Introduction to Aircraft Design
Prof. Rajkumar S. Pant
Department of Aerospace Engineering
Indian Institute of Technology - Bombay

Lecture – 13
Airliners

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Let us take a look at airliners now, the aircraft which are normally used by passengers like you and me for travelling long distances in flight. Even in airliners we can broadly define them into 3 categories; short range, medium range and long range.

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So, in the short range airliners, we normally start from about 1000 kilometers where the long range regions are ending and we go up to 6500 kilometers. Most of these aircraft operate with a cruise Mach number between 0.75 to 0.8 they fly at height of approximately 10 kilometers or 35000 feet above the Earth. Now in this particular category the popular aircraft that we see in India are the Airbus A 320 and the Boeing 737 as you can see in this particular picture.

So the aircraft which I show you together are the ones which are going to compete in the market also. You can see they look very similar, although one has come from the Airbus's table and the other from the Boeing's table, but it is very difficult just to make out just by looking at the aircraft which company has made it.

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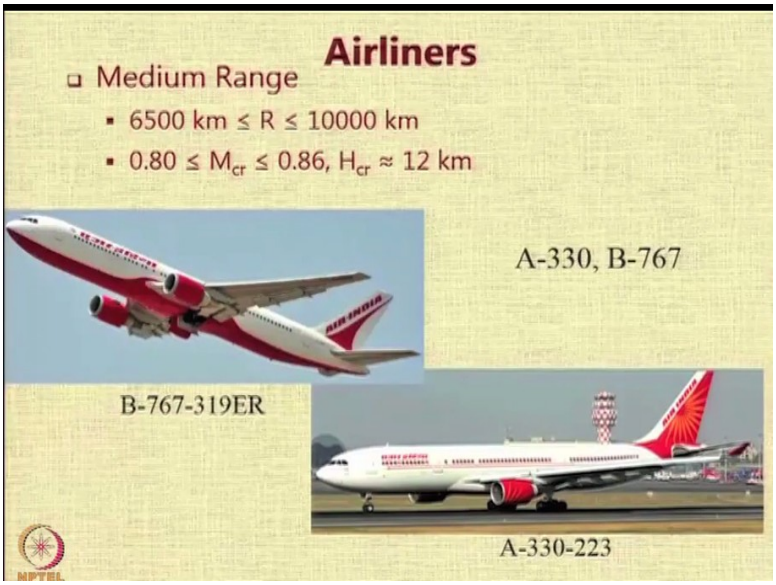

The next category is the medium range airliners which start at 6500 kilometers and goes up to 10000 kilometers. The cruise Mach number does not increase too much. It goes from approximately 0.80 to 0.86 and they may fly at a slightly higher altitude of around 12 kilometers. Obviously, the altitude that you fly is limited by the instruction from the air traffic controller okay.

So, you cannot just choose the altitude you fly, but the capability is built in the aircraft. In this category of medium range airliners, you see Boeing 767 and Airbus A-330 competing in the market and in this case the same airline is operating both aircraft types okay.

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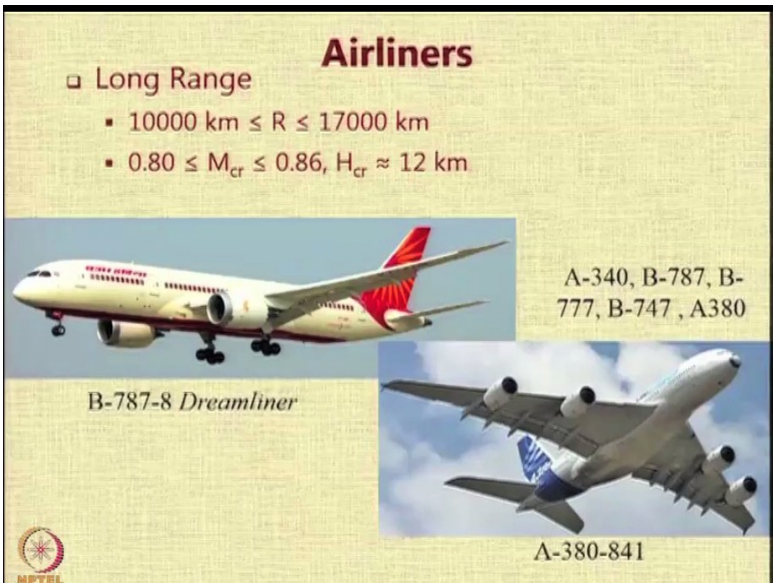

Then you have the category of long range airliners which go from around 10000 kilometers to 17000 kilometers. The Mach number range and the cruise altitude remains the same as the case of the medium range airliners. In this category, we see many aircraft and two of them which are directly head to head in the market are the Boeing 787 Dreamliner and the Airbus A-380 okay. So, this is how the airliners are divided.

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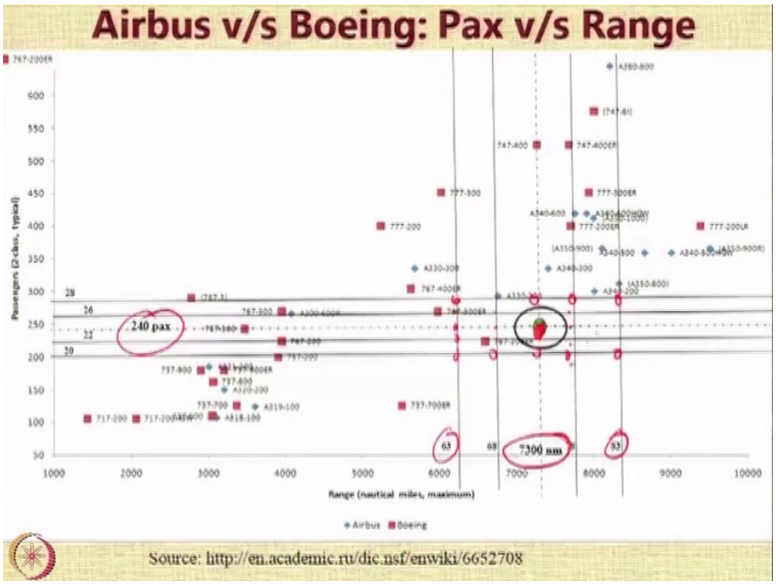

Alright, so when we look at airliners we have seen that the 2 companies Airbus and Boeing are competing head to head in the many sectors. In fact, in all the 3 categories which I showed you short range, medium range, long range airliners, we had at least one aircraft in the Airbus table competing with the Boeings table. This particular figure gives you a typical landscape of operation of these aircraft.

So you can see from around a 1000 kilometers nautical miles to around 10000, the aircraft that you see in the red square in this figure are from Boeings table and the aircraft that you see from blue rhombus are from the Airbus table and you notice that roughly everywhere there is going to be a competition. Let me show and you can see there are cluster as I showed you earlier. This is one cluster, this is another cluster and this is the third cluster.

They are the three cluster which I told you about and then you can notice that there are some gaps. Here is one gap, here is another gap, this is another gap, this is another gap. So new aircraft could actually be designed to fill these gaps okay, maybe there is a gap here also, maybe there is a gap here also, there is a gap here also, there is a gap here also, provided there is a requirement for aircraft to fill in that particular gap.

So, in the class room exercise one can always say okay design something in this particular box and that can become a theoretical problem, but there has to be a real-life requirement for an aircraft to travel 9000 kilometers, but only 250 passengers. Interestingly, a new aircraft that came in the market was the Boeing 787-8 which is marked here, and this aircraft with 7300 nautical miles and a capacity of 240.

Now in our exercise that we do in the future regarding the aircraft design calculation, we are going to do our evaluation based on this particular aircraft okay. So, I will try to get rid of all these voids and gaps which are there and I will just limit our attention to the basic aircraft. So this particular aircraft Boeing 787-8 for no specific reason is going to become our base line aircraft for analysis okay with 240 passengers and 7300 nautical miles range.

This will be the base line value and we will investigate variants which are 280 passengers, 260 passengers, 220 passengers and 20 passengers and we will also investigate the variants which are 6300 nautical miles to 8300 nautical miles. So, you can notice that the intersection of all of these lines they represent a matrix of you know aircraft requirements which could be addressed. Thanks for your attention. We will now move to the next section.