INSTITUTE OF AERONAUTICAL ENGINEERING

(AUTONOMOUS)

DUNDIGAL, HYDERABAD - 500 043

AERONAUTICAL ENGINEERING

LECTURE NOTES

ON

AVIATION MANAGEMENT

B. Tech VIII semester

PREPARED BY

Ms. K.Sai Priyanka, Assistant Professor

AVIATION MANAGEMENT

VIII Semester: AE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AAE019	Core	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes:Nil	Practical Classes: Nil				Total Classes: 60		

OBJECTIVES:

The course should enable the students to:

I. Understand about the history of aviation, major player's airline industry, current trends and challenges.
II. Impart the knowledge on airport planning, airport operation and various authorities involved in airport management.
III. Understand and gain the knowledge on the meteorological services, environmental regulation and airport fee, rates and charges.
IV. Gain the in depth knowledge on safety regulation, economic regulation and aviation security.
V. Understand about the air traffic control, air space and navigational aid.

COURSE OUT COMES(COs):

CO1: Explain briefly about Airline industry and Analysis of different market potential.
CO2: Illustrate Airport planning different types of privatizations.
CO3: Demonstrate the importance and role of private operators.
CO4: Illustrate the methodology followed by ATC & DGCA.
CO5: Demonstrate the role of air traffic control and the navigational aids.

COURSE LEARNING OUTCOMES (CLOs):

1. Provide knowledge on history of aviation industry.
2. Understand airport system planning, airport master plan, airport lay out plan.
3. Demonstrate governmental requirements on non-passenger related airport authority functions.
4. Explain Air Traffic Services Describe the history and development of Air Traffic Services (ATS).
5. Differentiate between private airports and public use airports, commercial service airports and primary commercial service airports.
6. Discuss and identify the economic, political and social role of airports.
7. Describe airport layout incorporating its different features navigation Explain air traffic rules and procedures.
8. Explain construction of runway and taxiway and aprons as per geometric design for all parameters.
9. Define the requirements of terminal area as per drawing, design and describe the visual aids for air traffic control system.
10. Explain various elements of Heliports and its planning aspects.
11. Understanding the Various Airport services- international air transport services – Indian Scenario
12. Understand the role of private operators- Airport development fees, Rates & Tariffs.
13. Understanding the role DGCA from the certification
14. Knowledge on the role of air traffic control in airspace & navigational aids with live examples
15. Understanding different cases in airline industry.
    Explore the use of learning about how airports work, especially about airport safety and international aviation laws.

UNIT-I	INTRODUCTION	Classes: 10
History of Aviation- organization, global, social & ethical environment-history of aviation in India-Major players in Airline industry-Swot Analysis of different Airline companies in India- market potential of Airline industry in India- new airport development plans-current challenges in airline industry- competition in Airline industry- Domestic & International from an Indian perspective		
UNIT-II	**AIRPORT INFRASTRUCTURE AND MANAGEMENT**	**Classes: 10**
Airport planning – Terminal planning design & operation -Airport operations – Airport functions- organization structure in an Airline – Airport Authority of India- comparison of global & Indian Airport management- Role of AAI -Airline privatization – Full privatization- Gradual privatization- partial privatization.		
UNIT-III	**AIR TRANSPORT SERVICES**	**Classes: 09**
Various Airport services- international air transport services – Indian Scenario- An overview of Airport in Delhi, Mumbai, Hyderabad & Bangalore. The role of private operators- Airport development fees, Rates & Tariffs.		
UNIT-IV	**INSTITUTIONAL FRAMEWWORK**	**Classes: 09**
Role of DGCA-Slot allocation -Methodology followed by ATC & DGCA – management of bi-laterals – economic Regulations.		
UNIT-V	**CONTROLLING**	**Classes: 07**
Role of air traffic control- airspace & navigational aids- control process – case study in airline industry- Mumbai-Delhi airport privatization-Navi Mumbai airport tendering process- six cases in the airline industry.		

Text Books:

1. Graham. A Managing airports - an International Perspective butter worth-heinemann, oxford 2001.
2. Wells. A. Airport Planning and Management, 4th edition McGraw-Hill, London 2000.

Reference Books:

1. Alexander t. wells, seth young, Principles of Airport management, McGraw-hill 2003Y. V. C. Rao,
2. Richard de neufille, Airport systems: Planning, Design & Management, McGraw-hill London 2007.

Web References:

1. https://memberfiles.freewebs.com/94/47/55224794/documents/airport%20planning%20and%20manag ement.pdf
2. https://books.google.co.in/books?id=RYR6cu4YSBcC&dq=Planning%20and%20Design%20of%20Ai rports&source=gbs_similarbooks

E-Text Books:

1. https://accessengineeringlibrary.com/browse/airport-planning-and-management-sixth-edition
2. https://www.only4engineer.com/2014/10/planning-and-design-of-airports-by.html

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The course should enable the students to:	
I	Understand about the history of aviation, major player's airline industry, current trends and challenges.
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IV	Gain the in depth knowledge on safety regulation, economic regulation and aviation security.

COURSE LEARNING OUTCOMES (CLOs):

Students, who complete the course, will have demonstrated the ability to do the following:

S. No	Description
AAE019.01	Provide knowledge on history of aviation industry.
AAE019.02	Understand airport system planning, airport master plan, airport lay out plan.
AAE019.03	Demonstrate governmental requirements on non-passenger related airport authority functions.
AAE019.04	Explain Air Traffic Services Describe the history and development of Air Traffic Services (ATS).
AAE019.05	Differentiate between private airports and public use airports, commercial service airports and primary commercial service airports.
AAE019.06	Discuss and identify the economic, political and social role of airports.
AAE019.07	Describe airport layout incorporating its different features navigation Explain air traffic rules and procedures.
AAE019.08	Explain construction of runway and taxiway and aprons as per geometric design for all parameters.
AAE019.09	Define the requirements of terminal area as per drawing, design and describe the visual aids for air traffic control system.
AAE019.10	Explain various elements of Heliports and its planning aspects.
AAE019.11	Understanding the Various Airport services- international air transport services – Indian Scenario
AAE019.12	Understand the role of private operators- Airport development fees, Rates & Tariffs.
AAE019.13	Understanding the role DGCA from the certification
AAE019.14	Knowledge on the role of air traffic control in airspace & navigational aids with live examples
AAE019.15	Understanding different cases in airline industry.

UNIT-I

INTRODUCTION

History of Aviation

Aviation industry is the business sector that manufactures, maintains, and operates the aircrafts and the airports. When it comes to aviation, there is a broad range of responsibilities within. It comprises activities at the airport as well as in the aircraft. It involves ground duties that are required to perform before the flight takes off, the activities during the flight, and the activities after it lands.

What is Aviation?

The term aviation, was coined by a French pioneer named Guillaume Joseph Gabriele La Landale in 1863. It originates from the Latin word Avishay literally means bird. Aviation means all the activities related to flying the aircraft.

What is Aviation Management?

Aviation management involves managing the workflow of airline, airport, or other businesses pertaining to aviation or aerospace industry by carrying out the day-to-day operations of an airport or an airline.

What is AAI in Indian Aviation?

The Airport Authority of India (AAI) is a public authority that provides Air Navigation Service(ANS)attheairports.ItworksundertheMinistryofCivilAviation(MoCA)tobuild, upgrade, maintain, and manage civil aviation infrastructure in India. The Indian government formed this organization in April 1995 by merging two organizations: One, International Airports Authority of India (IAAI) that was founded in 1972tomanagethenation'sinternationalairportsandtwo,the National Airports Authority (NAA) that was formed in 1986 to look after domestic airports.

Major Roles of AAI

The major roles of AAI include:

1. To provide communication, navigation, and surveillance systems(CNS).
2. To provide Air Traffic Management (ATM) service in Indian airspace and adjoining oceans.
3. To manage all the Indian airports.
4. To ensure the safety of the airports and aircrafts.
5. To provide calibration of navigational aids in the flights of Indian Air Force, Indian Navy, Indian Coast Guard, and private airfields in India.
6. To provide passenger facilities and information system at the passenger terminals at airports.

Ethical environment-history of aviation in India

Aviation is one of the fastest growing industries worldwide and the fastest growing transportation mode in India. In 2006-2007 the Indian civil aviation sector experienced a phenomenal growth rate of about 40%. Considering that less than 1 % of the population in India boards a plane during the year, the future growth potential seems massive. Leading aircraft manufacturer Airbus expects the Indian domestic aviation to be the strongest growing market for the next two decades worldwide. While aviation undoubtedly plays a vital role in supporting the economy and creates societal benefits, it also contributes significantly to climate change and to a lesser degree to air pollution. It was the IPCC (Intergovernmental

Panel on Climate Change) in 1999 that shed light on this issue for the first time by attributing 3.5% of man-made climate impact to the aviation sector.

Aviation has a number of environmental impacts that are experienced by local residents in the vicinity of airports and under flight paths. Noise has been the focus of concern over the last 20 years of growth in aviation and more recently air pollution and the health effects of air pollution from aircraft and land based transport have begun to cause concern.

Noise pollution

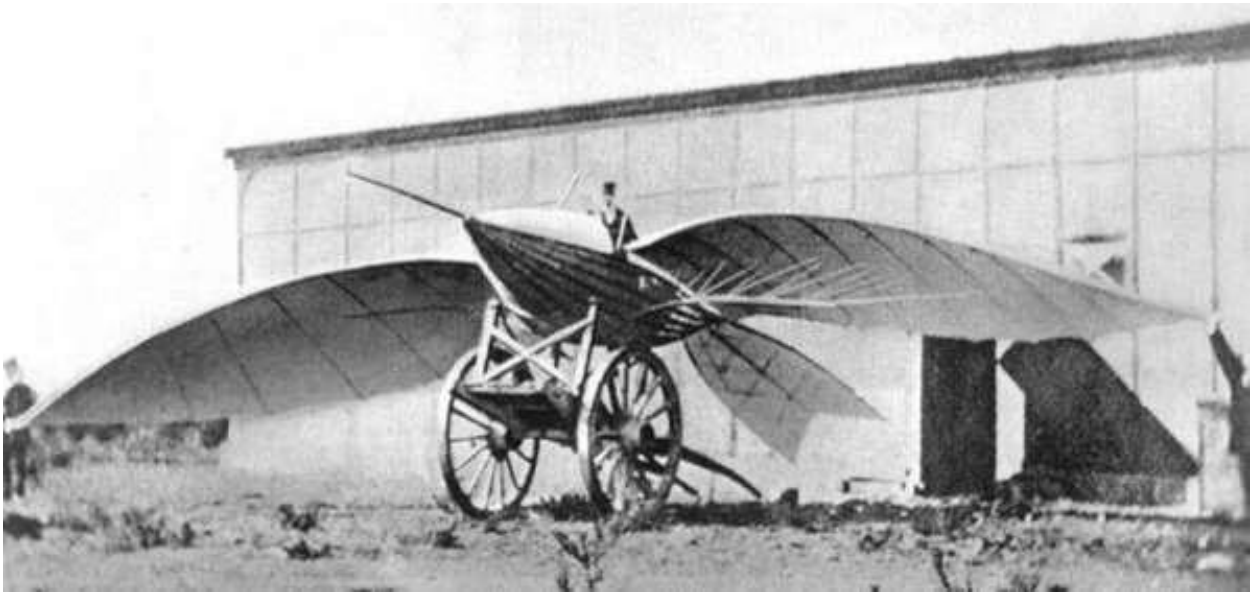
Noise is not just annoyance. It damages health, it detracts significantly from the quality of life, it stops local residents enjoying their gardens or simply enjoying peace and quiet, it damages wildlife, it damages the learning ability of schoolchildren and it costs a great deal of money through the costs of noise mitigation and noise abatement. Aircraft noise is a serious concern around all airports and under flight paths notwithstanding the adoption of quieter aircraft and engine technology. Aircraft noise is a controversial matter. It is frequently asserted by the aviation industry that the number of people exposed to noise problems, the so-called noise footprint, is shrinking rapidly.

This is disputed by local residents and has been shown at the Heathrow Terminal5inquiry to be based on unreliable and out-dated data (HACAN News, December 1997).Almost every aspect of aircraft noise is the subject of disagreement. The selection of a particular measure of noise can influence the extent to which noise is recognized as a problem. Measures that average values over long time periods can show low relatively levels of noise and measures that emphasise peak events can show serious noise problems. More discussion on measurement problems and selection can be found in the technical appendix together with an illustration of typical noise levels from different activities and the levels above which most people experience communication difficulties, sleep disturbance or discomfort

Effects of noise on humans

The World Health Organization 1993 document, "Community Noise" (WHO, 1993) reviews the international scientific evidence on the effects of noise. These include:

1. Hearing impairment
2. Pain
3. Perceived noisiness and annoyance
4. Interference with communication and speech perception
5. Sleep disturbance
6. Psychophysiological reactions during sleep (including effects on heart rate, finger pulse, respiration)
7. Stress
8. Cardiovascular effects
9. Psych endocrine effects
10. Startle reflex and orienting response
11. Effects on physical health (including nausea, headache, irritability, instability, argumentativeness, reduction in sexual drive, anxiety, nervousness, in somnia, and loss of appetite)
12. Mental disorders
13. Task performance and productivity
14. Deficits in reading acquisition among children
15. Effects on social behaviour (eg willingness to help others)



Ground level air emissions

US research (Natural Resources Defense Council, 1996) shows that air pollution from cars and industry has declined with time while aircraft continue to emit more ground level ozone precursors (Volatile Organic Compounds or VOCs and nitrogen oxides or NOx) with each passing year. Airports in the US are in the top four largest emitters of NOx and VOCs (depending on location), together with power plants, the chemical industry and oil refineries. These data are not readily available in the UK where published information (eg Environment Agency) does not list airports. Airports are also significant traffic generators, freight distribution centres, taxi destinations and bus stations and are responsible for significant amounts of pollution from the exhaust emissions of land based transport. They also have large amounts of fixed and mobile generating equipment to supply aircraft with power whilst they are on the stand and large scale maintenance facilities for engines and aircraft. They are also large fuel depots with storage tanks, fuel lines and refueling facilities all contributing evaporative emissions of VOCs to atmosphere.

A Brief History of Aviation

The original idea of kite-flying from China was the first attempt of humankind to fly some man-made object high into the air. Chinese used kites to send messages, lift humans, measure distances, and test winds during the5thCenturytothe7thCenturyAD.They also prepared Hot Air Balloons to scare away enemies in the 3rd Century BC. Later during the period of Renaissance, Leonardo Da Vinci studied the flying principles of birds and anticipated that the equal amount of resistance is offered by an object to the air, just as the resistance air offers to the object.

During the 17th century, the then experts tried to create copper spheres containing vacuum and lift an airship as they knew by then that the objects lighter than the air can remain up in the air. During the 18th Century, they conducted five flights using balloon successfully in France. In 1647, the Polish King Władysław-IV invited the Italian inventor, Tito Livio Burattinito his court in Warsaw and built a model aircraft with four fixed glider wings. The aircraft had successfully lifted a cat with minor injuries while landing .During the 19th and the 20th centuries, the experts around the world experimented continuously and came up with improved flying machines or aircrafts, which were heavier than air and based on the principles of aerodynamics. Most notable names are the Wright Brothers Orville and Wilbur Wright. According to the

Smithsonian Institution and Federation Aeronautics International (FAI),the Wright brothers made the first sustained, controlled, powered, and heavier-than-air fight at Kill Devil Hills, North Carolina on December 17, 1903. Orville Wright took the first flight at 120ft high for 12 seconds.

AIRLINE INDUSTRY

Genesis of the Indian Airline Industry

Mr. J.R.D.TATA flies a De Havilland Puss Moth from Karachi to Bombay as part of the first Tata Sons Ltd. flight to deliver mail carried by British Imperial Airways 1948: Govt. of India acquires 49% stake in Tata Airlines, designates it a flag carrier and renames it Air India International ("AII") 1953: Jawaharlal Nehru, in friendly transaction, convinces the Tata Group to let the Govt. of India acquire a majority stake in AII and nationalizes air transport 1953: Indian Airlines formed by merging eight former independent domestic airlines 1960: India enters the jet age with an Air India B707; USA and India are connected for the first time with an Indian airline 1989: Indian Airlines becomes one of the first airlines to induct the A320 into its fleet 1990: East West Airlines becomes the 1st private airline since 1953.

New players in top 10 largest airlines in India.

Indigo

Indigo is one of the fastest growing private airlines in India. Indigo has a market share of more than 39 percent and ranked at the first position. The Indigo Airlines is wholly owned by the Inter Globe Enterprises and serves in major destinations such as Kolkata, Chennai, Mumbai, Bangalore (Bengaluru) and New Delhi.

The fleet size of Indigo Airlines is 167 aircraft, which is considered as one of the largest fleet size in India in private airline companies.

Fast Facts About Indigo

Revenue: Rs. 239.68 billion (US$3.5 billion) (FY 2017–18)

Net income: Rs. 22.43 billion (US$330 million) (FY 2017–18)

Total Assets: Rs. 211 billion (US$3.1 billion) (FY 2017–18)

Employees: 14,604 (March 2017)

Fleet Size: 167, Orders: 437

Fig 1.1 Indigo Aircraft

Jet Airways

The Jet Airways is the second largest airline in India with a market share of 15.4 percent. It was established on 1st April, 1992 and started operations on 5th May, 1993. Chhatrapati Shivaji International Airport, Mumbai is the main hub of Jet Airways.

The revenue of Jet Airways is US$3.7 billion and profit US$ -92 million as of 2017-2018. It is one of the largest employers in India in airline sector with more than 16015 employees. The fleet size of Jet Airways is 121 aircraft and ordered another 233 new fleet to expand the network.

Fast Facts About Jet Airways

Revenue: Rs. 252 billion (US$3.7 billion) (FY 2017–18)

Net income: Rs. -6.3 billion (US$-92 million) (FY 2017–18)

Employees: 16,015 (March 2017)

Fleet Size: 121, Orders: 233

Fig 1.2 Jet Airways Aircraft

Air India

Air India is one of the oldest airline companies in India with presence in all the major as well as small cities of India. It was founded in July, 1930 as the Tata Airlines and started operations on 15th October, 1932. The airline was founded by one of the great industrialists JRD Tata.

Air India has a market share of more than 13%. They serves major, short as well as medium level destinations in India and across the world.

Fast Facts About Air India

Revenue : Rs. 222 billion (US$3.2 billion) (FY 2016–17)

Net income: Rs. 57.65 billion (US$840 million) (FY 2016–17)

Employees : 20,956 (November 2016)

Fleet Size : 118, Orders: Nil

Fig 1.3 Air India Aircraft

SpiceJet

SpiceJet is another budget airline company in India with a market share of 13.2 percent. It was founded in 1993 as ModiLuft and started operations on 5th May, 1993.

The SpiceJet Airlines serves in key cities of India such as Pune, Chennai, Ahmedabad, Goa and so on. Previously, it was owned by the NRI group and it was acquired by the media king Kalanithi Maran. However, Maran sold his shares back to Ajay Singh in 2015.

Fast facts about spice jet.

Revenue :Rs 7933 bilion (US$1.2 billion)(FY 2018).

Net income :Rs 557bilion (US$81 billion)(FY 2018).

Total Assests :Rs 4109 crore (US$600 million)(FY 2018).

Employees : 6902(2017)

Fleet size : 58,order:169

GoAir

GoAir is the one of the most popular budget airlines in India. GoAir is promoted by the Wadia Group. It was founded in 2005 and started operations in November, 2005. The fleet size of the Go Air is 38 aircraft and serves in more than 23 destinations. The GoAir is headquartered in Worli, Mumbai, Maharashtra with the slogan of "Fly Smart".

Fast Facts About GoAir

Revenue: Rs. 3513 crore (US$510 million) (FY 2017)

Profit: Rs. 205 crore (US$30 million) (FY 2017)

Fleet Size: 38, Orders: 125

Market Share: 8.5%

Air Asia India

Air Asia India is a new player in the aviation market of India. It was established on March 28, 2013 and the company started its operations from June 12, 2014. Kempegowda International Airport, Bengaluru is the operating base for the airline company. AirAsia India has a fleet size of 18 aircrafts and operates at 21 destinations.

Fast Facts About AirAsia India

Fleet Size: 18, Orders: Information not available

Destinations: 21

Market Share: 3.7%

Vistara Airlines

Vistara is an Indian airline company, promoted by Tata Sons and Singapore Airlines. It was founded in the year 2013 and the company started its operations on January 9, 2015. Indira Gandhi International Airport, Delhi is the primary hub of the company. Visatara has a fleet size of 21 aircraft and operates on 22 destinations.

Fast Facts About Vistara (Tata SIA Airlines Limited)

Jet Lite

JetLite is a one of the low-cost airlines in India, listed in the top 10 largest airlines in India by market share. Based on latest figures, JetLite has a market share of 2.4% in domestic market.

Jet Airways is the parent organization of JetLite. Based on figure available (February 2017), JetLite operates in 22 destinations. The market share of JetLite is 2.4% in domestic market.

Fast Facts About Jet Lite

Fleet size: 8

Headquarters: Mumbai, India

Founded: in 1991 as Sahara Airlines

Frequent-flyer program: Jet Privilege

Fig:1.4 Jet Lite Aircraft

TruJet

TruJet is a domestic airline company in India and 9th largest airline in India. The base of this airline company is Rajiv Gandhi International Airport, Hyderabad. Their first commercial flight was launched in 2015.

Right now, TruJet captured 0.4% market share in domestic market of India. They have a fleet size of five aircraft and operates in a few destinations.

Fast Facts About TruJet

Fleet size: 5 aircraft

Primary hub: Rajiv Gandhi International Airport, Hyderabad

First flight launched in 2015

Fig 1.5:Tru jet aircraft

Air Costa

Air Costa was a new player in Indian market. The company had started its operations on 15 October, 2013. The Chennai International Airport was the primary hub for Air Costa. It was having a fleet size of four and ordered another 50. The company operated on nine destinations across the country.

On 28 February 2017, it suspended operations until further notice. Air Costa was having a market share of 0.1% in domestic air traffic of India.

SWOT Analysis

Strengths

1. It is the first airline with full new fleet of aircraft.
2. It provide Quality hospitality to customers
3. It have already training academy.
4. Kingfisher have UB group backing for raising financing.
5. It is well capitalized airline, prepared to take losses.
6. It have experience to better handling of employees and staff; less centralized style of functioning.

Weaknesses

1. Chairman's people skills are better but employees have to work very erratic hours.
2. It provide service delivery only in metros and other big cities.
3. It is yet not in profit position.
4. Kingfisher's ticket pricing is also very high.
5. Kingfisher is yet to build itself into an organization; structures yet to fall in place.

Opportunities

The non-penetrated domestic market. Kingfisher entre into the market at that time when the less competitors are taken place.

1. International market
2. Untapped air cargo market
3. Expanding tourism industry
4. It is the expanding tourism industry mostly foreigners travel through airplanes this is the company opportunity which the company take profit as much as possible.

Threats

Due to increase in the number of Competitors the company threat increase day by day.

Infrastructure issue.

1. Fuel price are increasing constantly this is the main threat for the company because the company cost increases and profitability decreases due to this.
2. Economic slow down
3. Promotion and sponsorship declining

PESTEL ANALYSIS

POLITICAL FACTORS

1. Open sky policy
2. FDI limits: 100% for Greenfield airports
3. 74% for the existing airports
4. 100% through special permission
5. 49% for airlines.

Economical factors

1. Contribution to the Indian economy-since the industry is operating in Indian economy, the revenue generated by the company adds to economy
2. Rising cost of fuel-the fuel price is rising because the subsidies government t is providing are being taken off.
3. Investment in the sector of aviation
4. The growth of the middle income group family affects the aviation
5. Sector-in todays world with increasing income of middle class, people prefer to go by air because it saves time at is all new a different experience.

Social factors

1. Development of cities leads to better services and airports-metro cities first had airports but with development of the country new airports are being built up.
2. Employment opportunities-the aviation sector provided a lot of employement opportunities because the industry is so vast that a lot of people can be employed
3. Safety regulations.
4. The status symbol attached to a plane travel.

Technological factors

1. The growth of e-commerce and e-ticketing is now adopt the airline companies for the facilities and services to the customers.
2. Satellite based navigation system is the most advanced technological factor.
3. Modernization and privatization of the airports.
4. Bangalore the airport corporation limited.

Environmental factors

1. The increase in the global warming due to increase in the number of airplanes flying in the air.
2. This makes bad effect on our atmosphere.
3. The sudden and unexpected behavior of the atmosphere and the dependency on whether.
4. Shortage of the infrastructural capacity
5. Tourism saturation.

Legal factors

1. FDI limits.
2. Bilateral treaties.
3. Airlines acquisitions and the leasing cost.

SWOT analysis of Air India

Aviation industry means the entire aviation in India. Here, the industry can be divided into two major parts- civil aviation and military aviation. Among lots of other industries, the aviation industry is the fastest growing industry in India. The aviation manufacturing hub in India is located at Bangalore, and it constitutes around 65% share of manufacturing.

As the number of people, traveling by air, is increasing a lot, the prospect of the aviation industry is getting hiked. The amount of tax, paid by the Indian aviation sector, is more than INR 87.5 billion. The huge range of services, offered by the aviation industry in India includes cargo airlines, airport management, private jets and helicopters, maintenance, repair and overhaul, in-flight catering, ground handling and lots more.

Strengths in the SWOT analysis of Air India

1. Air India has been the largest air carrier in India in terms of traffic volume and company assets.
2. It owns the most updated fleet and competent repairs and maintenance expertise.
3. Its information systems are advanced and compatible with its operation and service.
4. It has a good reputation in both international and domestic markets, quality service and the age-old Goodwill that has still kept it alive in the interests of the rescue operators.
5. Has financial backing of the Government.

Weaknesses in the SWOT analysis of Air India.

Air India is operating across broad international and domestic markets competing with world leading giant airlines as well as local small operators. This lack of clarity on the strategic direction largely dilutes its capabilities and confuses its brand within markets.

Low profitability and utilization of capacity.

1. Growing Competitor base and entry of Low-Cost Carriers (LCC's)
2. The airline's high-cost structure and the compulsions of being a public sector unit are the reasons and it had been making a loss and shall continue to make losses for some more quarters.

Opportunities in the SWOT analysis of Air India

1. India airline industry is growing faster and will continue to grow as the GDP increases, and the trend is predicted to continue once the slowdown recedes.
2. Worldwide deregulations make the skies more accessible; the route agreement is easier to be achieved. The number of foreign visitors and investors to India is increasing rapidly.
3. Complementary industry like tourism will increase demand for airline service. The Civil Aviation Ministry's strong regulation and protection provides opportunities for consolidation and optimization.
4. Customers are getting wealthier, tend to be less price-conscious and prefer to choose quality service over cost.
5. Best time for introducing LCC's

Threats in the SWOT analysis of Air India

Air India faces imminent aggressive competition from world leading airlines and price wars triggered by domestic players.

The Indian Railway Ministry has dramatically improved speed and services in their medium/long distant routes, attracting passengers away from air service, with prices almost at par with the low cost carriers

History

1. In 1911 first commercial flight was airmails from Allahabad to nani (10 km) and in 1932 the aviation department of Tata sons ltd was established.

2. In 1938 Tata airlines was established and after 8 years in 1946 Tata Air Lines converted into a public Company and renamed Air India Limited
3. In 1948 Air India International was incorporated and in 1953 Nationalization of Aircraft Industry was established.
4. At that time Air India was serving the international sectors and Indian Airlines was serving domestic sectors
5. Other domestic airlines are Deccan Airways, Airways India, Bharat Airways, Himalayan Aviation, Kalinga Airlines, Indian National.
6. In 1986 Private Sector Players permitted as Air taxi operators.These players including Jet, Air Sahara, NEPC, East West,
7. In1990 Open sky policy was made came into existence.
8. In 1995 Private Carriers permitted to operate scheduled services.
9. 2005 was the phase of competition and low-cost carriers was entered into the market.
10. In 2007 Indian Airlines was merged into Air India.and Jet Airways acquired Air sahara.
11. In 2008 Kingfisher was acquired 49% stake in Deccan Aviation. Regulatory Authorities
12. Ministry of Civil Aviation was responsible for the formulation of policy, development and regulation of Civil Aviation. Its functions also extend to overseeing airport facilities, air traffic services and carriage of passengers and goods by air.
13. Directorate General of Civil Aviation (DGCA) was promote safe and efficient Air Transportation through regulation and proactive safety oversight system.
14. Bureau of Civil Aviation Security (BCAS) was the regulatory authority for civil aviation security in India
15. Airport Authority of India (AAI) who accelerate the integrated development, expansion and modernization of the operational, terminal and cargo facilities at the airports.

Policies

1. Open Sky Policy means to liberalize the rules for international aviation markets and minimizes government intervention.
2. It is 100% for green field operations and 74% for existing airports and 100% with special permissions.
3. In this policy 100% tax exemptions for 10 yrs.Airlines
4. In domestic airlines was 49% and 100% for NRI's and 74% in cargo & non-scheduled airlines.
5. Kingfisher airlines
6. The Chairman of Kingfisher airlines is Dr Vijay Mallya and also CEO of Kingfisher.

Airlines.

The Kingfisher Airlines Limited launched scheduled airline services on May 9, 2005 with 4 daily flights between BOM & BLR and one A-320 aircraft.

1. In Kingfisher airlines there are tools for mood lighting such as web chat, inseat
2. plugins for music, liveTV with 16 channels on each seat
3. Kingfisher airline provide 100 percent online ticket and many companies are following this.
4. The Kingfisher Airlines family will consistently deliver a safe, value-based and enjoyable travel experience to all passengers.

Jet Airways

1. Jet Airways founded in 1993 and the Chairman of jet airways is Mr.Naresh Goyal.The Headquarter of Jet Airways is situated in Mumbai.
2. It is the Country's second largest international airline and the largest domestic airline.
3. Its Primary hub is Mumbai's Chaatrapathi ShivajiAirport and Secondary hubs are Bangalore, Brussels, Chennai, Delhi,Hyderabad, Kolkata and Pune.
4. In April,2007 Air Sahara acquired the JetLite.but now JetLite integrated into Jet Airways.

5. Is primary Segments are Domestic & International and Customer Segments are First class, Premiere(Business) class & Economy class.
6. Its Target Segments are Business class.The Business travelers contribute 48% of passengers & 66% of revenues and they ready to pay higher prices, last time booking and don't like transit.
7. The Economy class leisure travelers, prefer low cost airlines, ready for transit if there is cost advantage and have large % of passengers.
8. The Yield Management Technique was adopted in which Positioning take place(High value for High price)
9. Unique Selling Price which make Customer relationship and Punctuality.

Jet Airways – Performance

1. Jet Airways annual Revenues is Rs.9481.5 crores in 2007 to 2008 and Rs.7401 crores in 2006 to 2007.
2. Profit (Loss) After Tax – Rs.253 crores loss in 2007 to 2008 and Rs.27 crores profit in 2006 to 2007.
3. All Other Domestic Players showed loss in 2006-07.

Market potential of Airline industry in India

Indian civil aviation sector has continued to experience high passenger growth (domestic traffic CAGR is 17% from 2009 to 2011), and if the trend continues it could rank among the top three aviation markets in the world by 2020. According to Indian Aviation: Spreading its wings, a strong market growth rate coupled with infrastructure expansion will help the sector back on its feet as the economy recovers. The FICCI-PwC report also finds that this would be a good time for global players to enter India and explore the potential of a large underserved market.

However, volatility in fuel prices combined with highest tax on aviation turbine fuel and other national policy related issues continue to challenge the sector's growth. The recent increase of FDI up to 49% in civil aviation might also not result in substantial increase in investment since it has been imposed on the aggregate of FDI and FII. The report also recommends a hike of the 26% cap on FDI in defence as it has failed to attract foreign investment. India has received only 4 million USD in the 10 years since FDI was allowed in the defence sector, while the entire economy has received over 180 billion USD.

India's military aviation sector needs better access to technology, funding and rationalise the tax and regulatory framework to keep pace with their global counterparts. The medium and long-term perspective plans should be shared with industry in a transparent manner, without compromising on national security. This will provide the industry information and confidence to invest in a production process that is measured in decades than years.

Dhiraj Mathur, Leader - Aerospace & Defence , PwC India said: "The proactive policy regime created by the government has begun to bear fruit. We see the green shoots of the development of an indigenous aerospace and defence industry. In the last five years there have been significant investments by large and small domestic companies that has entered this industry. However, the FDI inflow has been very low at about USD 4 million. The government needs to review the 26% cap on FDI as well as streamline the various polices to promote greater investment. India's acquisition programme and its offset policy can potentially generate investments in excess of 20 billion USD along with creating massive employment for skilled and professional manpower. The government should strive to make Indian industry an integral part of the global aerospace and defence supply chain."

The government continues to encourage private investment in both the civil and defence aerospace sector to encourage technology transfer and achieve in digenisation. However, the ambiguity in the definition of defence equipment, inconsistencies in multiple regulations further compounded by varying interpretations of government arms create barriers for investment. The complex and multi-tiered tax structure in India makes domestic manufacturing uncompetitive and directly works against the in digenisation policy of the government.

The government also needs to create policies that will enable creation of MSME clusters with quality infrastructure and building capabilities. There are roughly 500 MSMEs across different clusters in the aerospace sector, but the clusters are

fragmented and yet to evolve. The high cost of capital and business makes MSME players risk-averse and affect their ability to build innovative technologies.

The civil aviation industry in India has emerged as one of the fastest growing industries in the country during the last three years. India is currently considered the third largest domestic civil aviation market in the world. India has become the third largest domestic aviation market in the world and is expected to overtake UK to become the third largest air passenger* market by 2024.

Market Size

India's passenger* traffic grew at 16.52 per cent year on year to reach 308.75 million in FY18. It grew at a CAGR of 12.72 per cent during FY06-FY18.

Domestic passenger traffic grew YoY by 18.28 per cent to reach 243 million in FY18 and is expected to become 293.28 million in FY20E. International passenger grew YoY by 10.43 per cent to reach 65.48 million in FY18 and traffic is expected to become 76 million in FY20E.

In FY18, domestic freight traffic stood at 1,213.06 million tonnes, while international freight traffic was at 2,143.97 million tonnes.

India's domestic and international aircraft movements grew 7.93 per cent YoY and 6.36 per cent YoY to 2,153 thousand and 453.61 thousand during 2018-19, respectively.

In FY19, passenger* traffic in India stood at 344.70 million. Out of which domestic passenger traffic stood at 275.22 million while international traffic stood at 69.48 million. Total freight traffic handled in India stood at 3.56 million tonnes during the same time.

In FY19, domestic aircraft movement stood at 2.15 million while international aircraft movement stood at 0.45 million.

To cater to the rising air traffic, the Government of India has been working towards increasing the number of airports. As of March 2019, India has 103 operational airports. India has envisaged increasing the number of operational airports to 190-200 by FY40.

Further, the rising demand in the sector has pushed the number of airplanes operating in the sector. As of July 2018, there were nearly 620 aircraft being operated by scheduled airline operators in India. The number of airplanes is expected to grow to 1,100 planes by 2027.

Investment

According to data released by the Department of Industrial Policy and Promotion (DIPP), FDI inflows in India's air transport sector (including air freight) reached US$ 1,817.23 million between April 2000 and December 2018. The government has 100 per cent FDI under automatic route in scheduled air transport service, regional air transport service and domestic scheduled passenger airline. However, FDI over 49 per cent would require government approval.

India's aviation industry is expected to witness Rs 35,000 crore (US$ 4.99 billion) investment in the next four years. The Indian government is planning to invest US$ 1.83 billion for development of airport infrastructure along with aviation navigation services by 2026.

Key investments and developments in India's aviation industry include:

AAI is going to invest Rs 15,000 crore (US$ 2.32 billion) in 2018-19 for expanding existing terminals and constructing 15 new ones.

In June 2018, India has signed an open sky agreement with Australia allowing airlines on either side to offer unlimited seats to six Indian metro cities and various Australian cities.

The AAI plans to develop Guwahati as an inter-regional hub and Agartala, Imphal and Dibrugarh as intra-regional hubs.

Indian aircraft Manufacture, Repair and Overhaul (MRO) service providers are exempted completely from customs and countervailing duties.

Government Initiatives

Some major initiatives undertaken by the government are:

In February 2019, the Government of India sanctioned the development of a new greenfield airport in Hirasar, Gujarat, with an estimated investment of Rs 1,405 crore (US$ 194.73 million).

As of January 2019, the Government of India is working on a blueprint to promote domestic manufacturing of aircrafts and aircraft financing within the country.

In January 2019, the government organised the Global Aviation Summit in Mumbai which witnessed participation of over 1,200 delegates from 83 countries.

In January 2019, the Government of India's released the National Air Cargo Policy Outline 2019 which envisages making Indian air cargo and logistics the most efficient, seamless and cost and time effective globally by the end of the next decade.

In November 2018, the Government of India approved a proposal to manage six AAI airports under public private partnership (PPP). These airports are situated in Ahmedabad, Jaipur, Lucknow, Guwahati, Thiruvananthapuram and Mangaluru. AAI received 32 technical bids from ten companies.

In February 2018, the Prime Minister of India launched the construction of Navi Mumbai airport which is expected to be built at a cost of US$ 2.58 billion. The first phase of the airport will be completed by end of 2019.

The Government of Andhra Pradesh is to develop Greenfield airports in six cities-Nizamabad, Nellore, Kurnool, Ramagundam, Tadepalligudem and Kothagudem under the PPP model.

Regional Connectivity Scheme (RCS) has been launched.

Achievements

Following are the achievements of the government during FY18

In September 2018, Jharsuguda Airport in Odisha and Pakyong Airport in Sikkim were inaugurated. Pakyong airport is Sikkim's first ever airport and AAI's first Greenfield airport construction.

In December 2018, Kannur International Airport was inaugurated making Kerala the only state in India to have four international airports.

New airport development plans

1. India plans to open 100 airports in five years
2. Planning an Airport
3. To plan an airport, the AAI is concerned for three approvals −
4. Technical Approvals

5. Review and approve Airport Layout Plan (ALP).
6. Review and acceptance of forecast.
7. Airspace and procedure changes.
8. Land acquisition.
9. Financial Approvals
10. Funding for the airport is approved once the project gets clearance for safety, security, capacity, and airport access systems.
11. Environmental Approvals
12. Review and assess environmental issues.
13. Find out solutions to address the environmental problems.
14. Airport planning is vital to understand problems and potential environmental issues. Out of the reactive and proactive planning methods, an appropriate planning method is selected depending upon the requirement.

Airport Development

It includes the development of the land to build the terminals and base, and building the infrastructure for the ancillary facilities. All the infrastructural development is done in accordance with the ICOA standards.

Airport − Terminal Planning

The following criteria need to be considered while planning and designing a terminal −

1. Passenger flow and traffic peaking.
2. Minimum walking distance.
3. Level of service for passengers and sophistication.
4. Performance standards.
5. Area for Retailers: Duty free shops, food joints, and spas.
6. Area for Facility points such as Restrooms, ATM machines, and kiosks.
7. Easy access to retail area and facility points.
8. Compatibility of facilities with aircraft characteristics.
9. Ability to handle changes in technology and automation.
10. Expandability for future growth.
11. Area and processing time for checking-in, immigration/customs clearance, baggage security screening, and baggage delivery.

A**s per certain projections, by 2020, Indian airports are estimated to handle.**

1. 100 million passengers
2. Including 60 million domestic passengers
3. Cargo in the range of 3.4 million tones per annum

Table: Air Traffic Forecasts:

Year	Aircraft Movements (In '000)			Passengers (In Lacs)			Cargo (In '000 MTs)		
	Inter-national	Domestic	Total	Inter-national	Domestic	Total	Inter-national	Domestic	Total
2005-06 (Base Year)	190.89	647.42	838.31	223.62	509.76	733.38	920.15	483.80	1403.95
Growth Rate	**13.2%**	**14.7%**	**14.4%**	**15.9%**	**19.9%**	**18.8%**	**12.1%**	**10.1%**	**11.4%**
2006-07	216.14	737.94	954.08	258.54	609.05	867.59	1028.66	531.64	1560.3
2007-08	243.91	843.10	1087.01	298.54	728.72	1027.26	1151.05	584.61	1735.6
2008-09	275.58	965.54	1241.12	345.31	873.11	1218.42	1289.26	643.31	1932.5
2009-10	311.74	1108.39	1420.13	400.14	1047.51	1447.65	1445.50	708.39	2153.8
2010-11	353.09	1275.38	1628.47	464.54	1258.39	1722.93	1622.33	780.60	2402.9
2011-12	400.45	1470.99	1871.44	540.37	1513.63	2054.00	1822.69	860.78	2683.4

The government has taken a number of measures to step up the airport infrastructure for the country. It has envisaged a modernization plan with a view to modernize 37 non-metro airports. On the lines of the successful model of the Central Road fund, the government is considering setting up the Essential Air Service Fund to support the country's airport infrastructure.

Keeping in mind the huge requirement of funds for the development of airport infrastructure and the financial constraints coupled with other conflicting budgetary priorities of the government, the government has invited private participation in the modernization program of the major airports. Delhi and Mumbai airport development projects are being undertaken through public private partnership ventures.

There needs to be an effort towards optimum utilization of the existing airports by addressing the problems of outdated infrastructure, inadequate ground handling systems and night landing facilities, and poor passenger amenities. At the same time it will also be required to create new airports at several places where there is a scope. There needs to be improvement in the airside infrastructure & terminal infrastructure at India's airports.

Investments in airport infrastructure

With the increase in traffic for both passenger & cargo aviation services in India, the government has put in place a program for directing investments in the Airport infrastructure – through both internal resource mobilization, as well as through private sector participation in modernizing specific Airports. The Committee on Infrastructure has initiated several policy measures that would build world-class airport infrastructure in India. A Model Concession Agreement is also being developed for standardizing & simplifying the PPP transactions for airports. In any future projects for development of existing airports, it has been decided that the length of the runway would be at least 7,500 feet (which is needed for the A 320 and similar aircraft).

Table: Contours of the airport development programme

(Rs. in crore)

Particulars	Airport	Indicative Cost
Restructuring/ Modernisation for world class airports	Delhi & Mumbai	15,000
	Chennai & Kolkatta	5,000
Greenfield airports	Bangalore, Hyderabad, Goa, Pune, Navi Mumbai, Nagpur (Hub) & Greater Noida	10,000
Upgradation	25 selected airports	7,000
Modernisation / Improvement	55 airports	3,000
Total investment by 2010		40,000

i. Greenfield Airports

100% FDI is allowed through the automatic route for Greenfield Airports in the Country. In Bangalore and Hyderabad, the government has initiated the construction of Greenfield airports through Build Own Operate and Transfer (BOOT) basis with private sector participation. The project at Bangalore will cost Rs 14 billion, while the project at Hyderabad will cost Rs 17.6 billion. In both these projects, AAI holds 26% equity and the rest 74% is held by private stakeholders.

AAI has also proposed to establish a Greenfield airport in Navi Mumbai to meet the long term requirement of air traffic of the Mumbai region. A second airport for Goa, in Mopa, has also been planned. It has been estimated that Greenfield

Airports in Bangalore, Hyderabad, Goa, Pune, Navi Mumbai, Nagpur and Greater Noida will cost about Rs 10,000 crores.

For all future Greenfield airports in India, it has been mandated that there be atleast two parallel runways. ¾ Bangalore International Airport Ltd. (BIAL): The BIAL Master Plan has been developed to fulfill the need for an operationally efficient and passenger friendly airport. This new airport will be able to handle up to 11 million passengers and will be ready for operation by April 2008. A consortium led by Siemens, Germany with Unique Zurich, Swizerland and Larsen & Toubro India Ltd. as other members have been chosen as the strategic Joint Venture Partners. GoK is extending Rs. 3.5 billon as State support and is providing approximately 4000 acres of land on concessional rent. AAI's investment in the equity is capped at Rs. 500 million, while the approximate cost of the project is Rs. 14 billion.

Table: Funding plan for Bangalore and Hyderabad airports

	Hyderabad		Bangalore	
	Capital (In Rs. cr.)	Percentage of total	Capital (In Rs. cr.)	Percentage of total
AAI Share	49	3%	43	3%
State Support	422	24%	350	25%
Equity of Private promoters	330	19%	284	20%
Loans from Lenders	961	54%	735	52%
Total	**1762**	**100%**	**1412**	**100%**

Hyderabad International Airport Ltd. (HIAL): HIAL is a public-private joint venture between GMR Group, Malaysia Airports Holdings Berhad and both the State Government of Andhra Pradesh and Airports Authority of India (AAI).

GMR Group holds 63% of the equity, MAHB 11%, while the Government of Andhra Pradesh and Airports Authority of India each hold 13%. This new airport will be operational by August 2008. A Special Purpose Vehicle has been set up for the construction of this airport. AAI's equity is being capped at Rs 500 million, while the approximate cost of the project is Rs 17.6 billion.

ii. Modernization of existing airports in Delhi & Mumbai

The existing International airports in Delhi and Mumbai are being restructured and modernized through Private sector participation. In the Joint Ventures, AAI and other Government PSUs hold 26% equity, with the balance 74% being held by the strategic partner. As per the current policy of the government, the FDI in existing airports has a sectoral cap of 49%. The development plans for Delhi and Mumbai airports envisage an investment of Rs. 5,270 crore and Rs. 6,130 crore respectively (totaling Rs.11,400 crore) during the period of 2006-07 to 2013-14 for development of these two airports. The respective state governments have formulated State Government Support Agreement to provide support to the projects in matters relating to removal of encroachments or procurement of additional land for development of airport, removal of obstruction outside the airport boundary to ensure safe and efficient air traffic movement, and to improve the surface access to the airport and to provide utilities like water, power, etc.

Table: Funding of Delhi and Mumbai airports

(Rs. in crore)

S. No.	Source	Funding
1.	Equity contribution by AAI	302
2.	Private Equity	1,200
3.	Internal Resources of JV Co	2,298
4.	Borrowings of JV Co	7,600
	Total	**11,400**

iii. Modernization of Non-Metro Airports

The Prime Minister's committee on infrastructure has given its in-principle approval for modernization of 37 non-metro airports (including Sikkim and Arunachal Pradesh airports). The Ministry of Civil Aviation has set the target of 2008-09 for the completion of these projects. The project model would be such that all aeronautical activities at these airports would be handled by the AAI, while a public-private partnership (PPP) model would be followed for the development of non-aeronautical activities at the city side of these airports. The PPP model is likely to peg the foreign direct investment (FDI) levels at 49 per cent with the private sector partner being allowed to pick up 74 per cent equity in the project. AAI has decided not to seek any budgetary support for the modernization process that is expected to cost between Rs 7,000 and 8,000 crore. The funds required would be garnered from internal resource mobilization by the AAI.

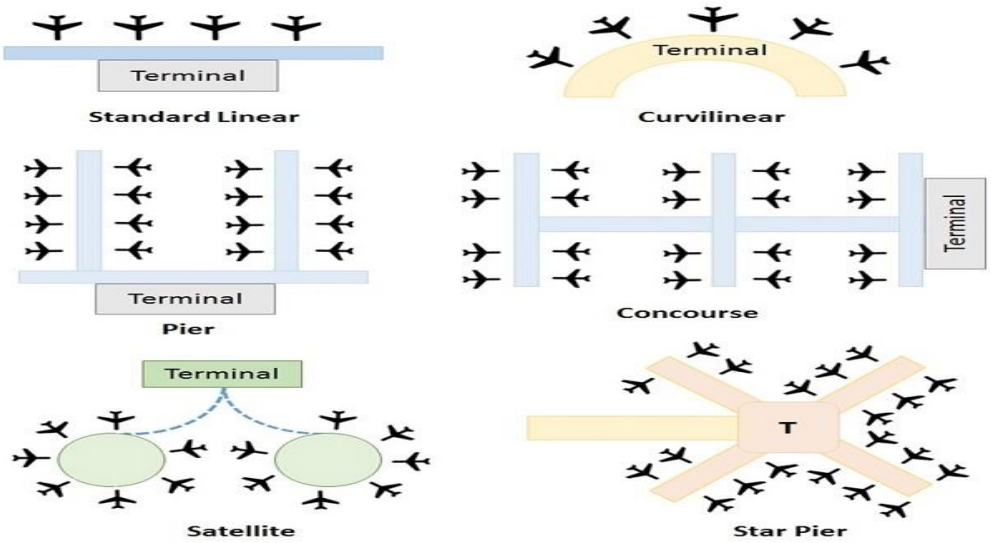
Table: Planned capex on thirty five non-Metro airports

(Rs. in crore)

Phase	Terminal Building, Carpark, Cargo	Air Side	City side	Total
Phase-I	1,496	420	1050	2966
Phase-II	1,240	682	300	22022
Phase-III	530	294	150	974
Total	**3,267**	**1,396**	**1,500**	**6,162**

Airport − Terminal Configurations

The following configurations are adapted while designing the airport terminals .



Current challenges in airline industry

Though growth is huge, still there are some challenges in the aviation sector that airlines are facing. Let's unravel some of the current challenges or issues in the airline industry.

Security in the sky: Safety and security are the greatest challenges that this industry is facing. This is because global terrorism continues to be predominant and aviation sector can be targeted easily. Airports, governments and airlines need to find out new and innovative ways to so that they can enhance their security, without compromising their service and overall comfort of the passengers. The aviation industry needs to employ some sagacious person who can provide them with the best security solutions without hampering the comfort of the passengers.

Technology:

Advances in technology is another big challenge in the aviation industry. Like any other sector, the aviation industry is being impacted by the move to digitalization. With the advent of new-fangled technologies like block chains, to big data, machine learning and artificial intelligence, the aviation industry is trying to accustom itself with these technologies. Big data is a major area in which every airline is working so that they can improve their product offerings and services and can wipe out their contenders by using those data prudently. Big data will help them to get a deeper insight of their customer's behaviour and in which area they need to do improvement. In order to stay competitive, airlines are embracing big data and are improving their services and offerings. Airlines also need to implement chat bots which will understand the needs of the customers through artificial intelligence and point the customer to the right director. This will also allow the airlines to cut down the costs of their call center and they can assist the customers in a better way.

New technology aircraft:

As the technology is penetrated in every sphere of life, new aircraft is being launched in the market. And the number of variants being introduced by the manufacturers has made the situation more complicated. The 737Max family of aircraft, for example, has five variants, which is more than any product grouping in history. The Airbus A320/1 family is less

stratified but this may change if Airbus launches are engine A321, dubbed the A322. So, the aviation industry is facing a huge challenge to get accustomed to these new products.

Customer satisfaction:

Customers are the key to the growth of any business and aviation industry is also trying to appease their customers. But customers are these days very finicky and they are also tech-savvy. Nowadays, everyone is carrying a smart phone with a stable internet connection which will help them to stay connected with the rest of the world. If your customers are not happy or satisfied with your services or offers, then they will certainly give a negative feedback about your airlines and will circulate it on various social media platforms. If this happened, then it will certainly tarnish your brand image and businesses. So, make more personalized interaction with your customers and try to improve your customer services core.

Bankruptcy:

Bankruptcy is another challenge that airlines often face. Bankruptcy for an airline creates an unfavorable situation for them. Although the airline may continue to operate their services after filing bankruptcy, the fares that are charged to the consumer are not always determined by the airline. The whole operation of the airline needs the approval of the bankruptcy board and even, prices, flight times and destinations will be governed by someone other than the airlines. Thus in case of bankruptcy, customers need to face the most problems and to hold back the trusts of the customers, the airlines need to implement some strong and robust strategies.

These are the challenges that the aviation industry is facing. But they are desperately looking for the fruitful solutions so that they can provide the customers with the best services and can enhance their growth and profit.

The future of the aviation industry

1. The future of the aviation industry is very bright and vivacious. As the airlines are becoming more technologically advanced, some will rebrand themselves. The customers will fly easily to more destinations at a reasonable price.
2. The airports will also rebrand themselves. They will not be considered just as a point of departure or arrival rather they will be jam-packed with restaurants, shopping centers, and other leisure facilities.
3. With the help of big data and artificial intelligence, the airlines will be able to know all the relevant information about their customers suck as likings, disliking, favourite destinations, travel time, etc. And, thus based on all these information they will able to provide them more customized services. In this way, they will able to retain their customers for a long time.
4. Not only, customer services, but with the help of technology, the aviation industry will also implement new safety and precautions so that the passengers can travel safely to their destination.

The aviation industry is a very big sector and hence, there are huge opportunities. In future, more people will earn more money and will be able to fly to more places. So, if aviation industry can find out the fruitful solutions for the present issues, then it will support more in a country’s GDP and growth.

Competition in Airline industry

The airline industry is a very competitive market, in the past 2 decades the industry have expanded and still expanding its routes domestic and globally in the beginning airline industry was partly government owned but in the recent years many privatization with airline industry have taken place. D E L A G (Deutsche Luftschiffahrts - Akiengesellschaft) the first world’s first airline which was on the 16 November 1909 this airline was started mainly with the government owned/assistance this airship manufacturers were the Zeppelin Corporation and their head quarters was in Frankfurt. The two Americans named Rufus and Marriott tried to start the America’s first airline but the attempts were failed due to the airline catching fire. The five airline which was first started still exist these airlines are the oldest ones. KLM it’s the Netherland’s owned, Avianca airlines owned by the Columbia. Qantas is Australian’s, Czech Airlines operated by the Czech Republic, Mexican Airlines by the Mexico. After the world wars there was some inventions have been made and

the demand for new planes the designs and the techniques have greatly constructed and soon after the world wars the air rout throughout the Europe have been set up since the past 15 years the airline route have became a baggiest necessity of both business and common peoples that it is hard to live without the air travel the main pros for the Air travel is it reduces time and making the peoples to visit world in the affordable time.

The airline industry can be categorized into four different and main Operations

1. **International:** This service take more than130 passengers and have them and can take anywhere in the world. In this category the business have its revenue for at least $ 1bn.
2. **National:** In this category it can take the passengers up to 150 and the business have its revenue for from $100 m – $1bn
3. **Regional:** The small companies which mainly focus on the flights with quick halts and the revenue of this business is less than $ 100 m.
4. **Cargo:** The main focus of these airlines is to carry goods.

Emirates (airline) introduction and its growth:

Emirates airline is the major airline of the UAE and it is the subsidiary of the Emirates group it is also the national airline of the UAE (Dubai) its major operations is from the Dubai International Airport. It was founded in the year 25th October 1985 The Hub of the Emirates airlines operates its services to the ninety six (96) destinations and about 56 countries and covering around 6 continents. The company also operates the world's longest flights to New York, los angles and other two states in Unites States of America including Houston (Texas) the cargo services of this airline is operated by the Emirates Cargo services Division at present the Emirates group has more than 40,000 Employees Employed and it is the one of the top 10 world class airlines in the world.

Emirates group as a new and young company faces problems back in 1980s when the gulf airways cut down its flights to Dubai the rescue of help from the Dubai royal family invested $10 million in order to begin, the head of the airlines was sheikh Ahmad Bin Saeed al Makhdoom and he is also the present chairman since then the airlines have made its growth in the fleet and also have expanded its destinations.

Emirates Airlines Growth and Incorporation:

Emirates group have made tremendous efforts to grow since 1990, research shows that Emirates is one of the fastest growing airline in the world since the Emirates group have made partnership with AA (American Airlines) in 1994 it started providing the world class service to the passengers throughout the world soon after the partnership Emirates revenue turned to $634 M in the end of 2004, then after the airlines ordered 7 new Boeing 777 in 1996 costs about $1 Billion. In May 1998 Emirates enter into the agreement with Sri Lankan Air Lines to manage the airlines for 10 year In the year 2008 Emirates launched its nonstop flight to New York. In the year 2010 Emirates group have launched its flights to many new destinations in UK, Paris, Bangkok, Australia, and Saudi Arabia

1. Do you agree with performance linked reward system? Summarize the recent trends of reward system in your organization or the organization you have chosen. Discuss its impact on productivity in your organization

Performance linked reward system:

The most important way to impress employees is only by reward to share the profits and allow them incentives by paying them bonuses the theory of reward system says that this is the way the employees will share in your dream when you fulfill their dream. The mechanism of this system can make this possible. The reward system is not just paying the bonuses and letting employee's shares in the stock options. It is more likely to do with promotions, benefits and other incentives which can motivate employees unfortunately many companies do not offer this which leads to the failure of their organization so all the employers and I should agree with the reward system to sustain in the market with the competitors.

The basic principle of reward system is that, “you get what you reward “the Employees. The main principle of management is things are done quickly if you reward the Employees, they shows positive attitude towards their works and their behavior changes if you reward them for their work. If you set a certain target for the employees and when they achieve it reward them immediately failure to do so will affect the results in the future and never hold behind the employees rewards.

Therefore the main principle of motivation is by providing rewards and every organization should agree with this system for a successful organization.

Benefits in working with airline industry (Emirates):

Individuals interested in finding a job which can provide a good career prospects which will provide the option to travel the entire world and enjoying all the benefits as a part of the Emirates group then it’s hard to find the better industry than airlines and specially working for the Emirates one of the world’s best flight. There are number of benefits packages for the employees and career development programmers the group provides.

In the further studies about the airline industry in the Unites States Of America there are nearly 100 airlines and 500,000 peoples are employed by them many of the positions provide excellent benefit packages, Emirates as world class airlines travels to providing services in 56 countries and expected to be added more in 2010 creates more job opportunities than the USA and runs a great reward system.

Emirates Group:

Emirates Group as a world class airline provides a very wide range generous benefits to the permanent employees who are employed globally. The group follows a detailed research and analysis on compensation and benefits policies by doing so the group can retain the top talented employees.

This case study provides the understanding of the total benefits working for the Emirates, the reward system the company includes the cash and non cash elements.

The Summary explains the basic elements of the Emirates group reward for the employees, this explanation for the compensation and reward system provides the information for the candidates working for the emirates group depending on what are their role and the unique skills and personality.

“The Najm award scheme is the reward and recognition program me of the Emirates Group. The Najm (‘Star’ in Arabic) recognizes, motivates and awards employees that either display exceptional behavioral competencies (‘going the extra mile’) or identifies organizational improvements (enhanced safety, reduced cost or improved revenue)

Cash elements rewards in emirates group

Competitive salary and progression through salary range:

Emirates employees enjoy the competitive salary into cash; depending on the country they like E.g. The employees working in Dubai and K.S.A enjoy the tax free salary per month and rest all countries pays the normal tax depending on their county’s legislations. Salaries are paid depending on their role and knowledge and specialization that the candidate can input into the role, the group carries a research with the relevant businesses and reviews on regular basis in order to remain competitive in providing the rewards to their employees. Employees receives the increase in salary range by the company when the responsibilities have been increased it is provided to keep employees motivates as money is a biggest motivator and used to divert route of employees to a desirable direction.

Allowances:

The Group provides the accommodation for their employees or they give out the allowances for accommodation and it also provides the transport allowance or transport. The candidates in specific roles are only eligible for this role.

Profit share schemes:

The company runs the profit share schemes to the employees depending on the financial statements of the group.

Protection in exchange rate scheme:

The employees who works in the UAE their 50% of the salary is protected against adverse exchange rate towards dirham and your currency classification

Professional allowance:

For the employees who possess the specialization skills company runs the scheme of recognizing their talents.

Non Cash elements rewards in Emirates Group:

Annual leave:

The company provides 30 days of the annual leave excluding the public holidays. The annual leave will increase depending on the length of service.

Gratuity/pension schemes:

Company runs a gratuity/pension schemes depending of the labor law rules and regulations of the country they work/ live in. For example in UK, if an employee signs up for the pension's Schemes Company deducts certain amount and pays monthly pension after the retirement age. The UAE labor law the employees are provided a gratuity on the end of service.

This type of service is available to the candidates depending of the conditions like of employment and circumstances.

Free holiday tickets:

Free holidays tickets are provided to the employees and their dependents/family for the destinations of their holiday and also runs schemes that employees can buy a ticket for the families and friends on the discounted fare.

Education allowances:

Company provides financial support for their employees towards their tuition fees for the employees who are on senior positions to train them to requisite job skills besides these children's of employees are allowed to claim the education allowance for the time of entire time of service.

Insurance:

Insurances like Medical, Dental, life and Accident are provided to the employees throughout the length of service they are with the company.

Provident funds:

On leaving the company employees are provided the provident fund that they have been saving throughout the service company decides either to pay the Gratuity or provident fund whichever is the higher the provident fund is like the long time savings of an employee with the company employee have to contribute 5% and company inputs 12% of the basic salary.

Emirates card:

Emirates employees enjoy the privilege of being an emirates employee they can enjoys the benefits throughout the 1000s of outlets of the emirates group in UK and around the world.

Additional reward system in Emirates Group:

Recognition reward from supervisors:

Employees with emirates enjoys the rewards from the supervisors when they feel the value of the candidate that they are performing consistently this the simple way to say thanks by words or by writing a thanks giving letter or by providing them an appraisal.

Airline Industry-Domestic & International from an Indian perspective

A domestic flight is a form of commercial flight within civil aviation where the departure and the arrival take place in the same country. Airports serving domestic flights only are known as domestic airports. There fore, any theoretical understanding of the geographic dimensions of the international airline industry must first start with international trade theory and the role of the nation-state(s) in terms of both the regulatory framework and the competitive strategic advantage of the airline industry by country.

Conventional theories of international trade based on the notion of comparative advantage (Ohlin,1933) argue that all nations differ in the factor endowments that form the basic inputs for production: land, labor, natural resources and capital. Nations can be expected to gain factor-based comparative advantage by producing goods and establishing industries which capitalize on the factors that they possess in abundance. In the context of air transport, the United States possesses a significant comparative advantage because of the country's geographic size and population. It is difficult for the smaller nations of Europe or As it to provide a domestic online feeder market in air transport to support the operations of the national flag carrier that is equivalent to that of the United States. In terms of international trade and strategic industrial policy this becomes important, 'since the economic equivalent of access to the internal US market would involve, for example, comparable access for US carriers in the intra Europe market(Kasper,1988 p. 93).We shall return to this fundamental point later. While the underlying comparative advantage of countries has played a role in shaping patterns of international trade, it is becoming increasingly obvious that the assumptions underlying comparative advantage theory (such as near perfectly competitive conditions) may not sufficiently explain all forms of international trade. One of the leading advocates for a radical reformulation of international trade the ory has been Krugman (1986). Krugman (1986, p. 9)argues that 'a good deal of trade now seems to arise because of the advantages of large-scale production,the advantages of cumulative experience, and transitory advantages resulting from innovation', especially in industries characterized by a small number of suppliers.

The fundamental premise is that comparative advantage and neoclassical economics play less of a role in accounting for markets where companies 'face a few identifiable rivals, they haves ome direct ability to affect prices, and they make strategic moves designed to affect their rivals' actions'(Krugman, 1986, p. 9).Much of this characterizes the current state of the international airline industry, and it is certainly difficult to view airline markets as anything like perfectly competitive in the orthodox sense. Rather ,the world airline industry can be characterized as being part of an imperfectly competitive market where an oligopolistic industrial structure, restrictive bilateral cartels, protectionist governmental policies, limited international traffic rights, price collusion, economies of scope through hub networks, and various other barriers to entry all act to limit the number of competitors. Much of this has little to do with the factor endowments of comparative advantage. To meet this problem and to provide an intellectual justification for airline deregulation, neoclassical theorists put forth the theory of con-testability (Baumoletal,1982; Bailey and Baumol,1984; Baumol and Willing, 1986).

Contestable conditions were theorized to arise not simply through the existence of classical perfect competition but from the potential threat of competition. Deregulated airline markets were believed to be contestable, and thus easy to enter,

because aircraft were mobile at relatively low cost-the ‘capital on wings’ rationalization. Consequently. an incumbent air carrier (even if monopolist) would not charge a high price on any given route because this might entice a new entrant onto the route. The new entrant might offer lower prices and divert traffic away from the incumbent. Therefore, contestability theorists believed that city-pair markets would remain competitive simply because ‘there exist firms not currently in a market that might conceivably enter it’ (Wilkins, 1984,p. 424).Such a conceptualization fails to address the industry as a whole because it ignores the fact that runways, airport terminals, air traffic control centers and governmental aviation policy are less able to respond dynamically to the changing conditions of the marketplace. Even in deregulated air transport systems such as the USA, the barriers to entry are191Conventional theories of international trade based on the notion of comparative advantage (Ohlin,1933) argue that all nations differ in the factor endowments that form the basic inputs for production: land, labor, natural resources and capital. Nations can be expected to gain factor-based comparative advantage by producing goods and establishing industries which capitalize on the factors that they possess in abundance. In the context of air transport, the United States possesses a significant comparative advantage because of the country’s geographic size and population. It is difficult for the smaller nations of Europe or Asia to provide a domestic on-line feeder market in air transport to support the operations of the national flag carrier that is equivalent to that of the United States. Inters of international trade and strategic industrial policy this becomes important, ‘since the economic equivalent of access to the internal US market would involve for example, comparable access for US carriers in the intra-Europe market (Kasper,1988 p. 93). We shall return to this fundamental point later. While the underlying comparative advantage of countries has played a role in shaping patterns of international trade, it is becoming increasingly obvious that the assumptions underlying comparative advantage theory (such as near perfectly competitive conditions) may not sufficiently explain all forms of international trade. One of the leading advocates for a radical reformulation of international trade theory has been Krugman (1986).

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UNIT-II

AIRPORT INFRASTRUCTURE AND MANAGEMENT

Airport planning

Introduction

The passenger and cargo terminals have been described as interface points between the air and ground modes, the movement of passengers, baggage, and cargo through the terminals and the turnaround of the aircraft on the apron are achieved with the help of those involved in the ground handling activities at the airport (IATA 2012). These activities are carried out by some mix of the airport authority, the airlines, and special handling agencies depending on the size of the airport and the operational philosophy adopted by the airport operating authority. For convenience of discussion, ground handling procedures can be classified as either terminal or airside operations.

2.2 Passenger Handling

Passenger handling in the terminal is almost universally entirely an airline function or the function of a handling agent operating on behalf of the airline. In most countries of the world, certainly at the major air transport hubs, the airlines are in mutual competition. Especially in the terminal area, the airlines wish to project a corporate image, and passenger contact is almost entirely with the airline, with the obvious exceptions of the governmental controls of health, customs, and immigration. Airline influence is perhaps seen at its

Terminal

1. Baggage check
2. Baggage handling
3. Baggage claim
4. Ticketing and check-in
5. Passenger loading/unloading
6. Transit passenger handling
7. Elderly and disabled persons
8. Information systems
9. Government controls
10. Load control
11. Security Cargo

Airside

1. Ramp services
2. Supervision
3. Marshaling Startup
4. Moving/towing aircraft
5. Safety measures

On-ramp aircraft servicing

1. Repair of faults Fueling
2. Wheel and tire check
3. Ground power supply Deicing
4. Cooling/heating
5. Toilet servicing
6. Potable water
7. Demineralized water
8. Routine maintenance
9. Nonroutine maintenance
10. Cleaning of cockpit windows, wings, nacelles, and cabin windows

Onboard servicing cleaning

1. Catering
2. In-flight entertainment
3. Minor servicing of cabin fittings
4. Alteration of seat configuration

External ramp equipment

1. Passenger steps
2. Catering loaders
3. Cargo loaders
4. Mail and equipment loading
5. Crew steps on all freight aircraft

Extreme in the United States, where individual airlines on occasion construct facilities In these circumstances, the airlines play a significant role in the planning and design of physical facilities that they will operate. Even where there is no direct ownership of facilities, industry practice involves the designation of various airport facilities that are leased to the individual airlines operating these areas. Long-term designation of particular areas to an individual airline results in a strong projection of airline corporate image, particularly in the ticketing and check-in areas and even in the individual gate lounges.

A more common arrangement worldwide is for airlines to lease designated areas in the terminal, but to have a large proportion of the ground handling in the ramp area carried out by the airport authority, a special handling agency, or another airline. At a number of international airports, the airline image is considerably reduced in the check-in area when common-user terminal equipment (CUTE) is used to connect the check-in clerk to the airline computers.

Apron passenger-transfer vehicles are usually of the conventional bus type Both airline and airport ownership and operation are common, airline operation being economically feasible only where the carrier has a large number of movements. Figure 6.6 shoVvs a typical airport-owned apron bus. Where a more sophisticated transfer vehicle, such as the mobile lounges shown in Figure 6.7 are used, it is usual for the operation to be entirely in the hands of the airport authority.

Airport operations

The term airport operations initially triggers the view of passengers being transported by aircraft. Further thought would give rise activities that directly or affect passenger operations, such as baggage handling systems, aircraft maintenance and passenger security. When in fact airport operations consist of numerous aspects; concourses, runways, parking, airlines, cargo terminal operators, fuel depots, retail, cleaning, catering and many interacting people including travellers, service providers and visitors. The facilities are distributed and fall under multiple legal jurisdictions in regard to occupational health and safety, customs, quarantine and security. For the airport to function these numerous systems must work together.

Currently decision making in this domain space is focused on individual systems. The challenge of delivering improved nation-wide air transportation security, while maintaining performance and continuing growth, demands a new approach. In addition, information flow and data management are a critical issue, where trust plays a key role in defining interactions of organisations.

Of great concern recently has been the need for rapid implementation of security measures in place at airports to protect passengers, staff and aircraft [1]. While individual systems are being improved to increase security, i.e. the use of EDS (Explosive Detection Systems) in baggage systems, a holistic view is required for this complex airport environment. By analysing the operations as a system of systems a more thorough understanding what is currently going into airport security can be achieved and the real and perceived levels of risk can be reduced. Also, a layered approach to security can be applied to the systems of systems to improve the safety of passengers, staff and aircraft. The financial cost of implementing a security policy in an airport can be reduced through the study of the individual systems within the airport and their interactions.

System of systems methodologies are required to rapidly model, analysis and optimise air transportation systems. In any critical real world system there is and must be a compromise between increased risk and increased flexibility and productivity. By approaching such problem spaces from a system of systems perspective we are in the best position to find the right balance.

2.1.1 Airport Security Airports have become a focus point of government security policy making since the September 11 attacks. Current research has focused on detection of contraband items before being loaded on aircraft and the allocation of Xray machines to passenger services, trading off between cost, effectiveness and deterrence.To gain an understanding of all the relevant security threats they will be discussed next.

2.1.2 Passengers (PAX) The first security threats we shall consider are those generated by passengers. Passengers pose three situations that are required to be dealt with, carry on baggage, the individual themselves and checked baggage, which will be discussed in the following section. Passengers would now be well aware of the security measures in place to protect from any threats. Metal detectors are used to screen individuals with more complex individual screening in development [4] and X-ray machines used to check carry on luggage. Behind the scenes profiling can identify ‘high’ risk passengers and a range of explosives detection technologies are being investigated for their effectiveness. Effectiveness can be achieved both through their perceived value (functioning as a deterrent) as well as the actual detection performance.

2.1.3 Passenger Baggage The second security threat is that of checked baggage. At passenger checkin bags are labelled with a bar code to identify the passenger, bag and flight details. Before the bags are delivered onto the plane they must undergo screening by X-ray machine or EDS. The BHS uses a layered security approach in order to accommodate large volumes of bags. The first layer involves examination by high capacity X-ray machines. Any bags not able to be cleared are escalated to a combination of human image inspection, human manual inspection or a more detailed X-ray machine. The layered approach ensures suspect items are identified while maintaining a high throughput.

2.1.4 Air Cargo A third security threat deals with the air cargo operations of an airport. Freight for an airline is managed by a cargo terminal operator (CTO). CTOs receive freight from a variety of sources including freight forwarders (FF), postal services and occasionally members of the public. The CTO utilises the cargo space of a flight, consolidating freight

where appropriate and balancing available space between passenger baggage and freight cargo. As air cargo provides a valuable addition to a countries economy it is essential it is kept secure while not imposing so strict a policy that the operations will grind to a halt.

2.1.5 Additional Security Concerns Further security areas include, but not limited to, physical access to sites within the airport, staffing, maintenance and aircraft supplies.

Typical Structure of an Airline Industry Company

If you look at an airline organizational chart, you will most likely find it is using a functional organizational structure, in that management is organized from the top down, more or less resembling a pyramid with airline departments or divisions based on the different functions of the company.

Typically, the airline would have a president or CEO reporting to a board of directors, with executives below her for the different divisions. A large airline with international flights and offices in multiple companies, for example, could have eight C-level executives reporting to the CEO, each with three to eight vice presidents below them, including.

1. Corporate Structure and Chains of Command
2. Chief Human Resources Officer: personnel, human resources, training, administrative affairs.
3. ChiefFinancial Officer: finance, accounting, purchasing.
4. Chief Investment Officer: investment management, international relations, corporate innovation.
5. Chief Development and IT Officer: customer solutions, IT strategy and governance, strategic projects.
6. Chief Flight Operations Officer: flight operations, cabin crews, operations control, crew planning.
7. Chief Commercial Officer: ground operations, regional flights, catering and in flight products.
8. Chief Marketing Officer: corporate marketing, corporate communications, marketing, domestic sales, regional sales

Chief Cargo Officer: cargo maintenance, cargo sales, cargo operations

Each of these divisions represent diverse specialization, many unique to the airline industry. The chief flight operations officer and the flight operations VP below him, for example, do not need to concern themselves with the intricacies of investment management, catering or the sale of cargo space.

If the airline organizational structure was based on geography instead of function, which would involve having top executives overseeing different regions or countries, their authority and responsibility would cross multiple functions. Each region would have a different culture and a different flavor in its marketing and customer service, even if they used the same procedures.

Without a functional structure, each region would also be duplicating many tasks and processes. Six different regional directors, for example, would each have different catering contracts and different marketing initiatives, and it would be more difficult to ensure they were all using the same IT policies and procedures. This would increase costs and make it difficult for the company to compete in what has always been a competitive market.

Corporate Structure of Southwest Airlines

In 2019, the Panmore Institute conducted an extensive evaluation of Southwest Airlines, which illustrates its use of a functional corporate structure and centralized control of all operations by executives in the head office. As an international, low-cost airline today, Southwest still uses what is essentially the same structure it used when it was a small local carrier in Texas.

Southwest has used this structure successfully while competing with other major carriers like American, Delta and United. Rigid chains of command all lead to a central authority,

which benefits the company in four ways:

1. Southwest can respond to changes in the industry and adopt new initiatives very quickly.
2. The company can efficiently control costs, an essential part of its business model as a low-cost airline.
3. It minimizes redundancies among different airline departments.
4. Its business functions are run by experts in their fields. The VPs of ground operations, in-flight operations and maintenance operations, for example, all report to the executive VP for daily operations.

Limitations of Functional Structures

A functional organizational structure is by definition rigid, and it does have a few drawbacks that don't only affect Southwest Airlines but any airline using this structure. Of particular note are two major weaknesses.

First, strong centralized control of all operations reduces the autonomy of individual departments, including local managers and supervisors. This can make it difficult for them to make changes or adjust strategies based on shifts in daily circumstances, which can be numerous in the airline industry.

Second, a functional structure doesn't naturally align itself to a sense of teamwork in corporate culture. Unless this is carefully managed, a company risks employees and customers feeling as if they are cogs in a machine.

Digging Deeper Into Operational Control

Airlines share many of the functions and divisions used by most other companies, like finance and marketing. What makes this industry unique is the management and orchestration required to ensure that flights across the world are properly scheduled, filled with passengers, staffed, fueled and maintained. This is done by the airline operational control center.

The AOCC is usually made up of a small group of experts supervised by an operational control manager. Its role is to monitor all of the disparate activities required to keep flights running smoothly. When there is a problem, like an aircraft malfunction, a sick crew member or a flight delayed due to weather, the AOCC is responsible for restoring operations as quickly as possible at a minimum cost.

AOCC Roles

There are usually five distinct roles within the AOCC:

Flight Dispatch: Responsible for preparing flight plans and requesting new flight slots from air traffic control entities, like the FAA in North America and EUROCONTROL in Europe

Aircraft Control: Responsible for managing aircraft and is the central coordinator in operational controls **Crew Control**: Manages crew resources, monitors crew check-ins and check-outs and updates crew rosters as needed **Maintenance Services**: Responsible for short-term maintenance scheduling and unplanned service requirements **Passenger Services:** Responsible for ensuring that decisions and changes minimize any impact on passengers. The number of people working in these roles depends on the size of the airline and how the AOCC is organized.

AOCC Organizations

There are three main AOCC organizations:

Decision Center: Aircraft controllers work in the same room, while other team members, like crew control and maintenance services, work in different places.

Integrated Center: All team members work in the same physical space, reporting to a supervisor.

Hub Control Center: Most roles are at different airports, where they can work in conjunction with airport operations. Most airlines use a combination of these organizations, specifically a decision center with hubs or an integrated center with hubs.

Small Airlines and Organizational Structure

It may be tempting to think that a smaller airline may have a more relaxed organizational structure, but as the Panmore Institute noted, Southwest Airlines used a hierarchical functional structure even in its early days.

Looking at the structure of smaller, regional airlines today, like Alaska Airlines and Air Wisconsin Airlines, reveals that while they have fewer positions than their larger competitors, the divisions are quite similar. Air Wisconsin Airlines, for example, has a CEO and president followed by three senior VPs in charge of operations, finances and technology and business analysis. Below them are five VPs:

1. Vice President of Tech Ops
2. Vice President of In-flight and Customer Service
3. Vice President of Information Technology and Business Intelligence
4. Vice President of Flight Operations
5. Vice President of Safety and Security

This is not to say that smaller companies can't have more of a team-based culture than their larger competitors — they often do. However, the primary objective of companies using functional organizational structure is to ensure efficiency in a competitive, cost-conscious aviation industry.

AIRPORT AUTHORITY OF INDIA

Airports Authority of India (AAI) was constituted by an Act of Parliament and came into being on 1st April 1995 by merging erstwhile National Airports Authority and International Airports Authority of India. The merger brought into existence a single Organization entrusted with the responsibility of creating, upgrading, maintaining and managing civil aviation infrastructure both on the ground and air space in the country.

AAI manages a total of 137 airports which include 23 International airports (3 Civil Enclaves), 10 Custom Airports (4 Civil Enclaves) and 104 Domestic airports (23 Civil Enclaves). AAI provides air navigation services over 2.8 million square nautical miles of air space. During the year 2018-19, AAI handled aircraft movement of 1309.54 Thousand [International 163.05& Domestic 1146.49], Passengers handled 158.79 Million [International 22.78& Domestic 136.01] and the cargo handled 944.90 thousand MT [International 487.36& Domestic 457.54]. Further, all Indian airports taken together have handled aircraft movement of 2605.96 Thousand [International 452.64& Domestic 2153.32], Passengers handled 344.70 Million [International 69.48 & Domestic 275.22] and the cargo handled 3561.90 thousand MT [International 2200.19& Domestic 1361.71].

PassengerFacilities

The main functions of AAI inter-alia include construction, modification & management of passenger terminals, development & management of cargo terminals, development & maintenance of apron infrastructure including runways, parallel taxiways, apron etc., Provision of Communication, Navigation and Surveillance which includes provision of DVOR / DME, ILS, ATC radars, visual aids etc., provision of air traffic services, provision of passenger facilities and related amenities at its terminals thereby ensuring safe and secure operations of aircraft, passenger and cargo in the country.

AirNavigationServices

In tune with global approach to modernization of Air Navigation infrastructure for seamless navigation across state

and regional boundaries, AAI has been going ahead with its plans for transition to satellite based Communication, Navigation, Surveillance and Air Traffic Management. A number of co-operation agreements and memoranda of co-operation have been signed with US Federal Aviation Administration, US Trade & Development Agency, European Union, Air Services Australia and the French Government Co-operative Projects and Studies initiated to gain from their experience. Through these activities more and more executives of AAI are being exposed to the latest technology, modern practices & procedures being adopted to improve the overall performance of Airports and Air NavigationServices.

Induction of latest state-of-the-art equipment, both as replacement and old equipments and also as new facilities to improve standards of safety of airports in the air is a continuous process. Adoptions of new and improved procedure go hand in hand with induction of new equipment. Some of the major initiatives in this direction are introduction of Reduced Vertical Separation Minima (RVSM) in India air space to increase airspace capacity and reduce congestion in the air; implementation of GPS And Geo Augmented Navigation (GAGAN) jointly with ISRO which when put to operation would be one of the four such systems in the world.

Security

The continuing security environment has brought into focus the need for strengthening security of vital installations. There was thus an urgent need to revamp the security at airports not only to thwart any misadventure but also to restore confidence of traveling public in the security of air travel as a whole, which was shaken after 9/11 tragedy. With this in view, a number of steps were taken including deployment of CISF for airport security, CCTV surveillance system at sensitive airports, latest and state-of-the-art X-ray baggage inspection systems, premier security & surveillance systems. Smart Cards for access control to vital installations at airports are also being considered to supplement the efforts of security personnel at sensitive airports.

AerodromeFacilities

In Airports Authority of India, the basic approach to planning of airport facilities has been adopted to create capacity ahead of demand in our efforts. Towards implementation of this strategy, a number of projects for extension and strengthening of runway, taxi track and aprons at different airports has been taken up. Extension of runway to 7500 ft. has been taken up to support operation for Airbus-320/Boeing 737-800 category of aircrafts at all airports.

HRDTraining

A large pool of trained and highly skilled manpower is one of the major assets of Airports Authority of India. Development and Technological enhancements and consequent refinement of operating standards and procedures, new standards of safety and security and improvements in management techniques call for continuing training to update the knowledge and skill of officers and staff. For this purpose AAI has a number of training establishments, viz. NIAMAR in Delhi, CATC in Allahabad, Fire Training Centres at Delhi & Kolkata for in-house training of its engineers, Air Traffic Controllers, Rescue & Fire Fighting personnel etc. NIAMAR & CATC are members of ICAO TRAINER programme under which they share Standard Training Packages (STP) from a central pool for imparting training on various subjects. Both CATC & NIAMAR have also contributed a number of STPs to the Central pool under ICAO TRAINER programme. Foreign students have also been participating in the training programme being conducted by these institution

ITImplementation

Information Technology holds the key to operational and managerial efficiency, transparency and employee productivity. AAI initiated a programme to indoctrinate IT culture among its employees and this is most powerful tool to enhance efficiency in the organization. AAI website with domain name is a popular website giving a host of

information about the organization besides domestic and international flight information of interest to the public in general and passengers in particular.

The functions of AAI are as follows:

1. Design, Development, Operation and Maintenance of international and domestic airports and civil enclaves.
2. Control and Management of the Indian airspace extending beyond the territorial limits of the country, as accepted by ICAO.
3. Construction, Modification and Management of passenger terminals.
4. Development and Management of cargo terminals at international and domestic airports.
5. Provision of passenger facilities and information system at the passenger terminals at airports.
6. Expansion and strengthening of operation area, viz. Runways, Aprons, Taxiway etc.
7. Provision of visual aids.
8. Provision of Communication and Navigation aids, viz. ILS, DVOR, DME, Radar etc.

AIRLINE PRIVATIZATION (gradual)

As part of a series surrounding airline privatization, we have dived into numerous ways airlines opt to join the market, including and trade sales. This covers a good portion of the industry, but there are still many ways that airlines go from the hands of the government to the investors either in full or in part.

In the third part to this series, we'll discuss gradual privatization. Gradual privatization is as the name says, the gradual privatization of an organization. In this situation, the entire company isn't sold to investors, but the controlling government gradually reduces its stake in the company to either a small portion under government ownership or 100% private ownership. One common example of this process is none other than Lufthansa.

Gradual Privatization of Lufthansa

Lufthansa has had owned by private shareholders for many years, however, the German government was still the largest single shareholder, with an ownership stake varying between 72 percent and 85 percent from the 1950s to late 1980s before declining to 65 percent.Then, in 1989, the German government took the first step in their ultimate goal of privatizing the airline. In the autumn of 1989, the airline issued additional shares that diluted the government stake in the airline from around 60 to 52 percent.

Pension Troubles

However, the issue of further shares hit a technical snag that proved to be a challenge for the airline. While some unfortunate financial luck hit with the Gulf War recession, an issue around Lufthansa employee pensions arose swiftly. As government employees, Lufthansa employees were covered by a government-backed pension fund. If the government's share of Lufthansa fell below 50 percent, the airline would lose pension rights from the fund.

Since fully funded pension funds are few and far between, it was no surprise that if the German government's ownership of Lufthansa were to fall below 50 percent, then Lufthansa as a private entity would not be able to fund its entire pension obligations.

This issue was finally resolved in 1994 when the German government agreed to give Lufthansa roughly 1.5 billion Deutsche Marks, just under $1 billion at the time, to help fund the pension benefits of the existing staff after the airline withdraws from the government-backed pension fund.

By the fourth quarter of 1994, Lufthansa issued additional shares to the public and the government sold off 2 million shares, placing them with institutions. This further reduced the government's share in the airline.

Foreign Ownership Challenges

With some of the major challenges out of the way, time went on and new challenges arose. Most shares in German companies at the time were "bearer" rather than registered in the shareholder's name. Similar to central bank notes, the owners aren't really known and can't be traced.

This made it quite difficult if not impossible to know who exactly was holding shares of the airline. This isn't really a problem when the government owns the majority of the airline, but as it gradually privatizes, it creates a problem. Foreign ownership restrictions and air services agreements come in to play.

Following full privatization, a group of state companies and institutions agreed to retain their holdings to ensure that there continues to be majority German ownership. In 2005, over three quarters of Lufthansa shares were in German hands. However, by the next year, this dropped to around 60 percent. However, the airline wasn't too concerned about the threat of excessive control at the time.

The airline is now fully private following the gradual selling of shares by the government to the general public. While the process took quite a long time, the eventual result was a company responsible for its own bottom line without the influence of government ownership.

Partial Privatization

Throughout this series surrounding airline privatization we have explored numerous ways airlines can join the public markets, such as public issuance of shares, trade sales, and gradual privatization. We've gone through a large chunk of the methods many airlines have gone through when going public but there still are a few more things to go through.

Partial Privatization of Kenya Airways

In the previous parts of the series we discussed how an airline goes from being a government controlled entity to an entirely public entity that is controlled by shareholders. However, in the fourth part to this series we'll discuss what happens when an airline doesn't want to go fully public, instead it just wants to have a partial privatization.

This is usually done through methods discussed earlier in the series such as issuing public shares or making a trade sale. Usually the entire airline won't be put into public markets, a part will still remain in government hands.

Kenya Airways is a great example of this. The Kenyan government used a two pronged approach similar to what Qantas did in terms of a trade sale and public share issuance. KLM acquired 26 percent of Kenya Airways shares in December 1995. Shortly afterwards a public offering took place in March 1996 with the issuance of 34 percent of Kenya Airways' shares on the Nairobi stock exchange.

14 percent of shares were put on sale internationally and 3 percent was allocated to employees. This left the Kenyan government with slightly less than a quarter of the airline in its possession. As with the trend we've seen in many other privatizations, foreign ownership limits were also implemented. This time the limit being a maximum of 40 percent.

KLM Investment

The sale of a portion of Kenya Airways to KLM is notable here since it has fostered considerable cooperation between the two airlines that has led to strong partnerships such as the Kenya Airways and KLM joint venture that was established in 1995.

This provided seamless travel experiences across the two carriers between Amsterdam and Nairobi. KLM saw Nairobi as being a strategic location to transfer passengers to Kenya Airways, from there passengers can connect to many places across Sub-Saharan Africa.

This purchase also came at a cost for Kenya Airways. KLM was appointed two board seats at Kenya Airways. This increases the involvement of KLM in the airline, which for some is a good thing and for others a bad thing.

In November 2017, after three years of consecutive losses the Kenyan government and lenders agreed to convert $405.3 million of the airline's debt into equity which gave the state a controlling share and also diluting the ownership stake of other shareholders, including KLM.

This comes at a time where some African airlines are considering banding together in the face of mounting competition. South African Airways, Kenya Airways, Air Mauritus, and RwandAir are in talks to create an alliance to fight off competition and foster connectivity across the African continent that continues to remain stifled.

Full privatization

Airport privatization refers to shifting governmental functions and responsibilities, in whole or in part, to the private sector. The most extensive privatizations involve the sale or lease of public assets.

Airport privatization, in particular, typically involves the lease of airport property and/or facilities to a private company to build, operate, and/or manage commercial services offered at the airport. No commercial airport property in the United States has been completely sold to a private entity. Long-term operating leases are the standard privatization contract. Only in the United Kingdom have outright sales of airport property been completed.

Although no U.S. commercial airport has been sold to a private entity, publicly owned airports have extensive private sector involvement. Most services now performed at large commercial airports, such as airline ticketing, baggage handling, cleaning, retail concessions, and ground transportation, are provided by private firms. Some estimates indicate as many as 90 percent of the people working at the nation's largest airports are employed by private firms. The remaining 10 percent of the employees are local and state government personnel performing administrative or public safety duties; federal employees, such as FAA air traffic controllers and TSA security screeners; or other public employees, primarily military personnel. Airports have been increasingly dependent on the private sector to provide services as a way to reduce costs and improve the quality and the range of services offered.

Airport privatization

In the mid-1990s some public administrations contracted with private firms to manage their airports; most notably, in 1995, the Indianapolis Airport Authority contracted with a private firm, the British Airports Authority, to manage its system of airports, including the Indianapolis International Airport. Since 1995, several, but not many, airports have been contracted out for full private management. More commonly a portion of the airport, such as an airport terminal, concessions, parking, and so forth, has been subcontracted for management by private sector firms.

Airports are, however, relying more on private financing for capital development. Airports have sought to diversify their sources of capital development funding, including the amount of private sector financing. Traditionally, airports have relied on the airlines and federal grants to finance their operations and development. However, in recent years, airports, especially the larger ones, have sought to decrease their reliance on airlines while increasing revenue from other sources. Nonairline revenue, such as concession receipts, now account for more than 50 percent of the total revenue larger airports receive.

In most other countries, the national government owns and operates airports. However, a growing number of countries, including Canada and Australia, have been exploring ways to more extensively involve the private sector as a way to provide capital for development and improve efficiency. These privatization activities range from contracting out services and infrastructure development, in a role similar to private sector activities at U.S. airports, to the sale or lease of nationally owned airports.

For example, Mexico passed legislation in 1995 to lease 58 major airports on a long-term basis. Most countries' privatization efforts do not transfer ownership of airports to the private sector, but involve long-term leases, management

contracts, the sale of minority shares in individual airports, or the development of runways or terminals by the private sector. Only the United Kingdom has sold major airports to the private sector. To privatize, the United Kingdom sold the government corporation British Airports Authority (BAA) and the seven major airports it operated (including London's Heathrow and Gatwick Airports) in a $2.5 billion public share offering. Proceeds from this sale were used to reduce the national debt. Even after privatization, the airports have remained subject to government regulation of airline access, airport charges to airlines, safety, security, and environmental protection. The government also maintains a right to veto new investments in, or divestitures of, airports. BAA has generated profits every year since it assumed ownership of the United Kingdom's major airports in 1987.

Several factors have motivated interest in expanding the role of the private sector at commercial airports in the United States. First, privatization advocates

Believe that private firms would provide additional capital for development. Second, proponents believe that privatized airports would be more profitable because the private sector would operate them more efficiently. Last, advocates believe that privatization would financially benefit all levels of government by reducing demand on public funds and increasing the tax base.

In 1997, the FAA implemented the Pilot Program on Private Ownership of Airports, under which five public-use airports would be operated under a private management group. The airports selected to participate in the program include Stewart International Airport in Newburgh, New York; Brown Field in San Diego, California; Rafael Hernandez Airport in Aguadilla, Puerto Rico; New Orleans Lakefront Airport in New Orleans, Louisiana; and Niagara Falls International Airport in Niagara Falls, New York. The program has been met with limited success, with only Stewart International Airport fully completing the privatization process.

The enthusiasm toward full airport privatization has appeared to wane since the late 1990s, as the overall economy of the United States has declined. However, the concepts that drive private enterprises toward competitive and efficient operations is becoming embraced by publicly owned and managed airports. As a result, more efficient organizational structures and management responsibilities have resulted in more streamlined and efficient airport management organizational structures

UNIT-III

AIR TRANSPORT SERVICES

Various airport services

Commercial Service Airports – These airports support some level of scheduled commercial airline service and have the infrastructure and services available to support a full range of general aviation activity. These facilities meet most needs of the aviation system and serve as essential transportation and economic centers of the state.

Enhanced Service Airports – These airports have runways 5,000 feet or greater in length with facilities and services that accommodate a full range of general aviation activity, including most business jets. These airports serve business aviation and are regional transportation centers and economic centers.

General Service Airports – These airports have runways 4,000 feet or greater in length with facilities and services customized to support most general aviation activity, including small to mid-size business jets. These airports serve as a community economic asset.

Basic Service Airports – These airports have runways 3,000 feet or greater in length with facilities and services customized to meet local aviation demands.

Local Service Airports – These airports support local aviation activity with little or no airport services.

International air transport services

Airline or Volar is.- Concessionaire Vuelta Compamia de Aviation, S.A.P.I. de C.V.

Initial Airline.- On interlineal flights, the airline who has the traffic rights on the first flight leg and transports passengers on that leg.

Final Airline.- On interlineal flights, the airline who has the traffic rights on the second or last leg of the flight, receives from the Initial Airline the passengers to transport them on the second or last leg.

Selling Airline.- On interlineal flights, the one who sells the Ticket for the air transportation.

Air Transportation Services.

Volaris will provide to the Passenger the International Air Transportation Service from one place to another subject to the policies, terms and conditions located on the Web Site and that are accepted at the purchase of Tickets at any of Volaris´ sale offices.

Also, Volaris will provide the Passenger with the International Air Transportation Services operated by them or by the airline who has celebrated an Interlineal Agreement with Volaris on the routes that Volaris or the other airline operates in accordance with the traffic rights they have and the terms and conditions of each party. In consideration of the air

transportation services provided by Volaris, the Passenger will pay Volaris a fixed price, as well as all applicable taxes and charges such as the Value Added Tax, the Airport Usage Tax, Security Inspection Charge, "Derecho de No Inmigrante" (DNI), Agriculture Tax, Customs Tax, International Transportation Tax, Passenger Facility Tax or any other charges that may be applicable from time to time, which can be reviewed by the Passenger using the Web Site, the Call Center or at Volaris sale channels inside the Airports, where available.

Passenger.

The Passenger shall pay the price of the Ticket in compliance with applicable legislation, as well as the policies, terms, and conditions set forth by Volaris, which can be consulted by the Passenger using the Web Site, the Call Center or at Volaris check-in counters inside the Airports. The Passenger has the right to be carried on a specific route, and in it case, to receive also the transportation of the baggage.

The Passenger has the following obligations, as well as the ones that the federal laws will establish from time to time: Provide, in the moment of the purchase, true and accurate information II. Pay the ticket III. Fulfill the applicable legislation, this Agreement and the terms, conditions and policies of Volaris, the Passenger can be informed of this in the Call Center or in Volaris sale channels IV. Provide a current and valid ID, as well as the documents that in accordance with the applicable laws are necessary for its legal admission in Mexico and in foreign countries. V. Comply with the security and operational rules given by the crew as well as the ones given for the airport use. VI. Occupy the assigned seat, unless the crew autorices a change of seat. VII. Any other regulation established on the Civil Aviation Law or other laws. The Passenger represents to have knowledge of the terms and conditions of this Agreement, and agrees to periodically consult the Web Site in order to review any modification there in.

Passengers with special needs.

The passengers with disabilities have the right to be carried with the security operational policies and to carry without cost the wheelchair, walker, prosthesis or any other instrument if it is strictly related to the disability they have and is for personal use.

Passengers that require a medical oxygen tank must notify the Airline at least 72 (seventy-two) hours prior to the flight's scheduled departure. Those passengers that require the use of a ventilator, respirator or continuous pressure machine for the respiratory system or personal portable oxygen must notify the Airline at least 48 (forty eight) hours before scheduled departure.

If a Passenger needs an additional seat, in accordance with Volaris security procedures he/she shall request such seat when purchasing or booking the Ticket, in order to be informed of the cost of said seat.

Pregnant women, infants, unaccompanied minors during their transportation, shall request the necessary services upon purchasing their Ticket, to the extent required or permitted by applicable law.

The passengers with any disability do not have to present any medical document that supports that condition, except in the following cases:

Flight in stretcher or incubator.

The Passenger needs Medical Oxygen during the flight.

- The Passenger presents any of the medical conditions considered by the World Health Organization as a counter-indication for flying. In these cases, the Passenger should present a medical certificate in which a doctor qualifies the Passenger as someone capable for the flight.
- When the intellectual or psychosocial capacity doesn't allowed him/her to manage without assistance.
- The Passenger with disabilities has the right to travel with a dog guide or an animal guide on passenger cabin without any extra charge presenting the certificate.

- Passengers with disabilities or with reductions on movement might be located on the closest seats to the boarding doors.
- Wheelchairs will be registered as baggage without extra charges. In case the Passenger with disability wants to registered an extra wheelchair, he/she might do it as part of his/her baggage franchise or paying the correspondent charges for additional baggage
- The checking of a wheelchair with wet battery will be subject to the "Norma Oficial Mexicana" which regulates de air transportation of dangerous merchandise, issued by the "Secretaria de Comunicaciones y Transportes".
- Flights to the U.S. and Puerto Rico, it will be subject to the DOT, the applicable regulation and/or the International Treaties.

Tickets.

Tickets are not transferable and non refundable. It is the Passenger´s sole responsibility to verify that his/her name is properly spelled out. The Passenger has the right to cancel his/her flight and request

the Ticket devolution only if they inform Volaris, in the 24 hours next to the purchase and only if the Passenger has not realized the check in of your flight by any of the possible manners.

Check-in.

The Passenger shall arrive at the Airport's check-in counter at least 180 (one-hundred and eighty) minutes before the scheduled flight departure time.

If the Passenger performs the check-in process at a location other than the Airport, he/she shall do the check-in accordance with the additional advance check-in requirements that the Airline sets forth for such purposes in the Web Site, through the Call Center or at Volaris check in counters inside the Airports.

Once the Passenger has checked-in, he/she shall arrive at the final boarding gate at least 45 (forty five) minutes before the scheduled flight departure time, with the boarding pass and an official ID, which must be shown to Volaris personnel in order to board the aircraft.

Volaris will not be held liable as a result of Passenger's non compliance with the above mentioned requirements, as any action contrary to order and control hinders Volaris operations to the detriment of those Passengers who comply with such requirements.

Baggage

For Flights on United States, Puerto Rico and Central America routes.

The Passenger has the right to carry without any charge, two carry on pieces which weight doesn't exceed 10 kilograms between both pieces, those pieces also need to comply with volume and dimension policies established by Volaris, those policies are located on the Web Site or the Passenger can know more about them on the Call center or at Volaris sale offices.

For Interlineal Flights

The Passenger can carry checked baggage and carry on baggage who complies with the policies of volume, weight and dimensions established on the Ticket issued by the Selling Airline, also according to policies of the Airlines who gives Interlineal Service and to International Conventions.

Extra charges on the baggage depends on the final destiny of it, in those cases an extra charge is applicable, the Selling Airline might inform those destinies with extra charges.

In case the Passenger travels with more baggage tan the one he/she paid, or the baggage does most accomplish all the weight, volume and size requirements, he/she most pay for the excess of baggage

the applicable rates plus taxes. Those rates and taxes are on the Web Site or the Passenger can have information about them on the Call Center or Volaris airport offices.

Transportation of excess baggage will be subject to aircraft's capacity in all cases.

All baggage shall be identified on the inside and outside, with the Passenger's name and address.

Volaris does not recommend the transportation in checked baggage of: money, jewelry, art pieces, securities, stocks, bonds, electronic devices such as radios, cell phones, computers and cameras among others; medication and treatments, perishables, liquids, fragile items.

It is also prohibited to carry weapons of any kind, gases, flammable substances, lighters, corrosive items, explosives and magnets among other things.

If for any reason the Passenger's Checked baggage does not arrive on the assigned conveyor with the rest of the flight's baggage, the Passenger in accordance with the Montreal Convention, shall present a claim with the Volaris personnel in charge that will provide a Passenger Irregularity Report. The same procedure shall be followed in case of baggage damage.

Baggage damage or loss:

Compensation due to damage or loss of the checked baggage will be determined pursuant to and in accordance with the limits established on the Montreal Convention.

The Airline in which leg occurred the damage will be the one responsible for the compensation

Baggage delay:

If Passenger's checked baggage does not arrive at the city of destination at the same time as the Passenger the compensation will be determined by what the Montreal Convention established

Delays

- Delays of flights having Mexico as origin:
- The compensation would be determined by the Civil Aviation Law and by the compensation policies duly registered.
- Delays of flights having United States or Puerto Rico as origin:
- The compensation would be determined by the regulations of the Department of Transportation (DOT) or the applicable regulation.
- Delays on the international interlineal air transportation service
- The compensation would be determined by the Interlineal Agreement and International Treaties or the applicable regulation
- If the delay cause is attributable to Volaris the compensation will be based on the Law as well as the Volaris compensation policies.

Overbooked or Cancelled Flights.

For flights having Mexico as origin:

In compliance with Mexico's Civil Aviation Law, if Airline issues Tickets exceeding aircraft's capacity, or if the flight is cancelled due to Airline's fault, (events related to the weather or external situations preventing a flight will not be deemed as Airline's fault), and as a result a Passenger is denied the contracted air transportation, Airline will, at Passenger's choice:

I. Refund the price paid for the Ticket, or the proportional amount regarding the incomplete segment of the trip.
II. Offer, through all possible means, substitute transportation on the first available flight, as well as provide, free of charge, telephone or cable communication services to the city of destination, meals in accordance with the time the Passenger had to wait to board another flight; hotel accommodations at the Airport or the city where an overnight is required in which case ground transportation services to and from the Airport will be provided.
III. Transportation on a later date, at Passenger's convenience, to the city of destination originally contracted.

In addition to the specified in subsections I and III above, Airline will indemnify the affected Passenger with a compensation of no less than 25% (twenty-five percent) of the price paid for the Ticket or the proportional amount regarding the incomplete segment of the trip.

In case of overbooking, Volaris has the right to ask for volunteers to travel on other date, in exchange, Volaris would give to those volunteers all the benefits announced while asking for such volunteers. The Passengers with disabilities, children without company, pregnant women and seniors are preferred on those seats.

For flights originating in the United States of America or Puerto Rico, alternate transportation or compensation will be provided to Passengers in accordance with rules issued by the U.S. Department of Transportation (DOT).

In case of overbooking, Volaris has the right to ask for volunteers to travel on other date, in exchange, Volaris would give to those volunteers all the benefits announced while asking for such volunteers. The Passengers with disabilities, children without company, pregnant women and seniors are preferred on those seats.

For Interlineal Flights:

In case the Selling Airline have issued Tickets that exceed the aircraft available capacity or in such case a flight is canceled because of imputable causes to such Airline, that Airline might compensate the non boarding based on applicable legislation.

The costs generated by the non boarding due to the causes previously described will be assumed at all by the responsible airline.

Fares.

The fares are freely established by Volaris.

Volaris Information and Advertising.

All text, images, data, graphics, brands and logos used on the Web site are property of Volaris or it is exclusively licensed to Volaris and are protected by the Mexican Intellectual Property Law and its Regulation, the Mexican Copyright Law and its Regulation and by international treaties on Industrial and Intellectual Property, therefore Passengers shall not use such content in any way.

Jurisdiction

In any case of controversy between the Airline and the Passenger flying between points in Mexico, Central America and the United States, the Passenger is subject on an irrevocable way to the jurisdiction of the federal courts of Mexico City and the federal laws.

The Passenger or the person who buys a Ticket in representation and interest of the Passenger can complain against the Airline at any court with competent jurisdiction according to the Montreal Convention.

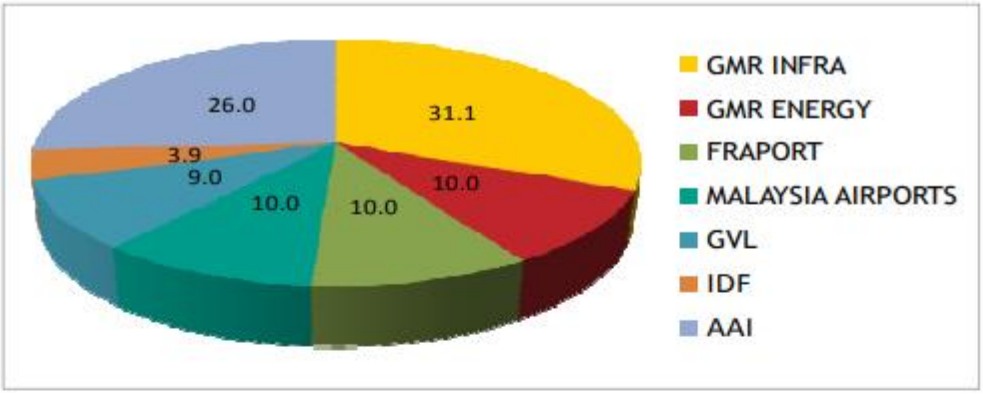
An overview of Airport in Delhi

A World-class Airport for Delhi is a few years away. L&T is executing the design and construction of terminal building, runway and associated works of Delhi International Airport valued at about Rs. 54.00 billion to be commissioned by 2010 for Commonwealth Games. Some of the features include: • The Passenger Terminal Building (T3) will cater to both domestic and international traffic and will handle 25 million passengers per annum, more than twice the present traffic. The total built-up area of the new terminal building (T3) will be 5.2 million sq.ft.. • A new code F runway, at 4.43 km, will be one of the longest in Asia and equipped with CAT IIIB – a landing system. • All airport facilities like baggage handling sytems, IT, communication, passenger boarding bridges, flight information and displays etc.

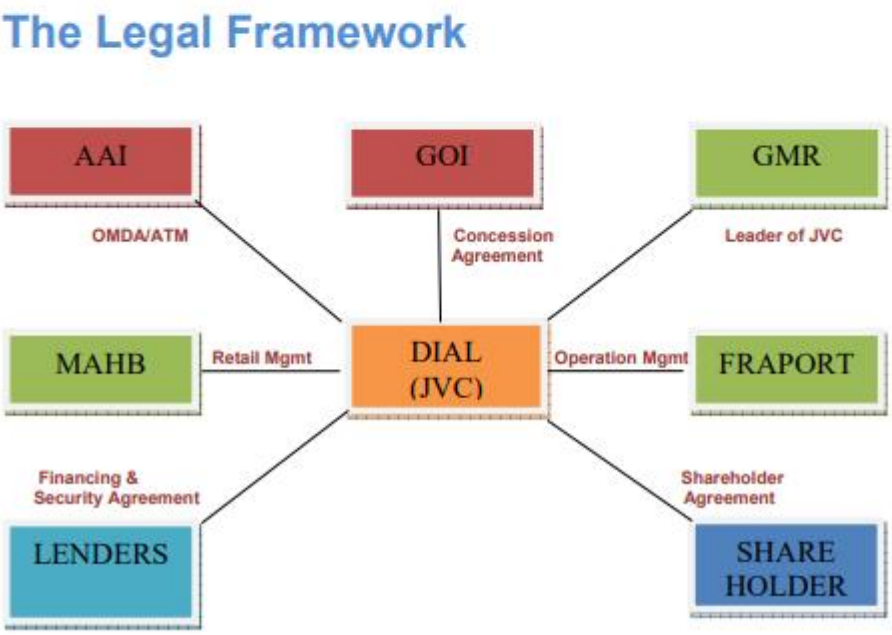
L&T is executing the Rs. 5400 crore Engineering, Procurement & Construction Contract for GMR Group which holds a majority stake in the recently privatized Delhi International Airport Limited (DIAL) The project scope involves Concept Enhancement, Design, Procurement and Construction of Delhi International Airport by L&T in a very tight schedule of 39 months. The Project aims at enhancing the traffic handling capacity of the airport from the existing 12 million passengers per annum (mppa) level to 37 mppa upon completion. This means from the existing capacity of 33000 passengers per day it is expected to be enhanced to 1 lakh passengers per day by 2010 Delhi Commonwealth Games. Currently, the existing runway and terminal facilities are severely overstressed by more than 150% of its capacity utilization at peak hours resulting in tremendous discomfort to all. Hence this fast track project has been kick started and L&T was chosen to execute this project in this stringent timeframe.

Scope of Works

The Scope of work involves construction of an additional run-way, taxiways, aprons, new terminal building - T3 for international and domestic passengers with all international standard state-ofthe-art specialist Airport systems like airfield ground lighting, aviation fuel hydrant system, satellite rescue & fire fighting, visual docking & guidance system, baggage handling system, passenger boarding bridges, integrated airport IT systems, etc. To support the airport infrastructure, the project also involves design and construction of many ancillary structures like multi level car park, airport services building, sewage and water treatment plants, electrical substations with large backup power facility, etc.



The legal framework of the Consortium can be depicted as below:



An overview of Airport in Mumbai

A World-class Airport for Mumbai will also be ready in 4 years. L&T has been entrusted withdesign and construction of terminal works, airside works and ancillary facilities at Chhatrapati Shivaji International Airport (CSIA) to be commissioned by 2012. The new terminal (Terminal 2) will come up in the existing international terminal amidst various challenges. • The terminal will handle 40 million passengers per annum and this will be commissioned in a phased manner from 2010 to 2012. The total built-up area of the new terminal building (T2) will measure 4.84 million sq.ft.. • Airside works including runway reconstruction, construction of new aprons and additional taxi ways. • All airport facilities like baggage handling sytems, IT, communication, passenger boarding bridges, Flight information and displays etc.

As a crucial step forward in the modernization and expansion of Chhatrapati Shivaji International Airport (CSIA), Mumbai International Airport Pvt. Ltd (MIAL) on October 30, 2007 awarded the EPC contract to India's leading technology, engineering and construction company Larsen & Toubro (L&T). According to the contract, L&T has been mandated to build the new integrated passenger terminal and expand the existing facilities, which will also include the

airside and landside works to be executed on a turnkey basis. Accordingly, the new terminal, catering to both domestic and international passengers is expected to double the passengerhandling capacity to 40 million passengers per annum. The total built up area of the new terminal will be 4.84 million sq.ft.. The scope of works apart from civil and structural works in the passenger terminal building involves finishing works, electrical and mechanical installations, passenger boarding bridges, elevators, and escalators, IT systems, security systems, flight information display systems, baggage handling systems, building management systems, furniture and signage, etc. The airside works includes re-construction of the runway (RW 09-27, RW 14-32), taxiways of 4.0 lakh sq.m and aprons of 8.00 lakh sq.m which will accommodate large wide bodied Code-F aircrafts, airfield ground lighting system, ARFF station and equipment and other airport support buildings. Ancillary facilities include construction of new international cargo terminal of approximately 1.0 lakh sq.m, new air traffic control tower at Santa Cruz, new multi-storey car parks at Sahar and Santa Cruz, etc. The entire project will be commissioned in a phased manner from 2010 to 2012.

An overview of Airport in Banglore

State-of-the-art terminal building having an area of around 1.00 million sq. ft.

•Construction of a 4km runway and other infrastructure.

• The airport will cater to the projected traffic demand of 11.5 million passengers and handling 3 lakh tons of cargo per annum.

• Modular construction adopted to ensure smooth and seamless expansion to cater to future growth.

• Integrated Cargo handling facilities with of a total built up area of 6.00 lakhs sqft

The long awaited swanky new Greenfield International Airport at Bengaluru is ready for commercial operations from May 23, 2008. Devanahalli, a sleepy village 35 km away from the Bangalore City, suddenly shot in to limelight in 1991, when the Central and State Governments decided to shift the existing HAL airport to this new Greenfield location. Construction work on this first ever Greenfield Airport at Devanahalli which commenced in July 2005 was completed on schedule by Larsen & Toubro (L&T) in 30 months. Test run of the commercial flight operations were conducted on March 7, 2008 and Air Deccan, Kingfisher, Jet Flights including L&T K-7 aircraft & IAF aircrafts touched down the virgin 4000m runway heralding a new era of air traffic. At peak of construction, more than 200 engineers and administrative staff with 5200 workmen wearing yellow and blue safety helmets carried out the construction of this airport bustling with various activities, non-stop for 30 months under devastating weather conditions like heat, cold, rain, noise, dust and pollution. With hardly any infrastructure in place for access, transport and accommodation, this virgin land on a remote location was transformed by battalions of workmen. Till end of March 2008, this was a beehive of buzzing activities and what stands today on this barren ground is a landmark structure dotted with a 4000m long runway and 71,000 sq.m terminal building, a 65m high air traffic control tower with many other amenities and facilities for a passenger friendly air-traffic. The runway is designed and built to ICAO standards and it is compatible for B-747 aircrafts. Of the total 4,000 acres of land, around 2,000 acres are occupied by the runways, terminal buildings, air traffic control tower, parking bays and other structures. The remaining land is used for other related infrastructure including phaseII expansion, extended air cargo terminals and cold storage including hotels, landscaping and horticulture facilities. The air traffic control tower attracts every visitor as one approaches the airport and this leads you in to the sprawling transparent passenger terminal building with its beautiful parking bays, ticketing counters, reception and spacious visitor lounges before one enters the departure bays. The exuberance of architectural and structural elements like the large glass facade panels, extensive black granite floor studded with granite clad columns standing tall and the entire area capped with specially designed precast shell roof elements with north light glazing stretching from one end to the other is totally awe inspiring and gives you a feeling of transparency, warmth and openness. One can bubble with energy in this new environment, which is the most striking feature of this passenger terminal building. The entire structure glows with pride like a shining star during the night.

The airport went through some last-minute design changes in December 2005 to accommodate an increase in the expected passenger traffic for the projected opening in 2008. The estimated traffic flows which stood at 6.7 million passengers during 2005-06 was expected to touch 8.5 million by 2010. Hence this necessitated an increase in the size of the passenger terminal building, number of aircraft stands, taxiways, passenger boarding bridges and the main access road enabling the airport to match the expected traffic in the coming years. The new airport has the capability to handle 11 million passengers per year and 45 aircraft per hour. Public Private Participation Built on public-private participation, the airport was executed by Bangalore International Airport Limited (BIAL), a consortium of companies comprising Siemens, Zurich Airport and Larsen & Toubro holding 74% stake while the state government & AAI holds the remaining 26%.

The detailed equity holdings held by the government and private promoters are as follows:

• Airports Authority of India: 13%

• Government of Karnataka: 13%

• Siemens Project Ventures: 40%

• Larsen & Toubro: 17%

• Unique Zurich Airport: 17%

The airport has been designed by Kaufmann and Van der Meer Planer AG of Switzerland. However, the structural, architectural & mechanical services design, detailing, procurement and construction have been carried out by ECC, L&T's Construction Division. The supply, engineering and installation of airfield lighting, the IT and communication systems, the baggage handling system as well as the power supply and the building services automation system were all executed by Siemens. Construction of the airport mainly involved major works as follows: Site Preparation Site preparation involved site grading and clearance of thick bushes as well as putting up temporary structures including major earthwork excavation to the tune of 70,20,000 Cum. Airside Infrastructure Building the airside infrastructure involved construction of a 4000 meter long 60 meter wide asphalt paved runway including 7.5m shoulders on either side; 1,80,000 sq.m of allied taxiways; 3,66,000 sq.m of aprons with rigid pavement, aircraft isolation bay and the civil works for the airfield lighting. The runway is designed to cater to B-747 aircraft.

Passenger Terminal Building:

The moment passengers descend from his or her vehicle in front of the passenger terminal building (PTB), they are led in to the spaciously designed and sheltered passenger drop-off area, which can receive a large number of passengers, well-wishers and other visitors. Making an entry in to the PTB, one can see the vastness of space with a clear view of the two levels – the ground and first floor levels. The ground floor is provided with an array of 54 Common User Terminal Equipment (CUTE) with passenger check-in counters, which look very beautiful with its trim and sleek design, just to ensure quick verification and issue of boarding passes. Automatic x-ray screening of check-in baggage helps passengers to move quickly to the security check without wasting time and take their seat in the security lounge either in the ground floor or first floor and await their boarding call. Special display system ensures operation of any counter at any point of time by any airline by selecting the required name.

Vertical transportation as well as elevators and stair cases help passengers to reach the first floor level Construction Marvel The passenger terminal building (PTB) is an outstanding example of marvellous construction by L&T. Having a floor area of 71,000 sq.m and built in three levels, the PTB is specially created for a hassle-free flow of passengers. The terminal building is 218m long, 147m wide and 15.7m high and at peak, this can handle more than 2700 passengers at a time. Illuminated view of the ptb Keeping in mind all comforts of air passengers, the terminal building is proposed as a single, fully air conditioned structure catering to every international and domestic flight passengers. Salient features of this include easy check-in, ease of movement to departure gates, minimal queuing as well as comfortable shopping and waiting areas. Thus, the entire PTB functions like a Central Processing Building, for departures and arrivals, baggage

handling, security check, departure lounges, and arrival baggage claim. Moreover, the design reflects the best of airline industry practices and caters for 24-hour-operations, under all weather conditions, meeting complete requirements of the IATA standards.

Concrete Shell Roof According to Mr.Javeed Shakil, Project Manager of L&T at BIAL project, “Bangalore International Airport is the only Airport in India which is provided with Terminal parking A beautiful car park in front of the terminal building at the ground level has been developed with aesthetic landscaping and garden provided with fountains, etc. for the convenience of passengers and visitors to the airport. Ancillary Buildings The strategically located Air Traffic Control (ATC) Tower having a height of 65m enables complete view of Airside Operations for all Phases of the Airport. It is one of the few Airports which have the Tower on the landside. In addition to the above infrastructure, a number of ancillary structures have been constructed to meet various requirements for the operation of the airport. This includes: • A three level Administration/Canteen/Security/ Technical Block (5260 sq.m), Landside Infrastructure • A four lane main Access Road • Secondary access road • Access roads to buildings • Car park and bus park – departure car dropoff for 100 vehicles Arrival car pick-up for 58 vehicles Car park for 1550 vehicles, Bus bay for 10 vehicles includes Private Taxi Parking. • Traffic Loop in front of terminal building • 1.3 km of main access road connecting trumpet flyover outside the boundary • Civil works for electrical services

An overview of Airport in Hyderabad

GMR Hyderabad International Airport Limited (GHIAL) L&T built the Greenfield Interna-tional airport at Shamshabad involving terminal building and other airside works including taxiways, runways, etc. The airport is functional and is designed to handle 12 million passengers per annum. Some of the features include: • The seven level Passenger Terminal Building with an area of 1.17 million sq.ft.. • Airside works involved construction of 4.26 km long runway including developing many other infrastructure.

With the touchdown of Lufthansa flight LH752 from Frankfurt at the Rajiv Gandhi International Airport in Shamshabad at 00.25 hours on Sunday March 2008, the commercial operations began at the new Airport. To receive and welcome the first ever international flight carrying 276 passengers from Frankfurt, Germany the entire airport was fully-lit up, with relatives and friends thronging the arrival area. The same aircraft was scheduled to depart at 2.30 am for Frankfurt, thus becoming the first international flight to take off from the airport. All passengers and crew members were given a rousing reception on their arrival at the new airport, which was declared open by Mrs. Sonia Gandhi on March 14, 2008. Passengers reaching the new Hyderabad International Airport for the first time were indeed surprised to see an awe inspiring and an entirely new looking modern airport incorporated with worldclass facilities and amenities, unprecedented in the country.

This is the first Greenfield airport built in public-private partnership and incorporates the best of facilities in other parts of the globe. With this, the 76-year-old Begumpet airport located in the heart of Hyderabad city was officially shut down. Passengers who want to reach this airport at Shamshabad have to drive 25 km from the City. All along the route to the new airport one can see the work in progress of widening of access roads, criss-crossing elevated expressways, new outer ring road, etc – all leading to the new airport. As one enters the sprawling Shamshabad facility having an area of 5500 acres, for some distance you will see a dry patch of land and from a long distance you can see the towering air-traffic control tower.

An aerotropolis is a new type of urban form comprising aviation-intensive businesses and related enterprises extending up to 25 kilometers (15.5 miles) outward from major airports. It is similar in form and function to a traditional metropolis, which contains a central city core and its commuter-linked suburbs. An aerotropolis has an airport city at its core and is surrounded by clusters of aviation-related enterprises. Airports have evolved as drivers of business location and urban development in the 21st century in the same way as did highways in the 20th century, railroads in the 19th century and seaports in the 18th century, according to Dr. John D. Kasrada, the American academic who defined the aerotropolis concept in 2000.

Aerotropolises are powerful engines of local economic development, attracting air-commercelinked businesses to the land surrounding major airports, analogous to the function of central business districts in the downtown areas of major cities. Aerotropolises typically attract industries related to time-sensitive manufacturing, e-commerce fulfillment, telecommunications and logistics; hotels, retail outlets, entertainment complexes and exhibition centers; and offices for business people who travel frequently by air or engage in global commerce. Clusters of business parks, logistics parks, industrial parks, distribution centres, information technology complexes and wholesale merchandise marts located around the airport and along the transportation corridors radiating from them.

Passenger Terminal Building - Highlights

1. India's first Greenfield airport
2. Integrated Passenger Terminal Building with initial capacity of 12 million passengers per annum
3. Unique concept of Airport village
4. 130 check-in desks with CUTE and 16 self check-in-kiosks
5. 46 immigration counters for Quick processing.
6. In-line baggage handling system with level-4 security system, the first of its kind in India
7. Awarded to L&T ECC on 25th November 2008.
8. Completed all the works in a record span of 28 months.
9. Built up area – 1.17 million sq.ft..

Special features of construction

1. Kalzip roof sheeting
2. Temple leafs for tapping natural light with great aesthetics
3. Bull Nose cladding surrounding PTB- the most challenging job
4. Good aesthetic Interiors including False ceiling, wall cladding, Flooring, etc.

Resources

1. Total Man hours (workmen) – 13.5 Million Man hours
2. Total staff months – 2000 staff months
3. No. of labourers at peak – 3200 Nos.
4. No. of staff at peak – 78 Nos. No. of tower cranes at peak – 6 Nos.

The passenger terminal building with its massive and design contoured Kalzip roof. However, as you reach closer, you can see the beautiful approaches with divided roads planted with ornamental date palm trees on the median, landscaped gardens with colourful flowering plants along the sides including fountain jets and sprinklers doing their routine of watering the plants. The airport is a 63:11:13:13 joint venture between Hyderabad-based GMR Hyderabad International Airport Limited (GHIAL), Malaysia Airports Holding Berhad, the Andhra Pradesh government, and the Airports Authority of India. Equipped to handle 7.2 million passengers in 2008, the airport (without any expansion) is expected to handle 12 million passengers by 2010, subsequently scaling up to 40 million in the final phase. The corresponding figures for cargo handling is expected to touch 1.0 million tonnes from its present 1.0 lakh ton capacity. The airport is South Asia's first A-380 aircraft compatible and has India's longest runway at 4,260 metres.

The passenger terminal building having an area of 1.17 million sq. ft. is capable of handling twelve million passengers per annum. It is provided with 42 stands consisting of 12 contact boarding bridges and 30 remote stands. There are 130 check in counters with common user terminal equipment (CUTE), 16 self-check-in- kiosks, 46 immigration counters, 30 escalators and 32 elevators. In addition, it has conference facilities for business travellers, hotel facilities, a hospital, retail shops and integrated information technology systems - in short, all the modern gadgets expected of a global standard airport.

Airport Village

For the first time in the country an "Airport village" has been created between the terminal building and the public land side at level D. This consists of a shopping arcade with a wide variety of stalls and food courts to serve as a place for people to "meet and greet." Those not using the airport can also drop in here for shopping.

L&T's Contribution

L&T secured two major contracts, against international competitive bidding at GMR Hyderabad International Airport, for the construction of:

Airside and Landside works

The airside and landside works involved construction of a 4260m long runway, taxiways and aprons to accommodate wide-body planes (code F- aircrafts), including new generation aircraft, such as the A380. In all there are 42 parking bays – 12 contact and 30 remote. This apart, L&T executed the complete airfield lighting system, fire-fighting system, fire.

The Passenger Terminal Building (PTB) L&T executed the complete civil and facade works of the fully operational passenger terminal building - a seven level modern building having a floor area of 1.17 million sq. ft., 75m high air traffic control tower including design, supply and installation of facade works for glass, glazing and roof.

Design Principle

The basic design of the passenger terminal building is simple, attractive and loose-fit. The fluid design is such that sequences of spaces are provided to facilitate easy and comfortable movement and orientation. This spaciously designed PTB ensures rapid transit between its Domestic and International concourses. In fact it has everything that gives one the out-of-the-ordinary feeling. The roof, designed as a Temple Leaf Structure, enables the natural light to filter through. Built with modular construction technique, the passenger terminal building has 16 skylights and this reflects the distinct Indian culture. L&T fabricated and erected the 75m long 3m high trusses for the erection of 40,000 sq.m Kalzip roof.

Kalzip Roofing

Another salient feature of the Passenger terminal building is the Kalzip roof. The Kalzip roof is a propriety product of Corus Building Systems, Singapore consisting of composite layers including GI liner at the bottom followed by Cement board, vapour barrier, rock wool insulation and kalzip sheet at the top. The system as a whole got excellent thermal and aesthetic properties. The method of construction involved lifting of the kalzip roll forming machine to the roof level for forming the corrugated sheets at that level followed by laying and fixing of the sheets with the kalzip accessories.

ATC tower

The tower structure is of 75m height with conical shape. ECC encountered many difficulties in arriving at the shape on ground due to the complexity in design – both architectural and structural. The RC shaft of the tower structure up to 54m height part was completed using Climbing formwork. The conical portion of the tower commences from 5m level and tapers outside from there till it reach 75m level. The construction imposed several challenges an working at such a height.

First in India

Airport village, a new concept introduced for the first time in India, is the place for retail, restaurants, supermarkets outside the passenger terminal building in level 'D'. The 40,000-odd sq.ft. covered village with free entry is also the place where visitors can meet, greet and see off passengers

Access Roads

Incoming vehicles in to the airport can find its way in to 3 different levels as per one's requirement. Passengers reaching the spacious car park at the ground level can take both the ramp or the elevators and reach either level D to pick up the

passengers or go for a shopping spree at the airport village. From here one can reach the departure lounge in level F through elevators.

Runway

The runway is the longest and the widest now in Inida. It is also the only runway in India designed and built compliant to the super jumbo Airbus A380 requirements. Currently it is the only runway to be validated by the International Civil Aviation Organisation (ICAO) for its standards and recommended practices. It is a proud achievement for the team who put in a lot of hard work and toil to stringent standards and practices It is a proud achievement for the team who put in a lot of hard work and toil to stringent standards and practices of the airfield construction. It took a little over 21 months to build this mammoth runway from start to finish.

The Role of Airport Operators

Together with telecommunications, air transport represents the sectors that epitomizes globalization in an economic as well as in a socio-political sense worldwide. Compared to other infrastructure sectors such as roads, water and sanitation, etc. the combination of rapid technological change, falling real unit costs, industry consolidation, the low cost carrier business model (LCC), the existence of adequate pricing mechanisms and consumer willingness-to-pay for safe cost-effective services has provided the opportunities for air transport to develop commercially, with minimal fiscal requirements (indeed potentially a positive fiscal contribution from an expanded economy). Government attention could be focused almost entirely on safety, security and increasingly, environmental issues. With today's competitiveness standards it is difficult to conceive of a country or region that will be able to integrate into global and national markets without well functioning communication and air transport systems. Without such systems and the best possible international linkages, national markets will be smaller and some markets may not exist. Because of the complementary nature of infrastructure services with the development of commercial services it is likely that private investment will be less profitable and there will be less private investment.

Economies of scale and scope are forgone and economic development constrained. The inter-action between efficient and effective ATI and domestic and regional economies can be significant. While there are numerous examples of over- or premature investment in ATI2, well targeted cost-effective timely investment with strong linkages into the actual and likely potential downstream markets has significant benefits e.g. the development of Dubai airport, Emirates airline and local tourism within a broadly "Open Skies" international aviation policy is striking while elsewhere in the UAE there are several significantly under-utilised airports3. The implication is that the development and implementation of the best possible air transport policies will be an important part of a successful economic development and poverty alleviation strategy. Improving the delivery of ATI services is important to growth and to the reduction of poverty.

The efficiency and effectiveness of a country's air transport system, together with the rest of the transport network, is a crucial part of its investment climate, and improving these services encourages investment by business, which fosters growth and job creation (e.g., one of the factors contributing to San Jose de Costa Rica's competitiveness in the manufacturing of microchips for computer hardware was the existence and easy access to modern and convenient airport facilities). In poorer countries where maintenance of the transport infrastructure, particularly roads, is a challenge, air transport services which use physical infrastructure less "intensively" and commercial operators, rather than government, can deliver the service to the customers, a fully liberalized and commercially-structured air transport sector may play a particularly important part in development.

Recent thinking about the role of aviation in national comparative advantage has been stimulated by the observation that a surprisingly high proportion of Chinese exports to the U.S. are air-freighted, well over 20%. The intuition is that air transport actually gives a comparative advantage to distant countries in the production of high value added goods while neighboring countries (Mexico in the case of the U.S.) have a comparative advantage in lower value goods, using cheaper land transport. Concerns about the adverse environmental effects of growth in aviation outputs (e.g., noise levels, other local emissions and global "green house" gas emissions) are increasing in developed countries and are likely to become an

issue in fast growing developing countries (e.g., Mexico DF airport). These need to be addressed in the context of the development of governments' overall environmental policies and policies to address urban emissions as airports and cities grow together.

Trends

The demand for air travel has historically out-performed economic growth. The general view is that this out-performance is likely to continue. In addition, as developing countries bring their policies, regulation, airlines and infrastructure into line with best practice there is likely to be out-performance of the under-lying trend for a significant period. Access to the low cost carrier business model innovation will be important for countries to receive the full benefits from aviation.4 After September 11 2001, security concerns as well as broader safety issues has faced market participants with a new level of requirements in terms of adequate infrastructure and increased ability to be able to rapidly respond in the events of emergencies5. The airline industry has also been experiencing its own changes and adaptations and new larger size aircraft as well as increased frequencies resulting from increased use of smaller commuter (so-called regional jets) aircraft will demand new transformations in and better performance from the air transport infrastructure6. The private sector has a very important presence in the air transport industry, dominating today the aircraft manufacturing sector as well as the airline sector.

The commercial aircraft market internationally has resulted in a wide range of technologies being available to aircraft operators: from small commuter aircraft through to the new A-380. There is similar specialization of freight capabilities. Technical constraints on aircraft serving smaller markets generally are not now the problem. Challenges of serving these smaller markets are more related to the existence of adequate infrastructure, commercial viability, economic and political conditions. There will be pressure from airlines for government air navigation services to provide better and safe services to airlines (e.g. direct routings and efficient flight profiles) by the greater use of satellite and aircraft based information. Environmental concerns, both local and global, will be an increasing policy challenge for governments. Likewise, security concerns are likely to be a continuing issue which along with safety regulation will require sound management and resourcing to meet domestic and international requirements.

The Roles of the Public and Private Sector The bulk of air transport infrastructure (airports and air navigational services) has been created by the public sector, in contrast, say, to the early development of railways in the US and the UK. In the US the airports, as well as ANS, are overwhelmingly (local) government owned12. The transfer of the major U.K. airports to privately-owned BAA by means of a divestiture in 1986 was the first major example of air transport. infrastructure moving to the private sector. Private sector participation has increased substantially during the last 20 years in the airport sector through a range of different schemes and models (i.e., BOTs13, concessions, management contracts, divestitures, public-private partnerships (PPPs), etc.). The public sector still dominates and controls ownership in the ANS sector although governments are increasingly setting up their ANS as more commercially orientated and autonomous state-owned entities, legally separate from the Government, albeit with differing degrees of autonomy, commercial freedoms and accountabilities, for example, Armenia and South Africa. This allows a closer linkage between the willingness of airlines to pay for cost-effective valued services and the service provider. More generally, air transport infrastructure services can be and generally are priced with customers (mainly airlines) being willing to pay for cost-effective services they need and value. Sound pricing generates an income stream, albeit subject to demand volatility, that can be used to pay for the appropriate maintenance, operation and development of the infrastructure. The income stream also allows for debt and potentially equity finance to be raised to finance development.

This illustrates the importance of pricing flexibility for ATI service providers. They need to be assured that they can levy at least cost-related charges on average and have the ability to price discriminate subject only to the limits imposed by competition law14. Formal control of prices has costs and should only be imposed if the benefits to the economy exceed these costs. There may be problems of run-down facilities, over-built facilities, and inadequate skilled staff alongside over-staffing that need to be addressed in transforming ATI to deliver value-for-money services on a financially self-sustaining basis. Transition assistance and funding may be needed and may be a profitable economic and government financial investment. Where the infrastructure remains government owned there is also the issue of whether the

government financial, budgetary and employment policies operate to deliver financial resources to socially profitable cost-effective uses in the infrastructure area. There are always competing demands for the usually limited revenue available to governments, including revenue generated by user fees from ATI. As a result some otherwise sound aviation infrastructure projects15 may not be funded.

AIRPORT DEVELOPMENT FEES

DEVELOPMENT fEE IN INDIA AIRPORTS

(1) The law authorises only [AAI] to levy [DF]" and "the said power cannot be sub-delegated to any person" including a private airport operator.76

(2) The [DF] is being levied although no additional service is being provided to the travelling public" (quid-proquo). "The [DF] is being appropriated by the [operator] for the purposes which have no nexus with any service, much less any additional service being provided to the travelling public."77

(3) Section 22-A of the AAI Act of 1994 "empowers AAI to levy and collect a development fee 'at the rate as may be prescribed.' The term 'prescribed' is defined by section 2(n) of the Act as to mean 'prescribed by rules made under this Act. Rules have not been notified by the central government and in the absence of such rules, the levy and collection of development fee is illegal."7 The High Court of Delhi dismissed the petition of the AAI Act, the AA is empowered to lease an airport for the performance of its functions and that such lease is a statutory lease which enables the lessee to perform the functions of the AAI.

The Court also held that the power to levy and collect the DF is not dependent on the existence of the rules and the power can be exercised even if the rules are not properly framed. This decision was challenged before the Supreme Court of India by the Consumer Online Foundation. 3 The petitioners argued:

(1) The levy of a DF without the same determined by AERA is ultra wires.

(2) The conclusion of the High Court that the power under Section 22A [of the AAI Act] to levy and collect [DF] from the embarking passengers can be exercised without the rules is erroneous.

(3) AAI only has the power to levy and collect DF under Section 22A of AAI Act since "the power to levy development fees from the embarking passengers have in fact not been assigned by the [AAI]" to the operators through the agreements. State Support Agreement (SSA) and Operations Maintenance and Development Agreement (OMDA) shows that the power under Section 22A was not assigned to the operators.

Whereas the Union of India contested that: (1) Section 12A permits a lease of some of the functions of AAI to the operator and to carry out such functions is necessary to have the power to levy, demand and collect DF from the passengers.8 (2) Section 22A of AAI Act permits AM to levy and charge DF with prior approval of the government of India. Accordingly, by two 2009 letters to the lessees DIAL and [Mumbia International Airport Limited (MIAL)], India has approved DF and hence the lessees can levy DF based on the letters of India.88 "[T] he absence of the rules prescribing the rate of development fees or the manner of regulation and utilization of development fees will not render Section 22A ineffective." 89 "Section 2 (n) of the 2008 [AERA] Act defines 'service provider' as any person who provides aeronautical services 'and is eligible to levy and charge user development fees [(UDF)] from the embarking passengers at any airport and includes the authority which manages the airport.'" Hence, the lessees are eligible to levy and collect a DF.90 The lessees, airport operators DIAL and MIAL, argued that: (1) "Development fees is not really a tax but charges levied and collected by the lessee for development of facilities for the use of the airport. The lessees, which are non-government companies, have established the utility in a public-private partnership, and do not require a statutory authorization or permission to recover such charges by way of development fee, from the passengers using the airport and the lessees do not require the support of the statutory provision of Section 22A for levy and collection of development fees.

"Section 22 of the 1994 Act identified the heads on which charges could be recovered. Section 22A, therefore, merely adds three more heads for which funds could be raised and this is akin to adding components of a tariff. Section 22A does not change the quality and character of the recovery of charges by the owners of the facilities from the users thereof. '92 (3) Under "sub-section (4) of Section 12A of the Act, the lessee who has been assigned some functions of the Airports Authority under Section 12 of the 1994 Act has the power of the Airports Authority 'necessary for the performance of such functions.'" 93 This includes the power under Section 22A also, to levy and charge development fees. 94 In its rejoinder, Consumer Online Foundation (the appellant) refuted the arguments of both UoI and the operator, and argued that under the privatization agreement, OMDA, the lessee had agreed to arrange for financing and/or meeting all of the financial requirements. 95 Hence, there was no question that levy of the DF by the lessee was for the purposes of developing the airport, which has been leased out by the lessee.96

The applicability of the AAI Act to private airports has not yet been discussed. This issue is relevant as the Supreme Court has said that any compulsory extraction of money by the government, such as a tax or a cess, must be construed strictly.155 Further, the court has held that "whenever there is compulsory extraction of money, there should be specific provision for the same and there is no room for intendment and nothing is to be read or nothing is to be implied and one should look fairly to the language used.' 5 6 Therefore, it would be prudent to examine whether the AAI Act applies to DIAL and MIAL, which are private airports. As per the AAI Act of 1994, private airports were not excluded from its scope. 157 Only military airports were originally exempted from the AAI Act until 2003.158 In 2003, as privatization of Indian airports was initiated, the AAI Act was amended. 159 The Statement of Objectives and Reasons of the Amendment Act says: This bill: * Amends section 1 as well as section 2 of the Act to exclude the private airports from the purview of the AAI Act except for certain limited purposes and to provide for definition of a private airport; and * Provides adequate comfort levels to enhance investors' confidence and to ensure a level playing field to the private sector greenfield airports by lifting control of the AAI except in certain respects.16° The term "private airport" was defined' and private airports were removed from the ambit of the AAI Act, except for Section 37 and Chapter V.A.' 6 2 Also, by the same Amendment Act, Section 12A was introduced to facilitate privatization of AAI airports through leasing.'63 Section 22A, regarding development fees, was also introduced by the 2003 amendment.'

The Objects and Reasons portion of the Amendment Act, which reflects the intention of the legislature, further states, regarding Section 22A of the AAI Act, that "[t]his amendment will make projects, relating to greenfield airports, economically viable by such fee collections." '165 As Section 22A permits the AA to levy and charge a DF, the Statement of Objects and Reasons makes it clear that the provision was introduced to generate revenue for greenfield airports. The Statement of Objects and Reasons does not say anything about the permissability of a DF for brownfield airports, as brownfield airports were to be developed by private capital. DIAL and MIAL are no longer AAI airports nor are the greenfield airports. 166 Delhi and Mumbai airport licenses under the Aircraft Rules of 1937 are also not in the name of the AAI, rather they are in the name of the lessees.1 67 Hence, if one strictly reads Section 28A, as opined by the Supreme Court, Section 22A cannot be applicable in the case of any entities other than the AAI. If DIAL and MIAL are private airports, as per the definition of the term in the AAI Act, then the AAI Act is not applicable to these airports. In some cases relating to the applicability of the Transparency Act of India, namely the Right to Information Act, DIAL and MIAL have argued that they are private entities, and hence those Acts are not applicable. 168 The judgments of the Karnataka and Mumbai High Courts, finding that MLAL and Bangalore International Airport Limited (BIAL) are "state entities" under Article 226 of the Constitution, were challenged by the private operators, and the decisions were stayed by the Supreme Court and the matters have been pending since 2008169 and 2009.7 ° The decisions of the Information Commission, declaring DIAL/MIAL as public authorities under the RTI Act, were stayed by the Delhi High Court in 2011.171 In these matters, MIAL and DIAL argue that they are private entities, not public entities. This exhibits that DIAL and MIAL are of the opinion that they cannot be considered the same as the AAI as they are private airport operators. DIAL argued before the Supreme Court that development fees are not taxes but charges levied and collected by the lessee for development of facilities for the use of the airport. 7 2 "The lessees, which are non-government companies, have established the utility in a public-private partnership, and do not require a statutory authorization or permission to recover such charges by way of development fee, from the passengers using the airport and the lessees do not require the support of the statutory provision of Section 22A for levy and collection of development fees." 1 73 DIAL also argued

that "Section 22 of the 1994 Act identified the heads on which charges could be recovered, Section 22A, therefore, merely adds three more heads for which funds could be raised and this is akin to adding components of a tariff.'" 74 DIAL further argued that "Section 22A does not change the quality and character of the recovery of charges by the owners of the facilities from the users thereof.'" 175 DIAL never conceeded that a DF is a tax, rather it argued that a DF is only a charge and that DIAL is a non-government entity.

The Indian government also has never taken the stance that the DF is a tax while defending its decision. DIAL never sought relief on the ground that DF is a tax, nor argued it can levy a tax. It is possible that DIAL and MIAL were aware that if the DF were to be considered a tax it may not be able to charge such a tax, as they are not government entities. However, the Supreme Court ruled that the DF is a tax.177 DIAL has never accepted that the AAI Act applies to it. DIAL has never argued that it occupies the shoes of the AAI in operating the Delhi Airport. In fact, it is AERA which considered DIAL to be in AAI's shoes and permitted the DF.'7 8 Therefore, the AAI Act would not be applicable to DIAL and MIAL as they are private airports, and accordingly levy of the DF by these private airports could be considered ultra vires.

RATES AND TARIFFS OF AIRPORT

Overview of aviation ticket taxes

Many EU Member States now implement aviation ticket taxes (CE Delft ; SEO, 2018). In the context of international agreements prohibiting the taxation of certain elements of a flight, such as the fuel used and flights themselves being levied a zero VAT rate, aviation ticket taxes are one way of levying a tax on the aviation sector. These taxes have been implemented in a number of countries. This chapter presents a short overview of aviation ticket taxes in the EU and worldwide. First a definition will be given of aviation ticket taxes used in this report (Section 2.1), after which the worldwide use of ticket taxes will be sketched, showing that ticket taxes are not only implemented in the EU (Section 2.2).

2.1 Definition of aviation ticket taxes

Ticket taxes levy a tax on each origin-destination passenger departing from an airport in the country where the tax is applied, with the airline being responsible for collecting the tax and paying it to the government. The taxable event is therefore a departing passenger leaving on a commercial airline. Features of most ticket taxes are the exemptions for transfer and transit passengers, and flights for State or military reasons. Since freight transport carries no passengers, freight is exempt from this tax. Whether the tax is passed on to passengers depends on the pricing-decision of the airline. Since airlines are liable for collecting the tax and paying it, they can chose the degree to which they pass it on to the customer. In this report the meaning of taxes follows the definition of the International Civil Aviation Organization's: "a tax is a levy that is designed to raise national or local government revenues" (ICAO, 2000). This is in contrast to their definition of a charge: "a levy that is designed and applied specifically to recover the costs of providing facilities and services for civil aviation" (ibid.). Since the ticket taxes were analysed from a legal perspective, case law was utilised to investigate which elements of the ticket tax could withstand legal challenges, and which elements could not. In cases which related to competition law the European Commission investigated distortions of the internal market, hence European case law was used for these cases. In cases where the tax itself was the source of the legal dispute because for instance it violated international air travel agreements, national case law was used.

2.2 Ticket taxes worldwide

In this report ticket taxes which have undergone legal challenges in the EU will be discussed. Ticket taxes are however implemented in various countries, also outside of the EU. In 2009 the International Air Transport Association (IATA) comprehensively listed all the ticket taxes in place in the various jurisdictions of the world. CE Delft and SEO (2018, ongoing) have updated this list, which will be published shortly. The 514 ticket taxes in total were further subdivided into

domestic and international taxes (one country can have more than one ticket tax). The IATA definition of ticket taxes is the following: “Taxes which are collected at [the] time of ticket sale and which appear in the tax box of a ticket or which are included in the price of a ticket”. These taxes are sometimes levied in return for a service, which does not fit our definition of a ticket tax, hence only the taxes which fit our definition will be summarised in Table 1. On the other hand some charges are levied 8 7.L14 - A study on aviation ticket taxes – November 2018 without the expectation of a service in return, hence these are included in the table. The charges and taxes where it is not known whether they were levied in return for a service, such as the Spanish Departure Charge, will not be included in the table. This table illustrates the exhaustive list of ticket taxes in the EU, as well as some of the taxes implemented in non-EU countries

Legal cases on aviation ticket taxes

Background

The Belgian municipality of Zaventem introduced a ticket tax on 18 December 1995 for all passengers departing from the municipality’s territory, i.e. departing from Brussels National Airport in the municipality of Zaventem. The tax was 12 frank per departing passenger over the period 1996 to 2000. The tax would be levied retrospectively over the past year: the airlines would be charged 12 frank for each of their passengers departing from Brussels National Airport in the past year.

Grounds for opposing the tax

In May 2005 B.A.R. Belgium, Sabena and Lufthansa brought this tax before the Belgian courts for violating Article 15 of the Chicago Convention. The last sentence of Article 15 states that “No fees, dues or other charges shall be imposed by any contracting State in respect solely of the right of transit over or entry into or exit from its territory of any aircraft of a contracting State or persons or property thereon”. Since no charges were allowed to be levied on an aircraft from a treaty country for merely flying over, landing or departing from a Belgian airport, the complainants argued that this Article was understood to have a broader definition than only prohibiting discrimination of foreign airlines relative to domestic airlines, which the municipality of Zaventem had argued. Furthermore the complainants argued that the tax was not compensated by any kind of service by the government, and it was therefore unjustified.

Air Passenger Duty UK

Grounds for opposing the tax

On 6 December 2006 the Chancellor of the Exchequer decided to double the APD from £ 5 to £ 10 in the EU, and from £ 10 to £ 20 everywhere else. The increase would come into effect on 1 February 2007, giving aircraft operators 7 weeks to adapt their prices. Following this decision the Federation of Tour Operators, which represents the majority of the UK’s larger outbound operators, claimed that the APD was in violation of the Chicago Convention Article 15, and that the increase was also unlawful. The APD is payable by the operator of the aircraft, however when a flight has been purchased by a tour operator the APD is passed on to it by the aircraft operator. The passing on of the APD to customers of tour operators is however constrained by the Package Travel Regulation, and according to the claimants this made it legally and practically impossible to change prices in published brochures after a tour package had been purchased. Furthermore some tour operators had included ‘no surcharge guarantees’ in the conditions of their contract, making it impossible to pass on the increase in the APD to their customers if this increase occurred after the contract was finalised. Even in the case where the tour operators could pass on the increase, they could not do so for the customers whose holidays would begin less than 30 days after the announcement of the increase, which was stipulated by the Package Travel Regulation. Another requirement was that operators absorb the first 2% of any increase in prices, and because the increase in the APD would in most cases be below 2% of the entire package, the tour operators would mostly bear the entire financial burden of the increase.

Dutch Aviation Tax

Grounds for opposing the tax MAA and Ryanair argued that Amsterdam Airport Schiphol and Air France/KLM unduly benefitted from the exemption on transfer and transit passengers as well as freight transport since these undertakings have a relatively high proportion of such passengers and flights, leading to unlawful State aid. The Maastricht Aachen airport does not serve transfer and transit passengers. The complainants also argued that the tax was in conflict with Article 15 of the Chicago Convention. This last dispute is based on the following sentence from Article 15: "No fees, dues or other charges shall be imposed by any contracting State in respect solely of the right of transit over or entry into or exit from its territory of any aircraft of a contracting State or persons or property thereon." MAA and Ryanair used this part of Article 15 to argue that any form of taxation which is independent from the costs of using the airport and its facilities should be prohibited (KiM, 2011). However the Dutch government argued that Article 15 should rather be seen as a ban on discrimination whereby airlines from other countries should not be treated differently from the country in which the airport is situated.

Irish Air Travel Tax

Grounds for opposing the tax

In July 2009 the Commission received a complaint from Ryanair criticising several aspects of the air travel tax implemented by Ireland. Ryanair claimed that the lower tax rate mainly benefited airlines operating the majority of their flights to destinations no more than 300 km from Dublin airport, such as Aer Arann. Furthermore according to Ryanair the non-application of the tax to transit and transfer passengers constituted unlawful State aid to the advantage of the airlines Aer Lingus and Aer Arann, because those companies had a relatively high proportion of passengers and flights in those categories. This last complaint is similar to Section 3.3 in the Dutch ticket tax case, where the Commission investigated whether the exemption of transfer and transit passengers from paying the tax led to unlawful State aid.

German Air Travel Tax

Grounds for opposing the tax On 19 March 2012 American Airlines filed suit against the air travel tax since it violated the principal of national sovereignty and several international agreements such as the Chicago Convention of 1944, the EU-USA Open Skies Agreement11 of 2007, and the Friendship, Commerce and Navigation Treaty12 between the Federal Republic of Germany and the USA of 1954. According to American Airlines the tax violates the principle of national sovereignty, which is seen as a general rule of international law, and it also violates national sovereignty by taxing acts in foreign territories (Articles 1, 11 and 12 of the Chicago Convention, and Article 7 of the EU-USA Open Skies Agreement). It was also claimed that Chicago Convention Articles 11 and 15 were violated, since the plaintiff argued that the tax unlawfully discriminates against foreign airlines by levying an inappropriate graduation of tax rates (i.e. group divisions according to distance led to discrimination). In particular it was argued that Article 15 supposedly prohibits signatories from charging fees or taxes for its territory merely for the right of transit, entry, or departure of an aircraft from a signatory country.

Legality of per flight taxes I

In this section we investigate the legality of levying taxes on a per flight basis. A per flight tax based on the maximum take-off weight and distance flown (preferred by the UK government of 2008 (Seely, 2012b) incentivises airlines to maximise the number of passengers and freight transported, thereby better targeting emissions. Other advantages relative to a ticket tax are that it broadens the tax base and the scope of targeted emissions since transit and transfer passengers and freight flights can be taxed, and that other environmental factors such as aircraft noise can also be included as a component in the tax. Per flight taxes have however not yet been introduced anywhere, and have therefore not been legally challenged. Still, the legality of this tax has been mentioned in proposals by the UK government to reform the Air Passenger Duty to a per flight tax, and indirectly in the judgement on the German Air Travel Tax.

UNIT-IV

INSTITUTIONAL FRAMEWWORK

Functions of DGCA .

Directorate General of Civil Aviation (DGCA) is responsible for governing safety aspects of civil aviation, which include certification of airlines and aerodromes, airworthiness of aircraft, personnel licensing and surveillance of aircraft operations in India.

The functions of DGCA include:

a. Registration of civil aircraft;
b. Formulation of standards of airworthiness for civil aircraft registered in India and grant of certificates of airworthiness to such aircraft;
c. Licensing of pilots, aircraft maintenance engineers and flight engineers, and conducting examinations and checks for that purpose;
d. Licensing of air traffic controllers;
e. Certification of aerodromes and Communication Navigation Systems (CNS)/Air Traffic Management (ATM) facilities;
f. Maintaining a check on the proficiency of flight crew, and also of other operational personnel such as flight dispatchers and cabin crew;
g. Granting of Air Operator's Certificates to Indian carriers and regulation of air transport services operating to/from/within/over India by Indian and foreign operators, including clearance of scheduled and non-scheduled flights of such operators;
h. Conducting investigation into accidents/incidents and taking accident prevention measures including formulation of implementation of Safety Aviation Management Programmes;
i. Carrying out amendments to the Aircraft Act, the Aircraft Rules and the Civil Aviation Requirements for complying with the amendments to ICAO Annexes, and initiating proposals for amendment to any other Act or for passing a new Act in order to give effect to an International Convention or amendment to an existing Convention;
j. Coordination of ICAO matters with all agencies and sending replies to State Letters, and taking all necessary action arising out of the Universal Safety Oversight Audit Programme (USOAP) of ICAO;
k. Supervision of the institutes/clubs/schools engaged in flying training including simulator training, Aircraft Maintenance Engineering training or any other training related with aviation, with a view to ensuring a high quality of training;
l. Granting approval to aircraft maintenance, repair and manufacturing organizations and their continued oversight;
m. To act as a nodal agency for implementing ICAO Annex 9 provisions in India and for coordinating matters relating to facilitation at Indian airports including holding meetings of the National Facilitation Committee;
n. Rendering advice to the Government on matters relating to air transport including bilateral air services agreements, on ICAO matters and generally on all technical matters relating to civil aviation, and to act as an overall regulatory and developmental body for civil aviation in the country;
o. Coordination at national level for flexi-use of air space by civil and military air traffic agencies and interaction with ICAO for provision of more air routes for civil use through Indian air space;
p. Keeping a check on aircraft noise and engine emissions in accordance with ICAO Annex 16 and collaborating with the environmental authorities in this matter, if required;

q. Promoting indigenous design and manufacture of aircraft and aircraft components by acting as a catalytic agent;
r. Approving training programmes of operators for carriage of dangerous goods, issuing authorizations for carriage of dangerous goods, etc.

The DGCA performs these functions through the following Directorates:

1. Directorate of Regulation & Information
2. Directorate of Air Transport
3. Directorate of Airworthiness
4. Directorate of Air safety
5. Directorate of Training & Licensing
6. Directorate of Aerodrome Standards (vii) Directorate of Flying Training

Methodology followed by ATC

Baseline Methodology

Consistent Simulation Conditions

Tightly controlled simulation procedures and laboratories provide the foundation for a successful system baseline. However, the facilities and equipment associated with ATC system baselines are extremely complex, making tight control over all aspects of the simulation very difficult. The Test Director, typically an engineering research psychologist, is responsible for ensuring that consistent conditions are maintained across all baselines that will be directly compared. Re-creating conditions from studies conducted years earlier is impossible without proper documentation and configuration management. The laboratories at the Technical Center are used constantly by many organizations. Therefore, the precise configuration of a laboratory or facility is difficult to determine after the fact. Researchers have a responsibility to document as many procedures, parameter settings, and configurations as possible and to provide this information to future studies. This should be done during the baseline. All past baselines have been conducted using only one ATC system at a time. As such, comparisons between systems were made using data collected from separate simulation activities sometimes conducted years apart.

This method has some advantages in terms of scheduling, but it makes internal validity and configuration management especially difficult. We recommend that future baselines collect data for each system that will be compared as part of a single, large baseline. For example, the participants could run the same scenarios using both systems and alternate between systems on subsequent runs or days. This would reduce or eliminate many internal validity problems and provide much tighter simulation control. All scenarios, operating procedures, the participants, auxiliary equipment, pseudopilots, SME observers, and questionnaires would be identical for both data sets. With a within-subjects design, the variance due to differences between individuals is reduced. A single, side-by-side comparison is likely to be long and costly. Overall, however, we believe that a side-by-side comparison will save time and money by reducing the need to organize, prepare, run, and analyze separate simulations for each system. More importantly, a side-by-side comparison provides the highest level of internal validity.

Simulation Realism

In baseline simulations, researchers should strive for a very high level of simulation realism. The SMEs involved with scenario testing and shakedown are the best source for feedback about realism. We recommend that researchers consult with these individuals after each shakedown run. Researchers should examine the following areas. a. Pseudopilots need adequate training during shakedown. In particular, pseudopilots need to learn the fixes associated with the sectors and when and where actions are typically taken. If they do not receive adequate training during shakedown, their communications and pilot actions may not be made in the most realistic or timely fashion. b. Personnel staffing the ghost sectors also need adequate training during shakedown. In particular, these personnel need to learn when to accept and

reject handoffs and point outs. If they do not receive adequate training, they may not provide realistic betweensector communications. c. Researchers should ensure that the operating procedures and LOAs used in the simulation are accurate with regard to those used at the facility.

Test Plan

As part of the formal preparations for a baseline, the Test Director should develop a formal test plan. The plan should contain the following sections. 1. Introduction: This section should provide a historical context and rationale for the baseline. 2. Method: This section should describe how the baseline will be conducted. It should contain the following subsections. a. Facilities: This subsection should describe which laboratories and other Technical Center facilities (e.g., the TGF) are needed during the planning and conduct of the baseline. b. Equipment: This subsection should describe what other equipment is needed (e.g., the WAKs). c. Personnel: This subsection should describe the study participants and the simulation support personnel needed. d. Procedure: This subsection should describe the general data collection method including the sectors and scenarios to be used, the data collection tools and techniques, and the simulation schedule. 3. Data Reduction and Analysis: This section should describe how the data from the baseline will be reduced and analyzed. It should contain the following subsections: 19 a. Equipment:

This subsection should describe what equipment is needed during data reduction and analysis (e.g., the Data Reduction and Analysis Tool [DRAT]). b. Personnel: This subsection should describe what support personnel and facilities are needed. c. Procedure: This subsection should describe the general data reduction and analysis method, detailing which measures will be calculated. 4. References: This section should include references to related literature, particularly regarding any tools and techniques used in the study. 5. Appendix: This section should contain copies of all the questionnaires, schedules, and briefing packages that will be given to the participants. The National Air Traffic Controllers Association (NATCA) is involved with most FAA research and acquisition activities. NATCA will assign a representative to the program, and coordination involving the controller participants must be conducted through this individual. The Test Director should provide the NATCA representative with a copy of the test plan before any baseline data are collected.

Schedules and Rotation

Researchers must not develop a schedule that violates the labor agreement between the FAA and the NATCA. That is, bargaining unit controllers must not be required to staff a position for more than 2 consecutive hours without a break. The agreement also requires a 30-minute meal break, no more than 8 hours per day (including breaks), and no more than 5 days a week. Other practical considerations set further limits on the schedule. Controllers, pseudopilots, simulation support staff, SME observers, and researchers all should be given short breaks (15-20 minutes each) between simulations and meal breaks (1 hr each). Fewer or shorter breaks will lead to fatigue and poor relations among the research team. Remember that participating in human factors research is voluntary and if participants feel ill-treated or overworked, they are unlikely to volunteer again (and are likely to tell their friends). In addition, the laboratory and simulation equipment requires reconfiguration time.

We recommend scheduling a minimum of 20 minutes between runs. In our experience, 5 hours of actual simulation time a day is about the maximum that can be supported. We also recommend against running scenarios longer than about 100 minutes without a position relief. Some controllers may become fatigued, bored, or unresponsive if required to staff a position longer than this. We also strongly recommend using at least two traffic scenarios. If participants work the same scenario multiple times, they quickly learn to “beat” it and to anticipate occurrences. This can lead to bored participants and unreliable data. Rotating participants through two scenarios and several sectors or positions usually is adequate to keep controllers’ interest through a 1-week simulation. If the simulation covers multiple weeks with the same participant sample, we recommend using more than two traffic scenarios.

Laboratory Platforms

The primary laboratories that support system baseline activities are located in Building 300 of the Technical Center. The laboratories for all current ATC systems are located in this building. Laboratories for many new ATC systems are located in Building 316. The Test Director must schedule laboratory time through the Facility Control Office (FACO). FACO creates their schedules on a priority basis. The Test Director and the Program Office should work with FACO to establish the proper priority for the system baseline. Requests should be made well in advance. FACO releases the schedules for each week on the preceding Thursday. We recommend that researchers inform the participants and technical staff that night shifts may be the only hours available. Most controllers are accustomed to working night shifts at their home facilities if these hours are the only times the laboratories are available. En Route Simulation Support Facility The En Route Simulation Support Facility (ESSF) in Building 300 houses 22 PVD consoles connected to the Technical Center HCS. The PVDs in the ESSF are arranged in two configurations as used in the operational environment. The PVDs have the full complement of hardware used in the field including flight strip bays, flight strip printers, and communication equipment. Simulations in the ESSF can be driven by the TGF or the DYSIM.

Display System Replacement Laboratory The DSR will eventually replace the PVD in the field. At present, the DSR Laboratory in Building 316 is used primarily for engineering tests of hardware and software. In the future, this laboratory will become the primary laboratory for highest fidelity, human-in-the-loop simulations in the en route domain. It has already served as the platform for the DSR Baseline. Simulations in the DSR Laboratory are driven by the TGF. Integration and Interoperability Facility The Integration and Interoperability Facility (I2 F) is directed and funded by the En Route Integrated Product Team and is located in Building 27. The primary function of the I2 F is prototype integration and operational tests of new en route technology. It contains a fully functional ARTCC Laboratory with DSR controller and supervisor workstations. The laboratory 24 is suitable for testing hardware, software, and operator integration. It has not been used to support system baselines in the past but may provide an alternative to the DSR Laboratory in the future.

Terminal Simulation Support Facility The Terminal Simulation Support Facility (TSSF) is housed in Building 300. It consists of several laboratories that simulate the different configurations used in TRACONs. These laboratories include the ARTS IIA, ARTS IIIA, ARTS IIIE, and En Route Automated Radar Tracking System (EARTS) Laboratories. The TSSF also supports simulations in the Technical Center Tower Cab Laboratory. Simulations in the TSSF Laboratories are driven by the TGF or by the Enhanced Target Generator (ETG). Standard Terminal Automation Replacement System Laboratory The ARTS computers and FDAD/DEDS displays will be replaced by the STARS. At present, the STARS Laboratory in Building 316 is used primarily for engineering hardware and software tests but will eventually be available for use in system baseline simulations.

Transition Laboratory The Transition Laboratory provides a capability for researchers to explore the issues involved when an original TRACON system and its replacement are in place simultaneously at one facility. This laboratory contains FDADs and STARS displays. Simulations in this laboratory are driven by the TGF. Oceanic Laboratory The Oceanic Laboratory is located in Building 300. It includes PVDs, strip bays, Oceanic Data Link (ODL) systems, and a simulated Airline Operations Center (AOC) workstation. Simulations in this laboratory are driven by an internal target generation system rather than the TGF. In oceanic ATC, a controller does not communicate directly with the pilots but works through an Aeronautical Radio, Incorporated (ARINC) radio operator. The radio operator establishes shortwave radio contact with each flight to relay ATC clearances. Aircraft contact the ARINC radio operator to relay position reports every 10 degrees of longitude.

Therefore, in a simulation, it is only necessary to provide a pseudo-ARINC radio operator and, if an airline presence is required, a pseudo-AOC operator. A suitable traffic scenario must still be developed that includes such events as position report messages and pilot requests from each aircraft at the correct intervalsSimulators The TGF, operated by the System Simulation Support Branch (ACT-510), is the primary simulator for the laboratories in Buildings 300 and 316. The TGF provides simulated air traffic (up to 3,000 flight plans simultaneously). TGF pseudopilot workstations display aircraft information and accept commands to change aircraft speeds, headings, altitudes, and so on. The TGF is also an important source of automated data. The Test Director should schedule TGF time with ACT-510. The MicroTGF software, a version

of the full TGF software that runs on standalone workstations, is also available. This version of the software can be ported to laboratories that do not receive direct TGF feeds, either within the Technical Center or at other facilities. The MicroTGF uses the same scenario definitions as the main TGF and provides the same pseudopilot and data collection tools. However, researchers should remember that the MicroTGF is not a display system simulator. It provides scenario generation and aircraft behavior, not emulation of controller hardware or software. An alternate simulator for en route is DYSIM. DYSIM is part of the ESSF and allows the laboratory to operate in a stand-alone mode. In this case, controllers working at PVDs in the laboratory serve as simulation pilots and maneuver the simulated traffic. The DYSIM cannot use TGF scenario definitions. The Test Director should schedule DYSIM time with FACO and the ESSF. In some cases, the DYSIM Laboratories at field facilities may also be available. These facilities must be coordinated through the field training departments. An alternate simulator for the terminal domain is the ETG. The ETG is contained in the ARTS and allows the TSSF to operate in a stand-alone mode. When using the ETG, several of the FDAD/DEDS workstations are used as simulation pilot stations. The ETG cannot use TGF scenario definitions. The Test Director should schedule ETG time with FACO and the TSSF.

The ETG can be used with the STARS EDC configuration but is not available in the STARS ISC or later configurations. In some cases, the ETG Laboratories at field facilities may also be available. These facilities must be coordinated through the field training departments. The ATCoach simulator also provides target generation for simulations in the STARS Laboratory. This software package runs on UNIX workstations. Scenario definitions that have been created for use by the TGF, DYSIM, or the ETG are not compatible with ATCoach. At present, the ATCoach software in the STARS Laboratory has not been used for baseline simulations. However, ATCoach has been used extensively in non-baseline simulations by ACT-510 and ACT-530, so some local expertise is available with this simulator.

Pseudopilots ATC simulations require that someone play the role of the pilots of the simulated aircraft. These can be pseudopilots or ATCSs, depending upon the target generator. When using the TGF, pseudopilots play the role of simulated aircraft and are responsible for communicating and executing clearances associated with those aircraft. They make air-ground communications with the controller participants and make adjustments to aircraft speed, heading, altitude, and flight plan as directed by controllers. Pseudopilots are trained in aviation phraseology, simulated airspace, and aircraft behavior but most are neither controllers nor pilots. As such, they can provide realistic communications and aircraft behavior under most conditions but perform less well when asked to make impromptu communications or flight plan changes to fit changing air traffic situations. ACT-510 coordinates the Technical Center pseudopilots. 26 When using the DYSIM or the ETG, ATCSs serve as simulation pilots. Controllers are trained on DYSIM or ETG in the field, and most are accustomed to serving as pilots. In the PVD Baseline, which used the DYSIM, the participants alternated between the controller and pilot roles. Though this was an efficient use of controller resources, we do not recommend this method for future baselines. The variance in skill among different controllers serving as pilots can be great. This results in some participants receiving less realistic pilot communications and aircraft behavior than others and creates internal validity problems. In addition, some controllers have used this as an opportunity to play jokes on their friends. For example, some controllers serving as pilots have changed headings, speeds, and altitudes without authorization from the controller actually working traffic. For a valid system baseline using the DYSIM or ETG, we strongly recommend that a cadre of controllers be assigned to the pilot role, and another cadre be assigned to the controller role, and that they do not alternate. The controllers selected to serve as pilots should be chosen because they take the assignment seriously and are aware of the need for consistency across conditions.

Ghost Sectors In addition to aircraft, ATC simulations also must simulate the other sectors and facilities (ghost sectors) with whom the controllers interact. This interaction includes approving and rejecting handoffs, point outs, and any other ground-ground communications. In past baselines, one individual from the TGF or simulation laboratory has staffed all the ghost sectors. We recommend that future baselines carefully review the workload of this individual to ensure that he or she can handle all the traffic in the simulation while still doing a credible and realistic job. If additional staffing is warranted, researchers should request it. We also recommend that the individuals staffing the ghost sector be very familiar with the operating procedures and the LOAs that apply to the sectors being simulated. The ghost sector should only accept handoffs that are made in a realistic fashion. For example, in the DSR Baseline, the participants sometimes handed aircraft

off at an altitude that violated an LOA, which would have been rejected in the field. Unfortunately, the person staffing the ghost sector did not know about the LOA, accepted the handoffs, and created an unrealistic simulation condition. We strongly recommend that a controller or other SME from the facility staff the ghost sector or that the support personnel receive substantial training on the simulated sectors and operations. Airspace Simulated Airspace The choice of airspace will affect most aspects of the baseline. The Program Office will probably choose the baseline airspace based on availability, cost, and schedule considerations. In most cases, the baseline airspace will be from one of the early facilities on the deployment schedule. Because the TGF provides target generation for Operational Test & Evaluation (OT&E), the Program Office will probably choose the OT&E facility for the baseline also. If there is some latitude in choosing airspace, researchers should consider external validity (i.e., how easily the baseline data can be generalized to the rest of the ATC system) when choosing an airspace to simulate. Because baselines are meant to characterize the system under typical conditions, we recommend that researchers choose airspace that does not have many unusual 27 characteristics. Some characteristics to consider include the presence of military warning areas and other special use airspace, interaction with international airspace, the mix of aircraft types, areas of limited radar coverage, and areas of unusual weather patterns. Consultation with SMEs from the chosen facilities should reveal any unusual characteristics.

Generic and Unfamiliar Airspace Generic airspace is airspace that does not exist in the field but has been developed for various testing purposes. The so-called ZCY generic airspace was developed for formal engineering tests purposes but is generally not appropriate for human factors studies. It is difficult to learn and does not “feel” like real airspace to controllers. However, a second form of generic airspace, known as Genera, has been developed by ACT-530 expressly to be easily learned by participants and to have the features of typical terminal or en route airspace (Guttman, Stein, & Gromelski, 1995). Genera Airspace allows participants to be drawn from diverse facilities thereby improving external validity and reducing staffing problems. Currently, the Genera Airspace is available only for the ATCoach simulation platform, but versions are under development for the TGF. Genera Airspace is not yet available for the oceanic domain. Some of the benefits of Genera Airspace can also be gained by using unfamiliar airspace. In this case, airspace from one facility is used, but the participants are drawn from other facilities. This requires less development than Genera Airspace because scenarios and airspace definitions are already available but allows the participants to be drawn from multiple facilities. The ODID IV Baseline used this technique, using controllers from several facilities working Washington ARTCC airspace. Genera and unfamiliar airspace require substantial training for the participants. In past baselines, this training has taken the form of classroom training on fixes, frequencies, routes, and procedures followed by several training runs. LOAs and operating procedures take longer to learn, depending upon their number and complexity. An SME from the home facility should identify the most important and most difficult procedures associated with the airspace, and the training should focus on those.

The ODID IV baseline trained non-Washington ARTCC (ZDC) controllers on ZDC airspace for 1 week prior to beginning formal ODID training. Using the Genera Airspace, 2-3 hours of training are typically required before controllers have completely learned the airspace. We recommend that future baselines use Genera Airspace when available for the appropriate domain. Training on Genera or unfamiliar airspace can be especially time consuming when the participants are also learning new equipment and procedures. Researchers should consider using a performance-based criterion or an over-the-shoulder rating procedure to ensure that all the participants are sufficiently trained before beginning the baseline runs. Research has shown that, with training, controller performance using Genera Airspace is equivalent to performance using home airspace (Guttman et al., 1995).

Traffic Scenarios A scenario is a set of simulated air traffic and environmental conditions that provides input to the simulator. A scenario specifies the aircraft call signs, flight plans, types, altitudes, beacon codes, 28 start times, and so on. Baseline traffic scenarios should provide a moderate-to-heavy level of complexity. We have found that this level is sufficient to keep the participants engaged in the simulation but is not so complex as to overwhelm them. This complexity level is also more likely to show between-controller variability than a lower level where all controllers usually perform equally well. Past baselines have created a moderate-to-heavy complexity by simulating a 90th percentile day for traffic volume. In each case, TGF personnel obtained traffic data from the chosen facility and converted those data to the appropriate simulator format. The resulting scenarios were refined by SMEs from the facility during shakedown. During

the DSR Baseline, however, our participants remarked that the scenarios were not complex enough to keep their interest or challenge their abilities. We believe this discrepancy resulted, in large part, from reduced requirements for between-sector coordination and from unrealistic aspects of the simulation such as inconsistent flight strip printer intervals. We recommend that researchers carefully evaluate scenarios to ensure that they contain the intended complexity level. For example, even during a 90th percentile day in the field, there are periods of high volume and periods of lower volume. If the selected time falls during a low volume period, the resulting traffic scenarios will not contain the intended complexity level. We recommend that researchers construct the baseline scenarios so that traffic can be easily added to increase complexity. Personnel at the TGF are familiar with this technique and can program their scenarios appropriately. Because flight data processing systems like the ARTS IIIA are designed for operational use, beginning and ending scenarios can create special technical problems. For example, aircraft cannot simply appear at altitude without the system generating serious errors. To prevent these errors, simulated aircraft usually must enter the airspace at a rate similar to the real world. As such, most simulators will require a "ramp up" period where the traffic volume is low and increases to the desired level over time. Past baselines have used a relatively short ramp up period, approximately 10 minutes. For data analysis purposes, we discounted the first 10 minutes of data to prevent biasing the data toward operations with unrealistically low traffic volumes.

Controller Participants

The controller participants for baseline simulations should be Full Performance Level (FPL). Unless Genera Airspace is being used, we recommend using only participants who are certified on the sectors that will be simulated. The ODID IV Baseline used participants who were not certified on the simulated sectors. Therefore, despite the extensive training provided in that study, it is unlikely that these controllers performed as well on the simulated airspace as on their home airspace. Developmental controllers vary widely in their skill level and, in general, should only participate if training and transition are the focus of the program. However, because the recommended experimental design is within-subjects, the training requirement may be relaxed for appropriate reasons without biasing the results. For example, a future baseline might choose to include 10% developmental controllers to better represent the controller population in the field. If the 29 simulation schedule design is appropriately counterbalanced (i.e., developmentals work both systems the same number of times), the effect of the developmental controllers should be equal for both systems. Researchers should recruit the controller participants as far in advance as possible. The union contract requires 60 days notice to distribute recruiting announcements and allow controllers to make arrangements. The controller participants receive their normal wages for the duration of the baseline plus travel costs and per diem. Researchers must respect participant rights during a baseline simulation. They are responsible for ensuring that all the participants know that the data they provide during the baseline are anonymous and confidential. We recommend that researchers adapt the Statement of Confidentiality and Informed Consent (Appendix B) to their baseline and distribute it to the participants during the pre-simulation briefing. Researchers should also assign participant codes at this briefing. All research conducted by the FAA using human participants is subject to approval by the Institutional Review Board.

Subject Matter Expert Observers In past baselines, SME observers were supervisors from the simulated facility. The SME observers were responsible for observing each simulation run and completing the SME Observer Rating Form. If supervisors are not available, quality assurance and training personnel are also suitable to serve in the SME observer role. However, we recommend against using field controllers who do not have this type of experience in the SME observer role. Controllers who are not accustomed to evaluating their peers may feel awkward doing so and may not provide valid results. 3.11 Briefings Researchers should schedule at least two briefings, one before the simulation runs begin and a second after all simulation runs are complete. For the initial briefing, researchers should provide a briefing package containing copies of the baseline schedule and any appropriate reference materials about the airspace. This is especially important if the participants are being tested on airspace other than their home airspace.

The participants should also complete the Background Questionnaire during this briefing. In the initial briefing, researchers should discuss the following topics:

a. Why is the research being conducted? Researchers should discuss the history of system baselines and the ATC system under evaluation.

b. How will the results of the research be used? Researchers should discuss how the baseline will be used by the Program Office.

c. How will the participants' confidentiality and anonymity be guaranteed? Researchers should assign participant codes at the initial briefing and explain that no names should be used on any materials. Researchers should also distribute the Statement of Confidentiality and Informed Consent (Appendix B).

d. What is the participants' role in the research? Researchers should discuss what is expected from the participants, emphasizing the simulation and the actions they are expected to perform.

e. How will the data be collected? Researchers should discuss each data source and describe what is expected from the participants regarding that source, emphasizing the WAK and the questionnaires.

f. How does the simulator differ from the field? Researchers should discuss hardware and software differences such as unavailable functions or entries. They should also discuss the pseudopilots and their abilities. Researchers should describe any differences in procedures and how to coordinate with ghost sectors. g. What is the schedule for runs, breaks, and briefings? Researchers should describe when and where each activity will occur, emphasizing the importance of starting and ending each simulation run on time. Researchers should also conduct a final briefing after all simulation runs have been completed. In this briefing, researchers should guide the discussion about the system under evaluation and about the baseline process itself. In particular, researchers should focus their discussion around the constructs so that adequate information is provided for each one.

The participants should complete the Final Questionnaire during this briefing. We recommend that researchers discuss the following topics with the participants. a. Was there a difference between the systems? Researchers should discuss each operational construct in general terms and solicit comments. They should also seek to understand how the participants compensated for any differences. b. Which aspects of the new system need to be evaluated more closely or improved in the future? c. Which aspects of the new system are an improvement over the existing system? d. How realistic was the simulation relative to operations in the field? Researchers should discuss areas where the simulation was less than perfect such as pseudopilots, ghost sectors, and procedures and try to understand how these may have affected participant performance. They should also seek to understand if the WAK, video cameras, or SME observers were intrusive or distracting.

Training Training for baselines can be a difficult issue. If the baseline uses fielded systems and the participants work their home airspace, as was the case in the PVD and ARTS IIIA Baselines, the training requirements should be minimal. In these studies, the participants required training with the WAK and the questionnaires but little else. On the other hand, if the participants are using new equipment or working unfamiliar airspace, they will require substantial training. In the ODID VI Baseline, the controller participants required a week of training on the Washington ARTCC airspace using the HCS-PVD and a week of training using the ODID equipment before data collection.

In the DSR Baseline, the participants received 2 weeks of training on the DSR 31 and had completed 2 weeks of other OT&E activities before the baseline. At a minimum, researchers should provide training in new equipment, unfamiliar airspace, unfamiliar procedures, the WAK, and the questionnaires. Data Collection Techniques and Tools Target Generation Facility Recordings All simulations using the TGF for target generation can record a variety of information about aircraft positions, flight plans, separation, pseudopilot actions, and so on. The TGF records data to disk and to 8mm data tape. The TGF does not record any data about controller interactions with the display or automation systems such as data entries. The Test Director should arrange with the TGF personnel to create and archive TGF tapes for each simulation run.System Analysis Recording Tapes The ESSF, the DSR Laboratory, and the Oceanic Laboratory can record SAR tapes. SAR tapes record a variety of information about controller interaction with the HCS. The Test Director should arrange with laboratory personnel to create and archive SAR tapes for each simulation run. The SAR tapes can be made in

a variety of modes, depending on what data are needed. The Test Director should consult with the laboratory personnel and provide them with a list of the measures that will be reduced from the SAR tapes to ensure that the proper modes are activated. The DSR Laboratory can also record a special version of SAR tapes called DSR SAR. These tapes contain mostly redundant information with the HCS SAR tapes. However, as data analysis tools are developed, DSR SAR tapes may eventually provide more detailed information than is currently available.

Aircraft Management Program Tapes The ESSF, DSR Laboratory, and Oceanic Laboratory can also record AMP tapes. These tapes provide information about aircraft movement and flight data such as the number of aircraft in the sector and the duration of each flight. Most of the data recorded on AMP tapes can also be obtained from TGF recordings, but AMP tapes can be useful as backups. ontinuous Data Recording The TSSF Laboratories can record CDR tapes that contain information about controller interaction with the ARTS. The Test Director should arrange with laboratory personnel to create and archive the CDR tapes from each simulation run. During the ARTS IIIA Baseline, the CDR tape drive was not reliable and introduced gaps and errors into the data. We recommend that future terminal baselines record data using the CDR disk drive rather than the CDR tape recorder. Communications Data The laboratories at the Technical Center vary in the specifics of their voice switch capabilities.

In each case, the voice switch can provide automated data about the number of PTT 32 communications between the participants and the pseudopilots (air-ground) and between the participants and the other sectors and ghost sectors (ground-ground). The Test Director should coordinate with personnel from the laboratory to configure the voice switch to record this information. With the development of the VSCS, more options are available for recording and analyzing communication data in the ESSF and DSR Laboratory. The VSCS can record voice communications on a system called the Legal Recorder. The VSCS can also provide data about the number of air-ground and ground-ground communications using the VSCS Log Recorder. The Log Recorder provides output of VSCS messages in 5-minute intervals. ACT-530 has developed reduction and analysis techniques to transform VSCS Log Recorder output into more useful counts of air-ground and ground-ground communications. Improved reduction and analysis tools for VSCS data are being developed by the communications specialists at the Technical Center and may be available for future baselines. The ETVS provides a similar capability for the ARTS Laboratories but has not yet been used in a baseline simulation. As it becomes more widely used, we expect that the ETVS will become an important data collection tool.

Audiotapes and Videotapes We recommend that researchers collect audiotapes and videotapes during each simulation run. The main purpose of these tapes is to provide backup information in case a technical problem corrupts other data sources and to allow SMEs to review critical incidents such as operational errors. Recordings are also useful for verifying start and stop times. Controller and pseudopilot voice communications are handled by the applicable voice switch system such as the VSCS or the ETVS. The Test Director should coordinate with communications platform personnel to ensure that the voice switch is configured to record the required data. Controller ambient communications (i.e., communications with the controllers sitting next to them) are recorded using wireless microphones worn by the participants. These recordings are made to capture any ground-ground communications that are not accomplished through the voice switch. Video recordings can be made in the laboratories using equipment in the Mobile Experimental Recording Rack (MERR) available from ACT-510. The MERR provides a complete suite of video recording equipment including low-illumination cameras, a time code generator, and multitrack recording. The MERR can receive audio input from the applicable voice switch and from wireless microphones worn by the participants.

The MERR can be transported to any laboratory at the Technical Center. We recommend that video cameras be positioned above and behind the controller participants so that the radar screen, controls, and flight strip bays are visible. We also recommend that researchers videotape a radar screen directly. This record can prove invaluable when verifying data and for reviewing operational errors. However, analog radar displays do not show up well on videotape because of their poor contrast. Digital displays show up better, but data blocks can still be difficult to read. 33 Taping a simulation raises some confidentiality concerns. The participants must be informed that recordings are being made, and they must give consent for these recordings. Controllers are accustomed to having their voice communications recorded, but they are less accustomed to having their physical actions and ambient discussions recorded. Researchers should explain what

information will be recorded and how it will be used. Workload Assessment Keypad The ATWIT has been widely used in the FAA (Stein, 1985), and a similar method is in use at Eurocontrol (Hering & Coatleven, 1996). It has been administered using a variety of techniques, but we recommend collecting data for the ATWIT Workload measure using WAKs. A WAK consists of numbered and lighted keys and a tone generator. At a predetermined rate during the simulation run (e.g., every 4 minutes), the WAK emits a beep and illuminates its lights. At this time, each participant presses the key corresponding to his or her subjective workload at that moment. If the participant does not make a rating during a predetermined duration (e.g., 20 seconds), the lights extinguish and no rating is recorded for that prompt. Up to four WAKs can be connected to one routing device that is then connected to a Windowscompatible laptop computer. ACT-510 has developed software that controls the WAKs and automatically records data on the laptop hard disk. We believe that using the WAKs is preferable to other methods that have been used to collect ATWIT data. In the PVD Baseline, the "cuckoo" alarm in the control room sounded, and controllers made a special entry on their PVD keyboards. This required that the ATWIT data be reduced from SAR tapes, which added delay and expense. In some other non-baseline studies conducted by the Technical Center, the ATWIT was administered manually—that is, by an experimenter with a stopwatch and paper and pen. This method is undesirable due to the potential for timing and recording errors. WAKs provide an efficient and accurate way to administer the ATWIT and require no hardware or software changes to the ATC systems being evaluated. Researchers should provide verbal and written instructions on the proper use of the WAKs. Sample instructions are provided in Appendix C (Stein, 1985). The Final Questionnaire also contains an item that serves as a check on the participants to ensure that they used the WAKs as intended. 4.8 Questionnaires and Ratings Appendix A provides the current versions of the baseline questionnaires. If researchers plan to compare their data to data from earlier baselines, they should consult the appropriate report to ensure that they use the proper versions.

There are five baseline questionnaires.

• **Background Questionnaire**. The controller participants complete this questionnaire as part of the initial briefing, before any simulation runs begin. It contains items about controller experience and training.

• **Post-Run Questionnaire**. The controller participants complete this questionnaire after each simulation run. This questionnaire contains seven items addressing the just-completed simulation run. Researchers should ensure that the participants complete every item on the questionnaire and that all coding information is complete.

• **Observer Log**. SME observers complete this questionnaire during each simulation run. They should record any unusual events (e.g., operational errors), noting the time and any details about the event. They should also record any technical problems.

• **Final Questionnaire**. The controller participants complete this questionnaire as part of the final briefing, after all simulation runs have been completed. Researchers should ensure that the participants complete every item and that they have sufficient opportunity to write comments.

This questionnaire is also suitable for other interested parties such as the SME observers as long as their data are not included with the participant data. This questionnaire now contains the item formerly known as the ATWIT Questionnaire. SME Observer Rating Form. SME observers complete this questionnaire during and after each simulation run. Because proper completion of the form requires substantial attention, observers should only evaluate one controller at a time, typically the controller staffing a challenging sector like Final. Appendix A contains two rating forms, one for the en route environment and one for the terminal environment.Keyboard Data Recorder The KDR consists of a specially equipped PC and cables that attach it to the DSR or STARS controller keyboards and captures each controller keystroke and trackball action. These data can then be analyzed to determine which keys were pressed and which typographical errors were made. Currently, the data reduction and analysis routines for the KDR are not mature, but the KDR may provide valuable information about controller keyboard and trackball use in the future.

Verifying and Archiving Data The raw data from each simulation run are irreplaceable. To prevent loss or corruption of data, researchers must verify and archive data throughout the simulation. Before each run, they should ensure that a. all

clocks are synchronized; b. all recording media are in place, have enough available space for the entire run, and are properly labeled; and c. enough blank copies of all questionnaires are available and labeled. Once the simulation run has been successfully started, researchers should verify that each automated data source is recording data by ensuring that a. the sound level indicators on video recorders are moving and the tape counters are increasing, b. the data tapes are turning on every automated data source and that any indicators are responding, 35 c. the WAKs are prompting at the appropriate interval and the ratings are being added to the database, and d. the SME observers are making notes on their Observer Rating Forms. After each run, we recommend that researchers conduct a more thorough verification of the data. The simulation schedule will often preclude examining every data source, but researchers should conduct spot checks. Researchers should a. check the labels on all the data, audiotapes, videotapes, and questionnaires; b. spot check the quality of the video and audio recordings by playing back a minute of one tape; c. reduce one data tape to ensure the recorders are operating correctly; and d. spot check the participant questionnaire answers to ascertain that they are completing all the questions.

At the end of each day, researchers should backup and archive all data. When using a data source that records to tape, it may not be feasible to immediately make a copy of every tape.

Researchers should

a. check that the tapes are labeled and stored in a safe place;

b. make a backup of data tapes;

c. change the permissions on backup files to prevent overwrites, if possible; and

d. make a photocopy of the completed questionnaires.

Data Analysis Techniques and Tools Automated

Tools Data from automated tools usually require at least one round of reduction before they can be analyzed. The Test Director should coordinate with data specialists from the TGF, the simulation laboratory, and the communications platform to run the appropriate reduction routines. The data specialists should note the routines they used and provide a list of all parameters and configurations to the Test Director so these can be archived and managed. TGF tapes are reduced using the DRAT, which is available at the TGF. The output of TGF reductions can be provided in hard copy or electronic format. In most cases, the electronic format is desirable because some reports may require a second round of reduction. These second-round reduction routines are typically written in a specialized language such as REXX or Perl. Researchers should consult with the DRAT specialist and specify their requirements before the data reduction begins. Once reduced using the DRAT, data are generally imported into spreadsheet software and a statistical software package for analysis and testing. SAR tapes are reduced using the Data Analysis and Reduction Tool (DART), which is available throughout the Technical Center. Using the DART requires specialized training and should be undertaken only by trained personnel. The DART produces large output reports that can be provided in hard copy or electronic format. The electronic format is desirable because most 36 DART reports require a second round of reduction. Researchers should consult with the DART data analyst and specify their requirements before the data reduction begins. Once reduced using the DART, data are generally imported into spreadsheet software and a statistical software package for analysis and testing. The CDR tapes are reduced using the ARTS computer maintained by AOS-400. The Test Director should coordinate with this organization to arrange for the reduction and analysis of these data.

As with SAR tapes, the output of CDR reductions can be provided in hard copy or electronic format. The reports usually must be reduced further using custom-written software. Researchers should consult with the CDR data analyst and specify their requirements before the data reduction begins. Once reduced using the DART, data are generally imported into spreadsheet software and a statistical software package for analysis and testing. Data from the VSCS are provided in a relatively raw electronic format from the Log Recorder. ACT-530 has developed techniques for reducing these data into a more useful format. As of this writing, the VSCS data specialists are in the process of improving the data analysis

capability, and we expect more capabilities in the future. Data from the WAKs are recorded in a spreadsheet file on the laptop hard disk. Data are organized by position and by prompt (though this can be modified if required). This file can be easily imported into spreadsheet software and requires no second-level reductions. 5.2 Manual Techniques Data from paper questionnaires must be entered manually into a spreadsheet or statistical analysis package. The entered data must then be thoroughly checked for accuracy. It is advantageous for several people to enter data, each checking the others' work for errors and wrong assumptions. In addition, some manual reduction of videotape data may be necessary. In the ARTS IIIA Baseline, ACT-530 prepared a videotape containing clips of the 10 minutes before and after every event that was counted as an operational error by the TGF. An SME from Boston TRACON viewed these clips and determined which were true operational errors and which resulted from the simulation environment or the data analysis. 5.3 Quality Assurance Quality assurance is an essential element of a successful baseline. Without it, the data, the analyses, and the conclusions drawn from them are called into question. Regardless of the experience or ability of a researcher or data analyst, small errors can still be introduced into the data. Researchers should take all necessary steps to ensure the integrity of the baseline data and of any analyses performed. Because the amount of data generated by a system baseline is enormous, we cannot recommend an audit of every data point. Instead, we recommend that Researchers conduct a spot check for each baseline measure.

An engineering research psychologist who was not closely involved with the original data reduction or analysis should conduct the audit. The original data analyst should provide the auditor with the definitions of each measure, the assumptions made in the analysis of 37 each measure, and the files from which each measure was originally calculated. The auditor should select one data point for each measure and attempt to re-create that data point. If the auditor cannot re-create a data point, the original analyst and auditor should examine the data files, calculations, and assumptions to determine the cause of the discrepancy. 5.4 Archiving Baseline data should be carefully archived to ensure that it is available for use in the future. Researchers should follow the requirements of the Project Configuration Management Guidelines (FAA, 1996). Researchers should archive copies of all questionnaires, raw electronic data (SAR tapes, CDR tapes, etc.), reduced electronic data (spreadsheet files, statistical package routines, etc.) and videotapes. Researchers should also write a short document that is archived along with the data, explaining what is contained on each tape and disk. The Test Director should obtain a list of applicable configuration parameters from the TGF, simulation laboratory, communications platform, and data reduction and analysis personnel. hese information lists should be archived along with the data. These explanations will be invaluable to future researchers trying to re-create analyses or use data from previous studies in new comparisons.

Methodology for Comparing Systems

Operational Review Team In future comparisons between systems, we recommend that researchers convene an Operational Review Team that will meet at the Technical Center for a period of several weeks.

The Review Team should consist of

a. The engineering research psychologists who designed and conducted the baseline; .
b. The Air Traffic SMEs from the field, typically the union representatives to the program;
c. Two to four controller participants from the baseline; d. technical SMEs for the data reduction and analysis tools;
d. Technical SMEs for the simulator and laboratory platform; and
e. Technical SMEs for the systems being compared.

The purposes of the Operational Review Team are a. to ensure that the data and the analyses are accurate and complete, b. to provide operational rationales for any differences found between systems, and c. to assist in detailed data analysis such as reviewing videotapes of operational errors to determine their cause. In the PVD-DSR Comparison, the team first reviewed a slide presentation showing comparisons between the two systems for every baseline measure. The definitions and analyses of each measure were provided, and the team members were encouraged to ask questions about how each measure was collected and analyzed. The team then reviewed each measure in detail, discussing the propriety of each analysis and requesting additional analyses if needed. In some 38 cases, the team determined that particular comparisons were invalid and that the baseline measure should not be reported. The team also provided valuable data analysis expertise by reviewing videotapes of operational errors.

They then determined if the error was truly caused by controller performance or was an artifact of the simulator environment. Finally, the team provided operational rationales for any differences observed between the DSR and HCS-PVD. For example, this analysis revealed that controllers in the DSR Baseline made many more data block positioning actions than in the PVD Baseline. Because team members had participated in both baselines, they were able to explain that the data blocks in the DSR created more obscuration than the PVD, and they needed to move the data blocks more frequently. These sorts of operational rationales are invaluable to researchers when trying to account for differences between systems. Reporting style In general, we recommend that researchers report data from baselines at three levels of detail: overall, sector, and interval. The level or levels at which researchers should report baseline measures are listed in Section 2. The Overall Level provides data for the entire study collapsed across runs, sectors, positions, and intervals. It also provides data that are not collected every run such as from the Background and Final Questionnaires. The Sector Level provides data for each sector collapsed across runs and intervals. The Interval Level provides data for each 12-minute interval for each section.

Personnel with limited statistics backgrounds often do not understand detailed analyses, and graphics provide them with the information that they need. Tabular data provides readers with more statistics experience with additional details and allows them to conduct analyses on their own. All participant written comments should be included as an appendix to the report. No identifying information such as the participant names should be included in this appendix. Researchers should report participant comments in an appendix with editing only for spelling and accuracy. Researchers should try to summarize comments in the text and can use direct quotes to illustrate points.

Using System Baseline

Data System baselines are one part of a larger process of human factors evaluations conducted throughout the system lifecycle. Baselines should not be the first or only human factors evaluation of a system nor should they be relied upon to identify all human factors problems. Baselines are not well suited to support task analyses or system specification development. Baselines are also not well suited to address detailed design issues such as how a control operates or which colors should be used. These issues are better examined in small-scale activities such as structured walkthroughs and part-task evaluations that allow researchers to focus on specific issues and allow run-offs between alternatives. These should be completed early in the acquisition process so that problems can be corrected while the impact to cost and schedule is still low. System baseline data allow researchers to compare the system first to the system it replaces and then to subsequent modifications to system hardware, software, procedures, or adaptation. Comparisons between baseline data help ensure that the system provides a benefit over the system it replaces and continues to improve as modifications are made to it. Comparisons may also identify aspects of the system that would benefit from future modifications. Figure 3 shows a process of human factors evaluations, including the baselines, that can be conducted once a fairly mature system engineering baseline is available. This process specifically does not describe human factors activities such as task analyses that should be conducted in support of system specification development. For guidance about human factors activities conducted before a system engineering baseline is available, consult the Human Factors Job Aid (FAA, 1997). For another description of the role of baselines in the larger ATC acquisitions process, consult Keegan, Skiles, Krois, and Merkle (1996).

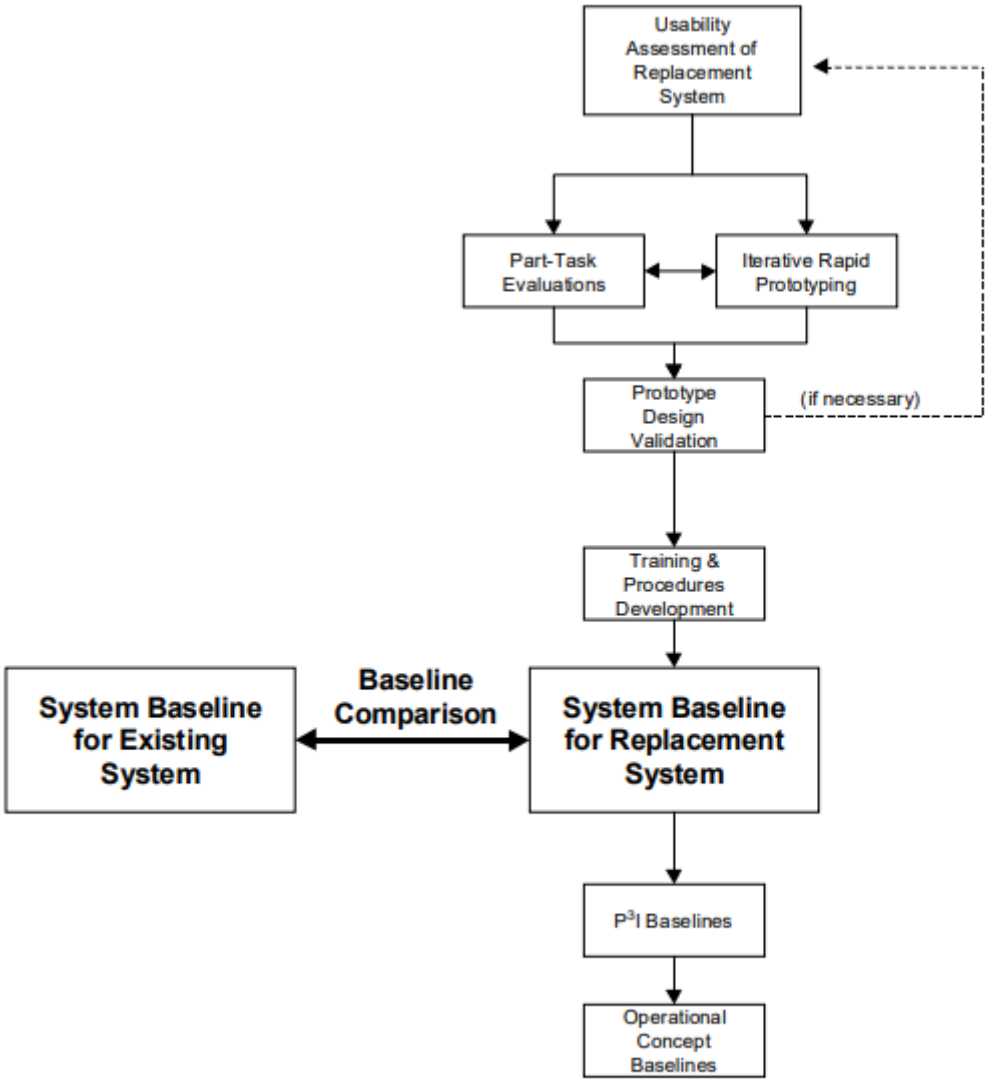


Figure 3. A process of human factors evaluations that can be conducted once the system engineering baseline is available.

7.1 Usability Assessment

A Usability Assessment (UA) is a medium-scale, human-in-the-loop simulation activity that is conducted soon after the engineering baseline becomes available to identify human factors issues. The UA does not use the baseline operational constructs nor does it require the extensive data collection and simulation realism of system baselines. Instead, researchers and SMEs develop a script of ATC activities that are relevant to the new system. These activities are designed to exercise the capabilities of the new system and to allow the participants to see and interact with it. The participants complete each of these activities using the new system under low-to-moderate traffic conditions. The participants are told that they are to focus on completing the scripted activities and that controlling the simulated traffic should not be their focus. As the participants complete the scripted activities, they provide feedback to human factors specialists about how successful they were. The human factors specialists then consolidate and categorize the participants feedback into a list of issues. This list guides the subsequent prototyping and part-task activities. Part-Task Evaluations and Iterative Rapid Prototyping Iterative Rapid Prototyping and Part-Task Evaluations are a series of activities conducted to develop and evaluate solutions to the issues identified in the UA. A multidisciplinary prototype team is convened containing human factors specialists, hardware and software engineers, prototype developers, and user representatives. The team categorizes the issues into

several design threads such as target displays, console controls, and data entry. The team generates ideas that address the issues comprising each design thread. The prototype developers then implement these ideas into a realistic emulation prototype that allows rapid modification. Team members then are given the opportunity to see and interact with the prototype and to refine the design further. The success of each design is evaluated through small-scale, part-task evaluations that focus on the specific design thread. These evaluations allow precise measurement of speed, accuracy, heads-down time, reach envelopes, viewing angles, readability, and so on. The lessons learned from these part-task evaluations are incorporated into the prototype, and the part-task evaluations are repeated if necessary to assess design readiness. Prototype Design Validation The Prototype Design Validation is conducted after all the prototype designs have been evaluated and refined.

The purpose of this validation is to ensure that the prototype designs work as a cohesive system. The validation is similar in form to the UA, with the participants completing a series of scripted actions and providing feedback to human factors specialists. Ideally, the participants in this activity are the participants from the UA. If necessary, feedback from this evaluation can be given to the prototype team to further refine and improve the prototype. 7.4 Training and Procedures Development All new technology requires some training and changes to existing procedures. In this phase, human factors specialists work with personnel from the Air Traffic Operations (ATO) and Air 42 Traffic Resource Management (ATX) Organizations to develop procedures and training that ease the transition to the new equipment. In most cases, the potential human factors contribution to this activity will focus on mitigating the effects of negative transfer. Negative transfer is a performance decrement that occurs when skills or experience from one work environment contributes to human error in a new environment (Cardosi & Murphy, 1995). Negative transfer is of greatest concern in areas where controllers rely on well learned, nearly automatic actions and procedures such as data entries and display control modifications. Controllers are so experienced with these actions on their current equipment that they may have difficulty learning new procedures, especially under conditions of high volume or complexity. Human factors specialists, following the results of the UA and the prototyping activities, can provide input as to how to minimize this sort of problem. In other cases, new training and procedures can mitigate the effects of a system design deficiency. Though intended to resolve all system deficiencies identified in the UA, it is possible that some of the solutions developed during the prototyping phase cannot be supported given cost and schedule considerations.

As a result, some system deficiencies may remain at various stages of system deployment. Human factors specialists, following the results of the UA and the prototyping activities, can identify possible effects of those deficiencies on controller performance and workload. 7.5 System Baselines System baselines are a high fidelity, human-in-the-loop simulation of ATC operations with many objective and subjective measures. These baselines provide data following the five operational constructs: safety, capacity, performance, workload, and usability. The data can be used to compare to the existing system and the replacement system. Comparisons are reviewed by an Operational Review Team consisting of psychologists, air traffic SMEs, and the participants from the study. The team identifies problems with the comparison and provides operationally meaningful explanations for any difference between systems. The focus of this evaluation is to ensure that the system provides a benefit over the system it replaces along the constructs and to identify areas where the new system is deficient. The data collected in the baselines guide further refinements to hardware, software, training, or procedures after deployment. Pre-Planned Product Improvements Baseline Studies After the system is deployed, the system baseline data serve as a basis for studying the effects of Pre-Planned Product Improvements (P3 I). P3 I are new system capabilities that were still under development at system deployment but are already scheduled and included as part of the program. Because the effort and expense of a baseline simulation are high, we recommend that baselines be conducted only for major P3 I or for a set of multiple, minor P3 I. For example, the upcoming Initial Conflict Probe (ICP) will provide major new capabilities (e.g., conflict prediction and resolution) to the baseline DSR system. The ICP will require not only major changes to hardware and software but also to how controllers work and interact with each other. Such a major change is suitable for a P3 I Baseline. Minor P3 I should be addressed through iterative rapid prototyping and part-task evaluations rather than full-scale baselines. 43 In these studies, researchers use the baseline scenarios, procedures, and the participants again but now also using the P3 I. Data collected from these baselines are compared directly to the system baseline data, and determinations are made about changes in safety, capacity, performance, workload, and usability resulting from the introduction of the P3 I. For example, a P3 I Baseline might show that the P3 I

substantially improves system capacity while only moderately increasing controller workload. As with system baselines, the P3 I Baselines should only be conducted using mature equipment and should not be used for design prototyping, requirement development, human-computer interface design, and so on. These are best addressed in small-scale prototyping and part-task evaluations conducted earlier in the acquisition process for the P3 I. 7.7 Operational Concept Baselines As in other baselines, these studies examine the effect on safety, capacity, performance, workload, and usability of a proposed change in operational concept.

A change in operational concept is a major procedural change or a set of multiple minor changes that affects what ATCSs do, especially their roles and responsibilities. The shared separation responsibility concept and the reduced vertical separation minima projects are good examples. Again, because the effort and expense of a baseline are high, we do not recommend a baseline-level simulation for most procedural changes that may be undertaken by a facility. Instead, these are better addressed through smaller-scale simulations that focus on the particular procedure change and its effects. In these studies, the participants work the baseline scenarios with the original equipment but while operating under different procedures. Because of tight control over the simulation environment, data from these baselines can be compared to the replacement system baseline where the original procedures were in effect. Like new equipment, baselines examining the effects of new procedures should use new procedures that are mature and developed. Small-scale, part-task evaluations and fast-time modeling may be more appropriate to test small modifications to the procedure.

Dgca methodology

The Directorate General of Civil Aviation (DGCA) is the Regulatory Authority in the field of Civil Aviation in India. It is responsible for regulation of air transport services to/from/within India and for enforcement of Civil Air Regulations, Air Safety and Airworthiness Standards. It also co-ordinates all regulatory functions with International Civil Aviation Organization. The headquarter is located in New Delhi with regional offices in the various parts of India. Directorate General of Civil Aviation is an attached office of the Ministry of Civil Aviation. There are 4 (four) Regional Air Safety offices located at Delhi, Mumbai, Chennai and Kolkata. One Sub- Regional Air Safety Office is located at Hyderabad. Apart from the Regional Air Safety Offices, there are Regional/ Sub- regional Offices in respect of various other Directorates of DGCA i.e. Airworthiness, Aerodrome Standard, Flight Standard, Training and Licensing and Air Traffic Management located at various cities of India. In addition one office of Aeronautical Engineering Directorate is located at Bangalore and the Gliding Centre at Pune.

Structure of dgca

DGCA has the following 11 Directorates;

1. Administration Directorate
2. Aerodrome Standards Directorate
3. Air Safety Directorate
4. Air Transport Directorate
5. Airworthiness Directorate
6. Flight Standard Directorate
7. Information & Regulation Directorate
8. Aeronautical Engineering Division
9. Training & Licensing Directorate

Responsibilities and functions of the dgca

Operation of aircraft involves a number of factors which contribute to the safety of aircraft. Although for every mode of travel there is an element of risk and danger to the travelling public, it is more so in the case of air travel for obvious reasons. A review of history of aircraft travel will show that there have been number of accidents resulting in loss of human life and property. In the early phase of aviation these dangers and risks were limited to daring individuals and group of people who were aware of the risks. Hence, as the air travel became a more common mode of public transport the responsibilities of ensuring safety of public became the responsibility of States. Almost all the States have established Civil Aviation Department to look after the various aspects of safety for air travel.

The factors contributing to the safety of air travel are of two types viz. the human factors and the machine factors i.e. the aircraft. It is the prime objective of the manufacturer to see that when an aircraft is delivered to a customer, it is airworthy, meaning that it meets the requirements and conforms to type certificate and is in a safe condition for operation.

i. To ensure the safety of air transport as mentioned earlier, most of the States through legal procedures have acquired powers to regulate aircraft operations.
ii. ICAO plays a vital role in this regard through annexes, standards, advisory materials and recommended practices and helps the States.
iii. DGCA set up in India was established in pursuance to Indian Aircraft Act 1934 and aircraft rules made there under. The set up as existing today is as given in Para 1.2. Air Safety Directorate is one of the wings of DGCA.
iv. The responsibilities and functions of the DGCA are enumerated below:
v. Registration of civil aircraft;
vi. Formulation of standards of airworthiness for civil aircraft registered in India and grant of certificates of airworthiness to such aircraft;
vii. Licensing of pilots, aircraft maintenance engineers and flight engineers, and conducting examinations and checks for that purpose;
viii. Approval of Cabin Crew training centers, Cabin Crew training Programme, SEP Instructors.
ix. Licensing of air traffic controllers;
x. Certification of aerodromes and CNS/ATM facilities;
xi. Maintaining a check on the proficiency of flight crew, and also of other operational personnel such as flight dispatchers and cabin crew;

Granting of Air Operator‟s Certificates/ Permit to Indian carriers and regulation of air transport services operating to/from/within/over India by Indian and foreign operators, including clearance of scheduled and non-scheduled flights of such operators; To overseeing the implementation of SSP and coordinates as appropriate, the activities of the various State aviation organizations encompassed under SSP. Also establishing corresponding SMS for service providers/ organizations engaged in commercial operations, maintenance of aircraft, aerodrome operations, provision of air traffic services, design organizations, training to implement a safety management system.

Conducting investigation into Serious incident /incidents and taking preventive measures for the same including formulation for implementation of Aviation Safety Management Programmes; Carrying out amendments to the Aircraft Act, the Aircraft Rules and the Civil Aviation Requirements for complying with the amendments to ICAO Annexes, and initiating proposals for amendment to any other Act or for passing a new Act in order to give effect to an international Convention or amendment to an existing Convention; Coordination of ICAO matters with all agencies and sending replies to State Letters, and taking all necessary actions arising out of the Universal Safety Oversight Audit Programme (USOAP) of ICAO; upervision of the institutes/clubs/schools engaged in flying training including simulator training, AME training or any other training related with aviation, with a view to ensuring a high quality of training approval to aircraft maintenance, repair and manufacturing organizations and their continued oversight; To act as a nodal agency for implementing Annex 9 provisions in India and for coordinating matters relating to facilitation at Indian airports including holding meetings of the National Facilitation Committee; Rendering advice to the Government on matters relating to air

transport including bilateral air services agreements, on ICAO matters and generally on all technical matters relating to civil aviation, and to act as an overall regulatory and developmental body for civil aviation in the country; Coordination at national level for flexi-use of air space by civil and military air traffic agencies and interaction with ICAO for provision of more air routes for civil use through Indian air space;Keeping a check on aircraft noise and engine emissions in accordance with ICAO Annex 16 and collaborating with the environmental authorities in this matter, if required; Promoting indigenous design and manufacture of aircraft and aircraft components by acting as a catalytic agent; Approving training programmes of operators for carriage of dangerous goods, issuing authorizations for carriage of dangerous goods, etc.

UNIT –V

ROLE OF AIR TRAFFIC CONTROLL

FAA is planning a program of technological improvements intended to enable the National Airspace System to handle a higher volume of traffic with increased efficiency and safety. This new technology will replace present equipment —some of which has been in use for over 40 years—with a modern integrated system that will be more reliable and productive. This should allow new or improved forms of service to be offered to airspace users. Operating costs should be lower than with the current generation of ATC equipment, but there would also be major capital cost requirements. Many of these improvements can be implemented during the next 10 years, but the full modernization program will not be completed until the late 1990's

Two technologies are at the heart of the new generation of ATC: 1) advanced computers; and 2) a two-way digital data link between aircraft and the ground. Advanced high-speed computers and new software will permit the ATC system to improve the overall management of traffic flow, as well as to formulate tactical measures that will ensure conflict-free, expeditious, and fuel-efficient flight paths for individual aircraft. Replacement computers will be installed first in en route ATC centers, then in terminal areas, and finally in a central flow control facility that will manage air traffic on a national basis. In addition to safety and capacity benefits, these computers will permit a level of automation in ATC that will greatly reduce the workforce needed to handle future traffic loads

The improved data link between aircraft and ground facilities will permit a rapid and extensive exchange of information and instructions without relying exclusively on voice radio for communication—for example, transmittal of clearances and weather information. FAA also proposes to use this data link as the basis for the Traffic Alert and Collision Avoidance System (TCAS) which will provide aircraft with an independent, airborne supplement to ground based separation assurance.

In terminal areas, the use of the Microwave Landing System (MLS) will provide more preciseand reliable guidance for landing in adverse weather conditions. In combination with procedural changes, MLS could also lead to more efficient use of airport capacity because it allows aircraft to follow any of several curving or segmented approach paths to the runway, thereby easing some of the constraint imposed by the present Instrument Landing System (ILS), which provides only straight-line guidance along a single path.

In general, OTA finds that the ATC system improvements proposed by FAA are technologically feasible and desirable with respect to safety, capacity, and productivity, although there are alternatives that might be equally effective. In most of the programs reviewed, detailed cost and benefit information is not yet available, making it difficult to judge the cost effectiveness of the FAA proposals in relation to the possible alternatives. For the same reason, it is not yet fully clear whether the overall benefits will exceed the capital expenditures needed to effect the improvements, how the benefits will be distributed among user groups, and how system cost will be allocated. Further information will be needed on implementation plans and specific costs and benefits throughout the Congress' consideration of the FAA's 1982 National Airspace System Plan.

NAVIGATIONAL AIDS

Aid to navigation was the first service provided to civil aviation by the Federal Government. At the end of World War I, the Post Office undertook to set up a system of beacons along the original airmail routes to guide aviators at night and in times of poor visibility. By 1927, this airway extended from New 'fork to San Francisco, with branches to other major cities. In the 1930's, ground beacons for visual guidance were replaced by two types of low-frequency radio navigation aids—non directional beacons and four-course radio range stations. The non directional beacon emitted a continuous signal that allowed the pilot to navigate, in a manner analogous to using a light ground beacon, by homing on the signal with an airborne direction finder. The radio range station was a further improvement in that it emitted a directional signal,

forming four beacons alined with respect to the compass, each defining a course. Pilots listened to a radio receiver and followed these radio beams from station to station along the route. The four-course radio range system was phased out beginning in 1950, after reaching a maximum deployment of 378 stations. Low frequency non directional radio beacons are still in limited use in the United States and widespread use in other parts of the world.

The technology that supplanted the low-frequency four-course range as the basic navigation system for civil aviation was very high frequency omnirange (VOR) transmitters, which were first put in service in 1950. This system had several advantages over low-frequency radio. VOR is less subject to interference and aberrations due to weather; it is omnidirectional, permitting the pilot to fly on any chosen radial rather than only the four courses possible with the radio range station; and the addition of a cockpit display freed the pilot from the need to listen to radio signals continuously. The major disadvantage of VOR is that signals are blocked at the horizon, and navigational signals from a station can be received over a much smaller area than low-frequency radio. To provide the same geographical coverage as the older low-frequency radio system, therefore, a great many more VOR stations were required. At present, there are 1,039 VOR stations in operation (930 FAA, 42 military, 67 non-Federal), providing extensive but not complete coverage of the contiguous 48 States and Hawaii and limited coverage of Alaska. In the 1960's, the basic VOR system was supplemented by distance measuring equipment (DME) that permitted measurement of range as well as direction to a station. The DME used the distance-measuring portion of a military Tactical Control and Navigation System (TACAN), co-located with a VOR station to create what is called a VORTAC.

This is the standard airway navigation aid in use today, and at present all commercial air carriers have VOR/DME equipment.Over 80 percent of GA aircraft are also equipped with VOR receivers, and over one third of these also have DME. In addition to the Federal investment in VORTAC facilities (on the order of $250 million), there is a very large private investment (roughly $300 million) in airborne navigation equipment to use the present VORTAC technology. As a result, both the Federal Government and the aviation community have a strong incentive to protect this investment by prolonging the operational life of their VORTAC equipment and the airway route structure based on it. Nevertheless, VOR which relies on 30- or 40-year-old technology has some inherent disadvantages. Because it is a ground-based system, it does not provide coverage of oceanic areas. Because it is a line-of-sight system, VOR is of limited usefulness at low altitudes or in mountainous areas. The VOR route structure concentrates traffic along rather narrow channels and produces a potential for conflict at intersections where airways cross. Further, navigation from one fix (intersection) to the next does not always produce the most direct routing from origin to destination. Several alternative navigational systems (developed principally for military aviation) are available, and some are already used in auxiliary applications by civil aviation. The Omega system, developed by the U.S. Navy, is a low-frequency radio system that provides global coverage. It has been purchased by some airlines for transoceanic flights. Loran-C (also low-frequency radio), operated by the Coast Guard, is a maritime navigation system that also covers most of the continental United States; it affords very good accuracy and low-altitude coverage, even in mountainous areas. Some airline and corporate jet aircraft have self-contained airborne navigation systems such as Doppler radar or Inertial Navigation System (INS), which are accurate and are usable worldwide.

All of these new systems permit "area navigation" (RNA V), whereby the pilot can fly directly between any two points without restriction to a VOR airway. There are also available RNAV systems that permit the aircraft to follow direct routings using VOR as a reference. Many commercial air carriers and more than 7 percent of GA aircraft (largely business and corporate aircraft) have RNAV capability. Since 1973, FAA has been gradually implementing RNAV routes in the upper airspace and instituting approach procedures at selected airports to accommodate aircraft equipped with such systems. Phasing out the current airways structure and converting to a more flexible system of area navigation is a process that will require many years to complete. At present, FAA is committed to upgrading VORTAC stations to solid-state equipment at a cost of roughly $210 million (fiscal year 1980 dollars) over the next 10 years. At the same time, FAA must face the question of adopting new navigation technology to conform to new international standards scheduled for consideration by the International Civil Aviation Organization in 1984. The issue is not so much selection of a single new navigation system to replace VORTAC as it is a question of adopting procedures for worldwide navigation (especially RNAV) that will be compatible with several possible technologies.

Landing Aids

A guidance system for approach and landing is simply a precise, low-altitude form of navigation aid with the additional accuracy and reliability needed for landing aircraft in conditions of reduced visibility. The standard system now in use, the Instrument Landing System (ILS), was first deployed in the early 1940's although a prototype system was first demonstrated by James Doolittle in 1929.ILS provides guidance for approach and landing by two radio beams transmitted from equipment located near the runway. One transmitter, known as the localizer, emits a narrow beam alined with the runway centerline. The other transmitter, the glide slope, provides vertical guidance along a fixed approach angle of about 3°. These two beams define a sloping approach path with which the pilot alines the aircraft, starting at a point 4 to 7 miles from the runway. Because the ILS is generally not accurate or reliable enough to bring the aircraft all the way onto the runway surface by instrument reference alone, the pilot makes a transition to external visual reference before reaching a prescribed minimum altitude on the glide slope (the decision height). The decision height varies according to the airport and the type of ILS installation: 200 feet for most airports (category I), but 100 feet on certain runways at some airports (category II). At present there are 708 category I and 44 category II ILS installations in commission in the United States. * FAA plans call for installation of ILS at additional sites, primarily commuter airports, and for modernization of some 250 existing sites by converting to solid state equipment and, in the process, upgrading 69 of them to category II capability. ILS has two major limitations, both of which affect airport capacity. First, since the ILS does not provide reliable guidance all the way to touchdown, there are times and conditions when ILS provides guidance for approach and landing by two radio beams transmitted from equipment located near the runway. One transmitter, known as the localizer, emits a narrow beam a lined with the runway centerline.

The other transmitter, the glide slope, provides vertical guidance along a fixed approach angle of about 3°. These two beams define a sloping approach path with which the pilot alines the aircraft, starting at a point 4 to 7 miles from the runway. Because the ILS is generally not accurate or reliable enough to bring the aircraft all the way onto the runway surface by instrument reference alone, the pilot makes a transition to external visual reference before reaching a prescribed minimum altitude on the glide slope (the decision height). The decision height varies according to the airport and the type of ILS installation: 200 feet for most airports (category I), but 100 feet on certain runways at some airports (category II). At present there are 708 category I and 44 category II ILS installations in commission in the United States. * FAA plans call for installation of ILS at additional sites, primarily commuter airports, and for modernization of some 250 existing sites by converting to solid state equipment and, in the process, upgrading 69 of them to category II capability. ILS has two major limitations, both of which affect airport capacity. First, since the ILS does not provide reliable guidance all the way to touchdown, there are times and conditions when

Commercialization/privatization: ANSP

The provision of air navigation services was neither corporatized, privatized nor commercialized. The AAI and other government agencies continue to hold under their responsibility the control functions on security issues, air navigation services, aeronautical regulation and services of communications, meteorology, search and rescue and, in general, the technical aspects of air navigation services. At the airport level, airport operators employ and supervise airport personnel and subcontractors, but they are not responsible for the maintenance and operation of air traffic operations or landing systems, which are handled by the AAI and government agencies. Nevertheless, the issue of separating the provision of air navigation services from the provision of airport services has been pending for a long time. It was first proposed in 1976, and the Naresh Chandra Committee, which was appointed in 2002 to examine various corporate issues, recommended to the Ministry of Finance and Company Affairs to set up a separate entity in charge of air navigation services. AAI and the Government of India are currently giving full consideration to a new report released in May 2012, which suggests hiving off air navigation services from airport operation.

Commercialization/privatization:

Airports The international airport of Kochi was the first to be built in a public-private partnership (PPP) and owned by a public limited company created by the State Government of Kerala in 1994. The Government of Kerala currently owns about one third of the share of the company, while several local, national (such as Air India) and international business groups own a significant share of the airport operator. Following this initiative, the Government of India passed a legislative amendment in 2003 allowing the private sector to enter the field of airport development: 100 per cent foreign direct investment was permitted for greenfield airports. In 2006, the ownership and the management of Mumbai and Delhi airports were transferred to Mumbai International Airport Limited (MIAL) and New Delhi International Airport Private Limited (DIAL). Subsequently, two consortia led by India's infrastructure holding company GMR were granted 30-year concessions to operate each airport under a PPP. In both cases, the GMR-led consortium holds 74 per cent of the airport operators share while AAI retains the remaining 24 per cent. In addition, MIAL and DIAL are requested to pay AAI, in consideration for the grant of concession, an annual fee of respectively 38.7 per cent and 45 per cent of their revenues. With respect to greenfield airports, Hyderabad International Airport Limited (GHIAL) was established with the participation of the Government of Andhra Pradesh (13 per cent), AAI (13 per cent), GMR (63 per cent) and Malaysia Airports Holdings Berhad (MAHB, 11 per cent). It was granted a 30-year concession and it is requested to pay to the Government of India an annual fee amounting to 4 per cent in consideration for the grant of

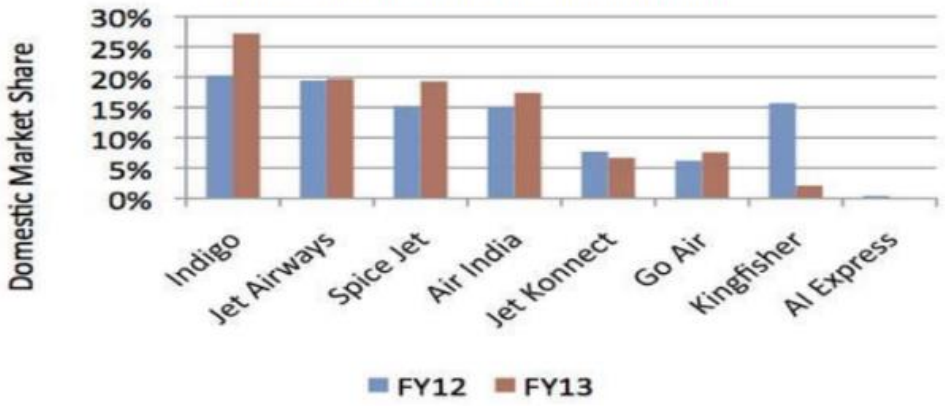
 concession. Bangaluru Airport Limited (BIAL) was established with the participation of Karnataka State Industrial Investment and Development Corporation Limited (13 per cent), AAI (13 per cent), Siemens Project Ventures GmbH (40 per cent), Flughafen Zurich AG (17 per cent) and Larsen & Toubro Limited (17 per cent). It was granted a 30-year concession and it is requested to pay to the Government of India an annual fee amounting to 4 per cent in consideration for the grant of concession. While six other airports were granted approval to be constructed and financed in PPP, all other airports are fully owned and operated by AAI.

Case study in airline industry

Indian civil aviation industry is among the top ten in the world, with a size of $16 billion. Domestic airlines carried 55.06 million passengers in January-October 2014 period as compared to 50.7 million a year ago (IBEF 2014). The air transport has attracted foreign direct investment (FDI) of $ 456.84 million from April 2000 to July 2013 (Indian Business, 2015). Indian aviation industry handles 121 million domestic and 41 million international passengers. More than 85 international airlines operate to India and five domestic Indian carriers connect to over 40 countries (Indian Business, 2015). Indian aviation industry promises huge growth potential due to large and growing middle class population, favorable demographics, rapid economic growth, higher disposable incomes, rising aspirations of the middle class, and overall low penetration levels. The first commercial flight in India took-off in, 1911. Nine airlines existed before 1953 including Indian Airlines, and Air India. In 1953, the airlines were nationalized and merged into Indian Airlines. In 1986, private players were allowed to operate as air taxis. In 2003, Air Deccan started operation as India first low cost carrier (LCC). In 2007, the industry witnessed consolidation when Jet acquired Sahara and Kingfisher acquired Air Deccan (ICRA, 2012).

The industry has growth potential due to growth-oriented policies of BJP government led by Mr. Narendra Modi. Indian aviation market is expected to be third largest in the world (Indian Business, 2015). The untapped potential presents an opportunity for the industry to enhance passenger traffic. The air traffic density in India is just 72, as compared to 282 in China and 2896 in USA (IBEF, 2014). The government has allowed 49% FDI by foreign airlines in the sector. The government plans to build 17 new airports in Twelveth five-year plan.To enhance the availability of skilled manpower, government is planning to establish an aviation university (Indian Business, 2015). The figure-1 shows the domestic market share of airlines. Indigo leads in the market share.

Figure-1: Domestic Market Share of Indian Airlines



Sources: CAPA India Aviation Outlook FY14

PRIVATE SECTOR AIRLINES

INDIGO

Indigo is the only Indian carrier running in profits. The company registered sales of Rs. 11,117 crore for FY 2014, a growth of 11.7% as compared to FY2013. The net profit was Rs. 317 crore. The company has registered profit for sixth consecutive year (Sanjai, 2014). IndiGo has performed well in terms of load factor (it carried 84 million passengers until Oct 2014, which is one third of all domestic passengers), revenues and profits. Indigo has been able to maintain its reputation on punctuality. The company has used a digital data link system called ACARS, to transmit messages between aircraft and ground stations via radio or satellite. The load factor has been better than competitors have. Use of single type of aircrafts has reduces maintenance cost. Thus, simple but effective operational focus has been useful for the company for smooth operations and cost savings. The focus on efficiency has allowed company to capture higher market share with lesser number of aircrafts. Indigo has 57 planes as compared to 101 with Jet Airways and 148 with Air India (Prabhakar, 2012).

The culture of simplicity flows down from the top bosses. Indigo President Mr. Aditya Ghosh himself drove in Wagon R along with Indigo promoter Rahul Bhatia, while other airlines executives came in swank chauffeur-driven cars. Indigo does not have large cars. The company has preferred not to offer frequent flier programmes, airport lounges, special check-in counters for a particular class of passengers and TV screens on board (Prabhakar, 2012). The focus of company is to do one thing and do it well. The airline projects the advantages as one type of airplane (Airbus 320):

SPICEJET

The company has debt of Rs 1,738 crore, cash balance of Rs. 5 crore, net worth turned negative at Rs. 1019 crore. It was reported in parliament in July that SpiceJet has not paid Rs. 110 crore airport usage charges to the Airport Authority of India (Narasimhan, 2014). The financial crisis was reflected in the news reports about failure of the company to deposit the tax deducted from employee's salary and that the employees were not provided form 16. It was reported that the promoter Mr. Maran was planning to offload his 53.48% stake in the airline. The cash strapped airline-suffered decline of 17.5% in its stock. The company denied any such plan of Mr. Maran to offload his stake. Sanjiv Kapoor, COO of the company wrote to the employees "SpiceJet is no Kingfisher" to contradict such news articles (Narasimhan, 2014).

The company has dropped at least six destinations since November 2013 to rationalize destinations to improve operational performance. The uncertainty about financial feasibility of the airline also affects the employee morale. The company spokesperson informed that their internal survey reveals that 90% of staff believes airline is moving in the right direction.

JET AIRWAYS

Mr. Naresh Goyal launched jet Airways in 1993. Jet borrowed $800 million to finance new aircrafts. The airline started international flights by focusing on nearby destinations in Asia. Later it acquired Air Sahara in 2007 for Rs. 1450 crore. The company has domestic market share of 22% (Sanjai, 2014). After buying Sahara, Jet Airways started facing financial issues. To optimize business operations Jet Airways sacked 1900 employees in October 2008, after operational tie up with Kingfisher. After media outcry and pressure from political establishments, the Chairman Mr. Naresh Goyal has to reinstate the sacked employees, citing the reason that he was not aware of these sackings. It also highlighted the lack of possible repercussions by the top management, coordination and communication, poor HR management in the company (Mehra, 2011). The employees were sacked without notice.

The sacking and reinstatement episode led to a feeling of insecurity among pilots and they formed a union; National Aviators Guild (NAG). Soon after the formation of NAG, two of the senior pilots were terminated without assigning any reasons. Pilots reacted and NAG called for strike and went on mass leave. Jet management took stay order from Bombay High Court, refraining pilots from strike. The discussions between management and union failed. The union was adamant on reinstatement of sacked pilots. The operational fall out of the strike was cancellation of 700 flights affecting 28000 passengers. Annoyed with the pilots Mr. Naresh Goyal referred to them as terrorists who were holding the country for ransom, and indicated that he would bring foreign pilots to manage the situation. Jet management used high profile lawyers to obtain a stay order on the strike. NAG filed a petition in Chennai high court against hiring foreign pilots by Jet Airways.

KINGFISHER AIRLINES

The Airline was grounded in October 2012 and the flying permit was cancelled in December 2012. The court has allowed banks to take possession of property as part of recovery process. As part of recovery process, SBI consortium took possession of Kingfisher house, estimated to be worth Rs. 100 crore. The banks have outstanding loans of Rs. 6800 crore on Kingfisher Airlines (The Times of India, 2015)The demand of legal representatives before the GRC was turned down by Calcutta High Court. Mr. Malaya commented “They are making me a bakra (fall guy) because they want to set an example for other defaulters. Let them prove me a willful defaulter after hearing me out. Then I have recourse to law. What they have done is unsustainable.There is natural justice to be followed” (Dhamija, Kurian, 2014)

CHALLENGES FACED BY INDIAN AVIATION INDUSTRY

Airline industry is suffering from huge debt burden. The industry has a debt of $15.83 billion (live mint, 2014). Airline industry is not able to generate profits and is suffering from losses. The industry has lost about $10.6 billion from 2007-2014 (live mint, 2014). According to the Centre for Asia Pacific Aviation, the industry is expected to record losses of $1.4 billion in financial year 204-15.

six cases in the airline industry.

Blockchain Technology

Blockchain technology has been intensely in the spotlight across 2016, and will continue riding the wave in 2017. It would be harsh to call it a hype as it's a genuinely disruptive force to be reckoned with in aviation and any other industry, in particular by intermediaries. Above all, it offers amazing opportunities which go well beyond financial transactions, albeit most of the popularity has been gained through Bitcoin and projects initiated by major international banks. Identity Management: Blockchain technology can take the hassle out of identity management. Here is a more detailed article on how it could revolutionise identity management in combination with biometrics technology. Tokenising Frequent Flyer Programs: Blockchain has the ability to turn airline miles into something much more pervasive and valuable outside the defined boundaries of airlines and their limited partners with whom passengers get to spend their miles. Imagine if your miles were accrued in real-time, and there was community-driven market place for you to use them instead of the limited spend options made available by individual airlines?

Encryption and hashing may be necessary to safeguard the information. Another case study would be aircraft parts as they change custody between manufactures, traders, maintenance service providers, and airlines.Tokenising e-tickets: Smart Contracts can facilitate tokenisation of e-tickets and empower the value chain partners for ticket sales and other actions related to tickets. Imagine if an airline could define the business rules and conditions on how tickets are sold and used by its partners through the use of smart contracts on a blockchain, empowering partners across the value chain to act on behalf of the airline in a secure and efficient manner.

Game of Drones

You either love them or hate them, or change your personal opinion according to different contexts. Drones have gained massive popularity among recreational users, and are rapidly becoming more and more affordable. 2017 may be the year of entry in the commercial space. Amazon is leading the "Game of Drones" race and has made some headway. The recent Amazon patent on the use of a flying warehouse shows where things are headed.

Uber has equally expressed aspirations through their white paper released a few months ago, on the feasibility of ultra-short-haul commercial flights in the urban space.

It's predicting the rise of VTOL (Vertical Take-off and Landing) vehicles offering on-demand flights in urban areas leveraging existing infrastructure (e.g. parking rooftops) as vertiports (airports for aircraft that can take-off and land vertically). Some of the challenges mentioned in the paper include:

Regulatory challenges

1. Battery technology readiness
2. Vehicle performance and efficiency
3. Air Traffic Management
4. Noise and Emissions
5. Vertiport Infrastructure in cities
6. Pilot training

Augmented Reality

Virtual Reality (VR) is often associated with glasses that take you to a virtual world where your actual real movements are translated to the virtual world. On the other hand, perhaps even more relevant, Augmented Reality (AR) is more likely to penetrate the airline and airport space (click here to learn the difference between VR and AR).

The above image shows a hypothetical AR view of a passenger, where the view is enhanced with information (sensory input, static and dynamic information sources, location, object and context awareness) and functionalities (e.g. buying lounge access by looking at the lounge access button at the top right corner of the view, and blinking twice, which would act as a click of a mouse).

AI (Chatbots)

In an extreme scenario a passenger is expected to download the app of the car rental company, the airline, the departure airport, connecting airport, arrival airport, and the hotel. That's 6 apps for a single trip, which may or may not occur again.2017 is likely to be the year of dialogue around consolidated chatbot engines that could act as a single gateway for customers.

Airline New Distribution Capability

The airline distribution space is gradually making headway towards a more dynamic and nimble model where airlines are in control, travel agents empowered, and Global Distributions System provided with an opportunity to build new products and services. New Distribution Capability (NDC) industry program has been the driving force in the last couple of years making the necessary standards and guidance available to the industry.

Indoor positioning systems (Beacons technology)

For a long time it seemed impossible to accurately know the location of moving objects (e.g. people) inside buildings. Global Positioning Systems (GPS) aren't fit for purpose for indoors as the satellite signals are often not strong enough, and the accuracy is not sufficient. With the rise of Beacons technology, airlines, and airports are very likely to start using this technology to provide better/ customised services to passengers as they travel through the airport terminal.

Privatization of Delhi and Mumbai

• Early Steps and Scope

• Transaction Agreement

• Pre and Post Bid Events

• Scoring and Rescoring Criteria/Factors

• Criterion for GMR's Choice

• Bid Specific and Other Issues

• Lessons Learned

• Post Bid Issues

Privatization of Delhi and Mumbai: Early Steps

1996	Modernization of Delhi and Mumbai was first considered by Airport Authority of India (AAI)
June 2003	AAI Board approved the modernization proposal costing Rs 30 bn
September 2003	Government approved on a long term lease by joint venture route with 74 per cent equity of a private consortium and 26 per cent of AAI. Empowered Group of Ministers (EGoM) was constituted
October 2003	Ministry of Civil Aviation (MoCA) constituted the Inter Ministerial Group (IMG) to assist the EGoM
December 2003	EGoM approved the appointment of ABN Amro as the financial consultants
February 17, 2004	An Invitation to Register an Expressions of Interest (ITREOI) for acquisition of 74 per cent equity stake in the Joint Venture Company (JVC) was issued
June 04, 2004	Last date of submission of expression of interest (EOI)

Delhi-Duty Free Retail Deal

- DIAL had awarded the duty free shopping contract to a consortium of US-based Alpha Airports Group Plc and Pantaloon Retail (India) Ltd, a Future Group venture. The venture is projected to generate sales of Rs 500 crore for DIAL in the next 39 months.
- DIAL hopes to extract maximum value from the duty-free shopping, car park and advertising. These three businesses are expected to grow 250%, 90% and 215%, respectively in 2007-08
- DIAL hopes to generate Rs 470 crore from non-aeronautical sources of business, in the first full year of operations, 2007-08. This is a 56% jump from what AAI collected from such sources in 2005-06.

Mumbai-Duty Free Retail Deal

IPCL-Aldeasa's bid was the highest at Rs 570 crore

a. They were awarded the contract
b. Second highest bid was from DFS at Rs 260 crores
c. IPCL-Aldeasa felt bidding very high and tried renegotiating with MIAL
d. MIAL refused to do so, since it was a global tender and renegotiating would have meant scrapping the entire bidding process
e. MIAL awarded the bid to the DFS

Aug-2018. Navi Mumbai International Airport Private Ltd (NMIAL) is engaged in negotiations with banks, including State Bank of India, to provide approximately INR135 billion (USD1.9 billion) in funding for phase two of the Navi Mumbai International Airport development project.

Jul-2018. Navi Mumbai International Airport phase one development will require an estimated investment of INR135.6 billion (USD2 billion), according to a report from credit rating agency CRISIL.

Apr-2018. India's Ministry of Civil Aviation (MoCA) and Navi Mumbai International Airport Private Ltd (NMIAL) signed a MoU for the execution of the Navi Mumbai International Airport development project.

Mar-2018. Maharashtra Chief Minister Devendra Fadnavis stated the developer assured the Maharashtra State Government that phase one of the development project at Navi Mumbai International Airport will be completed by Dec-2019, including construction of a runway and passenger terminal with capacity to handle 50,000 passengers. Mr Fadnavis added that the second phase of the project, including construction of a second runway, passenger terminal expansion works and development of a cargo terminal, is expected to be completed within two to two and a half years.

Jan-2018. GVK Power and Infrastructure Ltd signed an agreement with City Industrial Development Corporation Limited (CIDCO) to establish Navi Mumbai International Airport Private Limited (NMIAL), a special purpose vehicle (SPV) to implement the Navi Mumbai International Airport development project. GVK will hold a 74% stake in NMIAL while CIDCO holds the remaining 26%. The concession period covers 30 years, with the option to extend for a further 10 years. NMIAL expects to complete and commission phase one of Navi Mumbai by the end of 2021, two years later than the Dec-2019 launch date set by the Maharashtra State Government. CIDCO vice chairman Bhushan Gagrani reported NMIAL expects to complete construction of Navi Mumbai's first runway by Dec-2019 and its second runway by mid-2020.

Nov-2017. City Industrial Development Corporation Limited (CIDCO) representatives informed India's Ministry of Environment and Forests land reclamation and construction works for phase one of the Navi Mumbai International Airport development project will take at least two years to complete and the airport will not be equipped to commence operations until 2020 at the earliest. CIDCO also reported it established the special purpose vehicle Navi Mumbai International Airport Pvt Ltd with Mumbai International Airport Ltd (MIAL) to execute the project.

Oct-2017.

25-Oct-2017. Maharashtra Chief Minister Devendra Fadnavis stated the Maharashtra Cabinet "approved selection of Mumbai International Airports Ltd (MIAL) for development of Navi Mumbai International Airport on PPP basis".

19-Oct-2017. ‘Maharashtra State Government's Project Management and Implementation Committee (PMIC) approved Mumbai International Airport Ltd's (MIAL) bid for a contract to develop Navi Mumbai International Airport. City and Industrial Development Corporation of Maharashtra (CIDCO) senior public relations officer Mohan Ninawe reported CIDCO will issue the letter of award to MIAL following a State Government cabinet meeting to give final approval to the project on 31-Oct-2017, after which MIAL will have two months to establish a special purpose vehicle with Airports Authority of India to execute the project.

Jun-2017. India’s Maharashtra Government announced plans to fast-track the development of Navi Mumbai International Airport with a revised completion date as early as Dec-2019 for the first phase of the project.

May-2017. India's Minister of State for Civil Aviation Jayant Sinha commented on the progress of Navi Mumbai Airport. Mr Sinha stated: "We have completed the levelling and ground work. The contract has been given to GVK. Environmental clearance has also been given in stage-II. The work is in full swing. But there are two small mountains, a river and a sea which is making the work a little bit difficult. We hope that the levelling work will be completed in one-and-a-half years. As soon as we finish the work of a runway and the terminal, it will be thrown open for use".

29-Apr-2017. India's Minister of State for Civil Aviation Jayant Sinha stated the government expects to complete the first phase of Navi Mumbai Airport in 2020 by making one runway and one terminal operational. Mr Sinha said the situation at the airport is "complicated" due to various factors, including resettlement issues. Looking at all of that, it is going to tak a significant amount of time to resolve those issues and to construct the airport. "It will take significant amount of time to

resolve the issues. We also need to accelerate and expedite the process as much as possible… We are looking at it in phases and our hope is that sometime in 2020 or so, we will be able to get phase one up and running which would mean one runway and one terminal", Mr Sinha said. Navi Mumbai Airport was first proposed in 1997 and received government approval in 2007 with plans for completion in 2019, but has faced delays in land acquisition and obtaining necessary government permissions such as environmental clearance.

Apr-2017. Navi Mumbai international Airport's progress will be fast-tracked after Civil Aviation Minister Jayant Sinha confirmed stage II forest clearance would be expedited.

Feb-2017.

16-Feb-2017. City and Industrial Development Organization of Maharashtra (CIDCO) forecast it will need more than 12 months to complete predevelopment works for the Navi Mumbai International Airport project, including rehabilitation, hill cutting and river diversion. CICDO plans to ensure, "simultaneity of operations to meet the deadline", scheduled by the end of 2019.

14-Feb-2017. GVK Group's Mumbai International Airport Ltd (MIAL) bid for the Navi Mumbai International Airport development project was selected by City and Industrial Development Corporation of Maharashtra (CIDCO). CIDCO MD Bhushan Gagarin said the contract will now be submitted it to the state government for final clearance and an LOI is to be awarded within a month approval by the State Cabinet.

08-Feb-2017. City and Industrial Development Corporation of Maharashtra (CIDCO) MD Bhushan Gagrani hopes to see "more than two bids" submitted for Navi Mumbai International Airport's financial bidding process, due 13-Feb-2017. Mr Gagrani also remained positive about the new airport launching single runway operations by Dec-2019.

Jan-2017.

26-Jan-2017. City and Industrial Development Corporation (CIDCO) MD Bhushan Gagrani advised Navi Mumbai International Airport's bidding will be extended from 25-Jan-2017 to 13-Feb-2017, after having received only one bid from GVK Mumbai International Airport Ltd (MIAL). Navi Mumbai's public private partnership project is expected to cost USD2.5 billion. GMR, Voluptas Developers (Hiranandani), and MIAL may reportedly the only bidders for the proposed airport.

10-Jan-2017. India's City and Industrial Development Corporation of Maharashtra (CIDCO) extended Navi Mumbai International Airport's bidding deadline by 15 days from 09-Jan-2017. GMR group, Tata Realty and Hiranandani Group-Zurich Airport consortium reportedly advised they would no longer participate in the bids. GMR group reportedly cited challenges with predevelopment work, land acquisition/rehabilitation delays and an absence with stage two environmental clearance.

04-Jan-2017. GMR Airports (q.v.) and MIA Infrastructure (q.v.), the JV of Tata Realty (q.v.) and Vinci Concessions (q.v.) issued letters calling for the City and Industrial Development Corporation of Maharashtra (CIDCO) to extend the deadline for submission of financial bids for the Navi Mumbai International Airport project and address issues related to pre-development work, site preparation and compensation of affected residents. A GMR Airports spokesperson stated, "We are not bidding on account of project implementation and execution challenges as well as erroneous timelines and bid conditions." Local media is interpreting the statement as meaning "we will not bid at all." If so, there will be only two companies — GVK (q.v.)-led Mumbai International Airport (MIAL) and an Hiranandani Developers-Zurich Airport (q.v.) consortium — in the race for the project. Other reports indicate that the Hiranandani Group-Zurich Airport consortium also advised they would no longer participate in the bid.

India's Minister for Civil Aviation P Ashok Ganapathi Raju stated Navi Mumbai International Airport's construction will take "at least four years", if the development process remains efficient.

Dec-2016. Navi Mumbai International Airport's initial bids are likely to be opened in the second week of Jan-2017 after deadline submissions continued to be extended since Jul-2016. GMR, GVK, Hiranandani groups and Tatas, are expected amongst bidders to place bids for Request For Qualification (RFQ). City and Industrial Development Corporation of Maharashtra Ltd (CIDCO) expects the total cost of the project to be INR145.74 billion (USD2.14 billion) including INR23.58 billion (USD347.4 million), as cost for predevelopment.

Nov-2016.

30-Nov-2016. India's Ministry of Civil Aviation provided 'in principle' approval to Maharashtra Government for the Navi Mumbai International Airport construction project.

24-Nov-2016. Navi Mumbai International Airport's estimated development cost of INR167 billion (USD2.4 billion) reportedly increased 250% from the INR47.7 billion (USD692.6 million) when its plan was formulated in 2006/07. Minister for Civil Aviation Ashok Ganapathi Raju cited slow process of the airport project, stating: "Except for the few permissions from different departments, not much has moved at the airport. I have twice done aerial surveys of the place, but things are still the same. Nothing has moved forward". City and Industrial Development Corporation has extended the date for request for proposal from 07-Nov-2016 to 09-Jan-2017.

Oct-2016.

14-Oct-2016. India's City and Industrial Development Corporation of Maharashtra Ltd (CIDCO) PRO Mohan Ninawe advised four bidders have qualified for the request of proposal to the Navi Mumbai International Airport project, closing on 07-Nov-2016.

13-Oct-2016. India's City and Industrial Development Corporation of Maharashtra Ltd (CIDCO) senior PRO Mohan Ninawe advised construction equipment has been deployed at the Navi Mumbai International Airport site and "work has started".

12-Oct-2016. India's Pune district collector Saurabh Rao advised the revenue department formed a six member team including three from Maharashtra Airport Development Company's revenue department, to assess/review the Navi Mumbai rehabilitation project model.

Sep-2016. India's Maharashtra Chief Minister Devendra Fadnavis advised all approvals for the Navi Mumbai International Airport project are in place and first service will launch by Dec-2016.

Aug-2016.

19-Aug-2016. City and Industrial Development Corporation (CIDCO) is extending the request for proposal for bids to operate Navi Mumbai Airport to Dec-2016 or Jan-2017. As a result, the airport development may not be completed by its designated timeframe.

17-Aug-2016. India's Ministry of Civil Aviation prioritised completion of operational areas of Navi Mumbai Airport by 2019. The operational areas include a runway, terminal building and ATC tower. The Ministry said the rest of the airport can be completed at a later date.

Jul-2016.

23-Jul-2016. India’s Minister of State for Civil Aviation Jayant Sinha advised all approvals except for stage two forest clearance have been approved for the Navi Mumbai International Airport project. Selection of a concessionaire on public private partnership basis is to be finalised by Dec-2016.

20-Jul-2016. India’s Minister of State for Civil Aviation Jayant Sinha advised that site clearance had been granted for the proposed airport at Bhiwandi and “further development would depend on preparation of Detailed Project Report, its

economic viability and financial closure subject to the in-principle approval". Under India's greenfield airport policy, the impact of a new airport proposed within 150km of an existing civilian airport will be examined, with approval decided by the government on a case to case basis.

13-Jul-2016. India's Ministry of Environment and Forests (MoEF) provided stage two forest and wildlife clearance for the Navi Mumbai International Airport project.

Jun-2016.

29-Jun-2016. City and Industrial Development Corporation of Maharashtra (CIDCO) said no further approval would be required from the Ministry of Environment and Forest (MoEF) for the Navi Mumbai International Airport project after MoEF gives its final approval, which is expected in late Jun-2016 or early Jul-2016.

22-Jun-2016. India's City and Industrial Development Corporation (CIDCO) chief engineer Sanjay Choudhary said the company expects its development team, responsible for the Navi Mumbai International Airport project, will likely step in between Dec-2016 to Mar-2017 and the company aims to make the airport operational by Dec-2019.

22-Jun-2016. India's City and Industrial Development Corporation joint MD V Radha said contractors involved with the construction of Navi Mumbai International Airport "are expected to mobilise their machinery in a month".

21-Jun-2016. India's Supreme Infrastructure said it was awarded two land development projects worth INR3.9 billion (USD59 million) for Navi Mumbai International Airport.

21-Jun-2016. India's Gayatri Projects was awarded a INR7 billion (USD104 million) contract for the development of Navi Mumbai International Airport. The company stated: "Gayatri Projects has made inroads into the construction of airports by bagging a INR7 billion (USD104 million) contract as part of the larger Navi Mumbai International Airport from City and Industrial Development Corporation of Maharashtra."

May-2016.

11-May-2016. India's Minister of State for Home Affairs Haribhai Parathibhai Chaudhary stated that security clearance for GMR Airports Limited, MIA Infrastructure Pvt Ltd and Mumbai International Airport Private Limited were granted for the development Navi Mumbai International Airport.

04-May-2016. India's City and Industrial Development Corporation (CIDCO) sent RFPs to GMR Infrastructure, Mumbai International Airport Limited and MIA Infrastructure for the development of Navi Mumbai International Airport on 29-Apr-2016.

Feb-2016.

11-Feb-2016. India's City and Industrial Development Cooperation (CIDCO) plans to open financial bids for the pre-development works of proposed Navi Mumbai International Airport, and send the request for proposals (RFP) in Mar-2016. Pre-development works include levelling the land site and flattening hills, for which CIDCO expects to begin by Mar-2016.

08-Feb-2016. India's City and Industrial Development Corporation (CIDCO) proposes to seek the next step in the bidding process of Navi Mumbai International Airport in mid Feb-2016. CIDCO proposes to seek the project monitoring committee's approval in order to issue a formal request for proposal (RFD) to the airport bidders. CIDCO VC and MD Sanjay Bhatia said the Ministry of Civil Aviation (India) has already approved for the next step of the bidding process. Following the approval from the committee, CIDCO will seek the state cabinet's clearance. CIDCO aims to provide the RFD by Mar-2016 and issue the final contract by Jun-2016.

01-Feb-2016. India's City and Industrial Development Corporation (CIDCO) plans to extend the tender process for the pre-development construction works of proposed Navi Mumbai International Airport in order to attract more bidders. The tender for the pre-development work was scheduled to be opened on 05-Jan-2016. CIDCO was proposing to invite tenders of INR16 billion (USD236.4 million) for the pre-development works. The Maharashtra State Government is in the process of transferring land from the land owners.

Jan-2016.

22-Jan-2016. India's Ministry of Home Affairs rejected Hiranandani Developers and Zurich Airport's security clearance, with the companies being one of the four shortlisted companies to bid for the proposed Navi Mumbai International Airport. The three remaining airport bidders include GMR Infrastructure, GVK Power & Infrastructure Ltd, and MIA Infrastructure of France with Tata Realty.

18-Jan-2016. City and Industrial Development Corporation of Maharashtra (CIDCO) vice chairman and MD Sanjay Bhatia said financial bids for the Navi Mumbai International Airport project are likely to open on 20-Jan-2016. Bids for pre-development works are currently under consideration. CIDCO aims for land and sea transport connectivity projects to be complete by 2017/18.

15-Jan-2016. India's Federal Government had given its approval for the second stage of Navi Mumbai International Airport's RFP, which will involve selecting the final consortium for the development of the proposed airport according to City and Industrial Development Corporation (CIDCO). CIDCO will finalise the RFP and issue the document to the pre-qualified applicants in order to begin the second stage of the bidding process. CIDCO stated the consortium is expected to be selected by mid-2016 and the first service from the airport will begin by 4Q2019. The four shortlisted bidders for the privatisation of Navi Mumbai International Airport include GMR Infrastructure, GVK Power and Infrastructure, Zurich Airport with Hiranandani Developers, and MIA Infrastructure of France with Tata Realty and Infrastructure.

15-Jan-2016.

13-Jan-2016. India's City and Industrial Development Corporation (CIDCO) announced the RFP process for Navi Mumbai International Airport has been extended due to security clearances required of the four short-listed bidders from India's Ministry of Home Affairs, including GMR Infrastructure, GVK Power and Infrastructure, Zurich Airport with Hiranandani Developers, and MIA Infrastructure of France with Tata Realty.

11-Jan-2016. Navi Mumbai International Airport will begin the first phase of pre-development construction works in Feb/Mar-2016 and is scheduled to be completed by 2019, according to City and Industrial Development Corporation of Maharashtra (CIDCO) joint MD V Radhi. Ms Radhi stated the first phase of the pre-development plan is divided into four packages, in which "evaluations for the first three technical packets are almost done" and the fourth is expected to be completed by 15-Jan-2016. Financial bids will be opened for evaluation according to Ms Radhi. The pre-development plan is expected to cost approximately INR3000 crore (USD449 million) across 1160 hectares, and will include works such as the diversion of Ulwe River and ground levelling. CIDCO reported the construction of the airport is scheduled to begin from Sept/Oct-2016 with the first phase open to passengers by mid 2019.

08-Jan-2016. India's Civil Aviation Ministry is seeking for the Airports Authority of India (AAI) to become an equity partner in the special purpose vehicle (SPV) that will be formed to construct and operate the proposed Navi Mumbai Airport. The Navi Mumbai Airport project has been planned by City and Industrial Development Corporation (CIDCO), which will hold 26% stake in the project. Any equity allocation to AAI will reportedly be from CIDCO's 26% stake, with a charge for the stake.

05-Jan-2016. India's Ministry of Civil Aviation (MOCA) announced City and Industrial Development Corporation of Maharashtra (CIDCO) will provide the developer and operator of the proposed Navi Mumbai International Airport project

an interest free-loan worth INR3000 crore (USD451.6 million). The loan will be repaid over 10 years from CIDCO, and will be used for construction works such as filling the marshland around the airport and removing cables.

04-Jan-2016. City and Industrial Development Corporation of Maharashtra (CIDCO) vice chairman and MD Sanjay Bhatia confirmed the company expects approval from India's Government to issue RFPs for the Navi Mumbai International Airport project in early Jan-2016. Mr Bhatia said pre-development tenders will open in early Jan-2016 and works will commence by Feb-2016, land and environmental clearances are expected in three to four months, bidders may be appointed by May/Jun-2016 and the project is on track for initial operations in Oct/Nov-2019. CIDCO acquired 94% of the 1160 hectares required for the project and expects to acquire the remainder in the next two months. The overall cost of the project is expected to be INR150 billion (USD2.26 billion).

Dec-2015.

31-Dec-2015. India's Ministry of Civil Aviation has given in-principle approval for financial bids or request for proposals at Navi Mumbai International Airport.

30-Dec-2015. India's Ministry of Civil Aviation will review request for proposal (RFP) documents for the Navi Mumbai International Airport project on 30-Dec-2015.

07-Dec-2015. City and Industrial Development Corporation of Maharashtra (CIDCO) vice chairman and MD Sanjay Bhatia said pre-development works for Navi Mumbai International Airport will commence in Feb-2016. Works include river diversion, land clearance, levelling and reclamation and relocation of power lines. Pre-development is expected to cost INR35 billion (USD525.5 million). The first phase of construction is expected to be complete by Dec-2019 and require investment of an additional INR35 billion.

Oct-2015.

27-Oct-2015. City and Industrial Development Corporation of Maharashtra (CIDCO) vice chairman and MD Sanjay Bhatia said the acquisition of 261 hectares for the Navi Mumbai International Airport project is expected to be complete in the next two months. Mr Bhatia said all approvals and clearances for the project have been received, except stage two forest clearance. Mr Bhatia confirmed the tender for pre-development works will by awarded by the end of Dec-2015.

27-Oct-2015. City and Industrial Development Corporation of Maharashtra (CIDCO) vice chairman and MD Sanjay Bhatia said Navi Mumbai International Airport will operate at its full initial capacity of 10 million passengers p/a when it opens. Mr Bhatia expects the airport to reach capacity of 60 million passengers p/a by 2030. Mumbai Chhatrapati Shivaji International Airport currently has capacity for 40 million passengers p/a and Mr Bhatia said capacity may be increased to 45 million p/a, but the airport will be at full capacity by the time Navi Mumbai Airport is operational. Mr Bhatia said, "There is no dearth of passengers as I see it."

Aug-2015

05-Aug-2015. CIDCO stated INR27 billion (USD423.4 million) is required for pre-development work for the Navi Mumbai International Airport project. A tender for the work has been issued. The CIDCO will award the winning bidder with INR27 billion to commence the project, on the condition it be returned after 10 years, without interest. The pre-development work includes the diversion of the Ulwe River, clearing of the land, increasing the level from 2m to 5m above mean sea level and relocation of power lines. It is anticipated the winning bid will be selected by Dec-2015.

Aug-2015. City and Industrial Development Corporation of Maharashtra (CIDCO) plans to commence pre-development work for Navi Mumbai International Airport in Oct-2015. Work will include diverting waterways, land reclamation, terrain levelling and relocation of power lines. CIDCO will appoint a contractor for the project by the end of 2015.

Jul-2015.

27-Jul-2015. Maharashtra's Chief Minister Devendra Fadnavis said work will commence on Navi Mumbai International Airport within six months and the airport will be operational in 2019. Mr Fadnavis said developments including the runway will be complete in three years. The estimated project cost is INR151.5 billion (USD2,359 million)

22-Jul-2015. India's Minister of State for Civil Aviation Dr Mahesh Sharma confirmed the government granted in principle approval for the development of 13 new airports at cities including Mumbai.

13 Jul-2015. Maharashtra's Government plans to invest almost USD16 billion over five to six years to accelerate various infrastructure projects, including Navi Mumbai International Airport.

Jun-2015.

29-Jun-2015. India's Ministry of Environment, Forest and Climate Change National Board for Wildlife withdrew a requirement for the establishment of a mangrove sanctuary as part of the Navi Mumbai International Airport project. The project developer will be required to make the area designated for the sanctuary "unattractive to birds" to reduce the risk of bird strikes.

18-Jun-2015. India's Project Monitoring and Implementation Committee (PMIC) approved all four applicants for the submission of RFPs for the Navi Mumbai International Airport project. GMR Group, Mumbai International Airport Limited, a consortium of Flughafen Zurich and Hiranandani Developers and a consortium of MIA Infrastructure and Tata Realty and Infrastructure submitted RFQs for the project. City and Industrial Development Corporation of Maharashtra (CIDCO) aims to award the contract by Dec-2015 and the airport is expected to commence operations in 2019.

May-2015. City and Industrial Development Corporation of Maharashtra (CIDCO) intends to select a final bidder for the Navi Mumbai International Airport project by Apr-2016. CIDCO's project management committee is reportedly assessing technical submissions by four shortlisted bidders. Following approval by the committee, CIDCO will seek clearance from Maharashtra's Chief Minister Devendra Fadnavis and India's Ministry of Civil Aviation before inviting financial bids. CIDCO expects the airport to be commissioned by 2019.

Apr-2015.

21-Apr-2015. Maharashtra chief secretary Swadhin Kshatriya reported all central government permissions for Navi Mumbai International Airport have been approved. Mr Kshatriya said: “The competitive bidding process will be completed this year. Work on the ground will begin early in 2016 and planes will take to the skies from Navi Mumbai international airport in 2019. The onus is now on the state government.” The airport still requires permission to relocate 650 farmers currently located on the airport site, and the state government needs height clearance from the aviation ministry.

01-Apr-2015. City and Industrial Development Corporation of Maharashtra(CIDCO) received a series of environmental, technical, land acquisition and zoning approvals from India's Government for the Navi Mumbai International Airport project, resolving seven of eight outstanding issues. CIDCO reportedly expects to secure approval for the transfer of a 250 acre site to India's Ministry of Environment, Forest and Climate Change in three weeks. The project is also awaiting approvals related to height restrictions for buildings.

Mar-2015.

16-Mar-2015. City and Industrial Development Corporation of Maharashtra (CIDCO) vice chairman and MD Sanjay Bhatia said the company aims to complete the assessment of bids for the Navi Mumbai International Airport project by mid Apr-2015 and finalise the contract by the end of Dec-2015. Following completion of the assessment, bidders will be given three to four months to submit a financial proposal. CIDCO received bids from GMR Group, Mumbai International Airport, a consortium of MIA Infrastructure and Tata Realty and Infrastructure and a consortium of Flughafen Zurich and Hiranandani Developers.

09-Mar-2015. Maharashtra's Government plans to develop a 600sqkm city named NAINA around Navi Mumbai International Airport. The Government has secured the majority of clearances required for the project.

Feb-2015. India's City and Industrial Development Corporation of Maharashtra (CIDCO) plans to re-issue a tender for pre-development works at the Navi Mumbai International Airport site after modifying tender conditions in response to feedback from bidders. The tender may be re-issued on 20-May-2015. The contract includes land reclamation and terrain levelling works estimated to cost INR17.5 billion (USD281.5 million).

Jan-2015. City and Industrial Development Corporation of Maharashtra (CIDCO) reported GMR Group, a consortium of MIA Infrastructure and Tata Realty and Infrastructure, Mumbai International Airport and a consortium of Flughafen Zurich and Hiranandani Developers qualified for submission of financial bids for the contract to construct and operate Navi Mumbai International Airport. Financial bids are due by Aug-2015 and a contractor is expected to be appointed in Oct-2015. The airport is expected to open in phases from 2019.

CIDCO intends to finalise selection of a candidate to undertake pre-development works for the Navi Mumbai International Airport project by the first week of Mar-2015. Works include levelling terrain and land reclamation and are expected to take more than one year at a cost of INR17 billion (USD270 million). CIDCO expects to complete land acquisition for the project in mid Jan-2015.

Dec-2014. City and Industrial Development Corporation of Maharashtra (CIDCO) extended the deadline for submission of requests for qualification (RFQs) on 06-Dec-2014 for the Navi Mumbai International Airport project to 28-Jan-2015, according to CIDCO's website. Pre-qualified applicants for the contract are now scheduled to be announced on 31-Mar-2015. The submission deadline has been extended five times from the original date in Jun-2014.

Nov-2014. Maharashtra State Government confirmed that it still needs to acquire 291 hectares of land for the Navi Mumbai International Airport development.

Oct-2014. City and Industrial Development Corporation of Maharashtra (CIDCO) further extended the RFQ submission deadline for the Navi Mumbai Airport construction contract to 10-Dec-2014. An unidentified CIDCO official reportedly said the extension was granted to allow bidders to form JVs. Submissions were originally due on 18-Jun-2014 and the deadline was previously extended to 30-Jul-2014, 02-Sep-2014 and 30-Oct-2014.

India's City and Industrial Development Corporation of Maharashtra (CIDCO) plans to commence pre-development works at the Navi Mumbai International Airport site in Oct-2014. Works include land reclamation, river diversion, levelling of terrain and relocation of power lines and will commence once land acquisition is complete. CIDCO is considering replacing existing power lines with underground systems. Further site preparation works are expected to commence in Jan-2015. Pre-development projects are expected to take more than one year to complete and are estimated to cost more than INR20 billion (USD324.6 million).

Sep-2014. The High Court of Bombay dismissed a petition by local residents calling for the suspension of land acquisition for the Navi Mumbai International Airport project pending changes to compensation. The ruling allows City and Industrial Development Corporation of Maharashtra (CIDCO) to proceed with the acquisition of more than 670 hectares for the project. The court reportedly stated, "There is no question of halting the project as it is in the interest of the public at large."

Aug-2014. CIDCO further extended the deadline for submission of requests for qualification (RFQs) for the project from 02-Sep-2014 to 30-Oct-2014. Pre-qualified bidders are now expected to be announced by the end of Dec-2014. The submission date for RFQs was previously postponed from 18-Jun-2014 to 02-Sep-2014.

CIDCO issued a tender for the contract to develop land at the core aeronautical area for the airport project. The contract includes levelling land for construction of the airport's runways. The overall cost of land development for the project increased from INR23 billion (USD380 million) to INR27 billion (USD446 million).

Jul-2014. CIDCO extended the deadline for submission of RFQs for the project to 02-Sep-2014. India's Government approved a revised tender document for the project in mid Jul-2014. CIDCO plans to announce pre-qualified applicants for the project on 30-Oct-2014. The submission deadline was previously extended from 18-Jun-2014 to 30-Jul-2014.

The CAA approved a revised tender document prepared by CIDCO, allowing the company to invite tenders for the construction and operation of the airport. The initial draft of the tender document was originally submitted in early 2013 and the revised version was submitted in Mar-2014. CIDCO will hold a stake of at least 26% in the airport and up to 74% will be offered to a private consortium. The document establishes the maximum ownership limit for airlines in any consortium bidding for the project at 26%, up from 10% in the original draft. Foreign airlines may also participate in the project, subject to approval by India's Government. CIDCO is expected to contribute INR23.75 billion (USD395 million) to the project and the private consortium will provide INR122.2 billion (USD2.03 billion). Qualification bids are due to be submitted by 02-Sep-2014 and the selection process is expected to take eight months. Mumbai International Airport Ltd (MIAL) holds right of first refusal for the project.

Jun-2014. CIDCO reported it received 127 consent letters from landowners affected by the construction of the airport since the release of a new government resolution on compensation in mid Jun-2014. CIDCO requires a total of 1200 consent letters covering 671ha of land across 14 villages.

CIDCO vice chairman and MD Sanjay Bhatia reiterated that the first phase of the airport may be operational by Dec-2018. The first phase will include one runway, arrival and departure terminals and customs and immigration facilities. Mr Bhatia said the airport is still expected to cost INR145 billion (USD2.4 billion).

CIDCO extended the request for qualifications (RFQ) deadline for the development contract for Navi Mumbai International Airport from 28-Jun-2014 to 31-Jul-2014. Project bidders had requested amendment to provisions in the RFQ document, to provide more clarity about the development project, eligibility requirements and intervals between agreements regarding the project.

May-2014. CIDCO confirmed the deadline for requests for qualification for the development of Navi Mumbai airport will be extended from 18-Jun-2014 to 18-Jul-2014.

CIDCO issued a tender to prepare the site for construction. CIDCO stated it would extend the RfQ deadline for construction of the airport until 30-Jul-2014 as a result. The site has small hills to be cleared and a river that requires diversion.

Feb-2014. CIDCO formally issued a global request for qualification (RFQ) for the proposed international airport at Navi Mumbai, 10 biddershaving already expressed interest. Bids are due by 18-Jun-2014, with the bidding and evaluation process expected to take up to 10 months. CIDCO still needs to acquire 696 of the 2,268 hectares required for the airport project. Mumbai International Airport (MIAL) has first right of refusal on the project. According to CIDCO, in the event that MIAL matches the highest ranked bid, it shall be deemed to be the highest bidder and the project shall be awarded to MIAL. CIDCO expects the airport could begin operations with a single runway as early as 2018. Initial pre-development work to be carried out by CIDCO will require INR23.56 billion (USD375 million), with the initial two phases of the development requiring a total investment of INR95 billion (USD1.52 billion). Maharashtra State Chief Minister Prithviraj Chavan stated he hopes that the first stage of the bidding process for the construction tender would be over in the next 90 days and that final bidding will proceed swiftly after that.

Jan-2014. CIDCO dismissed claims that delays in the project could become a political issue ahead of parliamentary elections. CIDCO chairman Pramod Hindurao said: “We are not looking at it as a political issue. The airport project has been in limbo for 13 years. So, another year or so would not matter. But, I am equally hopeful that the problem of a few villages not agreeing to the best package worked out so far will soon blow over.”

Zurich Airport Management has evinced interest in developing the proposed Navi Mumbai Airport, according to Maharashtra Chief Minister Prithviraj Chavan, who met officials of Zurich Airport and discussed the airport development plans.

CIDCO announced the corporation intends to award approximately INR20 billion (USD321 million) in basic airport infrastructure work for the airport development project to local developers. CIDCO plans to launch the request for qualification process from 05-Feb-2014. Work to be awarded to local companies includes basic earth moving, relocation of utilities infrastructure and construction of civil amenities. The total cost of the Navi Mumbai development is now projected at INR145.7 billion (USD2335 million).

Dec-2013. The Minister of State for Civil Aviation K C Venugopal informed the Indian lower house of parliament that the Maharashtra State Government is in the process of issuing a request for qualification for the selection of a concessionaire regarding construction of the Navi Mumbai International Airport. Necessary clearances from Ministry of Defence, Ministry of Environment & Forest (MoEF) and other agencies have been obtained.

Nov-2013. CIDCO MD Sanjay Bhatia said work on the construction of the Navi Mumbai International Airport project is expected to begin within a year and the initial phase of the airport, with a single runway and terminal, is expected to be operational in 2017. A global construction tender will be floated in early 2014. Land clearing and non-construction preparatory works for the development are expected to start within six months.

Sep-2013. CIDCO's MD V Radha said the Navi Mumbai Airport project “may have to be scrapped as it has become unfeasible”, citing ongoing delays and building costs. The projected “cannot afford any more delays” with land acquisition. Discussions on compensation with individuals affected by the airport are ongoing and have resulted in more than a decade of delays. CIDCO has already cautioned that the development of the airport may be delayed another 12 months by the negotiations. Mr Radha however said the agency is committed to proceeding with the project, despite the delays and escalation of project costs.

Projected project costs have risen from INR47.660 billion (USD753 million) to INR145.73 billion (USD2.3 billion). AAI is reportedly preparing a number of long-term funding options for its development, in case private developers are uninterested in the bidding process. The Navi Mumbai International Airport has now suffered more than five years of delays due to land acquisition and environmental concerns.

Jul-2013. City and Industrial Development Corporation (CIDCO) vice-chairman and MD Sanjay Bhatia announced Navi Mumbai Airportstill requires approvals from the Indian Government for its global tendering process and from the Mumbai High Court for environmental clearances covering an area of mangroves on the proposed airport’s development area. Environmental clearances are expected to be granted in the next few months, but it will require at least eight months between tendering approval and awarding a developer a contract.

Jun-2013. India's City and Industrial Development Corporation (CIDCO) reportedly feels pressured to reach an agreement with land owners to acquire 475 hectares necessary for the Navi Mumbai International Airport project. CIDCO chairman Pramod Hindurao stated “All efforts are being made to reach at an early settlement with PAPs [project affected persons]”. CIDCO is reportedly concerned that unless it swiftly reaches an agreement with PAPs to avoid further delays, which could endanger the future of the project.

The Maharashtra state government plans to hold a meeting with the Indian Planning Commission to discuss the delays in land acquisitions which have stalled the development of the planned Navi Mumbai Int Airport. The Phase I cost was projected at USD960 million and the total cost USD1.6 billion but projected land acquisition costs alone have reportedly reached INR170 billion (USD2989 million).