Karpagam Academy of Higher Education

(Deemed to be University)

(Established Under Section 3 of UGC Act 1956)

Pollachi Main Road, Eachanari Post, Coimbatore, Tamil Nadu 641021

FACULTY OF ENGINEERING

Department of Mechanical Engineering

(Aerospace Engineering)

Subject Name **:** Airport Management (APM)

Subject Code **:** 16BTAR5E09 (Credits - 3)

Name of the Faculty **:** R. Suresh Baalaji

Designation : Asst. Professor

Year/Semester/Section **:** III / V / -

Branch **:** UG / B. Tech / Aerospace Engineering

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Faculty of Engineering
Department of Mechanical Engineering
(*Aerospace Engineering*)

16BTAR_E09 AIRPORT MANAGEMENT 3 0 0 3 1 0 0

OBJECTIVES:

- Ability to demonstrate a systematic understanding of relevant international and national regulations and explain their effects on airport business, planning, design, operations and safety management decisions.

UNIT-I AIRPORTS AND AIRPORT SYSTEMS

Introduction-Airport Management on an international level- Rules that govern airport management-Airport ownership and organization-Airport organization chart-Airport manager and public relations.

UNIT-II THE AIRFIELD

Components of an airport-The airfield-Navigation aids(NAVAIDS)located on airfields-Air traffic Control and surveillance facilities located on the airfield-Weather reporting facilities located on airfields-security infrastructure on airfields.

UNIT-IIIAIRSPACE AND AIR TRAFFIC CONTROL

Air traffic control management and operating infrastructure-Basics of air traffic control-Current and future enhancements to air traffic control.

UNIT-IV AIRPORT TERMINALS AND GROUND ACCESS

Historical development of airport terminals-Components of airport terminal-Airport ground access

Pavement management-Aircraft rescue and fire fighting(ARFF)=Snow and ice control-Safety inspection programs-Bird and wildlife hazard management.

UNIT-V AIRPORT SECURITY

Transportation Security Administration-Security at commercial service airports-Security at general aviation airports.

TEXT BOOKS:

S.NO.	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Richard de Neufville, AmedeoOdoni, Peter Belobaba, Tom Reynolds	Airport Systems: Planning, Design and Management	Mcgraw-hill,	2013
2.	Subhash C. Saxena	Airport Engineering: Planning & Design	CBS Publishers & Distributors	2008
3.	Norman Ashford and H. P. Martin Stanton	Airport Operations	Mc-Graw-Hill	2009

REFERENCES BOOKS:

S.NO.	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Anne Graham,	Managing Airports: An International Perspective	Butterworth Heinemann,	2008
2.	RigasDoganis	The Airport Business	Routledge	2005
3.	Richard D Neufville	"Airport Systems: Planning, Design and Management",	McGraw Hill,	2002
4.	Kathleen Sweet	Aviation and Airport Security	CRC Press	2008

WEB REFERENCES:

www.tdot.state.tn.us/aeronautics/handbook/**airportmanagement**guide.pdf
www.aviation.unsw.edu.au/.../AVIA5007_CourseOutline_2012web.pdf
en.wikipedia.org/wiki/Total_**Airport**_**Management**_Systems
alagappauniversity.ac.in/files/question.../M.B.A.(A%20&%20AM).pdf
www.unige.ch/formcont/aviation/aviation.pdf
www.studymode.com › Home › Literature › Periodicals

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LESSON PLAN

Subject Name/ Code **: Airport Management / 16BTAR_E09 (Credits - 3)**

Name of the Faculty / Designation **:** R. Suresh Baalaji / Asst. Professor

Branch / Year/Semester/Section **:** UG / B. Tech/Aerospace Engineering III / V / -

Sl. No.	No. of Periods	Topics to be Covered	Support Materials
UNIT – I : AIRPORTS AND AIRPORT SYSTEMS			
1.	1	Fundamentals of Airport Management	Airport Planning & Management Alexander T. Wells, Ed.D. Seth B. Young, Lecture Notes - KAHE
2.	1	Introduction to Airport	
3.	1	National administrative structure of airport	
4.	1	Airport Management on an international level	
5.	2	The categories of airports listed in the National Plan of Integrated Airport Systems NPIAS	
6.	1	Rules that govern airport management	
7.	1	Airport ownership and organization	
8.	1	Airport organization chart	
9.	1	Airport manager and Public relation	
10.	1	**Tutorial 1:** Discussion on Unit-I Part A questions	
Total No. of Hours Planned for Unit - I			**(1I + 9L + 1T) 11 Hours**

Sl. No.	No. of Periods	Topics to be Covered	Support Materials
UNIT – II : THE AIRFIELD			
11.	1	Components of an airport	Airport Planning & Management Alexander T. Wells, Ed.D. Seth B. Young, Lecture Notes - KAHE
12.	1	Introduction to the airfield	
13.	1	Layout of different airfield	
14.	1	Requirements of airfield aids	
15.	1	Navigation aids(NAVAIDS)located on airfields	
16.	1	Air traffic Control located on the airfield	
17.	1	Surveillance facilities located on the airfield	
18.	1	Weather reporting facilities located on airfields	
19.	1	Security infrastructure on airfields	
20.	1	**Tutorial 2:** Discussion on Unit-II Part A questions	
Total No. of Hours Planned for Unit - II			**(9L + 1T) 10 Hours**

Sl. No.	No. of Periods	Topics to be Covered	Support Materials
UNIT – III : AIRSPACE AND AIR TRAFFIC CONTROL			
21.	1	Introduction to Air traffic control management	Airport Planning & Management Alexander T. Wells, Ed.D. Seth B. Young, Lecture Notes - KAHE
22.	1	Airspace classes	
23.	1	Terminal Radar Approach Control (TRACON) facility	
24.	1	Basics of Air Traffic Control	
25.	1	Air traffic control management	
26.	1	ATC operating infrastructure	
27.	1	ATC Control Towers and Special-use airspace	
28.	1	Current and future enhancements to air traffic control	
29.	1	National Airspace System (NAS)	
30.	1	**Tutorial 3:** Discussion on Unit-III Part A questions	
Total No. of Hours Planned for Unit - III			**(9L + 1T) 10 Hours**

Sl. No.	No. of Periods	Topics to be Covered	Support Materials
UNIT – IV : AIRPORT TERMINALS AND GROUND ACCESS			
31.	1	Historical development of airport terminals	Airport Planning & Management Alexander T. Wells, Ed.D. Seth B. Young,
32.	1	Components of airport terminal	
33.	1	Airport ground access	
34.	1	Pavement management	
35.	1	Aircraft rescue and fire fighting (ARFF)	
36.	1	Snow and ice control	
37.	1	Safety inspection programs	
38.	1	Bird hazard management	Lecture Notes - KAHE
39.	1	Wildlife hazard management	
40.	1	**Tutorial 4:** Discussion on Unit-IV Part A questions	
Total No. of Hours Planned for Unit - IV			**(9L + 1T) 10 Hours**

Sl. No.	No. of Periods	Topics to be Covered	Support Materials
UNIT – V : AIRPORT SECURITY			
41.	1	Transportation Security Administration	Airport Planning & Management Alexander T. Wells, Ed.D. Seth B. Young,
42.	1	Security at commercial service airports	
43.	1	Passenger screening, Checked-baggage screening	
44.	1	Employee identification,	
45.	1	Secure Identification Display Area of International Airport	
46.	1	Security at general aviation airports	
47.	1	The future of airport security	
48.	1	Computer Assisted Passenger Pre-Screening System	Lecture Notes - KAHE
49.	1	Trusted Traveler Program	
50.	1	**Tutorial 5:** Discussion on Unit-V Part A questions	
51.	1	End Semester Possible Questions Discussion	
Total No. of Hours Planned for Unit - V			**(9L + 1T + 1D) 11 Hours**

TEXT BOOKS

S.NO.	AUTHOR(S)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Richard de Neufville, Amedeo Odoni, Peter Belobaba, Tom Reynolds	Airport Systems: Planning, Design and Management	Mcgraw-hill,	2013
2.	Anne Graham	Managing Airports	Routledge	2012
3.	Norman Ashford and H. P. Martin Stanton	Airport Operations	Mc-Graw-Hill	2011

REFERENCES BOOKS:

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1.	Anne Graham,	Managing Airports: An International Perspective	Butterworth Heinemann,	2014
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WEB REFERENCES:

www.tdot.state.tn.us/aeronautics/handbook/**airportmanagement**guide.pdf

www.aviation.unsw.edu.au/.../AVIA5007_CourseOutline_2012web.pdf

en.wikipedia.org/wiki/ Total **Airport Management** Systems

www.unige.ch/formcont/aviation/aviation.pdf

www.studymode.com › Home › Literature › Periodicals

UNIT	Total No. of Periods Planned	Lecture Periods	Tutorial Periods
I	10	9	1
II	10	9	1
III	10	9	1
IV	10	9	1
V	10	9	1
TOTAL	50	45	05 + 2 Discussion

I. CONTINUOUS INTERNAL ASSESSMENT : 40 Marks
(Internal Assessment Tests: 30, Attendance: 5, Assignment/Seminar: 5)

II. END SEMESTER EXAMINATION : 60 Marks

TOTAL : 100 Marks

FACULTY CO-ORDINATOR / AERO HOD / MECH DEAN / FOE

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Faculty of Engineering

Department of Mechanical Engineering

(*Aerospace Engineering*)

Subject Name: Airport Management **Year / Semester**: III / V

Subject Code:16BTAR_E09 **Programme:** UG / B. Tech. Aerospace Engineering

COURSE OBJECTIVE

Ability to demonstrate a systematic understanding of relevant international and national regulations and explain their effects on airport business, planning, design, operations and safety management decisions

To update the students knowledge on various standard and Airside Operation Management systems.

LEARNING OUTCOMES

On successful completion of this course,

1. Analyses the typical operations of airports from a management perspective
2. Identify the economic, political and social role of airports
3. Discuss the benefits and risks of airport privatization
4. Identify and discuss the impact of airport marketing
5. Design and evaluate airport master planning
6. Evaluate airport performance, efficiency, capacity, and delay

Unit – I

Airports and Airport Systems

Introduction

It is often said that managing an airport is like being mayor of a city. Similar to a city, an airport is comprised of a huge variety of facilities, systems, users, workers, rules, and regulations. Also, just as cities thrive on trade and commerce with other cities, airports are successful in part by their ability to successfully be the location where passengers and cargo travel to and from other airports. Furthermore, just as cities find their place as part of its county's, states, and country's economy, airports, too, must operate successfully as part of the nation's system of airports. In this chapter, the airport system in the will be described in a number of ways. First, the national airport system, as a whole, will be described. Next, the various facilities that make up the airport system will be described. Finally, the various rules and regulations that govern the airport system will be described.

The national administrative structure of airports

All civil-use airports, large and small, in one way or another, utilize the United States' Civil Aviation System. The civil aviation system is an integral part of the United States' transportation infrastructure. This vital infrastructure is administered through the **Department of Transportation (DOT),** led by the secretary of transportation.

The DOT is divided into several administrations that oversee the various modes of national and regional transportation in the United States. Such administrations include:

FHWA— Federal Highway Administration

FMCSA— Federal Motor Carrier Safety Administration

FRA— Federal Railroad Administration

FRA—Federal Transit Administration

MARAD—Maritime Administration

NHTSA—National Highway Traffic Safety Administration

USCG—Coast Guard

The administration that oversees civil aviation is the **Federal Aviation Administration (FAA).** The FAA's primary mission is to oversee the safety of civil aviation. The FAA is responsible for the rating and certification of pilots and for the certification of airports, particularly those serving commercial air carriers. The FAA operates the nation's air traffic control system, including most air traffic control towers found at airports, and owns, installs, and maintains visual and electronic navigational aids found on and around airports. In addition, the FAA administers the majority of the rules that govern civil aviation and airport operations, as well as plays a large role in the funding of airports for improvement and expansion. The FAA is led by an administrator who is appointed by the secretary of transportation for a 5-year term.

The FAA is headquartered in Washington, D.C. Headquarter offices within the FAA include the offices of Air Traffic Services (ATS), Office of Security and Hazardous Materials (ASH), Commercial Space Transportation (AST), Regulation and Certification (AVR), Research and Acquisitions (ARA), and Airports (ARP). Within the Office of Airports lies the Office of Airport Safety and Standards (AAS) and the Office of Planning and Programming (APP). It is in these offices where Federal Aviation Regulations and policies specific to airports are administered.

Airport Management on an International Level

Internationally, the recommended standards for the operation and management of civil use airports are provided by the **International Civil Aviation Organization (ICAO).** ICAO, headquartered in Montreal, Quebec, Canada, is a membership-based organization, comprised of 188 contracting states that span the world. ICAO came into existence as a part of the 1944 Chicago Convention on International Civil Aviation for the purpose of providing a source of communication and standardization among participating states with respect to civil aviation operations. ICAO publishes a series of recommended policies and regulations to be applied by individual states in the management of their airports and civil aviation systems.

In most individual countries, airports are managed directly by the federal government, most often under the ministry of transport. In some countries, including the United States, many airports are privately owned and operated, although, despite private ownership, they are still subject to much of the country's regulations regarding aviation operations.

The categories of airports listed in the (NPIAS) National Plan of Integrated Airport Systems are:

1. Primary commercial service airports

Primary commercial service airports are categorized in the NPIAS as those public-use airports enplaning at least 10,000 passengers annually in the United States. In 2002, there were 422 airports (less than 3 percent of the nation's to-tal airports) categorized as primary commercial service airports.

2. Commercial service airports

Commercial service airports are those airports that accommodate scheduled service airports operate under very specific regulations enforced by the Federal Aviation Administration, Transportation Security Administration, as well as state and local governments. In addition, other federal and local administrations, such as the Environmental Protection Agency, and local economic development organizations, indirectly affect how commercial service airports operate. The goal of commercial service airports, of course, is to provide for the safe and efficient movement of passengers and cargo between population centers through the nation's aviation system. In 2002, there were a total of 546 commercial service air-ports throughout the striving to fulfill this mission.

3. General aviation airports

Those airports with fewer than 2,500 annual enplaned passengers and those used exclusively by private business aircraft not providing commercial air carrier passenger service are categorized as **general aviation (GA) airports.** Al-though there are over 13,000 airports that fit this category, only a subset is included in the NPIAS. There is typically at least one general aviation airport in the NPIAS for every county in the United States. In addition, any general aviation airport that has at least 10 aircraft based at the airport and is located at least 20 miles away from the next nearest NPIAS airport is usually included in the NPIAS. In 2002, a total of 2,558 general aviation airports were included in the NPIAS.

4. Reliever airports

Reliever airports comprise a special category of general aviation airports. Reliever airports, generally located within a relatively short distance (less than 50 miles) of primary commercial service airports, are specifically designated by the NPIAS as "general aviation-type airports that provide relief to congested major airports." To be classified as a reliever airport, the airport must have at least 50 aircraft based at the airport or handle at least 25,000 itinerant operations or 35,000 local operations annually, either currently or within the last 2 years. Reliever airports are located within an SMSA with a population of at least 500,000 or where passenger enplanements at the nearest commercial service airport exceed 250,000 annually. As the name suggests, reliever airports are intended to encourage general aviation traffic to use the facility rather than the busier commercial service airport, which may be experiencing delays, by providing facilities of similar quality and convenience to those available at the commercial service airports.

The Rules that Govern Airport Management

As with any system intended for use by the public, a complex system of federal, state, and often local regulations have been put in place by legislation to ensure the safe and efficient operation of public-use airports. All airports included in the NPIAS are subject to a variety of **Federal Aviation Regulations (FAR).** The 14 CFR series is made up of over 100 chapters, known as parts, each of which provide regulatory mandates that govern various elements of the civil aviation system, including regulations for pilots, general aviation and commercial flight operations, and, of course, airport operations and management. Within airport management, regulations regarding airport operations, environmental policies, financial policies, administrative policies, airport planning, and other issues of direct concern to airports are covered.

Although all Federal Aviation Regulations are important to airport management, the following FARs are of specific importance to airport management, operations, and planning, and will be referenced in detail in this text:

FAR Part 1 Definitions and Abbreviations

FAR Part 11 General Rulemaking Procedures

FAR Part 36 Noise Standards: Aircraft Type and Airworthiness

Certification

FAR Part 71 Designation of Class A, Class B, Class C, Class D, and Class E Airspace Areas; Airways, Routes, and Reporting Points

FAR Part 73 Special Use Airspace

FAR Part 77 Objects Affecting Navigable Airspace

FAR Part 91 General Operating and Flight Rules

FAR Part 93 Special Air Traffic Rules and Airport Traffic Patterns

FAR Part 97 Standard Instrument Approach Procedures

FAR Part 121 Operating Requirements: Domestic, Flag, and Supplemental Air Carrier Operations

FAR Part 129 Operations: Foreign Air Carriers and Foreign Operators

of U.S. Registered Aircraft Engaged in Common Carriage

FAR Part 139 Certification and Operations: Land Airports Serving Certain Air Carriers

FAR Part 150 Airport Noise and Compatibility Planning

FAR Part 151 Federal Aid to Airports

FAR Part 152 Airport Aid Program

FAR Part 156 State Block Grant Pilot Program

FAR Part 157 Notice of Construction, Alteration, Activation, and Deactivation of Airports

FAR Part 158 Passenger Facility Charges

FAR Part 161 Notice and Approval of Airport Noise and Access Restrictions

FAR Part 169 Expenditure of Federal Funds for Nonmilitary Airports or

Air Navigation Facilities Thereon (for airports not operated under Federal Aviation Administration regulations)

In addition to the 14 CFR series, regulations regarding the security of airport and other civil aviation operations are published under Title 49 of the Code of Federal Regulations (49 CFR—Transportation) and are known as **Transportation Security Regulations (TSRs).** TSRs are enforced by the Transportation Security Administration (TSA). TSRs of specific importance to airport management include:

49 CFR Part 1500 Applicability, Terms, and Abbreviations

49 CFR Part 1502 Organization, Functions, and Procedures

49 CFR Part 1503 Investigative and Enforcement Procedures

49 CFR Part 1510 Passenger Civil Aviation Security Service Fees

49 CFR Part 1511 Aviation Security Infrastructure Fee

49 CFR Part 1520 Protection of Security Information (replaced FAR Part 191)

49 CFR Part 1540 Civil Aviation Security: General Rules

49 CFR Part 1542 Airport Security (replaced FAR Part 107)

49 CFR Part 1544 Aircraft Operator Security: Air Carriers and Commercial Operators (replaced FAR Part 108)

49 CFR Part 1546 Foreign Air Carrier Security (replaced parts of FAR Part 129)

49 CFR Part 1549 Indirect Air Carrier Security (replaced FAR Part 109)

49 CFR Part 1550 Aircraft Security Under General Operating and Flight Rules (replaced parts of FAR Part 91)

Each of these organizations is particularly concerned with the interests of their constituents; however there are numerous times when they close ranks and work together for mutual goals affecting the aviation community in general. The following is a brief listing of the most prominent associations. A complete listing can be found in the *World Aviation Directory* published by McGraw-Hill. These organizations, by virtue of the alphabetic acronyms they are most commonly referred by, make up the "alphabet soup" of aviation-related support organizations.

- *Aerospace Industries Association (AIA)—founded 1919.* Member companies represent the primary manufacturers of military and large commercial aircraft, engines, accessories, rockets, spacecraft, and related items.

- *Aircraft Owners & Pilots Association (AOPA)—founded 1939.* With almost 400,000 members, AOPA represents the interests of general aviation pilots. AOPA provides insurance plans, flight planning, and other services, as well as sponsors large fly-in meetings. In addition the AOPA's Airport Support Network plays a large role in the support and development of all airports, with particular support to smaller general aviation airports.

- *Air Line Pilots Association (ALPA)—founded 1931.* The Air Line Pilots Association is the oldest and largest airline pilots' union, supporting the interests of the commercial pilots and commercial air carrier airports.

- *Airports Council International—North America (ACI–NA)—founded 1991.* First established as the Airport Operators Council in 1947, the ACI–NA considers itself the "voice of airports" representing local, regional, and state governing bodies that own and operate commercial airports throughout the and Canada. As of 2003, 725 member airports throughout belong to ACI–NA. The mission of the ACI–NA is to identify, develop, and enhance common policies and pro-grams for the enhancement and promotion of airports and their management that are effective, efficient, and responsive to consumer and community needs.

- *Air Transport Association of America (ATA)—founded 1936.* The ATA represents the nation's certificated air carriers in a broad spectrum of technical and economic issues. Promotes safety, industry wide pro-grams, policies, and public understanding of airlines.

- *American Association of Airport Executives (AAAE)—founded 1928.* A division of the Aeronautical Chamber of Commerce at its inception, the AAAE became an independent entity in 1939. Membership includes individual representatives from airports of all sizes throughout the United States, as well as partners in the aviation industry and academia.

- *Aviation Distributors and Manufacturers Association (ADMA)— founded 1943.* Represents the interests of a wide variety of aviation firms including fixed-base operators (FBOs) who serve general aviation operations and aircraft component part manufacturers. The ADMA is a strong proponent of aviation education.

- *Experimental Aircraft Association (EAA)—founded 1953.* The EAA, with over 700 local chapters, promotes the interests of homebuilt and sport aircraft owners. EAA hosts two of the world's largest fly-in conventions each year, at Oshkosh, Wisconsin, and Lakeland, Florida.

- *Flight Safety Foundation (FSF)—founded 1947.* The primary function of the FSF is to promote air transport safety. Its members include air-port and airline executives and consultants.

- *General Aviation Manufacturers Association (GAMA)—founded 1970.* GAMA's members include manufacturers of general aviation aircraft, engines, accessories, and avionics equipment. GAMA is a strong proponent of general aviation airports.

- *Helicopter Association International (HAI)—founded 1948.* Members of HAI represent over 1,500 member organizations in 51 countries that operate, manufacture, and support civil helicopter operations.

- *International Air Transport Association (IATA)—founded 1945.* IATA is an association of more than 220 international air carriers whose main functions include coordination of airline fares and operations. IATA annually assesses international airports for their service quality and publishes their findings industry wide.

- *National Agricultural Aviation Association (NAAA)—founded 1967.* As the voice of the aerial application industry, NAAA represents the interests of agricultural aviation operators. The NAAA represents over 1,250 members including owners of aerial application businesses; pi-lots; manufacturers of aircraft, engines, and equipment; and those in related businesses.

- *National Air Transportation Association (NATA)—founded 1941.* First known as the National Aviation Training Association and later Trades Association, NATA represents the interests of fixed-base operators, air taxi services, and related suppliers and manufacturers.

- *National Association of State Aviation Officials (NASAO)—founded 1931.* The NASAO represents departments of transportation and state aviation departments and commissions from 50 states, Puerto Rico, and Guam. NASAO encourages cooperation and mutual aid among local, state, and federal governments.

- *National Business Aviation Association (NBAA)—founded 1947.* The NBAA represents the aviation interests of over 7,400 companies that own or operate general aviation aircraft as an aid to the conduct of their business, or are involved with some other aspect of business aviation.

- *Professional Aviation Maintenance Association (PAMA)—founded 1972.* PAMA promotes the interest of airframe and power plant (A&P) technicians.

- *Regional Airline Association (RAA)—founded 1971.* The RAA represents the interests of short- and medium-haul scheduled passenger air carriers, known as "regional airlines," and cargo carriers

<u>Airport Ownership and Operation</u>

Public airports are owned and operated under a variety of organizational and jurisdictional arrangements. Usually, ownership and operation coincide: commercial airports might be owned and operated by a city, county, or state; by the federal government; or by more than one jurisdiction (a city and a county). In some cases, a commercial airport is owned by one or more of these governmental entities but operated by a separate public body, such as an airport authority specifically created for the purpose of managing the airport. Regardless of ownership, legal responsibility for day-to-day operation and administration can be vested in any of five kinds of governmental or public entities: a municipal or county government, a multipurpose port authority, an airport authority, a state government, or the federal government.

A typical **municipally operated airport** is city owned and run as a department of the city, with policy direction by the city council and, in some cases, by a separate airport commission or advisory board. County-run airports are similarly organized. Under this type of public operation, airport policy decisions are generally made in the broader context of city or county public investment needs, budgetary constraints, and development goals.

Some commercial airports in the are run by multipurpose port authorities. **Port authorities** are legally chartered institutions with the status of public corporations that operate a variety of publicly owned facilities, such as harbors, airports, toll roads, and bridges. In managing the properties under their jurisdiction, port authorities have extensive independence from the state and local governments. Their financial independence rests largely on the power to issue their own debt, in the form of revenue bonds, and on the breadth of their revenue bases, which might include fees and charges from marine terminals and airports as well as proceeds (bridge or tunnel tolls) from other port authority properties. In addition, some port authorities have the power to tax within the port district, although it is rarely exercised.

The Airport Organization Chart

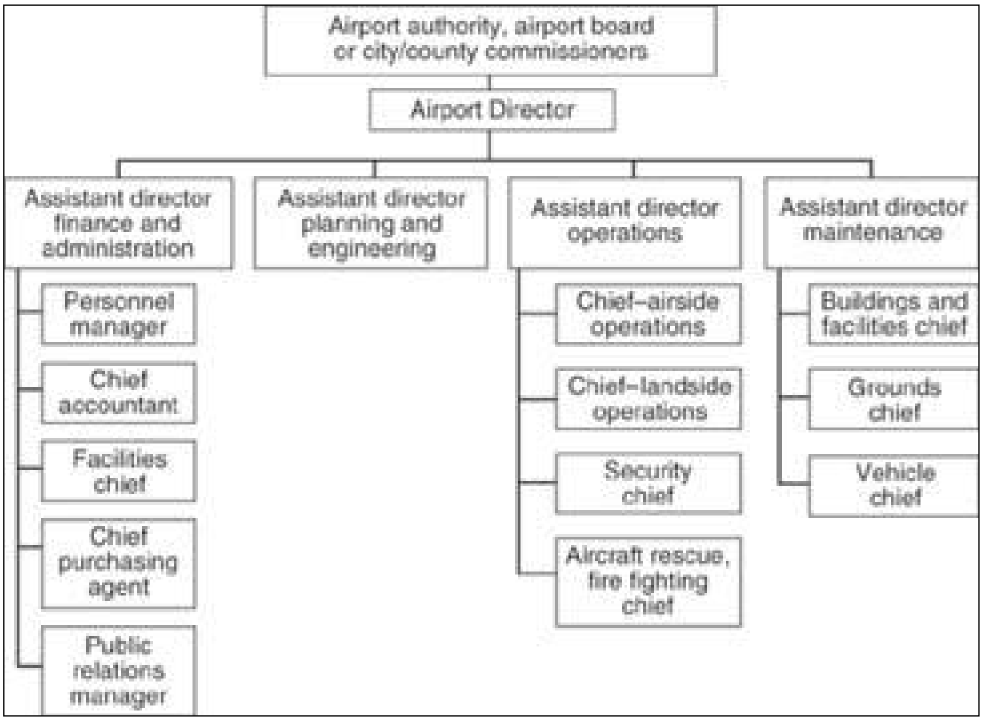
An **organization chart** shows the formal authority relationships between superiors and subordinates at various levels, as well as the formal channels of communication within the organization. It provides a framework within which the management functions can be carried out. The chart aids employees to perceive more clearly their positions in the organization in relation to others and how and where managers and workers fit into the overall organizational structure.

Airport management organization charts range from the very simple to the very complex, depending primarily on the size, ownership, and management structure of the airport.

The organization chart is a static model of an airport's management structure; that is, it shows how the airport is organized at a given point in time. This is a major limitation of the chart, because airports operate in a dynamic environment and thus must continually adapt to changing conditions. Some old positions might no longer be required, or new positions might have to be created in order that new objectives can be reached; therefore, it is necessary that the chart be revised and updated periodically to reflect these changing conditions.

The duties, policies, and theories that govern the job of airport management vary widely over time. In addition, many such policies vary from airport to air-port on the basis of individual airport operating characteristics. As a result, it is difficult to say that any organization chart is typical or that the chart of one air-port at any particular time is the one still in effect even a few months later; however, all airports do have certain common functional areas into which air-port activities are divided.

Understandably, the larger the airport, the greater the specialization of tasks and the greater the departmentalization.



Typical airport management organization chart

Airport director. The airport director is responsible for the overall day-to-day operation of the airport. He or she reports directly to the airport authority, the airport board, or governmental commission charged with the development and administration of the airport. This individual directs, coordinates, and re-views through subordinate supervisors, all aircraft operations, building and field maintenance, construction plans, community relations, and financial and personnel matters at the airport. The airport director also:

- Supervises and coordinates with airline, general aviation, and military tenants use of airport facilities.
- Reviews airport tenant activities for compliance with terms of leases and other agreements.
- Supervises enforcement of aircraft air and ground traffic and other applicable regulations.
- Confers with airlines, tenants, the FAA, and others regarding airport regulations, facilities, and related matters.
- Participates in planning for increased aircraft and passenger volume and facilities expansion.
- Determines and recommends airport staffing requirements.
- Compiles and submits for review an annual airport budget.
- Coordinates airport activities with construction, maintenance, and other work done by departmental staff, tenants, public utilities, and contractors.
- Promotes acceptance of airport-oriented activities in surrounding com-munities.

Assistant director—finance and administration The **assistant director— finance and administration** is charged with the responsibility for overall matters concerning finance, personnel, purchasing, facilities management, and office management. Specifically, this individual's duties include:

- Fiscal planning and budget administration.
- Accomplishment of basic finance functions such as accounts receivable and payable, auditing, and payroll.
- Administration of the purchasing function.
- Administration and use of real property including negotiation of tenant leases and inventory control.
- Personnel functions including compensation, employee relations, and training.
- Adequate telephone and mail service.
- Public relations.

Personnel manager The **personnel manager** is responsible for administering the airport personnel program. In such capacity, this individual's duties include:

- Dealing with personnel problems involving position classification, compensation, recruitment, placement, transfers, layoffs, promotions, leaves of absence, supervisor-subordinate relationships, and working conditions.
- Serving as equal rights and equal opportunity officer for the airport.
- Handling worker's compensation cases.
- Evaluating the organization pattern, reviewing and recommending pro-posed departmental organizational changes, and preparing position descriptions.
- Conferring with employees and their supervisors on personnel problems.
- Preparing personnel documents and maintaining personnel records.
- Interviewing or supervising the interviewing of applicants for airport positions.

Chief accountant The **chief accountant** is responsible for financial planning, budgeting, accounting, payroll, and auditing. The principal duties include:

- Coordinating, consolidating, and presentation of financial plans.
- Administering basic accounts such as general accounts, cost accounting, and accounts receivable and payable.

- Administering budget; reviewing and analyzing actual performance at budget review sessions.
- Supervising all receipts and disbursements.
- Administering payroll.
- Conducting periodic internal audit of all airport functions.

Facilities chief The **facilities chief** establishes criteria and procedures for the administration of all airport property. In this capacity, he or she is responsible for inventory control of all equipment and facilities. Principal duties and responsibilities of this individual include:

- Identification and control of all property and equipment including periodic audits.
- Evaluating and making recommendations concerning the most efficient use of airport real property utilization.
- Soliciting tenants and concessionaires.
- Developing policy and rate structure applicable to use of property by tenants and concessionaires.
- Coordinating with purchasing and legal staff concerning tenant and concessionaire leases.

Chief purchasing agent The **chief purchasing agent** directs the procurement of materials and services to support the airport; he or she prepares, negotiates, interprets, and administers contracts with vendors. This individual's principal duties include:

- Coordinating requirements for materials and services to be purchased.
- Purchasing all materials and services.
- Establishing bidding policies and procedures.
- Working closely with the facilities' chief and legal staff regarding con-tracts associated with purchasing equipment.

Manager of public relations The **manager of public relations** is the chief liaison officer between the airport and the surrounding community. In this capacity, he or she is responsible for all public relations activities including the development of advertising and publicity concerning the airport. This individual is also responsible for handling all noise and other environmental matters.

Principal duties include:

- Consulting with and advising airport management regarding public relations policies and practices.
- Coordinating all publicity releases to the various media.

- Supervising all airport guides and information booths.
- Coordinating VIP visits to the airport.
- Receiving and analyzing all public complaints regarding such things as noise and other environmental concerns.
- Preparing answers to complaints and advising management as appropriate.
- Sponsoring activities and special events to generate goodwill and public acceptance.

Assistant director—planning and engineering The **assistant director— planning and engineering** provides technical assistance to all airport organizations, and ensures the engineering integrity of construction, alteration, and installation programs. This individual also establishes industrial safety standards. Principal duties and responsibilities include:

- Developing standards and specifications for construction, alteration, and installation programs; monitors such programs to ensure compliance therewith.
- Reviewing all construction plans to determine technical integrity and conformance to aesthetic design standards.
- Developing and publishing standards and procedures for industrial safety.
- Participating in the negotiation of construction contracts.

Assistant director—operations The **assistant director—operations** is responsible for all airside and landside operations including security, and crash, fire, and rescue operations. Principal duties include:

- Directing the operations and security programs for the airport.
- Coordinating and supervising security activities with field maintenance personnel, police and fire departments, federal agencies, and airport tenants.
- Recommending and assisting in promulgating operational rules and procedures.
- Supervising investigations of violations of airport regulations.
- Preparing annual operations budget.
- Directing monitoring of noise levels and coordinating noise level studies.
- Participating in special programs relating to or affecting airport operations, such as studies of height limits around airport property and studies of noise control.

Chief—airside operations The **chief—airside operations** is responsible for all airfield operations. In this capacity, principal duties include:

- Enforcing operating and security rules, regulations, and procedures concerning landing, taxiing, parking, servicing loading and unloading of aircraft, operation of vehicular traffic on the airfield, airline activities, and emergency situations.
- Inspecting conditions of airfield lighting, runways, taxiways, and ramp areas.
- Correcting hazardous conditions.
- Coordinating airfield activities with maintenance and security personnel.
- Assisting in all airfield emergency calls and disasters by notifying control tower to close runways, directing maintenance personnel, directing security officers in crowd control, and overseeing other safety considerations and activities necessary to resume normal airport operations.
- Investigating and reporting on complaints and disrupted airport operations, including unscheduled plane arrivals, aircraft accidents, rule and procedure violations, airline activities, and other operations of the airport.
- Assigning gate and parking spaces to all aircraft.
- Coordinating special arrangements for arrivals and departures of important persons.
- Completing all report forms pertaining to operations activities on as-signed shifts.
- Assisting in directing noise level studies with other departmental personnel.

Chief—landside operations The **chief—landside operations** is responsible for all landside operations. In this capacity, principal duties include:

- Enforcing operating and security rules, regulations, and procedures concerning buildings, access roads, and parking facilities.
- Exercising authority to halt hazardous or unauthorized activities by ten-ants, employees, or the public in violation of safety regulations and procedures.
- Answering inquiries and explaining terminal use procedures and safety regulations to tenants.
- Coordinating terminal building and other facility activities with maintenance and security personnel.
- Coordinating all parking facility activities with tenants and transit companies.
- Preparing personal injury and property damage reports and general incident reports.
- Completing all report forms pertaining to operations activities on as-signed shifts.

Security chief The **security chief** enforces interior security, traffic, and safety rules and regulations and participates in law enforcement activities at the airport. This individual also works closely with federal security officials as-signed to the airport. Principal duties include:

- Enforcing ordinances and regulations pertaining to parking, traffic control, safety, and property protection.
- Patrolling facilities to prevent trespass and unauthorized or hazardous use.
- Preventing public entry into dangerous or restricted areas.
- Issuing citations and warnings for violations of specific provisions of airport rules and regulations.
- Securing gates and locks and watching buildings and facilities for indications of fire, dangerous conditions, unauthorized entry, and vandalism.
- Responding to emergencies and taking immediate action to control crowds, direct traffic, assist the injured, and turn in alarms.
- Responding to calls for police service; participating in arrests; apprehending, or assisting members of the police department in apprehending, law violators.
- Providing information to the public regarding locations and operations of the airport.
- Assigning uniformed and armed personnel to patrol and stand watch, on a 24-hour basis, to protect and safeguard all persons in the airport and property on the airport.

Aircraft rescue/fire fighting chief The **aircraft rescue/fire fighting chief** develops procedures and implements accident, fire, and disaster plans. Principal duties include:

- Conducting a training (continuing) program for all aircraft rescue, fire fighting personnel.
- Developing and implementing all aircraft rescue and fire fighting pro-grams.
- Staffing and operating all aircraft rescue and firefighting equipment on the airport.
- Inspecting and testing all types of fixed fire prevention and extinguishing equipment on the airport.
- Inspecting all facilities for fire and/or safety hazards.

Assistant director—maintenance The **assistant director—maintenance** is responsible for planning, coordinating, directing, and reviewing the maintenance of buildings, facilities, vehicles, and utilities. Principal duties include:

- Developing, directing, and coordinating policies, programs, procedures, standards, and schedules for buildings, utilities, vehicle maintenance, and field facilities.
- Coordinating work done by tenants and contractors.

- Inspecting maintenance work for compliance with plans, specifications, and applicable laws.
- Making recommendations as to adequacy, sufficiency, and condition of buildings, facilities, and vehicles.
- Overseeing maintenance contracts.

Buildings and facilities chief The **buildings and facilities chief** is responsible for ensuring that buildings are adequately maintained with a mini-mum of cost. Types of maintenance required are primarily electrical, mechanical, plumbing, painting, carpentry, masonry, and cement work. Principal duties include:

- Developing an approved maintenance schedule for all building maintenance requirements.
- Assigning qualified personnel to perform maintenance.
- Inspecting work for adequacy and compliance with requirements.
- Developing special maintenance methods where necessary.

Grounds chief The **grounds chief** is responsible for ensuring that the grounds are maintained in good repair and that the landscape is adequately maintained. Principal duties include:

- Developing approved schedules for maintaining all airport surface areas including paving, landscaping, and drainage systems.
- Assigning qualified personnel to accomplish ground maintenance.
- Inspecting work for adequacy and compliance with maintenance standards.

Vehicle chief The **vehicle chief** is responsible for the maintenance of all vehicles utilized by the airport. Vehicle maintenance includes tune-up, minor maintenance, washing and polishing, tires and batteries, lubrication, and fueling. Principal duties include:

- Developing an approved vehicle maintenance schedule.
- Coordinating schedule with users of airport vehicles.
- Assigning qualified personnel to perform maintenance.
- Inspecting all work to determine compliance with established maintenance standards.
- Coordinating with purchasing to obtain vendor services as required.
- Maintaining vehicle usage and maintenance records.
- Coordinating with purchasing in developing a vehicle disposal and re-placement program.

The Airport Manager and Public Relations

Unquestionably, one of the most important and challenging aspects of an air-port manager's job is that of public relations.

Public relations is the management function that attempts to create goodwill for an organization and its products, services, or ideals with groups of people who can affect its present and future welfare. The most advanced type of public relations not only at-tempts to create goodwill for the organization as it exists, but also helps formulate policies, if needed, that of themselves result in a favorable reaction.

Aviation and airports have such great impact on our lives, and on the life of our nation, that it is difficult to find a person who has no knowledge or opinion of airports. Despite the tremendous growth in all segments of aviation over the past 25 years, and the resulting challenges, problems, and opportunities, aviation has not been exempted from the controversies that inevitably are part of any endeavor affecting or touching the lives of a large number of people. This controversy is the reason why every opinion, whether positive or negative, will be a strong one. The net result is that every airport has an image—either good or bad.

The great problems of airports are always related to the original and elemental images resulting from the collective opinions of the public. These images are really the balancing or compensating factors that correspond with the problems the public encounters with airports. These images are deposits representing the accumulated experience of jet noise, hours of struggle to reach the airport on clogged highways under construction, the frustration of trying to find a close-in parking place, the lines to obtain tickets, the time waiting for luggage, and other inconveniences.

In this respect, some of the public will have an image of the airport as a very exciting place that makes major contributions to our society through commercial channels, and even more valuable contributions of a personal nature, by offering a means to efficient travel, and thus greater personal development and greater enjoyment of life.

Despite the hundreds of positive impacts of aviation, negative images do arise. Perhaps such negative images result from the fact that the industry has been so intent on the technological aspects of resolving problems that it has overlooked the less tangible components. The industry has the technology and resources to resolve many of the problems of the airport-air-way system; however, the important link or catalyst in bringing together technology and community opinion is the airport public relations effort.

Both the airport and the community have a responsibility to work together to solve their mutual problems, attain desired goals, and ultimately achieve a better community. It takes continuing contributions—and sometimes sacrifices as well—to the general welfare on the part of individual citizens and the aviation industry to earn the opportunities and rewards of a good community for the public. This two-way relationship has its problems too. Many are spawned by misunderstanding that can arise and grow to disproportionate size, and in our context, result in a negative image for the airport and a loss of public confidence in the aviation industry. Ensuring that problems are met head-on, with full and explicit information made continuously available to the public to pre-vent misunderstanding, is the point at which airport public relations enters the picture.

Regardless of the size of an airport, there are several basic principles underlying the public relations process:

- Every airport and every company and interest on the airport has public relations, whether or not it does anything about them.

- Public goodwill is the greatest asset that can be enjoyed by any airport, and public opinion is the most powerful force. Public opinion that is informed and supplied with facts and fair interpretation might be sym-pathetic. Public opinion that is misinformed or uninformed will probably be hostile and damaging to an airport.

- The basic ingredient of good relations for any airport is integrity. With-out it, there can be no successful public relations.

- Airport policies and programs that are not in the public interest have no chance of final success.

- Airport public relations can never be some kind of program that is used only to respond to a negative situation. Good public relations have to be earned through continuing effort.

- Airport public relations go far beyond press relations and publicity. Public relations must interpret the airport interests to the public, and should be a two-way flow with input and interpretation of public opinion to airport management and community leadership.

- Public relations must use many means of reaching the various segments of the public interested in airport operations, and must try to instill the public relations spirit into all facets of the airport's operation.

The airport and its public

Basically, every airport has four "publics" with which it deals, and despite the wide variance in size and scope of activities of airports, these publics are basically the same for all airports:

- *The external business public.* These are the past, present, and future airport customers for all the services offered on an airport. It includes all segments of the business, government, educational, and general flying public.

- *The external general public.* These are the local citizens and taxpayers, many of whom have never been to the airport but who vote on airport issues or who represent citizen groups with particular concerns.

- *The internal business public.* These are the businesses and enterprises whose interests are tied directly to the airport—the airlines, FBOs, other members of the general aviation community, government officials, and other aviation and travel-oriented local businesses and trade organizations, and the employees of all of these enterprises.

- *The internal employee public.* This group includes everyone who works for the airport and its parent organization.

These are the most important airport publics. These are the sources of vital in-formation that management must have in order to know what and how it is doing, and they are the ones who must be informed and persuaded if any airport objective is to be achieved.

Public relations objectives

The primary objectives of an airport's public relations activities are as follows:

- Establishing the airport in the minds of the external public as a facility that is dedicated to serving the public interest: Many airports work closely with the local chamber of commerce in developing a brochure or pamphlet citing various accomplishments and activities at the airport that would be of interest to the local business community and the com-munity in general.

- Communicating with the external public with the goal of establishing and building goodwill: The airport manager and other members of his or her staff often serve as guest speakers at various civic and social organizations. They also become active members of local or civic organizations in order to informally promote the airport and determine the pulse of the community. Public announcements of new developments at the airport are made through all media. This is a continuing part of the communications process.

- Answering general and environmental complaints on an individual basis: It is important that the airport develop a good rapport with its neighbors and concerned citizen groups. Working closely with the air-lines and other internal business publics, airport management attempts to work out such problems as noise by changing traffic patterns and adjusting hours of flight operation. Tours of the airport are given to various community groups in order for them to get a better understanding of operations. Civic-oriented activities are also conducted at the air-port to improve relations with airport neighbors and address their concerns. Citizen participation in airport planning and public hearings is another means by which airport management is continually apprised of community feelings about airport-related activities.

- Establishing good working relationships with internal business publics whose interests are similar to those of airport management.

- Promoting programs designed to enhance and improve employee morale.

Unit – II

The Airfield

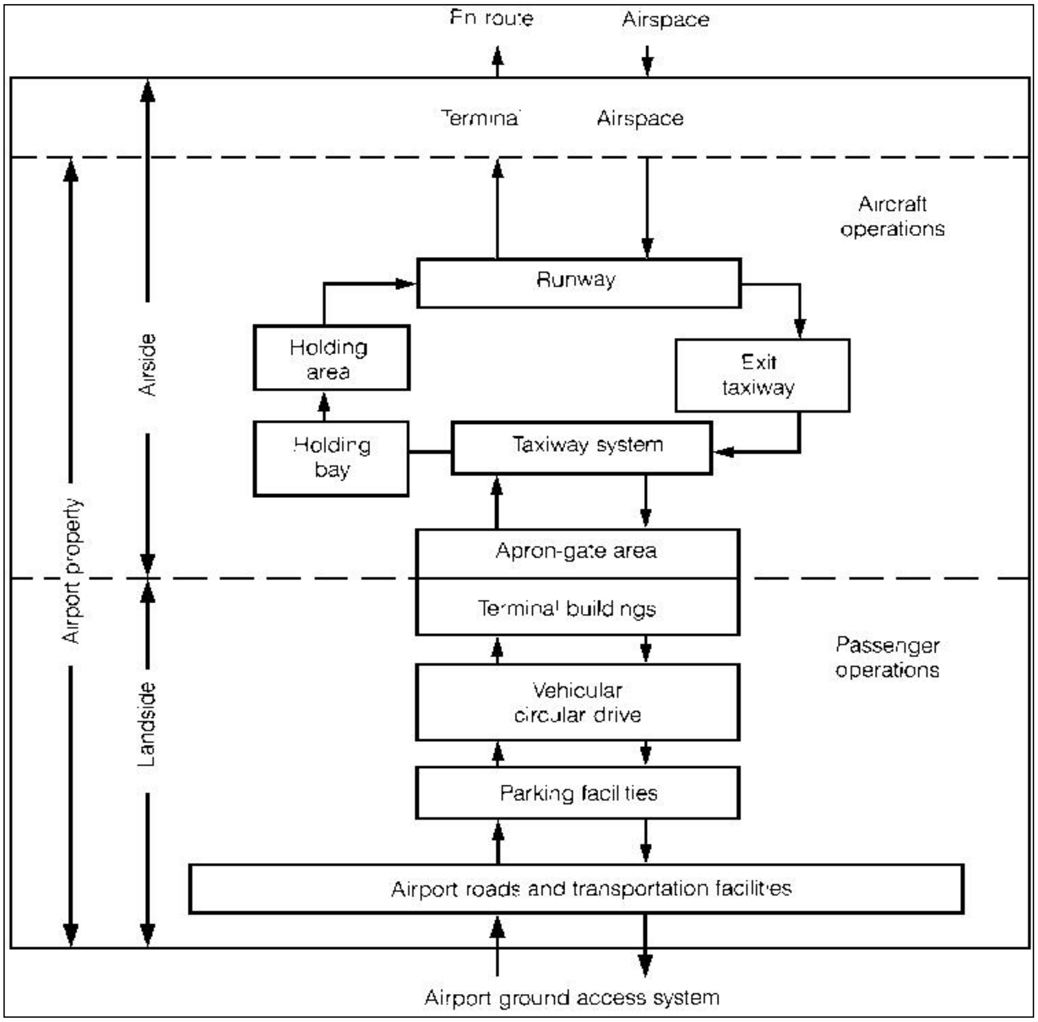
The Components of an Airport

An airport is a complex transportation facility, designed to serve aircraft, passengers, cargo, and surface vehicles. Each of these users is served by different components of an airport. The components of an airport are typically placed into two categories.

The **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. The airside components of an airport are further categorized as being part of the local air-space or the airfield. The airport's **airfield** component includes all the facilities located on the physical property of the airport to facilitate aircraft operations. The **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.

The **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. The airport **terminal** component is primarily designed to facilitate the movement of passengers and luggage from the landside to aircraft on the airside. The airport's **ground access** component accommodates the movement of ground-based vehicles to and from the surrounding metropolitan area, as well as between the various buildings found on the airport property.

No matter what the size or category of an airport, each of the above components is necessary to properly move people from one metropolitan area to an-other using air transportation. The components of an airport are planned in a manner that allows for the proper "flow" from one component to another. An example of a typical "flow" between components is illustrated in Fig. Further identifies some of the facilities located on the airfield and ground access components of the airport.



The components of an airport

The Airfield

The area and facilities on the property of an airport that facilitate the movement of aircraft are said to be part of the airport's airfield. The airfield of any given airport is planned, designed, and managed to specifically accommodate the volume and type of aircraft that utilize the airport. As one would expect, the planning and management of airfields at small general aviation airports is very different from that of large commercial service airports, although many of the fundamental principles that govern the planning and management of each type of airfield are very similar.

The most prominent facilities that are located on an airport's airfield are run-ways, taxiways, aircraft parking areas, navigational aids, lighting systems, signage, and markings. In addition, facilities to aid in the safe operation of the airport, such as air rescue and fire fighting (ARFF) facilities, snow plowing and aircraft de-icing stations, and fuel facilities may be located on or closely near the airfield. The smallest of airports may have very simple airfield infra-structures, such as a single unlit runway with very minimal markings, no taxi-ways, and little in the way of signage or aircraft parking areas, whereas larger airport airfields may have complex systems of multiple runways and taxiways, various airfield lighting systems and navigational aids, and the highest levels of ARFF and other facilities.

Runways

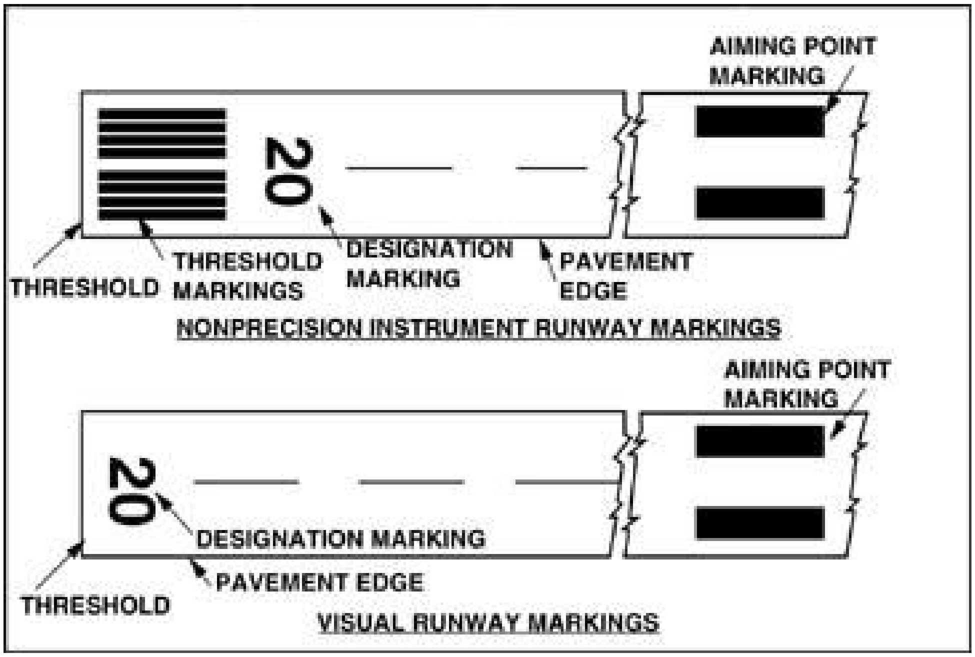
Perhaps the single most important facility on the airfield is the **runway.** After all, without a properly planned and managed runway, desired aircraft would be unable to use the airport. Regulations regarding the management and planning of runway systems are some of the most comprehensive and strict in air-port management. For example, strict design guidelines must be followed when planning runways, with particular criteria for the length, width, orientation (direction), configuration (of multiple runways), slope, and even pavement thickness of runways, as well as the immediate airfield area surrounding the runways to assure that there are no dangerous obstructions preventing the safe operation of aircraft. Runway operations are facilitated by systems of markings, lighting systems, and associated airfield signage that identify run-ways and provide directional guidance for aircraft taxiing, takeoff, approach, and landing. Strict regulations regarding the use of runways, including when and how the aircraft may use a runway for takeoff and landing, are imposed on airfield operations.

Runway length and width

Because aircraft require given minimum distances to accelerate for takeoff and to decelerate after landing, runways are planned with specific lengths to accommodate aircraft operations. Characteristics that determine the required length of a runway include the performance specifications of the runway's design aircraft and the prevailing atmospheric conditions. Specifically, the *maximum gross takeoff weight,* acceleration rate, and safe lift off velocity of aircraft are considered. In addition, the elevation above sea level (known as **MSL**) of the airport, along with the outside air temperature significantly affect required runway lengths. This is due to the fact that air at higher elevations and at higher temperatures is less dense that cooler air and air closer to sea level. The density of air is a significant determinant in the takeoff performance of aircraft.

Runway markings

There are three types of markings for runways: visual, non-precision instrument, and precision instrument. These marking types reflect the types of navigational aids associated with assisting aircraft on approach to land on the runway. A visual runway is intended solely for aircraft operations using visual approach procedures. A non-precision instrument runway is one having an instrument approach procedure using air navigation facilities with only horizontal guidance for which a *straight-in* non-precision instrument approach procedure has been approved by the FAA. A precision instrument runway is one having an instrument approach procedure using a precision instrument landing system (e.g., ILS) or precision approach radar (PAR) that provide both horizontal and vertical guidance to the runway.



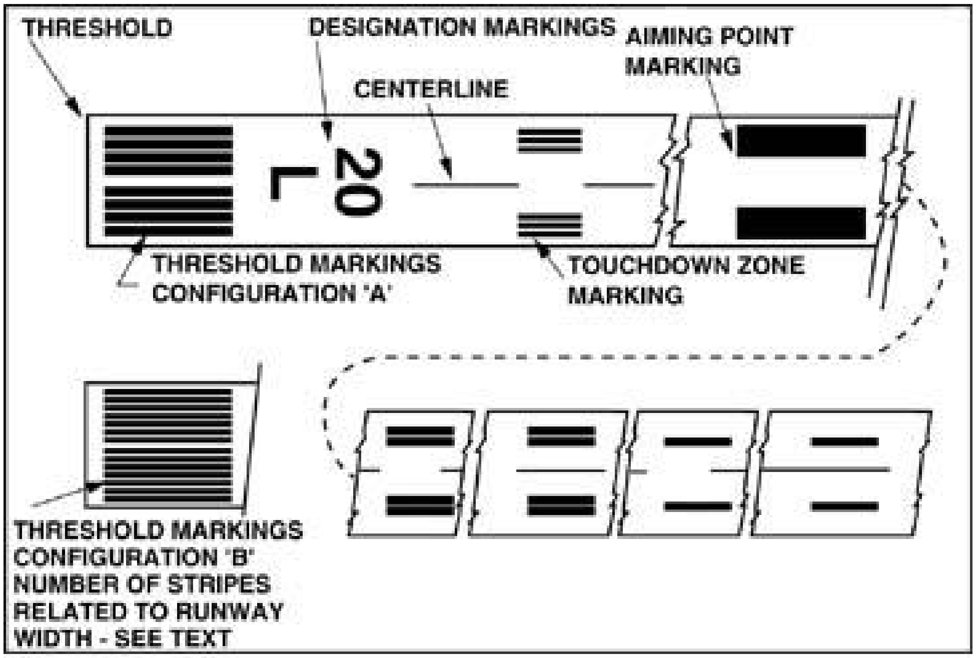
Visual and non-precision runway markings

Runway designators identify the name of the runway by the runway's orientation. The runway number is the whole number nearest one-tenth the magnetic azimuth of the centerline of the runway, measured clockwise from magnetic north. The letters differentiate among left (L), right (R), or center (C) parallel runways, as applicable.

Runway centerlines identify the center of the runway and provide alignment guidance during takeoff and landings. The centerline consists of a line of uniformly spaced stripes and gaps.

Runway threshold markings help identify the beginning of the runway that is available for landing. In some instances, the landing threshold may be *relocated* or *displaced* up the runway from the actual beginning of pavement. Run-way threshold markings come in two configurations. They either consist of eight longitudinal stripes of uniform dimension disposed symmetrically about the runway centerline or the number of stripes is related to the width of the runway.

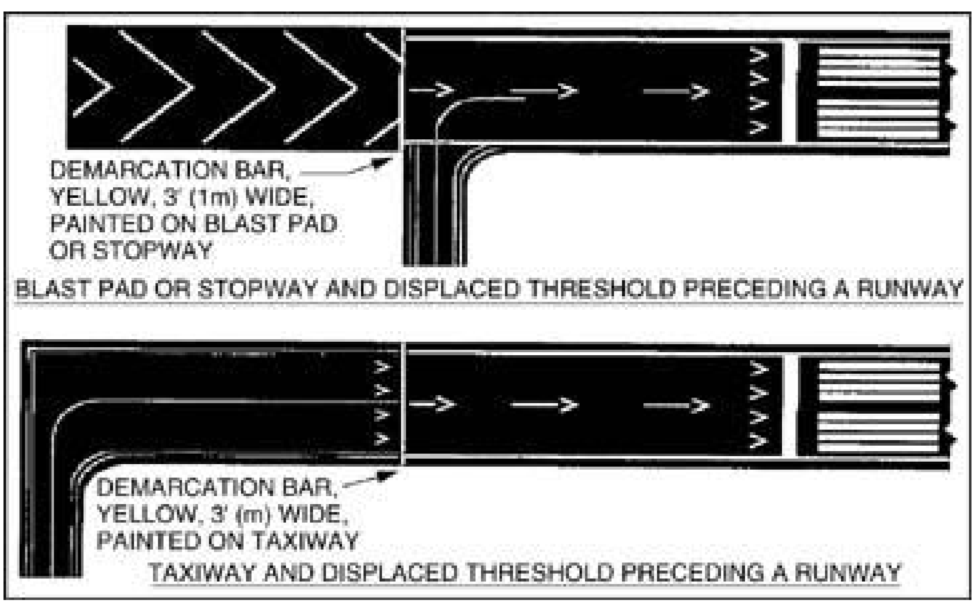
A **displaced threshold** is a threshold located at a point on the runway other than the designated beginning of the runway. Displacement of the runway threshold reduces the length of runway available for landings. The portion of the runway behind a displaced threshold is available for landings and takeoffs in either direction and landings from the opposite direction. A 10-foot-wide white threshold bar is located across the width of the runway at the displaced thresh-old. White arrows are located along the centerline in the area between the be-ginning of the runway and the displaced threshold.



Precision runway markings

Number of Runway Threshold Stripes

Runway Width, ft	(m)	Number of Stripes
60	(18)	4
75	(23)	6
100	(30)	8
150	(45)	12
200	(60)	16



Displaced threshold markings

Runway aiming points serve as visual aiming points for a landing aircraft. These two rectangular markings consist of a broad white stripe located on each side of the runway centerline and approximately 1,000 feet (300 m) from the landing threshold, that is, the beginning of the runway allowable for landing.

Runway touchdown zone markings identify the touchdown zone for land-ing operations. They are coded to provide distance information in 500-foot (150 m) increments for a distance of 2,500 feet from the threshold. These mark-ings consist of groups of one, two, and three rectangular bars, symmetrically arranged in pairs about the runway centerline. For runways having touchdown zone markings at both ends, those pairs of markings that extend to within 900 feet (270 m) of the midpoint between the thresholds are eliminated.

Runway side stripes delineate the edges of the runway. They provide a visual contrast between the runway and the abutting terrain or shoulders. Side stripes consist of continuous white stripes located on each side of the runway. Run-way shoulder stripes may also be used to supplement runway side stripes to identify pavement areas contiguous to the runway sides that are not intended for use by aircraft. Runway shoulder stripes are yellow stripes marked at a 45-degree angle to the direction of the runway, upward in the direction of operation, from the threshold to the midpoint of the runway.

Runway lighting

Runway lighting is extremely important for nighttime aircraft operations or in poor visibility weather conditions. Runway lighting systems are placed into three categories, approach lighting systems, visual glide slope indicators, run-way end identifiers, runway edge light systems, and in-runway lighting systems. As their names imply, approach lighting systems aid aircraft in properly.

Approach lighting systems **Approach lighting systems** (ALS) provide the basic means for aircraft to identify runways when operating in poor weather conditions and when operating under IFR. ALS are a configuration of signal lights starting at the landing threshold and extending back from the runway, called the *approach area*, a distance of 2,400 to 3,000 feet for precision instrument runways and 1,400 to 1,500 feet for non-precision instrument runways. Some systems include sequenced flashing lights which appear to the pilot as a ball of light traveling toward the runway at high speed.

Visual glide slope indicators Visual glide slope indicators are lighting systems located adjacent to runways on the airfield to assist aircraft with visually based vertical alignment on approach to landing. The five most common visual glide slope indicators are visual approach slope indicators (VASI), precision approach path indicators (PAPI), tricolor systems, pulsating systems, and alignment of elements systems.

The **visual approach slope indicator (VASI)** is a system of lights so arranged to provide visual descent guidance information during an aircraft's approach to a runway. These lights are visible from 3 to 5 miles during the day and up to 20 miles or more at night. The visual glide path of the VASI provides safe obstruction clearance within 10 degrees of the extended runway centerline and to 4 nautical miles from the runway threshold.

The **precision approach path indicator (PAPI)** uses light units similar to the VASI, but they are installed in a single row of their two or four light units. These systems have an effective visual range of about 5 miles during the day and up to 20 miles at night. The row of light units is normally installed on the left side of the runway. As with the VASI, the light units on the PAPI are equipped with red and white beams that project various degrees of glide path to the runway. The PAPI is said to be more precise than a VASI because it allows the pilot to judge approximately how many degrees above or below the glide path the air-craft is on approach by the number red versus white lights observed. For ex-ample, on a four-light PAPI, observing two red and two white lights denotes on glide path, three red and one white light denotes slightly below (approximately 0.2 degrees) glide path, four red lights denote 0.5 or more degrees below glide slope.

Runway end identifier lights (REIL) *Runway end identifier lights (REILs)* are installed at many airfields to provide rapid and positive identification of the approach end of a runway. The system consists of a pair of synchronized flashing lights located laterally on each side of the runway threshold. REILs may be either omni directional or unidirectional facing the approach area. They are effective for identifying a runway surrounded by a preponderance of other lighting, a runway which lacks contrast with surrounding terrain, or a runway during reduced visibility.

Runway edge light systems Runway edge lights are used to outline the edges of runways during periods of darkness or reduced visibility. These light systems are classified according to the intensity or brightness they are capable of producing. Runway edge light systems include:

HIRL—high-intensity runway lights

MIRL—medium-intensity runway lights

LIRL—low-intensity runway lights

In-runway lighting Lighting systems integrated into the runway pavement include runway centerline lighting systems (RCLS), touchdown zone lights (TDZL), taxiway lead-off lights, and land and hold short lights. These lighting systems are intended to aid aircraft on approach, on takeoff, and for taxiing on and off the runway.

Runway centerline lighting systems (RCLS) are installed on some precision instrument runways to facilitate landing under reduced visibility conditions. They are located along the runway centerline and are spaced at 50-foot intervals. When viewed from the landing threshold, the runway centerline lights are white until the last 3,000 feet of the runway. The white lights begin to alternate with red for the next 2,000 feet, and for the last 1,000 feet of runway, all centerline lights are red.

Touchdown zone lights (TDZL) are installed on some precision approach runways to indicate the touchdown zone when landing under adverse visibility conditions. They consist of two rows of transverse light bars disposed sym-metrically about the runway centerline. The system consists of steady-burning white lights that start 100 feet beyond the landing threshold and extend to 3,000 feet beyond the landing threshold or to the midpoint of the runway, whichever is less.

Taxiways

The major function of taxiways is to provide access for aircraft to travel to and from the runways to other areas of the airport in an expeditious manner. **Taxi-ways** are identified as *parallel taxiways, entrance taxiways, bypass taxiways,* or *exit taxiways.* A parallel taxiway is aligned parallel to an adjacent runway, whereas exit and entrance taxiways are typically oriented perpendicular to the runway, connecting the parallel taxiway with the runway. Entrance taxiways are located near the departure ends of runways; exit taxiways are located at various points along the runway to allow landing aircraft to efficiently exit the runway after landing. Bypass taxiways are located at areas of congestion at busy airports. They allow aircraft to bypass other aircraft parked on the parallel or entrance taxiways in order to reach the runway for takeoff.

Taxiways are planned with the following principles in mind:

1. Aircraft that have just landed should not interfere with aircraft taxiing to take off.

2. Taxi routes should provide the shortest distance between aircraft parking areas and runways.

3. At busy airports, taxiways are normally located at various points along runways so that landing aircraft can leave the runways as quickly as possible.

4. A taxiway designed to permit higher turnoff speeds reduces the time a landing aircraft is on the runway. Such taxiways are called *high-speed exit taxiways* and are typically aligned at a 30 to 45 degree angle connecting the runway with the parallel taxiway.

5. When possible, taxiways are planned so as not to cross an active run-way.

Taxiway markings

All taxiways should have centerline markings and runway holding position markings whenever they intersect a runway. Taxiway edge markings are pre sent whenever there is a need to separate the taxiway from a pavement that is not intended for aircraft use or to delineate the edge of the taxiway.

The *taxiway centerline* is a single continuous yellow line, 6 to 12 inches in width.

Taxiway edge markings are used to define the edge of the taxiway. They are primarily used when the taxiway edge does not correspond with the edge of the pavement. There are two types of markings depending upon whether air-craft are permitted to cross the taxiway edge. *Continuous markings,* consisting of a continuous double yellow line, with each line being at least 6 inches in width spaced 6 inches apart, are used to define the taxiway edge from the shoulder or some other abutting paved surface not intended for use by aircraft.

Dashed markings are used when there is an operational need to define the edge of a taxiway on a paved surface where the adjoining pavement to the taxiway edge is intended for use by aircraft, for example, an aircraft apron or parking area. Dashed taxiway edge markings consist of a broken double yellow line, with each line being at least 6 inches in width, spaced 6 inches apart. These lines are 15 feet in length with 25-foot gaps.

Taxiway lighting

Many airports are equipped with taxiway lighting to facilitate the movement of aircraft on the airfield at night or in poor visibility conditions. Taxiway lighting includes taxiway edge lights, taxiway centerline lights, clearance bar lights, runway guard lights, and stop bar lights.

Taxiway edge lights are used to outline the edges of taxiways during periods of darkness or restricted visibility conditions. These lights emit blue light. **Taxi-way centerline lights** are located along taxiway centerlines in a straight line on straight portions, on the centerline of curved portions, and along designated taxiing paths in portions of runways, aircraft ramp, and parking areas. Taxiway centerline lights are steady burning and emit green light.

Clearance bar lights are installed at holding positions on taxiways in order to increase the conspicuity of the holding position in low-visibility conditions. They may also be installed to indicate the location of intersecting taxiways during periods of darkness. Clearance bars consist of three in-pavement steady-burning yellow lights.

Runway guard lights are installed at intersections of runways and taxiways. They are primarily used to enhance the conspicuity of taxiway/runway inter-sections during low-visibility conditions but may be used in all weather conditions. Runway guard lights consist of either a pair of elevated flashing yellow lights installed on either side of the taxiway, or a row of in-pavement yellow lights installed across the entire runway, at the runway holding position marking.

Stop bar lights are used to confirm instructions from air traffic controllers' clearance to enter or cross an active runway in low-visibility conditions. A stop bar consists of a row of red, unidirectional, steady-burning in-pavement lights in-stalled across the entire taxiway at the runway holding position, and elevated steady-burning red lights on each side. A controlled stop bar is operated in conjunction with the taxiway centerline lead-on lights which extend from the stop bar toward the runway. Following clearance to proceed, the stop bar is turned off and the lead-on lights are turned on. The stop bar and lead-on lights are automatically reset by a sensor or backup timer.

Airport and heliport beacons have a vertical light distribution to make them most effective from 1 to 10 degrees above the horizon; however, they typically can be seen well above and below this peak spread. The beacon may be an omni directional capacitor-discharge device, or it may rotate at a constant speed which produces the visual effect of flashes at regular intervals. Flashes may be one or two colors alternately. The total numbers of flashes are:

1. 24 to 30 per minute for beacons marking airports

2. 30 to 45 per minute for beacons marking heliports

The color or color combination displayed by a particular beacon indicates the type of airport it is identifying:

1. Alternating white and green:	Lighted land airport
2. Alternating white and yellow:	Lighted water airport
3. Alternating green, yellow, and white:	Lighted heliport
4. Flashing white:	Unlighted airport

Military airport beacons flash alternatively white and green, but are differentiated from civil beacons by dual-peaked (two quick) white flashes between the green flashes.

Navigational aids (NAVAIDS) located on airfields

Various types of **navigational aids (NAVAIDS)** are in use today to aid aircraft both to fly between locations and to approach an airport for landing, particularly in poor weather conditions. Often these aids are located on air-port airfields and, hence, airport management and planners should be aware of how they operate and where they may be placed in relation to other facilities on the airfield.

Non-directional radio beacons (NDB)

The **non-directional radio beacon,** or **NDB,** is the oldest of the radio signal–based Navigational Aids Used on Airfields. NDBs emit low- or medium-frequency radio signals whereby the pilot of an aircraft properly equipped with an automatic direction finder (ADF) can determine bearings and "home" in on the station. NDBs normally operate in the frequency of 190 to 535 kilohertz (kHz) and transmit a continuous carrier with either 400 or 1,020 hertz (Hz) modulation. NDBs are considered to be non-precision navigational aids, and thus runways approached by aircraft utilizing an NDB for navigational aid are equipped with non-precision instrument markings.

Very-high-frequency omni directional range radio beacons (VOR)

The **VOR** is the most common ground-based electronic navigational aid found in the United States today. The VOR transmits a set of very-high-frequency navigational signals, which, when identified by navigation instruments in aircraft, determine the location of the VOR from the aircraft with respect to magnetic north. VORs operate within the 108.0 to 117.95 MHz frequency band and have a power output necessary to provide coverage within their assigned operational service volume. The standard VORs found on airports are called TVORs, and have a typical operational service volume of 25 nautical miles in radius from the airport. VORs are considered to be non-precision navigational aids, and thus runways approached by aircraft utilizing a VOR for navigational aid are equipped with non-precision instrument markings.

Instrument Landing Systems (ILS)

The most common navigational aid used by aircraft for both lateral and vertical guidance on approach to runways is the **Instrument Landing System (ILS).** The ILS is designed to provide an approach path for exact alignment and descent of an aircraft on approach to a runway. By virtue of the fact that the ILS provides both lateral and vertical guidance, it is considered a *precision approach* system, and is associated with precision approach markings on its associated runway. The ILS has been the standard precision approach navigational aid since its introduction in the United States in 1941. The ILS provides guidance by radio beams that define a straight-line path to the runway at a fixed slope of approximately 3 degrees, beginning 5 to 7 miles from the runway threshold. All aircraft approaching the airport under ILS guidance must follow this path in single file.

The **localizer** transmitter operates on one of 40 ILS channels within the frequency range of 108.10 to 111.95 MHz. Signals provide the pilot with course guidance to the runway centerline. The localizer antenna is sited on the ex-tended runway centerline 1,000 to 2,000 feet beyond the far end of the runway. An area of radius 250 feet along with a rectangular area extending from the antenna down the runway at lengths ranging from 2,000 to 7,000 feet and widths ranging from 500 to 600 feet is called the *ILS critical area,* and must be left free of any objects. In addition, when an aircraft is on approach using the ILS as guidance, no other vehicles or aircraft are allowed in or over the ILS critical area.

The **glide slope transmitter** transmits UHF frequencies on one of the 40 ILS channels within the frequency range 329.15 to 335.00 MHz radiating in the direction of the approach. The glide slope transmitter is located between 750 feet and 1,250 feet from the approach end of the runway (down the runway) and offset 250 to 650 feet from the runway centerline. The glide slope antenna may be located on either side of the runway, but preferably the side offering the least possibility of signal reflections from buildings, power lines, and other objects.

Microwave Landing Systems (MLS)

Another precision approach navigational aid found at airports is the **Microwave Landing System (MLS).** The MLS was developed in the early 1970s and at the time was slated to replace the ILS as the standard in precision approach NAVAIDS. In 1995, however, these plans were discontinued by the FAA.

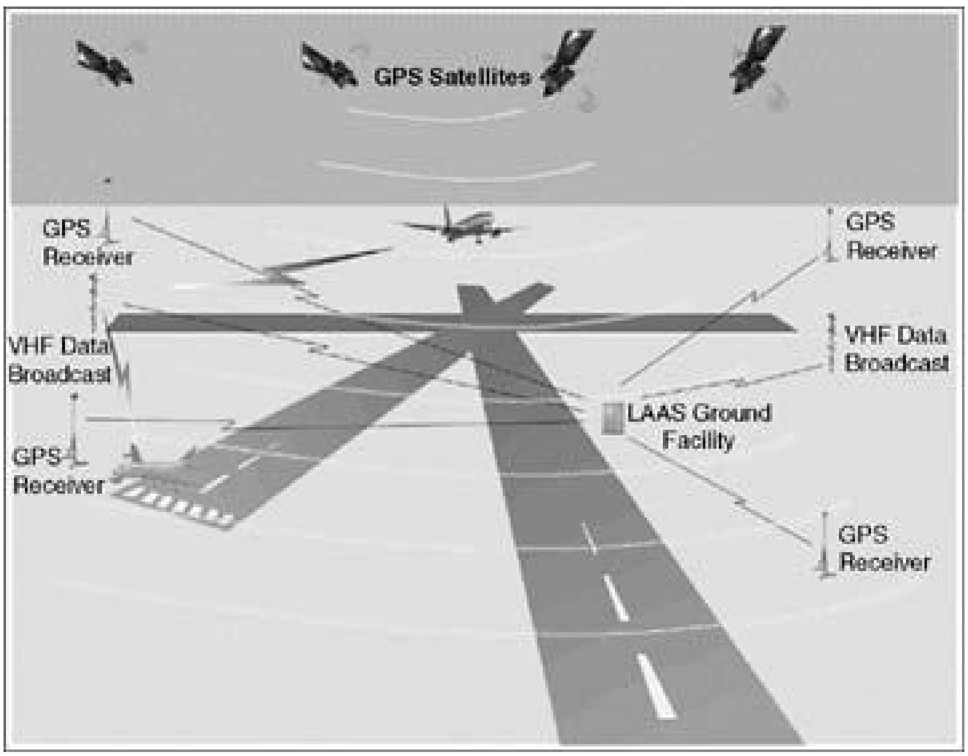
The MLS transmits a radio beam at microwave-level frequencies sweeping from left to right, and right to left, across the sky. By automatically timing the intervals between successive interceptions of the sweeping beam, the MLS can accurately estimate an aircraft's position relative to the runway while on approach. MLS is not particularly susceptible to signal interference as a result of buildings, trees, power lines, metal fences, and other large objects. However, when these objects are in the coverage area, they may cause multipath (signal reflection) or shadowing (signal blockage) problems.

GPS Local Area Augmentation Systems (LAAS)

Global Positioning System (GPS) to provide satellite-based navigational aids with sufficient accuracy and information to allow precision approaches to runways. To improve the accuracy of GPS systems for approaches, system equipment enhancement infra-structure, known as the **Local Area Augmentation System (LAAS)** is being implemented on airport airfields. LAAS infrastructure includes a ground facility (LGF) made up of four reference receivers and antenna pairs and a redundant very-high frequency data broadcast (VDB) equipment and antenna. This equipment is installed on airport property where LAAS is intended to provide ser-vice. These ground stations, called pseudolites, are located at precisely surveyed ground locations on the airfield, to ensure accurate and consistent data transfer between the LAAS, GPS satellites, and aircraft.

Air traffic control and surveillance facilities located on the airfield

At many airports, especially those that experience a high level of operational activity, air traffic control and surveillance procedures are located on the air field to control and facilitate the safe and efficient movement of aircraft to, from, and around the airport's airfield.



Air traffic control towers

Perhaps the most prominent air traffic control facility located on an airfield is the **air traffic control tower (ATCT).** From control towers, air traffic control personnel control flight operations within the airport's designated airspace [typically within a 5-mile radius of the airport, from the ground to 2,500 feet above ground level (AGL)] and the operation of aircraft and vehicles on the air-field's movement area.

Airport surveillance radar (ASR)

Airport surveillance radars (ASR) are radar facilities located on the airport airfield used to control air traffic. ASR antennas scan through 360 degrees to present an air traffic controller with the location of all aircraft within 60 nautical miles of the airport. The site for an ASR antenna is flexible, subject to certain location and clearance guidelines.

Airport Surface Detection Equipment (ASDE)

Surveillance and control of aircraft movement on the airport surface is normally accomplished largely by visual means, but during periods of low visibility caused by conditions such as rain, fog, and night, the surface movement of aircraft and service vehicles are drastically reduced. To improve the safety and efficiency of ground movement operations in low visibility, controllers take advantage of two radar-based systems employed at the busier airports. These systems are called **airport surface detection equipment (ASDE-3)** and **Airport Movement Area Safety Systems (AMASS).**

Weather reporting facilities located on airfields

Many airports are equipped with automated weather reporting facilities to pro-vide pilots with up-to-date meteorological information including cloud height, visibility, wind speed and direction, temperature, dew point temperature, and precipitation information. Two of the most common systems are the Auto-mated Weather Observing System (AWOS) and the Automated Surface Observing System (ASOS).

The **Automated Weather Observing System (AWOS)** is a suite of sensors which provide a minute-to-minute update that is usually provided to pilots by a radio on a frequency between 118.0 and 136.0 MHz. Six different AWOS types are available with varying weather reporting capabilities. Table 4-3 lists the different types of AWOS systems and their capabilities.

The **Automated Surface Observing System (ASOS)** is another automated ob-serving system sponsored by the FAA, National Weather Service (NWS), and the Department of Defense (DOD). ASOS provides weather observations that include air and dew point temperature, wind, air pressure, visibility, sky conditions, and precipitation. A total of 882 airports are currently equipped with ASOS or AWOS of varying capabilities.

Wind indicators

Perhaps the simplest system located on airfields that report meteorological conditions are *wind indicators.* Three of the most common wind indicators include wind socks, wind tees, and tetrahedrons. These systems provide vital information at airports where no other sources of weather information are provided so that pilots may appropriately determine the appropriate runway to use for take-off and landing. At airports where other sources of weather information are provided, wind indicators give the pilot supplemental information of possibly highly variable wind changes while on approach or takeoff.

. AWOS Capabilities

System	Capabilities
AWOS I	Wind speed, wind gust, wind direction, variable wind direction, temperature, air pressure, and density altitude
AWOS II	AWOS I capabilities, visibility, and variable visibility
AWOS III	AWOS II capabilities, sky conditions, cloud heights and type
AWOS III-P	AWOS III capabilities, present thunder and precipitation identification
AWOS III-T	AWOS III capabilities, thunderstorm and lightning detection
AWOS III-P-T	AWOS III capabilities, present weather and lightning detection.

A **wind sock** is a hollow flag like object that depicts approximate wind direction and speed. As air flows into the wind sock, it becomes oriented so that it is pointing away from the source of the wind, that is, in the *downwind direction,* toward the approach end of the runway of appropriate use. In addition, the stronger the wind, the straighter the extension of the wind sock.

A **wind tee** is similar to that of a typical weather vane. The wind tee points into the direction of the source of the wind. The typical wind tee is designed in the form of an aircraft to illustrate the suggested direction of operations on the basis of wind direction. The wind tee does not provide any information regarding the speed of the wind.

A **tetrahedron** is a landing indicator typically located near a wind direction indicator. The tetrahedron may swing around with the small end point into the wind, or it may be manually positioned to depict recommended landing direction. The tetrahedron is usually large and painted in such a manner that makes it easily visible to aircraft on approach to the airport.

At airports without control towers, wind direction indicators are usually placed on airfields surrounded by a segmented circle. A segmented circle is a set of markings that depict the runway configuration and recommended traffic pat-terns of aircraft at the airfield. The segmented circle provides further assistance to pilots with relation to suggesting the proper runway and traffic procedures to use when utilizing the airfield.

Security infrastructure on airfields

Airport facilities require protection from acts of vandalism, theft, and potential terrorist attack. To provide a measure of protection, unauthorized persons must be precluded from having access to all airfield facilities. At most airports where air traffic control facilities, approach lighting systems, and other navigation and weather aids are present, *perimeter fencing* around the airfield is strongly recommended. In addition, security procedures should be established for the protection of the airfield and its facilities.

Access to the airfield from the perimeter is typically regulated by some means of *controlled access*. At smaller airports controlled access measures may be limited to simple padlocks securing access gates adjoining the perimeter fence. Other access controls include the use of identification cards and number combinations to open electronically secured access points. Further details regarding airport security infrastructure may be found in Chap. 8 of this text.

Unit – III

Airspace and Air Traffic Control

Air Traffic Control Management and Operating Infrastructure

Air Traffic Control System Command Center

At the top of the air traffic control operational hierarchy is the Air Traffic Control System Command Center (ATCSCC). The ATCSCC provides macro level management of every aircraft currently in the national airspace system, as well as those aircraft with itineraries planned hours into the future. The ATCSCC in its current form was established in 1994 and currently resides in Herndon, Virginia. The role of the ATCSCC is to manage the flow of air traffic within the continental United States. The ATCSCC regulates air traffic when weather, equipment, runway closures, or other impacting conditions place stress on the National Airspace System. In these instances, traffic management specialists at the ATCSCC take action to modify traffic demands in order to reduce potential delays and unsafe situations in the air. Some of the strategies used by ATCSCC include the implementation of speed restrictions on aircraft, and imposition of ground delay programs, known as *ground holds,* on aircraft. Under a ground delay program, aircraft destined for an airport with potential delays upon arrival time will be held at its originating airport in order to avoid congestion and delays on route.

The Basics of Air Traffic Control

Aircraft flying between airports within the United States operate under varying levels of air traffic control, depending on the location and altitude at which they are traveling and the weather conditions while in flight. In many areas of the United States, particularly at low altitudes around unpopulated areas, air-craft may fly under no direct control by ATC. In contrast, in poor weather conditions, around busy air traffic areas, and at high altitudes, aircraft must fly under *positive control,* where altitude, direction, and speed of aircraft are dictated by air traffic controllers.

Visual flight rules (VFR) versus instrument flight rules (IFR)

One factor that determines the level of control an aircraft will be subject to depends, in part, on the type of flight rules the aircraft is operating under. The flight rules, in turn, depend, in part, on the weather conditions during flight. Under weather conditions where the visibility is sufficient to see and avoid other aircraft, and the pilot can keep the aircraft sufficiently clear of clouds, the pilot may operate under **visual flight rules (VFR).** When visibility is insufficient or a pilot's route takes the aircraft through clouds, the aircraft must fly under **instrument flight rules (IFR).** While flying under VFR, there are often times when positive control by ATC is unnecessary; under IFR, positive control is mandated.

Airspace classes

The visibility and cloud clearance criteria determining whether or not an air-craft must fly under IFR versus VFR depends largely on the class of airspace through which the aircraft will be flying. The airspace class of any given location in the United States is defined by the FAA and identified by pilots by referencing air traffic control maps, called *sectionals, terminal area charts,* or *aeronautical charts.* It is important for airport management, as well, to identify the class of airspace under which their airport lies, for it certainly has an impact on aircraft operations at the airport. Since 1993, airspace has been classified as either Class A, Class B, Class C, Class D, Class E, or Class G airspace.

Class A airspace, known as **Positive Control Airspace** prior to 1993, is located continuously throughout the continental United States, including the waters surrounding the continental United States out to 12 miles from the coastline, and Alaska, beginning at an altitude of 18,000 feet above sea level (MSL) up to 60,000 feet MSL (known as FL 600). Unless otherwise authorized, all aircraft operating in Class A airspace must operate under IFR.

Class A airspace is controlled by ATC at Air Route Traffic Control Centers (ARTCCs). There are 21 ARTCCs in the United States, each controlling one of 20 contiguous areas in the continental United States, and the area surrounding Alaska.

Class B airspace, known as **Terminal Radar Service Areas (TSRA)** prior to 1993, surrounds the nation's busiest airports (in terms of commercial passenger enplanements or IFR operations). The configuration of each Class B airspace area is specific to each area, but typically consists of a surface area and two or more layers of controlled airspace. The shape of Class B airspace is often de-scribed as an "upside down wedding cake." Generally, Class B airspace centers around the busiest airport in the area, extending from the surface to 10,000 feet MSL. Aircraft must be granted permission to fly within Class B airspace. Aircraft flying under VFR must be able to remain clear of clouds while in Class B air-space. All aircraft flying in Class B airspace fly under the control of ATC.

Class B airspace is identified by thick dark blue lines, and altitude designations on aeronautical charts.

Class C airspace, known as **Airport Radar Service Areas (ARSA)** prior to 1993, surrounds those airports that serve moderately high levels of IFR operations or passenger enplanements. Class C is generally considered areas of moderate air traffic volumes, but not as busy as Class B airspace. Class C airspace is usually centered on an airport of moderately high volumes of traffic, rang an inverted wedding cake. When in Class C airspace, each aircraft must establish two-way radio communications with the ATC facility providing air traffic services prior to entering the airspace, and thereafter maintain those communications while in the airspace. To fly under VFR, there must exist at least 3 miles of visibility and aircraft must be able to remain at least 500 feet below, 1,000 feet above, and 2,000 feet horizontally from any clouds. ATC will control aircraft fly-ing under both VFR and IFR to maintain adequate separation from other aircraft under IFR. Aircraft flying VFR are responsible to see and avoid any other traffic. Class C airspace is identified by solid magenta rings and altitude designators on aeronautical charts.

TRACONs

Class B and Class C airspace, as well as some airspace extending beyond the limits of Class B and Class C airspace, is typically serviced by a **Terminal Radar Approach Control (TRACON) facility.** There are 185 TRACON facilities located within the United States controlling air traffic within approximately a 30-mile radius of the busiest airport in the area, from altitudes under 15,000 feet MSL, with the exception of the areas immediately surrounding the airport, which are typically controlled by an **air traffic control tower (ATCT).** The primary objectives of TRACON controllers are to facilitate the transition of air-craft to and from the local airport's airspace into an aircraft's en route phase of flight, and to coordinate the typically high volumes of air traffic flying within the area. TRACON facilities operate strictly by monitoring aircraft by radar and hence may not necessarily be located on airport property, although many are.

Class D airspace, known as Airport Traffic Areas or **Control Zones** (CZ) prior to 1993, surround those airports not in Class B or Class C airspace but do have an air traffic control tower in operation. Class D airspace is generally a cylindrical area, 5 miles in radius from the airport, ranging from the surface to 2,500 above the elevation of the airport. Unless authorized, each aircraft must establish two-way radio communications with the ATC facility providing air traffic services prior to entering the airspace and thereafter maintain those communications while in the airspace. While IFR traffic is controlled by ATC to maintain adequate separation in the airspace, VFR traffic generally is not, except when performing runway operations (takeoffs or landings). In order to operate VFR in Class D airspace, pilots must have at least 3 miles of visibility and be able to remain at least 500 feet below, 1,000 feet above, and 2,000 feet horizontally from clouds.

Class D airspace is identified by a dashed blue ring and altitude designator on aeronautical charts.

Airports operating under Class B, Class C, and Class D airspace almost always have an operational control tower (ATCT) monitoring operations on and within 5 miles of the airport. The ATCT typically controls all surface movement on the airport, as well as any air traffic departing, landing, or overflying the airport from the surface to 2,500 feet above the ground (AGL). ATCTs located at air-ports within Class B, Class C, and some Class D airspaces may be equipped with airport surveillance radar (ASR) to facilitate air traffic controllers in identifying and adequately managing the flow of potentially high volumes of traffic within the local airspace. ATCTs in Class B and Class C airspace may also be equipped with airport surface detection equipment (ASDE) to aid in controlling the movement of aircraft on the airfield itself.

Air traffic control towers

As of 2003, over 400 airports in the United States were equipped with air traffic control towers. The vast majority of these ATCTs are directly managed by the FAA, although there are an increasing number of ATCTs operated by private companies at smaller airports. These airports are part of the FAA's Con-tract Tower Program, which provides funding to airports to construct and support the operation of federal contract towers (FCTs). Services provided to airports under the Contract Tower Program are identical to that of Federal ATCTs, with the exception that they do not control traffic under IFR, but tend to have operating costs approximately half their federal counterparts. Under the federal Contract Tower Program, "low-density airports" are eligible to participate in the program.

Class E airspace, known as **General Controlled Airspace** prior to 1993, generally exists in the absence of Class A, B, C, or D airspace extending upward from the surface to 18,000 feet MSL within 5 miles of airports without control towers. In other areas, Class E airspace generally exists from 14,500 feet MSL to 18,000 feet MSL over the contiguous United States, including the waters within 12 miles off the coast, and Alaska. In addition, federal airways, known as Vic-tor Airways, and Jet Routes, which generally exist from 700 or 1,200 feet above the ground (AGL) are considered Class E airspace. Only aircraft operating under IFR receive positive control in Class E airspace. VFR traffic is responsible to see and avoid all traffic. All aircraft operating under VFR must have at least 3 miles of visibility and be able to remain at least 500 feet below, 1,000 feet above, and 2,000 feet horizontally from clouds at altitudes below 10,000 feet and must have at least 5 miles of visibility and remain 1,000 feet above, 1,000 feet below, and 1 mile clear of clouds at or above 10,000 feet MSL.

Class G airspace, known as **Uncontrolled Airspace** prior to 1993, encompasses the airspace in the absence of Class A, B, C, D, or E airspace. This limited area typically reaches from the surface to 14,500 feet MSL in areas that aren't part of federal airways, and from the surface to 700 or 1,200 feet AGL in areas that are part of federal airways. Many remote airfields lie under Class G airspace, and hence have the very basic minimum of air traffic control services, if any at all. Air-craft flying in Class G airspace receive air traffic control assistance only if the workload on air traffic controllers permits. Aircraft flying under IFR generally do not operate in Class G airspace. Aircraft flying under VFR are responsible to see and avoid all other aircraft, must have at least 1 mile of visibility, and be able to remain clear of clouds when flying in daylight conditions below 1,200 feet AGL. At night, when operating under 1,200 feet AGL, VFR aircraft must have at least 3 miles of visibility, and be able to remain 500 feet below, 1,000 feet above, and 2,000 feet horizontally from clouds. When operating at altitudes above 1,200 feet AGL but less than 10,000 feet MSL, aircraft operating in Class G airspace require at least 1 mile of visibility during the day, and 3 miles of visibility at night, and be at least 500 feet below, 1,000 feet above, and 2,000 feet horizontally clear of clouds. When operating at or above 10,000 feet MSL, and 1,200 feet AGL (at areas of high ground elevation, it is possible to be flying at greater than 10,000 feet MSL and less than 1,200 feet AGL), aircraft in Class G airspace must have at least 5 miles of visibility and remain at least 1,000 feet below, 1,000 feet above, and 1 mile horizontally clear of clouds.

Special-use airspace

ATC designates certain areas of airspace as special-use airspace (SUA), de-signed to segregate flight activity related to military and national security needs from other airspace users. There are six different kinds of special-use airspace: prohibited areas, restricted areas, military operations areas, alert areas, warning areas, and controlled firing areas.

Prohibited areas are established over security-sensitive ground facilities such as the White House, certain military installations, and presidential homes and retreats. All aircraft are prohibited from flight operations within a prohibited area unless specific prior approval is obtained from the FAA or the local con-trolling agency.

Restricted areas are established in areas where ongoing or intermittent activities occur that create unusual hazards to aircraft, such as artillery firing, aerial firing, and missile testing. Restricted areas differ from prohibited areas in that most restricted areas have specific hours of operation. Entry during restricted hours requires specific permission from the FAA or the local controlling agency.

Since September 11, 2001, the FAA and TSA have collaborated in designating and issuing **temporary flight restrictions (TFR)** that identify restricted areas for a period of time for reasons of national security. TFRs have been issued to restrict aviation activity around sporting events, military base activities, or other areas deemed to be security sensitive or potential terrorist targets for given periods of time. It is of utmost importance to pilots and airport managers alike to be aware of any TFRs that may be issued.

Military operations areas (MOA) are established to contain certain military activities, such as air combat maneuvers, intercepts, and acrobatics. Civilian flights are allowed within an MOA even when the area is in use by the military. ATC will provide separation services for IFR traffic within MOAs.

Alert areas contain a high volume of pilot training or an unusual type of aerial activity, such as helicopter activity near oil rigs, which could present a hazard to other aircraft. There are no special requirements for operations within alert areas other than heightened vigilance by pilots.

Warning areas contain the same kind of hazardous flight activity as restricted areas, but are located over domestic and international waters. Warning areas generally begin 3 miles offshore.

Controlled firings areas contain civilian and military activities that could be hazardous to nonparticipating aircraft, such as rocket testing, ordnance disposal, and blasting. They are different from prohibited and restricted areas in that radar or a ground lookout is used to indicate when an aircraft is approaching the area, at which time all activities are suspended.

Current and future enhancements to air traffic control

A variety of development and implementation programs have been sponsored by the FAA with the goal of further improving the safety and efficiency of air traffic control. Airspace and air traffic control development studies specifically have striven to reduce inefficiencies in the system by determining how best to restructure airspace and modify prescribed procedures for aircraft arrivals, departures, en route positions, and terminal area flow patterns. In mid-1998, the FAA initiated the National Airspace Redesign Program, a large-scale analysis of the national airspace structure that began by identifying problems in the congested airspace over the New York metropolitan area. Additional FAA airspace studies are ongoing in Chicago, northern and southern California, Salt Lake City, the southern region of the United States (from Florida through Georgia), and the Caribbean. The goal of the National Airspace Redesign Program is to ensure that the design and management of the NAS is prepared as the system evolves toward navigation reliant on the satellite-based Global Positioning Sys-tem known as *free flight.* The National Airspace Redesign Program consists of incremental changes to the national airspace structure consistent with evolving air traffic technologies, communications, and operational concepts.

The capacity of today's national airspace system is constrained by rules, procedures, and technologies that require air traffic controllers to direct aircraft within narrow, often inefficient guidelines. As air traffic continues to grow, these inefficiencies and their associated costs are compounded. Responding to these limitations, the FAA and the aviation industry are working together on two major, interdependent capacity initiatives: free flight and NAS modernization.

Free flight

Free flight is a concept for safe and efficient flight operating capability under IFR in which pilots have the freedom to select their own path and speed in real time. Air traffic restrictions are imposed only to ensure separation, to preclude exceeding airport capacity, to prevent unauthorized flight through special-use airspace, and to ensure the safety to flight. Restrictions are limited in extent and duration to correct the identified problem. Any activity that removes restrictions represents a move toward free flight. The transition to free flight requires changes in air traffic philosophies, procedures, and technologies.

The principal philosophical change required for free flight is a shift from the concept of air traffic control (ATC) to **air traffic management (ATM).** ATM differs from ATC in several ways: the increased extent of collaboration between users and air traffic managers, greater flexibility for users to make decisions to meet their unique operational goals, and the replacement of broad restrictions with user-determined limits and targeted restrictions only when required.

NAS modernization (National Airspace System (NAS))

To achieve the free flight concept and accommodate projected increases in air traffic, the FAA is modernizing and replacing much of the equipment, computers, and software used to manage air traffic and assure safe operations. Modernization of the NAS is intended to give users new abilities such as flexible departure and arrival routes and increased usage of preferred flight trajectories. The goal of NAS modernization is to increase the flexibility and efficiency of the NAS by improving traffic flow and weather predictability, and reduce user operating costs. The challenge to NAS modernization lies within maintaining a balance between the need to sustain and replace current critical ATC infra-structure with the desire to provide new capability to NAS users. The principal NAS modernization changes may be categorized into five functional areas: communications, navigation, surveillance, weather, and air traffic management.

Communications

NAS modernization intends to reduce the required amount of voice-to-voice communication between aircraft and ground facilities with the implementation of electronic data transfer between the flight deck and air traffic management systems using digital data link technology.

Changes in the communication sys-tem will create the following capabilities:

- Integration of voice and data communications
- More efficient use of the existing radio frequency spectrum available to civil aviation
- Improved quality and clarity of ATC messages to aircraft
- Enriched flight and traffic information services, such as weather graph-ics and proximity traffic data
- Seamless communications across all operational domains (airport, ter-minal, en route, and oceanic)
- Information sharing with all NAS users
- An effective interchange network to support dynamic usage

Aeronautical data link systems

The term "data link" refers to the overall system for entering, processing, transmitting, and displaying voice, alphanumeric, and graphic information between aircraft and ground facilities. Conceptually, a data link can be thought of as an information pipeline. Many systems connect with this pipeline, including ground automation, avionics, applications, sub networks, and transmission equipment.

Controller-to-pilot data link communications **Controller-to-Pilot Data Link**

Communications (CPDLC) is a data link service that will improve the speed, quality, and reliability of controller-to-pilot communications in the terminal and en route environments. To achieve this, the CPDLC will replace sets of controller-to-pilot voice messages with data messages displayed in the cock-pit. By permitting more timely and effective communication of ATC messages, CPDLC will improve airspace use and capacity by reducing frequency congestion and operational errors resulting from verbal miscommunication.

Next-generation air-to-ground communication system (NEXCOM) **Next-Generation**

Air-to-Ground Communication (NEXCOM) is a digital radio system designed to alleviate the problems of the current system while meeting future requirements. It is an analog/digital system incorporating the latest technological advances in radio communications. NEXCOM will provide capability to accommodate additional sectors and services; reduce logistical costs; replace expensive-to-maintain VHF and UHF radios; provide data link communications capability using VHF Data Link (VDL), reduce air-to-ground radio frequency interference and provide security mechanisms. When completed over 46,000 radios will be installed throughout the FAA system.

Flight Information Service (FIS) and Cockpit Information System (CIS)

The **Flight Information Service (FIS)** used a ground-based data server and data links to provide a variety of nonoperational control information to the cockpit such as weather products, traffic information, SUA status, NOTAMs, and obstruction updates. The **Cockpit Information System (CIS)** processes and displays FIS information and integrates it with navigation, surveillance, terrain, and other data available in the cockpit. When fully operational, the CIS will also be capable of sending and receiving route requests via data link to the air traffic controller. Weather information will be obtained via data link from a ground-based source or from other aircraft. SUA information may be stored prior to flight or may be updated in real time while in flight.

Navigation

In recent years, navigation has become increasingly reliant on the satellite-based **Global Positioning System (GPS).** Contrary to the traditional ground-based navigation systems such as NDBs, VORs, and ILSs, GPS is a space-based radio positioning, navigation, and time-transfer system. GPS was developed and is maintained by the U.S. Department of Defense, primarily for the military and activities associated with national defense. In July 1995, GPS gained full operational capability for civilian use, although with reduced accuracy. Since 1995, GPS navigation has been used at increasing volumes, particularly in sea-faring transportation, aviation, and even automobiles.

The **Wide Area Augmentation System (WAAS)** is one such augmentation. WAAS includes integrity broadcasts, differential corrections, and additional ranging signals. The primary objective of WAAS is to provide the ac-curacy, integrity, availability, and continuity required to support all phases of flight. In doing so, WAAS is designed to allow GPS to be used for en route navigation and non-precision approaches throughout the NAS, as well as for making precision (equivalent to ILS CAT I) approaches to selected airports. WAAS allows a pilot to determine a horizontal and vertical position to within 25 feet. The wide area of coverage for this system includes the entire United States and some outlying areas.

The GPS **Local Area Augmentation System (LAAS),** described in detail in Chap. 4 of this text, is yet another differential GPS system designed to augment the accuracy of GPS with the goal of allowing precision approaches to runways under IFR conditions where LAAS units are installed.

Surveillance

Knowing the position and intended path of aircraft relative to other aircraft, both on the ground and in the air, is necessary to ensure safe separation. The accuracy and certainty with which aircraft positions can be tracked determines the procedures and spacing allowed to maintain safe operations. Enhanced surveillance improves the efficiency of airspace usage by allowing reduced separation requirements, for example. In order to realize reduced separations standards, the free flight concept imposes particularly high demands on the ability to accurately and reliably locate and track the movement of aircraft with greater precision and at a faster update rate than is used today.

Technology placed in aircraft cockpits, known as the Traffic Alert and Collision Avoidance System (TCAS), is currently being implemented in aircraft to provide the pilot with enhanced traffic surveillance information. Part of the TCAS capability is a display showing the pilot the relative positions and velocities of aircraft up to 40 miles away. The instrument sounds an alarm when it determines that another aircraft will pass too closely to the subject aircraft. TCAS provides a backup to the air traffic control system's regular separation processes.

To augment existing surveillance procedures and radar, the implementation of a new system known as Automated Dependent Surveillance (ADS) is under process. Unlike radar, which tracks aircraft by using interrogating radio signals, ADS transmits position reports on the basis of onboard navigational instruments. ADS relies on data link technologies to transmit this information. Currently, there are two forms of ADS: ADS-Address (ADS-A) and ADS-Broadcast (ADS-B). The ADS-A system exchanges point-to-point information between a specific aircraft and an air traffic management facility, whereas the ADS-B sys-tem broadcasts information periodically to all aircraft and all air traffic management facilities within a specified area. The primary objective of ADS-A and ADS-B technology is to improve surveillance coverage, particularly in areas having poor or no radar coverage.

Weather

Today's fragmented weather gathering, analysis, and distribution systems are being enhanced by a more harmonized, integrated system. Incremental improvements in weather detection sensors, processors, dissemination systems, and displays are also occurring. Improved weather technologies are intended to provide the following enhancement to air traffic control and management:

- Common situational awareness among service providers and users through the use of integrated weather products
- NAS-wide availability of distributed weather forecast data
- Improved accuracy, display, and timeliness of weather information to service providers and users
- Better separation of aircraft from convective weather (such as thunder-storm, hurricanes, and tornadoes)
- Integrated weather information into associated air traffic automation systems

Weather is the single largest contributor to delay in the civil aviation system and is a major factor in aircraft safety incidents and accidents. Short-term forecasts and timely, accurate weather information on hazardous weather are critical to ensure safe flight and to plan fuel- and time-efficient flight plans.

Integrated Terminal Weather System (ITWS) The **ITWS (Integrated Terminal Weather System)** provides terminal aviation system users with safety and planning products that characterize current terminal weather situations and forecast about 30 minutes into the future. This is achieved by integrating data products from various FAA and **National Weather Service (NWS)** sensors, such as Terminal Doppler Weather Radar (TDWR), Airport Surveillance Radar-9 (ASR), Next-Generation Weather Radar (NEXRAD), Low-

Level Wind shear Alert System (LLWAS), Automated Surface Observing System (ASOS), and other NWS systems. Products generated by ITWS include wind shear and microburst predictions, storm cell and lightning information, terminal area winds aloft, runway winds, and short-term ceiling and visibility predictions.

Weather and Radar Processor (WARP) To aid in the integration of weather information disseminated by multiple independent units, the FAA has supported the implementation of Weather and Radar Processors (WARP) and multiple air traffic control facilities. WARP systems collect and process weather data from Low-Level Wind shear Systems (LLWAS), Next-Generation Weather Radar (NEXRAD), and Terminal Doppler Weather Radar (TDWR) and disseminates this data to controllers, traffic management specialists, pilots, and meteorologists. In addition to radar information, meteorological observations, warnings, forecasts, lightning strikes, satellite data, and oceanographic information will be received by WARP. Information that is significant to operations will be sorted and overlaid on ATC displays as they monitor flights. By providing a mosaic of weather information to advanced display systems, WARP will assist meteorologists in analyzing rapidly changing weather conditions and ATC in managing and minimizing weather-related delays.

Air Traffic Management

Managing air traffic and airspace utilization is becoming increasingly augmented with computer-based decision support systems. These systems are in-tended to improve the efficiency and effectiveness of NAS-wide information, enhancing all phases of surface and flight operations. The use of advanced automation and decision support systems is intended to enable the following capabilities:

- Greater collaboration on problem resolution through dynamic airspace management.
- More efficient use of airports through improved sequencing and spacing of arrival traffic and assigning aircraft to runways
- Improved acquisition and distribution of flight-specific data
- More information from static and dynamic data, such as route structures, NAS infrastructure states, special-use airspace restrictions, and aircraft position and trajectories
- Improved accommodation of user preferences through improved traffic flow management, conflict detection and resolution, sequencing, and optimal trajectories
- More flexible airspace structure by reducing boundary restrictions and creating dynamic sectors

Standard Terminal Automation Replacement System (STARS) and Display System Replacement (DSR) The **Standard Terminal Automation Replacement System (STARS)** is a joint FAA and DOD program to replace Automated Radar Terminal Systems (ARTS) and other capacity-constrained, older technology systems at 172 FAA and up to 199 DOD terminal radar approach control facilities and associated towers.

Collaborative Decision Making (CDM) Collaborative Decision Making (CDM) is a joint FAA-industry initiative designed to improve traffic flow management through increased interaction and collaboration between airspace users and the FAA. Through improved communication and more efficient use of airline schedules, CDM is intended to reduce the use of ground delay pro-grams and to give users more flexibility in responding to airport arrival constraints. The FAA runs ground delay programs through the ATCSCC when weather, air traffic control, system outages, airport operational status, and other factors are affected to the point where restricting the flow of aircraft into or out of affected airports is required.

The **Flight Schedule Monitor (FSM),** a primary component of CDM, is a sup-port tool that collects and displays arrival information, retrieves real-time demand and schedule information, monitors ground delay performance, and provides “what-if” analyses capable of projecting arrival rates, slot availability, and departure delays. The FSM is shared among CDM participants and is up-dated as schedules change.

Unit – IV

Airport Terminals and Ground Access

Introduction

The airport terminal area, comprised of passenger and cargo terminal buildings, aircraft parking, loading, unloading, and service areas such as passenger service facilities, automobile parking, and public transit stations, is a vital component to the airport system. The primary goal of an airport is to provide passengers and cargo access to air transportation, and thus the terminal area achieves the goal of the airport by providing the vital link between the airside of the airport and the landside. The terminal area provides the facilities, procedures, and processes to efficiently move crew, passengers, and cargo onto, and off of, commercial and general aviation aircraft.

The term *terminal* is in fact somewhat of a misnomer. Terminal implies ending. Although aircraft itineraries begin and end at an airport's terminal area, the itineraries of passengers and baggage do not. It is vitally important to understand that the airport terminal is not an end point, but an area of transfer along the way. As will be discussed in this section, the building configurations, facilities, and processes that comprise an airport terminal area require careful planning and management to ensure the efficient transfer of passengers and cargo through the airport and aviation system.

The historical development of airport terminals

Just as there were no runways or other airfield facilities during the very earliest days of aviation, there certainly were no terminals, at least the way they are recognized today. The first facilities that could be remotely considered airport terminal areas evolved in the early 1920s with the introduction of airmail ser-vice. Airmail operations required small depots in order to load and unload mail, fuel aircraft, and perform any required maintenance. Little in the way of formal passenger or cargo processing was required, and hence, airport terminal facilities were little more than single-room structures with the most basic of infrastructure.

The introduction of commercial passenger air service in the late 1920s resulted in the need to develop certain basic passenger processing policies. The earliest passenger processing strategies evolved from the major intercity transportation mode of the day, the railroads. Tickets and boarding passes were issued for passengers, and similar to policies set for rail transport, cargo rates were also charged, typically by the weight of the cargo being transported. (Sometimes passengers were weighed as well, primarily to ensure that the aircraft did not exceed its maximum takeoff weight. The facilities required for performing basic ticketing and weighing functions, as well as for aircraft boarding and alighting the relatively few passengers and little cargo that used civil air transportation could be, and were often, incorporated into one-room facilities, strikingly similar to the facilities that served the railroads.

Unit terminal concepts

These first terminals were the earliest **centralized facilities,** centralized mean-ing that all passenger processing facilities at the airport are housed in one building. These first centralized facilities became known as the earliest **simple-unit terminals,** because they contained all required passenger processing facilities for a given air carrier in a single-unit building. In addition to passenger processing facilities, the airport's administrative offices, and even air traffic control facilities, were located within the unit terminal building.

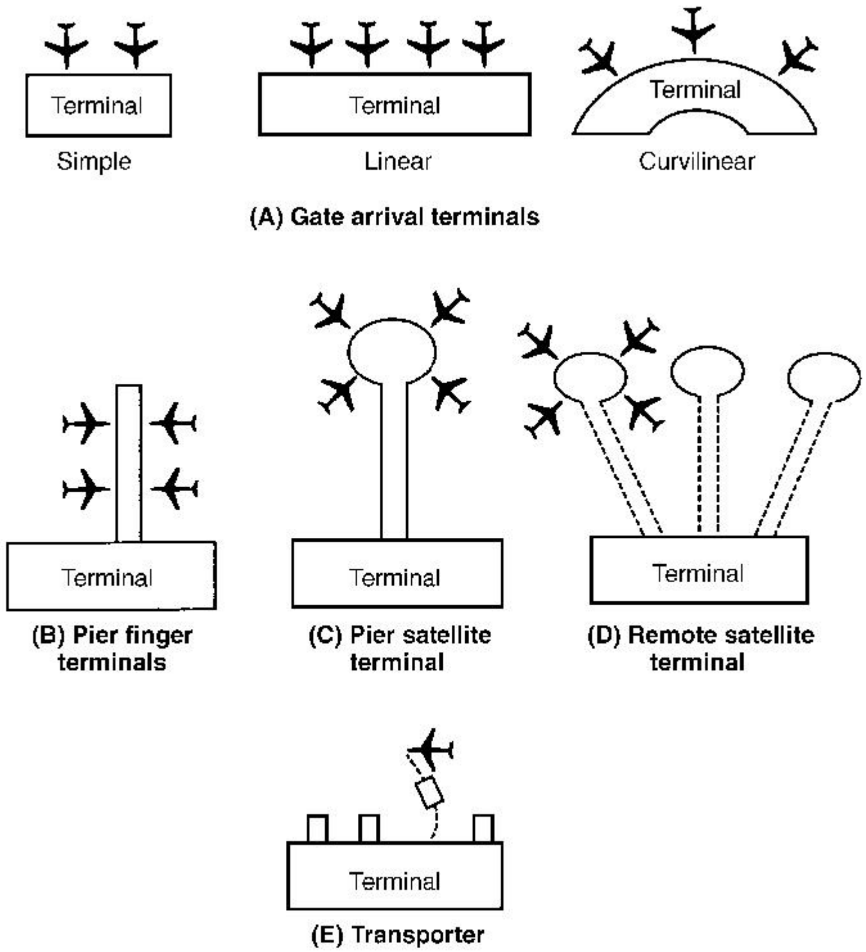
As air service became more popular, particularly in the 1940s and 1950s, airport terminals expanded to accommodate increasing volumes of aircraft, passengers, and cargo. As multiple airlines began to serve single communities, airport terminals expanded in two ways. In smaller communities, two or more airlines would share a common building, slightly larger than a simple unit terminal, but have separate passenger and baggage processing facilities. This configuration became known as the **combined unit terminal.** In larger metropolitan areas, separate buildings were constructed for each airline, each building behaving as its own unit terminal. This terminal area configuration became known as the **multiple-unit terminal** concept. Even though the multiple-unit terminal area consisted of separate facilities for each airline, it is still considered an individual *centralized* facility because all passenger and cargo processing required for any given passenger or piece of cargo to board any given flight still exists in one facility.

Linear terminal concepts

As airports expanded to meet the growing needs of the public, as well as the growing wingspans of aircraft, simple-unit terminals expanded outward in a rectangular or *linear* manner, with the goal of maintaining short distances between the vehicle curb and aircraft parking that existed with unit terminals. Within linear terminals, ticket counters serving individual airlines were introduced and loading bridges were deployed at aircraft gates to allow passengers to board aircraft without having to be outside on the apron, thereby improving convenience and safety for passengers.

In some instances airports were extended in a **curvilinear** fashion, allowing even more aircraft to park "nose-in" to the terminal building while maintaining short walking distances from the airport entrance to the aircraft gate.

One of the main disadvantages of linear terminals becomes evident as the length of the terminal building increases. Walking distances between facilities, particularly distantly separated gates, become excessive for the passenger whose itinerary requires a change in aircraft at the airport. Prior to airline deregulation the percentage of these transfer passengers was insignificant. After 1978, however, this percentage increased dramatically and the issue of long walking distances between gates became a major issue, particularly at the hub airports.



Pier finger terminals

The **pier finger terminal** concept evolved in the 1950s when gate *concourses* were added to simple unit terminal buildings. Concourses, known as *piers* or *fingers,* offered the opportunity to maximize the number of aircraft parking spaces with less infrastructure. Aircraft parking was assigned to both sides of a pier extending from the original unit terminal structure. The pier finger terminal is the first of what are known as **decentralized facilities,** with some of the required processing performed in common-use main terminal areas, and other processes performed in and around individual concourses.

Many airports today have pier finger terminals in use. Since the earliest pier finger designs, very sophisticated and often convoluted forms of the concept have been developed with the addition of hold rooms at gates, loading bridges, and vertical separation of enplaning and deplaning passengers in the main-unit terminal area.

Pier satellite and remote satellite terminals

Similar to pier finger terminals, **pier satellite terminals** formed as concourses extended from main-unit terminal buildings with aircraft parked at the end of the concourse around a round atrium or *satellite* area. Satellite gates are usually served by a common passenger holding area.

Satellite terminal concepts, developed in the 1960s and 1970s, took advantage of the ability to create either underground corridors or **Automated Passenger Movement Systems (APMs)** to connect main terminal buildings with con-courses. Such terminals are said to be built on the **remote satellite concept.**

The main advantage of the remote satellite concept is that one or more satellite facilities may be constructed and expanded when necessary while providing sufficient space for aircraft taxi operations between the main terminal building and satellites. In addition, although distances from the main terminal to a satellite may be quite large, APMs or other people-mover systems such as moving walkways or shuttle buses are provided to reduce walking distances.

The mobile lounge or transporter concept

In 1962 the opening of Dulles International Airport west of Washington, D.C., designed as the first airport specifically for the new jet aircraft of the day, introduced the **mobile lounge** or *transporter concept* of airport terminals. Some-times known also as the *remote aircraft parking concept,* the Washington Dulles terminal area attempted to maximize the number of aircraft that may be parked and maximize the number of passengers that may be processed, with minimal concourse infrastructure. In this concept, aircraft are parked at remote parking locations away from the main-unit terminal building. To travel between aircraft and the terminal building, passengers would board transporters, known as mobile lounges that would roam the airfield among ground vehicles and taxiing aircraft.

With the mobile lounge concept, walking distances were held to a minimum because the main, relatively compact, terminal building contains common passenger processing facilities, with automobile curbs and parking located in close proximity to the terminal building entrances. Theoretically, expansion to accommodate additional aircraft is facilitated by the fact that there is no need to physically expand concourses, piers, or satellites, just merely add additional mobile lounges, if necessary.

Hybrid terminal geometries

With the volatile changes in the amount and behavior of civil aviation activity in the 1970s, with increasing numbers of large aircraft (with high seating capacities and large wingspans), volumes of passengers, and changes in route structures, particularly after airline deregulation in 1978, airport management has had to expand and modify terminal areas to accommodate almost constantly changing environments. As a result, many airport terminal geometries expanded in an ad hoc manner, leading to *hybrid terminal geometries* incorporating features of two or more of the basic configurations. In addition, for airports that accommodate an airline's hub, airport terminal planning became necessary to accommodate up to 100 or more aircraft at one time and efficiently handle record volumes of passengers, particularly those passengers transferring between air-craft.

The airside-landside concept

The most significant terminal area concept to emerge involved a more physical separation between facilities that handle passengers and ground vehicles and those that deal primarily with aircraft handling. The **airside-landside concept** emerged with the opening of the Tampa International Airport in 1972, and has proliferated throughout the United States at airports such as Pittsburgh International Airport and Orlando International Airport.

Off-airport terminals

In the 1980s the airside-landside concept formed the basis for a series of experimental concepts known as **off-airport terminals.** With the notion that certain passenger processes, such as ticketing and baggage check-in, and certainly automobile parking, did not need to be within any proximity of aircraft, such processes weren't necessarily required to be performed on airport property. As a result, facilities located miles away from the airport itself were introduced whereby passengers could park their personal vehicles, check themselves and their baggage in for their flights, and then take a shuttle bus to the airport. With the use of these off-airport terminals, passengers would avoid the often significantly more crowded passenger processing facilities at the main terminal. Also the passenger would not be required to find parking at the often more crowded and expensive parking facilities at the main terminal.

Present-day airport terminals

With over 650 million passengers traveling annually, each with different agendas, itineraries, needs, and desires, airport terminals have become complex systems in their own rights, incorporating both necessary passenger and bag-gage processing services as well as a full spectrum of customer service, retail shopping, food and beverage, and other facilities to make the passengers' transition between the airside and landside components of the airport system as pleasant as possible.

It is clear that no single airport terminal configuration is best for all airports. The airfield, schedules of airlines, types of aircraft, volumes of passengers, and local considerations, such as local architecture, aesthetics, and civic pride, dictate different choices from airport to airport and from one time to another. The airport terminal planner has the dubious task of anticipating conditions up to 10 years in the future in an environment that seems to change by the day. To ensure that present-day airport terminal plans will be effective in the future, the airport planner must rely on the fundamental requirements of airport terminals and behaviors of passengers, and also must plan with the idea of flexibility in mind, such as considering facilities that can be expanded modularly or can pro-vide the opportunity for relatively low-cost, simple modifications that future circumstances might demand.

For airport management, airport terminal areas, when properly planned and managed, have provided significant sources of revenue from airline leases to retail concessions. Airport terminals have also become a sense of pride for communities in general, as they are typically the first impression that visitors get of their destination city and the last experience they get before leaving. Several airport terminals today appear more to be shopping malls than passenger processing facilities, and other airport terminals are fully equipped with hotels and conference centers. These facilities have actually encouraged visitors to use the facilities at the airport without ever intending to board an aircraft.

The size and shape of airport terminal configurations has both an uncertain yet exciting future. New security regulations imposed by the Transportation Security Administration have established the need to expand airport security facilities, whereas advances in information technologies have suggested the ability to reduce the size of other passenger processing facilities such as staffed ticket counters. No matter how policies, regulations, technologies, and behaviors change, however, the basic function of the airport terminal area, that of efficiently linking passengers and cargo to the airside and landside components of the civil aviation system, should always be understood by airport managers and planners alike.

Components of the airport terminal

The airport terminal area is in the unique position of accommodating the needs of both aircraft and the passengers that board them. As such, the component systems of the airport terminal area may be thought of as falling into two primary categories: the **apron and gate system,** which is planned and managed according to the characteristics of aircraft, and the *passenger and baggage handling systems,* which are planned and managed to accommodate the needs of passengers and their baggage in their transition to or from the aircraft.

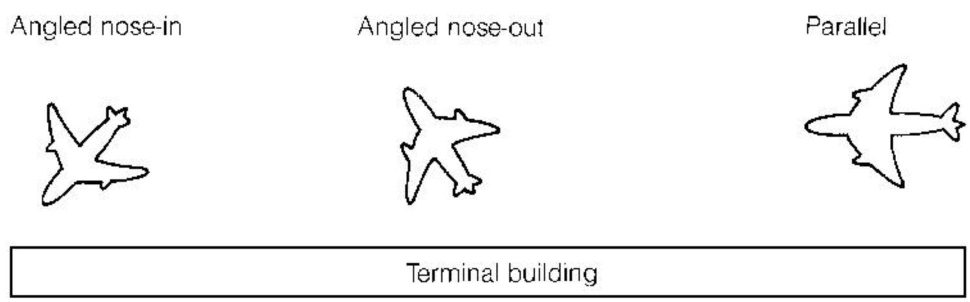
The apron and gate system

The apron and gates are the locations at which aircraft park to allow the loading and unloading of passengers and cargo, as well as for aircraft servicing and preflight preparation prior to entering the airfield and airspace.

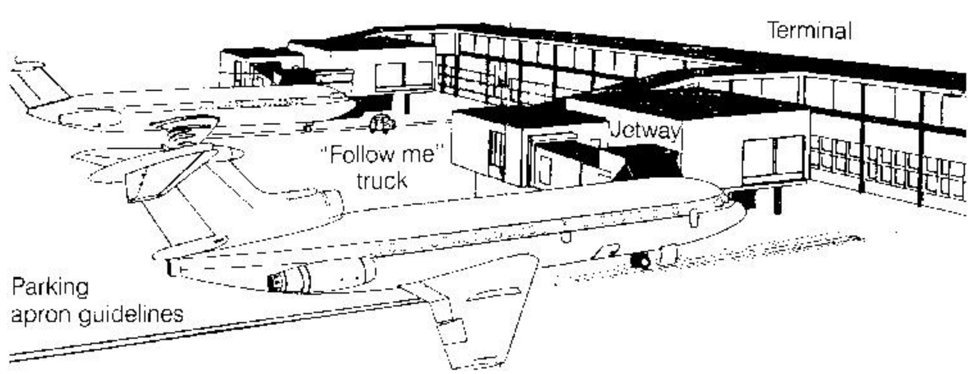
The size of aircraft, particularly their lengths and wingspans, is perhaps the single greatest determinant of the area required for individual gates and apron parking spaces. In fact, the grand size of airport terminals is a direct result of large numbers of gates designed to accommodate aircraft of wingspans reaching 200 feet in length. The size of any given aircraft parking area is also deter-mined by the orientation in which the aircraft will park, known as the *aircraft parking type.* Aircraft may be positioned at various angles with respect to the terminal building, may be attached to loading bridges or *Jet ways,* or may be freestanding and adjoined with *air stairs* for passenger boarding and deplaning. Some aircraft parking types require aircraft to be maneuvered either in or out of their parking spaces by the use of *aircraft tugs,* whereas other parking types allow the movement of aircraft in and out under their own power. The five major **aircraft parking** types are *nose-in parking, angled nose-in, angled nose-out, parallel parking,* and *remote parking.*

Angled nose-in parking brings aircraft as close to the terminal building as possible while maintaining enough maneuvering room so that aircraft may exit the parking space under its own power. Angled nose-in parking is typically used by smaller aircraft, such as turboprops or small regional jets. Air stairs are typically used to board and deplane passengers, removing the necessity for loading bridges. Angled nose-in parking requires slightly more parking area over nose-in parking for aircraft of similar size. However, because smaller air-craft tend to use angled nose-in parking, the difference in sizes of the two parking areas is not significantly different.

Angled nose-out parking brings aircraft slightly farther from the terminal building than nose-in and angled nose-in parking, because the blast from jets or large propellers has the potential of causing damage to terminal buildings if too close to the facility. Angled nose-out parking is typically used by larger general aviation aircraft and at facilities with relatively low levels of activity.



Aircraft parking positions



Nose-in parking

Parallel parking is said to be the easiest to achieve from an aircraft maneuvering standpoint, although each space tends to require the largest amount of physical space for a given size of aircraft. In this configuration, both front and aft doors of the aircraft on a given side may be used for passenger boarding by loading bridges. Typically, however, parallel parking is employed only by smaller general aviation aircraft with relatively large amounts of parking space near the terminal building. In addition, cargo aircraft may parallel park at their respective cargo terminals to facilitate the loading and unloading of their respective loads.

Remote parking may be employed when there is limited parking area avail-able at the terminal building itself or when aircraft parked may be stationed there overnight or for longer durations. Remote parking areas are typically comprised of a series of rows of parking spaces, sized to accommodate varying sizes of aircraft. Smaller commercial and general aviation aircraft may be boarded and deplaned from the remote parking areas with the use of shuttle buses or vans. Larger commercial aircraft are typically taxied to a close-in parking space prior to passenger loading.

Most airports have more than one aircraft parking type to accommodate the various types of aircraft that serve the different terminal geometries and air carrier or general aviation activities. Furthermore, airports with a high number of **based aircraft** or air carrier aircraft that **remain overnight (RON)** at the air-port, must take into consideration higher volumes of remote parking that is flexible to accommodate aircraft of various shapes and sizes.

The passenger handling system

The commercial airport terminal's **passenger handling system** is a series of links and processes that facilitate the transfer of passengers between an aircraft and one of the modes of the local ground transportation system. These processes include the *flight interface, passenger processing,* and *access/processing interface.*

The **flight interface** provides the link between the aircraft gates and passenger processing facilities. The flight interface includes gate lounges and service counters, moving sidewalks, buses, and mobile lounges; loading facilities such as loading bridges and air stairs; and facilities for transferring between flights, including corridors, waiting areas, and mobile conveyance facilities.

Passenger processing facilities accomplish the major processing activities required to prepare departing passengers for use of air transportation and arriving passengers to leave the airport for ground transportation to their ultimate destinations. Primary activities include ticketing, baggage check, security, pass-port check, baggage claim, customs, and immigration. Facilities include ticketing and baggage check-in counters, baggage and passenger security stations, information kiosks, baggage claim carousels, customs facilities, and rental car and other ground transportation desks.

Passengers and their required processing facilities

One of the greatest challenges of managing airport terminal operations is the challenge of accommodating the necessary and desired processing needs of a wide spectrum of passengers. It is staggering to think that nearly every one of the more than 650 million passengers that travel annually on commercial air carriers has a unique itinerary, and unique needs that must be accommodated. **Passengers** may be categorized in several manners, some of which include a passengers' segment of itinerary, trip purpose, group size, type of baggage carried, and type of ticket, and whether the passenger is an international or domestic traveler. Each passenger, by nature of the various categories that passenger may fall into, requires certain facilities, known as *essential processing* facilities within the airport terminal area. The understanding of each of these facilities on an individual basis, as well as an understanding of how each facility interacts with the other facilities, is itself essential for terminal operations to be successful.

Passenger processing requirements and other needs vary widely on the basis of the **segment of itinerary** the passenger is on while at the airport. The three primary itinerary segments are *departing, arriving,* and *transferring.*

Departing passengers are those passengers who are entering the terminal from the ground access system through the access/processing interface.

Arriving passengers are those passengers who have just deplaned an aircraft and entered the terminal from the flight interface with the intentions of leaving the airport terminal for their final destinations through the access/egress interface.

Transfer passengers are entering the terminal from the flight interface with the intention of boarding other flights for their ultimate destinations within a relatively short period of time, again through the flight interface.

The **trip purpose** of a passenger has traditionally been an indicator of the passenger's individual needs. The two most common trip purposes identified in the industry are **traveling on business,** or **traveling for leisure,** although it is understood that many travelers' itineraries combine both business and leisure activities.

Ticketing

The **ticketing** process has come a long way since the early days of passenger processing at airport terminals, although some characteristics dating back to the original ticketing policies, including the term *ticketing,* remain. Traditional ticket counters are facilities staffed by air carrier personnel. As with gates, ticket counters may be configured for exclusive use or common use.

Security screening

The processing of passengers and baggage for the purpose of ensuring the security of the civil aviation system has undergone a virtual overhaul following the terrorist attacks on the United States on September 11, 2001. As of 2003, passenger and baggage security screening is managed and operated by the Transportation Security Administration (TSA). Although the TSA has ultimate authority over the facilities and procedures that comprise the security screening processes, air-port managers and planners should be keenly aware of the security screening process, because the process has presented the most significant impacts on air-port terminal planning and operations in recent years. A detailed description of security screening processes may be found in Chap. 8 of this text.

At-gate processing

The remaining processing to be performed on a passenger prior to boarding an aircraft typically occurs at the gate area. Each air carrier has its own method of boarding passengers onto aircraft. Some air carriers board in order of fare class, first class first, coach class next. Others board passengers in order by the row number of their assigned aircraft seats (rear to front). Yet others board simply on a first-come, first-served basis. For all air carriers, however, regulations state that each passenger must show a boarding pass and government-issued photo identification to an air carrier gate agent prior to boarding.

Baggage handling

Baggage handling services include a number of activities involving the collection, sorting, and distribution of baggage. An efficient flow of baggage through the terminal is an important element in the passenger handling sys-tem.

Departing passengers normally check their baggage at one of a number of sites including curbside check-in and at the ticket counter in the terminal building. The bags are then sent to a central sorting area, where they are sorted according to flights and sent to the appropriate gate to be loaded aboard the departing aircraft. Arriving baggage is unloaded from the aircraft and sent to the central sorting area. Sorted bags are sent to a transferring flight, to the baggage claim areas, or to storage for later pickup.

Security screening of checked baggage

As of January 1, 2003, all baggage checked in by passengers boarding commercial air carrier aircraft must be screened for explosives and other prohibited items upon check-in at the airport terminal. A detailed description of the facilities and processes that handle checked baggage screening may be found in Chap. 8 of this text.

Baggage claim

For passengers who checked baggage at the airport prior to departure, facilities for claiming their baggage must exist at the airport as well. Baggage claim facilities are typically located in an area conveniently positioned near facilities that accommodate ground transportation from the airport, including parking lots, shuttle vans, taxi cabs, and rental car counters.

Airport ground access

Access to the airport from the surrounding community is an integral part of the overall passenger and baggage processing system. The *access/egress link* of an airport's passenger handling system includes all of the ground transportation facilities, vehicles, and other modal transfer facilities required to move the passenger to and from the airport. Included in the access/egress link are highways, intercity and metropolitan rail service, autos, taxicabs, buses, shuttles, limousines, and transfer stations, including off- and on-airport parking sites and rail stations.

Airport access is usually divided into two major segments:

- Access from the **CBD (central business district)** and suburban areas via highway and rapid transit systems to the airport boundary
- Access from the airport boundary to parking areas and passenger un-loading curbs at the terminal building

Vehicle parking facilities

Parking facilities at or near the airport must be provided for passengers, visitors accompanying passengers, people employed at the airport, car rentals and limousines, and those doing business with airport tenants.

Public parking facilities are provided for airline passengers, meters/greeters, and other members of the public doing business at the airport. Most commercial service airports have separate parking facilities for short-term and long-term parking. Surveys at a number of major airports indicate that a large number (75 percent or more) park 3 hours or less and a much smaller group parks from 12 hours to several days or longer; however, short-term parkers, due to their relatively short parking durations, typically represent only about 20 percent of the total maximum vehicle accumulation. Consequently, many air-ports designate relatively few parking spaces to short-term parkers, typically the most convenient (closest area) spaces. Parking rates for short-term parking are typically higher than that for longer-term parking. This rate strategy achieves two goals. First, it provides incentive for those intending to park their vehicles for a relatively long period of time to use long-term parking facilities, thereby leaving spaces available for short-term parkers in the closer, more convenient, short-term parking area. Second, it tends to maximize the amount of total revenue generated by the parking system to the airport.

Off-airport parking

Recent years have seen an increase in the number of public airport parking facilities located off-airport property and operated by independent private operators. These facilities typically offer parking at lower rates than airport-operated facilities. Although they tend to be located farther away from the airport terminal, frequent shuttle service between the parking facility and the terminal often offsets the extra distance. In addition, some off-airport parking facilities offer extra amenities ranging from free coffee and newspapers for customers, to automobile washes and valet service. The success of off-airport parking facilities can have a direct, significant effect on airport revenues, because these facilities do not pay any portion of their revenue to the airport.

Pavement management

For most aircraft, the presence of strong, level, dry, and well-maintained pavement surfaces are required for safe movement to, from, and around an airport's airfield. Thus, the inspection, maintenance, and repair of the runways, taxi-ways, and apron areas as part of an airfield pavement management program are of utmost importance to airport management.

FAR Part 139, Section 139.305, covers some specific characteristics that define the minimum quality standards for airfield pavements, including:

- Pavement edges shall not exceed 3 inches difference in elevation between abutting pavement sections and between full-strength pavement and abutting shoulders.
- Pavement surfaces shall have no hole exceeding 3 inches in depth or any hole the slope of which from any point in the hole to the nearest point at the lip of the hole is 45 degrees or greater as measured from the pavement surface plane, unless, in either case, the entire area of the hole can be covered by a 5-inch diameter circle.
- Pavement shall be free of cracks and surface variations which could impair directional control of air carrier aircraft.
- Mud, dirt, sand, loose aggregate, debris, foreign objects, rubber de-posits, and other contaminants shall be removed promptly and as completely as practicable, with exceptions for snow and ice removal operations.
- Any chemical solvent that is used to clean any pavement area shall be removed as soon as possible, with exceptions for snow and ice removal operations.
- The pavement shall be sufficiently drained and free of depressions to prevent ponding that obscures markings or impairs safe aircraft operations.

The following symptoms provide evidence of potential pavement failures:

- Ponding of water on or near pavement
- Building up of soil or heavy turf at pavement edges, preventing water runoff
- Clogged or overgrown ditches
- Erosion of soil at pavement edges
- Open or silted-in joints
- Surface cracking or crumbling
- Undulating or bumpy surfaces

An accurate and complete evaluation of the existing pavement system is one of the key factors contributing to the success of a maintenance project. Major strides have been made in this area with the development and application of **nondestructive testing (NDT).**

Runway surface friction

One of the more important characteristics of runway pavements, in particular, is surface friction. Surface friction allows aircraft to safely accelerate for takeoff, and to decelerate after landing. Lack of sufficient surface friction will result in aircraft skidding, slipping, and general loss of control on the runway surface.

The *high-pressure water method* is based on high-pressure water jets aimed at the pavement surface to blast contaminants off the pavement surface. The technique is environmentally clean and removes deposits in a minimum of time. High-pressure water equipment operates between 5,000 and 8,000 psi and is capable of pressures exceeding 10,000 psi. The high-pressure water method of runway surface cleaning may be used only in temperatures greater than 40 degrees Fahrenheit, where the risk of icing is minimized.

Chemical solvents have also been used successfully to remove contaminants from both concrete and asphalt runways. Chemicals must meet environmental standards. Acid-based chemicals are used on concrete runways and alkaline chemicals on asphalt.

The *high-velocity impact method* consists of throwing abrasive particles at high velocity at the runway surface. This technique blasts contaminants from the surface and can be adjusted to produce the desired surface texture. The abrasive material is propelled mechanically from the peripheral tips of radial blades in a high-speed, fanlike wheel. This reconditioning operation may be carried out during all temperature conditions and seasons except during rain, or in standing water, slush, snow, or ice.

Aircraft rescue and fire fighting (ARFF)

Although the incidents of fires and emergencies occurring at an airport are rare, when they do occur, especially on an aircraft, the fire fighting and rescue capabilities at the airport may mean the difference between life and death for pi-lots, passengers, and other airport personnel. Because of this, aircraft rescue and fire fighting (ARFF) services are strongly recommended at all airports and are required to be present at all airports operating under FAR Part 139. For those airports not operating under FAR Part 139, an agreement with local municipal rescue and firefighting agencies is necessary for safe operations.

The characteristics of aircraft fires are different from those of other structures and equipment because of the speed at which they develop and the intense heat they generate. Because of this, FAR Part 139 designates specific ARFF requirements based on the type of aircraft that typically use any given airport.

FAR Part 139.315 designates the *ARFF index* of an airport based on the length (from nose to tail) of air carrier aircraft that use the airport and the average number of daily departures of air carrier aircraft. ARFF index is determined by the longest aircraft that serves the airport on an average of five departures per day.

Index determination based on aircraft length is as follows:

Index A: Aircraft less than 90 feet in length

Index B: Aircraft more than 90 feet but less than 126 feet in length

Index C: Aircraft more than 126 feet but less than 159 feet in length

Index D: Aircraft more than 159 feet but less than 200 feet in length

Index E: Aircraft greater than 200 feet in length

The index system is based on an area that must be secured to effect evacuation or protection of aircraft occupants should an accident involving fire occur. The protected area is equal to the length of the aircraft, multiplied by a 100-foot width, consisting of 40 feet on each side of the fuselage plus a 20-foot allowance for fuselage width. The indexing system was based on this critical area concept, expressed in aircraft length, to provide a more equitable protection to all aircraft using the airport.

ARFF uses combinations of water, dry chemicals, and **aqueous film-forming foam (AFFF)** to fight aircraft-based and other airfield fires. FAR Part 139.317 describes the required ARFF equipment and agents to be present at the airport, based on the airport's ARFF index. These minimum requirements are as follows:

Index A airports require one ARFF vehicle carrying at least:

1. 500 pounds of sodium-based dry chemical

or

2. 450 pounds of potassium-based dry chemical and 100 pounds of water and AFFF for simultaneous water and foam application

Index B airports require either of the following:

1. One vehicle carrying at least 500 pounds of sodium-based dry chemical, and 1,500 gallons of water, and AFFF for foam production

or

2. Two vehicles, with one vehicle carrying the agents required for Index A and one vehicle carrying enough water and AFFF so that the total quantity of water for foam production carried by both vehicles is at least 1,500 gallons

Index C airports require either:

1. Three vehicles, with one vehicle carrying the agents required for Index A, and two vehicles carrying enough water and AFFF so that the total quantity of water for foam production carried by all three vehicles is at least 3,000 gallons

or

2. Two vehicles, with one vehicle carrying the requirements for Index B, and one vehicle carrying enough water for foam production by both vehicles is 3,000 gallons

Index D airports require three vehicles, including:

1. One vehicle carrying the agents required for Index A

2. Two vehicles carrying enough water and AFFF so that the total quantity of water for foam production carried by all three vehicles is at least 4,000 gallons.

Index E airports require three vehicles, including:

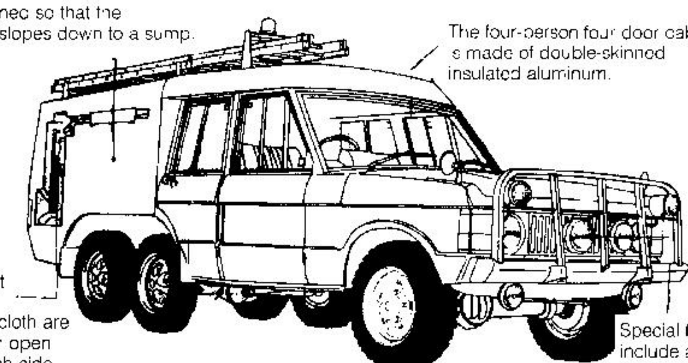
1. One vehicle carrying the agents required for Index A

2. Two vehicles carrying enough water and AFFF so that the total quantity of water for foam production carried by all three vehicles is at least 6,000 gallons

FAR Part 139 indicates a minimum response time of the first vehicle to an incident, defined by the ability to reach the midpoint of the runway farthest from the vehicle's assigned post, of 3 minutes from when an alarm is sounded, with all other vehicles required to the scene within a minimum of 4 minutes.

The light rescue unit illustrated on the left can carry 300 pounds of dry powder sodium bicarbonate in two units pressurized by carbon dioxide Each discharge nozzle can eject powder at the rate of 3 pounds per second over a range of 39 feet.

The heavy-duty fire tender illustrated on the right can discharge over 10.000 gallons of water or foam a minute through its monitor and over 1,000 gallons through each of its two hand-lines, while moving forward or backward.



The rapid intervention fire rescue vehicle shown above is designed to accelerate to 70 mph as fast as a sports car, despite the weight of foam and equipment carried. It carries 240 gallons of a concentrated ready-mixed water and foam solution, and first aid and rescue equipment. It is used to contain the fire and keep aircraft escape routes open until the main fire fighting force arrives. This versatile chassis can be fitted with stretchers and other special equipment, for use as an ambulance.

Training is a key ingredient to the overall effectiveness of ARFF. There are two basic challenges to airport management in this regard, initial training and maintaining fire fighting readiness and efficiency. To keep ARFF personnel and equipment in top working order, intensive in-service training programs should be developed. FAR Part 139 suggests that any ARFF training curriculum contain instruction in the following areas:

- Internal injuries
- Movement of patients
- Burns
- Triage
- Airport familiarization
- Aircraft familiarization
- Rescue and fire fighting personnel safety
- Emergency communications systems at the airport, including fire alarms
- Use of the fire hoses, nozzles, turrets, and other appliances required for compliance
- Application of the types of extinguishing agents required for compliance
- Emergency aircraft evacuation assistance
- Fire fighting operations
- Adapting and using structural rescue and firefighting equipment for aircraft rescue and fire fighting
- Aircraft cargo hazards
- Familiarization with firefighters' duties under the airport emergency plan

Furthermore, at least one ARFF person on duty must be trained in emergency medical care, covering the following areas:

- Bleeding
- Cardiopulmonary resuscitation
- Shock
- Primary patient survey
- Injuries to the skull, spine, chest, and extremities

Snow and ice control

In many areas in the northern and mountainous regions of the United States, the removal of snow and ice from airfield pavements represents a significant portion of an airport's overall operations budget. How effective this expenditure is depends on the ability of management to plan and execute an efficient snow and ice control program.

FAR Part 139.313, states specifically that all airports operating under FAR Part 139 where snow and icing conditions regularly occur shall prepare, maintain, and carry out a snow and ice control plan. The snow and ice control plan shall include instructions and procedures for:

- Prompt removal or control, as completely as practical, of snow, ice, and slush on each pavement area
- Positioning snow on movement area surfaces so that all air carrier air-craft propellers, engine pods, rotors, and wingtips will clear any snow-drift and snow bank as the aircrafts' landing gear traverses any full-strength portion of the pavement area
- Selection and application of approved materials for snow and ice control to ensure that they adhere to snow and ice sufficiently to minimize engine ingestion
- Timely commencement of snow and ice control operations
- Prompt notification of all air carriers using the airport when any portion of the pavement area normally available to them is less than satisfactorily cleared for safe operation by their aircraft

A typical snow and ice control plan tends to include:

1. A brief statement of the purpose of the plan.

2. A listing of the personnel and organizations (airport and other) responsible for the snow and ice control program: Many airports hire additional personnel during the winter months or utilize personnel from the streets and sanitation departments on an emergency basis.

3. Standards and procedures to be followed: There are a number of excellent sources that airport management uses in preparation of this aspect of their snow and ice control program. They include the *Air Transportation Snow Removal Handbook*, published by the ATA, and FAA Advisory Circular 150/5200-30A, Airport Winter Safety and Operations. The AAAE also sponsors an annual International Aviation Snow Symposium at which workshops are held covering all aspects of snow removal.

4. Training: Because the airport snow removal program requires special skills, a training program is normally an integral part of the plan. This includes classroom training in such areas as airport orientation, snow removal standards and procedures, use of various types of equipment, aircraft characteristics (capabilities and limitations), description of hazards and problem areas at the airport, communications, and safety procedures. On-site training includes a review of operational areas and hazards, test runs with equipment to accustom operators to area dimensions and maneuvering techniques, and communications practice while on the job.

Timing

Knowing when to implement the snow and ice control program in order to maintain safe operations and avoid unnecessary repetition of certain activities is critically and generally learned through experience. Weather forecasts including the following information can be helpful in this regard:

- Forecasted beginning of any snowfall
- Estimated duration, intensity, and accumulation
- Types of precipitation expected
- Anticipated wind directions and velocities during the snowfall
- Temperature ranges during and after the snowfall
- Cloud coverage following the snowfall

Snow removal is generally geared to the operational limitations of the most critical aircraft using the airport. Large jet aircraft have a takeoff limitation of 1/2 inch of heavy wet snow or slush, and 1 inch of snow of medium moisture con-tent. This means that removal operations must get underway before such conditions occur, and must continue without interruption until the end of the snowfall event and snow removal has progressed to the point where aircraft operations may be carried on with safety.

Safety inspection programs

Clearly one of the most important concerns of airport management is operational safety. The Federal Aviation Act of 1958 and the requirements surrounding FAR 139 were primarily established in the interest of promoting safety. To ensure that these regulations are continuously met, airport management should carry out a comprehensive safety inspection program. The frequency of over-all inspections varies by airport, but certain facilities and equipment must be inspected as often as daily, if not hourly. Some of these facilities include runways, taxiways, and navigational aids. Other elements are normally inspected with a frequency commensurate with how critical they are to the over-all safety of airport operations. The FAA's *Airport Certification Program Handbook* suggests the following general categories in which emphasis on elimination, improvement, or education should be placed:

1. Hazards created by weather conditions such as snow, ice, and slush on or adjacent to runways, taxiways, and aprons

2. Obstacles on and around airfield surfaces

3. Hazards that threaten the safety of the public

4. Hazards created by erosion, or broken or damaged facilities in the approach, takeoff, taxi, and apron areas.

5. Hazards occurring on airports during construction activity, such as holes, ditches, obstacles, and so forth

6. Bird hazards adjacent to the airport

7. Inadequate maintenance personnel or equipment

Ramp/apron–aircraft parking areas

1. Unsealed pavement cracks, weak or failing equipment, buildup of shoulders causing entrapment of water, poor drainage, and growth of vegetation are repaired.

2. Adequate aircraft parking and tie down areas are provided, well clear of taxiways, and prominently marked.

3. Areas are free of obstructions such as blocks, chocks, loose gravel, bag-gage carts, and improperly parked ground service vehicles.

4. Deadlines are provided for safe passenger loading and unloading, cargo handling, and aircraft servicing.

5. Fuel trucks and other airport vehicles are parked in specified areas away from aircraft.

6. Unauthorized vehicles are prohibited from entering the ramp area.

7. "NO SMOKING" signs are prominently displayed in all areas where air-craft are being fueled.

8. Fire extinguishers are provided and are in good working condition.

9. Adequate directional signage is provided.

10. Flood lights, power outlets, and grounding rods are all in good condition.

Taxiways

1. Unsealed pavement cracks, weak or failing pavement, buildup or erosion of shoulders, poor drainage are repaired.

2. The taxiway is free of weeds, foreign object debris (FOD), and other obstructions.

3. Shoulders are firm and are marked as necessary for easy reference.

4. Yellow centerlines are provided and are in good condition.

5. Hold lines are provided and clearly visible.

6. Unauthorized vehicles, people, or animals are prevented from occupying taxiways.

7. Necessary directional signs are provided and are so located as to be well clear of taxi areas.

8. Lighting systems are in good working order

Runways

1. Runway lights and markers are clearly visible, are operated at correct brilliance, properly leveled and oriented, equipped with usable lamps of correct wattage, clear; clean lenses are in runway lights, clean green lenses are in threshold lights, and all lights are unobstructed by vegetation.

2. The threshold is properly marked and lighted.

3. Runway designators are well painted.

4. The ends of runways are flush with the surrounding ground (no lip).

5. Overrun areas are in good condition.

6. Shoulders are firm, clearly marked, and free from washouts, holes, or ditches.

7. The centerline (white) is well painted.

8. All approach areas are clear of obstruction. It should be noted whether views of ends of other runways are unobstructed by vegetation, trees, terrain, or other obstruction, and whether unauthorized vehicles or live-stock have access to the runways or airfield.

9. Procedures for removal of disabled aircraft from runways are in place.

Fueling facilities

1. Fueling areas are clearly defined and are located away from aircraft parking areas.

2. Pumps are placarded to properly identify the type of fuel dispensed.

3. Grounding means are provided for all fueling operations.

4. Fire extinguishers are provided and are in good condition.

5. Fuel hose and nozzle units are stored in clean areas for protection from weather and contamination.

6. Fuel filters are regularly checked.

7. Tanks are regularly checked for water or contamination.

8. Locks are provided and used on fuel tank filler caps.

9. Fuel tank vents are regularly checked.

10. Fueling areas are kept clean and free of debris.

11. Rags are stored in closed containers.

12. Oil is kept in storage bins or closets.

13. Oil cans are kept in proper containers.

14. "NO SMOKING" signs are posted.

15. Stepladders are provided, properly stored, clean, and in good repair.

Buildings and hangars

1. All buildings and aircraft hangars are free of debris, trash, unusable air-craft parts, and other potentially hazardous objects of no practical use.

2. Fire protection with an adequate umber of fire extinguishers in good operational condition and with dates of service record are available. Fire and rescue equipment and first aid and emergency services are provided. Smoke detectors and emergency lighting are in working order.

3. All tools and unused equipment are properly stored.

4. Paints, oils, and other chemical compounds are stored in exclusive, preferably fireproof, areas.

5. "NO SMOKING" signs are properly posted.

6. Restricted area signs are properly posted.

7. Exit signs are posted.

8. Building identification is properly posted with signs or numbers.

9. Buildings are provided with appropriate locks on doors and windows commensurate with security needs.

10. The areas around buildings are clean, free of weeds, debris, and unsafe terrain.

<u>Bird and wildlife hazard management</u>

Birds and other wildlife striking aircraft in operation in the vicinity of an airport has the potential to cause serious damage to aircraft and loss of human life. In 2001, over 5,600 aircraft reported a wildlife strike, nearly five times the amount reported in 1990. Between 1990 and 2001, an estimated $400 million per year in aircraft damage and over 500,000 hours per year of aircraft downtime was associated with these events. Because most strikes occur on or near airports, emphasis on bird and wildlife management is mandated.

FAR Part 139.337 directs airports to conduct a study and provide a wildlife management program for airports when any of the following events has occurred on or near the airport:

1. An air carrier aircraft experiences a multiple-bird strike or engine ingestion.

2. An air carrier aircraft experiences a damaging collision with wildlife other than birds.

3. Wildlife of a size or in numbers capable of causing either of the above events is observed to have access to any airport flight pattern or movement area.

Unit – V

Airport Security

Introduction

One of the most significant issues facing airports in the early twenty-first century is that of airport security. Most users of commercial service airports are subjected to security infrastructure, policies, and procedures within the airport terminal area. Airport security is not limited to the terminal area, however. Air-port security concerns all areas and all users of the airport.

Airport security procedures are designed to deter, prevent, and respond to criminal acts that may affect the safety and security of the traveling public. Criminal activity includes the hijacking of aircraft, known as **air piracy,** dam-aging or destroying aircraft with explosives, and other acts of **terrorism,** de-fined as the systematic use of terror or unpredictable violence against governments, publics, or individuals to attain a political objective. Criminal ac-tivity also includes acts of assault, theft, and vandalism against passengers and their property, aircraft, and all airport facilities.

The Transportation Security Administration

As a result of the events of September 11, 2001, and the subsequent signing of the **Aviation and Transportation Security Act (ATSA),** the practice of airport security began to undergo radical changes, beginning with the creation of the Transportation Security Administration.

With the signing of the ATSA, the **Transportation Security Administration (TSA)** was incorporated into the organizational structure of the U.S. Department of Transportation, to be operated in close coordination with all other transportation administrations, including the FAA, and headed by an undersecretary of transportation security. On December 10, 2001, Secretary of Transportation Norman Mineta announced the appointment of then Chief of the Bureau of Alcohol, Tobacco, and Firearms, and former Secret Service agent, John Magaw, as the TSA's first undersecretary of transportation.

The **air operations area (AOA)** is defined as a portion of an airport, specified in the airport security program, in which security measures are carried out. This area includes aircraft movement areas, aircraft parking areas, loading ramps, safety areas for use by aircraft, and any adjacent areas (such as general aviation areas) that are not separated by adequate security systems, measures, or procedures. This area does not include the secure area.

The **secure area** is defined as a portion of an airport, specified in the airport security program, in which certain security measures specified in 49CFR Part 1542—*Airport Security* are carried out. This area is where aircraft operators and foreign air carriers that have a security program under 49CFR Part 1544—*Air-craft Operator Security: Air Carriers and Commercial Operators* or 49CFR Part 1546—*Foreign Air Carrier Security* enplane and deplane passengers and sort and load baggage and any adjacent areas that are not separated by adequate security measures. Specifically, the secured area is the area at the airport where commercial air carriers conduct the loading and unloading of passengers and baggage between their aircraft and the terminal building.

The **sterile area** is defined as a portion of an airport defined in the airport security program that provides passengers access to boarding aircraft and to which the access generally is controlled by TSA, or by an aircraft operator un-der 49CFR Part 1544 or a foreign air carrier under 49CFR Part 1546 through the screening of persons and property. Specifically, the sterile area is that part of the airport to which passenger access must be gained through TSA passenger screening checkpoints.

The **security identification display area (SIDA)** is defined as a portion of an airport, specified in the airport security program, in which security measures specified in the TSRs are carried out. This area includes the secured area and may include other areas of the airport. Within the SIDA, all persons must display proper identification or be accompanied by an authorized escort.

An **exclusive area** is defined as any portion of a secured area, AOA, or SIDA, including individual access points, for which an aircraft operator or foreign air carrier that has a security program under 49 CFR Part 1544 or 49 CFR Part 1546 has assumed responsibility for the security of its area. Examples of exclusive areas include aircraft storage and maintenance hangars, air cargo facilities, and fixed-base operators (FBOs) serving general aviation and charter aircraft.

Areas that do not fall within the above definitions are considered public areas, and are not directly subject to TSA security regulations concerning restricted access. These areas include portions of airport terminal lobbies, parking lots, curb frontage.

Security at commercial service airports

The events of September 11, 2001, the associated legislative action of the ATSA, and the formation of the TSA have all contributed to the changing rules, regulations, policies, and procedures associated with airport security. In addition, state and local governments, along with organizations representing members of the aviation industry, from the Air Line Pilots Association, to the American Association of Airport Executives, to the Aircraft Owners and Pilots Association, have made major contributions to the potential future security for the users of the nation's commercial service and general aviation airports.

At commercial service airports, areas of airport security are commonly categorized as passenger screening, baggage screening, employee identification, and controlled access and perimeter security.

Passenger screening

The processing of passengers and baggage for the purpose of ensuring the security of the civil aviation system has undergone a virtual overhaul following the terrorist attacks on the United States on September 11, 2001. As of 2003, passenger and baggage security screening is managed and operated by the Transportation Security Administration (TSA).

Even though the TSA has ultimate authority of the facilities and procedures that comprise the security screening processes, airport managers and planners should be keenly aware of the security screening process, because the process has presented the most significant impacts on airport terminal planning and operations in recent years. As of 2003, policies surrounding passenger and baggage security screening remained in a high state of flux. Despite this, certain fundamentals of the passenger and baggage screening process remain.

Passenger screening facilities include an automated screening process, con-ducted by a **magnetometer** that attempts to screen for weapons potentially carried on by a passenger that are metallic in content. As a passenger walks through a magnetometer, the presence of metal on the passenger is detected. If a sufficient amount of metal is detected, based on the sensitivity setting on the magnetometer, an alarm is triggered. Passengers who trigger the magnetometer are then subject to a manual search by a TSA screener. Manual searches range from a further check of metal on the passenger's person with the use of a handheld wand, to a manual pat down, to the inspection of the passenger's shoes.

Carry-on baggage screening facilities are located at security screening stations to examine the contents of passengers' carry-on baggage for prohibited items such as firearms, sharp objects that may be used as weapons, or plastic or chemical-based *trace explosives.* All carry-on baggage is first inspected through the use of an x-ray machine. Bags selected because of suspicions as a result of the x-ray examination, or selected on a random basis, are further inspected through the use of **explosive trace detection (ETD) equipment** and/or by manual search. In addition, personal electronic items such as laptop computers or cellular phones are frequently inspected by being turned on and briefly operated to check for authenticity.

Checked-baggage screening

Facilities to conduct screening of checked baggage for explosives have been placed at airports to adhere to the requirement implemented by the TSA on January 1, 2003, to have every piece of checked baggage screened by certified explosive detection equipment prior to being loaded onto air carrier aircraft (known as the 100 percent EDS rule). As of 2003, the primary piece of equipment used to perform checked-baggage screening, the **explosive detection system (EDS),** uses computed tomography technology, similar to the technology found in medical CT scan machines, to detect and identify metal and trace explosives that may be hidden in baggage.

Employee identification

TSA regulations require any person who wishes to access any portion of an air-port's security identification display area (SIDA) must display appropriate identification. This identification, known typically as a *SIDA badge,* is usually in the form of a laminated credit card–sized identification badge with a photograph and name of the badge holder. Persons typically requiring a SIDA badge include air-port employees, air carrier employees, concessionaires, contractors, and government employees such as air traffic controllers and airport security staff.

In many instances the SIDA badge is color coded or otherwise marked to identify the areas within the airport the badge holder may access. In addition, many identification badges are equipped with magnetic strips, bar codes, or other formats readable by electronic means which carry detailed data regarding access authority of the badge holder, including any associated personal identification numbers needed to enter through certain access points, areas of authorization, as well as an electronic badge expiration date.

Prior to obtaining an identification badge, persons must complete an application and undergo a fingerprint-based criminal history records check. Any of the following criminal histories within a 10-year period prior to the date of application will result in the disqualification for obtaining an SIDA badge: Secure Identification Display Area of International Airport

1. Forgery of certificates, false marking of aircraft, and other aircraft registration violation

2. Interference with air navigation

3. Improper transportation of a hazardous material

4. Aircraft piracy

5. Interference with flight crew members or flight attendants

6. Commission of certain crimes aboard aircraft in flight

7. Carrying a weapon or explosive aboard aircraft

8. Conveying false information and threats

9. Aircraft piracy outside the special aircraft jurisdiction of the United States

10. Lighting violations involving transporting controlled substances

11. Unlawful entry into an aircraft or airport area that serves air carriers or foreign air carriers contrary to established security requirements

12. Destruction of an aircraft or aircraft facility

13. Murder

14. Assault with intent to murder

15. Espionage

16. Sedition

17. Kidnapping or hostage taking

18. Treason

19. Rape or aggravated sexual abuse

20. Unlawful possession, use, sale, distribution, or manufacture of an explosive or weapon

21. Extortion

22. Armed or felony unarmed robbery

23. Distribution of, or intent to distribute, a controlled substance

24. Felony arson

25. Felony involving a threat

26. Felony involving:

i. Willful destruction of property

ii. Importation or manufacture of a controlled substance

iii. Burglary

iv. Theft

v. Dishonesty, fraud, or misrepresentation

vi. Possession or distribution of stolen property

vii. Aggravated assault

viii. Bribery

ix. Illegal possession of a controlled substance punishable by a maxi-mum term of imprisonment of more than 1 year.

27. Violence at international airports

28. Conspiracy or attempt to commit any of the criminal acts listed above

Controlled access

A variety of measures are used around airports to prevent, or more appropriately, control the movement of persons and vehicles to and from security-sensitive areas of the airport property.

At most commercial service airports, controlled access through doors that pro-vide access to the AOA, secure areas, sterile areas, and other areas within the SIDA, as well as many employee-only restricted areas, is enforced by the use of control systems. These systems range from simple key locks to smart-access technologies, such as keypad entry systems requiring proper pass code. In many cases, pass codes are calibrated with a person's SIDA badge, requiring both a presentation of the person's badge and proper pass code entry to gain access.

Biometrics

Advanced identification verification technologies, including those that employ biometrics, are continuously being developed to enhance access control at air-ports.

Biometrics refers to technologies that measure and analyze human body characteristics such as fingerprints, eye retinas and irises, voice patterns, facial patterns, and hand measurements, especially for identification authentication purposes.

Biometric devices typically consist of a reader or scanning device, software that converts the scanned information into digital form, and a database that stores the biometric data for comparison.

Perimeter security

An important part of an airport's security plan is its strategy for protecting the areas that serve as the border between secured and unsecured areas of the air-port, known as the airport perimeter. Four of the most common methods for securing the airport's perimeter are perimeter fencing, controlled access gates, area lighting, and patrolling of the secured area.

Perimeter fencing is one of the most common methods of creating a barrier in otherwise easily accessible areas of an airport's secured area boundary. Fencing can vary in design, height, and type, depending on local security needs. Generally, however, the following standards, as recommended by FAA Advisory Circular 107-1, Aviation Security, Airports, are followed:

- Fencing of number 10 gauge, galvanized steel, chain-link fabric, which is installed with a three-stand (12-gauge) barbed wire overhang with a minimum of 6 inches of separation between strands is recommended. The overhang should be installed at a 45-degree angle from the horizontal and extend outward (away from the airfield). Installation of a double-apron barbed wire overhang and fencing in excess of 8 feet is considered highly desirable when an area to be protected is located in a high-risk area.

- Fence posts should be installed at 10-foot intervals on-center.

- Top and bottom selvages of the fence having a twisted and barbed finish are recommended. The bottom of the fence should be installed to within 2 inches of hard surfacing or stabilized soil; however, in areas where unstable soil conditions are prevalent, the fabric should be in-stalled at least 2 inches below the surface or imbedded in concrete curbing.

- All fencing should be grounded. Care should be taken that metallic fencing is not installed when it will interfere with the operation of navigation aids.

- Where traverse culverts, troughs, or other openings larger than 96 square inches in the perimeter are unavoidable, the openings should be protected by fencing, iron grills, or other suitable barriers to preclude unauthorized access into the area. These barriers should be of materials at least equal in strength and durability to the fence and should be installed in a manner so as to deter unauthorized removal and not deter drainage.

- Fencing should be installed to within 2 inches of any wall that forms a part of the perimeter.

- If practical, where property lines, location of facility buildings, and adjacent structures permit, the fence should be located not less than 50 feet from any interior structures. At least 20 feet clearance should be al-lowed between the perimeter fence and interior parking lots, or natural or aesthetic features. Such installations restrict ease of access and minimize the means of concealment in the immediate vicinity of the fence. Where property lines or other limiting factors restrict installation in accordance with these recommendations, the height of the fence should, therefore, be increased to compensate for these conditions.

- Clear zones can be provided around a facility through installation of perimeter fencing 10 to 20 feet inside the property line.

- Fencing may be alarmed in areas considered high-risk areas in order to provide early warning of an attempt by an intruder to enter the area.

- Perimeter fencing should be inspected on a daily basis by the facility guard force or operational personnel at manned facilities.

Lighting units for perimeter fences should be located a sufficient distance within the protected area and above the fence so that the light pattern on the ground will include an area on both the inside and the outside of the fence. Generally, the light band should illuminate the fence perimeter barrier and ex-tend as deeply as possible into the approach area.

Various lighting systems include:

- *Continuous lighting.* This is the most common protective lighting system. It consists of a series of fixed lights arranged to flood a given area with overlapping cores on a continuous basis during the hours of darkness.

- *Standby lighting.* Lights in this system are either automatically or manually turned on when an interruption of power occurs or when suspicious activity is detected.

- *Movable lighting.* This type of lighting consists of manually operated movable floodlights.

- *Emergency lighting.* This system may duplicate any one of the afore-mentioned systems. Its use is limited to periods of power failure or other emergencies and is dependent upon an alternate power source.

Patrolling by airport operations staff, as well as local law enforcement, often con-tributes to enhancing airport perimeter security. Patrols of the airport perimeter, for the most part, are performed on a routine basis. In addition, air traffic control towers, responsible for the movement of aircraft and vehicles on the movement areas of an airport’s airfield, are able to keep a consistent watch over activities within the airport perimeter. Because of the nature of the task, most air traffic control towers are situated so that they have an optimal view of the entire airfield. This facilitates the ability for air traffic controllers to spot potential security threats. Coordination between air traffic controllers, airport operations staff, and local law enforcement further enriches the security of the airport perimeter.

Security at general aviation airports

Historically, the Federal Aviation Administration focused virtually all of its aviation security programs toward the commercial aviation sector of the industry. As such, the vast majority of regulations created for airport security are those for airports that serve the flying public using certificated carriers or regularly scheduled aircraft with more than 60 passenger seats. The FAA's justification for this strategy was that nearly 100 percent of all passenger air travel takes place at commercial airports using the airlines or other large aircraft.

The majority of general aviation activity, on the other hand, is performed by private pilots, using their own aircraft for the purposes of personal travel or recreation. In addition, the majority of general aviation aircraft have dramatically less mass than commercial airliners and cargo aircraft, making them relatively less suited for use as kinetic energy weapons or "guided missiles." This in turn has led local law enforcement officials to historically labeling GA airports as "low security threats." In addition, because most general aviation airports are relatively small and used by relatively few, frequent users, the people using the airport are usually known by one another.

Similar to commercial service airports, common security attributes that general aviation airports may be equipped with are:

- Personnel and vehicle identification procedures
- Perimeter fencing
- Controlled access gates
- Security lighting
- Locks and key control
- Patrolling

These recommendations included suggestions for improving general aviation security for passengers, aircraft, and for airports. Those suggestions for airports included:

- Outdoor signage should be prominently displayed near areas of public access warning against tampering with aircraft or unauthorized use of aircraft. In addition, signage indicating the phone number for reporting suspicious activity should be placed in areas where pilots and/or ramp personnel gather.
- Pilots should be advised to be on the lookout for suspicious activity on or near airports, including:

- Aircraft with unusual or unauthorized modifications
- Persons loitering for extended periods in the vicinity of parked air-craft or in air operations areas
- Pilots who appear to be under the control of other persons
- Persons wishing to obtain aircraft without presenting proper credentials or persons who present apparently valid credentials but do not have a corresponding level of aviation knowledge
- Anything that doesn't "look right" (i.e., events or circumstances that do not fit the pattern of lawful normal activity at an airport)

The future of airport security

Since the first criminal threats to civil aviation, reactive policies to prevent fur-ther occurrences of current threats have been implemented. This reactive par-adigm has resulted in two consequences: (1) the reduction in the number of attacks from a current type of threat and (2) the creation of new threats against civil aviation that the system has not been prepared to mitigate. This has been evidenced by the historical development of different threats, from nonviolent hijackings, to violent hijackings using firearms, the placing of unattended ex-plosives on aircraft, suicide hijackings, attempted suicide bombings, and most recently, attempts to down aircraft using shoulder-fired missiles near airports where aircraft are at relatively low altitudes and speeds.

As a result, thoughts regarding the future of airport security suggest a shift of policy, from a reactive approach to screening for the placement of weapons or explosives on aircraft, to a proactive approach to protecting against violent or other criminal acts by persons in and around the entire airport environment. This proactive approach requires technological and human expertise to screen persons for suspicious activity, rather than simply screening them for unauthorized possessions. Two such programs in development that address this include the **Computer Assisted Passenger Pre-Screening System (CAPPS II)** and the **Trusted Traveler Program.**

CAPPS II

The Computer Assisted Passenger Pre-Screening System, known as CAPPS II, is an enhancement of a profiling system employed by the FAA that selected passengers for additional screening based on their air carrier itinerary and citizen-ship. CAPPS II, designed to be a nondiscriminatory selection system uses passenger information to verify identity and then determine risk, which is presented in a score and its corresponding color: red, yellow, or green. The sys-tem is designed to start with four pieces of passenger information, voluntarily given when passengers purchase airline tickets: name, address, phone number, and date of birth. CAPPS II then combs criminal activity and other databases to build a risk assessment score based on verified passenger information.

CAPPS II is designed to reduce the number of random security searches that have occurred since TSA regulations have been implemented. In addition, CAPPS II is designed to provide comprehensive prescreening of passengers without racial bias.

Trusted Traveler Program

While CAPPS II focuses on prescreening passengers for prior criminal or other suspicious activity, a program known as Trusted Traveler is being developed to allow members of the traveling public to enter themselves into a database of “trusted travelers,” by submitting an application for the program and inviting a background check, similar to those performed for airport employees. Once accepted into the database, the trusted traveler would be relieved from secondary searches, which historically have existed on a random basis, or be allowed to proceed through expedited security screening at the airport. This program is thought by supporters to have the potential of significantly streamlining the efficiency of passenger screening at airports by allowing security screeners to focus their efforts on those persons not in the Trusted Traveler Program, while allowing those in the program to proceed more quickly through the airport terminal.

Critics of these programs site issues of public privacy and bias toward select groups of persons, from negative bias toward those persons with petty criminal and adverse financial records, to unfair positive benefits to frequent travelers paying typically higher air carrier fares.

These programs, along with the further development of advanced biometric and information technologies, are expected to provide a contribution to enriching airport security, with the goal of proactively mitigating any future threats to the aviation system while preserving the efficiency of the system it-self.

Question	a	b
The administration that oversees civil aviation is the __________	F AA	FAR
The FAA headquarters is in ______________	London	New Delhi
Internationally, standards for the operation and management of c	ICCA	ICWA
Primary commercial service airports are categorized in the _____	NIA	NPIAS
Commercial service airports are those airports that accommodate	F AA	FAR
Which is the smallest airport in the world?	Caribbean Island	Andaman Island
_____________ is a country spent 6 billion for constructing an un	America	Russia
A Boeing 747 airplane is made up of __________ parts.	6 million	5 billion
________________ is the world's oldest airline established in 191	Kingfisher	RLM
A commercial aircraft flies at an speed of _________________ K	600 kmph	800 kmph
________________ is a location used for emergency landing for a	heliport	highway
______________ is world recorded in aircraft landed at high altitu	IAF	USAF
The C-17 global master aircraft Advance Landing Ground at an a	6000 ft	2000 ft
Abbreviation for DGCA in India _____________	Director General of	Damian Gerard
Which among the airline body is owned by government of India?	Indigo airlines	Indian airlines
__________ is a body in India is framing the rules and regulation	DRDO	DGCA
What is meant by FAA?	Food Authority of A	Federal Aviation
Internationally rules and Regulations for aviation is framed by _	AFFF	FARR
The Security regulations in India are assessed by _____________	CRPF	RAF
The communication between aircraft and air traffic was handled	ATCT	ATC
The airports that handle the aircrafts that flies only within a coun	Domestic airport	International air
The airport that handle foreign aircrafts are called ____________	Overseas	continental
____________ is the branch of study that teaches the organization	Airline managemen	Aircraft mainten
__________ is defined as the rectangular area prepared for landin	high way	runway
_____________ provides information on airline commercial opera	Airline organization	Aircraft mainten
In 1919 the first ________________ was introduced for aircraft ta	propeller	runway
Runways are named by the numbers between ________________	1 to 360	0 to 45
_________________ is used for public address and media system	signal voice	airport bulletin
White line shoulder markings are visible in ______________	taxiway	runway
In 1930 _________________ system was introduced.	lighting	signal
The places were aircraft maintenance work is carried out is_____	Terminal block	Hangar
Vertically Short take off and landing is referred to ____________	UAV	Lighter aircraft
Most of the world's airports are owned by local, regional, or nati	Contract	Privet
Loading of goods in airport at ____________	terminal block	Cargo
Helicopters take-off and land into the wind in order to achieve m	Surveillance	Helipad
Along taxiways, _________________ indicate the taxiway's edge	green light	red light
Airports have embedded green lights that indicate the__________	centerline	edge line
The location of Anna International Airport at ___________	Bangalore	Chennai
Registration numbers of an aircraft appear on the ______.	rudder	aircraft belly
Private Helicopter is under control of _________ Surveillance.	Defense	city
Avionics is the combination of ______	Airline and Electror	Aviation and El
Navigation system is used to _____________	Traffic control	Communication
During the First World War ___________ technology is used for (	wireless	Dopple
DME stands for __________	Distance measuring	Distance monito
Following one is the type of navigation system	Medium frequency	pilotage

c	d	answer	
ARR	CAR	F AA	
Washington	Colombo	Washington	
IOCA	ICAO	ICAO	
NIPA	NSPIA	NPIAS	
ARR	CAR	F AA	
Nicobar Island	Hawaii Island	Caribbean Island	
Yugoslavia	India	Yugoslavia	
7 corer	1 lack	6 million	
KLM	Silk	KLM	
400 kmph	1000 kmph	600 kmph	
sea port	ground field	sea port	
RAF	A. RBAF	IAF	
6200 ft	4500 ft	6000 ft	
Dean Gread for Ci	Director of General Civil	Director General of Civil Avia	
Air India	Both b and c	Both b and c	
FAARR	ADA	DGCA	
Federal Aviation A	Failure Assessment and A	Federal Aviation Administrati	
FAA	RFAR	FAA	
BSF	CISF	CISF	
AFC	ATF	ATC	
Military airbase	airside	Domestic airport	
foreign airport	International airport	International airport	
Airport manageme	Airport maintenance	Airport management	
taxiway	heliport	runway	
Airport manageme	Airport maintenance	Airline organization	
fuel	apron	runway	
0 to 36	1 to 27	0 to 36	
airport vision	DGCA	airport bulletin	
apron	end lines	runway	
RADAR	ATC	lighting	
Parking	Shed room	Hangar	
Helicopter	Space ship	Helicopter	
Government	Govt / PVT	Government	
Control block	Flight route	Cargo	
Windsocks	Lightings	Surveillance	
blue lights	bright white light	blue lights	
touchdown line	parking line	centerline	
Mumbai	Hyderabad	Chennai	
airfoil	fuselage	aircraft belly	
DGCA	Airport control	DGCA	
Aircraft and Electr	Aviation and Electrical	Aviation and Electronics	
Weather detection	Find position and directio	Find position and direction	
Radio	RADAR	wireless	
Direct measuring e	Doppler monitoring equip	Distance monitoring equipmen	
High frequency	Low frequency	pilotage	

Electronic Warfare is mainly used to search the ___________	Communication sig	Ultrasonic wave
In communication system __________ is used as a transmitter li	fiber	iron
__________ memory is require a power to maintain the stored i	Non volatile	virtual
Aerodrome information to be provided for a certified aerodrome	Movement area	Administration
Aerodrome information to be not provided for a certified aerodro	Chart	Administration

Sound waves	Radio frequency band		Radio frequency band	
mica	silver		fiber	
protected	volatile		volatile	
ATF	Speed		Administration	
Location	Navigtion aids		Navigtion aids	

Questions	a	b
Lighting systems are mainly used for _______________ in airport.	day takeoff	day landing
Airport lighting systems are controlled by _____________	Controller of ATC	taxi control
Airport ATC stands for _______________	Air Traffic Contro	Asian Tele
A minimum length of the runway is ________________	1.85 km	2.86 km
_________________ is designated for takeoff and landing an aircraft wi	airfield	taxiway
Water aerodrome are used to land ______________	sea planes	amphibious
__________________ is called as fit to fly certificate for aircraft.	airworthiness	air boon
_______________ is a place certified for aircraft landing and takeoff.	sea port	airport
ALG is stands for ________________	Advance Landing	Aircraft Lan
AIM in airport is stands for ___________________	Aeronautical Info	Aircraft Ins
___________ country airports have yellow markings in runway instead	Norway	Sweden
IATA was found in the year _______________	1935	1925
Head quarters of DGCA is located at ________________	Chennai	Mumbai
As per DGCA, CAA is stands for ___________	Civil Aviation Au	Civil Airpo
Aviation industry in booming and is predicted to reach a massive ___ p	4 Billion	7 Billion
_____________ is specified as the tallest building in the airport.	Terminal	ATCT
All airports included in the NPIAS are subjected to variety of ________	FRAA	FAAA
__________ is the place the passengers get out from the airplane.	Runway	Taxiway
Who is responsible for the overall day to- day operations of the airport'	ATC controller	Airport Dir
Administrating and functional process of airport are responsible to ___	PRO Manager	airport direc
Chief accountant is responsible for _______________ of airport.	fire and rescue	finance and
Airfield operations are carried under ______________	control area opera	land area op
Aircraft __________ develops procedures of implements fire accidents a	rescue	refueling
____________ airport comprises a special category of general aviation a	domestic	internationa
VT is the registration code for ____________ country aircrafts.	India	China
Airline logo is located at ____________ part of an aircraft.	cockpit	rudder
______________ is the busiest airport in Asia.	Dubai	China
Runway includes _____________ colour lighting system.	Yellow	White
Aircraft transfers signals in __________ form.	wave	pulse
International airports have maximum of ___________ size of runway.	9000 ft	6000 ft
The minimum length of parallel runway is ____________	1400 ft	1500 ft
Y type runways are used in ______________	airport	seaport
______ is the processing of passengers and baggage for the purpose of	screening	ensuring
______________that attempts to screen for weapons potentially carried	Pulse eco meter	Magnetome
Maximum flying altitude for lighter weight aircrafts is _____________	Below 25,000ft	Below 20,0
Aircraft operating under Flight rules is ______________.	Flight plans	VFR and IF
The location of Indra Gandhi International Airport at _______________	Bangalore	Delhi
____________ includes parking lots, public transportation train stations	Area side	Landside
Colors and flash intervals of lights became standardized under the ____	FAA	IACO
Preventing collisions between aircrafts is referred to as _____________	Safety	Security
The ____control includes all areas accessible to aircraft, runways, taxiv	Terminal	Fuel station
Controllers may use a radar system called___________ Surveillance Ra	Primary	Secondary
The maximum altitudes and airspace boundaries assigned to a ________	Surveillance	Radar
Radar control is referred to as______________.	hangar control	Control for
Radio navigation is under ________________.	VFR & IFR	RNR & RN
Focus light is mainly used for focusing ______________	clouds	Collision av

c	d		Answers	
night landing	day taxing		night landing	
ATC unit	Both a and c		Both a and c	
Airport Traf	Both a and b		Air Traffic Control	
1.25 km	1.68 km		1.85 km	
apron	seashore		airfield	
helicopters	both a and b		both a and b	
air turbulenc	air vortex		airworthiness	
heliport	airbase		airport	
Aircraft Loc	Both a and b		Advance Landing Ground	
Aircraft Infc	both a and c		Aeronautical Information Manual	
Nepal	Dubai		Norway	
1945	1955		1935	
Goa	New Delhi		New Delhi	
Central Airli	Civil Aviatio		Civil Aviation Authority	
5 Billion	6 Billion		6 Billion	
Admin block	Hangar		Hangar	
FAA	FAR		FAA	
Apron	Terminal		Apron	
DGCA	Airline Admi		Airport Director	
Asst. directo	CAR		PRO Manager	
air traffic co	system arch		finance and budgeting	
airside opera	signal area op		airside operation	
defueling	maintenance		rescue	
military base	reliever		reliever	
Nepal	Cuba		India	
wings	flaps		rudder	
Nepal	Cuba		Dubai	
Green	Red		White	
beep	code		wave	
7000 ft	10000 ft		7000 ft	
1300 ft	1600 ft		1400 ft	
aircraft carri	aerodrome		aircraft carrier	
blocking	emigrating		screening	
Lactometer	Thermometer		Magnetometer	
Below 35,00	Below 40,000		Below 35,000ft	
Flight contro	Flight route		VFR and IFR	
Mumbai	Chennai		Delhi	
Airside	Sea sore		Landside	
ICAO	ICIO		ICAO	
Separation	Signal		Safety	
Airport	Airside		Airport	
Primary and	ATC		Primary and Secondary	
Approach	Terminal		Radar	
ATC control	Terminal cor		ATC control	
VOR & VH	FAR & FAA		VFR & IFR	
runway	airspace		runway	

Longitudinal separation can be based upon ___________as measure by	time	distance
Aircraft Red colour lightings appear for __________________	co-pilot side	pilot side
Logo lighting may appear on the ______________	wings	rudder
ATC operations are conducted either in the ________________ comm	Native language	Numbering

time and spe	speed		distance	
ATC	Auto pilot sys		pilot side	
airfoil	fuselage		rudder	
Identificatio	English		English	

Questions
_____________services are responsible for the compilation and distribution of all aeronautical information necessa
It's the process by which aircraft are safely separated in the sky as they fly and at the airports where they land and
It's an activity that is done before flights take place.
______________ requirements for communications, navigation and surveillance
An air base is an ____________ with significant facilities to support for reserved military bases.
_______________International Airport is the first green field airport in India
A _______________is an airport serving traffic within a relatively small or lightly populated geo
A ____________ terminal is a building detached from other airport buildings, so that aircraft car
A _____________movement radar was installed for effective monitoring of flights in the runwa
_________________ academy provides education for avation science.
The air ambulance service is exclusive for _______________
________________ are personnel responsible for the safe, orderly, and expeditious flow of air t
A _____________ is a defined rectangular area on a land aerodrome prepared for the landing an
The runway _________ are markings across the runway that denote the beginning and end of th
______________ runways are used at small airstrips
If you are landing on runway 270 degree, which direction are you heading?
Intrumental landing system is used in ______________
_________________ is documents are required for flying in inter states
The ____________develops engineering, design, and construction standards for civil airports,
Fit to fly certificate is referes to _____________ of an aircraft
Red colour light indicate in aircraft is ________
Aerodrome is also called as __________
______________ a document that allows entry to a country
___________systems used in the provision of air traffic services
Radar measurement of range ismade possible because of the properties ofradiated ___________
Federal Aviation Regulations defines __________
SOS code is tyed for _____________
The human activity that surrounds aircraft is called _______________.
Recording and transmission of information on the progress of flights is _________
A ___________ is a travel document, usually issued by a country's government, that certifies the
Port side indicate in aircraft is ________
The National Aviation Day is celebrated on _______________
An airport is an aerodrome certificated for ____________ flights.
Satellites are used in _____________
Vertical axis in aircraft through the top and bottom of the fuselage refers to_________________
Navigation system is used to _____________
During the First World War ___________ technology is used for communication.
DME stands for __________
Starboard side indicate in aircraft is ________
Wing span = ______________
____________indicates the direction of aircraft

a	b	c	d	Answers
Aeronautical Information Services	Airport Manage	Air Traffic Flow Management	Air Traffic Control	Aeronautical Information Services
ARR	ATC	CAR	TRM	ATC
Aeronautical Information Services	Airport Manage	Air Traffic Flow Management	Air Traffic Control	Air Traffic Flow Management
Aeronautical Information Services	Air Traffic Ma	Air Traffic Flow Management	Air Traffic Control	Air Traffic Managem
aerodrome	airport	airspace	airstrip	aerodrome
Coimbatore	Chennai	Kochi	Cochin	Cochin
domestic airport	regional airport	International airpo	Sea base	regional airport
area	aerodrome	satellite	airport	satellite
ATC	terminal	airspace	surface	surface
Engineering	aviation	merain	management	aviation
passenger	military	business	medical	medical
ATC	ATAD	ARR	FAR	ATC
High way	rail way	runway	sea way	runway
Blast pads	Overrun	center line	thresholds	thresholds
Optimal	Visual	airbase	airfield	Visual
East	West	North	South	South
VFR	IFR	VOR	RNP	IFR
passport	visa	ticket	MC	ticket
SETCE	DGCA	ARR	FAA	FAA
FC	Airworthiness	Repair	overhauling	Airworthiness
Port side	starboard side	front side	rear side	Port side
airbone	airport	airdrome	aeroport	airdrome
Passport	Travel visa	Airticket	MC	Travel visa
hydralic	pneumatic	electronic	Radar	Radar
magnatic	electromagnetic	kinamatic	heat	electromagnetic
IFR	VFR	IFR & VFR	RNA	IFR & VFR
emergency landin	taxing	takeoff	crusing	emergency landing
aviation	aeronautical	aerospace	nautical science	aviation
FIS	FMS	FMC	FAR	FIS
visa	passport	MC	Air ticket	passport
Pilot	co-pilot	air crew	passenger	Pilot
4-Oct	12-Aug	19-Aug	1-May	19-Aug
commercial	fighter	rocket	spaceshuttle	commercial
Global positionin	Global point s	Global plane syste	Galaxy l positionin	Global positioning sy
pitching	yawing	rolling	climbing	yawing
Traffic control	Communication	Weather detection	Find position and d	Find position and dire
wireless	Dopple	Radio	RADAR	wireless
Distance measuri	Distance monit	Direct measuring e	Doppler monitorin	Distance measuring e
Pilot	co-pilot	air crew	passenger	co-pilot
wing tip to wing tip	wing root to wing	nose to enpanage	rudder to elevator	wing tip to wing tip
red	yellow	green	white	white

nent	
ystem	
ection	
quipment	

Lateral axis in aircraft refers to_________________
Rules of the air state with _________
_________ are under which a pilot operates an aircraft clear enough to allow the pilot to see where the a
Airspace Class A type aircrafts fly above ___________ altitude.
An international airport is an airport that offers customs and ___________
John F. Kennedy International Airport is located at _____________
A water aerodrome is an area of open water used regularly by ____________
Airoprt is also called as __________
International Civil Aviation Day is celebrated on ____________________
Longitudinal axis in aircraft refers to_________________
Green colour light indicate in aircraft is ________
A ________________ is an airport that handles only domestic flights—flights within the same co
Cochin International Airport became the world's first fully _______________ airport

fuselage	wings	nose	rudder	wings
IFR & VFR	IFR	VFR	CCR	IFR & VFR
VFR	IFR	RNAV	RNP	VFR
18,000	10,000	25,000	35,000	18,000
customs	terminal path	airboom	immigration	immigration
New York City	New Delhi	New Jersey	New Sweden	New York City
gliders	seaplanes	fighter jets	rotocraft	seaplanes
airbone	airport	aerodrome	aeroport	aerodrome
7-Dec	7-Nov	9-Mar	4-Dec	7-Dec
fuselage	wings	nose	rudder	fuselage
Port side	starboard side	front side	rear side	starboard side
domestic airport	International air	Aerodrome	Sea Base	domestic airport
Thermal Powered	Nuclera powere	Hydro powered	solar powered	solar powered

Questions
Air traffic control uses a _________, knowns as plan position indiactor radar.
ARSR stands for __________
An ____________ is a location where aircraft such as fixed- wing aircraft, helicopters, and blimps take
Components of An Airport Layout is divided into __________ parts
A _________ is the area where an aircraft lands or takes off.
____________ these buildings are the spaces where passengers board or alight from flights.
Aircraft _________ are the areas where the aircraft park.
A _________is a path on an airport connecting runways with ramps, hangars, terminals and other facilit
A portion of an apron designated as a taxiway and intended to provide access to aircraft __________ on
A tower at an airfield from which air traffic is controlled by radio and observed physically and by radar
_______ is a specific area of airport at which vehicles park
Airports can be classified on ______ basis
The FAA classification of airport is based on
Which of the following is not a characteristic of centralised system of the terminal Area?
Air traffic control uses a CRT knowns as __________ radar.
Which of the below does not affect the site-selection of an airport site?
Runways are oriented in a direction against the prevailing wind.
The wind intensity during calm period in runways should be ____________
The application of __________ diagram is used to find the orientation of runway to get the desired winc
How many type of Fly Rules are there, according to FAR
During winter conditions, signs and markings may be obscured by ________
International airports have maximum of ___________ size of runway.
Y type runways are used in ______________
Controllers may use a radar system called___________ Surveillance Radar
Preventing collisions between aircrafts is referred to as __________________.
The location of kempegowda International Airport is at ______________________
Aircraft operating under Flight rules is ______________.
The attempts to screen for weapons potentially carried on by a passenger.
______________ is world recorded in aircraft landed at high altitude.
Location used for emergency landing for an aircraft is ___________

a	b	c	d		Answers		
CCTV	CRT	CDT	CVR		CRT		
airport	seaport	busport	station		airport		
8	9	6	4		8		
Apron	Taxiway	runway	Hanger		runway		
Hanger	runway	Taxiway	airport tern		airport terminal		
Apron	Taxiway	runway	Hanger		Apron		
Hanger	runway	Taxiway	airport tern		Hanger		
airport ter	stands	Apron	Taxiway		stands		
ATC	ATS	TRM	PRK		ATC		
Hanger	Runway	Parking	Apron		Parking		
5	4	3	2		4		
Function	Geometric	Airport ap	Length of R		Airport approach speed		
Passengers	Passenger	Walking c	Common fa		Passenger facilities in small units		
plan point	plan powe	plan posit	plan proces		plan position indiactor		
Adequate	Air traffic	Sufficient	Number of g		Number of ground staff		
TRUE	FALSE	same dire	opposite di		FALSE		
Below 4.6	Above 5kı	Between 5	Below 6.4kı		Below 6.4km/hr		
Wind Butt	Wind Cycl	Wind Star	Wind Rose		Wind Rose		
2	3	4	5		2		
fire	water	snow	stones		snow		
4000 ft	7000 ft	7500 ft	8000 ft		7000 ft		
parallel ru	single run	aircraft ca	airbase		aircraft carrier		
Primary	Secondary	both a anc	ATC		both a and b		
Safety	Security	Separatio	Signal		Safety		
Bangalore	Mumbai	Hyderaba	Chennai		Bangalore		
Flight pla	VFR and	Flight rou	Flight cont		VFR and IFR		
Pulse eco	Magnetor	Lactomete	Thermome		Magnetometer		
IAF	USAF	RAF	RBAF		IAF		
heliport	highway	sea port	ground fiel		ground field		

Question
Inrecent year ,navigation hasnbecome increasingly reliant on the satellite based
_____________ airspace,known as uncontrolled airspace priorto 1993
____________ airspace,known as controlled airspace priorto 1993
_______________airspace,known as positive control airspace priorto 1993
The pier finger terminal is the first of what are known as _____________
In the 1980's the airside -landside concept formed the basis for a series of experimental concepts is knownas
The___________ concept emerged with the opening of the tampa international airport in 1972
The subsequent signing of
__________ was incorporated into the organizational structure of the u.s department of transportation
__________ type of lightning consists of manually operated movable flood lights
These first centralized facilites became is known as the earliest __________
In some instances airports were extended in a__________ fashion
Controllers may use a radar system called___________ Surveillance Radar.
The areas of responsibility for ATCT controllers fall into _________ general operational discipline.
________________ is the position that is responsible for ensuring that both controllers and pilot have the most curren
Clearance Delivery is the position that issues ______________ to aircraft, typically before they commence taxiing.
The primary responsibility of Clearance Delivery is to ensure that the aircraft have the__________.
The maximum altitudes and airspace boundaries assigned to a _________________.
Radar control is referred to as______________.
Lateral separation minima are usually based upon the position of the aircraft is derived visually, from____________
Radio navigation is under ________________.
Focus light is mainly used for _________________.
Longitudinal separation can be based upon ____________as measure by DME.
Red colour lightings appear for ___________________.
_____________ will come under area control.
Logo lighting may appear on the _______________.
Coastal Guard Helicopter are used in_______________.
Registration Alphabetic codes used for Australian Flights are ____________________.
The height of the airplane above the earth is indicated by the ______________.
___________ is under the Divisions of ATS.
______________ is a non-power-driven, unmanned, lighter than air aircraft in free flight.
Maximum flying altitude for international air transportation is_________.
A Pilot to able to see outside the cockpit, to control the aircraft altitude,navigation and avoid obstacles.

option A	option B	option C	option D			answer	
navigation	IRNSS	Gps	none of these			Gps	
class E	class D	class B	class G			class G	
class E	class D	class B	class G			class E	
class A	class D	class B	class G			class A	
decentralized faclities	multiple-unit terminal	combined unit terminal	all the above			decentralize d faclities	
presend-day airport terminal	component of the airport terminals	off-airport terminals	none of these			off-airport terminals	
airside-landside	only lanside	only airside	non of these			airside-landside	
TSA	ATSA	AOA	SIDA			ATSA	
TSA	ATSA	AOA	SIDA			TSA	
movable lighting	standby lighting	continuous lighting	non-continuous lighting			movable lighting	
simple-unit terminals	cetralised facilities	both a and b	none of these			simple-unit terminals	
linear terminal	curvilinear	both a and b	none of these			curvilinear	
primary	Secondary	both	none of the given			secondary	
2	3	4	5			4	
flight registratic	flight idntifica	Flight Data	Flight plans			flight plans	
bird clerance	weather clerai	routed	birds flying clearence			weather clerance	
proper route	slot time	both a and b	none of the given			both a and b	
Surveillance Cc	Radar Control	Terminal Rada	non radar control			radar control	
hanger control	control for air	ATC control	terminal control			ATC control	
dead reckoning	internal navig	radio navigatic	all navigation aids			all navigation aids	
VHR&IFR	RNR & RNA	VOR & VHAI	VHR			ENR &RNAP	
focusing air spa	collision avoi	fousing runwa	uncontrolled air space			collision avoided	
time	distance	both a and b	none of the given			both a and b	
co pilot side	pilot side	air traffic cont	auto pilot system			pilot side	
Aerodrome Cor	Approach Coi	Area Control S	all ATS Services			area control service	
wing	rudder	airfoil	fuselage			rudder	
airport surveilla	city surveillar	sea sore surve	border Surveillance			sea source survilence	
VHT	AUS	VIT	VHRT			AUS	
Radar altimeter	Flight stability	Direction indi	Sprit level indicator			radar altimeter	
Area control sei	Approach coi	Aerodrome cc	ATCS			aero drome conrol servi	
Unmanned free	UAV	Mono plan	Tri-cycle			UAV	
25,000ft to 30,	40,000ft to 4:	30,000ft to 35,	20,000ft to 25,000ft			25000ft to 30000 ft	
IFR	RNP	RNAP	VFR			RNP	

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