Transportation Engineering - II
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Lecture - 27
Introduction of Air Transport

Dear students, I welcome you back to the lecture series of course material on Transportation Engineering – II. So far in the previous lectures we have discussed about the various aspects of railway engineering. Now, as our course extends, we will be now shifting over gear and we will be moving into another component of our course that is airport engineering. Now onwards, whatever lectures will be delivered they will be delivered with respect to the various aspects of airport engineering, as we have seen in the railway engineering.

We will be looking at the aspects related to the aircrafts, the airports, the design features of the airports, the terminal buildings and various associated features of the terminal buildings and likewise.

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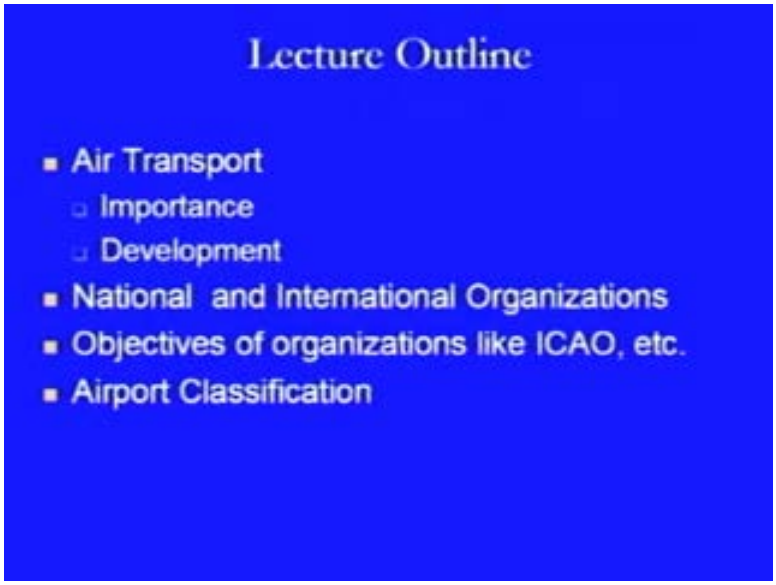

In today's lecture, it is totally related to the introduction of air transport in the world and in India and then, we will be having some more features and this particular lecture has been outlined in the form like the air transport, its importance, the development of air transport, the national and international organizations which are involved in air transport, the objectives of organizations like ICAO, etc., and airport classification.

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Starting with air transportation, air transportation is one way of, one system of transportation which tries to improve the accessibility to otherwise inaccessible areas. What we have seen so far is that we have read about the highways or the roads. We have then read about in this lecture series on railways, where railways is one of the system which provides accessibility to certain remote areas like especially in the case of the mountainous regions. But still, there may be some more areas which do not have the accessibility in terms of connectivity of road or by rail and that is where the air transportation comes into picture. It provides a continuous connectivity over land and water. Therefore, there is no requirement of changing of equipment, as in the case of other equipments, like we are using the road transport and then, when the land is no more, we cannot use the road transport and we have to use the water transport system.

This may be for the inter country system or intercontinental system or it may be within the city itself like Goa or like in some parts of Kerala, where as soon as the road ends, then they provide a water connectivity in terms of ferries and whole of the vehicle is being transported using that ferry to the other side of the water body and again the road is used. So, it means there is change of equipment in this type of scenario, whereas if we are having air transportation, then there is no such change of equipment and it is a continuous connectivity.

Another thing is related to the emergency conditions. In the case of emergency conditions, air transportation is the best way which can provide the relief and that is what we have seen in the case of the flooding conditions where we just drop the food packets or medical boxes which are required in that area that point of a time and similar conditions may be there, where the air transportation may have better requirement. It may prove to be a better system as compared to the other systems. Then, because of its speed it saves the productive time and there is no loss of this type of productive time in journey. That is another specific advantage especially for those where the time is having a much value.

Then, it increases the demand of specialized technical skill work force. As we know that air transportation is mostly dependent on the electronic gadgets and therefore, this is more technical in the sense of the work force as compared to the other systems. Therefore it is, as soon as the air transportation facilities are provided in an area that means we are increasing the demand for the technically skilled workforce. That also adds to the foreign reserve. That is another added advantage of air transportation, because it helps in improving the tourism facilities and if there is a flow from outside, then that will add to the reserve for the country.

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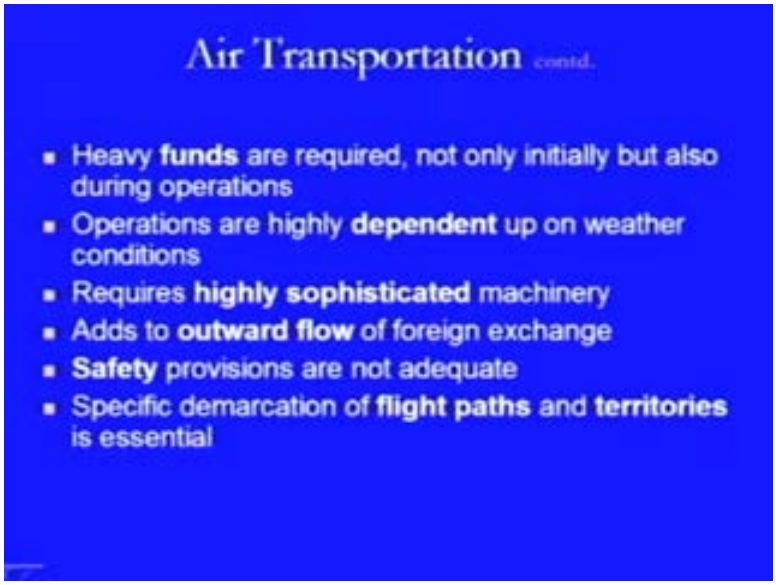

Further, there are some problems too, associated with the air transportation system with that because for setting up in any area it requires heavy funds and these heavy funds are continuously required. It is not that these funds are required only at the time of provision of the facilities, but at the time of its operation as well as its maintenance, the continuous flow of funds has to be made, then only the system can be maintained. Then, operations are highly dependent on the weather conditions. That you must have seen nowadays also. You must also have seen in the previous conditions, when there was winter and there are the news coming on that there is delay to the flight or there are some flights which have been cancelled, because of flooding conditions like in Gujarat or in Mumbai or in other parts of the country.

So, that is what happens is that this is more dependent on the other conditions as compared to the other modes of transportation that is the road based transportation or the railways transportation. Further, it requires highly sophisticated machinery and without that it cannot be operated. It cannot be safely and efficiently operated on all the routes whatever is being provided. It adds to the outward flow of foreign exchange in terms of getting the know how related to these highly sophisticated machinery or the other way of

looking at this aspect is that we have to purchase the big aircrafts from outside and that is one thing which creates the outward flow of the foreign exchange.

Safety provision is one of the biggest problems in air transportation, because there is no supporting system which is being provided while the aircraft is in air. Therefore, in that condition, if there is anything wrong happens to the flying aircraft, then biggest problem is the safety of the passengers or the freight, which is being transported by that aircraft. So, that is one of the biggest areas of concern. Then, specific demarcation of flight paths and territories is essential, so that there is no overlap of the flight paths or there is no crossing of the flight paths at the same altitude, which may otherwise cause an accident, because the aircrafts which are moving on those flight paths like in the case of railway tracks, if there is any crossing then the pilot will not be able to know about those crossings at those particular altitudes and if any aircraft comes from the other path, then it will just get resolved into the accident and this has happened in the past, especially somewhere in Yugoslavia, where the two aircrafts which were coming from the different flight paths and the flight paths were crossing and both the pilots could not understand and they were not having the information regarding that movement and finally the aircrafts collided in the air itself killing all the persons on board. So, that is why it is very important to demarcate flight paths and territories. If this is not done, then this is going to be a big safety hazard in this operation.

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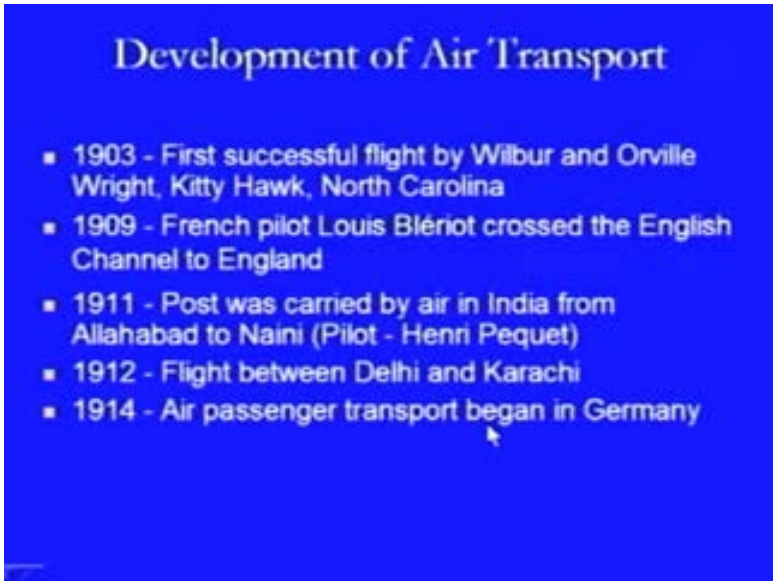

Now, we will look at the development of air transport in the world, how air transport has kept on developing. Towards 1903, when the first successful flight was made by Wilbur and Orville Wright that was in Kitty Hawk, North Carolina, this was, can be, this is being taken as the first flight, successful flight by air vehicle that is the aircraft which was made by these two brothers. Then, in 1909, French pilot named Louis Bleriot crossed the English Channel to England. That was from France towards the England side. So, this was after 6 years of the first successful flight.

Then, in 1911, the post was carried that is the postage was carried by the air in India from Allahabad to Naini. That was the first time when aircraft was operated in India also and that was in Allahabad and Naini is just the outer skirts of Allahabad. So, between Naini and Allahabad that is crossing Ganga that is, that was the first flight which was done. What we can see is that just in a span of 8 years after that we had a flight in India. So, probably we were one of the first who has operated these air transport flights and the pilot was Henri Piquet. In 1912, the flight between Delhi and Karachi was operated. In 1914, air passenger transport began in Germany. That is after India.

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In 1918, the first international service between France and Spain was operated. 1919, the London-Paris flight was inaugurated and in 1919, International Commission on Air Navigation was established that is abbreviated as ICAN and it was for the movement of the air transport, so as to look at number of air transport vehicles which were coming up at that time and it was felt to have that type of a commission to control it. Then, further in 1919, the six European airlines formed one association that was named as International Air traffic association, IATA and that was formed in Hague and this was again another effort, so as to control the movement of aircrafts by different airlines and to have a coordinated approach which is beneficial for all.

It was mainly having a concern or objective of the airlines as compared to the countries or as compared to the passengers. Then, in 1928, there was a Havana Convention on Civil Aviation and this Havana Convention on Civil Aviation transformed into another convention in 1929, which was Warsaw Convention on Civil Aviation.

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The effect of these types of conventions was that, slowly we had major body of air transport and that we will look at. But, between that in 1930, there was one flight which was round the word flight operated. Then, 1944 saw the setting up of International Civil Aviation Conference. This was one conference which finally culminated into a body and this body with Chicago Convention and all, was finally established into a provisional form of ICAO that is International Civil Aviation Organization, a body which internationally controls the overall movement of civil aviation not related to the military aviation, the civil aviation operations throughout the world, so that there is a coordinated effort between all of the countries to provide such connectivities.

In 1945, International Air Transport Association, IATA was established in meeting at Havana, Cuba. That was, finally it was successfully established. In 1947, the International Civil Aviation Organization was established as a body of United Nation. So, it became a body of United Nations, whereas initially only the participating states or participating countries in the conference they basically agreed, so as to establish the International Civil Aviation Organization. But then, in 1947, after three years it was incorporated as one part of United Nations.

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Then, in 27th July, 1949, the world's first jet airline, the de Havilland DH 106 Comet 1, it made its first flight from Hatfield airport, just north of London and it was piloted by Captain John Cunningham to an altitude of 8000 feet. So, that was the first jet airline flight in 1949. Then, in 1954 we saw, the first one was coming from the Boeing. That was Boeing - 80 prototype B707 and it made the first flight. So, this was the first Boeing which was manufactured by the Boeing Company.

Then, in 1969, Concorde was having its first flight. It is one of the peculiar and design was there of this Concorde which was more aerodynamic and it has the cutting edge in terms of the speed also. Then, in 1969, Boeing also came out with another model of Boeing that was named as B747-100, because within the 747 category, then they had manufactured some more type of models, so that was the hundred which fly in 1969. Then, coming to 1988, there was air bus A 320 and this air bus A 320 was 'Fly by Wire'. That means it was possible to control it by the remote form and that entered into the service and now in 2006, what we have seen is that there is an air bus which has come up and this is A 328, which has taken its maiden flight and it also came to India and we will be looking at its dimensions etc., when we discuss about various types of aircrafts. But, this is one of the biggest passenger aircraft, which has been manufactured so far by any of

the manufacturing agencies like Boeing or Air Bus and it can seat up to like 800 persons in one vehicle that is the aircraft.

Now, we come to the development of air transport in India.

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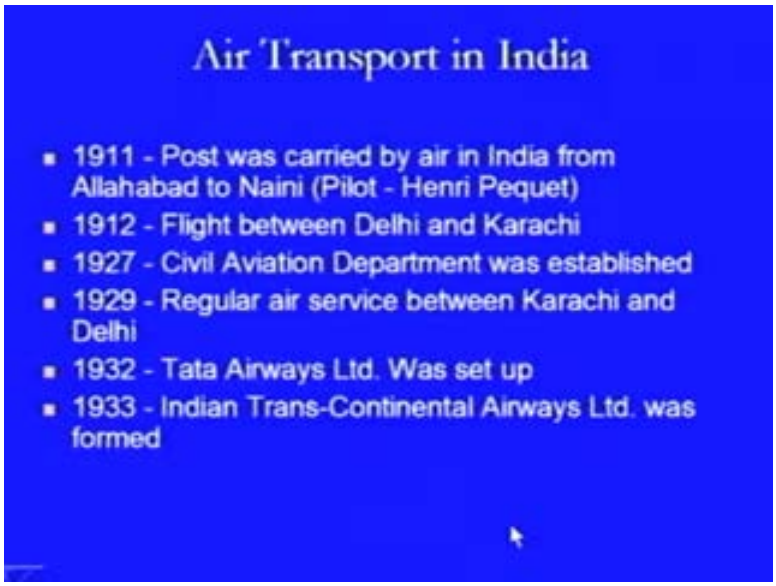

In this case, in 1911 that was the post was carried by air in India from Allahabad to Naini, as we have already discussed that the pilot was Henri Piquet. Then 1912, there was a flight between Delhi and Karachi. Then, 1927, Civil Aviation Department was established, so as to control the flights from different places. From 1929, there was a regular air service between Karachi and Delhi. Then, in 1932, Tata Airways limited was set up, that was the private airways. 1933, the Indian Transcontinental Airways Limited was formed, so as to provide a connectivity between the continents.

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Then, in 1938, by the end of the year, 153 aircrafts were registered in India by that time. In 1946, Air Transport Licensing Board was established, because number of companies were coming up and they were having large number of size of the fleet. 1947, Tata Airways changed its name to Air India Limited. So, the Air India Limited, which is now being operated, that was basically started by Tata and it was Tata airways. In 1948, Air India International Limited was established by the Government. In 1953, Air Transport Corporation bill was made, provision for establishing two corporations, one for the domestic services and other for the international services. So, this is the point at which we came up with the division between the international and domestic services.

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In 1972, the International Airport Authority of India that is IAAI was set up, so as to coordinate the international aviation from different locations of the country and suggest the measures by which we can operate or we can provide such facilities. In 1981, Vayudoot service was started and later it merged into Indian Airlines in 1993. Then, in 1985, there was a air taxi policy. It was announced at that point of time. In 1994, Airport Authority of India was formed by merging International Airport Authority of India and National Airports Authority. So, these two agencies which were separately working, they were merged together and AAI was formed and this is what is working now.

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Now, we come to the different type of agencies. As we know that we started discussing about the agencies, the setting up of the agencies, which later on became the part of United Nations in 1947 that was International Civil Aviation Organization, in short term as ICAO. Then, this is the site of this agency www.icao.int Another one is the Federal Aviation Administration being run in United States. This is another big agency which is working in the area of provision of air transport facilities and making rules and regulations related to that and that is the site for this one is www.faa.gov Then, there is Airports Authority of India, which is controlling the air navigation in India and it is www.airportsindia.org.in Then, we have Air India International Corporation, which look towards the international connectivities by Air India and it is www.airindia.com

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Then there is Indian Airlines Corporation, which is www.indian-airline.nic.in That is the site for this one and then, there are number of private air transport agencies like Jet Airways, Sahara Airways, Go Airways or Indigo and likewise. So, they have their own sites which can be looked at.

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Out of these agencies, some of the important agencies we will be looking at and we will try to look what are the objectives for which those agencies were set up and how they work. We will start with the first one and the most important one which is globally controlling the overall civil aviation and that is International Civil Aviation Organization. This was established in 1994, as a result of Chicago convention, this already we have seen. Its headquarters is in Montreal, Canada and this organization is made up of three constituent parts. One is an assembly, a council of limited membership with various subordinate bodies and a secretariat. The assembly is composed of representatives from all contracting states and is the sovereign body of ICAO, whereas the council is the governing body which is elected by the assembly for a three year term and it is composed of 36 states.

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Out of the total members or countries which are there as member of ICAO, these states are elected to the council for a three year term and the Secretariat is headed by a Secretary General and is divided into five main divisions and the divisions are: Air Navigation Bureau, the Air Transport Bureau, the Technical Cooperation Bureau, the Legal Bureau and the Bureau of Administration and Services. This is how it is being divided and this is, this works with the help of all these bureau.

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Further, the aims and objectives of ICAO are to develop the principles and techniques of the international air navigation and to foster the planning and development of international air transport, so as to ensure the safe and orderly growth of international civil aviation throughout the world that is the one important thing, encourage the art of aircraft design and operation for peaceful purposes that is related to the manufacturing units, encourage development of airways, airports and air navigation facilities for international civil aviation that is for providing the connectivity between nations and continents, meet the needs of the people of the world for safe, regular, efficient and economical air transport means try to make this facility to be a mass based facility as far as possible.

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Further, so as to prevent economic waste caused by unreasonable competition that is the controlling factor between the different airlines or the different countries or the private airlines which are operating at international level, so that unreasonable competition should not result into a waste. So, the economics has to be dealt and ensure that the rights of contracting states are fully respected and that every contracting state has a fair opportunity to operate international airlines. So, that is again, another controlling and coordinating factor between the different member countries or the member airlines of this organization and avoid discrimination between contracting states. That is there should not be a bias as far as the movements are concerned in air and provision of facilities are concerned and use of those facilities is concerned. Promote safety of flight in international air navigation, promote generally the development of all aspects of international civil aeronautics. These are the aims and objectives of ICAO.

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And this organization has established some strategic objectives for a period, that is five year time period, 2005 to 2010 and they are as follows: safety to enhance global civil aviation safety, security - enhance global civil aviation security, environmental protection that is minimize the adverse effects of global civil aviation on the environment, efficiency so as to enhance the efficiency of aviation operations, continuity to maintain the continuity of aviation operations and the rule of law that is strengthen law governing international civil aviation.

So, these are the points to which it is giving more stress in this period which is going on, starting 2005 and ending 2010.

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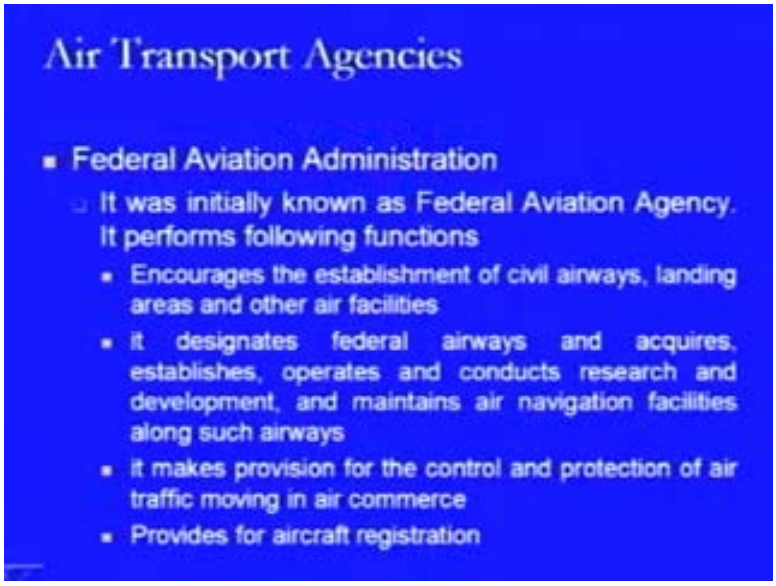

Then, coming to another important agency, which is working in the area of civil aviation, design, operation and maintenances, the federal aviation administration. This Federal Aviation Administration is a US body and it was initially known as the Federal Aviation Agency and there are number of functions which it is performing, like it encourages the establishment of civil airways, landing areas and other air facilities. It designates federal airways and acquires, establishes, operates and conducts research and development and maintains air navigation facilities along such airways.

So, it is completely involved in all of the processes which are required for the provision of facilities starting from its planning to its execution and implementation. So, it means whatever aspects are there, it tries to provide its guideline on all those aspects. It makes provision for the control and protection of air traffic moving in air commerce. That is obviously, wherever the aviation agencies are there they always look to control and protect the system and provides for aircraft registration that is the registration within the country that is US, not outside.

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Then, there are some more functions of this one, like it undertakes or supervise technical development work in the field of aeronautics and the development of aeronautical facilities. That is towards the other side of the air transport, it is not exactly the passenger air navigation, but it is talking about the aeronautic condition in terms of profiles and in terms of provision of facilities towards the space also. Then, it prescribes and enforces the civil air regulations for safety standards and includes the effectuation of safety standards, rules and regulations, the examination, inspection or rating of pilots and other flight personnel, aircraft engines, air navigation facilities, aircraft and air agencies again in US, issuance of various types of safety certificates again in US.

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Then, it also requires notice and issues and orders with respect to hazards to air commerce and it issues airport operating certificates to airports servicing air carriers. So, these are some of the things which are being done by FAA in US and there are many of its guidelines, which are being given in the area of learning, designing, maintenance and operation of facilities, they have been used by other agencies throughout the world, because most of the agencies are not having their R and D facilities available to them.

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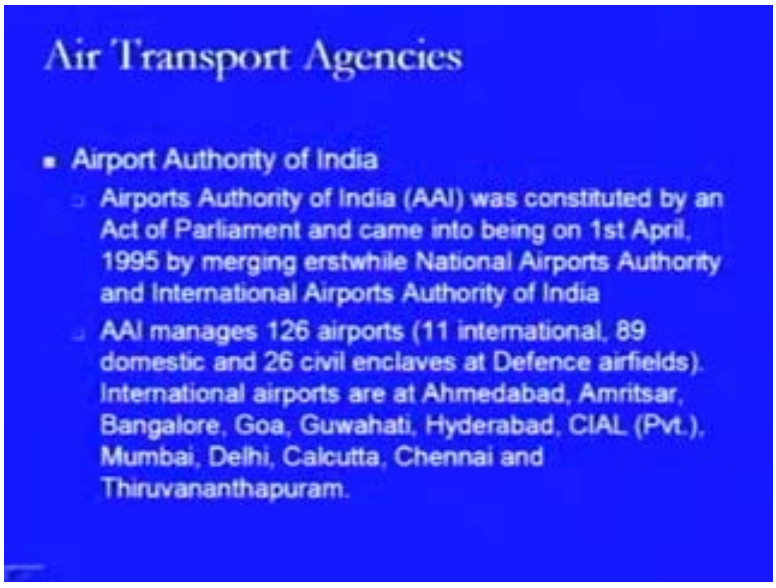

Now, in India, we have the Airport Authority of India and this Airport Authority of India is controlling the overall air navigation here and this Airport Authority of India was constituted by an act of parliament and it came into being on 1st April, 1995 and that was made possible by merging the two agencies which were working at that point of a time, at the national and international level, that was the National Airport Authority and International Airport Authority of India. Then, this AAI that is Airport Authority of India manages 126 airports in the country and out of these 126 airports, 11 are of international category that is they are providing the international flights, 89 are domestic and 26 are civil enclaves, which are basically the defence air fields, but can also be used for passenger traffic movements. The international airports are at Ahmedabad, Amristar, Bangalore, Goa, Guwahati, Hyderabad, CIAL(Pvt.), Mumbai, Delhi, Calcutta, Chennai and Thiruvananthapuram.

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Then, there are certain functions which AAI is looking at and they are the control and management of Indian air space extending beyond the territorial limits of the country as accepted by ICAO, means it is working in coordination with ICAO and it looks and controls and manages the overall airspace being provided to India. Then, design, development, operation and maintenance of International and Domestic airports and civil

enclaves, construction, modification and management of passenger terminals, development and management of cargo terminals at International and Domestic airports. So, these are some of the functions.

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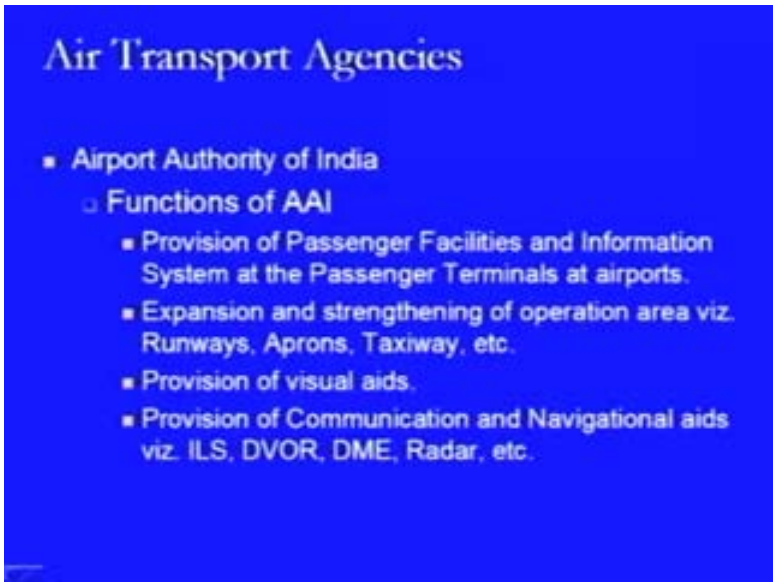

Continuing with that, there is a provision of passenger facility and information system at passenger terminals of airports, expansion and strengthening of operation area viz. runways, aprons, taxiway, etc., which are the features of the geometrics or the facilities to be provided on airports, the provision of visual aids for safe navigation of the aircrafts on the airports and the provision of communication and navigational aids viz. ILS, DVOR, Radar, etc., the various equipments, electronic gadgets, which army did for the safer, efficient movement again for aircrafts.

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Now, this is the symbol of Airport Authority of India - suraksha sahith seva.

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Now, we look at another airport agency in India that is Director General of Civil Aviation and this Director General of Civil Aviation is basically an attached office of Ministry of Civil Aviation and this is the regulating body in the field of civil aviation primarily dealing with safety issues. The headquarters are located in New Delhi, with regional

offices being provided in different parts of the country that is India. There are 14 regional airworthiness, 5 regional air safety offices, the Regional Research and Development Office that is RRDO and that is located at Bangalore and the gliding centre at Pune.

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Then, there are some of responsibilities and functions are there of the Director General of Civil Aviation, like it is statutory authority responsible for laying down standards and their implementation that covers airworthiness, safety and operation of aircraft, flight crew standards and training, air transport operations. Then, another thing is the licensing of flight crew, aircraft engineers and civil aerodromes, the certification of aircraft operators. Like some of the things which we can see is that they are synonymous of the functions or the responsibilities which we have seen in FAA.

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Then, further it has the responsibility of investigation into incidents and minor accidents, regulation and control of air transport operations, formulation of aviation legislation, research and development activities in the field of civil aviation, handling of matters relating to ICAO, advising to government on policy matters and supervision of training activities of flying or guiding clubs. So, these are different responsibilities and functions with which it is working.

Now, another agency which is providing the operational facilities in India, basically the previous agencies which we have seen, the two agencies like AAI and Director General of Control of Air Navigation in India, they are the administrative sort of agencies which are trying to provide the guidelines and controlling the overall system.

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Indian Airlines corporation, which is now named as Indian is the operational wing of the same and it came into being in 1953 with the enactment of Air Corporation Act and it is providing air transportation within the country as well as to some of the neighboring countries and it started after merging 8 private airlines, which were operating at that point of a time. At the time of nationalization, Indian Airlines inherited a fleet of 99 aircraft. So, that was, it started with 99 aircraft at that point of a time which came from the 8 private airlines. Between 1970 and 1982, Indian Airlines started inducting its first batch of wide bodied airbus and that was A320 aircraft. So, this A320 aircraft was inducted between 70 and 82.

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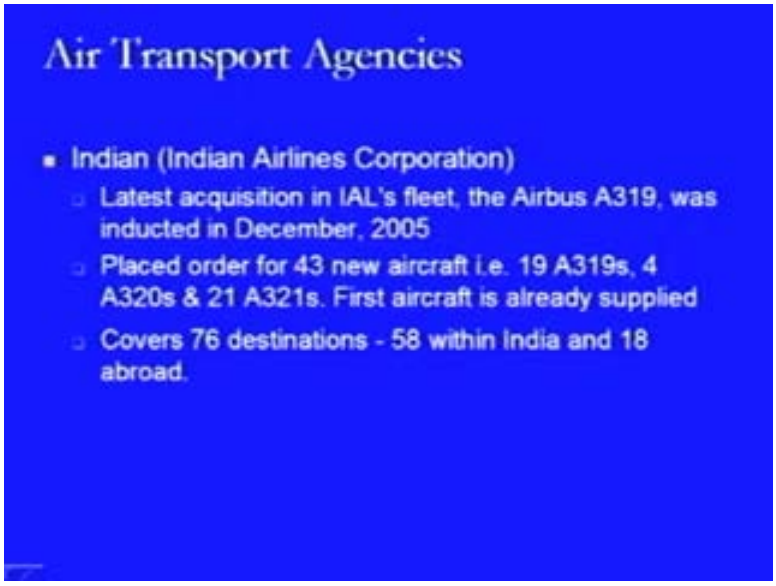

Then, its latest acquisition is airbus A319, which was inducted in December, 2005. This is another airbus, which they have purchased in this operating with Indian Airlines Corporation. It has also placed orders for 43 new aircrafts, out of which 19 are of category A319's, 4 are A320's and 21 are A321's. These are the numbers of the airbuses. A stands for airbus and if it is a B condition, then it stands for Boeing. Generally, Boeing's are having numbers like 7, something or so. The first aircraft is already supplied to Indian Airlines out of these. It covers 76 destinations, 58 within India and 18 abroad.

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This is the new design of Indian Airlines that is Indian and with the logo of the Sun and they have used the colour on the ….. also as well as these are the engines and these engines are also being coloured with the same logo has been provided on the tail.

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Now, another agency which is working in India is the Air India Corporation. This Air India Corporation came in with the formation of basically a private airline by Tata. That

was Tata Airlines founded by Tata sons limited. Then, in October 15, 1952, a light single-engine puss moth took off from Karachi on its flight to Mumbai that is Bombay via Ahmedabad. That was the first flight being made by the Tata airlines flight. Tata airlines was converted into a public limited company on July 29, 1946 and it was renamed as Air India. Air India International, which was registered on March 8, 1948, it inaugurated its international operations modestly with a weekly service from Mumbai to London via Cairo and Geneva on June 8, 1948. So, that was the first flight being provided.

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Then, the first Boeing 707 was received in February 1960 by Air India Corporation. The word international was dropped in 1962. It became an all-jet carrier, all jet carrier agency that is all the aircrafts which were available with Air India of jet category. Then, in 1970, Air India moved to its present Air India building at Nariman point. Then, arrival of the first Boeing was in 1971 that was 747-237B. 747 is the trade bench mark and 237 is the sub category within the 747. Formation of Hotel Corporation of India limited and Air India Charters Limited in 1971, so the Air India is also operating its own hotels that is known as the Hotel Corporation of India and then the 747 simulator was installed at Bombay in 1972, because there was arrival of Boeing 747 with respect to that the simulator was installed, so that the pilots can be given training on this one and that is how

they can operate 747 in India. Then, Air India's first hotel 'Centaur' was opened in Bombay in 1972 that was under Hotel Corporation of India Limited.

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Then, a real time computer system was installed in Bombay in 1979, again with respect to providing the pilots an atmosphere, an environment in which they can understand the complexities of air transportation. The New International Airport Terminal was opened in Bombay in 1980. Then, computerized passenger reservation system was introduced in Bombay in 1981. Then, Air India purchased three airbuses, A300-B4s in 1982. That was enhancing the capacity of the passenger load which was available with Air India at that time.

In the second phase, 6 A310-300s were ordered in 1985 for induction into the fleet by 1986. Then, Indira Gandhi International Terminal was opened at Delhi airport in 1986. Then, computerized departure system was installed at Bombay in 1986. Then, Boeing 707 was withdrawn from the services. That was the first Boeing which was purchased and which was made even by the Boeing company and that was the first jet plane which came to the services for Air India also. So, that was taken out of service in 1986.

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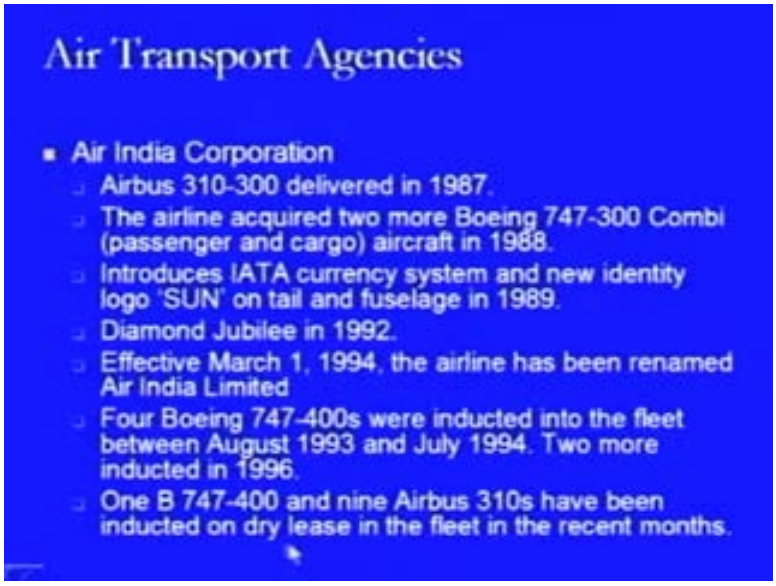

Then, the air bus 310-300 was delivered in 1987 by the airbus company. The airline acquired two more Boeing 747-300 Combi. Combi is the name which is given, because it can handle both the passengers and the cargo. So, if it is only mainly handling the passengers, then it is different category. If it is mainly handling the cargo, then it is different category and this was acquired in 1988. Then, it introduces IATA currency system and the new identity logo SUN on tail and fuselage in 1989. Then, there was diamond jubilee in 1992 and effective March 1, 1994 the airline has been renamed as Air India Limited. Then, 4 Boeing 747-400's were inducted into the fleet between August, 1993 and July, 94. Two more were inducted in 1996. That is how it is continuously increasing its traffic handling capacity and now, further there are B 747-400s and 9 airbuses that is 310s have been inducted on dry lease in the fleet in the recent months only.

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This is the logo of Air India Corporation, The Maharaja.

Now, we come to the classification of airports. The classification of airports has been given by the different agencies which are working in the area of providing the guidelines for planning, design, maintenance and operation of the facilities or the construction of the facilities.

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The main two organizations which are being working in this area are ICAO and FAA and therefore, the classification of other guidelines are coming from these two organizations only. Now, within these airport classification systems, the one way of classifying the airport is on the basis of take-off and landing. Take-off and landing means that aircraft is moving from the runway into the air and landing means it is coming from air and it is moving on the land now. So, on the basis of the distances being provided for taking off or for landing on the runway strip, we can classify the airports.

In this category, the conventional take-off and landing airports are there, where the runway length is more than 1500 meters. Then, there are reduced take-off and landing airports that is RTOL, this is CTOL in short; conventional take-off and landing that is CTO and L, whereas the reduced take-off and landing is RTOL and in this airport condition the runway length varies between 1000 and 1500 meters, whereas there is a STOL, that is short take-off and landing airport, where the runway length is 500 to 1000 meters and then there is a VTOL that is vertical take-off and landing airports where operational area is defined in terms of square meters and that is 25 to 50 square meters, generally used for the operation of helicopters.

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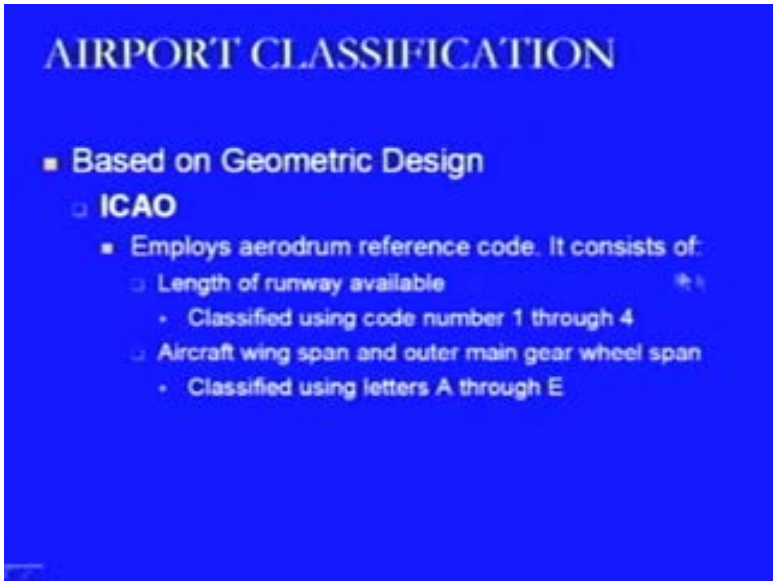

Then, based on geometric design, ICAO classification system if we take, then it employs aerodrome reference code and it consists of two things: one is the length of the runway available where it is classified using the code number ranging from 1 to 3, 4 and the aircraft wing span and outer main gear wheel span, these are other two characteristics which they use and based on these things it is being classified using letters A through E.

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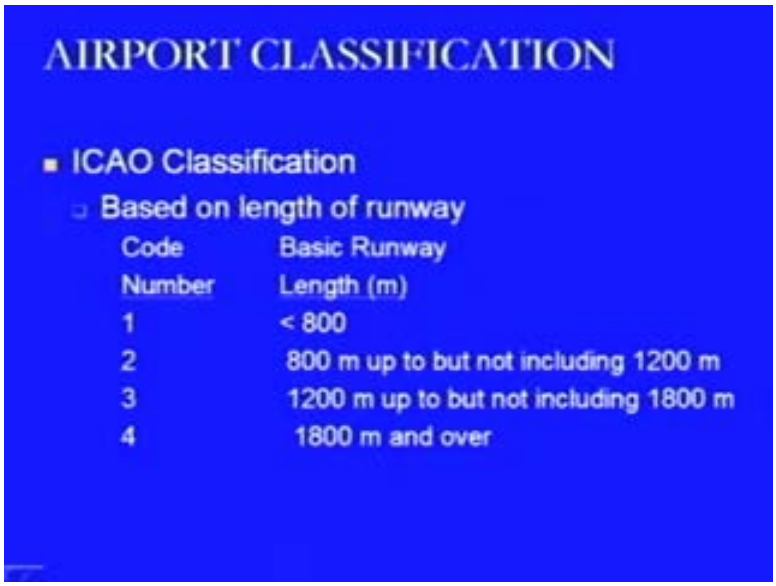

We look at based on the length of the runway, then we have the code number and basic runway length. The code number if it is 1, then the basic runway length is less than 800 meters. If it is 2, then it is 800 meters up to but not including 1200 meters. If it is 3, then it is 1200 meters up to but not including 1800 meters and the fourth category is 1800 meters and over. So, that is classification of airports on the basis of the length of runway being provided, on the basis of guidelines given by ICAO.

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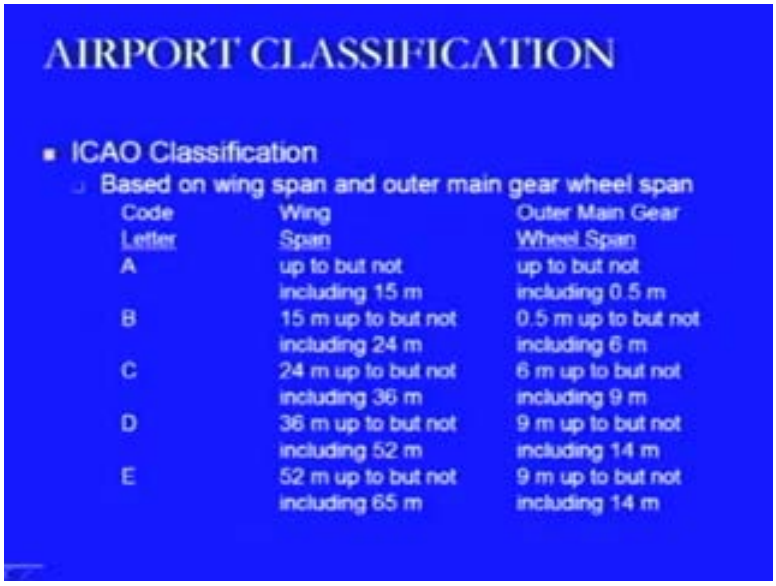

Then, further we have the classification on the basis of wing span and outer main gear wheel span and here we have again the code letters which are in the form of A B C D and we have the wing span and outer main gear wheel span. In the case of category A, it is up to but not including 15 meters, whereas wheel span is up to but not including 0.5 meters. Then, for B it is 15 meters up to but not including 24 meters and 0.5 meters up to but not including 6 meters in the case of outer main gear wheel span. Then, c is another category which is 24 meter up to but including 36 meters. That is what we see is that the span of the wing span keep on increasing like this and that is why we require that means we are talking about bigger aircraft and with respect to that we require higher runway length and here it is outer main gear wheel span is 6 meters up to but not including 9 meters and in case of D, it is 36 meters up to but not including 52 meters for the wing span and for gear span it is 9 meters up to but not including 14 meters. Then, the E category is there where it is 52 meters up to but not including 65 meters for the wing span and for the gear span it is 9 meters up to but not including 14 meters.

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Now, we come to another classification system of the airports which has been given by FAA that is the Federal Aviation Administration and here it is talking in terms of the aircraft approach speed which is generally given in knots and 1 knot is equivalent to 1.9 kilometer per hour speed. So, here if we take in that form, then the approach speed and approach category and the approach speed in knots, then category A is for less than 91 knots, category B is for 91 to 120 knots, category C is from 121 to 140 knots and category D is from 141 to 165 knots and category E is for 166 or greater knots. So, that is the one way of classification by FAA.

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Then, based on function also we can classify and we can classify the airports in terms of the civil aviation airports and within that civil aviation airports, again the classification can be on the basis of the type of the facilities or the type of the flights being provided that is whether they are, flights are being provided at the international level for providing the connectivity between the countries or the continents, then that is the international civil aviation or on the basis of the flights which have been provided within a country that is what is known as the domestic civil aviation. So, on the basis of function we can have international and domestic civil aviation airports. That means there are some airports which may be providing only the domestic flights, but then there can be other airports which are providing either the international flights only or a combination of international and domestic flights may be there depending whether they have that size by which we can segregate the two types of the flights within the same airport.

Then, there is another aviation that is military aviation which is related to the military or the strategic needs of protecting a country and providing the strategic weaponry terms of the striking area from where the aviation or our army can provide that …., by which they can defeat the enemy. So, that is the total dependent on the military aviation conditions, but then still whatever such types of airport are being provided there is always a

possibility that if required then the passenger flights can also be provided on those airports. Therefore, they may be of a military as well as a passenger conditions and slowly we have to come to this type of a scenario where the military airports will also be used for passenger airport. Still, there is an emergency at what time we can use them only for military purposes.

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Then, we come to the aerodromes being provided in India, the classification of all those aerodromes in India. In case of India, we have the international hubs. Hubs means the locations from where the connectivities to different directions are provided and in this category we include the airports which are currently classified as international airports and which are having the facilities of world class standards. At present, these would cover only some of the international airports out of the 11 international airports which are available or having ….. in India which we have already seen and they are Mumbai, Chennai, Calcutta and Thiruvananthapuram.

These are the four such airports which are providing the international flights, at the same time which can also be termed as international hubs, because they are mostly being used by the large number of airlines of the world and they also provide the connectivity from

one part of the world to another part of the world. So, that is what is the function of any hub. Then, further there can be regional hubs and in the case of regional hubs they have to act as operational bases for regional airlines and also they have all the facilities which are currently postulated for model airports including the capability to handle limited international traffic if it is required. So, that is the case of the step 2 condition within the aerodromes in India that is after international hubs we can have the regional hubs. So, what we can say is that some of the major airports plus the other airports which have been listed as international airports in India they are basically working as regional hubs providing connectivities to certain countries, not all the countries as such.

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Then, further we have another category that is the domestic airport category and in the case of domestic airport category, again we have further three categories by which we can divide all these domestic airports. What we found is that there are certain airports which have been defined as a model airport like they have been developed in that ways that they can be enumerated by the other airports which have been coming up in the neighboring areas or the regions. So, that is how they are being defined and some of the examples of this category are the airport being provided at Indore, Nagpur, Vadodara, Bhubaneshwar, Imphal, etc., whereas there are some more airports which are operational in nature in the

sense that any time they can be operated without waiting for some modifications to be done at that location. So, that is the category which is termed as operational airport. There is some personal being provided by AAI which are controlled by AAI or regional hubs. They are stationed there, they maintain the facilities and as and when it is required, then these airport strips or airports are made operational.

So, example in this category are like Udaipur, Kota, Kanpur, Cochin, etc., and the third category within the domestic airport is the non-operational category where the airports have been provided, but they are being in such a condition, so that they cannot be operated at any point of time in a sense, as soon as there is requirement we cannot directly operate an aircraft on that one. So, it requires some improvements in the form of upliftment, providing better facilities on runways, taxiways or aprons or may be in the controlling systems being provided at that location. The air strips which are available but which are not under operation, some of the examples for that are like Patna, Malda, Akola, Mysore, etc. So, these are the three categories within the domestic airports.

Another category is for custom airports. These are having the international tourist potential and therefore, they have to be slowly and slowly upgraded to that level. We have some examples in this case like the airport being provided at Jaipur, Calicut, Agra, Gaya, etc., they are all custom airports and they are the locations basically of having the tourist potential. That is why this is how they have been defined.

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Finally, we come to the other categories of aerodromes in India. They are the civil enclaves which are at defence airfields and again they may be operational and they may be non-operational in the sense that not many a times even by the defence personals the flights have been operated by those locations, but then they come under the control of the defence personals and they are termed as the defence airfields being provided within the country for protecting our boundaries or for protecting or providing the space, air space from where the strikes can be done without any chance or with a very small chance of being hit at the same time.

So, under the operational categories we have Bagdogra, Leh, etc., which are, which can be said that they are very near to the frontier boundaries where there are certain non-operational civil enclaves like Allahabad that comes under the defence category and that is being maintained as defence runway strip, but it is not operational in otherwise sense and then there are air force aerodromes which are totally under the control of Air Force of India and there are sorties being done by the fighter planes from these particular aerodromes and they are not allowing or basically the passenger movements are not allowed from these airports, looking at their safety and security concerns and strategic

values. So, that is another category of aerodromes which are there. So, that is how we have classified the airports.

So students, in this today's introductory lecture of airports air transports what we have seen is the development of air transport in the world as well as in India and then, we have looked at some of the important agencies which are working globally or which are working within our country, so as to control our navigation and provide the guidelines for their operations and finally we looked at the classification of the airports which are being given by the two primary or the prime agencies that is ICAO and FAA based on certain criteria and then, the way the aerodromes have been classified in our country that is India. That is where we will be stopping in this lecture and we will be continuing with other aspects of air transportation in the next lecture. Till then good bye and thank you.