Lighter-Than-Air Systems
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Lecture - 68
Ground Handling of Airships

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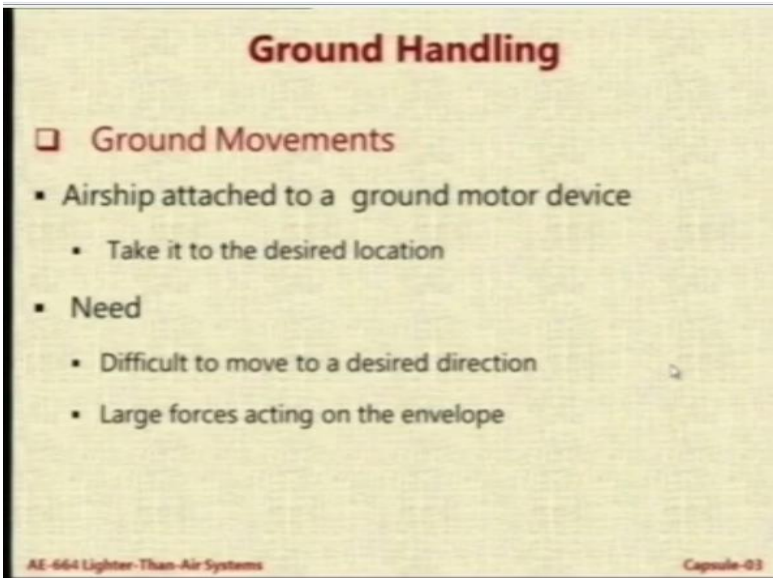

Now, ground handling basically is important because of ground movements. So, what you do is you attach the airships to some device which can allow it to move forward. It could be by hand for small airship or it could be by some kind of a vehicle if it is not manageable by hand. The need is because it is not so easy even if you have to move a small airship from let us say our department to Gymkhana ground and the airship is already inflated. It is not easy to move it.

First of all where do you hold it? And how do you ensure that while pulling it you do not tear the envelope? So, it is not an easy task. And the forces acting on the envelope are extremely large because of the large size which is almost giving us a projection to the side flow.

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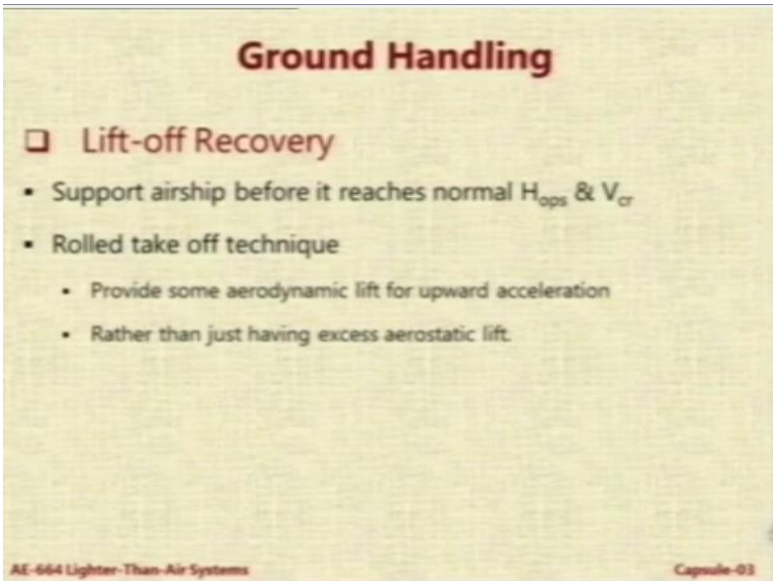

So, one important aspect of ground handling is what is lift-off recovery. So, what you do is you support the airship before it reaches the normal operating altitude and the cruising speed. So till the time you have to support the airship. So, one way of doing it is called as a rolled takeoff technique, which is like an aircraft. So, instead of releasing the airship you can allow it to take off like an aircraft.

So, it will have a rolled takeoff and then it will build up. So, what will happen is because of the huge aerodynamic body if you move against the wind at some speed, you will get aerodynamic lift that aerodynamic lift will overcome static heaviness. And when it overcomes that heaviness, you will be able to leave the ground. So a short distance of maybe 100, 200, 300 feet the airship can take off.

Rather than providing it aerostatic lift extra or by always having to swivel the engine which is also one way of takeoff and we saw that film where the Zeppelin NT able to take on vertically by tilting the engines.

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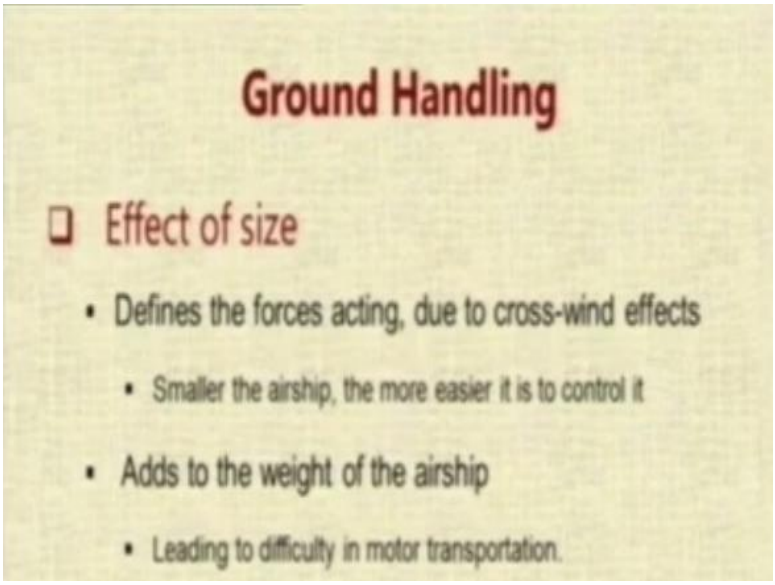

Now effect of size. Size definitely affects a lot and if it is smaller it is easier to operate it and it adds to the weight of the ship because of that it is very difficult to move it around. Now let us see another video. This will tell you how many people are needed on the ground.

(Video Starts: 02:50) This is Hindenburg airship LZ 129. You can see now the airship is slowly up, Look at the grass blades which are moving, you will get an idea about the wind. So it is not still condition. It is a little bit windy you can see the grass blades are moving. And here is the airship there it comes. Try and count the number of people in the ground. This is nothing, there are still, this is not the complete here. There you go. This is all one side, on one side on one hook. Then we have on the nose because it has to be brought and attached to the mast. There you go. This is a huge mast.

On that mast there are people who are attaching the airship to the mast slowly. So, they are virtually pulling the airship and you see there is a big drum on which it is being attached. And this person with a megaphone is talking to people on the ground. This is the communication at that time. He is telling them do this, do that, move that, move forward. **(Video Ends: 04:23)** So this is what were needed in the past.

I would like to now show you what is needed today. And for that I will again repeat that video which I had shown last time.

(Video Starts: 04:38) Now you can count the number of people on the ground. Maybe just one single mast man and 3 people. This is what Zepplin NT claims. Ground handling by only 3 people on the ground. Because here there are two engines on the side.

And there is one the back not visible that is used to provide the required forces employing so many people at every location where he will takeoff and land is a very expensive proposition and that can increase the cost by a large amount. So, that is why one of the contributions of Zeppelin NT design is to make the airship completely free of ground handling by so many people, only 3 people are needed on the ground. **(Video Ends: 05:48).**

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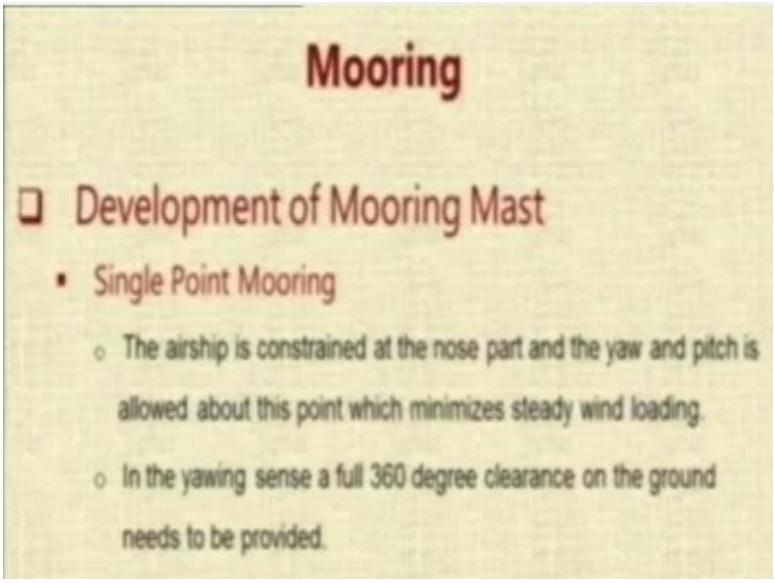

So, the mooring mast there are many types. One could be called as a single point mooring. This is what you saw in the previous video. The airship is moored at just one point at the nose attached to the mast. The mast is supposed to withstand all the loads coming on the airship in all directions and the airship simply aligns with the wind when attached to the mast. So, there is a 360 degree freedom in yawing. But in roll there is a limitation and roll forces are not expected too much on the airship.

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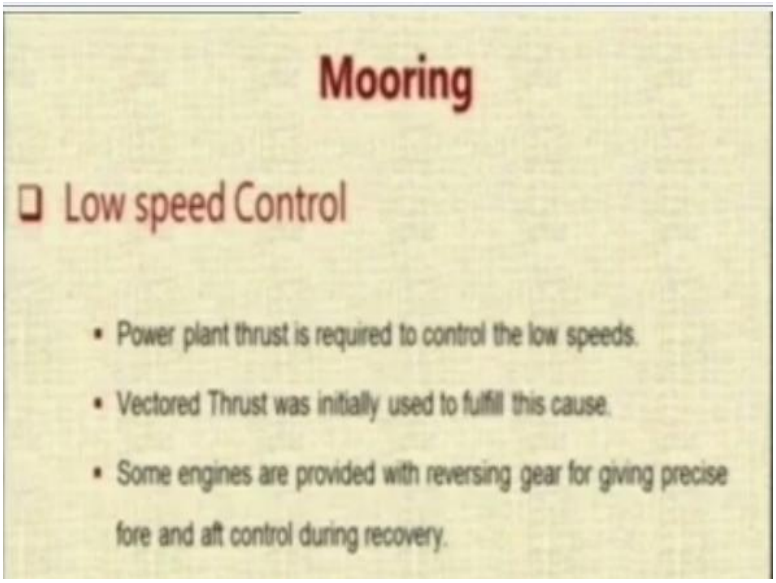

Now for low speed control, we normally use power plant thrust. So the force of the power plant can be used to provide this low speed. Initially, people suggested using vectored thrust. The vectored thrust is very expensive to provide because then you have to go for very special kind of mechanisms onto the engine. It increases the cost and the complexity of the engines.

But if you can achieve it such as Zeppelin NT, it can really be used to get rid of many people needed on the ground. And some of the engines can also give you reverse force. So, you can actually tilt it and leave it. So, the thrust vector can be vectored from 0 degree which is forward to 90 degrees downwards to 120 degrees and in that case it will move back. So, it can be used to give forces in all forward and backward direction.

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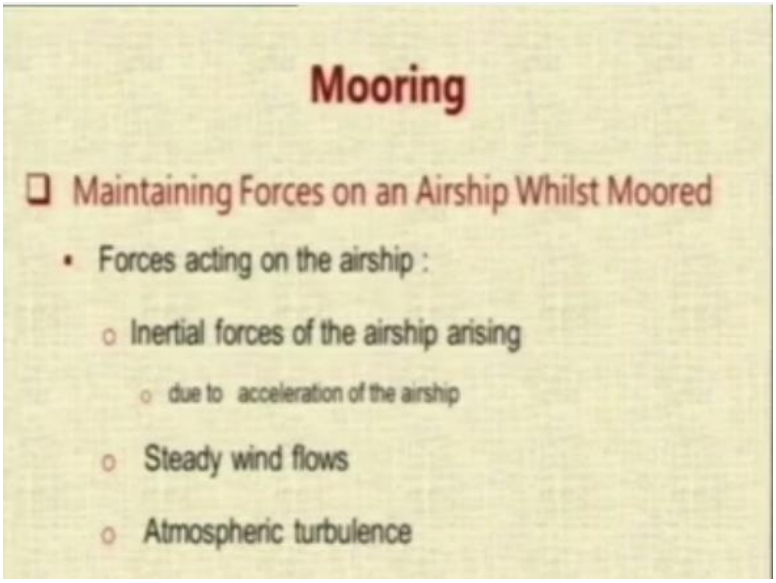

Now, to maintain the forces acting on the airship during the moored condition, you have to understand first of all what are the causes of these forces. First is of course the inertial force of the airship which is coming because of the airship itself. And then you have steady wind flow, so that will create a drag force. And then we have turbulence which keeps disturbing it.

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So, this is a paper which came up in 1997 about a new airship ground handling system, which they say really works. And this has come from a company called TCOM which is one of the most ancient companies in the world which makes tethered aerostat systems, really large systems. So, TCOM LP is a very good company in the US making aerostats and there is this company called Zeppelin NT which makes airships in Germany.