Introduction to the Airline Industry

Course eTextbook

International Aviation Training Program

2nd Edition

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INTRODUCTION TO THE AIRLINE INDUSTRY COURSE TEXTBOOK

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Introduction to the Airline Industry

Welcome to the exciting world of the airline industry! Whether you are interested in an airline career or already work in the industry, this course has been designed with you in mind. It will provide an overall understanding of the airline industry and a wealth of information needed to apply your new skills and knowledge.

We will discuss in detail the scope and structure of the aviation industry, including the impact of deregulation. We will take you on a tour of airports and their services and explain how airplanes fly. You will discover how airlines adapt to the socio-economic, environmental, industrial and technical changes that impact the airline industry as a whole. Being highly competitive businesses, airlines must recognize the importance of providing employees with the best training available to ensure they acquire the proper skills and knowledge.

We trust you will enjoy and successfully complete this course. We have structured it into nine modules, each containing the following learning aids and organizers:

- Module Overview,
- Lesson Overviews,
- Lessons,
- Units,
- Progress Checks,
- Lesson Summaries,
- Module Summary,
- Apply Your Learning,
- Key Learning Points, and
- Did You Know?

We have also included a Glossary at the end of this document.

We wish you every success!

Course Structure

To help you successfully complete and enjoy this course, we have structured the content into nine modules. Each module contains the following parts:

Module Overview

Each module begins with an overview of the module's content and a list of learning objectives.

Lessons

Each module is made up of three to five lessons, and each lesson includes the following:

Lesson Overview

Each lesson begins with an overview of the topics to be covered and a list of learning objectives.

Units

Each lesson includes from two to twelve units.

Progress Checks

Each lesson ends with a short exercise made up of multiple choice questions, similar to those on the final exam. The questions are designed to provide an opportunity to test your understanding of the material. An Answer Key is provided at the end of each module so you can check your responses. Should you obtain errors in your responses, please repeat the appropriate lesson(s) to ensure you have a strong grasp of the content.

Lesson Summary

Each lesson ends with a summary of the lesson's main points.

Module Summary

Each module ends with a summary drawing together the main points of the module's lessons.

Key Learning Points

Key Learning Points are highlighted throughout the text and are designed to emphasise particularly important issues and conclusions.

Did You Know?

Did You Know? Points are highlighted throughout the text and are designed to offer interesting or fun facts related to the topic area.

Apply Your Learning

These sections follow the Module Summary sections and provide you with opportunities to apply what you have learned. You will get the most from this course if you make the effort to complete these exercises.

References and Other Reading Material

This section is included at the end of each module (where applicable). It provides references to additional reading materials for those who would like to research the topic area in greater depth.

Glossary

All terms in italics throughout the text are defined at the end of this course textbook.

Note: All statistics and figures are provided for information and illustration purposes only and were valid at the time of the development of this course (2011). Students will not be examined on statistics and figures.

Module 1

The Airline Industry Today

1.0 The Airline Industry Today

Module Overview

This module will introduce the basic concepts that will serve as the foundation for the rest of the modules in this course. Some of the questions we will answer are: What is the airline industry? What does it include and what types of services are provided? We will also review passenger and air cargo transportation to identify their individual importance to the industry as a whole. You will discover the role of the airlines as a stimulus for global employment and how air transportation has been a positive influence in world development.

Module Learning Objectives

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

- Identify the main elements of the airline industry and their role in the system. (Lesson 1)
- Describe air cargo transport and the role of freight forwarders. (Lesson 2)
- Describe the main economic and social impacts of the airline industry. (Lesson 3)

1.1 The Airline Industry

Lesson Learning Objectives

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

- Describe what is meant by the airline industry and its scope.
- Describe the difference between scheduled and non-scheduled flights.
- List the three categories of airlines that provide scheduled service.
- Identify two basic types of air travel for passengers.

Lesson Overview

The airline industry is a very complex system that consists of interdependent components or elements. Depending on your previous experience with airlines, you probably have been exposed to some parts of this system. However, as an aviation professional, you need to have a very good understanding of the major components of the airline industry system. Each component of this system has an impact on other components. Even minor changes in one part of the system may affect the operational activities of other segments of the system.

Therefore, in this lesson we will introduce the main components of the airline industry and describe how the airline industry fits into the aviation industry. This lesson will provide an overview of the scope of the airline industry. In addition, we will explain the difference between scheduled and non-scheduled flights as well as the categories of airlines that provide these services. We will also cover the basic types of travelers.

1.1.1 What is the Airline Industry?

The airline industry is a system of transportation. It is part of a much larger transportation industry, focusing on moving people and goods from one place to another. The most widely used modes of passenger transportation are automobiles followed by buses, airplanes and trains. The most popular modes of freight transport are sea, followed by road, rail and air.

All modes of transportation have certain common features. They require transport networks, terminals, vehicles and operations to control the transportation systems. In the airline industry the “transport networks” are referred to as airways and the “terminals” as airports. The “vehicles” are different types of airplanes. “Operations” include air traffic control which is a service offered by the appropriate authority to promote the safe, orderly flow of air traffic. We will explain more about these specific terms later in the course.

Key Learning Point

An airline's basic function is to transport people and goods from one location to another using the airways. The airline industry consists of organizations providing this service for passengers and/or cargo.

An airline's basic function is to transport people and goods from one location to another using the airways. Airways are designated routes in the air. The airline industry consists of many different organizations that provide this service. Airline companies will either own or lease commercial transport planes to supply this service. The majority are designed specifically to carry passengers and some cargo. The scale and function of airlines range from small operations carrying only cargo, called freighters, through to international passenger service airlines operating hundreds of airplanes in their fleet.

Air transport provides the only global transportation network for both passengers and cargo, making it essential for global business operations as well as for personal travel and tourism. Air transport also provides substantial economic and social benefits by connecting people and facilitating communication between different parts of the world. Finally, air travel provides greater access to remote areas of the world.

1.1.2 Scope of the Airline Industry

Did You Know?

The A380 is the world's largest passenger plane. It has a capacity of 575 passengers and a range of 8,300 nautical miles. It entered commercial service in October 2007.

The airline industry is part of a much larger industry, the aviation industry. The *aviation industry* refers to the range of activities provided by aircraft manufacturers, airport operations, aviation support industries and other service providers.

Aircraft manufacturers produce commercial transport planes. Most are jet planes with two, three or four engines carrying from 20 to hundreds of passengers. Manufacturers also produce *general aviation* planes which are small airplanes with one or two engines. Although some of these smaller planes have jet engines, most are propeller-driven. These light planes are used for a variety of general aviation activities, such as flight instruction, inspection of telephone lines, spraying field crops or air taxi services. They also serve small communities and provide connecting flights to larger airports, these are referred to as commuter planes. This category includes business jets used to fly executives to meetings. Manufacturers also produce military planes which include bombers, fighters and military transports.

Airport operations refer to the ground facilities required for air travel, including runways and navigation aids. While many people may be familiar with larger airport facilities, most airports are small airfields that are able to serve only light planes, helicopters or other specialized aircraft such as seaplanes.

Key Learning Point

The airline industry is part of a larger industry, the aviation industry, which includes aircraft manufacturing, airport operations and aviation support industries.

Aviation support industries provide a wide range of services and supplies to airlines and airports. For example, some companies supply fuel for airplanes; others furnish maintenance or repair services. A variety of food suppliers prepare meals to be served on flights. Other companies service airports with ground transportation, including van, shuttle or taxi services. Freight forwarders organize arrangements for shipping air cargo. There are specialized professional industries providing a variety of services, such as flight insurance and weather information.

Travel agents are an important contributor to the airline industry. Their responsibilities include being authorized to sell and issue airline tickets. Accredited agents accept payments from customers on behalf of airlines issuing tickets. Customers and airlines rely on travel agents for tickets to be issued according to the required standards and for payments to reach the airlines in a timely manner. Travel agents work hard on behalf of their customers. The main role of a travel agent is to make a customer's traveling experience stress-free and memorable. Travel agents personalize their services for each client by scheduling an appropriate itinerary, obtaining affordable prices, making reservations and issuing tickets. Support industries include the hospitality service industries such as hotels, car rentals, tour companies and cruise operators. These services attend to the needs of air travelers once they reach their destinations.

1.1.3 Types of Airline Service

There are a number of ways to categorize airline service. Here, we will differentiate between two main types of airline service: *scheduled* flights and *non-scheduled* flights.

Scheduled flights take place using predetermined routes according to a planned timetable. These timetables refer to regular, published schedules. Customers are bound to the airline's schedule. Airlines use wide or narrow-body commercial transport aircraft for scheduled flights, depending on their operating needs and aircraft specifications. Much of the content covered in this course will deal with scheduled flight service and operations.

Non-scheduled flights do not operate under a planned published timetable. They are typically flights that are chartered for commercial use by tour operators or other hiring arrangements with customers.

As explained in Lesson 1.2, some airlines, in addition to their scheduled passenger flights, operate scheduled or charter cargo flights (using cargo aircraft). However, other airlines operate only cargo aircraft, on a scheduled or charter basis.

Key Learning Point

The two main types of airline service are scheduled flights and non-scheduled flights. Scheduled flights take place using predetermined routes according to a planned timetable.

Figure 1.1.3—Airport Departure Check-In (Courtesy of Creative Commons Timattrio)

The International Air Transport Association (IATA) is the trade association of airlines. IATA members represent 84 percent of the world's international scheduled traffic as measured in available seat kilometers. IATA now has 240 member airlines from 118 countries worldwide. The latest statistics show that there were more than 1.8 billion scheduled passengers and 44 million tonnes of cargo transported by air, of which 39 million were international.

Aviation encompasses two categories: civil and military. Civil aviation represents all non-military aviation, both private and commercial.

Civil aviation includes two major categories:

- *Commercial air transport,* encompasses all passenger and/or cargo scheduled or charter flights operated by a company that receives remuneration for the transport.
- *General aviation (GA),* encompasses all other civil flights including private aviation and recreational flights (gliders, powered parachutes, etc.)

Key Learning Point

Airlines that provide scheduled flight service can be categorized as major airlines, low-cost carriers or regional airlines.

Did You Know?

Air Southwest, considered the first LCC, began operating in 1967. Today, Southwest Airlines is the largest LCC in the U.S. based on domestic passenger travel.

1.1.4 Scheduled Flight Service

The airlines that provide scheduled flight service can be categorized as *major* airlines, *low-cost carriers* or *regional* airlines. Major airlines are large airlines that connect the major cities of the world. These airlines have the capability to handle international destinations and represent the bigger names often heard about in the news. Typically, these airlines are also the largest employers in the airline business.

Low-cost carriers (LCCs), also known as “no-frills” airlines, offer lower fares in exchange for eliminating many traditional passenger services. The term originated within the airline industry referring to airlines with a low–or lower–operating cost structure than their competitors.

Regional airlines represent a type of airline service that is intended to connect with, or “feed”, the major airlines, also known as feeder airlines. The role of feeder airlines is to bring passengers to the major airports, where they will connect for longer distance flights on larger aircraft.

Did You Know?

Regional airlines are the fastest growing segment of the airline industry.

Regional airlines are sometimes formed to offer transportation service between small, isolated communities unable to support larger aircraft. In these cases, they are referred to as *commuter* airlines. Sometimes, a commuter airline is the only practical connection to the outside world. Peninsula Airways, for example, links the remote Aleutian Islands of Alaska to the city of Anchorage. In general, small carriers are more common than major airlines in developing countries and remote regions. In parts of the world that do not have highways or railroads, these light aircraft are used to carry both passengers and cargo.

Many large airline companies, particularly in the U.S., are associated with a regional airline that typically uses the same company logo. These commuter airlines may even be subsidiaries of the major airline. In Europe, the regional airlines serve the intra-continental sector. This means that they offer essential direct services between many of the continent's peripheral or secondary regions, allowing passengers to avoid transfers at larger airports. As in the U.S., some of these regional airlines are also subsidiaries of national air carriers. The remainder represent independent airlines organized in innovative ways.

Did You Know?

Over the next 20 years, the freighter fleet will grow by more that two-thirds, and are expected to expand to 2,967 airplanes in 2029 (Boeing).

Airlines can also be classified by the routes they take: intercontinental (between continents), intra-continetnal (within a continent), inter-national (between countries) or domestic (within a country).

Airlines are owned privately or by the government. Many countries have one or more government-owned airline.

Key Learning Point

Non-scheduled flights do not operate under a planned published timetable. They are typically planes that are chartered for commercial use.

1.1.5 Non-Scheduled Flights

As mentioned previously, most passenger travel takes place on *scheduled* flights, which are made over specific routes according to a published timetable. Non-scheduled flights do not operate under a planned published timetable. They are typically planes that are chartered for commercial use by tour operators or other hiring arrangements with customers.

Air charter service is a growing part of the airline industry. Markets for these services include athletic teams, corporations and government agencies. Charter airline companies can be found all over the world. They tend to be cooperatively linked in worldwide groups, allowing a company to help with contacts or arrangements anywhere in the world through their associates.

With chartered aircraft, a passenger may have access to many more airports than with scheduled flights. In Europe, for example, there are over 2,000 airports, but only 10 percent are reached by scheduled airlines. There are over 5,000 airports across the United States; the scheduled airlines, however, serve roughly four percent of them.

Key Learning Point

There are essentially two main types of air travelers, those who travel for business and those who travel for pleasure–the leisure market.

1.1.6 Passenger Travel

Essentially there are two types of travel markets: the business market and the leisure market.

Simply defined, the business market consists of travelers whose main goal is to meet with customers and/or colleagues or attend conferences in different parts of the world. Fast-growing emerging markets and world trade in the Asian market are the main driving factors contributing to business travel. This travel market is the most profitable segment of passenger travel. *Business aviation* refers to the transportation of passengers and/or, cargo for business purposes.

The leisure market consists of passengers traveling for a more extended period of time for the purpose of recreation or other personal reasons. In 2010 alone there were over 950 million tourist arrivals worldwide. Tourism is an important, and in some cases vital, economic contributor for many countries. It brings in large amounts of income for goods and services available, contributing to the worldwide gross domestic product (GDP). It also creates opportunities for employment in the service industries associated with tourism. As indicated in the graph below, Emerging Economies are expected to account for nearly 60 percent of world economic growth until 2030.

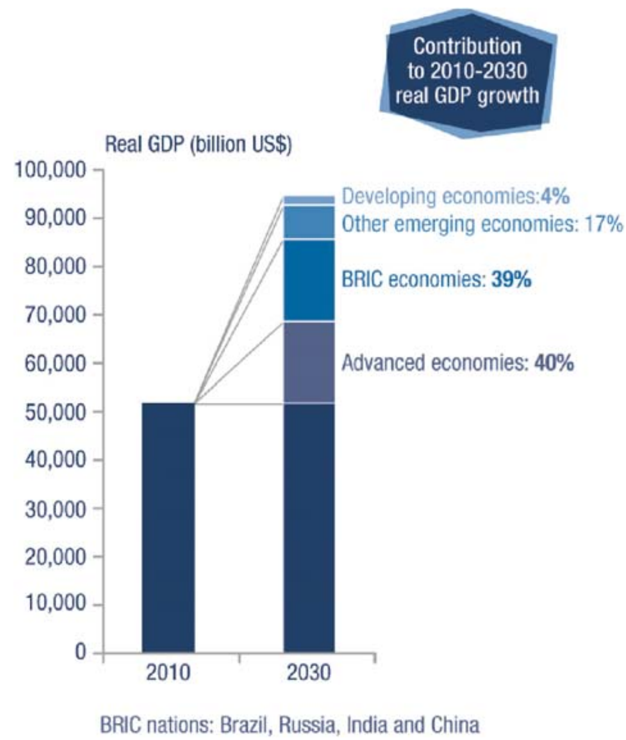


Figure 1.1.6—Emerging economies expected to account for 56 percent of world economic growth from 2010 to 2030.

Lesson Summary

An airline's basic function is to transport people and goods from one location to another using the airways. The airline industry consists of organizations providing this service for passengers and/or cargo. It is part of a larger industry, referred to as the aviation industry. This includes the range of activities involved in building and flying aircraft and include aircraft manufacturing, airport operations and aviation support industries.

The two main types of airline service are scheduled flights and non-scheduled flights. Scheduled flights take place using predetermined routes according to a planned timetable. Non-scheduled flights do not operate under a planned published timetable. They are typically planes that are chartered for commercial use by tour operators or other hiring arrangements with customers.

The airlines that provide scheduled flight service can be categorized as major airlines, low-cost carriers and regional airlines. Major airlines are usually those large airlines that connect the major cities of the world. Low-cost carriers usually provide point-to-point travel with no additional services. Regional airlines feed the major airlines.

There are essentially two main types of air travelers, those who travel for business and those who travel for pleasure–the leisure market.

Progress Checks (Lesson 1)

1. General aviation planes can be used for __________.
   (a) international passenger transportation
   (b) connecting flights to larger airports
   (c) military transport
   (d) spraying field crops

2. The term “feeder airlines” refers to airlines that predominately carry passengers __________.
   (a) to the major airports
   (b) to vacation destinations
   (c) for a lower price
   (d) on chartered flights

3. The most profitable passenger travel market segment is __________ travel.
   (a) business
   (b) leisure
   (c) commuter
   (d) international

4. The term “charter flight” refers to flights on narrow body commercial transport aircraft.
   (a) True
   (b) False

5. The term “intra-continental” refers to airlines that fly routes ____________________.
   (a) between continents
   (b) within a continent
   (c) between countries
   (d) within a country

6. One of the main challenges of flying chartered flights is the limited number of airports that accept these flights.
   (a) True
   (b) False

1.2 Cargo Transport

Lesson Learning Objectives

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

- Explain the role of cargo transportation in the airline industry.
- Describe the role of the freight forwarder.

Lesson Overview

This lesson will provide an understanding of another key area of the airline business–the transport of cargo. Cargo transportation, in addition to being a separate sector of the airline industry, is also a significant revenue generator for passenger carriers. In this lesson, we will delve deeper into this aspect of the airline industry.

Figure 1.2—747 cargo aircraft

1.2.1 Air Cargo

There are various types of cargo each needing special handling of some kind. A few examples are: dangerous goods, perishable and non-perishable cargo and live animals. All types of cargo must be prioritized for shipping. Perishable items will have a higher priority than non-perishable. In addition, there are special regulations for transporting dangerous and other goods.

Air freight can ride on three main categories of aircraft:

- Passenger airlines
- Dedicated cargo planes
- Super cargo planes such as the Antonov 225

One of the largest passenger planes, the Boeing 747-400 can hold 5,330 cubic feet (150 cubic meters) of cargo. Most commercial airlines can make anywhere from five to 10 percent of their revenue by carrying freight. In 2010, 44 million tonnes of air cargo were shipped worldwide. In the case of passenger airlines, air freight is reserved and then confirmed for travel. Depending on the type of aircraft, freight is normally stored in containers (also used for baggage). Larger freight items (e.g., large crates of fruit, vegetables, fresh flowers, machinery, spare parts, furniture or even disassembled helicopters) are shipped on wooden pallets. The pallets are assembled in the cargo warehouse, brought out to the aircraft and loaded into the belly of the plane using specific equipment such as high loaders. They are loaded in specific order using the load plan provided by the operations department of the commercial carrier to ensure the correct weight and balance of the aircraft. Live animals are usually loaded into the rear compartment of the hold where the temperature can be adjusted throughout the flight. The 747-400 passenger aircraft can also be configured in “Combi” mode whereby part of the passenger compartment is used to store freight. In this configuration, the plane can carry over 10,000 cubic feet (283 cubic meters) of cargo and 266 passengers.

Cargo can also be transported on dedicated aircraft using freighter planes. With the substantial size of these freighters, the variety of freight shipped is endless. Everyday, planes are filled with items such as mail, packages, race cars and even horses. The 747-400 cargo aircraft can hold up to 30 pallets of goods on the main level, depending on the configuration. Aircraft configurations can change depending on the type of cargo. These changes are made through the operations department of each airline. The pallets are 96 by 125 inches (2.4 by 3.2 meters) and up to 120 inches (3.05 meters) tall. Special containers called airstables are used to transport horses. They connect to pallets and fit in the cargo hold. On the lower level, the plane can hold another five pallets along with 14 specially-fitted containers, each up to 64 inches (1.6 meters) tall. All of these goods are loaded through hatches in the side of the plane. Most commercial carriers also operate “cargo only” aircraft and have their own cargo division. Some of these are: British Airways, Cathay Pacific, Thai Airways, Air France, China Airlines and others. They are contracted through a reservations system, much in the same way as a passenger carrier.

In order to haul very large cargo, a super transporter may be required. This is a class of plane designed for moving only huge articles, such as vehicles, large machinery, or even a disassembled plane. It is built with a huge cargo area, allowing freight to fill almost the full length of the plane. It typically can transport about 47 tonnes of cargo. One of the world's biggest transport planes is the *Antonov AN-225.* Its cargo capacity is over 250 tonnes, allowing it to haul three or four military tanks.

Figure 1.2.1—AN-225

1.2.2 Air Freight Forwarders

With the growth of the air cargo market, the role of the freight forwarder is becoming increasingly important. A freight forwarder's main duties are to arrange the national and international movement of goods. They find the most appropriate and cost-effective way of moving these goods, co-ordinate the transport and keep records of all arrangements.

A typical day for a freight forwarder would consist of preparing goods for dispatch, communicating with road, rail, air and sea carriers, booking transport cargo space and preparing quotations and invoices. Freight forwarders must confirm the transport arrangements, complete all necessary documentation (such as bills of lading and dangerous goods labelling) and arrange for insurance and payment of duties and taxes. They must also contact international freight forwarders to pick-up and deliver the goods upon arrival at destination. Freight forwarders spend much time in front of the computer or on the telephone. They must communicate with all parties involved in the shipping process (e.g. shippers, customs agents, exporters, clients, warehouses and transportation companies around the world). They must be aware of any freight in transit, the arrival and departure times, any delays in the shipments and the type of transportation used. It is essential that the freight forwarder provide the correct cargo documentation (manifest) and that it accompany the shipment at all times.

In other words, freight forwarders are the travel agents of the cargo industry. Export freight forwarders are licensed by the International Air Transport Association (IATA) to handle air freight. They arrange for smaller shipments to be combined into larger shipments for *economies of scale*. The freight forwarder works as a wholesaler of transportation services and often specializes in traffic operations, customs clearances, shipping, tariffs and schedules. They assist the exporter in determining the cost of transportation and insurance. Freight forwarders must have knowledge of international laws and standards regarding the transport of goods, global shipping terms, dangerous goods regulations and methods of correct packing and stowing goods.

Lesson Summary

Almost anything can be shipped by air, including letters, packages, cars and horses. Air cargo is transported in a variety of ways, such as within passenger airline cargo space or on dedicated aircraft using freighter airlines. The freight forwarder combines small shipments from different shippers into larger shipments for economies of scale.

Progress Checks (Lesson 2)

1. The main purpose of the load plan is to ensure that ____________________.
   (a) the correct balance of the aircraft is achieved
   (b) all cargo is properly confirmed for travel
   (c) all cargo is stored in containers and pallets
   (d) the correct temperature is adjusted throughout the flight

2. The basic role of the freight forwarder is to ____________.
   (a) organize cargo shipments
   (b) transport cargo shipments
   (c) get customs clearance for air cargo
   (d) provide insurance for air cargo

3. The “Combi” mode of the Boeing 747-400 passenger aircraft ____________________.
   (a) can carry more passengers
   (b) can carry more cargo
   (c) can fly longer distances
   (d) can carry air stables

4. Live animals are usually loaded into the rear compartment of the hold because ____________________.
   (a) the rear compartment is safest during accidents
   (b) a loaded rear compartment allows for easier takeoff
   (c) the rear compartment has appropriate air ventilation
   (d) the temperature can be adjusted in the rear compartment

5. Export freight forwarders are licensed by ____________.
   (a) the International Association of Freight Forwarders (IAFF)
   (b) the International Air Transport Association (IATA)
   (c) the local government authorities
   (d) the airport cargo department

1.3 Economic and Social Impacts

Lesson Learning Objectives

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

- Describe how the airline industry contributes to employment in its own sector.
- Explain how the airline industry impacts the development of other industries.
- Describe how the airline industry can offer opportunities for sustainable development.

Lesson Overview

In this lesson, we will discuss the impact the airline industry has on global economic and social development. We will discover that the airline industry is a major employer and it offers opportunities for sustainable economic growth in developing countries.

1.3.1 Impact as Major Employer

The airline industry was one of the first truly global businesses. From its early beginnings, it has transported people, cargo and mail across national and international boundaries. As part of the larger aviation industry, it provides vital economic benefits as a major employer and a highly efficient user of resources.

Businesses, and tourism depend heavily on air transportation. Today, without air transportation, it would be difficult to do everyday activities such as meet with partners and customers, deliver mail and other goods, explore geography and other cultures or visit friends and family. No other mode of transportation can offer the same speed and reliability.

The airline industry not only employs millions of people directly, it is also dependent on supplier services which employ millions more. Such supplier services include airport services, meal caterers, aircraft refueling, aircraft repair and maintenance, ticketing and distribution including travel agents and tour operators, freight forwarding, aircraft financing and more. Aviation contributes to the global economy in many important ways: through job creation, by generating tax revenues and making it possible for foreigners to visit and make local purchases that support the local economy.

Key Learning Point

The air transportation industry facilitates global business growth, leading to worldwide employment for more than 57 million direct and indirect jobs (including supply and tourism businesses).

With the help of IATA and other travel industry bodies, Oxford University's Department of Economics collected data measuring air transport's contributions to the global economy and to the economies of individual countries. The world's airlines transport 2.5 billion passengers annually. They directly employ 5.5 million people. Airline supply-chain businesses employ another 9.5 million people and airlines generate another 18 million indirect jobs in tourism. Oxford Economics produced country-specific reports that explain the benefits of aviation to national economies. These can be found on the following web page: http://www.benefitsofaviation.aero/Pages/download.aspx.

Country	Passengers (in millions)	International flight departures	Jobs	Tax revenues (in billions)	Total Contribution to economy (in billions)
Canada	71	318,000	401,000	C$5.4	C$33.3
Denmark	22	112.000	45,000	Kr 2.3	Kr 19.7
Germany	159	730,000	816,000	€9.2	€47.9
Hong Kong	23	134,000	153,000	HKDS5.9	HKD$88.9
Iceland	2.1	14,400	9,200	ISK 10.1	ISK102.2
India	70	130,000	1.700.000	INR 87.5	INR 330
Italy	107	395,000	195,000	€2.1	€12.7
Kenya	6	35,800	46,000	KES 3.2	KES 24
Mexico	49	148,000	158,000	MXN 4.7	MXN 50.2
Netherlands	46	220,000	175,000	€2.0	€11.8
Norway	30	87,000	61,000	Kr 9.0	Kr 47.7
Singapore	37	132,000	119,000	S$1.5	S$14.2
South Africa	21	52,500	227,000	ZAR6.0	ZAR50.9
Spain	149	495,000	260,000	€2.2	€14.2
Sweden	25	89,000	83,000	SEK 9.4	SEK 52.8
Thailand	40	26,000	393,000	THB 4.8	THB 139
UAE	56	206,400	224,000	AED 104.5	AED 61.3
UK	197	750,000	921,000	£7.9	£49.6

Table 1.3.1—The Aviation Sector's Average Annual Contribution Per Country (http://www.benefitsofaviation.aero/Pages/download.aspx)

1.3.2 Impact on Tourism

Tourism is a rapidly growing phenomenon that has become one of the largest industries in the world. Tourism plays an important role in the socio-economic and political development of destination countries by offering new employment opportunities. In certain instances, it also may be said to contribute to a broader cultural understanding by creating awareness of the diversity of cultures and ways of life.

The World Travel and Tourism Council (WTTC) states that nearly 260 million jobs worldwide are supported by travel and tourism– either directly in the industry or in related sectors. These jobs are vital not only for the livelihoods of those employed, but also for their families and the wider communities in host destinations. According to the World Travel Organization, international tourist arrivals grew by seven percent in 2011 to a record 980 million, with positive growth reported in all world regions. Reflecting global economic trends, growth was driven largely by emerging economies, a development that looks set to continue over the coming years.

Tourism helps reduce poverty by generating economic growth, providing employment opportunities and increasing funds for tax collection. Furthermore, it often serves as the only reason for transportation to remote areas, thus promoting social involvement.

Did You Know?

The United States is the Number One travel destination in the world. According to the United Nations World Tourism Barometer and based on international tourism receipts from 2011, $116.3 billion was spent on travel to the U.S. The Number Two and Three destinations, Spain and France, had receipts of only $59.9 billion and $53.8 billion, respectively.

Source: Expert Flyer Blog (http://s.tt/1cayq)

Did You Know?

In 2010, Botswana was honored with the World Travel and Tourism Council's Tourism for Tomorrow Award, which recognized the country's protection of popular tourist sites, including the Okavango Delta, Tsodilo Hills (a UNESCO World Heritage Site) Moremi Game Reserve and community lands.

1.3.3 Opportunities for Promoting Sustainable Development

According to the Brundtland Report, a 1987 report from the United Nations, *sustainable development* is a process of developing land, cities, business, and communities, that “meets the needs of the present without compromising the ability of future generations to meet their own needs”. The “pillars” of sustainable development are economic development, social development and environmental protection.

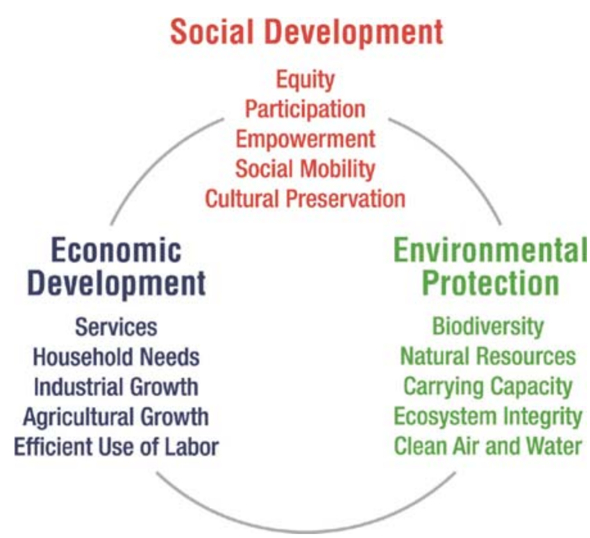


Figure 1.3.3—The Three “Pillars” of Sustainable Development

Africa provides an excellent example of the potential for air transport to contribute to sustainable development and is able to attract a large number of international visitors. The expansion of nature-based tourism (also known as eco-tourism) is becoming a significant source of future revenue and employment. An important additional environmental benefit is the conservation of such protected areas. Economic benefits from eco-tourism, including entry fees, licences and concessions, often generate substantial funds to support conservation and management of natural environments. In a number of countries, tourist expenditures on lodging, transportation, food, guides and souvenirs are an important source of income for local communities.

Key Learning Point

The airline industry provides vital economic and social benefits as a major employer and a stimulant for tourism. It offers significant opportunities for sustainable development in developing countries.

A case in point is Botswana, a southern African nation found just north of South Africa. Botswana has differentiated itself as an eco-tourism destination since 2002, when it first developed the Biokavango Project. This is a national eco-tourism strategy aimed at conserving the Okavango wetland system. The Project, which is funded by the Global Environment Facility (GEF) and the Government of Botswana, culminated in the introduction of an Eco-tourism Certification System in 2008. The Eco-tourism Certification is based on such standards as the Global Sustainable Tourism Criteria and Green Key. Green Key is an eco-label awarded to over 1,800 establishments in 29 countries worldwide. The voluntary program is open to all hotels, lodges and tour operators regardless of their size.

1.3.4 Additional Benefits

The advantages of air transportation involve increased availability of travel connections, resulting in greater mobility of people and cargo. On a social level, air transport increases understanding of different cultures and nationalities. Another important impact: seasonal fruit and vegetables are now more available year-round and worldwide at reasonable prices. Air travel also contributes by rapidly delivering humanitarian aid in times of war, famine and natural disasters. For emergency aid, airplanes are able to offer the swift delivery of medical supplies, water, shelter and other necessities.

Lesson Summary

The airline transport industry generates more than 57 million jobs globally, making it one of the largest employers in the world. It is an industry that stimulates tourism on a large scale and provides economic and social benefits for sustainable development. It also promotes greater understanding of cultures and nationalities.

Progress Checks (Lesson 3)

1. To calculate the full economic impact of the airline industry, we need to take into consideration the number of people employed by ______________.
   (a) the aviation industry
   (b) the supply chain
   (c) the tourism industry
   (d) all of the above

2. The “pillars” of sustainable development are economic development, social development and ______________.
   (a) intercultural exchange
   (b) technological development
   (c) energy conservation
   (d) environmental protection

3. In recent years, growth in the tourism industry has been driven by emerging economies.
   (a) True
   (b) False

4. One important contribution of the tourism industry is creating awareness of the diversity of cultures and ways of life.
   (a) True
   (b) False

5. What country has differentiated itself as an eco-tourism destination by conserving the Okavango wetland system?
   (a) New Zealand
   (b) South Africa
   (c) Guatemala
   (d) Botswana

Module Summary

The airline industry is part of the much larger transportation industry, which focuses on moving people and goods from one place to another. The airline industry is one component of the aviation industry, which includes aircraft manufacturing, airport operations and aviation support industries.

The two main types of airline service are scheduled flights and non-scheduled flights. Scheduled flights take place using predetermined routes according to a planned timetable. Non-scheduled flights are typically charter flights and flights that are not governed by a specific timetable. The airlines providing scheduled flight service can be categorized as either major airlines, low-cost carriers or regional airlines. Major airlines are large airlines that connect the major cities of the world. Regional airlines feed the major airlines. Low-cost carriers provide point-to-point service with no additional amenities. There are essentially two main types of air travelers: those who travel for business and those who travel for pleasure.

Air cargo is transported in a variety of ways, such as within passenger aircraft or on dedicated aircraft using freighter airlines. Shipment of cargo is a separate business line which is becoming increasingly important due to the amount of profit it generates.

The airline industry provides vital economic and social benefits as a major employer and as a stimulant for tourism. It offers significant opportunities for sustainable development in developing countries.

Apply Your Learning

1. Which airport is closest to your home?
2. Name the major airline(s) of your country. For each airline, identify if it:
   (a) Is government-owned
   (b) Flies domestic routes
   (c) Flies international routes
3. Name the regional airlines of your country.
4. What types of cargo planes have you seen at the airport?
   (a) What types of cargo are commonly imported to your country?
   (b) Can you name the freight forwarders that serve your airport?

Answer Key

Progress Checks (Lesson 1.1)

1. d
2. a
3. a
4. b
5. b
6. b

Progress Checks (Lesson 1.2)

1. a
2. a
3. b
4. d
5. b

Progress Checks (Lesson 1.3)

1. d
2. d
3. a
4. a
5. d

Module 2

Regulatory and Business Context

Module Learning Objectives

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

- Describe how the airline industry is regulated worldwide. (Lesson 1)
- Describe the standard measurements required to determine airline profitability. (Lesson 2)
- Identify the main features of the airline industry. (Lesson 3)

2.0 Regulatory and Business Context

Module Overview

This module provides an introduction to the regulatory and business aspects of the airline industry. We will discuss how the industry adopts governmental and regulatory standardized practices to ensure consistent safety and security worldwide. Then, we will see how airline profitability is measured. Lastly, we will determine the main features of the industry. These will set the stage for the remainder of the modules in this course.

2.1 Regulatory Bodies

Lesson Overview

Most passengers take for granted that they can fly to their destination through more than one country and aboard more than one airline. Seamless international traveling is the result of long efforts to standardize air transportation processes. Knowledge of the regulating bodies and history of the regulations will help us gain a better understanding of how different entities interact to create a safe traveling environment. This lesson will take us through the basic regulatory structure of the civil aviation industry. We will identify the main governmental agencies, their role and how the industry is able to achieve standard practices worldwide.

Lesson Learning Objectives

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

- Identify key performance indicators used to calculate airline profitability.
- List the three key factors that determine profitability.
- Describe the goal of revenue management.

2.1.1 Introduction of Standardization

Very early in the history of air transportation, governments realized there was a need to introduce a level of consistency across borders. To ensure safe and secure practices, and avoid chaos in the airways, the need for a common set of standards became obvious.

An important milestone in creating these standards is known as the Chicago Convention on International Civil Aviation. Representatives of 54 nations met in Chicago on November 1, 1944 to establish a legal structure or framework for civil air services. It established rights over territorial airspace and the basic principles managing the transport of passengers and goods. The Conference also discussed the principles and methods to be followed in the adoption of a new aviation convention. Finally, it called for a permanent body to oversee international cooperation on regulations, standards and procedures governing civil aviation called the International Civil Aviation Organization (ICAO).

ICAO's mandate is to promote the safe and orderly development of international civil aviation among its 191 member states. It sets international standards in such fields as air navigational facilities, air operations, airports, airworthiness of aircraft and communications. It is also concerned with the efficiency and economics of air transport. In addition, it works to establish international laws that deal with such security crimes as acts of terrorism, hijacking and sabotage. ICAO also helps developing countries construct and upgrade airports. ICAO's headquarters are located in Montreal, Canada.

Key Learning Point

Although ICAO and IATA have distinct mandates, they have common objectives: to make air travel safer, more efficient and economical.

Another key organization important to ensuring standardization is the International Air Transport Association (IATA). Many operators of scheduled international airlines in countries throughout the world today are members of IATA. This organization, founded in 1945, promotes safe, regular and economical air transport. Also, it fosters air commerce and studies the problems connected with it. Any airline that has been licensed to provide scheduled air service by a government eligible for membership in ICAO may join IATA. Today, this organization has some 240 members representing 84 percent of the world's total air traffic as measured in available seat kilometers.

Although these organizations have distinct mandates, they have common objectives: to make air travel safer, more efficient and economical. They work in close cooperation on many issues. The key distinction between these two organizations is that whereas IATA represents the airlines only, ICAO is part of the United Nations and deals with civil aviation at governmental levels.

Key Learning Point

ICAO Standards and Recommended Practices provide the basis for standardized operations in the aviation industry.

2.1.2 Standards and Recommended Practices (SARPS)

ICAO develops and adopts requirements that must be applied by all member states in order to achieve consistency throughout the world. Standards and Recommended Practices, commonly referred to as "*SARPs*", cover all technical and operational aspects of international civil aviation. These include safety, personnel licensing, operation of aircraft, airports, air traffic services, accident investigation and the environment. There are two types of requirements:

- A *Standard* is a specification for physical characteristics or performance of a facility or personnel, the uniform application of which is recognized as necessary for reasons of safety or regularity of international air navigation. 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 recognized as desirable.

Where can you find SARPs? They are published in documents called Annexes. There are eighteen (18) such annexes, each dealing with various aspects of aviation. These are annexes to the Chicago Convention of 1944 that created ICAO.

Key Learning Point

The Chicago Convention in 1944 laid out the fundamental building blocks of air navigation regulation, known as the "Freedoms of the Air". They are a set of commercial aviation rights granting a country's airline(s) the privilege to enter and land in another country's airspace.

Did You Know?

The idea of freedom to fly over other countries is based on a principle first outlined in 1609 by Hugo Grotius. This principle defended the right of the Dutch India Company to trade in the Far East. Called Mare Librium (i.e., freedom of the seas), it stated that any country could sail on the world's oceans without restriction from other nations. The work of Grotius, and of others like him, form the basis of modern international transportation law.

The Chicago Convention is the treaty that still governs the conduct of international civil aviation and is constantly being amended.

Some of the key Annexes are as follows:

- Annex 1 Licensing, which refers to the licensing requirements of flight crews, air traffic controllers and aircraft maintenance personnel;
- Annex 2 Rules of the Air, which provides the rules relating to the conduct of visual and instrument flights;
- Annex 6 Operation of Aircraft, which lists specifications which will ensure similar operations throughout the world at a level of safety above a prescribed minimum;
- Annex 8 Airworthiness of Aircraft, which lists requirements for certification and inspection of aircraft.

We will be referring to these Annexes, as well as some others, throughout this course.

2.1.3 Freedoms of the Air

The Chicago Convention in 1944 laid out the fundamental building blocks of air navigation regulation. These are commonly known as the "*Freedoms of the Air*" and are basic to the international route network we have today. They are a set of commercial aviation rights granting a country's airline(s) the privilege to enter and land in another country's airspace. There are five basic freedoms that are, more or less, recognized by all countries:

- First Freedom: the right to fly across a country's territory without landing. Almost all countries are partners to this right.
- Second Freedom: the right to land for non-traffic purposes (i.e., for technical reasons such as refueling without boarding or deplaning passengers).
- Third Freedom: the right to carry passengers or cargo from one's own country to another.
- Fourth Freedom: the right to carry passengers or cargo from another country to one's own. Third and fourth freedom rights are almost always granted simultaneously in bilateral agreements between countries.
- Fifth Freedom: the right to carry passengers from one's own country to a second country and from there to a third country.

ICAO characterizes all "freedoms" beyond the Fifth as "so-called" because only the first five "freedoms" have been officially recognized as such by international treaty. There are four others that are not officially recognized.

2.1.4 The Role of Governments

One of ICAO's principal mandates is to work toward standardization of aviation laws around the world. There are certain guidelines that must be followed when flying into a foreign country. Airlines must follow the country's rules in the following areas: air traffic control, ground services, sanitation, environmental requirements and the rights of passengers in case of theft, loss or accidents. It is sovereign governments who maintain ultimate control over access to their countries.

Most countries have agencies that enforce air safety regulations and handle certain economic matters in the interest of safety. These can include their general transportation department which looks after all forms of transportation–air, land and sea. In the case of countries with a more developed aviation industry, governments will assign these responsibilities to specialized transportation departments. An example of this would be the FAA (Federal Aviation Administration) in the United States. There are also joint authorities such as the EASA (European Aviation Safety Agency) which operate across national borders. EASA was created in 2003 for EU member states.

Some regions have their own commissions or councils such as: the African Civil Aviation Commission (AFCAC), the Arab Civil Aviation Council (ACAC), the European Aviation Commission (EAC), the Latin American Civil Aviation Council (LACAC) and the South Pacific Regional Civil Aviation Council (SPRCAC). Each of these plays a specialized part in assuring the safe and orderly development of the industry.

There are also regional airline organizations, such as the Air Transport Association of America (ATA), the African Airlines Association (AFRAA), the Arab Air Carriers Organization (AACO), the Association of European Airlines (AEA), the Association of Latin American Air Transport (AITAL), the Association of Asia-Pacific Airlines (AAPA), the Association of South Pacific Airlines (ASPA), the Association of South Asian Airlines (ASAA) and the European Regions' Airline Association (ERAA).

It is important to understand how an ICAO Standard or Recommended Practice, adopted by ICAO, affects the industry. ICAO has no direct authority over its member states. Once ICAO has adopted a SARP, it is up to member states to adopt it. New or revised SARPs are communicated to member states through the authority responsible for civil aviation in each country. In cases where a member state decides not to adopt an ICAO SARP, it must notify ICAO who will publish the exception. This will ensure that pilots flying to this country are aware of any variation to operations.

2.1.5 Other Agreements and Treaties

The first worldwide Traffic Conference was held in Rio de Janeiro in 1947. It reached unanimous agreement on nearly 400 resolutions covering all aspects of air travel, including items such as fare construction rules for multi-sector trips and ticket design. Today, that work is still reflected in the Resolutions made through IATA which affect issues such as fares, ticketing, passenger and cargo agreements as well as debt settlement.

Lesson Summary

ICAO, an agency of the United Nations (UN), sets up common air safety standards among member countries. Many operators of scheduled international airlines in countries throughout the world today belong to IATA. Although ICAO and IATA have distinct mandates, their common objective is to make air travel safer, more efficient and economical.

Most countries have agencies to enforce air safety regulations and to handle various economic matters relating to aviation. Other agencies include joint authorities operating across national boundaries as well as councils, commissions and regional airline organizations.

Progress Checks (Lesson 2.1)

1. One of ICAO's principal mandates is to enforce air safety regulations in all member states.
   (a) True
   (b) False

2. Where are the ICAO Standards and Recommended Practices published?
   (a) In the Chicago Convention Treaty
   (b) In the Annexes
   (c) On the ICAO Web site
   (d) In the Traffic Conference resolutions

3. The basic difference between ICAO Standards and Recommended Practices is that Standards are mandatory, but Recommended Practices are not.
   (a) True
   (b) False

4. Which two “Freedoms of the Air” are almost always granted simultaneously in bilateral agreements between countries?
   (a) The right to fly across a country's territory without landing and the right to land for non-traffic purposes
   (b) The right to carry passengers from another country to one's own and the right to carry passengers from one's own country to a second country and from there to a third country
   (c) The right to land for non-traffic purposes and the right to carry passengers from one's own country to a second country and from there to a third country
   (d) The right to carry passengers from one's own country to another and the right to carry passengers from another country to one's own

5. To which of the five “Freedoms of the Air” are almost all countries partners?
   (a) The right to carry passengers or cargo from another country to one's own
   (b) The right to carry passengers or cargo from one's own country to another
   (c) The right to land for non-traffic purposes
   (d) The right to fly across a country's territory without landing

2.2 The Business Side of the Industry

Lesson Learning Objectives

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

- Identify key performance indicators used to calculate airline profitability.
- List the three key factors that determine profitability.
- Describe the goal of revenue management.

Lesson Overview

The airline industry is capital intensive as well as highly competitive. The emergence of low-cost carriers (LCC) increased the level of competition even more. Airlines are continuously being challenged to respond to their financial expectations of their shareholders.

This lesson will introduce the key concepts of how profitability is measured in the airline industry. It is important to master the concepts described in this lesson because, at the end of the day, an airline's performance on these indicators affects whether or not the airline stays in business.

2.2.1 Key Performance Indicators

How do the airlines determine profitability? There are several measures, or KPIs (Key Performance Indicators) that establish part of the calculation. They are: Revenue Passenger Kilometer, Yield, Available Seat Kilometer, Unit Costs and Passenger Load Factors. Let us briefly look at each one in turn.

2.2.1.1 Revenue Passenger Kilometer

One of the most important measures is called the Revenue Passenger Kilometer (RPK). This is used as a *measure of passenger traffic.* The RPK is calculated by multiplying the number of paying passengers by the number of kilometers flown during a flight leg (i.e., segment of flight):

Revenue Passenger Kilometers

Example 1:

One paying passenger flying **one** kilometer creates **one** RPK.

Example 2:

150 paying passengers flying **7,000** kilometers generate **1,050,000** RPKs

To get an idea of how some of the major airlines compare in terms of RPKs, please refer to the next table.

Did You Know?

Over 3.2 billion passengers were carried by the world's airlines in 2012.

Rank	Airline	RPK (million)
1	Delta Airlines	111,159
2	Southwest Airlines	106,228
3	American Airlines	86,129
4	China Southern Airlines	76,078
5	Ryanair	71,229
6	Lufthansa	56,693
7	United Airlines	54,015
8	US Airways	51,814
9	China Eastern Airlines	50,336
10	Air France	47,029

Figure 2.2.1.1—Total scheduled Revenue Passenger Kilometers flown in 2010

2.2.1.2 Yield (Average Unit Revenue)

The yield is the average revenue received for carrying one passenger one kilometer. To calculate yield for a given flight, divide passenger revenue for that flight by total RPKs.

Revenue / RPK = Yield

Example:

$177,000 / 1,050,000 = $0.16 per passenger-kilometer

2.2.1.3 Available Seat Kilometer

Another important measure is referred to as the Available Seat Kilometer (ASK). This is used as a measure of *capacity available.* The ASK is calculated by multiplying the number of seats available on a flight leg by the number of kilometers flown during that flight leg:

(# of seats) X (# of kilometers flown) = Available Seat Kilometers

Example 1:

One seat (empty or filled) flying **one** kilometer is **one** ASK.

Example 2:

200 seats flying a **7,000**-kilometer segment equals **1,400,000** ASKs.

2.2.1.4 Unit Costs

Operating costs are an important factor in determining airline profitability. In order to get a measure of unit costs, we must calculate costs per ASK as follows:

Expenses (Operating Costs) / ASK = Cost/ASK

Example: $140,000 / 1,400,000 = $0.10

2.2.1.5 Passenger Load Factor

The measure of how well an airline is balancing the capacity it makes available with the traffic it is able to attract is called the Passenger Load Factor (PLF). It compares the *actual passenger traffic* to the *capacity available* on a given flight. In other words, the PLF is the percentage of seating capacity actually used by customers as calculated by the relationship between the RPKs and the ASKs flown.

RPKs / ASKs = PLF

Example:

1,050,000 RPKs /1,400,000 ASKs = 75% PLF

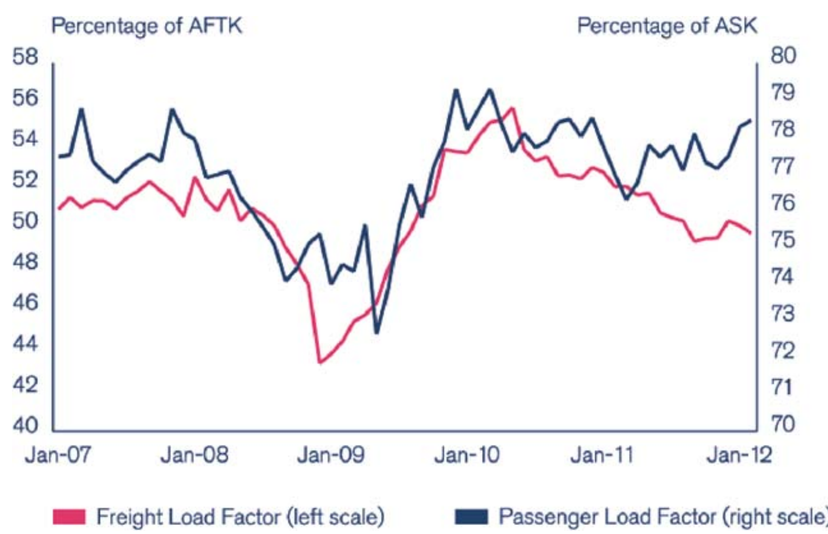


Figure 2.2.1.5a—PLF on international and freight markets (IATA)

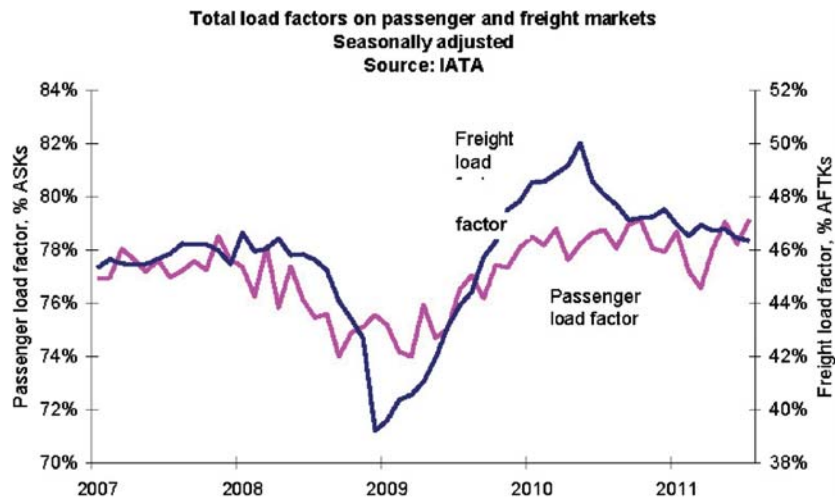


Figure 2.2.1.5b—Recent global load factor trends (IATA)

In terms of achieving airline profitability, the objective is to maximize load factors, but not at the expense of yields. This requires a difficult balancing act on the part of the airlines who are attempting to maximize the utilization of available space as well as maximize revenue.

2.2.2 Airline Profitability

Airline profitability is a function of three key factors:

- Yield–average revenue received for carrying one passenger one kilometer
- Available Seat Kilometer Cost (e.g., Cost per ASK)–operating cost to fly one aircraft seat one kilometer
- Load Factor–Total Revenue Passenger Kilometers divided by total aircraft seat kilometers

Every airline strives to increase yields, decrease seat costs and maximize load factors. If one of these factors moves significantly in the wrong direction, profit will suffer. It is important to remember that it is revenue per ASK (yield), cost per ASK (seat cost), and load factor that determine the operating profit for an airline.

Key Learning Point

Airline profitability is a function of three key factors: Yield, Available Seat Kilometer Cost, and Load Factor.

2.2.3 Revenue Management

In today's competitive market environment, revenue management is necessary for survival. It goes hand-in-hand with pricing, cost and scheduling considerations. Revenues are directly affected by the following factors:

- Price–the level of fares charged
- Yield improvement
- Type of passenger traffic (first, business, economy, groups, etc.)
- Traffic (RPKs)–the volume of traffic carried

The goal of revenue management is to maximize profits from every seat, every flight and every route. The basic question airlines ask themselves is:

> How many seats should be reserved for each fare type in order to maximize revenue from each flight?

It is a highly complex and multi-dimensional question. Not only must revenue management decisions be made under uncertain conditions, but the result is highly sensitive to competitor actions and external economic factors. The key to yield management is estimating how many customers are willing to buy at each price. Customers have a maximum price that they are willing to pay, known as the reserve price. For an airplane seat, this is determined by the time left before the flight and the passenger's reason for traveling. To successfully maximize their profits, airlines need to work out the distribution of reserve prices for their potential customers and avoid losing potential revenue by selling a ticket for less than a customer was willing to pay. Knowing the reserve price distribution allows airlines to set the number of seats they offer at lower prices while ensuring there are still enough to satisfy demand from higher-paying customers.

Airlines estimate the reserve price distribution by analyzing previous sales data, looking for trends such as less popular days for flying or certain time periods where foreign holidays are more popular. Knowing the distribution is not enough to maximize revenue, because it is possible that the total demand will be higher than the number of seats on the plane, so airlines also use optimization techniques. Competitive responses from low-cost carriers and legacy carriers (major established carriers) are putting much pressure on existing revenue management practices, and they must undergo continuous changes to assure profitability.

Did You Know?

The airline industry was the first to practice yield management in the 1970s when it was realized that selling some tickets early at a discounted rate could fill seats that might otherwise not have sold.

Key Learning Point

The goal of revenue management is to maximize profits from every flight and route network.

2.2.4 Growth of Passenger Service Worldwide

The following graph uses Revenue Passenger Kilometers (RPKs) to show the growth of the air passenger industry over the past 40 years. It shows that the airline industry has grown at different rates around the world.

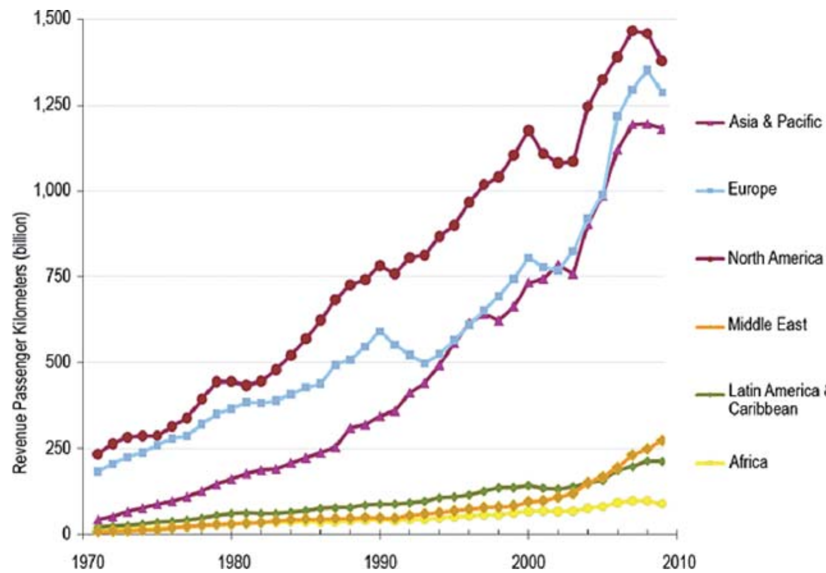


Figure 2.2.4—Passenger Travel Growth ***(ICAO, scheduled services of commercial air carriers)***

We can see that North America holds a leading position in terms of scheduled RPKs, followed by Europe and Asia-Pacific. The end points of the graph demonstrate the position of the regions and provide an indication of relative standing.

2.2.5 Growth of Cargo Service Worldwide

The IATA statistics for 2011 show that 44 million tonnes of cargo were transported worldwide. Of this amount, 30 million tonnes were shipped internationally (between countries).

The graph below shows the growth of the air cargo (freight) industry over the past 40 years. The statistic used is the FTK (Freight Tonne Kilometer). The FTK is calculated by multiplying the number of tonnes transported by the number of kilometers flown during a certain period.

Freight Tonne Kilometer =
(# of tonnes of freight) X (# of kilometers flown during period)

In this chart, we see that Asia and the Pacific now hold the leading position in terms of FTKs, followed by Europe and then North America.

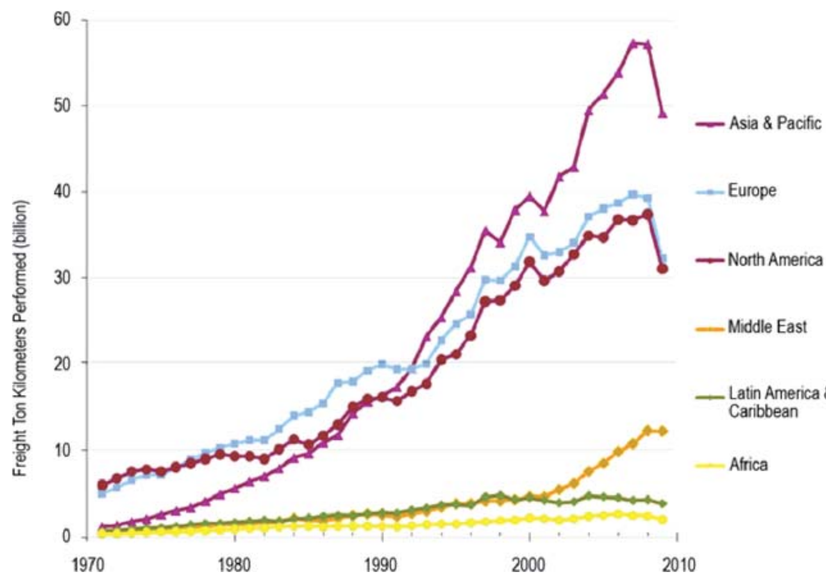


Figure 2.2.5—Air Cargo Growth ***(ICAO, scheduled services of commercial air carriers)***

2.2.6 Larger Profit Margins in Cargo

Cargo is a separate business line which is becoming increasingly important due to the amount of profit it generates. In general, cargo generates less revenue than passengers, but has a larger profit margin. The larger profit margin is due to cargo being less expensive to transport than passengers. The table below shows transported cargo by carrier in FTKs.

	Airline	FTK per million
1	Federal Express FEDEX	15,743
2	United Parcel Service UPS	10,194
3	Cathay Pacific Airways	9,587
4	Korean Airlines	9,542
5	Emirates	7,913
6	Lufthansa	7,428
7	Singapore Airlines	7,001
8	China Airlines	6,410
9	Eva Aiar	5,166
10	Cargolux	4,901

Figure 2.2.6—2010 total scheduled freight tonne-kilometers flown (IATA)

2.2.7 Air Transportation Activity–Regional Breakdown

As we know, air transportation activity consists of the movement of passengers and cargo by air. The volume of service offered for each activity varies depending on the world region, as we have seen earlier in this lesson. The following map shows the distribution of air transportation activity around the world, using RPKs and FTKs. It also shows the distribution of airlines and airports worldwide.

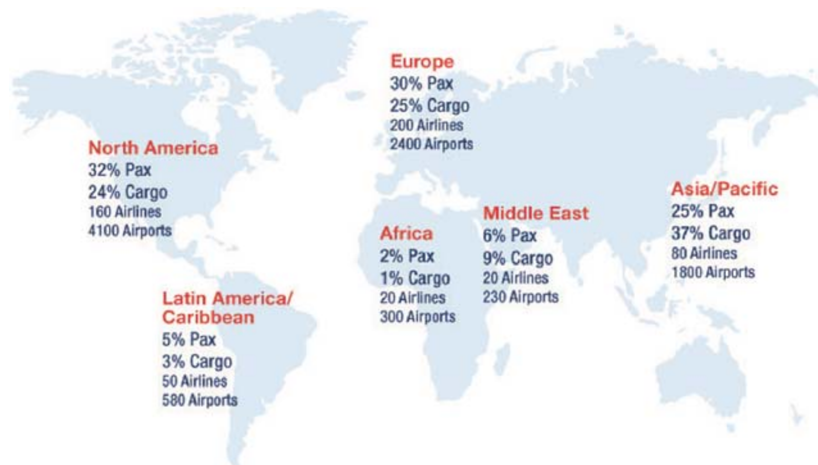


Figure 2.2.7—Air transportation activity in 2010, percentage of worldwide passengers (Pax) and cargo

Lesson Summary

In this lesson, we have discussed a number of KPIs. We have seen how each of these KPIs indicates an important aspect of an airline's performance and how they are calculated. Furthermore, these KPIs are crucial for various important decisions that an airline's management needs to take in order to ensure the airline's profitability. Airline profitability is a function of three key factors: Yield, Available Seat Kilometer Cost and Load Factor. The yield is the average revenue received for carrying one passenger one kilometer. The Available Seat Kilometer (ASK) is used as a measure of capacity available. The measure of how an airline balances the available capacity with the traffic it is able to capture is called the Passenger Load Factor (PLF). It compares the actual passenger traffic to the capacity available on a given flight. The goal of *revenue management* is to maximize profits from every flight and route network.

At the time this course textbook was developed, North America currently holds the leading position in terms of scheduled Revenue Passenger Kilometers (RPKs), followed by Europe and Asia-Pacific. Asia and the Pacific now hold the leading position in terms of Freight Tonne Kilometers (FTKs), followed by Europe and then North America.

Progress Checks (Lesson 2.2)

1. The Revenue Passenger Kilometer (RPK) allows us to measure ______________________ .
   (a) airline productivity
   (b) airline profitability
   (c) airline total revenue
   (d) airline passenger traffic

2. A measure of the average revenue received for carrying one passenger one kilometer is called ____________ .
   (a) yield
   (b) profit
   (c) unit revenue
   (d) unit capacity

3. Airline profitability is a function of the following three factors: yield, available seat kilometer cost and ____________ .
   (a) operating costs
   (b) passenger revenue
   (c) passenger traffic
   (d) load factor

4. In terms of Freight Tonne Kilometers, which area of the world occupies the leading position?
   (a) Africa
   (b) Asia-Pacific
   (c) Europe
   (d) North America

5. According to IATA statistics for 2011, the greatest amount of cargo was transported domestically.
   (a) True
   (b) False

6. Why does air cargo transportation generate larger profit margins than passenger transportation?
   (a) Because cargo service is less costly
   (b) Because cargo airport taxes are generally lower
   (c) Because cargo airplanes are more fuel efficient
   (d) Because cargo load factor is greater

2.3 Main Industry Features of Passenger Airlines

Lesson Overview

Since the mid 1950s, when engineers began designing commercial jet airliners, commercial passenger service has experienced significant growth as an industry. At this point, we would like to provide a brief overview of common features of airlines across the industry.

Lesson Learning Objectives

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

- Describe the main features of the airline industry.

2.3.1 A Service Industry

Airlines perform a service for their customers by transporting passengers, baggage and cargo. A service industry provides a service for people but does not produce goods. Unlike the manufacturing industry, for example, there is no product provided by the airline industry.

2.3.2 Capital Intensive

The start-up and operation of an airline requires a huge amount of financial funding to invest in aircraft, simulators and maintenance hangars to name a few examples. Because the business is so capital intensive, many airlines are leasing equipment rather than spending large sums of money on a new product. At times, airlines will also lease equipment they have sold (lease buy-back). Below, we have provided examples of some of the types of aircraft and their purchase prices.

Boeing 747-400	$228–260 million
Boeing 777-200	$244–280 million
Boeing 747-8	$340 million
A-380	$389 million

Did You Know?

The leasing industry has grown significantly over the past decade. Leased aircraft account for as much as 40 percent of the worldwide fleet, with all indications pointing to additional growth.

2.3.3 High Cash Flow

Major airlines most often own a large fleet of very expensive aircraft. These aircraft depreciate in value over time, but also generate a substantial amount of cash flow. Cash flow is determined by movement of money in and out of a business. Most airlines use their cash flow to pay debts, for maintenance and to invest in new information technology. If profits and cash flow decline, an airline's ability to repay debt and reinvest is severely jeopardized.

2.3.4 Labor Intensive

Major airlines employ thousands of people. This is generally known as a labor intensive industry. A few examples of staffing requirements include: pilots, cabin crew, mechanics, baggage handlers, security agents and managers. There are many other resource areas that need staff as well. For example, in the corporate offices, there are requirements for lawyers, accountants, information technology specialists and financial analysts.

We discussed how the airline is a service industry. Employee costs are one of the main expenditures in this industry. One third of generated revenue is spent on its workforce. To enable increased profitability in the longer term, airlines are outsourcing certain areas of their business. These include maintenance, human resources and reservations.

2.3.5 Highly Competitive

Because of increased competition, airlines must be constantly looking for innovative ways to attract and retain their customer base. This must be done while maintaining at least minimum services in line with industry standards.

2.3.6 Thin Profit Margins

IATA predicts that the airline industry is at risk of becoming unprofitable if oil prices rise enough to hurt the global economy. Rising fuel costs have already greatly affected airline profit margins which in turn reduces cash flow as discussed in section 2.3.3 of this lesson. Travelers are also feeling the effect of the increase as airlines pass on this expense in the price of tickets. The continuing challenge for airlines is to satisfy their stockholders as well as invest in new equipment and facilities.

2.3.7 Seasonal

The airline business is very seasonal. The busiest periods are the summer months and the last two weeks in December. Additionally, some destinations are sought only during specific seasons or times of the year. The result of such peaks and valleys in travel patterns is that airline revenue also rises and falls significantly through the course of the year.

Key Learning Point

The business of running an airline requires large sums of money. Earning enough profit to satisfy their stockholders as well as invest in the equipment and facilities they require is a genuine challenge for airlines.

2.3.8 Current Status

The airline industry is highly globalized both in passenger travel and cargo transportation. In the last five years, the industry has experienced a great deal of turmoil, making it very unstable. Economic recession, increased fuel prices and higher security costs following terrorist activities are the main contributing factors to this highly volatile environment. The current environment will require even more enhanced levels of security which, in turn, will add cost to the airlines' already capital intensive structure.

Lesson Summary

The following terms characterize the airline industry: a service industry, capital intensive, low profit margins, highly competitive, seasonal, high cash flow, and labor intensive. The business of running an airline requires large sums of money. For the airlines, earning enough profit to satisfy their stockholders as well as invest in the equipment and facilities they require is a genuine challenge.

Progress Checks (Lesson 2.3)

1. Airlines lease aircraft in order to avoid paying large sums of money upfront for the aircraft.
   (a) True
   (b) False

2. Profits and ______________ are critical for the airline's ability to repay debt and reinvest in its development.
   (a) operational costs
   (b) cash flow
   (c) revenue
   (d) yield

3. Airlines are considered capital intensive because ____________________________ .
   (a) fares are more expensive than other forms of transportation
   (b) airlines pay high salaries to their employees
   (c) the start-up of an airline requires huge investment
   (d) airlines pay high government taxes

4. Which of the following is NOT characteristic of the airline industry?
   (a) Seasonal
   (b) Labor intensive
   (c) Highly competitive
   (d) High profit margins

5. Passenger travel is a highly globalized sector of the airline industry, but cargo transportation is not.
   (a) True
   (b) False

Module Summary

Although ICAO and IATA have distinct mandates, they have common objectives: to make air travel safer, more efficient and economical. ICAO Standards and Recommended Practices provide the basis for standardized practices in the aviation industry.

The Chicago Convention in 1944 laid out the fundamental building blocks of air navigation regulation, known as the “Freedoms of the Air”. They are a set of commercial aviation rights granting a country's airline(s) the privilege to enter and land in another country's airspace.

Airline profitability is a function of three key factors: Yield, Available Seat Kilometer Cost and Load Factor. The goal of revenue management is to maximize profits from every flight and route network. The business of running an airline requires large sums of money. For the airlines, earning enough profit to satisfy their stockholders as well as invest in the equipment and facilities they require is a genuine challenge.

Apply Your Learning

1. If you have access to a computer, visit the ICAO website (www.icao.int).
   (a) Browse through the website and take note of the services and information they offer.
   (b) Find the three Strategic Objectives for the period 2011–2013.

2. Try to find the following information for your country.
   (a) What agency enforces air safety regulations and handles various economic matters relating to aviation *(e.g., general transportation department or a specialized air transportation department)*?
   (b) Is there a joint authority that operates across national boundaries *[e.g., European Aviation Safety Agency (EASA)]*?
   (c) Is there a regional commission or council? *[e.g., the African Civil Aviation Commission (AFCAC), the Arab Civil Aviation Council (ACAC), the European Aviation Commission (EAC), the Latin American Civil Aviation Council (LACAC), the South Pacific Regional Civil Aviation Council (SPRCAC)].*
   (d) Is there a regional airline organization? *[e.g., the Air Transport Association of America (ATA), the African Airlines Association (AFRAA), the Arab Air Carriers Organization (AACO), the Association of European Airlines (AEA), the Association of Latin American Air Transport (AITAL), the Association of Asia-Pacific Airlines (AAPA), the Association of South Pacific Airlines (ASPA), the Association of South Asian Airlines (ASAA), the European Regions, Airline Association (ERAA)].*

Answer Key

Progress Checks (Lesson 2.1)

1. b
2. b
3. a
4. d
5. d

Progress Checks (Lesson 2.2)

1. d
2. a
3. d
4. b
5. b
6. a

Progress Checks (Lesson 2.3)

1. a
2. b
3. c
4. d
5. d

Module 3

From Flying Machines to Airline Alliances: A Trip through History

3.0 From Flying Machines to Airline Alliances: A Trip through History

Module Learning Objectives

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

- Describe the global growth of the commercial airline industry. (Lesson 1)
- Define deregulation in the airline industry and its current status worldwide. (Lesson 2)
- Describe how deregulation has resulted in the growth of privatization, cooperative agreements and alliances. (Lesson 3)

Module Overview

This module will take us back in time to the early beginnings of air travel. These early years, the building blocks of the aviation industry, will provide a frame of reference to understand current practices and gain a global perspective of the industry. We will discus the birth of first commercial airlines and the major influences on growth and development of the industry. We will review the impacts of both World Wars on aviation and the introduction of the jet age. This was the time when air travel became a fast growing means of transporting people and goods.

Moving on to more recent events in history, we will focus on two of the most important changes affecting the airlines: deregulation and cooperative agreements/alliances.

3.1 Development of Commercial Airlines

Lesson Overview

Since its beginning over 100 years ago, aviation has evolved into one of the world's most important high technology industries. Civil aviation represents a vital tool for global economic development. Its remarkable progress is due to military developments, technological advances and standards established by the world aviation community. This lesson will provide an understanding of the overall growth of the commercial airline industry. Each era of aviation will be discussed in light of the advances in technology, the regulations that were introduced and their impact on commerce.

Lesson Learning Objectives

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

- Describe the early development of airlines worldwide.
- Describe the impact of World War I and World War II on the airline industry.
- Identify the key factors that affected the growth of the airline industry from the beginning of the jet age to the present.

3.1.1 Early Beginnings Pre-World War I

In the early 1900s, when airplane designers in several countries succeeded in achieving flight, aviation as we know it had its beginnings. The first flight, taken by Orville Wright, was 37 meters (120 feet) in length and 12 seconds in duration.

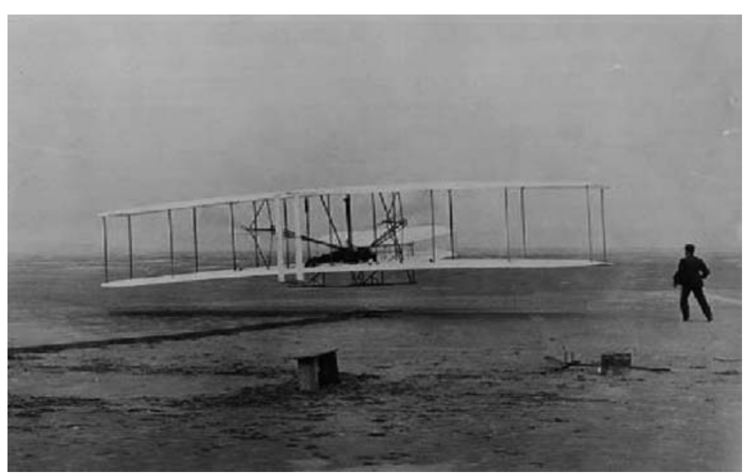


Figure 3.1.1—First Flight on December 17, 1903

Key Learning Point

A large number of military aircraft became available after World War I; they provided the basis for starting many of the world's first airlines, especially in Europe.

Did You Know?

In 1913, a British newspaper, the Daily Mail, offered a prize of 10,000 pounds sterling to the first aviator to cross the Atlantic. John Alcock and Arthur Brown were awarded the prize money in London by the British Secretary of State for War and Air, Winston Churchill. They were later knighted by King George V.

Key Learning Point

The 1920s saw growth of commercial airline services worldwide.

Did You Know?

Although the Douglas DC-3 was built in many versions over time (e.g., military, passenger, cargo), the original design was so successful that the basic specifications were never changed. In 2000, 65 years after it was introduced, hundreds of DC-3s were still flying.

When early flyers like the Wright Brothers took on passengers for short rides, we were witnessing the birth of passenger travel. When these pioneering aircraft began to transport items, as early as 1910, we also saw the beginnings of freight or cargo service. As people learned about the efficiencies of air transport, it did not take long for these practices to become established.

When World War I began in Europe in 1914, the focus of aviation research turned to the demands of nations at war. Factories used newly designed engines to put thousands of fighters and bombers into the skies. Following the war, there was no longer a need for the large number of military planes, and many of these planes became available for civilian use.

3.1.2 Impact of World War I

In the aftermath of WWI, nearly 20 small passenger airlines were created using bomber planes, notably in Germany, France and Great Britain. In 1919, the year of the world's first non-stop transatlantic flight, the International Air Traffic Association (IATA) was created. IATA was founded to establish the first set of common technical standards for the industry. The original IATA ceased to function during World War II, but was recreated as today's International Air Transport Association in 1945.

During the 1920s, scheduled commercial air services were introduced in Africa, Australia, Japan, Mexico and most South American countries. There was also a significant expansion of air routes across Europe. In the U.S., the main focus of early air transport was the delivery of mail. It soon replaced the railways as the main means of providing transcontinental mail service. Passenger service only became significant in 1926 when the airline companies flying mail between major U.S. cities began carrying passengers.

Although the early airlines were mostly founded as privately-owned companies, governments soon became interested in the industry and began forming larger, national airlines. Great Britain was the first major country to establish a government-owned airline, Imperial Airways, in 1924. Air transport continued to experience growth during the 1930s, as European governments continued to form large national airlines, such as Air France and Italy's Ala Littoria. The European airlines were able to make great progress during this time, further expanding their networks across Europe and most continents, including Africa. These networks were essential in supporting the colonies and also the commerce related to those colonies.

3.1.3 Growing Demand in the 1930s

In 1938, the world's airlines carried almost 3.5 million passengers. With the growing amount of air traffic, it was becoming more important for international airlines to cooperate. The International Air Traffic Association, founded two decades earlier, was able to provide the framework for this collaboration. Technical standards and commercial air transport regulations were developed and implemented. This included the standardization of flight decks and guidelines for marine airports as well as the prevention of fire on board aircraft and the build-up of ice deposits. In addition, industry standards and procedures relating to traffic handling and revenue accounting were introduced.

As the demand grew for larger and faster aircraft, manufacturers began to produce twin-engine planes, such as the Boeing 247 and the Douglas DC-3. The Boeing 247, developed in 1933, was revolutionary for its time and became the first modern passenger airliner.

Did You Know?

The Boeing 247 took 20 hours, with seven stops, to fly between New York and Los Angeles. Because the Boeing 247 flew at 304 kilometers per hour (189 miles per hour), its trip was seven and a half hours shorter than those made by any previous aircraft. Introduction of the DC-3 in 1935 cut this trip down to 17 1/2 hours with only three refueling stops.

3.1.4 Impact of World War II–1945 to 1960

When World War II began in September 1939, commercial aviation in Western Europe came to a full stop. Meanwhile, during the 1940s, commercial aviation in Central and South America continued to grow, especially in Brazil, Argentina, Mexico and Colombia. Unaffected by the war, they were able to establish extensive domestic networks as well as services to neighboring countries.

As in the case of World War I, the demands of the Second World War provided a tremendous push to aviation technical development. Military needs again forced the advancement of aircraft technology, navigation services and airport facilities. Aircraft of different types and sizes were built, different propulsion systems were discovered, and the range and speed of operations were increased. The first jet engines were developed for military use, and Germany flew the world's first jet aircraft in 1939. The advanced technology resulted in significant improvements in aircraft design, production and operational capabilities. The elements for a full-fledged air transportation industry were coming together. Since World War II, many countries have invested national pride in the creation and defence of state-owned airlines, sometimes called *flag carriers* or *legacy* airlines.

As we explained in Module 2, the Convention on International Civil Aviation, also known as the Chicago Convention, was signed in 1944 by 52 states. It provided the basic framework for the progressive, safe and orderly development of civil aviation on a global scale.

Key Learning Point

The military demands of World War II provided a tremendous push to aviation technical development, resulting in advances in aircraft design, navigation services and airport facilities.

Did You Know?

The Heinkel He 178 was the world's first practical jet aircraft. It was a private venture by the German Heinkel company in accordance with director Ernst Heinkel's emphasis on developing technology for high-speed flight. It first flew on 27 August 1939.

Key Learning Point

Commercial aviation played an essential role in the economic growth and social progress of developing nations.

The Convention established the rules of airspace, airplane registration and safety. It also detailed the rights of the signatories in relation to air travel and created ICAO.

Today's IATA, also referred to in Module 2, was formed just after World War II in April 1945, in Havana, Cuba. At its founding, IATA had 57 members from 31 nations, mostly in Europe and North America. The most important tasks of IATA during its earliest days were technical, because safety and reliability are fundamental to airline operations. The industry requires the highest standards in air navigation, airport infrastructure and flight operations. The IATA signatory airlines provided vital input to the work of ICAO, as that organization drafted its Standards and Recommended Practices. By 1949, the drafting process was largely complete and was reflected in “Annexes” to the Chicago Convention, the treaty that still governs the conduct of international civil aviation.

The 1940s also saw the development of radar. This technology was used by air traffic controllers to maintain a safe distance between aircraft along commercial airways and at airports. The installation of airborne radar equipment in commercial aircraft enhanced flight safety by providing pilots with the means to detect and navigate around hazardous thunderstorms. It also paved the way for establishing ground radar, used by meteorologists for identification of thunderstorm activity.

3.1.5 The Jet Age

During the 1950s, jet aircraft capable of carrying up to 200 passengers were developed and the airplane became established as a popular means of transportation. With the introduction of long-range aircraft on the North Atlantic, the ocean liner began to be replaced as a practical means of transportation.

During this time, tourist class service was introduced to cross the North Atlantic, affecting both fares and seating arrangements. Fares were generally 20–25 percent lower than the standard first class fares. In tourist class configuration, the aircraft could accommodate an average of 25 percent more passengers, compared to the first class seating arrangement. The introduction of this service set the stage for the development of one of the world's largest industries, global tourism.

Key Learning Point

The introduction of tourist class fares signalled the beginning of the development of one of the world's largest industries, the global tourist trade.

Following the successful launch of tourist class fares, many airlines then agreed to launch another new class of service–economy class. Fares for this class of service were about 20 percent lower than tourist class. The lowering of fares made air travel more affordable, allowing greater numbers of people to take to the air.

3.1.6 Growth and Setbacks–1960s

In the 1960s, the passenger airline industry experienced further global growth. Scheduled cargo traffic also made impressive gains. Tourists, mainly from North America and Europe, traveled to Africa, the Pacific and Asia as jet aircraft enhancements improved the speed, safety and comfort of air travel. Tourist traffic from Japan began to develop at the end of this decade and into the next. Meanwhile, the Caribbean countries became a favourite winter holiday destination. Middle East carriers modernized their fleets and were able to increase their share of the international airline market. At the same time, airline hijacking, or air piracy, became a serious issue in the 1960s.

3.1.7 The 1970s

Moving into the 1970s the world's scheduled airlines experienced a slower growth rate than expected. During this time they were faced with heavy capital investments, escalating fuel costs and global inflation. Hijacking throughout the world in the 1970s was at an all-time high due to political unrest in certain parts of the world. A complete review of air security processes followed resulting in stricter policies at airports. Most major airlines now had replaced propeller-driven planes with jet transport. Pan Am became the first airline to offer jumbo jet service, using Boeing 747s, which carry more than 400 passengers. In 1976, France and Great Britain began passenger service with their supersonic transport, the Concorde. The end of this decade saw the start of deregulation, a move which would drastically change airline business operations. Deregulation is the removal of government restrictions on an industry to encourage the efficient operation of markets.

3.1.8 The 1980s and 1990s

The 1980s began slowly for the airline industry, but ended with accelerated revenue growth. Early in the 1980s, international deregulation started to appear in the form of "open skies" agreements. These will be discussed in detail later in this module. From 1987 to 1989, more than one billion passengers traveled by air on an annual basis. This increase in passenger traffic began to result in congestion in the air and on the ground. Airline privatization trends and questions of foreign ownership continued into the 1990s.

3.1.9 2000 to Today and Beyond

Since 2000, the air transportation industry has faced several serious challenges. Airlines have increasingly become targets of terrorism related to international political tensions. The tragedy of September 2001 involving terrorist use of four aircraft in the United States and the rise of terrorists targeting airports has had serious economic consequences on the industry. Other factors, such as the SARS epidemic of 2003 and Avian Flu have also had a negative impact. These factors, coupled with a serious economic downturn, have resulted in the reduction of air travel.

However, despite these setbacks, experts are optimistic and predict growth of the airline industry over the next decade. The reasons for optimism include the potential for economic growth worldwide and the resulting increase in disposable income, continued deregulation and the on-going development of low-cost carriers. We will explore the future growth of the industry in the last module of this course.

3.1.10 Growth of Airline Passenger Traffic

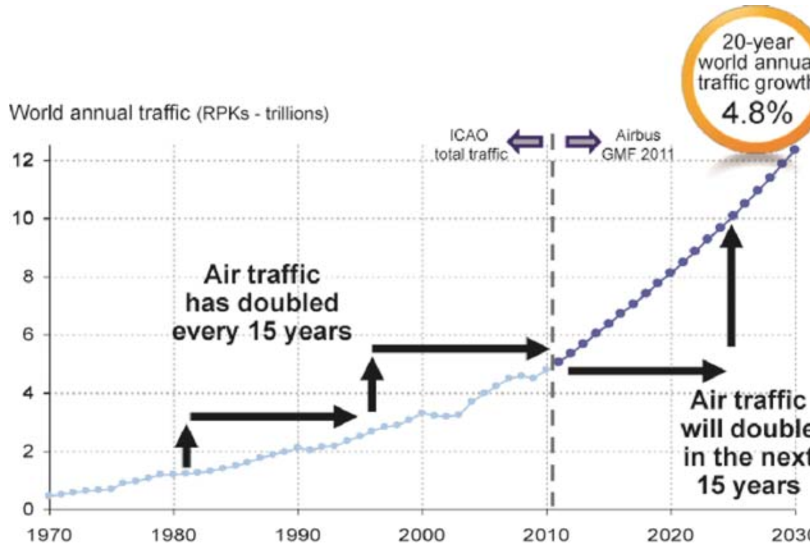


Figure 3.1.10—Historical and Projected Passenger Volumes[1]

Passenger traffic has grown 45 percent since 2000 and has doubled over the last 15 years with a projected growth of 4.8 percent expressed in RPKs (Revenue Passenger Kilometers) until 2030. (Airbus Market Forecast 2010–2030)

Key Learning Point

Air cargo began to play an important role in the world's economy, particularly in international trade, in the early 1950s.

3.1.11 Airline Cargo Traffic

Air cargo began to play an important role in the world's economy, particularly in international trade, in the early 1950s. The shipping of goods by air became a new mode of transport with great potential for the future. Cargo traffic has increased sharply since 1960. Air freight traffic is expected to almost triple over the next 20 years. Passenger planes still carry a large percentage of domestic and international freight.

[1] ICAO Bulletin and ACI Worldwide Airport Traffic Statistics

3.1.12 Timeline: The First Years of Aviation 1903–2012

1903: Orville and Wilbur Wright of the U.S. flew the world's first successful self-propelled airplane, signalling the start of flight and civil aviation.

1905: Charles and Gabriel Voisin started the world's first airplane-manufacturing company in France.

1909: Louis Bleriot crossed the English Channel in a monoplane, stirring great interest in Europe.

1914: The world's first scheduled airline began service across Tampa Bay, Florida, in the U.S.

1918: Army pilots in the U.S. flew the world's first permanent airmail service.

1919: The first scheduled airlines began to operate in Europe, using converted World War I bombers.

1920: QANTAS was launched.

1923: Commercial aviation started in Japan with the start of a mail service between Osaka and Tokyo.

1924: First flight around the world began and ended in Seattle, Washington, U.S.

1925: The Bolivian airline company, Lloyd Aero Boliviano (LAB), one of the oldest airline companies in South America, was launched.

1927: The first major agreement by IATA member airlines was reached, adopting the first standard format for an airline ticket and air waybill.

1927: Charles Lindbergh made the first solo, non-stop transatlantic flight from New York to Paris.

1929: Japan started regular passenger services, which were soon introduced to Korea.

1933: The Boeing 247 was built and modern air travel was born.

1935: Amelia Earhart was the first pilot to fly solo from Hawaii to California.

1937: British inventor Frank Whittle built the first successful jet engine.

1944: The Chicago Convention on International Civil Aviation was signed.

Did You Know?

The first aircraft to fly around the world covered over 42,390 kilometers and took 175 days with a total flying time of 363 hours. The point of origin and destination was Seattle, Washington, U.S.A. in 1924.

Did You Know?

Ferdinand Graf von Zeppelin set up the first commercial airline in 1912 using a form of dirigible to transport more than 34,000 passengers before WW1.

Did You Know?

Charles Lindbergh had no forward vision during his historic flight, except for a small periscope. Fighting off fog, ice and overwhelming fatigue, he navigated his journey to a perfect landing at Le Bourget Field in Paris 33 hours, 30 minutes and 29.8 seconds after departing from New York. A huge crowd of 150,000 on-lookers awaited his arrival.

1952: British Overseas Airways Corporation (now British Airways) began jet passenger service with De Havilland Comets.

1956: Seaboard and Western Airlines scheduled all-cargo services across the North Atlantic.

1959: American Airlines started jet service across the U.S. with Boeing 707s.

1968: The maiden flight of the first prototype of the world's first supersonic jet aircraft, the Russian Tupolev TU-144 took place.

1969: The world's first wide-body airliner, the Boeing 747-100, made its initial flight.

1971: The Boeing 747 made its first commercial flight from New York to London.

1975: Aeroflot launched the world's first commercial supersonic service, carrying commercial cargo and mail.

1976: Air France and British Airways began passenger service with supersonic transport planes (the Concorde).

1978: The U.S. introduced the Airline Deregulation Act, which removed statutory control of domestic airline operations.

1989: Qantas Airways set a world distance record for commercial airliners by flying a Boeing 747-400 from London to Sydney, Australia non-stop (17,008 kilometers) in just over 20 hours.

1990: The International Air Cargo Association (IACA) was established as a global organization representing the air cargo industry.

2003: The first 100 years of aviation was celebrated. On a sadder note, British Airways and Air France retired the SST Concorde.

2004: Air France and KLM merged to form a new airline, Air France-KLM.

2005: Boeing launched the 744-8 jumbo jet. The first non-stop flights since 1949 took off from mainland China to Taiwan.

2006: Kobe Airport, a controversial offshore airport in Japan, opened for airline service. The A380 made its debut landing at Heathrow Airport.

Key Learning Point

The term deregulation refers to the removal of government restrictions on the operations of a business.

2007: The world's largest passenger plane, the Airbus A380 superjumbo, completed its first commercial flight. The giant Singapore Airlines aircraft touched down safely at Sydney International airport with 477 passengers on board. Virgin America began operations in that same year.

2009: The first flight of the Boeing 787 Dreamliner took place in Seattle.

2010: Northwest Airlines merged with Delta. The second eruption of Eyjafjallajokull in Iceland caused large areas of controlled airspace to be closed and widespread suspension of services across Europe.

2011: KLM became the first airline in the world to provide flights using bio fuel.

2012: The women's international record-holder for number of flight hours logged as a pilot in a lifetime, Evelyn Bryan Johnson, died at the age of 102. Between her first solo flight on November 8, 1944 and her retirement from flying in the mid-1990s, she had logged 57,635 hours (approximately 6.5 years) in the air, flying about 5,500,000 miles.

Lesson Summary

Aviation has evolved into one of the world's most important high-technology industries. Its remarkable progress has been made possible by a number of factors, including military developments, technological advances and standards established by the world's aviation community. A large number of military aircraft became available after World War I; they provided the basis for starting many of the world's first airlines, especially in Europe. The 1920s saw the growth of commercial airline services worldwide. The military demands of World War II provided a tremendous push to aviation technology, resulting in the development of advances in aircraft design, navigation services and airport facilities. Air cargo began to play an increasingly important role in the world economy in the early 1950s, particularly in international trade. Since the beginning of the Jet Age, both Tourist Class and Economy Class service have been introduced. This signalled the beginning of the development of one of the world's largest industries, the global tourist trade. Commercial aviation has played an essential role in the economic and social progress of developing nations. The world's scheduled airlines experienced a slower growth rate than expected during the 1970s because of a number of setbacks.

Progress Checks (Lesson 3.1)

1. World War I was a main factor in the development of civil aviation because, after the war, many military planes were used for passenger transportation.
   (a) True
   (b) False

2. In which country, during the early 1920s, was the focus on the delivery of mail by air transport?
   (a) Australia
   (b) Great Britain
   (c) Japan
   (d) USA

3. The earliest airlines were privately-owned companies.
   (a) True
   (b) False

4. Which country was the first to establish a government-owned airline?
   (a) France
   (b) Great Britain
   (c) Italy
   (d) USA

5. The most distinctive feature of the Concorde passenger aircraft was ______________________.
   (a) supersonic speed
   (b) fuel efficiency
   (c) the wide-body
   (d) 400 passenger capacity

3.2 Deregulation

Lesson Overview

Historically, governments have regulated fares, routes and types of services offered both domestically and in international air travel. In the past thirty years, however, deregulation of air travel has been adopted by many countries around the world. Different perspectives exist, depending on interpretations of the role of government. The United States was the first nation to deregulate in 1978, with Canada introducing deregulation legislation in 1985. Australia followed in 1990 and then the European Union (EU) deregulated the industry in 1997. International regulation has been liberalized by bilateral processes, including “open skies” agreements.

Lesson Learning Objectives

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

- Define the general outcomes of deregulation.
- Describe three perspectives on deregulation of the airline industry.
- Explain the “hub and spoke” route structure.
- Define the impact of Open Skies Agreements.

3.2.1 Perspectives on Deregulation

Deregulation is an important topic in the airline industry. The definition of “deregulation” is to remove government regulatory controls and/or restrictions from an industry.

One perspective places a high value on deregulation. The deregulation philosophy in the U.S., for example, supports the idea that market forces have the ability to create the best commercial environment for stakeholders. Stakeholders would include the public who travels, shippers and air carriers. This viewpoint supports deregulation even if the result is fewer airlines and increased concentration of market share.

A second viewpoint recognizes that while greater competition is beneficial, the process should be evolutionary. This perspective, held generally in most industrialized nations, also emphasises that it is important to recognize the public service character of airline operations.

Yet a third approach exists in some countries, where the airlines are viewed as an important instrument of the government. If airlines are seen as serving national interests, then deregulation is not desirable as it reduces government controls.

Key Learning Point

Deregulation has been adopted by many countries around the world.

3.2.2 The Start of Deregulation

The U.S. was the first major country to endorse deregulation. Until 1978, the U.S. government had regulated many areas of commercial aviation such as fares, routes and schedules. The U.S. introduced cargo deregulation in 1977, followed by passenger deregulation in 1978 with the passage of the Airline Deregulation Act by the U.S. Congress. This legislation has proved to be one of the most important events in the history of the airline industry. In one stroke, it cut government control over fares and domestic routes. For the first time, this gave airlines the freedom to operate as true businesses. By 1984, the Civil Aeronautics Board (CAB), which had been regulating the U.S. airline industry, was dissolved.

The objective was not to affect government controls over areas such as safety, air traffic control, airworthiness, personnel licensing and aircraft maintenance. The purpose, instead, was to ease controls over airline fares and routes in order to encourage greater competition and better service.

Opponents to deregulation have included major airlines that may not have welcomed free competition. In the face of increased competition, “legacy” carriers risked incurring losses in order to offer competitive service on routes served by new low-cost airlines. Labor unions were apprehensive of the effect of a deregulated industry on employees. A great concern to all was the increased air traffic resulting from deregulation and safety concerns surrounding less government oversight of the industry.

3.2.3 Continued Adoption of Deregulation

As we have seen, domestic deregulation has been adopted by many countries around the world. In the 1980s and 1990s, other industrialized nations followed the U.S. lead in creating a more competitive environment by adopting policies to free the industry from government restrictions. These included countries such as Canada, Australia, members of the European Union (EU), the U.K. and Japan.

The Canadian airline industry went through structural changes that were very similar to those in the U.S. Beginning in 1984, the Canadian airline industry moved quickly toward a high degree of market concentration and, in 1985, the government introduced deregulation legislation. In the EU, however, the movement to reduce airline regulation was slower as these countries followed a more cautious approach. This was due to the fact that most of the major European airlines were owned by their respective governments at that time.

The European Union (EU) completed deregulation of the airline industry within its boundaries in 1997. The European airline industry had been historically highly regulated with national quotas on flight capacity and fixed prices. The EU introduced a series of liberalization measures in 1987, which allowed for a ten-year phase-in of legislation to permit greater competition among European airlines. As a result, on paper, the European airline industry appears to be a totally open market.

In actual practice, however, it is not operating as smoothly as would appear. There are several factors that have a continuing impact on the industry. First, the European Commission treaty states that, in some circumstances, government interventions are necessary for a strong economy. Through a series of legislative acts that provide for a number of exemptions, the European Commission has established a system of rules under which state aid is monitored by the EU.

Second, new competition in Europe is likely to be slowed by infrastructure constraints at European airports. A number of large European airports, serving main industrial centers, do not have the space to accommodate new start-up carriers and have restrictions on slot sales. Landing slots, or airport slots, are rights allocated by an airport or government agency granting an airline the right to schedule a landing or departure at a specific time. Slots have been historically given to airlines free of charge and are allocated based on grandfather rights–if an airline used a slot last year, it has the right to use it in the next year. This follows the general principle under which an air carrier, having operated its particular slots at 80 percent capacity or more during the previous year, is entitled to the same slots in the following year (so-called grandfather rights). While new carriers do get priority at the time available slots are allocated, the number of new slots that becomes available each year is limited. However, the existing EU legislation on airport slot allocation does not prohibit secondary slot trading. Secondary trading is the transfer of slots from one carrier to another for monetary compensation.

Third, the aviation industry is characterized by strong nationalist sentiments towards each country's ‘flag carrier'. In many parts of the world, airlines will therefore continue to face limitations on where they can fly and restrictions on their ownership of foreign carriers.

While Australia's domestic airline industry has been largely deregulated, it's international airline industry remains highly regulated. This is because it is subject to the detailed capacity controls that are part of the system of bilateral air service agreements (ASAs). ASAs have historically provided the international legal framework enabling the operation of scheduled international air services between countries. These agreements control fares and seat capacity that may be scheduled on individual international routes.

Japan's airlines were regulated by the government until 1996, by which point there remained only three: Japan Airlines (JAL), All Nippon Airways (ANA) and Japan Air System (JAS). JAL concentrated on international routes, while ANA and JAS concentrated on domestic traffic. All three airlines offered the same fares, which were set by the Ministry of Transportation (MoT). In 1996, the MoT agreed to let the airlines set their own fares. The initial result was that most fares rose slightly, while fares during peak travel periods skyrocketed. Eventually, half-price restricted fares emerged, but the base fares remained at unusually high levels due to lack of competition (industry concentration).

Despite these hindrances, the airline industry has proceeded along the path towards globalization and consolidation. It has done this by establishing alliances and partnerships between airlines linking their networks to provide expanded routes. Globalization and consolidation are characteristics associated with the normal development of industries. Consolidation is defined as the merger or acquisition of companies. Alliances are agreements between two or more airlines to cooperate on a substantial level.

The wave of mergers, new entrants and airline failures is likely to continue in the future as deregulation continues to be adopted in the industry. Mergers are defined as two airlines that combine their operations into one company. Examples include the Air France and KLM merger in 2004 and the more recent merger between British Airways and Iberia. Mergers may be total or partial and involve the purchase of equity in other carriers or joint marketing agreements and cooperative ventures.

3.2.4 Effect of Deregulation on the U.S. Airline Industry

One key impact of deregulation in the U.S. was the entry of many new airlines into the market. The industry was able to introduce a wider range of promotional fares, numerous airlines disappeared through bankruptcies and a number of takeovers and mergers took place during a “shake down” of the industry.

An important positive effect was the growth of “hub-and-spoke” route networks, in which an airline routes its flights through one or several “hub” cities. The major airlines adopted key cities as centers for their operations. These key cities served as stops for most flights, even if they were not on a direct route between two other end points. This move served to increase efficiency in a number of ways:

- It allowed better adaptation of equipment to markets (i.e., small props and jet props for short trips and few passengers; big jets for dense, long-haul routes).

- It permitted the use of larger and more efficient planes, and
- It offered a wider variety of destinations.

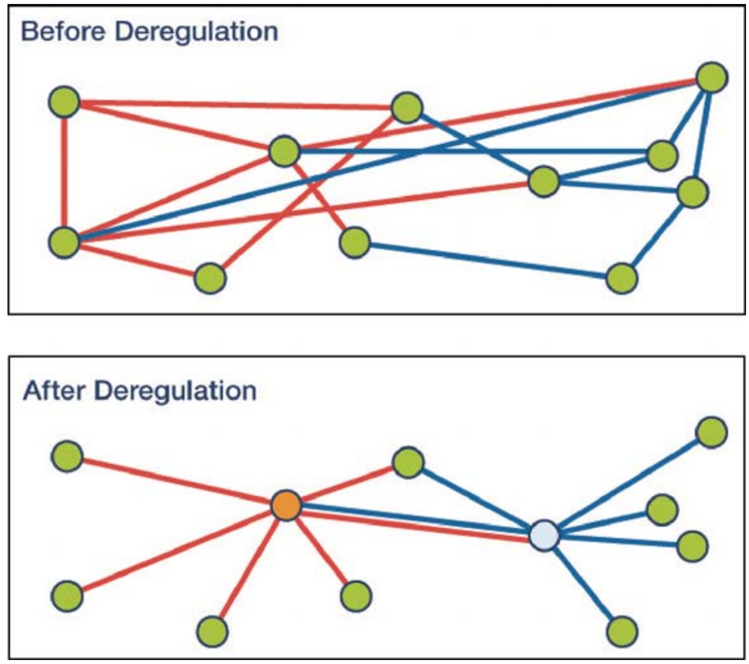


Figure 3.2.4—Comparison of Route Networks Before and After Deregulation

In the above figure, two airline companies are servicing a network of major cities. Before deregulation, a fair amount of direct connections exist, but mainly at the expense of the frequency of services and high costs. While many cities receive airline service by both airlines, connections are likely to be inconvenient. After deregulation, a system of hub-and-spoke routes emerges as airlines rationalize the efficiency of their services.

A common consequence is that each airline assumes control over a hub and services are modified so the two hubs are connected to several spokes. The two airlines tend to compete for flights between their hubs and specific spokes, if demand warrants. However, as this network matures, it becomes increasingly difficult to compete at hubs as well as spokes. As an airline assumes control of a hub, it may increase airfares for specific segments. The advantage of such a system for airlines is the achievement of regional market dominance and higher loads, while passengers benefit from better connectivity. Passengers can also experience delays while making connections and more frequent plane changes.

Another major accomplishment of deregulation has been the improvement of airline productivity. Deregulation of prices, for example, allowed airlines to fill their planes by offering large numbers of heavily discounted fares for seats that would otherwise go unused.

While analysts continue to debate the long-term effects of deregulation, it is generally recognized that the U.S. airline industry has become more efficient, innovative and customer-oriented. It has not yet, however, become more profitable.

3.2.5 Open Skies Agreements–International Deregulation

Air transportation differs from many other forms of commerce, not only because it has a major international component, but also because many of the airlines were wholly or partly government-owned. As international competition grew, various degrees of protectionism were imposed.

The term *open skies* refers to either a bilateral (between two countries) or multilateral (involving more than two countries) Air Transport Agreement (ATA) which opens the aviation market to foreign access and removes barriers to competition.

Moving toward deregulation, Open Skies ATAs create a free market for aviation services and provide substantial benefits for travelers, shippers and communities as well as for the economy of each country involved. These agreements lead to expanded demand for international aviation service and create new business for international air carriers. In addition, they promote increased travel and trade, productivity, high-quality job opportunities and economic growth. They do this by reducing government interference in the commercial decisions of air carriers, freeing them to provide affordable, convenient and efficient air service for consumers.

Bilateral Open Skies Agreements give the airlines of both countries the right to operate air services from any point in one country to any point in the other, as well as to and from third countries. These rights enable airlines to network using strategic points across the globe. International routes have been deregulated only gradually, through negotiated bilateral or multilateral open skies agreements. These open skies agreements do not create fully competitive markets, however, as they do not allow foreign carriers to transport passengers between cities within any other country, only to and from the countries.

A Bilateral Open Skies Agreement involving the United States, for example, allows air carriers designated by the United States and the foreign signatory to make decisions on routes, capacity, and pricing. These decisions include unrestricted code sharing rights.

Code sharing refers to two airlines jointly selling tickets for a flight. The "codeshare" airline will be identified with a different flight number from the airline operating the route. By allowing air carriers unlimited access to points in the signatory countries (countries that have signed the codeshare agreement) and unlimited access to intermediate points and beyond, such agreements provide maximum operational flexibility for airline alliance partners.

As discussed, the last 25 years have seen significant beneficial changes in international airline regulation. Most of the existing civil aviation agreements include:

1. Free market competition: No restrictions on international route rights, number of designated airlines, capacity, frequencies and types of aircraft.
2. Pricing determined by market forces: A fare can be disallowed only if both governments agree–“double-disapproval pricing”–and only for specific reasons intended to ensure competition.
3. Fair and equal opportunity to compete: For example, all carriers of both countries may establish sales offices in the other country and convert earnings and remit them in hard currency promptly and without restrictions. Designated carriers are free to provide their own ground-handling services–“self-handling”–or choose among competing providers. Airlines and cargo consolidators may arrange ground transport of air cargo and are guaranteed access to customs services. User charges are non-discriminatory and based on costs; computer reservation system displays are transparent and non-discriminatory.
4. Cooperative marketing arrangements: Designated airlines may enter into codesharing or leasing arrangements with airlines of either country or with those of third countries, subject to the usual regulations. An optional provision authorizes codesharing between airlines and surface transportation companies.
5. Provisions for dispute settlement and consultation: Open Skies Agreements typically include procedures for resolving differences that arise under the agreement.
6. Liberal charter arrangements: Carriers may choose to operate under the charter regulations of either country.
7. Safety and security: Each government agrees to observe high standards of aviation safety and security as well as to render assistance to the other in certain circumstances.
8. Optional 7^{th} freedom all-cargo rights: The airline of one country can operate all-cargo services between the other country and a third country via flights that are not linked to its homeland.

Lesson Summary

The term deregulation refers to the removal of government restrictions on the operations of a business. There are different perspectives on deregulation based on differing values. In the past thirty years, deregulation of air travel has been adopted by many countries around the world. The United States was the first nation to deregulate in 1978, with Canada introducing deregulation legislation in 1985. Australia followed in 1990 and then the European Union deregulated the airline industry within its boundaries in 1997. With deregulation, the industry went through a period of dramatic change with many bankruptcies, take-overs and mergers. The growth of “hub-and-spoke” routes increased the efficiency of airline operations. Numerous new airline companies soon entered the marketplace. Fares were reduced, allowing travelers to save. International air transport has been liberalized by “open skies” agreements.

Progress Checks (Lesson 3.2)

1. The first major country to introduce deregulation was ______________.
   (a) Australia
   (b) France
   (c) Great Britain
   (d) USA

2. Major airlines opposed deregulation because they feared ______________.
   (a) increased competition
   (b) lack of safety regulation
   (c) lack of personnel licensing
   (d) rapid development of new routes

3. The initial result of deregulation of fares by Japan's Ministry of Transport was ______________.
   (a) lower fares for all classes
   (b) lower fares for the economy class
   (c) lower fares during peak travel periods
   (d) slight rise of most fares

4. Open Skies Agreements create a free market environment by reducing government interference in the commercial decisions of air carriers.
   (a) True
   (b) False

5. From a passenger's perspective, one of the disadvantages of a mature “hub-and-spoke” route system is the dominance of one airline in a hub.
   (a) True
   (b) False

Lesson Learning Objectives

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

- Describe how privatization of an airline may benefit the government.
- List three ways that airlines can formally consolidate their interests.
- List three types of cooperative arrangements for airlines.
- Describe what is meant by an alliance and name the world's three major airline alliances.
- Describe the impact of deregulation on airport facilities and services.

3.3 Impact of a Deregulated Airline Industry

Lesson Overview

Deregulation of the airline industry can have a variety of impacts. Routes and fare structures can be dramatically adjusted. Governments can decide to privatize nationally-owned airlines. Airlines can consolidate their operations and enter into cooperative arrangements or alliances. These alliances can provide airlines with efficient ways to improve their services and profitability. Both industrialized developing countries can use these options as opportunities for growth.

3.3.1 Privatization

More and more governments are viewing privatization of government-owned or controlled companies as an important means of achieving their economic and public policy objectives. Privatization of their airline(s) is a way by which governments can:

- Raise money through the sale of companies
- Reduce public expenses by freeing itself of a money-losing asset
- Allow companies to become economically viable and profitable by freeing them from government constraints
- Encourage competition.

Key Learning Point

The impact of deregulation can affect all aspects of the airline industry and those entities that interface with it.

Many national airlines have been reborn as private companies, including Air Canada, Air New Zealand, British Airways, Deutsche Lufthansa, Japan Airlines, Lan Chile and Qantas Airways. Industry experts predict that more airlines (and even airports) in industrialized countries will continue to be privatized.

There are some governments, however, who will continue to view their international airlines as significant, strategic national assets. These countries will most likely try to maintain their airlines under government control.

3.3.2 Consolidation

Spurred on by deregulation, consolidation is a trend in the airline industry. Airlines are forming new business partnerships, including:

- loose, limited bilateral partnerships
- long-term, multi-faceted alliances of groups of companies
- equity arrangements between companies
- mergers or takeovers.

Since governments often restrict foreign ownership of airlines, we see most consolidation taking place within a country. In the U.S., for example, over 200 airlines have been merged, taken over or simply gone out of business since deregulation began in 1978. International airline representatives are pressing for government action to permit greater consolidation. The rationale behind greater consolidation is an increase in economies of scale and efficiencies.

3.3.3 Cooperative Arrangements

To ensure economic sustainability, airlines in industrialized countries find it necessary to establish trans-border alliances or partnerships. In developing countries, this need is even greater and often a question of survival. These alliances or partnerships are referred to as “cooperative arrangements”.

Key Learning Point

Many of today's airlines are finding it necessary to establish trans-border alliances, partnerships and other cooperative arrangements.

One form of cooperative arrangement consists in combining the air services of two or more airlines, with joint scheduling, to offer a wider choice of frequencies and to maximize load factors. Other types of cooperative arrangements are:

- sharing of computer facilities for the purposes of reservations, scheduling, as well as fleet and crew planning
- development of regional airline training centers
- combining of aircraft spare equipment
- agreements for aircraft and engine overhaul and maintenance
- purchasing of aircraft and equipment

- partnering in fuel service companies to maintain stable fuel supplies

Critical tools serve the airlines to assist in their cooperative efforts. One of these tools is the CRS (Computer Reservation Systems). These systems play an important role in the marketing and selling of air transport products.

Another tool is the codesharing of services. With codesharing, passengers can fly a portion of their trip on an airline other than the airline they purchased their ticket from.

The practice of codesharing has become the foundation of many strategic marketing alliances for the world's airlines; it allows two or more carriers to integrate their networks and synchronize their services and schedules. Codesharing permits airlines to operate with increased efficiencies to more destinations and offer seamless service.

Developing nations also benefit from increased cooperative arrangements, ranging from the merger of two or more carriers to collaboration projects to improve their efficiencies. These efforts can include sharing equipment, joint scheduling and sharing facilities and aircraft maintenance. The result can be reduced costs and improved market share. Deregulation enables the formation of regional airlines from a number of small carriers. Coping with this changing industry will require airline management and governments of developing nations to work closely together.

3.3.4 Alliances

An alliance represents a formal agreement between companies to achieve a particular aim. This can allow companies to increase their efficiencies while remaining separate entities. Alliances allow for increased customer service with minimal increased cost to individual airlines. The degree of cooperation will differ among alliances. Currently, the major airline alliances are the Star Alliance, SkyTeam and Oneworld.

Key Learning Point

An alliance represents a formal agreement establishing an association between groups to achieve a particular aim. Currently, the major airline alliances are the Star Alliance, SkyTeam and Oneworld.

The following table compares these three main alliances:

	Star Alliance **www.staralliance.com**	**Oneworld** **www.oneworld.com**	**SkyTeam** **www.skyteam.com**
Countries Served	189	146	173
Daily Departures	21,230	8,107	14,500
Passengers per Year	653 million	288 million	487 million
Fleet	4,386	2,194	2,431
Market Share	24.7%	9.4%	14.0%
Member Airlines	27	14	15

Figure 3.3.4—Comparison of major airline alliances (2010)

Airline alliance agreements greatly increase airline efficiencies. They achieve cost reductions by sharing facilities (offices) and operational staff. They have increased purchasing power on investments and expenses which provides them with volume discounts. These operational costs can be passed on to customers through shorter travel times, reduced fares and more departure times and destinations. Alliances provide a network of connectivity and convenience.

That being said, there are also disadvantages if an alliance forms a monopoly on certain routes–increased prices and reduction of frequencies.

Alliances provide convenient marketing branding to improve sales and simplify travel arrangements for customers. Also, an airline's mileage reward programs are extended to alliance partners.

This means that a customer can travel on airline “A” while being a member of a frequent traveler program on airline “B” and still earn air miles if these two airlines are part of the same alliance.

3.3.5 Impact on Airport Facilities and Services

The increased competition and traffic brought about by deregulation have resulted in a strain on airport and airspace capacities. Increasingly, this has become a problem for the airline industry in many parts of the world, particularly in Europe, the Far East and North America. Building new airports or improving existing airport facilities requires huge cash investments and, as a result, many governments worldwide are moving toward the privatization of airports.

Lesson Summary

The deregulation of the airline industry can have a variety of impacts. Governments can decide to privatize nationally-owned airline companies. Airlines can consolidate their operations or they can enter into cooperative arrangements. Many of today's airlines are finding it necessary to establish trans-border alliances, partnerships and other cooperative arrangements. An alliance represents a formal agreement establishing an association between companies to achieve a particular aim. Currently, the largest airline alliances are the Star Alliance, SkyTeam and Oneworld. Alliances can provide airlines with an efficient means of improving their services and their profitability. Routes and fare structures can be dramatically adjusted as competitive market forces are allowed to impact airlines' operations. Both industrialized nations and developing countries can use these options as opportunities for growth.

Progress Checks (Lesson 3.3)

1. The main rationale behind greater consolidation is an increase in economies of scale and efficiencies.
   (a) True
   (b) False

2. Privatization of government-owned airlines can lead to ____________.
   (a) economic viability of these airlines
   (b) bankruptcy of these airlines
   (c) reduced competition
   (d) neglect of safety standards

3. The main benefit of joint scheduling between several airlines is ____________.
   (a) reduction in staff expenses
   (b) lower IT expenses
   (c) increase in check-in options
   (d) maximization of load factors

4. Currently there are three main airline alliances in the world: Oneworld, Sky Team and ____________.
   (a) World Alliance
   (b) Sky Alliance
   (c) Star Alliance
   (d) Fly Alliance

5. Airline alliances can lead to a reduction in flight frequencies when ____________.
   (a) governments do not stimulate competition
   (b) regional airlines are part of the alliance
   (c) government regulation is too rigid
   (d) alliances have a monopoly on specific routes

Module Summary

The last century has brought about remarkable progress in the airline industry in large measure because of military developments, technological advances and standards established by the world's aviation community. Domestic and international routes were established in the 1920s and 1930s. With the rapid growth of the industry, the need for governmental regulation was evident.

Deregulation began in the United States in 1978 and was followed by other countries in later years. This opened the industry to competition. Deregulation has had a number of impacts on the industry worldwide, including the growth of cooperative arrangements and alliances.

Apply Your Learning

1. We invite you to do some research on the development of the airline industry in your region of the world. When did commercial airlines begin using your nearest airport? What type of impact did this have on your area?

   To answer these questions, we suggest that you use the following resources, if available: local library, computer for Internet research and people you know who have worked in the aviation industry.

2. To what extent has deregulation affected the airline industry in your region?

   Use the resources listed in #1 above to help you answer the question.

3. Identify if any major airlines operating in your region are members of an airline alliance.

Answer Key

Progress Checks (Lesson 3.1)

1. a
2. d
3. a
4. b
5. a

Progress Checks (Lesson 3.2)

1. d
2. a
3. d
4. a
5. a

Progress Checks (Lesson 3.3)

1. a
2. a
3. d
4. c
5. d

Module 4

Within the Airlines

4.0 Within the Airlines

Module Overview

As a global operation, the airline industry provides employment to hundreds of thousands of people. More than two million people are employed in the aviation, aerospace and air transportation industries across the world. An airline's key assets are its airplanes and its people. Airlines invest in newer planes and upgrade their facilities from time to time. Airlines must also invest in their employees to deliver the highest level of customer service. The airline industry provides many different kinds of job opportunities for individuals who are looking for an exciting career.

Examples of airline job functions include piloting an aircraft and providing customer service in the cabin, at the airport or in a reservations office. In this module, we will ask you to make connections between your job interests and how airlines work. Learning about the organizational culture, customer service orientation and other factors regarding how airlines conduct business will help you plan your career in the industry.

Boeing 747-8, Courtesy of Boeing

Module Learning Objectives

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

- Describe the basic organizational structure of most airlines. (Lesson 1)
- Describe the key responsibilities of the flight crew and the cabin crew. (Lesson 2)
- Describe the importance of training in standardized procedures for pilots and flight attendants. (Lesson 3)
- Describe the role of seniority within the culture of an airline. (Lesson 4)
- Describe the importance of a customer service orientation within an airline. (Lesson 4)

Lesson Learning Objectives

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

- Describe the role of management in a typical airline.
- Name and describe the two main areas of operation for an airline.
- Differentiate between the responsibilities of various departments in an airline.
- Describe the difference between line personnel and back-office staff.
- Define outsourcing and describe when it is used.

4.1 How Airlines are Structured

Lesson Overview

Airlines are, above all, service organizations. A service industry is one that provides services rather than manufactured goods. The entertainment industry is a good example of a service industry. An airline's basic function is to provide the service of transporting passengers, their luggage and other cargo from one place to another. To provide this service, airlines have a very specific organizational structure. In this lesson, we will explain this particular organizational structure.

Key Learning Point

Most airline employees fall into two categories: flight operations and ground operations.

Did You Know?

The typical organizational structure of an airline is likely to include several layers of management.

4.1.1 Basic Organizational Structure

An organizational structure is the term used to define how employees of a company work together to support their mission. Each airline has complex operations that require large numbers of employees. While the operations of each specific airline may vary somewhat, there is a basic similarity across the operating structures of most airlines, resulting in common types of positions. Larger airlines may employ more people, but the employee categories are generally the same, regardless of the airline's size.

Airlines usually have an organizational structure that looks like the chart below.

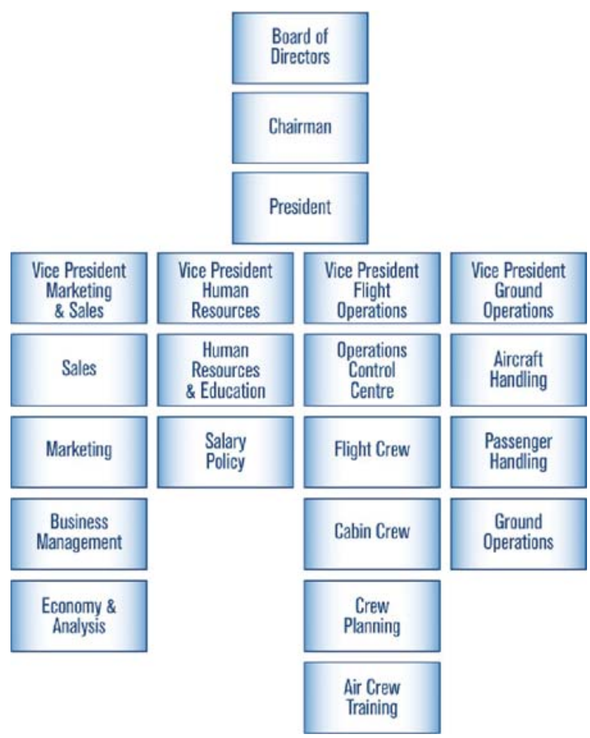


Figure 4.1.1—Typical Organizational Chart

Such organization charts show the vertical reporting relationships of a series of functions which is often referred to as a “top-down” structure.

Generally, airline organizations have a level of management that guides the company strategically in terms of setting policies and planning for the future. As in most corporate structures, these include positions such as Chairman of the Board of Directors, Chief Executive Officer and President. Each broad area of operations (e.g., Flight Operations, Ground Operations, Human Resources, Marketing & Sales) is typically supervised by a vice-president. Larger airlines often appoint vice-presidents to oversee each of the airline's hubs as well.

Most airline employees report into two main areas of operations: flight operations and ground operations. People employed in flight operations are responsible for the safe and efficient operation of an airline's fleet, including training, assignments and performance monitoring. Ground operations personnel are responsible for ground handling and all other ground operational activity. Staff employed in ground operations are responsible for passenger processing, baggage handling, aircraft handling and the support functions necessary for those positions.

4.1.2 Types of Airline Personnel

Let us take a look at the most common types of positions in flight operations and ground operations.

4.1.2.1 Flight Operations Personnel

This includes the following groups of airline staff:

- **Flight Crew**
  The flight crew is responsible for the safety and operation of the aircraft and all other crew members. The flight crew consists of the captain (pilot-in-command) and first officer (co-pilot) responsible for the operation and safety of the aircraft and all persons aboard.
- **Cabin Crew**
  The cabin crew is responsible for safety in the cabin. Cabin crew ensure that passengers are comfortable throughout the flight and that their experience on board is a pleasant one. They attend to passengers' needs and provide a high level of customer service. The cabin crew may include a cabin service director, purser and flight/cabin attendants.

- **Operations Control Center**
  This is the area responsible for movement control, flight planning, load planning and flight crew briefings. Critical decisions are taken with regard to incidents and delays to support ground management. The operations control center is also a communications center for information concerning all aircraft movement.

Figure 4.1.2.1–1—Operations Control Center

- **Air Crew Training**
  This area of the airline is responsible for the training of flight crews.
- **Other Flight Operations Personnel**
  These employees include those responsible for crew scheduling. In larger airline companies, there is one scheduling department responsible for flight attendants and another for pilots. Schedulers work closely with the training and operational control departments. They are always aware of the number of crew required for different types of aircraft and if crew have the required training.

4.1.2.2 Ground Operations Personnel

This includes the following groups of airline staff:

- **Reservation Agents**
  This group of people work in large reservation call centers responding to telephone calls and email inquiries. They assist people in booking reservations, issuing tickets and generally planning their business or leisure trip. They are able to provide suggestions or offer information about travel arrangements. Reservation agents quote fares and use proprietary networks to obtain information in order to make, change or cancel transportation reservations.

- **Airport Check-in Staff**
  Personnel working at airport check-in can be referred to as passenger service agents or airport ticket agents. Typically, they work at the ticket and check-in counters in the airport terminal. Their main job functions are dealing with travelers' needs at the airport. Staff assist passengers to check in their luggage, assign their seats, answer any questions and direct them to the boarding gate area. Many passengers now use the self-service areas of the airport and agents are assigned to this area to facilitate this process.
- **Gate Personnel**
  These employees work in the airport concourse in the departure gate areas and have the following responsibilities: They assist passengers boarding airplanes, direct passengers to the correct boarding area, check tickets/seat assignments and make boarding announcements. Gate personnel also provide special assistance to young, elderly or passengers with disabilities when they board or disembark.
- **Aircraft Maintenance**
  Airplanes are multi-million dollar machines that must be maintained in top working order. Personnel in the aircraft maintenance division include avionics, airframe and power plant technicians. They are trained on various aircraft types and assure they are airworthy. Aircraft are only profitable for an airline when they are in the air.
- **Ramp Personnel**
  Ramp service personnel guide planes in and out of the airport gates. Their duties include loading and unloading cargo and baggage. Another type of ramp personnel is responsible for maintaining the cleanliness of the aircraft. Other types of ramp service personnel duties are catering, de-icing and fueling. Part of their duties is to follow all safety and security guidelines.

Did You Know?

After 10 years of service, 90 percent of an aircraft's original parts have been replaced.

4.1.2.3 Other Personnel

- **Sales and Marketing**–The sales and marketing divisions of an airline is responsible for setting the price of the airfare. They are also tasked with advertising, sales, promotion, reservations, customer service and, in some cases, scheduling.
- **Specialists**–An airline employs specialists to perform particular duties. Specialized staff include lawyers, accountants, employee and public relations specialists, human resources and clerical staff. They are located at the airline's headquarters or in the larger regional or national offices in the case of international airlines.

Key Learning Point

Outsourcing is the contracting of services to external companies.

4.1.3 Line Personnel and Back-Office Staff

Airlines are represented by employees who have the most contact with travelers, such as the cabin crew on board the airplanes and the ground service personnel at the airports. There are also many airline employees working behind the scenes to create a seamless product.

One way of looking at an airline, is as employees being either front-line personnel or back-office staff. Front-line personnel interact directly with the customer and back-office staff are the support staff who help deliver the service.

The largest number of employees are front line, those who are directly engaged in interacting with the customer. By customers we mean travelers, in the case of passenger airlines, and cargo shippers in the case of the cargo business. These employees include everyone who deals directly with customers, from reservation agents, who book flights, to the cabin crew, who attend to passengers in flight.

4.1.4 Outsourcing

As we have seen in previous modules, airlines constantly need to find innovative ways to reduce costs and increase profit margins. One way to cut costs is by outsourcing certain services. These services could include cleaning, fueling, de-icing, security, catering, maintenance or even crew training. Many airlines have also completely outsourced their reservations departments to drastically reduce their overall costs in this area. The practice of *outsourcing* occurs under a variety of circumstances, such as the following.

- **In locations that are too small to support permanent staff:** It is likely that most, if not all, airlines will contract for services in such situations. An airline will subcontract to local companies or to the local national/international carrier if it has similar aircraft types.
- **In order to reduce costs:** As airlines seek to reduce expenses, a recent industry trend has been to outsource certain airline functions completely to subcontractors, even at the airline's home base.
- **In associating with alliance partners:** Another trend has been to outsource to alliance partners. Alliance partners can provide all forms of ground services in many locations. This helps the partners realize some of the efficiencies of forming an alliance.

Subcontractors are separate companies or divisions to whom the airlines contract out work. It can be a cost effective way to do business. Employee benefits are one of the main drivers of cost within an airline. By subcontracting the work, airlines can drastically reduce that cost.

In general, smaller airlines and start-up airlines will contract out more work/services than larger airlines. Their size does not support a large pool of employees with expertise in every area necessary to run an airline. Some services, especially fuel and catering, tend to be outsourced. Even the major airlines do not usually own or operate their own fuel and catering services.

Some airlines have outsourced the maintenance function to an aircraft maintenance facility that works closely with the operations departments of one or more airlines. In some instances, the maintenance facility previously belonged to the airline it now services, having been sold off as an independent unit. As part of the deal, such companies hire most of the facility employees from the airline, further reducing the airline's overhead.

Crew training has been outsourced for several reasons. The size of the airline, for example, may not support staffing a training department. Simulators and other training devices can be too costly for smaller airlines.

Lesson Summary

Most airline organizations have a vertical structure, in which the top level of management guides the company by setting policies and strategies as well as planning for the future. Airline employees report into two main areas of operations: flight operations and ground operations. Employees in flight operations are responsible for the safe and efficient operation of an airline's fleet; ground operations employees are responsible for operations on the ground.

An airline's front-line personnel interacts directly with the customer, while its back-office staff support the front-line personnel in delivering the service. An airline may decide to outsource various services to external companies. The main reason is to reduce overall cost.

Progress Checks (Lesson 4.1)

1. Staff employed in ground operations is responsible for passenger processing, baggage handling and ____________.
   (a) performance monitoring
   (b) aircraft handling
   (c) airport maintenance
   (d) terminal management

2. Schedulers work closely with the training and operational control departments because they need to consider whether the crew assigned to a particular aircraft has had appropriate training for that type of aircraft.
   (a) True
   (b) False

3. The load planning and flight crew briefings are the responsibility of the ____________.
   (a) operations control center
   (b) cabin crew
   (c) flight crew
   (d) air crew training

4. Boarding announcements are normally made by ____________.
   (a) reservation agents
   (b) airport check-in staff
   (c) gate personnel
   (d) ramp personnel

5. Aircraft maintenance personnel are responsible for cleaning the aircraft cabin in preparation for the next flight.
   (a) True
   (b) False

6. One area of service that is subcontracted even by major airlines is ____________.
   (a) marketing
   (b) sales
   (c) security
   (d) catering

4.2 Key Airline Personnel: Flight Crew and Cabin Crew

Lesson Learning Objectives

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

- Describe the key responsibilities of the flight crew.
- Describe the key responsibilities of the cabin crew.

Lesson Overview

We will now take a closer look at the two key groups that are essential to flight operations. These are flight crew and cabin crew. The responsibility of the flight crew is to safely operate the aircraft and fly passengers to their destination. The cabin crew is responsible for the safety and comfort of the passengers.

4.2.1 Close-Up on Flight Crew: Duties and Responsibilities

We will focus first on the duties and responsibilities of the flight crew. The chain of command on board an aircraft begins with the captain.

4.2.1.1 Captain

Key Learning Point

The primary reason for having two pilots on every flight is safety; this is especially necessary on long-distance flights due to the fatigue factor.

On many long-haul (long-distance) flights there are two sets of flight crew. One will be on duty while the other rests in order to take over on the second leg of the journey.

The pilot-in-command (PIC) is the “captain” and sits on the left side of the flight deck and is ultimately responsible for the events of the flight. Some of their responsibilities include making major command decisions, managing the flight and cabin crew teams and handling emergencies such as particularly troublesome passengers. Captains are generally the most experienced pilots in an airline and must pass written and practical tests each year. The minimum number of pilots required on any flight is two. On flights of over 10 hours a third pilot is added. On longer journeys, usually more than 14 hours, the flight is staffed with two complete sets of flight crew.

Did You Know?

By law, an airline pilot may not fly more than 85 hours a month or 1,000 hours a year. The average pilot works more than 100 hours a month including duties such as filing flight plans, working on reports, briefing crews and attending training classes.

4.2.1.2 First Officer/Co-pilot

The first officer sits in the right-hand seat of the flight deck, facing forward. He/she is second-in-command and has the same controls as the captain as well as the same level of training. The primary reason for having two pilots on every flight is safety; this is especially necessary on long-distance flights due to the fatigue factor. Obviously, if something happens to the captain, a plane must have another pilot who can step in. The first officer provides a second opinion on piloting decisions. This helps keep pilot error to a minimum.

4.2.2 Key Pilot Tasks

The role of the pilot has evolved a great deal over the years. In earlier aircraft, the control systems were relatively simple. With advanced technology and avionics, more training is required. During flights, pilots must use these technologies to monitor progress and maintain communications with air traffic control facilities on the ground.

4.2.2.1 Prior to Takeoff

A pilot usually arrives at the airport at least an hour before departure. Most large and medium-sized airlines have a computerized check-in system in the pilot's lounge. The information provided to pilots are the flight details, weather, flight planning, total fuel needed, cargo on board, passenger manifest and crew on board. In order to keep everything in one place, pilots generally keep their flight papers and any other information in a large flight bag.

Key Learning Point

The pilot's main responsibilities are to monitor the automatic systems to make sure the plane is flying correctly, to communicate and respond to air traffic control, to alter course when necessary and to fly the course laid out by the flight plan.

The pilots review this information and meet with the rest of the crew. The first officer performs a general inspection of the plane to make sure everything is in good order. After the walk around is completed, the pilots meet on the flight deck to discuss details of the flight, enter the flight plan into the computer system, verify and sign off on the load plan, verify the aircraft defect log and ensure that the plane is airworthy.

While they are preparing for takeoff, the pilots will receive an up-to-date weather report and passenger count. Most aircraft today are fitted with a computer to receive this additional, last minute information or changes to the original paperwork. This system is called an ACARS system. It stands for Aircraft Communications Addressing and Reporting System. It is a data link system that enables ground stations and commercial aircraft to communicate data, such as fuel quantity, weather, gate assignments, security advisories and other information, via a Communications Management Unit (CMU).

Key Learning Point

The cabin crew is in charge of the cabin and is responsible for the safety and comfort of the passengers.

4.2.2.2 Takeoff and Flight

When the paperwork is finished and clearance has been given by Ground Control, the flight attendants secure all the doors and the captain gives the go-ahead for “pushback”. “Pushback” is the term used when the aircraft is pushed back from the gate by a vehicle that is attached to the nose gear of the aircraft with a tow bar. Once pushed out, the captain will start the engines and move out to the taxiway for takeoff.

The pilot's main responsibilities are to monitor the automatic systems to make sure the plane is flying correctly, to communicate and respond to air traffic control, to alter course when necessary and to fly the course laid out by the flight plan. In an emergency, of course, things change quickly. All airline pilots have extensive training in dealing with the unexpected and keeping a cool head in emergency situations. Fortunately, it is only on rare occasions that pilots put this training to work, but they must be prepared at all times.

4.2.3 Close-Up on Cabin Crew: Duties and Responsibilities

Members of the cabin crew are in charge of the cabin and responsible for the safety and comfort of the passengers. The flight attendant is the most visible employee to passengers of an aircraft. This crew member spends more time with passengers than any other airline employee and tends to a wide variety of needs and requests.

Did You Know?

Generally, flight attendants fly from 65 to 85 hours per month. In addition to performing flight duties, flight attendants sometimes make public relations appearances for the airlines, such as during career days at high schools, fund raising initiatives and corporate activities.

4.2.3.1 Flight Attendants/Cabin Crew

The role of the flight attendant has changed significantly since the beginnings of commercial air travel. The first airliners were primarily used to transport mail with a few extra spaces for passengers, who had to fend for themselves. The crew consisted of two pilots only. Some early airlines added cabin boys to flights; they were usually teenagers or small men. Their role was mainly to load luggage and to reassure nervous passengers.

In the 1930s, registered nurses were hired to care for passengers should they become ill. Boeing Airlines hired eight nurses for a three-month trial run. Soon, attendants called “stewardesses” became an integral part of the airline industry. Eventually, they were not required to have a nursing degree, although the first aid aspect of the profession remains important.

Major airlines are required by law, for the safety of the traveling public, to provide a minimum number of flight attendants depending on the total number of passengers on board. Although the primary job of flight attendants is to ensure that safety regulations are followed, attendants also ensure that passengers are comfortable and the service on board is enjoyable. Cabin crew, being highly visible, are valuable in retaining the loyalty of customers by ensuring they are treated with care and their flight experience is enjoyable.

4.2.3.2 Purser/Cabin Service Manager

The purser is the lead flight attendant who oversees the work of the other attendants aboard the aircraft while performing many of the same duties. Should a passenger have a complaint or require special assistance, it is often dealt with by the purser. The purser, or Cabin Service Manager, deals directly with the flight crew and, in the event of an emergency, completes the paperwork needed by the airline and governmental authorities.

4.2.4 Key Flight Attendant Tasks

4.2.4.1 Prior to Takeoff

At least one hour before each flight, attendants are briefed by the Purser/Cabin Service Manager on such things as emergency evacuation procedures, coordination of the crew, length of the flight, expected weather conditions and special issues having to do with passengers. Cabin crew also have their predeparture checks to complete. These include the following checks: emergency equipment in the cabin is functional, catering supplies, cabin defects (seats and lighting, etc.) and other amenities. Once boarding begins, each flight attendant has their assigned position in the cabin to greet and assist passengers.

Before departure, flight attendants instruct all passengers in the use of emergency equipment and check to see that seatbelts are fastened, seat backs are in upright position and all carry-on items are properly stowed under seats or in the overhead bins. On newer aircraft, a safety video is shown on the screens provided in the cabin. In the air, helping passengers in the event of an emergency is the most important responsibility of a flight attendant. Safety-related actions may range from reassuring passengers during rough weather to directing passengers when evacuating a plane following an emergency landing.

4.2.4.2 Takeoff and Flight

Flight attendants also answer questions about the flight, distribute reading material, pillows and blankets as well as help small children, the elderly and persons with disabilities or any others needing assistance. They administer first aid to passengers who become ill. Flight attendants generally serve beverages and other refreshments and, on long-haul flights, heat and distribute precooked meals or snacks. Prior to landing, flight attendants take inventory of headsets, alcoholic beverages and money collected. They also report any medical problems passengers may have experienced, the condition of cabin equipment and lost-and-found articles.

Lesson Summary

The chain of command on board an aircraft begins with the captain whose responsibilities include: making major command decisions, leading the flight and cabin crew team, managing emergencies and handling particularly troublesome passengers. The second person in the flight crew is the first officer. The cabin crew includes flight attendants and a purser or cabin service director. The flight attendant is the most visible employee to passengers on an aircraft and is responsible to ensure safety regulations are followed.

Progress Checks (Lesson 4.2)

1. Most flights today do not have a flight engineer because their function is fulfilled by ____________.
   (a) the new computerized systems
   (b) the aircraft captain
   (c) the first officer
   (d) the ground crew

2. The primary reason for having two pilots on every flight is to have a second pilot in case something happens to the captain.
   (a) True
   (b) False

3. A general inspection of the plane prior to takeoff is the responsibility of the ____________.
   (a) captain
   (b) first officer
   (c) designated cabin crew member
   (d) ground service

4. The primary responsibility of the flight attendants is to provide refreshments and ensure that passengers are comfortable.
   (a) True
   (b) False

5. Among the predeparture checks to be completed by the cabin crew are emergency equipment in the cabin, any cabin defects and ____________.
   (a) fuel level
   (b) loading plan
   (c) catering supplies
   (d) aircraft defect log

6. While on board the aircraft, the responsibility for administering first aid lies with the ____________.
   (a) captain
   (b) first pilot
   (c) flight attendants
   (d) medical professionals

Lesson Learning Objectives

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

- Describe the importance of training in standardized procedures for pilots and flight attendants.
- Identify the training needs for new hires in various positions.

Did You Know?

For many pilots, flight training also includes English language lessons. English is the official language for airplane communication.

4.3 The Role of Training within the Airlines

Lesson Overview

Well-trained staff are an essential requirement for an efficient, profitable and safe airline company. An airline will usually provide new personnel with initial training and will offer recurrent training as mandated or necessary. This lesson will describe how airlines train staff to be qualified for new positions and to perform to the standards set by the organization.

4.3.1 Entry-Level Positions

Entry-level positions cover a wide variety of operations and duties. Most of these positions involve extensive customer service contact requiring strong interpersonal and communication skills. More technical entry-level positions such as pilot or mechanic usually require internationally recognized licenses and/or specific previous work experience.

Management and executive positions are generally filled by existing employees as these positions become available. This internal promotion policy allows entry-level employees to transfer laterally within each division or advance up the corporate structure. A lateral transfer is to a position that is of similar grade.

4.3.2 Pilot Training

The road to becoming a commercial airline pilot can be long and challenging. It also varies considerably depending on the path taken. Some pilots in-training pay for their own flight training, logging flight hours and practicing however they can. Some may come from the military; others are part of specialized airline training programs and aviation college programs.

All pilots must have progressed through a flight training program and earned a commercial pilot's license or an airline transport rating. They are required to have extensive training and flying experience. Often, they will also have one or more advanced ratings such as instrument, multi-engine or aircraft type ratings depending upon the requirements of their particular jobs.

Key Learning Point

Each airline will generally have its own training program for flight crew. Regardless of experience, a new hire will be trained on the airline's specific procedures based on its approved training curriculum.

Each airline will generally have its own training program for flight crew. Regardless of experience, a new hire will be trained on the airline's specific procedures based on its approved training curriculum. Although many airlines fly similar types of airplanes, each airline has slightly different methods and procedures. So, the goal of an airline is to train its pilots to meet its own distinct standards. Learning standardized procedures is key to a pilot's training. This means flight deck behaviour and procedure will be identical on every flight for that airline. This serves to minimize misunderstandings while at the controls and helps in maintaining a safe airline.

Ongoing training will occur as necessary, according to the airline's requirements or as stipulated by government regulations. Training is provided as a matter of course for recertification, which is mandatory, for example, when a pilot moves from one aircraft type to another.

Did You Know?

Large airlines have schools with campus-like facilities for training flight attendants. Training periods typically range from four to seven weeks and training hours vary. Methods of instruction differ from airline to airline, however, much of the training is provided in classrooms.

4.3.3 Flight Attendant Training

Airlines typically prefer to hire poised, tactful and resourceful people who can interact comfortably with strangers and remain calm in stressful situations. As in the case of pilot training, an airline will usually provide specific training based on its own procedures and approved training curriculum. New cabin crew need to know the standard procedures of the airline; this is fundamental to airline safety. Standard procedures are also critical to maintain efficiency because flight attendants are frequently scheduled with different coworkers on each trip.

Upon being hired, candidates usually undergo formal training in the airline's flight training center. Airlines that do not operate their own training centers generally send new employees to the training facilities of another airline. The period of training usually ranges from four to seven weeks, depending on the size and type of carrier. Generally, new trainees are not considered employees of the airline until they successfully complete the training program.

Key Learning Point

Generally, new trainees are not considered employees of the airline until they successfully complete their training program.

New hires learn flight regulations and duties as well as company operations and policies. Trainees also learn emergency procedures such as evacuating an airplane, operating emergency systems and equipment, administering first aid and water survival tactics. In addition, trainees are taught how to deal with disruptive passengers as well as hijacking and terrorist situations. As they will be in the public eye, new hires may receive instruction on personal grooming, healthy eating habits and how to effectively ease the ill effects of jet lag. Towards the end of their training, students go on practice flights.

Key Learning Point

In most cases, flight attendants must receive a specific number of hours of training in emergency procedures and passenger relations each year.

After completing their initial training, flight attendants are assigned to one of their airline's bases. New flight attendants are placed on “reserve status”. They are asked to staff extra flights or to fill in for crew members who are sick, on vacation or rerouted. When not on duty, reserve flight attendants must be available to report for flights on short notice.

In most cases, flight attendants must receive a specific number of hours of training in emergency procedures and passenger relations each year.

4.3.4 Reservation/Ticket Agent Training

Training for most airline reservation or ticket agents is usually provided through formal company training programs. The content for the training of new hires in this area covers company and industry policies as well as ticketing procedures. It also includes instruction in the use of the airline's computer system to obtain information on schedules, fares, seat availability and to make reservations. In addition, training is provided in airport/airline code designations, regulations and safety procedures.

After completing classroom instruction, new agents may work under the direct supervision of an experienced agent. During this time, the supervisor may monitor the new agent's telephone conversations with customers to improve the quality of service and provide feedback to the new employee. This helps new agents provide customer service in a courteous manner.

4.3.5 Passenger Service Agent Training

Passenger Service Agents (PSAs) learn how to check in all types of passengers and their baggage as well as pets that can travel in the cabin. PSAs also receive instruction on how to examine travel documents and, in some cases, make reservations and issue tickets. They learn how to operate self-service machines or kiosks in order to assist passengers. PSAs also learn how to handle passengers at the terminal's boarding gate; this involves checking tickets, assigning seats and making boarding announcements. In addition, they are trained to provide assistance to young, elderly and disabled passengers when they board or disembark.

IATA offers a Passenger Ground Services course through distance learning. For more information, please refer to www.iata.org/aviation-training

Lesson Summary

An airline will usually provide new personnel with initial training when they are hired and offer continuing training as mandated or necessary. Although all pilots are required to have extensive training and flying experience, the goal of an airline is to train its pilots to meet its own unique standards. Similarly, an airline will usually provide new cabin crew specific training based on its own procedures and approved training curriculum. This training is fundamental to airline safety. Training for most airline reservation or ticket agents, as well as for airport customer service agents, is also provided through formal company training programs.

Progress Checks (Lesson 4.3)

1. The main reason that airlines retrain even experienced pilots when they are hired is that ______________.
   (a) airlines are suspicious of other training programs
   (b) government regulations stipulate it
   (c) the planes of each airline differ somewhat
   (d) an airline's flight procedures should be identical on every flight

2. Generally, training is not required when a pilot moves from one aircraft type to another, if this is within the same airline.
   (a) True
   (b) False

3. The main reason why flight attendants are trained in the airline's standard procedures is that they ______________.
   (a) fly on different airplanes with different emergency rules
   (b) are frequently scheduled to fly with different team members
   (c) are expected to fulfil a variety of procedures
   (d) should be ready to take the responsibility of a purser

4. Training for most airline reservation agents covers ticketing procedures and the use of the airline's computer system in order to ______________.
   (a) send customers weather reports
   (b) notify cabin crew of schedule changes
   (c) obtain information on seat availability
   (d) notify ground services of reservation changes

5. Gate agents are generally trained in how to check in pets.
   (a) True
   (b) False

4.4 Organizational Culture of an Airline

Lesson Overview

In this lesson, we will discuss some important traits of an airline's organizational culture, such as how seniority plays a role in determining internal practices and how a focus on customer service is critical to the survival of the airline industry.

Lesson Learning Objectives

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

- Describe what is meant by organizational culture.
- Define seniority and describe its role within an airline.
- Describe the impact of a customer service orientation on an airline.

4.4.1 Norms and Values

Key Learning Point

At most airlines, the career track for flight and cabin crew is based almost completely on length of service.

Organizational culture is described in the company's mission and vision statements. In simpler terms, an organization's culture is its beliefs, goals and practices. Each company has its own personality, just like people. When one signs on to work for a company, we agree not only to perform a set of tasks and responsibilities, but also to adopt the company's “way of life”. How well one comes to understand this way of life, also known as “corporate culture”, will have as much to do with our success as our performance related to specific tasks.

Two key elements of organizational culture are norms and values. “Norms” describes how things get done in an organization. “Values” refer to what is important to a company, which tasks should have the highest priority and which aspects of an employee's performance are most important.

4.4.2 The Role of Seniority

In terms of organizational culture, many airlines will share certain features. A key feature involves the recognition of seniority. For example, although each member of a flight crew has equal levels of training, they usually have varying degrees of seniority. In most airlines, an employee's career track is based almost completely on length of service. Again, for example, to become a captain, one has to rise through the ranks and wait one's turn until a position opens up. Seniority also dictates the types of aircraft pilots fly and their schedule.

At many airlines, pilots with more seniority pick out a regular flight schedule, called a “line”. Pilots holding a line will live a more “normal” lifestyle, in the sense that they have a predetermined schedule. However, even pilots holding a line spend a lot of time away from their families, as they never know what delays they may encounter.

Depending on the airline, pilots who are relatively new to an airline will fly “reserve”, meaning they do not have a set flying schedule. A reserve pilot may have to be “on call” for 12 hours, or longer, at a stretch. During this period, the pilot must be packed and ready to fly, as they may be contacted at any time by the crew scheduler. If called in, the pilot must report immediately for a flight assignment. For many airlines, the pilot must be ready to go within an hour of being contacted. Reserve pilots are called when the scheduled pilot becomes ill or another flight is delayed and the entire crew needs to be replaced. The life of the reserve pilot is largely unpredictable. Pilots might spend several days on reserve and never get a flight call or they might get contacted to fly every day.

The concept of seniority applies as well to cabin crew. Depending on seniority, a flight attendant may be directed by a more senior flight attendant or may direct the work of a more junior flight attendant. Flight attendants who are no longer on reserve apply monthly for regular assignments. Because assignments are based on seniority, the most senior attendants get their choice of assignments. The flight attendant's home airport and routes worked are assigned based on seniority and, at times, on language requirements.

Did You Know?

Business culture, organizational culture and corporate culture are all terms that describe the common values and norms of a business. Shared beliefs, understood taboos and other shared characteristics of a company are all part of its culture. Each company has its own unique culture, typically driven by top management, that affects the attitude of employees and the way they work.

4.4.3 Focus on Customer Service

An organization's norms and values are often expressed in the company's mission and vision statements. The following are excerpts from mission statements of some of the world's leading airlines.

- Japan Airlines: “appreciate each and every customer” and “provide perfect service with absolute peace of mind”.
- Southwest Airlines: “dedication to the highest quality of customer service delivered with a sense of warmth, friendliness, individual pride and company spirit.”
- Qantas: “The Qantas vision is to offer the best airline experience.”
- Federal Express: “FedEx will produce superior financial returns for shareowners by providing high value-added supply chain, transportation, business and related information services through focused operating companies. Customer requirements will be met in the highest quality manner appropriate to each market segment served. FedEx will strive to develop mutually rewarding relationships with its employees, partners and suppliers. Safety will be the first consideration in all operations. Corporate activities will be conducted to the highest ethical and professional standards.”

There is a common theme of customer service in many of the mission statements produced by today's airlines. This is to be expected since the airline industry is a service industry and most airline staff interacts with customers.

Most passengers choose their airline based on the quality of service they receive from its personnel, whether those individuals are visible to them or not. Passengers will remember their telephone conversations, the comfort of their flight and the condition in which their baggage arrived. Every moment an airline employee spends with a passenger or potential passenger is critical and may determine if that individual chooses the same airline for future travel. Most airlines today understand the importance of providing excellent customer service in order to stay in business.

This has not always been the case. As with many industries over the past 30 years, there has been a shift towards a customer-oriented attitude. A classic example of a major cultural change effort is the transformation of British Airways, a national airline, in the 1980s. It changed from an unprofitable airline with a poor reputation into a model of excellent service and profit. This was not a simple task. According to Rod Eddington, Chief Executive of British Airways from 2000 to 2004, “Changing airline culture is like trying to perform an engine change in-flight”. Privatization resulted in modernizing operations and eliminating over 23,000 jobs. British Airways emerged as a clear winner in this effort, demonstrating high employee morale and providing an industry standard for customer service.

Key Learning Point

Most passengers choose their airline based on the quality of service they receive from its personnel, whether those individuals are visible to them or not.

Key Learning Point

An organization's norms and values are often expressed in the company's mission and vision statements. There is a common theme of customer service in many of the mission statements produced by today's airlines.

Did You Know?

Handling customer complaints is one of the essential pillars of customer service and customer retention.

Key Learning Point

There is currently an increased focus on cultural transformation, as aviation companies worldwide realize they must change their cultures if they are to succeed.

Another well-known example of the importance of culture within the airline industry is that of Southwest Airlines (SA) in the U.S. It has managed to generate profits for 25 consecutive years. It has won such distinctions as the Triple Crown Award (best customer satisfaction), most admired company, world's safest airline and one of the world's best companies to work for.

How has this airline been able to achieve such distinction? Herb Kelleher, the founder of SA, played a big role in this achievement. He claimed that “employees come first”. The importance of the employee is evident in the organizational culture. For example, each employee is treated as a member of the SA “family”. In terms of hiring practices, SA chooses applicants with a positive attitude and sense of humour.

Their organizational culture demonstrates that a fun atmosphere creates a sense of community, serves as a balance to hard work and enhances the customer experience. Employees are offered the flexibility to express their personalities to serve customers. In sum, SA has been able to create an organizational culture that works well for its employees, who, in turn, do their best to serve the company well.

Singapore Airlines (SIA) has also achieved excellence in its service orientation, winning dozens of industry awards. It has been able to overcome economic downturns three times in the last thirty years. With international expansion and operational growth, SIA put into place a set of core values that would apply across cultures and geographical boundaries. SIA management identified these six core values: pursuit of excellence, safety, customer first, concern for staff, integrity and teamwork.

There is currently an increased focus on cultural transformation, as aviation companies worldwide realize they must change their cultures if they are to succeed. Many airlines in Europe, Asia-Pacific and the U.S. must change strategies, organization, route structure, equipment and basic approaches to compete with low-cost carriers. As industry analyst Edward Shackford (“Charting a Wiser Course: How Aviation Can Address the Human Side of Change”, 2003) noted:

> “The business press is full of articles about the need for change. Heritage airlines must reinvent themselves to compete with Low-Cost Carriers. Aircraft manufacturers need to integrate seamlessly with tiers of suppliers. Lean/Six Sigma efforts must incorporate the spirit of lean, not just the techniques. Businesses must change the relationship between employee groups and management. Even Southwest must assure it doesn't lose its cultural core as it enters a post-Herb Kelleher era.”

Korean Air is a recent case of an airline identifying the need to change its culture based on new economic realities. It began its operations 36 years ago as a cargo carrier and regional passenger airline, serving Korea and the Asia-Pacific region. Its culture was built on discipline, overcoming adversity and hard work. This earned it the status of one of the best cargo airlines in the world. It has now become integrated with alliance partners and is undergoing a culture change as it must now function at a world-class level. The airline requires physical changes in cabin interiors, sleeper beds, food service and the like. The shift also requires a change in the type of service delivered, requiring a focus on delivering excellent passenger service.

In general, we know that the airline industry is continuing to change at a rapid rate. Companies must face structural, technical and procedural changes in their attempts to respond to competitive pressures. It is critical for organizations to address issues related to norms and values, such as customer focus. The last quarter of a century has proven the importance of a customer-service orientation for the industry.

Industry surveys and awards exist to recognize excellence in customer service. One such award, Skytrax Airline of the Year, is based on passenger opinions about airlines around the world. Travelers from over 160 countries take part each year in the world's largest airline passenger satisfaction survey. The Skytrax Award is the global benchmark for airline excellence. The results in 2012 indicated the following rankings:

The World's Best Airlines	
1	Qatar Airways
2	Asiana Airlines
3	Singapore Airlines
4	Cathay Pacific Airways
5	ANA All Nippon Airways
6	Etihad Airways
7	Turkish Airlines
8	Emirates
9	Thai Airways
10	Malaysia Airlines

Figure 4.4.3—Skytrax Airline of the Year Rankings for 2012

Staff service within the airport and on-board aircraft were rated on criteria such as service efficiency, staff attitude and friendliness, responding to passenger requests, cabin presence through flights, assisting parents with children and staff language skills.

Lesson Summary

Two elements of organizational culture are *norms,* which describe how things get done in an organization, and *values,* which refer to what is most important in a company. Seniority refers to length of service in an organization and often determines norms such as career track as well as selection of planes and schedules for flight and cabin crew. Customer service, as an organizational value, is critical to the survival of an airline in today's competitive environment. Most passengers choose their airline based on the quality of service they receive, whether those individuals are visible to them or not.

Progress Checks (Lesson 4.4)

1. The two key elements of organizational culture are _____________ and values.
   (a) mission
   (b) vision
   (c) goals
   (d) norms

2. The company's values affect which tasks should have the highest priority and which aspects of an employee's performance are most important.
   (a) True
   (b) False

3. The type of aircraft a pilot flies depends mainly on _____________.
   (a) his/her grades during training
   (b) his/her seniority in the airline
   (c) the number of years worked as a reserve pilot
   (d) the crew scheduler

4. For many airlines, the reserve pilot must be ready to go within_____________ of being contacted.
   (a) an hour
   (b) two hours
   (c) three hours
   (d) four hours

5. An organization's norms and values are often expressed in the company's _____________.
   (a) procedural manual
   (b) marketing strategy
   (c) training programs
   (d) mission and vision statements

6. Most passengers choose their airline based on ______________.
   (a) loyalty programs
   (b) price of tickets
   (c) flight schedule
   (d) quality of service

7. Which airline's organizational culture demonstrates that a fun atmosphere creates a sense of community and enhances the customer experience?
   (a) British Airways
   (b) Southwest Airlines
   (c) Singapore Airlines
   (d) Korean Air

Module Summary

In this module, we have explained that most airlines are organized around flight operations and ground operations. There is a wide range of employees required to keep an airline company in operation, including front-line personnel and back-office staff. Specific focus was given to the flight crew and cabin crew and their individual sets of responsibilities.

In this module, we also discussed the concept of organizational culture and how it is expressed in company values. We looked at the importance of seniority as a distinct trait of the culture of many airlines. A key characteristic of today's most successful airlines is a focus on customer service. We examined the significance of culture change in the airline industry.

Apply Your Learning

If you are working in the airline industry, take some time to see how this module applies to your work environment.

If you are not currently working in the airline industry, choose an airline that you are interested in, or would like to work for, and see if you can find the answers to these questions (by using company literature such as an annual report, doing web research or conducting interviews with airline staff).

1. What is the organizational structure of the airline?
   (a) Identify the key executive positions.
   (b) Try to locate an organizational chart that shows how the airline is structured. This may be available in a current annual report or on the airline's web site.
2. Identify the positions that report to Flight Operations and to Ground Operations.
3. Interview a member of a flight crew. Ask them about:
   (a) their previous experience
   (b) the training they received
   (c) their flight schedules
   (d) their preferred routes and destinations
4. Interview a member of a cabin crew. Ask them about:
   (a) their previous experience
   (b) the training they received
   (c) their flight schedule
   (d) their preferred routes and destinations
5. Find out about the values of the organization, including its mission statement.

Answer Key

Progress Checks (Lesson 4.1)

1. b
2. a
3. a
4. c
5. b
6. d

Progress Checks (Lesson 4.2)

1. a
2. a
3. b
4. b
5. c
6. c

Progress Checks (Lesson 4.3)

1. d
2. b
3. b
4. c
5. a

Progress Checks (Lesson 4.4)

1. d
2. a
3. b
4. a
5. d
6. d
7. b

Module 5

All about Airports

Module Learning Objectives

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

- Define the term “airport” and describe its relevant features. (Lesson 1)
- Explain how airlines can be considered to be internal customers of airports. (Lesson 2)
- Describe the types of personnel that work at an airport. (Lesson 2)
- Describe how airports process passengers and their luggage. (Lesson 3)
- Describe how airports process freight. (Lesson 3)
- Describe the security procedures that airports must put into place. (Lesson 4)

5.0 All about Airports

Module Overview

From the spectacular ocean approach to Japan's Kansai International Airport to the high altitude arrival into Denver International's ‘mile high' airport in the Colorado Rocky Mountains in the United States, there is no doubt that an airport can provide an impressive entry point to a traveler's destination. Airports have a number of customers, all of whom, including the airlines, have one primary mandate: to keep their end-users satisfied. Understanding the role that airports play in delivering a positive experience is an important part of aviation knowledge. Airports deliver not only to travelers, but also to airlines, governmental agencies (e.g., customs and immigration) and suppliers.

This module will describe certain aspects of the “ground-based” infrastructure necessary for airlines to operate. It is important to understand the “give and take” relationship between airlines and airports. The airlines are the airports' reason for existence and, as such, airlines are the airports' most important customers. On the other hand, airports provide the key services that airlines require to operate safely and securely.

5.1 Introduction to Airports

Lesson Learning Objectives

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

- Define what is meant by an airport.
- Describe who owns and operates an airport.
- Describe how airports are identified by codes and names.
- Describe the physical layout of a typical airport.

Lesson Overview

There are approximately 4,000 airports worldwide, including over 1,000 international airports. Just about every country or region in the world has at least one operating airport or aircraft landing facility. In this lesson, we will describe what airports are, their purposes as well as who owns and operates them. Without a place to takeoff and land, the transport of people and cargo by air would be impossible. Despite their humble beginnings, airports have grown to become interesting and multi-dimensional commercial ventures. We will also discuss how the international system of three-letter codes used to identify each airport was devised and how the codes are assigned. Finally, we will describe some of the basic components of the ground-based infra-structure that are common to most airports handling commercial air traffic.

5.1.1 What is an Airport?

Landing fields, airstrips, aerodromes...these are all different names for what has become a vital necessity for airlines: a functioning airport. But what exactly is an airport? It is surprising that not even the International Civil Aviation Organization (ICAO) has attempted to define the word “airport” (although they do define the word “aero-drome” - see below). This is because, over the years, airports have evolved in so many directions that no one airport model can be considered definitive.

Did You Know?

From the start of air travel, there was talk that the sky should be treated similarly to the oceans of the world. In fact, in 1919, Albert Plesman, founder of KLM Royal Dutch Airlines, one of the world's oldest airlines, stated: “The Air Ocean unites all peoples”. Thus, the term “air port” was coined to denote a place where air “ships” came to refuel as well as take on and disembark passengers and cargo.

The first “air ports” or “airfields” catered to the small airplanes of the time. They required nothing but a relatively flat, even surface so that takeoffs and landings could take advantage of the prevailing (existing) wind. Early aircraft, for the most part, took off and landed in grassy fields, approaching from any angle that provided the best wind direction. Improvement came from the use of dirt fields, which eliminated the drag from grass. Both grass and dirt, however, function well only in dry conditions. Eventually, paved asphalt or concrete surfaces were constructed to allow all-weather landings.

Some early airfields were called *aerodromes* (from the Latin and Greek words for “air” and “races”, i.e. *dromus/dromos)* because they were built for entertainment purposes. These aerodromes consisted of a grassy field, an aircraft hangar for storage and servicing of aircraft plus observation stands for visitors. One of the world's first aerodromes was Taliedo Aerodrome in Milan, Italy, which was opened in 1910 for an international airshow. In the mid-1920s, it was transformed into an airport and opened to commercial traffic.

Did You Know?

The longest paved runway in the world is in the People's Republic of China. It is at Qamdo Bangda airport in Tibet. Its length is 5,500 meters or 18,045 feet. Qamdo Bangda is also the highest airport in the world at an elevation of 4,334 meters (14,219 feet). Source: Wikipedia.

ICAO describes an *aerodrome* as a defined area on land or water (including any buildings, installations and equipment) intended to be used either wholly or in part for the arrival, departure and surface movement of aircraft. The term *aerodrome,* therefore, has evolved to refer to any surface used as an aircraft takeoff or landing facility. The terms “landing fields”, “airfield”, “landing strips” and “airstrip” are typically used to refer to facilities that have little more than a *runway* (for takeoff and landing) and perhaps small structures, such as terminal or hangar buildings. Military facilities can also be referred to as airfields (but also as airbases, air stations and airports).

In most cases, however, in order to avoid confusion, the term *airport* has come to mean an aerodrome that has been specifically licensed for commercial aviation operations by a responsible national government organization, such as a Department of Transport (DOT), Ministry of Transport (MOT) or Federal Aviation Administration (FAA). This means that an airport has to be maintained to higher safety standards, whereas there are often no minimum standards for a basic aerodrome. In fact, the word “aerodrome” has essentially been made obsolete by the word “airport” in the English language. When used, an aerodrome typically refers to a small landing area for private planes (i.e., a small airport) (Source: 2010, www.dictionary.com).

Key Learning Point

The term *airport* has come to mean an aerodrome that has been specifically licensed for commercial aviation operations by a responsible national government organization. The term “aerodrome” refers to any surface used as an aircraft takeoff or landing facility, but has fallen out of everyday usage.

In addition to providing aircraft with the necessary space for safe and secure takeoff and landing, the primary functions of a commercial airport are to provide aircraft with space for parking, refueling maintenance (repairs) as well as facilities for the processing of passengers and freight (cargo).

5.1.2 Airport Ownership

Most of the world's airports are still owned by local, regional or federal government bodies, who then lease the airport to private companies. These companies oversee the airport's entire operation or a part thereof. This is often referred to as a government-owned/ commercially operated (GOCO) arrangement. Services that have been taken over by commercial, non-government enterprises cover a wide range. These include services that are airline-related, such as catering and maintenance, and those that are passenger-related, such as ground transportation, parking, food concessions and retail stores. Some airports allow airlines to own and operate their own terminals and maintenance facilities.

Some airport operators are extremely large public corporations, such as the British firm, BAA PLC, which operates most of the commercial airports in the U.K. as well as several more across the world through subsidiary companies (i.e., BAA Indianapolis Inc., which operates the Indianapolis International Airport on lease from the City of Indianapolis in the U.S.A.). Others are private companies, such as Fraport AG, which operates Frankfurt International Airport in Germany. In the U.S.A., which has the largest number of airports in the world, most airports are still operated directly by government departments or government-created airport authorities (also known as port authorities). Elsewhere, there are also state-owned airport authorities, such as AENA (Aeropuertes Espanolas de Navigacion Aeria) which is the world's leading airport operator.

Did You Know?

The top three airports, according to the Skytrax Passenger Survey, are: Hong Kong, Singapore and Incheon in South Korea

Until recently, most airports around the world were under full government ownership (either national, regional or local) and financed mainly through ticket surcharges, fuel taxes and bond issues. Increasingly, airports have added Airport Improvement Fees (AIFs) to fund their growth. Historically, many airports originated as military airports. Once these airports reverted to civilian use, it was considered in the nation's interest to retain ownership of them should national security issues become a priority. However, the cost of infrastructure improvements and building new airports has become so expensive that some governments have now ‘privatized’, or allowed the private sector to assume ownership of, certain of the larger airports.

Key Learning Point

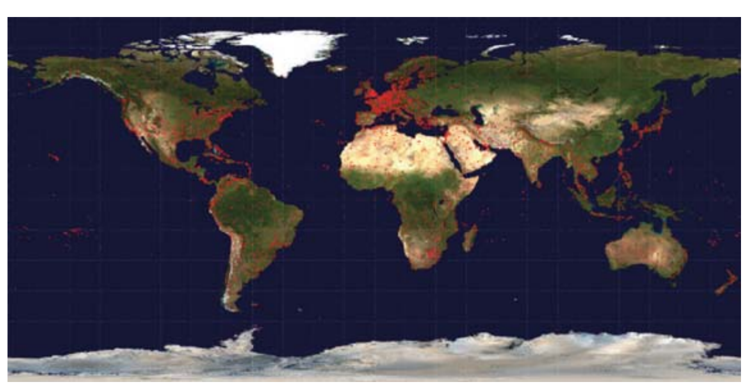
Most of the world's airports are still owned by local, regional or federal government bodies who then lease the airport to private companies. These companies oversee the airport's entire operation or a part thereof.

So far, there have been only a relatively small number of airports privatized through the full or partial sale of assets to private investors. Most of these have taken place in Europe and New Zealand. Another option has been to not sell ownership outright, but to lease (rent) the airports for long-term development and/or operation by private companies. Greece, Australia, Latin America and the U.S. have chosen this option for a few large airports. Most governments appear to be taking a “wait and see” attitude before making the final decision.

Those who are in favor of the concept of airport privatization argue that it is in both the government's and the traveling public's interest to privatize airports. They argue that airports should be run as profit centers and that money should be spent on good design to attract visitors to the airport. Hence, we see the movement towards making airports destinations in themselves, which is part of the success of award-wining airports such as Changi Airport in Singapore and Schipol Airport in the Netherlands. Those against the idea of privatization argue that good airport governance is more important than transferring ownership to the private sector. Their position is that only government involvement can ensure that public safety is placed above profit.

5.1.3 Airport Codes and Names

For airline purposes, airports receiving scheduled and/or non-scheduled flights are identified through unique three-letter codes. These codes serve to simplify airline operations where it is necessary to indicate airport points of origin and destination. For instance, the duplications in city names around the world (i.e., London, England, in the U.K. and London, Ontario, in Canada) would result in confusion in ticketing and baggage handling if just the city names were used. The use of airport location identifier codes, which are unique, eliminate a large possible source of error.



Key Learning Point

IATA assigns unique three-letter codes to airports to simplify airline operations where it is important to clearly indicate points of origin or destination.

The International Air Transport Association (IATA) administers the assignment of new location identifiers. Once assigned, city/airport codes are considered permanent and cannot be changed without strong justification. Thus, airports have to retain their IATA code even when the airport's name is changed.

IATA airport codes can be abbreviated forms of the name of the airport, such as HRE for Harare International Airport in Zimbabwe, Africa. Often they do not bear any immediate resemblance to the airport or city name simply because with over 4,000 airports worldwide it would be impossible to make them all instantly recognizable. All airports in Canada, for example, are prefixed by a “Y”. The airport in Vancouver is assigned YVR, while YYZ is the identifier for Toronto's Lester B. Pearson International Airport.

Airports are also often assigned names. Sometimes, the name of the airport is its location, such as the Islamabad International Airport (ISB) in Pakistan or the Los Angeles International Airport (LAX) in the U.S.A. Or, it can be the name of a prominent national celebrity, such as a politician (e.g., Indira Gandhi International Airport (DEL) in Delhi, India; Norman Manley International (KIN) in Kingston, Jamaica; or John F. Kennedy International Airport (JFK) in New York, U.S.A.) or a historical figure (e.g., Charles de Gaulle Airport (CDG) in Paris, France.)

Other airports named for famous people include Queen Alia International Airport (AMM) in Amman, Jordan; King Abdulaziz International Airport (JED) in Jeddah, Saudi Arabia; Chiang Kai Shek International Airport (TPE) in Taipei, Taiwan; and Liverpool's John Lennon International Airport (LPL) in the U.K. Prominent figures in aviation history are also a source of airport names. Kingsford Smith International Airport (SYD) near Sydney, Australia, for example, is named after the pioneering Australian aviator Charles Kingsford Smith. Similarly, the Santos-Dumont Airport (SDU) in Rio de Janeiro, Brazil is named after the Brazilian aviator, Albertos Santos-Dumont, who first flew from Parc St-Cloud in Paris around the Eiffel Tower and back in a dirigible in 1901.

Did You Know?

The airports with the most runways are Dallas/Fort Worth and Chicago O'Hare, both in the U.S.A., with seven runways each.

5.1.4 Physical Layout of an Airport

All airports have a basic operational structure in common. Every airport has a “landside”, “airside” and “terminal” area. The landside of an airport is the part accessible to everyone who comes to the airport. The airside has controlled access and is kept secure. The terminal, which is divided into arrival and departure sections, provides a physical structure that serves to control access to and from the airside.

Figure 5.1.4a—The three main areas of an airport

The landside, also called the “groundside”, includes the general entry areas to the airport, such as access roads and ground transportation access (i.e., buses, trains, taxis, limousines). It also encompasses parking areas, car rental businesses, traveler drop-off points, restaurants, stores, currency exchanges and flight check-in.

The landside has three major functions. These are:

(a) to provide ease of access to all the airport services.
(b) to provide safe drop-off and parking facilities.
(c) to generate additional revenues for the airport operator (e.g., commercial leases, services).

Did You Know?

Many of the world's runways even those at some of the world's biggest airports, may have to be rebuilt or widened to accommodate the increased width and wingspan of the Airbus 380, the biggest passenger plane in the world.

Did You Know?

Runways are numbered 01 to 36 and are numbered with reference to their magnetic orientation. For example: runway 09 has an orientation of 90 degrees and points east. These points and numbers are determined by the compass rose. A runway has two directions. In the case of runway 09, the opposite direction would be 27. The opposite directions always differ by 180 degrees.

The airside is the side that has controlled access and is considered to be secure. Airside areas include all runways, taxiways and aprons leading to the ramp adjacent to the airport terminal building. Main runways are usually oriented to line up with the prevailing wind patterns, so airplanes can takeoff into the wind and land with it. A runway can be surfaced with grass, dirt, sand, gravel, asphalt or concrete, depending on the size, weight and type of aircraft (i.e., jet, turboprop, helicopter) landing at the facility.

Planes use taxiways to get from the gate to a main runway for takeoff and from a main runway to the gate after landing. Parking areas for aircraft away from terminals are generally called “aprons”. The area where aircraft park next to a terminal to load passengers and baggage is known as a ramp (or “the tarmac”). Due to their high capacity and busy airspace, international airports will have an air traffic control tower located airside.

Large airports for international flights generally have two, three or more paved runways of 2,000 m (6,600 ft) or longer. Smaller airports may have only a single paved runway shorter than 1,000 m (3,300 ft). Depending on the national authority, there are usually minimum dimensions for these paved fields. These include considerations for safety margins during landing and takeoff. Typically, larger and heavier aircraft require longer runways.

The airport terminal is divided into arrival and departure sections. These can be superimposed one on top of the other if it is a two-story terminal, or located at either end of the terminal building if it is not. The more modern international airports also provide facilities such as stores, bars, restaurants, banks, currency exchange services and travel insurance vendors. These are the public access areas of the terminal.

A Simple, Linear Terminal

Terminals include:

- **Arrival areas:** These are divided into two distinct areas: domestic and international. Here we find customs and immigration, baggage carousels, oversized baggage claims and the lost baggage counter. Typically, representatives from the airlines will be present to assist passengers.
- **Departure areas:** These include areas to check in baggage, register for flights and obtain boarding passes. This can be done at a counter with a customer service agent or at the self-check-in kiosks. Departure areas also have security screening zones and passport control areas.
- **Gates:** The gate area is a secure zone. Passengers must have a boarding pass to have access to this area. This is a waiting area for passengers until they board the aircraft.
- **Concourses:** Concourses are passageways that lead to the gate areas. Only ticketed passengers may enter the concourse. Here you will find waiting areas, restaurants, shops, spas and play areas for children.
- **Airport freight processing areas:** In this area freight is counted, identified, weighed, measured and labeled. International freight is subject to customs and to more rigid security inspection.

Of course, authorized airport, airline and security personnel are allowed to enter the secure zones of the terminal.

Once passengers have gone through the security screening into the controlled areas it is usually impossible to leave again, except by boarding their plane. If someone does absolutely need to leave the secure area, the entire security screening process must be repeated to return to the unsecured areas of the terminal.

The three areas of the airport, that is, the landside, airside and terminal, have well defined boundaries. However, 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.

Did You Know?

As of January 2012, San Francisco International Airport opened the world's first airport yoga studio. The “Zen Room” in Terminal 2 features dimmed lights to soothe weary spirits, a glass wall to act as a sound barrier from the busy terminal and felt-covered rocks to add to the Zen garden atmosphere.

Key Learning Point

All airports have a basic operational structure in common: “landside”, “airside” and “terminal” areas.

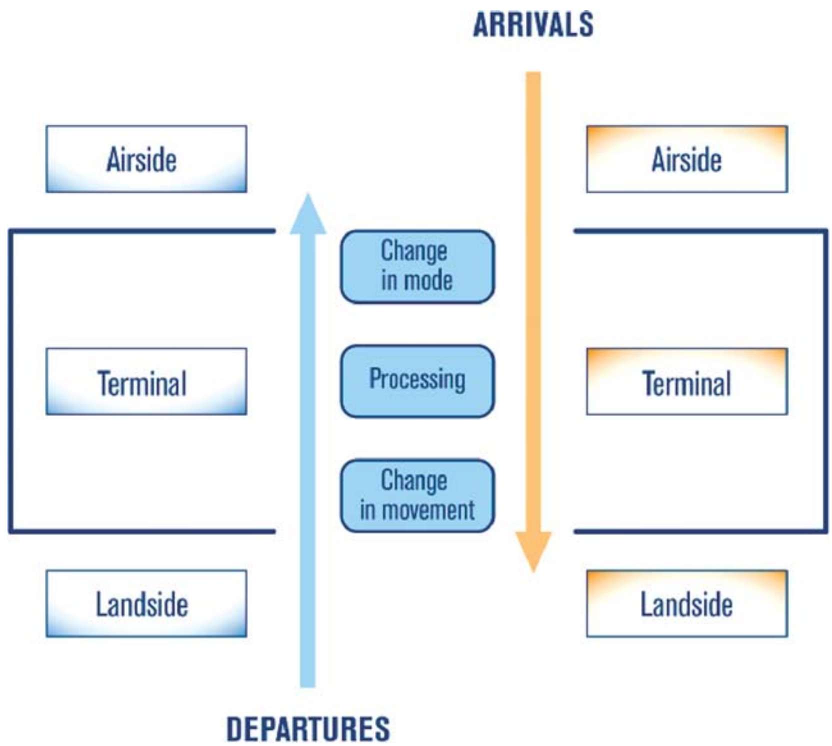


Figure 5.1.4b—The overall airport operational system

In terms of actual physical layout, each airport is unique since the floor plan depends on architecture, geographic location and the physical limitations of the site. Other factors come into play as well, including the commercial traffic that the airport attracts and the types of aircraft that can land there.

Lesson Summary

The term “aerodrome”, now obsolete, refers to any surface used as an aircraft takeoff or landing facility, while the term “airport” has come to mean an aircraft takeoff or landing facility that has been specifically licensed for commercial aviation operations. In addition to providing an aircraft with the necessary space for safe and secure takeoff and landing, the primary functions of a commercial airport are to provide an aircraft with space for parking, refueling, maintenance (repairs) as well as facilities for processing passengers and freight (cargo).

Most of the world's airports are still owned by local, regional or federal government bodies. Generally, these airports are leased to private companies who oversee some or all of the airport's operations. IATA assigns unique three-letter codes to airports so as to be able to clearly indicate points of origin or destination.

Every airport has a “landside”, “airside” and “terminal” area. The landside of an airport is the part accessible to everyone who comes to the airport. The airside is the part that has controlled access and is kept secure. The terminal, which is divided into arrival and departure sections, provides a physical structure which serves to control access to and from the airside.

Progress Checks (Lesson 5.1)

1. The key requirement for the first “air ports” was ______________.
   (a) observation stands for the visitors
   (b) a grassy field that would mitigate the effects of rain
   (c) an aircraft hangar for storage and servicing of aircraft
   (d) the need to approach from any angle depending on wind conditions

2. One of the newer strategies to make airports profitable is to ______________.
   (a) increase airport taxes
   (b) increase the fees paid by airlines
   (c) receive more government subsidies
   (d) make airports destinations in themselves

3. Which of the following airports is named after a prominent figure in aviation history?
   (a) Norman Manley International (KIN) in Kingston, Jamaica
   (b) Lester B. Pearson International Airport (YYZ) in Toronto, Canada
   (c) Santos-Dumont Airport (SDU) in Rio de Janeiro, Brazil
   (d) Chiang Kai Shek International Airport (TPE) in Taipei, Taiwan

4. Every airport has the following three parts: the landside, the airside and the ______________.
   (a) taxiway
   (b) runway
   (c) terminal
   (d) parking area

5. Which of the following is NOT part of an airport's airside?
   (a) Runway
   (b) Taxiway
   (c) Apron
   (d) Flight check-in

6. For arriving passengers on international flights, the airside areas include immigration, baggage pickup and ______________.
   (a) passport control
   (b) animal vaccination
   (c) currency exchange
   (d) customs

5.2 Airport Personnel

Lesson Learning Objectives

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

- Describe how airlines can be considered customers of airports.
- List the various types of employees who work at an airport.

Lesson Overview

In this lesson, we will discover the ways in which airlines are "customers" of airports. Airports cater to the needs of airlines, passengers and cargo shippers as well as many other on-site and external partners and customers. Here, we will explain more about airport personnel–who they are and why they are vital to the airport's operations.

Although airlines represent the airports' largest and most visible customer base, there are many other organizations involved in the air transport industry that can also be considered key airport customers. The role of the airport operator is to manage the needs and priorities of all their customers effectively, as sometimes conflicts can occur. How successfully the airport manages these needs contributes to its financial success.

5.2.1 Airlines as an On-site Customer

Airlines need airports to provide physical infrastructure (including runways, terminal buildings and parking lots), operational infrastructure (e.g., electricity, air conditioning, heat, water, communications, sand/snow clearing), and manpower in order to function. It is in this sense that airlines are "customers" of the airport and pay for these facilities and services.

Operationally, however, there can be some conflict, as the scheduling needs of their various services do not always coincide. For instance, to be operationally effective, an airport must provide its services 24 hours a day, whereas airlines have peak travel and shipping hours and off-peak or slower travel periods. This is because airlines concentrate arrival and departure times to best meet the needs of their customers–the traveling public and freight shippers. An airline's customer's expectation is to spend as little time as possible getting themselves, or their goods, from one place to another. The airport, however, prefers to spread the traffic out during the day in order to use its facilities and manpower most efficiently.

The services offered by an airport come at a price, which airlines pay in the form of user fees. It is customary for airports and airlines to formalize their relationship through some form of long-term written agreement or contract. These agreements list what facilities and level of service the airport commits to provide and the fees that apply (such as landing fees, terminal fees, space and land rent). These agreements can be amended as market, economic and other conditions, such as the addition of airport improvements, change.

Key Learning Point

Airlines need airports to provide physical infrastructure (runways, terminal buildings, parking lots, etc.), operational infrastructure (electricity, air conditioning, heat, water, communications, sand/snow clearing, etc.) and manpower in order to function. As such, airlines are an airport's most important customers.

In today's business environment, airport operators must be prepared to react quickly to the changing needs of their airline customers. This requires cooperation and consultation, which is achieved through the establishment of joint committees–an Airline Operators Committee (AOC) and an Airline Consultative Committee (ACC). It is worth remembering that both airlines and airports have similar goals: to provide quality, stable, services to end-user passengers and cargo shippers.

5.2.2 Other Airport Customers

Although the airlines account for approximately 50 percent of all the revenues generated by most airports, there are a large number of other airport customers to which the airport operator must cater. These customers are a vital part of the industry. They are needed by both the airport and the airlines in order to keep the air transport industry running effectively. About 90 percent of employees at airports work for private companies, such as airlines, contractors, concessions and other land tenants (e.g., hotels, car rental agencies, freight forwarders) who are located at the airport for sound commercial reasons. Please refer to the table below for a listing of the typical businesses that could be considered the customers of an airport.

Figure 5.2.2a—Aircraft maintenance service providers

Air navigation and air traffic suppliers
Aircraft fuel service providers
Aircraft maintenance service providers
Concessionaires including food services, retail services, travel insurance and currency exchange providers, banks, etc.
Customs and immigration for passengers
Customs and excise for freight
Emergency services providers including fire, hazardous material handlers, EMR (Emergency Medical Responders)
Freight forwarders and handlers
Ground handling service providers including fuel suppliers and deicing
Ground transportation providers for both passengers and freight
Land tenants–commercial ventures benefiting from an airport location includes hotels, car rental companies, parking lot providers, shuttles services
Maintenance and other infrastructure workers and suppliers including garbage collection suppliers, cleaners, sewage treatment
Passengers
Security services providers, including police, private security firms and government agencies
Visitors

Figure 5.2.2b—Airport Customers at a Glance

Among the many types of personnel who are found at an airport, we can find the following in more detail:

Ground transportation personnel–Airports depend on a massive surface-transportation system to allow people to travel to and from the airport, park and get from place to place within the airport structure itself. Drivers (bus, coach, rail, taxis, shuttles, car rental) as well as parking lot attendants, supervisors, dispatchers, conductors, ticket sellers and counter personnel are all required to keep the ground transportation network operating effectively.

Ground services personnel–Routine airplane servicing, such as loading of supplies, washing, de-icing and refueling is performed by either airline personnel or a ground services provider.

Key Learning Point

Airports require a variety of personnel to meet the diverse needs of their customers.

Airport maintenance personnel–The requirement to process hundreds of thousands of people every year, means people and systems are needed to keep the airport terminals, runways and aircraft loading areas clean and in top working order. Therefore, there are numerous crews for collecting and disposing of trash, keeping the terminals and concourses clean and in working order as well as keeping runways and aircraft parking aprons clear during bad weather.

Emergency, security and safety personnel–Fire, emergency medical service (EMS) crews and some airport police are often employees of the nearby metropolitan area. Large airports have crews permanently assigned to the airport to handle fire and EMS duties. They may also have their own police crews. In many airports there are also private security companies contracted to patrol airport grounds (such as the perimeter fences that limit access to the airfield) and even to operate security inspection points within the terminals.

Airport operator personnel–There is a group of employees who work directly for the airport as administrators as well as terminal- and grounds-maintenance personnel and safety crews. Airports also have their own departments of finance, human resources, administration and public relations, much like any large business or municipality.

Lesson Summary

Airlines need airports to provide physical infrastructure (i.e., runways, terminal buildings, parking lots, etc.), operational infrastructure (i.e., electricity, air conditioning, heat, water, communications, sand/snow clearing) and manpower. As such, airlines are an airport's most important customers. This relationship is usually formalized through a long-term written contract, that lists what facilities the airport commits to provide and the fees that apply.

Airports require a variety of personnel to meet the diverse needs of their customers. These include ground transportation personnel, ground services personnel, airport maintenance personnel, emergency, safety, and security personnel, and airport operator personnel. About 90 percent of employees at airports work for private companies, such as airlines, contractors, concessions and other land tenants.

Progress Checks (Lesson 5.2)

1. Airport management prefers to spread air traffic out during the day in order to ______________.
   (a) avoid creating traffic congestion on the approaching highways
   (b) allow passengers to spend more time in the airport
   (c) use its facilities and manpower most efficiently
   (d) increase security screening

2. About 90 percent of employees at airports work for private companies, such as airlines, contractors, concessions and other land tenants.
   (a) True
   (b) False

3. Airplane servicing such as de-icing is usually done by ______________.
   (a) ground services personnel
   (b) ground transportation personnel
   (c) airport maintenance personnel
   (d) airport operator personnel

4. According to international regulation, airports are not allowed to contract private security companies to operate security inspection points within the terminals.
   (a) True
   (b) False

5. Generally, emergency medical service crews in an airport are employees of the ______________.
   (a) airport
   (b) the consortium of airlines
   (c) the local municipality
   (d) the central government

Lesson Learning Objectives

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

- Describe how airports process passengers and luggage.
- Describe how airports process freight.

5.3 Processing Passengers and Freight

Lesson Overview

This lesson deals with two important processes that occur in the terminal–the processing of passengers and baggage, and the processing of freight. To help us understand the interface between the passenger and the airport, we will go through the sequence of steps that passengers must take when departing from an airport and upon arrival at their destination airport. To conclude this section, we will walk through the steps required to process freight.

5.3.1 Processing of Passengers

As we saw at the beginning of this module, the airport terminal building is the primary boundary between the landside and the airside of an airport for most passengers and visitors. It is crucial to the smooth running of airport operations. To help us better understand how an airport manages this interface with passengers, we will follow a departing passenger and his baggage through the airport terminal and onto the plane. We will then follow the progress of another passenger who has just deplaned and is making her way through the terminal after her trip is over.

Note: Many of the passenger, baggage and freight processing procedures concern safety and security issues. These are described in greater detail in the next lesson. The process described below refers to an airport that does not provide IATA's Fast Travel features (self-service check-in, boarding, baggage drop-off and reclaim, etc.), which we will explain in modules to come.

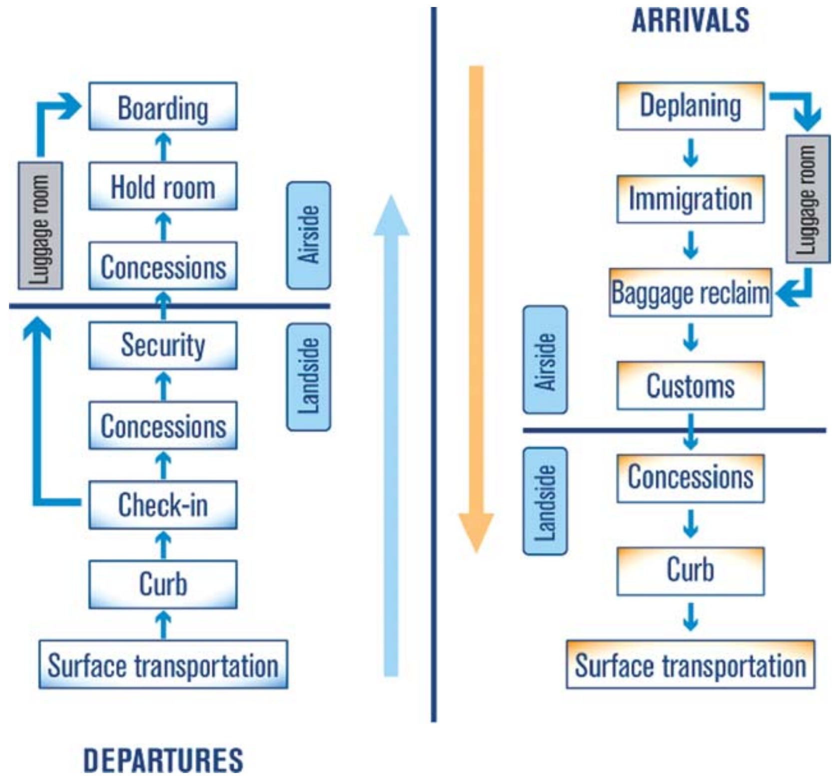


Figure 5.3.1—Departure and arrival flow

5.3.2 The Journey Begins

STEP 1: Arrival at the airport: Our passenger arrives at the airport by car and drives to the multi-level car park in front of the terminal building, where he parks his car and unloads his luggage. He takes an elevator up to the departure level and makes his way along the curb in front of the terminal building carrying his luggage. He decides to take a baggage cart for his two pieces of luggage. Opening the nearest door he enters the terminal on the departure level, which is also known as the check-in concourse. This is the area where passengers register with the airline with which they made a reservation.

Note: Most check-in concourses follow a similar design consisting of:

(a) A concourse or long hallway with doors opening from the car park or roadway outside, through which people enter with their luggage.
(b) A row of counters placed parallel or perpendicular to the building façade.
(c) A conveyance system for luggage located at the rear of the counters.

Did You Know?

In 2004, only 18 percent of tickets were electronic. Just four years later, 100 percent eticket issuance was achieved.

STEP 2: Check in at the airport counter: Upon entering the terminal, our passenger quickly locates the check-in area of the airline he is flying with. He has a direct view of all the airline names and logos by looking down the row of counters. He sees his airline counter is about halfway down the row. He also checks the overhead monitors/ TV screens to see if the gate number of his flight has been posted. It has not, as he has arrived earlier than the two hours requested by his airline.

Reaching his airline's row of check-in desks, his next step is to locate the right counter. Certain counters are reserved for check in by first class, business class and frequent-flyer customers.

He stands in line at his counter. Once he reaches the check-in counter, he presents his passport for identification to the airline agent who checks his ticket data for validity. His baggage is weighed and labelled with his destination and put on the conveyor belt for processing. The agent gives him a luggage claim ticket and issues a boarding pass. The boarding pass shows the number of the seat assigned to him as well as the boarding gate and time his flight leaves.

Once these procedures are completed, our passenger leaves his luggage cart by the back wall for someone else to use. Now, he has to make some choices. He can go shopping, play a video game, visit a restaurant or have a relaxing massage. He can also decide to make his way directly to the waiting area by his aircraft departure gate, which is referred to as the “gate area”. There, he can wait in the general seating area and enjoy reading his book until the flight boarding time.

STEP 3: Commercial Facilities–Landside: Our passenger remembers that he needs to buy foreign currency and check out the bookstore to see if they have the latest bestseller. He is aware that only passengers with boarding passes and authorized employees can go through the security checkpoint to buy from the stores on the airside. Due to this restriction, some concessionaires have set up stores on the landside of the terminal building to accommodate the needs of passengers who have not yet checked in as well as visitors and employees who are required to stay on the landside of the terminal.

Available commercial services: These consist of a variety of offerings providing passengers, employees and visitors with a range of services. The amount, type and quality of these concessions vary with the size of the terminal and local market conditions. A small terminal may have only two or three such concessions while a large international terminal may include one hundred or more outlets.

The most common airport commercial services are:

(a) Porters
(b) Luggage carts
(c) Restaurants, bars and cafeterias
(d) Foreign currency exchanges
(e) Banking services
(f) Travel insurance counters
(g) Business centers, including wi-fi access
(h) Specialty shops (for clothing, shoes, candies, gifts, books, etc.)
(i) Newspaper stands
(j) Duty-free shops
(k) Barber shops, hairdressers and beauty parlours
(l) Hotels (co-located with terminal)
(m) Car rental counters
(n) Television watching areas
(o) Entertainment machines
(p) Pay telephone booths
(q) Post office
(r) Advertising displays

Most popular commercial services: Food outlets are among the most widely used services. They range from basic fast-food type concessions to elaborate dining rooms. A range of different food options may be provided depending on the airport's size, geographical location and the local approach to food. The other most frequently used commercial services are newsstands, gift shops, bookstores and duty-free shops.

Did You Know?

Many airports have a chemical ‘sniffer’. This is essentially an automated chemistry lab in a box.

At random intervals, a security attendant will swipe a cloth over an electronic device such as a laptop computer and place the cloth on the sniffer. The sniffer analyses the cloth for any trace residue of the types of chemicals used to make explosives. If there is any residue, the sniffer warns the security attendant of a potential bomb. These sniffers can be used to detect both explosives and narcotics.

Non-commercial services: These are usually provided free of charge for the convenience of the traveling public. They include:

(a) Flight information displays
(b) Public address systems
(c) Information desks
(d) Seating areas
(e) Lost luggage counters
(f) Toilets and baby changing facilities
(g) Drinking fountains

Suddenly, our passenger notices that a long line has formed at the security screening point. He decides to make his purchases only if he has time once he has passed through to the airside of the terminal, as he does not want to arrive late or feel too rushed at his departure gate.

STEP 4: Security screening:

The most common pieces of equipment found in this area are:

(a) Walk-through metal detectors, complemented by hand-held detectors
(b) X-ray equipment
(c) Explosive detection equipment

We will describe the screening process further in the next lesson on Airport Security.

While our passenger waits in line to pass through the security screening point, he watches the other departing passengers being thoroughly checked for compliance with the revised aviation security requirements. He is impressed by the smoothness of the process. When it is his turn, he is asked to empty his pockets and place any items in a small container on the conveyor belt. He is also asked whether he is carrying a computer. He then puts his briefcase on a conveyor belt to go through the x-ray machine, so its contents can be visually checked. Meanwhile, he passes through a walkthrough metal detector. It rings, so he is asked to step to the side. He is physically patted down by the security agent, who also rechecks the entire length of his body with a hand-held metal detector. It is his belt buckle that had set off the metal detector, as the hand-held metal detector buzzes when it passes over his middle. He is told that next time he should remove his belt. At some airports he would have been required to remove his shoes. Meanwhile, his carry-on briefcase is being checked for traces of explosives with a special detector. Then, the screening agent asks him to open it so he can conduct a manual search of the case. The agent finds nothing suspicious. Our passenger reclaims his bag and the coins he took out of his pockets after passing through the metal detector.

Figure 5.3.2a—Security screening area

Once through security, depending on the size and layout of the terminal, he may find himself near his departure gate or he may be quite a distance away from it.

STEP 5: Government Controls–International Passengers: Since our passenger is traveling internationally, his country requires all outbound international passengers to go through an inspection of travel documents before leaving the territory. In this case, counters are provided where his passport and boarding card are scrutinized. In many international airports, this step occurs prior to the security screening (described in Step 4).

STEP 6: Commercial Facilities–Airside: Our passenger is happy to find a wide selection of commercial facilities beyond the security screening point, including another branch of the bookstore he likes. It is only when most of the processing has been completed that many passengers feel comfortable about spending some time in a concession, without the stress of missing their flight. This is especially true if there appears to be long delays at the various control points (e.g., security, passport checks). The providers of commercial services often duplicate their services on both the airside and landside of the terminal.

The next step is for our passenger to go to the gate departure area and wait.

STEP 7: Departure Gate: Here, our passenger reaches the place where the airline assembles all the passengers for a particular flight. It is from here that he will board the aircraft. The departure area is located immediately adjacent to the exit door. Since the wait may be lengthy, this area usually provides plenty of seating.

Figure 5.3.2b—Departure Gate Area

Key Learning Point

Airports are organized so as to move departing passengers from the “public” landside of the terminal to the “secure” airside as efficiently as possible.

STEP 8: Preboarding Check: Suddenly, our passenger's wait is over–his flight is ready to board. The gate attendant makes a preboarding announcement inviting first and business class passengers as well as those requiring assistance or with small children to board the aircraft first. For the remainder of the passengers, it is customary to board a flight by row number, starting from the rear seats to reduce congestion in the cabin and give everyone time to find their seats and stow their carry-on luggage. The preboarding check is the final step in the processing of departing passengers. Airline attendants or gate personnel will verify each boarding pass. This check can be done manually or with a special boarding pass scanner. Personnel may also verify the identity of the boarding passengers by asking to see a passport, travel document or some other type of photo identity card.

STEP 9: Boarding: After the final check of his passport and boarding card to ensure he is taking the correct flight and has valid travel documents, our passenger leaves the gate area and is now ready to board the airplane. He now has a few boarding options depending on the airport he is traveling from:

(a) A passenger jet bridge. This is the preferred option as it protects people from the weather elements, it ensures security as passengers cannot mix with other people, and it provides a safety element, as passengers cannot wander onto the apron where an accident with ground vehicles might occur.

(b) A transfer vehicle, such as a bus or transporter. It is either parked on the apron adjacent to the exit door or is mated directly with the door. The latter option provides the same degree of comfort, security and safety as a passenger jet bridge.
(c) A walk from the exit door to the aircraft. This option does not provide protection from the elements and it exposes passengers to some risk. Ground personnel guide and monitor passengers for safety and security reasons. This option is often used at terminals and gates where regional jets and propeller-driven aircraft operate.

Our passenger is flying on a large passenger jet and from a large international airport. The boarding gate has therefore been equipped with a passenger jet bridge. He enters the aircraft easily and is greeted by the flight crew waiting at the door to welcome him aboard.

Meanwhile, our passenger's luggage has been processed and is placed on the aircraft. Our passenger checks his boarding pass one more time and moves towards his assigned seat. He stows his briefcase in the overhead bin, sits down and buckles his seatbelt. He is ready for a pleasant flight.

5.3.3 Arriving Passengers

We will now go through the process of an arriving passenger. Arrivals are divided into two sections: the national and international streams. As with the previous departure process, we will follow an arriving international passenger who has just deplaned.

STEP 1: Deplaning: Our new passenger has just arrived from an overseas destination. Her aircraft has been assigned a gate in the international arrivals area. If this had been a domestic flight, she would have deplaned in the domestic or national arrival area and she would have no need to go through the customs and immigration formalities. Due to the lack of available gates, our passenger's aircraft has been diverted to a "remote" gate. These are further away from the terminal and do not have jet bridge access. Our arrival passenger, therefore, will be transported to the terminal by bus. Once inside the terminal, our passenger begins to walk along the international arrivals concourse towards the immigration-processing hall. Passengers that arrive “nationally” just make their way to the baggage claim area to retrieve their luggage.

STEP 2: Government Controls–Immigration: Passengers arriving from a foreign country are required to go through a number of government controls. Depending on the origin of the flight and the various restrictions in effect at the time of the arrival, these could include Immigration, Customs and sometimes Health and Agriculture. Some of these controls may require a substantial amount of time. This means that our arriving passenger joins a long line of passengers moving their way toward a row of counters where she will meet with the immigration officer.

Immigration process–Immigration is only the first type of control she needs to pass through. Immigration's objective is to control the entry of people into the country. It consists primarily of checking the passenger's passport. If there is any doubt about the admissibility of the passenger, she will be escorted to an adjoining section–the Immigration Office–for further interviews. In some countries, the immigration officer also checks a landing card, which the passenger has filled out on board the plane or while waiting in line for immigration. The landing card lists the amount of duty-free purchases the passenger can claim without having to pay excise tax or customs duty. It also asks if they are carrying controlled or prohibited items such as agricultural items, firearms, other weapons and business products.

Since our passenger is returning home, her passport is in order, she did not visit a farm and she has brought home presents that do not exceed the value allowed, she is readily admitted. She then walks down some stairs to reach the luggage reclaim area, located on a floor beneath the immigration area. In some airports, the luggage reclaim is located on the same floor as the immigration facilities.

STEP 3: Luggage Reclaim Area: This area consists of a concourse designed to accommodate the number of passengers expected at peak travel times. Passengers assemble along the luggage reclaim device provided. Various systems exist, ranging from a simple straight conveyor belt to sophisticated revolving conveyors or inclined carousels.

Our arriving passenger locates her flight number posted above Carousel No. 5. This is where she and her fellow passengers are to be reunited with their checked luggage. This is also where the baggage claim checks will be useful, as many bags look very similar. Passengers check that they have off-loaded the right bag by comparing the claim tag on the piece of luggage with the claim tag in their hand to see if they match.

Our passenger picks up her bags from the luggage carousel and moves on to Customs.

STEP 4: Government Controls–Customs: Government Customs and Excise departments control the entry of goods into the country. Luggage, both checked and carry-on, may be opened and searched at this time. Any prohibited goods will be confiscated and admissible goods in excess of the allowed quantity will be subject to the payment of a customs duty. Our passenger has only brought a few gifts back for her family and friends, so she has no customs duty to pay. However, she is stopped and asked to unlock her bags. The customs officer searches her bags, but finds nothing out of order. This was just a routine check. At this point, our passenger is allowed to exit the government control area. She walks through the automatic doors into the airport landside in the arrivals concourse, where her family is waiting for her at the safety barrier.

Figure 5.3.3—Arrivals area

STEP 5: Commercial Facilities–Landside: Arriving passengers do not spend unnecessary time in the terminal; they usually want to leave the airport as quickly as possible. Accordingly, few commercial facilities exist in this area. There are, however, some minimum services:

(a) Car rental counters. Arriving passengers can obtain a vehicle parked either in an area adjacent to the terminal or in a remote location served by a courtesy shuttle service.
(b) Foreign currency exchange. International passengers can buy local currency.
(c) Telephone booths. Useful to make a business call or to notify friends or family of one's arrival.
(d) Courtesy phones to call for taxi or hotel pickup service.
(e) Coffee shops and other limited services.
(f) Most airports have a hotel connected to the terminal building for connecting passengers or passengers taking an early morning flight.

STEP 6: Access to the Curb and Surface Transportation: Our passenger is tired. She and her family have a long drive home. They exit the terminal and wait at the curb for the shuttle bus that will take them to the parking lot to reach their car.

5.3.4 Luggage Processing

In air transportation, luggage is not permitted to travel in the same compartment as the passenger (except for small carry-on luggage that can fit in overhead bins in the aircraft cabin or under the seat). Instead, passengers and luggage are separated from check-in to reclaim. Although luggage does not follow exactly the same routine as passengers, it is subject to a similar process that includes processing, circulation and holding.

Key Learning Point

Freight is processed in a separate terminal, away from the passenger terminal to avoid mixing passenger cars and the large, slow-moving trucks serving the freight terminal.

5.3.5 Processing of Freight

5.3.5.1 Freight Terminals and Processing

Freight is processed in a separate terminal, away from the passenger terminal to avoid mixing passenger cars and the large, slow-moving trucks serving the freight terminal. However, it must be connected to the passenger terminal apron by an airside service road. This allows the quick and efficient transfer of freight between passenger aircraft and the freight terminal. Only dedicated freighter aircraft have access to the freight terminal. This requires an apron and a taxiway connection to the manoeuvring area.

Freight terminals may be owned and operated by various combinations of agencies (airport operator, airlines or tenants). They include other partners like Security, Customs, Health and Agriculture. Other tenants may include Customs Brokers (commercial enterprises that get international goods cleared through Customs on behalf of the consignee) and Freight Forwarders, who act on behalf of exporters in arranging transportation services.

Freight processing shares some of the characteristics of passenger processing. Freight is subject to Customs inspection and to security requirements and it must be protected from the elements. However, because freight does not move on its own power between landside and airside as passengers do, freight terminals are more mechanized than passenger terminals. Both the shipper and the consignee are not obliged to make a trip to the airport to ship or receive goods. Freight forwarders will pick up the goods from the shipper and transport them to the freight terminal. At destination, a similar company will be waiting upon arrival of the goods and transport them to the consignee.

We will now follow the processing of a freight shipment to see how it arrives on board the aircraft and then see what happens to an incoming shipment.

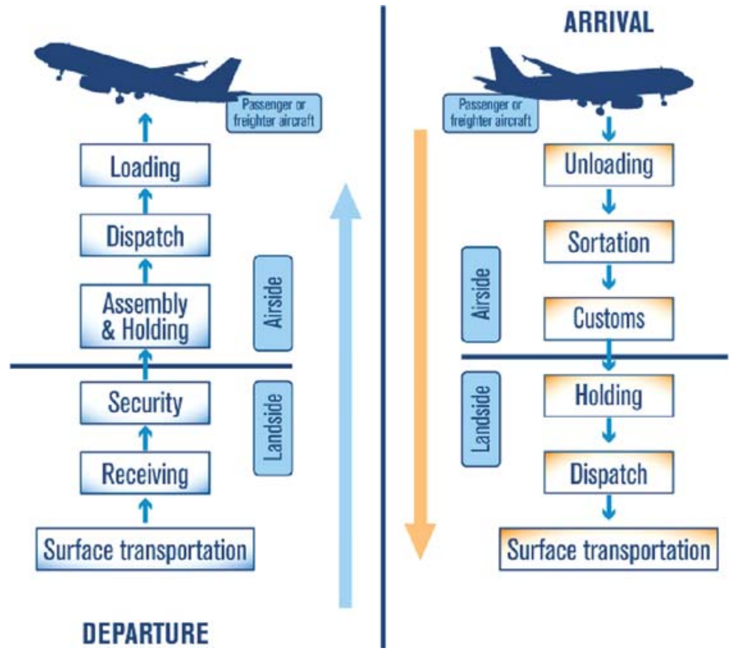


Figure 5.3.5.1—Freight processing flow

5.3.5.2 Outbound Freight Processing

STEP 1: Access to the Terminal: Upon reaching the terminal, goods are unloaded on a dock and moved inside the building.

STEP 2: Receiving Area: Freight is brought to a receiving area where it is counted, identified, weighed, measured and labelled.

STEP 3: Security Screening: Freight is not always screened. It depends on national regulations. When required, this is where cargo is screened. Currently, 100 percent cargo screening is mandatory for shipments to and from the USA, Canada and Europe on all passenger aircraft.

STEP 4: Assembly and Holding: Small shipments are consolidated into aircraft loads and sorted by flight.

STEP 5: Dispatch to Aircraft: Loads are dispatched either to a freighter aircraft positioned on a nearby stand or transported by truck to a passenger aircraft.

Key Learning Point

Although freight processing shares some of the characteristics of passenger processing, freight terminals include more mechanization than passenger terminals.

5.3.5.3 Inbound Freight Processing

STEP 1: Access to Terminal: Freight is brought from the aircraft to the terminal by truck or conveyer (i.e., the same process as during departure).

STEP 2: Sorting and Check-In: Freight is sorted into separate packages and checked in.

STEP 3: Customs Clearance: International freight goes through Customs inspection and clearance.

STEP 4: Holding: Once cleared, it is brought to a holding area where it awaits pick up by a consignee, freight forwarder, etc.

STEP 5: Delivery: Finally, freight is brought to the landside dock for dispatch to the consignee through surface transportation.

Figure 5.3.5.3—The loading of freight into a cargo hold.

Lesson Summary

The airport terminal building is the primary common boundary between the landside and airside of an airport for most passengers and visitors.

Airports are structured to effectively move departing passengers from the “public” landside of the terminal to the “secure” airside. Departing passengers will follow this sequence of steps:

1. Arrival at the airport;
2. Check-in at the airport counter;
3. Commercial Facilities–Landside;
4. Security screening;
5. Government Controls–International Passengers;
6. Commercial Facilities–Airside;
7. Departure Gate;
8. Preboarding Check;
9. Boarding.

This airport design is also used for the arrival process. Arriving passengers will follow this sequence of steps:

1. Deplaning;
2. Government Controls–Immigration;
3. Luggage Reclaim Area;
4. Government Controls–Customs;
5. Commercial Facilities–Landside;
6. Access to the Curb and Surface Transportation.

Freight processing shares some of the characteristics of passenger processing (e.g., Customs inspection, security requirements, protection from the elements). However, as freight does not move on its own power between landside and airside, freight terminals include more mechanization than passenger terminals.

Progress Checks (Lesson 5.3)

1. Because not everyone can go through the security checkpoint to the airside, some concessionaires have ____________.
   (a) their stores only on the landside
   (b) their stores only on the airside
   (c) their stores on both the landside and airside
   (d) their stores in the concourse

2. Which of the following is the most popular type of outlet in airports?
   (a) Travel insurance counters
   (b) Amusement machines
   (c) Car rental counters
   (d) Restaurants, bars and cafeterias

3. At which of the following steps could the customer be asked to provide a photo identity card?
   (a) Commercial Facilities–Landside
   (b) Security screening
   (c) Preboarding check
   (d) Boarding

4. Which of the following steps is out of sequence?
   (a) Security screening
   (b) Commercial Facilities–Airside
   (c) Preboarding Check
   (d) Check-in at the airport counter

5. Which of the following boarding options ensures that passengers cannot wander onto the apron?
   (a) A passenger jet bridge
   (b) A transfer vehicle
   (c) A walk from the exit door to the aircraft
   (d) Non of the above

6. Some countries require passengers arriving from a foreign country to fill out a landing card. By whom is this landing card checked?
   (a) Cabin crew
   (b) Immigration officer
   (c) Baggage handler
   (d) Security officer

7. At which stage are passengers most likely to be asked to open their luggage for inspection?
   (a) Deplaning
   (b) Government Controls–Immigration
   (c) Luggage Reclaim Area
   (d) Government Controls–Customs

8. Which of the following outbound freight processing steps is out of sequence?
   (a) Security Screening
   (b) Assembly and Holding
   (c) Dispatch to Aircraft
   (d) Receiving Area

5.4 Security

Lesson Overview

In this final part of the *All about Airports* Module, we will look at airport security. Airport security has grown to become one of the most important aspects of the airline industry in the aftermath of hijackings in the 1970s, the events of September 11, 2001 and subsequent terrorist attempts. We will look at the procedures used to control access to aircraft and how passengers, baggage and air freight are handled in tandem with governmental and corporate requirements.

Lesson Learning Objectives

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

- Define security requirements for airport operators.
- Describe procedures used to control the access of passengers, luggage and airfreight aboard aircraft.

5.4.1 Airport Security

Security is everyone's concern and requires the involvement and commitment of the airport community. It is everyone's responsibility. In the 1970s, we saw an increase in airplane hijackings and bomb threats as militant organizations worldwide drove their personal political agendas. With the events of September 11, the realization came that the security measures in place at the time were not enough. In order to protect civil aviation, each airport is required by their national government, through their Civil Authority operating according to the SARPS of Annex 17 of the ICAO Convention on Civil Aviation, to establish and implement an Airport Security Program. This program is directed towards the prevention of and response to unlawful interference and threats to passengers, cargo and aircraft.

The Airport Security Program, developed locally at each airport, is pertinent to that airport and is individually approved by the National Aviation Security Authority. It should contain the following ten elements:

(a) Responsibilities of the airport operator
(b) Coordination and communications planning details
(c) Plan for the protection of the airport, aircraft and air traffic facilities

Key Learning Point

Each airport is required by their national government to establish and implement an Airport Security Program. It is primarily directed towards the prevention of and response to unlawful interference and threats to passengers, cargo and aircraft.

(d) Plan for the orderly control of persons, baggage, cargo and other items placed on board an aircraft
(e) Details of security equipment (i.e., cameras, x-ray machines, e-passes, etc.)
(f) Details of the security personnel and their duties
(g) Details of the required responses to acts of unlawful interference
(h) An evaluation of the effectiveness level of the measures outlined in the plan by a security expert
(i) Program adjustment procedures
(j) Contingency plans

The Airport Security Program must include detailed descriptions of all proactive and preventative measures. The main preventative measures are the control of access to restricted areas and to aircraft as well as the control of passengers, luggage and freight. The implementation of the security program is a combined effort among everyone concerned with this issue. This includes the National Civil Aviation Security Authority, the airport operator, the airlines who use the airport, the airport tenants, concessionaires and all employees. It also includes the passengers, visitors and cargo shippers.

Key Learning Point

The terminal area of the airport is where the actual transfer between ground and air transportation of passengers, luggage and freight takes place.

5.4.2 Procedures for Controlled Access of Passengers, Luggage and Airfreight

Keeping aviation secure is extremely costly to the industry and a major hassle for passengers.

IATA's Checkpoint of the Future (which will be discussed later on) is designed to enhance security while reducing queues and intrusive searches at airports, using intelligence-driven risk-based measures.

There are a number of procedures in place at airports to ensure control of access; these are described in some detail in the sections which follow.

5.4.2.1 Passenger and Carry-on Baggage Screening Procedures

The terminal area of the airport is where the actual transfer between ground and air transportation of passengers, luggage and freight takes place. The terminal has several subsystems linked together to process everything in a predetermined, rigorous and traceable sequence. The first opportunity to initiate passenger control occurs during check-in at the terminal building. Airline check-in agents ask passengers whether they packed their own baggage, if they are carrying any dangerous objects and if they left their bags unattended in a public area. These agents are also trained to detect suspicious behaviour by a passenger.

Once the passenger has checked his or her luggage and obtained a boarding card, the next control point encountered is usually the security screening point, where both the passenger and the carry-on baggage is checked for potentially hazardous items or materials.

On international flights there is one intermediate step. This is passport control - and sometimes immigration control, which occurs where Nation States have reciprocal agreements in place, so passengers can pass through immigration prior to arriving in the country in question (i.e., this happens between Canada and the U.S.A.). In most instances, immigration control happens at the destination airport or at the first airport of arrival in a country.

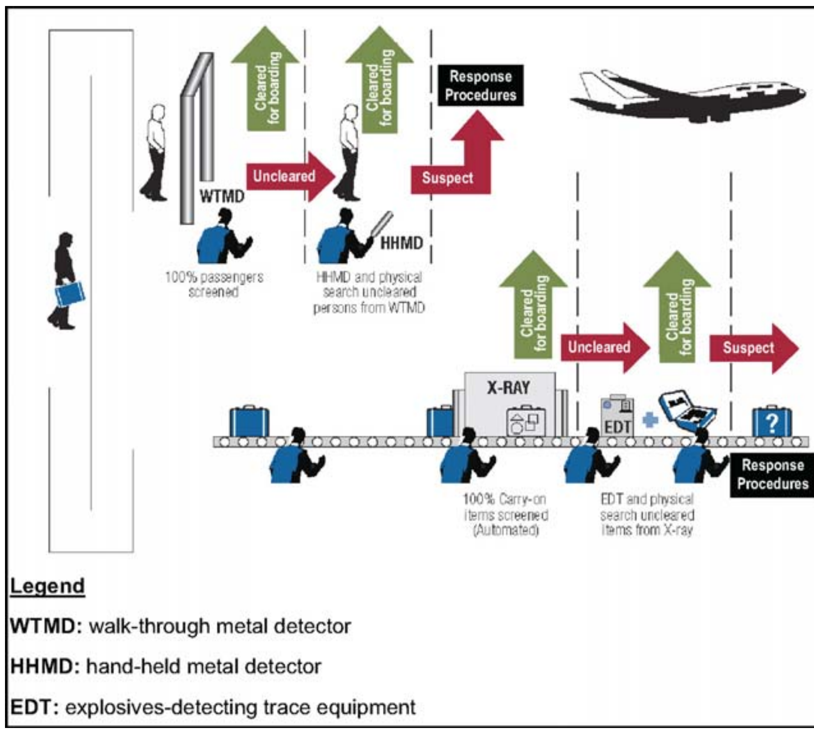


Figure 5.4.2.1-1—Multi-stage process for preboarding screening. (http://www.tc.gc.ca/tcss/catsa)

At the security screening point, a passenger encounters several types of equipment and security screening personnel. These include:

(a) Radioscopic (X-ray) equipment for most carry-on luggage and pocket contents;
(b) Explosive vapour detectors for carry-on luggage;

Did You Know?

Prior to September 11, only five percent of checked bags were screened. Shortly after, in January 2002, airlines were mandated to screen every bag for explosives or match each piece of checked luggage with its owner. By January 2003, more than 90 percent of checked baggage was electronically screened for explosives. Airports that were unable to electronically screen the bags did a search of the luggage by hand or with specially trained dogs or continued to match bags with passengers.

Did You Know?

Hold Baggage Screening (HBS) is the process by which all checked baggage is screened using the latest innovations in explosives detection equipment at airports. Relying on a combination of both security personnel and state-of-the-art technology, HBS scans baggage density and tests for trace amounts of chemicals.

(c) Passenger walk-through metal detector equipment as well as hand-held detectors;
(d) Manual searches for both passengers and for carry-on luggage, where the equipment has indicated further screening is required.
(e) Full body scanner for detecting objects on a person's body, without physically removing clothes or making physical contact.

Passengers who refuse these security controls or refuse to hand over unauthorized objects will not be permitted to access the controlled area of the terminal building.

5.4.2.2 Parallel Screening Channel

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 a manual search is required it should be conducted with privacy and sensitivity. Since any control process causes some degree of anxiety, some airport operators seek to ease this feeling of discomfort by providing an atmosphere of calm. With IATA's Checkpoint of the Future, passengers approaching the checkpoint will be directed to one of three lanes: ‘known traveler', ‘normal' and ‘enhanced security'. The determination will be based on a biometric identifier in the passport or other travel document resulting from 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.

5.4.2.3 Checked Baggage Screening Procedures

The control and screening of checked baggage or luggage is another key aspect of the security program. Its objective is to prevent the unauthorized carriage of weapons, explosives and other dangerous objects on board an aircraft.

In most modern airports, all checked baggage passes through an automated screening device. This device varies in different parts of the world, but is usually either a large, automated radioscopic (X-ray) machine, which is the fastest method, or the slower computer tomography (CT) scan machine. Only checked baggage that has been subjected to security controls is allowed on board an aircraft. It must belong either to a passenger traveling on the same flight or it must have been security cleared by the appropriate authority. An example would be a passenger suitcase that was misrouted and is now being forwarded to the proper destination. Security screening processes are constantly under development.

5.4.2.4 Luggage Protection Procedures

Luggage must be kept secure from the time it is handed over to the airline at the check-in counter to the time it is loaded on board the aircraft. Baggage checked in at an off-airport location such as hotels must also be kept secure between the point of check-in and the aircraft, and is subject to the mandatory security controls prior to loading.

5.4.2.5 Airfreight Screening Procedures

Air shipments of mail and cargo (freight) are subject to appropriate security controls. Freight can be extremely difficult to screen and specific procedures have been developed to ensure compliance with basic safety principles throughout its journey by air. These include:

(a) Aircraft carrying freight must operate within a secure environment;
(b) Freight must be subjected to a 100 percent security screening process before being loaded onto a passenger aircraft (such as safe, secure storage facilities, protection during transfer to the aircraft, controlled access to parked aircraft);
(c) Questionable consignments whose security status cannot be readily determined must be subjected to additional screening or other security measures;
(d) Once a consignment has been security cleared, it must be protected from unlawful interference.

If a freight shipper is unknown and security controls cannot be readily accounted for, or if a threat assessment demands additional security measures, a number of other measures should be implemented. These include:

(a) Manual inspection
(b) Use of specially trained “sniffer” dogs
(c) Use of metal detectors and/or radioscopic equipment
(d) Use of explosive vapour detectors
(e) Use of a decompression chamber to simulate (mimic) a high altitude environment
(f) Quarantine and delay of shipment to allow for expiration of potential time-operated devices

Key Learning Point

Procedures in place at airports to ensure control of access include rigorous screening procedures of passengers and their luggage as well as specific security controls of airfreight.

Lesson Summary

Each airport is required by their national government to establish and implement an Airport Security Program that Program is directed towards the prevention of and response to unlawful interference and threats to passengers, cargo and aircraft. Rigorous screening procedures of passengers and their luggage as well as specific security controls of airfreight are in place at all airports. It is mandatory that airport operators have procedures in place to ensure control of access to the restricted zone, passenger and carry on baggage screening, checked baggage screening, luggage protection procedures and airfreight screening procedures.

Progress Checks (Lesson 5.4)

1. Baggage checked-in at an off-airport location is not subject to the mandatory security controls prior to loading.
   (a) True
   (b) False

2. During which of the following steps is the first opportunity to initiate passenger control?
   (a) Check-in
   (b) Security screening point
   (c) Passport control
   (d) Immigration control

3. Specially trained "sniffer" dogs are used for screening ______________.
   (a) international passengers
   (b) international mail
   (c) airline personnel
   (d) freight

4. Which of the following is NOT used for passenger screening?
   (a) Decompression chamber
   (b) Radioscopic (X-ray) equipment
   (c) Explosive vapour detectors
   (d) Manual searches

5. Which of the following is NOT used as a means to screen freight?
   (a) Manual inspection
   (b) Use of radioscopic equipment
   (c) Use of explosive vapour detectors
   (d) Full body scanner

Module Summary

This module has provided an introduction to the world of airports. We explained that the term “aerodrome” refers to any surface used as an aircraft takeoff or landing facility and that the term “airport” has come to mean an aerodrome that has been specifically licensed for commercial aviation operations by a responsible national government organization. Most of the world's airports are still owned by local, regional or federal government bodies, who then lease the airport to private companies. These private companies oversee the operation, in whole or in part. We also discovered that IATA assigns unique three-letter codes to airports to simplify airline operations. We described that all airports have a basic organizational structure in common: every airport has a “landside”, “airside” and “terminal” area.

This module helped us understand the relationship between airlines and airports. Airlines need airports to provide physical infrastructure (runways, terminal buildings, parking lots, etc.), operational infrastructure (electricity, air conditioning, heat, water, communications, sand/snow clearing, etc.) and manpower. As such, airlines are an airport's most important customers. Airports also require a variety of personnel to meet the diverse needs of their customers.

We looked at how airports manage the passenger interface. Airports are structured to effectively move departing passengers from public landside areas of the airport to the secure airside and vice versa. Although freight processing shares some of the characteristics of passenger processing, freight terminals include more mechanization than passenger terminals.

Related to security, we explained that each airport is required by their national government to establish and implement an Airport Security Program that is primarily directed towards the prevention of, and response to, unlawful interference and threats to passengers, cargo and aircraft. Procedures are in place at airports to ensure control of access through rigorous screening of passengers, their luggage and of airfreight.

Apply Your Learning

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

1. Investigate the airport terminal. Walk around inside the terminal building. Take note of the airline counters and concessions serving the terminal. Answer the following questions:
   (a) How many airlines serve the airport?
   (b) How many service providers can you identify (e.g., airlines, vendors, other airport personnel, etc.)?
2. Take note of the landside of the airport. This includes the general entry areas to the airport, such as access roads and ground transportation access (e.g., buses, trains, taxis, limousines).
3. Try to obtain the following information:
   (a) When was the airport built?
   (b) Who owns and operates the airport? Is the operator different from the owner?
   (c) How many runways does it have?
   (d) What is the length of the longest runway?
   (e) How many employees work on site at the airport?
   (f) How many flights arrive and depart on a daily basis?
4. If you have access to the airside section of the airport, take note of the following:
   (a) How many types of ground personnel can you see?
   (b) What security procedures have been implemented for the processing of passengers?
   (c) How is freight processed? Is there a separate freight terminal? Draw a simple map showing the process from accessing the terminal to being dispatched to the aircraft.

Answer Key

Progress Checks (Lesson 5.1)

1. d
2. d
3. c
4. c
5. d
6. d

Progress Checks (Lesson 5.2)

1. c
2. a
3. a
4. b
5. c

Progress Checks (Lesson 5.3)

1. c
2. d
3. c
4. d
5. a
6. b
7. d
8. d

Progress Checks (Lesson 5.4)

1. b
2. a
3. d
4. a
5. d

Module 6

Air Navigation Services (ANS)

6.0 Air Navigation Services (ANS)

Module Learning Objectives

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

- List and describe the three types of air navigation services. (Lesson 1)
- Describe the structure of controlled airspace. (Lesson 2)
- List and describe the three types of air traffic control services. (Lesson 2)
- Describe what is meant by navigation facilities. (Lesson 3)
- Describe the new provider of Air Navigation Services. (Lesson 3)

Module Overview

In this module, we will describe today's crowded airways and have a "behind the scenes" look at Air Navigation Services (ANS), their requirements and what services are provided to ensure the safety of aircraft both in the air and on the ground. We will gain a greater understanding of what happens on the airside (controlled access part of the airport) and how it affects the ability of pilots to safely navigate the skies and taxiways. We will examine the structure of airspace and the various classification systems that apply.

6.1 Overview of Air Navigation Services

Lesson Learning Objectives

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

- List and describe three types of air navigation services.
- Describe the difference between Instrument Flight Rules and Visual Flight Rules.
- Describe what is meant by separation of aircraft.

Lesson Overview

This lesson provides an introduction to air navigation services. The three types of services that make up air navigation services are air traffic control, flight information and alerting services. In this lesson, we will discuss a few basic concepts regarding air traffic control services. We will introduce the two different types of flight rules and the concept of separation of aircraft.

Key Learning Point

The three types of services that make up air navigation services are air traffic control, flight information and alerting services.

6.1.1 Types of Navigation Services

All types of transportation need control services to manage their movement through the various systems in which they function. For example, road transport uses traffic signals, road signs and others. There are, however, some key differences that apply to air transportation. First, unlike ground or sea transport, aircraft cannot stop and wait for information or direction while in transit. Second, the global scope of aviation needs more international cooperation than any other mode of transportation. These factors have led to the development of a fine-tuned system of air navigation services.

Currently, air navigation services are comprised of air traffic control, flight information and alerting services. Air traffic control involves managing the airport movements of airside vehicles and aircraft, both on the ground and in the air. Flight information services provide the information pilots need to decide whether flights can be conducted safely and efficiently. Finally, alerting services notify appropriate organizations when an airplane is missing or in trouble.

The original function of air navigation services was to control air traffic. When the density of air traffic increased, especially around airports, it was necessary to institute measures to keep in-flight safety a priority. Control towers were given the responsibility to prevent collisions both on the ground and in the air near airports.

Did You Know?

One form of horizontal separation is called lateral separation. Lateral separation spaces two aircraft at the same altitude side by side instead of one behind the other.

Their purpose was also to ensure a smooth flow of traffic. With these responsibilities came the need for radio communication between pilots and air traffic controllers. This communication began with the installation of radio transmitters and receivers.

Air traffic control remains the most important responsibility of Service Providers. Before exploring this topic in more depth, it is important to understand the basic concepts involving navigation and separation of aircraft. We will review flight information and alerting services, the two other types of air navigation services, later in this module.

6.1.2 Navigation Basics

Quite simply, there are two ways for a pilot to navigate an airplane. The pilot can look out the window, remaining clear of any cloud formations, and use landmarks and maps as a guide while checking the surroundings for other aircraft. The use of only these visual references to fly aircraft has severe limitations. Poor weather conditions, for example, can make flying dangerous. The alternative, is for the pilot to use instruments located in the flight deck to navigate, while relying on Air Traffic Control (ATC) for the required information.

The pilot has a variety of controls, instruments and navigation aids. The primary flight display or EFIS (Electronic Flight Information System) displays the information regarding the aircraft's situation, position and progress. It mainly covers horizontal and vertical position, but also indicates time and speed. Another part of the flight deck instrument panel displays the aircraft's systems' conditions and engines' performance.

There are two sets of regulations governing all aspects of civil aviation aircraft operations for navigation. Visual Flight Rules (VFR) and Instrument Flight Rules (IFR). Different air navigation services are provided for each type of flight. VFR are the set of rules concerning aircraft flight where the pilot is primarily or exclusively responsible for the observation and avoidance of obstacles. IFR are a set of regulations and procedures for flying aircraft without the assumption that pilots will be able to see and avoid obstacles, terrain and other air traffic.

Under IFR, pilots do not fly their aircraft by visual reference to the ground, nor do they maintain adequate separation from other aircraft visually. Instead, they fly along well-determined air routes, called *airways.* These are, in fact, the highways of the sky. Flying under IFR has 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 takeoff and land by IFR.

Key Learning Point

Visual Flight Rules (VFR) are the set of rules concerning aircraft flight where the pilot is primarily or exclusively responsible for the observation and avoidance of obstacles. Instrument Flight Rules (IFR) are a set of regulations and procedures for flying aircraft under conditions that preclude the use of VFR. Under IFR, pilots do not fly their aircraft by visual reference to the ground, nor do they maintain adequate separation from other aircraft visually.

Air traffic controllers have responsibility for ensuring that airplanes flying IFR maintain minimum distances from other airplanes, thus reducing the likelihood of collisions. The generic term for this action is *separation.* In-flight collisions are avoided by ensuring that horizontal and vertical separation is maintained between aircraft. Vertical separation is obtained by requiring aircraft to operate at different flight levels, or altitudes.

One form of horizontal separation is longitudinal separation, in which the spacing between aircraft is never less than a prescribed minimum.

In conclusion, the most important function of air navigation services is controlling air traffic. Two key objectives are to prevent collisions between airplanes or with other vehicles and obstacles as well as to expedite and maintain an orderly flow of air traffic.

Lesson Summary

Air navigation services are a main function of airside airport operations. The three types of services that make up air navigation services are air traffic control, flight information and alerting services. There are two different types of flight rules: Visual Flight Rules (VFR) are the set of rules concerning aircraft flight where the pilot is primarily or exclusively responsible for the observation and avoidance of obstacles. Instrument Flight Rules (IFR) are a set of regulations and procedures for flying aircraft under conditions that preclude the use of VFR. Under IFR, pilots do not fly their aircraft by visual reference to the ground, nor do they maintain adequate separation from other aircraft visually. Air traffic controllers have responsibility for ensuring that airplanes flying IFR maintain minimum distances from other airplanes, thus reducing the likelihood of collisions. The generic term for this action is *separation.*

Progress Checks (Lesson 6.1)

1. The two key differences between air and other forms of transportation are that aircraft cannot stop and wait for information while in transit and the need for ____________.
   (a) special infrastructure
   (b) special security measures
   (c) international cooperation
   (d) special communication technology
2. Alerting services notify the pilot if a flight can be conducted safely and efficiently.
   (a) True
   (b) False
3. The original function of air navigation services was to ____________.
   (a) control air traffic
   (b) ensure in-flight safety
   (c) ensure a smooth flow of traffic
   (d) prevent collisions on the ground
4. The Electronic Flight Information System displays not only the aircraft's position and speed, but it also indicates ____________.
   (a) progress
   (b) situation
   (c) time
   (d) altitude
5. Under Visual Flight Rules pilots fly their aircraft along well-determined air routes, called airways.
   (a) True
   (b) False
6. In the context of air traffic control the term “separation” refers to ____________.
   (a) the moment when the plane takes off
   (b) the minimum distance between flying airplanes
   (c) the distance between a plane and the runway
   (d) the distance between the plane and destination point

Lesson Learning Objectives

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

- Describe the difference between controlled and uncontrolled airspace.
- List and describe the three areas that make up controlled airspace.
- List and describe three types of air traffic control services.
- Describe the ICAO Airspace Classification scheme.

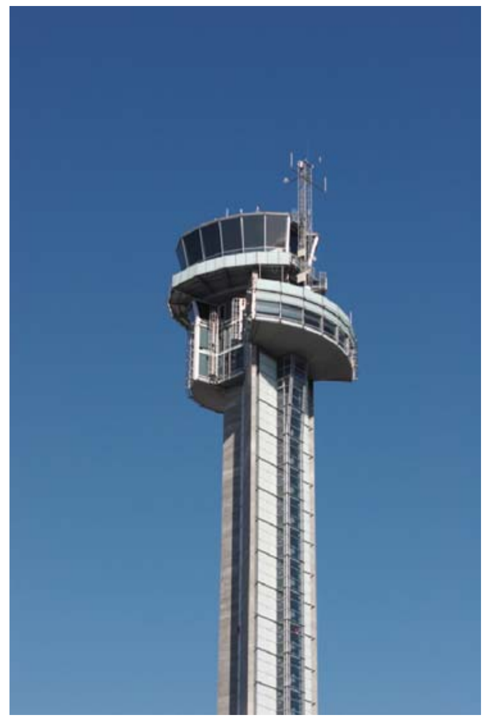
Did You Know?

Croydon Aerodrome (in the United Kingdom) became the first airport in the world to introduce air traffic control in 1921. It was closed in 1952.

6.2 Air Traffic Control (ATC)

Lesson Overview

In this lesson, we will discuss how airspace is structured and how ATC assigns responsibilities based on this structure. We will explain how ICAO has categorized airspace into seven different classes using the two basic airspace designators: "controlled" and "uncontrolled".



6.2.1 ATC Services

ATC towers are facilities located within the airport terminal that use air and ground communications, visual signalling and other devices to provide ATC services to aircraft operating in the vicinity of the airport. They authorize aircraft to land or takeoff at the airport. A tower may also provide approach control services to keep arriving and departing aircraft separate and to correctly sequence arriving aircraft to land.

6.2.2 The Structure of Controlled Airspace

Airspace is designated as "controlled" or "uncontrolled". In *controlled airspace*, air traffic controllers maintain separation between airplanes and terrain. In *uncontrolled airspace,* pilots are responsible for making sure they keep sufficient distance from other airplanes and terrain. Commercial, passenger-carrying airplanes operate almost exclusively inside controlled airspace.

Did You Know?

APPROACH AND LANDING is the single most demanding phase of flight, and the one that carries the highest risk.

In order to effectively manage the responsibilities for controlled airspace, air traffic controllers subdivide it into three areas: Airway, Terminal Control Area and Control Zone.

6.2.2.1 Airways

In controlled airspace, airplanes must fly along published routes called *airways.* As mentioned previously, airways are the highways of the sky. Upon reaching its assigned cruising altitude, an airplane flies along a predetermined flight path. Airplanes are not allowed to deviate from an airway unless authorized to do so by Air Traffic Control.

6.2.2.2 Terminal Control Area

A *terminal control area* is a block of airspace of cylindrical or irregular shape, located at the intersection of several airways, and typically situated at high-density traffic areas near one or more busy airports. The block extends from at least 656 feet (approximately 200 meters) 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.

6.2.2.3 Control Zone

A control zone is a block of airspace of defined dimensions that extends upwards from the surface of the earth and is located above and around an airport. Where there is radar service being provided in the control zone, the radius is seven nautical miles(NM), while other control zones are typically five NM. To manage traffic, the control tower uses a variety of technologies including: radios, radar, computers and signalling devices (when required).

6.2.3 Air Traffic Control Services

In order to carry out its function efficiently, air traffic control provides services for each of the three areas described below.

(a) **Area control service** *(Airways)*: for controlled flights en-route between terminals; it is under the control of an area control center.

(b) **Approach control service** *(Terminal Control Area)*: actual airspace boundaries and altitudes assigned to a terminal control area are based on factors such as traffic flows and terrain, and vary widely from airport to airport. Terminal area controllers are responsible for providing all ATC services within their airspace. As aircraft move in and out of the terminal airspace, they are handed off to the next appropriate control facility (a control tower, an en-route control facility, or a bordering terminal area control). These services are provided under the responsibility of an approach control unit.

Key Learning Point

Air traffic controllers subdivide airspace into three areas: Airway, Terminal Control Area, and Control Zone.

(c) **Airport control service** *(Control Zone)*: tower controllers fall into several categories: ground control (generally includes all taxiways, holding areas and some transitional areas or intersections where aircraft arrive having left the runway or departure gates) and tower control (responsible for active runway surfaces). Tower control clears aircraft for takeoff or landing and ensures the runway is clear for these aircraft; this service is under the responsibility of a control tower.

Each service deals with a different stage of flight and is under the responsibility of a separate unit (see figure below). Once en-route, as an aircraft reaches the boundary of a Center's control area, the aircraft is "handed off" to the next Area Control Center. This process is only a transfer of identification between controllers so that air traffic control services can be provided in a seamless manner. Following the hand off, the aircraft is given a frequency change and begins talking to the next controller. The process continues until the aircraft is handed off to a terminal area controller ("approach").

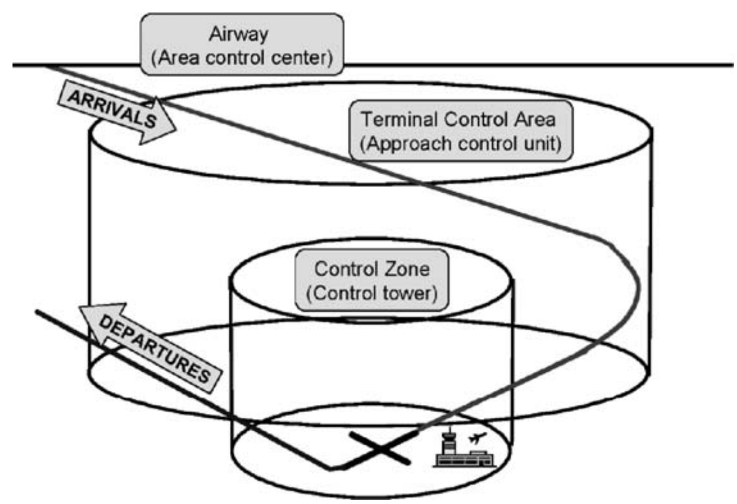


Figure 6.2.3—Airspace and ATC Responsibilities

6.2.4 Description of Air Traffic Services

The Area Control Center (ACC) provides services to controlled flights within a designated controlled area. The ACC assigns a specific altitude and route to an airplane. Air Traffic Control tracks the movements with radar to prevent any risk of collisions. Pilots must request approval before making any change in speed or altitude in order to maintain separation from other airplanes. Air Traffic Control will authorize pilots to take an alternative route to avoid unfavorable weather conditions.

Key Learning Point

The Area Control Center (ACC) provides services to controlled flights within a designated controlled area.

Key Learning Point

The Approach Control Unit (APP) will keep air traffic moving smoothly and safely in the airspace surrounding a major airport.

Key Learning Point

Airport Control directs the pilot in the vicinity of the airport and gives permission to land and takeoff.

The Approach Control Unit (APP) keeps air traffic moving smoothly and safely in the airspace surrounding a major airport. Its main functions are to keep arriving and departing aircraft separate and to correctly sequence arriving aircraft to land. This unit prevents collisions between incoming and outgoing airplanes. It directs departing airplanes to fly away from the airport on different paths from those being used by arriving airplanes. It provides all aircraft flying IFR with control, information and alert services, and is generally located within the control tower building. The tools used by this unit to manage traffic are: radio communication, surveillance radar and computers.

When an approaching airplane is within five or eight kilometers (three or five miles) of the airport, Airport Control takes over from the Approach Control Unit. The tower controller, overlooking the airport and its approaches from a high tower, directs the pilot and gives permission to land.

When flying IFR, pilots receive guidance during the final phase of the flight, called the approach, from electronic devices and personnel in Airport Control. The most common electronic system is the Instrument Landing System (ILS). When using the ILS, the pilot determines aircraft position primarily by referring to instruments. The ILS consists of:

- the localizer transmitter
- the glide path transmitter
- the outer marker
- the approach lighting system.

As mentioned above, in-flight collisions are avoided by ensuring longitudinal, lateral and vertical separation between aircraft. In-flight separation is ensured by a central air traffic control agency.

Countries determine the need for air traffic services in specific areas of their airspace by considering the type and density of air traffic, meteorological conditions and other relevant factors. When demand exceeds capacity in a fixed volume of airspace, it leads to traffic congestion and delays. Service providers adjust airplane routes, departure times and airspeed to manage the flow of traffic and reduce congestion.

6.2.5 Airspace Classifications

According to the airspace classification scheme adopted by ICAO in 1990, airspace is categorized into seven classes. Each is identified by a letter from A to G. The classes are fundamentally defined by flight rules and interactions between aircraft and Air Traffic Control (ATC). Regulations specify the type of flight permitted (IFR, VFR, or SVFR–Special Visual Flight Rules) and the type of air traffic control service provided for each. Special Flight Rules apply in the case of a VFR flight cleared by ATC to operate within a control zone when visual meteorological conditions (VMC) are poor, i.e., in terms of visibility, distance from cloud and ceiling allow.

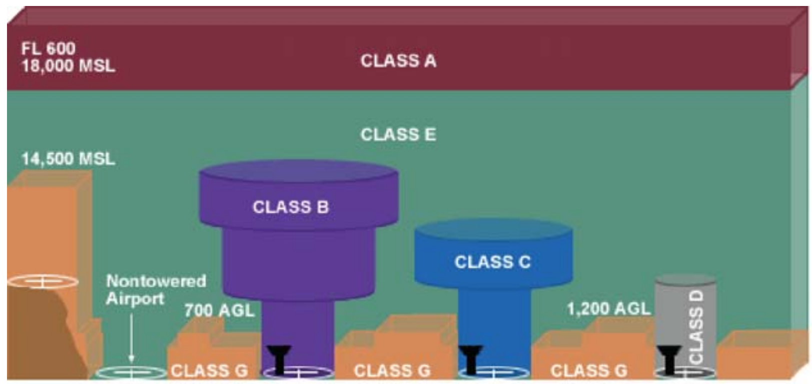
The classifications adopted by ICAO are:

- Class A: All operations must be conducted under Instrument Flight Rules (IFR) or Special Visual Flight Rules (SVFR) and are subject to ATC clearance. All flights are separated from each other by ATC.
- Class B: Operations may be conducted under IFR, SVFR, or Visual Flight Rules (VFR). All aircraft are subject to ATC clearance. All flights are separated from each other by ATC.
- Class C: Operations may be conducted under IFR, SVFR, or VFR. All aircraft are subject to ATC clearance. Aircraft operating under IFR and SVFR are separated from each other and from flights operating under VFR. Flights operating under VFR are given traffic information with respect to other VFR flights.
- Class D: Operations may be conducted under IFR, SVFR, or VFR. All aircraft are subject to ATC clearance. Aircraft operating under IFR and SVFR are separated from each other and are given traffic information with respect to VFR flights. Flights operating under VFR are given traffic information with respect to other VFR flights.
- Class E: Operations may be conducted under IFR, SVFR, or VFR. Aircraft operating under IFR and SVFR are separated from each other and are subject to ATC clearance. Flights under VFR are not subject to ATC clearance. As far as is practical, traffic information is given to all flights with respect to VFR flights.
- Class F: Operations may be conducted under IFR or VFR. ATC separation will be provided, so far as practical, to aircraft operating under IFR. Traffic Information may be given as far as is practical with respect to other flights.
- Class G: Operations may be conducted under IFR or VFR. ATC separation is not provided. Traffic information may be given as far as is practical with respect to other flights.
- Separation: Maintaining a specific minimum distance between aircraft and from terrain to avoid collisions, by requiring aircraft to fly at set altitudes, on set routes at set speeds.
- Clearance: Permission given by ATC for an aircraft to proceed under certain conditions contained within the clearance.
- Traffic Information: Information given by ATC on the position and, if known, intentions of other aircraft likely to pose a hazard to flight.

Classes A-E are referred to as controlled airspace. Classes F and G are uncontrolled airspace. Each national aviation authority determines how it uses the ICAO classifications in its airspace design. In some countries, the rules are modified slightly to fit the airspace rules and air traffic services that existed before the ICAO standardization.

Key Learning Point

ICAO's seven airspace classes are fundamentally defined in terms of flight rules and interactions between aircraft and Air Traffic Control (ATC).



Airspace Features	Class A	Class B	Class C	Class D	Class E	Class G
ATC Facility	ARTCC	TRACON	TRACON or ATCT	ATCT	ARTCC	None
Operations Permitted	IFR	IFR & VFR	IFR & VFR	IFR & VFR	IFR & VFR	IFR & VFR
Entry Requirements	ATC Clearance	ATC Clearance	ATC Clearance for IFR. All require radio contact	ATC Clearance for IFR. All require radio contact	ATC Clearance for IFR. All require radio contact	None
VFR Minimum Distance from Clouds	N/A	Clear of clouds	500' below, 1,000' above, and 2000' horizontal	500' below, 1,000' above, and 2000' horizontal	500' below, 1,000' above, and 2000' horizontal	Clear of clouds
Aircraft Separation	All	All	IFR, SVFR, and runway operations	IFR, SVFR, and runway operations	IFR and SVFR	None

Courtesy of FAA

Figure 6.2.5—Airspace Classifications.

Lesson Summary

The responsibility for the control service provided by air traffic controllers falls under the function of ATC. In order to manage the airspace it is necessary to structure it. Air traffic controllers subdivide airspace into three areas: Airway, Terminal Control Area and Control Zone. The ATC assigns responsibilities based on this structure. The Area Control Center (ACC) provides services to controlled flights within a designated controlled area. The Approach Control Unit (APP) will keep air traffic moving smoothly and safely in the airspace surrounding a major airport. Airport Control directs the pilot in the vicinity of the airport and gives permission to land and takeoff. ICAO's seven airspace classes are fundamentally defined by flight rules and interactions between aircraft and Air Traffic Control (ATC).

Progress Checks (Lesson 6.2)

1. The key difference between controlled airspace and uncontrolled airspace is that in the former air traffic controllers maintain separation between airplanes and the ground.
   (a) True
   (b) False

2. Air traffic controllers subdivide controlled airspace into three areas: Airway, Terminal Control Area and ______________.
   (a) Control Zone
   (b) Separation Zone
   (c) Controlled Airspace
   (d) Movement area

3. Upon reaching their assigned cruising altitude, airplanes are not allowed to deviate from an airway unless ______________.
   (a) they need to avoid air turbulence
   (b) they can shorten the flying time
   (c) they are authorized to do so by Air Traffic Control
   (d) a medical emergency has occurred on board

4. Pilots must request approval before making any change in altitude, but not in speed, in order to maintain separation from other airplanes.
   (a) True
   (b) False

5. Which entity takes over control when an approaching airplane is within five or eight kilometers (three or five miles) of an airport?
   (a) Air Traffic Control
   (b) Approach Control Unit
   (c) Area Control Center
   (d) Airport Control

Lesson Learning Objectives

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

- List what is included in Flight Information Services.
- Explain what is included in Alerting Services.
- Describe what is meant by Air Navigation Services.
- Describe the new provider of Air Navigation Services (ANS).

Key Learning Point

Flight Information Services provide the information a pilot needs to determine whether the flight can proceed safely.

6.3 Additional Air Navigation Services, Facilities and Providers

Lesson Overview

In addition to air traffic control, air navigation services include flight information and alerting services; these will be discussed in this lesson. We will also elaborate on what is included in navigation services. Finally, we will discuss the privatization of Air Navigation Services and the evolution of independent Service Providers.

6.3.1 Flight Information Services and Alerting Services

Flight Information Services provide the information a pilot needs to determine whether the flight can proceed safely. Flight information includes weather conditions, changes in serviceability of navigation aids, changes in airport conditions or associated facilities, collision hazards and any other information likely to affect safety. It is used as required by the pilot.

The Alerting Services task is to notify appropriate organizations when an airplane is missing or in trouble. Emergency assistance is provided when an airplane is low on fuel, involved in a hijacking, overdue or missing. When an airplane is overdue or missing, a search is initiated to determine when the airplane last communicated with an ATC facility. Flight information centers or area control centers serve as the central point for collecting all information relevant to the state of emergency within the concerned flight information region or control area.

If an airplane has an emergency while it is under the control of an airport control tower or approach control unit, the unit will alert all local rescue and emergency organizations which can assist as required. The airport control tower will then take the next steps to activate the emergency response. They will notify the flight information center or responsible area control center, which will in turn notify the rescue coordination center.

Key Learning Point

The Alerting Services task is to notify appropriate organizations when an airplane is missing or in trouble.

Key Learning Point

Any equipment, system or manned unit that provides a pilot with information to enable him/her to reach the intended destination safely and on-time falls into the category of air navigation facilities.

6.3.2 Air Navigation Facilities

Air Navigation Facilities is defined as any facility used in aid of air navigation. These include landing areas, lights, equipment used for weather information, signalling, for radio-directional finding and any other structure or mechanism having a similar purpose for guiding or controlling flight in the air or the landing and takeoff of aircraft.

Air navigation services provide electronic navigation facilities on the ground. These enable airplanes with suitable navigation receivers to know their position at all times and to navigate from departure to destination. They are gradually being replaced by navigation systems using satellites that orbit around the earth. It is expected that, eventually, all aviation navigation and communications will rely on satellite systems. The launch of the first two operational satellites of the EU's global navigation satellite system took place in October 2011. This is just the first of a series of launches due to takeoff from Europe's Space Port.

Navigation aids and communication systems progressed quickly from the early days of aviation. This is due partly to industry partners such as the International Telecommunications Union (ITU), the World Meteorological Organization (WMO) as well as vendors including Aeronautical Radio Inc. (ARINC), which has been associated with the industry almost as long as it has existed, and relative newcomer Inmarsat, for satellite systems. The air transportation system now has a network of navigation, communication and surveillance facilities covering most of the world.

Satellite technology has brought accuracy and flexibility to navigation and greatly increased the range and quality of communication. But as is the case with any new technology, the issues of standardization and transition need to be considered. ICAO has a very important role to play in the global implementation of the new Communications, Navigation, Surveillance/Air Traffic Management (CNS/ATM) systems. Its role is to ensure that standards are developed for these new systems.

Did You Know?

Galileo is Europe's global navigation satellite system providing a highly accurate, guaranteed global positioning service under civilian control. Galileo will begin to provide services in 2014/2015 based on an initial constellation of 18 satellites. The Galileo satellites will be launched to an altitude of 23,600 km. Other launches will complete the constellation by 2019.

ICAO also provides a forum for reaching consensus on uniform standards and equipment and, at the same time, ensuring compatibility with current systems until any required transitions are complete. The future is an integrated system of global communication, navigation and surveillance functions with a modern, efficient Air Traffic Management system.

6.3.3 Air Navigation Service (ANS) Providers

Traditionally, air navigation services were provided by the government and paid for with taxes. The International Civil Aviation Organization (ICAO) is encouraging the formation of independent, private organizations to provide this service (i.e., Air Navigation Service Providers) and many countries have taken this step, or are planning on doing so through privatization efforts. Each sovereign government, however, is still responsible for the safety of air navigation within its airspace and must regulate these organizations.

The International Air Transport Association (IATA), speaking on behalf of the majority of the world's international scheduled carriers, encourages safe, efficient and cost effective ATC. The ultimate goal is to avoid high ATC charges which, in turn, would allow airlines to keep prices at a reasonable level. As in any market economy, if a commercial entity (in this instance the airlines) is to remain in business, it must factor all costs into the price of its service. This includes the cost of air navigation services which is levied as part of the ticket price.

ICAO has made several recommendations for establishing a system of charges that is fair to both service providers and users. It recommends that fees for air navigation services be based on the costs required to provide the services, including buildings, equipment and maintenance as well as staff salaries, with enough profit to pay for improvements.

Each country chooses the way it will privatize its air navigation services and regulate charges. Because ANS providers enjoy a monopoly, it is important for governments to develop regulations and perform inspections to guarantee efficient, economic service that treats all users fairly.

Lesson Summary

In addition to air traffic control, air navigation services include flight information and alerting services. Flight Information Services provide the information a pilot needs to determine whether the flight can continue safely. The Alerting Services task is to notify appropriate organizations when an airplane is missing or in trouble. Any equipment, system or manned unit that provides a pilot with information to enable him/her to reach the intended destination safely and on-time falls into the category of air navigation facilities. ICAO is encouraging the formation of independent, private organizations to become Air Navigation Service Providers.

Progress Checks (Lesson 6.3)

1. Air navigation services enable airplanes with suitable navigation receivers to know their position at all times and to navigate from departure to destination.
   (a) True
   (b) False

2. Traditionally, air navigation services were provided by ____________.
   (a) IATA subsidiaries
   (b) ICAO subsidiaries
   (c) government agencies
   (d) private enterprise

3. When an airplane is overdue or missing, the central points for collecting all information relevant to the state of emergency are the ____________.
   (a) flight information centers
   (b) airport control towers
   (c) approach control units
   (d) air control centers

4. Currently, the air transportation system has a network of navigation, communication and surveillance facilities that cover ____________.
   (a) one third of the world
   (b) half of the world
   (c) most of the world
   (d) the whole world

5. The main challenge of navigation systems using satellites is ____________.
   (a) quality of communication
   (b) standardization
   (c) flexibility
   (d) accuracy

6. Current Air Navigation System providers operate in a very competitive environment.
   (a) True
   (b) False

Module Summary

The three types of services that make up air navigation services are air traffic control, flight information and alerting services. The most important type is air traffic control services, which are provided through control towers, approach control units and area control centers. Their main tools are radios, radars and computers. Flight Information Services provide the information a pilot needs to decide whether the flight can proceed safely. The Alerting Services, task is to notify appropriate organizations when an airplane is missing or in trouble.

Visual Flight Rules (VFR) are the set of rules concerning aircraft flight where the pilot is primarily or exclusively responsible for the observation and avoidance of obstacles. Instrument Flight Rules (IFR) are a set of regulations and procedures for flying aircraft without the assumption that pilots will be able to see and avoid obstacles. ICAO's seven airspace classes are fundamentally defined in terms of these flight rules and interactions between aircraft and Air Traffic Control (ATC).

The Area Control Center (ACC) provides services to controlled flights within a designated controlled area. The Approach Control Unit (APP) will keep air traffic moving smoothly and safely in the airspace surrounding a major airport. Airport Control directs the pilot and gives permission to land.

Any equipment, system or manned unit that provides a pilot with information to enable him/her to reach the intended destination safely and on-time falls into the category of air navigation facilities.

ICAO is encouraging the formation of independent, private organizations to become Air Navigation Service Providers, and many countries are doing this through privatization efforts.

Apply Your Learning

If you have access to the airside of an airport terminal, find the location of the control tower, which provides control, information and alert services to all aircraft in flight and control service to all vehicles on the ground.

If possible, arrange to see how the control tower operates. Try to observe the variety of technologies used, including radios, radar, computers and signalling devices.

Answer Key

Progress Checks (Lesson 6.1)

1. c
2. b
3. a
4. c
5. b
6. b

Progress Checks (Lesson 6.2)

1. a
2. a
3. c
4. b
5. d

Progress Checks (Lesson 6.3)

1. a
2. c
3. a
4. c
5. b
6. b

Module 7

Airplanes and Flight

IATA Training & Development Institute
KNOWLEDGE • EXPERIENCE • NETWORKING • SKILLS • RESULTS

Module Learning Objectives

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

- Describe the five main parts of an airplane. (Lesson 1)
- Describe how the principles of gravity and lift help an airplane fly. (Lesson 1)
- Describe how the principles of drag and thrust help an airplane fly. (Lesson 1)
- Describe four leading aircraft manufacturers. (Lesson 2)
- Describe three types of common airliners. (Lesson 3)

7.0 Airplanes and Flight

Module Overview

In this module, we will examine the basic components of an airplane. We will learn about today's leading aircraft manufacturers and the types of planes currently used by commercial airlines. We will answer questions such as: What makes an airplane fly? How do planes as huge as the A-380 and the B-747 get off the ground? To answer these questions, we will explain the basic principles of flight, including the essential terms, expressions and concepts that are the essence of flight.

Airbus 380, Courtesy of Airbus

Lesson Learning Objectives

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

- List the five main parts of an airplane and describe the function of each.
- List the parts of an airplane that make up the airframe.
- Describe how the principles of gravity and lift help an airplane fly.
- Describe how the principles of drag and thrust help an airplane fly.
- List and describe three movements an airplane can make.

Key Learning Point

All airplanes have the same basic parts: 1) wings, 2) fuselage, 3) tail assembly, 4) landing gear, and 5) engine(s).

7.1 Introduction to Airplanes and How They Fly

Lesson Overview

In this lesson, we will explain how airplanes get off the ground and stay in the air. Once we have covered these concepts, we will demonstrate a sample "test flight" to put into practice what we have discussed.

7.1.1 Parts of an Airplane

Airplanes have the same basic parts regardless of their shape and size: 1) wings, 2) fuselage or body, 3) empennage or tail assembly, 4) landing gear, and 5) engine(s). These parts, with the exception of the engine, make up a plane's *airframe.* Before we learn about how planes fly, we'll take a closer look at each of these main parts.

The figure below illustrates the parts of an airplane and their functions. The airplane shown is a turbine-powered airliner. This configuration was chosen only as an example. Individual aircraft may be configured quite differently from this airliner, but they will still have the same basic parts.

Did You Know?

Wings can have various shapes, depending on the type of plane for which they are designed. Straight wings perform best at both high and low speeds. Many high-speed airplanes, especially jets, have swept back wings. These slant backward from the root to the tip. Delta wings, shaped like a triangle, are used on some jet fighters to provide high speed and lift.

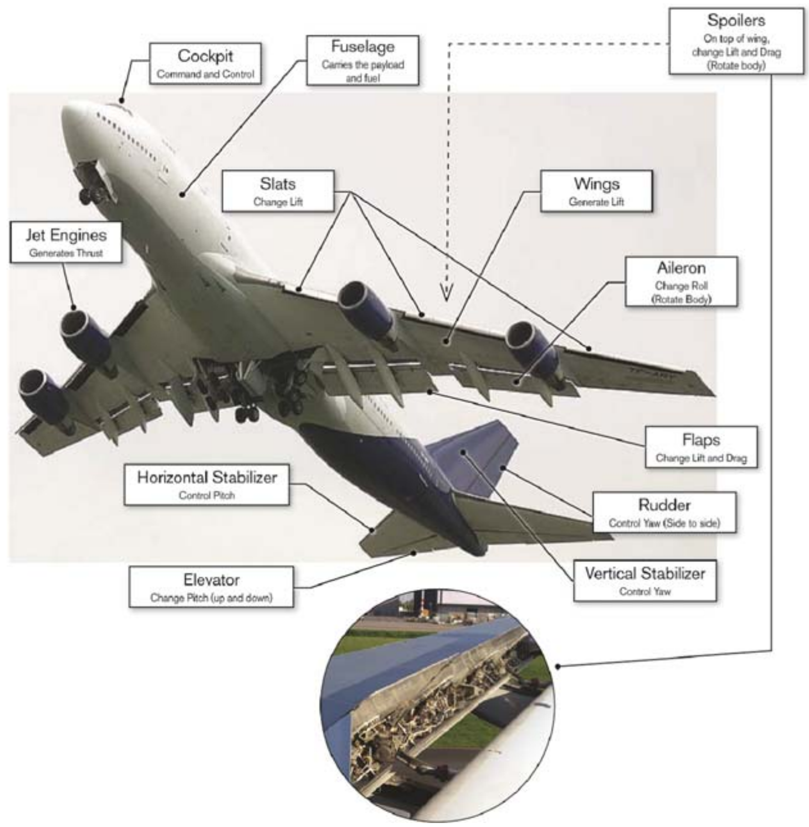


Figure 7.1.1—Parts of Aircraft

The *wings* of an airplane extend outward from each side of the body of the plane, called the fuselage. A wing has a curved top and a nearly flat bottom. This shape helps create the lift that raises an airplane off the ground and keeps it in the air. Wings are usually metal and cantilever (i.e., attached only at one end), completely supported by the fuselage.

The wings have additional hinged, lift-producing surfaces called *flaps.* Flaps are deployed downward on takeoff and landing to increase the amount of lift produced by the wing. On some aircraft, flaps are integrated into both the leading and trailing edges of the wing. Slats are another type of lift producing surface, installed solely on the leading edge, which are also used at takeoff and landing. The spoilers, located on top of the wing, are used to reduce the amount of lift created by the wing once the aircraft has landed. The next time you fly on an airplane, notice how these components change the wing shape during takeoff and landing.

The *fuselage,* or body, of the airplane extends from the nose to the tail. Most have a tube-like shape and are covered with a lightweight skin consisting of either aluminium or, on newer aircraft, a composite material. The fuselage contains the controls, crew, passengers and cargo. Commercial aircraft normally have a flight deck for the flight crew, a cabin for the passengers and separate cargo compartments. The engine on most single-engine planes is located in the front part of the fuselage. On multi-engine aircraft, the engines are either attached to the wings or are located at the rear of the fuselage, or both. The fuel is typically carried in the wings as well as in the fuselage. Long-range aircraft may carry additional fuel in tanks located in the tail section.

The tail assembly, or *empennage,* is the rear part of the airplane. Control surfaces on the empennage help to control and manoeuvre the aircraft. The tail usually has a fixed horizontal piece (called the *horizontal stabilizer)* and a fixed vertical piece (called the *vertical stabilizer).* The stabilizers' job is to provide stability for the aircraft, to keep it flying straight. The vertical stabilizer keeps the nose of the plane from swinging side to side, while the horizontal stabilizer prevents an up-and-down motion of the nose.

At the rear of the horizontal and vertical stabilizers are small moving surfaces that provide a means of controlling and manoeuvring the airplane. The hinged part of the vertical stabilizer is called the *rudder* and is used to steer the plane left and right. The hinged part of the horizontal stabilizer is called the *elevator* and is used to move the plane up and down.

The *landing gear,* or undercarriage, of an airplane consists of the wheels (or floats) upon which it moves when on the ground (or in the water). The landing gear also supports the weight of the plane on the ground or in the water. Planes designed for use on land usually have a tricycle-configuration landing gear, which is made up of a main gear, with as many as 12 wheels under each of the wings, and a nose gear with one or more wheels. Landing gear may be fixed or retractable. A fixed landing gear remains extended in flight, while a retractable one is retracted into either the wings or the fuselage after takeoff. Fixed landing gear create drag, which can slow down the plane, so most high-speed planes are designed with retractable landing gear.

An airplane's engine produces the power, or thrust, that makes the plane fly. Jet *engines* enable large airplanes to fly long distances at high speeds. A jet engine takes in air at low speed or velocity. The air is compressed and then burned with jet fuel in a combustion chamber, forming a high-velocity jet exhaust. This causes the engine to move forward at an equally high speed. Before the exhaust passes out of the engine's tail pipe, it spins a turbine wheel. This turbine runs the different parts of the engine.

Key Learning Point

Four basic forces act on an airplane in flight: gravity, lift, drag and thrust.

Did You Know?

Try this!

Let's try a small experiment to see if air really exerts a force and why it matters. Get yourself two pieces of paper (or cut a page in half). Crumple up one piece into a ball and leave the other piece flat. Hold one in each hand. Now, drop both pieces of paper at the same time and watch what happens. Which piece of paper fell the fastest? Was it the crumpled paper ball? Why? Simply because the ball of paper has a smaller surface area. Thus, it is subjected to less wind resistance and falls faster! So, air exerts a force, but how can air, which is so light, support a huge airplane?

Did You Know?

A 747 weighs up to 870,000 pounds at takeoff. After takeoff, its range is 7,260 nautical miles which is 13,450 km. The range of an aircraft is the distance it can fly without stopping to refuel.

7.1.2 How Planes Fly

We will look at how a plane takes off, stays in the air and lands safely. It all starts with an understanding of the power of air. The next time you ride in a vehicle, if the window opens, try putting your hand outside the moving vehicle. Now, rotate your wrist. Did you feel the air pressure lift you hand slightly? Well, that is the power of air and movement to lift an object heavier than air…your hand.

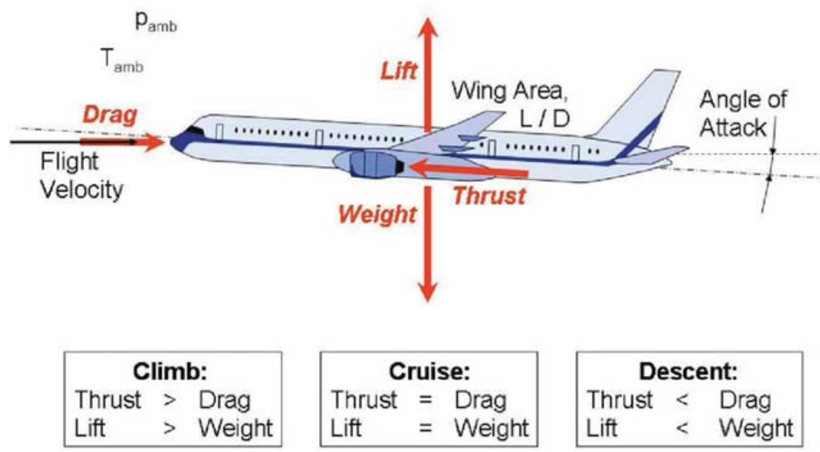


Figure 7.1.2—The Four Forces Acting on an Aircraft in Flight

To understand flight, we must learn about the four basic forces that act on an airplane in flight: gravity, lift, drag and thrust. Gravity is the natural force that pulls everything towards the center of the earth. Lift is the mechanical force that pushes a plane upward, against the gravitational pull. The movement of a plane's wing through the air creates lift. Drag is the force of air opposing the forward movement of the airplane. Thrust is the force that opposes drag and moves the plane forward. The plane's engines or propeller create this thrust.

7.1.2.1 Gravity and Lift

For any airplane to fly, the weight of the airplane as well as the fuel, the passengers and the cargo must be lifted into the air. The wings generate most of the lift to hold the plane in the air. To generate lift, the airplane must travel through the air. Lift is created by the difference in air pressure on the top and the bottom of the wing as the plane moves along the ground or through the air. Overall pressure on the top of a lift-producing wing is lower than that on the bottom of the wing, and it is this net pressure difference that creates the lifting force. The curved top and a nearly flat bottom of an airplane wing helps create the lift that raises an airplane off the ground and keeps it in the air. For a plane to become airborne and to stay in the air, its wing must create a lifting force greater than the downward force of gravity.

Did You Know?

The B-777LR (Long Range) Worldliner is the world's longest range aircraft. It can carry 301 passengers up to 9,420 nautical miles (17,445 kilometers). It was brought into service in January 2006.

In general, the wings on most planes are designed to provide an appropriate amount of lift (along with minimal drag), while the plane is operating in its cruising mode (about 560 miles per hour, or 901 km per hour, for the Boeing 747-400). However, when these airplanes are taking off or landing, their speeds can be reduced to less than 160 miles per hour (259 kph). To accommodate both flight modes (fast and high as well as slow and low), the moveable control surfaces on the airplane wings come into use. During takeoff and landing, the flaps on the wings are extended rearward and downward from the trailing edge of the wings. Most jet aircraft also have flaps and/or slats on the leading edge of the wing that extend in a similar manner during takeoff and landing. This effectively alters the shape of the wing, allowing the wing to turn more air and thus create more lift.

7.1.2.2 Drag and Thrust

A wing produces lift only if it is moving through the air. The engine(s) provide the thrust to push the airplane forward through the air. The air resists the motion in the form of aerodynamic drag. Increased thrust will move a plane forward faster. As a plane's speed increases, however, drag increases as well. This is why airplanes are designed to be as aerodynamic as possible, in order to slip through the air more easily. To oppose drag, more thrust is required. In a jet airplane, it is the rapid movement of gases through the jet engine that produces thrust. The faster the jet engine works, the greater the force of the thrust. When thrust exceeds drag, the plane will accelerate. When drag exceeds thrust, the plane decelerates. When a plane is cruising at a constant speed and altitude, thrust and drag are said to be “balanced”.

A jet engine, also known as a gas turbine or continuous combustion engine, is a rotary engine that extracts energy from a flow of combustion gas. Early gas turbine engines worked much like a rocket engine, creating a hot exhaust gas which was passed through a nozzle to produce thrust. While rocket engines carry oxygen for combustion, the turbine engine gets its oxygen from the surrounding air. It has an upstream compressor coupled to a downstream turbine, and a combustion chamber in-between. Energy is released when air is mixed with fuel and ignited in the combustor. Combustion increases the temperature, which in turn increases the pressure, resulting in an increase in the velocity and volume of the gas flow. This is directed through a nozzle over the turbine's blades, spinning the turbine and powering the compressor. Most modern, high-speed passenger aircraft are powered by gas turbine engines.

Turbojet engines take a relatively small mass of air and accelerate it by a large amount, whereas a propeller takes a large mass of air and accelerates it by a small amount. The high-speed exhaust of a jet engine makes it efficient at high speeds and high altitudes. On slower aircraft and those required to fly short stages, a gas turbine-powered propeller engine, commonly known as a turboprop, is more common and more efficient. This is not a jet, a gas turbine engine is used as power plant to drive a propeller shaft. Very small aircraft generally use conventional piston engines to drive a propeller, but small turboprops are getting even smaller as engineering technology improves. A turboprop engine drives one or more propellers.

7.1.3 Changing Altitude and Direction

When an airplane is cruising in level flight, it has balanced lift against gravity and thrust against drag. In order to climb, the pilot must increase the amount of lift produced by the wing. Therefore, the pilot increases the plane's angle of attack, that is, the angle at which the plane flies through the air. The pilot raises the nose of the airplane slightly so that the wing is at an upward angle to the flight path, thereby increasing lift. In addition to lift, this produces additional drag. The pilot then increases engine power to gain more thrust to balance the drag and to ensure that adequate airspeed is maintained.

To descend, the pilot must decrease the engine power, reducing the plane's thrust. As the speed reduces, the amount of lift produced also decreases and the airplane starts to move downward. Meanwhile, drag increases its effect. This further slows down the airplane and adds to the rate at which the plane descends.

To turn a plane, a pilot increases the lift on one wing or the other. To make a left turn, for example, the pilot will increase lift on the right wing, putting the airplane into a left bank (i.e., the left wing dips lower than the right one). Lift will always occur at a right angle to the surface of the wing. It is the lifting force of the wing, which occurs at an angle to the horizon, which makes an airplane turn.

When any one of the four forces (i.e., lift, gravity, drag, thrust) changes, the airplane will turn, climb or otherwise change its position or direction. If, for example, the amount of drag becomes greater than the amount of thrust, the plane will slow down. If the thrust is increased, so that it is greater than the drag, the plane will speed up. Similarly, if the amount of lift drops below the weight of the airplane, the plane will descend. By increasing the lift, the pilot can make the airplane climb.

7.1.4 Flying an Airplane

Airplanes have three basic movements: *pitch, roll,* and *yaw.* Pitch is the movement of the plane as its nose moves up or down. A roll occurs when one wingtip dips lower than the other. Yaw is the movement of the plane as its nose turns left or right. The pilot can use the plane's controls to make these movements.

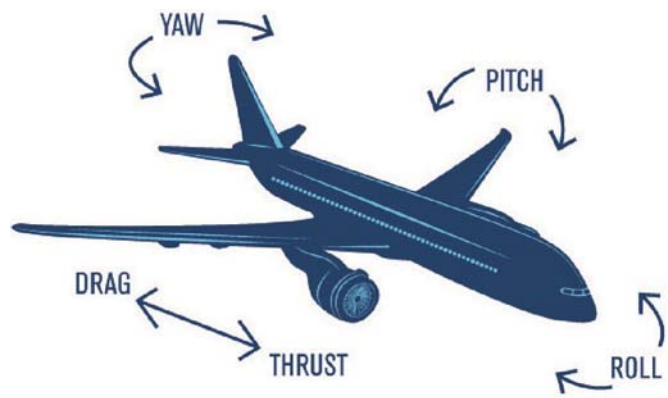


Figure 7.1.4—An airplane's basic movements

Key Learning Point

When any one of the four forces (i.e., lift, gravity, drag, thrust) changes, the airplane will turn, climb or otherwise change its position or direction.

An airplane's four basic controls are the ailerons, the elevator, the rudder and the throttle. The ailerons are on the wings, while the elevator and rudder are part of the tail assembly. The pilot uses the throttle to control the engine's power and speed. A mechanical system of cables, rods and pulleys leads from the outside controls to the cockpit controls of the pilot. Newer commercial transport aircraft are designed with "fly-by-wire" technology. Fly-by-wire means that computers on the plane transmit the pilot inputs into electrical signals that are sent through wires to actuators that move the control surfaces.

To make a plane pitch, the pilot raises or lowers the elevator, the hinged part of the horizontal stabilizer. The aileron, the control surface on the trailing edge of the wing, is used to roll the wings and cause the aircraft to turn. The pilot operates two pedals that control the rudder in conjunction with use of the ailerons when the aircraft is turning.

7.1.5 Ready to Fly?

Key Learning Point

Airplanes have three basic movements: pitch, roll and yaw.

Let's pretend for a moment that you are the captain of a passenger airliner.…Even before you leave for the airport, you will need to check the weather conditions–ceiling height (clouds), wind direction, temperature and barometric pressure. On your arrival at the airport, you plan your route with the aid of a chart detailing the navigation beacons and major landmasses. A flight plan is normally registered and approved by the ground controller and you receive the manifest list. Before passengers and cargo are loaded, you will need to inspect your plane for damage and sign-off your approval.

Did You Know?

The “right of way” rules in the air are similar to those on the ground, but as aircraft operate in three dimensions, some additional rules are required. When two aircraft come together at approximately the same level, the aircraft on the right has the right of way, except that airplanes must always give way to gliders, balloons, airships and to aircraft that are towing objects. An aircraft overtaking you on the right must give you the right of way and the overtaking aircraft must remain clear by altering its course to the right. When two aircraft are approaching each other head-on they must both alter heading to the right. (ICAO Annex 2: Rules of the Air)

You take the captain's seat in the cockpit (on the left). You will review the checklist with your co-pilot (in the right seat). Once you are both satisfied, you signal to air traffic control that you are ready for departure by requesting a clearance to either pushback or taxi away from the gate. As the captain, you are now the ultimate authority on board responsible for all passengers, the airplane and your crew.

While moving on the ground, the direction of your plane is controlled primarily by a tiller in the cockpit that turns the nose wheel in the direction you need to go. Brakes are applied through foot pedals. As you are navigating on the apron to the takeoff point, the ground controllers issue taxi instructions to direct you to your departure runway.

As you turn onto your departure runway, the local tower controller issues clearance for altitude and direction route from the airfield. The non-flying pilot acknowledges the controller while the flying pilot increases power to the engines. The runway rushes by until rotation speed is reached–then pull back and you are airborne. Remember–pull up (retract) your landing gear once the aircraft has begun to climb, as you need to reduce drag so the aircraft can accelerate and gain altitude more easily.

Leaving the airport terminal area, you will be instructed to contact a departure controller located in a radar facility for further clearance. The authority to fly in a given “airway” is given by each air traffic control sector. Each air traffic control sector has regional authority and stacks aircraft over its sector according to speed and altitude. On long distances over land, you may fly through several regional air traffic facilities, receiving revised route or altitude clearances, weather reports or traffic advisories as you go.

As you near your destination, your approach is initially overseen by an approach control facility, which places all aircraft arriving into the terminal airport area in a sequence with adequate separation to ensure a safe flow of traffic to the runway. Control of the flight is transferred to the airport tower approximately 10 nautical miles from the runway. You are given information as to the wind direction, weather conditions, which runway to use, the runway exit and the gate number.

As you enter final approach, you monitor and control airspeed, flaps, and altitude. The tower controllers are also monitoring your approach to ensure proper separation from other aircraft. With landing gear down and locked, your touch down is finalized with a sudden screech of rubber as your wheels hit the runway. As you roll down the runway, reverse thrust is activated to deflect a portion of the engine thrust forward, helping the aircraft to decelerate. You steer your aircraft using the plane's nose wheel steering and tail rudder in order to keep the aircraft on the runway centerline. Applying breaks to the landing gear, you reach your preassigned exit marker at a low speed to permit a safe turnoff. You steer onto the apron and follow the gate markers. As you approach your assigned gate, the ground crew signal your alignment to the gate position with orange signalling batons.

You apply your parking brakes and shut down your engines, confirming this as you accomplish the postflight checklist with your co-pilot.

Congratulations–you have done a great job on your first flight!

Lesson Summary

All airplanes have the same basic parts: 1) wings, 2) fuselage or body 3) empennage or tail assembly, 4) landing gear, and 5) engine(s). Four basic forces act on an airplane in flight: gravity, lift, drag and thrust. Gravity is the natural force that pulls everything towards the center of the earth. Lift is the mechanical force that pushes a plane upward, against the gravitational pull. The movement of a plane's wing through the air creates lift. Drag is the force of air opposing the forward movement of the airplane. Thrust is the force that opposes drag and moves the plane forward. Depending on the aircraft type, the plane's engines or propeller create this thrust. Airplanes have three basic movements: pitch, which is the movement of the plane as its nose moves up or down; roll, which occurs when one wingtip dips lower than the other; and yaw, the movement of the plane as its nose turns left or right.

Progress Checks (Lesson 7.1)

1. Another word for fuseIage is______________.
   (a) chassis
   (b) tail
   (c) body
   (d) empennage

2. The curved top and a nearly flat bottom of an airplane wing helps create the lift that raises an airplane off the ground and keeps it in the air.
   (a) True
   (b) False

3. The main function of the flaps is to______________.
   (a) manoeuvre the aircraft
   (b) increase the amount of lift
   (c) provide stability to the aircraft
   (d) prevent an up-and-down motion of the nose

4. Which of the following is NOT one of the four basic forces that act on an airplane in flight?
   (a) gravity
   (b) drag
   (c) thrust
   (d) resistance

5. In order to climb, the pilot must increase______________.
   (a) the plane's angle of attack
   (b) the lift on one wing
   (c) the plane's drag
   (d) the plane's roll

6. The plane's nose turning left or right is the plane's ____________________________.
   (a) thrust
   (b) pitch
   (c) roll
   (d) yaw

7.2 Today's Airframe Manufacturers

Lesson Overview

This lesson will introduce the main aircraft manufacturers used by airlines today. It will describe who they are, give a brief history and list some of their current aircraft models. The stories of these airframe manufacturers are fascinating and reveal an important part of the history of aviation.

Lesson Learning Objectives

By the end of this lesson, you should be able to:

- List and describe the main characteristics of four leading airplane manufacturing companies.

Key Learning Point

There are a variety of aircraft manufacturers and engine manufacturers and they must collaborate to produce the finished product.

7.2.1 Manufacturing Companies

There are a number of manufacturing companies building aircraft today, located throughout most regions of the world. These aircraft manufacturers are more correctly referred to as "airframe manufacturers" since they provide all the components of the airplane except the engines (see previous lesson).

Two of the most famous builders of large commercial airplanes today are Boeing and Airbus. Two of the largest manufacturers of smaller regional jets are Bombardier and Embraer. These are the four manufacturers we will be profiling since they are represented in the greatest number of fleets. Aircraft are very costly and usually remain in service for more than 25 years. Airlines generally retire aircraft when they become too expensive to operate and maintain, or when competitors decide to modernize their fleets.

The table below lists the airframe manufacturers currently in operation. We have also included a list of engine manufacturers.

Airframe Manufacturer	Country
Airbus Industrie	France
Alenia Aermacchi	Italy
Avions de transport régional (ATR)	France
Aviastar-SP	Russia
Boeing	USA
Bombardier Aerospace (Part of Bombardier Inc)	Canada
BAE Systems	UK
Dassault Aviation	France
Embraer	Brazil
Fábrica Argentina de Aviones “Brigadier San Martín” S.A.	Argentina
Lockheed Martin	USA
Mitsubishi Heavy Industries	Japan
SAAB AB	Sweden
Shanghai Aviation Industry Group (SAIC)	Shanghai

Figure 7.2.1a—Main Airframe Manufacturers

Engine Manufacturers	Country
General Electric Aviation	USA
International Aero Engines Consortium: Pratt and Whitney/JAEC/MTU Aero Engines	USA, Germany Japan
MTU Aero Engines	Germany
Pratt and Whitney	USA/Canada
Rolls Royce PLC	UK
Aero Engine Controls (Joint venture between Rolls Royce and Goodrich Engine Control Systems	UK

Figure 7.2.1b—Main Engine Manufacturers

7.2.2 Airbus Industrie–France

In the last quarter of the 20th century, the century that saw the birth of the aviation industry, a new model of airframe manufacturer began to appear, the consortium. Airbus Industrie is probably the best-known example of this new business model. As we have already seen, building airplanes is an expensive business. Few companies have the money, manpower and expertise required to finance the long research, design, planning, sales and construction cycles required to improve and manufacture planes that the airlines require. Airbus Industrie started life in the 1960s as a consortium, or partnership, of a number of different aerospace companies from several different European countries; each one coming with specific knowledge and expertise. Around the turn of the millennium, Aérospaciale-Matra (France), DaimlerChrysler Aerospace (Germany), CASA (Spain) and BAE Systems of the UK formed EADS, the parent company of Airbus. In 2006, BAE Systems sold its interest in Airbus to the other partners.

Manufacturing, production and sub-assembly of parts for Airbus aircraft are distributed around 16 sites in Europe, with final assembly in Toulouse, France and Hamburg, Germany. There are also centers for engineering design, sales and support in North America as well as sales and customer support centers in Japan and China. Airbus has a joint engineering center in Russia with Kaskol known as ECAR.

Airbus draws on a global network of more than 1,500 suppliers in over 30 countries. The company creates ties with industry in all countries where it is represented, aiming to place its suppliers where its customers are.

Airbus was created to design, develop and build the next generation of medium to large jetliners. In fact, Airbus, in less than 45 years, has become the largest manufacturer in terms of actual delivery and orders for new commercial jetliners, surpassing Boeing for that title in 2004. It offers a comprehensive family of jets in a variety of sizes.

One of the advanced features of the Airbus product line is the fact that they were specifically designed to incorporate a high degree of commonality between airplane family group members. The benefits of commonality in such areas as cockpit design and aircraft systems, coupled with the practical use of modern technology, can produce valuable savings in aircraft and engine spares holdings, maintenance and training, as well as in operational flexibility. All these features mean excellent operational savings for the airline and have contributed to the phenomenal growth and success that Airbus has enjoyed.

Did You Know?

The first commercial flight of the A-380 was in October 2007. Singapore Airlines was the first to fly the super jumbo from Singapore to Sydney.

The A380, which celebrated its first flight in 2005, is the world's largest passenger jetliner. It is designed for long-range travel with two complete passenger decks, stacked one on top of the other. So, it is, in fact, a “double-decker” plane, capable of carrying up to, or even more, than 555 passengers, depending on its configuration into one, two or three classes of service (First, Business, Economy). The 555-passenger configuration allows for 221 on the top deck (to accommodate increased space for first and business passengers) and 334 on the lower deck. There is also space for commercial stores, exercise, spa, or bar facilities, as well as rest cabins for the increased number of crew required on long-distance flights.

Airbus is currently developing what it calls the most technologically advanced aircraft in the world - the A350 XWB. It claims a 25 percent reduction in fuel consumption as a result of lower weight through greater use of composite materials, refined aerodynamics and new engines. The A350 XWB is designed to carry from 250 to 400 passengers on medium to long-haul flights.

Headquarters	Toulouse, France
Employees	59,000 worldwide
Current Aircraft Fleet	Narrow bodies: A320 Family–A318, A319, A320, A321, Wide bodies: A330/340 family–A330-220/300, A340-300/500/600, Double-decker: A380 family–A380, A380F Cargo: Beluga
In Development	A350 family–A350XWB

Figure 7.2.2—Airbus basic facts

Key Learning Point

Boeing has over 12,100 jetliners in service worldwide. This includes aircraft produced by McDonnell Douglas which was merged with Boeing in 1997.

7.2.3 The Boeing Company–USA

The Boeing Company represents the more classic business model. Created by an aviation pioneer, William E. Boeing in 1916, it grew as a result of one man's dream and hard work to become one of the leaders in aircraft manufacture. It was the undisputed world leader in large commercial aircraft design and production for many years, growing bigger and stronger through innovation and acquisition, until it was overtaken by Airbus Industrie.

In 1928, Boeing introduced America's first airliner–the Model 80A–designed specifically for passenger comfort. As markets evolved, so did Boeing jets. The company developed a series of innovative jet liners, powered by a variety of sophisticated power trains. Airlines have always had the option of outfitting their Boeing planes with the engine of their choice, from the manufacturer of their choice-typically General Electric, Pratt & Whitney or Rolls-Royce. The B737 was initially designed as a smaller, short-range, twin-engine jet. It was so successful that, over the years, it has become the largest selling aircraft in the world in terms of overall numbers, with many advancements introduced with the Next Generation series. The massive B747 jumbo jet was built when crowded airports and increased airline traffic indicated a need for an airliner with even greater payload capacity and range. Until the launch of the Airbus 380, it was the largest commercial passenger jet in service worldwide, and had held that title for more than a quarter of a century.

On August 1, 1997, Boeing merged with the McDonnell Douglas Corporation, its long-time archrival in the large aircraft market sector. In the 21st century, The Boeing Company continues to be a world leader in air travel. The aviation giant that has evolved from the original Boeing, Douglas and McDonnell companies is now a vast, global enterprise. Their newest product, the B787-8 Dreamliner carries 210 to 250 passengers on routes of 7,650 to 8,200 nautical miles (14,200 to 15,200 kilometers). The B787-9 Dreamliner will carry 250 to 290 passengers on routes of 8,000 to 8,500 nautical miles (14,800 to 15,750 kilometers).

In addition to bringing big-jet ranges to mid-size airplanes, the 787 provides airlines with unmatched fuel efficiency, resulting in exceptional environmental performance. The airplane uses 20 percent less fuel than today's similarly sized airplanes. It travels at a similar speed as today's fastest wide bodies, Mach 0.85. In addition, airlines enjoy more cargo revenue capacity.

The B787 Dreamliner made its first commercial flight from Tokyo to Hong Kong in 2011. According to Boeing, its carbon composite body makes it lighter and cheaper to run than other aircraft.

The company has nearly 12,000 of its commercial jetliners in service worldwide, which is roughly 75 percent of the world fleet of airliners.

Headquarters	Chicago, Illinois, USA
Employees	170,000
Current fleet	B737, B747, B767, B777, B787

Figure 7.2.3—Boeing basic facts

Key Learning Point

Bombardier's growth came about mostly through acquisition of existing companies, namely, Canadair, Short Brothers PLC, Learjet and de Havilland Canada (DHC).

7.2.4 Bombardier Aerospace Group–Canada

The Bombardier Aerospace Group is the third business model of airframe manufacturers that we will look at in this module. Interestingly, it is the only one of our four to have its roots outside of the aviation industry. Its parent company Bombardier Inc. was founded in 1942 to build motorized snow vehicles. It has grown hugely since the 1980s and is now recognized as a world-class designer and manufacturer of planes and trains. Its recreational products division was spun off in 2003.

Its growth came about mostly through acquisition of existing companies, namely, Canadair, Short Brothers PLC, Learjet and de Havilland Canada (DHC).

Canadair is credited with creating the first commercial regional jet. In effect, the Canadair Regional Jet (CRJ) opened up a commercial opportunity for airlines. It is perfectly sized for high-frequency use on high/medium/low-density, short to medium haul routes. Since entering service in 1992, the Bombardier CRJ has revolutionized the commercial air transport industry and changed the way people travel. Today, more than 1,300 Bombardier CRJ aircraft fly with operators large and small all over the world and the CRJ Series family of aircraft has become the most successful regional aircraft program in the world.

Short Brothers PLC holds the title of the world's first and oldest aircraft manufacturer, as they have been operating non-stop for more than 104 years. They built the first twin-engined aircraft in 1911. As a result of major investments in plant and equipment by Bombardier, Short Brothers is a Bombardier Center of Excellence in advanced composite manufacture, metal bonding and chemi-milling as well as a world leader in nacelle systems, fuselage and wing control design and manufacture. It plays an important role in the design and manufacture of the 50-seat Canadair Regional Jet, responsible for the aircraft's complete center fuselage assembly as well as a range of major flight components.

Bombardier acquired Learjet Inc. of Wichita, Kansas, USA in June 1990. This included the Learjet product line as well as the super midsize and large jet family, which includes the medium to long-range Challenger 300, 605, 850 and the super large, high-performance and ultra long-range jet family–the intercontinental Global 5000 and Global Express XRS.

The de Havilland Aircraft Company was founded in the United Kingdom (UK) by Sir Geoffrey de Havilland in September 1920. The first flight of the DHC-3 Otter took place in 1951. This aircraft became popular with operators in the Canadian North and in other remote regions of the world for its rugged construction and ability to land almost anywhere. The Twin Otter was instrumental in the overall development of the regional airline industry. It was followed by the Dash 7 STOL (Short Takeoff and Landing) aircraft in 1975. Many of these de Havilland planes are still in service in some of the most challenging flight terrains in the world, such as Africa, Antarctica and Papua New Guinea.

The stretched Dash 8 Series 300 was launched in 1986, entering commercial service as a 50-passenger plane in 1989. The Dash 8 Series 400, powered by the Pratt & Whitney Canada engine–the PW150–entered commercial service in 1999.

Today, Bombardier Aerospace continues to lead the commuter aircraft manufacturing industry with the introduction of the CSeries, scheduled to enter into service in 2014. The CSeries is the new benchmark in the 100–149 seat class, offering advanced technology, reduced environmental impact and unsurpassed economics (www.bombardier.com). The CSeries' advanced systems integration, lighter weight structure and advanced aerodynamics, coupled with the Pratt & Whitney engine, will deliver a minimum 20 percent fuel burn advantage and a minimum 15 percent operating cost advantage compared to other aircraft in its class. Beyond maintenance savings, significant investment in testing will ensure 99 percent reliability at entry into service.

The CRJ NextGen family of aircraft is the benchmark for regional jet efficiency in the 60-99 seat segment, offering the lowest operating costs, reduced environmental impact and enhanced cabin interiors.

The Q400 NextGen aircraft is one of the most technologically advanced regional aircraft in the world. It has an enhanced cabin, lowest operating costs, low fuel burn and low emissions–providing an ideal balance of passenger comfort and operating economics, with a reduced environmental scorecard.

Headquarters	Montreal, Quebec, Canada
Employees	35,500
Current Aircraft Fleet	CRJ series, Challenger 300, 605 and 850, Corporate RJ, Global 7000 and Global 8000, Global Express, Q Series–Cseries 200/300/400, Learjet LJ 40XR :J 45XR, Learjet, Learjet 45, Learjet 60, CL415 Waterbombers, CL-289 unmanned surveillance system

Figure 7.2.4—Bombardier basic facts

Key Learning Point

Embraer has become the leading producer of aircraft in the commercial jet segment of up to 110 seats.

7.2.5 Embraer–Empresa Brasiliera de Aeronautica–Brazil

Brazil's aviation history dates back to the early 1900s. In 1901, the aviation pioneer Alberto Santos Dumont flew his airship from St Cloud, near Paris, around the Eiffel Tower and back. Many Latin Americans and French passionately believe this feat to have been much greater than that of the Wright Brothers; and that the “first flight” as attributed to the Wright Brothers at Kitty Hawk in the USA should really be a Franco/Brazilian claim to fame.

Embraer represents the fourth business model in our sample: government ownership. The origin of Empresa Brasileira de Aeronáutica S.A. (Embraer) can be found as far back as the 1940s, when the Brazilian Federal Government implemented a long-term strategic project to develop the country's aircraft manufacturing capabilities. In the late 1970s, the development of new products, such as the EMB 312 Tucano and the EMB 120 Brasilia, enabled the company to reach a new technological and industrial milestone.

More than 35 years later it had produced and delivered more than 4,800 aircraft to commercial and military operators worldwide. However, a widespread financial crisis in the early 1990s led the company to privatization in December 1994. The employees retained 10 percent and the Brazilian government 18.4 percent of all voting shares.

Privatization for Embraer meant a deep cultural transformation process. This change brought about a new type of culture introduced by the controlling shareholders. Not only was Embraer able to completely recover by this new “entrepreneurial” culture, but it also embarked on a new expansion process, primarily driven by the ERJ 145 regional jet product family project. In the following years, it has significantly increased its market presence and succeeded in growing revenues by dividing the market into several groups. Embraer has become the leading producer of aircraft in the commercial jet segment of up to 110 seats.

The company has some 1,000 employees abroad providing services through subsidiaries, sales offices, technical assistance and supply parts distribution centers in China, Singapore, USA and France. In 2003, Embraer began operations at its facility in Harbin in northeast China, its first plant outside Brazil. The recent acquisition in 2005 of OGMA–Indústria Aeronáutica de Portugal has meant the addition of approximately 1,600 employees to Embraer's worldwide workforce.

Embraer was created to design, develop, produce and market: a range of turbo-prop and jet aircraft for regional and military use; light reciprocating and turbo-prop aircraft for general aviation, business, corporate and agricultural use; a range of aviation related mechanical and hydraulic systems. Embraer has produced more than 5,000 aircraft that operate in 92 countries on five continents, and it leads the market in commercial jets with up to 120 seats. In addition, Embraer manufactures some of the best executive jets in operation, and is now entering a new level in the defense segment.

Headquarters (Empresa Brasiliera de Aeronautica)	Sao Jose dos Campos, São Paulo, Brazil
Employees	18,000
Current Aircraft Fleet	EMB-120, ERJ135, ERJ 140, ERJ145, ERJ145XR, Embraer 170, Embraer 175, Embraer 190, Embraer 195

Figure 7.2.5—Embraer basic facts

Lesson Summary

This lesson introduced the major aircraft manufacturers with Airbus being the largest. Boeing has over 12,100 commercial jetliners in service worldwide. Bombardier's growth came about mostly through acquisition of existing companies, namely, Canadair, Short Brothers PLC, Learjet and de Havilland Canada (DHC). Embraer has become the leading producer of aircraft in the commercial jet segment of up to 110 seats. There are a variety of aircraft manufacturers and engine manufacturers and they must collaborate to produce the finished product.

Progress Checks (Lesson 7.2)

1. Airbus Industrie is probably the best-known example of the ______________ business model.
   (a) incorporated
   (b) integrated
   (c) consortium
   (d) limited liability

2. Airbus creates ties with industry in all countries where it is represented by aiming to place its suppliers where its customers are.
   (a) True
   (b) False

3. Airbus' strategy of creating a high degree of commonality between airplane family group members helps reduce ______________.
   (a) the total number of suppliers
   (b) the cost of training
   (c) carbon emissions
   (d) load capacity

4. Airlines have always had the option of outfitting their Boeing planes with engines from the manufacturer of their choice.
   (a) True
   (b) False

5. The ______________ was so successful that, over the years, it has become the largest selling aircraft in the world in terms of overall numbers.
   (a) B737
   (b) B747
   (c) B767
   (d) B777

6. The only one of our four aircraft manufacturers to have its roots outside of the aviation industry is ______________.
   (a) Airbus
   (b) Boeing
   (c) Bombardier
   (d) Embraer

7. Which company is credited with creating the first commercial regional jet?
   (a) Bombardier
   (b) Canadair
   (c) Learjet
   (d) Short Brothers PLC

7.3 Aircraft Types

Lesson Learning Objectives

Upon completion of this lesson you should be able to:

- List and describe three types of common airliners.
- Describe ICAO's classification of aircraft.
- Describe common features of the interior of commercial aircraft.

Lesson Overview

There are several common classifications of commercial airliners: wide-body jets, narrow-body jets and regional airliners. This lesson will provide a brief overview of these classifications. We will also take a look at how ICAO classifies aircraft according to wake turbulence. Finally, we will look inside the airliner and provide a brief overview of interior configurations.

Key Learning Point

Most airliners are wide-body jets, narrow-body jets or regional airliners.

7.3.1 Types of Airliners

7.3.1.1 Wide-body Jets

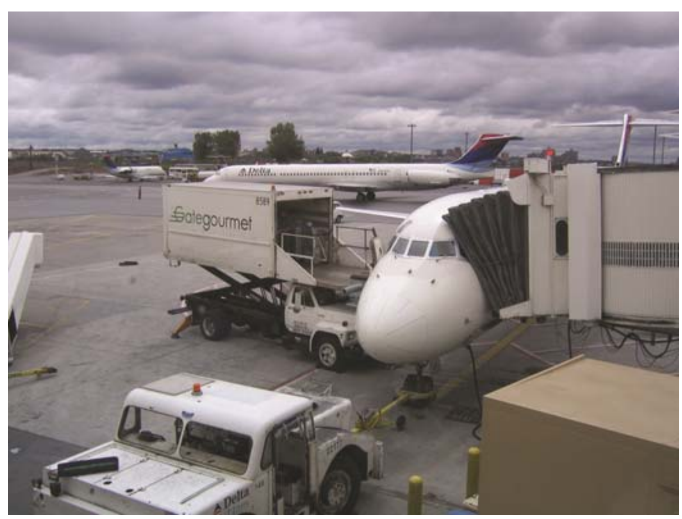
The largest airliners are wide-body jets, commonly known as jumbo jets. Wide-body jets have a fuselage diameter of five to six meters (16 to 20 feet). These aircraft are frequently called twin-aisle aircraft because they usually have two separate aisles running from the front to the back of the passenger cabin. Typical wide-body aircraft can accommodate between 200 and 700 passengers, usually seated seven to 10 abreast. Freight or cargo wide-bodies also exist. These aircraft are commonly used for long-haul flights between airline hubs A380 can take 853 passengers in an all-economy configuration. Aircraft in this category include the 787 Dreamliner, Bombardier Busines Jet (BBJ), Boeing 747, Boeing 767, Boeing 777, Airbus A380, A300/A310, A350-900, A330/A340, DC-10, MD-11 and Ilyushin Il-86/96.

7.3.1.2 Narrow-body Jets

A smaller, more common class of traditional airliner is the narrow-body jet. This airliner has a diameter of three to four meters (10 to 13 feet), a single aisle and seats arranged two to six abreast. The largest narrow-bodies carry about 280 passengers. These smaller airliners are generally used for medium distance flights with fewer passengers than their wide-body counter-parts. Examples include the Boeing 737, 757, MD80 series and Airbus A320 family. Older airliners like the Boeing 727, Fokker 70/100, VC10, Tupolev and Yakovlev jets also fit into this category.

7.3.1.3 Regional Airliners

Regional airliners generally seat fewer than 100 passengers and may be powered by turbofans or turboprops. These airliners, though smaller than aircraft operated by major airlines, frequently serve customers who expect service similar to that offered by crew on larger aircraft. Therefore, most regional airliners have a flight attendant to look after the in-flight needs of passengers. Airlines and their partners sometimes use these for short flights between small hubs, or for bringing passengers to hub cities where they may board larger aircraft.



Typical aircraft in this category are the Bombardier CRJ series and "Q" (DASH-8) series, Embraer ERJ 145 family, ATR 42/72 and Saab 340/2000.

Key Learning Point

The wake turbulence category is used to guide the separation of aircraft. A "Heavy" category aircraft will require greater separation behind it than a "Medium" category aircraft which, in turn, requires more separation than a "Light" category aircraft.

7.3.2 ICAO Classifications

ICAO categorizes aircraft according to the amount of wake turbulence they produce. Wake turbulence is the turbulence that forms behind an aircraft as it passes through the air. This can be especially hazardous during the landing and takeoff phases of flight. Wingtip vortices (regions of high circulation which develop at the tip of a wing as it flies through the air) make up the primary and most dangerous component of wake turbulence. Because wake turbulence is related to the weight of an aircraft, these categories are based on weight. Aircraft with a maximum takeoff weight of 300,000 lbs (136,000 kg) or more are classed as Heavy; those between 15,500 lbs and 300,000 lbs (7,000 kg and 136,000 kg) are classed as Medium; and those below 15,500 lbs (7,000 kg) are classed as Light. Due to their weight, all current wide-body aircraft are categorized as Heavy. Also, the narrow-body Boeing 757, while not being a Heavy by weight, is classed as Heavy due to the amount of wake turbulence it creates. The wake turbulence category is used to guide the separation of aircraft. A Heavy category aircraft will require greater separation behind it than a Medium category aircraft which, in turn, requires more separation than a Light category aircraft.

7.3.3 Cabin Configurations

An airliner may have several classes of seating: first class, business class and/or economy class.

Due to the recent economic recession mostly affecting the European and North American markets, airlines have seen their business class travelers decline. To respond to this trend, some airlines have developed a new economy class product, which is often called "premium economy" or "economy plus". It allows passengers to enjoy wider seats, more legroom and additional amenities compared with standard economy class, without paying much more.

Domestic flights usually have a two-class configuration; first or business class and coach class. Many airlines, depending on the route flown, have switched to all-economy seating. International flights have either a two-class configuration or a three-class configuration, depending on the airline, route and aircraft type. While airlines used to offer movies or audio/video on demand (VOD) to their first and business class passengers and just preprogrammed movies to their economy class passengers, many airlines now offer VOD in economy as well.

The types of seats that are provided and amount of legroom given to each passenger are decisions made by the individual airlines, not the aircraft manufacturers. Seats are mounted in "tracks" on the floor of the cabin and can be adjusted by the maintenance staff. The airline generally tries to maximize the number of seats available in every aircraft to increase the number of passengers. Passengers seated in an exit row at a door (the row of seats adjacent to a door emergency exit) enjoy substantially more legroom than those seated in the remainder of the cabin to allow for a more orderly evacuation in case of an emergency. The seats directly in front of a window emergency exit row may have less legroom and generally do not recline (for evacuation safety reasons). Requirements regarding exit row seats demand that they only be occupied by passengers who are willing and able to assist with the exit operation in the event of an emergency. Passengers seated in these seats are briefed by the cabin crew before takeoff on how to open these exits for evacuation.

The seats are designed to withstand strong forces so as not to break or come loose from their floor tracks during turbulence or accidents. The backs of seats are often equipped with a fold-down tray for eating, writing, or as a place to set up a portable computer or a music or video player. Seats without another row of seats in front of them have a tray that is either folded into the armrest or that clips into brackets on the underside of the armrests. Many seatbacks now feature small colour LCD screens for videos, television and games. Controls for this display as well as an outlet to plug in audio headsets are normally found in the armrest of each seat. Passengers can control some of these systems with their own remotes or with touch screens.

Overhead bins are used for stowing carry-on baggage and other items. While the manufacturer will normally supply a standard product, airlines often prefer to customize this feature. They choose to have bins of differing size, shape or colour installed. Stowage bins have increased in size to compensate for the reduction in the overall passenger baggage allowance and the fees now associated to extra checked baggage.

Under the overhead bins are the Passenger Service Units (PSUs). These PSUs typically contain a reading light, a “gasper” air vent and a flight attendant call button. The units often have small “Fasten Seat Belt” and “No Smoking” illuminated signage installed. They may also contain a speaker for the cabin public address system.

The PSUs will also generally contain the drop-down oxygen masks, which are activated if there is a sudden drop in cabin pressure. These are supplied with oxygen by means of a chemical oxygen generator in late model aircraft. By using a chemical reaction rather than a connection to an oxygen tank, these devices supply breathing oxygen long enough for the aircraft to descend to thicker, more breathable air. Oxygen generators create considerable heat and must be thermally shielded.

Airliners must have space on board to store baggage that will not safely fit in the passenger cabin. Designed to hold baggage as well as freight, these compartments are usually called “cargo compartments” or “holds”. These compartments can be accessed through doors on the outside of the aircraft. Depending on the aircraft, baggage holds are normally pressurized just like the passenger cabin although they may not be heated. Baggage holds on modern airliners are equipped with fire detection equipment and larger aircraft have automated or remotely activated firefighting devices installed. Many airlines also have cameras installed in the cargo holds.

Lesson Summary

There are several common classifications of commercial airliners: wide-body jets, narrow-body jets and regional airliners. ICAO classifies aircraft according to wake turbulence. Wake turbulence is in direct relation to the weight of an aircraft; these categories are based on weight. An airliner may have several classes of seating: first class, business class and/or economy class.

Progress Checks (Lesson 7.3)

1. Which of the following airliners is NOT a wide-body jet?
   (a) Boeing 757
   (b) Airbus A300
   (c) DC -10
   (d) Ilyushin Il-86

2. The narrow-body jets are generally used for medium distance flights.
   (a) True
   (b) False

3. According to ICAO categorization of aircraft, the wake turbulence category is used to determine ____________.
   (a) the amount of air turbulence an airplane can resist
   (b) the separation of one aircraft from another
   (c) the amount of fuel an airplane consumes
   (d) the length of the runway

4. Most regional airliners do not have a flight attendant to look after the in-flight needs of passengers.
   (a) True
   (b) False

5. The term "cabin configuration" generally refers to ____________.
   (a) the number of aisles
   (b) the number of decks
   (c) classes of seating
   (d) type of aircraft

6. Passenger Service Units (PSUs) are typically situated ____________.
   (a) in the cockpit
   (b) in front of the airplane
   (c) in the back of the airplane
   (d) under the overhead bins

Module Summary

All airplanes have the same basic parts: 1) wings, 2) fuselage, or body, 3) empennage, or tail assembly, 4) landing gear, and 5) engine(s). Four basic forces act on an airplane in flight: gravity, lift, drag and thrust. Gravity is the natural force that pulls everything towards the center of the earth. Lift is the mechanical force that pushes a plane upward, against the gravitational pull. The movement of a plane's wing through the air creates lift. Drag is the force of air opposing the forward movement of the airplane. Thrust is the force that opposes drag and moves the plane forward. Depending on the aircraft type, the plane's engines or propeller create this thrust.

Aircraft manufacturers have been great contributors to the industry. Without the companies to design and build the aircraft, the airlines could not conduct their business. There are a variety of aircraft manufacturers and engine manufacturers and they must collaborate to produce the finished product.

Airbus is the largest commercial airframe manufacturer. Boeing has over 12,000 commercial jetliners in service worldwide, which is roughly 75 percent of the world fleet. Bombardier's growth came about mostly through acquisition of existing companies, namely, Canadair, Short Brothers PLC, Learjet and de Havilland Canada (DHC). Embraer has become the leading producer of aircraft in the commercial jet segment of up to 110 seats. Most airliners are wide- body jets, narrow-body jets or regional airliners.

Apply Your Learning

If you already work for an airline company:

1. List the main types of aircraft used in your company's current fleet.
2. Try to visit various types of airplanes to get a sense of their similarities and differences. Note both the external features and internal cabin configurations.
3. Make a point of observing a cargo plane and how cargo is processed.

If you do not work for an airline company:

1. Take the opportunity when you are at an airport to observe the types of planes being flown. Note the types below.
2. What narrow-body types do you see? Wide-body?
3. Do you see any cargo planes?

Answer Key

Progress Checks (Lesson 7.1)

1. c
2. a
3. b
4. d
5. a
6. d

Progress Checks (Lesson 7.2)

1. c
2. a
3. b
4. a
5. a
6. c
7. b

Progress Checks (Lesson 7.3)

1. a
2. a
3. b
4. b
5. c
6. d

Module 8

Air Safety and Security

Module Learning Objectives

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

- Describe the measures undertaken by all responsible parties to ensure aircraft are safe prior to flight. (Lesson 1)
- Describe the safety measures to be exercised during flight. (Lesson 2)
- List and describe safety issues and factors. (Lesson 3)
- Describe the benefits of accident investigation and the general procedures outlined by ICAO. (Lesson 4)
- Describe the security measures outlined by ICAO to safeguard civil aviation. (Lesson 5)

8.0 Air Safety and Security

Module Overview

In this module, we will explain how being safety and security conscious is an airline's number one priority. It is important to understand the current safety culture in the industry as a whole.

Although the industry has an excellent safety record, accidents and incidents do occasionally happen.

In this module, we will demonstrate that both safety and security require strong, well-designed preventive measures. It is everyone's responsibility to assure these preventive measures are taken. Stake-holders include regulatory bodies, manufacturers as well as airline staff in all departments and all areas as well as passengers.

We will cover the preventive measures and a description of the key safety issues affecting airline travel. We will also discuss how the industry uses the information available to ensure a safe and secure environment.

Lesson Learning Objectives

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

- Describe regulatory responsibilities in ensuring safe aircraft.
- Describe responsibilities of manufacturers to ensure aircraft are safe.
- Describe the role of maintenance crew in keeping aircraft safe.
- Describe the responsibilities of airports in minimizing risk of airside accidents.

8.1 Ensuring Safe Aircraft

Lesson Overview

Aviation safety is about everyone working together to ensure flying is as safe as possible. It is a combined result of:

- Regulatory oversight
- How stakeholders operate

How airplanes are designed and produced and how air traffic and airport infrastructure support them is why all stakeholders must join the airlines and regulatory bodies to continuously advance safety in all aspects of the aviation industry.

This lesson will provide an overview of the steps taken to ensure the aircraft's safety. This responsibility begins with the regulatory authorities such as ICAO and the civil aviation authorities (CAAs) and their member states.

8.1.1 The Role of Regulatory Agencies

The responsibility for ensuring that airplanes are safe to fly begins with the regulatory agencies that we described earlier in this course. Annex 8 of the Chicago Convention provides the standards that determine whether an airplane is ‘fit to fly’. These are referred to as the standards for *aircraft airworthiness* certification.

The Standard Airworthiness Certificate is a document that grants authorization to operate a civil aircraft in flight. Before this certificate can be issued, it must be established that the design, construction and operating characteristics of the aircraft meet required standards. This means that the airplane must be in compliance with the appropriate airworthiness requirements of the State of Registry of the aircraft (i.e., the country in which the aircraft is registered).

Did You Know?

Nearly six million people board airplanes worldwide daily.

"Aviation in itself is not inherently dangerous. But to an even greater degree than the sea, it is terribly unforgiving of any carelessness, incapacity or neglect."

–Captain A. G. Lamplugh, British Aviation Insurance Group, London. 1930

The majority of aircraft are thus certified according to the standards set out in the codes of each national CAA. These codes are very similar all over the world. The main differences are with reference to the equipment and the environmental standards of the individual State of Registry.

To support the maintenance of safety standards, different aviation authorities issue airworthiness directives and bulletins with updated information regularly. For example, the FAA issues an airworthiness directive when an unsafe condition exists in any of the following products: aircraft, aircraft engines, propellers or appliances. They specify the inspections to carry out, conditions and limitations to comply with and any actions to take to resolve an unsafe condition. These directives are legally enforceable rules.

How then do government regulatory agencies actually enforce aircraft safety rules? They do so in several ways, namely they:

- Review airline training programs and audit maintenance records, production facilities and airport security methods;
- Assign maintenance, operations and security inspectors to each airline; and
- Assign engineering and quality inspectors to airplane design and manufacturing facilities.

In 1988, ICAO established the Universal Oversight Audit Program (USOAP) at a global level to ensure that all member countries comply with the standards and recommended practices set out in the Annexes of the Chicago Convention. This means it conducts regular safety audits of the civil aviation authorities in different countries in the areas of personnel licensing (Annex 1), operation of aircraft (Annex 6) and airworthiness (Annex 8).

Yet another means of ensuring safety globally has been created through IATA's Operational Safety Audit (IOSA) Program. This is an internationally recognized and accepted evaluation system designed to assess the operational management and control systems of an airline. Specific areas include: Flight Operations, Aircraft Engineering & Maintenance, Cabin Operations, Aircraft Ground Handling and Cargo Operations.

IOSA uses internationally recognized quality audit principles and is designed so that audits are conducted in a standardized and consistent manner. IATA members must have successfully undergone the IOSA audit in order to achieve or maintain IATA membership.

Key Learning Point

The Standard Airworthiness Certificate is a document that grants authorization to operate a civil aircraft in flight. Before this certificate can be issued, it must be established that the design, construction and operating characteristics of the aircraft meet the required standards.

ISAGO (IATA Safety Audit for Ground Operations) a standards audit complimentary to IOSA and aims to improve safety and lower costs by drastically reducing accidents and injuries on the ground.

Raising safety standards is the primary objective although it is recognized that many areas of ground operations which will be covered by the audit are ones to which the cost savings of safety can be directly attributable. This strengthens the business case for safety improvements.

ISAGO is conducted in a standardized and consistent manner using internationally recognized quality auditing principles. Aircraft Ground Handling Service Providers are the primary target of ISAGO. Both the range of services they provide and the issues raised by multiple client aircraft operators are addressed.

The regulatory agencies play a key role in monitoring and enforcing practices that ensure safe aircraft and operations. Initiatives such as IATA's IOSA and ISAGO and the SMS (Safety Management System) help to guarantee that safety standards are reaching higher levels of enforcement on a global basis.

8.1.2 Manufacturer Responsibilities

8.1.2.1 Meeting Airworthiness Requirements

At the beginning of this module, we discussed how everyone has a part in ensuring the safety of an aircraft. Aircraft parts are built in different locations around the world and brought together at a final assembly plant. To ensure that the CAA (Civil Aviation Authority) of the manufacturing state meets and/or exceeds the requirements of the State Registry, governments, manufacturers, regulatory authorities and the airline must all work together to ensure an airworthiness certificate is granted.

Ongoing bulletins are issued by the manufacturer to ensure that safety standards are maintained. These bulletins are issued to rectify any design, equipment or operational flaws.

In addition to meeting the minimum certification standards set by the government regulatory agencies, an aircraft must be designed to avoid problems and function at full capacity if something goes wrong. Airplanes are designed to perform in conditions well beyond what would normally be needed in regular operations. It is the responsibility of aircraft manufacturing engineers to focus on any safety issues that could arise during the serviceable life of an airplane.

8.1.2.2 Safety Improvements

To meet strict safety demands and to address safety concerns that become known after an aircraft type is put into service, manufacturers are close partners with the airlines and government agencies; they work collaboratively to meet passenger safety needs. Airlines, for example, have recommended that over-the-wing exits be widened to assist evacuation during emergency situations. Manufacturers have agreed and revised the cabin designs to add more space in those rows. Airlines themselves have followed up with regulations mandating that only adults with enough strength to open the emergency exits be seated in those rows.

8.1.2.3 Design Considerations

Redundancy is a basic safety principle, which stipulates that major airplane systems be designed with backups. In effect, redundancy is the duplication of critical components of an aircraft system. These have been purposely built-in to increase reliability and safety. In some cases, parts of the control system may even be triplicated. In these cases, an error in one component is backed-up by two other components, which means that all three would have to fail before the entire system fails. Since each one rarely fails and the sub-components are expected to fail independently, the probability of all three failing at the same time is calculated to be extremely small. All parties concerned must take great care to build the concept of ‘redundancy’ into aircraft operating systems.

Since some sources estimate that up to 70 percent of all commercial airplane accidents may be the result of human error, manufacturers also make the study of human factors a high priority when designing airplanes. The study of human factors plays a critical role in making flying safe. Human factor specialists, many of whom are pilots or mechanics, refer to concepts from cognitive psychology, human performance studies, physiology, visual perception, ergonomics and human-computer interface design. They use this knowledge in the design of all aircraft equipment that requires an interaction with humans.

Did You Know?

Today, Boeing and Airbus place huge emphasis on the use of aviation safety equipment, which is now a billion-dollar industry in its own right.

Key Learning Point

Not only do manufacturers work together with the airlines in making sure each aircraft type gets an airworthiness certificate, they are also continuously adding safety improvements.

A key application, for example, can be found on the flightdeck, where pilots conduct various tasks at the same time. These include reading displays, conversing with ground control, scanning the horizon for other aircraft, operating controls and steering the aircraft. With so many things competing for the attention of the pilot, it is easy to understand why good interface design is critical. Instruments and displays, for instance, need to be easily read and operated in order to contribute to the safe operation of the aircraft.

One area in which we have seen numerous improvements based on human factors research is display technology. Current flight deck instrumentation and displays are often digital LCD panels that can accommodate 3-D graphics. These displays are capable of presenting several layers of information resulting in fewer displays and the reduction of clutter. Colour coding is now possible and may be used to distinguish flight plans from traffic information on the screen. As display technology continues to improve, even better displays will become possible. Increasing automation of these displays helps to improve the pilot's efficiency and accuracy, while relieving the pilot of additional tasks.

Not only do manufacturers work together with the airlines in making sure each aircraft type gets an airworthiness certificate, they are also continuously adding safety improvements. These are the result of the demands for improved safety from the traveling public and pressure from regulatory bodies. Advances in technology as well as the study of human factors have resulted in improvements in the safety features of aircraft and will continue to do so.

Did You Know?

Besides undergoing daily maintenance, each airplane is taken apart and put back together again every three to five years.

8.1.3 Maintenance Procedures

Airlines set up regular, detailed maintenance programs that help detect and prevent problems before they become serious enough to jeopardize an airplane's ability to fly safely. Maintenance on an aircraft is therefore an ongoing process. Across the industry, there are a number of standard maintenance checks and specific timeframes in which they must be performed.

One of the common forms of maintenance check is the ramp check, also known as a departure check or preflight check/postflight check. This is the routine and vitally important check that takes place during the ground time on the ramp before and after every flight. It is conducted by the ramp mechanics assigned by the airline operations to that flight.

Key Learning Point

Airlines set up regular, detailed maintenance programs that help detect and prevent problems before they become serious enough to jeopardize an airplane's ability to fly safely. Maintenance on an aircraft is therefore an ongoing process.

Usually, two mechanics conduct this check by verifying a set list of items using the airline's official ramp maintenance checklist. This can include a ‘walk around’ to check the aircraft exterior for Foreign Object Damage (FOD) as well as routine battery, landing gear and air pressure checks. It may also require running on-board cockpit equipment diagnostic checks. After these checks, the mechanics deal with specific problems with respect to the aircraft exterior, engines or cabin interior that might have appeared during the previous flight. Specific problems occurring during flight are recorded by the pilots in the aircraft's logbook and are addressed by maintenance crews after landing.

In addition to this routine flight-by-flight check, there are periodic checks that have to be done on all aircraft after a certain amount of time or usage. Airlines generally refer to these checks as one of the following: A check, B check, C check or D check. A and B checks are lighter checks, while C and D are considered heavier checks.

- A Check–performed approximately every month and is usually done overnight at an airport gate. The actual timing of this check varies by aircraft type, the cycle count (takeoff and landing is considered an aircraft “cycle”) and the number of hours flown since the last check.
- B Check–performed approximately every three months and is also usually done overnight at an airport gate. Similar factors go into the timing of the B check as for the A check.
- C Check–performed approximately every 12 to 18 months. This maintenance check puts the aircraft out of service and requires plenty of space–usually in a hangar at a maintenance base. The schedule has many factors and components and thus varies by aircraft category and type.
- D Check–This is the heaviest check for an airplane. This check occurs approximately every four to five years. This is the check that, more or less, takes the entire airplane apart for inspection. This requires even more space and time than all other checks, and must be performed at a maintenance base.

Each of these checks follows a detailed prescribed set of procedures so that a consistent and standardized approach is followed.

Did You Know?

Bird strikes cause damage to commercial aircraft valued at $4 billion per year.

8.1.4 Airside Safety

8.1.4.1 Threats to Airside Safety

As we saw in an earlier module, the airside is the most complex area in the airport. Safety of aircraft operations in this area is of primary concern. This can be threatened by a number of factors, including:

(a) Condition of pavement, including runways, taxiways and aprons, due to the presence of standing water, snow, ice, sand and rubber deposit.
(b) Obstacles within or around the airport, including temporary obstacles caused by construction.
(c) Broken or damaged ground facilities such as approach lights, signs and faded markings on the runways, taxiways and aprons.
(d) Presence of debris on the runways, taxiways and aprons.
(e) Bird or other wildlife activity on or near the airport.

Aircraft can also be damaged by ground equipment at the airport. While servicing the aircraft between flights, a great deal of ground equipment must operate in close proximity to the fuselage and wings. Occasionally, an aircraft gets bumped or damaged. The pieces of ground equipment that most frequently damage aircraft are the passenger boarding bridge (also called the jetway or jet bridge), catering trucks and cargo “belt loaders” (conveyor belts used for loading baggage into the cargo hold of the plane). However, any other equipment found on an airport ramp or apron can also cause damage to an aircraft through careless use or mechanical failure.

Damage may be in the form of simple scratches in the paint or small dents in the skin. (The colloquial industry term for this damage is “ramp rash”) However, because aircraft structures (including the outer skin) play such a critical role in the safe operation of a flight, all such damage is inspected. It is measured and possibly tested to ensure that any damage is within safe tolerances.

Key Learning Point

A Safety Management System (SMS) is a set of organizational measures and procedures designed to manage safety at an airport. Safety Management Systems also apply to airlines and air navigation service providers.

8.1.4.2 Safety Management Systems

To monitor these ground conditions, the airport operator must carry out certain safety measures on a routine basis. These include conducting regular inspections and audits of airport facilities and procedures. The safety measures requiring particular attention in terms of airside safety are attention to obstacles, runway pavement conditions, visual aids and emergency plans. Airport operators need to ensure they have an adequate Safety Management Systems (SMSs) in place to identify and address safety issues and concerns, including keeping the risk of airside accidents to a minimum.

An SMS is a set of organizational measures and procedures designed to manage any hazards that affect airline safety. It exists to ensure compliance with all safety requirements and to achieve continuous improvements in safety performance. It includes a description of the specific measures undertaken by the airport for the promotion of safety and accident prevention. An SMS is an ICAO requirement for airlines–not just airports. Many other regulators also require airlines to have an SMS in place. This also applies to air navigation service providers.

A complete description of the SMS in effect is important for the airport operator to maintain, and is the most crucial requirement for an airport seeking certification. Aerodrome certification, as defined by Annex 14 volume 1 section 1.4 of the Chicago Convention, is one of the primary tools to ensure the continued safety of aircraft and airport operations. To quote the Chicago Convention: “when an aerodrome is granted a certificate, it signifies to the aircraft operators and other organizations operating on the aerodrome that, at the time of certification, the aerodrome meets the specifications regarding the facility and its operation, and that it has the capability to maintain these specifications for the period of validity of the certification. Part of the certification process shall ensure that an aerodrome manual including a safety management system is submitted by the aerodrome prior to granting the certificate”.

8.1.4.3 ISAGO (IATA Safety Audit for Ground Operations)

The implementation of the IATA Safety Audit for Ground Operations (ISAGO) aims to improve safety and cut airline costs by drastically reducing ground accidents and injuries.

ISAGO is modeled on the successful IATA Operational Safety Audit (IOSA) program. The ISAGO program is an audit system conducted in a standardized and consistent manner, using internationally recognized quality auditing principles.

While airlines have similar operational practices appropriate to one common audit, ground handlers cover a wide scope of activities. These activities include passenger and baggage handling, load control and cargo handling.

To respond to the diversity of ground services, ISAGO has been built upon a 'backbone' of audit standards applicable to all ground handling companies worldwide. As a result, the ISAGO audit can be applied consistently to multi-national ground handlers as well as smaller companies providing services at a single station.

ISAGO is an essential alternative to the redundant audits ground handlers can be subject to.

ISAGO offers benefits to airlines, ground handlers as well as regulatory and airport authorities:

- Safer ground operations with fewer accidents and injuries
- Elimination of redundant audits from airlines
- Reduced costs from less damage and fewer audits
- Uniform audit process and harmonized standards
- Improved safety oversight
- Harmonized auditor training and qualifications
- Improved quality standards
- Enhanced understanding of high-risk areas within ground operations.

8.1.4.4 Airport Design

Airport design and location can have a big impact on air safety, especially since some airports were originally built for aircraft of a certain size and weight. Many airports are in congested areas, where it can be difficult to meet newer safety standards that may call for wider and longer runways, for example. Where these standards are impossible to implement due to lack of space, these airports can either be relegated to short-haul use for regional and/or general aviation needs, or closed entirely and converted to other uses (i.e., residential and/or commercial).

Larger airports may then be constructed further away from the metropolitan center to accommodate the needs of international and long-haul flights using larger aircraft and incorporating the newer safety standards and equipment. In many large metropolitan areas, there may be several airports serving the region with aircraft operating out of different airports, according to the type and size of aircraft and equipment they can accommodate.

Lesson Summary

The responsibility for aircraft safety starts with aviation regulatory bodies such as ICAO and the civil aviation authorities (CAAs) of its member countries. The Standard Airworthiness Certificate is a document that grants authorization to operate a civil aircraft in flight. Before this certificate can be issued, it must be established that the design, construction and operating characteristics of the aircraft meet the required ICAO standards. Manufacturers are accountable for their role in incorporating safety features into the design of their products. Not only do manufacturers work together with the airlines in making sure each aircraft type gets an airworthiness certificate, they also are continuously adding safety improvements. Once an airplane is in service, airline maintenance staff regularly check equipment and parts to ensure regulatory standards are met. Detailed maintenance programs are in place to detect and prevent problems before they become serious enough to jeopardize an airplane's ability to fly safely. Maintenance of an aircraft is therefore an ongoing process. Finally, the airport itself must exercise precautionary measures to make certain that the risk of airside accidents is kept at a minimum. A Safety Management System (SMS) is a set of organizational measures and procedures designed to manage safety at an airport. SMSs also apply to airlines and air navigation service providers.

Progress Checks (Lesson 8.1)

1. The key difference between two countries' airworthiness standards is their ____________ standards.
   (a) safety
   (b) training
   (c) maintenance
   (d) environmental

2. The recommendation to widen exits over the airplane's wings to assist evacuation during emergency situations was made by ____________.
   (a) ICAO
   (b) IATA
   (c) airlines
   (d) manufacturers

3. Airplanes are designed to perform in conditions well beyond what would normally be needed in regular operations.
   (a) True
   (b) False

4. Redundancy refers to a basic safety principle, which stipulates that ____________.
   (a) captain commands should be repeated
   (b) safety instructions should be repeated
   (c) major systems should have backups
   (d) emergency procedures should be duplicated

5. One of the common forms of maintenance check is the ramp check which is conducted ____________.
   (a) after every flight
   (b) after every two flights
   (c) after every three flights
   (d) after every four flights

6. Airside safety is NOT compromised by ____________.
   (a) the condition of the pavement
   (b) scratches on the jetway
   (c) damaged ground facilities
   (d) wildlife activity near the airport

Lesson Learning Objectives

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

- Describe the responsibilities of the crew in ensuring flight safety.
- List and describe key navigation safety aids.

8.2 Safety in the Air

Lesson Overview

In this lesson, we will discuss the safety of an aircraft in flight. This includes the safety training given to crew members, the preflight safety check conducted by the flight crew and the on-board safety briefing of the passengers conducted by the cabin crew. We will explain that the passenger also has a proactive role to play. We have already discussed the important role of air navigation services, including ATC, in an earlier module. Here, we will provide a brief description of some of the navigation aids used to help the pilots and the air traffic controllers do their jobs safely.

8.2.1 Crew Responsibilities

8.2.1.1 Flight Crew

Every flight begins with the all-important preflight inspection of the airplane. In general, this includes an inspection of the cockpit, engines, airframe and landing gear. The first officer, or co-pilot, usually completes this inspection while the captain performs preflight checks on the flight deck, receives the necessary ATC clearance and programs the on-board navigation systems. Once the preflight inspection is completed, the captain completes the checklist with the first officer to ensure that all required tasks have been properly executed. This is another example of the safety principle of built-in redundancy: one pilot doing the flight check, the other reviewing it.

Key Learning Point

Once in operation, the captain is ultimately responsible for the airworthiness of the aircraft. However, the co-pilot and the cabin crew also have critical roles in ensuring the aircraft's continued safety.

Once in operation, the captain is ultimately responsible for the airworthiness of the aircraft. The co-pilot and the cabin crew also have critical roles in ensuring the aircraft's continued safety.

8.2.1.2 Cabin Crew

Preflight inspection is also an important part of the cabin crew duties. The inspection includes all safety and emergency equipment located in the cabin (such as evacuation slides, firefighting and first aid equipment) in the general cabin area. Their first priority and main role is to ensure the safety and well-being of the passengers and assist them in the event of flight emergencies. For this reason, safety procedures and evacuation routes are part of the preflight briefing.

Although major in-flight emergencies are rare, the flight attendants are required by the airline and the aviation authorities to review the aircraft's safety procedures with the passengers before every flight. In turn, it is the personal responsibility of each passenger to listen carefully to the safety briefing.

8.2.2 Culture of Safety

Adopting a proactive approach, the aviation industry has a methodology in place to identify operational safety issues and address them before an accident can happen. The Line Operations Safety Audit (LOSA) has helped airlines understand those gaps. With LOSA, trained observers actually sit in the cockpit with pilots and crew and observe them in normal operations during regularly scheduled flights. LOSA looks closely at crew performance to determine how well situations involving hazardous weather and equipment malfunctions are handled. They also examine how mistakes are managed. In 1999, ICAO endorsed LOSA as the primary tool to develop countermeasures to human error in aviation operations. Thousands of observations have been conducted. Data collected through LOSA can be immediately used to prevent adverse events by identifying specific events leading to accidents.

Significantly, LOSA findings have helped aviation understand its own culture and how that culture affects safety. As an example, where once a rigid hierarchy often prevented a first officer from pointing out an error to the captain, teamwork is now much more the norm. Crew Resource Management (CRM), provides training to teach pilots, cabin crew and other airline personnel to work as a team to reduce errors. Training simulations address teamwork as well as operational skills. CRM training is now required of airlines around the world.

The Aviation Safety Reporting System (ASRS) is another means of promoting air safety within the industry. This is a voluntary system that allows pilots and other crew members to anonymously report inadvertent errors in the interest of improving air safety. The independent nature of the reporting is key to its success, since people do not have to worry about any possible negative consequences of coming forward to report problems. The ASRS report provides some immunity from FAA sanction if the error was not intentional or due to gross negligence.

Another initiative in air safety is the Fatigue Risk Management System (FRMS). Existing crew flight duty and flight time limits are being reexamined in the light of new, more scientific approaches to managing the risk of crew fatigue.

Crew fatigue has typically been controlled by a simple set of prescriptive rules concerning flight time limitations (FTL) and flight duty limitations (FDL). These vary slightly from country to country, but generally limit the total number of hours that flight and cabin crew may fly (FTL) and be at work (FDL) in a set period.

A different system was needed on long-haul flights, where circadian rhythms, which are the body's natural daily cycles, are interrupted due to time zone changes.

A prescriptive approach, based only on daily time limits, cannot take into account the complex interaction of factors that are linked to hours of work and rest periods.

In other words, with a well-managed fatigue risk management system, flight duty time and schedule of operation can be optimized.

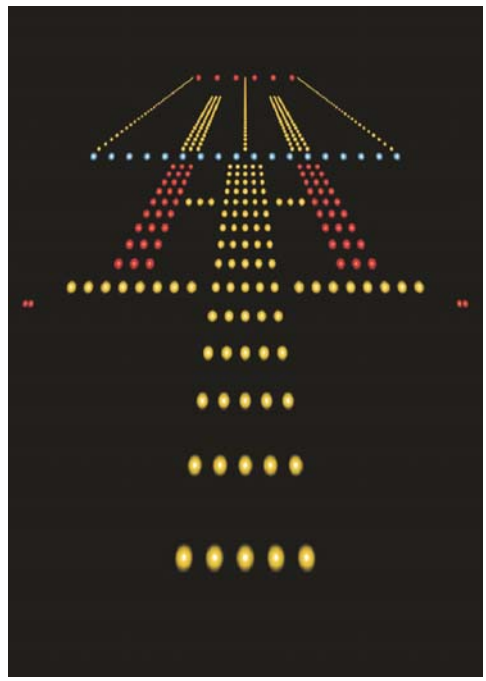
Through initiatives such as LOSA, CRM and ASRS and FRMS, the aviation industry has succeeded in building a ‘culture of safety’ that is coming to the attention of other industries as a role model.

8.2.3 Navigation Safety Aids

As we discussed earlier in the course, the objectives of air navigation services are to safely separate aircraft, 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 focus is safety, and their main services reflect this goal: control (both air and ground), information and alert. Navigation safety aids serve to support and supplement these services; they include the following, to name a few.

8.2.3.1 Airport Lighting

One of the first navigation aids to be introduced was airfield lighting, which assists pilots landing in poor weather or after dark. Approach lighting was developed in the 1930s, indicating to the pilot the angle of descent to the airfield. This was later adopted internationally through the standards of ICAO and remains an important navigational aid.



8.2.3.2 Instrument Landing Systems

With the spread of radio technology since the 1920s, several experimental radio-based navigation aids were developed. These were most successful when used in conjunction with Instrument Landing Systems (ILS) in the cockpit. ILS was first used by a scheduled flight to make a landing in a snowstorm at Pittsburgh, U.S.A. in 1938. A form of ILS was adopted by ICAO for international use in 1949.

An ILS is an instrument-based landing navigation system that is used only within a short distance from the airport. Its purpose is to provide both lateral and vertical guidance to the runway. While transport category aircraft today generally use an ILS during landing in all weather conditions, it is a critical navigational aid when visibility is limited and the pilot cannot see the runway. An ILS consists of two independent sub-systems, one providing lateral guidance and the other vertical guidance to an aircraft approaching a runway. The system, which is ground-based, broadcasts very precise directional signals. These signals provide a lateral and vertical path to the runway to a distance of up to 50 nautical miles from the runway.

The pilot has to fly within range of the ILS in order to use it. While the pilot is approaching an airport, the air traffic controller provides vectors to position the aircraft on the ILS course and glide slope. The pilot tunes the aircraft's navigational receivers to the ILS frequency in order to receive the signals that provide lateral and vertical guidance to the runway threshold.

8.2.3.3 Global Positioning Systems (GPS)

Procedures called improved radio navigation, or RNAV, and required navigation performance (RNP) improve enroute navigation as well as approach and landing precision at airports that have limited ground-based navigation equipment. Using Global Positioning System (GPS) receivers, these processes allow airlines to navigate using satellites in places with little or no ground-based navigation. GPS provides precise guidance in all weather conditions.

All of the ground-based navigation aids are rapidly being supplemented by satellite-based aids like GPS, which makes it possible for aircrews to know their position with great precision anywhere in the world. With the arrival of the Wide Area Augmentation System (WAAS), GPS navigation has become accurate enough for vertical (altitude) as well as horizontal use, and is being used increasingly for instrument approaches as well as en-route navigation.

The concept of a single, global satellite-based navigation system for Air Traffic Management is being pursued under the support of ICAO. Known as the CNS/ATM (Communication, Navigation, Surveillance/Air Traffic Management) system, it calls for one system to be the ‘sole means’ navigation system to support area navigation (RNAV) operations worldwide. At the present time, as with the United States GPS system, CNS/ATM services are running parallel with existing ground-based navigation systems. Plans state that by 2015 there will be only one CNS/ATM operation.

Lesson Summary

The captain is ultimately responsible for the airworthiness of the aircraft, however, the first officer and the cabin crew play critical roles in ensuring the aircraft's continued safety. Measures to ensure in-flight safety include:

- safety training given to crew members,
- preflight safety check conducted by the flight crew, and
- safety briefing of the passengers conducted by the cabin crew.

Navigation safety aids serve to support and supplement the services offered by air navigation services in ensuring the safe and efficient conduct of flights.

Progress Checks (Lesson 8.2)

Write your answer in the space provided.

1. The practice when one pilot does the flight check and another one reviews it is called ______________.
   (a) Safety Management System
   (b) Preflight debriefing
   (c) Redundancy principle
   (d) Co-pilot testing

2. The responsibility to examine how mistakes are managed lays with the ______________ program.
   (a) Crew Resource Management
   (b) Line Operations Safety Audit
   (c) Safety Management System
   (d) Fatigue Risk Management System

3. The main point of the Aviation Safety Reporting System (ASRS) is that mistakes are ______________.
   (a) reported anonymously
   (b) used to adjust training simulations
   (c) observed during regularly scheduled flights
   (d) registered by the aircraft system automatically

4. The key function of Instrument Landing Systems (ILS) is to ______________.
   (a) aid en-route navigation
   (b) indicate the angle of descent
   (c) assist pilots to land in poor weather
   (d) provide vectors to position the aircraft

5. So far GPS navigation has become accurate enough for horizontal but not for vertical use.
   (a) True
   (b) False

6. The main purpose of flight time limitations (FTL) is to ______________.
   (a) limit the number of time zones that a crew can be on duty
   (b) limit the number of hours that the captain can be on duty
   (c) manage the time that flight attendants can be on duty
   (d) manage the risk of crew fatigue

8.3 Air Safety Issues

Lesson Learning Objectives

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

- Describe natural hazards and weather conditions that present aircraft safety concerns.
- List and describe possible sources of aircraft system and component failures.
- Explain how human factors can pose a safety risk.

Lesson Overview

The key factors affecting aircraft safety will be the main topic of this lesson. We will describe the impact of severe weather and other conditions of nature which present considerable danger to an aircraft. Their effect can be seen at takeoff, landing or in mid-flight. We will also cover mechanical problems that can occur on board even though strict maintenance inspections are carried out consistently. Finally, we will touch upon the "human" factor and how it can impact air safety.

8.3.1 Natural Hazards and Weather Conditions

Let us begin with naturally occurring conditions that can threaten aircraft safety.

8.3.1.1 Bird Strike

The term "bird strike" is an aviation description for a collision between a bird and an aircraft. It is a common threat to aircraft safety and has caused a number of fatal accidents. The highest risk of a bird strike is during takeoff and landing, at low altitudes, in the vicinity of the airport. Today, most jet engines have the capability of surviving ingestion of a bird.

Some airports are proactive in using countermeasures, such as the use of environmentally sound land-management practices. These include avoiding the use of land-fills that could attract birds and planting grasses that deter insects and the birds that they attract.

8.3.1.2 Lightning

Studies conducted by Boeing have shown that airliners are struck by lightning on average twice per year. Aircraft are built to withstand these ‘normal’ lightning strikes.

The effects of normal lightning on traditional metal-covered aircraft are well understood. Serious damage from a lightning strike on an airplane is extremely rare. With advanced technology, some aircraft, such as the B787 Dreamliner, are constructed with non-conducting composite materials that reduce electrical conductivity as much as 1,000 times less than aluminum.

8.3.1.3 Ice and Snow

Snow and ice accumulations on the runway or on critical parts of the plane can adversely affect safety. Hazards include loss of braking and/or steering on the ground as well as a loss of control while in flight due to ice accumulation on aircraft control surfaces or engines. The greatest concern regarding ice on the wings is that even a small amount of ice or coarse frost can greatly decrease the ability of a wing to develop lift. A loss of lift can affect airplane performance in all phases of flight and can prevent an otherwise capable aircraft from safely taking off or landing.

Airlines and airports expend considerable effort to ensure that aircraft are properly de-iced before takeoff whenever the weather threatens to create icing conditions. Airliners are designed to prevent ice build-up once airborne. Heated air from the jet engines is routed through the leading edges of the wing, tail and engine inlets. Slower aircraft use inflatable rubber “boots” that expand and break off any accumulated ice.

Finally, ATC and airline dispatch offices keep close watch on weather reports forwarded by flight crews along flight routes and thus help pilots avoid the worst of possible icing conditions while in flight.

8.3.1.4 Sand and Dust

In some parts of the world, sand and dust storms are an issue of great concern. An aircraft's jet engines can easily suck in huge quantities of sand or dust contaminants, which constitute a real hazard to aircraft safety. Most airports and airlines operating in these areas have developed methods to deal with these types of natural hazards.

Key Learning Point

Weather conditions can pose a serious safety hazard to aircraft unless proper precautions are taken.

8.3.1.5 Volcanic Dust Particles

In recent years, there have been a number of volcanic eruptions that have sent huge clouds of dust into the atmosphere. If not tracked correctly, or if wind conditions make them change course dramatically, these clouds can affect the flight path of aircraft around the world. Regional air traffic control, however, are usually able to warn aircraft flying in the areas of the eruption or through the prevailing wind direction coming from the eruption area.

Volcanic ash near active volcanoes continues to present a risk, especially for night flights, as it is not easily detected. The ash is hard and abrasive and can quickly cause significant wear on engine propellers and turbo-compressor blades as well as scratch the cabin windows, impairing visibility. Ash can also contaminate fuel and water systems, jam gears and cause a flameout of the engines. Its particles have a low melting point, so they melt in the combustion chamber and the ceramic mass then sticks onto the turbine blades, fuel nozzles and combustors. This can lead to a total engine failure. It can also get inside the cabin and damage the electronics.

With the growing density of air traffic, encounters like this are becoming more likely. In 1991, the aviation industry decided to set up Volcanic Ash Advisory Centers (VAACs), one for each of nine regions of the world, to act as liaisons between meteorologists, volcanologists and the aviation industry.

Did You Know?

Metal fatigue is a common everyday occurrence. One example is when a paper clip is bent back and forth until it breaks. This is an example of cyclic stress.

8.3.2 Component and System Failures

Aircraft system and component failures can seriously affect aircraft safety. Let us provide a brief overview of some factors that can lead to such failures.

Metal fatigue is one factor that has occasionally caused failure, either of the engine or of the aircraft fuselage. Quite simply, metal fatigue refers to the fact that metal parts that are repeatedly stressed eventually fail at a loading far below their original strength. On the other hand, fatigue does not cause a progressive loss of strength; a partly fatigued component remains just as strong as a new one until, at some point, cracks develop. Furthermore, until cracking begins, there are no detectable signs of fatigue. As understanding of this concern increases, rigorous inspection and non-destructive testing procedures are being put in place to attempt to identify potential problems before they happen.

Key Learning Point

Aircraft system and component failures can seriously affect aircraft safety. These failures can occur from metal fatigue, delamination, complete or partial engine failure, or from accidental events that cause the aircraft to stall or catch on fire.

Another factor is the *delamination* of composite materials, which consist of layers of fibres embedded in a resin matrix. In some cases, especially when subjected to cyclic stress, the fibres may tear off the matrix and the layers of the material then separate from each other; this is referred to as delamination. As this type of failure develops inside the material, nothing is shown on the surface. Specific testing methods, most often ultrasound-based, must be used to detect this type of failure.

While engine failures do represent a safety threat, aircraft are designed to safely fly when one engine fails (redundancy concept at work again). For example, in the event of a failed engine at takeoff, four engine airplanes are capable of completing their takeoff with only three engines. In fact, at a certain point in the takeoff roll, this is considered to be safer than aborting a takeoff at a high speed and potentially running out of runway. Once airborne, the pilots have the time they need to deal with the situation in an orderly manner. They can prepare to land again with a full length of runway at their disposal at either their originating airport or a designated alternate airport.

Another safety hazard can occur if the aircraft's wings fail to produce the lift necessary to sustain flight, or *stalling* an aircraft. A stall results from disruption of the airflow necessary to produce lift. This is a potential danger, but is normally recoverable. Stalls may occur at low speeds during takeoff or landing. Stalls may also occur at high airspeeds. Devices have been developed to warn the pilot as a stall approaches; these include stall warning horns, stick shakers and voice warnings.

Lastly, a fire on board the aircraft, and more especially the toxic smoke generated by burning materials, constitute a critical safety hazard. There is also a risk of fires within a turbine engine. There are smoke detectors located in the cabin and hold areas of the airplane. Additionally, there are fire extinguishers located throughout the hold area and at designated places in the cabin. The pilots can discharge the fire extinguishers in the hold and the flight attendants are trained in the use of fire extinguishers and firefighting techniques should a fire occur in the cabin.

In conclusion, we have seen that failures can occur from metal fatigue, delamination, complete or partial engine failure, or from accidental events that cause the aircraft to stall or catch on fire.

8.3.3 Human Factors as Causes

The airline industry makes extensive use of extremely sophisticated automated systems. However, there is no industry in the world that operates completely without some human input, including the airline industry.

People make errors; this is what is referred to as the ‘human factor' element in safety. Individuals can make poor decisions in times of great stress. They may disregard the rules or fail to comply with them for a variety of reasons–mistakes, fatigue, confusion, or inattention, to name a few. These can cause crucial errors to be made in aircraft operations, maintenance and servicing, leading to potential safety problems.

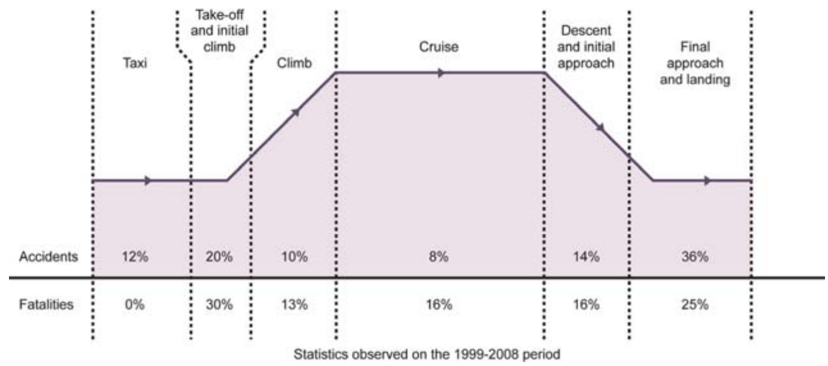


Figure 8.3.3—When do accidents occur?

The study of these types of errors can also be called ‘ergonomics’, which addresses how people interact with procedures, operating controls, tools and other items. We discussed this concept earlier in this module when we looked at aircraft design. The primary focus of human factors is the complex nature of the operating environment and the numerous interface issues for pilots when dealing with emergency or non-normal situations. Human factor issues pose a significant potential danger, and are currently one of the most common factors in major aviation accidents. In fact, since 1950, more than half the fatal accidents on regularly scheduled flights have been caused by human factors.

Cause	% Total (since 1950)
Pilot error	50
Other Human Error	7
Weather	12
Mechanical failure	22
Sabotage	9
Other	1

Figure 8.3.3-1—Causes of Airplane Accidents (excluded military, private, charter aircraft)

The table above is compiled from a world-wide accident database and represents 1,085 fatal accidents, involving commercial aircraft from 1950 through 2010, for which a specific cause is known. This does not include aircraft with 18 or fewer people aboard, military aircraft, private aircraft or helicopters.

Progress, however, in improving human factor issues in safety has been continuous throughout the history of aviation. The study of human factors continues to provide important advances, such as the cockpit design example we looked at earlier in this module.

One of the most important areas related to human factors is concerned with the ability of the flight crew to maintain *situational awareness* and control. Situational awareness can be described as a person's state of knowledge or mental perception of the situation around him or her. It is important for effective decision-making and performance in any challenging, multi-dimensional environment. Originally, it was used to describe awareness during tactical situations in aerial warfare. It is now used to describe personal knowledge and alertness in all complex, dynamic situations requiring human control. As such, it makes an important contribution to air safety.

Key Learning Point

Human factors pose a significant potential danger to aircraft safety, and are currently the most common factors in major aviation accidents.

The lack of situational awareness is considered to be one of the possible causes for a class of accident known as Controlled Flight into Terrain (CFIT). This is a class of accident in which an undamaged aircraft is seemingly flown, under control, into terrain, such as a mountain, the ocean or the ground. These accidents generally are considered to be a result of pilot error or of a navigational system error.

Crew awareness and constant monitoring of navigational systems can prevent, or eliminate, CFIT accidents. As mentioned earlier in this module, the Line Operations Safety Audit (LOSA) and Crew Resource Management (CRM) are proactive methods now widely used to improve the human factors of air safety. There are also other technical aids that can be used to help pilots maintain situational awareness. The ground-proximity warning system that we mentioned earlier, for example, is one such aid. It is an on-board system that alerts a pilot if the aircraft is about to fly into terrain.

Certain electronic equipment that passengers carry and wish to use on board can also threaten the safety of aircraft. They are partially or entirely prohibited, as they may interfere with aircraft navigation or communication systems. Airlines have installed technologies to allow mobile phones to be connected within the airplane as it flies. Such systems were tested on flights in 2006 and 2007. In 2008, several airlines started to allow in-flight use of mobile phones. The FAA, however, has banned all in-flight cell phone usage. Most electronic devices are still prohibited for takeoff and landing.

Lesson Summary

Weather conditions can be a serious safety hazard to aircraft unless proper precautions are taken. Aircraft system and component failures can seriously affect aircraft safety. These failures can occur from metal fatigue, delamination, complete or partial engine failure, or from accidental events that cause the aircraft to stall or catch fire. Human factors pose a significant potential danger to aircraft safety, and are currently the most common factors in major aviation accidents.

Progress Checks (Lesson 8.3)

Write your answer in the space provided.

1. A proactive way to reduce “bird strikes” is to plant grasses in the vicinity of the airport to deter insects that attract birds.
   (a) True
   (b) False

2. The greatest concern regarding ice on the wings is that even a small amount of ice can ______________.
   (a) increase the weight of the plane
   (b) limit the aircraft's ability to pitch
   (c) decrease the ability of a wing to develop lift
   (d) impair the function of the fuel reservoirs in the wings

3. Volcanic ash is a risk factor, especially if the aircraft flies ______________.
   (a) at high altitude
   (b) against the wind
   (c) at high speed
   (d) at night

4. Human factors are currently the most common factors in major aviation accidents.
   (a) True
   (b) False

5. One of the most important areas related to human factors is concerned with the ability of the flight crew to
   (a) communicate clearly with control tower
   (b) follow the redundancy principle
   (c) follow emergency procedures
   (d) maintain situational awareness

8.4 Accident and Incident Investigation

Lesson Learning Objectives

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

- Describe the rationale for accident and incident investigation.
- List the basic steps in an accident investigation and final outcome.
- Describe the main tools of accident investigation.

Lesson Overview

With flight comes the risk of accidents. In this lesson, we will study how the airline industry deals with accidents in order to learn from them. We will cover the standardized procedures for accident investigation and the role of ICAO in setting those procedures. We will also look at some of the important tools that assist the investigation.

8.4.1 Why Study Accidents?

Why does a specific accident occur–what can we learn from it? Who/what was responsible? Was it a case of metal fatigue, or was it human error? Did a mechanic fail to check the engine bolts properly or was the cause deterioration in the condition of the metal struts holding the engine to the wing of the plane? The findings of an accident investigation are an opportunity to make changes to the system and improve aviation safety.

These are the types of questions that accident investigation teams from the airline, the manufacturers and the national authorities have to ask. Their goal is to find the answers to these questions in order to determine the causes of the accident or incident and make safety recommendations to improve practices.

An aviation accident is an occurrence on board an aircraft resulting in damage to the airplane and/or in injury or death to one or more persons. An aviation incident is an occurrence other than an accident, associated with the operation of an aircraft, which affects or could affect the safety of operations.

Some examples of the typical accidents that merit an investigation are: aircraft veering off a runway, an aircraft overshooting the runway, landing gear collapsing on landing, tire mishap, severe turbulence or an aircraft fire.

8.4.2 Procedures

Annex 13 of the Convention on International Civil Aviation (Chicago Convention) sets out the rules on the notification, investigation and reporting of all accidents. It describes who should conduct the investigation, who can be involved, what rights each participant party has, as well as how the investigation should be conducted and how the final results should be reported.

A number of investigative agencies spring into action when accidents occur. There is an agency within each country responsible for coordinating accident investigations. The name of the agency varies with each country, however, all signatories of the Chicago Convention follow the same guidelines. In addition, any sovereign State supporting the Convention has the right to request assistance from the agency of another State. The lead State investigating the accident/ incident may also call on the best technical expertise available from any source to assist in the investigation.

U.S.A.	National Transportation Safety Board (NTSB)
Canada	Transportation Safety Board
European Union	European Aviation Safety Agency (EASA)
U.K.	Air Accidents Investigation Branch (AAIB)
Ireland	Air Accident Investigation Unit (AAIU)
Australia	Australian Transport Safety Bureau
Austria	Ministry of Transport, Innovation and Technology
Columbia	Departmento Administrativo de Aeronautico Civil (DAAC)
Germany	Federal Bureau of Aircraft Accidents Investigation
Italy	Italian Air Safety Board
Japan	Aircraft and Railway Accidents Investigation Committee
Singapore	Ministry of Transport
Spain	Civil Aviation Accidents and Incidents Investigation Commission

Figure 8.4.2—Examples of Safety Agencies

Did You Know?

Each flight data recorder and cockpit voice recorder is equipped with an Underwater Locator Beacon (ULB) to assist in locating it in the event of an ‘over water’ accident. The device, called a “pinger”, is activated when the recorder is immersed in water. It transmits an acoustical signal on 37.5 KHz that can be detected with a special receiver.

The investigation process includes the following five basic steps:

- Gathering, recording and analysis of all relevant information.
- Preparation of a preliminary report.
- In-depth determination of the causes.
- Formulating appropriate safety recommendations.
- Completion of the final report.

While the initial field phase of an accident investigation can, at times, be concluded within weeks, or even days, the investigators' final report and recommendations may take years to complete. The final report consists of factual information about the accident, an analysis, conclusions (probable cause) and safety recommendations.

8.4.3 Investigative Tools

Worldwide computerized databases greatly facilitate the analysis of information on accidents/incidents. These safety information-sharing networks facilitate free exchange of information on actual/potential safety deficiencies. Other tools include specialized equipment as well as experienced professionals from the aviation industry (agencies, airlines and manufacturers).

There are two specialized devices that the industry has developed to help determine the “probable cause” of an accident. These are the Flight Data Recorder (FDR) and the Cockpit Voice Recorder (CVR). These devices have been around since the 1960s. Since then, they have consistently proved their value to the airlines and the aviation safety improvement industry. They have steadily improved in crash worthiness as well as in the quantity and quality of data they can record. Both recorders are installed in the most crash survivable part of the aircraft, usually the tail section.

8.4.3.1 The Flight Data Recorder (FDR)

Flight data recorders (FDRs) are referred to as ‘Black Boxes’, although they are, in fact, orange in colour. This colour was chosen to aid in location and retrieval. The FDR on board the aircraft records many different operating conditions of the flight. By regulation, the FDRs on newly manufactured aircraft must monitor at least 88 important parameters, such as time, altitude, airspeed, heading and aircraft attitude. In addition, some FDRs can record the status of more than 1,000 other in-flight characteristics that can aid in the investigation. The items monitored can be anything from flap position to autopilot mode or even smoke alarms.

With the data retrieved from the FDR, investigators can generate a computer-animated video reconstruction of the flight. They can then visualise the airplane's altitude, instrument readings, power settings and other characteristics of the flight. This animation enables the investigating team to visualise the last moments of the flight before the accident, which can provide clues as to the cause.

Figure 8.4.3.1—Flight data recorder FDR (courtesy of Michaell Davis Photography)

8.4.3.2 The Cockpit Voice Recorder (CVR)

Cockpit Voice Recorders (CVRs) are devices that record radio transmissions, conversations and sounds throughout an aircraft's cockpit on digital tape or on a digital microchip. Sounds of interest to an investigator could be engine noise, stall warnings as well as landing gear extension and retraction. From these sounds, parameters such as engine rpm (revolutions per minute), system failures, speed and the time at which certain events occurred can often be determined. Just as important, conversations with Air Traffic Control, automated radio weather briefings and communications between the pilots or with the cabin crew are also recorded. In the event of an accident, this information may be used by investigators to determine what was occurring in the cockpit throughout the incident.

Key Learning Point

Annex 13 of the Convention on International Civil Aviation (Chicago Convention) sets out the rules on the notification, investigation and reporting of accidents. It describes who should conduct the investigation, who can be involved, what rights each participant party has, as well as how the investigation should be conducted and how the final results should be reported.

8.4.3.3 The Role of the FDR and CVR in Accident or Incident Investigation

Following an accident, both recorders are immediately removed from the accident site and transported for processing. Both the FDR and the CVR have proven to be valuable tools in the accident investigation process. They can provide information that may be difficult or impossible to obtain by other means. When used in conjunction with other information gained in the investigation, the recorders are playing an ever-increasing role in determining the probable cause of an aircraft accident or incident.

Lesson Summary

Annex 13 of the Convention on International Civil Aviation (Chicago Convention) sets out the rules on the notification, investigation and reporting of an accident. It describes who should conduct the investigation, who can be involved, what rights each participant party has, as well as how the investigation should be conducted and how the final results should be reported. Some of the important tools that facilitate the investigation include the Flight Data Recorder (FDR) and the Cockpit Voice Recorder (CVR), commonly known as ‘black boxes’.

Progress Checks (Lesson 8.4)

Write your answer(s) in the space(s) provided.

1. The rules for the notification, investigation and reporting of all accidents are defined in ______________.
   (a) Annex 13 of the Chicago Convention
   (b) ICAO Safety Manual and Procedures
   (c) IATA Recommendations for Investigation
   (d) International Agreement on Air Accidents Investigation

2. The key difference between an accident and an incident is that in an accident ______________.
   (a) the pilots bear full responsibility
   (b) safety of operations are affected
   (c) human health and/or life is affected
   (d) state agencies conduct the investigation

3. The final report of an accident investigation consists of factual information about the accident, an analysis, conclusions (probable cause) and ______________.
   (a) estimated cost of damage
   (b) safety recommendations
   (c) technical recommendations
   (d) reconstruction of the events

4. Which of the following is NOT a step in the investigation process of an accident?
   (a) Gathering, recording and analysis of all relevant information
   (b) Preparation of a preliminary report
   (c) In-depth determination of the causes
   (d) Identification of responsible entities

5. Generally the color of the Flight Data Recorders (FDRs) is ______________.
   (a) black
   (b) white
   (c) green
   (d) orange

6. Cockpit Voice Recorders (CVRs) are generally located in the ______________ of the aircraft.
   (a) empennage
   (b) cabin
   (c) cockpit
   (d) cargo section

8.5 Security

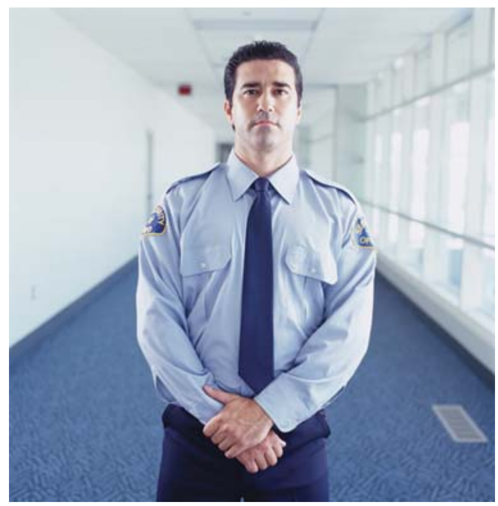
Lesson Overview

Much of the focus of this module has been on safety. Security, of course, is also high on the list of concerns. In this lesson, we will discuss what we mean by security. Then we will describe the national measures established by ICAO that countries must implement and how they are translated into airport-level measures. We have already discussed (in the Module "All about Airports") about the implementation of local-level measures designed to prevent and respond to threats and unlawful acts against people, aircraft, airports and navigation facilities.

Lesson Learning Objectives

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

- Describe the difference between aviation safety and aviation security.
- Describe the national measures that countries must implement to safeguard civil aviation.



8.5.1 What Do We Mean by Aviation Security?

Many people use the terms "safety" and "security" interchangeably, especially as they relate to travel. Although the two words are often used synonymously, the aviation industry makes a distinction between them.

Aviation *safety,* which we have been discussing through most of this module, refers to the efforts that are taken to ensure airplanes are free from factors that may lead to injury or loss. Aviation security refers to efforts taken to safeguard planes and installations from intentional damage. Aviation security is one important component that may affect passenger safety. More specifically, Annex 17 to the Convention on International Civil Aviation defines aviation *security* as: 'A combination of measures and human and material resources intended to safeguard civil aviation against acts of unlawful interference'. The objective of civil aviation security is to safeguard passengers, crews, ground personnel, the general public, aircraft, airports and navigation facilities against such acts.

Key Learning Point

The objective of civil aviation security is to safeguard passengers, crews, ground personnel, the general public, aircraft, airports and navigation facilities against such acts of unlawful interference.

8.5.2 Response of ICAO

Aviation Security (AVSEC) has long been an aviation issue requiring continuous oversight and precautions. It has been of particular concern for about the last 45 years. Specifically, it relates to the use of passengers as hostages and the unlawful possession of aircraft as negotiating devices or terrorism targets. This has necessitated the implementation of effective security controls and procedures by governments, airport authorities and airlines to ensure the safety of passengers, crew, ground personnel and the general public at airports and in flight.

Annex 17 contains Standards and Recommended Practices (SARPS) for safeguarding international civil aviation operations worldwide. It requires that each Contracting State establish a National Security Program to protect the safety, regularity and efficiency of civil aviation by providing practices and procedures, that safeguard against unlawful interference. States must establish measures that will provide a standardized level of security for all flights. These measures must include resources, organizations, plans and procedures.

Airports must establish an Airport Security Program in order to protect civil aviation at the airport level. It is an extension of the National Program. It consists of the same objectives and components. However, the Airport Security Program is more action oriented. 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.

Each State must also create a National Civil Aviation Security Authority responsible to develop, implement and maintain all elements of the National Civil Aviation Security Program. In many States, this authority is part of the Civil Aviation Authority.

We discussed the essential objectives of the Airport Security Program in the module, All About Airports. These are the protection of airport, aircraft and air navigation facilities as well as the control of persons and items placed on board aircraft. The primary objective of preventive measures is to prevent the presence of weapons, explosives and other dangerous substances on board aircraft.

Lesson Summary

Aviation *safety* refers to the efforts that are taken to ensure airplanes are free from factors that may lead to injury or loss. Aviation *security* is a combination of measures and human and material resources intended to safeguard civil aviation against acts of unlawful interference. The objective of civil aviation security is to safeguard passengers, crews, ground personnel, the general public, aircraft, airports and navigation facilities against such acts of unlawful interference.

Progress Checks (Lesson 8.5)

Write your answer(s) in the space(s) provided.

1. The key difference between aviation safety and aviation security is that security is mostly concerned with acts of unlawful interference.
   (a) True
   (b) False

2. The main difference between the National Security Program and the Airport Security Plan is that the Airport Security Plan ______________.
   (a) is enforced by the local police force
   (b) is financed by municipal taxes
   (c) includes many parties
   (d) is more action oriented

3. The establishment of a National Security Program is a recommendation for ICAO member states published in Annex 17 of the Standards and Recommended Practices.
   (a) True
   (b) False

Module Summary

The regulatory agencies play a key role in monitoring and enforcing the practices that ensure safe aircraft. Manufacturers work together with the airlines to ensure each aircraft type is airworthy and invest heavily in the technology to improve safety.

The captain is ultimately responsible for the airworthiness of the aircraft, however, the co-pilot and the cabin crew all have critical roles in ensuring the aircraft's continued safety. Key factors affecting aircraft safety include the impact of weather and natural conditions, material and structural problems in an aircraft as well as human factors, such as pilot error.

The goal of accident investigation is to determine the causes of the accident. Only by asking the right questions and exploring all possible alternatives is it possible to make safety recommendations and improve practices.

Countries are required to establish a National Security Program to protect the safety, regularity and efficiency of civil aviation by providing practices and procedures that safeguard against unlawful interference.

Apply Your Learning

1. If you have access to the airside of an airport terminal, try to observe a maintenance check on an aircraft. If it is a ramp check (also known as a departure check or preflight check/postflight check), note the routine steps taken by the mechanics. Do they use an official checklist? Do they conduct a ‘walk around’ to check the aircraft exterior for Foreign Object Damage (FOD)?
2. When airport emergencies occur, what procedures exist to handle them? Is there an Emergency Operations Center?
3. What natural hazards affect your airport? Does your airport have a wildlife problem?
4. Observe the screening of departing passengers. 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?
5. Walk through airport public areas and workplaces. Do you see any security awareness statements?
6. The next time you travel by air, take note of the following: security checks for passengers, security checks for baggage, emergency equipment located on the airplane (can be indicated by small signs installed on certain cabinet doors), signs and directions on exit doors/windows. Also, review the emergency information card located in the seat pocket in front of your seat.

Answer Key

Progress Checks (Lesson 8.1)

1. d
2. c
3. a
4. c
5. a
6. b

Progress Checks (Lesson 8.2)

1. c
2. b
3. a
4. c
5. b
6. d

Progress Checks (Lesson 8.3)

1. a
2. c
3. d
4. a
5. d

Progress Checks (Lesson 8.4)

1. a
2. c
3. b
4. d
5. d
6. a

Progress Checks (Lesson 8.5)

1. a
2. d
3. b

Module 9

Future of the Industry

9.0 Future of the Industry

Module Learning Objectives

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

- Describe why the airline industry will remain a growth industry. (Lesson 1)
- Describe the main threats to the profitability of the industry. (Lesson 2)
- Describe IATA's five priorities in supporting the airline industry. (Lesson 3)

Module Overview

The future. What does it hold for the airline industry? What elements will generate profitability? What are the main threats that will affect the profitability of the world's airlines over the next 10 years? Although the industry remains fragile, leaders at IATA are optimistic and believe the airline industry will generate profit. In this final module, we will present the five priorities IATA has identified to support the industry in its endeavours to simplify the business and reduce cost. Here is what Tony Tyler, Director General and CEO of IATA said in December 2011:

"The facts clearly show that aviation enables economic growth. Our goal is to encourage positive policy frameworks that allow aviation's economic benefits to flourish. A safe, efficient and environmentally responsible aviation industry drives economic growth. And growth is what economies need to improve their state of health. Aviation is a catalyst for growth. It supports the livelihood of some 57 million people and over a third of the value of goods traded internationally is transported by air. Connectivity drives business. With the aim of setting a future strategic vision for the industry, IATA's Vision 2050 will encompass emitting half the carbon, eliminating queues with integrated systems ensuring security as we process more passengers operating with almost no delays in globally united skies, and reducing accidents to almost zero. IATA's vision is also to have a consolidated industry of a dozen global brands supported by regional and niche players and deliver value to investors.

Lesson Learning Objectives

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

- List the main events in the 1990s that negatively affected airline profitability.
- List the key factors that led to the growth of leisure travel.
- List the key factors that led to the growth of business travel.
- Describe major factors driving the changes in the airline industry.

9.1 Predicted Growth of the Industry

Lesson Overview

In this lesson, we will discuss why the air travel industry will remain a large and growing industry. In order to understand where the industry is going, it will be useful to take a look at where it has been. We will start with a brief market overview and a look at why the last 15 years have been so turbulent in the air transport industry. We will look at current trends such as the low-cost carriers, the drive of the scheduled carriers towards efficiency, industry deregulation and the birth of alliances.

9.1.1 Industry Overview

Industry predictions continue to forecast that air travel will remain a large and growing industry. It is recognized globally as an industry that facilitates tourism, world trade, economic growth and international investment. It is central to the globalization efforts taking place in many industries around the world.

Airline profitability is closely tied to economic growth and trade. During the first half of the 1990s, the industry suffered from world recession and events such as the 1991 Gulf War, which served to reduce travel. Orders for new aircraft, placed during the boom years of the late 1980s, were being delivered during the 1990s. As a result, there were more seats to fill (increased capacity) during a period of declining demand for air travel. IATA member airlines suffered cumulative net losses of US$20.4 billion in the years from 1990 to 1994. In spite of this, the 1990s saw worldwide travel for both business and leisure purposes grow by seven percent per year.

9.1.1.1 The Leisure Market

The availability of large aircraft such as the Boeing 747, the B787 and the A-380 made it convenient and affordable to travel further to new and exotic destinations. This promoted the growth of the leisure, or recreational, travel market. Many governments in developing countries realized the benefits that tourism could have on their national economies. They invested heavily in the development of resorts and other infrastructure to entice tourists from the prosperous countries in Western Europe and North America to visit their countries. The increased tourism brought in much needed foreign currency and investment. This encouraged their own citizens to start to travel as their economies, and their own personal incomes grew.

9.1.1.2 The Business Market

With the increase in world trade and global investment, companies are becoming globalized. The result is an increased need for business travel as managers need to oversee these distant business opportunities and new customers.

9.1.1.3 Market Growth

In the mid 1990s, IATA forecasts indicated that worldwide international air travel would grow by an average 6.6 percent a year to the end of the decade and over five percent a year from 2000 to 2010. In Europe and North America, where the air travel market was already highly developed, a slower growth of four to six percent was projected. The most dynamic growth picture, however, was centerd on the Asia-Pacific region, where fast-growing trade and investment, along with rising domestic prosperity meant air travel was rising by up to nine percent a year and was forecast to continue to grow rapidly.

Airbus predicts that some of the main drivers for growth from 2011–2030 will be the replacement of aircraft already in service, dynamic growth in emerging markets, continued growth of LCCs in Asia and greater continued market liberalization. Growth for the expanding regions such as China, Middle East/Asia and Eastern Europe is predicted at 6.1 percent while the maturing regions such as Western Europe, North America and Australasia is at 3.7 percent from 2009 to 2029.

9.1.1.4 Decade of Disastrous Growth

However, no one was able to correctly forecast the tumultuous events of the last 15 years. After a few years of rising profits, profitability began to weaken with the Asian financial crisis in 1997 and 1998. Then, the "Y2K" dilemma, in which businesses were faced with addressing computer software issues at the turn of the millennium,

Did You Know?

"Improving business confidence and encouraging news from the US economy are heartening developments. But it is far too early to start predicting a soft landing. The euro zone crisis is far from over. Failure to achieve a durable solution will have dire consequences for economies around the world, and it would most certainly tip the airline industry into the red.

Airlines have made massive investments in new fuel-efficient, environmentally friendly aircraft. The challenge is to deploy them profitably into a dynamic and uncertain market. Governments, meanwhile, need to take a strategic view of the airline industry that recognizes its value as a catalyst for economic growth".

Tony Tyler, DG & CEO, IATA

caused a great deal of expense. Next were the catastrophic events of September 11, 2001 and the SARS epidemic of 2002–3, both of which had dramatic effects on the air transport industry.

9.1.2 Changes in the Industry

Since then, airlines have had to recognize the need for radical change to ensure their survival and prosperity. Many have tried to cut costs aggressively, slow down capacity growth and increase load factors (percentage of seating capacity actually used by customers) in an effort to reduce operating costs and improve profit margins. In the United States, which has the largest domestic airline industry, many airlines have been forced into what is called Chapter 11 bankruptcy protection in an effort to restructure and cut costs. Some have suffered complete liquidation. Other airlines have merged in the effort to survive and improve profit margins.

9.1.2.1 The Drive Towards Efficiency

A number of factors forced the airlines to become more efficient. In Europe, the European Union (EU) ruled that governments could not subsidize airlines that were suffering losses. Elsewhere, governments' concerns over their own finances and a recognition of some of the benefits of privatization have led to a gradual transfer of airline ownership from the state to the private sector. In order to appeal to prospective shareholders, the airlines had to become more efficient and competitive.

The EU ETS is a cap-and-trade system, which forms a major part of the European Union's climate policy and its efforts to reduce GHGs (greenhouse gases). These gases contribute to global warming and are emitted by factories, power plants and other installations in the system. The EU-ETS has now mandated that all 4,000 airlines (EU and non-EU) be part of this scheme. Certain non-EU states are appealing this decision.

Sustainable bio-fuels to help reduce dependence on fossil fuels in air transport and reduce carbon emissions have been introduced. Major airlines have begun using biofuels on their long haul flights. Airbus, Boeing and Embraer signed a collaboration agreement to accelerate the commercialization of sustainable biojet fuel.

9.1.2.2 Deregulation Intensified

Deregulation stimulated competition, especially from new, smaller, low-cost carriers (LCCs). The USA began the deregulation process in 1978 and the European Union countries eventually gave way to market pressure, with the EU's final stage of deregulation taking place almost 20 years later in April 1997. This allowed an airline from one member state to fly passengers within another member's domestic market without the need for government approval.

The ‘open skies’ agreements began to erase a few of the regulations governing certain carrier's routes. Nevertheless, the aviation industry is still characterized by strong nationalist ties towards domestic ‘flag carriers’, which is also reflected in the names of carriers (e.g., Air China). In many parts of the world, especially Asia, airlines will continue to face limitations on where they can fly and restrictions on their ownership of foreign carriers.

9.1.2.3 Airline Alliances

The international scheduled airline industry has proceeded along the path towards globalization and consolidation. It has done this through the establishment of global alliances and partnerships between airlines, linking their networks to expand access to their customers. Hundreds of airlines have entered into alliances, ranging from marketing agreements and code shares to franchises and equity transfers. The three largest passenger alliances are the Star Alliance, SkyTeam and Oneworld. Alliances also form between cargo airlines, such as the WOW Alliance, SkyTeam Cargo and ANA/UPS Alliance. Alliances provide a network of connectivity and convenience for international passengers and international packages. Alliances also provide convenient marketing branding to facilitate travelers making inter-airline codeshare connections within countries.

9.1.2.4 New Services

The most successful carriers will be those who continue to reduce costs and improve their products and overall customer service.
In order to meet the requirements of the business customer, airlines are becoming more proactive in introducing mobile applications to their websites. This service mainly targets the business market which has the highest profit margins. It allows increased transactions while on the move–from booking flights to checking-in. Innovative on-board technology, high-end customer service and product enhancements are continuously introduced to retain and attract customers. As more and more passengers utilize electronic devices (e.g., laptops, iPhones, other smartphones) to manage their business or leisure travel, airlines are offering more self-service products. The launch of new smartphone applications keeps passengers informed in real time of flight delays, cancellations, gate changes and even if their bag has gone missing. Self-service bag drop has now been adopted in certain airports. Passengers traveling from these airports (e.g., Amsterdam and Montreal) can now check in and print their baggage tags before proceeding to a self-service bag drop area.

9.1.2.5 Arrival of the Low-Cost Carriers (LCCs)

With the arrival of the new millennium, the established network airlines suffered from the impact of terror attacks, high costs, recessions, over-capacity, natural disasters, global medical alerts and rising fuel prices. This resulted in falling profits for five straight years (2001–2005) providing the opportunity for the low-cost carriers to emerge. In the mid 1980s, companies such as Ryanair began to receive attention, this being one of the results of deregulation.

Based on a new point-to-point market model, the budget travel airlines thrived on a combination of low fares and bare-bones service to keep prices low (i.e., no meals or other product enhancements). Low-cost carriers offered much lower fares compared to the "legacy" carriers. This was due to their much lower operating cost structure. Some larger airlines have high operating costs in part because airport passenger and landing fees are based on number of passengers carried and the actual landing weight of aircraft. As the budget airlines carry fewer passengers with smaller aircraft, this creates a significant reduction in overall operating costs.

The impact of liberalization is particularly dramatic in the case of these low-cost airlines, which are stimulating air travel by lowering fares and opening new markets. In order to compete, established airlines are forming low-cost units, further expanding the affordability and availability of air travel.

In Europe and the US, these airlines attracted more and more passengers. By 2005, a wide range of these low-cost, “no-frills”, low-fare members of the airline industry were available around the world.

9.1.2.6 Projected Growth of Low-Cost Carriers

North America is where this low-cost carrier business model is the best established, and remains the model for the rest of the world. Many conditions were in place for the low-cost carrier to emerge. This includes deregulation, large regional domestic markets and a multitude of airports. Attractive lease rates for new aircraft, the availability of used aircraft and a well-trained human resource pool. Some examples of low-cost carriers are: JetBlue, Horizon, Southwest and Spirit airlines in the United States and WestJet and Air Transat in Canada. In addition, many low cost carriers have already started to merge as per the model of legacy carriers.

Nearly 130 low-cost airlines operate worldwide–of which 62 are on the European continent.

Since 2002, 30 additional low fare airlines joined the market, in Thailand, Singapore, the Philippines, Indonesia, India, China and Japan. In 2006, in India, Spicejet and Kingfisher entered the market to compete against the existing LCCs, Air Deccan and GoAir. Asia is expected to see a huge growth in this market segment in the coming years. It is developing into the third major low-cost arena after North America and Europe.

The Latin American aviation market expects to see continued expansion in the immediate future with a number of new budget airlines forecast to be launched.

Low-cost carriers have also sprung up in Sub-Saharan Africa as well as in the Middle East and North Africa. New names include Jazeera, TUI 9 owned Jet4You) in Morocco and Sama in Saudi Arabia.

9.1.2.7 Future Growth

Key Learning Point

Airlines have had to recognize the need for radical change to ensure their survival and prosperity.

Aviation is the nucleus of global economic development. The future holds many challenges and fierce competition will be the main driver of innovation. For the next 20 years, global growth is expected to be 4.8 percent with Asia-Pacific, Europe and North America leading this growth. Passenger numbers are expected to double by the year 2020. Boeing predicts that new business models and emerging economies will support airplane demand. Airplane deliveries for fleet growth and replacement of aging airplanes will total 33,500 over the next 20 years. Asia leads the demand for large aircraft.

While air transport markets in the rest of the world shrank during the global economic downturn of 2009, international air travel continued to grow for Middle East carriers, demonstrating the region's prominence in global air travel. International traffic continued to grow during 2010, rising 17.8 percent for Middle Eastern carriers–far exceeding the world average of 8.2 percent growth. Newly emerged low-cost carriers are stimulating demand for travel, targeting the young local population and the large migrant workforce. There are approximately 885 airplanes on order in the Middle East.

The prospects for the long-term remain positive with global economic growth shaping the future.

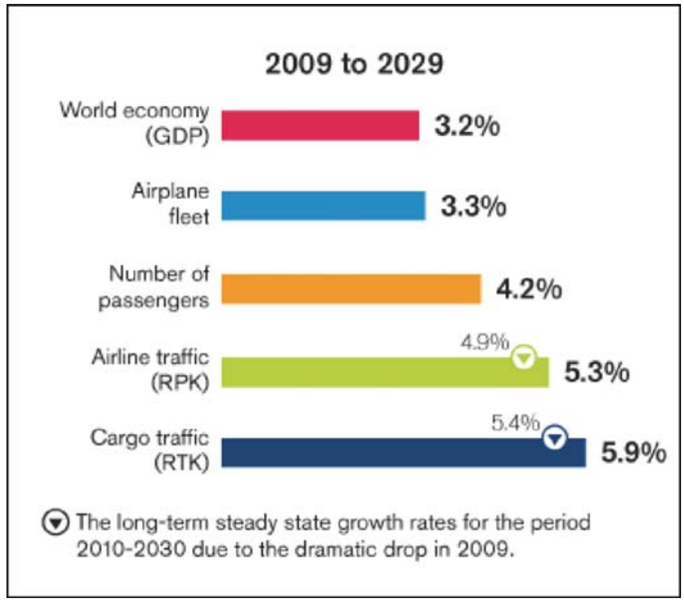


Figure 9.1.2.7—Global Market Forecast 2009–2029 (Boeing)

Lesson Summary

In this lesson, we reviewed why the last 15 years have been so turbulent in the air transport industry, including the impact of world events which severely reduced air travel. Recent trends in the industry have included the low-cost carriers, the drive of the scheduled carriers towards efficiency, industry deregulation and the birth of alliances. It is predicted that the air travel industry will experience continued growth. Much of it is expected to come from the low-cost carrier segment of the industry. The main air travel markets of the future will continue to be Europe, North America and Asia.

Progress Checks (Lesson 9.1)

1. A review of key performance indicators shows that airline profitability is not tied to economic growth and trade.
   (a) True
   (b) False

2. Which of the following measures were taken by airlines to minimize operating costs and improve profit margins?
   (a) Open new routes
   (b) Slow down capacity growth
   (c) Use biojet fuel
   (d) Market their services more aggressively

3. One of the drivers for airlines to become more efficient was ______________.
   (a) privatization
   (b) government subsidies
   (c) increase load factors
   (d) Chapter 11 Bankruptcy protection

4. Deregulation in the European Union allowed an airline from one member state to fly passengers within another member's domestic market without the need for government approval.
   (a) True
   (b) False

5. Airlines are introducing mobile applications to their web sites in order to mainly target ______________.
   (a) the younger generation
   (b) the older generation
   (c) the leisure traveler
   (d) the business customer

6. One important development resulting from the increase in the number of customers using electronic devices is ______________.
   (a) more targeted marketing programs
   (b) the end of the paper boarding pass
   (c) increase in self-service products
   (d) better communication with customers

9.2 Threats to the Airline Industry

Lesson Learning Objectives

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

- Describe the main factors that are predicted to affect airline profitability in the next decade.

Lesson Overview

In this lesson, we will discuss the main factors that are predicted to affect the profitability of the world's airlines during the next ten-year period. As we will see, many of these factors can potentially be viewed as threats to the stability of the industry as a whole.

Some of these threats are not new to the airlines, such as high fuel prices, low fares, aggressive competition, taxes and surcharges. The industry has seen them and survived them before. There are, however, some newer ones, such as industry consolidation and global health issues that could become the breaking point for some carriers.

9.2.1 State of the Industry

According to figures issued by IATA, air travel markets in 2010 had essentially recovered from the financial crisis of 2008, measured by the number of passenger kilometers flown. The industry, however, remains fragile with continued threats to airline profitability.

Key Learning Point

One of the biggest threats to airline profitability is the high cost of fuel.

9.2.2 Fuel Prices

Without a doubt, one of the biggest threats to airline profitability is the high cost of fuel. Recently, prices per barrel have been at an all time high. Since the market downturn in 2001, after the terrorist attacks on U.S. territory, the average cost for a barrel of U.S.-based jet fuel has steadily increased. In October 2005, following the Hurricanes Katrina and Rita, prices spiked even higher. Political uncertainty also drove oil prices higher in 2011. With the current economic downturn persisting in parts of the world and slow to recover in others, oil prices are not expected to decrease any time soon.

9.2.3 Fares

Low fares represent a threat. Air fares are currently at or below the level they were at more than two decades ago, adjusted for inflation. This is partially to ward off competition from the low-cost carriers. When airlines have stagnant fares and high fuel prices, there is a basic profitability problem. It becomes extremely difficult to cover operating costs and come out with a profit.

Key Learning Point

The combination of high fuel prices and low fares make it extremely difficult to cover operating costs and come out with a profit.

In the face of the continued growth of the LCCs, legacy carriers have been forced to compete in order to remain profitable. Most airlines try to carefully mix yield (price) and inventory (volume) to maximize revenue per flight, rather than per person. This is why it is not good practice to look at *yield* or *load factor* alone. It is a combination of many elements, such as revenue per available seat mile (RASM), that airlines monitor to ensure that they are covering their unit operating costs. This effort has resulted in historic growth in load factors and new travelers, who could not afford to fly prior to airline deregulation.

The closer to the flight time a scheduled airline holds an open seat, the more it must charge to cover the risk of allowing the seat to go unsold. The risk associated with holding seats open close to the departure date is that not all of them could be sold. Therefore airlines need to charge more for open seats close to departure date to cover their expenses for the seats that were held open but were not sold. It becomes a question of supply and demand.

The charter airline does not have this same problem. It can charge lower prices because, as a non-scheduled flight, it can choose not to operate the flight if the load factor, or breakeven point, is not high enough (i.e., if it does not fill all or most of its seats). Charters can also choose to fly only at seasonal peak demand times and not the rest of the year. Scheduled airlines, due to their certification, do not have this flexibility. They are required to operate the flight regardless of the number of seats filled.

With the arrival of Internet booking and industry e-ticketing (electronic ticketing), a new element has entered the fare price mix. Some carriers choose to offer unsold inventory on-line at very low prices close to departure time in order to fill the seat at almost any price. This involves the traveler booking directly with the airline website to avoid the costs of the reservation booking service.

9.2.4 Impact of Low-Cost Carriers

The growing number of low-cost carriers (LCCs) is adding a new dimension to competition throughout the world. The worldwide popularity of budget priced travel attracts huge numbers of the traveling public who might not otherwise fly. Less expensive travel options also help the development of small businesses. Also, many corporations have travel cost restrictions in place that dictate the classes of travel staff are permitted to book.

This has become a significant threat to the legacy carriers. They must either match those fares or fly with empty seats, which depending on the aircraft load factor (percentage of seating capacity actually used by customers) may mean an operational loss on that flight. The effect on the legacy carriers has been huge, especially on their domestic, regional or short-haul routes. This means the legacy airlines have looked to their long-haul flights to make up the difference. Even though the business traveler provides the largest profit margins to the airlines, there are not enough of them flying at the higher fares. The leisure traveler who usually travels in economy, remains the largest group of travelers and forms the majority of passengers. This means the legacy airlines have looked to their long-haul flights to make up the difference.

9.2.5 Capacity Management

Key Learning Point

Capacity management refers to managing the number of seats in aircraft owned or operated by an airline.

Capacity management is a highly developed skill. It is managing the number of seats in aircraft. The process of purchasing an airplane has a long completion cycle from design and order to delivery. This long purchase cycle lies at the root of many capacity management issues. Typically, this means an airline orders new aircraft when business is good, but sometimes takes delivery when demand has dropped for whatever reason.

According to IATA, more than 1,400 deliveries were made to the world's airlines for 2011, equating to just under 120 per month. This highlights an acceleration of the global fleet, following just under 100 aircraft deliveries per month in 2010. IATA added that aircraft utilisation rates are now returning to more normal levels, which will likely further push up overall rates of capacity growth in the years to come.

9.2.6 Taxes and Surcharges

High taxes and surcharges imposed by airports, service providers and air navigation service providers are a constant concern for the airlines. High costs for these services heavily impact aviation profitability. IATA has stated that the cost to global airlines yearly for heightened security services has reached $7.4 billion dollars and threatens the financial viability of the airlines.

9.2.7 Health Issues

Key Learning Point

The development of a global pandemic could have a disastrous impact on the airlines and the global economy.

Influenza pandemics are remarkable events in that, with air travel, they can spread, within a matter of months, to infect all countries. All populations are susceptible to pandemic viruses and all countries are equally at risk. Pandemic influenza is a global threat from which no country is immune and the actions required are a shared responsibility of the international community. The interdependence of today's world necessitates strong cooperative effort for all nations to benefit from better regulation, foresight, advanced preparation and risk management.

As the leading international agency for human health, the World Health Organization (WHO) assumes a global leadership role in response to any pandemic. The most recent outbreak being H1N1 in 2009.

Emerging and re-emerging infectious diseases can have a major impact not only on the health sector, but also on regional, national and global economies. The consequences can be catastrophic. The airline industry has already seen the effect that SARS had on just one city–Toronto, Canada. It is presumed that SARS was brought there by a passenger returning home from Hong Kong. The effect on air travel to Canada, and on Toronto's tourism industry, was disastrous. Scenarios drawn up during the H1N1 crisis painted a grim picture for human heath, and the health of the global economy. Thankfully, the worst of these predictions did not come to pass. Nevertheless, the impact on the airline industry was significant as thousands of people canceled travel plans for fear of contracting the disease.

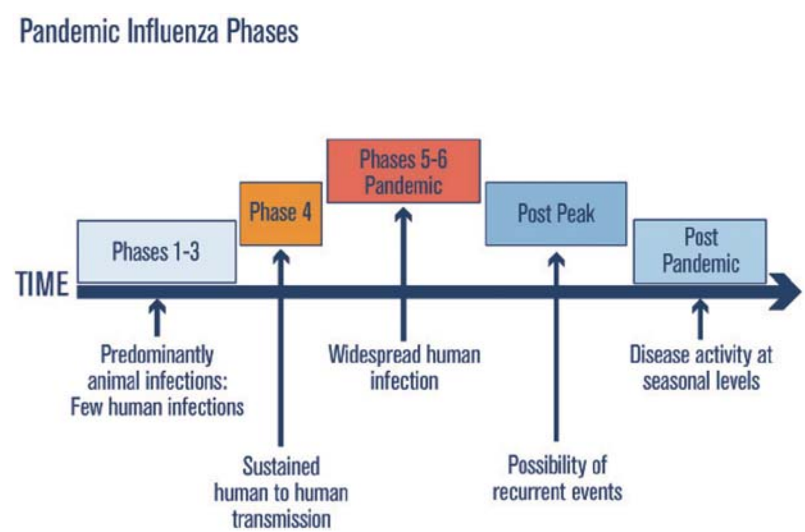


Figure 9.2.7—World Health Organization. (ref: WHO website)

IATA is working closely with the WHO to ensure that the air transport industry is prepared for the next global flu pandemic, which is expected to appear sometime over the next ten years.

9.2.8 Freight Shipments

Today's airfreight market is showing signs of weakness. Traffic growth may be slowing amid rising concern that soaring energy prices are holding back global economic activity. Declining trade volumes and business confidence have had a severe impact on air freight, with year-over-year growth for all routes well in negative territory. The Far East market has been more sensitive than other routes, having the largest decline in 2011. On the other hand, the Far East experienced the strongest performance in 2010. According to IATA, cargo profitability began to fall in the second half of 2010 and declined further in 2011. Pessimistic expectations are driving the demand for air freight down, with purchasing managers' confidence index forecasting no growth.

The turning point for air freight markets has continued into the back end of 2011, with international freight volumes falling 3.8 percent. Domestic freight fell sharply by four percent in October compared with a year earlier, a notable drop from the previous month. International FTKs continued a similar degree of decline, down 4.8 percent.

9.2.9 Consolidation of Freight Forwarders

Key Learning Point

Freight forwarder consolidation presents a threat to the traditional air cargo giants.

A developing industry trend that is of concern to some analysts is the consolidation of freight forwarders. As we saw in an earlier module, a freight forwarder is an agent for exporters in moving cargo to an overseas destination. This serves to benefit some airlines (and airports) at the expense of others. Consolidation refers not only to outright mergers and acquisitions of companies, but also to cooperative agreements to combine freight shipment volumes allowing some forwarders to continue to grow in spite of the global slowdown in airfreight. They create logistics centers at a chosen airport where they concentrate smaller shipments into much larger ones. This provides increased negotiating powers with the airlines to obtain more stable economies of scale and improved terms.

Lesson Summary

In this lesson, we discussed the main factors that are predicted to affect the profitability of the world's airlines, both passenger and freight, during the next decade. Some of these threats are not new to the airlines; they include high fuel prices, low fares, aggressive competition, taxes and surcharges. The industry has seen them, and survived them, before. The newer threats, such as industry consolidation and global health issues, could become the breaking point for some carriers. Unless the airlines adopt individual and collective strategies to deal with these threats, some carriers, both legacy and low-cost, will not survive.

Progress Checks (Lesson 9.2)

1. One of the biggest threats to airline profitability is ____________.
   (a) high cost of fuel
   (b) high cost of personnel training
   (c) high cost of aircraft
   (d) overcrowded airports

2. One of the outcomes of deregulation has been ____________.
   (a) historic growth in load factors
   (b) opening of new international routes
   (c) increase of the business travel market
   (d) increase in leisure travel market

3. In what segment have the LCCs most significantly affected the legacy carriers?
   (a) Chartered flights
   (b) Long-haul flights
   (c) Short-haul flights
   (d) International flights

4. The consolidation of freight forwarders is a potential threat to airlines because it gives increased negotiating powers to freight forwarders.
   (a) True
   (b) False

5. Capacity management refers to managing the number of seats in aircraft.
   (a) True
   (b) False

Lesson Learning Objectives

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

- List and describe the five main initiatives undertaken by IATA to simplify the airline business.
- List and describe IATA's five other business priorities for 2012.

9.3 IATA's Industry Priorities

Lesson Overview

This module is focused on providing information on the growth of the aviation industry for the next 10 years. The speed of the aviation industry's recovery from the latest 2008/2009 financial crisis is a testament to the importance of aviation to the world's businesses and to people in their day-to-day lives. The global forecast suggests that traffic will more than double in the coming 20 years as aviation becomes more accessible to those in emerging markets as well as continued growth in the more traditional markets in Asia, Europe and North America. With ongoing globalization, people will increasingly travel between the major population centers around the globe to develop, strengthen and sustain relationships in a way that only face-to-face communication allows. At the same time, the industry will continue to innovate and improve the travel experience for passengers. However, it will continue to be subject to a variety of very real threats to its profitability. In order to survive, the airlines will need to adopt individual and collective strategies to deal with these threats. Throughout this course we have presented various means by which this can be done, including the use of alliances, cooperative arrangements and cost-containment strategies.

This lesson will provide an overview of what IATA is working on to support the airlines' efforts. One priority is to assist the airlines to simplify their common business processes. The primary purpose of “Simplifying the Business” (StB) is assisting the airlines with cost reduction plans and streamlining shared practices. This will result in more cost effective and efficient initiatives for the industry as a whole. It will also highlight important changes required for the airlines to remain competitive and financially viable in the long term. Lastly, we will look at a brief overview of IATA's remaining industry priorities that include safety, operational and regulatory issues as well as financial savings.

9.3.1 IATA's Role

The air transport industry has always been a model of international cooperation and shared processes. IATA has always been a leader in this respect, assisting airlines and other members of the industry in the development and implementation of necessary global standards. As a prime mover of change, IATA's role is to bring all parties involved together, so they may develop practical industry-wide standards.

9.3.2 Simplifying the Business

According to IATA, the main challenge for the airline business is to find ways to reduce costs and simplify the industry's complex processes: "The future of travel is more choice, more control for passengers, and lower costs for the industry. Approximately 75 percent of passengers worldwide have expressed the need for more self-service options. The answer is in simplifying processes and making the most effective use of existing technology." (Source: www.iata.org)

Simplifying or streamlining certain common business processes benefits both the industry and the customer by making a more efficient travel experience for everyone. The aim is to offer improved services to passengers and reduce costs to the airlines while saving at least $18.1 billion every year. The following projects make up the Simplifying the Business program:

- e-Freight
- Baggage Improvement Program (BIP)
- Fast Travel
- IATA e-services–EMD implementation

We will discuss each of these projects in the sections that follow.

9.3.2.1 e-Freight

The e-freight project aims to take the "paper" out of the air cargo supply chain and replace it with a less expensive, more accurate, more reliable electronic messaging system. Today, each air cargo shipment carries with it as many as 30 paper documents, enough to fill 80 Boeing 747 freighters every year. The target is 100 percent e-freight by 2015. A paperless supply chain has many benefits, which include:

- Online tracking functionality
- Cost savings of up to US$4.9 billion annually for the industry.
- Reduced cycle time (i.e., faster service to customers with greater reliability and accuracy).

Facilitated by IATA, the project is an industry-wide initiative involving carriers, freight forwarders, ground handlers, shippers and customs authorities.

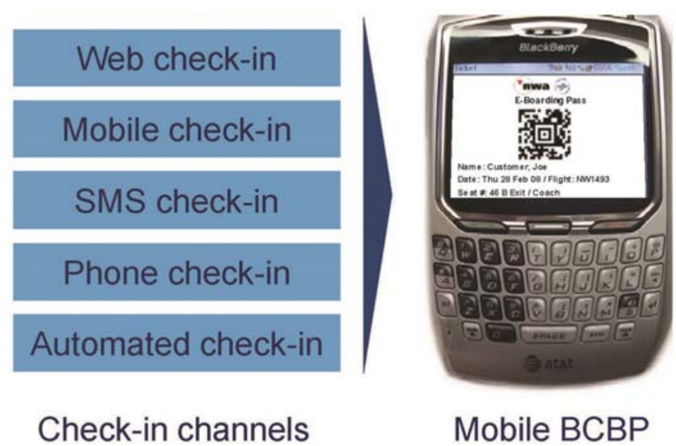
9.3.2.2 Baggage Improvement Program

Mishandled baggage is a US$3.3 billion dollar problem for the industry–every year. It also affects 42 million passengers annually and is the second most important factor in having an unpleasant trip, according to an IATA survey.

BIP provides the industry with solutions that address all causes of baggage mishandling. BIP brought these solutions to 200 airports around the world by the end of 2012. When fully implemented, BIP solutions will save the industry US$1.9 billion every year.

9.3.2.3 Fast Travel

The future of travel? More choice and more control for passengers, with lower costs for the industry. The need for seamless products is more and more evident in today's technological travel environment. Approximately 75 percent of passengers worldwide would like more self-service options.



IATA's Fast Travel project is providing self-service options in six areas of a passenger's airport journey. These six areas are:

- Check-in
- Document scanning
- Flight rebooking
- Self-boarding
- Bag recovery

Together, they represent an annual cost saving of up to US$2.1 billion for the industry. By creating uniform standards and recommended practices, IATA will facilitate the adoption of these procedures–which will result in an improved travel experience for the customer. In 2012, IATA implemented three Fast Travel solutions in 100 airline/airport pairs.

To learn more about IATA's Fast Travel, please visit: http://www.iata.org/whatwedo/stb/fast-travel/Pages/index.aspx.

Key Learning Point

Simplifying certain common business processes benefits both the industry, through cost reduction, and the customer by providing a more efficient self-service travel experience.

The following are examples of airline/airport pairs that have implemented a number of Fast Travel solutions:

- SAS at Copenhagen International Airport
- British Airways at London Gatwick Airport
- Lufthansa at Munich Airport
- Air New Zealand at Auckland International Airport
- Etihad Airways at Abu Dhabi International Airport
- Air China at Beijing Capital International Airport
- Lufthansa at Frankfurt Airport
- Iberia at Madrid-Barajas Airport

Watch how IATA's Fast Travel program can benefit the industry and the passengers:
http://www.youtube.com/watch?v=bufLeBGwRJA&feature=related

9.3.2.4 IATA e-Services—EMD Implementation

Recognizing the trend of growing airline ancillary services, the IATA Board of Governors approved the IATA e-services project in December 2009.

The project aims to facilitate sales and collection of ancillary services through all distribution channels. In the airline industry, ancillary services are revenues rendered from non-ticket sources, such as baggage fees and on-board food and services. The Electronic Miscellaneous Document (EMD) is an IATA standard tool used to track airlines' ancillary sales and usage. This is an important step toward 100 percent electronic capability. Using IATA's EMD standard will also help remove the remaining “paper” from the airline ticketing process. By creating a paperless environment, the project enables a whole range of services across the industry–from fast track security to on-board wi-fi access to limo transfers.

Airlines can improve customer satisfaction by offering ancillary services across journeys, even those that involve multiple airlines, thereby making life simpler for passengers traveling on alliance or interline partners.

Did You Know?

The BSP system (Billing and Settlement Program) is a worldwide system. At the close of 2011, there were 82 BSPs, covering 173 countries and territories serving about 400 airlines. Gross sales processed amounted to US$249 billion.

IATA Board targets:

- The key benefits are annual cost savings up to US$2.9 billion.
- Easier access. Both airlines and travel agents can sell these services through online and mobile channels.
- 100 percent billing settlement process (BSP) usage by the end 2013.

9.3.3 IATA's Additional Industry Priorities

In addition to simplifying the airline business, IATA has targeted five additional priorities. These are:

9.3.3.1 Security

Keeping aviation secure is extremely costly to the industry and a major inconvenience for passengers. The Checkpoint of the Future, IATA's project for improving security screening, is designed to enhance security while reducing queues and intrusive searches at airports, using intelligence-driven risk-based measures. The concept, endorsed by member states during ICAO's 2010 Assembly, has been translated into a first prototype unveiled at IATA's Annual General Meeting in June 2011.

Some of the key concepts of Checkpoint of the Future are:

- Strengthened security by focusing resources on the greater risk areas.
- Supporting this risk-based approach by integrating passenger information into the checkpoint process, whereby passengers approaching the checkpoint will be directed to one of three lanes: ‘known traveler’, ‘normal’ and ‘enhanced security’.

Figure 9.3.3.1—Mock-up of the Checkpoint of the Future

Key Learning Point

IATA's five industry priorities are: finances, regulation, environment, security and costs to member airlines.

9.3.3.2 Finances

The focus of this priority is savings and cost reduction/avoidance for the airlines.

9.3.3.3 Environment

The environment priority concentrates on reducing costs related to the global climate-related tax on carbon. ICAO's priorities are to:

- Secure member commitment to develop a global framework for aviation by 2013.
- Secure ICAO commitment on establishing a CO_2 standard for new aircraft types for consideration by ICAO's Committee on Aviation Environmental Protection (CAEP).
- Secure commitments from five governments to support the construction of commercial scale biofuel plants.

9.3.3.4 Regulation

This IATA priority deals with issues of a regulatory nature. One key goal is to secure the airlines' full involvement in decision making in SESAR (European air traffic control infrastructure modernization program) issues. SESAR aims to develop the new generation air traffic management system capable of ensuring the safety and fluidity of air transport worldwide for the next 30 years.

9.3.3.5 Costs to Member Airlines

This priority is simply to find innovative ways to reduce IATA's fees and charges to member airlines by $6 million.

Lesson Summary

This lesson presented an overview of what the International Air Transportation Association (IATA) is working on to support the airlines in their improvement efforts. One priority is to assist the airlines in simplifying their common business processes. The primary purpose of this “Simplifying the Business” initiative is to assist the airlines with cost reduction and streamline shared practices. Our lesson concluded with a brief overview of IATA's other priorities for the industry, including safety, financial savings, environmental and regulatory issues as well as reducing member costs.

Progress Checks (Lesson 9.3)

1. According to IATA, one important avenue for cost reduction for airlines is ______________.
   (a) outsourcing labor-intensive tasks
   (b) laying off non-essential personnel
   (c) limiting the self-service options for customers
   (d) streamlining the industry's complex processes

2. Which of the following is NOT an outcome of implementing industry-wide global standards?
   (a) improved customer experience
   (b) effective use of technology
   (c) improved security measures
   (d) decreased fuel prices

3. One of the key concepts of Checkpoint of the Future is supporting a risk-based approach by integrating passenger information into the checkpoint process.
   (a) True
   (b) False

4. The IATA e-freight project will enable ______________.
   (a) a decrease in number of carriers
   (b) an increase in customs fees
   (c) increased cycle time
   (d) online tracking

5. The main objective of IATA's Fast Travel Program is to increase the number of ______________.
   (a) hub airports
   (b) flights available
   (c) self-service options
   (d) personnel assisting with check-in

Module Summary

The airline industry has gone through a challenging period over the last 20 years or so. The industry will continue to be challenged by ongoing threats such as high fuel prices, low fares, aggressive competition, taxes and surcharges. There are, however, some newer challenges, such as industry consolidation and global health issues, that could become the breaking point for some carriers. In order to survive, all airlines will need to adopt individual and collective strategies to deal with these threats. The various means by which this can be done include the use of alliances, cooperative arrangements and cost containment strategies such as outsourcing.

The International Air Transportation Association (IATA) is working on a number of initiatives to support the airlines in their efforts. One priority is to assist the airlines to simplify their shared business processes. The primary purpose of StB (Simplifying the Business) is to assist with cost reduction and streamline shared practices. This will result in more efficient and cost effective initiatives. It also highlights many of the changes and adaptations the airlines need to implement in order to remain competitive and financially viable in the long-term. IATA's other priorities for the industry include safety, financial savings, environmental and regulatory issues as well as lowering costs for its members.

Apply Your Learning

If you work for an airline company, what evidence of new initiatives (such as the ones listed in this module) do you see?

If you have the opportunity to visit an airport, what evidence of new initiatives (such as the ones listed in this module) do you see at the airport?

Answer Key

Progress Checks (Lesson 9.1)

1. b
2. b
3. a
4. a
5. d
6. c

Progress Checks (Lesson 9.2)

1. a
2. a
3. c
4. a
5. a

Progress Checks (Lesson 9.3)

1. d
2. d
3. a
4. d
5. c

Glossary

Glossary

A

AERODROME
A defined area on land or water (including any buildings, installations and equipment) intended to be used either wholly or in part for the arrival, departure and surface movement of aircraft. Source—ICAO Annex 14.

AIRPORT CONTROL
Air traffic control service for airport traffic. Takeoff and landing permissions are given by Airport Control.

AIR CARGO
Also known as air freight, consists of goods shipped by air, including letters, packages, cars, horses, and construction equipment.

AILERONS
Controls located on the wings used to control the roll of the aircraft.

AIRFRAME
Consists of an airplane's wings; fuselage, or body; empennage, or tail assembly; and landing gear, or undercarriage.

AIR NAVIGATION SERVICES (ANS)
A main function of airside airport operations that includes three types of services: air traffic control, flight information and alerting services.

AIR NAVIGATION FACILITIES
Any equipment, system or manned unit that provides the pilot with information to reach the intended destination, safely and on time.

AIR TRAFFIC CONTROL
The Air Navigation Service that involves managing the airport movements of airside vehicles and aircraft, both on the ground and in the air.

AIRPORT
An area of land or other hard surface, excluding water, that is used or intended to be used for the landing and takeoff of aircraft, including any buildings and facilities.

AIRPORT OPERATIONS
Ground facilities required for air travel, including runways and navigation aids.

AIRPORT SECURITY PROGRAM
A government-mandated program directed towards the prevention and response to unlawful interference and threats to passenger cargo and aircraft.

AIRSIDE
Area of the airport with controlled access.

AIRSPACE CLASSIFICATION SCHEME
Categorizes airspace into seven classes. Each is identified by a letter from A to G. The classes are fundamentally defined in terms of flight rules and interactions between aircraft and Air Traffic Control (ATC). Regulations specify the type of flight permitted (IFR, VFR, or SVFR—Special Flight Rules) and the type of air traffic control service provided for each.

AIRWAYS
Published routes known as the “highways of the sky”. Upon reaching its assigned cruising altitude, an airplane flies along a predetermined flight path. Airplanes are not allowed to deviate from an airway unless authorized to do so by the local Air Traffic Control service.

ALERTING SERVICES
The Air Navigation Service that notifies appropriate organizations when an airplane is missing or in trouble.

ALLIANCE
A formal agreement establishing an association between airlines to achieve a particular aim. This can allow companies to remain as separate entities, yet increase their efficiencies. Alliances allow for increased customer service with minimal increased cost to individual airlines.

APPROACH CONTROL UNIT (APP)
A terminal ATC facility that uses radar and non-radar capabilities to provide approach control services to aircraft arriving, departing, or transiting airspace controlled by the facility.

AREA CONTROL CENTER (ACC)
Provides air traffic services to controlled flights within a designated controlled area.

AVAILABLE SEAT KILOMETER (ASK)
A measure of capacity available. The ASK is calculated by multiplying the number of seats available on a flight leg by the number of kilometers flown during that flight leg.

AVAILABLE SEAT KILOMETER (ASK) COST
Operating cost to fly one aircraft seat one kilometer.

AVIATION ACCIDENT
An occurrence associated with the operation of an aircraft in which a person is fatally or seriously injured, the aircraft sustains damage or structural failure or the aircraft is missing or is completely inaccessible.

AVIATION INCIDENT
An occurrence other than an accident, associated with the operation of an aircraft, which affects or could affect the safety of operations.

AVIATION INDUSTRY
The design, development, production, operation and use of aircraft. This also includes airport operations.

AVIATION SAFETY
A documented process for managing risks, that integrates operational and technical systems, to ensure aviation safety or the safety of the public.

AVIATION SAFETY REPORTING SYSTEM (ASRS)
A means of promoting air safety within the industry. This is a voluntary system that allows pilots and other crew members to anonymously report near misses and close calls in the interest of improving air safety.

AVIATION SECURITY
A combination of measures as well as human and material resources intended to safeguard civil aviation against acts of unlawful interference.

AVIONICS
The science and technology of electronics and the development of electronic devices as applied to aeronautics and astronautics.

B

BACK-OFFICE STAFF
Employees whose primary objective is to support the front-line personnel who deliver a service.

BAR-CODED BOARDING PASSES (BCBP)
An industry standard bar code (IATA Resolution 792). It replaces magnetic stripe boarding passes and can hold information for multiple segments and multiple carriers in one single boarding pass.

BIRD STRIKE
A collision between a bird and an aircraft. It is a common threat to aircraft safety and has caused a number of fatal accidents.

BUSINESS AVIATION
The transportation of passengers, as well as cargo, for business purposes. Sometimes referred to as corporate aviation.

C

CAPACITY MANAGEMENT
Managing the number of seats in aircraft owned or operated by an airline.

CHARTER FLIGHTS
Non-scheduled flights operated by a charter airline. A charter airline operates these flights that take place outside normal schedules through hiring arrangements with a particular customer.

CHICAGO CONVENTION
The treaty that governs the conduct of international civil aviation. Established the International Civil Aviation Organization. It is a treaty that establishes and governs the rules of airspace, aircraft registration and aviation safety. It also details the rights of the signatories.

CIVIL AVIATION
The segment of aviation that includes commercial and private aviation, as well as general aviation, but excludes military aviation.

CNS/ATM SYSTEMS
Acronym for Communications, Navigation, Surveillance/Air Traffic Management Systems, a navigation network of satellites and ground- based systems.

COCKPIT VOICE RECORDER (CVR)
Devices that record conversations and sounds throughout an aircraft's cockpit on digital tape or on a digital microchip.

CODE-SHARING
Code sharing or codeshare is an aviation business term for the practice of multiple airlines selling space on the same flight.

COMMERCIAL TRANSPORT PLANES
The large planes owned or leased by an airline company designed specifically to carry passengers and cargo (or just cargo).

COMMON USE SELF-SERVICE (CUSS)
CUSS (Common Use Self-Service) is a shared self-service kiosk offering check-in facilities to passengers traveling on various airlines.

COMMUTER AIRLINES
Regional airlines that offer transportation service between small, isolated communities unable to support larger aircraft.

CONTROL ZONE
A cylindrical block of airspace, centered on the airport, with an eight kilometer radius, extending from the ground to about 3,000 meters above sea level.

CONTROLLED AIRSPACE
An airspace of defined dimensions within which air traffic control service is provided in accordance with the airspace classification. It is sub-divided into three areas: Airway, Terminal Control Area and Control Zone.

CONTROLLED FLIGHT INTO TERRAIN (CFIT)
A situation where an airplane that is otherwise functioning normally is inadvertently flown into the ground, water or other obstacle.

CREW RESOURCE MANAGEMENT (CRM)
A training program for pilots and cabin crew aiming to increase effectiveness and efficiency in crew teamwork and flight-deck management. It integrates the application of human factors in the aviation system to ensure safe flight operations.

D

DELAMINATION
Delamination is a mode of failure for composite materials. In laminated materials, repeated cyclic stresses, impact and other factors can cause layers to separate.

DEREGULATION
The process by which governments remove restrictions on businesses to encourage the efficient operation of markets.

DRAG
The force of air opposing the forward movement of the airplane.

E

ECONOMIES OF SCALE
A reduction in cost per unit resulting from increased production.

e-FREIGHT (EF)
An industry-wide initiative facilitated by IATA that aims to remove the “paper trail” from the air cargo supply chain and replace it with a more cost effective, accurate and reliable electronic messaging system.

ELECTRONIC TICKETING (ET)
Paperless airline ticket retrievable through a machine or airline agent on presentation of a suitable identity document (ID) at an airport terminal.

ELEVATOR
The hinged part of the horizontal stabilizer that is used to deflect the tail up and down.

EMPENNAGE
The tail assembly, which stabilizes the rear part of the airplane.

F

FLAPS
The hinged, rear sections on the wings near the body. Flaps are deployed downward on takeoff and landing to increase the amount of lift produced by the wing.

FLIGHT DATA RECORDER (FDR)
A device used to record specific aircraft performance such as airspeed, altitude and headings. It is popularly referred to as the “black box”.

FLIGHT INFORMATION SERVICES
A service provided for the purpose of giving advice and information useful for the safe and efficient conduct of flights.

FREEDOMS OF THE AIR
A set of commercial aviation rights granting a country's airline(s) the privilege to enter and land in another country's airspace laid out in the Chicago Convention in 1944.

FREIGHT FORWARDER
A person or company that arranges to deliver goods, on instructions of a shipper or consignee, using various carriers, including air. A freight forwarder is a “travel agent,” for the cargo industry.

FREIGHT TONNE KILOMETER (FTK)
The FTK is calculated by multiplying the number of tonnes of freight by the number of kilometers flown during a certain period.

FUSELAGE
An aircraft's main body section that holds crew and passengers or cargo.

G

GENERAL AVIATION
All flights other than military and scheduled airline and cargo flights, both private and commercial. General aviation flights range from gliders and powered parachutes to large, non-scheduled cargo jet flights.

GLOBAL POSITIONING SYSTEM (GPS)
The use of satellites to convey the positions of airplanes to air traffic controllers.

GRAVITY
The natural force that attracts an object toward the center of the earth.

H

HORIZONTAL SEPARATION
The concept of keeping an aircraft outside a minimum distance from another aircraft to reduce the risk of those aircraft colliding and to prevent accidents due to wake turbulence. Air traffic controllers apply rules, known as separation minima, to do this.

HUB AND SPOKE
An airline network concept, prompted by economic deregulation, whereby small aircraft carry passengers between small airports (feeders) and main airports (hubs).

HUMAN FACTORS
The study of how people interact with procedures, operating controls, tools and other products; can also be referred to as “ergonomics”.

I

INTERNATIONAL AIR TRANSPORT ASSOCIATION (IATA)
An organization, founded in 1945, that promotes safe, regular and economical air transport. Today, this organization has 240 members representing 84 percent of total air traffic as measured in ASK. It is headquartered in Montreal, Canada.

IATA OPERATIONAL SAFETY AUDIT (IOSA) PROGRAM
An internationally recognized and accepted evaluation system designed to assess the operational management and control systems of an airline.

INSTRUMENT FLIGHT RULES (IFR)
Rules which allow properly equipped aircraft to be flown under instrument meteorological conditions.

INSTRUMENT LANDING SYSTEMS (ILS)
A precision runway approach aid having two radio beams to provide pilots with vertical and horizontal guidance during the landing approach.

INTERNATIONAL CIVIL AVIATION ORGANIZATION (ICAO)
An agency of the United Nations which sets international standards in such fields as air navigational facilities, air operations, airports, airworthiness of aircraft and communications. In addition, ICAO defines the protocols for air accident investigation followed by transport safety authorities in countries signatory to the Convention on International Civil Aviation, commonly known as the Chicago Convention. Its headquarters are located in Montreal, Canada.

J

JUMBO JETS
Very large aircraft that can accommodate up to 600 passengers, such as the B-747 and the A-380.

L

LANDING GEAR
The structure that supports an aircraft on the ground and allows it to taxi, takeoff and land.

LANDSIDE
The part of an airport that is open to the public; includes parking lots, public transportation, train stations and access roads.

LOW-COST CARRIER (LCC)
Also known as “no-frills” airlines, a low-cost carrier offers generally low fares in exchange for eliminating many traditional passenger services such as in-flight meals.

LEISURE MARKET
Passengers who travel for recreational or personal reasons.

LIFT
The mechanical force that pushes a plane upward against the gravitational pull. The movement of a plane's wing through the air, combined with the shape of the wing, creates lift.

LINE OF OPERATIONS SAFETY AUDIT (LOSA)
An organizational audit strategy aimed at developing countermeasures to human errors in aviation. LOSA enables operators to assess their level of resilience to systemic threats, operational risks and front-line personnel errors. It provides a principled, data-driven approach to prioritize and implement actions to enhance safety. Recently, ICAO named LOSA a recommended practice for airlines around the world.

LINE PERSONNEL
Personnel who interact directly with the customer.

LOAD FACTOR
Total Revenue Passenger Kilometers (RPKs) divided by total Available Seat Kilometers (ASKs).

M

MAJOR AIRLINES
Large airlines; mostly “legacy” carriers that connect the major cities of the world.

METAL FATIGUE
Refers to the fact that metal parts that undergo many repeated strains eventually fail at a loading far below their original strength.

N

NARROW-BODY JETS
A common class of traditional airliners that has a diameter of three to four meters (10 to 13 feet), a single aisle and seats arranged two to six abreast. The largest narrow-body aircraft carry approximately 280 passengers depending on the aircraft configuration.

NON-SCHEDULED FLIGHTS
Commercial charter flights reserved by demand rather than on a regular schedule.

NORMS
Required company standards; the general level of quality to be met.

O

OPEN SKIES
An international policy concept which calls for the liberalization of rules and regulations on the international aviation industry, opening a free market for the airline industry.

ORGANIZATIONAL CULTURE
The collective behavior of people that are part of an organization. The organization's beliefs and practices.

ORGANIZATIONAL STRUCTURE
The framework of a company, mainly by position (hierarchy), within which an organization arranges its lines of authority. It also determines the manner in which the roles and responsibilities are delegated and communicated.

OUTSOURCING
The contracting of services to external companies.

P

PASSENGER LOAD FACTOR (PLF)
The measure, in percentage, of seating capacity actually used by customers. It is measured by the relationship of the RPK and ASK flown.

PITCH
The alternate lift and descent of the nose and tail of an airplane.

R

RADIO FREQUENCY IDENTIFICATION (RFID)
The use of a wireless non-contact system that uses radio-frequency electromagnetic fields to transfer data from a baggage tag for the purposes of automatic identification and tracking.

RECOMMENDED PRACTICES
Principles, procedures and methods to assure commonality and efficiency with a working environment.

REDUNDANCY
The duplication of critical components of an aircraft system, that have been purposely “built-in” in order to increase reliability and safety.

REGIONAL AIRLINES
Feeder airlines whose role is to bring passengers to the major hubs, where they will connect for longer distance flights on larger aircraft.

REVENUE MANAGEMENT
Maximization of profits from every flight and route network.

REVENUE PASSENGER KILOMETER (RPK)
A measure of passenger traffic that is calculated by multiplying the number of paying passengers by the number of kilometers flown during a flight leg (i.e., segment of flight).

RADIO NAVIGATION (RNAV)
Radio navigation is the application of radio frequencies to determine a position on the earth.

REQUIRED NAVIGATION PERFORMANCE (RNP)
Required navigation performance is a type of performance-based navigation (PBN) that allows an aircraft to fly a specific path between two 3D-defined points in space.

ROLL
The movement of the plane that occurs when one wingtip dips lower than the other.

RUDDER
The hinged part of the vertical stabilizer that is used to deflect the tail to the left and right as viewed from the front of the fuselage.

S

SAFETY MANAGEMENT SYSTEM
A set of organizational measures and procedures designed to manage safety at an airport. It exists to ensure compliance with all safety requirements and to achieve continuous improvements in safety performance.

SAFETY OVERSIGHT AUDIT (SOA) PROGRAM
A universal program established by ICAO in 1998 to conduct regular safety audits of the civil aviation authorities in different countries in relation to personnel licensing (Annex 1), operation of aircraft (Annex 6) and airworthiness (Annex 8).

STANDARD AND RECOMMENDED PRACTICES (SARPs)
Standards and Recommended Practices are technical specifications adopted by the Council of ICAO in accordance with Article 37 of the Convention on International Civil Aviation in order to achieve “the highest practicable degree of uniformity in regulations, standards, procedures and organization in relation to aircraft, personnel, airways and auxiliary services in all matters in which such uniformity will facilitate and improve air navigation”.

SCHEDULED FLIGHTS
Flights taking place using predetermined routes according to a planned timetable.

SEPARATION
The action of air traffic controllers undertaken to ensure that airplanes flying IFR maintain minimum distances from other airplanes, thus reducing the likelihood of collisions.

SITUATIONAL AWARENESS
A person's state of knowledge or perception of the situation around him or her.

SLATS
Aerodynamic surfaces on the leading edge of the wings of fixed-wing aircraft which, when deployed, allow the wing to operate at a higher angle of attack.

STABILIZERS
A stabilizer provides stability when the aircraft is flying straight. The airfoil of the horizontal stabilizer balances the forces acting on the aircraft. The vertical stabilizer and rudder are always placed on the empennage (the rear of the aircraft or tail), or at the ends of aft-swept wings. The horizontal surfaces can be placed on the front or the rear. When placed at the rear, the horizontal stabilizer is called a tailplane.

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

STANDARD AIRWORTHINESS CERTIFICATE
A document that grants authorization to operate a civil aircraft in flight, that is granted when an aircraft conforms to type design and is in safe operating condition.

SUSTAINABLE DEVELOPMENT
A process of developing land, cities, businesses and communities that “meets the needs of the present without compromising the ability of future generations to meet their own needs”.

T

TERMINAL
A building at an airport where passengers transfer between ground transportation and the facilities that allow them to board and disembark from aircraft. Within the terminal, passengers purchase tickets, transfer their luggage and go through security. Terminals are divided into public access and secure areas.

TERMINAL CONTROL AREA
A block of airspace of cylindrical or irregular shape, located at intersections of several airways and typically situated at high-density traffic areas near one or more busy airports. The block extends from at least 200 meters 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.

THROTTLE
A control used by the pilot to control the engine's power and speed.

THRUST
The force that opposes drag and moves the plane forward. The plane's engines or propeller create this thrust.

TRAVEL AGENT
An important contributor to the airline industry, authorized to sell and issue airline tickets.

U

UNCONTROLLED AIRSPACE
Defined as class G airspace. In uncontrolled airspace, the responsibility of assuring aircraft separation is entirely that of the pilot.

UNIT COSTS
A measure of operating costs, an important factor in determining airline profitability.

V

VALUES
Refers to corporate prioritization of the relative worth, merit or importance of tasks it performs.

VERTICAL SEPARATION
The concept, used by air traffic controllers, to keep an aircraft outside a minimum vertical distance from another aircraft to reduce the risk of those aircraft colliding and prevent accidents due to wake turbulence.

VISUAL FLIGHT RULES (VFR)
A set of procedures that govern the piloting of a plane when weather conditions allow the pilot to see the ground and the natural horizon as well as maintain distance from other aircraft.

W

WINGS
The parts of an airplane that extend outward from each side of the fuselage. A wing has a curved top and a nearly flat bottom. This shape helps create the lift that raises an airplane off the ground and keeps it in the air. Wings are usually metal and cantilever (i.e., attached only at one end), completely supported by the fuselage.

Y

YAW
The movement of the plane as its nose turns left or right.

YIELD
Average revenue received for carrying one passenger one kilometer. To calculate yield for a given flight, divide passenger revenue for that flight by total Revenue Passenger Kilometers (RPKs).

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