Introduction to Airport Operations

Course eTextbook

Customized for Airports Authority of India

![IATA]

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![Airports Authority of India]

भारतीय विमानपत्तन प्राधिकरण
AIRPORTS AUTHORITY OF INDIA

Customized for Airports Authority of India

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Module 0—Introduction

0.1 Profile of AAI

Airports Authority of India (AAI) is a Statutory Authority constituted by an act of Parliament (Airports Authority of India Act, 1994). It came into existence on 1st April 1995 by merging the erstwhile International Airports Authority of India and National Airports Authority with a view to accelerate the integrated development, expansion and modernization of the air traffic services, passenger terminals, operational areas and Cargo facilities at the airports across the country.

AAI owns and maintains 125 airports including 68 operational airports and 26 Civil Air Terminals (CAT). AAI provides Air Navigation Services (ANS) at all airports/civil enclaves in the country. AAI manages the designated Indian air space measuring 2.8 million square nautical miles which includes land area measuring 1.05 million square nautical miles and oceanic airspace measuring 1.75 million square nautical miles. AAI is committed to its mandate of creating more airport infrastructure and navigation infrastructure across the length and breadth of the nation. New Terminal Buildings were commissioned at Chennai, Kolkata, Raipur, Ranchi, Bhubaneshwar and Puducherry Airports in recent times.

0.2 Mission

"To achieve highest standards and quality in air traffic services and airport management by providing state-of-the art infrastructure for total customer satisfaction, contributing to economic growth and prosperity of the nation"

0.3 Vision

"To be a world-class organization providing leadership in air traffic services, airport management and making India a major hub in Asia Pacific region by 2016"

0.3.1 Organizational Structure
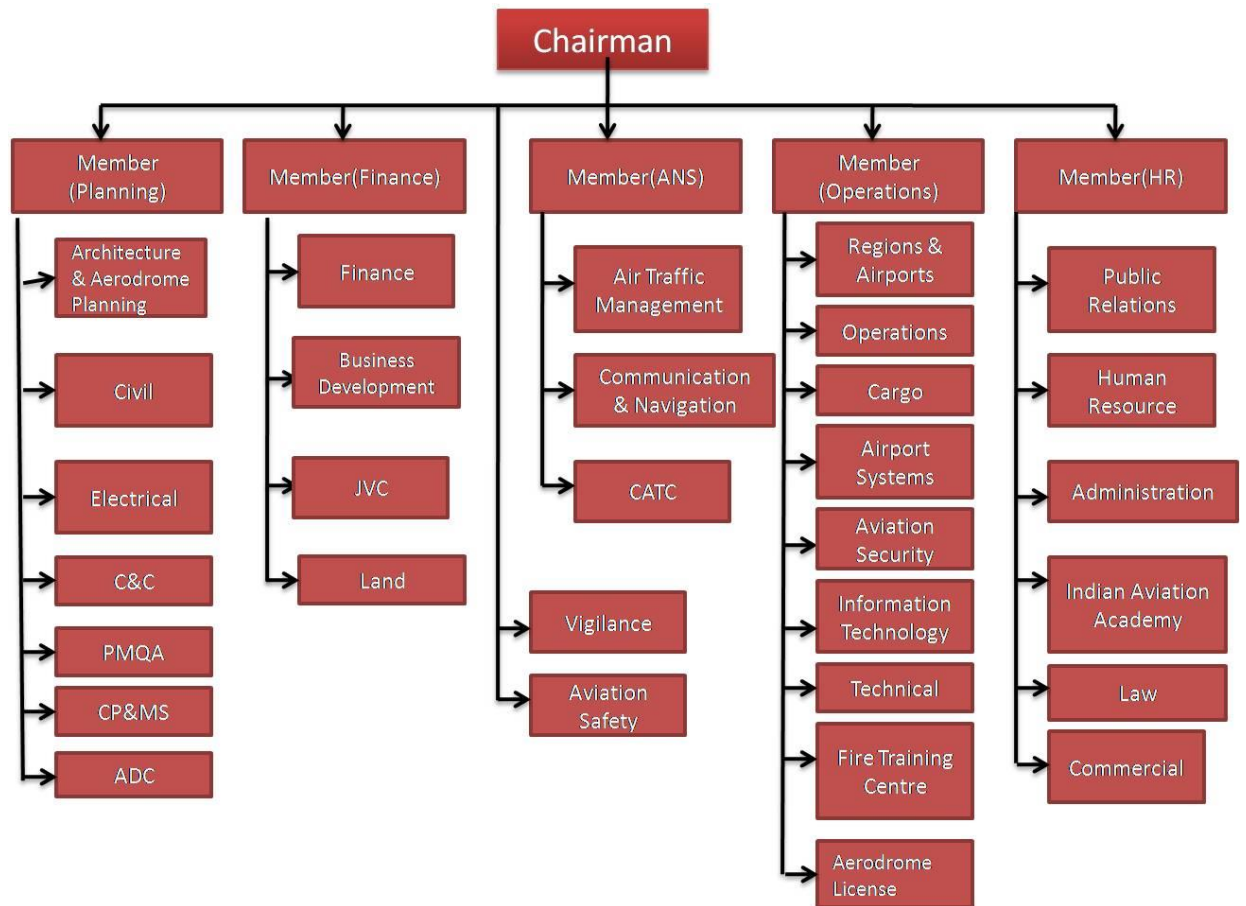
Figure 1. Organisational Structure

0.3.2 Functions of AAI

- Design, Development, Operation and Maintenance of international and domestic airports and civil enclaves.

- Control and Management of the Indian airspace extending beyond the territorial limits of the country, as accepted by ICAO.

- Construction, Modification and Management of passenger terminals.

- Development and Management of cargo terminals at international and domestic airports.

- Provision of passenger facilities and information system at the passenger terminals at airports.

- Expansion and strengthening of operation area, viz. Runways, Aprons, Taxiway etc.

- Provision of visual aids.

- Provision of Communication and Navigation aids, viz. ILS, DVOR, DME, Radar etc.

Useful references in the following IATA Airport Operations modules and IATA Internet resources:

IATA Airport Operations 1.3.1

Table 1. Departments/Directorates of AAI

1.	Aerodrome License
2.	Airport Systems
3.	Air Traffic Management (ATM)
4.	Architecture And Planning
5.	Aviation Safety
6.	Cargo
7.	Central Radio Stores Depot (CRSD)
8.	Commercial
9.	Communication, Navigation & Surveillance-Operations & Maintenance (CNS-OM)
10.	Communication, Navigation & Surveillance Planning (CNS-P)
11.	Consultancy & Coordination (C&C)
12.	Corporate Affairs & Company Secretary (CA & CS)
13.	Corporate Planning & Management Services (CPMS)
14.	Engineering
15.	Finance & Accounts
16.	Fire Directorate
17.	Flight Inspection Unit (FIU)
18.	Human Resource (HR)
19.	Information Technology (IT)
20.	Key Infrastructure Development (KID)
21.	Legal
22.	Land Management
23.	Official Language
24.	Operations & Terminal Management

25. Project Monitoring & Quality Assurance (PMQA)
26. Public Relations (PR)
27. Radio Construction & Development Unit (RCDU)
28. Security
29. Technical
30. Vigilance

0.4 Roles of various Departments/ Directorates in AAI

0.4.1 Aerodrome License

Directorate of Aerodrome License is mainly responsible for coordination with DGCA for fresh and renewal of Aerodrome License of AAI Airports

Related functions and responsibilities:

1. To submit application along with relevant documents to DGCA for fresh issue of Aerodrome licenses.

2. To submit application along with relevant documents to DGCA for renewal of Aerodrome Licenses. (2 months prior to expiry of Licenses).

3. To submit periodical Action Taken Reports (ATR) in respect of CAR non-compliances and various surveillance inspection conducted by DGCA.

4. To co-ordinate with the Airports and guide for timely submission of documents/ATRs. Also, advise them in case of any changes in the procedures.

5. To co-ordinate with DGCA for any other issues pertaining to Aerodrome Licenses.

Useful references in the following IATA Airport Operations modules and IATA Internet resources:

IATA Airport Operations 2.4

0.4.2 Airport Systems

Directorate of Airport Systems is mainly responsible for Planning, Procurement, Installation, & Maintenance of terminal equipment's

for passenger facilitation & cargo automation systems. It is also responsible for creating and modernizing airport security infrastructure by planning, procuring, installing & subsequently maintaining, various security equipment i.e. X-BIS (In-Line, RB, HB, & OOG) DFMD, HHMD, ETDs etc. for the purpose of securing the safety of Aircraft operations at the Civil Airports in India. It also procures 28 types of Bomb Detection & Disposal Squad (BDDS) equipment that includes Search, Detection, Disposal, Protection & Transportation equipment i.e. RTVs, NLJDs, Bomb Suit, Liquid Explosive Detectors, Telescopic Manipulator, MROV, Cell Phone Jammers, Frequency Jammers etc. confirming to the specification laid down by Bureau of Civil Aviation security (BCAS), under Ministry of Civil Aviation. Project Monitoring through Progress Reports obtained from Project-in-charge/Nodal officer at respective stations. This department also look after Procurement of Spares and AMCs for the equipment/systems for in-house maintenance.

Useful references in the following IATA Airport Operations modules and IATA Internet resources:

IATA Airport Operations 2.0

www.iata.org/whatwedo/security/Pages/index.aspx

0.4.3   Air Traffic Management (ATM)

AAI provides the Air Traffic Management Services over the Indian airspace and adjoining oceanic areas in accordance with the ICAO Standards and Recommended Practices(ICAO Doc 4444 PANS ATM with the following functions:

a)   Air Traffic Services

b)   Air Traffic Flow Management

c)   Airspace Management

Airspace sectorization, Upper airspace harmonization, conflict management and decision making tools for controllers have been taken up and are in various stages of implementation. This will lead to flexible and dynamic management of airspace contributing to safe and efficient flow of en route traffic. In addition, improvement in Air Space Management procedures, implementation of ATFM, establishment of in-house R&D capability and improvement in Training infrastructure are being implemented which will lead to enhanced Safety, Efficiency and Capacity of aircraft operations. Latest Air Space management procedures have already been implemented leading to considerable increase in airspace capacity.

A Central Control Unit is being established to monitor all flights in the country from the security point of view. Air Traffic Control (ATC) services will normally be provided by AAI, except for approach and aerodrome control services, which may be provided by licensed ATCOs engaged by the airport operators.

Useful references in the following IATA Airport Operations modules and IATA Internet resources:

IATA Airport Operations 2.1.2.2

www.iata.org/whatwedo/workgroups/Pages/air-traffic-management.aspx

www.iata.org/whatwedo/workgroups/Pages/mettf.aspx

0.4.4 Architecture and Planning

The very genesis of creation of infrastructure starts from planning. In AAI, Department of Planning plays two major functions. One is Architectural Planning and other is Aerodrome Planning. Architecture planning is based on capacity assessment, creation of new capacities and building designs and Aerodrome planning dovetails it with airside planning & budget planning. Both wings of the Planning department complement each other in technical assessment of all existing facilities and creation of new infrastructure.

Primary functions of the Architecture Planning wing for all the 120 existing Airports and the new airports being developed for regional connectivity are

1. Site selection for new Airports

2. Land use and Master Planning

3. Capacity evaluation, Data Analysis and preparation of feasibility reports

4. Geometric design of airfield and aprons

5. Identification of areas to meet commercial requirements

6. Passenger Terminals and Cargo Terminals designs

7. Co-ordination with Site & Consultant during Construction

8. Design evaluation of the proposals of user agencies

9. Consultancy Management of outsourced air terminal projects

10. Modification/up gradation of air-side facilities.

11. Beautification & development of city side spaces

12. Design of all other infrastructural buildings including

    i.   Hangars,

    ii. Technical Block & Control towers,

    iii. Administrative buildings/Office complexes

    iv. AAI & CISF Residential complexes,

    v.   Fire Stations

    vi. Medical centres

    vii. MT workshops

    viii. Various Others projects under Corporate Social responsibility at Airports from time to time.

13. Preparation of replies to questions from Parliament, Consultative Committee of parliament, VIPs etc. concerning airport planning and projects.

14. Co-ordination with State Govts & all stakeholders for Airport developments.

Major functions of the Aerodrome Planning wing are

1. Providing support to MoCA and DGCA in Aviation System Planning.

2. Planning of airports including land use, pavements, terminal and other buildings.

3. Co-operation with airlines, DGCA, NEC and other bodies.

4. Defining scope of work, preparation of project report.

5. Preparation of annual plans for aerodrome works.

6. Preparation of replies to questions from Parliament, Consultative Committee of parliament, VIPs etc. concerning airport planning and projects.

7. Overall monitoring of the progress of projects.

8. Providing inputs of strategic level to top management for strategy formulation to fulfill the organization's vision;

9. Providing inputs at Project level for project formulation viz. scope of work, Detailed Project Report, Environmental clearance, etc.

10. Feasibility study for site selection of Aerodromes.

11. Planning airport system of various financial modes.

12. Provide requisite support to MoCA in framing policy in Airport infrastructure.

13. Interact with ANS departments for integrating and synergizing the Air Space System plan to Airport System Plan for optimum capacity creation at Air Side.

14. Interact with Aviation Safety Department, Operations Department and Security Department to enhance the operational efficiency & safety and security levels at aerodromes.

15. Assisting in preparation of Airport Master Plan and land use plan including city side development.

16. Provide logical support in Airport Tariff fixation.

17. Maintain and periodical updating of the data on aerodromes in the form of Airport Directory.

18. Prepare National Register of Aerodromes and update it periodically devise various methods for increasing Air side capacity in an optimum way.

19. Assisting in implementation of Next Generation Systems in ANS by designing appropriate supporting infrastructure.

20. Interact with the State Govt. to prepare the city plan interwoven with the Airport Master Plan.

Useful references in the following IATA Airport Operations modules and IATA Internet resources:

IATA Airport Operations 1.6

IATA Airport Operations 5

www.iata.org/whatwedo/ops-infra/Pages/index.aspx

0.4.5   Aviation Safety

Aviation Safety department is mainly responsible for:

1. Monitor the *Aerodrome operations* and detect the safety hazards and point out to the ATM Directorate and the other concerned Directorates.

2. Monitor the Air Navigation operations and detect the safety hazards and point out to the ATM Directorate and the other concerned Directorates.

3. Monitor the Aerodrome design activities of the Planning and Engineering Directorates and detect the non-compliances of regulations and point out to the concerned Directorates.

4. Guide the various departments for SMS documentation.

5. Assist all the Directorates to establish the Safety Management System, throughout the organization, including the education and training.

6. Coordinate the safety matters of AAI with DGCA, ICAO and other stake holders.

7. Promote the safety of aerodromes and air navigation services.

8. Present the safety reports to the Safety Review Board (SRB) and implement the directions, given on safety matters, by SRB.

9. Maintain consistency in the functions and the practices in the activities of all departments of AAI which may affect the safety of the system(s).

10. Develop the new tools and methods of audit and inspections and mitigation procedures.

11. Implement effective safety programmes in all areas of operations and passenger facilities with a view to provide safe environment for aircraft operations and passengers at all AAI airports.

12. Carry out annual audit of all AAI airports, civil enclaves and other facilities with the objective of identifying operational and system deficiencies, hazards and trends at ground level.

13. To monitor that air traffic services, communication, navigational and landing aids, rescue and fire fighting services at AAI aerodromes are provided and maintained inconformity with ICAO standards and recommended practices and civil aviation requirements issued from time to time.

14. Recommend appropriate actions to prevent accident/incidents.

15. Promote and develop activities that increase knowledge and safety awareness amongst all department personnel of AAI and to the extent possible amongst all personnel of other departments working at the Airport.

Useful references in the following IATA Airport Operations modules and IATA Internet resources:

IATA Airport Operations 2.1.2.4

IATA Airport Operations 2.1.3.1

www.iata.org/whatwedo/workgroups/Pages/airside_safety.aspx

www.iata.org/services/statistics/gadm/Pages/index.aspx

www.iata.org/whatwedo/workgroups/Pages/isago.aspx

0.4.6 Cargo

The main functions of the cargo department are as under:

1. Framing corporate policies on AAI's cargo handling at international as well as domestic airports

2. Implementation of IATA rules, ICAO recommendations, Implementation of BCAS, CBEC objectives and regulations, pertaining to cargo handling

3. Liaison at apex level with the regulatory Ministries, and other bodies, as well as user agencies such as Central Board of Excise and Customs, DGCA, Ministry of Commerce

4. Tapping hitherto untapped areas of operation for harnessing additional revenue from cargo handling, including Express and Courier Operations

5. Finalization of long and short term infrastructural requirements, in consultation with Department of Planning, Engineering and Finance including Annual Plan and Five Year Plan

6. Overseeing AAI's cargo operations at the two metro airports and other domestic airports

7. Representing AAI in the various trade bodies like SCOPE-Air, sectoral meeting on EC/EDI Taskforce Meeting, Conventions and high level meetings arranged by BAR-India (Cargo), CII, Federation of Freight Forwarder's Association of India (FFFAI), Air Cargo Agents Association of India (ACAAI), Federation of Indian Exporter's Organization (FIEO), Chambers of Commerce, etc.

8. Setting up of cargo terminals and managing them by providing services comparable to international standards

9. Modernization of cargo handling system, re-engineering systems and procedures for hassle free terminal operations resulting reduction in dwell time

10. Finalization of tariff on cargo handling services in consultation with the user community like airlines, freight forwarders, etc.

11. Make proposals on various policy and operating matter to the AAI board; implementation of the policy decisions taken by the Board/Government of India.

Useful references in the following IATA Airport Operations modules and IATA Internet resources:

www.iata.org/whatwedo/workgroups/Pages/dgttf.aspx

www.iata.org/whatwedo/workgroups/Pages/dcsmwg.aspx

www.iata.org/whatwedo/workgroups/Pages/cbpp.aspx

www.iata.org/whatwedo/workgroups/Pages/cditf.aspx

www.iata.org/whatwedo/workgroups/Pages/coag.aspx

www.iata.org/whatwedo/workgroups/Pages/cpcmg.aspx

www.iata.org/whatwedo/workgroups/Pages/cstf.aspx

www.iata.org/whatwedo/workgroups/Pages/csc.aspx

www.iata.org/whatwedo/workgroups/Pages/eawbag.aspx

www.iata.org/whatwedo/workgroups/Pages/tttf.aspx

0.4.7   Central Radio Stores Depot (CRSD)

The Central Radio Stores Depot (CRSD) is a key storage unit of the Communication, Navigation & Surveillance (CNS) wing of the Airports Authority of India for keeping critical CNS spares and equipment's. The main function of the CRSD is delivery of spare parts of all Communication, Navigation and Surveillance (CNS) equipment to all the Aeronautical Communication Stations (ACS) for proper operation and upkeep of these equipment as per the requirement received from the stations. In view of the importance of uninterrupted operation of these equipments, a huge inventory is maintained at CRSD. This inventory is maintained in SAP/ERP system with effect from 1st April 2013. The CRSD is also responsible for purchase of the CNS Spare items, inward & outward Insurance, custom clearance, receipt of the stores, proper storage by assigning a unique material code (VOCAB No), packaging before dispatch etc. The items which are no longer in use due to upgraded technology or due to obsolescence are surveyed and disposed of by e-auction through MSTC.

Apart from the inventory management, CRSD also facilitates the repair of the imported equipment's and their modules during the warranty period which involves liaisoning with the supplier, necessary insurance and co-coordination with the concerned bank for approvals for re-export for custom purposes. Such items are re-exported with the help of a designated Custom House Agent (CHA). After the item is repaired by the foreign supplier, it is re-imported following all the laid down procedures. A Management Information System (MIS) is maintained for the total inflow and outflow of the stores on monthly basis.

CRSD also undertakes transit insurance of CNS Equipment/spares from any station in India to any station in India through open marine inland insurance policy provided advance approval is sought by the consigner station from CRSD

0.4.8   Commercial

Economic viability of airports has assumed utmost importance and the trend to privatize airports and make them economically self-sustained has gained worldwide momentum. The capital intensive nature of airport establishment throws up challenges of unprecedented magnitude to generate revenues to sustain operations and maintain growth. With limited scope for enhancement in traffic related revenue, the emphasis world over has been to increase the non-traffic revenue by increased commercial exploitation of available airport infrastructure, improved and competitive passenger shopping facilities, advertisements etc. are subjects necessitating professionalism in managing commercial aspect of an airport. From non-traffic revenue of 10-15% of total AAI revenue in early 90s, the AAI has moved to a regime of non-traffic revenue in the range of 20-30% of total revenue while the British Airport Authority (BAA) generates 70% of its revenue from non-traffic sources. Cargo revenue has seen a growth of almost 300% in last 5-6 years. AAI has over the last 10 years or so developed a team of experts in the field of commercial aspects and based on the experience gained, can provide assistance to other airport operators in improving the financial viability of the airports.

Useful references in the following IATA Airport Operations modules and IATA Internet resources:

IATA Airport Operations 1.5

0.4.9   Communication, Navigation & Surveillance-Operations & Maintenance (CNS-OM)

The directorate of CNS-OM is responsible for proper operations & maintenance of CNS equipment infrastructure for safe, Secure and orderly movement of aircrafts in air and ground. Directorate of CNS-Operation & Maintenance [CNS-OM] at CHQ is headed by Executive Director [CNS-OM]. ED [CNS-OM] reports to Member [ANS]. Broad functions/job profile of CNS-OM Department is as given below:

1. The Communication, Navigation, Surveillance and ATM Data Processing facilities are the backbone for provision of Air Navigation Services for safe and smooth operation of Aircraft at Airports and for both Continental and Oceanic Indian airspace. CNS-OM Directorate ensures that provision of these facilities for their Serviceability, Availability, Reliability and Integrity is as

per Standard and Recommended practices of ICAO and Civil Aviation Requirements (CARs) promulgated by DGCA.

2. CNS-OM Dept by framing maintenance policies and supervision systems delivers system management, maintenance standards/ instructions and maintenance services to assure and ensure that Serviceability, Availability, Reliability and Integrity of CNS/ATM systems as mentioned above.

3. Provision of Aeronautical Mobile Services, Aeronautical Fixed Telecommunication Network, VOLMET, Pre Flight Com Briefing and International Notam Offices.

4. Provision of Telecom infrastructure (Datacom, Telephones, Fax & Mobile etc.) for provision Air Navigation Services and to other AAI Departments/Units for operational and administrative requirements.

5. Human Resource Management of CNS Manpower

6. Coordination with DGCA/ICAO for issue related to CNS and amendment to ICAO Annex/documents related to CNS.

7. Coordination with National Regulator, WPC and ICAO for Civil Aviation Frequency requirements/Protection.

8. Preparing and implementation of replacement and up gradation proposal of CNS/ATM Data processing system.

9. Implementation of Safety Management System (SMS) related to CNS and Automation facilities.

Useful references in the following IATA Airport Operations modules and IATA Internet resources:

IATA Airport Operations 6.1

0.4.10 Communication, Navigation & Surveillance-Planning (CNS-P)

Directorate of CNS-P is responsible for Planning, procurement, testing & commissioning of all Communication, Navigation & Surveillance (CNS) facilities and support systems for air navigation based on short term and long term requirements to synchronize the organization's plan with ICAO's approved plans is managed by department of CNS. Preparation of qualitative requirements and system specifications in coordination with all concerned agencie/ organizations, preparation of estimates, invitation of tenders, tender evaluation of technical and commercial bids, placement of orders, factory inspection of equipment and its subsequent installation and commissioning are the responsibilities discharged by the CNS Planning Department. Conducting site surveys for equipment

location, from technical and operational suitability point of view, coordination with planning, civil and electrical engineering departments for associated construction activities for installation and commissioning, post installation performance checks and organizing flight calibration before equipment commissioning are the aspects intrinsically involved in the process.

To meet the challenges posed by ICAO, CNS ATM transition plans for SATCOM based Air Traffic Management, which the CNS Planning Department has already accomplished. Implementation of a dedicated SATCOM Network amongst 80 airports all over India to support data and voice communication, including remote controlled VHF coverage over the entire Indian air space, networking of Radars and ATS data communications is in progress. Automatic Dependent Surveillance (ADS) has already been installed and successfully tested for operations at Chennai, Kolkata, Delhi & Mumbai airports.

GPS and geo-augmented navigation system (GAGAN) is an implementation of a regional satellite-based augmentation system (SBAS) by Airports Authority of India. This space based augmentation systems for airspace has been taken up in collaboration with ISRO. Initial technical demonstration phase and the total operational phase has been successfully completed.

Useful references in the following IATA Airport Operations modules and IATA Internet resources:

IATA Airport Operations 6.1

0.4.11 Consultancy & Coordination (C&C)

AAI is a pool of talent in various fields in aviation and have become a one stop shop to provide consultancy and coordination for all kinds of aviation projects. Some of the major expertise are:

1. Airport Feasibility Studies.

    i.   Site selection/Technical Feasibility.

    ii. Topography Surveys, Cartography and Soil & pavement Investigation Facilities.

    iii. Airport Obstruction Clearance Surveys.

    iv. Air Traffic Forecasts & Normative Surveys.

2. Airport Development Services.

    i.   Concept to commissioning service for new green filed airports. Preparation of TOR.

    ii.   Preparation of DPRS.

    iii.   Mandatory ministry clearances.

    iv.   RFP for module implementation/Scrutiny/Award.

3. Airport Commercial Viability Studies/Audit Services/Planning, Designing, Evaluation of:

    i.   Air Passenger Terminals/Air Cargo Terminals.

    ii.   Airport Pavements.

    iii.   Design of Aircraft Hangars and Supporting Infrastructure.

    iv.   Airport Electrical Installations/Approach and Night Landing Facilities.

    v.   Remodeling, Modernization of Airports.

4. Planning, Installation, Operation & Maintenance of:

    i.   Radars, Nav Aids, Visual & Non-Visual Landing Aids and Com. Facilities.

5. Air Space & Air Traffic Management, Air Route Re-Structuring.

    i.   Development of SIDS, STARS, IAL Procedures, Obstruction Charts.

    ii.   Planning & Design for Airport Fire Safety Services.

6. Airport Management on Turnkey Basis

0.4.12 Corporate Affairs & Company Secretary (CA&CS)

The role of Directorate of CA & CS is as under:

- Acts as a vital link between the Ministry of Civil Aviation, Board Members, stakeholders and regulatory authorities.

- Plays a key role in ensuring that the Board procedures are followed and regularly reviewed.

- Provides the Board with guidance as to its duties, responsibilities and powers under various laws, rules and regulations.

0.4.13 Corporate Planning & Management Services (CPMS)

The functions of directorate of CP&MS include:

1. Preparation and implementation of Corporate plan & five year plans of AAI.

2. Collection, Compilation, Analysis and publication of air traffic data in respect of aircraft movements, passengers and cargo handled at Indian Airports.

3. Scanning the environment (internal and external) to identify factors having impact on corporate policies of AAI as well as civil aviation sector & formulation of strategies to achieve set objectives.

4. Undertaking/conducting various system studies such as Operational Research studies, economic planning exercise, Statistical Surveys, opinion surveys, Normative planning surveys, Origin & Destination Survey and Capacity assessment studies at passenger as well as cargo terminals.

5. Providing all necessary inputs to the various working groups, planning groups, committees appointed for specific purposes, national and international organizations related to Aviation Sector.

6. Developing capacity estimation norms for the future capacity planning and to assess the capacities in existing terminals through Normative Planning Surveys.

7. Preparing short term, medium term and long term air traffic forecast.

8. Assessment, rationalization & forecasting of manpower.

9. Monitoring air traffic statistics and benchmarking of airports in respect of Airport Service Quality and Customer Satisfaction Surveys.

10. Preparation of Memorandum of Understanding (MOU) between Airports Authority of India & Ministry of Civil Aviation. Action plan for implementation and monitoring of MOU.

11. Providing inputs to MOCA for preparation of RFD (Results Framework Document) & follow up action

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Useful references in the following IATA Airport Operations modules and IATA Internet resources:

IATA Airport Operations 6.3.6

0.4.14 Engineering

The main functions of Department of Engineering of AAI inter-alia include construction, modification & management of passenger terminals, development & management of cargo terminals, development & maintenance of apron infrastructure including runways, parallel taxiways, apron, Ground Lighting facilities, runway/taxiway lighting facilities etc. The Engineering Department is headed by Member (Planning), and there are various departments under Engineering wing which includes Project Management & Quality Assurance (PMQA), Key Infrastructure Department KID and the other infrastructure activity of the organization.

0.4.15 Finance

Economic viability of airports has assumed utmost importance and the trend to privatize airports and make them economically self-sustained has gained worldwide momentum. The capital intensive nature of airport establishment throws up challenges of unprecedented magnitude to generate revenues to sustain operations and maintain growth. With limited scope for enhancement in traffic related revenue, the emphasis world over has been to increase the non-traffic revenue by increased commercial exploitation of available airport infrastructure, improved and competitive passenger shopping facilities, advertisements etc. are subjects necessitating professionalism in managing commercial aspect of an airport. From non-traffic revenue of 10-15% of total AAI revenue in early 90s, the AAI has moved to a regime of non-traffic revenue in the range of 20-30% of total revenue while the British Airport Authority (BAA) generates 70% of its revenue from non-traffic sources. Cargo revenue has seen a growth of almost 300% in last 5-6 years. AAI has over the last 10 years or so developed a team of experts in the field of commercial aspects and based on the experience gained, can provide assistance to other airport operators in improving the financial viability of the airports.

0.4.16 Fire

1. Fire protection and technical support for aviation and related facilities in accordance with the current ICAO guidelines

2. Dealing with all fires, emergencies and related incidents on an airport. These will include for example aircraft or aircraft related fires occurring on or in the immediate vicinity of the airport as well as building fires, fuel spillage.

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3. Develop specifications for fire appliances and equipment utilized by the department and is responsible for the purchase of such equipment upon approval.

4. Establishes rules and regulations for the department and manages the discipline all officers and members of the department in accordance with department rules and regulations.

5. Responsible for coordinating mutual aid fire protection plans with surrounding city municipalities and industrial fire service.

6. Responsible for ensuring the efficient and effective management of the operation and maintenance of fire stations and equipment

Useful references in the following IATA Airport Operations modules and IATA Internet resources:

IATA Airport Operations 4.1.1

0.4.17 Flight Inspection Unit (FIU)

The functions of the FIU are:

1. To carry out the flight inspection of Communication and Navigation surveillance facilities at all the airports throughout the country, catering at present for 64 ILS (including CAT-III) and 93 VORs with a fleet of Two Dornier 228 and one B-300 aircraft.

2. Flight check of RADARs (SSRs, ARSRs, MSSRs) and RADAR training of ATCOs.

3. Undertake flight inspection of Ground Navigational Aids and Visual Landing Aids at Air Force and Naval Air Fields as well.

4. Flight Inspection of DMEs, NDBs, Approach Lighting systems, and VASI/PAPI are also undertaken.

5. Has earlier undertaken Flight Inspection of Nav. Aids in the Neighboring countries like Vietnam, Laos, Nepal, Maldives, Bangladesh and Bhutan, initially under the UNDP project, but later on under bilateral agreements

6. FIU has three fully Automatic Flight Inspection Systems, capable of undertaking flight inspections under low visibility/bad weather conditions. Two Flight Inspection Systems are installed in DO-228 aircrafts and one in B-300. The calibration is augmented with a "Laser Auto Tracker" System for Cat-III ILS calibration.

7. FIU is equipped with "Ground Survey Kit" for carrying out Airfield survey for position information of Nav. Aids/Airfield.

Useful references in the following IATA Airport Operations modules and IATA Internet resources:

IATA Airport Operations 2.1.3.2

0.4.18   Human Resources

AAI maintains high standards of service in airport management through its trained and dedicated manpower and for the purpose of motivation, HR Directorate takes initiatives and various welfare measures for the benefit of its employees, as also, strengthen the organizational structure.

The year 2014 was an eventful year on the HR front too. HR Directorate, in line with its objectives of employee's welfare and organizational growth has succeeded in the following endeavour:-

1. Preparation of Human Resource Policies and Procedure Manual.

2. New Superannuation Benefit Scheme as per DPE instructions has been approved by AAI Board. The same has been forwarded to Ministry of Civil Aviation for its approval.

3. Internal Deputation Policy for AAI employees has been introduced.

4. Approval has been given for construction of new staff quarters.

5. Office Uniform has been issued to all employees.

Useful references in the following IATA Airport Operations modules and IATA Internet resources:

www.iata.org/whatwedo/workgroups/Pages/airside_safety.aspx

0.4.19   Corporate Social Responsibility (CSR)

The HR Department of Airports Authority of India aims to achieve, consolidate and strengthen good corporate governance including socially and environmentally responsible business practices that balance financial profit with social well-being. Our approach for Corporate Social Responsibility (CSR) has been to bring empowerment opportunities for the underprivileged communities near our airports in order to create an environment of inclusive growth.

AAI has undertaken various activities under CSR in accordance with Guidelines on CSR for Central Public Sector Enterprises issued by the Department of Public Enterprises, Ministry of Heavy Industries and Public Enterprises. There is a comprehensive CSR Policy on guideline for selection of NGO's/Non Profit Organisations/ External Specialised Agencies for Corporate Social Responsibility of AAI.

AAI being motivated by the spirit of PM's "Swachh Bharat Swasth Bharat" slogan, have undertaken Swachh Vidyalaya Campaign by constructing new toilets for Girls in schools across India. AAI plans to build toilets in 765 schools in 37 districts where AAI airports are presently using their in-house engineers and will also maintain them for a period of two years. To begin with, six airports such as, Rajkot, Tirupati, Rajahmundry, Udaipur, Kolkata and Porbandar have been identified for constructing the first batch of toilets. The Airport Directors of these airports have been informed of the schools in which the toilets are to be built and how to get the toilets built at the earliest.

0.4.20   Information Technology (IT)

Information Technology holds the key to operational and managerial efficiency, transparency and employee productivity. AAI initiated a programme to indoctrinate IT culture among its employees and this is most powerful tool to enhance efficiency in the organization. AAI website with domain name www.airportsindia.org.in or www.aai.aero is a popular website giving a host of information about the organization besides domestic and international flight information of interest to the public in general and passengers in particular.

0.4.21   Key Infrastructure Development (KID)

Key Infrastructure Development (KID) Group was established during 1998 for the development of infrastructure at various airports run by Airports Authority of India (AAI) through public private participation. Since its establishment, KID Group was assigned with the major role of assisting Ministry of civil Aviation/AAI in selection of private joint venture partners for development, operation, management of some of the airports run by AAI, based on the decision taken by the Govt. of India. KID Group also assisted Ministry of Civil Aviation/AAI in finalizing various transaction documents for establishment of State Government sponsored Greenfield airport projects at Devanahalli, Near Bengaluru and at Shamshabad near Hyderabad.

0.4.22 Legal

The main responsibilities of the Legal Department are:

1. Issues related to Aviation Law

2. Handling Domestic and International arbitration

3. Searching Constitutional provisions for employees rights and duties

4. Issues related to Corporate Planning

5. Suggesting modalities for BOO, BOLT, BOT

6. Advising and assisting on Contract Management

7. Drafting required Legal Instruments Regulations, Bye Laws for effective management and for effective Administration

8. Advising on out sourcing measures

9. Finding effective solutions to the problems posed with facts and data based decisions.

10. Imparting expert advice and information on legal issues to various departments.

0.4.23 Land Management

AAI is proud owner of more than 100 airports in the country with which comes responsibility of managing huge land asset belonging to it. The Directorate of Land Management assures to keep this asset safe for the functioning in present and also keeping in mind the future development. Some of the crucial responsibilities of this directorate are:

1. Land Records & Acquisition

    i.   To establish ownership documents of the land and keep a record of all the documentation.

ii. Wherever land records are not available, to liaise with the authorities to create the land ownership documents.

iii. Wherever land is required to be acquired by AAI to liaison with the State Governments and take follow up action for getting it registered in the name of AAI and taking over possession of the said land.

2. Prevention/Removal of Encroachment/Settling of Local Disputes

i. Shall monitor the entire land which is vested with the Airports Authority of India.

ii. Shall assess the encroachment that exist historically on AAI land.

iii. Shall define the said areas and initiate a dialogue with the State Governments for the removal/rehabilitation of the said encroachments and take all follow up actions where necessary.

iv. Shall take adequate steps to prevent any encroachments that may take place on AAI land with the help of a suitable protection force.

v. Shall take follow up action in consultation with the Department of Law where ownership documents have been disputed or land acquisition process has been challenged and the parties have taken recourse to legal action.

3. Commercial Utilization of Land

i. Shall formulate and implement Land Lease Policy.

ii. Shall prepare proposals for commercial utilization of land.

iii. Shall take follow up actions for lease of land to various parties in the operational area as well as the non-operational area whether by direct allotment or by call of tenders?

iv. Shall monitor leases and take follow up action.

v. Shall take follow up action for recovery of dues wherever necessary.

vi. Shall monitor taxation of property and payment of taxes, if any, to State Government.

vii. Shall prepare by-laws for lease/licence of land and construction thereof keeping in view the Master Plan of the Airports/Aeronautical Stations.

राजभाषा (Official Language)

भारतीय विमानपत्तन प्राधिकरण में भारत सरकार की राजभाषा नीति के अन्तर्गत अधिनियम व नियमों के अनुपालन सुनिश्चित करने का हर संभव प्रयास किया जाता है । भारतीय विमानपत्तन प्राधिकरण के निगमित मुख्यालय सहित सभी अधीनस्थ कार्यालयों में हिन्दी की प्रगति की समीक्षा करने एवं सरकारी कामकाज में कार्मिकों द्वारा हिन्दी में कार्य करने की प्रवृत्ति को प्रोत्साहित करने के लिए हर तिमाही में हिन्दी कार्यशालाओं का आयोजन किया जाता है । इन हिन्दी कार्यशालाओं में कार्मिकों को हिन्दी के कार्य करने में आ रही कठिनाइयों को दूर करने के हर सम्भव प्रयास किए जाते हैं ।

भारतीय विमानपत्तन प्राधिकरण के निगमित मुख्यालय एवं सभी अधीनस्थ व फील्ड कार्यालयों में राजभाषा हिन्दी के प्रगामी प्रयोग की समीक्षा करने के लिए राजभाषा कार्यान्वयन समितियों का गठन किया गया है । निगमित मुख्यालय में इस बैठक की अध्यक्षता स्वयं अध्यक्ष महोदय द्वारा की जाती है और सभी निदेशालयों के विभागाध्यक्ष इस बैठक में भाग लेते हैं । यह बैठकें हर तिमाही में नियमित रूप से आयोजित की जाती हैं ।

भारतीय विमानपत्तन प्राधिकरण में राजभाषा हिन्दी के प्रगामी प्रयोग को प्रोत्साहित करने हेतु हिन्दी पत्राचार योजना, हिन्दी में टिप्पण/आलेखन कार्य योजना आदि लागू है । ये प्रोत्साहन योजनाएं प्रत्येक तिमाही के आधार पर कार्यान्वित होती हैं ।

विभिन्न प्रकार के कागजातों का अनुवाद किया जाता है जैसे मुख्यालय स्तर पर भारतीय विमानपत्तन प्राधिकरण की वार्षिक रिपोर्ट, मंत्रालय की वार्षिक रिपोर्ट में भारतीय विमानपत्तन प्राधिकरण का भाग, विभिन्न माननीय संसदीय समितियों के समक्ष पेश किए जाने वाले कागजात, विभिन्न अवसरों पर अध्यक्ष महोदय के संदेश, हवाईअड्डों के टर्मिनल के उद्घाटन के अवसर पर ब्रोशर, तकनीकी अनुदेश का अनुवाद किया जाता है । क्षेत्रीय कार्यालय एवं स्टेशनों पर परिपत्रों एवं अन्य धारा 3(3) से सम्बन्धितकागजात का अनुवाद किया जाता है ।

0.4.24   Operations & Terminal Management

Directorate of Operations & Terminal Management is responsible for carrying out following functions:

1. To frame corporate policies on Terminal/airside Management of all AAI airports.

2. Monitoring implementation of ICAO standards and recommended practices (SARP's), and Civil Aviation Regulations (CAR's) formulated by Director General Civil Aviation (DGCA) for Aerodrome Operations and Airport Management.

3. Liaise at apex level with the various ministries, regulatory bodies like DGCA and Bureau of Civil Aviation Security (BCAS) on issues related to Airport Management (Operations) and Aviation Security.

4. Granting approval of Slots to international and domestic flights.

5. Allocating night parking stands to domestic flight operators at AAI Airports.

6. Overseeing and monitoring activities related to terminal management of all AAI airports.

7. Monitoring First-aid medical services at all AAI airports.

8. Draw up plans for upgrading the operational facilities, passenger facilitation and ground services to meet the future needs.

9. Finalizing training programmes for staff and officers of Operations Department in coordination with National Institute for Aviation Management & Research (NIAMAR).

10. Coordinate with DGCA for safety assessment on the planning, construction & commissioning of changes to airport infrastructure, and maintenance programs.

Useful references in the following IATA Airport Operations modules and IATA Internet resources:

IATA Airport Operations 1.4

IATA Airport Operations 6.2

www.iata.org/whatwedo/workgroups/Pages/airport_atc.aspx

www.iata.org/whatwedo/workgroups/Pages/airside_safety.aspx

www.iata.org/whatwedo/workgroups/Pages/bwg.aspx

www.iata.org/whatwedo/workgroups/Pages/cfwg.aspx

www.iata.org/whatwedo/workgroups/Pages/cusag.aspx

www.iata.org/whatwedo/workgroups/Pages/dcsmwg.aspx

www.iata.org/whatwedo/workgroups/Pages/ramp.aspx

www.iata.org/whatwedo/workgroups/Pages/ipac.aspx

www.iata.org/whatwedo/workgroups/Pages/lcamwg.aspx

www.iata.org/whatwedo/workgroups/Pages/pemg.aspx

www.iata.org/whatwedo/workgroups/Pages/pfwg.aspx

www.iata.org/whatwedo/workgroups/Pages/psc.aspx

www.iata.org/whatwedo/workgroups/Pages/isago.aspx

www.iata.org/whatwedo/workgroups/Pages/uldp.aspx

0.4.25 Project Monitoring & Quality Assurance (PMQA)

Directorate of PMQA is responsible for monitoring the progress of the projects in order to arrest time & cost overrun. It is also responsible for implementation of Integrity Pact in all high value transactions, nomination of External Independent Monitors and organizing vendor's meet.

0.4.26 Public Relations (PR)

The PR Department deals with all print and electronic media. It is responsible for all media briefings, arranging Press meetings, analysis of media reports, issue of Corporate News Bulletin, Issue of Notice Inviting Tenders (NITs) and publication of in-house journal. As part of International Liasioning, the PR Department is dealing with all international delegations and bodies such as ACI, IATA, ICAO, CANSO etc. The PR Department is handling official visits of high level dignitaries at CHQ level like Parliamentary Committees, Official Language etc. as part of their protocol duty.

The PR Department also assists and undertake branding/marketing of AAI's activities. It coordinates delivery of lectures, delegates in Exhibitions, advertisements, corporate branding etc in Seminars, symposiums, Conferences in India and abroad for enhancing Corporate Visibility.

0.4.27   Radio Construction & Development Unit (RC&DU)

The main functions of RC & DU are as under:

1. Site Selection

    Site selection for installation of new navigational aids viz. VOR, DME, NDB & ILS.

2. Planning

    Planning is carried out after finalizing the site. The list of works (LOW) related to civil and electrical works for execution by station in order to construct the building and provision of electricity to install these navigational equipment.

3. Installation

    Executes the physical installation of equipment. A team from RCDU is deputed to house the equipment in the building and antennas. It also includes erection/dismantling of masts, hoisting antennas with a good safety records.

4. Testing and Alignment

    The equipment are tested at site for its proper functioning. Any alignment, if required is carried out to keep the parameters within the prescribed limits as per ICAO standards.

5. Calibration

    During the air check/calibration of the facility, all the necessary adjustments are carried out as per the requirement of flight inspection aircraft to meet the ICAO standards.

6. Others

    RC & DU has expertise in installation of masts/Radar scanners etc. Such activities are also made use by other organizations viz, Indian Air Force, Indian Navy for installation of their Radars, Voice Communication Control System (VCCS) and status indicators. They are designed and installed on demand from various airports

0.4.28   Security

Directorate of Security is responsible for carrying out following function:

1. Ensure effective functioning of security apparatus.

2. Ensure requisite physical barriers/structures.

3. Ensure installations of requisite equipment.

4. Ensure proper coordination:

    i. With all departments in the Corporate Hqrs. regarding policy matters related to airport security.

    ii. With Bureau of Civil Aviation Security and monitoring of implementation of Bureau of Civil Aviation Security guidelines at all airports.

    iii. With Central Industrial Security Force: induction of Central Industrial Security and related issues.

Useful references in the following IATA Airport Operations modules and IATA Internet resources:

IATA Airport Operations 2.1.2.4

www.iata.org/whatwedo/security/Pages/index.aspx

www.iata.org/whatwedo/workgroups/Pages/cstf.aspx

0.4.29 Technical

Technical Department has responsibility of providing mechanical and logistical solution for efficient airport operation. Functions of Technical Department include:

1. Procurement: Induction of various Equipment/Vehicles/Tools, Plants & Machinery by purchasing/leasing or hiring, required for the operations and maintenance of Airports, such as: -

    i. Fire Services Equipment: Crash Fire Tenders, Water Tenders, Ambulances, and High Mask Lights and rescue equipment like BA Sets, Power Saw, Hydraulic Metal Cutter and portable Gen-Sets, etc.

    ii. Engineering Equipment: RRM, Runway Marking Machines, PEN Testing, Friction Testing

    iii. Ground Flight Safety Equipment : Grass cutting machines, earth moving equipment and Bay cleaning, Runway sweeper Machine, etc

2. Provide Materials Management services e.g.

    i. Procurement of uniforms, distribution and maintenance of records

    ii. Procurement of fire and rescue tools, accessories like fire proof dungarees, BA Sets, Gumboots and Fire rescue suits.

    iii. Monitoring and preparing MIS for stock/Assets.

    iv. Physical verification of stock

    v. Issue of MM instructions on policy matters

3. Maintenance Support

   i. Extended maintenance support to regions/workshops

   ii. Budget allocation for various related activities

   iii. Progress review etc.

4. Provide vehicles/Ground Safety and Rescue Equipment: To provide, maintain and operate various type of Vehicles/Ground Safety and Rescue Equipment at all airports & CHQ

0.4.30   Vigilance

The Vigilance Department of AAI, headed by Chief Vigilance Officer, plays an active and positive role in ensuring that the true spirit of vigilance, which is eternal alertness, is appreciated right through the organization. Department of Vigilance constantly endeavours to take swift and effective actions on all complaints against any employee of AAI. The role and functions of Vigilance Directorate are in conformity with CVC's special chapter on vigilance for the PSU's.

0.5   Training Establishments Associated with AAI

A large pool of trained and highly skilled manpower is one of the major assets of Airports Authority of India. The development initiatives and Technological enhancements as well as consequent refinement of operating standards and procedures, new standards of safety and security and improvements in management techniques call for continuing training to update the knowledge and skill of officers and staff.

AAI has three major training establishments, viz. Indian Aviation Academy (IAA) in Delhi, CATC in Allahabad, Fire Training Centres at Delhi & Kolkata besides RTCs and local training centres. These training institutes are responsible for in-house training of its engineers, Air Traffic Controllers, Rescue & Fire Fighting personnel etc. Foreign students have also been participating in the training programme being conducted by these institutions

All these training institutes are members of ICAO TRAIN AIR programme under which they share Standard Training Packages (STP) from a central pool for imparting training on various subjects. These institutes are having Course Development Units (CDU) and are also actively involved in development of STPs to the Central pool under ICAO TRAIN AIR programme.

iaa

0.5.1   Indian Aviation Academy, New Delhi

Indian Aviation Academy formerly known as National Institute of Aviation Management and Research (NIAMAR) has seen various transformations. Initially Institute of Airport Management (IAM) was formed in the year 1986. This institute started its operations from Patterson Farm House, located in the vicinity of Indira Gandhi International Airport. In the year 1988, IAM moved to its present campus at Gurgaon Road. The IAM was renamed as National Institute of Aviation Management and Research (NIAMAR) in the year 1997. In the year 2010, AAI board decided to convert NIAMAR in to a society with Airports Authority of India (AAI), Director General of Civil Aviation (DGCA) and Bureau of Civil Aviation Security (BCAS) as participating organizations. Indian Aviation Academy (IAA) has been setup as the joint training academy of the above participating organizations under the aegis of NIAMAR-Society which was formed on 22nd July 2010.

IAA aims to be Global Centre of Excellence in areas of Education, Training & Research in Aviation Management and imparts training to the employees of AAI, DGCA, BCAS and other stake holders across ASIA-PACIFIC Region & African countries.

MoU with IATA (*from left*) Victor De Barrena, Director IATA Training and Development Institute – R.K. Srivastava, Chairman AAI – Anuj Aggarwal, Member HR AAI

IAA has trained 32 senior level officers of AAI on Corporate Governance during 2014 as per MOU targets. IAA has conducted two training programs during 2014 by engaging ICAO experts and has offered fellowship to 12 participants from developing countries in coordination with ICAO, Montreal. IAA has also conducted

trainings for Afgan Civil Aviation Personnel through United Nations Office of Project Services (UNOPS) on payment basis. IAA has started a process of extending training facilities in India for SAARC countries in the year 2015. IAA has been selected by the European Society for "Best Quality Leadership Award" on 9th December, 2014 at Las Vegas.

IAA is also an Associate Member with TRAINAIR PLUS and has recently established a fully functional Course Developers Unit (CDU). Presently six officers are posted in CDU who are trained for course development by ICAO and are currently developing two numbers of Standardized Training Packages (STPs) for global market. STPs are developed in line with the ICAO goal of improving the safety and efficiency of air transport through the establishment, maintenance and monitoring of high standards of training and competency of aviation personnel on a world-wide basis and in a cost-effective manner. IAA is aiming to achieve full membership of TRAINAIR PLUS program of ICAO.

Useful references in the following IATA Airport Operations modules and IATA Internet resources:

www.iata.org/training-airport

0.5.2 Civil Aviation Training College, Allahabad

The Civil Aviation Training College (CATC), situated at Bamrauli, Allahabad is one of the modernized training establishment of Airports Authority of India (AAI) in terms of Infrastructure, training facilities, laboratories and simulators. This is one of the oldest institute of its kind in India which is in existence since 1948 under, the then Civil Aviation Department, Govt. of India. It has two more extensions NIATAM, Gondia & Begumpet Airport, Hyderabad. These Institutes meet training requirement in the field of ATM and CNS Maintenance & Operations, as per International Civil Aviation Organisation (ICAO) standards.

0.5.3 Fire Service Training Centres

There are two Fire Service Training Centres, one in New Delhi and the other at Kolkata.

The objectives of these Centres are to impart training to develop required knowledge skill and attitude for:

1. Efficient execution of aviation fire fighting and rescue operation in accordance with ICAO standards.

2. Operation of various types of Airfield rescue and fire fighting vehicle and other appliances

3. Fire prevention, structural fire fighting and emergency evacuation.

4. Management of fire station.

5. Professional skills in operation of RT, BA Set and rescue equipment.

6. Enhance the professional skills and human behaviour in fire services.

7. Contribute in skill development in the community.

8. Provide services on payment basis for other aviation sectors and airports within the country and abroad.

0.5.4   National Flying Training Institute

There are two Pilot Training Centres, one at Rae Bareilly and the other at Gondia which constitute two out of 9 CAE Oxford Aviation Academy locations across 4 continents around the world. CAE Oxford Aviation Academy Rae Bareli, also known as the Indira Gandhi Rashtriya Udan Akademi, is one of the flight school operates to the highest standards and produces newly-trained efficient pilots. Indira Gandhi Rashtriya Udan Akademi (IGRUA) is the Indian government's national flying institute which was established in 1985. Managed by CAE, the academy is dedicated to improving flight training standards and providing high-quality training to aspiring pilots from India and around the globe. The Rae Bareli academy trains approximately 300 cadets per year on a modern aircraft training fleet.

0.6   MoU between AAI & Ministry of Civil Aviation

Each year a MoU is signed between AAI & Ministry of Civil Aviation to monitor the overall performance of AAI. The main parameters of the MoU signed for the year 2014-15 are as under:

1. Static Financial Parameters

   i. Mandatory parameters

      o Sales Turnover

- o Gross Operating Margin

- o EBIT/Avg Capital Employed

- o PAT Per Employee.

ii. Optional parameters

- o Debtors Turnover

- o Current Ratio

2. Dynamic/Non Financial Parameters

i. CSR & Sustainability

ii. Research & development

iii. Initiatives for growth

iv. Non-Aeronautical Revenue

v. Risk Assesment Study

vi. Disaster Management Plan

vii. Project Management and Implementation

viii. Project Implementation

ix. Capital Expenditure (CAPEX)

x. Productivity and Internal Processes

xi. Customer Satisfaction

xii. Technology, Quality, Innovative Practices

xiii. Implementation of ground based augmentation technology at Chennai

xiv. Training of senior Management Officials (DGM & above) in corporate Governance

xv. Validation of upper air space harmonization project in Kolkata FIR using TAAM

xvi. Implementation of ERP for land and Non aeronautical revenue

3. Sector/Enterprise Specific Parameters

i. Benchmarking for aircraft separation infringement

ii. Implementation of Internal Auditor's report

iii. Bird Strike Rate

iv. Physical verification & reconciliation of fixed assets & inventory with book

v. Availing power through open access syste pilot project for 2 airports

The overall performance of the AAI is worked out on the basis of the above MoU parameters. This overall performance is known as MoU composite score which is used for determining the amount of profit to be distributed among the employees of AAI as Performance Related Pay (PRP). The pictorial depiction of how MoU composite score affects PRP is given below:

MOU Composite Score

Year	Score
2009-10	1.63
2010-11	1.4
2011-12	1.7
2012-13	2.979
2013-14	1.74
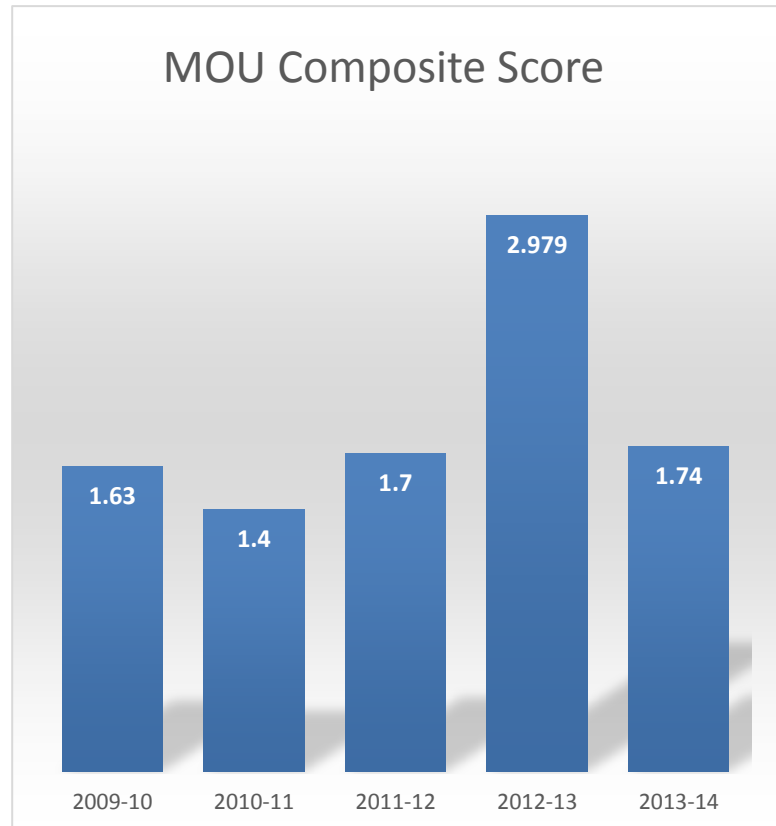
MoU Composite Score	Grading
1.00 – 1.50	Excellent
1.51 – 2.50	Very Good
2.51 – 3.50	Good
3.51 – 4.50	Fair
4.51 – 5.00	Poor

0.7   How MOU affects PRP …

0.8   Uniformity & Transparency

0.8.1   Right to Information Act

The basic object of the Right to Information Act is to empower the citizens, promote transparency and accountability in the working of the Government, contain corruption, and make our democracy work for the people in real sense. It goes without saying that an informed citizen is better equipped to keep necessary vigil on the instruments of governance and make the government more accountable to the governed. The Act is a big step towards making the citizens informed about the activities of the Government. This law is very comprehensive and covers almost all matters of governance. This Law has a wide reach, being applicable to Government at all levels-Union, State and Local as well as to the recipients of substantial government funds.

Right to Information Act 2005 mandates timely response to citizen requests for government information. The information on the details of first Appellate Authorities, PIOs etc. amongst others, besides access to RTI related information/disclosures published on the AAI website, with the GUIDE ON RIGHT TO INFORMATION ACT, 2005.

All AAI employee shall abide by the provisions of RTI, Act.

0.9   Expectations of Stakeholders from AAI

- Creation of world class airports and maintain thereof as per international standards

- Excellence in Service Quality/Facilitation to Passengers.

- Availability of Wi-Fi, Recreational activities etc.

- Revenue Generation and maximum utilisation of Terminal Building, etc.

- Project/Procurement timely delivery and quality improvement.

- Optimum utilisation of Human Resource including trained and motivated staff.

- Ensure Safe operation of aircrafts.

- Minimum inconvenience in security checks.

- Availability of help for Timely redressal of grievances

0.10 Recognitions & Accolades

Airports Authority of India received various accolades over the years, some of the latest awards received during last two years being: –

- Two ATC Global Awards 2013 for Excellence in ANSP Management as well as for Strategic Advancement in Air Transport.

- India Pride Award 2013-14 for Excellence in Infrastructure & Development in the category of "Public Sector Undertaking – Central".

- Today's Traveller Award 2013 for "Excellence in Development of Airport Infrastructure in India".

- "Engineering Excellence Awards" conferred by Engineering Watch Magazine for five AAI airports namely, NSCBI Airport Kolkata received 2nd Best Engineering Marvel, Biju Patnaik Airport, Bhubaneswar received Best Future-Ready Engineering Marvel, Raipur Airport received Public Choice Award, Birsa Munda Airport, Ranchi received Special Mention Awards, New Domestic and International Terminals at Chennai Airport received Special Mention Awards.

- AAI has received Hospitality India Award in the Category for creation of "Best Infrastructure" for the year 2013.

- On the CSR front, AAI won the 3rd Asia Best CSR Practice Award 2013.

- AAI's Lounge Magazine (Airports India) received the Best Magazine Award by Hospitality India for the year 2013.

- NSCBI Airport, Kolkata has been conferred with several Awards like "Excellence in Built Environment 2013" by Indian Building Congress (IBC) (6th Feb. 2014), "Best Improvement Award – Asia Pacific (First place)" by Airports Council International (ACI-International body of Airport Operators) (19th Feb. 2014), "Vishwakarma Award 2014" under category "Best Construction Projects" conferred by Construction Industry Development Council (CIDC) [under Planning Commission, Govt of India] (07 March, 2014).

- Swami Vivekananda Airport, Raipur won "National Toursim Awards" "Best Non-Metro Airport" (Rest of India) conferred by Ministry of Tourism, Govt. of India (Feb. 2014).

- AAI has been awarded TRAINAIR Plus Certificate and membership plaque by ICAO.

- Janes International ATC Award 2014 (second year in succession (3 March, 2014).

- New Integrated Terminal Building at Goa Airport conferred with "Outstanding Concrete Structure Award, 2013" (Infrastructure Category) by Indian Concrete Institute (ICI) (19 March, 2014).

0.11 Mandate/Expectations from AAI Employees

0.11.1 Image Building (Brand AAI)

All AAI employees are required to be courteous and helpful at all times with every customer and other employees. The employees are expected to meet or exceed these following standards of Employee Attitude, Appearance, Awareness and Knowledge

Attitude, all employees shall:

- Greet all customers in a friendly and professional manner.

- Address customers proactively—be friendly and approachable—anticipate customer's needs and initiate first.

- Display a smile and eye contact towards passengers and fellow employees at all times.

- Project a pleasant, friendly and maintain proper posture at all times.

- Be capable of communicating clearly when in contact with customers.

- Refrain from using foul or inappropriate language at any time. Use a proper and courteous vocabulary and a pleasant tone of voice with customers and fellow employees.

- Make every effort to satisfy customers' needs, even when those needs are outside the employee's specific job scope. "This is not my Job" attitude must be avoided in all situations.

- Do not gather in a group, sleep, chat eat, drink, (including alcoholic beverages), chew gum or smoke

Appearance, all employees shall:

- Be well groomed, clean and present a professional appearance and be in uniform wearing appropriate accessories while on duty

- Wear nametags and/or official identification that is visible to the public at all times.

- Display Photo Identity card above waist height at all security check points.

- Wear clean, neat and pressed uniforms including appropriate footwear while on duty.

- When speaking to customers, remove sunglasses (unless medically required otherwise) to facilitate eye contact. Sunglasses may only be worn outdoors and during daylight hours

Awareness, all employees shall:

- Be obligated to challenge persons and to report suspicious items and/or activity. Ensure that all airports and offices doors and gates are closed properly after each use and entry is through proper identification

- Report any alarm for security or fire or any item or area that is in need of repair through the appropriate airport protocol for timely action.

Knowledge, all employees shall:

- Be well informed, capable of providing directions and know where and how to obtain requested information or services for customers. Convey accurate information using clear and understandable terms. If unable to satisfy the customer or resolve the issue, direct the customer to immediate supervisor.

- Know where and how to obtain assistance to resolve customers' questions or problems if language barrier arise.

- Know where and how to obtain assistance and more sensitively for Passengers with Reduced Mobility in order to respond to medical emergencies and operational disruptions as referred in Operational manual.

Standards of Cleanliness

- All frontages, sidewalks and crosswalks shall be clean and free of debris Entrance and exit doors, glass; windows shall be clean free of smudges and dirt

- Trash receptacles shall be clean and emptied to prevent the overflow of debris.

- Awnings or canopies, where present, shall be clean at all times.

- Walls shall be clean and free of graffiti. Light fixtures and assemblies shall be clean and free of dust.

- Any deviation from above standards of cleanliness should be communicated to duty manager immediately.

0.11.2   Team work (Team-AAI)

This means a sense of unity, of enthusiasm for common interests and responsibilities, as developed among a group of persons closely associated in a task, cause, enterprise, etc. Teamwork is also the oil that makes the team work. It can enable smoother movement towards targets, can prolong forward momentum, and can help teams to overcome obstacles.

Teamwork has the potential to underpin so much of what is valuable in work. In fact, the benefits to be gained from teamwork synergies are essential for the effective management of resources. It doesn't mean everybody doing the same thing or everybody being able to do each other's jobs. It's more a means to a synergistic way of working, where the sum is greater than the parts. Properly managed, teamwork maximizes strengths, bringing out the best in each team member, a key theme on this site. These specific, possibly unique individual strengths are then complimented by the strengths of others, or of the team as a unit.

Essential Skills for Teamwork:

1. Listening: listen to each other's ideas.

2. Questioning: question each other.

3. Persuading: exchanging, defending, and rethinking ideas.

4. Respecting: respect the opinions of others. Encouraging and supporting the ideas and efforts of others.

5. Helping: help each other.

6. Sharing: offering ideas and reporting their findings to each other.

7. Participating: Each member contributing to the project.

0.11.3   Customer Service Culture at AAI Airports

Exceeding Customer Expectations one in almost every industry are rising. What was once considered a perk, bonus or plus is now a promise clients expect – and even demand – time and again. And while everyone may agree that providing superior service is essential to continued success in a competitive world, too many

executives still regard service as "the fuzzy stuff" they don't know how to measure, manage or make happen on a companywide scale.

AAI believes that all employees should thrive to work towards making all our airports Customer friendly and consistently make travel a memorable experience for all. As there is a direct relationship between brand, service levels, image and revenues. It is expected to realise by themselves how important it becomes to work hard towards AAI mission and vision.

0.11.4 Airport communication and Public Relation

Airports are probably the most complex organization in aviation. Airports are often presented as a city within a city where anything can happen and sometime does. Airport professionals must have the capacity to deal with complex and sometimes political issues. Any miscommunication by an official can damage the image of AAI and create panic in public. Only designated officials who are well versed with the communication plan of AAI must speak in public about new ventures, plans, and activities and can divulge details of any type of accident/incident which has happened at airports.

0.12 Way Ahead

The world is experiencing a tremendous growth in aviation business with air traffic doubling in every 15 years. The requirement of modern air transport infrastructure and competent/trained manpower is need of the hour. Following plan of action has been initiated by AAI management in short term:

- Improvement of regional connectivity and development of airports in remote areas.

- Development of low cost airports

- Activation of unused airports

- Development of 4 airports through PPP

- To adopt latest technology in the market

- Training & development of the manpower

- Commercialization of airports to generate more revenue, through different fields like hotels, motels, Ground handling, duty free, retail etc.

- Explore cargo potential of the airports

- Upgrade facilitation facilities for passengers

- Uniform implementation of policies

- Prompt action on the public grievances

- Strengthen the transparency and effective implementation of RTI

- Bring more airports under the coverage of CSI and ASQ survey to increase the competition.

Module 1—Understanding the Airport

Module Learning Objectives

Upon completion of this Module, you should be able to:

- Describe the need for air transportation, the history of aviation and airports, and the factors that generate technological changes in airports (Lesson 1)

- Define the term "airport" and name its customers and partners (Lesson 2)

- Describe the various airport management and ownership options (Lesson 3)

- Describe the national and international requirements for standardisation in airports (Lesson 4)

- Describe the key elements of the airport business and the impact it has on the area the airport serves (Lesson 5)

- Describe the importance of airport master planning as a long-term management tool (Lesson 6)

1.1   Understanding the Airport

Module Overview

Before starting to learn about the detailed functions of airport operations, it is essential that you acquire a broad knowledge of how aviation and airports were born and how they developed. You also need to understand the complexity of the airport environment, as well as the relationships between the various players involved.

Regardless of their size and complexity, airports operate in a highly regulated environment, they serve a wide variety of customers with sometimes conflicting needs, they receive services from many external providers, and they generate both positive and negative impacts on the community they serve. Their activities extend well beyond their property boundaries. Finally, yet importantly, they can be highly sensitive to social, economic, environmental, technological, and political influences.

In response to rapid and radical changes in the air transport industry, airports must constantly adapt and foresee these changes. Adopting a business approach allows airports to better serve their customers, in a safe, efficient and economical manner.

1.1.1   History of Aviation and Airports

Aviation is a relatively new industry: the first sustained, controlled and powered flight took place only a century ago when, on December 17, 1903, Orville Wright flew his wood and fabric aircraft for 12 seconds over a 37-meter distance, operating from a sandy strip (Figure 2). This strip in North Carolina, U.S.A. was probably indistinguishable from other surrounding areas but it can be considered as the first airport. In spite of its extremely basic characteristics, it met the very simple needs of the day.

The first known official airports date back to 1909. As flight became more common and as the number of aeroplanes increased, so did the number of airports. They were still open fields but they included minimum facilities allowing aeroplanes to take off and land, to be

parked, fuelled, and repaired. These are the basic aeronautical functions of an airport.

During World War I (1914 to 1918), it became apparent that aircrafts could play an important role in national defence. As a result, this period saw the production of the first combat aircrafts and the construction by countries involved in this conflict of many military airports.

Following the war, some of these military airports remained operational and were converted to civil use; they formed the early nucleus of a national airport system.
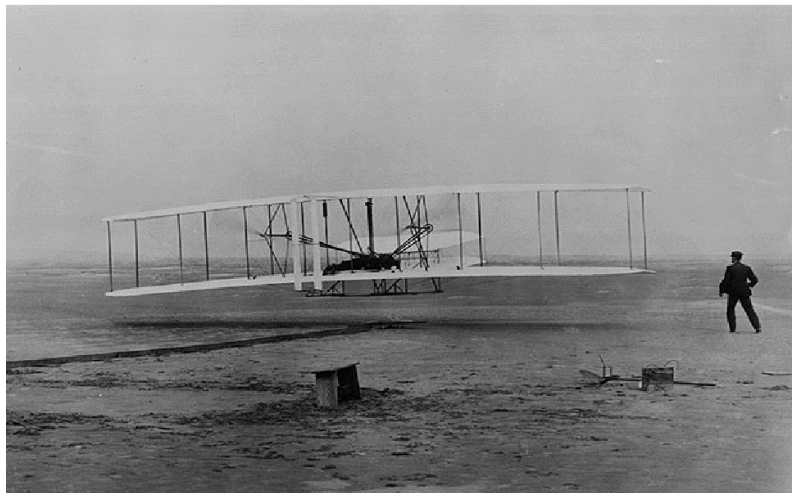
Figure 2.   First Flight on December 17, 1903

Initially a local responsibility, after World War I airport development became a mix of military, commercial, and private responsibilities. One of the most obvious and attractive benefits of flying, besides the simple thrill of no longer being restricted to the earth's surface, was the possibility of carrying mail at several times the speed of a train. As a result, in 1918, the first intercity air mail service was established. At the same time, communities discovered the importance of airports to connect them to the rest of the country. By 1925 some airmail transport was contracted out to private aircraft operators: this was the birth of the airline industry.

Between 1925 and 1940, air transportation grew steadily in several countries. In 1940, with the outbreak of World War II, countries involved in this conflict constructed large numbers of air bases, some of them being planned so as to be useful to civil aviation after the war.

By the end of World War II, in 1945, several countries owned surplus air bases; many surplus transport aircraft, and qualified

aircrews were also available: all the ingredients for a full-fledged air transport industry were present. This is when air transportation really started to grow worldwide (Figure 3).
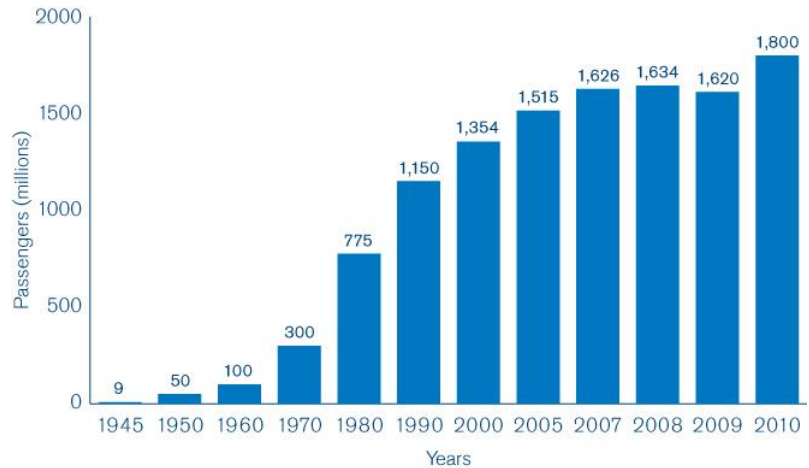
Figure 3. Historical Passenger Volumes[1]

Progress Check 1

1. What is the main focus of the air transport?

    a) Profit

    b) Customer

    c) Expansion

    d) Employment

1.1.2 Technological Advancements– Overview

Key Learning Point

Technological changes are generated by factors such as safety, security, reliability, efficiency, and protection of the environment.

In general terms, "technology" means the application of science to industrial uses. In this textbook, we will use this word as meaning the various physical components that make up the overall aviation infrastructure and that allows airports, airlines, air traffic control agencies and other service providers to move people and goods by air, safely and efficiently.

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[1] ICAO–Economics of Airports and Air Navigation Services and IATA World Air Transport Statistics (WATS)

Aviation technology constantly evolves to meet the changing needs of its customers. Technological changes are generated by the following factors: safety, security, reliability, efficiency, and protection of the environment. In the following paragraphs, you will learn about technological advancements that affect airports. These will also be explained in detail in the modules that follow.

Airside

Refer to Figure 4 throughout this section. In the early days of aviation, aircrafts were light, slow and operated in good meteorological conditions (*Visual Meteorological Conditions or VMC*). They could operate out of grassed strips and a small hangar was the only ground facility required. As aircrafts became faster and heavier and as the need for reliability increased, hard surface runways had to be constructed; eventually, these runways were equipped with edge lighting to allow flights to operate in reduced visibility conditions or at night.

Figure 4.   The Three Areas of an Airport

As the characteristics of aircrafts became increasingly demanding, airports had to construct longer and wider runways, along with higher pavement strength. This trend lasted until the mid 1970s when new, more powerful engines became available and the take off length required by the heaviest aircraft stabilised, and then gradually decreased.

As the density of traffic increased, especially on and around airports, some sort of order had to be instituted to keep flying safe. Air Traffic Control was created, first in the form of *Control Towers*, with the responsibility to prevent collisions on the ground and in the

air, near airports, and to provide a smooth flow of traffic. With Air Traffic Control came the need for radio communication between pilots and air traffic controllers. To that effect, radio transmitters and receivers were installed at airports and on-board aircrafts.

Flying under Visual Meteorological Conditions brings about severe limitations to the reliability of air transport: when meteorological conditions fall below prescribed limits, it becomes dangerous and eventually impossible to fly by visual reference to the ground.

A new way of flying aircrafts had to be devised: it was called *Instrument Flight Rules (IFR)*. Under these rules, pilots do not fly their aircraft by visual reference to the ground, nor do they maintain adequate separation from other aircrafts visually. Instead, they fly along well-determined air routes, called *Airways*. They are defined by ground-based radio beacons; in-flight separation is ensured by a central air traffic control agency that keeps aircraft separate vertically or longitudinally. These agencies are called *Area Control Centres (ACC)* for en-route traffic and *Approach Control Units (APP)* for traffic operating near airports. Their main tools are radio-communication and surveillance radar.

When flying IFR, pilots also need guidance during the final phase of the flight, called the approach. Various electronic devices provide such assistance, coupled with visual systems. The most common electronic system is the **Instrument Landing System (ILS)**, which guides pilots to the runway using two electronic beams for vertical and lateral guidance. It is combined with lighting systems such as *approach lights*. It was first introduced in 1941 and it is still in use at hundreds of airports.

Flying under the Instrument Flight Rules made flying safer and more reliable. Today, commercial aircraft normally fly IFR. Airports serving commercial air transport are equipped with the technology required for aircraft to take off and land by IFR.

Terminals

The terminal building is the place where passengers, luggage and freight change between the surface mode and the air mode. It is a processing facility for which technological changes have been constant and profound. While the first terminal buildings were designed only to protect passengers and employees from the elements, modern terminals are sophisticated infrastructures with almost unlimited amenities.

Much of the improvements revolved around security, efficiency and comfort. Large terminals often provide moving sidewalks to reduce

walking distance. Computerised ticketing and check-in procedures have become common to speed up the process and reduce congestion. Automated baggage sorting equipment expedites baggage processing and reduces the risk of misdirected baggage.

Aviation security did not become an issue until the 1960s, when the first threats against civil aviation were made. Up until that time, it was customary for airports to allow public access near aircraft, with only minimum pre-boarding control: search of passengers was unheard of and baggage screening was unnecessary.

As security became more important, states implemented measures to prevent unlawful interference with aviation: fencing of airports, restricted access to aircraft, and screening of passengers and baggage. Initially a manual operation, passenger screening now relies on state-of-the-art technology such as metal detectors, machine-readable passports and *biometric* recognition equipment.

Landside

Nearly every air trip starts and ends with a car or a bus ride. However, not all rides are made by passengers: visitors come to the airport to meet or greet passengers, employees come to work, and delivery and service vehicles can be numerous. These vehicles require an efficient road network, adequate parking facilities, and a good connection to the outside highway network.

Roadway and parking congestion can be a major cause of disruption and delay. Technological improvements to alleviate this problem include dedicated rail *links* between the city and the airport; use of intra-airport automated people movers and automated pay equipment in parking lots.

1.1.3   Protection of Environment

Protection of the environment became a major concern in the 1960s. More specifically, water, air and soil pollution were of concern on airports along with the impact of aircraft noise on people living near airports.

Airports are industrial organisations that generate waste such as oil, fuel, hydraulic fluid, sanitary sewage, and *de-icing* chemicals. Positive steps were taken to reduce the effect of airport operations on the natural and human environment. Airports implemented technological improvements like fuel and oil separators and recovery systems for spent de-icing chemicals.

With the advent of the jet age, aircraft noise became a major issue for residents living near busy airports, especially those with frequent night traffic. Several aircraft engine improvements were implemented to reduce noise at the source, supplemented by operational procedures.

You will learn more about current and future technologies in Module 2 (The Airport as an Operational System).

1.2 Airport Definition, Function, Customers and Partners

Lesson Overview

Early airports had only very basic functions, designed at meeting the simple needs of early flyers. As air transportation evolved, airports became more complex entities, linking communities together through an intermodal system.

Airports provide facilities and services to many organisations involved in air transportation. These agencies play different roles with sometimes-conflicting objectives. In addition to direct customers, airports need to deal with a number of external partners, who in spite of their remoteness play an important role in the success of the airport.

In the introduction to this module, you learned that the air transport industry was composed of several partners who must work as a team to achieve success. You will now learn more details about this topic.

1.2.1 What is an Airport?

In the previous, you learned that the main functions of an airport were to provide for the landing, taking off, parking, fuelling and repairing of aircraft. Although this statement is still correct today, the air transportation industry has evolved so much that we need to have a closer look at this definition.

Ask yourself the following apparently simple question: "What is an airport"? Take a minute or so to think about it. Did you find a satisfactory answer? Most people cannot. Although we intuitively know what it is and what it looks like, it can be difficult to make a proper definition.

Lesson Learning Objectives

Upon completion of this lesson, you should be able to:

- Describe the different definitions of the word "airport"
- Describe the key function of an airport
- List the main airport customers
- Describe the key functions of airport customers

Key Learning Point

An airport is a complex intermodal facility meeting the needs of passengers and shippers. It generates important benefits for the community it serves.

Surprisingly enough, there is no official definition of the word "Airport". Even the International Civil Aviation Organisation does not define it.

Let us start from the obvious and work up toward a more comprehensive definition. Starting from the statement in the first paragraph of this unit, we can see that it addresses aircraft operations only. However, remember that the landside aspect of airports is as important as its *airside*.

If you have ever used an airport, either as a passenger or a visitor, ask yourself the following question: how did I reach the airport? Most likely, you arrived by some kind of surface transportation such as a private car, a taxicab, or a bus, even maybe a train. As an arriving passenger, the process would be reversed and you would arrive by air and leave the airport by surface transportation.

From the above statement, we can formulate the following definition: An airport is a facility where a transfer is made between the surface mode and the air mode. This definition introduces the concept of inter-modal processing. The only exception to this statement is a situation whereby you would arrive by air and connect to another flight without leaving the airport. However, at most airports, the number of connecting passengers represents a small percentage of the total traffic.

Let us expand our investigation of the word airport. How do marketing people view an airport? It is a commercial enterprise whose mission is to provide passengers and shippers with facilities and services that meet their needs. This definition introduces the concept of customer needs and market.

Finally, economists and politicians view it as a business centre with important local and regional economic benefits. This definition introduces the concept of external benefits.

Which of the above definitions should you remember? All of them. They are all valid and they apply to all airports to some degree.

From simple fields, airports have become complex centres linking communities and countries together. Their main function is to provide an interface between the surface mode and the air mode.

Progress Check 2

1. Air transportation is provided to meet the needs of passengers and shippers.

    a) True

    b) False

2. Name the main electronic approach system in use at many airports:

    _____

3. An airport can be defined as:

    a) Strictly and aviation facility

    b) An inter-modal centre

    c) A commercial enterprise

    d) b and c

1.2.2   On-Site Airport Customers

Airlines

Airlines are the most visible and important customers of the airport. They also are a major source of revenues for the airport operator accounting typically for approximately fifty percent of operating revenues.

In order to cater to their passengers and freight, airlines need many facilities, normally provided and maintained by the airport: runways, approach aids, taxiways, aprons, gates and many areas of the terminal building (check-in/ticketing area, hold rooms, office space, baggage processing rooms); they use electricity, water and telephone service; they often lease land for the purpose of building facilities used for processing air freight, storing fuel, maintaining aircraft or to park ground support equipment (GSE). Finally, their employees, visitors and suppliers use airport roads and parking lots.

The interrelationships between the airport and airlines are complex. Their respective operational interests sometimes conflict: for example, airlines want to concentrate their flights at specific times

of the day to meet passengers' needs, thereby creating traffic peaks. This puts pressure on the airport to provide the required capacity, which may be unused during off-peak periods. The airport, on the other hand, would like to spread traffic throughout the day to make more efficient use of its facilities and avoid additional investments.

The airport provides airlines with facilities and services for a fee. Both organisations operate under budgetary constraints, trying to maximise revenues and minimise costs. Therefore, negotiations are common and they often translate in financial and operational compromises. Figure 5 shows the interrelationships between the airport operator, the airlines, and the passenger.
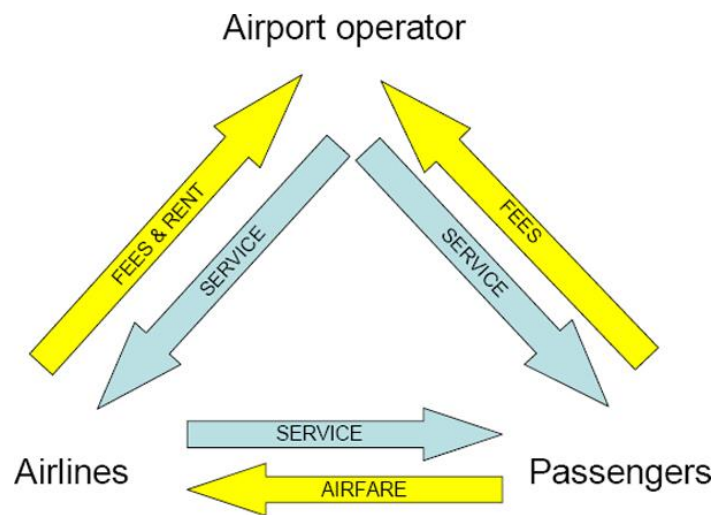
Figure 5. Interrelationships Between the Airport, Airlines, and Passengers

In order for both organisations to know the "rules of the game", it is customary for airports and airlines to formalise their relationship through some form of long-term written agreement. These agreements list what facilities and level of service the airport commits to provide and the fees that apply (landing fees, terminal fees, space and land rent). These agreements can be amended as conditions change.

Before commercial *deregulation*, the air transport situation was more stable, with few changes in the number of airlines, number of flights, schedules and type of aircraft. Under a de-regulated environment, however, market conditions fluctuate and some services are abandoned or introduced, some airlines simply stop serving an airport altogether while others want to start serving it. Therefore, airports have to be prepared to quickly react to these fluctuating requirements.

Ground Handlers

Ground handling means the activities required to service a parked aircraft, after its arrival and prior to its departure for another flight. Ground handling includes:

a) Handling of the aircraft itself

b) Handling of its passengers, baggage and freight

Three types of organisations can carry out this responsibility:

a) An airline, for its flights or for the flights of other airlines

b) An enterprise working under contract for the airlines

c) The airport operator

Often more than one organisation is present on a given airport, competing for customers.

The main activities included in ground handling are:

a) Fuelling

b) Baggage loading and unloading; delivery to the retrieval area

c) Minor repairs to the aircraft

d) Cooling/heating of the cabin

e) Cleaning of the cabin

f) Re-supplying potable water tanks

g) Catering (in-flight meals)

h) Provision of ground power supply (feeding electricity to the aircraft while its engines are shut down)

i) Provision of start up unit (aircraft engines require a special type of current to be started)

j) De-icing (in countries where the build up of ice or snow on aircraft is frequent)

k) Passenger and baggage check-in

Ground handlers are land tenants who require open space, normally on airside, to park and maintain their Ground Support Equipment.

Passengers

Passengers are customers of the airlines, for the purpose of being transported by air between two points. They are also customers of the airport while using its facilities and services:

a) Directly, when using airport roads, parking lots, washrooms, lounges.

b) Indirectly, through the use of concessions (restaurants, bars, shops).

Since many of these facilities and services are provided for a fee, passengers generate revenues for the airport.

As customers of the airlines, passengers also contribute to the financial health of the airport since they represent the main source of income for the airlines, who in turn use these revenues, in part, to pay a fee to the airport for the use of its facilities.

As customers, passengers expect ease of way finding, absence of congestion and waiting, cleanliness, equipment in good working order, comfort, courteous and helpful staff. The overall impression of their airport experience will leave a lasting impression. Several international organisations conduct passenger surveys based on these standards, or comparable ones. They publish annual results, ranking the surveyed airports in decreasing order of customer satisfaction.

Visitors

There are three types of visitors:

a) Greeters and well wishers (people meeting arriving passengers or seeing off departing ones).

b) People who come to the airport for business purposes (meetings).

c) People who come to the airport as simple visitors for the sole purpose of watching aircrafts or general airport activities.

The number of non-passengers using the airport can be considerable and it has two types of effects on the airport:

a) They occupy space in the terminal building, in parking lots and on airport roads. Therefore their needs must be taken into account when planning facilities.

b) They spend money at the airport, in shops, restaurants, bars and parking lots. Therefore, they represent a source of income for the airport.

Concessionaires

Airports have other important customers catering to the needs of passengers, visitors and employees. We call them concessionaires. Typical examples are:

a) Restaurants

b) Bars

c) Specialty shops

d) Newspaper stands

e) Foreign exchange counters

They occupy leased space in the terminal building. Although several types of arrangements exist, the airport will normally provide unfinished space. It is up to tenants to finish this space to suit their business requirements. They have long-term agreements with the airport operator, specifying the amount of rent to be paid to the airport, and other conditions such as the level of service to be provided, and hours of operation.

The number and types of concessions is only limited by the size of the airport, its traffic characteristics, and the management philosophy of the airport operator. Services provided can be as basic as one small restaurant with few dozen seats, to a huge commercial area counting hundreds of shops (Figure 6).

Figure 6.   The concessions Area in a Large Airport

Land Tenants

Another important type of customers is the land tenant. These are businesses that occupy one or several lots on airport property, usually through a long-term lease. They build, operate and maintain the facilities required for their operations. The airport provides road access and utilities (electricity, water, sanitary sewer, communications) to the lot boundary. It is up to the tenant to connect his facilities to the airport utilities.

There are two basic categories of land tenants: those who are engaged in aviation-oriented activities and require access to the

Key Learning Point

The two basic categories of land tenants are those who are engaged in aviation-oriented activities and require access to the airside, and those who are involved in non-aviation functions and who do not require such access.

airside, and those who are involved in non-aviation functions and who do not require such access.

The first category includes airline maintenance facilities, airfreight terminal operators, ground handlers, and *general aviation* operators such as flight training centres.

In the second category, we find tenants who do not carry out aviation activities but who may have on-airport customers (such as hotels and car rental companies) or who may have an interest in being located on airport.

These tenants have long-term agreements with the airport operator. They pay rent based on the amount of land leased from the airport.

Government Agencies

Arriving international passengers and baggage require the presence of a number of governmental controls:

a) Immigration, responsible to ensure that arriving passengers carry proper documentation such as passports and visas, and have the right to enter the country. Some countries also keep track of departing passengers to ensure that they should not be prevented from leaving the country.

b) Customs, responsible for the screening of goods entering the country, including freight.

c) Agriculture, ensuring that no prohibited plants or animals are imported.

d) Health, ensuring that passengers entering the country do not carry contagious diseases.

In addition, there is often a police presence to prevent unlawful interference with normal operations.

All the above agencies need substantial amounts of floor space for the purpose of passenger examination, and office space for their personnel to carry out administrative functions. As a rule, these government organisations are accommodated free of charge.

Air Traffic Services

Any airport with commercial traffic is likely to have an Air Traffic Services Unit, likely a Control Tower. There is a strong interface between the airport operator and the Control Tower. Coordination is required between the two agencies for any activity causing closure of or limitations to facilities provided in support of aircraft operations: maintenance of pavement, grass cutting near runways, presence of birds, snow clearing, unavailability of aircraft stands, and many others.

1.2.3 Off-Site Associated Partners

In addition to their business and operational customers, airports deal on an ongoing basis with a number of external partners:

a) One or more municipalities, dependent on the geographical and political context. Their relationship relates to the provision of a highway network to the airport, utilities, and land use compatibility.

b) Specific interest groups such as business associations, Chamber of Commerce, Tourism Associations.

c) **Government:** airports operate under a number of laws and regulations, both aeronautical and non-aeronautical (labour code, fire protection and building codes). The airport operator can be a tenant of the government in cases where it only operates the airport.

d) The public at large, who is served by the airport; neighbours who may be exposed to aircraft noise.

e) Media, an often-ignored partner who can be of assistance to the airport operator if a proper rapport is established.

f) **Suppliers:** airports rely on many external suppliers to function as an enterprise: water, electricity, waste water treatment, communications, fuel, parts, materials, stationary, banking services, building and maintenance contractors, legal firms, rental of equipment, etc.

Other airports and other transportation components: airports must keep in close coordination with other airports because, as members of the same trade, they can benefit from sharing common problems and learn from successful solutions adopted by others; as inter modal facility operators, airports need to keep in touch with other modes of transportation, from a technological, planning and competitive stand point (Figure 7).

Key Learning Point

Airports cater to the need of airlines, passengers and many other on-site and external customers and partners. Their business and operational relationships are complex and must be kept in balance.
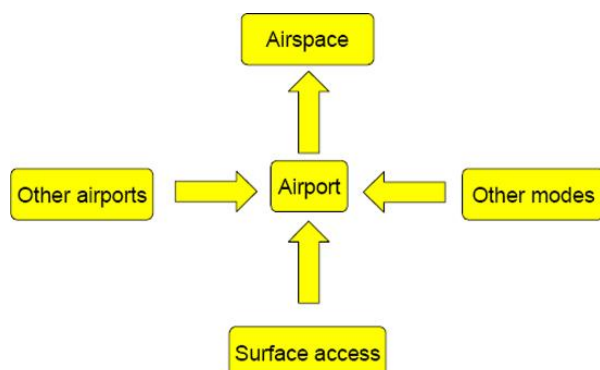
Figure 7. Relationships Between the Airport and the Transportation Environment

It is important that airports maintain a good balance of relationship with all these internal and external customers and parents.

Lesson Summary

The main customer of the airport is the airlines. Passengers are customers of the airlines and of the airport. Other important airport customers exist and they cater to the airlines and to the airport: ground handlers, land tenants, concessionaires, and government control agencies.

Given that airports obtain most of their services from external sources and that they can cause negative impacts on their neighbours, it is essential that good relationships be established and maintained with external organisations such as the community, the public, interest groups, the Government, and the media.

Progress Check 3

1. List the main airport customers:

    _____

2. What are the responsibilities of the Ground Handlers in an airport? Circle all answers that apply.

    a) Handling of the aircraft itself

    b) Handling of its passengers, baggage and freight

    c) Customs control

    d) Immigration control

Lesson Learning Objectives

Upon completion of this lesson, you should be able to:

- Describe the difference between airport ownership and airport operation

- Describe the various degrees of involvement in airport activities that airport operators can pursue

- Describe the different types of organizational structures that airport can implement

- List the key skills required for airport management

Key Learning Point

Most airports are publicly owned. However, there is a worldwide trend to commercialise their operation in order to better respond to the needs of its customers.

1.3 Airport Management and Operation

Lesson Overview

Irrespective of who owns and operates airports, there is a worldwide thrust to commercialise airport organisations by giving them the mandate to operate on a commercial basis, with due regard for the needs of their customers and for financial viability.

Depending on national or local preferences, airport operators can elect to get involved in many aspects of airport activities, or to carry out only core functions and let airlines and other agencies take responsibility for all other tasks.

Although most airports have some commonality of functions, there are several ways of organising their human resources.

Airport management is an attractive career requiring highly skilled managers. Several programs exist that can prepare candidates for this career path.

1.3.1 Ownership and Operation

Airports throughout the world are owned and operated under a variety of arrangements. It is important to distinguish between airport *ownership* and airport operation.

Airport Operation

Most airports are owned by a government entity (the State, a province, a city, or another level of government). There are, however, exceptions to this situation. For example, British Airports Authority (BAA) owns and operates seven large airports in the United Kingdom. This private company issued shares that trade on the London Stock Exchange. Also, many very small airports serving recreational aircraft are privately owned.

In times of air traffic growth, governments cannot afford to finance expansion projects to meet demand. There are therefore under pressure to provide airports with the required degree of autonomy to meet this challenge. It should be noted that autonomy does not imply any particular type of organisation.

Various steps exist relative to the amount of autonomy provided: Commercialisation is a management approach whereby business

principles are applied in managing an airport, without involving the private sector. Corporatisation means creating a separate entity outside of government to manage an airport without change in ownership. Private sector participation refers to a situation whereby the private sector plays a role in the ownership and operation of an airport, although its ownership remains with the government. Privatisation means that the airport is fully owned and operated by a private enterprise.

Airport Management

When it comes to responsibility for day-to-day operation of an airport, several arrangements exist:

a) The government may operate the airport, as part of a Public Service Department, with or without commercial orientation.

b) It may create a special government agency to operate the airport with some independence from the government (autonomous airport authority).

c) It may divest itself entirely from the operation of the airport by transferring this responsibility to a fully independent organization, which may be a private corporation, through a management contract, a long-term lease or concession arrangement.

There has been a strong thrust, for a number of years, to evolve from government to private operation, sometimes with an intermediate step whereby government-operated airports first adopted some business principles, in order to better develop commercial activities.

There are many examples, on all continents, of such initiatives. The result has been largely successful: these airports have become viable enterprises, able to finance their long-term capital requirements and to better meet the needs of their customers.

Degree of Involvement by the Airport Operator

Irrespective of the type of ownership and operation arrangement discussed above, the role assumed by the airport operator may vary greatly. It may heavily involve itself in many aspects of airport activities or it may carry out only core functions. In the first instance, the operator may take on such responsibilities as the provision and operation of cargo and passenger terminals, general aviation facilities, baggage and aircraft ground handling, passenger processing, surface transportation, retail activities, even air traffic control or meteorological services. In the second case, the airport operator will only provide and maintain basic infrastructure such as

runways, taxiways, access roads, and utilities; airlines, ground handling agencies, tenants, concessionaires and contractors would carry out all other responsibilities. This option may include, in extreme cases, the construction and operation of terminal buildings by airlines.

In general terms, the first situation is more common in Europe, while the second one is the norm in North America. Both approaches have advantages and disadvantages and there is no ideal solution. Airport operators will often adopt an intermediate arrangement. The decision to adopt one option over the other depends on local and national circumstances, especially political leanings.

One of the consequences of the selected approach is the number of employees required by the airport operator: obviously, taking on more responsibilities will create higher staff requirements for the airport operator.

Airport Organisational Structures

All airports, irrespective of their size, have some common functions. However, there is no unique way of structuring airport organisations. One obvious reason is the size of the airport: small, simple airports will require fewer employees and fewer departments.

The role assumed by the operator will also affect the size and shape of the organisation: more responsibilities will require more expertise in the organisation. In a large airport, departments will be more numerous.

Irrespective of the size of the airport, there are several ways of organising the staff, either by function or by physical area of responsibility (Figure 8).

Figure 8. Two Examples of Airport Organisations, by Function and by Area

1.3.2 Airport Management as a Career

Airports are service organisations, producing services rather than goods. They cater to a variety of customers and they operate in a

highly regulated environment. They operate on a 24 hours a day basis, and they may be subjected to disruptions and crisis such as congestion, aircraft accidents, bad weather conditions, equipment breakdowns and security threats. As a result, airport management differs, in some respects, from the management of other types of enterprises.

The title of the top airport position can vary from country to country or from one airport to the next: Airport Manager, Airport General Manager, Airport Director, Executive Director, Director of Aviation, and Airport Chief Executive Officer. For the purpose of this manual, we will use the generic term Airport Manager.

As you learned in the previous section, there are many disciplines in the field of airport management.

The position of airport manager being the highest one in an airport organisation, it can usually be reached through advancement within the organisation. Often, employees enter the industry at a junior level, and through education, application and motivation work they way up the organisation.

The Aviation Management Program, Distance Learning is a good place to start one's career. In addition, many professional courses are available through the IATA Training and Development Institute, through formal classroom courses or through Distance Learning Training Programmes. This course textbook constitutes a good preparation tool to that effect.

The job of Airport Manager varies greatly, from the director of a large international airport processing tens of millions of passengers to the manager of a small, privately owned general aviation airport. The former is a high-level executive managing a large staff and budget and having significant public relations functions; the latter will combine many responsibilities and will do most of the work himself.

The Airport Manager is both a property manager or landlord, catering to the needs of his land tenants and concessionaires, and a businessperson, running an enterprise with many customers. The key skills required for this job are:

a) Leadership

b) Vision

c) Understanding the business and the needs of his customers

In all cases, the primary responsibility of an airport manager is to ensure the safe, secure and efficient operation of his airport and of all its facilities.

Lesson Summary

The majority of airports are publicly owned and operated. Many countries have taken steps to commercialise the management of their major airports. This situation provides the operator with much needed autonomy and with the ability to better respond to the needs of his customers.

Irrespective of the owner/operator relationship, the operator may take an active role in providing many facilities and services for its customers; on the other hand, he may elect to limit his involvement to core activities and delegates other responsibilities to airlines, ground handlers and other tenants.

There is no single way of structuring the organisation of an airport. It depends on the size and complexity of the airport and on the degree of involvement of the operator in airport activities.

The position of Airport Manager has dual responsibilities: landlord and business leader. It requires business management skills such as leadership, vision, and understanding of his customers' needs. This manual is a good tool to start moving in this direction.

Progress Check 4

1. The position of airport manager has dual responsibilities: _____ and _____ .

2. Name the three key skills required for airport management:

    _____

Lesson Learning Objectives

Upon completion of this lesson, you should be able to:

- Describe the need for standardisation in the aviation industry

- Describe the role of the International Civil Aviation Organization

- Name the organisation that develops and promulgates SARPs

Key Learning Point

Safety and efficiency dictate that a strong level of uniformity be provided throughout the world for all aspects of aviation. From an airport standardisation perspective, we follow the ICAO Standards and Recommended Practices.

1.4 The Need for Standardisation

Lesson Overview

Aircrafts regularly operate over several countries and continents within a single flight. In the absence of a uniform way of operating, chaos would rapidly appear. In order to avoid this grave risk, airlines, airports and countries decided, very early in the history of aviation, to establish a high level of uniformity relative to all aspects of civil aviation.

The main body involved in this effort is the International Civil Aviation Organization. It develops a number of technical and policy statements aimed at achieving maximum uniformity between countries. This has a direct impact on the way airports operate

1.4.1 Why Standardise?

Aviation is, by nature, largely international. Imagine a pilot flying from his home country to a foreign country where the following things are different: language, units of measurement, rules of the air, runway markings, radio communication procedures, and electronic guidance systems. In such an environment, this flight would be subjected to many uncertainties; safety, efficiency, and reliability would certainly suffer.

This situation created problems that individual airlines and nations could not solve unilaterally. As a result, attempts to standardise aviation were made early in the twentieth century and several international organisations were created to that effect.

In 1945, the International Air Transport Association (IATA) was established. The mandate of this association of international *airlines* is to represent, lead and serve the airline industry, with a view to providing safe, secure, efficient, economical, and seamless air travel. Today, this organisation has 270 members representing 98% of the world international scheduled traffic. In 1944 with the Chicago Convention, the International Civil Aviation Organization (ICAO)–an association of states – was created. The mandate of this specialised agency of the United Nations is to standardise all aspects of civil aviation among all member states. Today, ICAO has 188 members.

Finally, the Airports Council International (ACI), an association of *airports*, was established in 1991. Its mandate is to foster cooperation among its member airports, and with other partners in world aviation, including airlines, governments, and aircraft manufacturers. ACI has over 1500 members in 169 countries.

In spite of the apparent distinct mandates of these organisations, they have common objectives: to make air travel safer, more efficient and economical. They work in close cooperation on many issues.

In your day-to-day duties, the organisation having the most impact on your work is the ICAO. Therefore, you must become familiar with its role as it affects *your* airport.

ICAO develops and adopts statements that must be applied by all member states in order to achieve consistency throughout the world. There are two types of such statements: Standards and Recommended Practices (SARP).

A Standard is a specification for physical characteristics or performance of a facility or personnel, the uniform application of which is recognised as necessary for reasons of safety or regularity of international air navigation[2]. Its application by all member states is *mandatory*.

A Recommended Practice is a specification for physical characteristics or performance of a facility or personnel, the uniform application of which is recognised as desirable.

Where can you find these SARPs? They are published in documents called Annexes. There are eighteen (18) such annexes, each of them dealing with one particular aspect of aviation.

Out of these Annexes, three are of particular interest to you: Facilitation (Annex 9), Aerodromes (Annex 14) and Security (Annex 17). You will learn more about these two topics in Modules 2 and 3.

It is important for you to understand how a Standard or Recommended Practice adopted by ICAO affects your airport. ICAO does not have any authority over its member states, nor over individual airports. Once ICAO has adopted a SARP, member states must adopt it. This is normally done through national aviation laws and regulations and also through procedures promulgated by the authority responsible for civil aviation matters in each country. This is usually the Civil Aviation agency or equivalent authority.

In cases where a state decides not to adopt an ICAO SARP, it must so notify ICAO, who will publish the difference. This will ensure that pilots flying to this country are aware of it.

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[2] Internation Civil Aviation Organization - Annex 14–Aerodromes, Preamble

Lesson Summary

Aircrafts frequently operate beyond the geographical limits of their home state. In order to avoid confusion and potential risks, it is imperative that pilots fly with the assurance that wherever they go, they will work in a familiar environment.

Early in the development of air transport, airlines, airports and states took measures to ensure a high degree of consistency in aviation. This led to the creation of the International Air Transport Association, the International Civil Aviation Organization, and the Airports Council International.

In the case of airports, the ICAO develops and promulgates Standards and Recommended Practices (SARPs) aimed at standardising all airport facilities. Since ICAO does not have authority over states, a mechanism ensures that each member state adopts these SARPs by enacting them in their national aviation laws and regulations.

Progress Check 5

1. _____ develops the Standards and Recommended Practices (SARP).

2. What is the role of International Civil Aviation Organization (ICAO)

    a) To standardise all aspects of civil aviation among all member states.

    b) To promote airlines and aviation industry

    c) To foster cooperation among its member airports, and with other partners in world aviation

    d) To represent, lead and serve the airline industry, with a view to providing safe, secure, efficient, economical, and seamless air travel

1.5 The Airport Business and its Economic Impact

Irrespective of the type of management adopted, airports must strive to achieve financial balance: revenues must at least cover costs; ideally, there should be a sufficient accumulated surplus to fund physical improvements required to meet demand, such as the expansion or major rehabilitation of facilities.

1.5.1 The Airport Business Costs

Airports incur costs to build, operate and maintain facilities. These costs can be broken down into two main categories:

a) Capital Costs

    i. Construction or expansion of airport infrastructure (runways, taxi-ways, terminal buildings, service buildings, roads and parking lots).

    ii. Purchase of heavy equipment and vehicles (trucks and cars).

b) Operating Costs

    i. Maintenance of the above assets.

    ii. Utilities (electricity, water, telephone).

    iii. Materials and supplies.

    iv. Salaries and wages of airport personnel.

Salaries account for a substantial percentage of the total operating costs.

Revenues

Airports generate revenues from the following two main sources:

a) Aeronautical Revenues

    i. Landing fees, paid by aircraft operators upon each landing. They are often based on the weight of the aircraft.

    ii. Terminal fees, paid by airlines using terminal building facilities. They are usually based on the number of passengers on board each departing aircraft.

    iii. Aircraft parking fees, paid by aircraft operators for parking aircraft at the airport. They are generally based on the size of the aircraft.

b)
Non-aeronautical Revenues

    i.   Car parking fees, paid by passengers and visitors who park their vehicle at the airport.

   ii.   Land rental, paid by land tenants for the use of airport land.

  iii. Concession fees, paid by operators of restaurants, bars and shops in the terminal building. They can be based on floor space occupied, or on a percentage of revenues, or a combination of the two.

  iv. Office and operational areas rent (such as airline office space and ticket counters). They are usually based on floor space occupied.

   v. Worldwide industry surveys reveal that non-aeronautical revenues account for 54% of total revenues (Figure 9), and that there is a trend toward an increase of this percentage. This means that airport rely more and more on these non-aeronautical revenues because they are less sensitive to sudden changes in traffic, being generated by such stable activities as leases. In addition, these non-aeronautical revenues can be used to offset the cost of providing the aeronautical infrastructure, thereby keeping airline costs lower.
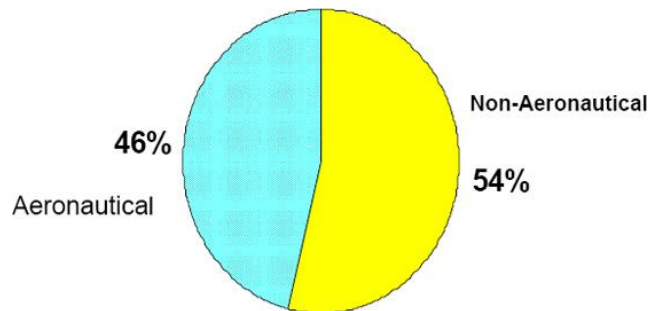
Figure 9.   Split Between Aeronautical and Non-aeronautical Revenues

Freedom to Set Rates

Set centrally, thereby preventing the airport operator from setting the rates required to cover his costs, and to respond to local market conditions. In a commercially oriented context, however, the airport operator is free to set these rates, which translates into a more efficient and customer-oriented organisation. Airports operated by autonomous authorities or private enterprises usually enjoy that freedom.

Key Learning Point

Capital expenditures can be financed through the implementation of an Airport Improvement Fee.

Financing Major Expenditures

When airports have a requirement to undertake major expansions, they may not have a sufficient accumulated surplus to fund them. Other sources of financing must therefore by envisaged. One of the most common ones is the implementation of a special, time-bound fee, often called Airport Improvement Fee or Passenger Facility Charge.

This fee is paid directly by each departing passenger, either immediately before boarding or, preferably, as part of his airline ticket (in the latter case, airlines collect the fee on behalf of the airport).

There are advantages in adopting the latter option:

a) From an airport perspective, there is no requirement to provide a collection system, which requires equipment, personnel, and occupies much needed floor space, in addition to adding processing time for departing passengers. The fee paid to the airlines to collect the Airport Improvement Fee more than offsets the above problems.

b) From a passenger perspective, the financial impact of paying this fee is less perceived when included in the overall price of the airline ticket than when having to pay at the airport.

An Airport Improvement Fee must be directly and visibly linked to a specific airport improvement. It can remain in place only until such time as the cost of the said improvement has been paid off.

Other financing options include bonds, bank loans, and grants.

1.5.2   The Economic Impact of Airports

Transportation is key to the economy of any region. It connects suppliers, manufacturers, and consumers through an efficient distribution process. A local airport represents a gateway to the national and international air transportation systems. The tourist industry depends on it. Many businesses consider that having access to an airport is a benefit, not only to passengers and shippers but also to the general population. Conversely, not having an airport can be detrimental to the progress of a community.

Airports are important employment centres, which contributes to the health of the economy.

Key Learning Point

Airports generate important benefits for the community they serve: Convenience for enterprises, employment, and local expenditures.

Employment

It is a well-documented fact that airports generate substantial economic benefits for the area they serve and for the country. The most visible benefit is the fact that airports can be a major source of employment. Some large international airports can employ up to 70,000 people (including the airport operator, airlines, ground handling agencies, land tenants, concessionaires, government departments, and others).

Economic Impact

The wages paid to these employees have a significant effect on the local economy; employees are likely to reside in the communities near the airport and they spend their wages to purchase goods and services (housing, cars, food, transportation, entertainment), which in turn generates further benefits.

Other benefits are generated by on-airport enterprises that purchase goods and services such as fuel, food, parts, and ground transportation.

Finally, employees and businesses (including the airport) pay local taxes, which contribute to the wealth of the local economy.

In order to illustrate the above statements, here are some recent economic impact figures for a number of airports of different size (Table 2).

Airport	Passengers (Millions per annum)	Employment (on airport)	Employment (total)	Economic Impact (in billions US dollars)
1	3	1700	4700	1
2	16	26000	60000	8
3	26	70000	138000	12
4	60	35000	265000	30

Table 2. Economic Impact of Selected Airports[3]

Lesson Summary

Airports are businesses. As such their management must ensure that its operating revenues at least cover its operating costs.

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[3] Various Airport Web Sites

There are two types of costs: operating costs, incurred in the day-to-day running of the airport, and capital costs incurred for the acquisition or construction of durable assets.

There are two types of revenues: aeronautical and non-aeronautical. The first type is directly generated by aircraft and passenger movements and it fluctuates with changes in the number of flights. The second type is generated by commercial activities such as land leases and concession rent. Airports strive to rely more on the second category (the world average is 54% of total revenues).

Airport operators who have the freedom to set rates are in a better position to respond to the needs of their customers and to cover their costs.

When faced with the requirement to invest large amounts of money to construct, renovate or expand a facility, airports that do not have sufficient accumulated revenues must revert to some type of financing. The most commonly used is the temporary implementation of an Airport Improvement Fee.

Airports are important economic generators for the area they serve. They link the community to the national and international air transportation systems. Enterprises rely on them to connect to their suppliers and customers.

As employment centres, airports contribute to the wealth of the economy through the salaries and wages that employees spend in the community.

Progress Check 6

1. Name the two main categories of costs that airports incur:

   _____

2. Name the two main sources of revenue in an airport:

   _____

3. What are the three benefits that airports generate for the community they serve?

   _____

1.6   Airport Master Planning

Lesson Overview

In previous lessons, you learned that airports are complex, public entities that interact with several other public and private organisations; you also learned that they provide infrastructure for the air transport industry, a major factor for the health of the economy. With this in mind, it is essential that airports adopt an organised approach to guide their development and evolution.

1.6.1   Why Plan

It takes several years between the time a decision is made to build a new facility and the day this facility becomes operational. For example, it takes at least three years to build a new runway or a new terminal building. In addition, the cost to provide such facilities is very high. If airport management waits until the time that such a requirement materialises, the required facility will become usable years after it was required. This will create congestion problems that could have been avoided had a plan been in place. Moreover, securing funding at the last minute may contribute to financial difficulties. Therefore, an organised and systematic approach is necessary. In summary, planning means being ready for the future.

1.6.2   How to Plan?

In any business, planning is a two-level process. The first level is to set the course in general terms. It is done through the development of a Business Plan. It is a written summary of what the enterprise hopes to accomplish over a specific period of time. It describes how resources should be organised to reach this goal. It explains the overall strategies and objectives in support of this goal, expressed in words and numbers that can be used to measure progress along the way.

The Business Plan describes all aspects of the business, such as products and services provided, potential customers, competition, management resources, and financial needs.

It also identifies the strengths and weaknesses of the organisation (the internal factors under its control), and the threats and opportunities (the external factors not within its control).

In summary, a Business Plan is a road map (a flight plan in aviation terms!) that focuses on the future growth of the business, anticipates changes, helps control the business, and measures progress against goals and objectives. Business Planning is a management tool that reduces uncertainty and the risks associated with it.

The second level is called operational planning. It addresses more detailed issues such as marketing, financial planning, commercial planning, and facilities planning. We will now address the subject of facilities planning.

The tool that airports have developed to meet the requirements of facilities planning is called an Airport Master Plan. The ICAO defines it as "a guide for the development of airport facilities and for land uses on the airport and in its vicinity". In other words, an Airport Master Plan tells you "when and where to pour concrete and at what cost". All *physical* facilities described in this manual are normally addressed as part of a Master Plan (*not* commercial or levels of service issues).

1.6.3   Land Use Compatibility

You may have noticed that this definition uses the term "for land uses on airport and in its vicinity". We need to explain this apparently strange statement. Because of the nature of their activities, airports may generate some negative impacts on their neighbours, such as aircraft noise, water and air pollution, and vehicular traffic. Air safety may be affected by obstructions erected near airports.

On the other hand, they rely on their neighbours for the provision of many services such as road access, water, and electricity. Therefore, this strong two-way relationship requires that Airport Master Plans be developed with due consideration for other related plans such as urban development plans, and municipal or regional transportation plans. You will learn more about this relationship in Module 2, titled "The Airport as an Operational System".

Key Learning Point

The main steps in the planning process are: inventory, forecasts, alternatives, evaluation, and recommendations.

1.6.4   The Planning Process

The Airport Master Planning process is based on a simple, logical approach. It can be broken down into the following steps:

a) Determine what facilities we have, what their capacity is, and what their life expectancy is. It is called the inventory. For

example, our terminal building can handle 1000 passengers per hour. Our current peak demand is 600 passengers per hour.

b) Develop forecasted demand for the next twenty years, for facilities such as runways, terminal buildings, parking lots, roads, and utilities (electricity and water supply for example). Taking the above example, we would determine that the capacity of 1000 passengers per hour would be reached in 10 years from now.

c) Development of possible alternatives that would resolve the expected capacity shortfall identified in step b). These could include expanding the terminal building, remodelling it without increasing its size, demolishing it and building a new building on the same site, or building a new building on a different site.

d) Evaluate these alternatives using a set of criteria and rank them in decreasing order of merit. Some of the criteria used in the evaluation would include costs, financial impact on customers, ease of implementation, and environmental impact.

e) From this list of solutions, we would select the highest ranking one and make it the preferred option for a given facility.

Once all facilities have been addressed, it is important to create a visual depiction of how they should be positioned on the airport (remember that we need to have a "systematic and organised approach"). We meet this objective by developing a Land Use Plan. It is a coloured map that shows where each type of facility should be located on the airport, taking into account their relative functions (Figure 10).

Figure 10. An Airport Land Use Plan

Since the recommendation of the Master Plan have various impacts on its customers and neighbours, public consultation during development is vital.

Progress Check 7

1. It is not critical for airports to achieve financial viability.

    a) True

    b) False

2. The main economic benefits of an airport are:

    a) They link enterprises to their suppliers and customers

    b) They create employment

    c) They generate taxes

    d) All of the above

3. An airport Master Plan deals with:

    a) Physical facilities

    b) Land uses on and off airport

    c) Commercial and level of service issues

    d) a and b

Module Summary

The air transportation system is made up of airlines, airports, and a number of partners. It caters to a huge number of customers. It generates tremendous levels of employment worldwide. All players must work as a team in order to stay focused on the most important element: the customer.

In spite of its relatively recent introduction, aviation grew at an astounding rate, especially in the last fifty years. In spite of several setbacks over that period, the number and percentage of people using this mode of transportation keeps increasing worldwide. Ongoing technological changes have allowed airlines, airports, and air traffic control agencies to meet the increasing challenges of safety, security, efficiency, and protection of the environment.

An airport is an inter-modal facility that allows passengers and goods to transfer between the surface mode and the air mode. It is also a commercial enterprise catering to the needs of passengers

and shippers. Finally, it is a business centre with important economic benefits for the area it serves.

Airports have two main customers: the airlines and the passengers. They also have many other internal and external partners with whom they must establish and maintain business and social relations. The objectives of these customers and partners do not necessarily coincide with those of the airport. Therefore, constant efforts must be deployed by the airport to keep the relationships in balance.

Aviation is largely international. It cannot operate safely and efficiently unless national differences are levelled. To this effect, several international organisations were established and they work in cooperation to achieve a high level of consistency between countries. The most important one from an airport standpoint is the International Civil Aviation Organization (ICAO). It achieves the required level of standardisation by developing Standards and Recommended Practices (SARP) for all areas of the aviation industry. These SARPs must then be adopted by each member state.

Most airports are operated by some level of government. However, there is a strong worldwide trend to commercialise the management of airports, with the objectives to make them more autonomous. This status makes airports more responsive to the needs of their customers. In all cases, this commercialisation initiative has proven successful. Airport operators can involve themselves in the provision of facilities and services to different degrees, from widespread involvement to a minimal one. The structure of the airport organisation can be arranged in several ways, depending on the size and complexity of its mandate. Modern airport management is an attractive business, which requires a solid educational background.

Airports are businesses that need to recover their costs. Airport revenues come from two main sources: aeronautical and non-aeronautical. The latter category represents 54% of the total revenues and this percentage tends to increase. Commercial airport operators enjoy the freedom to set rates in order to better respond to market conditions. Financing of major capital expenditures can be achieved through the implementation of a user fee.

For a community, an airport represents a gateway to the world. It is an asset for businesses who need to have quick access to their suppliers and customers. Airports are important employment

centres and they generate important economic benefits for the community they serve.

All airports need to adopt a systematic and organised approach in developing their facilities to meet future requirements. An Airport Master Plan serves this purpose. It is a management guide for the long-term development of the airport, taking into account economic, technological, financial, and environmental considerations. The Land Use Plan portion of the Master Plan depicts where each type of facility will be positioned in order to achieve an efficient and orderly development.

Apply Your Learning

1. If you work at an airport, collect statistical data relative to your airport:

   a) When was your airport constructed?

   b) Gather and review historical passenger and flight data as well as forecasts.

   c) How many airlines serve your airport?

   d) How many employees work on site?

   e) Gather data on the characteristics of the main facilities (runways, approach systems, size of terminal building, capacity of parking lots, etc...).

2. If you work at an airport or are able to visit an airport in your area, here are some worthwhile activities for you to complete.

   a) Observe the movement of passengers and baggage from the parking lot to the boarding gate and vice-versa: witness the intermodal aspect of the airport.

   b) Walk around the terminal building. Take note of all the airline counters and concessions.

   c) Drive around your airport. Take note of all the land tenants.

   d) What types of businesses do you recognize from the course material?

3. If you work at an airport, visit the Operations Office.

   a) Locate ICAO Annexes

   b) Ask Operations people how they apply SARPs.

   c) Has your country informed ICAO of any differences (noncompliance)?

4. In your airport, observe the airport management.

    a) Who owns and operates your airport?

    b) Is it the same organisation or is there a distinct operator?

    c) Is your airport being managed in a commercial, business-like manner?

    d) How much involvement does the operator have in airport activities?

    e) Find an organisation chart of your airport. How is it structured?

5. If you have access to financial data of your airport, find the most recent financial statements for your airport.

    a) Do revenues cover expenses?

    b) What is the percentage of non-aeronautical revenues?

    c) How does your airport fund its capital expenditures?

6. Is there an Economic Impact Study available for your airport? What are its findings?

    If not, find out how many employees work at your airport (all categories).

7. What off-airport businesses rely on the airport for transportation?

8. Does your airport have a Master Plan? Find a copy and read it.

    a) What recommendations are included?

    b) Is its format consistent with what you learned in this manual?

    c) Is there compatibility of land use between your airport and surrounding lands?

    d) Can you see evidence that there was adequate public consultation?

Further Reading

Alexander T. WELLS, Ed.D. *Airport Planning & Management,* McGraw Hill, second edition.

Norman Ashford, H P Martin Stanton, Clifton A Moore: *Airport Operations*, Pitman Publishing.

Norman Ashford, Paul Wright: *Airport Engineering*, Wiley Interscience, third edition

International Air Transportation Association: *Airport Development Reference Manual*

International Civil Aviation Organization: *Annex 14, Aerodromes*

Answer Key

Progress Check 1

1. b

Progress Check 2

1. a

2. Instrument Landing System or ILS

3. d

Progress Check 3

1. Ground handlers, passengers, visitors, concessionaires, land tenants, government agencies, air traffic services

2. a, b

Progress Check 4

1. Landlord and business

2. Leadership, vision, and understanding the business and the needs of customers.

Progress Check 5

1. ICAO

2. a

Progress Check 6

1. Capital costs and Operating costs

2. Aeronautical revenues and Non-aeronautical revenues

3. Convenience for enterprises, employment, and local expenditures

Progress Check 7

1. b

2. d

3. d

Module 2—The Airport as an Operational System

Module Learning Objectives

Upon completion of this module, you should be able to:

- Name the main facilities that make up each area of an airport (Lesson 1, 2 and 3)

- Describe the physical and service components that make up the airside of an airport (Lesson 1)

- Name key operational procedures and their applicability within each area of an airport (Lesson 1, 2, 3)

- Describe the overall airport processing functions and their interactions as a system (Lesson 4).

- Define the main operational procedures used on an aerodrome (Lesson 4)

- Define the need for aerodrome certification and explain its key processes (Lesson 5)

2.1   The Airport as an Operational System

Module Overview

In Module 1, you learned about the basic functions of an airport; you also learned that it was made up of three distinct areas: airside, terminal, and landside. In this Module, we will concentrate on the description and functions of the many facilities that make up each of these areas.

We will start with the airside, because it is the most complex area, the most technology-intensive, and the one having the most significant impact on air safety. It is also the most regulated and standardised: this is where ICAO Standards and Recommended Practices prevail.

We will continue with the two other areas: the Terminal, where most processing activities take place, and the landside, which provides surface access to the airport.

You will then learn about a vital aspect of operations: aerodrome certification.

Finally, we will look at how these three areas work together as a system.

Lesson Learning Objectives

Upon completion of this lesson, you should be able to:

- List the three components of the movement area

- Describe the main functions of visual aids and name the main types

- Describe the functions of electronic approach aids and name the main types

- Describe the importance of meteorological services in aviation

- Describe the objectives of Air Traffic Services and name its physical and service components

- Explain the need for secondary power supply

- Describe the importance of obstacle restrictions and describe their main components

- Describe the functions of airside commercial tenants

2.2   The Airside

Lesson Overview

We are now going to define and describe the physical and service components that make up the airside; we will explain their functions and define their providers.

Then we will learn about the many operational procedures that airport operators should develop and maintain to safely and efficiently manage their aerodrome.

In Module 1, we defined the word Airport and we used it consistently. In Module 2, you will read the term Aerodrome. In order to avoid any confusion, we will clarify this issue right away.

ICAO designates those facilities exclusively used for the arrival, departure and surface movement of aircraft as the Aerodrome. This term is exclusively used in Annex 14–Aerodromes[1]. For the purpose of this lesson, we will use the same terminology as ICAO. For practical purposes, we will assume that it has the same meaning as Airside.

We will use the word Airport as a general term, designating the whole of the three areas (airside, terminal, and landside), or its management. Figure 11 depicts the airside in the overall airport context.

Figure 11. The Airside in the Overall Airport Context

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[1] ICAO Annex 14–Aerodromes

2.2.1 Physical Components of the Airside

2.2.1.1 The Movement Area

The movement area is the part of an aerodrome used for the take off, landing and taxiing of aircraft. It consists of the manoeuvring area and the apron(s).

The airport owner or operator always provides the movement area.

Refer to Figure 12 throughout this lesson for ease of reference.

2.2.1.1.1 Maneuvering Area

Runways

A runway is a defined rectangular area on a land[2] aerodrome prepared for the landing and take off of aircraft. Runways can consist of a hard surface (asphalt or concrete) or be made of sand or gravel. Jet engines being sensitive to the ingestion of loose material, the latter type can only serve light, propeller-driven aircraft.

Orientation of Runways: Runways at not placed at random. Aerodynamic considerations dictate that aircraft take off and land facing into the wind: it reduces the ground run required to become *airborne* or to decelerate and stop. Since the direction of wind fluctuates, runways must be constructed in such a way as to be aligned with the prevailing wind conditions of the proposed site, as recorded over several years. This ensures that in most occurrences, the runway will be reasonably aligned with the wind.

Numbering of Runways: For the purpose of identification, runways are numbered, using a two-digit number, from 01 to 36. This number represents the **magnetic orientation** of the runway, rounded to the nearest 10 degrees. The last digit of the number is then dropped.

For example, let's take a runway with a magnetic orientation of 053 degrees. First, we round the number up to 050, and then we drop the end zero. We would call this runway "05"; one with a magnetic orientation of 239 degrees would be numbered 24.

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[2] There are some water aerodromes.

The opposite direction has an orientation that differs by 180 degrees. Therefore, in the two above examples, these runways would be identified as 05-23 and 06-24 respectively (the lower number is always mentioned first).

In cases where an airport has two parallel runways, we add the letter "R" for right and "L" for left. For example: runways 06R-24L and 06L-24R.

There are two practical applications for this numbering system: first of all, it provides pilots with confirmation that they are indeed on the runway that was assigned to them, for taking off or landing. Secondly, while positioned at the beginning of the runway prior to take off, pilots can check their compass. If the compass reads roughly the same heading as the runway number, the compass is accurate.

Number of Runways: Many airports have more than one runway, sometimes up to five. Multiple runways can converge, intersect or parallel. Figure 12 shows an airport with two converging runways.

There are two reasons why airports may have more than one runway. The first reason relates to the limitations that aircraft have to operate in **cross wind** conditions. Although they can operate when the wind is not blowing exactly down the runway, there is a limit to the amount of cross wind that a particular aircraft type can safely sustain.

For illustration purposes, light single-engine aircraft can take off and land with a maximum cross wind component of about 10 *knots* or 18 km/h; larger aircraft can sustain about 13 knots; large multi-engine aircraft can sustain about 20 knots. Beyond these values, operations may become unsafe.

Figure 12. Airport Layout

If there is a substantial percentage of time when the wind direction and speed cause a crosswind component in excess of the capabilities of the aircraft that the aerodrome serves, then there is a requirement to provide another runway, called a **secondary runway**. This runway is generally shorter than the **primary runway** because, when the crosswind on the primary runway is too strong to operate safely, then the head wind on the secondary runway will be such that it will require a shorter take off and landing run.

ICAO breaks down aircraft in three categories according to their crosswind capabilities:

a) 10 knots

b) 13 knots

c) 20 knots

Based on these values, ICAO developed a Recommended Practice to the effect that airports should ensure that for 95% of the time there should be one direction available for landing or take off, taking into account the crosswind limitations of the aircraft that the airport is intended to serve.

This percentage is called the **usability factor**. Therefore, when the excessive cross wind component exists more than five percent of the time, a secondary runway should be provided.

The second reason has to do with runway capacity. A single runway can accommodate a certain number of **aircraft movements** over a given period of time. For example, a given runway might have an hourly capacity of 60 movements. When demand exceeds this capacity, aircraft must wait to take off or land, and delays occur. Delays generate inconvenience for passengers as well as additional costs and operational problems for airlines and for the airport operator.

Adding one runway will increase capacity (as long as the two runways can be used simultaneously). Large airports with very high traffic volumes sometimes have parallel runways, one used for take offs, one for landings. A third runway, oriented in accordance with prevailing crosswind conditions, will provide the recommended usability factor.

Length of Runways: The length of a runway must be sufficient to accommodate the operational requirements of the **critical aircraft**. Heavy aircraft require a longer runway to take off and land than light ones. High air temperature and aerodrome elevation will also negatively affect the performance of aircraft.

There is no lower and upper limit for runway length. It ranges from a few hundred meters to 4000 m or more.

Width of Runways: The width of a runway is a function of its length. It ranges from 18 meters to 60 meters.

Strength of Runways: Runways must be of sufficient strength to accommodate the weight of the critical aircraft.

Taxiways

A taxiway is a defined path on a land aerodrome established for the taxiing of aircraft and intended to provide a link between one part of the aerodrome and another. Taxiways usually connect aprons and runways.

There is a special type of taxiway called rapid exit taxiway. These taxiways, located along the runway at an approximate angle of 30 degrees, allow aircraft on the landing roll to exit the runway at a relatively high speed. It reduces the time that landing aircraft spend on the runway (the runway occupancy time) and it increases the rate at which aircraft can be processed (the capacity of the runway). Figure 12 shows an example of rapid exit taxiways.

The width of a taxiway must be sufficient to meet the requirements of the critical aircraft. The width of taxiways ranges from 7.5 m to 23 m. Letters, in alphabetical order, designates them (for example, taxiway **Alpha** for the letter "A").

Taxiways must be of sufficient strength to accommodate the weight of the critical aircraft.

2.2.1.1.2 Aprons

An apron is a defined area, on a land aerodrome, intended to accommodate aircraft for the purpose of loading or unloading passengers, mail or cargo, fuelling, parking or maintenance.

There is a special type of apron, called a De-icing Centre. At airports where snow and ice conditions are frequent, air safety requires that departing aircraft be free of any accumulation of snow, ice, and frost on their surfaces. It is done by spraying a mix of water and special chemical that melts these contaminants and prevents further accumulation during taxi, take off, and the initial climb. The effect of these chemicals being limited in time, de-icing centres must be located in close proximity to runways. De-icing procedures can be lengthy, and the requirement for all aircraft to go through a

Key Learning Point

The movement area consists of one or more runways, of taxiways, and aprons. These surfaces are respectively used for the take off and landing of aircraft, for their surface movement, and for parking, loading and unloading them.

central facility may cause congestion and delays. These facilities allow aircraft to stop momentarily before take off, to be de-iced.

The size of an apron must be sufficient to accommodate the number of aircraft expected at peak times, plus adequate circulation. Each aircraft is parked on a defined surface called a **Stand**. A number designates each stand.

Aprons must be of sufficient strength to accommodate the weight of the critical aircraft.

Progress Check 1

1. The movement area of an aerodrome can be defined as:
    a) Runways, taxiways and aprons
    b) Runways and aprons
    c) Taxiways and aprons
    d) Is the same as the manoeuvring area

2. Which direction should the aircraft face to reduce the ground run required while taking off and landing?

a) The aircraft have to face the wind
b) The aircraft have to go opposite the wind
c) The aircraft have to be in 90 degree angle with the wind
d) The direction of the wind does not have an effect on the length required for the ground run

2.2.1.2   Visual Aids

Visual aids are devices that provide pilots with visual reference while taxiing, landing and taking off. The airport operator provides these visual aids. There are four categories of visual aids:

a) Indicators and signalling devices.
b) Paint markings.
c) Signs.
d) Lights.

They can serve three different purposes:

a) To help navigation.
b) To denote obstacles.
c) To denote restricted areas.

Aerodrome visual aids are numerous and diverse. They apply differently to different categories of aerodromes and can vary with local conditions. Since this manual is of an introductory level, we are not going to cover all the variations in visual aids that are available. Instead, we will describe the most common types, so that you can acquire a general knowledge of these systems. It will allow you to easily identify them and their purpose, at your aerodrome or at any other location.

2.2.1.2.1 Visual Aids for Navigation

Wind Direction Indicator: This is a very prominent feature on all aerodromes (Figure 13). It is a white and orange[3] truncated cone, made of fabric, located near the runway **threshold** and mounted on a high post. Its purpose is to provide pilots with a visual indication of the direction and speed of the wind.

Landing Direction Indicator: It is a T-shaped, horizontally mounted indicator. It can be rotated and set in the direction of the runway in use.

The two devices described above are particularly useful at airports where there is no control tower, or where aircraft not equipped with radio operate. When used in conjunction with radio communications, they confirm the information provided to pilots.

Figure 13. Wind Direction Indicator

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[3] Some wind indicators can be all white or orange.

Signalling Lamp: It is a portable, multi-colour light, located in the control tower and used by air traffic controllers to provide pilots of aircraft not equipped with radio, with visual instructions such as clearance to land or take off.

Pavement Markings: The next type of visual aids consists of markings painted on aerodrome pavement. They serve the same purpose as the painted markings you see on roads and streets. They provide pilots with visual information that help them navigate.

Refer to figure 14 throughout this section.

Figure 14. Runway Markings

Threshold Markings: Seen from the air, the threshold of a runway is not always well visible because of lack of contrast between pavement and surrounding terrain. Threshold markings indicate the beginning of the usable pavement area. They consist of a pattern of longitudinal narrow stripes.

Aiming Markings: These are longitudinal rectangles located exactly 300 meters from the runway threshold. They allow pilots on approach to visualise the landing area from a distance.

Touchdown Zone Markings: These are longitudinal stripes located on either side of the centreline extending several hundred meters from the threshold. They provide pilots with visual information relative to the area within which landing aircraft should touch down.

Runway Side Stripe Markings: These are longitudinal stripes located along the two edges of the runway. They provide a good

reference when there is no contrast between the pavement and the surrounding ground.

Taxiway Centre Line Markings: They look like the lines painted on the centre of roads. However, they serve a different purpose: they provide guidance for pilots to ensure that their aircraft remains well within the taxiway surface, when following the centre line. All taxiway markings are yellow.

Taxi-holding Position Markings: While waiting to access a runway, aircraft must remain at a safe distance from the edge of the runway. This distance is shown with one or more transverse lines painted across the taxiway.

Aircraft Stand Markings: When approaching their assigned stand, pilots must be able to identify its location well ahead of time. To that effect, various markings are used: starting from the end of the taxiway centre line, there is a lead-in line (which points the aeroplane in the right direction), a stand identification marking (its number), and a stop line which positions the aeroplane accurately on the gate. Other markings can include a leadout line, which provides guidance when departing from the gate.

Positioning an aeroplane on a gate is a complex task, which is sometimes done with the assistance of electronic parking aids, which will be discussed in Lesson 2, "Terminal".

Apron Safety Lines: For safety reasons, it is important to separate *ground support equipment* from the path of an incoming aeroplane. This is achieved using red lines delineating the area where equipment can safely be parked while the aeroplane is moving. Red-hatched lines sometimes supplement them (Figure 15).

Lights: Painted markings are useful during daytime and conditions of good visibility. However, since operations during nighttime and daytime periods of low visibility are necessary for the sake of reliability of service, other visual aids are required. Lights are used, and they are more effective than markings in the above conditions.

There are many types of aerodrome lights, each type serving a specific purpose. You will now learn about these systems.

Aerodrome Beacon: Seen from the air, aerodromes are not necessarily easy to identify visually. This is especially true when highly developed urban areas surround the aerodrome. For this reason, an aerodrome beacon is installed at all aerodromes intended for night use.

It consists of a white or coloured rotating or flashing light emitting about twenty flashes per minutes. It is often installed on top of the control tower or other prominent airport structure. You can easily see it if you stand on an open area with good view on the aerodrome.

Figure 15. Aircraft Stand with Red Safety Lines

Approach Lighting Systems: In module 1, you learned that pilots who fly in IFR conditions, require guidance during their approach to the runway. Two types of guidance are required: visual and electronic. In this section you will learn about visual systems. They are always used in conjunction with electronic aids, and you will learn about them in the next section.

One of the key components of visual guidance is the approach lighting system. Although there are several types, approach lighting systems all serve the same purpose: to provide pilots approaching in low visibility or ceiling conditions with a visual reference of the runway extended centre line and of their distance from the threshold

They consist of one or more rows of bright lights, mounted on posts, and installed along the extended centreline of the runway. They extend from the runway threshold to a distance of up to 900 meters, depending on the type of approach (Figure 16).

Cross bar lights provide distance information. They are located at 300 meters from the threshold.

Visual Approach Slope Indicator Systems: Runways used by jet aircraft or runways where the approach area does not provide adequate vertical reference must be equipped with a vertical

guidance visual system. Two main types exist: the Visual Approach Slope Indicator System (VASIS) and the Precision Approach Path Indicator (PAPI). Both systems provide pilots of approaching aircraft with visual information as to whether the aircraft is approaching along an adequate slope, or whether it is too high, or too low.

VASIS and PAPIs consist of a number of directional lights, installed on the side of the runway near the touch down area. Depending on the position of the aircraft in relation to the proper approach slope, the pilot will see various combinations of red and white lights (Figure 17).

Figure 16. Approach Lighting System

Figure 17. Runway Edge Lights–Note: PAPI Red Lights on the Left Hand Side

Runway Threshold Identification Lights: When the threshold of a nonprecision runway is not conspicuous, the airport operator should install Runway Threshold Identification Lights. They consist of a pair of white flashing lights installed on either side of the runway threshold.

Runway Edge Lights: When a runway is intended for night operations, edge lighting must be installed so that pilots can see the

lateral limits of the runway. They consist of fixed white lights, spaced no more than 60 meters apart for **instrument runways** and no more than 100 meters apart for a non-instrument runway (Figure 17).

Runway Threshold Lights: With runway edge lighting comes the need to show the exact location of the beginning of the runway, while approaching it. It is achieved by placing a row of green lights on the threshold (Figure 18).

Runway End Lights: In order to complete the visual delineation of a runway for night use, it is necessary to install a row of red lights at the far end of the runway. They indicate where the runway pavement ends.

Runway Centre Line Lights: For low visibility conditions (Category II and III approaches), it is necessary to provide pilots with an illuminated centreline. It consists of white recessed fixed lights, installed flush with the pavement between 7.5 and 30 m apart along the whole length of the runway centreline (Figure 18). Towards the end of the runway, these lights are then alternated red and white, and finally all red to indicate that the aircraft is approaching the end of the runway. They serve the same purpose as the painted centre line markings.

Runway Touchdown Lights: Under the same conditions, it is required to install a number of transverse bars on the first 900 m of the runway. In very low visibility conditions, they provide pilots with the location of the touch down area.

Figure 18. Runway Threshold, Centreline, and Edge Lighting

Taxiway Edge Lights: Similar to runways, taxiways intended to be used at night must be equipped with lights delineating the lateral boundaries of the pavement. They consist of fixed blue lights spaced no more than 60 m, closer in turns.

Taxiway Centre Line Lights: When a taxiway is intended to be used in low visibility conditions, there is a requirement to install fixed green lights along its centre line, no more than 30 m apart (Figure 19). In this case, it is not necessary to install blue edge lighting.

Taxi-holding Position Lights: To complement the taxi-holding lines, taxiholding position lights should be installed on each side of the abovementioned lines. They consist of two alternatively illuminated yellow lights.

Apron Floodlighting: Although this is not an aerodrome visual aid per se, it is important to adequately illuminate aprons, which are intended to be used at night. It allows for the safe servicing of aircraft. It usually consists of bright spotlights mounted on top of high posts.

Figure 19. Taxiway Centreline Lights

Signs: Another type of visual aids found on aerodromes is signs. They are useful to provide pilots with information and they reduce the amount of radio communications between the control tower and pilots who are not familiar with the aerodrome. There are three types of signs: mandatory instructions, directional information, and location signs.

Signs must be of standard shape and design. They consist of a rectangular panel, placed horizontally.

Signs intended to be used at night or during conditions of low visibility must be illuminated.

All aerodrome signs must be frangible so that, if an aircraft hits them, no damage will occur to the aircraft.

Mandatory: These signs are used when the unauthorised access by an aircraft may jeopardise safety. For example entry into a prohibited area or beyond an ILS holding point. The most common mandatory signs are: STOP, NO ENTRY, CAT I, CAT II, and CAT III. All mandatory signs consist of an inscription in white on a red background (Figure 20).

Figure 20. Mandatory Sign

Directional: These signs provide information on the direction to take to reach a certain destination on the aerodrome. They consist of an inscription in black on a yellow background, with an arrow pointing in the direction of the destination point (Figure 21). The most common directional signs show direction towards a runway a taxiway, or an apron.

Location: These signs provide confirmation to pilots about their location. They consist of an inscription in yellow on a black background (Figure 21). The most common location signs indicate the taxiway you are on.

Figure 21. Combined Location and Directional Sign

Markers: When the surface of a runway or a taxiway is not paved, the lack of contrast of the ground may make it difficult to determine the boundaries of the usable surface. In this case, it is appropriate to install markers. They consist of flat or conical panels painted red or orange.

2.2.1.2.2 Visual Aids for Denoting Obstacles

When obstacles located on or near an aerodrome are likely to constitute a hazard to aircraft, these obstacles must be marked and, if the aerodrome is intended to be used at night, lighted.

The most common obstacles are: tall buildings, communication towers, chimneys, water towers, overhead wires, trees, high terrain, and vehicles.

When feasible, these obstacles are marked with a chequered pattern of orange and white, or red and white. Vehicles operated on an aerodrome should be marked with a single conspicuous colour such as red or yellow.

When lighting is required, various combinations of colours and locations are provided depending of the type of obstacle: fixed red, flashing red, or flashing white.

Lights installed on vehicles should be flashing red or yellow.

2.2.1.2.3 Visual Aids for Denoting Restricted Use Areas

There are several reasons why an aerodrome area can be restricted to aircraft:

a) The area is closed for construction, maintenance, or has been decommissioned.

b) The area cannot bear the weight of an aircraft, such as the shoulder of a taxiway.

A permanently closed area is identified by day with markings in the form of a cross. If night use is intended, unserviceability lights must be used. These lights must be fixed red or flashing red or yellow.

If an area is closed but it is still possible to bypass it, markers in the form of flags or cones will be used. When areas adjacent to a taxiway or apron are not designed for use by aircraft and if these surfaces are not readily identifiable, markings in the form of a pair of solid lines must be implemented.

Key Learning Point

Visual aids provide pilots with visual reference while on the ground and in the air. They consist of indicators and signalling devices, paint markings, signs, and lights. They help navigation and the denotation of obstacles and restricted areas.

Progress Check 2

1. Name the three different purposes that visual aids can serve.

   a) _____

   b) _____

   c) _____

2.2.1.3   Electronic Aids

2.2.1.3.1 Approach Aids

The approach lighting system that you just learned about provides pilots with visual reference during the last seconds of flight, immediately prior to landing. In order to bring aircraft to that point, other systems with more range are required. These are electronic approach devices that bring the aircraft from a point located several kilometres from the aerodrome to a point aligned with the landing runway, at an altitude where the pilot can visually complete a landing.

Several systems exist to that effect. We will discuss the three most widely used ones:

a) The Instrument Landing System (ILS), a precision approach.

b) The Very High Frequency Omni-directional Range (VOR), a non-precision approach.

c) The Non-Directional Beacon (NDB), a non-precision approach.

d) The Global Satellite Navigation System (GNSS), both non-precision and precision approaches.

A precision approach is one executed with lateral and vertical guidance, while a non-precision approach is executed with lateral guidance only.

The Instrument Landing System (ILS)–What is an ILS and How Does it Work? An ILS provides pilots with guidance through two thin radio beams and at least two distance beacons. These two beams intersect each other, and when approaching along the intersection of these two beams, an aircraft is perfectly aligned with the extended centreline runway and on the right descent slope.

A radio transmitter providing lateral guidance generates the first beam. This transmitter is called the localiser. It is located on the opposite end of the runway seen from the approach side, on the extended centreline, approximately 335 m beyond the runway threshold (Figure 22). This beam activates an instrument in the aircraft that contains a vertical needle sensitive to deviations from the localiser beam. By observing this needle, the pilot can determine whether his aircraft is flying along the extended centreline of the runway. If not, the needle will indicate which way he must turn his aircraft to return to the centreline.

The second beam provides vertical guidance. It is called the glide path. Its transmitter is located on the side of the runway, approximately 120 to 150 m from the runway centreline and 320 m past the threshold seen from the approach side (Figure 23). This beam activates a horizontal needle sensitive to deviations from the glide path beam. By observing this needle, the pilot can determine whether his aircraft is flying along a predetermined 3-degree slope leading to the runway. If not, the needle will tell him which way the slope is located, up or down. He will then adjust his rate of descent accordingly.

Figure 22. Localiser Antenna of an ILS

Figure 23. Glide Path Antenna of an ILS

By keeping both needles centred, the pilot can guide his aircraft down to a point where he will be able to continue his approach and land by visual reference to the ground or to approach or touch down lights[4].

What is missing is distance information. How far is the aircraft from the runway? This information is provided by at least two radio beacons, called marker beacons, shooting a signal upward. As the descending aircraft passes thought these narrow vertical beams, a light will flash on the instrument panel and an audio signal will sound. Each marker beacon emits on a different frequency and will trigger a different light signal in the cockpit. The distance between the runway and each marker being precisely known, the pilot can then determine his exact distance from the runway.

There is another way of determining the distance between the runway and the aircraft. It is called a **Distance Measuring Equipment (DME)**. When collocated with an ILS, it provides the pilot with continuous distance information.

Categories of ILS: The glide slope originates near the touchdown zone. This is the area where a landing aircraft makes contact with the runway. When conducting an ILS approach (or any instrument approach), the pilot must make a transition from relying on on-board instruments to follow a proper trajectory to using visual reference to the ground in order to land the aircraft, aided by runway lights and markings.

This transition requires a minimum cloud ceiling height and visibility. Therefore there is a minimum height (the decision height) at which a pilot can safely descend and a minimum visibility to carry out this transition (a commercial jet aircraft approaches at a speed in excess of 120 knots (222 km/h) which translates in 60 m per second).

ICAO promulgated three categories of ILS, based on their capability to bring aircraft down to specific minima. The following table illustrates the different minima. You will note that Category III c approaches do not require any visibility or ceiling height. A Cat III c approach can only be accomplished by adequately equipped aircraft and qualified pilots (Table 3).

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[4] Except for ILS Category III c approaches (Refer to table 3)

ILS Category	Decision Height	Visibility
CAT I	60 m	800 m
CAT II	30 m	400 m
CAT III a	0 m	200 m
CAT III b	0 m	50 m
CAT III c	0 m	0 m

Table 3. ILS Decision Height and Visibility Minima[5]

Although the ILS is the most common **type of instrument approach, other approaches using other navigation aids are also used.**

The Very High Frequency Omni-directional Range (VOR) Approach: The VOR approach brings the aircraft down to minima in the order of a 150 m ceiling and a visibility of 2.5 km m. VORs are often located several kilometres from the aerodrome and they often serve the dual function of approach aid and enroute navigational aid (Figure 24).

The Non-Directional Beacon (NDB) Approach: The NDB approach provides minima comparable to those provided by a VOR approach. Similar to VORs, NDBs often serve as approach and enroute functions (Figure 25).

These minima can be attained in ideal conditions, when the transmitters are not negatively influenced by topographical irregularities and when the surroundings of the aerodrome are free from obstacles.

Figure 24. VOR

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[5] Source: ICAO

Figure 25. NDB

The Global Satellite Navigation System (GNSS) Approach: A relatively new system, GNSS is gaining worldwide acceptance as a non-precision and precision approach. It has the advantage of not relying on ground-based navigation aids. Instead, it uses the signals emitted by a number of satellites to determine the three dimensional position of the aircraft. This information can be used to conduct approaches with minima comparable to those provided by the VOR, NDB and ILS.

GNSS allows airports with limited approach aids to afford the level of service provided by traditional electronic aids, without the complication and cost of their installation. This subject will be further elaborated in Module 6–The Future of Airports.

Which Approach Aid to Provide? The decision to provide a specific type of approach largely depends on the following criteria:

a) What are the meteorological conditions at the aerodrome? Do prevailing weather conditions cause a high percentage of diversions to other airports?

b) What is the cost of providing and maintaining navigational aids? Electronic aids providing lower approach minima are likely to cost more to install and maintain.

c) What are the needs of the customers? A commercial scheduled operator will require higher reliability of operation than a flying club.

Key Learning Point

Electronic aids are used to guide aircraft in flight, during the en route and approach phases. The most widely used are radars, ILSs, VORs, and NDBs.

2.2.1.3.2 Radars

You learned that the main tools used by air traffic controllers to do their work were radars and communications. You will now learn more about radars.

The word radar is an acronym that comes from the expression Radio Detection And Ranging. It was invented many decades ago and saw development during World War II. Since then, radar technology has improved considerably but the basic principles of early systems still apply today: a radar detects the presence of an object and displays its position in relation to its antenna. If the object is an aircraft, the controller can use this information to monitor its position in relation to other aircraft, to obstacles, and to pre-determined flight paths like airways.

There are two types of radar:

a)   Primary radars

b)   Secondary radars

Primary Radar: A primary radar (Figure 26) consists of a radio transmitter that emits a signal through a rotating antenna. This signal travels into airspace until it hits an object. Part of the signal will be reflected back to the antenna. Metallic objects like aircraft provide a better return than non-metallic objects.

The return signal will be displayed on a flat screen, providing a two-dimensional map of the airspace swept by the signal.

On a primary radar, an aircraft return is shown as a small dot. The screen is graduated from 0 to 360 degrees and it contains range rings. From this information, the controller can determine the distance of the aircraft and its bearing from the antenna.

However, other objects can provide returns: high terrain, rough seas, and precipitation. Although this information can be useful, it tends to clutter the screen. Another type of radar, called secondary, was developed to eliminate these problems.

Figure 26. Primary Radar

Secondary Radars: A secondary radar consists of a radio transmitter that emits a signal from a rotating antenna. However, contrary to the primary radar, no reflection signal goes back to the antenna. Instead, when the signal hits an aircraft, it triggers an electronic reply generated by an onboard device called a transponder. The transponder sends a coded signal that incorporates not only the position of the aircraft but also its identification, speed, altitude, and other related data. The information is displayed on the controller's screen as a small tag showing the location of the aircraft and other important data (Figure 27).
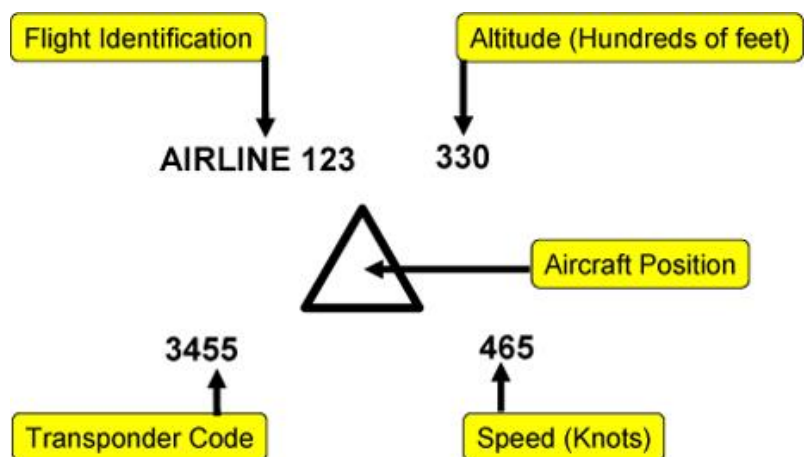
Figure 27. Example of a Secondary Radar Display

The secondary radar has two advantages:

a) There is no screen clutter caused by unwanted returns.

b) The amount of information, updated with every antenna revolution and displayed on the screen reduces the volume of air-ground communications, thereby reducing the workload of pilots and controllers.

Depending on the technical characteristics of radars, they can be used for different phases of flights:

a) Enroute Surveillance Radars (ARSR) are best suited to monitor and control enroute aircraft flying along airways. Typically, they have a 200 nautical mile (360 km) range. They are associated with Area Control Centres.

b) Airport Surveillance Radars (ASRs) are used for controlling traffic in the vicinity of airports. Their range is normally 30 to 60 nm. They are associated with Approach Control units and Control Towers.

c) Surface Movement Radars (SMRs) are specially-designed radars used to aid controllers in the safe manoeuvring of taxiing aircraft, when visibility is poor or when the configuration of the manoeuvring area is confusing to pilots unfamiliar with the aerodrome. They are associated with Control Towers.

d) Precision Approach Radars (PARs) are used to guide approaching aircraft, with lateral and vertical guidance, like an ILS. However, contrary to the ILS where the pilot receives guidance information and manages his approach accordingly, the PAR approach is guided by a ground-based controller who provides the pilot with the position of his aircraft in relation to the runway extended centreline and the ideal approach slope. He then provides the pilot with instructions as to which course of action will bring him back on course.

The PAR consists of two antennas, one scanning the vertical plane and the other scanning the horizontal plane. It is associated with Approach Control Units.

Technological improvements in electronic approach aids have reduced the attractiveness of PARs. They are no longer common in civil aviation.

Protection of Electronic Aids: All aeronautical systems that emit electronic signals are sensitive to interferences. In general terms, two types of interference must be avoided:

a) Objects likely to cause reflection or blockage of signals (buildings, metallic objects).

b) Electrical noise caused by engine ignitions, electric motors, welding, and high tension lines.

Limitation and removal of sources of interference ensures protection. Proper planning when locating a new electronic system or a new structure is key. It can cause considerable restrictions, taking into account that some particularly sensitive systems (ILS, radars) require a several hundred-meter protection radius.

2.2.1.4   Communication Aids

Key Learning Point

Aeronautical communications are the main tools used to establish clear and efficient communication between pilots and air traffic controllers.

The other tool at the disposal of air traffic controllers is communications. Aeronautical communications are essential to the rapid and efficient exchange of information between different organisations. There are three types of communication services:

Fixed Services

Fixed services are used to transmit information between two or more organisations such as airports, airlines, and ATC units. They rely on cable or radio technology. Examples of messages transmitted over this type of service are **Flight Plans**, weather observations and forecasts, and other messages related to the safety and progress of flights.

Mobile services

Mobile services rely exclusively on radio technology to send and receive voice messages. In spite of their name, they consist of a fixed and a mobile station. They are the most common example of air-ground communications used by ATS units to provide pilots with instructions and information. This technology uses Very High Frequencies (VHF) (from 118.0 **MHz** to 136.0 MHz). Airlines also use this type of service to communicate with their own aircraft for reasons such as estimated time of arrival, aircraft serviceability, and other operational reasons.

Portable Services

Portable services are extensively used by airport personnel to exchange operational information relative to emergencies or routine maintenance. They use small radio transmitters and receivers commonly called "Walkie-Talkies". They operate on Ultra High Frequencies (UHF). Users include police forces, security personnel, and airport maintenance employees.

1. An ILS provides pilots with:

    a) Visual guidance only.

    b) Visual and electronic guidance.

    c) Lateral electronic guidance only.

    d) Electronic lateral and vertical guidance.

2.2.2 Service Components of Airside

2.2.2.1 Meteorological Services

Key Learning Point

Air transportation is highly sensitive to meteorological conditions. It is therefore essential that pilots, airports, and ATS have access to reliable meteorological observations and forecasts.

Air transportation is highly sensitive to some meteorological conditions. Aircraft are affected by the following factors:

a) Wind direction and speed (crosswind on runways, headwind while in flight).

b) Ceiling and visibility (when landing and taking off).

c) Icing in flight (ice forming on aircraft surfaces and engines).

d) Pavement contamination (ice, snow or water on runways and taxi-ways).

e) Thunderstorms (lightning strikes in flight and on the ground).

f) Turbulence (can cause uncomfortable flight or structural failure of the aircraft).

Given the need for reliability in air transportation, and in light of all the above elements that may affect it, it is essential that pilots, airport operators and air traffic controllers obtain as much meteorological information as possible.

How Does it Work? The first step is to collect meteorological data. This is done hourly (on the hour, or more frequently if conditions change significantly), by weather observation stations. These stations are commonly located on airports. Although it is normally a government responsibility, contractors operate some observation stations mostly on behalf of the government. There are also automated weather observation stations that can collect and disseminate data.

The collection of data requires specialised instruments located in a protected compound. This compound is located on the aerodrome, in an area where it is not affected by the heat and blast from aircraft engines, or other undesirable effects.

A remote **anemometer** and a **wind vane** located on the aerodrome and directly linked to the control tower and the weather office, monitor wind direction and speed.

Data to be Collected: The following data can be collected manually by qualified observers, or automatically transmitted by the instruments to the weather office:

a)   Height of the ceiling and description of clouds.

b)   Visibility.

c)   Type and severity of precipitation, obstructions to visibility such as fog.

d)   Air temperature and dew point.

e)   Wind direction and speed.

f)   Atmospheric pressure.

g)   Supplementary information as required.

How do we Use the Data? Once collected, data are organised in a standard format developed by ICAO. In light of the large amount of data to be transmitted, codes are used to shorten transmission times and to eliminate language differences. You can recognise these observation messages by the term METAR (regular hourly observations), or SPECI (for special reports).

Observations are disseminated through a dedicated worldwide communication network. This allows easy and immediate access to the latest weather observation, at any airport in the world.

The following users have access to this network:

a)   Airport operators.

b)   Airlines and other aircraft operators.

c)   Air Traffic Services (ATS) units.

Obtaining information on the current weather conditions at any airport is useful. However, it is not sufficient to allow aircraft operators, ATS units, and airports to plan for and avoid adverse conditions. The next important step is forecasting.

Forecasting: Forecasting predicts key weather conditions for specific airports and for larger areas. Forecasting Centres accomplish this task by preparing weather maps using observation data from many stations. From these maps, experts develop

forecasts for vast areas of airspace. You can recognise aviation forecast messages by the term TAF.

TAF is useful for airlines for flight planning since they need reliability. Important factors are: winds that can slow down flights or cause crosswind problems at airports; low visibility or ceiling conditions at the destination airport that can prevent aircraft from landing; in-flight icing conditions and severe turbulence that can cause accidents.

Forecasts are also very useful to airport operators: low visibility and ceiling may disrupt traffic and cause flights to divert to another airport; conversely, bad weather at other airports may cause many flights to divert to your airport and generate congestion; snow and ice on runways may require the availability of extra personnel and equipment.

ATS needs to know that bad weather conditions are expected because it may affect the rate at which they can process aircraft. This may cause delays.

Some airports have a meteorological radar and other detection equipment designed for early detection of atmospheric occurrences such as rain, snow, and thunderstorms. It gives all affected parties advance warning in cases of severe weather likely to affect operations.

What is Important for You? In your day-to-day work in the Operations Division, you will need regular access to the following data:

a) Weather observations

b) Terminal forecasts

Progress Check 4

1. Name four meteorological factors that can affect aircraft.

    _____

2. The ATS unit responsible to control air traffic in a control zone is:

    a) An area control centre

    b) An approach control unit

    c) A control tower

    d) None of the above

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The objectives of Air Traffic Services are to prevent aircraft collisions, to provide pilots with advice and information, to assist responsible agencies in search and rescue operations, and to ensure the safe and efficient conduct of flights.

They provide these services through control towers, approach control units, and area control centres. Their main tools are radios, radars and computers.

Aircraft in flight are kept apart using longitudinal, lateral, and vertical separation.

2.2.2.2   Air Traffic Services

In Module 1, you learned about the needs that created Air Traffic Control. You are now going to learn more about this subject. We will also expand the concept to Air Traffic *Services*, which goes beyond the control function.

When you observe the movement of aircraft landing and taking off, it looks like a natural and smooth flow of arrivals and departures. However, there is a lot going behind the scene, including significant resources, highly qualified people, procedures, and complex although invisible air routes.

Although all types of transportation need some form of control services, there are some key differences inherent to air transportation:

a) Contrary to cars, trucks, buses, and ships, aircraft cannot be held en route for any significant period. They cannot stop and wait unless they are on the ground.

b) The worldwide scope of aviation implies more international involvement than any other mode.

Objectives of Air Traffic Services (ATS)

The objectives of Air Traffic Services are:

a) To prevent collisions between aircraft in flight and between aircraft on the ground and obstacles, including vehicles (control service).

b) To provide aircraft with advice and information to ensure the safe and efficient conduct of flights (information service).

c) To notify and assist agencies involved in search and rescue operations (alert service).

In-flight collisions are avoided by providing longitudinal, lateral, and vertical separation between aircraft.

ATS Units and their Respective Areas of Responsibility

In order to carry out their functions efficiently, ATS break down the airspace into smaller, manageable volumes. Each volume deals with a different stage of flight, and is under the responsibility of a separate unit (Figure 28):

a) Control zones, under the responsibility of a control tower.

b) Terminal control areas, under the responsibility of an approach control

c) Airways, under the control of an area control centre.

Control Zone: A control zone is a cylindrical block of airspace, centred on the aerodrome, with an 8 km radius, extending from the ground to about 3000 m above sea level. Within this airspace, a control tower provides control, information, and alert services to all aircraft in flight or operating on the manoeuvring area, and control service to vehicles on the ground.
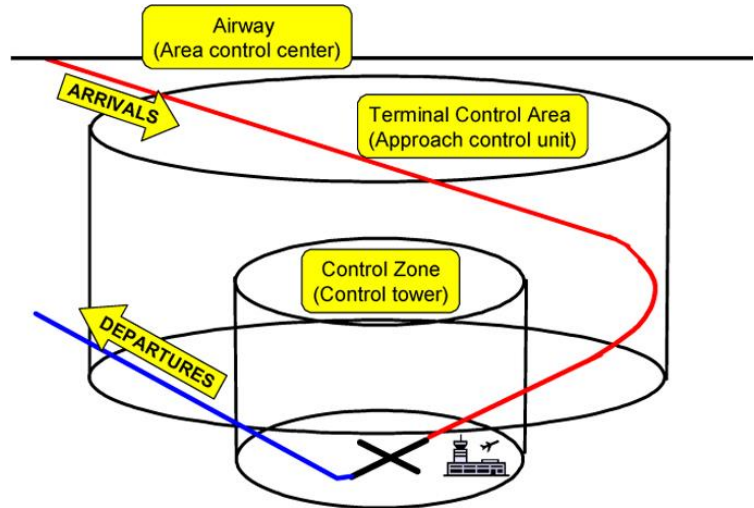
Figure 28. The Structure of Controlled Airspace

The tools used by the control tower to manage traffic are:

a) Radios

b) Radars

c) Computers

d) Signalling devices (when required)

Terminal Control Area: A terminal control area is a block of airspace of cylindrical or irregular shape, located at intersection **airways**, and typically situated at high-density traffic areas near one or more busy airports. It extends from at least 200 m above the ground to an altitude determined by local traffic conditions and by the airspace structure above it. Its lateral dimensions depend on the amount and density of traffic to be handled.

Within this airspace, an approach control unit provides all aircraft flying IFR with control, information, and alert services. Its main functions are to keep arriving and departing aircraft separate and to arrange all arriving aircraft in a proper line to land. The approach control unit is generally co-located with the control tower building.

The tools used by the approach control unit to manage traffic are:

a) Radios

b) Radars

c) Computers

Airways: While established at their cruising altitude, aircraft fly along predetermined flight paths. An area control centre provides control, information and alert services to aircraft flying along these airways.

The tools used by the approach control unit to manage traffic are:

a) Radios

b) Radars

c) Computers

Interface between the Three Types of Airspace

Each type of ATS unit provides services to aircraft during a different phase of the flight:

a) The control tower (Figure 29) deals with all departing IFR aircraft from the apron boundary to the time they are airborne. On arrival, they deal with aircraft from the time they are on final approach to the apron boundary. It also deals with VFR aircraft regardless of their position within the control zone.

b) The approach control unit deals with all departing IFR aircraft, from the time they leave the control tower area of responsibility to the time they are well established into the climb to their cruising altitude. For arriving aircraft, the approach control unit takes charge of aircraft from the time they are well established in their descent to the time they contact the control tower.

c) Finally, the area control centre deals with all IFR aircraft while at their cruising altitude, as well as the initial descent and the last portion of the climb.

Figure 29. Control Tower

Interface between ATS and the Airport

The airport operator has interface with the control tower mainly since this ATS unit is responsible for the control of aircraft operating on and near the airport, as well as vehicles operating on the manoeuvring area.

The areas of interface are:

a) Condition of the manoeuvring area (closures due to maintenance or construction, contamination caused by water, snow or ice).

b) Unserviceability of visual or electronic navigation equipment.

c) Presence of birds on or near the aerodrome.

d) Congestion in the air and on the ground, causing delays.

These issues require ongoing communication and consultation between the airport operator (normally through the Operations Division) and the control tower personnel. Such communication is vital in providing a safe and efficient service to customers. Table 4 presents a summary of ATS units and their responsibilities.

ATS Unit	Area of responsibility	Phase of Flight Involved
Control Tower	Control Zone	Ground, take off, landing
Approach Control	Terminal control area	IFR departures and arrivals
Area Control Centre	Airways	IFR Enroute

Table 4. Summary of ATS Units and Responsibilities

Secondary Power Supply

Most airside facilities and equipment that we described so far rely on electricity. Since many of them are in support of air safety, a continuous supply of electricity to these facilities should be available in case a power failure occurs.

Most airports rely on utility companies for their electrical needs. They are major customers, with a significant consumption. It is not unusual for an airport to have thousands of lights (runways, taxiways, approach lights, apron, parking lot and roadway floodlights, plus all the interior lighting lamps). Radio transmitters and receivers, and navigation aids also consume electricity.

When conducting an approach in low visibility conditions, pilots rely on electronic aids and on approach and runway lights. These are the only things that allow them to keep their aircraft properly aligned

Key Learning Point

Airside facilities require electricity. For safety reasons, a continuous supply of electricity should be available in case a power failure occurs.

in the air, and within pavement boundaries once on the ground. Can you imagine what would happen if all these lights would suddenly disappear in such a critical moment?

To avoid such a problem, airports should provide a secondary source of power, feeding all critical systems, automatically and with minimum interruption. In the case of a precision approach runway, the availability of secondary power is mandatory.

The various sources of secondary power are:

a) An alternate power line originating from a different power substation.

b) A standby power unit such as a generator or batteries.

When secondary power is supplied, it must feed the following systems:

a) Obstacle lights.

b) Approach, runway and taxiway lights.

c) Meteorological equipment.

d) Security lighting.

e) Equipment and facilities for the aerodrome emergency response agencies.

f) Floodlighting for aircraft stands.

2.2.2.3 Airside Commercial Tenants

Key Learning Point

Airside commercial tenants are subject to the same safety requirements as other airside operators.

In Module 1, you learned that there are some land tenants who, because of the nature of their business, need to be located on airside. There are two categories of airside tenants:

a) Enterprises who cater to aircraft on their property, such as freight terminal operators, airline maintenance bases, aircraft repair shops, fixed base operators and flight training centres.

b) Enterprises who need direct vehicular access to the airside for the purpose of servicing aircraft elsewhere. Examples of this category include flight kitchens, and fuel companies.

These enterprises need to comply with all aerodrome safety standards as they relate to:

a) Driving on the aerodrome.

b) Construction and maintenance activities on the land they occupy.

c) Working around aircraft.

2.2.2.4   Safety and Security

The airport operator should provide suitable means of protection against the intrusion on the aerodrome of:

a) Animals large enough to constitute a hazard to aircraft (safety).

b) Unauthorised persons (security).

Fencing: The most common form of protection meeting the above objectives is the provision of a perimeter fence of suitable height and material.

Fencing for security purposes should also apply to aeronautical facilities located off aerodrome, such as NDB, VORs, and radars.

Lighting: For added efficiency, security fences should be adequately illuminated if deemed necessary.

2.2.2.5   Obstacle Restriction and Removal

In Module 1, you learned that obstacles erected near airports might affect air safety. You will now learn more about this important subject.

Aerodromes and surrounding lands must be free of obstacles, to permit the safe operation of aircraft and to prevent the aerodrome from becoming restricted or unusable due to the erection of obstacles or natural growth.

In order to achieve these objectives, airports establish a number of imaginary surfaces, called Obstacle Limitation Surfaces (OLS) originating on the aerodrome and extending well beyond its boundaries. No object is allowed to penetrate these surfaces.

The path of aircraft needs to be protected from obstacles during the following phases of flight:

a) Take off and landing run.

b) Initial climb, immediately after take off.

c) Final approach, immediately prior to landing.

d) Missed approach.

e) Circling.

We are now going to describe the various surfaces used to ensure this protection.

Runway Strip: During the take off and landing run, while an aircraft is still on the ground, it may accidentally deviate from its trajectory and leave the paved area. In order to reduce the risk of damage, airports provide a **runway strip**, which is a rectangular area that includes the runway. It must be free of obstacles (Figure 30).

There are exceptions to this requirement: Some aeronautical equipment needs to be located on that area because of its function: runway lights, approach lights, signs, and the antenna for the localiser and glide path transmitters. As a compromise, these structures must be frangible: they will break on impact to present the minimum hazard to aircraft.

Take Off and Approach Surface: During their initial climb and particularly during their final approach, aircraft fly along a shallow slope (remember the glide slope of an ILS is set at 3 degrees). There is therefore a risk in having obstacles along these flight paths.

Airports can protect these paths by establishing a take off and approach surface. It is an imaginary slope, originating at the end of the runway strip and extending outward to distances up to 15 km for precision approach runways (Figure 31).

No object is allowed to penetrate this surface.

Transitional Surface: During the approach phase, pilots must sometimes abort their landing, go around and try again. This manoeuvre can be required in the following conditions:

a) The pilot cannot see the ground or the runway lights once he reaches minima.

b) The pilot conducted an unsuccessful approach (too long or off centre).

c) The runway is not clear (there is another aircraft or a vehicle on the runway).

d) There is too much crosswind for the capabilities of the pilot or of the aircraft.

e) The pilot decided to abort his landing because of the condition of the runway surface.

During the missed approach procedure, the aircraft may deviate from the centreline of the runway. This is especially possible in conditions of low visibility, strong crosswind, or failure of one engine.

In order to protect flight paths for some distance on either side of the runway, airports can establish a transitional surface. It consists of an imaginary surface, originating at the edge of the runway strip and extending upward at a 14% slope. No object is allowed to penetrate this surface (Figure 32).

Horizontal Surface: When manoeuvring at low altitude near an aerodrome or while conducting a Circling Procedure, aircraft must be protected from obstacles. This is achieved by establishing a Horizontal Surface. It is an imaginary surface, located 45 m above the aerodrome elevation, with a typical radius of 4 km. No object is allowed to penetrate this surface (Figure 32).

How do Airports Achieve this Protection? On Airport: The airport operator has the authority to control the erection of obstacles within the airport property. He can establish procedures to ensure that he is made aware ahead of time about any proposal to erect objects on the airport: buildings, signs, chimneys, or any other structure likely to affect air safety.

A good way of meeting this objective is to establish a permit system whereby any occupant of the airport must obtain an authorisation from the airport operator before erecting any obstacle, regardless of its height and location on the airport. This application will normally be reviewed by the Operations Division in consultation with any other organisation having an interest in this matter (ATS, CAA, etc.).

The purpose of this technical review is to assess whether the proposed obstacle meets the requirements of the Obstacle Limitations Surfaces (OLS). If compliant, the request will be granted and the new obstacle will be recorded.
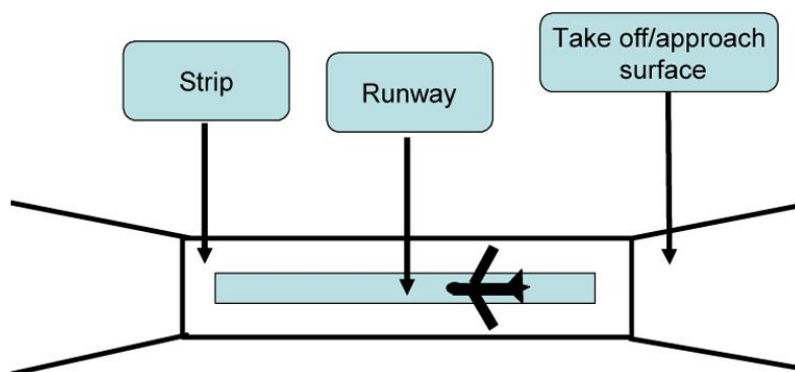
Figure 30. Runway Strip and Approach/Take Off Surface (Seen from Above)
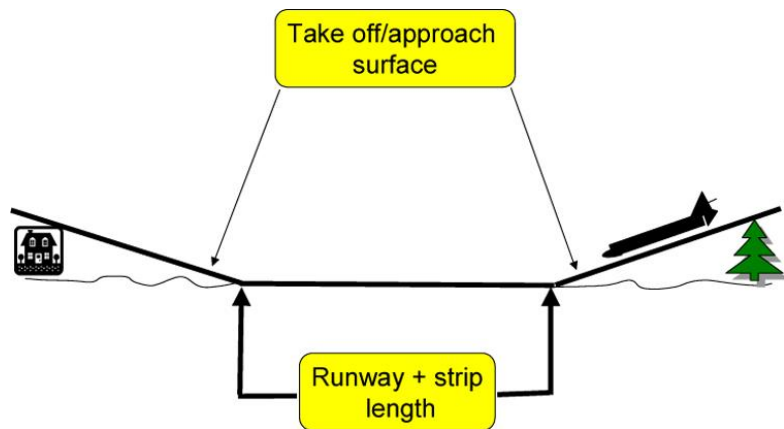
Figure 31. Runway Strip and Approach/Take Off Surface (Seen from the Side)
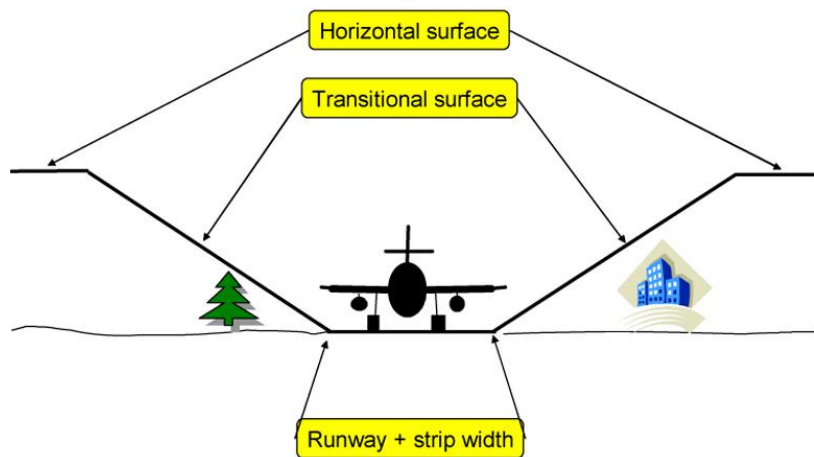
Figure 32. Runway Strip, Transitional Surface, and Horizontal Surface (Seen in Cross-Section)

Off Airport: Protecting OLS off airport is a more challenging issue. The airport operator has no power to prevent the erection of obstacles outside of the property he manages. However, several measures can be successfully implemented:

a) Consultation with all neighbouring municipalities and establishment of a procedure whereby the airport operator must review all development proposals submitted to the municipality. Technical assessment of proposals will be done using the same process as for the on-airport permit system.

b) Since municipalities might be reluctant to implement such a procedure, the airport operator must emphasise to officials the socio-economic problems that may result from non-compliance with OLS protection requirements (remember the economic benefits of airports).

c) Establishment of Zoning Regulations. It is possible to enact regulations embodying the requirements to protect OLS off airport. Once established, these regulations become law and they are enforceable. It should be noted, however, that they have no retroactive effect. Therefore, any existing obstacle must be removed or it will otherwise create some restrictions on aircraft operations (for example a displaced threshold).

d) Once zoning regulations have been established, it is up to the affected municipality to ensure that any development proposal complies with its provisions. If there is a doubt, the Civil Aviation Authority should be consulted for advice. In all cases, the municipality must inform the airport operator of the proposal.

e) Finally, the airport operator may secure an easement to protect a specific area, such as the final approach to a runway. In this case, he will have to negotiate with the property owner a financial compensation for any loss of enjoyment of his property.

If these negotiations fail, the airport may elect to purchase the property outright.

ICAO Type "A" Obstacle Charts: ICAO maintains a number of Regional Air Navigation Plans containing a list of designated International Airports. These airports are required to compile a number of data that include an inventory of obstacles located within the take off path of their runways.

This inventory must be kept current and re-validated every time new obstacles are erected, or at least every five years.

Progress Check 5

1. Name the obstacle limitation surfaces (OLS).

    _____

2.2.3 Operational Procedures of Airside

2.2.3.1 Safety

Safety means the absence of accidents through prevention. Accidents can cause:

a) Injuries or death of people.

b) Damage to property.

Accidents are very costly in terms of loss of life or assets, and social costs (disability compensation, insurance payments, loss of productivity, replacement of people and equipment).

For an organisation, an accident causes a substantial drain on resources, generated by staff time spent for investigations and enquiries, legal proceedings, and eventually legal suits. In this section, we will deal with both aspects of safety: aeronautical and human.

Safety is one of the most important concerns of airport management and employees. We will now examine its different aspects and the procedures necessary to facilitate its achievement.

Threats to Aeronautical Safety: Air transport is one of the safest modes of transportation. This is due in large part to the very stringent standards imposed by aircraft, aerodromes, and aircrew certifying agencies.

Aeronautical safety on the ground can be threatened by the following factors:

a) Pavement condition, such as the presence of standing water, snow, ice, and rubber deposit, on runways, taxiways, and aprons. Broken slabs or irregular surfaces can also affect the safety of aircraft operations.

b) Obstacles penetrating OLS or located within runway strips. These obstacles can exist due to several factors: negligence, ignorance, or natural causes.

c) Temporary obstacles caused by construction or maintenance activities: cranes, trucks, trenches, holes, barricades, and earth piles.

d) Broken or damaged ground facilities such as approach lights, signs, and faded markings.

e) Presence of debris on all surfaces.

f) Bird activity on and near airports.

g) Inadequate maintenance personnel or equipment, caused by lack of training or supervision, wrong equipment specifications, or lack of performance monitoring.

h) Finally, in-flight emergencies caused by human error, mechanical failures, fire, fuel shortage, or unlawful acts. Although these factors are unrelated to ground facilities, they require the deployment of resources by the aerodrome operator. This subject is addressed in more details in a subsequent section, titled "Aerodrome Emergency Plans".

Procedures to Reduce the Risk of Aeronautical Accidents: There are proven measures that can keep the risk of aeronautical accidents to a minimum. These measures include:

a) Ensuring the aerodrome continuously meets all the provisions of its certificate.

b) Carrying out regular inspections and audits of all aerodrome facilities and procedures, paying particular attention to obstacles, runway pavement condition and friction, visual aids, and emergency plans.

c) Promptly informing all affected parties if any non-compliance is detected.

d) Taking immediate corrective action to return facility to a safe condition.

e) Ensuring your aerodrome meets the appropriate standards for Rescue and Fire Fighting Services.

f) Developing a safety plan for any airside work contract.

g) Including all of the above procedures in your Aerodrome Manual for ease of reference and audit.

Risks to Human Health and Safety: Working on an aerodrome presents some inherent risks. The most common ones are:

a) Exposure to jet blast, jet engine suction and turning propellers.

b) Exposure to high noise levels.

c) Exposure to exhaust fumes from aircraft and vehicle engines.

d) Risk of being hit by aircraft, vehicles and ground support equipment.

e) Work in inclement weather conditions.

f) Exposure to lightning strikes.

g) Moving around on slippery surfaces.

h) Risk of falling from elevated devices.

i)   Working around chemicals and other hazardous products (fuel, aircraft lavatory waste, deicing fluids).

j)   Work in confined spaces (sewer manholes, tanks).

k)   Work around high voltage equipment.

l)   Work under pressure to meet stringent turnaround times for aircraft or to return a critical facility to operational status.

Procedures to Reduce the Risk of Accidents to People: The following measures will, if implemented and enforced, yield immediate results in reducing the risk of accidents to people:

a)   Be visible: wear approved safety vests everywhere on airside.

b)   Protect your hearing: wear ear plugs or other approved gear.

c)   Protect your head: wear a hard hat while working in construction areas.

d)   Protect yourself against falls: use proper safeguards or a safety harness.

e)   Be aware of your surroundings: watch for aircraft, vehicles and GSE.

f)   Wear protective gear when working with hazardous materials.

g)   Wear safety shoes.

h)   Do not work alone in a confined space.

i)   Use applicable safety procedures when working with electrical equipment.

j)   Wear clothes adapted to weather conditions.

k)   Install a lightning warning device, especially for work around refuelling activities.

l)   Train employees in safety procedures, promote safety, recognise safe records, and take disciplinary action when required.

These basic procedures should not eliminate the need to be fully familiar with applicable State or local work safety codes. This should be part of employee training. Another useful and often required tool is the establishment of a Safety Committee, with representatives from all areas dealing with safety.

2.2.3.1.1 Safety Management Systems (SMS)

A Safety Management System is a set of organisational measures and procedures designed to manage safety at an aerodrome.

Its objectives stem from the need for aerodrome certification: an SMS is established to ensure compliance with all safety requirements and to achieve continuous improvements in safety performance. Its key components are:

a) Statement of the overall safety policy for the aerodrome.

b) Structure and organisation of the SMS, and individual responsibilities.

c) Setting of performance targets.

d) Methods for communicating safety messages.

e) Special safety measures required in critical areas.

f) Measures for the promotion of safety and accident prevention.

g) Internal audit and review system.

h) Inventory of safety-related airport facilities including design, construction and maintenance of pavements and aerodrome lighting systems.

i) Staff training and competency.

j) Incorporation and enforcement of safety-related clauses in construction contracts.

2.2.3.1.2 Safety Plans during Maintenance and Construction

Construction or major maintenance activities on the aerodrome create potential risks that are inherent to this type of environment. This is particularly true when work is done by an outside contractor who may not be familiar with the aerodrome environment.[6]

Contrary to highway or building construction, where contractors have freedom of action within the limits of the construction site, airside construction work has security and safety ramifications. In this section, we will deal with the safety issue. The security aspect will be addressed in Module 3.

What makes Airside Work so Special? Construction work on airside does not appear to be different from off-airport work. However, the aerodrome environment creates many special conditions. The main ones are:

a) It affects the facilities used by aircraft.

b) The aerodrome must remain operational with as few restrictions as possible.

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[6] This statement does not imply that maintenance or construction work done by airport staff is not subject to the same safety conditions.

c) The progress of work is frequently hampered by scheduling constraints (work must be done around scheduled operations, or at night).

d) It causes unwanted obstacles near the movement area.

e) It causes unwanted hazards to the circulation of aircraft, such as closed areas, trenches, holes, and stock piles.

f) Working around aircraft can be hazardous for workers.

g) There is a general sense of constraint slowing down progress.

Procedures: In order to avoid unexpected problems upon start up of construction work, it is imperative to clearly spell out what safety requirements will apply during its execution. This will avoid counterproductive discussions between the contractor and the airport operator.

This is best achieved by developing a Construction Safety Plan including the above considerations. This Plan should be included in the tender documents. A tender briefing attended by potential bidders, the airport operator, ATS, aircraft operators, and if possible by a representative of the Licensing Authority will be helpful.

Bidders shall be requested to include in their proposal a description of the practical measures they intend to implement to meet the requirements of the Construction Safety Plan.

Contents of a Construction Safety Plan: The contents of a Construction Safety Plan may vary with the scope of work and the level of activity at the aerodrome. However, the Plan should include the following subjects:

a) Scope of work: what facilities will be affected, what work will be done.

b) Scheduled date and time of start up and finish.

c) If the work is to be phased, describe the different phases and timing.

d) Description of the operational impacts on all affected parties (a runway or taxiway may not be available, some stands may be temporarily out of service).

e) Mitigation measures to be implemented in order to reduce such impacts to a minimum (re-routing around closed areas, alternate parking stands, etc).

f) A description of the temporary markings, lights, markers, and other visual aids that will be installed to meet the provisions of ICAO Annex 14 and national regulations.

g) Designated areas where the contractor can safely store materials, equipment, and stockpile earth or gravel.

h) A guarantee that work will not prevent the Rescue and Fire Fighting Services from meeting their mandatory response time to aircraft emergencies.

i) Description of how the contractor's staff will access the construction site (by providing an escorted bus for example).

j) Names, telephone numbers and availability of key representatives from the contractor, so that they can be reached outside of working hours should the need arise.

k) Notification chain in case of changes in plan.

l) Requirement and timing to issue notification to affected parties.

Actions Required During Construction: It is incumbent upon the airport operator to carry out a regular follow up on safety measures required by the Plan:

a) Follow up on safety procedures.

b) Check proper installation of temporary markings, lights, and markers.

c) Monitor safety practices daily.

d) Promptly discuss specific concerns with the contractor.

e) Ensure the safe movement of vehicles and people.

f) Review level of restriction to aircraft and vehicular activity.

2.2.3.2   Inspections and Audits

In the Section titled "Aerodrome Certification" you learned that one of the responsibilities of the aerodrome operator is to conduct audits and inspections. We are now going to learn more about this subject.

An audit is a verification of documents and procedures by experts, while an inspection deals with the verification of physical facilities by the Certifying Authority.

Scope: Audits will ensure that the aerodrome's SMS is appropriate for its type of activities; they will ensure that the data published in AIP are current; inspections will deal with the visual verification of all facilities of the movement area, rescue and fire-fighting facilities, fuel facilities, and a night inspection for verification of aerodrome lighting systems.

Responsibilities: Audits and inspections are conducted by the CAA at regular intervals, usually once a year, less for smaller

aerodromes. The objective of these verifications is to ensure that, at the time of verification, all safety procedures and facilities are in compliance with the applicable provisions of the airport certificate.

However, since the provision of a safe aerodrome is a continuing requirement, the aerodrome operator must conduct regular internal verifications, to establish with certainty and on an ongoing basis that his aerodrome is in permanent compliance.

This is best done by staff from the Operations Division, assisted by technical experts from various disciplines such as civil and electrical engineers, and safety personnel.

2.2.3.3 Airside Vehicle Operator Training Programme

Maintenance and operations activities require the regular presence of vehicles and equipment on airside for several purposes:

a) Inspections, maintenance and repairs.

b) Transport of personnel, parts, equipment.

c) Aircraft ground handling (baggage, cargo, fuelling, catering, etc.).

This type of vehicular operations substantially differs from highway driving because:

a) Most of these tasks are performed in areas where vehicles and aircraft share manoeuvring surfaces.

b) The presence of vehicles near the manoeuvring area constitutes obstacles.

c) The driving environment is unfamiliar especially at night.

d) On controlled aerodromes, the operators of these vehicles are required to use radiotelephony communications.

Airside Vehicle Operator Permit (AVOP): In light of the above considerations, the operation of vehicles on airside requires special qualifications on the part of operators. Since these qualifications are not part of a regular driver's license requirements, airport operators must develop and implement procedures leading to the issuance of a site-specific Airside Vehicle Operator Permit.

Training of Operators: An important aspect of this process is training. The airport operator should develop a comprehensive training program for all operators, regardless of their responsibilities or employer. This program should include the following items:

Knowledge: The applicant should be fully familiar with the following information:

a) Geography of the aerodrome.

b) Aerodrome signs, markings, and lights.

c) Radiotelephony procedures.

d) Rules of traffic services as they relate to priorities.

e) Other relevant airport rules and regulations.

f) Special rules that may apply to some specialties such as rescue and fire fighting.

Competency: In addition to theoretical knowledge, the applicant should acquire the following practical competency:

a) Proper operation of radiotelephony equipment.

b) Understanding and complying with ATS instructions and authorisations.

c) Vehicle navigation on the aerodrome.

d) Special skills required by particular functions.

e) Possession of a valid State driver's license.

f) Possession of a valid State radio operator's license.

Bringing an operator up to this level of qualification is time consuming and expensive. Therefore, it may not be necessary to train all operators to the same level. For example, operators whose responsibilities are strictly limited to aprons may be trained to a more basic level, consistent with aerodrome safety considerations.

Training Requirements: Airport operators should develop a formal training package and a follow up process, arranged in the form of a training plan. It should include the following steps:

a) Training by a qualified instructor.

b) Self-study of theoretical aspects.

c) Theoretical and practical testing.

d) Issuing of permit.

Since the possession of such permit is a requirement for some positions, AVOP training should be integrated in hiring procedures (a new employee will not be authorized to carry out his full functions until he is fully qualified).

Management of AVOP Programme: Issuing a permit should not be the end result. There is a continued requirement to ensure that aerodrome safety is not jeopardized. This should be done through:

a) Enforcement by the appropriate authority (airport operator or police).

b) Corrective action when non-compliance is observed or reported (feedback, re-training and testing, follow up).

c) Disciplinary action if warranted (suspension or cancellation of permit).

d) Recognition of operators with impeccable driving record.

e) Promotion of aerodrome safe driving habits.

f) Validity of permit (operators must be re-tested at regular intervals to ensure a consistent level of competency).

2.2.3.4 Aerodrome Emergency Response Plans

In Module 1, you learned that planning means being ready for the future. Nowhere is this statement more valid than in the area of aerodrome emergencies. It involves the preparation of the airport to cope with an aviation emergency on the aerodrome or in its immediate vicinity.

Emergencies include:

a) Aircraft emergencies (fire, crash, fuel shortage, engine failures).

b) Unlawful interventions (seizure, bomb threats, sabotage).

c) Dangerous goods occurrences (radioactive materials or explosives on board aircraft).

d) Building fires (terminal building, control tower, maintenance facilities)[7].

e) Natural disasters (hurricane, flood, earthquake).

How to Cope? No matter how well equipped an airport is, it is unlikely to succeed in responding with full efficiency to an actual emergency, unless the following four conditions are met:

a) Having a comprehensive and current emergency plan.

b) Having repeatedly tested the procedures contained in this plan through realistic exercises.

c) Having qualified and competent emergency response personnel.

d) Having formally secured the assistance of off-aerodrome specialised agencies.

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[7] Aerodrome Rescue and Fire-Fighting Services are not necessarily trained and equipped to fight structural fires. In this case, the operator will make formal arrangements with the most appropriate external structural fire-fighting service.

The Aerodrome Emergency Plan: ICAO requires that aerodromes establish an emergency plan commensurate with the type and level of aircraft activities taking place at the aerodrome.

The objective of such a plan is to save lives, minimise the effects of an emergency, maintain normal aircraft operations, and return the aerodrome to its normal status as quickly as possible. It should address three important concepts:

a) Be prepared, by defining procedures and assigning responsibilities.

b) Follow these procedures in a real emergency or during an exercise.

c) Learn from weaknesses observed during an emergency or an exercise.

Contents of the Aerodrome Emergency Plan: The aerodrome emergency plan should include the following sections:

a) Types of emergencies covered in the plan.

b) Procedures applicable to each type of emergency.

c) Agencies involved in the plan.

d) Responsibilities and roles of each agency.

e) Names and telephone numbers of key people to be contacted for each type of emergency.

f) A grid map of the aerodrome and of its vicinity for ease of reference.

Need for Logistical Resources: Each aerodrome should establish an Emergency Operations Center (EOC). Its role is to ensure the overall interagency coordination and management of emergencies.

A mobile Command Post (CP) should also be established to ensure on-site coordination.

Finally, a person or persons should be designated to assume the overall control of the Emergency Coordination Center and of the Command Post.

The successful coordination of an emergency rests with good communications (radio, telephone) between the EOC, the CP, and all internal and external agencies involved.

Assistance from Other Agencies: Aerodrome operators must coordinate the response to emergencies with a number of specialised agencies, who will contribute to the successful resolution of the emergency. The type and number of such

agencies varies with the size and complexity of the airport. However, the most common ones are:

a) ATS

b) Aircraft operators

c) Fixed Base Operators

d) Police

e) Security

f) Medical and ambulance services

g) Fire departments

h) Hospitals

2.2.3.5   Aerodrome Maintenance

Now that you have learned about all the facilities and systems that make up an aerodrome, you may be wondering about how airport operators can keep all this technology running smoothly all the time.

We are now going to discuss the many tasks that an airport operator must carry out to ensure safety, regularity and efficiency of aircraft operations.

To meet this objective, the airport operator should establish a comprehensive maintenance program, addressing the following facilities and issues.

Pavement: Runways, taxiways and aprons bear the weight of aircraft weighing up to a 350 tons. The impact of such weight upon landing is tremendous and imposes a high stress on pavement. However, runways are designed to withstand this wear and tear: they are made of a thick layer of concrete or asphalt overlaid on top of a strong sub-base made of crushed stone.

In order to keep these pavement surfaces in safe condition over their life time, two types of aerodrome maintenance are required:

a) **Preventative:** done at regular and predetermined intervals. Replacement of specific pieces of equipment, regardless of their apparent condition, prevents failures requiring urgent attention and potentially causing the temporary closure of facilities.

b) **Corrective:** done when something breaks down or becomes unsafe.

The following maintenance procedures must be carried out on the movement area:

a) Sweeping to remove debris that can cause damage to engines and airframes and may be an early sign of pavement deterioration.

b) Sealing cracks to prevent surface water from seeping into the pavement base and weakening it.

c) Repairing eroded runway or taxiway edges.

d) Correcting irregularities such as uneven slabs that can cause vibrations and damage to undercarriages.

e) Measuring pavement friction to ensure that the runway provides adequate breaking action. Friction can be reduced by contaminants such as rubber deposit (from tires), snow, ice, slush, and standing water.

f) Removing contaminants that reduce friction. This is done through ploughing and sweeping in the case of snow, use of chemicals to melt ice, and various chemical or mechanical measures to remove rubber deposit. Standing water must be prevented or removed through adequate drainage and sweeping.

g) Restoring faded paint markings.

Visual Aids: With hundreds of lights to maintain, this is a time-consuming task. For approach and runway lighting, there is a maximum number of lights that can be out of service at any given time. Preventative maintenance is key for these facilities. Bulbs are replaced before they fail so that there is no interruption in service.

Electronic Aids: Although this is normally not an aerodrome operator's responsibility, you should know what maintenance is required on electronic aids.

The strength and quality of the signal must be periodically checked. It is done through direct tests of the equipment by expert technicians, and from time to time, by flight-checking the signal with specially-equipped aircraft.

Grass: Grass on runway strips must be kept short so as to maintain an even, smooth surface. Outside of strips, the height of grass should be monitored in accordance with bird hazard management techniques and to display a sense of occupancy and cleanliness.

It is best done using fast, commercial grass mowers that can cover large areas in a minimum amount of time (the presence of equipment near runways constitutes an obstacle).

Fences: Aerodrome fences must be inspected regularly (at least daily) to ensure that their integrity is not affected. Possible problems may include damage by vehicles or equipment, attempted intrusion, or vandalism.

Security fences must be kept free of vines and tall grass to make trespassing more difficult and easier to detect. The best method is the application of a chemical weed killer (if local regulations allow), complemented by mechanical removal if required.

It is a good practice to provide a patrol road along fences to facilitate inspections.

Obstacle Limitation Surfaces: In spite of a good monitoring system, obstacles can appear on and near airports:

a) Construction cranes

b) Light posts

c) Tall buildings

Natural growth is more insidious because of its unnoticeable rate of growth. However, trees can become obstacles that must be removed promptly or they can affect the aerodrome certificate.

To prevent this problem, it is a good practice to regularly drive around the aerodrome and its surroundings, to detect new obstacles as soon as possible. This can be supplemented by feedback from air traffic controllers who, because of their prime location, have a good view of the aerodrome and its approaches.

What to do if an off-Aerodrome Obstacle is Discovered? The following actions are required:

a) Immediately inform ATS and the CAA.

b) Implement Aeronautical Information process.

If the OLS are protected by Zoning Regulations, contact the municipality who issued the building permits. Advise of the non-compliance situation and request corrective action. In cases of mobile obstacles such as cranes, have them lowered.

If the OLS are not protected by Zoning Regulations, your only recourse is to ask that the obstacle be removed. However, there is no assurance that your request will be complied with. As a result, the usable length of the affected runway may be reduced. This illustrates the benefits of implementing Zoning Regulations.

Presence of Birds: The person inspecting the aerodrome must immediately report the presence of birds to the control tower and to the person responsible for wildlife control at the airport. The location and number of birds may require that aircraft be momentarily held or re-routed to another runway.

2.2.3.6   Wildlife Control

This issue relates to the hazard of collisions between aircraft and animals, in flight and on the ground.

Although large mammals have caused damage to aircraft during the take off or landing run, the major problem is caused by collisions with birds.

Such collisions have caused major air disasters. They also cause airlines substantial damage on engines and airframes, with the ensuing repair and unserviceability costs. It is therefore a very serious question.

Airports do not cause the presence of birds on and near their property. However, after collisions causing death or damage, courts have consistently ruled that the airport operator is responsible to take any appropriate measure to reduce the presence of birds on and near airports. This sounds like an impossible task. However, there are some proven measures and procedures that do yield tangible results.

What Attracts Birds on Aerodromes? Aerodromes are vast expanses of land with relatively low activity. Birds feel safe in such an environment and they use it for loafing (sitting about).

Aerodromes provide food and water (insects, small mammals, worms, waste, standing water).

Trees, shrubs, and buildings provide habitat and nesting.

Birds fly over aerodromes while going between feeding points and habitat sites, although they may be located at a significant distance from the aerodrome.

Procedures on how to Reduce Bird Hazard: It is incumbent upon the aerodrome operator to take steps to deal with bird hazard. He should follow a number of standard steps:

a)   Understand the Problem

The first step is to assess the level of risk by collecting data on reported bird strikes. Aircraft operators often keep track of such occurrences. Data collected should include the date and time, the location of the strike in relation to the aerodrome, its

altitude, and weather conditions. It may be possible to identify the bird specie from crew reports or from discovery of bird remains by airport personnel.

Monthly and annual statistics are then developed to identify the magnitude and characteristics of the problem.

b) Implement Reduction Measures

Removal: Birds can be killed with firearms, poisoned or trapped. These measures may require special authorisation from police and wildlife conservation authorities.

Deterrence: The following measures are commonly used:

a) Auditory: pyrotechnic devices, gas cannons, recorded distress calls.

b) Visual: dead or model birds, trained falcon.

c) Chemical: repellent products.

Exclusion: Standing water in ditches or low-lying areas attracts waterfowl such as ducks. Installing wires or horizontal fences over these water points will prevent birds access.

If the presence of large mammals on the aerodrome is a problem, it may be necessary to install high fences in critical areas (some species can easily jump over a 2 m fence).

Habitat Modification: The following measures are commonly used:

a) Control garbage on and near the aerodrome (this can be part of Zoning Regulations).

b) Remove features that attract waterfowl: remove standing water, improve drainage.

c) Remove berry-producing trees and shrubs.

d) Remove trees and shrubs that foster nesting and loafing.

e) Modify building structures that attract birds: ledges, sills, overhanging roofs. This is better done at the design stage. Alternatively, wire mesh can be installed if an existing building attracts birds.

f) Control the height of grass on the aerodrome. Birds tend to feel less secure while standing on short grass, where they are an easy prey for predators.

What Works Best? All the above methods have advantages and disadvantages. Some measures (such as keeping the grass short) will attract grasshoppers that will, in turn, attract some species of

birds; conversely, tall grass may attract small mammals that will, in turn, attract birds of prey.

Birds become habituated to scare tactics: after few days of high scare, they will get closer and closer to scaring devices.

Bird activity near the aerodrome is very difficult to control.

What is the Solution? The airport operator should develop a Wildlife Control Plan. This plan should include the following subjects:

a) Statistics on bird strikes.

b) Inventory and behaviour of bird species (it may be useful to solicit the advice of an ornithologist).

c) Implement more that one method and rotate them; move scaring devices around the aerodrome.

d) Make one person responsible to implement the Plan.

e) Establish a Bird Hazard Clause in your Zoning Regulations (prohibit land uses that attract birds: garbage dumps, waste disposal sites, fish processing plants, and some agricultural uses).

2.2.3.7   Environmental Protection Management

Airports are industrial enterprises that can be a source of pollution for the natural environment and human health. These negative effects exist on airport property, but they can be felt at a considerable distance outside of its boundaries. It is therefore vital that airport operators adopt measures that create equilibrium between the needs of the airport, of the local communities, and of the natural environment. This is challenging goal but there are many examples of successful achievements in this regard.

Many States have developed environmental protection laws and regulations. Airports must therefore abide with the provisions of this legislation, not only because it is the law but also to be good corporate citizens and partners in the regional environment.

The components of the natural environment that airports can affect are:

a) Air

b) Water

c) Soil

d) Fauna and Flora

There are also impacts on human health such as noise. However, this subject will be dealt with under Aircraft Noise Management.

We will now review what sources of pollution can affect these components and you will learn about the measures that can be implemented to eliminate or mitigate these unwanted effects.

Air: From a public perspective, the most obvious source of airport air pollution is exhaust gases from aircraft engines. However, studies have demonstrated that the main source is in fact vehicle engines, such as cars, buses, trucks, and airport equipment.

Modern aircraft are not only quieter than older types, they are also more fuel efficient and less polluting. You can visually verify this fact by observing different aircraft types take off: older types emit a very visible plume of dark smoke, while no smoke is visible from newer generation types.

Heat generation plants can generate smoke. Construction and maintenance activities may generate dust or smoke which can affect air quality.

Procedures: The following measures contribute to the improvement of air quality:

a) Convert airport equipment to propane gas or electric. It produces less pollution than gasoline or diesel. This is particularly useful in constrained or closed areas.

b) Avoid prolonged idling of vehicles while waiting.

c) Reduce vehicular congestion, which causes unnecessary idling.

Water–Hydrocarbons: The main risk of water pollution at airports comes from fuel and oil spillage. Operators store and handle large quantities of fuel, oil and hydraulic fluid. They carry out aircraft refuelling and maintenance with care. However, there are numerous daily fuelling operations; they regularly transfer fuel from storage tanks to fuel trucks and transport it from the fuel depot to the apron, thereby increasing the risk of spillage.

It takes very little fuel or oil to harm the environment. Few litres that find their way into a storm sewer pipe are sufficient to pollute water streams several kilometres from the airport.

De-icing Chemicals: Airports located in cold climates need to use de-icing chemicals for several reasons:

a) Remove ice, snow and frost from aircraft surfaces prior to take off, using a mix of water and chemical antifreeze.

b) Remove or prevent the formation of ice on the movement area and on roads, using various solid or liquid chemicals, or salt (on landside only).

Some of these chemicals have harmful effects on aquatic life, especially on fish and vegetation.

Bacteria: Another potential source of water pollution is bacteria. They can originate from a variety of sources. The most common ones are seepage from sanitary sewer pipes and from food waste containers.

Sediments: Sediments are not really a cause of pollution. However, their presence in streams is often regulated and must be kept within specified limits.

Temperature: Environmental regulations often require that airport effluents do not increase the existing temperature of streams as it may affect the health of aquatic plants or animals

Soil Pollution: The main source of soil pollution originates from leaking underground fuel or oil tanks and from slow but repeated fuel or oil leaks from parked vehicles and equipment. It is particularly insidious because its effects are not discovered until soil is excavated.

Fauna and Flora: The main effects come from construction and maintenance activities. Any addition of paved surfaces such as the extension of a runway, road or car parking lot reduces the amount of grass, trees and shrubs. This may affect or destroy the natural habitat of animals.

Recommended Operational Procedures: The following measures contribute to reducing the impact on the fauna and flora:

a) Prohibit washing and maintenance of vehicles, aircraft and equipment, outside of designated areas.

b) Contain, collect and remove spilled fuel, oil, and hydraulic fluid. Make the polluter responsible for corrective actions and for any cost associated with these actions.

c) Install and maintain approved fuel and oil interceptors on storm sewer pipes, especially on aprons, in fuel depots, and in vehicle, aircraft and equipment maintenance areas.

d) Conduct de-icing activities in areas where spent fluids can be recuperated. An added advantage is that spent chemicals can be recycled and re-used.

e) Use environment-friendly runway de-icing chemicals.

f) Ensure the integrity of sanitary sewer pipes.

g) Store food waste in sealed containers.

h) Provide a settling pond if water run off carries sediments or if warm water is regularly released.

i) Adopt a policy requiring the use of above-ground double-walled tanks or tanks with an appropriate containment barrier.

j) Ensure that construction projects take into account expected effects on the local environment.

k) Develop and implement a policy making it mandatory to carry out an environmental impact assessment as part of the planning of any construction or maintenance project. This extra effort will yield invaluable benefits down the road.

l) Monitor air, water and soil quality in accordance with all applicable laws and regulations. Ensure that regulated limits are met. Take corrective action if required. Share your results with the appropriate regulatory agency.

m) Reduce the amount of waste (re-use and re-cycle).

n) Implement an Environmental Protection Plan incorporating the above procedures.

2.2.3.8 Foreign Object Damage (FOD)

Key Learning Point

The highest risk area for Foreign Object Damage (FOD) is the apron because it is where the highest level of activity occurs.

This term designates damage caused to aircraft engines and airframe by Foreign Object Debris. Damage can also extend to buildings, equipment, and cause injury or death to personnel working around aircraft.

FOD damage is caused by objects that do not belong to the aerodrome and that can be:

a) Ingested by jet engines

b) Blown away by jet blast or propeller wash and thrown onto other aircraft, equipment, buildings, or people.

The highest risk area is the apron because it is where the highest level of activity occurs. However, FOD can also be found on runways and taxiways.

Examples of FOD: The following objects are regularly found on an aerodrome:

a) Baggage tags

b) Suitcase caster wheels

c) Plastic coffee cups

d) Tools, wrenches

e) Nuts and bolts

f) Plastic wrapping

g) Loose pavement

h) Aluminium cans and plastic bottles

What is the Source of FOD? FOD is generated by equipment and materials used by agencies that carry out work on the aerodrome:

a) Caterers/Flight Kitchens

b) Ground handlers

c) Fuelling companies

d) Airlines

e) Airport maintenance

f) Construction and maintenance contractors

g) Any agency having a presence at the aerodrome

What can be done about it? FOD can be reduced in two ways:

a) Avoidance

b) Removal

Avoidance is the most effective method. For example, employees who work around aircraft should ensure that they do not leave loose objects lying around. Removal will avoid damage.

FOD can be controlled through a coordinated effort between all involved agencies. It can be achieved by training, inspections, and maintenance coordination.

Employees must be made aware of the safety and financial effects of FOD.

Inspect work areas, pick up FOD.

Install magnetic bars on GSE and other vehicles. They will collect any piece of iron lying on the ground.

It is a matter of attitude. FOD is everybody's business.

Use well-identified FOD containers and empty them regularly.

FOD Control Plan: Prepare and implement an FOD Control Plan in consultation with all affected agencies.

Recommended actions include:

a) Statistics on reported FOD damage or injuries.

b) Regular inspection of key areas.

c) Training and promotion.

Key Learning Point

All noise abatement procedures have negative effects on airport customers. Therefore, the best alternative is prevention of noise problems through land use compatibility. When done at the planning stage, it eliminates downstream operational, financial and public relation difficulties.

2.2.3.9   Noise Management

Airports generate no noise, aircraft do. However, aircraft noise is probably the most significant operational challenge facing airport management. It is a worldwide problem dating back to the advent of the commercial jet age in 1958. It was first officially acknowledged in 1966 at the International Conference on the Reduction of Noise and Disturbance Caused by Civil Aircraft.

The problem grew steadily over time and it has become a major public concern and a constraint to airport development.

Aircraft noise interferes with normal life and distracts from the enjoyable use of one's property. It is a subjective problem because different people react differently to aircraft noise: some do not seem to be bothered while others find it intolerable. Noise has adverse physiological and psychological effects on people. It is therefore a sensitive issue.

ICAO developed Annex 16 (Environmental Protection–Volume I–Aircraft Noise) dealing exclusively with this issue. It includes a number of measures that can alleviate this problem.

Measures to Reduce Exposure to Aircraft Noise: The problem of aircraft noise can be mitigated through four types of measures:

a) Prevention at the source (quieter aircraft engines).

b) Control of Noise Exposure near Airports (land use compatibility).

c) Noise Abatement procedures (flight paths, hours of operations, ground noise).

d) Noise insulation program or expropriation (to reduce indoor noise level or remove incompatible land uses).

Prevention of Aircraft Noise at the Source: Several measures exist that have already contributed to the reduction of aircraft noise:

a) New aircraft types and imported used aircraft must be certificated by the appropriate State authority before entering service. Part of this certification process deals with noise emission levels.

b) Phase out of noisy aircraft (they are known as "Chapter 2" aircraft)[8]: ICAO coordinated the phase out of the noisier aircraft types in all Contracting States effective April 1, 2002.

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[8] They are listed in Chapter 2 of ICAO Annex 16–Part 2. The quieter aircraft types, listed in Chapter 3 are referred to as "Chapter 3". The first generation jet aircraft were listed in Chapter 1 and are no longer in service).

Chapter 3 aircraft are noticeably quieter than Chapter 2 aircraft (up to 75%). You can easily perceive this difference by listening to the noise level generated during take off by two different categories of aircraft, a Chapter 2 and a Chapter 3 aircraft.

Control of Noise Exposure Near Airports: This is where the airport operator can really make a difference.

In Module 1, you learned that airports could generate negative impacts on their neighbours. Noise is one of them. One way of alleviating this problem is to ensure that municipalities near airports do not permit the establishment of noise-sensitive developments such as residential or institutional uses (houses, apartment buildings, schools, hospitals, retirement homes, auditoriums, etc).

Similar to the height restriction issue that you just learned about, airport operators have no power to prevent the establishment of noise-sensitive developments near them. Accordingly, they must ensure, through a proper consultative planning effort, that land uses near their airport are compatible with existing and forecasted airport operations.

Although the types of land uses that are sensitive to aircraft noise are easy to determine, it is more difficult to lay down on a map the areas near airports where noise levels are deemed too high.

ICAO developed a standard unit of noise measurement called the Effective Perceived Noise Level (EPNL). Some States have developed their own system. However they all have the same objective: to translate the various components[9] that make up perceived aircraft noise into an index. A maximum acceptable value is assigned for each type of land use. This value can then be represented on a map of the area surrounding the airport. From this map, it is then easy to determine areas where the municipality should not allow noise-sensitive developments (Figure 33).

This can only be achieved through persistent effort on the part of the airport operator. Municipalities may acknowledge the short-term benefits of new developments in terms of local taxes, but ignore the long term socioeconomic problems caused by aircraft noise on residents; unhappy residents may apply pressure on the municipality to prevent aircraft operations during quiet hours. Here again, the airport must demonstrate to municipal officials that the airport must be allowed to operate and develop free of constraints, within reasonable limits.

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[9] Noise intensity, duration of the noise, number of times it is repeated, and time of day or night.
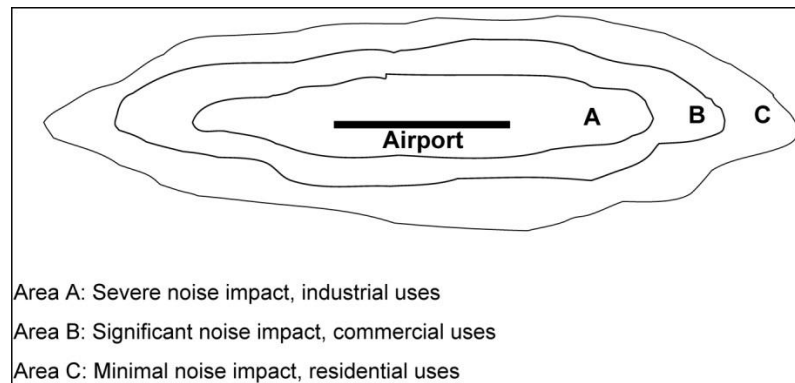
Figure 33. Noise Exposure Contours

Noise Abatement Procedures in the Air–Restrictions to Hours of Operations: To reduce noise during quiet hours, the operation of noisy aircraft can be prohibited. It is called a curfew. Curfews are typically established between 11:00 P.M. to 07:00 A.M.

Establishment of a Landing Fee Surcharge: As a deterring measure, airports can establish a higher landing fee for the noisier aircraft types operating during quiet hours.

Use of Preferential Runways: If a less than optimal runway orientation affects fewer people, it should be used as a preferential runway, within the limits of air safety (take off length required and crosswind limitations).

Minimum Noise Routings: This procedure calls for changes in aircraft heading after take off so that they fly around noise-sensitive areas.

Reduced Power after Take Off: A power reduction after a safe altitude has been reached will decrease the noise level emitted by the engines. This procedure has safety limitations because it calls for a reduction in engine power at a time when the aircraft needs to accelerate to its climb speed.

Noise Abatement Procedures on the Ground-Engine Run-Ups: Aircraft operators often take advantage of night time to carry out engine maintenance. This work sometimes requires that a pre-flight engine run up be done. It consists in starting up the affected engine and running it for some time at various power settings to ensure its serviceability.

This major source of complaint occurs when noise-sensitive land users exist near the airport. The airport operator can therefore decide to designate a remote area of the airport as a run up point.

Alternatively, run ups may be banned during certain hours, or be limited to low power settings.

Thrust Reversal: After landing, jet aircraft need to decelerate as quickly as possible. In addition to applying brakes, the pilot can use a device called a thrust reverser. It is a system that redirects the engine thrust forward, thereby causing deceleration.

When used at night, this burst of engine power can be a nuisance. This procedure can be banned during certain hours, within the limits of air safety.

Impact of Noise Abatement Procedures on Aircraft and Airport Operators: The measures explained above have a number of negative impacts:

a) Increased distance translating into extra flight time and fuel cost.

b) Higher operating costs.

c) Added complexity in flight procedures for flight crews.

d) Constraints in meeting market demand when curfews are in effect.

e) Constraints on engine maintenance schedules.

f) Waste of available airport capacity.

In light of the above considerations, ICAO requires that noise abatement procedures not be introduced unless there exists a demonstrated noise problem. If deemed warranted, such procedures should be developed after due consultation with aircraft operators (through the AOC), ATS, and the CAA.

Sound Insulation Program and Land Purchase: In some cases, airport operators or governments may provide a grant to be used to add features such as double window glazing or other sound-proofing techniques. This can be quite expensive and it does not reduce outdoor noise levels.

Finally, in extreme cases, airports may purchase lands that have become subject to unacceptable noise levels. Needless to say that this avenue is very expensive and highly unpopular. It should only be considered as a last resort and in cases where living conditions have become unacceptable and the survival of the airport is at stake.

Noise Monitoring: Noise being a subjective matter, airport operators should collect facts relative to noise complaints from the public. One of the tools that can be used to that effect is a noise

monitoring system. Available technology ranges from simple microphones located at specific points in areas affected by aircraft noise, to highly sophisticated computers that record noise on a continuous basis and correlate the information with specific flights by displaying them on a live screen. Data are recorded and can be played back if and when a complaint arises.

These systems allow the airport operator to monitor the noise situation, to identify non-compliance with noise abatement procedures and take corrective action, and to provide complainers with factual feedback.

Communications with the Public: From a public relations perspective, the key ingredient in managing a noise problem is to be attentive to those people who suffer from it. This can be done on an individual basis or through a noise management committee if the severity of the problem warrants. Care should be exercise in inviting the public to such committees. It is best to invite one representative who can speak on behalf of his neighbourhood than to face an emotional crowd.

Using factual feedback provided by a noise monitoring system goes a long way toward removing the subjective aspect of noise complaints.

Noise Management Plan: All implemented procedures designed at mitigating noise problems at your airport should be organised in an official document called a Noise Management Plan, to be developed in consultation with aircraft operators, ATS, and the CAA.

This Plan should include the following aspects:

a) Statistics on noise complaints and trend.

b) List of current and proposed aircraft types serving the airport.

c) List of implemented prevention and mitigation measures.

d) Enforcement actions.

e) Public consultation.

Conclusion: All noise abatement procedures have negative effects on airport customers. Therefore, the best alternative is prevention of noise problems through land use compatibility. When done at the planning stage, it eliminates downstream operational, financial and public relation difficulties.

Noise management is a time-consuming activity requiring substantial manpower and equipment particularly if aircraft noise is a major problem in the community.

2.2.3.10 Apron Management

Apron management consists of the following activities:

a) Control of aircraft and vehicles operating on the apron

b) Allocation of aircraft stands

c) Monitoring safety of operations

Control of Aircraft and Vehicles: When the density of aircraft and vehicular traffic, and the complexity of the apron layout warrant, apron control should be provided to maintain an adequate level of safety.

The objectives of this service are to:

a) Prevent collisions between aircraft and between aircraft and vehicles.

b) Regulate the circulation of aircraft on the apron and the entry into and exit from the apron of aircraft, by coordinating with ATS.

c) Ensure the safe and expeditious movement of vehicles.

d) Monitor the safety of operations on the apron, especially on stands.

Apron Control may be provided by one of the following agencies:

a) ATS, through an agreement with the airport operator.

b) The airport operator.

c) A third party on behalf of the airport operator.

The main tool used to provide Apron Control service is radiotelephony.

Allocation of Aircraft Stands: This activity consists in planning the allocation of incoming aircraft to specific stands, using predetermined rules and procedures, and in resolving operational conflicts caused by:

a) Early arrivals.

b) Late departures.

c) Changes in type of aircraft.

d) Closure of stands due to maintenance, construction, fuel or oil spills, and other operational irregularities.

e) Unexpected arrivals caused by diversions from other airports.

This service can be provided by one of the following agencies:

a) The airport operator.

b) An airline, if it owns or operates its own terminal, or uses dedicated stands.

Basic Stand Assignment Rules: Three categories of assignment rules exist:

a) **Dedicated assignment:** specific stands are reserved for specific operators. This system benefits airlines because they will always operate from the same general area. However, from an airport operator's perspective, it provides limited assignment flexibility: a flight may have to wait for a stand while there is a free but inaccessible stand.

b) **Common assignment:** any flight can be assigned to any stand, within the constraints of aircraft/stand compatibility and access to Government Control facilities for international arrivals. However, it provides maximum flexibility for the agency responsible for stand assignment. For a given peak demand, it requires the smaller number of stands.

c) **Preferential assignment:** this is a modified common use method. Airlines with high volumes of traffic are given priority over the stands they use most often. It provides good flexibility of assignment while providing the major airlines with some operational benefits.

When it comes to the assignment of stands, it is important to establish clear and well-understood rules. The idea is to provide equitable access to stands, within operational constraints.

Here are some basic procedures that will help provide an efficient service to customers:

a) Stands should be assigned so as to provide the shortest walking distance for the greatest number of passengers.

b) Aircraft compatible with a loading bridge should be given priority for a bridge-equipped stand over a non-compatible aircraft.

c) Regular flights should have priority over charter flights or technical stops

Monitoring Safety of Operations: The stand assignment unit is generally located in a control tower-like cab, with good view over

the entire apron. This must sometimes be complemented by remote cameras when blind spots exist.

Given this vantage position, the stand assignment unit can monitor all apron activities and rapidly detect any unsafe or irregular activities taking place within this area.

Some examples of such irregular operations are:

a) Lack of adequate clearance between parked aircraft.

b) Fuel or oil spills.

c) Presence of FOD.

d) Suspicious or unsafe practices (smoking on the apron, vehicle speeding, non-compliance with apron service roads, etc.).

Key Learning Point

Operational Procedures provide practical measures to deal with aerodrome operations, in regular and irregular conditions. The main procedures deal with safety, emergencies, security, maintenance, environmental protection, aircraft noise management, apron management, and aeronautical information publications.

2.2.3.11 Aeronautical Information Publications (AIP)

The planning of any flight requires access to a considerable amount of aeronautical information: condition of departure and destination airports, airspace restrictions, aerodrome layouts, profile of instrument approaches, hours of operation, availability and type of fuel, radio and navigation frequencies, air traffic control requirements, etc). When a flight is of an international nature, these requirements are multiplied many times.

ICAO developed an international format for the production and dissemination of aeronautical information. Each State has established a national agency responsible for the management of these tasks.

Aeronautical Information Publications have two basic objectives:

a) Compile and make known what exists.

b) Compile and disseminate what has changed and is of an urgent operational nature.

The first task consists in developing and maintaining a number of documents that provide pilots with all the technical information required to plan a flight with due knowledge of all the facilities and services provided at any airport, and in the airspace of the State. There are eight categories of facilities and services, as laid out by ICAO:

a) General

b) Aerodromes

c) Communications

d) Meteorology

e) Rules of the Air

f) Facilitation

g) Search and Rescue

h) Aeronautical Charts

Since there are frequent changes to facilities and services, there is an amendment service provided in each State to keep the AIP current.

The second task consists in collecting and disseminating to the attention of pilots, urgent notices relative to upcoming or existing changes to aviation facilities or services. This is done through messages of a standard format, called NOTAMs, for Notice To Airmen. NOTAMs are normally disseminated by the fastest means available such as electronic mail or telex.

The information contained in NOTAMs is coded according to an ICAO coding system[10]. This allows for a condensed format and it eliminates language problems.

NOTAMs are initiated by Airport Operations personnel for any information relative to aerodrome facilities and services under their responsibility. Therefore they must be familiar with the coding system, not only to prepare NOTAMs but also to decipher NOTAMs received from other airports.

NOTAMs are useful to pilots, airport operators, ATS and the CAA.

The most common subject of NOTAMs is the closure or temporary unserviceability of facilities. Some examples may include:

a) Closure of a runway for repair purposes.

b) Unserviceability of an ILS for preventative maintenance.

c) Closure of a volume of airspace due to a military exercise.

d) Presence of a new obstacle.

Lesson Summary

The movement area consists of runways, taxiways and aprons. They are respectively used for the take off and landing of aircraft, their surface circulation, their parking, and loading and unloading.

---

[10] NOTAMs of national scope may not be coded.

Visual aids provide pilots with visual reference while taxiing, landing and taking off. There are four categories of visual aids: indicators and signalling devices, paint markings, signs, and lights. They can be used to help navigation or to denote obstacles and restricted areas.

Electronic aids provide pilots with reliable guidance to bring their aircraft safely down to the vicinity of the ground when meteorological conditions do not allow to do it visually. The most widely used are the Instrument Landing System (ILS), the Very High Frequency Omni-directional Range (VOR), and the Non-directional Beacon (NDB). A new navigation system being implemented is the Global Satellite Navigation System (GNSS).

Radars use the property of electronic signals to bounce back on metallic objects. The return signal is displayed on a screen, providing air traffic controllers with a two-dimensional map of the airspace. They use this information to determine the distance of the aircraft and its bearing from the antenna. Radars are used to monitor and control air traffic, enroute or near airports.

Aeronautical communications are essential to the rapid and efficient exchange of information between different bodies, particularly between pilots and air traffic controllers.

All systems that emit electronic signals are sensitive to interference. For reliability reasons, such equipment must be adequately located, away from potential sources of interference.

Air transportation is highly sensitive to meteorological conditions. It is therefore essential that pilots, airports, and ATS have access to reliable meteorological observations and forecasts.

The objectives of Air Traffic Services are to prevent collisions, to provide aircraft with advice and information to ensure the safe and efficient conduct of flights, and to assist in search and rescue operations. The main services they provide are control, information, and alert. The main ATS units are control towers (responsible for a control zone), approach control units (responsible for a terminal control area), and Area Control Centres (responsible for airways).

Airside facilities and equipment operate with electricity. Since many of them are in support of air safety, a continuous supply of electricity to these facilities should be available in case a power failure occurs.

Aerodromes and surrounding lands must be free of obstacles, to permit the safe operation of aircraft, and to prevent the aerodrome from becoming restricted or unusable due to the erection of obstacles or natural growth. This is achieved by establishing a

number of imaginary surfaces, called Obstacle Limitation Surfaces (OLS), originating on the aerodrome and extending well beyond its boundaries. No object is allowed to penetrate these surfaces.

The airport operator should provide suitable means of protection against the intrusion on the aerodrome of animals large enough to constitute a hazard to aircraft (safety) and of unauthorised persons (security). This is done by installing fences around the airside and by providing lighting where appropriate.

Airside tenants are enterprises who cater to aircraft on their property or who need direct vehicular access to the airside for the purpose of servicing aircraft elsewhere. Examples are freight operators, flight training schools, flight kitchens, and fuel suppliers.

States are responsible to ensure the safety, regularity, and efficiency of aircraft operations at aerodromes under their jurisdiction. All public aerodromes must provide uniform conditions for aircraft. To achieve these objectives, ICAO requires that aerodromes be certified in accordance with stringent specifications. A Safety Management System and an Aerodrome Manual are important tools in maintaining a safe operation.

Written Operational Procedures are necessary to ensure that Airport Operations personnel have at their disposal a comprehensive set of measures to deal with all aspects of aerodrome operations. These procedures are useful in regular and irregular conditions.

The main areas to be covered are: safety, inspections and audits, airside vehicle operator training, emergency response plans, security, maintenance, wildlife control, environmental protection, foreign object damage control, aircraft noise management, apron management, and aeronautical information publications.

Progress Check 6

1. Who develops Airside Vehicle Operator Permits (AVOP)?

   a) It is part of the international aviation examination

   b) It is part of the national aviation examination

   c) It is developed by airport operators

   d) It is part of the regular driver's license requirements

2. Apron Management includes:

a) _____

b) _____

c) _____

3. The components of the natural environment that airports can affect are:

a) _____

b) _____

c) _____

d) _____

e) _____

4. Allocation of Aircraft Stands can be provided by following agencies:

_____

2.3   The Terminal Area

Lesson Overview

In Lesson 1, you learned about all aspects of the airside. In this second lesson, you will learn about its adjacent companion, the terminal area. We will define its physical components, its functions, its complexities, and its providers.

From the passenger's perspective, the terminal area is the best-known part of the airport: it is where passengers live most of their airport experience, at the beginning and at the end of their trip. It leaves a lasting impression about the overall air travel experience. The quality of its infrastructure and of the services it provides is therefore of paramount importance.

Although it is a familiar environment for frequent travellers, the terminal area contains many behind-the-scene activities that passengers never get to see. You are now going to discover this fascinating aspect of airport operations.

We will first describe the terminal area and its physical boundaries. We will then define the many subsystems that make up the total terminal system, and explain their respective functions and importance for the processing of passengers, luggage, and freight.

Lesson Learning Objectives

Upon completion of this lesson, you should be able to:

- Define the terminal area and explain its key functions.

- Name the five types of subsystems that make up the terminal area and explain their purpose.

- Describe the processing of passengers, luggage and freight.

- Describe the purpose of facilitation and name its main components.

- Name the principal types of terminal concepts and explain their advantages and disadvantages.

- Name key operational procedures and describe their applicability.

Next, you will learn about the actual processing sequence that takes place in passenger and freight terminals: This is the heart of terminal operations.

Finally, we will describe the operational procedures that a terminal operator should develop and maintain, to safely and efficiently manage his facilities.

2.3.1 Physical Components of Terminal

The terminal area is that part of the airport where the actual transfer of passengers, luggage, and freight takes place, between the surface mode and the air mode.

Besides the terminal building, the terminal area includes *passenger bridges* (when provided), and the *curb*.

Many of the principles stated in this text apply to passenger and freight terminals. However, some differences exist. We will address them separately.

Passenger bridges and the curb are the facilities that provide a physical connection between the terminal building and surface mode vehicles on landside, and with the air mode vehicles (aircraft) on airside.

The terminal is partly airside, partly landside. The dividing line is the security screening point on the departure side, and the government controls area on the arrivals and departures side

Objectives: The objective of the terminal is to allow passengers to move between a vehicle and an aircraft, as quickly, easily, and comfortably as possible.

2.3.2 Operational Procedures of Terminal

Providing properly designed terminal facilities goes a long way toward ensuring a quick, easy, and comfortable transfer of passengers between the surface mode and the air mode. However, without adequate and consistently applied operational procedures, these facilities may, at times, cause operational disruption.

This is more likely to happen at peak time, when demand on facilities approaches or reaches their capacity, or when a mechanical failure causes a subsystem to slow down or shut down completely.

A terminal being made up of a chain of subsystems, any reduction in throughput in one subsystem is likely to cause negative downstream effects. If the cause of the problem is not rectified promptly, the whole processing chain may become clogged. This very serious situation may cause the following problems:

a) Missed flights for passengers, causing stress and inconvenience.

b) Late departures for airlines, causing downstream effects on the whole network.

c) Increased operating costs.

d) General customer dissatisfaction with the airport, potentially leading to the loss of customers for the airlines and the airport operator.

In order to avoid these problems, the terminal operator–in consultation with its partners–should develop, maintain, and enforce a number of operational procedures aimed at reducing the risk of irregular operations.

We are now going to examine a number of such procedures.

2.3.2.1 Curb Management

Curb congestion is a common problem at busy airports, and a challenging one to solve. The curb is meant to provide a safe stopping place for vehicles to load and unload passengers and their luggage.

This applies to all types of surface transportation vehicles (private cars, taxicabs, buses, coaches, hotel shuttle buses, remote parking shuttle buses, etc).

Terminal designers should plan to provide a curb that meets the level of traffic expected at peak times, and take into account the mix of surface transportation types. The types of passengers, the available surface transportation services, and socio-cultural considerations determine this mix.

Some of the solutions to be taken into account during planning are (Figure 34):
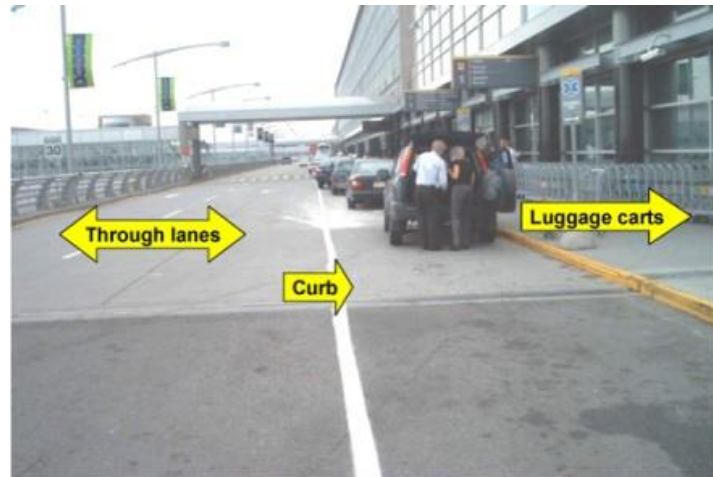
Figure 34. A Departure Curb

a)   Separate arrivals and departures curb (two levels).

b)   Provide one or more through lanes allowing vehicles to drive by the curb without being delayed by stopped vehicles.

c)   Provide several terminal entrances to spread demand on the maximum curb length possible.

d)   Provide remote parking lots and bring passengers to the terminal with a shuttle service.

e)   Provide pedestrian overpasses or underpasses to reduce the risk of accidents while crossing the curb and bypass lanes.

In spite of the above physical measures, it is necessary to establish operational procedures.

Procedures

Efficient signage must indicate that the curb area is limited to picking up and dropping off passengers, excluding any parking time. Drivers should not be allowed to leave their vehicle except for assisting their passengers in loading or unloading luggage. A maximum stopping time may be imposed. It may be advisable to install warning signs to that effect on the terminal access road.

Double parking should not be tolerated as it prevents vehicles stopped on the curb to leave.

There should be a visible presence of uniformed enforcement officers, with power and motivation to prevent congestion in addition to resolving it.

If congestion problems are frequent and severe, it may be necessary to revert to the use of a towing service to remove vehicles obstructing the normal flow.

For the safety of pedestrians, a speed limit should be instituted on the frontage roads. Properly signed and marked pedestrian crosswalks should be provided.

When local conditions require that public transportation vehicles park on the curb while waiting for passengers, designated and marked areas should be implemented and enforced. Private vehicles should be separated from other types of traffic like coaches and taxicabs.

In order to avoid the accumulation of taxicabs and coaches on the curb, it is advisable to provide a remote holding area for these vehicles, and to allow only a limited number of vehicles at any given time on the curb or a maximum waiting time.

Delivery vehicles should not be allowed on the curb. Instead, a delivery point, located away from passenger traffic, should be provided.

2.3.2.2   Crowd Control

A crowd forms when people accumulate to wait for something or to watch something. In a terminal, crowds form at processing points: check in, security screening, concessions cashier (especially food outlets), government control points, luggage reclaim area, and access points to public transportation.

Another type of terminal crowding occurs when greeters gather in the arrivals concourse to wait for arriving friends or relatives.

Crowding in a terminal impedes the smooth flow of passengers and causes disruption to the efficient use of space.

Several operational measures can alleviate the formation of crowds:

a)   Install stanchions in waiting areas so that people wait in a linear, orderly fashion. This is particularly useful in the check in concourse and at security screening points. When lines are left unchecked, waiting passengers tend to line up all the way to the back wall of the terminal, thereby impeding walk-through circulation.

b)   Ensure that processing points are adequately staffed in relation to demand. This may require coordination with other agencies.

c) During peak times, position adequately trained employees in areas known to cause congestion. They will control the size and shape of queues by asking people to move to certain locations.

d) The provision of properly disseminated automated ticketing and check in equipment (discussed in Section 3) will reduce the number of passengers having to wait in front of a counter. Similarly, feature recognition equipment at Security and at Immigration will reduce queuing time and crowding.

2.3.2.3   Allocation of Space

Similar to the allocation of aircraft stands, the allocation of airline processing space (particularly ticketing, check in and gate counters) can be done on an exclusive basis or a common-use basis.

2.3.2.4   Exclusive Use

Under this concept, each airline occupies, on a long-term basis, dedicated counters. Since peak time requirements determine the number of counters, there is unused capacity during off peak times. Given the high cost of providing space and the rental rates for this type of facility, it causes a waste of resources for the terminal operator and for airlines.

However, this arrangement allows individual airlines to install company names and logos. It provides a strong corporate presence, and it facilitates the orientation of frequent flyers, since they know the location of each airline counter.

2.3.2.5   Common Use

Under the common use concept, several airlines may share some counters when their schedule permits. A successful concept meeting this objective is called Common Use Terminal Equipment, or CUTE. It allows any airline to use any available common use counter, and access their own computer system as if they were working from their own stations.

Since common use counters are used by different airlines at different times, airlines cannot install permanent wall-mounted names and logos. Instead, they use electronic displays. When an airline occupies a counter, the attendant will access the airline's data processing system and display the airline name, logo, and flight information on the electronic display. Upon leaving this position, the information will be removed, and the counter will be available for another airline (Figure 35).

Figure 35. A CUTE System

The overall benefit of a CUTE system is that it reduces the total amount of counter and gate space that the terminal operator needs to provide, and that airlines need to lease.

In some cases, airlines use a mixed concept whereby some dedicated counters provide a core ticketing and check in area, while a number of CUTE counters provide the required flexibility and savings.

2.3.2.6   Cleaning

Any public building used by thousands of people daily requires regular cleaning. The many electrical and mechanical systems found in a terminal require regular preventative and corrective maintenance, especially systems that help process passengers, baggage, and freight.

Passengers, visitors and tenants expect to use a clean facility. For passengers, it is part of the overall impression of their travel experience.

Building cleaning may be done by the terminal operator, by a contractor, by individual tenants, or by a combination of the above. There are economies of scale in having one agency responsible for the whole building, in addition to providing a consistent level of service.

The following areas require particular attention:

a)   Curb and sidewalk, for dirt, garbage, and cigarette butts.

b)   All public area floors, especially where people gather, for dirt, spilled beverages and garbage.

c) All office and operational areas, leased or otherwise.

d) Washrooms, a good indicator of the degree of cleanliness of a terminal.

e) Concessions, especially food outlets, for spilled food and beverages.

f) Seating areas, for discarded newspapers and magazines.

g) Passenger bridges, for garbage and discarded newspapers.

h) Glassed partitions and walls where frequent human contact causes stains and marks.

i) Signs, where dust accumulates.

Procedures

Building cleaning requires well-structured procedures. Regardless of who is responsible for it (the terminal operator or a contractor), a cleaning plan should be implemented. It should cover the following subjects:

a) Detailed description of the areas to be cleaned.

b) Level of service required: frequency of inspections, expected results (must be measurable).

c) Cleaning logs, to be located in each cleaning areas.

d) Collecting complaint and compliment feedback from users.

e) Communication procedures between cleaning personnel and operator.

f) Requirements to work around traffic to avoid or reduce impact on passenger flows and airline operational requirements.

g) Notify users of planned cleaning activities as they may disrupt their activities.

h) Place well visible signs when cleaning or closing public areas, especially washrooms.

2.3.2.7   Maintenance

Several building components require preventative and corrective maintenance. The terminal operator usually does it, except that some specialised tasks may be carried out by outside experts.

Mechanical Systems

The most critical terminal systems are those that support the processing of passengers and luggage:

a) Baggage conveying systems.

b) Elevators.

c) Escalators.

d) Moving sidewalks.

When one of these systems breaks down, the effects can be severe for airlines and passengers:

a) Luggage conveying belts: impossibility to transfer luggage to or from the luggage rooms, causing late departures or unacceptable waits in the reclaim area.

b) Elevators or escalators: impossibility for passengers with heavy luggage to change levels in the terminal.

c) Moving sidewalks: longer walking time between processing points, leading to fatigue and missed connections.

Needles to say that this type of failures causes major inconvenience and costs for airlines and passengers. Therefore, the terminal operator must establish preventative and corrective measures to avoid such occurrences, and if they occur, to restore the system as quickly as possible and with the least amount of disruption. Some of these measures include:

a) Carry out regular visual inspections of all mechanical systems. Report any problem immediately.

b) Replace moving components that are subject to wear and tear in accordance with a predetermined schedule (do not wait for a disruptive failure).

c) Carry out inspections and preventative maintenance outside peak times. Proper coordination between Operations, airlines, tenants, Government agencies, and Maintenance personnel is key.

d) Advise affected agencies of any planned closure of systems, and suggest a contingency plan.

Heating and Ventilation Systems

The provision of a safe and comfortable terminal environment requires that the heating and cooling system be kept operational at all times.

Although maintenance or repairs to such systems are not likely to have a severe impact on the processing of passengers, extended shut downs may make the terminal environment unliveable. It is recommended to use the same general procedures as those used for mechanical systems.

Key Learning Point

Electrical Systems

Similar to the aerodrome, many terminal components rely on electricity. Therefore, the terminal operator should ensure that electrical systems are maintained in good running order at all times. Key areas include lighting, distribution of electrical power to the many motors that operate luggage systems and heating and ventilation fans.

Structural Systems

Any building requires regular maintenance of its concrete and steel components. A frequent area of concern is structural damages caused by moving equipment hitting columns and walls. This is more likely to occur in luggage rooms and on aircraft stands.

The installation of strong protection bollards helps reduce the risk of structural damage. However, regular visual inspections are necessary to immediately detect potential weakening of structural components.

Lesson Summary

The terminal area is that part of the airport where the actual transfer of passengers, luggage, and freight takes place, between the surface mode and the air mode. It includes the terminal building itself, passenger bridges, and the curb and associated roadways. Its key functions are to process passengers, effect a change in mode, and a change in movement type.

The terminal consists of several subsystems, linked together in a logical manner, and providing five types of purpose: processing, circulation, holding, subsidiary, and support.

Passengers, luggage and freight are processed through the terminal in a predetermined and rigorous sequence. The origin or destination of passengers, luggage and freight, as well as the purpose of passengers trip greatly affect the processing requirements.

Government control measures tend to slow down the processing of passengers, luggage and freight. The aim of facilitation is to ensure that these controls do not affect the speed advantage inherent to air transportation. Its key ingredients are the provision of adequate facilities, the use of automation and the efficient use of passenger data processing.

Although all terminals serve the same basic purposes, their design can vary greatly to serve different types and volumes of traffic. The two basic concepts are the centralised and the decentralised ones. Each concept provides its users with advantages and disadvantages. Ultimately, a terminal must allow airlines to carry out profitable and efficient operations. The centralised concept meets these objectives to a greater extent.

Terminal operators must adopt a systematic approach in managing their facilities. They should develop operational procedures addressing the most critical areas: curb management, crowd control, allocation of space, and cleaning and maintenance.

Progress Check 7

1. Vehicles should not be allowed to park on the curb because:

    a) The weight of parked vehicles may cause damage to the structure.

    b) Vehicles are better parked in a pay parking lot.

    c) It causes congestion, which is detrimental to efficient processing.

    d) It interferes with delivery vehicles.

2. Preventative maintenance of terminal mechanical systems should be done:

    a) During busy periods.

    b) Always at night.

    c) Outside peak times.

    d) Whenever technical personnel is available.

2.4   The Landside

Lesson Overview

Now that you have learned about the airside and the terminal area, we are going to discuss the third part of the airport: the landside. The fact that we address it last does not imply that it is the least important. It provides the infrastructure in support of access to the airport, equivalent in importance to the airside.

It also provides parking facilities for many types of vehicles and users.

We will describe its processes and its relationship with the outside world.

Next, we will discuss commercial lands and activities, and the revenue potential they bring to the airport operator.

Finally, we will describe some operational procedures that airport operators should develop and implement to safely and efficiently manage their facilities.

We will conclude this lesson with an overview of the total airport operational system, and how its three components work together as a system.

In order to add a final operational overview of this important module, we will briefly address airport capacity issues and solutions.

2.4.1   Physical Components of Landside

The landside is that part of an airport that is normally accessible by the public. It is bound by the airside and the terminal and by the airport property boundary (Figure 36).

Figure 36. The Landside in the Overall Airport Context

Subsystems: The landside consists of three physical subsystems:

a) Access infrastructure, supporting various access modes.

b) Parking infrastructure, supporting these modes.

c) Commercial lands, supporting commercial activities by tenants.

Functions: The landside provides three functions:

a) Access to the airport (link).

b) Parking for all modes (node).

c) Revenues for the airport operator.

We will discuss these three subsystems and their functions in the order they appear in the above paragraphs.

2.4.1.1   Access Infrastructure

Several categories of people have a need to travel to and from the airport:

a) Passengers

b) Greeters and well wishers

c) Visitors

d) Employees

e) Suppliers

These people use at least one of several categories of vehicles:

a) Road vehicles.

b) Rail equipment

c) Waterborne equipment (boat)[11]

d) Air link (helicopter)[12]

These vehicles need some infrastructure to move to and from the airport:

a) Roads

b) Tracks

Key Learning Point

When passengers have a choice between several types of access, they will select the one that best meets their needs.

---

[11] Listed for the sake of completeness.

[12] Listed for the sake of completeness.

Finally, they need some infrastructure to stop and park at the airport:

a) Parking lots

b) Train stations

When passengers have a choice between several types of access, they will select the one that best meets their needs, based on a number of factors:

a) **Purpose of the trip:** Business travelers, whose time is valuable, will tend to use taxicabs because they provide door-to-door service, luggage handling assistance, and some extra working time during the ride to or from the airport. Arriving tourists, on the other hand, will tend to use airport coaches or trains because they can accommodate more luggage and are cheaper. Local originating tourists often go to the airport with friends in a private automobile.

b) **Socio-economic and Physical Characteristics:** Income and age will influence the choice. Passengers with limited means will tend to select the cheapest alternative, irrespective of its convenience. People who are uneasy about traveling in an unfamiliar city or country, and people with limited mobility may select a worry-free, accessible alternative. Since public transit vehicles often do not provide wheelchair access, passengers with limited mobility are likely to use coaches or trains.

c) **Convenience:** Sometimes, the cheapest or fastest alternative cannot take the users close enough to their destination. In such cases, they may opt for a less desirable but more convenient alternative.

d) **Availability of Competitive Alternatives:** The range of available alternatives, along with their respective cost, convenience, reliability, level of comfort, and speed will influence the choice of users. For example, a high-speed train providing a fast and reliable trip to the airport, at times of road congestion, may attract passengers who would otherwise select a cheaper alternative.

We will now address the various types of infrastructure that support the movement and parking of the above vehicles.

Roads

A recent IATA survey of 38 airports from several continents reveals that on average 82% of passengers use a road vehicle to and from the airport[13] (Table 5). Therefore, roads play a major role in airport access.

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[13] IATA, *Airport Development Reference Manual*

Mode	Percentage Use
Automobile	50
Taxicab	21
Rail	18
Bus/coach	11

Table 5. Modal Split Based on a Survey of 38 Airports

Providers: The overall road access system consists of three components (Figure 37):

a) The external highway system, providing a link between the urban area and the airport boundary. It is the responsibility of regional or urban authorities.

b) The airport main access road, originating at the airport boundary and providing access to the terminal area.

c) Secondary roads and streets serving various airport tenants and businesses. Both of these categories are the responsibility of the airport operator.
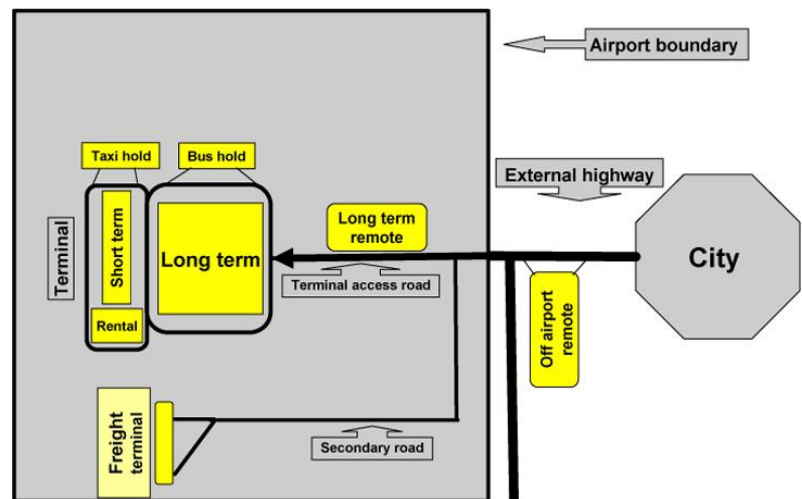
Figure 37. Airport Access Layout

Vehicular traffic generated by airports affects the surrounding road infrastructure. This influence increases with the size of airports and with their proximity to urban areas. In order to provide an efficient and economic link, the external and internal access networks must achieve a balanced level of service. If not, congestion will occur at peak times, causing delays. It will affect the speed advantage inherent to air transportation.

It is therefore vital that the airport operator and external authorities work together to integrate the airport into the regional highway

network. This is consistent with the economic benefits of the airport on the community it serves.

There have been some cases where international airports had to limit their aerodrome throughput because external highways could not cope with the demand imposed by airport-related vehicular traffic. This is an unacceptable situation with serious impacts on the traveling public, airlines, the airport operator, and the community in general.

Types of Vehicles Used: Airport access depends on surface vehicles in the vast majority of cases. We will discuss them in detail. For the sake of completeness, we will briefly mention other types of access such as waterborne and air access.

a) Automobiles, carrying passengers, well-wishers and greeters, employees, and visitors.

b) Taxicabs, carrying mainly passengers.

c) Buses and coaches, carrying passengers and employees.

d) Trucks, carrying freight and other goods to and from freight terminals and to other airport businesses.

Private Automobile: Passengers use a private automobile in 50% of trips to an airport (Table 5). This situation is not likely to change. It is due to the high degree of flexibility they afford: They provide door-to-door service, they are comfortable, and they are not constrained by scheduling considerations. However, they can be subject to road congestion, especially when a trip to the airport coincides with peak times on the urban network.

Other important users of private automobiles are employees working at the airport. They may generate a large amount of traffic especially if the airport supports a maintenance base for a major airline. Operational positions often cover close to twenty-four hours a day, and public transit schedules may not suit the needs of these employees. They will likely travel by private automobile.

Many automobiles traveling to and from the airport have only one person on board: they contribute to road congestion and to air pollution.

Taxicabs: Taxicabs provide the same flexibility as private automobiles and they eliminate the potential stress and fatigue caused by driving on congested roads under time constraints. An added benefit is the handling of luggage by the driver.

They are, however, not immune to road congestion. Their fare can be expensive if the distance to be covered is important. However, if the length of stay at the airport is significant, a taxicab fare is likely

Key Learning Point

Airport access can be provided by road vehicles and rail. The vast majority of passengers use a private automobile to go to and from airports.

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to be cheaper than parking one's vehicle at the airport. The same principle applies if several passengers share the fare.

Business passengers are more prone to use taxicab service than other types of passengers. Taxicabs are also convenient when arriving at an unfamiliar airport where the itinerary to one's final destination is unknown.

Many airport operators license taxicabs doing business at the airport. It ensures the provision of a minimum quality and availability of service.

Rented Automobiles: This type of transportation is highly popular at many airports around the world. It is convenient for arriving business or leisure passengers who will be spending some time at a particular destination and who need to be mobile.

Buses and Coaches: The main advantage of mass transportation is a reduction in the number of vehicles, and the corresponding reduction in the requirement for access and parking facilities. Every vehicle can carry as many people as ten to twelve fully loaded automobiles. It reduces road congestion and air pollution. Several types of service exist:

a) Public transit, linking the airport to the urban network. Employees who work regular business hours are more likely to use it than passengers because of the lack of luggage storage and the potential need to transfer.

b) Dedicated airport coaches, operating on a schedule and generally serving the city center with some intermediate stops at predetermined points. This service is more passenger-oriented, with adequate luggage storage and a comfortable ride (Figure 38).

Figure 38. Airport Coaches Parked in their Holding Area

c) Intercity coach lines, making a stop at the airport, on their way to another city. This service can be useful for passengers whose destination is either not served by air service or requires a very long connection time.

d) Shuttle service, operated by hotels, airlines, the airport operator, or private companies, using small to medium size buses and serving a fixed itinerary with scheduled stops at predetermined points (Figure 39). This type of service is very convenient for passengers going to or from hotels. They operate on a schedule and are well adapted to the need of passengers.

Figure 39. A Hotel Shuttle Bus Waiting on its Designated Area on the Curb

Trucks: Truck traffic uses airport access roads for a variety of reasons. The most common ones are:

a) Deliveries and pick up of goods at freight terminals.

b) Deliveries to the airport aviation fuel depot.

c) Delivery of goods to airlines, tenants, concessionaires, and the airport operator.

It is a good practice to separate heavy vehicle traffic from passenger traffic soon after the airport entrance. A service road may be provided to that effect.

Design Standards: Roads must be designed and built in accordance with strict standards, to ensure a safe and efficient flow of vehicles. National or local highway regulatory authorities should be consulted to ensure consistency of level of service between off airport highways and airport roads.

Rail Access

A commonly sought alternative to road access is rail service. The track may be constructed at ground level, elevated, or underground, depending on the technology used. Many international airports throughout the world have access to some kind of rail service. This technology is immune to congestion and inclement weather conditions. When it is well adapted to passengers' needs, it may capture an important proportion of passengers.

Providers: Several options exist, depending on local conditions and customers' needs:

a) Part of the Urban or Regional Transit System (surface or underground).

This is the most flexible option as it serves a wide geographical area. It may be attractive to employees but may cause difficulties to air passengers if connections are required, especially for those carrying luggage. Traveling at peak times, when workers commute, may be uncomfortable if there is high occupancy and air passengers compete with commuters for seats. Frequency of service outside urban peak times may be inadequate to meet passengers' needs.

There are, however, some successful examples of such systems.

b) Part of the Inter City Network.

This service serves the same purpose as inter city coach lines. There are several examples where a train station is collocated with a terminal or connected to it by a bus shuttle. A potential weakness is the lack of coordination between train and air schedules.

c) Dedicated Airport Link.

This type of technology is purposely built around the needs of passengers: trains are fast, comfortable, have luggage space, and they display a business ambience. The line goes directly from the terminal to the downtown area, with no or few stops.

At airports that provide access to such service, the proportion of users may be high, sometimes higher than the automobile share.

They are, however, expensive to build and operate. They are sometimes subsidised by public authorities, the airport operator, or a combination thereof.

Types of Vehicle Used: The technology used depends on the type of provider:

a) Urban or regional transit use light rail equipment, possibly an underground type.

b) Inter-city systems use a regular railway equipment, possibly high speed technology.

c) Dedicated airport link: alternatives range from light rail (Figure 40) to high speed trains, possibly advanced technology such as elevated tracks.

Figure 40. Light Rail Equipment

Water Access

Although not widespread, this type of access mode exists at some airports. It can be a good alternative to road and rail access if the airport and the urban area it serves are located along a common body of water.

The only required infrastructure is docking facilities at both ends of the crossing. It is preferable that the vessels providing the service be fast and comfortable. This mode can be attractive to tourists who experience a scenic crossing between the airport and the city.

The technology used ranges from regular ferries to high speed *hydrofoil boats*.

Helicopter Shuttle

It consists of a short-haul air service between a downtown heliport and the terminal area. It has been tried with limited success due to its high cost, its unreliability due to weather conditions, and public opposition due to noise problems.

The technology used consists of heavy, multi-engine helicopters.

1. Name various categories of people who need to travel to and from the airport.

   _____

2. List the physical subsystems of the landside.

   _____

2.4.1.2   Parking Infrastructure

The change of mode between surface and air requires a change of vehicle. In Lesson 1 of this module, you learned that aircraft need to be parked in a convenient location while waiting to take up a load of passengers. Similarly, surface vehicles need to be parked in an appropriate location.

For order and efficiency reasons, vehicles must accumulate in an organised and controlled environment: parking lots and train stations provide it.

Parking lots also provide the airport operator with non-aeronautical revenues. Similarly to terminal concessions, these revenues should be applied toward reducing the financial burden of airlines.

Users: Parking facilities accommodate a number of users with different characteristics and needs:

a) Passengers

b) Visitors (greeters, well-wishers)

c) Employees

d) Deliveries

Providers: Parking facilities are generally provided by the airport operator. Their management may be contracted out to a specialised firm. Automobile rental companies normally lease parking space from the airport operator.

Range of Parking Facilities: The size of the airport and its traffic characteristics influence the size, types, and number of parking facilities required. For example, a small airport may only need one parking lot to satisfactorily accommodate all its customers. On the other hand, a large international airport may need to provide parking facilities to accommodate a wide range of customers with very different needs.

Key Learning Point

Parking facilities are generally provided by the airport operator. Their management may be contracted out to a specialised firm.

Key Learning Point

Good customer service requires that parking facilities be of sufficient capacity to accommodate the maximum number of vehicles expected at peak times as well as the requirements of present and future traffic levels.

For learning purpose, we will assume that all types of parking facilities are available at a given airport.

Parking facilities can be constructed as a single level (Figure 41) or be multi-level (Figure 42) above or under ground. Ground level parking lots are less expensive to construct. However, they occupy more valuable land and they do not provide the protection against the elements afforded by multi-level structures.

Design Standards: Good customer service requires that parking facilities be of sufficient capacity to accommodate the maximum number of vehicles expected at peak times. The number of parking spaces may range from few hundreds at a small airport to over thirty thousands at some very large international airports.

Their capacity should be sufficient to meet the requirements of present and future traffic levels (refer to the Master Planning section of Module 1). When the number of parked vehicles approaches the capacity of the facility, drivers have difficulty finding the few available spaces and they may look for another, more accessible parking lot.

Airports with a high percentage of connecting passengers require fewer parking spaces than an airport of similar size where most passengers originate or terminate.

Need to Park: With the exception of vehicles that access the airport for the only purpose of picking up and dropping off passengers, vehicles that stay at the airport for any time must park in an appropriate location.

Figure 41. A Single-Level Parking Facility

Figure 42. A Multi-Level Parking Facility

The purpose of the trip to the airport and the type of vehicle and service involved will influence the need to park and the facilities required. We will now examine the different types of parking lots and their respective customers.

Types of Parking Spaces

Short Term: Short term lots are used by non-passengers for short stays at the airport, typically less than 3 hours. This type of parking facility is located as close as possible to the terminal and has the highest rate (hourly or fraction thereof). The number of spaces provided is relatively small because vehicles do not park for an extended time.

Long Term: Long term parking lots are used by the majority of passengers. They are located further away from the terminal than short term parking lots but they are still accessible on foot, especially in the case of a multi-level structure. Their rate is lower than that of the short term parking lot (hourly and daily).

Long Term Remote (on or off airport): Airports that have a sufficient proportion of passengers with extended stays (more than one week), may provide a remote parking facility, located away from the terminal area (where land is less valuable), and connected to the terminal by a shuttle service. This type of parking facility is the least expensive and has daily and weekly rates. It can also be an alternative to expanding the long term parking facility when the availability of land and the construction cost make an expansion non-viable. Private enterprises can provide off-airport parking facilities with shuttle service, and compete with the airport for customers. Their remoteness and the added transfer time are offset

by lower rates and other incentives sometimes offered by the operator.

Rented Automobile Pick up and Return

Passengers who rent a vehicle need convenient access to the vehicle at the time of pick up and convenient access to the terminal upon return.

To this effect, rental companies lease some prime space close to the terminal, providing a level of service equivalent to a short term parking lot.

Since the cost of leasing such space is high, rental companies often lease just enough space to provide adequate capacity for the scheduled pick-ups and returns. They lease more space in a remote area, for a vehicle reserve.

Taxicabs and Bus Holding Area

In this module, you learned that good curb management requires the provision of holding areas for taxicabs, buses and coaches: it keeps the time spent on the curb to the strict minimum to off load and pick up passengers.

The airport operator provides such holding areas away from the terminal area prime space, but close enough to achieve quick dispatch to the curb when vehicles are needed.

Employees: Although employees working at the airport may use public transit services when they are available and convenient, many prefer the convenience of driving to work. Therefore, adequate parking facilities are required.

Employee parking should be conveniently located in relation to the place of work. If walking distances are excessive, a shuttle service may be provided, especially if local weather conditions are inclement.

When there is a large proportion of employees working on rotating shifts, the number of spaces needs to be increased to take into account the fact that, at the time of shift change, for every position two vehicles need to be parked simultaneously.

Employees usually park free of charge, although the airport operator may charge their employer for the space used. The applicable fee should at least cover the maintenance cost of the facility.

Other Types: Depending on local conditions and market needs, the airport operator may provide other types of parking facilities. Some examples include:

a) **Premium parking lots:** high security fenced and guarded; valet service parking, whereby the vehicle owner hands out his car to a driver who will park it. These parking lots may include extra services such as car cleaning and servicing.

b) **Contractors' parking:** it is a good practice to provide a small number of spaces for contractors who regularly do business at the airport and need to park a vehicle in close proximity to the terminal.

c) **Deliveries:** to avoid delivery vehicles parking on the curb, a dedicated space with a loading dock should be provided in an appropriate location.

Technology

Public parking lots normally require the payment of a fee, calculated based on the length of stay. The occupancy time starts when the vehicle enters the parking lot and triggers the dispensing of a time-stamped ticket. Upon leaving the parking lot, the length of stay is calculated and the fee determined.

Several options exist to collect these fees. The most common ones are:

a) **Exit pay booths:** users tend their ticket and the cashier determines the fee owed. Payment can be in cash or by credit card. This option requires a sufficient number of cashiers to cover operating hours, and the provision of climatised booths (Figure 43).

Figure 43. Parking Lot Pay Booths

Automated pay station at the exit: the user simply inserts his ticket into the pay station. The fee is immediately calculated and displayed. Payment can be made in cash or with a credit

Key Learning Point

The main types of parking lots are short term and long term. Short term facilities provide quick access to the terminal and they are used by non-passengers for short stays at the airport. Long term lots are best suited for passengers, who may leave their vehicle at the airport for an extended time. The proximity advantage of short term parking lots comes with a premium fee.

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card. Upon acceptance of payment, the system will immediately open the exit gate. This option only requires a small number of attendants to assist users who have difficulty in paying their fee or in case of equipment malfunction.

b) Payment in the terminal, before returning to the vehicle. This convenient method allows users to pay their fee at one of the automated pay stations located throughout the terminal. Sufficient time is built in to allow users to walk to their vehicle and exit the parking facility. Staff requirements are comparable to those of the automated pay station system described above.

c) Pre-payment upon parking. This method is convenient for short term parking lots (Figure 44). Users simply "buy" enough time for their anticipated stay and place a receipt showing the expiry time in a visible location in their vehicle. This method requires some form of monitoring to prevent abuse.

d) The three latter options have the advantage of eliminating long waits upon leaving the parking lot.

Figure 44. A Pre-Payment Automated Machine

Progress Check 9

1. Passengers will select a mode of access based on:

   _____

2. Expressed on an hourly basis, the rate charged in long term parking lots is usually:

   a) The same as that of short term lots

   b) Lower

   c) Higher

2.4.1.3 Commercial Lands

In Lesson 1, you learned about airside commercial lands. On the landside, there is another category of commercial tenants. They are businesses that do not require airside access but may have some advantages in being located on airport property. Those businesses can be:

a) Companies that cater to airport customers, such as hotels, business centres, and gas stations.

b) Companies that frequently use air transportation in the course of their activities.

c) Companies that do not have ties with airport activities but may find location or financial advantages in being on airport property. This category may include office buildings, warehouses, and business parks in general.

As any other airport tenants, these enterprises lease serviced land from the airport operator on a long term basis (more than twenty years). The monthly rent paid to the airport operator provides a constant income, unaffected by fluctuations in traffic levels.

2.4.2 Processes

We are now going to describe the processes that access vehicles and their occupants go through from the time they enter the airport property to their final destination at the airport, and vice-versa.

The type of vehicle and service influences the path that vehicles follow.

2.4.2.1 Trip to Airport

Automobiles: Upon entering the airport property, signage will assist drivers in making decisions to reach their final destination easily and safely. The characteristics of good signage discussed in Lesson 2 apply here as well.

Key Learning Point

Landside commercial lands provide tenants with an opportunity to serve airport customers, or to benefit from an airport location. They provide the airport operator with non-aeronautical revenues.

Drivers will follow the following steps:

a) **Step 1**–The first step will be to determine the direction of the passenger terminal area, as opposed to other destinations such as freight terminals, fuel depot, or other businesses. This choice is normally available soon after accessing the airport.

b) **Step 2**–The second step is to determine the direction of the appropriate terminal (if there is more than one).

c) **Step 3**–Once the desired terminal location is found, the next step is to select the desired destination: curb (Figure 45) or parking lot.

d) **Step 4**–If the desired destination is a parking lot, the last choice is to select the most appropriate one depending on the driver's needs (short term, long term, remote, or rented automobile return–Figure 46).

e) If the driver is a well wisher and desires to remain with his or her passengers until their departure, he or she will drive the vehicle from the curb to the short term parking lot. Its access should be simple and well identified.

Figure 45. Directional Signage with Pictograms

Figure 46. A Directional Sign to Parking Lots

Taxicabs, Buses, and Coaches: Most of the steps described above apply. The only difference is that the destination will be a designated area on the curb. From that point, the driver will either leave the airport or go park in the taxicab holding area and wait to be dispatched to the curb for a pick up.

Buses and coaches may be allowed to wait in a designated area of the curb before their scheduled time of departure (Refer to Curb Management Procedures in Lesson 2).

Trucks: The truck driver will follow signage information toward the desired destination. Once on secondary roads, signage will assist him/her in finding his/her final destination.

Rail: The process is simpler as it does not involve any destination decision: the final destination is the terminal station. If there is more than one, voice announcements should be made to ensure that passengers get off at the right terminal.

If the station platform is within the terminal, passengers should be close to the check in hall. There may be a change in level required, with the provision of elevators and escalators.

If the station is located at some distance from the terminal entrance, proper signage will direct passengers to the terminal entrance.

2.4.2.2   Trip from Airport

Automobile: Drivers who parked their vehicle in a pay parking lot will pay their fee using the available options. They will then drive out of the parking area, and follow signage information to reach their off airport destination.

Those using the curb will simply drive along the terminal frontage road and intercept the airport exit road.

Rail: Trains will normally stop in a single location to load and off load passengers. They will then simply leave the station and merge with the outbound track.

2.4.2.3   Trips to and from Airport-Other Technologies (Waterborne and Air)

Airport access by vessel only requires a disembarking facility and equipment to assist passengers and luggage to safely and efficiently transfer to the air terminal.

Providing a suitable interface between a helicopter landing area and the terminal may be more challenging as heavy helicopters generate a strong rotor downwash. The landing area may have to be somewhat remote to circumvent this problem.

2.4.3 Operational Procedures of Landside

2.4.3.1 Vehicular Traffic Control

Like passengers in the terminal, vehicles must follow predetermined paths and procedures while maneuvering and parking.

Speed: Roads are designed to be safe under specific conditions. Speed is an important one. Therefore, all airport roads should have a speed limit, based on applicable laws and regulations. Speed limit signs should be posted at appropriate locations.

The airport operator should ensure that speed limits are respected and enforced as necessary, either by the police corps having jurisdiction at the airport, or by a dedicated airport agency.

Road Occupancy vs. Capacity: If congestion occurs frequently, it is recommended to conduct traffic surveys to assess the level of demand on airport roads at peak times (especially the main access road), relative to its design capacity. If there is little capacity left and there is an observed upward trend, measures should be taken to plan for increased capacity. Alternatively, other access modes could be encouraged or more efficient procedures implemented. You will learn more about the issue of capacity later in this module.

Parking Restrictions: Parking in areas non intended for this use should be prohibited and enforced: it causes potentially unsafe situations and it reduces the efficiency of traffic flows.

Parking Lot Occupancy Vs. Capacity: If congestion occurs frequently in some parking lots, it is recommended to collect occupancy statistics to determine the level of demand on parking lots at peak times, relative to their capacity. If there is little capacity left and there is an observed upward trend, measures should be taken to plan for increased capacity. Alternatively, other access modes could be encouraged or more efficient procedures implemented.

Key Learning Point

For safety and efficiency reasons, road traffic and parking occupancy must be monitored. Airport grounds must be maintained for reasons of durability, safety, and aesthetics.

Key Learning Point

Ground maintenance and vehicular traffic control are the main operational procedures of the landside of the airport.

2.4.3.2   Grounds Maintenance

Landside facilities must be maintained for reasons of durability, safety, cleanliness, and aesthetics.

The following facilities require attention:

a)   Pavement (roads, parking lots).

b)   Concrete (sidewalks, curbs, walls, barriers).

c)   Signs (traffic, directional, information).

d)   Lights (street and parking lot lighting, traffic lights).

e)   Landscaping (lawns, grass, flowerbeds, trees, shrubs).

Pavement: Roads and parking lots are subject to ongoing wear and tear. Every day, thousands of vehicles drive on airport roads (automobiles, buses, and heavily loaded trucks). Without regular maintenance, the surface of these facilities would rapidly deteriorate and become unsafe.

Therefore, the airport operator should implement a formal inspection and repair program. It should include the following procedures:

a)   Regularly drive around all roads and parking lots and visually inspect asphalt surfaces for cracks, potholes and other defects. This is best done during periods of low activity when road traffic and parked vehicles do not conceal defects.

b)   Report to the unit responsible for surface maintenance any observation that may require action.

c)   If work is required, schedule it to minimize impacts on airport users.

d)   Advise all affected users of the planned facility closure or restriction. Provide contingency measures such as re-routing of traffic or use of alternate parking lots or alternate access modes.

e)   It is a good practice to advise the traveling public and the community in general, through local media and advertisement.

f)   Upon completion of the work, inform affected parties accordingly.

In addition to repairs, it is necessary to keep roads and parking lots free of debris that may cause damage to vehicles and that are visually unpleasant. It should be done with adequate sweeping equipment. Depending on local arrangements, the airport operator or an outside firm can perform this task

Concrete Surfaces: All concrete surfaces should be inspected for safety and condition. In particular, sidewalks should be kept free of debris, slippery, rough or uneven surfaces. Sweeping with appropriately sized equipment is recommended.

Signs and Lighting: Signs play a vital role in traffic safety and in assisting drivers to navigate through the road network. They should be regularly inspected for accuracy and condition. This inspection can be done at the same time pavement is inspected.

Road and parking lot lighting provides safety and ease of orientation. Light bulbs should be replaced in accordance with a preventative maintenance program to avoid failures.

Traffic lights must be kept in good working condition and well synchronised to maintain a safe and efficient traffic flow.

Landscaping: It is usually concentrated in the terminal area and it provides visitors with a green environment amidst an otherwise concrete and asphalt context.

However, landscaping requires ongoing attention to keep its aesthetical character intact. In the absence of regular maintenance, it will rapidly deteriorate and present a sad picture to first time visitors. It will negatively affect their overall impression of the airport.

The following procedures should be implemented:

a) Install native vegetation that has a better chance to thrive than other, less acclimatised species.

b) Install low maintenance trees and shrubs that do not grow rapidly and require frequent trimming.

c) Avoid species that require frequent watering: water is expensive and watering is labour intensive. If watering is required, the installation of an automated sprinkler system should be considered.

d) Avoid fruit-bearing species that attract birds (refer to Wildlife Management).

e) Always purchase plants from reputable suppliers. It is advisable to have the supplier or grower install the plants himself.

f) Follow the recommendations of the grower or supplier relative to care (watering, fertilizing).

Grass cutting should be done in accordance with some acceptable standards:

a) Lawns in highly visible areas should be regularly mowed and kept clean.

b) Grassed surfaces in more remote locations should be maintained not to exceed a specific height.

c) Grass in undeveloped areas should be regularly trimmed to display a sense of occupancy.

The airport operator is responsible for maintenance of all public areas. It is customary for tenants to carry out maintenance within their leased areas.

Lesson Summary

The landside is that part of an airport that is normally accessible by the public. It is bound by the airside, the terminal, and the airport boundary.

It consists of three physical subsystems: access infrastructure, parking infrastructure, and commercial lands.

It provides three functions: access to the airport, parking for all modes, and revenues for the airport operator.

The access modes frequently found at airports are road and rail. Road vehicles provide the highest flexibility and are used by a majority of passengers. They are however subject to road congestion. Rail is immune to road congestion and can attract a substantial percentage of passengers if its routing, schedule, and equipment are adapted to the carriage of passengers and luggage.

The airport operator and external transportation agencies must work in conjunction, to provide a safe and efficient overall access system.

Road signage guides vehicles to their airport destination. Upon arrival, they need to park in an appropriate facility.

Parking lots provide various levels of service and are distinguished by their distance from the terminal and their rate structure. Short term lots provide parking facilities for non-travellers, spending little time at the airport. They are located closest to the terminal. Long term lots are designed for passengers and are located further away.

Users select an access mode according to criteria such as trip purpose, socio-economic and physical considerations, compatibility of the routing of the access mode and the location of their point of departure or destination, and availability of competitive modes.

Airport operators should develop operational procedures in the areas of vehicular control (speed and parking control) and grounds maintenance (pavement, lighting, and landscaping).

![check mark with airplane icon]

Progress Check 10

1. If road congestion is frequently observed, the airport operator should:

    a) Ask the police to speed up traffic

    b) Conduct a traffic survey

    c) Immediately widen the road

    d) Reduce the number of flights to decrease demand on roads

2. Landscaping implementation and procedures should take into account:

    _____

2.5 Airport Certification

Lesson Overview

In this lesson, we will learn about a vital aspect of operations: aerodrome certification.

The verb "to certify" means "to make certain". Certification is the action of certifying something. In the aerodrome context, certification means the action of making certain that an aerodrome meets the requirements of ICAO Standards and Recommended Practices specified in Annex 14– Aerodromes, or as implemented by the Contracting State when differences exist.

By following these requirements, airports can receive Aerodrome Certificate.

2.5.1 International Obligations of States

All public aerodromes under the jurisdiction of a Contracting State must provide uniform conditions for the aircraft of all other Contracting States.

Each Contracting State must provide, within its territory, aerodromes and other air navigation facilities and services in accordance with Annex 14 SARPs.

Each State is responsible to ensure the safety, regularity, and efficiency of aircraft operations at aerodromes under its jurisdiction.

Lesson Learning Objectives

- Describe the international obligation of states in relation to airport certification.

- Describe the obligation of the CAA in covering various aspects of the certification process

- Describe the obligation of the airport operator in complying with certification requirements

- Describe the importance of aerodrome certification and explain its key processes

When the operation of an aerodrome is delegated to an operator, the State must retain its overseeing responsibility and ensure that the operator complies with the relevant ICAO SARPs and other relevant national regulations[14].

2.5.2 Obligations of the CAA

The safety oversight authority is subject to a number of obligations that cover all aspects of the total certification process. These obligations are:

a) To process applications for aerodrome certification and to issue certificates.

b) To notify Aeronautical Information Services of the certified status of the aerodrome and of changes in aerodrome facilities.

c) To conduct safety audits and aerodrome inspections.

d) To evaluate aerodrome emergency exercises.

e) To provide technical advice during the design and construction of aerodrome projects; to inspect completed projects for compliance.

f) To promote compliance with safety requirements through promotion and training.

g) To take formal enforcement action when required.

2.5.3 Obligations of the Aerodrome Operator

Complying with certification requirements imposes certain obligations on the aerodrome operator. These obligations are:

a) To comply with SARPs and with national conditions.

b) To employ an adequate number of qualified employees to operate and maintain the aerodrome.

c) To operate and maintain the aerodrome in accordance with the procedures set out in the Aerodrome Manual.

d) To arrange for audits of the Safety Management System and for inspections of aerodrome facilities.

e) To allow pre-arranged access of the aerodrome by authorised CAA personnel.

f) To notify the CAA, ATS, and pilots of any planned or unplanned changes to aerodrome facilities, including OLS that are likely to endanger the operation of aircraft.

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[14] This requirement applies equally when the operation of an aerodrome is the responsibility of a government body.

2.5.4   The Need for Certification

The first edition of Annex 14 was adopted in 1951 and has been used since by international airports to design and maintain their aerodrome facilities to uniform specifications. However, ICAO did not require its Contracting States to certify their aerodromes. Instead, it was incumbent upon each State to ensure that all international aerodromes within its territory complied with Annex 14 SARPs.

However, recent changes in the world aviation context prompted a review of this position:

a) Increasing aerodrome privatization/commercialisation trend.

b) Rapid air transport growth.

c) Expansion of existing aerodromes.

d) Construction of new aerodromes.

e) Increasing global concern for air safety.

As a result, on 1 November 2001, ICAO promulgated an amendment to Annex 14, introducing specifications requiring aerodrome certification[15]. More specifically, the following provisions were adopted:

a) As of 27 November 2003, States shall certify all aerodromes used for international operations in accordance with the specifications of Annex 14, as well as other relevant specifications, through an appropriate regulatory framework.

b) States should certify aerodromes open to public use in accordance with the specifications of Annex 14, as well as other relevant specifications, through an appropriate regulatory framework[16].

c) As of 24 November 2005, a certified aerodrome shall have a Safety Management System;

d) The establishment of a regulatory framework will ensure that states can effectively enforce compliance with the specifications of Annex 14.

e) A separate safety oversight entity will be established to ensure effective compliance. This entity is generally the national Civil Aviation Authority (CAA) of each Contracting State.

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[15] Some contracting states have already implemented an aerodrome certification system.

[16] This Recommended Practice applies to non-international aerodromes.

f) A well-defined safety oversight mechanism will be established, with support of appropriate legislation.

In summary, within each State, national regulations will govern the requirements and procedures to certify aerodromes.

Key Learning Point

The document proving that an aerodrome is certified is called an Aerodrome Certificate.

2.5.5   The Aerodrome Certification Regulatory System

When developing certification regulations, States should consider the following issues:

a) Requirement to certify all or only certain categories of aerodromes (some aerodromes being exempt if used by aircraft with less than a defined number of seats, or less than a given weight).

b) The certification procedures.

c) The duties and responsibilities of the aerodrome operator.

d) Safety audits, inspections and testing.

e) Imposition of sanctions for non-compliance with the regulations.

f) Other considerations as appropriate.

2.5.6   The Aerodrome Certification Concept

Given that aerodrome certification was a new concept for many States, ICAO prepared a guide specifically addressing this issue. This document is called ICAO Document 9774–Manual for the Certification of Aerodromes.

The intent of this manual is to facilitate States in establishing their own regulatory regime. In developing this manual, ICAO drew from the appropriate practices used by States who had already implemented a formal certification process.

2.5.7   The Aerodrome Certifications Process

The certification process is complex and rigorous. It consists of a number of mandatory steps:

a) The aerodrome operator submits a formal application to the CAA, complete with an Aerodrome Manual

b) The CAA assesses the application and evaluates the Aerodrome Manual

c) The CAA assesses the aerodrome facilities and equipment of the applicant, through an on-site inspection

d) The CAA issues the certificate (or refuses it with notification of corrective actions)

e) The CAA promulgates the certified status of the aerodrome in the Aeronautical Information Publications (AIP). This notifies pilots that the said aerodrome is certified.

The CAA may issue an aerodrome certificate for an unspecified period; in this case it remains valid until it is suspended or cancelled. Alternatively, it can be issued for a specific period. This decision rests with the CAA.

2.5.8   The Aerodrome Manual

An aerodrome certificate is usually a one-page document, posted in a visible location in the Airport Administration Office. It contains very few details. Therefore, a more elaborate document is required in support of the certificate: it is the Aerodrome Manual.

The Aerodrome Manual is an important document for the approval process and the continued validity of the certificate. It is also an excellent source of information for new employees of the Operations Division for their initial orientation. It contains a lot of data, too numerous to list in this manual. However, you should know its main components:

a) Name of aerodrome.

b) Geographical coordinates.

c) Elevation.

d) Name of operator.

e) Plan of the aerodrome.

f) Detailed characteristics of all facilities on the aerodrome (the ones you learned about in Sections 1.3 to 1.12).

g) Plan for the removal of disabled aircraft from the aerodrome.

h) Level of protection provided for aircraft rescue and fire-fighting.

i) Procedures in place to report changes to the aerodrome physical characteristics.

j) Procedures developed to prevent unauthorised entry of people, vehicles, equipment and animals on the movement area.

Key Learning Point

Aerodrome certification is the main tool to ensure the continued safety of aircraft operations. It consists of many demanding requirements that operators must consistently apply to obtain and maintain their aerodrome certificate.

k) Plan for dealing with aerodrome emergencies.

l) Procedures for the inspection and maintenance of the movement area including OLS.

m) Safety procedures relative to work on the aerodrome.

n) Handling of dangerous goods.

o) Protection of navigational aid sites.

p) Qualifications of key personnel.

q) Safety Management System (SMS).

Lesson Summary

States are responsible to ensure the safety, regularity, and efficiency of aircraft operations at aerodromes under their jurisdiction. All public aerodromes must provide uniform conditions for aircraft. To achieve these objectives, ICAO requires that aerodromes be certified in accordance with stringent specifications. A Safety Management System, which was mentioned in Lesson 2.1–Airside and an Aerodrome Manual are important tools in maintaining a safe operation.

Aerodrome certification is to ensure that aircraft operation safety is continuous. Operators must consistently apply the requirements to obtain and maintain their aerodrome certificate.

Progress Check 11

1. From an aerodrome certification point of view, obligations of an aerodrome operator are:

   a) _____

   b) _____

   c) _____

2.6 The Overall Airport Operation

Lesson Overview

In this module, titled "The Airport as an Operational System", you learned that an airport consists of three distinct areas: airside, terminal, and landside. The English dictionary defines a system as an assemblage of things designed to fit and work together. Nowhere is this definition more valid than in the airport operations world.

In this lesson, we will look at how the three areas of the airport work together as a system.

2.6.1 Airport Operational System

Although these three areas have well defined boundaries, they cannot work independently. Their individual processes are linked together and they make up an overall process in support of people, luggage, freight, vehicles, and aircraft: The inter modal function of the airport (Figure 47).
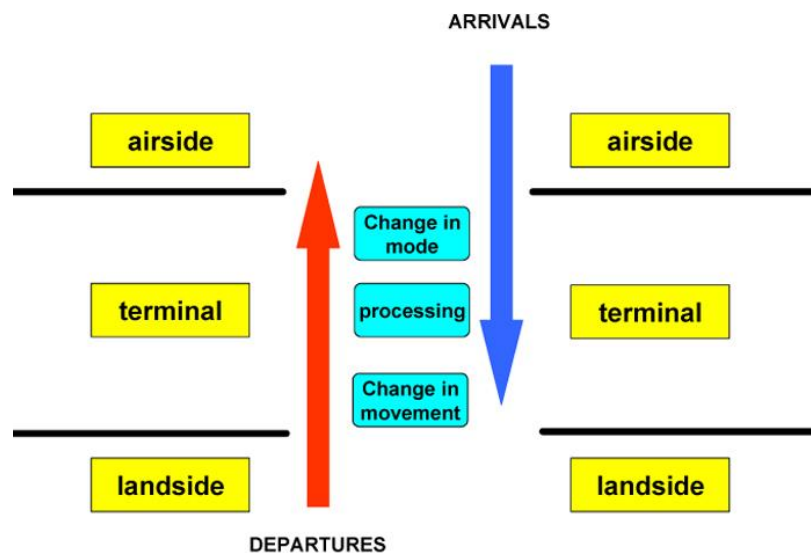
Figure 47. The Overall Airport Operational System

In order to function efficiently, the three airport areas must provide a balanced capacity and level of service. Failure to do so will result in suboptimal conditions, potentially leading to a poor level of service, customer dissatisfaction, and financial losses for airlines and the airport operator.

Airport facilities and services must be provided according to certain criteria:

a) On a timely basis

b) Efficiently

c) Safely

Any weakness along the process will cause negative downstream effects. Many factors may affect airport operations, some internal, others external:

a) Mechanical or structural breakdowns

b) Weather conditions

c) Labour disputes

d) Staff shortage

e) Accidents

f) Human errors

g) Unexpected flight schedule changes

h) Unexpected passenger loads

The smooth and efficient process of passengers, luggage and freight is challenged by the stop-and-go pattern inherent to inter modal changes (links and nodes) and by the frequent switch in service suppliers along the process (airlines, airport, security, concessionaires, Government control agencies, surface transportation providers, etc.). It is therefore vital that all providers of facilities and services work together as partners with one objective in mind: the customer.

Lesson Summary

The three components of the total airport operational system must function as one, well-coordinated entity. All partners providing facilities and services must work as a team to achieve this goal.

Any weakness may have negative affect on airport operations.

Module Summary

In this Module, we introduced you to the complex world of real airport operations. Let's summarise what you have learned. An airport consists of three areas: the airside, the terminal, and the landside.

The airside is the most complex one, involving a significant amount of technology. It is highly oriented toward air safety. A high level of standardisation governs the design, construction, operation, and maintenance of its components. Its key physical and service components are the movement area, visual and electronic aids, meteorological services, air traffic services, secondary power supply, obstacle restriction and removal, safety, security, and commercial tenants.

Aerodrome certification is a standard process, which ensures that aerodromes are operated in a continued state of air safety. A certificate can only be obtained after a due process demonstrating to the licensing authority that the aerodrome meets a number of stringent specifications. Then certificate must be maintained on a permanent basis. Audits and inspections are key instruments in achieving this objective.

Given the complexity of airport operations, operators must develop and use a number of detailed operational procedures, each addressing a specific facet of their activities. They form a recipe manual that is key to the daily activities of operations management and employees.

The terminal area is that part of the airport where the actual transfer of passengers, luggage, and freight takes place, between the surface mode and the air mode.

The terminal consists of several subsystems, linked together in a logical manner, and providing several of service.

Passengers, luggage and freight are processed through the terminal in a predetermined and rigorous sequence. The origin or destination of passengers, luggage and freight, as well as the purpose of passengers trip greatly affect the processing requirements.

Government control measures tend to slow down the processing of passengers, luggage and freight. The aim of facilitation is to ensure that these controls do not affect the speed advantage inherent to air transportation. The provision of adequate facilities and the use of automation support this objective.

Although all terminals serve the same basic purposes, their design can vary greatly to serve different types and volumes of traffic. The two basic concepts are the centralised and the decentralised ones. Each concept provides its users with advantages and disadvantages. Ultimately, a terminal must allow airlines to carry out profitable and efficient operations.

Terminal operators must adopt a systematic approach in managing their facilities. They should develop operational procedures addressing the most critical areas: curb management, crowd control, allocation of space, and cleaning and maintenance.

The landside is that part of the airport normally accessible to the public. It provides access and parking to a number of vehicles. It also offers commercial opportunities through the establishment of tenants who do business at the airport or find an advantage in being in that location.

The main access modes are road and rail. Road access provides the highest flexibility and a majority of users choose it, in particular private automobiles.

Airport roads and the external highway network must provide a balanced capacity and level of service. This is best achieved through coordination between the airport operator and outside transportation agencies.

Rail access being immune to traffic congestion, it provides a good alternative to road access if the type of equipment and schedule used meet the needs of passengers and employees.

Users make a modal choice based on a number of factors such as trip purpose and socio-economic considerations.

Parking lots allow drivers to park their vehicle while they are traveling, working, or visiting the airport. Several types of parking lots meet the needs of various categories of users, depending of their length of stay and trip purpose. Providing adequate capacity is key to a safe and efficient environment.

Commercial lands provide business opportunities for tenants and non-aeronautical revenues for the airport operator.

Landside operational procedures are tools that allow the airport operator to manage its facilities in a safe and efficient way. Of prime importance are traffic flow control and grounds maintenance.

The three components of the total airport operational system must function as one, well-coordinated entity. All partners providing facilities and services must work as a team to achieve this goal.

Apply Your Learning

1. Locate the Aeronautical Information Publications for your aerodrome. What is the length of the runway (or of the longest runway?). What is the elevation of the aerodrome?

2. Locate the Aerodrome Certificate and the Aerodrome Manual. At what frequency does the Licensing Authority inspect your aerodrome?

   Does your aerodrome have a wildlife problem? Is there a Wildlife Control Plan?

   Do residents complain about aircraft noise? Is there a Noise Management Plan? What measures exist to alleviate noise problems?

   When aerodrome emergencies occur, what procedures exist to cope with them? Is there an Emergency Operations Center?

3. Airlines serving your airport have been complaining for some time that the approach aids currently installed do not provide adequate approach minima and that, as a result, too many flights must divert to other airports. They demand that the aerodrome operator install a better approach system. Think about how you would deal with this request.

4. The OLS of your aerodrome are not protected by Zoning Regulations. During a routine inspection, you discover that a power line with tall towers is being constructed near the end of the primary runway. An inspection by the CAA reveals that this obstacle penetrates the take off surface and that, consequently, a threshold displacement is imperative. This change will require that some international flights reduce their payload to be able to safely take off. This constitutes a major operational and financial impediment for these airlines. You have been asked to deal with this issue. Think about ways of resolving it.

5. You are responsible, among other things, for wildlife control. You just learned that a nearby town is going to establish a new garbage disposal site a few hundred meters from the airport boundary. Think about the steps you may take to avoid a bird hazard problem at your aerodrome.

6. Collect passenger statistics for your airport. List the different volumes of passengers based on their origin and destination. What is the prevailing type?

   Walk through the terminal at your airport, or at any airport you may be travelling through.

Observe the processing of passengers. Can you see any evidence that facilitation measures are being used?

7. Observe the terminal building at your airport. Try to determine its concept. Do you think it is appropriate for the types and volumes of traffic it handles?

8. Observe vehicular traffic on the curb, at a busy time. Is there congestion? Are there any curb control measures in place? Are they enforced?

9. Your airport is the only international point of entry for air travellers into your country. Due to an increase in the tourism market, airlines have indicated that, in the medium term, they will operate more international flights and that many of the arriving passengers will connect to national flights destined to new resort areas.

   In response to this change, the airport operator wants to build a second terminal. However, airlines are concerned with the cost of such expansion and fear that connections will be inefficient and timeconsuming.

   Think about this issue and explain what in your opinion should be done.

10. The physical facilities in your terminal are adequately sized and provide a good level of facilitation. However, you have observed that processing passengers through Government control areas causes frequent congestion because many counters are not staffed at busy times. How would you approach this problem?

11. Observe the parking lots at your airport, or any airport. Can you see a physical distinction between short term and long-term lots? What are the respective rates?

12. You observe that vehicles parked along the airport access road cause a slow down of incoming cars. Are there any traffic signs prohibiting parking in these areas? If so, can you see any enforcement measures?

13. For the past few years, road traffic has been chaotic and your airport management recently decided to invest in a road widening and realignment project. This improvement will impose a heavy burden on airport finances and is not well received by the airlines. Can you think of any other alternatives that should be investigated?

14. You work at a small airport with only one parking lot for all users. No parking fee is charged, and attempts to implement one have met with strong opposition from all users. Can you think of ways to convince your customers that a reasonable parking fee must be implemented?

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Further Reading

ICAO Annex 11: Air Traffic Services.

ICAO Annex 14: Aerodromes.

ICAO Manual for the Certification of Aerodromes, Doc 9774.

ICAO Annex 16: Environmental protection.

ICAO Annex 9–Facilitation.

Norman Ashford, H P Martin Stanton, Clifton A Moore, Airport Operations, Pitman Publishing.

Answer Key

Progress Check 1

1. a

2. a

Progress Check 2

1.

   a) Navigation

   b) Denoting the obstacles

   c) Denoting restricted use areas

Progress Check 3

1. d

Progress Check 4

1. Any four from: wind direction and speed; ceiling and visibility; icing in flight; pavement contamination; thunderstorms; turbulence

2. c

Progress Check 5

1. Runway strip, take off and approach surface, transition surface, and horizontal surface.

Progress Check 6

1. c

2.

   a) Control of aircraft and vehicles operating on the apron

   b) Allocation of aircraft stands

   c) Monitoring safety of operations

3.

    a) Air

    b) Water

    c) Soil

    d) Fauna

    e) Flora

4. The airport operator, or an airline (if it owns or operates its own terminal, or uses dedicated stands).

Progress Check 7

1. c

2. c

Progress Check 8

1. Passengers, greeters and well wishers, visitors, employees, suppliers

2. Access infrastructure, Parking infrastructure, and Commercial lands

Progress Check 9

1. Trip purpose, Socio-economic and physical characteristics, Convenience, Availability of competitive alternatives

2. b

Progress Check 10

1. b

2. The degree of public visibility, Bird hazard control, Need for watering

Progress Check 11

1.

    a) To comply with SARPs and national conditions.

    b) To employ an adequate number of qualified employees.

    c) To notify the CAA, ATS, and pilots of planned or unplanned changes to aerodrome facilities.

Module 3—Security

Module Learning Objectives

Upon completion of this module, you should be able to:

- Define security, its objectives and its general principles (Lesson 1).

- Explain what makes civil aviation a target (Lesson 1).

- Describe various levels of Civil Aviation Security (Lesson 1).

- Describe the main preventative and response security measures that airports should implement (Lesson 2).

- Explain the need for personnel training and security awareness (Lesson 2).

- Explain how security and facilitation can be integrated (Lesson 2).

- Describe the key components of an Aircraft Operator's Security Programme (Lesson 3).

- Describe some of the measures that should be used to test the efficiency of preventative and response security measures (Lesson 4).

3.1   Security

Module Overview

In Module 2, you learned that airports include areas to which access is controlled. You also learned that passengers, luggage and freight are subject to rigorous security controls before boarding or being loaded on an aircraft, or transferred between aircraft.

In this module, you will learn about all key aspects of civil aviation security, from its general international principles to the implementation of local-level measures designed at preventing and responding to threats and unlawful acts against people, aircraft, airports, and navigation facilities.

First, we will deal with the international aspect of civil aviation security and its origin. We will then briefly review the international legal instruments that constitute the foundation of aviation security measures. Then, you will learn about the national measures that States must implement and how they are translated into airport level measures.

From that point, we will concentrate on learning the practical measures that individual airports must develop, implement, and constantly review and adapt, to cope with local security threats and unlawful acts.

You will then learn about the challenge of dealing with the apparent conflict between security and facilitation, and what technological opportunities can be exploited to maintain the speed advantage inherent to air transportation, while ensuring a high level of security.

The success of security measures is mostly dependent on people; we will discuss the need for a security training programme, and review its components.

We will then discuss the measures that aircraft operators should implement relative to the protection of their aircraft on the ground and in flight.

Finally, you will learn about the tools that States and airports should use to test the effectiveness of security measures.

3.2 Civil Aviation Security

Lesson Overview

In this Lesson, we will first define civil aviation security and explain its objectives and general principles. You will learn how the first acts of unlawful interference with civil aviation occurred, which prompted ICAO to initiate measures to prevent and to counter them.

Then you will learn about the various mechanisms developed by ICAO to counter threats. We will address the two types of international documents that were developed to that effect.

We will then discuss measures States should implement to deal with the prevention of, and response to threats and acts of unlawful interference against civil aviation within their territory.

3.2.1 Introduction to Civil Aviation Security

ICAO defines civil aviation security as a combination of measures and human and material resources, intended to safeguard civil aviation against acts of unlawful interference[1].

As described in Annex 17 Standard 2.1.3, the objective of civil aviation security is to safeguard passengers, crews, ground personnel, the general public, aircraft, airports, and navigation facilities against acts of unlawful interference.

States must establish measures (including resources, organisations, plans, and procedures) which together will provide a standardised level of security for all flights, in conditions of regular operations, and which are capable of rapid extension to cope with an increase of security threat, or an actual act of unlawful interference.

3.2.1.1 Brief History

At the time ICAO was created, threats to civil aviation were practically unheard of. Consequently, the Chicago Convention (the instrument that founded ICAO) does not address this issue.

During the 1960s, however, civil aviation started to be the focus of unlawful acts, usually in the form of aircraft *hijacking*. As a result, ICAO initiated a series of measures addressing the prevention and repression of such acts.

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[1] ICAO Annex 17. *Aviation Security*. 2006 Edition

Key Learning Point

The objective of security is to safeguard people, aircraft, and aviation infrastructure against acts of unlawful interference.

3.2.1.2   Aviation as a Target

The first acts of unlawful interference with civil aviation were mostly in-flight hijacks carried out by politically motivated or mentally deranged individuals. However, overtime, these acts became more frequent and diverse: aircraft and terminal bombings, aircraft attacks with ground-based weapons, use of aircraft as weapons of destruction, and attacks on passengers.

Experience demonstrates that aircraft in flight constitute the main target of unlawful acts against civil aviation: they can be used as a very powerful bargaining tool to obtain something (often a politically-motivated want). Consequently, the control of access to aircraft on the ground is of primary importance.

Progress Check 1

1. Experience demonstrates that aircraft in flight constitute the main target of unlawful acts against civil aviation.

    a) True

    b) False

3.2.2   The International Framework

After the advent of the first acts of unlawful interference against civil aviation, ICAO initiated two types of documents designed to set the framework for a worldwide prevention of, and response to such acts. For ease of reference throughout the next two units, refer to Figure 48, which illustrates the overall framework of civil aviation security.
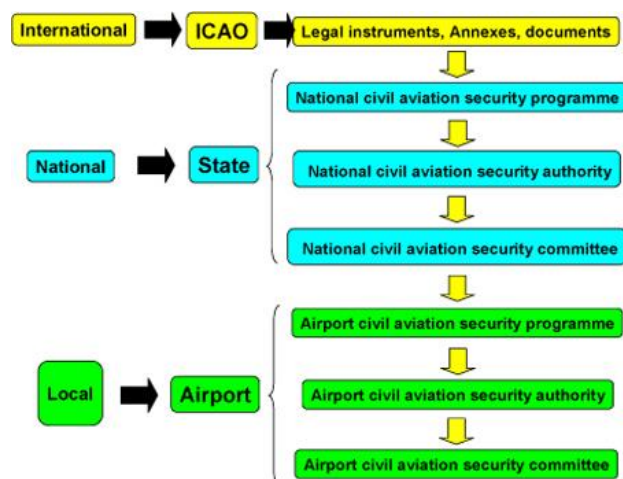
Figure 48. The Overall Framework of Civil Aviation Security

3.2.2.1 Legal Instruments–Conventions and Protocol

In response to the rising level of threat against civil aviation, ICAO developed several legal instruments addressing the prevention and repression of unlawful acts[2]:

a) The Tokyo Convention (1963), dealing with offences committed on board aircraft.

b) The Hague Convention (1970), dealing with the suppression of unlawful seizure of aircraft.

c) The Montreal Convention (1971), dealing with the suppression of unlawful acts against civil aviation.

d) The Montreal Protocol (1988), an addendum expanding on the Montreal Convention and dealing with the suppression of unlawful acts of violence at international airports.

e) The Convention on the Marking of Plastic Explosives for the Purpose of Detection (Montreal, 1991).

To effectively prevent and respond to acts of unlawful interference, States must ratify these Conventions and Protocol, and create a national regulatory framework to allow their enforcement within their territory.

3.2.2.2 Technical Documents–Annexes and Other Documents

Further to the above legal instruments, ICAO developed two technical documents that provide States with SARPs and guidance:

a) Annex 17, Security–Safeguarding International Civil Aviation Against Acts of Unlawful Interference. This document provides technical specifications in the form of SARPs.

b) Security Manual Against Acts of Unlawful Interference–Document 8973/7. This document provides States with guidance for the development and implementation of a National and an Airport Civil Aviation Security Programme.

As signatories to the Chicago Convention, States must comply with the provisions contained in all Annexes to this Convention. Annex 17 is one of them.

Key Learning Point

ICAO developed four Conventions, one Protocol, one Annex, and one guidance document to set the international framework for the prevention and repression of acts of unlawful interference against civil aviation.

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[2] ICAO Doc 8973, *Security Manual Against Acts of Unlawful Interference*. Chapter 4.1

Progress Check 2

1. Which legal instrument was developed by ICAO that provides States with SARPs?

   a) Security Manual Against Acts of Unlawful Interference

   b) Annex 17, Security

   c) Marking of Plastic Explosives for the Purpose of Detection

   d) The Montreal Convention against civil aviation

3.2.3   The National Framework

3.2.3.1   The National Civil Aviation Security Programme

Similar to the Aerodrome Standards and Recommended Practices you learned about in Module 2, States must adopt the provisions of ICAO Annex 17–Security. They require, among other things, the implementation of a National Civil Aviation Security Programme. ICAO Document 8973/7, Vol. 1 Chapter 7 provides detailed guidance for its implementation.

Objective

This programme is established in accordance with the Government Policy on National Security. Its objective is to safeguard civil aviation operations against acts of unlawful interference through:

a) Regulations

b) Practices

c) Procedures

In order for States to translate ICAO security requirements into practical and enforceable measures meeting national needs, the National Civil Aviation Security Programme must be based on a regulatory framework.

Contents

A model programme provided by ICAO[3] suggests the following contents

a) Programme objective

b) Definitions

c) Legislation

d) Responsibilities

e) Coordination and Communications

f) Protection of airports, aircraft, and air navigation facilities

g) Control of persons and items placed on board aircraft

h) Security equipment

i) Personnel

j) Response to acts of unlawful interference

k) Evaluation of effectiveness

l) Programme adjustment

m) Contingency plans

n) Financing

o) Appendices

3.2.3.2   The National Civil Aviation Security Authority

Each State must create a National Civil Aviation Security Authority responsible to develop, implement, and maintain all elements of the National Civil Aviation Security Programme[4]. In many States, this authority is part of the Civil Aviation Authority.

This authority should be equipped with the resources necessary to meet its objectives. Its responsibilities are to:

a) Develop and update a programme commensurate with the specific aviation security needs of the State.

b) Assess the national threat level, in line with the regional and global context.

c) Ensure that all airports develop and implement their own Civil Aviation Security Programme.

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[3] ICAO Doc 8973/7–Appendix 2

[4] Annex 17 Standard 3.1.2

d) Carry out audits, inspections and tests.

e) Adjust the programme following audits, inspections, tests, and actual incidents.

Key Learning Point

In order to translate the ICAO legal instruments into practical security measures, States must develop a National Civil Aviation Security Programme, managed by a National Civil Aviation Security Authority.

3.2.3.3 National Civil Aviation Security Committee

Each State must establish a National Civil Aviation Security Committee[5]. If a State has more than one international airport, individual committees must be established to address the specific needs of each airport.

Role

The role of the committee is to provide advice on security policies, recommend measures and procedures and review their efficiency, and ensure the required level of coordination to achieve the success of the security programme. It should also ensure the liaison with committees at each airport.

Membership

Membership of the National Security Committee should include (but not be limited to) representatives from the following organisations:

a) Civil Aviation

b) Authority in charge of police functions

c) National security agency or services

d) Immigration

e) Customs

f) Other border control agencies

g) Postal services

h) Foreign Affairs and External Relations

Other interested parties should be invited on an ad-hoc basis, when appropriate:

a) Aircraft operators

b) Airport operators

c) Air traffic services

d) Organisations representing employees likely to be affected by acts of unlawful interference against civil aviation (crew members, security screening personnel, airline agents, etc), who can provide technical expertise during deliberations.

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[5] Annex 17, Standard 3.1.5

Lesson Summary

In the early days of civil aviation, security was not a concern. As acts of unlawful interference started to emerge and develop, ICAO took steps to provide States with the power to prevent and respond to such acts within their territory.

In response to mounting acts of unlawful interference against civil aviation, ICAO developed several international legal and technical documents. These documents form the foundation of measures that States must implement to counter unlawful acts against civil aviation.

ICAO Annex 17 requires that States develop and implement a National Civil Aviation Security Programme. As part of this programme, States should create a National Civil Aviation Security Authority responsible to develop, implement, and maintain all elements of the National Civil Aviation Security Programme. This Authority should establish a National Civil Aviation Security Committee that provides advice on security policies, recommend measures and procedures and review their efficiency. Its membership should include all national authorities having an interest or an expertise in the protection of civil aviation.

Progress Check 3

1. When ICAO was created, the protection of civil aviation was already an important issue.

    a) True

    b) False

2. The National Civil Aviation Security Authority established by each State is often part of:

    a) The Army

    b) The police

    c) The Civil Aviation Authority

    d) The Ministry of Defence

Lesson Learning Objectives

Upon completion of this lesson, you should be able to:

- Explain the need to develop an Airport Security Programme and name its main elements.

- Explain the main responsibilities of an Airport Security Authority.

- Name the three parallel approaches used as preventative security measures.

- Describe the procedures used to control the access of employees, vehicles, passengers, checked luggage, and freight aboard aircraft.

- Describe the security measures that airport operators should consider when designing a new or expanded facility.

- Define the measures that airport operators should establish to respond to acts of unlawful interference with civil aviation.

- Describe the conflict between security and facilitation.

- Explain ICAO's position relative to facilitation.

- Explain the importance of security awareness and the need to train airport employees on security issues.

- Name the key components of a security training programme.

3.3   Airport Security

Lesson Overview

The third level in the effort to ensure security takes place is at the airport itself. It is the most action-oriented and detailed one in its application. We will address the many measures implemented by airport operators to prevent acts of unlawful interference (control of access to restricted areas and to aircraft by passengers, luggage, freight, and employees), and to respond to them (emergency plans and facilities).

In order to protect civil aviation at the airport level (where most threats and unlawful acts originate), each airport must establish a written Airport Security Programme[6]. It is an extension of the National Programme and it consists of the same objectives and components. However, it is more action-oriented: it is where the prevention of, and the response to threats and acts of unlawful interference take place.

At the airport level, the protection of civil aviation against acts of unlawful interference is a joint effort between many parties, including tenants, concessionaires, passengers, and visitors. However, the three key partners are the National Civil Aviation Security Authority, the airport operator, and aircraft operators.

Recent Increases in security measures lengthen the total transfer time from the surface mode to the air mode. We will look at ICAO's recommendation relative to this issue and some of the measures that airports can implement to mitigate the impact of security processes on facilitation.

We will then explain the need to train airport employees on security issues and explain the importance of security awareness.

3.3.1   Airport Security Programme

According to Annex 17, Standard 3.2.1, each Contracting State shall require each airport serving civil aviation to establish, implement and maintain a written airport security programme. This programme, to be approved by the National Civil Aviation Security Authority, should include the following elements[7]:

a) Responsibilities of the airport operator

b) Coordination and communications

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[6] Annex 17, Standard 3.2.1

[7] ICAO Doc 8973/7, Vol 111, Chapter 3

c) Protection of airport, aircraft, and air navigation facilities

d) Control of persons and items placed on board aircraft

e) Security equipment

f) Personnel

g) Response to acts of unlawful interference

h) Evaluation of effectiveness of measures

i) Programme adjustment

j) Contingency plans

3.3.2 Response to Acts of Unlawful Interference

In spite of all the preventative measures implemented by States, airports, and airlines, acts of unlawful interference against civil aviation do occur from time to time. Consequently, well-designed and ready-to-use response measures must be available. Resources, facilities, and personnel must support them.

General Measures

Security authorities will provide assistance to aircraft subjected to an act of unlawful interference[8]: provision of navigation aids, air traffic services, and permission to land will not be denied[9].

When such aircraft has landed at an airport, the appropriate security authority will endeavour to detain it if practicable, unless its departure is required by the overriding objective of protecting human lives[10].

Emergency Plans

The primary objective of security emergency plans is to ensure the safeguard of passengers, crews, the general public, and employees[11]. Plans should cover the following subjects:

a) Increased security measures: screening procedures for passengers, luggage, and freight; patrolling, additional access restrictions.

b) Unlawful seizure or sabotage of aircraft or facilities.

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[8] ICAO Doc 8973/7, Vol. V, Chapter 5

[9] Annex 17, Standard 5.2.3

[10] Annex 17, Standard 5.2.4

[11] Annex 17, Standard 5.1.4

c) Threats (bomb, fire).

d) Armed attacks within airport boundaries.

e) Armed attacks against aircraft from the vicinity of the airport.

f) Disposal of weapons, explosives, and sabotage devices.

g) Hostage taking situations.

Emergency Operations Centre (EOC)

When a situation requiring the use of emergency measures occurs, the airport operator should have at his disposal an appropriate facility where all response resources are grouped, and from which all decisions can be made and communicated: the Emergency Operations Centre (EOC). This topic was already covered in Module 2–Aerodrome Emergency Plans.

The EOC is a central facility, furnished with appropriate equipment and staffed with qualified personnel, from which the coordination of all activities and decisions is made during a security-related occurrence. The EOC can be supplemented by a Command Post, located closer to the actual incident.

Personnel staffing the EOC should consist of operational members of the organisations represented on the Airport Security Committee. They need to have appropriate authority to ensure immediate decision and action. One individual must be tasked with the overall direction of EOC operations.

Isolated Aircraft Parking Position

When an aircraft has been seized or may contain explosive or incendiary devices, it should be isolated in a remote parking position specifically designated to that effect. It must be located far enough from any facilities and public areas so that an explosion or fire would not endanger the life of people or jeopardise the integrity of airport facilities.

Security Manual

All security measures dealing with the prevention of unlawful acts against civil aviation and with the response to actual incidents should be grouped in a single document called the Airport Security Manual. It should be divided into independent sections, each addressing a specific type of occurrence. The text should be concise for clarity purposes and for ease of reference in tense situations. The following subjects should be covered:

a) International framework, applicable Conventions.

b) Description of the Airport Security Authority.

Key Learning Point

The main response measures to unlawful acts are the activation of the EOC and the implementation of the Emergency Plan. This plan should contain procedures dealing with the unlawful seizure or sabotage of aircraft or facilities, threats, armed attacks within airport boundaries and against aircraft from the vicinity of the airport.

c) Composition of the Airport Security Committee.

d) Threat assessment.

e) Aircraft security.

f) Passenger, luggage and freight screening.

g) Protection of restricted areas and vulnerable points.

h) Emergency plans and procedures: hijacks, bomb threats, attacks, sabotage, disposal of explosives, and hostage situations.

i) Training of key personnel.

j) Awareness plan.

k) Inspections, testing, and audits.

This manual should be a living document, reviewed after each exercise and actual event, and kept current. Since it contains information used to prevent and counter acts of unlawful interference against civil aviation, its circulation should be limited to those people who have a need to use it in the course of their duties. Appropriate parts of the document should be distributed to involved stakeholders.

Progress Check 4

1. Opaque security fences are preferred because they prevent view over restricted areas.

   a) True

   b) False

2. The control of passengers is only done in times of a high threat levels.

   a) True

   b) False

3. When a passenger does not present himself for boarding, his checked luggage must be:

   a) Sent to its normal destination and stored until the passenger arrives.

   b) Immediately unloaded and considered suspect.

   c) Checked and sent to its destination.

   d) Unloaded and stored at the departure airport.

e) Media, an often-ignored partner who can be of assistance to the airport operator if a proper rapport is established.

f) Suppliers: airports rely on many external suppliers to function as an enterprise: water, electricity, waste water treatment, communications, fuel, parts, materials, stationary, banking services, building and maintenance contractors, legal firms, rental of equipment, etc.

Other airports and other transportation components: airports must keep in close coordination with other airports because, as members of the same trade, they can benefit from sharing common problems and learn from successful solutions adopted by others; as inter modal facility operators, airports need to keep in touch with other modes of transportation, from a technological, planning and competitive stand point (Figure 49).

Figure 49. Relationships Between the Airport and the Transportation Environment

It is important that airports maintain a good balance of relationship with all these internal and external customers and partners.

3.3.3   Security Vs. Facilitation

The various security controls described in this module are nodes that lengthen the total transfer time from the surface mode to the air mode. Recent increases in security measures have further exacerbated this problem. We will explain ICAO's recommendation relative to this issue, and explain some of the measures that airports can implement to mitigate the impact of security processes on facilitation.

How to Cope?

In order to maintain the speed advantage inherent to air transportation, ICAO recommends that, whenever possible, States arrange for the security measures and procedures to cause a minimum of interference with, or delay the activities of, international civil aviation[12]. It further states that, in light of the security vs. facilitation dilemma, security must prevail.

The challenge is to achieve a proper balance between these two elements. Consequently, States should ensure that the level of control measures and procedures applied in terminals should be flexible, and directly proportioned with the current level of threat against civil aviation.

Practical Measures

For reasons of facilitation, controls should rely primarily on automated systems whenever possible, with manual control being used as a supplementary measure when the primary method reveals a potential threat. It ensures that most passengers and luggage go through a quick and efficient control system, while only those passengers and luggage having failed this step are subjected to a longer process.

In the area of checked luggage screening, new technology allows automated on-line control of luggage. Only those pieces of luggage that trigger an alarm will be removed from the regular process and manually checked. It ensures that all other pieces of luggage are not delayed.

Passengers, who, for any reason, fail the screening process, should be processed in a parallel channel so that other passengers are not unduly delayed. If manual search is required, it should be conducted with privacy and sensitivity.

Since going through a control process inevitably causes some degree of anxiety, the airport operator should ease this feeling through the provision of features creating an atmosphere of calm rather than frustration. Solutions include soothing elements such as carpeting, pleasant lighting, music, and video displays. These features give passengers something to look at, do, or talk about.

The airport operator should provide adequate space to control passengers. Centralised screening (as opposed to gate screening) is favoured as it provides for a uniform level of service and a single location to respond to in cases of a security threat.

Key Learning Point

Security measures should cause minimum interference with or delay of the activities of civil aviation. Measures exist that can maintain the speed advantage inherent to air transportation.

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[12] Annex 17, RP 2.3

The number of qualified screening personnel should be adequate to meet demand, with particular emphasis on peak times. The availability of standby equipment to cope with high volumes of passengers and equipment breakdowns should also be secured.

Progress Check 5

1. In the apparent conflict between security and facilitation, the speed advantage inherent to air transportation should prevail.

    a) True

    b) False

Lesson Summary

No degree of preparedness would be complete without putting the Airport Security Programme to test. Therefore, screening equipment, staff, plans and procedures must be tested regularly in accordance with approved criteria. This will disclose potential weaknesses that can be corrected to strengthen the performance of equipment, staff, plans, and procedures.

Progress Check 6

1. A well-known employee presents himself at the access point to a restricted area. He forgot his restricted area permit at home. Which action on the part of the security guard on duty is appropriate?

    a) Allow the employee to access the restricted area under the condition that he presents his permit on the next day.

    b) Strictly prevent access.

    c) Call his supervisor to seek advice.

    d) Allow access under the condition that he remains in his vehicle.

2. A security awareness programme should be designed exclusively for airport employees.

    a) True

    b) False

3. Name two actions used to test Equipment.

    a) _____

    b) _____

Module Summary

Civil aviation security is a combination of measures and human and material resources, intended to safeguard international civil aviation against acts of unlawful interference. Its objective is to safeguard passengers, crews, ground personnel, the general public, aircraft, airports, and navigation facilities against acts of unlawful interference.

States must establish measures which together will provide a standardised level of security for all international flights, in conditions of regular operations, and which are capable of rapid extension to cope with an increase of security threats or an actual act of unlawful interference.

Acts of unlawful interference with civil aviation are mostly carried out by politically motivated individuals. Aircraft in flight constitute the main target of such unlawful acts. Consequently, the control of access to aircraft on the ground is of primary importance.

ICAO developed two types of documents addressing the protection of civil aviation against acts of unlawful interference: four Conventions and one Protocol; and Annex 17 and Document 8973.

In order to equip themselves with appropriate tools to prevent and respond to unlawful acts, States must establish their own Civil Aviation Security Programme, and a National Civil Aviation Security Authority responsible to develop, implement, and maintain all elements of the National Civil Aviation Security Programme.

At the airport level (where most unlawful acts originate) the airport operator must establish an Airport Security Programme, consistent with the requirements of the National Civil Aviation Security programme. This programme consists of preventative and response measures.

The main preventative elements of an Airport Security Programme are the control of access to restricted areas, the control of departing passengers, luggage, and freight; the control of access to aircraft; and the integration of security measures in the design of facilities.

The main response measures are the development of an Airport Security Emergency Plan that includes the provision of an Emergency Operations Centre, and of aircraft isolation areas.

In order to cover all aspects of the protection of access to aircraft, aircraft operators must develop and implement a security programme meeting the requirements of the National Civil Aviation Security Programme. This programme covers the control of access to aircraft by unauthorised persons, the detection of prohibited objects on board aircraft, the response to in-flight security incidents, and the participation in the activation and management of the EOC.

Security controls lengthen the total transfer time from the surface mode to the air mode. In order to maintain the speed advantage inherent to air transportation, States should arrange for the security measures and procedures to cause a minimum of interference with, or delay the activities of, international civil aviation. In all cases, security must prime. Control measures should rely primarily on automated systems to ensure that most passengers go through an efficient and quick control system, while only those passengers and carry on luggage having failed this step are subjected to a longer process.

The availability of properly trained and qualified personnel is a key element in delivering an efficient security programme at each airport. In order to achieve maximum impact, security training should be tailored to the needs of different categories of employees. Security awareness complements training by reaching to the whole airport population, including tenants, concessionaires, and the general public.

The most effective security personnel, measures and equipment would not be complete without assessing their effectiveness. It should be done regularly through theoretical and practical testing of security personnel, calibration and testing of screening equipment, inspection of security facilities, exercises, and audits of plans and procedures.

Apply Your Learning

1. Try to locate information relative to the National Civil Aviation Security Authority of your country. Where does it belong within the overall government organisation?

   Can you find information describing the membership of a Security Committee?

2. Observe the screening of departing passengers (you can do it as a passenger as well). What organisation is responsible for it? What types of measures are in place? What route is taken by freight between the freight terminal(s) and passenger aircraft? Is the route located in a restricted area throughout?

   At what frequency are emergency exercises carried out at your airport? Who participates?

   Ask to be invited as an observer to such an exercise.

3. Walk around or through your terminal building. Take note of all the airline counters and concessions.

   Drive around your airport. Take note of all the land tenants.

   What types of businesses do you recognize from the course material?

   Does your airport have an AOC and an ACC, or a similar arrangement?

4. Visit remote aircraft stands. Are they well illuminated? Are mobile stairs removed from the aircraft at night?

   When parked overnight on a stand equipped with a bridge, is the bridgehead disconnected?

5. As an airport employee, did you receive any security awareness exposure? Do you use it in your day-to-day work? Do you find it valuable?

6. What practical measures are in place at your airport (or any airport you are going through as a passenger) to reconcile civil aviation security and facilitation?

7. Ask permission to attend (as an observer) a security exercise from the EOC. Observe what weaknesses appear, and in what. In order to get the best out of it, attend the exercise debriefing. What measures were established to correct the observed weaknesses?

   Walk through airport public areas and workplaces. Can you see any security awareness statements?

Activities and Discussion

1. By the year 2027, worldwide passenger and luggage volumes are expected to double from today's level. This demand will put tremendous pressure on airport processing facilities. On the other hand, there is no anticipated overall relaxation of security measures in the air transportation industry. Can facilitation really be achieved when security drives policy?

2. What do passengers want? A worry-free trip. What do airlines want? Satisfied and repeat customers. What do airports want?

More efficient use of facilities. What do border control agencies want? Improved controls. What do States want? An efficient air transportation system. Everyone wants to increase security, reduce costs, and provide high customer service. Can this situation go on forever?

3. Freight is relatively immune to time-consuming security screening procedures for the reasons explained in this Module. If the level of threat on freight suddenly increase, with a parallel increase in control requirements, there would be a tremendous loss in the speed advantage inherent to air transportation. Think about the impact that this would have on the shipment of some life-saving items (blood, plasma, medication), and on the screening equipment and processing space required in freight terminals. Can you think of any measures that shippers may devise to maintain the speed advantage without compromising the requirements of the National Civil Aviation Security Programme?

Further Reading

ICAO Annex *17, Security Safeguarding International Civil Aviation Against Acts of Unlawful Interference.*

Security Manual Against Acts of Unlawful Interference–Doc 8973.

Convention on Offences and Certain Other Acts Committed on Board Aircraft (Tokyo).

Convention for the Suppression of Unlawful Seizure of Aircraft (The Hague).

Convention for the Suppression of Unlawful Acts Against the Safety of Civil Aviation (Montreal).

Protocol for the Suppression of Unlawful Acts of Violence at Airports Serving International Civil Aviation (Montreal).

Convention on the Marking of Plastic Explosives for the Purpose of Detection (Montreal).

Answer Key

Progress Check 1

1. a

Progress Check 2

1. b

Progress Check 3

1. b
2. c

Progress Check 4

1. b

2. b

3. b

Progress Check 5

1. b

Progress Check 6

1. b

2. b

3.

> a) Calibration of screening equipment with sample metallic or explosive materials
>
> b) Pre-arranged carriage of prohibited objects through screening points by authorised personnel.

Module 4—Support Services

Module Learning Objectives

Upon completion of this module, you should be able to:

- Define the on-site support services of an airport (Lesson 1).

- Define the external support services of an airport (Lesson 2).

4.1 Support Services

Module Overview

Now that you have learned about all the facilities and services that airports provide to their customers, we need to discuss what facilities and services they must obtain from external partners.

But first, you will learn about a vital on-airport service that is normally provided by the airport operator: the Rescue and Fire Fighting service directly provided in support of air safety.

In Module 1, you learned that airports rely on external partners for utilities (such as water, electricity, and communications). They also rely on these partners to treat their sanitary and solid waste, and absorb the large quantities of surface run-off water released by airport surfaces.

In this Module, you will learn about the importance of these utilities, how they are used, who provides them, and how airports recover the cost of providing them.

We will also discuss other services that airport operators must secure from outside sources, in order to function as an enterprise.

Lesson Learning Objectives

Upon completion of this lesson, you should be able to:

- Explain the objective of aerodrome Rescue and Fire Fighting services.

- State the maximum response time to be provided.

4.2 On-Site Services

Lesson Overview

In this lesson, you will learn about the requirement and objective of aerodrome Rescue and Fire Fighting services. You will learn about their scope and providers, and the maximum response time to an aircraft accident. We will then briefly discuss the equipment and materials used in fighting aircraft fires. Finally, you will learn about the basis for determining the level of Rescue and Fire Fighting services to be provided at a specific aerodrome.

- Explain what equipment and materials are used to fight aircraft fires.

- Define the basis for determining the level of protection to be provided at each aerodrome.

4.2.1   Rescue and Fire Fighting

Although aircraft accidents and fires are very rare, they do occur. Therefore, rescue and fire fighting measures must be available for immediate response. The aerodrome's Rescue and Fire Fighting services provide them.

ICAO requires that Rescue and Fire Fighting services and equipment be provided at all aerodromes.

Objective: The objective of Rescue and Fire Fighting services is to save lives after a survivable accident. It is achieved by extinguishing fire and by assisting passengers and crew to evacuate the aircraft safely.

Scope: Most aircraft accidents occur on the aerodrome or during the few seconds preceding a landing or following a take off. Therefore, Rescue and Fire Fighting services are provided on the aerodrome and in its immediate vicinity.

The requirement to fight building and other structural fires is not taken into account.

Provider: The airport operator normally provides Rescue and Fire Fighting services. However, other suitably equipped and located agencies may provide them.

Since aerodrome Rescue and Fire Fighting services are neither responsible nor equipped to respond to building and other structural fires, other agencies must be available to respond to them. Airport operators often rely on the nearest municipal Fire Fighting service to do it. It requires that this service be familiar with the airport layout, its access points, and its building occupants and uses.

Response Time

Response time is defined as the time elapsed from the initial call for assistance to the first effective intervention by a Rescue and Fire Fighting vehicle. In optimum conditions of visibility and surface conditions, the response time to the end of each runway should be two minutes; it should not exceed three minutes[1].

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[1] ICAO Annex 14, *Aerodromes*

4.2.1.1   Equipment and Materials

Aircraft fires are caused by fuel carried in their tanks that ignites in flight or following an accident on the ground. The extinguishing agent used to fight aircraft fires is foam. It is produced by mixing water with a dry chemical powder. The foam produced is then pumped and discharged onto the fire.

The equipment used to carry water and dry chemical, and to discharge foam on a fire consists of trucks, specially designed for this task and capable of manoeuvring on unprepared surfaces (Figure 50).

Figure 50. Typical Aerodrome Fire-Fighting Vehicle

When an aerodrome is located near a body of water or a marshy area, the equipment used should be capable of responding to an aircraft accident occurring on water or on wet ground (Figure 51).

Figure 51. Rescue Boat Standing by Near the End of a Runway

Key Learning Points

Rescue and Fire Fighting services must be provided at all aerodromes. Their objective is to save lives. The response time to an on-aerodrome accident should be two minutes in optimum conditions. The length of the longest aircraft serving the aerodrome determines the level of protection required.

4.2.1.2 Level of Protection

Given the range of aerodrome activity and the size of aircraft serving an aerodrome, the level of Rescue and Fire Fighting services to be provided varies. It is based on the length of the longest aircraft serving the aerodrome on a regular basis.

There are currently ten aerodrome categories for Rescue and Fire Fighting, numbered from 1 to 10, in increasing order of requirements (Figure 52).

Annex 14 — Aerodromes   *Volume I*

Table 9-2. Minimum usable amounts of extinguishing agents

Aerodrome category	Foam meeting performance level A		Foam meeting performance level B		Complementary agents
	Water[1] (L)	Discharge rate foam solution/ minute (L)	Water[1] (L)	Discharge rate foam solution/ minute (L)	Dry[2] chemical powders (kg)
(1)	(2)	(3)	(4)	(5)	(6)
1	350	350	230	230	45
2	1 000	800	670	550	90
3	1 800	1 300	1 200	900	135
4	3 600	2 600	2 400	1 800	135
5	8 100	4 500	5 400	3 000	180
6	11 800	6 000	7 900	4 000	225
7	18 200	7 900	12 100	5 300	225
8	27 300	10 800	18 200	7 200	450
9	36 400	13 500	24 300	9 000	450
10	48 200	16 600	32 300	11 200	450

Note 1.— The quantities of water shown in columns 2 and 4 are based on the average overall length of aeroplanes in a given category. Where operations of an aeroplane larger than the average size are expected, the quantities of water would need to be recalculated. See the Airport Services Manual, Part 1 for additional guidance.

Note 2 — Any other complementary agent having equivalent fire fighting capability may be used.

Services Manual, *Part 1 for additional guidance.*

Note 2.— Any other complementary agent having equivalent fire fighting capability may be used.

Figure 52. Ten Aerodrome Categories for Rescue and Fire Fighting[1]

The applicable category determines the quantity of water and dry chemical to be made available and the discharge rate of foam that vehicles must be capable of delivering.

Ultimately, the above quantities determine the number of vehicles and fire fighters that must be provided. One vehicle may be sufficient for a small airport, while large airports serving numerous large aircraft should have at least three.

4.2.1.3 Changes in the Level of Service

When traffic characteristics change significantly and stabilise themselves at a higher or lower level, the aerodrome category must be adjusted accordingly, and the change published.

When, for reasons of equipment unavailability (break down or maintenance), the aerodrome operator becomes unable to maintain the published category, he must inform aircraft operators and Air Traffic Services. Once the situation returns to normal, affected parties must be advised immediately.

4.2.1.4   Personnel

Aerodrome fire fighters must be trained, fit, and qualified to carry out their functions efficiently. They should regularly participate in exercises designed to test their technical and physical skills, and their equipment. Exercises consist in extinguishing practice fires and in participating in aerodrome-wide emergency exercises. The presence of a representative from the Rescue and Fire Fighting services at the EOC or at the Command Post during exercises and real emergencies is key.

Lesson Summary

ICAO requires that aerodromes provide Rescue and Fire Fighting services. Their objective is to save lives after a survivable aircraft accident. The aerodrome operator or any other suitable agency can provide them.

The response time to an on-aerodrome accident should be two minutes in optimum conditions and should not exceed three minutes.

Aircraft fires are fought using foam discharged by specially designed vehicles capable of manoeuvring on unprepared or soft surfaces.

The level of Rescue and Fire Fighting services to be provided at a given aerodrome is based upon the length and of the longest aircraft serving this aerodrome. There are ten Rescue and Fire fighting categories. Each category determines the quantity of water and dry chemical to be made available. These quantities determine the number of vehicles and fire fighters to be provided.

Any permanent or temporary change in the provided category must be communicated to aircraft operators.

Aerodrome fire fighters must be trained, fit, and qualified. They benefit from participating in emergency exercises.

Progress Check 1

1. Rescue and Fire Fighting services should be provided exclusively on aerodrome property.

   a) True

   b) False

2. Rescue and Fire Fighting services should provide a response time not exceeding:

   a) Ten minutes

   b) Five minutes

   c) Three minutes

   d) One minute

3. The level of Rescue and Fire Fighting protection to be provided at a given aerodrome is determined based upon:

   a) The annual number of aircraft movements.

   b) The length of the longest aircraft serving the aerodrome regularly.

   c) The number of seats of the largest aircraft serving the aerodrome.

   d) The weight of the heaviest aircraft serving the aerodrome.

4. The objective of aerodrome Rescue and Fire Fighting services is to:

   a) Extinguish building and aircraft fires.

   b) Extinguish aircraft fires.

   c) Extinguish aircraft fires and assist passengers and crewmembers to evacuate safely.

   d) Participate in emergency exercises.

5. Aerodrome Rescue and Fire Fighting services can only be provided by the aerodrome operator.

   a) True

   b) False

4.2.1.5   Management Techniques

The design of any paved surface must include water collectors. They consist of two types of infrastructure:

a)   Surface gutters and ditches (Figure 53).

b)   Underground pipes.

Figure 53. Airport Drainage Ditch

Inside these infrastructures, water flows by gravity to their lowest point. Since water run-off cannot be retained on airport property indefinitely, it must eventually be discharged into an external system. Depending on the topography of the airport, more than one outlet may be required. National or local regulations often require that airport operators monitor the quality of water released at their property boundary (Refer to Module 1–Airside Operational procedures, Environmental Protection).

For reasons of environmental protection, control of erosion, and pipe size limitation, rainwater cannot be released uncontrolled into municipal pipes and ditches, or into natural ditches and streams.

Water should be accumulated into one or several detention ponds with sufficient capacity to hold a typical rainfall, and then released gradually into pipes or ditches (Figures 54 and 55). This is achieved by constructing an outlet of smaller diameter than the inlet pipe, thereby causing a partial and temporary accumulation of water inside the pond.

Some airports are using accumulated rain water to water landscaped areas.

These detention ponds are dry most of the time: under light rain conditions, water will flow through them, with little or no accumulation. Only in heavy precipitation conditions will they hold water for some time, until it is gradually released downstream.
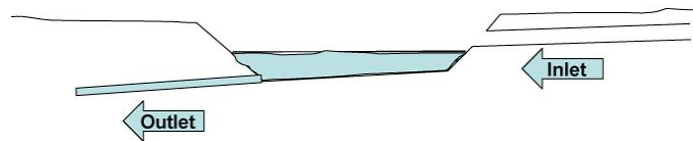
Figure 54.

Figure 55.

4.2.2   Communications

In Module 1, Lesson 1–Airside, you learned that airports rely on a number of communication systems, one of them being fixed systems. They consist of telephone and fibre optic links. These systems support telephone communications, facsimile, Internet, airline reservation systems, all crucial for operations.

The providers of such infrastructure are public or private agencies that provide a communication backbone to which customers connect.

The cost of providing and maintaining this infrastructure is recovered through a regular service fee paid by each user.

Progress Check 2

1. Fixed communication systems support several types of uses. Name two of them that are crucial for operations.

    _____

Lesson Summary

Airports rely on external suppliers for the provision of many services: water, electricity, communications, sanitary sewers, surface water run-off sewers, natural gas, and waste disposal.

Water is often a scarce and expensive commodity and its provision and use should be managed with care. Where potable water is not required, the use of raw water is recommended. The cost of providing water to tenants should be recovered from them.

A large proportion of the water used by airports ends up in sanitary sewers. It must be treated by the airport or by the municipality before being released into the environment.

Airports are large consumers of electricity and they need a reliable power supply. The cost of providing electricity to tenants should be recovered from them.

Airport paved areas generate large quantities of surface run-off. This water cannot be released off airport property without controlling its flow and its quality. Temporary detention on airport property and gradual release is recommended.

Public or private suppliers provide airports with the communication infrastructure required to support telephone, Internet, and other fixed communication requirements.

The availability of a natural gas distribution network near the airport is an asset that can provide an efficient and relatively inexpensive way of heating buildings, either through a central heating plant or through dedicated building heating systems.

Airports generate solid waste such as food and industrial waste. Food waste is disposed of through the regular municipal waste management process, except for international waste, which must be incinerated. It is desirable to reduce the amount of industrial waste through re-use and recycling.

Airports must purchase some goods that are not available on-site, such as fuel, tools, and parts, and purchase or lease services that may prove more efficient when acquired from an external supplier.

Progress Check 3

1. All food waste should be destroyed by incineration.

   a) True

   b) False

2. Name two types of industrial waste generated by airports.

   _____

3. Airports purchase or lease goods and services from external sources for the three following reason(s):

   a) _____

   b) _____

   c) _____

Module Summary

Aerodrome operators must provide Rescue and Fire Fighting services. Their objective is to save lives after an aircraft accident. Several categories of Rescue and Fire Fighting services exist, meeting the needs of individual aerodromes.

Airports have many needs that cannot be satisfied through on-site resources. They must therefore secure services and goods from outside suppliers. The most important ones are public utilities such as water, electricity, communications, natural gas, sanitary, and surface run-off sewers. Airports must also purchase or lease goods and services such as fuel, tools, parts, and administrative support services such as legal or accounting services.

Apply Your Learning

1. Ask around your airport, or research appropriate Aeronautical Information Publications. What is the published category for Rescue and Fire Fighting services?

2. What is the source of potable water at your airport? Are tenants billed for their water consumption? Does the airport operator treat the sanitary sewage effluent on-site, or is it simply discharged into a municipal sewer for further treatment?

3. How is the terminal building at your airport heated or cooled? Does it rely on a central plant or on a dedicated building system? What source of heat is used? Who provides it?

4. Are you aware of a recycling programme to reduce the amount of industrial waste at your airport? If so, find out about its results. What is being re-used or re-cycled, and how much?

5. You are aware that there is no attempt to reduce the amount of waste generated at your airport. This situation is not only prevalent with the airport operator but also with all land tenants and concessionaires. As a result, a lot of industrial waste is carried to the local waste disposal site, which is a cause for concern for municipal authorities, as it is nearing capacity.

6. Can you think of ways to make the airport (as a whole) contribute to reducing the amount of industrial waste? Where would you start?

Further Reading

Norman Ashford, Paul Wright: *Airport Engineering*, Wiley Inter science–Third edition

Answer Key

Progress Check 1

1. b

2. c

3. b

4. c

5. b

Progress Check 2

1. Any two from: telephone, facsimile, Internet, and airlines reservation system.

Progress Check 3

1. b

2. Any two from:

    Used oils

    Cleaning detergents

    Scrap metal from maintenance and repair shops

    Scrap materials from construction or maintenance work (concrete, bricks, asphalt)

    Waste paper, cardboard, and plastic

3.

    a)   They are not available on-site

    b)   Leasing proves more efficient than buying

    c)   Leasing may prove more efficient than doing it in-house.

Module 5—Airport Issues and Challenges

5.1   Economics

Lesson Overview

We will first review what factors drive demand for air transportation. We will then learn about the effects of a sudden and drastic reduction in air travel on airlines and airports.

You will learn what actions airlines and airports can take to face this challenge. Next, we will review some important statistics relative to the financial health of airports worldwide.

5.1.1   Current Aviation Environment

In Module 1–Understanding the Airport Environment, you learned that airports generate their operating revenues from two sources: aeronautical and non-aeronautical, shared roughly equally. Any fluctuation in the level of traffic affects both sources of revenues. Therefore, any discussion about airport economics must start with an outline of the economic situation of airlines, the airport's main customer and partner.

5.1.2   The Airlines' Challenge

In 2001, the airline industry was already suffering from a general economic slowdown. It was caused by a combination of factors such as:

a) Overcapacity (too many empty aircraft seats).

b) Competition from low-cost airlines, especially on busy national routes.

c) High operating cost levels.

The September 11 events exacerbated this problem and created an unprecedented industry-wide crisis, lasting through 2002, 2003, and 2004. Some key figures and facts include:

a) Loss of 35 billion dollars between 2001 and 2004[1] (the losses incurred in 2001 and 2002 alone equal the total profits from 1945 to 2000).

b) Loss of 200,000 airline jobs (400,000 industry-wide).

c) Several major carriers that had been in operation for decades went bankrupt.

d) Other carriers requested bankruptcy protection and re-organised themselves.

e) Losses in 2004 are estimated to be in the order of 5 billion dollars.

f) The airline industry may break even in 2005 if the price of oil remains stable around 36 dollars a barrel.

Challenges faced by airlines are to:

a) Restore the confidence of the public in air travel.

b) Absorb the cost increases generated by enhanced security requirements and insurance.

c) Restore their profitability.

5.1.2.1   Airlines' Actions

Airlines have taken drastic steps to reduce their costs and increase their efficiency: significant results have been achieved in this area (13% increase in efficiency). In spite of a marked recovery in 2004, airline *yields* are diminishing.

5.1.3   The Airports' Challenge

Economic challenges faced by airports are:

a) Reduced revenues from aeronautical and non-aeronautical sources

b) Additional security expenses

c) Increases in insurance costs

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[1] IATA press release–December 15, 2004.

5.1.3.1 Airports Actions

Airports have taken a number of steps to cope with diminishing revenues and increasing expenditures:

a) Cutbacks in operating expenditures

b) Employee layoffs

c) Cutbacks in capital expenditures

Airports are, to a large extent, dependent on the recovery of the airline industry. However, they must adjust to reality and be responsive to the needs and means of the airlines. Airlines need efficient, affordable facilities and services. In particular, low-cost airlines need low-cost airports to thrive.

Airlines want to have a say in the development of facilities that affect their operations and their costs. They also want airport pricing and charges to be in line with ICAO's principles on user charges, more directly linked to the delivery of specific outputs (defined services, increased capacity and agreed service quality), and subject to economic oversight.

Therefore, it is of the utmost importance, for the health of the aviation industry, that airport operators be attentive to these needs. There is no other way.

Lesson Summary

Demand for air transportation is driven by economic activity and by airfares.

Over the past few years, some negative conditions (security and health-related) have caused a sharp decrease in the demand for air travel. As a result, airlines and airports have suffered from reduced traffic levels and increased security-driven costs. Their operating margin and net profit have decreased sharply, causing some airlines to cease operations.

Airlines and airports have responded by reducing their costs and increasing their efficiency. The current challenge is to restore passengers' confidence, and financial viability. Although recent improvements in traffic levels are an encouraging sign, it will take persistent efforts on the part of the industry to recover from the worst-ever economic downturn in aviation history. This can only be achieved by a close cooperation between airports and their airline partners.

Progress Check 1

1. What are the three economic challenges faced by airports?

2. What are the three measures airports have taken to cope with diminishing revenues and increasing expenditure?

5.2 Capacity

Lesson Overview

Airports are service providers who must provide adequate operational capacity to their customers. In this lesson, you will learn about the definition of capacity and other key words. We will then discuss the effects of lack of capacity on users.

Next, we will review the strategies and technological solutions available to deal with capacity problems.

You will then learn about the capacity cycles the industry goes through on a regular basis, and we will discuss the current worldwide situation in this respect.

5.2.1 What are Capacity, Congestion, and Delay?

5.2.1.1 Capacity

Capacity is the power of containing a certain quantity of things or the ability of a component to accommodate a given level of traffic (aircraft, people, luggage, freight, and vehicles). Capacity cannot be exceeded without consequences.

5.2.1.2 Congestion

When demand on a facility approaches or exceeds its capacity, congestion occurs. Congestion is an excessive accumulation causing disorder and delays.

Lesson Learning Objectives

Upon completion of this lesson, you should be able to:

- Define capacity, congestion and delay.

- Describe the characteristics of airport demand.

- Explain why airports do not plan for ultimate peak capacity.

- Explain the strategies available to cope with capacity problems.

- Explain the technological solutions to deal with capacity issues.

- Define capacity cycles and explain where the airport industry currently is.

5.2.1.3   Delay

A delay is a restraint of the motion of something or an increase of the time necessary to do something. At an airport, delays can occur in all processing points: runways, taxiways, stands, all terminal processing facilities, access infrastructure and parking lots. Airspace and external highway delays can also affect airport operations. The consequences of delay are poor level of service, customer dissatisfaction, and possibly unsafe conditions.

5.2.2   Planning for Peak Demand

Forecasted peak demand determines the size of facilities that must be provided. However, providing facilities sized to accommodate the highest peak (which may occur only once a year) would result in uneconomical and wasteful operations. Consequently, airport facilities are normally designed to accommodate a typical peak, as opposed to the highest peak. In practical terms, it means that, for few hours or days during the year, there will be an acceptable level of overload.

5.2.2.1   Characteristics of Airport Demand

Most airports display large variations in demand over time (hourly, daily, and monthly). Peaking characteristics also vary with the type of passengers (business vs. leisure).

Figure 56. A Check in Concourse at Peak Time and One Hour Later

Progress Check 2

1.   Airport demand can be characterised as:

    a)   Constant

    b)   Slightly fluctuating

    c)   Deeply fluctuating

5.2.2.2 Conflicting Objectives

On one hand, airlines want to maximise fleet utilisation to improve *load factors* by offering services at the most attractive times. On the other hand, the airport operator and various providers of processing services (security, Government Controls, concessionaires) would like to spread demand evenly to keep the amount of facilities to be provided to a minimum.

5.2.2.3 Strategies to Bring Demand and Capacity into Balance

When recurring congestion occurs, several strategies are available:

a) Make more efficient use of available capacity. The common use concept discussed in Module 2, Lesson 2–Terminal, is a good example: by sharing available capacity, the need to expand may be postponed or eliminated. On the airside, imposing a maximum time that aircraft can spend on a stand also makes better use of the available number of stands.

b) Manage demand. Demand may be curtailed by diverting it to other, less challenged facilities. For example, diverting passenger access from road to rail may yield some relief on parking lots and congested access roads. Diverting some types of air traffic to other, under utilized airports in the area (especially light general aviation) may also help. Finally, implementing higher user fees at peak times may shift demand to less busy hours.

c) Expand facilities. It increases capacity upon commissioning. However, it is capital intensive, it may create further demand, it takes time to provide (refer to the Master Plan unit), and it may lead to unused capacity and create a financial burden if traffic levels drop.

In the event that the infrastructure proves unable to accommodate additional demand, airlines will be obliged to reject some demand for air travel.

Key Learning Point

Capacity problems should be addressed in a phased manner: do more with existing facilities, divert demand, and then expand.

Progress Check 3

1. Faced with a recurring congestion problems, an airport operator should:

   a) Immediately expand facilities.

   b) Do nothing.

c) Try to increase the efficiency of existing facilities.

d) Try to divert traffic to under-utilised facilities.

5.2.3 Smart Solutions to Capacity Problems

5.2.3.1 Technology

Technology allows airports and airlines to do more with existing facilities by reducing demand on certain facilities. For example, *paperless tickets* reduce demand on check-in and ticketing concourses: instead of waiting in line, passengers will use ticket and boarding pass dispensers dispersed throughout the departures area, and they do not accumulate in one area.

There are some examples of airports that were experiencing congestion in their ticketing concourse few years ago. Today, with a comparable peak demand but with the expanding use of paperless tickets, this problem has been temporarily eliminated.

5.2.3.2 Smart Terminal Design

Some terminals have the right amount of floor space but it is improperly allocated: a re-balancing of internal floor space can provide relief at a cost inferior to an expansion.

5.2.3.3 Smart Operational Procedures

Common use check-in and ticketing counters, discussed in Module 2, reduce the overall number of counters required, with corresponding savings and delays in expansion.

Some airlines provide a special passenger service whereby those passengers who carry light checked luggage can retrieve it directly from the aircraft upon disembarking, thereby reducing demand on inbound luggage systems and waiting time in the arrivals concourse.

Some terminals have implemented a premium service providing access between surface and air modes without using the regular check-in concourse or luggage claim areas. This process removes some pressure on these facilities.

In the area of runway and airspace capacity, congestion might be reduced by operating larger aircraft. This issue will be further discussed in the following unit.

Progress Check 4

1. Name three smart solutions to capacity problems.

    _____

5.2.4 Capacity Cycles

Capacity problems at airports fluctuate in accordance with cycles. For example, when traffic levels decrease capacity problems are temporarily alleviated. After a facility has been expanded, the capacity provided to meet long-term requirements eliminates congestion, until such time as demand equals capacity again.

Key Learning Point

After several years of reduced traffic levels, demand is increasing again and airports need to invest in infrastructure expansions.

### 5.2.4.1 Where Are We Now in the Capacity Cycle?

Until 2001, the major preoccupation of many airports was capacity and demand management. It is a preoccupying issue because providing capacity costs money, it can be technically challenging, and wrong solutions hang around for a long time.

From 2001 to 2004, with worldwide unstable traffic levels and security threats, states, airlines, and airports concentrated their efforts on meeting the challenge of security threat levels. In an effort to keep costs low over this period, capacity was certainly not a priority. Nevertheless, this notion had to change dramatically, as air travel proved resilient to crises (security and health threats, financial recession, volcanic eruptions) and many airports in emerging markets were already operating at or near design capacity (Figure 57).
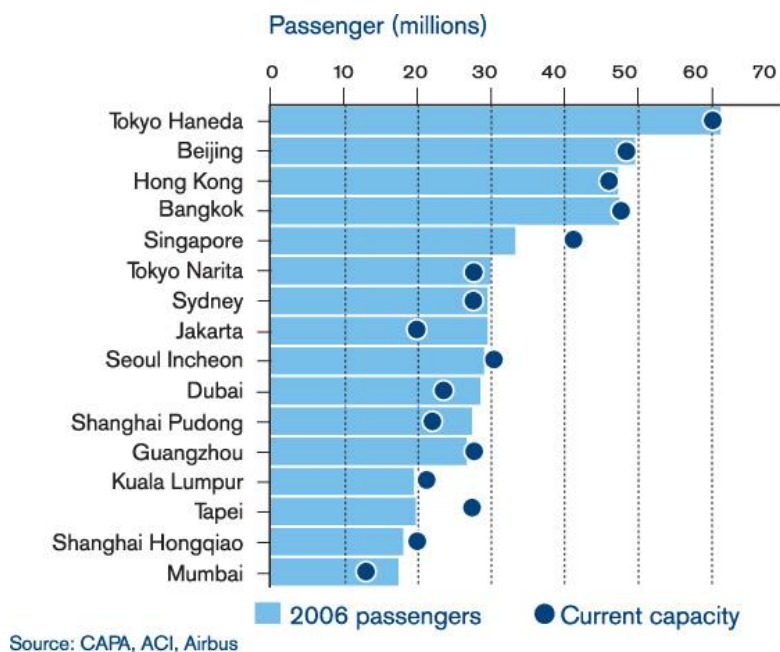
Figure 57. Airports already operating at or near design capacity

Markets in the emerging economic nations (mainly in Asia) continue to grow; their economies and demographic developments are driven by and are benefiting from air travel. In addition, continued liberalization is giving greater market access to airlines and wider choice for passengers and for industrial air cargo shippers. This means that over the 2007–2026 period, world passenger traffic is expected to increase by 4.9% per annum and the number of frequencies offered on passenger routes will more than double (Figure 58).
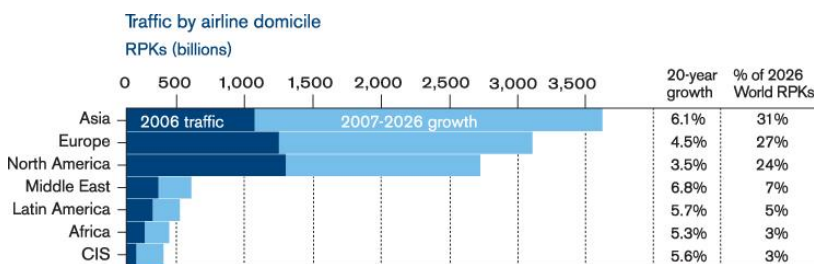

Figure 58. Asia is the world traffic leader (source: Airbus)

Statistics for global traffic in 2010 indicate that figures are back to prerecession levels with load factors nearing 80%. Asia-Pacific leads with a 2.2 billion in profit. North American carriers moved into the black at $1.9 billion. Latin American airlines returned $900 million. Middle Eastern and African carriers reached profits of $100 million[2].

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[2] State of the Air Transport Industry–DG & CEO, IATA

Long-term, statistics show that over the 2007–2026 period:

- Passenger traffic to double, reaching 9 trillion PRKs (Revenue Passenger Kilometers)–Figure 59

- Freight traffic to triple, reaching 450 billion FTKs (Freight Tons Kilometers)–Figure 60

- 24,262 new passenger and freighter aircraft will be delivered, out of which 13,772 will be replacing less eco-efficient models–Figure 61
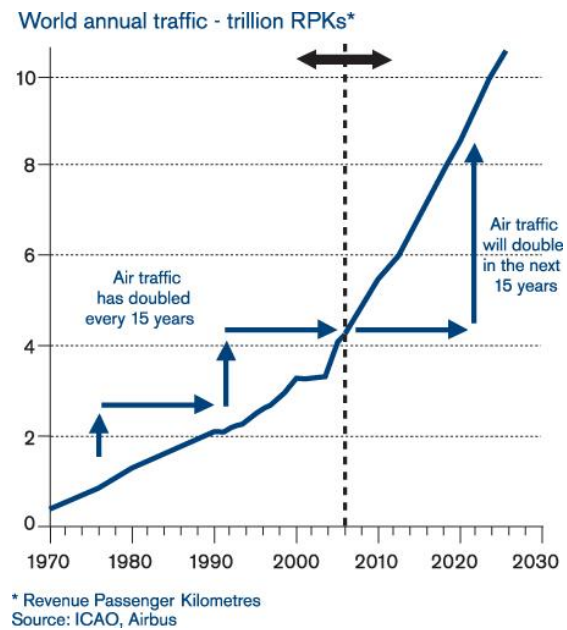
Figure 59. Passenger traffic to double
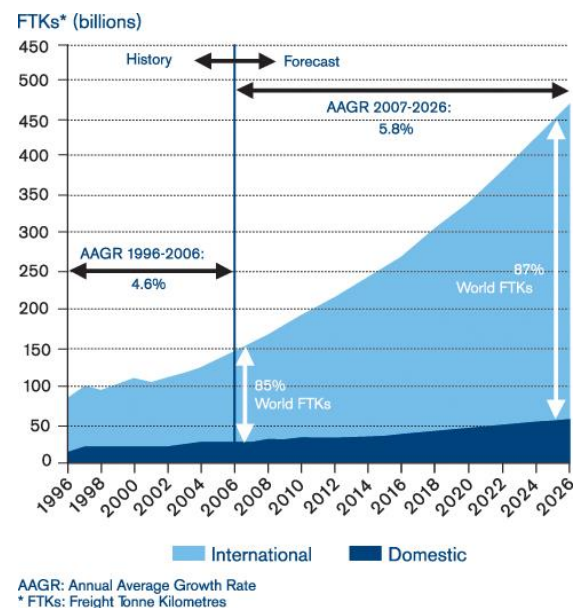
Figure 60. Freight traffic to triple (source: Airbus)

Passenger aircraft ≥100 seats
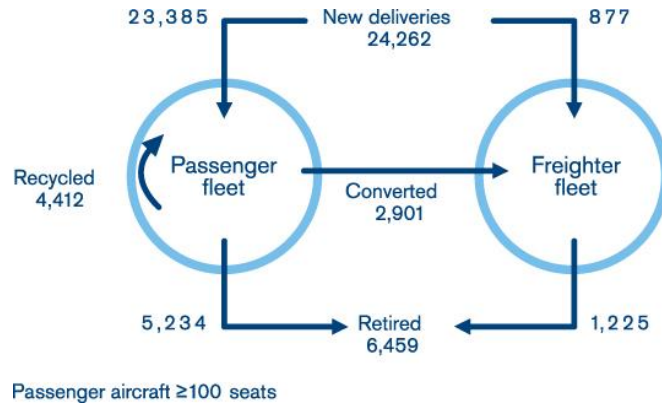
Figure 61. Over 24,000 new aircraft deliveries (source: Airbus)

To meet this challenge the regions with expected increase are already looking at infrastructure developments. In the Asia-Pacific for example the statistics speak for themselves. More new terminals and airport expansions are in the pipeline. China expects to have 43 new airports by 2011 and 224 airports by 2020. India targets 500 operational airports by 2020. Airports worldwide have invested over US$ 150 billion in capital infrastructure between 2005 and 2010[3].

As a result, around 350 billion dollars will be needed for airport infrastructure development in the next 12–15 years:

a) Airfield improvements and expansion.

b) Terminal improvements and expansion.

c) Ground access enhancement.

Although forecasts may be off from a timing perspective, they will eventually materialise.

5.2.4.2   Conclusion

Capacity management is a challenging function of airport operations. Some forms are easier and less expensive to implement. However, any form of demand management denies some users free access to the airport, and it may affect the growth of the aviation industry.

When an airport faces unacceptable congestion and delays, gradual strategies should be implemented, starting with those that increase the efficiency of existing facilities. Demand management and expansion of facilities should then be considered in that order.

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[3] IATA Global Traffic Forecast 2006–2026

Lesson Summary

Capacity is the power of containing a certain quantity of things or the ability of a component to accommodate a given level of traffic. It cannot be exceeded without consequences.

When demand on a facility approaches or exceeds its capacity, congestion occurs: It is an excessive accumulation causing disorder and delays. A delay is a restraint of the motion of something or an increase of the time necessary to do something. Airport delays can occur in all processing points. The consequences of delay are poor level of service, customer dissatisfaction, and possibly unsafe conditions.

Airport congestion is caused by growing and concentrated demand, the desire for frequency of service, and the resulting pressure on infrastructure, including airports and ATC systems. This has become a constraint that will increasingly influence how airlines respond to future demand. Congestion is causing serious operational disruptions, with a growing number of delayed departures and arrivals, not to mention the knock-on implications across networks.

In an effort to help manage the allocation of scarce airport resources at congested airports, the International Air Transport Association (IATA) has identified 93 airports where congestion is so high that demand already exceeds capacity and where any expansion of capacity is improbable, at least in the short term. To prevent undue delays, diversions or cancellation of flights at these airports, it has been recognised that a more coordinated approach to slots is necessary between the airlines, airports, air traffic control and government authorities[4].

Airport demand is characterised by regular and deep fluctuations. Providing capacity for peak demand would be uneconomical and would create overcapacity. Therefore, airports provide capacity for a typical peak, with the understanding that congestion may occur from time to time.

Coping with capacity problems requires a phased approach: do more with existing facilities, divert demand, and then expand facilities.

Technology, smart design, larger aircraft (A380), and operational procedures can alleviate capacity problems and postpone the need to expand.

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[4] Airbus Global Market Forecast 2007–2026

5.3   Sustainable Development

Lesson Overview

In Module 2–Airside, you learned about the operational procedures that airports should implement to manage their impacts on the human and natural environment.

In this lesson, we will address the same topic but from a much broader perspective.

We will first define the concept of sustainable development from a global perspective. We will briefly mention some of the recent international initiatives put forward by States in support of it. You will learn about some examples of recent losses in environmental quality that, if left unattended, may jeopardise the quality of life on our planet.

We will then review the key impacts that the aviation industry and airports have on the global natural environment.

Finally, you will learn about what concrete actions airports are already taking in support of sustainable development.

5.3.1   Sustainable Development at the Airport Level

The issue of sustainable development is gathering increased importance with airports, airlines and governments, all conscious of the need to be responsive to such major public issues

In line with the overall philosophy of sustainable development, many airports have adopted a corporate Sustainable Development statement, supported by a programme and by policies. This programme requires that they conduct their operations and undertake development in ways compatible with sustainable development, as previously defined.

Airport Policies–Corporate Level: An airport Sustainable Development Programme should include the following elements:

a) An Environmental Charter spelling out the airport's formal commitments to protect the environment for future generations.

b) A multi-year environmental action plan.

c) A formal and transparent public communication plan with affected residents. An airport Web site with input and feedback capability is an asset.

d) An annual environmental report, clearly showing achievements against set goals (it can be part of the Airport Annual Report).

e) *ISO* 14001 Certification (desirable).

Airport Procedures: More specifically, airports need to ensure that their operations are conducted in ways that minimize Noise: Ensure aircraft operators comply with noise abatement procedures, implement land use compatibility policies, deal with all complaints relative to aircraft noise.

a) **Air Quality:** Measure and reduce pollution. Convert airport vehicles to non-polluting sources of energy, to reduce the emission of greenhouse gases. Convert heating equipment to non-polluting sources of energy to reduce the emission of greenhouse gases.

b) **Water Quality and Preservation:** Hold, monitor and treat surface water run-off before releasing it in the environment. Meet applicable water quality standards. Re-use run off water for industrial uses such as for heating and cooling purposes, and for watering landscaped areas.

c) **Soil Quality:** Ensure all tanks and pipelines containing pollutants comply with applicable laws and regulations. Monitor them for leaks.

d) **Energy Consumption:** Measure and reduce. Develop and implement an airport-wide energy consumption management plan (reduce engine idling time, install timers or automatic switches on lighting systems). Train employees to be energy-conscious.

e) **Domestic and Industrial Waste:** Measure and reduce. Implement an airport-wide selective re-cycling programme. Burn domestic waste to produce heat.

Airports also need to ensure that new facility and infrastructure development is done in ways compatible with the preservation of wildlife and natural resources. They should integrate environmental management throughout airport planning and construction. For example, when developing a new runway or terminal, the preservation of existing fauna and flora must be taken into account during the design stage. If trees must be removed, an equivalent number of trees should be planted elsewhere. Realigning streams must be avoided if possible.

Airports must at least meet applicable environmental regulations and standards. However, they can elect to do better.

Finally, as an objective for ongoing improvement, airports should strive to continually adopt best management practices.

5.3.2 The Challenge of Sustainable Development

Although everybody agrees that sustainable development is a good objective, reality shows that different demands generate conflicts. For example, as people become more affluent, they wish to travel more by air. They also have higher expectations in terms of their desire to protect the environment. They expect a higher of quality of life, generating a lower tolerance for pollution and disturbance.

It means that friction between communities and their airports will get worse without a pro-active approach on the part of airports to establish a meaningful dialogue with the community they serve.

Lesson Summary

There is widespread concern that economic growth may have a negative impact on the environment and that it could, in the long term, jeopardise life on our planet.

Sustainable development is a development meeting the needs of present generations without compromising the ability of future generations to meet their own.

Over the past decade, the United Nations held a number of conferences designed at promoting sustainable development, based on social, environmental, and economic premises.

The rate of exploitation of natural resources is higher than the earth's capability to regenerate them.

As a result, a number of them have significantly decreased over the past few decades (forests, oceans, agricultural lands).

Although they have limited reserves, non-renewable energies currently provide a large proportion of our energy needs. They also generate greenhouse gases.

The emission of greenhouse gases by the aviation industry is increasing, in spite of international commitments to reduce them.

Airport activities generate a risk of pollution of surface and ground water, and of soil and substrate.

They also affect the survival of many species of fauna and flora. Aircraft noise may cause poor neighbour relations.

Many airports have adopted a sustainable development policy, supported by procedures and a transparent communication plan. The main elements of such an initiative are practical measures aimed at preserving the natural and human environment. Target areas are water, air, and soil quality; energy management, waste reduction, and aircraft noise management.

In spite of the overall agreement with the sustainable development concept, different interests generate conflicting goals such the need to travel more while doing more for the environment.

Progress Check 5

1. What does sustainable development mean?

    a) To participate in recycling programs

    b) To use solar and wind energy as much as possible

    c) To meet current needs without compromising future generations ability to meet theirs

    d) To use nuclear power instead of fossil fuels in order to preserve natural resources for future generations

Module Summary

Security threats and acts of unlawful interference have far-reaching economic effects on the aviation industry, having caused bankruptcy of major airlines and hardship on the whole industry.

Acts of unlawful interference evolved over the past thirty years. They have become more diverse, and terrorists have become more sophisticated. As a result, airports have introduced new procedures, more skilled security personnel, and more sensitive screening equipment.

Biometric is a recent but promising technology that allows the quick and automatic identification of pre-registered people. It is used for controlling employees' access to restricted areas and, on a limited trial basis, to screen pre-registered frequent flyers. Its use constitutes an improvement to passengers' identification and facilitation.

Airports derive an important percentage of their revenues from airlines. When demand for air travel decreases sharply, the financial impact felt by airlines has immediate effects on the airports they serve. The operating margin and net profit achieved by airports over the past few years has declined.

Airlines and airports have taken drastic steps to cope with the financial challenge created by declining traffic volumes and increasing security costs.

Recent increases in traffic coupled with positive forecasts for the upcoming years should help the aviation industry to recover from the worst-ever economic downturn in aviation history.

Capacity is the ability of a component to accommodate a given level of traffic. It cannot be exceeded without consequences. When demand on a facility approaches or exceeds its capacity, congestion occurs, with its corresponding delays and low level of service.

Airport demand is characterised by regular and deep fluctuations. Providing capacity for peak demand would be uneconomical. Therefore, airports provide capacity for a typical peak, with the understanding that congestion may occur from time to time.

Coping with capacity problems requires a phased approach: do more with existing facilities, divert demand, and then expand facilities.

Technology, smart design, and operational procedures can alleviate capacity problems and postpone the need to expand.

In the past, the advent of new aircraft types had various challenging impacts on airport facilities. Their size, weight, take off distance, and capacity required a corresponding increase in runways, taxiways, stands, and terminal facilities.

These requirements peaked in the 1980s and current facilities are adequate to meet the needs of the existing fleets.

Some of known future aircraft, due to their size, weight, and capacity, will impose further challenges on existing airport facilities.

Future technology may bring more fuel-efficient aircraft, and possibly new types of fuels. It is not expected that these changes will have significant impacts on airport facilities.

The principle of sustainable development is to ensure that development needs of the present generation are met without compromising those of future generations. The United Nations held a number of conferences in support of sustainable development, based on social, environmental, and economic premises.

The aviation industry generates greenhouse gases and airport activities pose a risk to the quality of water, air, and soil; and to the survival and various fauna and flora species. Aircraft noise may cause poor neighbour relations.

Many airports have adopted a sustainable development policy, with supporting procedures and public communication tools. Practical measures should ensure the protection of water, air, and soil quality, the preservation of energy, the reduction of waste, and the limitation of aircraft noise impact on neighbours.

Apply Your Learning

1. Find out whether your airport is currently experimenting with biometric technology for access control purposes. If so, which one of the technologies you learned about in this unit is in use? Observe its operation.

   If none is installed, are you aware of any plans to do so, using what technology?

2. Can you see evidence of the fluctuating characteristics of airport demand at your airport? Are there obvious capacity problems? If so, what tangible measures are in place to deal with them?

   Are there plans to invest in infrastructure improvements?

3. Does your airport have a Sustainable Development policy? If so, is it known to the public?

   Does the policy include environmental goals? Are annual results shared with employees and the community?

4. Due to an increase in tourism and business opportunities in your country, airlines are planning on adding a substantial number of flights to cater to this new demand. On one hand, this new business will generate new revenues for the airport

used as point of entry to the country; on the other hand, existing facilities cannot accommodate this new traffic, as the proposed operating times coincide with existing peak times.

Airlines are insisting that this new business be accommodated at the stated times, and are threatening to use another airport as point of entry. Think about the alternatives available to resolve this pressing issue.

5. Senior management at your airport recently decided to embark on the preparation of a Sustainable Development programme. You have been asked to participate in this effort. You are aware that environmental protection at this airport has only recently become a priority, and that, in the past, there might have been some negligence in this area. Think about how you would organise this interesting project.

Further Reading

Norman Ashford, H P Martin Stanton, Clifton A Moore: *Airport Operations*, Pitman Publishing.

Answer Key

Progress Check 1

1. Reduced revenues from aeronautical and non-aeronautical sources, additional security expenses, Increases in insurance costs.

2. Cutbacks in operating expenditures, employee layoffs, cutbacks in capital expenditures.

Progress Check 2

1. c

Progress Check 3

1. c

Progress Check 4

1. Technology, smart terminal design, smart operational procedures.

Progress Check 5

1. c

Module 6—The Future of Airports

6.1   The Future of Airports

Module Overview

Several factors will affect the future of airports. First of all, we will review what technological improvements are likely to change the way airports conduct their business, in the airside, terminal, and landside areas.

Then, we will discuss some scenarios about the future of airport ownership and operations.

Finally, you will learn about the concept of uncertainty, how it affects airports, and what tools are available to cope with it.

Module Learning Objectives

Upon completion of this module, you should be able to:

- Describe how emerging and future technological improvements will affect airports (Lesson 1).

- Describe how airport ownership and operations are likely to evolve in the future (Lesson 2).

- Define the concept of uncertainty and how airport operators can cope with this challenge (Lesson 3).

6.2   Future Technology

Lesson Overview

In Modules 1 and 2, you learned about airport technology, as it exists today. We are now going to discuss what new technologies may be implemented in the future, based on known research and current development initiatives.

We will first address airside technology, such as navigation aids, aircraft and pavement de-icing methods, bird hazard control, and pavement design and maintenance.

Next, you will learn about terminal new technologies, how they will enhance security and the processing of passengers and luggage, and what new services they will make available to passengers.

Lesson Learning Objectives

Upon completion of this lesson, you should be able to:

- Name technological advances that may be implemented at airports in the future.

- Describe the effect of technological improvements on airports, in the areas of efficiency, safety, security, and protection of the environment.

We will then discuss landside technological enhancements, in the area of airport access.

Finally, you will learn how technological improvements can benefit airline operations and how airports can benefit from these advancements.

6.2.1 Airside

6.2.1.1 Navigation Aids–Global Positioning System (GPS)

The principal aim of air navigation is for successfully piloting the airplane without getting lost, breaking aircraft laws or endangering the safety of the passenger.

Aircraft are generally navigated under the Visual Flight Rules (VFR) and the Instrument Flight Rules (IFR). In case of IFR, the pilots are permitted to navigate with the help of instruments and other radio navigation devices, where as in case of VFR pilot moves forward by using direction, speed, time and distance of travel along with visual observation.

Prior to the advent of Global Positioning System (GPS) the two common methods of navigation that pilots frequently used were the Automatic Direction Finder (ADF) and the VHF Omni-directional Range (VOR).

The new advancement in GPS provides position accuracy by the help of 24 earth-orbiting satellites. The position data is updated time by time for accuracy. Satellites are positioned in such a way that every GPS unit can locate at least 4 satellites (5 in case of air navigation) to determine its own position.

The GPS unit catches the signals of different satellites and measures the time between the transmission and reception of signal. By following the method of triangulation with respect to different satellites the GPS receiver determines its own location. GPS unit calculates latitude, longitude and also altitude.

Hence, GPS is now the latest technological innovation used for air navigation and manufacturer now provides units that have data on all commercial airports including runway length, direction and location. Users can update the database at any time by using their personal computers[1].

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[1] http://www.roseindia.net/technology/gps/gps-differen-from-ade-vor-Air-navigation.shtml

Key Learning Point

The principal aim of air navigation is for successfully piloting the airplane without getting lost, breaking aircraft laws or endangering the safety of the passenger.

6.2.1.2 Navigation Aids–Performance–based Navigation (PBN)

Another new navigation concept to meet future challenges will be the Performance-based Navigation or PBN. PBN technology will allow airlines, airline passengers, airports and the communities they serve to achieve significant environmental and economic benefits. But community noise reduction, fuel savings and reductions in CO_2 emissions won't materialize if aviation stakeholders don't successfully engage communities in the change process.

The concept of PBN leverages on GNSS by advancing aircraft systems, improving cockpit displays and modern aircraft auto-flight capabilities. PBN precision and predictability can reduce route-structure track miles and can facilitate environmentally sound operations, such as Continuous Decent Arrivals (CDAs) and optimised departures.

PBN unleashes the full potential of current-generation aircraft to fly precisely-defined paths without relying on ground-based radio navigation signals. Required Navigation Performance (RNP), an enhanced mode of PBN, guarantees the aircraft does not stray from the path and enables additional navigational flexibility, such as the ability to follow curved paths.

PBN and RNP unlock a world of previously unrealized possibilities for shortening aircraft paths, placing them over non-residential areas and lowering community noise levels[2].

Major stakeholders of the world aviation community have signed a declaration calling for the rapid implementation of Performance-based Navigation (PBN) that will contribute to further improving the safety, efficiency and sustainability of the global air transport system.

ICAO's President Roberto Kobeh González, said that PBN "will help reduce airport and airspace congestion, conserve fuel and protect the environment, reduce the impact of aircraft noise near airports, and ensure reliable, all-weather operations. It will also provide operators with greater flexibility, while increasing safety and efficiency."[3]

Performance-based Navigation (PBN) and Required Navigation Performance (RNP) unlock a world of previously unrealized

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[2] http://www.air-cosmos.com/news/business-wire/airlines-and-communities-poised-to-reap-major-pbn

[3] http://www.arabianaerospace.aero/article.php?section=technology&article=icao-demands-pbn-now

possibilities for shortening aircraft paths, placing them over non-residential areas and lowering community noise levels.

6.2.1.3 Aircraft De-icing–Environment Friendly Chemicals

Currently, aircraft are de-iced using glycol, a fluid that contains chemicals harmful to the environment, particularly aquatic life. Environmental protection regulations limit the concentration of glycol that airports can release in the environment. This requirement prompted many airports to construct expensive de-icing centres. In addition to their financial implications, deicing operations generate delays, as all aircraft requiring de-icing must go through the bottleneck created by a central facility.

Ideally, de-icing should be conducted with neither environmental nor operational impacts. Chemicals that are more environmental-friendly and can be applied while aircraft are parked on their stands should be developed. The recovery of spent fluids for recycling purposes would still be available, using existing surface run-off collectors and diversion pipes. There would be no concerns about leakage of harmful chemicals into the environment.

De-icing aircraft on their stand would eliminate costly delays and the need to provide and operate expensive and land-intensive de-icing centres.

6.2.1.4 Aircraft De-icing–Infrared or Gas-fired De-icing Heaters

The environmental impact and escalating costs of chemical de-icing have prompted the research of alternative methods. Tests have been conducted to de-ice aircraft using heat as a means of melting ice or snow from their surfaces: a medium size aircraft covered with 6 mm of ice can be de-iced in 5 to 9 minutes[4], substantially quicker than with glycol. The facility used consists of a taxi through structure, equipped with heat generators. After completion of the operation, only harmless water is produced, therefore eliminating the need for product recovery, and the monitoring of water quality for the presence of de-icing chemicals.

This method also eliminates the need for de-icing fluid purchase, storage, and handling. However, the disadvantage of going through

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[4] Federal Aviation Administration–Airport Technology Research & Development Branch

a central facility still exists. Finally, this method does not provide for anti-icing capability.

6.2.1.5   New Pavement De-icing Methods

Laboratory tests were conducted between 1998 and 2000 to evaluate the effectiveness of a new type of pavement, called conductive concrete overlay[5]. This technology consists in heating the top layer of a surface with electricity. The resultant heat melts or prevents the accumulation of snow and ice. Further tests using bridge decks are underway to assess the applicability of this technology to large aerodrome surfaces.

6.2.1.6   New Aerodrome Pavement Products

Maintaining and replacing aerodrome pavement surfaces is expensive and disruptive to operations. Research is underway to increase pavement durability and to reduce its maintenance costs. In particular, the production of fuel and abrasion-resistant surfaces is being researched.

6.2.1.7   Bird Hazard Control

Besides the management methods outlined in Module 2, new techniques are being developed and tested. For example, it was discovered that laser beams repel birds. This technology is non-lethal for birds. However, more experience is required to determine whether all species respond to this method and whether birds get habituated to this type of scare tactic.

6.2.1.8   Runway Rubber Removal

New techniques are being developed to remove rubber deposits more efficiently[6]. Examples include high water pressure, emulsifying chemicals, high impact pellets, and sweeping.

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[5] Federal Aviation Administration–Technology Transfer Conference–Technical Papers

[6] SITA's Vision for the Next Generation

Key Learning Point

New technology in the airside area will enhance the efficiency of operations and maintenance, and reduce the environmental impact of de-icing operations.

6.2.1.9 Hybrid Equipment and GSE

This will be the next area of development. Airports will begin to see more hybrid equipment and Ground Service Equipment (GSE) such as tow tractors and platform trucks with diesel, electric or hybrid drive. The advantage of hybrid equipment and GSE is that they:

- Reduce Emissions (up to 90%)

- Achieve 25%–50% Better Fuel Economy

- Improve Driveability, Quieter

- Improve Performance

- Reduce Maintenance (brakes, transmission)

- Use Standard Fuels

- Are similar to Today's Vehicles

Progress Check 1

1. GPS is a positioning system that relies on:

    a) Ground-based infrastructure.

    b) Satellites.

    c) A combination of satellites and airport infrastructure.

    d) Airport Control Tower.

2. Name two possible alternatives to glycol aircraft de-icing:

    _____

3. Prior to the advent of Global Positioning System (GPS) the two common methods of navigation that pilots frequently used were the _____ and the _____.

4. Bird hazard reduction using laser technology can be implemented: Circle all answers that apply.

    a) Immediately.

    b) After more experience is accumulated relative to the response of more species to this technology.

    c) After it is determined whether birds become habituated to this technology.

    d) If it is determined that it is non-lethal to birds.

6.2.2 Terminal

It is in the terminal area that technological improvements will create the most profound changes, designed to change passengers' experience by enhancing security, facilitating their processing, and providing unlimited access to a myriad of airport goods and services.

6.2.2.1 New Security and Government Control Technology

Security has been a primary goal of the air transportation industry for the past three years, and will be for some time to come. Biometric technology discussed in Module 5 is still in an embryonic stage of implementation. However, its proven potential leads to the vision of a widespread application to enhance both security and facilitation.

This application could be extended to Immigration and Customs functions, for frequent flyers enrolled in such a programme. Iris recognition tests are underway to that effect at several international airports.

An IATA-sponsored initiative, called S-travel (Secure Travel) is underway. It incorporates digital certificates for registered passengers.

Unrelated to transportation, biometric technology could be extended to serve other purposes, such as access to buildings, and access to computers (to replace passwords).

One other area where technology will be brought into play will be for Travel Documents. ICAO sets the international standard for travel documents in Doc 9303. This specifies the need for harmonization and interoperability of passports and travel documents by many countries so as to facilitate inspection and enhance security.

6.2.2.2 Web Applications

To further speed up document processing a number of manually-based processes will go into web applications. This is already in place for airline tickets in form of e-tickets. Similarly, there is work in progress for States to accept cargo manifests and other documents for aircraft clearance when transmitted by operators and received by public authorities in electronic form.

6.2.2.3   Passenger Screening

The future automated system would use biometrics as a means of verifying the identity of the passenger. Real time queries with government databases would improve aviation security and national security. This means improving the existing system by replacing repetitive checks of passengers and their documentation with a new streamlined system. The new system will collect the information once and then share it electronically with subsequent service providers.

6.2.2.4   Luggage and Freight Processing Technology

Efficient processing of checked luggage and freight is an important element of customer satisfaction. To this effect, speed, accuracy, and reliability of processing are essential. Emerging technology, using electronic tags and sensors, would allow real-time tracking of every piece of luggage and freight, providing immediate feedback to customers' enquiries. For example, in Hong Kong, Radio Frequency ID (RFID) technology is already being used for baggage reconciliation.

This technology would also enhance the accuracy of luggage dispatch at large airports, where high volumes of luggage must be dispatched to multiple flights.

6.2.2.5   Common Use Self Service (CUSS)

This is an initiative by IATA and ATA. It is the standard for multiple airlines to provide a check-in application for use by passengers on a single device. IATA and ATA adopted this new standard during the Joint Passenger Service Conference in November 2000.

These kiosks fundamentally allow passengers to control a key component of their journey through the airport thus saving time spent queuing or standing in line waiting for their boarding pass to be issued by a check-in agent at the desk.

It harnesses the technological shift provided by the e-ticket project, shares with the Bar Code Boarding Pass (BCBP) project for Boarding Pass production, mirrors trends in internet usage for passenger check-in, and delivers a platform for bag tag issuance.

Key Learning Point

Common Use Self Service (CUSS) harnesses the technological shift provided by the e-ticket project, shares with the BCBP project for Boarding Pass production, mirrors trends in internet usage for passenger check-in, and delivers a platform for bag tag issuance.

6.2.2.6   Technology in Security Screening

Technology will also be coming into security screening to help speedier processing of passengers and their baggage while maintaining security effectiveness. For screening of passengers, new technology such as Personnel X-ray Systems, Millimetre Wave Imaging Systems, Explosive Detection Portals, shoe scanners and Body Orifice Security Scanners will become a common feature in airports to supplement current technology such as Walk Through and Hand Held Metal detectors.

Personnel x-ray systems, such as body scanners will be able to assist in identifying any threat item that a passenger is concealing on his or her body. Explosive detection portals will also be introduced to assist in detecting traces of explosives or drugs that a passenger may be intelligently disguising on their body.

As for the screening of passenger baggage, more advanced technology for detection of other threats such as liquid explosives will be introduced. A new airport scanner that can tell the difference between water and liquid explosives is now available. The scanner, which has been developed by British scientists, can even check the barcode to make sure the contents haven't been tampered with. The X-ray machines have been given official EU approval, which will help introduce this new technology at all European airports[7].

For cargo screening, Thermal Neutron Analysis (TNA) and Pulse Fast Neutron Analysis (PFNA) will bring with it more powerful screening capability. They use a nuclear source to bombard baggage with neutrons, which will react with atomic nuclei of material in baggage producing gamma rays. Gamma ray emission signatures are then analysed against the database of nitrogen gamma rays.

Shoe scanners are now able to scan your shoes without you taking them off at airports. These shoe-scanning devices are now in use at the Orlando International Airport. This will speed up check-in and help overcrowded airports move people through security checkpoints much faster.[8] One of the latest innovations in airport security is a product which quickly detects explosives, narcotics, ceramic weapons and inorganic materials such as metal.

[7] http://www.dailymail.co.uk/travel/article-1323570/EU-approves-X-Ray-airport-scanners-tell-water-liquid-explosives.html#ixzz140F9sNDQ

[8] http://shoescanner.com

Checkpoint of the Future

In June 2011, IATA unveiled the first mock-up of a Checkpoint of the Future, designed to enhance security while reducing queues and intrusive searches at airports, using intelligence-driven risk-based measures.

The main concepts of the Checkpoint are:

1. strengthened security by focusing resources where risk is greatest

2. supporting this risk-based approach by integrating passenger information into the checkpoint process, and

3. maximizing throughput for the vast majority of travelers who are deemed to be low risk with no compromise on security levels.

How does it work?

The Checkpoint of the Future ends the one-size-fits-all concept for security. Passengers approaching the checkpoint will be directed to one of three lanes: 'known traveler', 'normal', and 'enhanced security'.


Figure 62. The 3 lanes of the checkpoint

The determination will be based on a biometric identifier in the passport or other travel document that triggers the results of a risk assessment conducted by government before the passenger arrives at the airport.

The three security lanes will have technology to check passengers according to risk. "Known travelers" who have registered and completed background checks with government authorities will have expedited access. "Normal screening" would be for the

majority of travelers. And those passengers for whom less information is available, who are randomly selected or who are deemed to be an "Elevated risk" would have an additional level of screening.
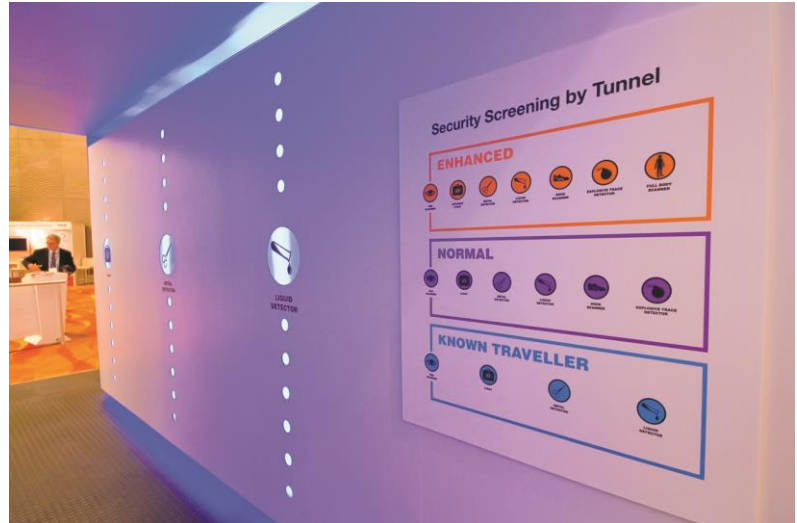
Figure 63. Security screening according to risk

Screening technology is being developed that will allow passengers to walk through the checkpoint without having to remove clothes or unpack their belongings. Moreover, it is envisioned that the security process could be combined with outbound customs and immigration procedures, further streamlining the passenger experience.

Figure 64. The biometric features

Through the International Civil Aviation Organization (ICAO), 19 governments, including the United States, IATA is working to define standards for a Checkpoint of the Future. IATA is also coordinating

closely with the US Department of Homeland Security's Checkpoint of Tomorrow program which has similar goals.

6.2.2.7   Customer Service Technology

Wireless and wearable information technology is continuing to change the way airports and their customers do business. Wireless personal devices proliferate around the world: mobile Internet, personal digital assistants, and smart phones. Some examples of possible airport applications include:

a) Mobile commerce and mobile payment: passengers would be able to purchase and pay for goods on-line, using a mobile device remotely connected to a tagged and coded good, then to a cash register for payment. This technology could be extended to food concessions, where passengers pressed for time would be able to pay their bill from their table, without having to wait for it, and wait at the cash register.

b) Using the same technology, registered passengers would be automatically informed of discount sales, or of the availability of a particular type of goods they purchased in the past. The name and location of the shop offering such opportunities would be displayed for assistance.

c) Sensors and transducers would detect the arrival of passengers at the airport, trigger their automatic check in, and inform them accordingly, including boarding time and gate. The mobile device worn by the passenger would display a map of the path to follow to the boarding gate, along with an approximate walk time.

d) At airports providing a personalised luggage delivery service, technology would advise the passenger of the location of his or her luggage along the delivery path to his home or hotel.

e) Possibility to make ticket purchases and reservations, or change existing ones.

f) On 1 June 2008, the industry moved to 100% electronic ticketing (ET) and the paper ticket became a thing of the past. Apart from substantial cost savings for the industry of up to US$ 3 bilion per year, ET is also more convenient for passengers who no longer have to worry about losing tickets and can make changes to itineraries more easily.

6.2.3   Landside

An equivalent level of service improvement in the landside area must follow the above airside and terminal technological

improvements. Barring this, an imbalance will exist, which is detrimental to the objective of facilitation.

It is conceivable that airports will provide new surface access vehicles such as high speed dedicated trains or monorail linking selected points to their terminal buildings. From a passenger's perspective, this technology would eliminate delays caused by road congestion or adverse weather conditions. From an airport operator's perspective, it would reduce the cost of providing additional parking capacity.

As for air transportation security, passenger and luggage checking would be done at the origin station, and luggage delivered to the appropriate airline, thereby eliminating the check in function at the airport for these passengers.

6.2.4   Airline Operations

Improved and seamless wireless communications between all agencies involved in aircraft ground handling would reduce aircraft turnaround time. In addition, implementation of technology in airline operations benefits airports by:

a) Streamlined passenger processing, speeding up the flow of people and reducing congestion.

b) Reduced demand on some traditionally space and time-intensive functions and facilities such as check in and Government Controls.

c) Enhanced processing of aircraft, reducing airside congestion and delays.

d) Revenue opportunities in the concession areas.

e) Satisfied customers.

Lesson Summary

On airside, the widespread establishment of GPS and PBN approaches will allow airports that are unable to install an ILS to provide a precision approach. This improvement will benefit aircraft and airport operators.

In the terminal area, the expansion of biometric technology will enhance security prevention measures and facilitation. Its use could be extended to streamline government control functions.

The most radical changes expected will be provided by wireless, portable technology. Such devices will allow users to remotely order and pay for goods and services. They will also have a real-time information capability, allowing passengers to keep track of flight time or gate changes.

In the landside area, new rapid and dedicated access vehicles will allow passengers to reach the airport unaffected by road congestion. They will provide the required capacity to match enhancements in airside and terminal, and maintain the balance required to achieve facilitation. By shifting demand from road vehicles to another type of access, airport operators will avoid costly expansions of parking lots.

Progress Check 2

1. Name two possible applications for biometric technology beyond airport security functions.

   _____

2. Name two possible airport applications of wireless, wearable devices.

   _____

3. Name the two new methods of cargo screening?

   _____

6.3   Ownership and Operation

Lesson Overview

In Module 1, you learned about the issue of airport ownership and
operation. In the following lesson, we will examine the status of the
factors that drive the need for airport commercialisation and private
sector participation.

You will then learn about the relative potential for airports to follow
this trend.

Finally, we will discuss the different types of specialisation likely to
be adopted by airports to meet the needs of the airlines.

6.3.1   The Need for Commercialisation and
Private Sector Participation

There is persistent pressure on the part of airlines for airports to
operate with a business approach. In addition, Governments are no
longer able to finance the required rate of infrastructure
development.

The first factor is still present and has taken even higher importance
over the past few years, in extremely challenging times for the
airline industry.

The second factor still exists and is gaining in importance, now that
traffic recovery is underway and that expansion needs are looming
again.

Overall, the results of airport commercialisation and private sector
participation have been positive.

Based on the above considerations, it is logical to assume that the
thrust toward airport commercialisation and private sector
participation will continue.

6.3.2   The Future

Will all airports eventually be commercialised and privatised?
Probably not, and some of the reasons include:

a)   Impossibility to achieve financial viability in the current and
foreseeable future economic context.

b) Presence of severe environmental problems (such as soil contamination) requiring mitigation by the current owner.

c) Political orientation of the State or airport owner, having decided not to pursue this alternative, or not having recognised the potential of its airports.

d) Conflicting demands of being a business and meeting the legal requirement of aerodrome safety.

e) Particular situations whereby only one airport in a country is attractive to private investors, leaving the other, unprofitable airports isolated.

Key Learning Point

The trend to commercialise and privatise airports will continue. Airports will focus on the needs of their customers by specialising in the provision of tailor-made facilities and services. New airports may be built to accommodate demand.

6.3.3   Many Types of Airports

The airline industry has become segmented to focus on specific target markets. As a result, airports can no longer provide a generic type of facilities when their main customers have specialised. What we will see more and more in the future is market-tailored airports, such as:

a) Passenger airports.

b) Freight airports.

c) Origin and destination airports.

d) Transfer airports.

e) Retail airports (focussing on non-aeronautical activities).

f) Low cost airports (catering to low cost, no-frill airlines).

Entirely new airports will be constructed when it is financially more appropriate to start from a "green field" than remodelling or expanding what exists. Technology will allow the construction of new airports even in areas where topography or the unavailability of land made it impossible in the past (removing hills, building artificial islands). This approach, however, must give full consideration to all environmental protection procedures put forward by the sustainable development concept.

Lesson Summary

The trend to commercialise airports and to involve the private sector will continue. Not all airports will reach this level of autonomy, for reasons of lack of potential, political context, or environmental issues.

Airports will specialise by providing facilities catering to specific target markets, such as passenger or freight traffic, origin/ destination or transfer passengers, and low-cost carriers.

Progress Check 3

1. Name the three reasons that will keep airports from commercialising and privatising:

    _____

2. Name two types of market-tailored airports.

    _____

6.3.4 New Planning Strategies

Do the above tools to cope with uncertainty contradict the planning principles that you learned about in Module 1 ("planning means being ready for the future")? The answer is no, for the following two reasons:

a) We still plan for the future, although we tend to plan for a more shortterm future, to reduce the risk caused by uncertainty.

b) We still plan within a long-term overall scheme of things. It re-enforces the concept that an Airport Master Plan must be general enough so that it does not become obsolete following a change in the timing or accuracy of forecasts.

Progress Check 4

1. Name the two factors that create uncertainty in the airport world.

    _____

Unit Summary

Uncertainty means doubt about the future. It is re-enforced by the fear of re-occurrence of past challenging changes.

Uncertainty has become a fact of life, in private life and in business alike, including airports.

Uncertainty in air transportation can be generated by economic, security, health and safety, and technological factors.

Coping with uncertainty requires that the risk of overbuilding be minimised by providing only for proven and affordable needs.

This prudent, short-term approach, does not contradict the planning objective of being ready for the future.

Module Summary

Global Positioning System (GPS) and Performance-Based Navigation (PBN) are the two newer navigation aids that will help current-generation aircraft to fly precisely-defined paths without relying on ground-based radio navigation signals.

GNSS approaches will allow airports that are unable to install an ILS, to provide a precision approach. This improvement will benefit aircraft and airport operators.

In the terminal area, the expansion of biometric technology will enhance security prevention measures and facilitation. Its use could be extended to streamline government control functions

The most radical changes are provided by wireless, portable technology. Such devices allow users to remotely order and pay for goods and services. They have a real-time information capability, allowing passengers to keep track of flight time or gate changes.

In the landside area, new rapid and dedicated access vehicles will allow passengers to reach the airport unaffected by road congestion. By shifting demand from road vehicles to another type of access, airport operators will avoid costly expansions of parking lots.

The trend to commercialise airports and to involve the private sector will continue.

Airports will specialise by providing facilities catering to specific target markets.

Uncertainty means doubt about the future. It is re-enforced by the fear of re-occurrence of past challenging changes. It has become a fact of life, in private life and in business alike, including airports.

Uncertainty in air transportation can be generated by economic, security, health and safety, and technological factors.

Coping with uncertainty requires that the risk of overbuilding be minimised by providing only for proven and affordable needs.

This prudent, short-term approach, does not contradict the planning objective of being ready for the future.

Apply Your Learning

1. You have learned that future technological improvements will bring far-reaching changes to the way airports conduct their business. Some of these changes will rely on technologies that are still under development, and that, upon implementation, will provide users with unmatched capabilities, only dreamed of in science-fiction novels few years ago. The air transportation industry has evolved so much over the past fifty years that one wonders how far it will evolve, assisted by technology. Think about some radical changes that might materialise during your lifetime. Ask yourself the question: "Is there a limit to what technology can do"? Keep in mind the following statement made in 1949 by a team of experts: "There is no future for the jet engine in civil aviation".

2. If you observe the day-to-day business at your airport, would you say that it is operating in a stable or uncertain environment? In your opinion, what factors are causing the observed stability or uncertainty? Relate your findings to what you learned in this module.

3. Observe changes in the traffic served by your airport. Can you detect any trends toward one of the "markets" you learned about in this module?

Answer Key

Progress Check 1

1. b

2. Environment-friendly chemicals; infrared or gas-fired heating

3. Automatic Direction Finder (ADF), VHF Omni-directional Range (VOR)

4. b and c

Progress Check 2

1. Any two from: immigration and customs; access control to buildings or computers; facilitation

2. Any two from: mobile commerce; information relative to the availability of goods; automated check-in; tracking of luggage; reservation or purchase of tickets; and making changes to reservations.

3. Thermal Neutron Analysis (TNA) and Pulse Fast Neutron Analysis (PFNA)

Progress Check 3

1. Lack of potential, political context, or environmental issues.

2. Any two from: Passenger airports, Freight airports, Origin and destination airports, Transfer airports, Retail airports, Low cost airports.

Progress Check 4

1. Fluctuation of demand, Fluctuation of costs.

Glossary

Air Traffic Control: A service provided by an appropriate authority to provide for the safe, orderly, and expeditious flow of air traffic.

Airside: The movement area of an airport (runways, taxiways, and aprons), including adjacent land and buildings, access to which is controlled.

Airway: A defined path in navigable airspace within which air traffic control is provided.

Approach Control Unit: A unit that provides air traffic control services to aircraft while approaching an airport or departing from it.

Approach Lights: An airport lighting facility that provides pilots with visual clues while approaching a runway in low visibility or ceiling conditions.

Area Control Centre: An air traffic control unit responsible for the control of aircraft during the en-route phase.

Biometrics: Technology that allows the automated identification of passengers or employees by comparing a number of body features (iris, palm, facial features) with stored data for the individual.

Concourse: An open space used by passengers and the public for circulation or waiting.

Control Tower: A unit that provides air traffic services to aircraft flying in the vicinity of the airport and to aircraft and vehicles operating on the airport.

Curb: The landside front of the terminal, its sidewalk and frontage road. It provides a link for passengers and visitors between surface transportation vehicles and the terminal.

De-icing: Process by which snow, ice or frost are removed from aircraft surfaces for safety reasons, prior to flight, using various hot liquid chemicals.

Deregulation: Removal of government control over the way the airline industry does business.

General Aviation: That segment of civil aviation that excludes air carriers.

Ground Support Equipment: A mix of vehicles and other equipment designed to provide servicing to aircraft while on the ground (baggage dollies, tow carts, fuel trucks, lavatory waste trucks, etc).

Hijacking: The unlawful seizure of an aircraft in flight or on the ground.

Hub and spoke: An airline network concept, prompted by economic deregulation, whereby small aircraft carry passengers between small airports (feeders) and main airports (hubs). From there, passengers connect to large aircraft to fly the longer part of their journey. It increases air transportation efficiency by providing the right aircraft size and flight frequency for the right trip length and passenger volumes. It draws its name from its graphic shape.

Hydrofoil Boat: A boat capable of reaching high speeds by using wing-like surfaces that raise the hull slightly above the water surface.

Instrument Flight Rules: Flight conditions that exist when weather conditions, expressed by ceiling and visibility, fall below the prescribed minima for flight under VMC.

ISO: International Standards Organisation. ISO 14001 is an international standard based on the ongoing improvement of environmental performance by a company.

Landside: Those parts of an airport that are normally accessible by the public.

Link: In a transportation system, a facility where people or vehicles move between two nodes.

Load Factor: The proportion of aircraft seating capacity that is actually sold and utilised.

Net profit: Operating margin less interest, taxes, depreciation, and amortisation.

Node: In a transportation system, a facility where people or vehicles accumulate for the purpose of processing.

Operating margin: Earnings before interest, taxes, depreciation, and amortisation.

Paperless ticket: A virtual ticket, identified by a reservation code, and used to obtain a boarding pass (from a ticket counter or an

automatic dispenser) for the flight on which a reservation was made. Proof of identity is required for this purpose.

Passenger bridge: An enclosed ramp, permanently connected to the terminal building on one side and mechanically adjustable to connect to various aircraft sizes on the other side. It provides direct and protected passenger and crew access between the terminal and parked aircraft.

Pressurisation: Technique whereby the pressure inside the cabin of an aircraft is maintained at a constant value, close to that at sea level, irrespective of the aircraft altitude. It allows aircraft to fly at altitudes where air pressure is too low to sustain human life.

Supersonic: Faster than the speed of sound (approximately 1200 km/h–or 333 metres per second–at sea level).

Turboprop engine: Ajet engine the power of which drives a propeller.

Yield: Revenue per passenger-kilometre.

Visual Meteorological Conditions (VMC): Weather conditions, expressed by ceiling height and visibility, that allow pilots to fly by visual reference to the ground or water and to visually maintain adequate separation from other aircraft.

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