Introduction to Aircraft Design
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Lecture - 25
Canards and Flying Wing

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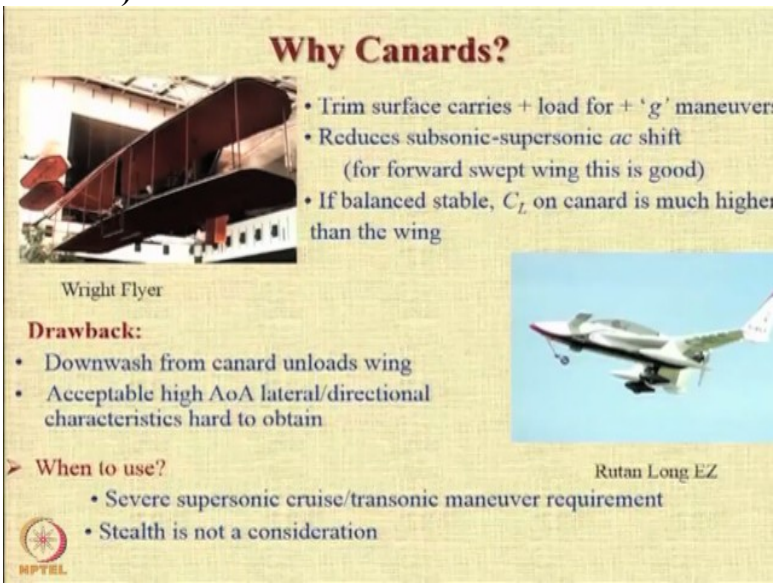

Another feature that we would like to understand is a canard, a canard is basically a tail mounted ahead of the aircraft rather than a conventional tail mounted behind. One of the advantages of providing a canard is that the trim surface or the canard carries a positive load for positive g maneuvers and that helps in reducing the load that the wing has to carry. Secondly a canard reduces the subsonic supersonic aerodynamic centre shift.

We all know that the aerodynamic centre shifts from around a quarter chord location for subsonic flight to approximately 0.5 chord location in supersonic flight. This causes a huge stability issue and if you have a forward swept wing, then by putting a canard this particular subsonic supersonic aerodynamic centre shift is minimized and if you make it if you design it properly, then C L on the canard can be much higher than on the wing and that is very much beneficial.

But there is an always a drawback one drawback is that your primary lifting surface which is the wing is now going to be in a downwash or a disturbed flow from the canard and with the canard it is not easy to obtain high angle of attack and lateral directional characteristics. So, the question is when do we use canards, canards are recommended when you have a severe

supersonic cruise or transonic maneuver requirement and also is not a consideration because the canard in the front is going to reflect immediately and it is going to reduce the stealth characteristics of the aircraft.

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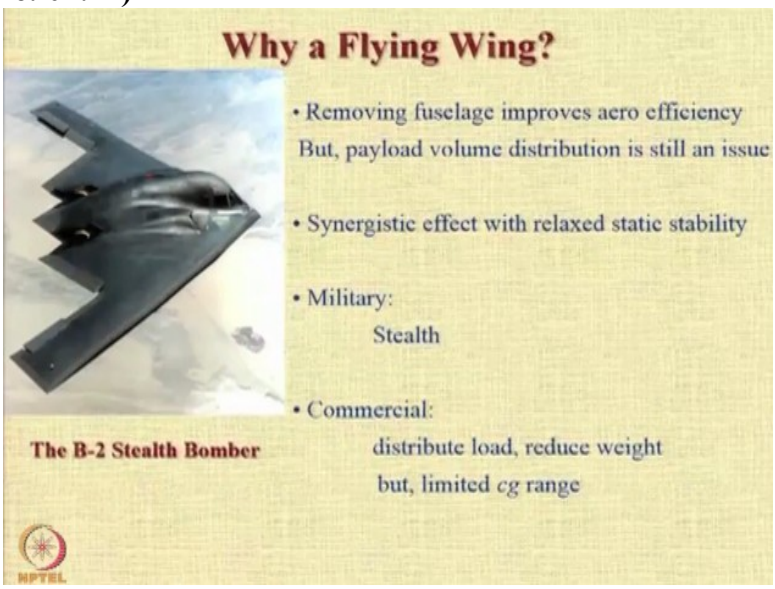

Then, there is a question that many people want to know is why we have something like a flying wing where there is no fuselage or there is no distinctive fuselage as can be seen in the photograph of this B 2 stealth bomber the spirit aircraft. But flying wing concept is not a new concept. Actually, Northrop has been trying to advocate use of flying wings since many, many years. Let us look at us historic film about a flying wing configuration.

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Germany is a machine of color it did not affect a pair of rigid wings or to turn it off another famous machine 500,000 pounds if necessary, is being tested for stability. A striking picture of the machine in flight before the fuselage landing on a single wheel completes a successful experiment.

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So, it is not a new concept as many people think, by removing the fuselage, you improve the aerodynamic efficiency. However, distribution of the payload volume is still a problem, because you will have a bulbous thing a bulbous area in the centre where you need to distribute the payload. But if you are providing a relaxed static stability, then this configuration gives you a synergistic effect in military aircraft.

A flying wing gives us stealth and that is the principle the reason why the B 2 bomber has a flying wing configuration in commercial aircraft a flying wing allows us to distribute the load

all over the structure and that can lead to reduced weight. However, the centre of gravity range is a huge compromise and that can be a real problem. Thanks for your attention we will now move to the next section.