Introduction to Aircraft Design
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Lecture - 23
Podded Engines on Wings

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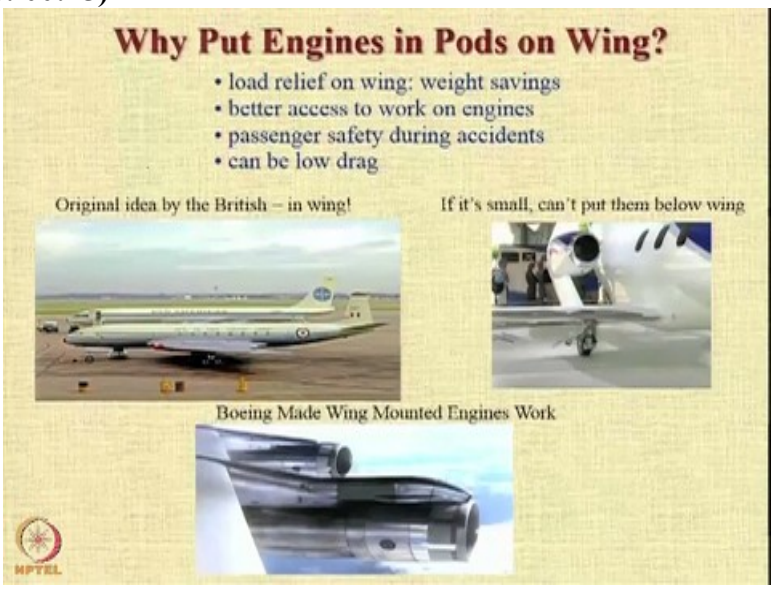

Why put engines in pods on the wing? The main reason for this is that by putting engines below the wings or on the wings, you lead to what is called as load relief on the wings. The aircraft wing is supposed to carry n times the total weight of the aircraft because the main lift producing devices the wing. The lifts produced by the fuselage could be a very small percentage maybe around 8 to 10% in some cases unless it is shaped in that form where it can become a lifting surface.

Generally a fuselage carries around 8 to 10% of the lift. So, the 90% of the lift is coming from the wings and you have to design the wing to take care of let us say 2 and a half times the weight because during certain flight operations or in maneuvers or because of the disturbances coming due to the gusts, the total vertical load might exceed their craft weight by a factor of 2-2.5. So, now, if you have to carry such a large amount of load on the wing or if the lift has to be generated by such a large value.

Anything that you hang below the wing is going to give you a relief because it is going to load the wing in a direction opposite to what it is normally loaded and this can lead to weight savings. Secondly, from the maintenance point of view, it is very easy to access the wings, to access the engines if they are mounted below the wings because then you do not need very large number of special devices or contraptions to reach out the wing.

If the wing is mounted on the vertical tail for example, then you need a huge crane every time you want to work on the wing. Putting engines on the pods in the wings also results in enhanced levels of passenger safety during accidents. In many cases, there are situations when there is a problem in the engine and you know the engine simply leaves or is shed by the aircraft. If the engine was mounted on the wing at the root or at some other part in the aircraft and any problem happens in the engine, then it will be very difficult for the structure to be isolated.

It has also been shown that by properly designing the pylons on which the Nacelles or the pods are mounted below the wing, you can actually go for a very low drag configuration. The original idea of putting the engine on the wing was by the Britishers when they put these engines in the root of the comet aircraft. However, very soon it was realized that this is a maintenance nightmare. Because for any issue, if the engine has to be removed and replaced, you literally had to rip the whole wing structure near the ring road junction.

And also because of the heat as the aircraft was operated, the wing was becoming very hot and there are many examples of very dark black colored marks on the root of the wing because of heating. If the engine is small and if you have a low wing configuration, if you suspend the engine below the wing there going to lead to a problem of the clearance. So there is at least one example, a recent example of an aircraft called Honda jet H420, in which the designers have decided to put the engine over the wing on a nacelle.

But generally we can credit the Boeing aircraft company to perfect the design of suspending the engines below the wings in the pods through attached to the wing using what are called as pylons. And they are the ones who made the wing mounted engines work. The first example of this was Boeing 707. And after that almost every transport aircraft, subsonic civil airliner they go

for engines mounted below the wings. Thanks for your attention. We will now move to the next section.