Introduction to Flight
Department of Aerospace Engineering
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Aircraft Component Nomenclature: Fuselage and its Components
Lecture No. 02.2

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Alright this is the fuselage or the body and the various parts that are attached to it. Notice here the front of the fuselage you can see this yellow colored, what do you think that is? What would that be or what is it called? I am talking about this part, this part in the front so this is something that you have to now figure out and tell me what it is, what do you call that part this yellow colour part on the front of the fuselage.

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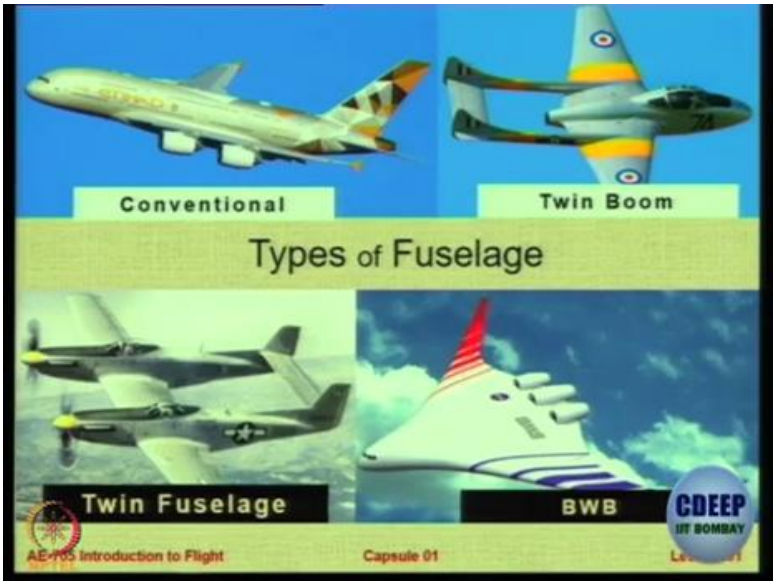

Let us look at types of fuselage this is a single fuse large type but can you identify the aircraft A 380 why A 380? How you so sure?

But even 747 is double decker and four engines.

So you should have said that first full cabin length double decker transport aircraft with four engines, no need to say four engines. there is no other aircraft even with 0 engines there is no aircraft available today which is double decker from length to the tail, nose to the tail okay.

So this is a conventional fuselage, this one is a twin boom. Now, we will not go into the details right now, this is twin fuselage not twin boom there are two fuselages and notice there are two cock pits, so who is the boss do you think there are two engine.

So are these two aircrafts welded together to save money? Think about it and then this is only fuselage, no fuselage sorry only wing this is called as a blended wing body BWB. This is the shape of the aircraft of the future. What is expected is that in future the aircraft would be like that okay, so these are type of fuselages.

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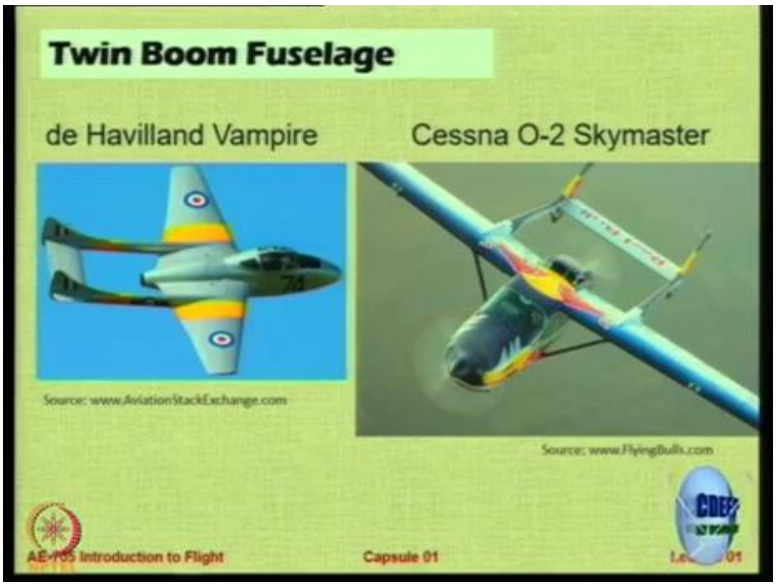

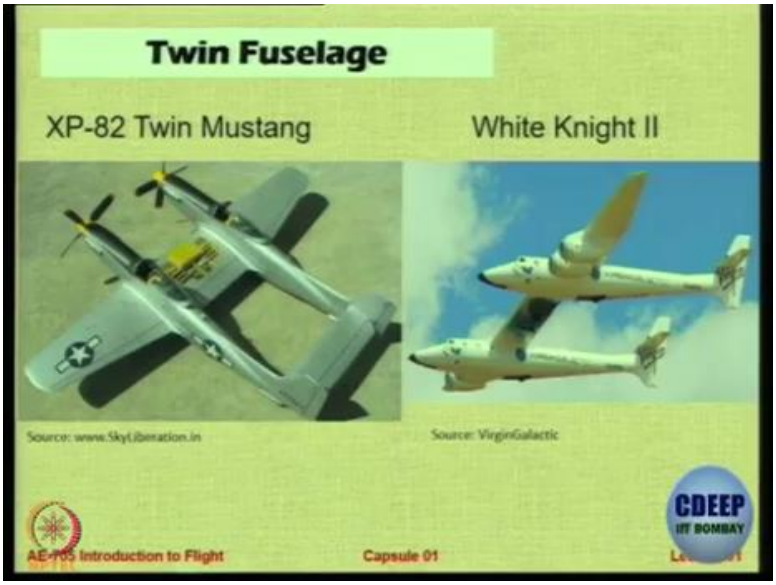

Let us focus on twin boom fuselage, that was a vampire aircraft Cessna Skymaster and many many UAVs are like that available this is the twin mustang and white knight. White knight is very famous, what does it carry?

Not the space shuttle, it carries something like a space shuttle, it carries a small aircraft that can be used to give you a experience of near space flight it is a carrier for a another aircraft, what is it called? Come on you should know this, this is simple general knowledge. I do not want to tell you, look at the website of virgin galactic and you will get the answer there.

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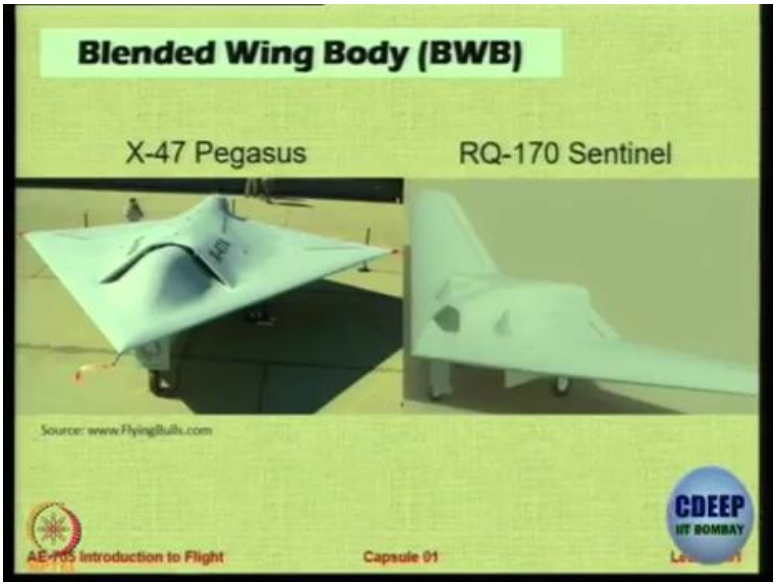

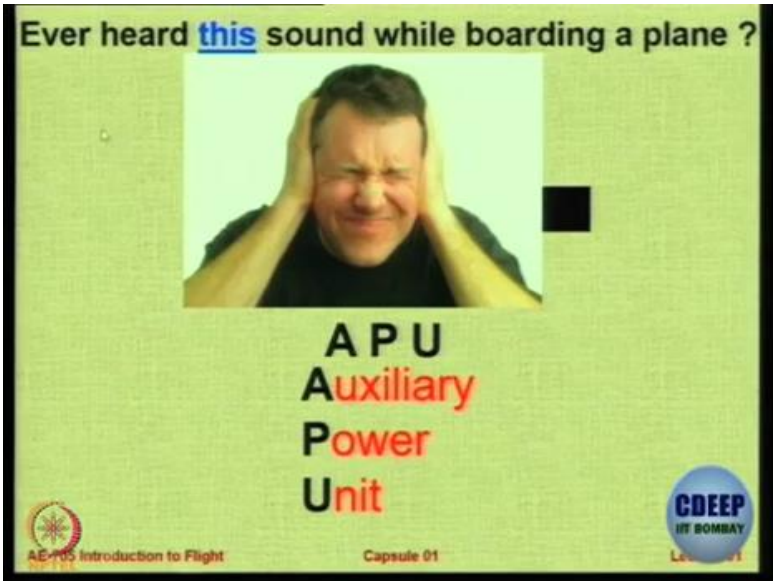

It is designed by Burt Rutan, this is a UAV Pegasus X-47 this is also UAV. Now what is meant by this APU? Auxiliary power unit.

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So this is the location right on the back on the tail, on the rear part of the fuselage this is where you normally see an APU. In some cases you can clearly see the exhaust pipe of an APU. So APU basically the small engine, separate engine.

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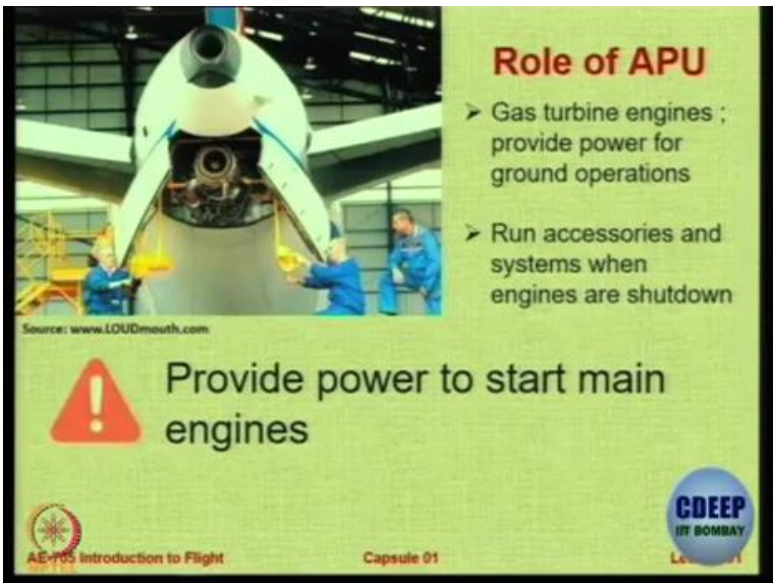

And you can see now the APU has been opened up so it is a gas turbine engine that provides power for ground operations it runs accessories and the system when the engines are shut down and it also provides the power to start the main engine. Without APU you to start the engines you will need external power that means you have to depend upon the airports for providing that much power. So APU is a small starter for the main engine.

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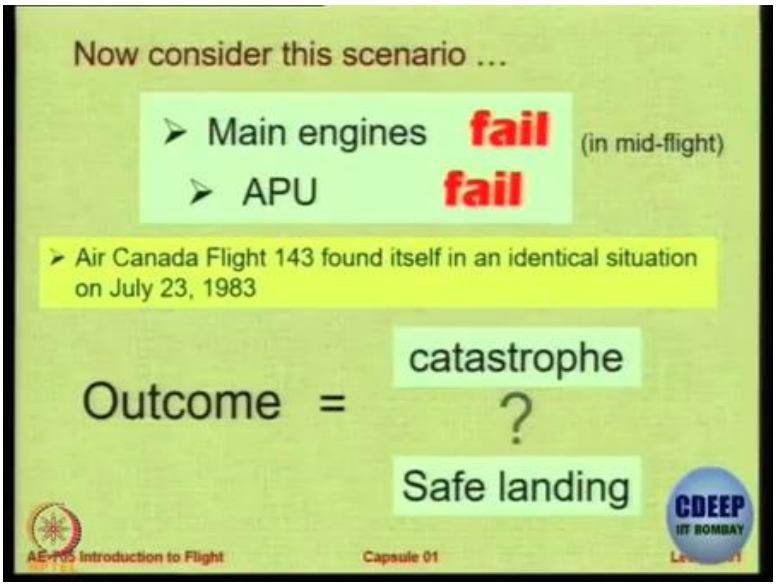

Now let us look at one scenario yeah.

On the sides of the fuselage there are small loobs which allows the air to be sucked so it is not a jet engine it is a turbo prop engine so therefore it just needs some air so there is an intake manifold normally on the sides good, any other question?

So let us look at this scenario during flight the two engines or four engines all have failed then the APU should help you out, APU also has failed. Can it happen? Can happen okay, this happened in a flight called air Canada, complete loss of power so what does a pilot do in this case? Yes, what do you think?

So there can be catastrophe and safe landing.

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So we have RAT okay this is the aircraft which landed safely so this is what aircraft carry with them they carry an animal which will provide power. No, RAT is a ram air turbine, it is a small turbine that comes down below when needed and it creates, it gives the required, it gives the required power.

So I have lost all the power and I do not have a rat with me okay. So it generates power from the ram pressure of air stream, this small fan which is mounted below this fan will start rotating, when it picks up some minimum speed it will start generating power.

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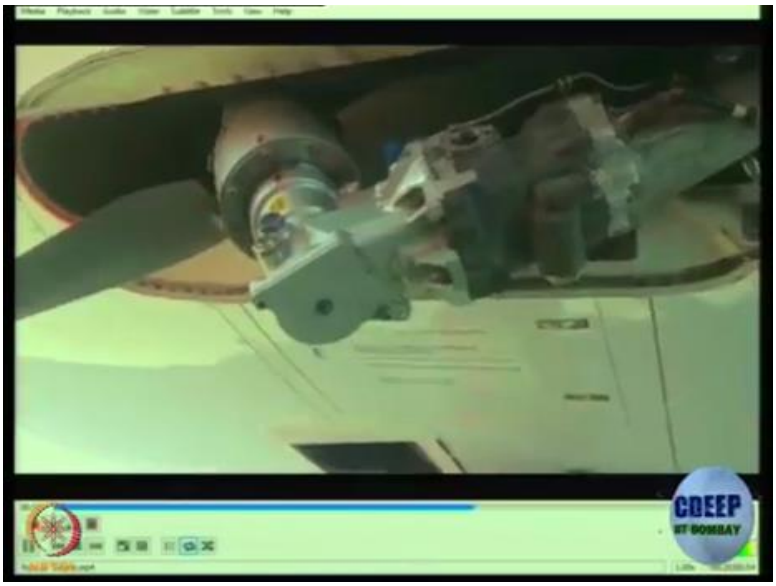
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And the usual location of rat, this is where the rat is, you will see this is how it comes out and starts rotating and, this is for the ground for maintenance purposes. This is how it goes back inside.

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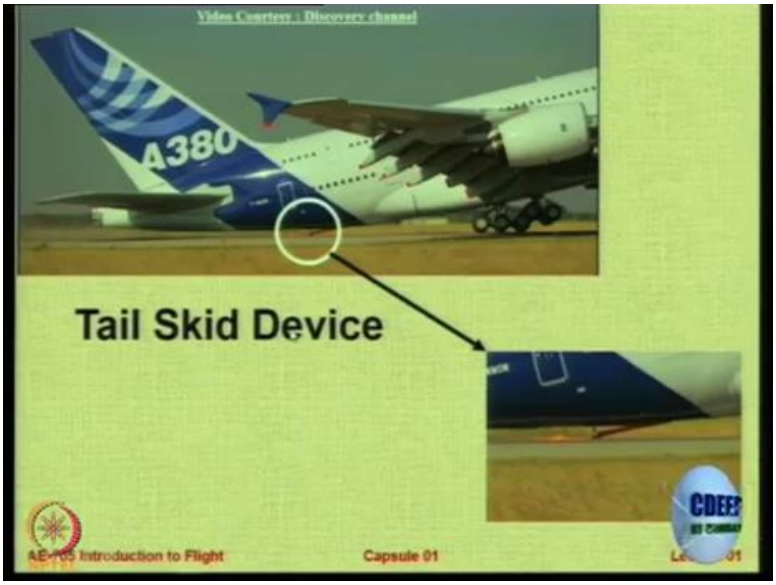

Alright so we also have something called as a tail skid, it is there, yes. Ram air turbine yes. So ram air turbine is only able to give a small amount of power which can only run the main functional components it cannot run everything so it will run only one hydraulic system which is required for safe landing it will not run air-conditioning unlike APU it will not run other passenger entertainment systems, movies, etcetera may not run. So it is a small turbine for emergency for just the minimum power.

Student: Ram may increase the drag

But what is the option everything else has stopped working, now I need something that works like a windmill purely on the function of the ambient speed of the aircraft and I wanted to be completely independent it should not be connected to anything.

So the ram is lowered by the pilot manually there is a ram deployment lever, it is not deployed hydraulically because you can assume there is no hydraulic oil or no pressure available. So sometimes there is a small wheel or there is a jack or a kind of a lever. So they want a system which is completely self-sufficient, which can bring the aircraft down safely in emergency.

Student: Sir, what exactly it will it power the control.

Yes, it will power one of, see an aircraft normally has three hydraulic systems, we call them as yellow, blue, green. So it will power one of the control systems which will be connected to the primary flight surfaces so it may move only one radar only one inboard aileron okay.

May only move some flaps so it will be used to power only the minimum thing required for a for a safe landing so therefore the power requirements are also limited, all the emergency systems that you need landing gear extensions it will be powered by ram otherwise everything is be fine but you cannot come down, sometimes it is does not work also, sometimes it does not give enough power those things also happen but they wanted to have a system so that in case there is a situation, then we have something okay so tail skid is a very interesting device obviously you can see that tail skid is essentially trying to, what is it doing?

Avoiding the rubbing of the fuselage on the ground and very costly repairs for which the aircraft have to be ship to the manufacturer. So what you do is you have a disposable kind of a skid it rubs but why is it needed? Why will an aircraft go at an angle such a large that the fuselage will hit the ground, when can it happen?

Yes, loudly please. That means in a large aircraft routinely there is a tail skid which gets burnt away.

If I say that it is used mainly in landing then? Yes you what you said is not wrong it is correct, but that is not the main driver, yes loudly please.

Okay, some kind of disturbance, so this is not something that you desire to happen okay it is like a safety device. When it happens?

Here is trial a trial flight

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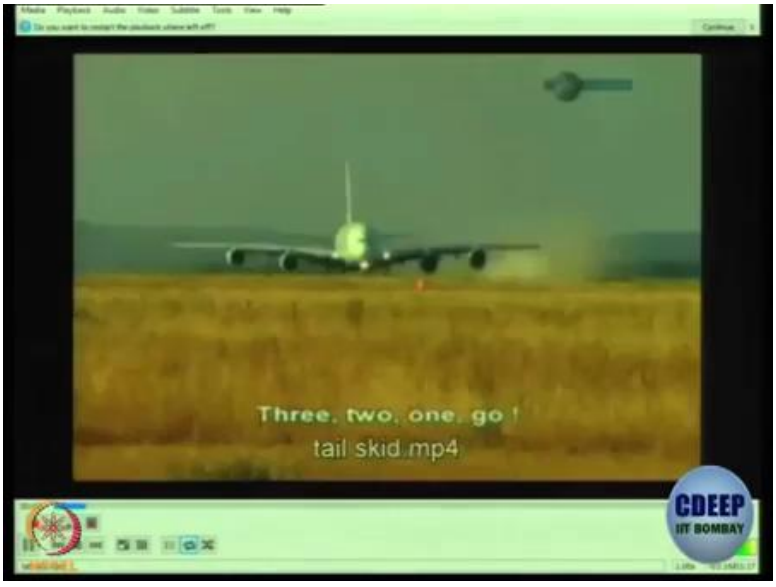


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100 knots
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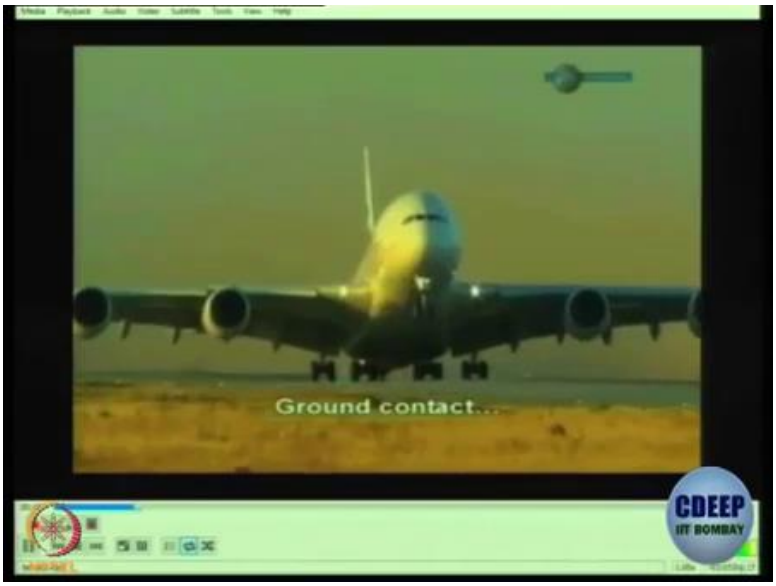
Ground contact...
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Liftoff.


We're climbing. It's perfect.
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We scraped quite a long time.
Yeah, a very long time.
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I'm afraid we scraped further back.
Further back?
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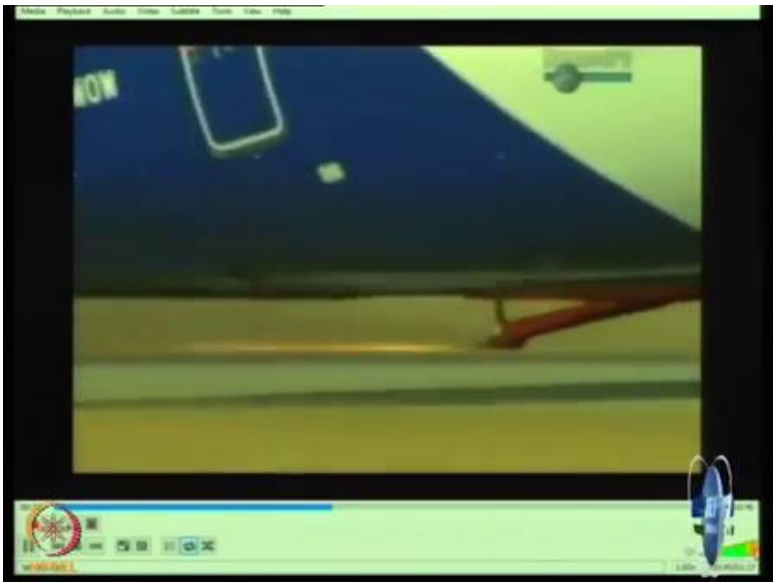


We're climbing. It's perfect.
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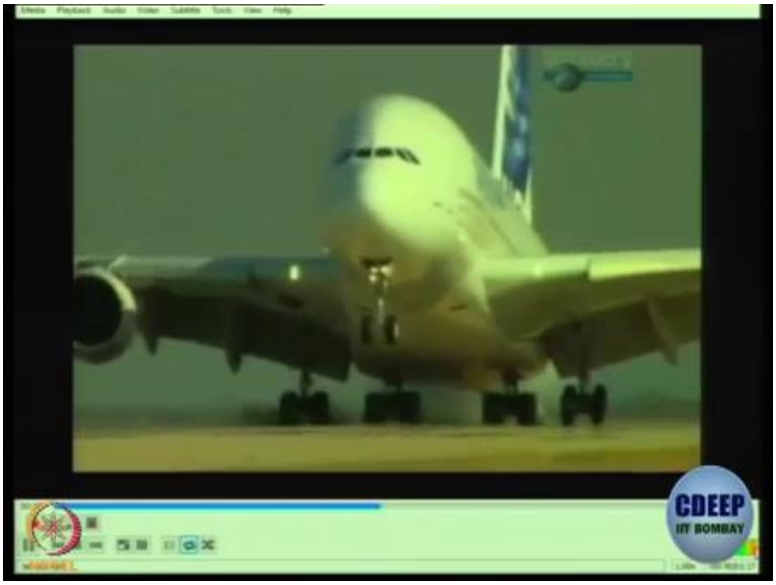
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Discovery


Discovery
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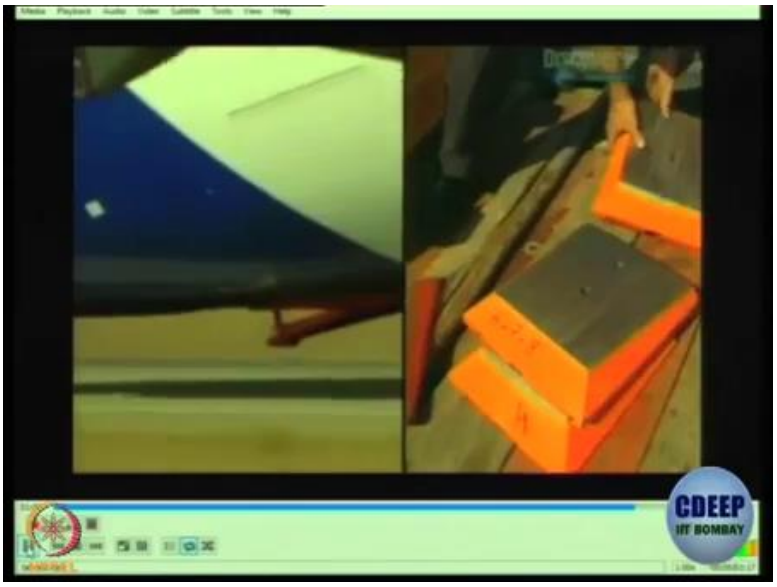
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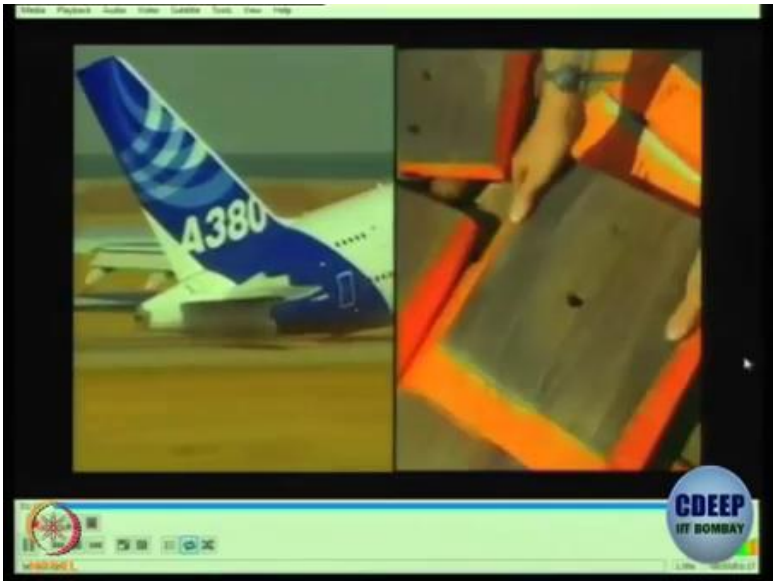

You can see it starts hitting.

Video: The second run appears to be a success but with time pressing the ground crew races to the aircraft to discover the despite of more control takeoff the shredded skid will be replacing once more. Unfortunately there is a limited number of the specially engineered skids available. So the crew know that they could only.

So this is the tail skid which has got this portion which can be burn away and replaced but as you saw in this test, even the rear fuselage end scrapped little bit and because of that they have to now change the skin, change the skin on the bottom.

Video: to use one skid for every two rounds from this point on even the slightest air could but the entire campaign on standby

This is that skid which burns away yeah.

Small, and that wheel will break and go inside the fuselage because of the high impact so they have decided that the best way to overcome a very bad situation even with the skid you saw that the rear was slightly damaged but imagine if there was no skid, then the whole of the rear fuse large conical would have had to be changed.

No no, the skid contains material which will wear away without damaging the runway so the it uses cork or some other such material it is a very interesting thing, in fact it is one of the challenging materials to be used. What is the material is to be used so that the aircraft is protected but runway is not damaged? So it is a very interesting material and lot of research is done in designing or identifying the suitable material for the tail skid device.

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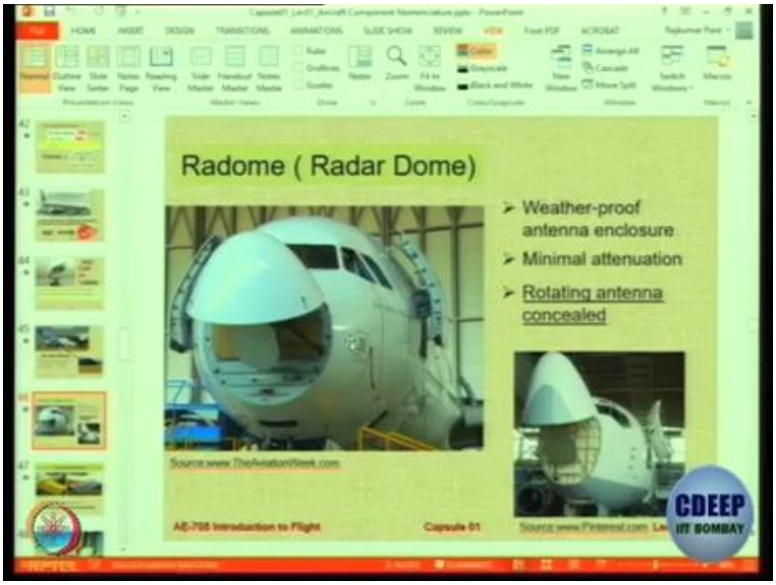

Let us look at the Radome, Radome is basically a cover it is like a nacelle again there is a radar inside the aircraft you put a cover over it. It is called as a Radome and it has an antenna.

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You can see the Radome covers this antenna. This antenna is for which radar? What kind of radar is this?

Yes, no it is not Omni because it is not going behind it is only going 180°. It is a weather radar, this is a transport aircraft, they do not have to hit any targets or drop any passengers from there. They are basically going to scan the weather ahead of them so therefore it has to move 180° and if you do not have the cover you know what will happen so just to cover it up you have this Radome.

Hence, the material in the Radome has to be radar transparent, so one of the first modification that was done by us in India was to when we worked on the Dornier 228 in Kanpur was to build the Radome in India, a very expensive Radome was use to come from Germany so a small composite laboratory was set up. Radome is a non-load carrying body except for the loads which come in the front okay it does have aerodynamic loading but it is not impact load or something

So we were able to do it and we were able to save a huge amount of foreign exchange instead of buying it from the Germans every time, now we make our own Radome and after that we began supplying Radome to other countries and other places also.

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Okay these are the stabilizers. Stabilizers basically are moving surfaces either partially moving or fully moving on the rear of the aircraft which allows it for the longitudinal balance, this is the longitudinal axis so to avoid uncontrolled pitch we have stabilizers.

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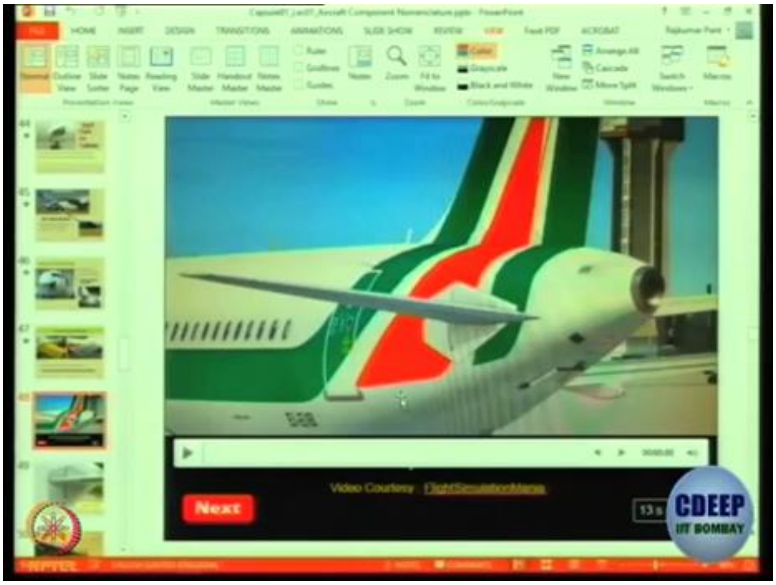

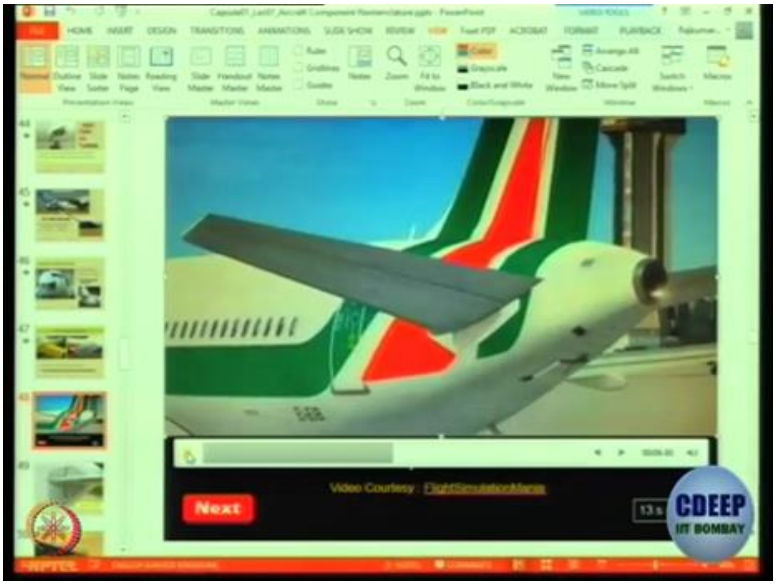

Now let us see also a small film on Trimmable Stabilizers. You can see here, you can actually adjust the whole surface to provide the required moments. So this is not moving in the air during flight. During flight only the rear portion moves. This is adjustment of the whole thing on the ground before the flight, adjust and lock, so that you get a constant moment to balance it. Yeah.