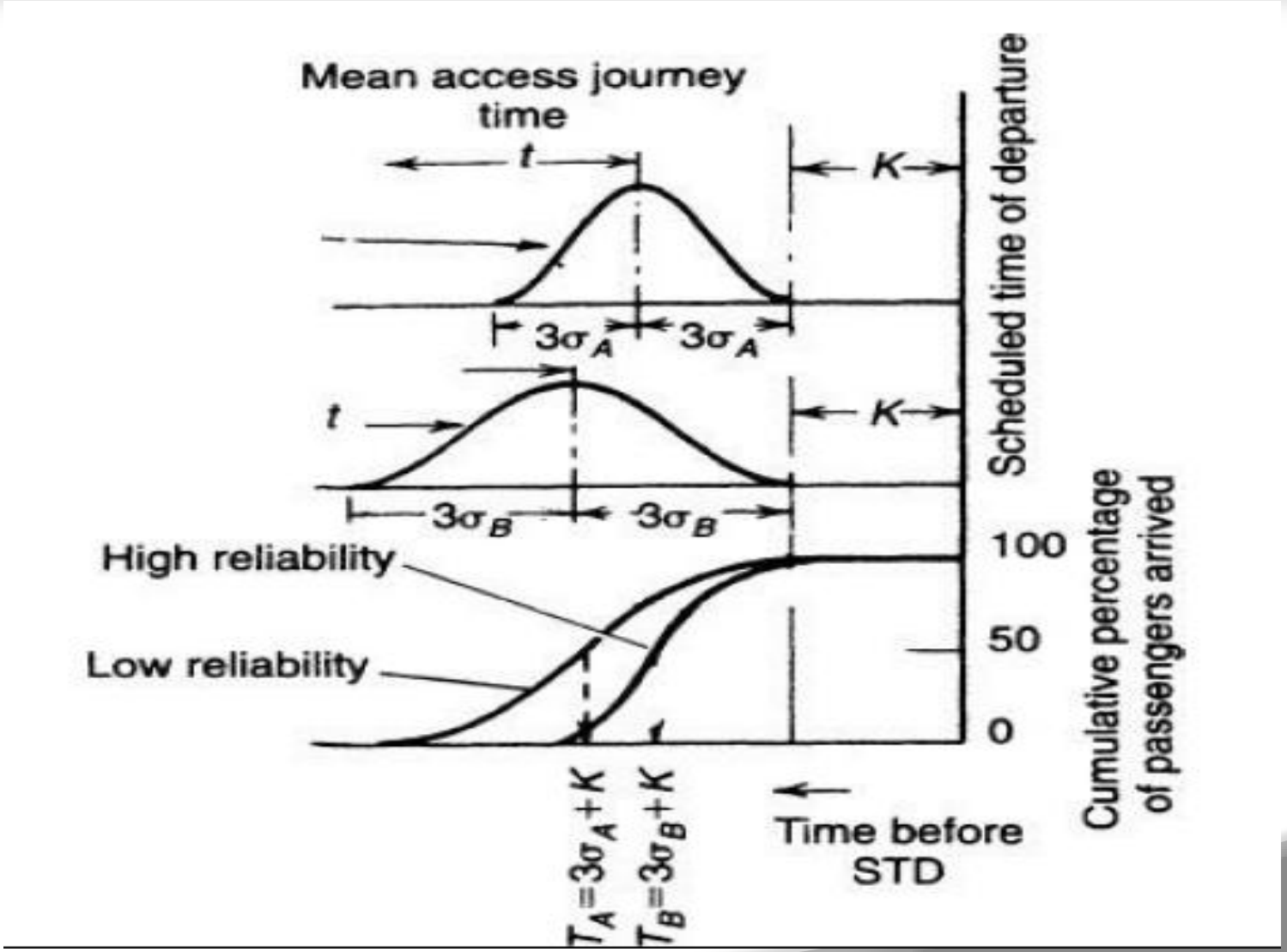
Comparison of passenger terminal dwell times for long-and short-access



Reliability of Access Trip

The effect of reliability on departing terminal dwell times is shown in next Figure. If there are two access trips each with the same mean trip time of t but with standard deviations of σA and σB, it can be seen that the mean terminal dwell time, under assumptions of normality and 99.5 percent arrivals by K minutes before STD, are 3σA + K and 3σB + K, respectively. The effect on the cumulative curve is demonstrated to be a more gradual slope for low reliability access. Access routes with very low reliability can result in very long average passenger dwell times in the terminal.

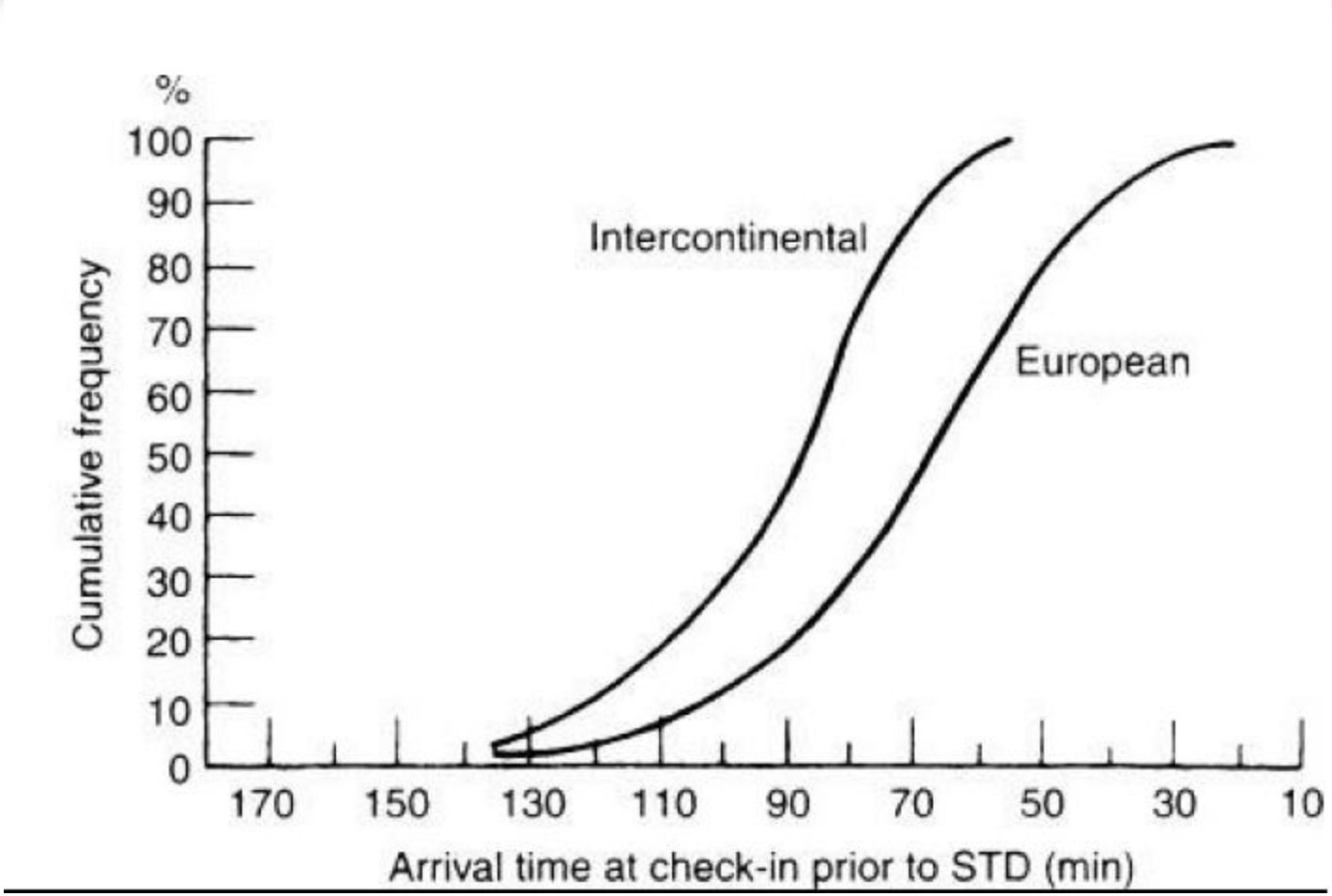
Effect of reliability of access times on passenger terminal dwell times



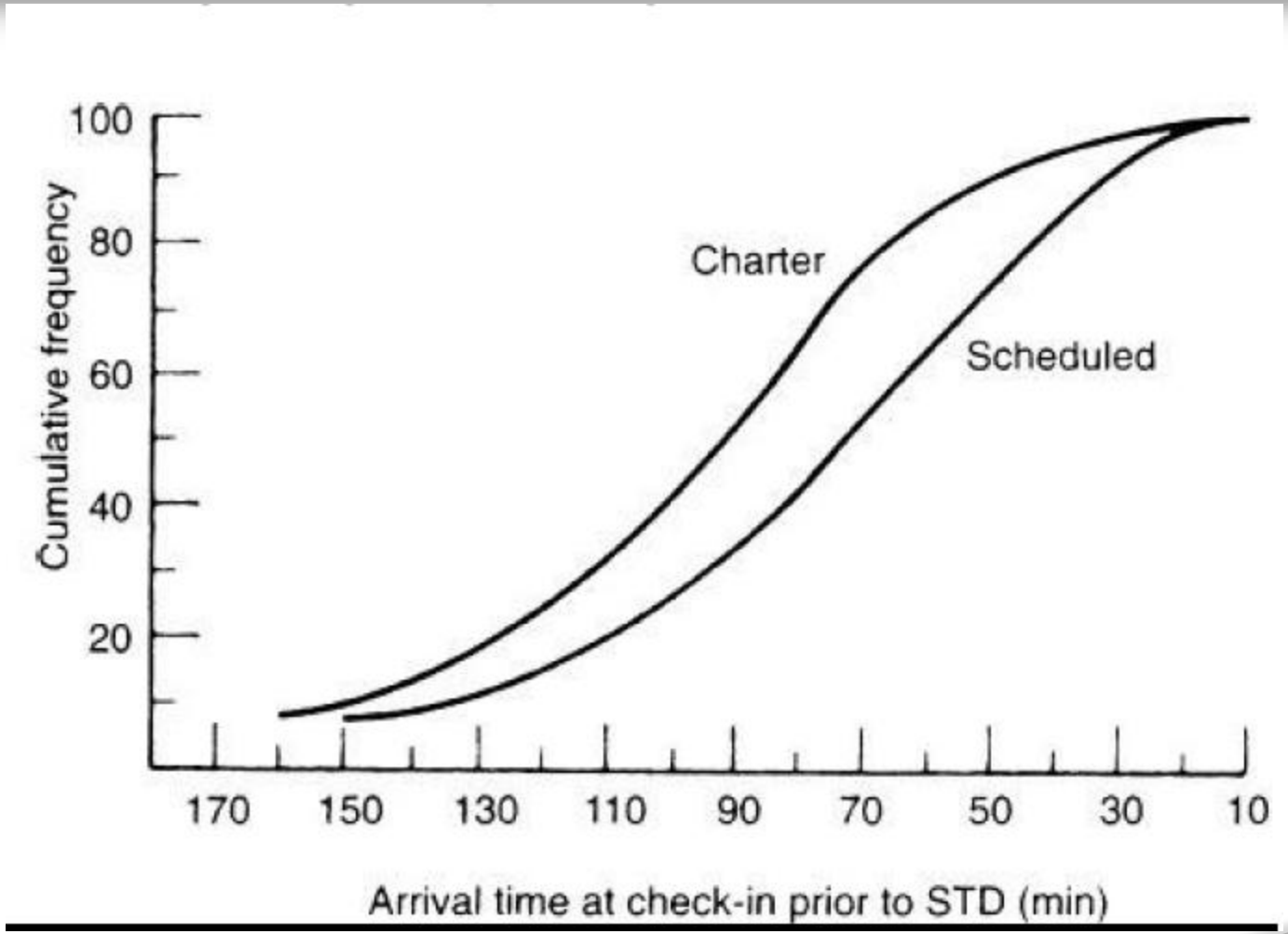
Checkin Procedures

- Checkin requirements are not the same for all flights. For many long-distance international flights, checkin times are a minimum of one hour before scheduled time of departure,
- whereas for domestic and short haul international flights, this is usually cut to 30 minutes.
- The effect is a leftward shift of the cumulative arrival curve; an example of this can be seen on the passenger data from Manchester International Airport.
- With long-haul passengers spending an average of 22 more minutes in the terminal than short haul passengers.
- Similar differences are often observed between checkin procedures for chartered and scheduled passengers.
- Passenger on a charter flight to receive instructions to check in at least 90 minutes before scheduled departure

Effect of flight length on passenger terminal dwell times



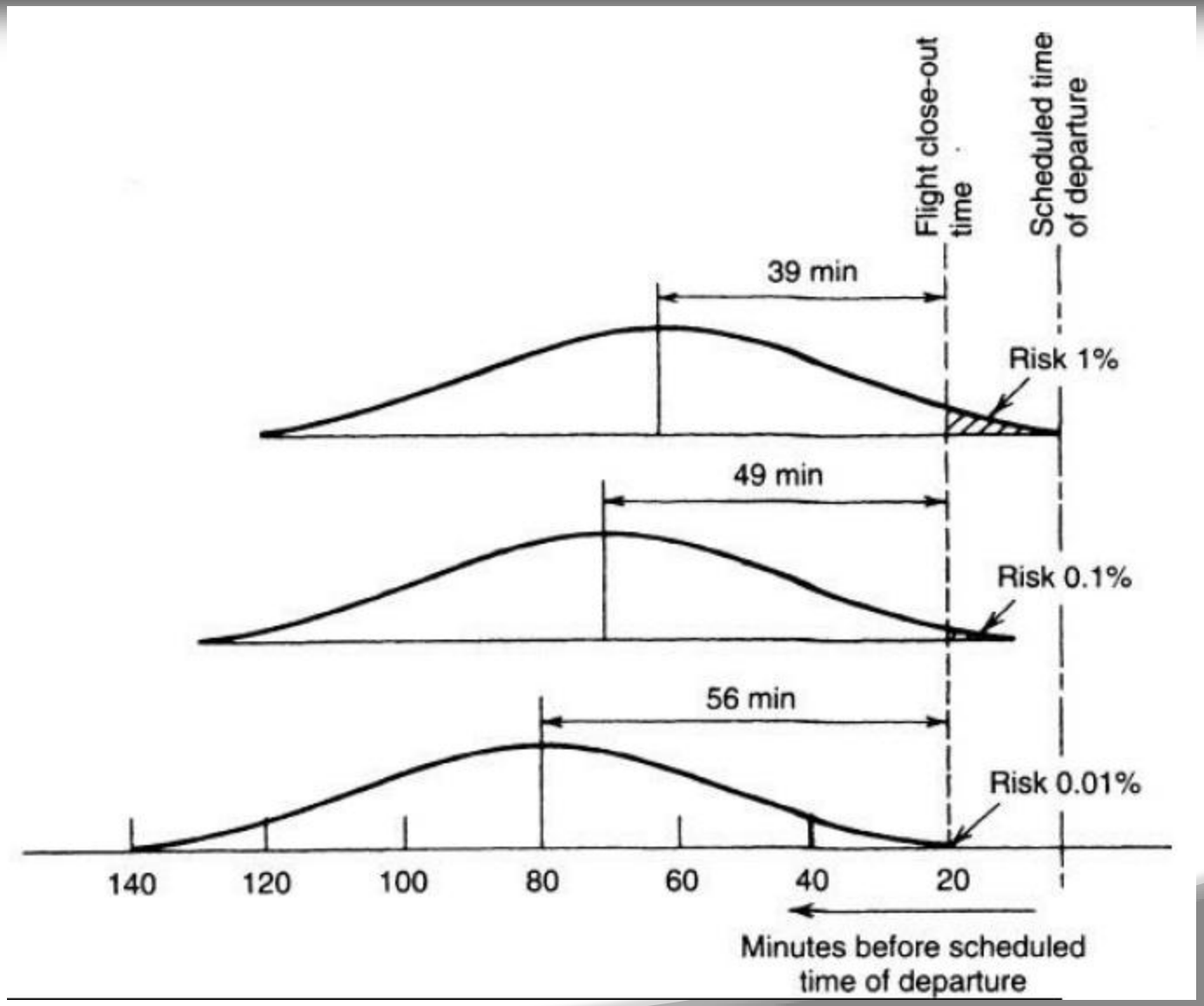
Effect of flight type on passenger terminal dwell times



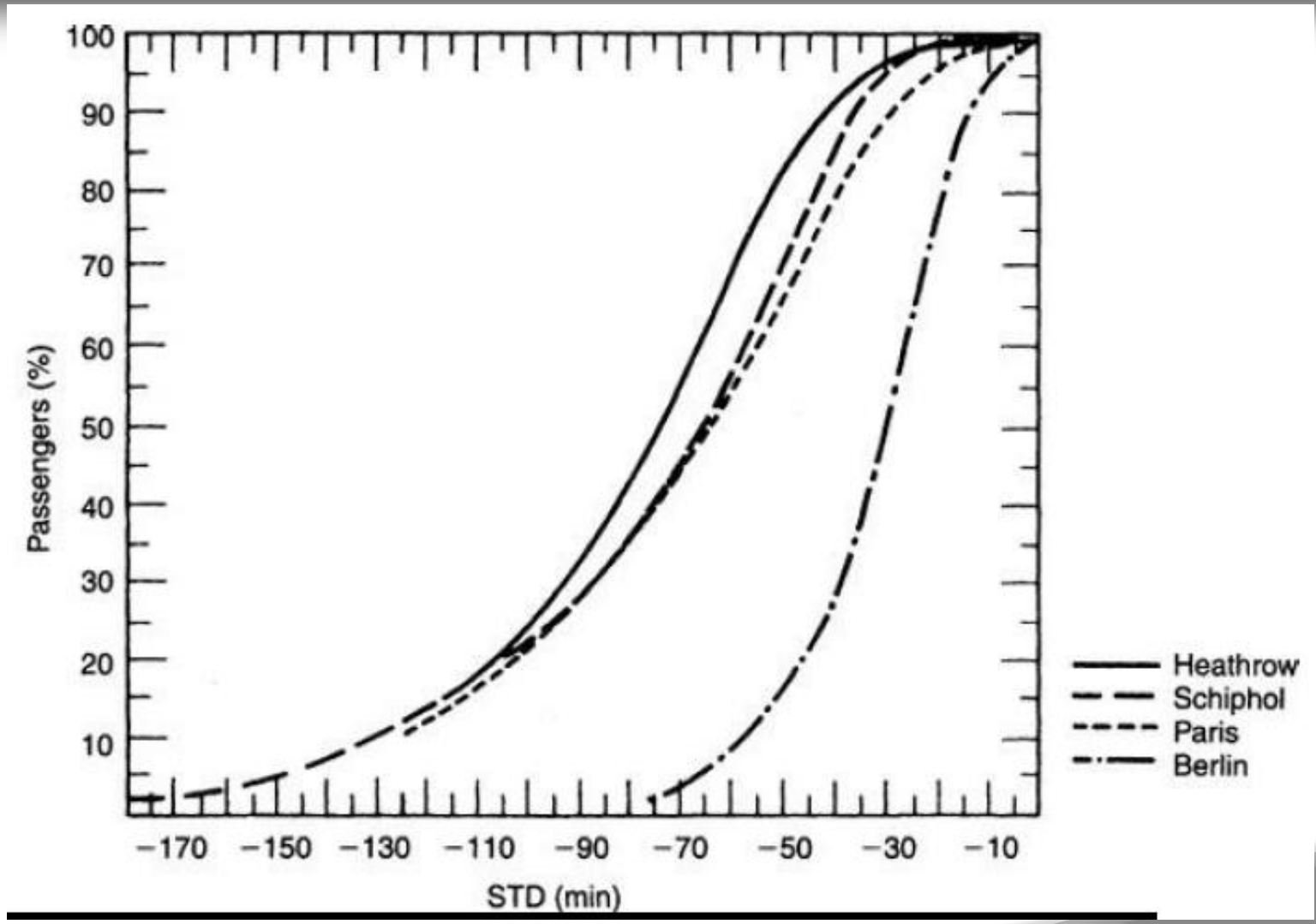
Consequences of Missing a Flight

- Depending on the type of flight and the type of ticket, the passenger will have a very different attitude toward arriving after the flight has closed out and consequently missing the aircraft.
- This can be exemplified by considering a hypothetical trip maker making three different flights from Tampa International Airport. The first flight is on a normal scheduled ticket at full fare to Miami; the second is on a normal scheduled full-fare ticket to Buenos Aires.
- In the case of the second flight, the ticket remains valid, but because the connections will now be lost and there might not be an alternative flight rapidly available chartered holiday flight to London.

Effect of the risk of missing a flight



Checkin times for passengers prior to scheduled time of departure



Access Modes

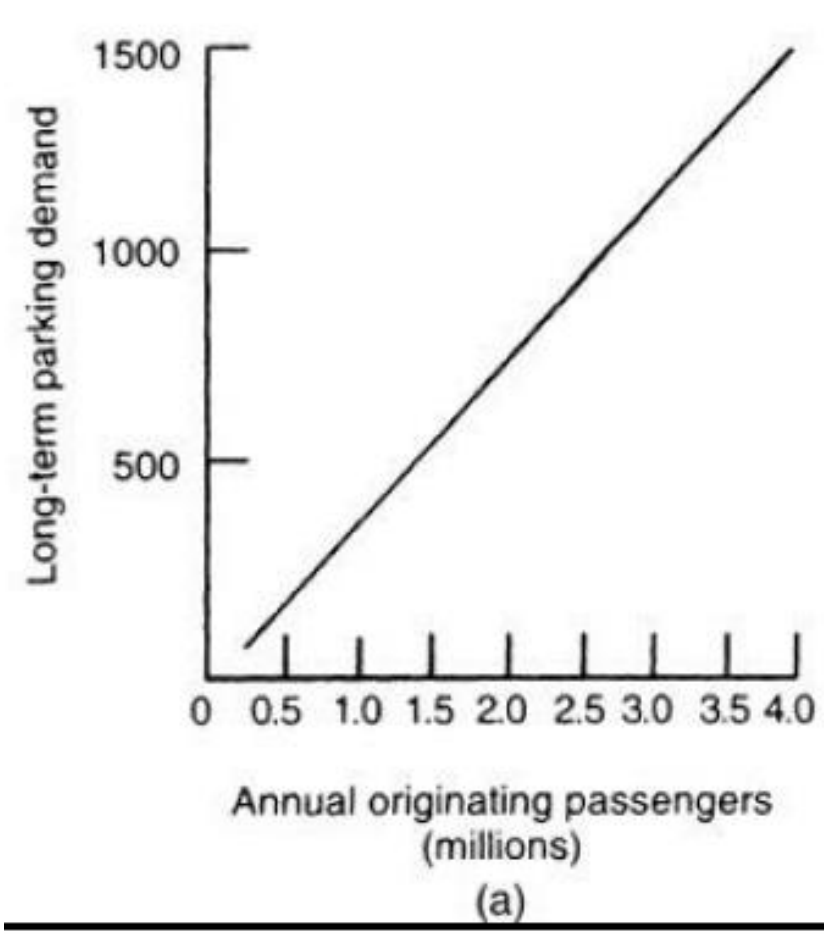
Automobile

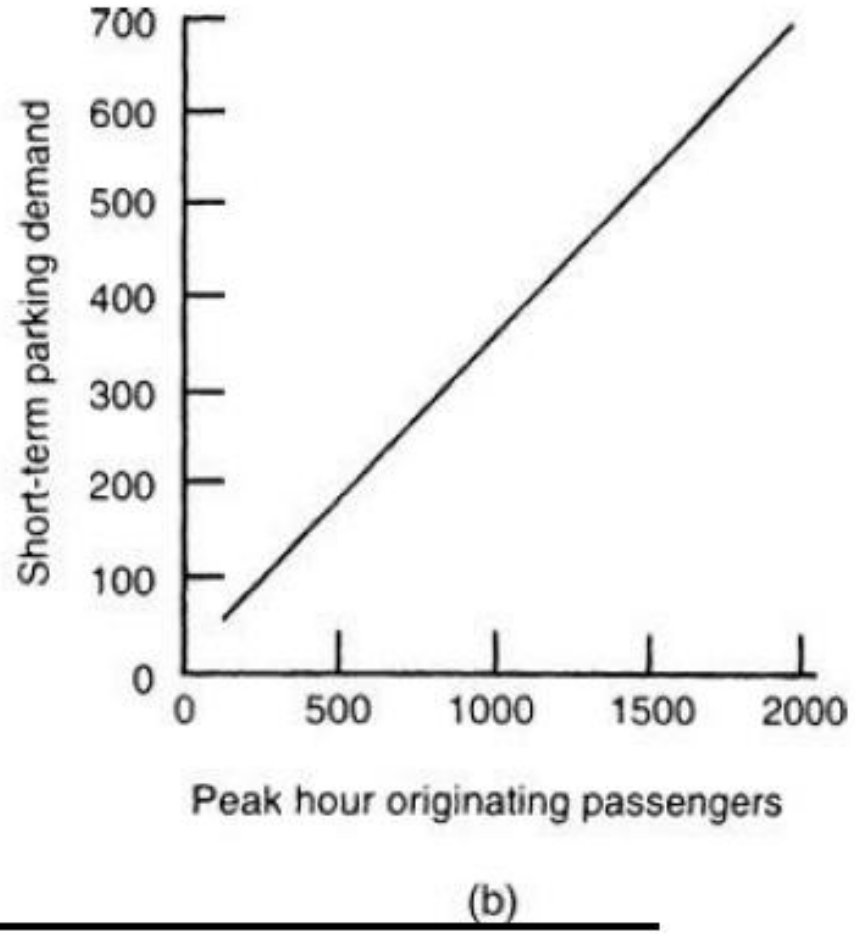
In most developed countries, the private car is the principal method of accessing airports. This has been the case since the inception of commercial air transport, and the situation seems most unlikely to change in the foreseeable future. As a consequence, airports must integrate a substantial parking capability into their design and operation.

As airports grow in size, it becomes difficult to provide adequate parking space within reasonable walking distance of the terminals.

It is common to divide the parking areas into short-term facilities close to the terminal and both medium-and long-term parking areas often served by shuttle services

Long-term parking demand related to annual originating passengers





Taxi

- For the air traveler, the taxi is perhaps the ideal method of accessing the airport from all aspects except one—cost.
- This mode involves the least difficulty with baggage, is highly reliable, operates from a real origin or destination, and provides access directly to the airport curbside Unfortunately, it can be comparatively expensive.
- Personally owned car and is likely to incur high parking charges for an extended parking stay.
- The airport operator normally has two principal interests with respect to taxi operations at the airport: (1) the balance of supply and demand and (2) the financial arrangements with taxi operators

Limousine

- Minibuses or large automobiles that provide connection between the airport and a number of designated centers (usually hotels) in the city.
- The limousine company pays the airport operator in exchange for an exclusive contract to operate a service to provide access according to an agreed-on schedule.
- In small cities, the limousine usually operates to only one central location; in larger cities, to designated multiple locations.
- Operationally, a limousine is similar to a bus, and where bus services are feasible, it is unusual to have limousines as well

Rail

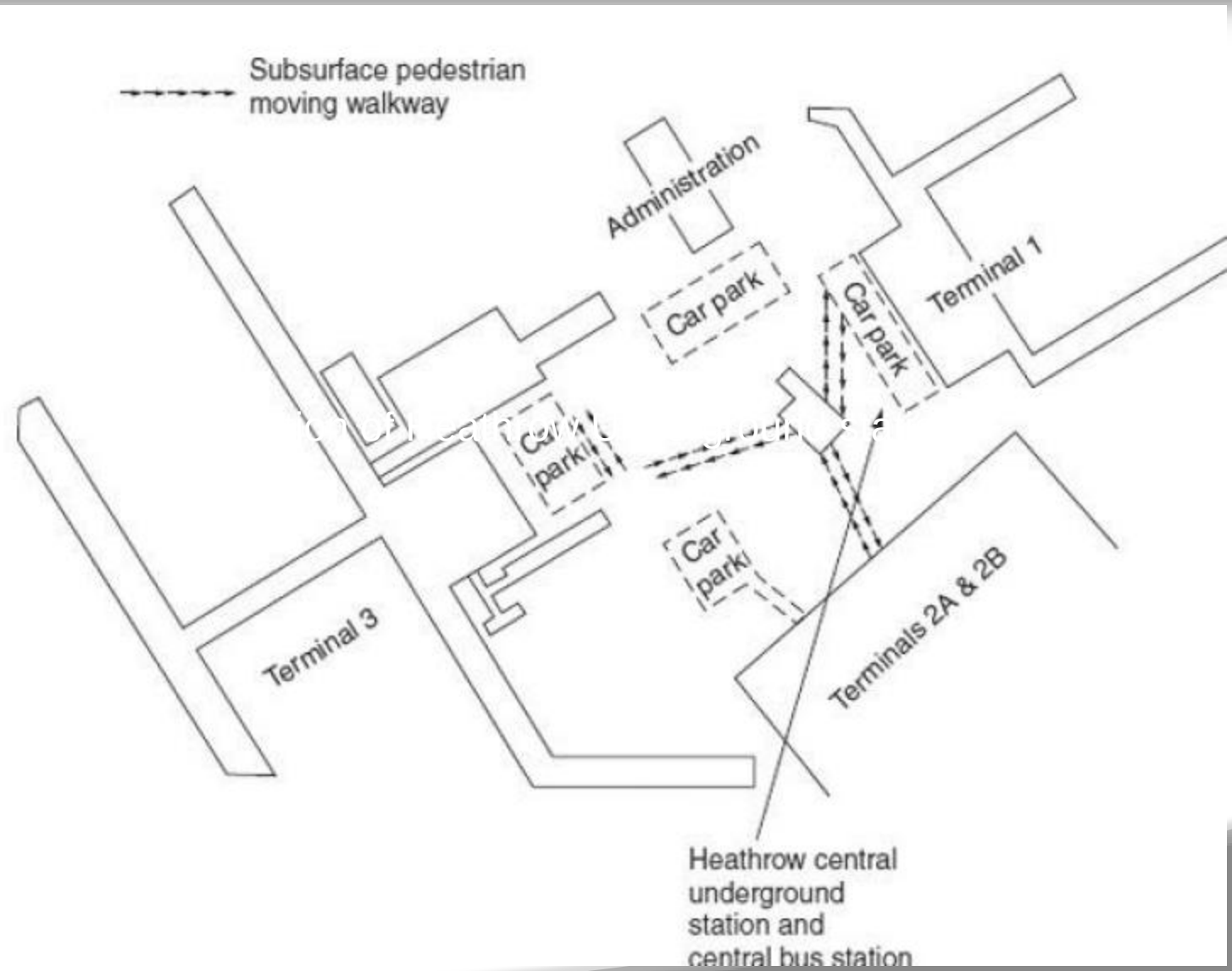
The rail access facilities fall into three categories:

Provision of a connection into an existing rail **rapid-transit system**—for example, Atlanta, Chicago O'Hare, Ronald Reagan Washington National, Paris Charles de Gaulle, and London Heathrow

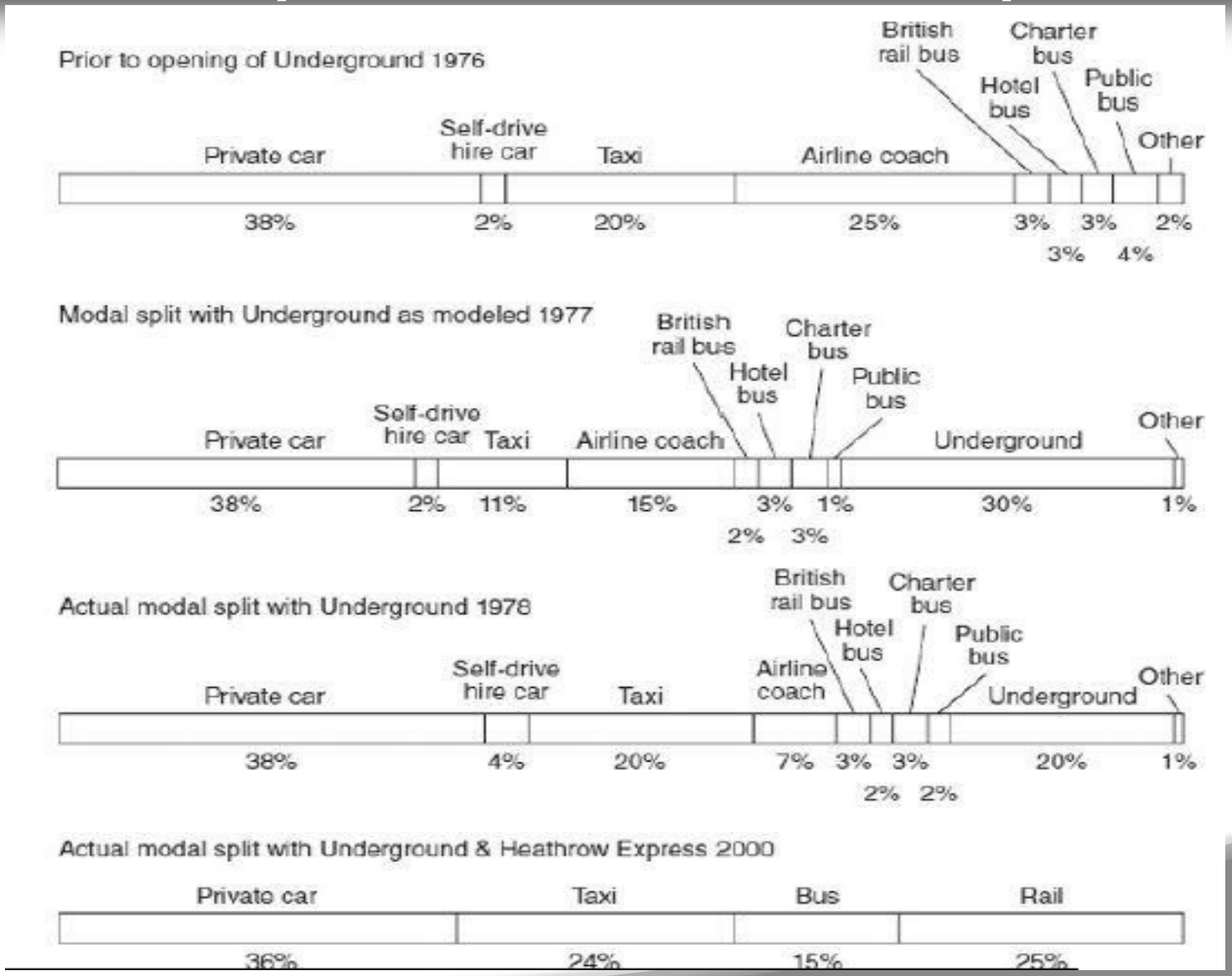
Direct connection to an existing national intercity rail network—for example, Zurich Kloten, Schiphol Amsterdam, Frankfurt, London Gatwick, and Brussels

Dedicated link from airport to city center location or locations—for example, Munich, Oslo, Beijing, Incheon, and Shanghai

Location of Heathrow Underground station



Effect of providing Underground (rapid transit) link on access modal split



Bus

- All airports carrying reasonable volumes of passengers by scheduled and charter operators are connected by bus to the city center.
- This is arranged by a contract between the bus operator and the airport authority.
- The bus company usually pays the airport a concessionary fee.
- Service is supplied to a number of points in large cities but perhaps to only one point in a small urban area.
- Buses are an extremely important mode of access.
- Many airports therefore emphasize bus access and supply sophisticated curbside bus bays and bus unloading arrangements.

Bus bays at London

Bus bays at London Heathrow

Remote bus park

Remote bus park for Caribbean resort airport

Factors Affecting Access-Mode Choice

Lo The level of traffic attracted to any access mode is a function of the traveler's perception of three main classes of variables:

- Cost
- Comfort
- Convenience

Decisions in terms of these variables are made not only on the level of service provided by a particular mode but also on the comparative level of service offered by competing access modes. In addition to making an out-of-pocket price comparison, the traveler makes a decision based on the level of comfort and convenience provided by the various modes.

Factors Affecting Model Choice

Car	Bus	Rail
Ease of loading and unloading	Location of bus terminal	Location of terminal within airport
Distance baggage must be carried and difficulties such as stairs	Speed and reliability of service	Need to use shuttle bus to reach terminal at airport end
Ease of finding long- or short-term parking	Whether specialized express service of part of urban bus network	Difficulty in handling baggage
Access-route congestion and Travel-time reliability	Difficulty in handling baggage	Siting of station or stations in town relative to ultimate destination or to taxis, buses and other train terminals
Shuttle arrangements for long-term car parks	Siting of in-town terminal relative to ultimate destination or to taxis, buses, and trains	
Vulnerability of car to vandalism and theft		

Importance of Selected Attributes in Passengers' Choice of Access

Attribute	Rank
Ease of baggage handling	1
Convenience of transfer to check-in area	2
Expected access journey time	3
Comfort of mode	4
Parking space availability	5
Convenience of interchanges where more than one vehicle or mode is used	6
Actual journey time	7
Delay and congestion	8
Cost of mode	9
Overall opinion of access	10
Access information	11
Parking cost	12

UNIT-V

OPERATIONAL ADMINISTRATION AND PERFORMANCE

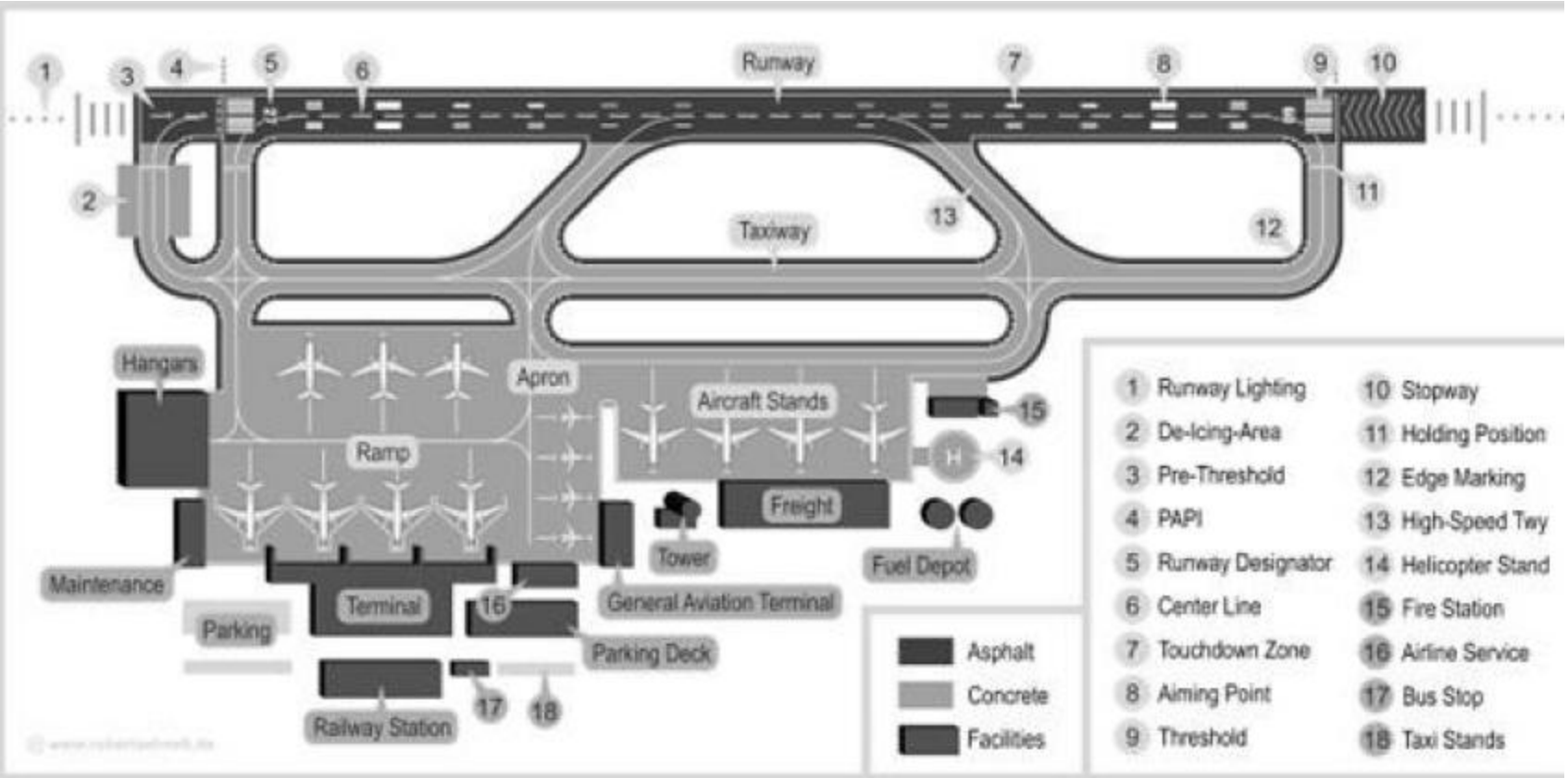
Course Learning Outcomes

CLOs	Course Learning Outcome
CLO13	Remember about the difference between general aviation and commercial airports.
CLO14	Understand the hub and its types used in airport system.
CLO15	Describe airport planning and master plan.
CLO16	Explain about forecasting, design alternatives and land use for the airport operations.

Strategic Context

a. Airport operations or airport logistics may be defined as the entire series of activities that must take place to process passengers and goods from surface and air transport modes to the aircraft.
b. These activities also may extend to accommodate users and merchandise transiting through the airport to connect to other flights.
c. Airport operations activities include guiding aircraft for landing, takeoff, and also maneuvering through the runways to parking positions at various sections of an airport; servicing aircraft; inspection services; passenger and luggage checkin; security screening processes; VIP handling

Schematic airport layout



Schematic airport layout

A strategic business plan (SBP)

a. comprehensive, action-orienting, top-level corporate plan which clearly defines, following a thorough analysis of the business environment in which it operates, the specific vision, mission, areas of excellence and the mission-critical objectives of the enterprise, the means to realize them and measure results as well as the financial implications of the overall corporate strategy.
b. SBPs drive the formulation and coordination of lower-level functional plans that support the realization of the overall corporate strategy in the context of predetermined and airport-specific areas of excellence.

Airport strategic business plan

Airport strategic business plan: Functional-level plans relationship

Determinants of service effectiveness.

Determinants	Definition	Examples
Reliability	Consistency of performance and dependability	Accuracy of billing Keeping records Performing the service at the designated time
Responsiveness	The willingness or readiness of employees to provide service	Calling the customer back quickly Giving prompt service
Competence	Possession of the required skills and knowledge to perform the service	Knowledge and skill of the contact personnel Knowledge and skill of operational support personnel
Access	Approachability and ease of contact	Reasonable waiting time to receive service Convenient hours of operation
Courtesy	Politeness, respect, consideration, and friendliness of contact personnel	Consideration for the customer's property Clean and neat appearance of the contact personnel
Communication	Keeping customers informed in language that they can understand and listening to them	Explaining the service itself Assuring the customer that a problem will be handled
Credibility	Trustworthiness, believeability, honesty	Company reputation Personal characteristics of the contact personnel
Security	Freedom from danger, risk or doubt	Physical safety Financial security
Understanding the customer	Making the effort to understand	Learning the customer's specific requirements Providing individualized attention

Tactical Approach to Administration of Airport Operations

the administration of airport operations should be subdivided in two different dimensions handled ideally by two different organizational units:

- Dimension one. Development and monitoring of the airport operations program incorporating LOS policies, procedures, processes, and Corresponding allocation of resources. Assigned to airport operations department.
- Dimension two. Ongoing execution of the airport operations program and service-delivery integration, optimization, and reporting.

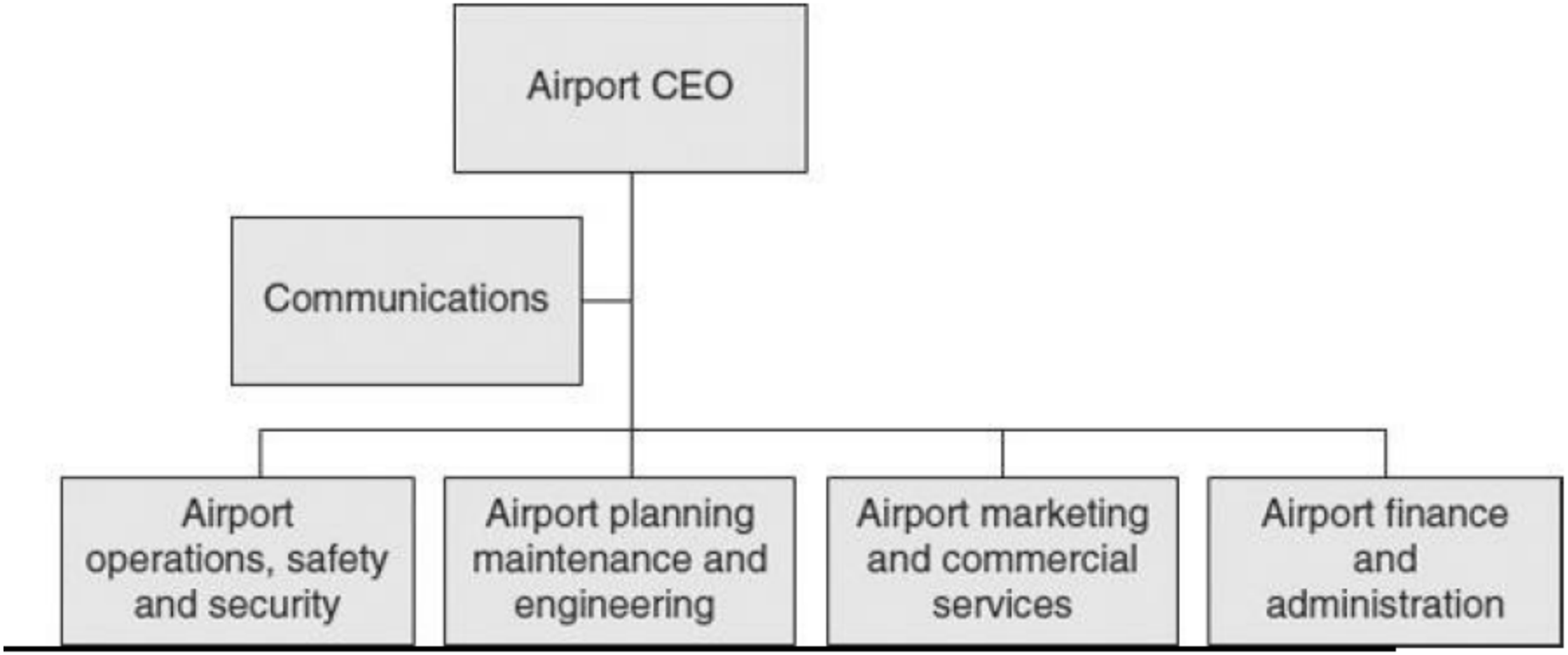
Contd-----

- The recommended tactical approach advocates separation of the planning/control of the airport operations program, which is an administrative function, from its execution, which is an operational function.
- These two dimensions require different types of expertise and focus on separate, interconnected, but discrete tasks. They build on different areas of excellence. An analogy for this would be architects with construction managers.
- This tactical approach to the delivery of the airport operations program is also predicated on the need to call on highly specialized/contemporary expertise.
- The need to deploy airport logistics multidisciplinary duty personnel.
- Inefficiencies that would result from operations functional specialists

Components of the airport operations program

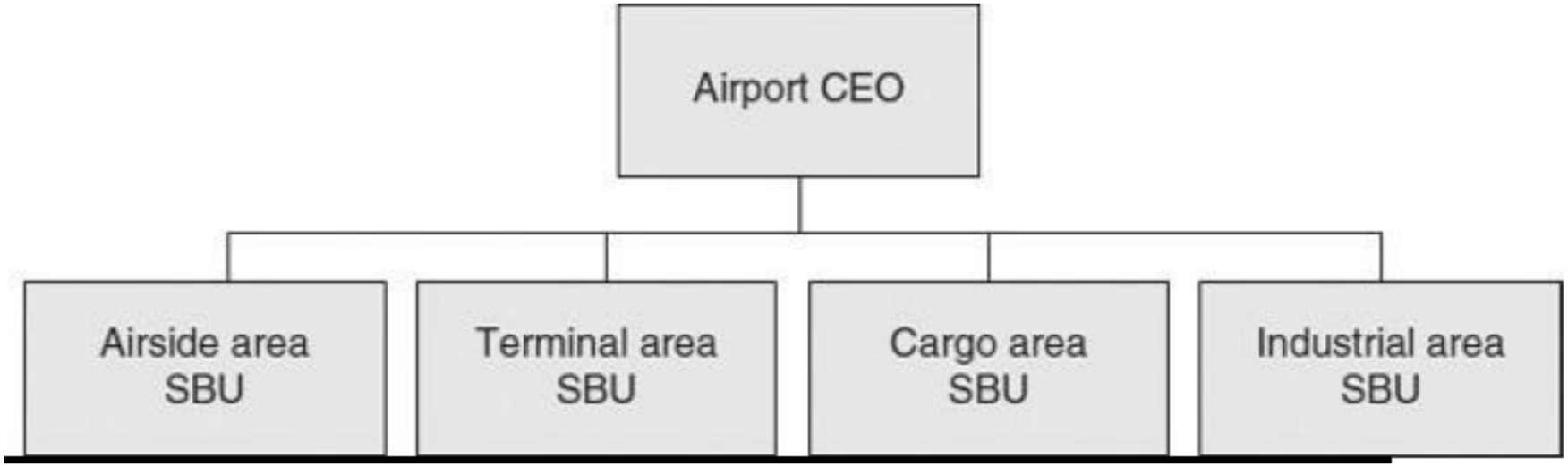
- Air traffic services plan
- Airport emergency plan
- Commercial services plan
- Common-use facilities assignment plan
- Environmental management plan
- Ground handling management plan
- Ground transportation services plan
- Incident/occurrence management and reporting system
- International inspection services plan
- Operational stakeholders engagement plan
- Operational support maintenance management plan
- Public relations and communications plan
- Safety management system
- Security plan
- Terminal operations management plan

Organizational Considerations



Traditional airport organizational structure

Strategic business units (SBUs)



SBU-based airport management organizational structure

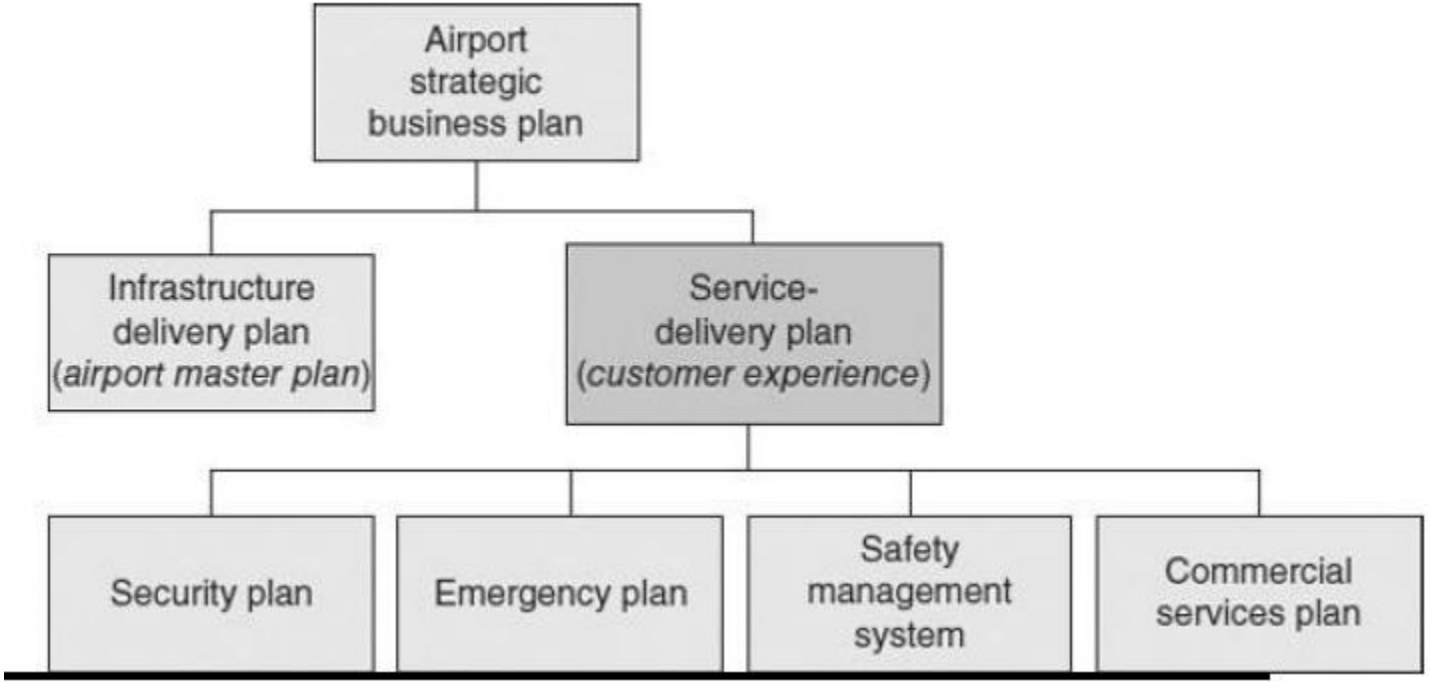
Managing Operational Performance

The successful management of operational performance requires airport operators to act on three fronts. The airport operations program should be planned, executed, and controlled. The main underlying theme is the creation of an enterprise culture that is fundamentally driven by providing a service to airport .

Planning for Performance

The development of a performance-based operations program must find its foundation in the airport strategic business plan. The enterprise's unique vision, mission, strategic objectives, and areas of excellence must provide the driving force and rationale for the development of operational-level policies, plans, procedures, processes, and performance measures. users as customers.

Service delivery plan



Service delivery plan—focusing on the customer experience

Elements of service delivery

• Statement of purpose • Description of hierarchical and logical linkage between the airport enterprise vision → mission → strategic objectives → areas of excellence → LOS policy → strategic-level KPIs
• Airport-wide customer experience map
• Real-time service index and KPI dashboards
• Service-delivery, decision-making, and support system • Customer experience statements for all functional areas • Facilitation committee and service-delivery consultative mechanisms • Airport/partners LOS agreements • Passenger charter of rights
• Management and staff customer-service awareness training program • Customer-service accountability matrix

Benefits of service delivery plan

- Encourages and promotes contractors to be innovative and find cost-effective ways of delivering services
- Results in better prices and performance
- Maximizes competition and innovation
- Achieves cost savings
- Expects contractors to control costs
- Creates better value and enhanced performance
- Gives the contractor more flexibility in general to achieve the desired results
- Shifts risk to contractors so that they are responsible for achieving the objectives
- Provides incentives to improve contractor performance and ties contractor compensation to achievement
- Allows contractors to have buy-in and shared interests
- Requires less day-to-day monitoring

Operations Program Execution

Aspects that affect their performance:

1. The end product is a service rather than manufactured goods.
2. They deal with a transformation process that is relatively complex and calls on the participation of a large number of stakeholders.
3. They operate in a highly regulated environment
4. They deliver services using technologically sophisticated tools and information systems.
5. They operate in a highly political framework.
6. They operate in an international environment
7. Operation is frequently on a continuous, 24-hour basis.
8. Emergencies can be routinely anticipated at any time.
9. Although they provide ground-based aerodrome-related services for the air traveler or the cargo

Operations Program Control

- Monitoring the operational performance of an airport can be divided into internal and external assessments.
- The purpose of the first type of control is to inform the airport management and the board of directors.
- Second type of assessment is usually to respond to a regulatory requirement or to benchmark the performance of one airport against another comparable facility for the
- Purpose of competitive analysis or even pure marketing, as in the case of outstanding results.

External Assessment

Impact of Airport Industry Commercialization

Ten Key Lessons for Successful Airport Privatization

I. A strong focus should be placed on achieving a more management of the airport assets through the transfer to private ownership.

II. Good governance is extremely important if the privatization is to be in the public interest.

III. Independent, robust economic regulation is essential in order to create incentives for efficiency improvements. Government interference in airport regulation

IV. automatically creates an unacceptable conflict of interest.

V. The economic regulator should also be overseen by an independent Competition authority to which airports and their customers have the right to appeal.

Contd----

1. Economic regulators have, so far, been more effective at extracting efficiencies from existing assets rather than ensuring cost-effectiveness from new investment.
2. Mechanisms to incentivize cost efficiency must be built into the process from the outset.
3. Service level agreements (or similar systems) must also be put in place to deliver a good-quality as well as a cost-effective service.
4. Controls must be put in place to prevent unjustified asset revaluations or regulatory structural changes
5. Customer involvement in new investment is essential to ensure it appropriate, cost-effective and delivered on time and on budget. The ‘gold plating’ of investment must be avoided.”

Industry Benchmarking

One of the motivations of airports is to reach “best-in-class” recognition that enhances the image of award winners, gives them an additional tool to market themselves as a destination, and in the case of global airport operators, provides them with an interesting selling point when pursuing new markets.

Benchmarking may be achieved in at least three different ways: (1) An airport can enter a competition where results are determined by passenger surveys [there are two major global and somewhat competing providers of this service.

(2) an airport can hire a specialized firm to conduct a benchmarking study on some aspects of its activity

Key Success Factors for High-Performance Airport Operations

- Closely align the operations program on the airport strategic business plan.
- Design and implement the operations policies, plans, procedures, processes.
- Implement service-delivery plans to tackle the anagement of customer service in a holistic/integrated manner.
- Clearly delineate the tasks of airport operations planning/ monitoring from those of executing the operations.
- Apply proven best practices in the selection key performance indicators.
- Implement effective leadership, coordination, and consultation mechanisms for interfacing with entities involved in various phases.

Assessment of the Current Safety Level

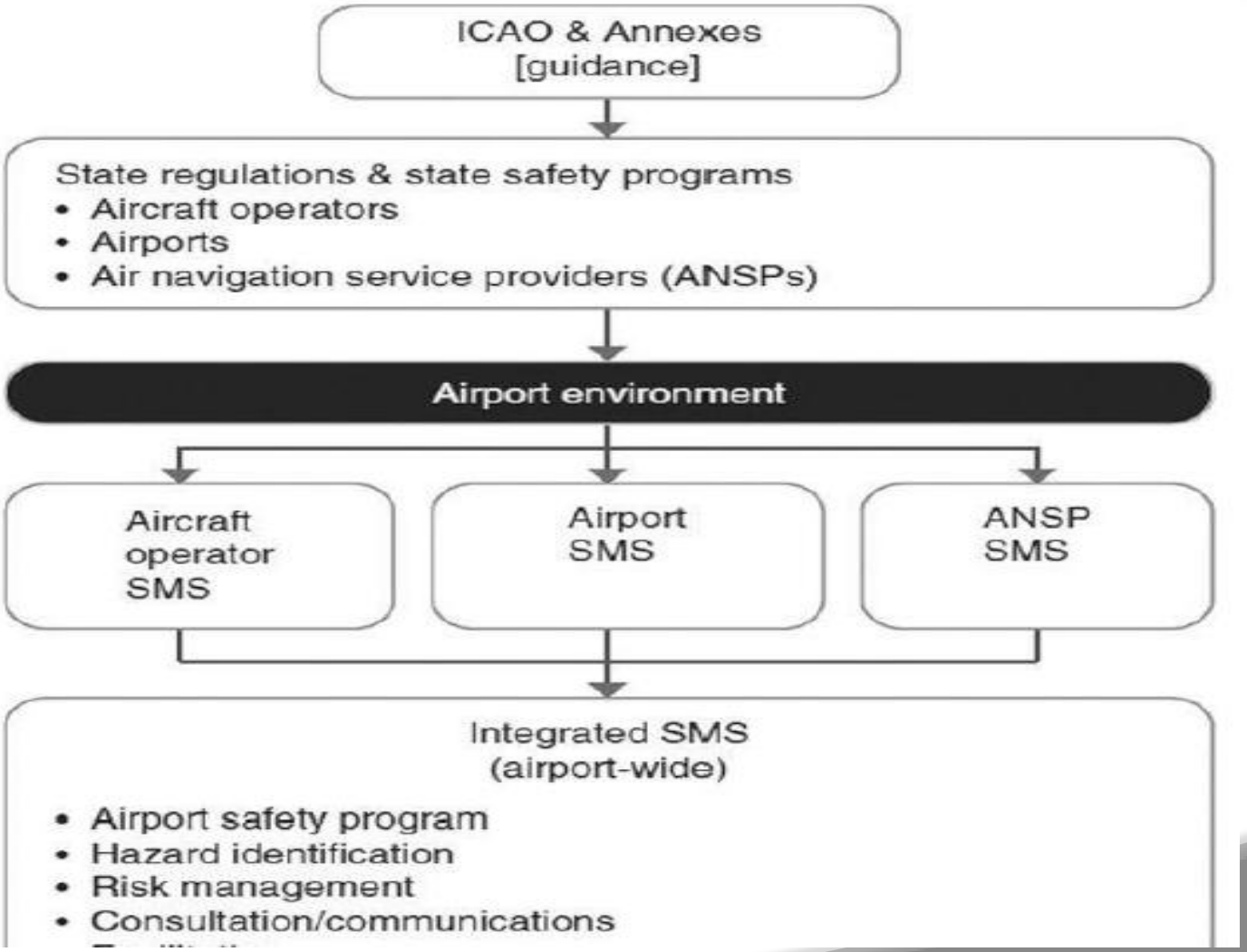
Some simple steps to take include the following

1. What systems and processes are in existence now?
2. Have all the hazards relative to operations been identified?
3. Have the risks been assessed for each?
4. Are there controls in place for the risks?
5. What residual risk gaps are there?
6. How does this relate to the rest of the airport's operations?
7. Is there some common ground with other stakeholders?
8. What impacts do others have on us and us on them?
9. How do we help each other instead of working in isolation?
10. How do we integrate existing SMSs and any new ones?

Objectives of the Member State's safety program

- Oversight should include audits of each certified service provider's SMS. Who should do this? The Civil Aviation Authority (CAA), internal, independent, or all three?
- The effectiveness of Member State safety programs, in turn, is audited periodically by ICAO through the Universal Safety Oversight Audit Program
- ICAO Annex 14 establishes that Member States require that the aerodrome manual submitted for aerodrome certification contains details of the SMS.
- To reinforce the link between certification and the SMS, ICAO Document 9774 states that "suspension of an aerodrome certificate may be considered if an aerodrome
- operator's SMS is found to be inadequate."

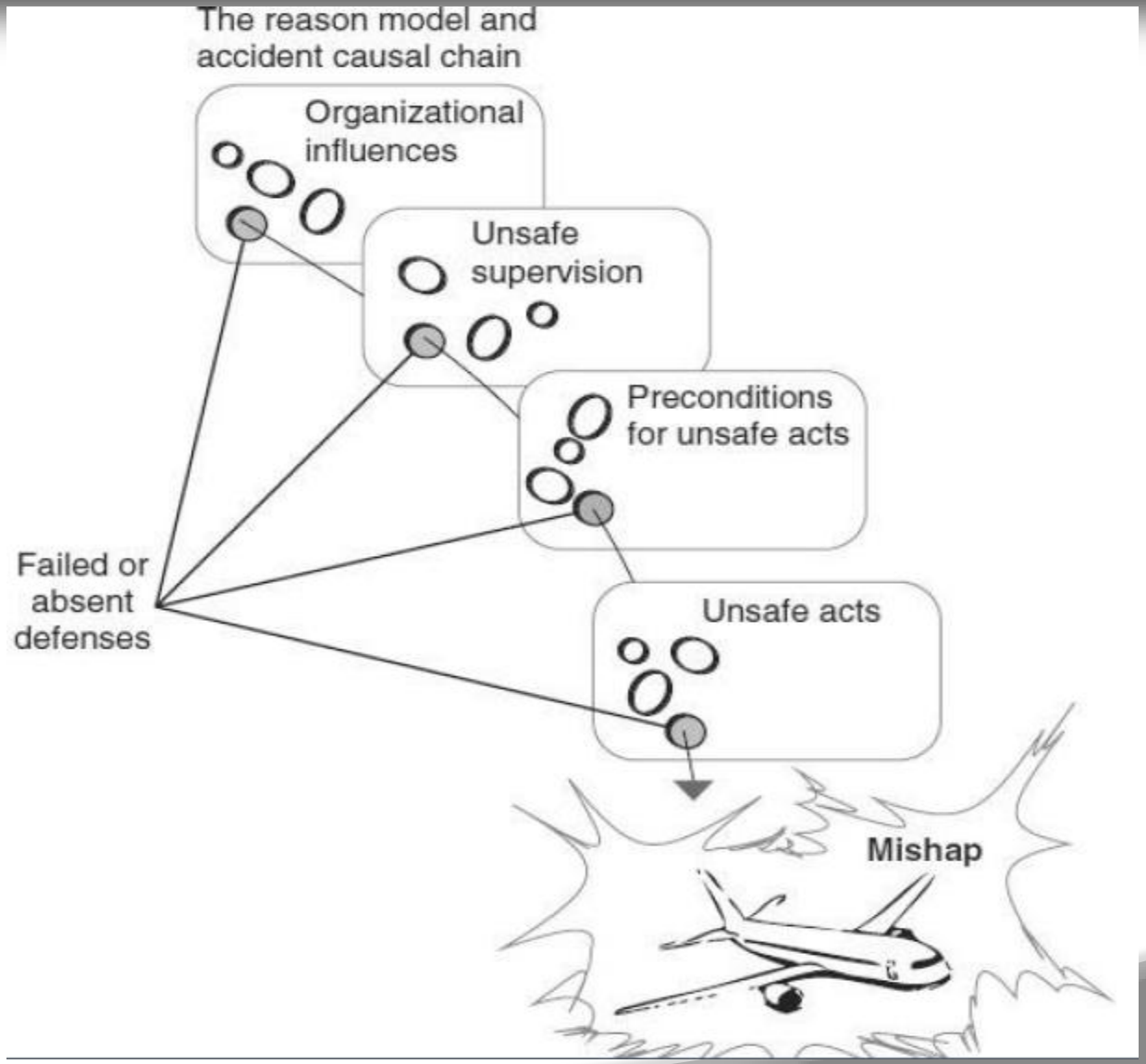
Airport SMS regulatory



Damage to moving aircraft

1. Property/equipment damage from jet blast
2. Equipment/equipment damage
3. Equipment/facility damage
4. Spillages (fuel and others)
5. Injuries to personnel or passengers relating

Model of Accident Causation

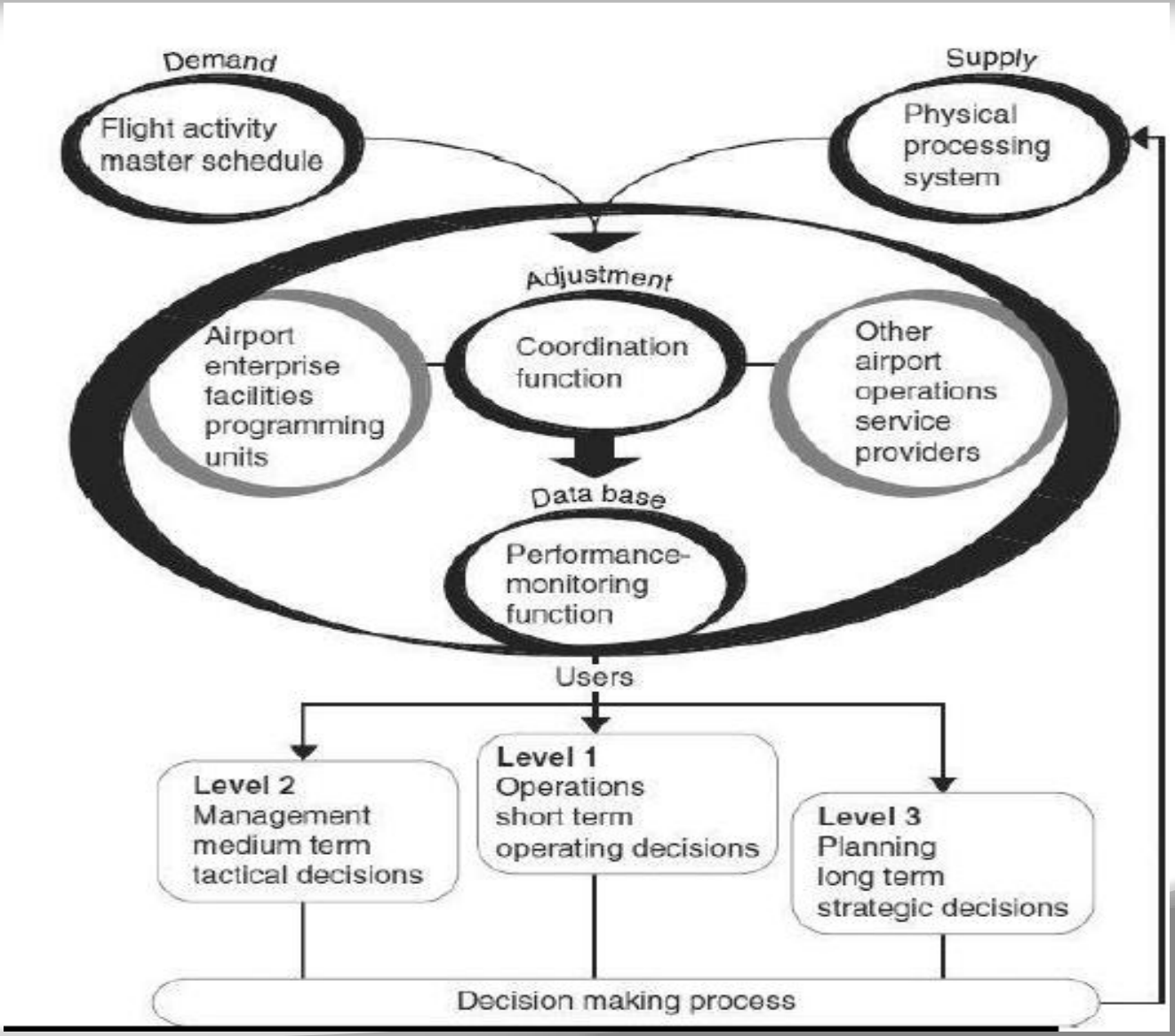


Hazard Identification

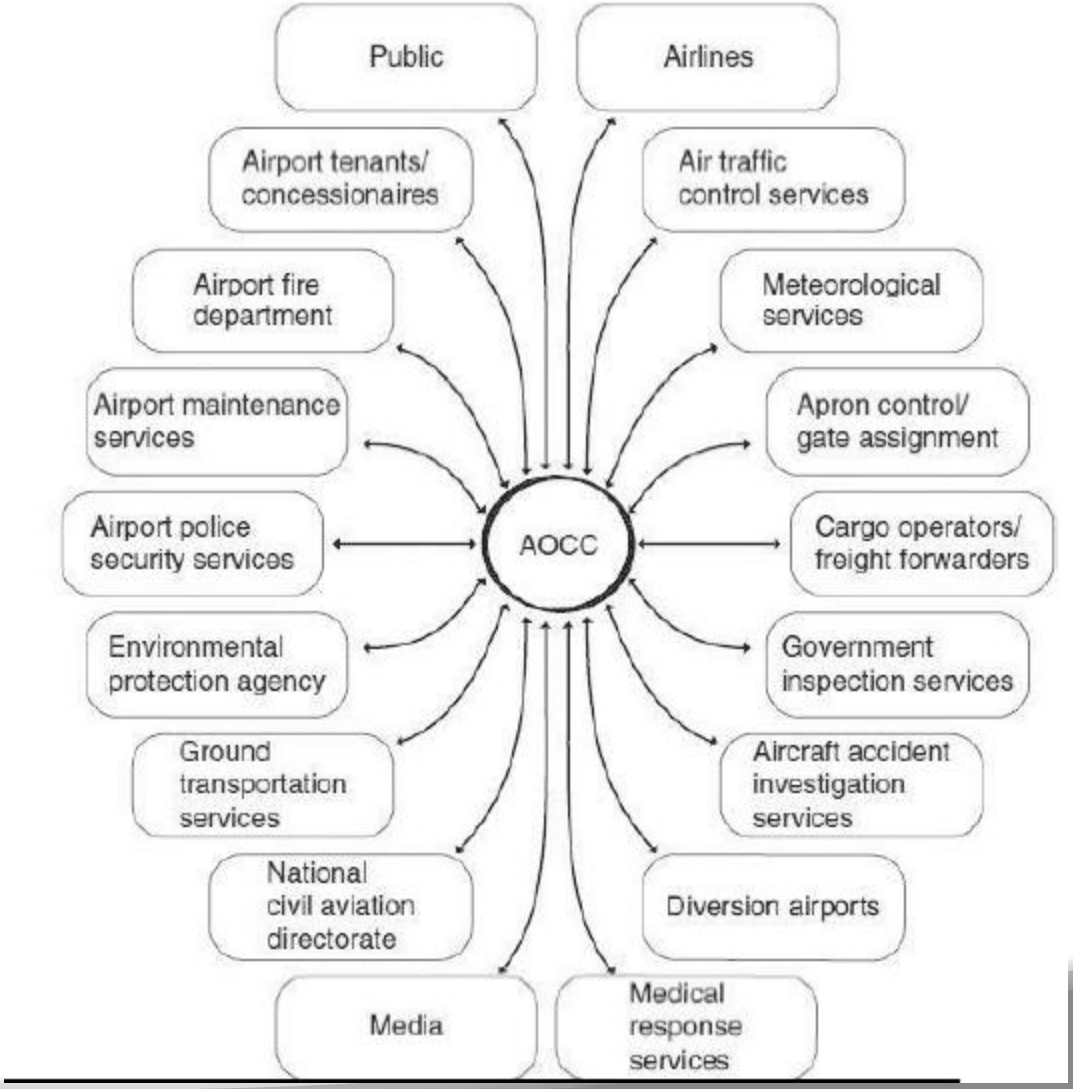
A partial list of known hazards in the apron area,

- Traffic volume and mixture (including high-density periods)
- Vulnerability of aircraft on the ground (fragile, etc.)
- Abundance of high-energy sources (including jet blast, propellers, fuels, etc.)
- Extremes of weather (i.e., temperatures, winds, precipitation, and poor visibility)
- Wildlife hazards (i.e., birds and animals)
- Aerodrome layout
- Inadequacy of visual aids
- A physical and process example could be the operation of stop bars and advanced surface movement guidance and control systems

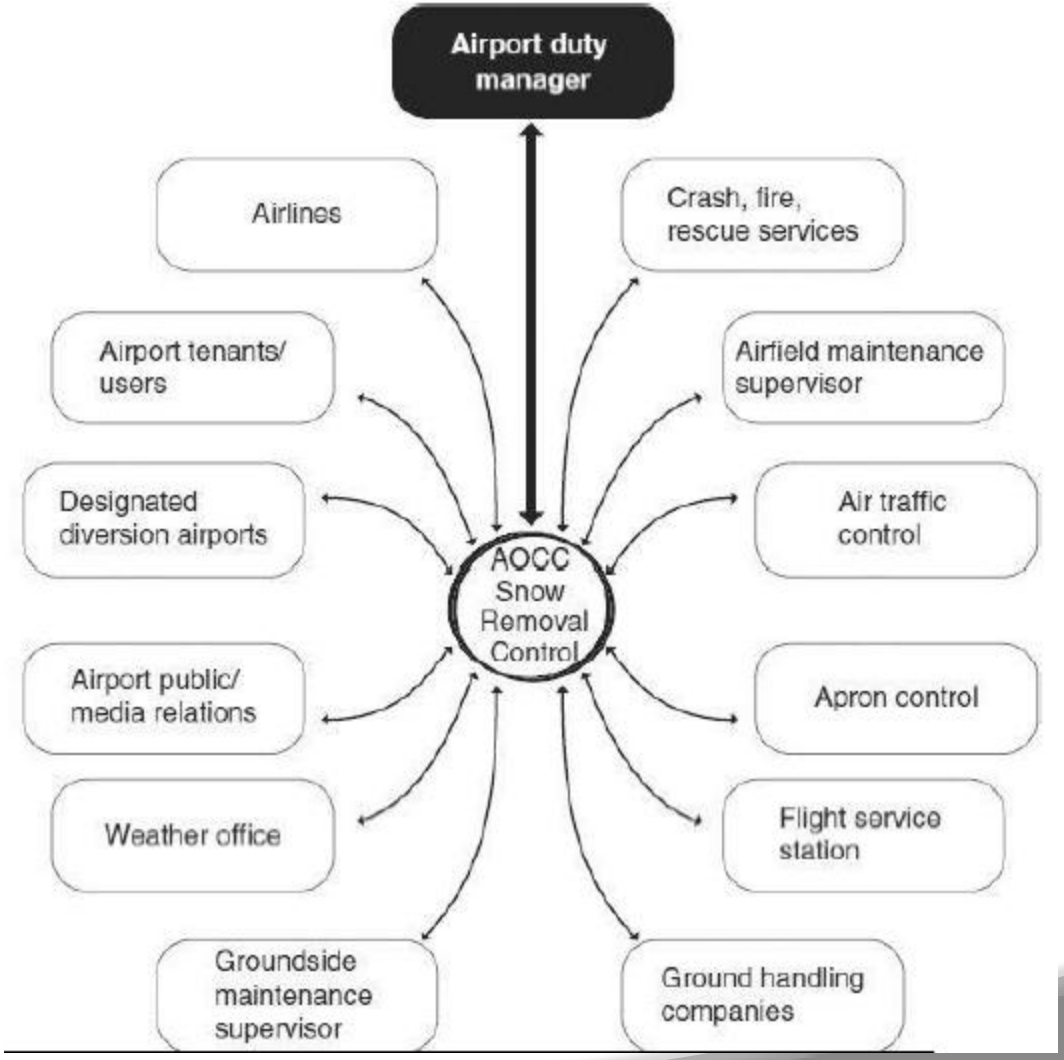
Air Operation control system (AOCS)



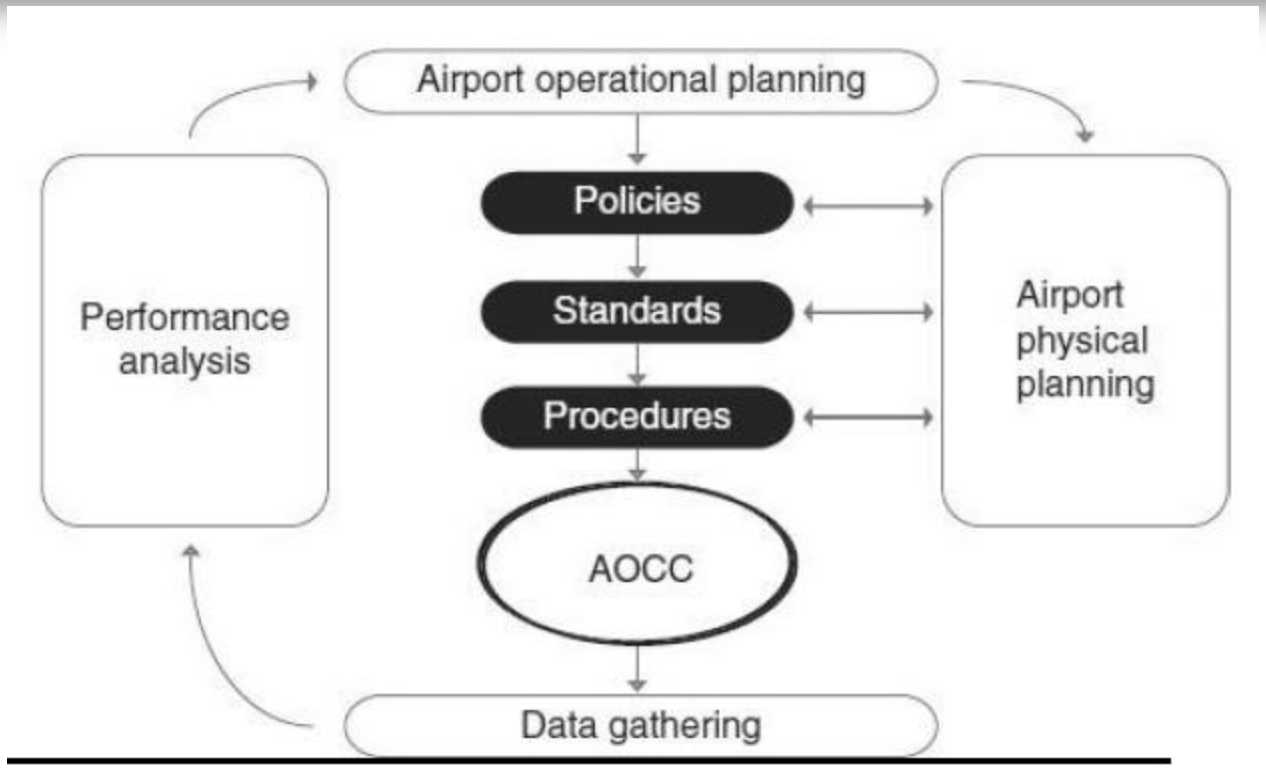
Air Operation Control Center (AOCC)



Communication Chart

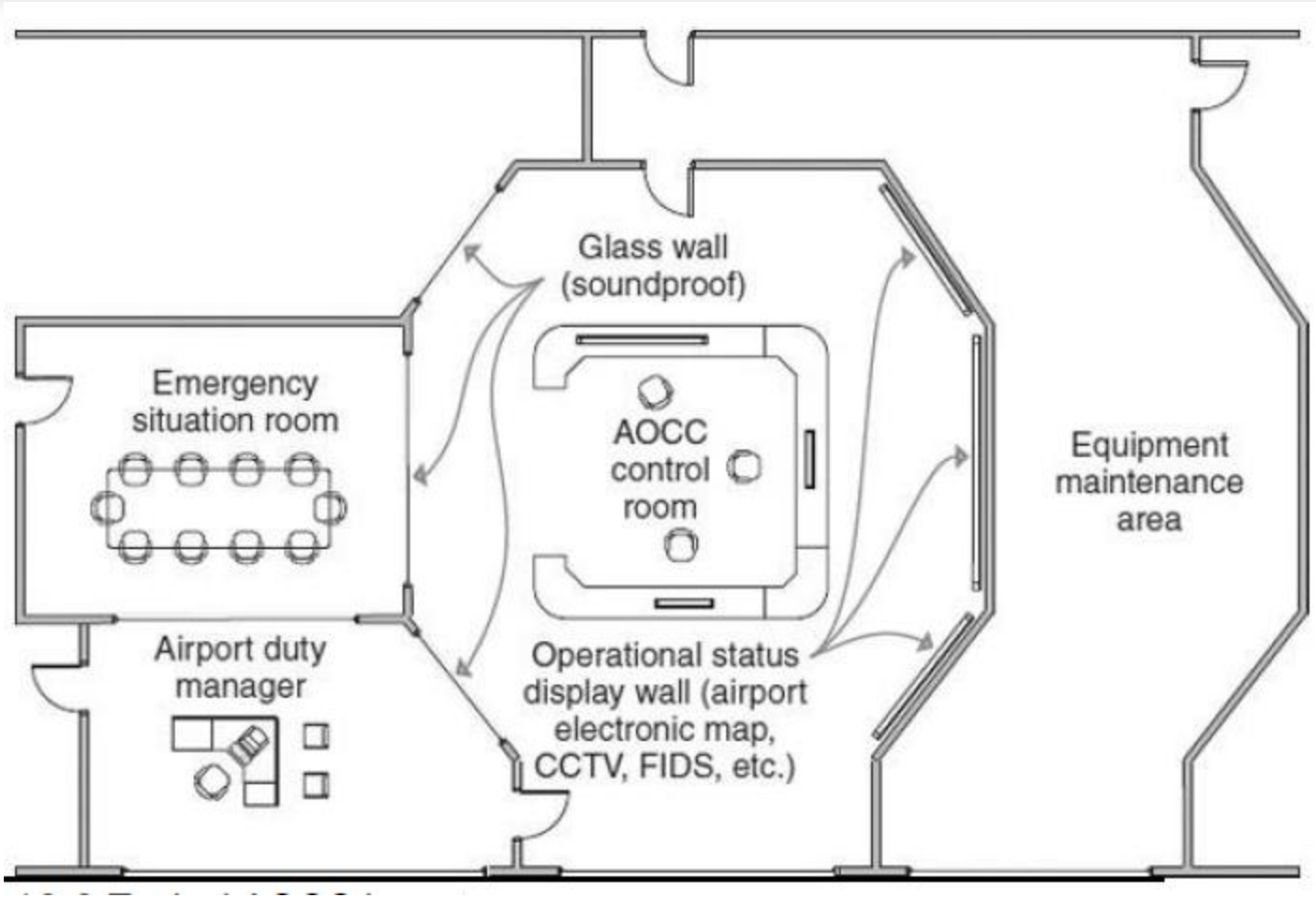


Airport Performance-Monitoring Function



The second AOCC role relates to its performance-monitoring function (above Figure), which pertains to the collection and recording of all information required to perform analysis of the level of service offered to airport users

Typical AOCC layout



The End