Lighter-Than-Air Systems
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Lecture – 102
Technological Challenges in HALE Platforms Development – Part II

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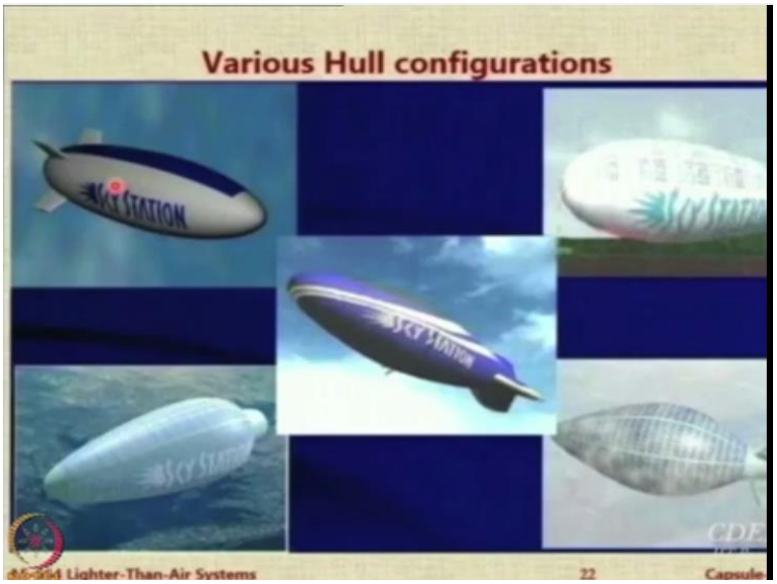

Now, whenever we go to the design the output will change according to the requirement because user will give basically user requirement in two modes. What are the power requirements for the systems and what is the payload he used to take. So, depending upon the power requirement and payload requirement, the shape will change. If power requirement is more important or big power requirement related to the payload we will design airship in such a way that it gives a maximum power.

Because profile of the airship systems the power availability due to that same area will be different. Are you getting my point? Because the angle and orientation of the normal of the solar cells will vary with the profile and that will affect output. So, it will depend upon what is more important, you have to trade off between. And if you have to consider only payload then you do not have to bother about the solar systems like in normal airship.

But we have to take care of the power input as well and that will drive the shape to take care of these effects simultaneously. These are big problems actually.

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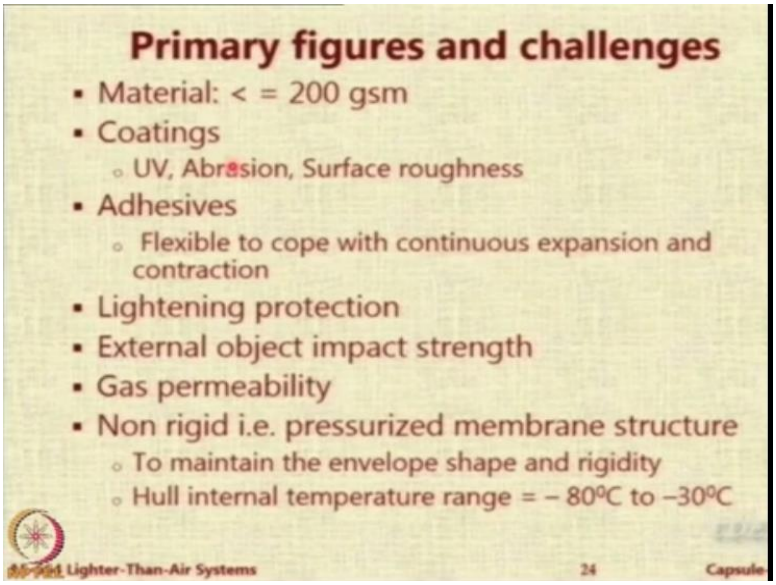

So, while designing you have to. There are so many research going on to minimize the structural weight because the structural weight is driven by the envelope gsm. And 50% of the system's weight is due to its envelope's structure. So, we we want to use a very low weight density of the material which can perform same strength as a big one that is the challenge.

And another challenge is it should be at the end of the course we are much aware that UV protection should be there. And adhesive to manufacture that envelope. Lightning protection as I said. External object impact strength. something hit the airship and it should be durable. It should be able to withstand. Gas permeability and proper pressurization to maintain the envelope shape and rigidity, otherwise the performance will go down to withstand with the temperature variations. These are the challenges.

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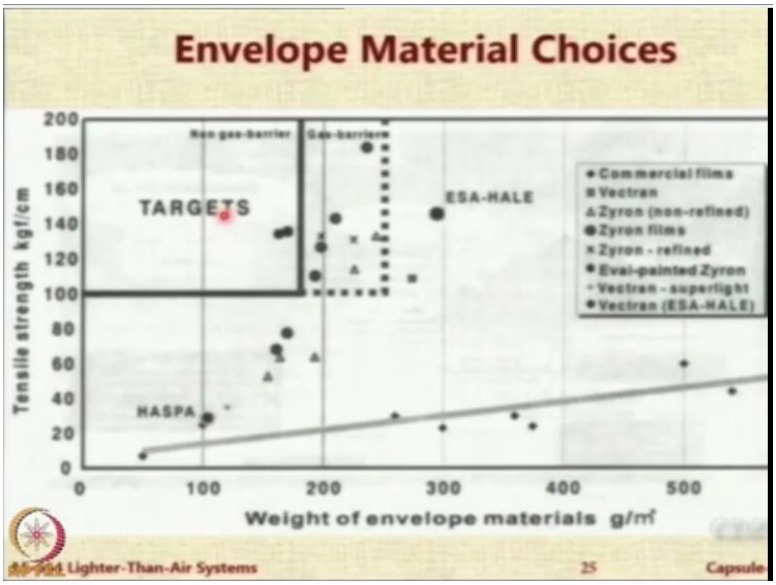

So, when we come to the envelope material choices actually these are the target which will fulfill our requirement. We want very low density with a high strength material.

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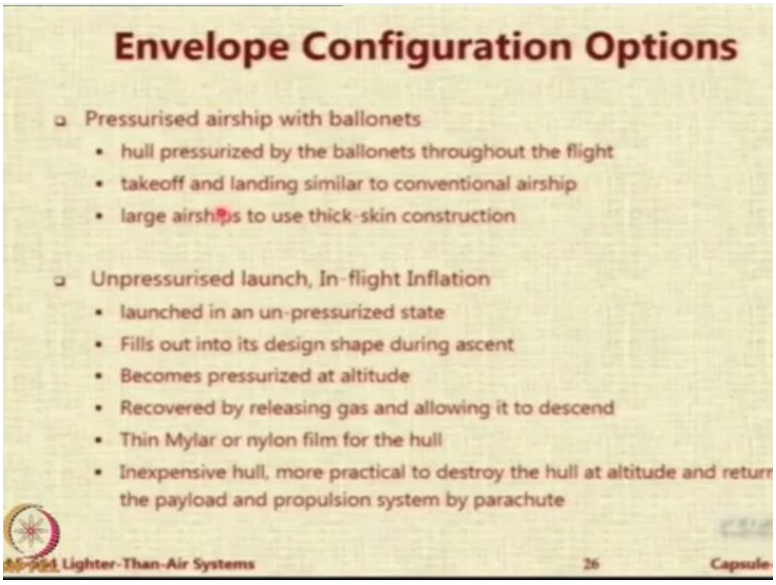

So, envelope configuration options; different options may be there. We have to take care of the pressurization, takeoff and landing. You need an infrastructure and these are the other requirements for the configuration.

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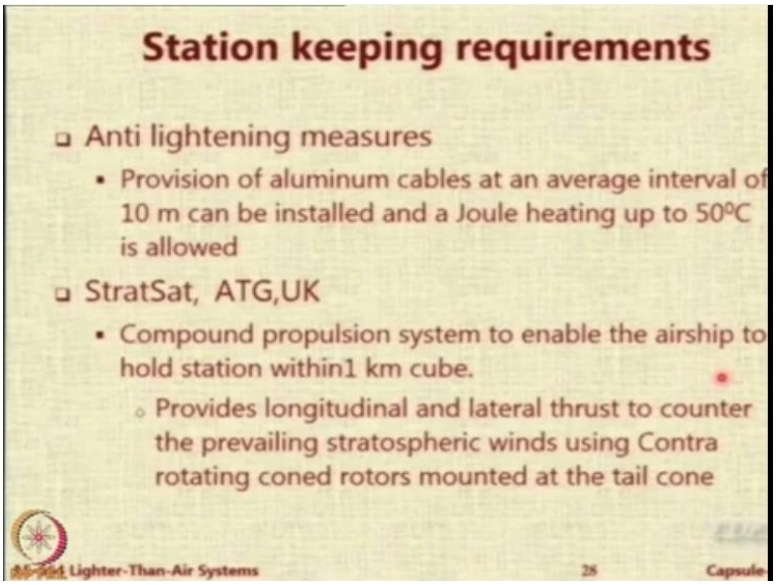

Station keeping and thermal consideration we have to take care of. Anti-lightning measures because it will affect the systems and whenever it get damaged in other systems, another problem will arise. It is because the envelope is not a big issue. It is not so much of costly, but the systems mounted in that airship is actually very costly. It is a major advantage over the satellite system.

Because in satellite we do not recover our systems after it is expired. But in this systems you can recover actually and envelope is not a big issue in place, very cheap material and whenever we can compare to the systems and as a payload which will serve the requirement. So to handle these systems, people are working around the globe. You can see StratSat, ATG, UK compound propulsion system to enable the airship to hold station within 1 kilometer of cube.

It is designed in such a way that it will not go beyond that cube in three dimension one kilometer cube accuracy is needed. And to take care of that they have included in the lateral thrust to counter the prevailing stratospheric wind and other systems. There is a requirement actually, otherwise it will shift to some other location and that will create a problem and it will go beyond your radar. Main purpose which we want to serve it will go beyond it will shift. It will create a problem.

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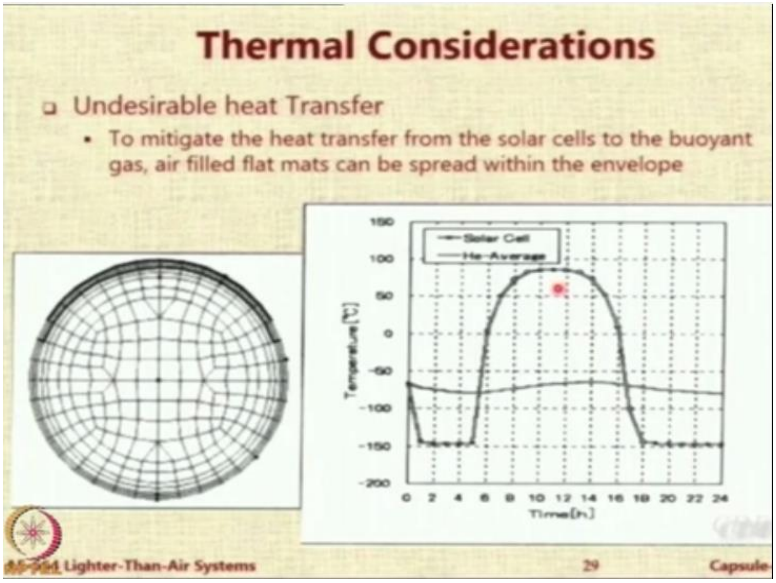

So, thermal consideration is a big issue while designing because the temperature at the day will be higher, at the night will be very low. And the temperature will affect the buoyancy as well as the energy output of the systems. And because whenever temperature will be high gases will try to expand and solar cell will not perform very accurately at a high temperature. Its efficiency will go down that is the problem.

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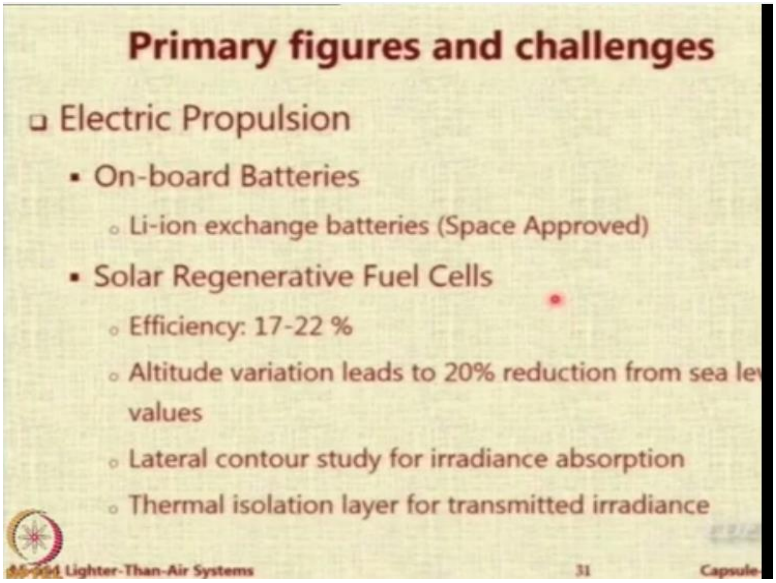

So, onboard system tool. Because at the daytime we can give directly power to the propulsion system and to the payload system, but at night we do not have any power sources. So, we have to store that power in the daytime so that it can serve the power requirement to the payload as well propulsion system at night as well. So, you will need storing systems, so onboard batteries and solar regenerative fuel cells.

Solar regerantive fuel cells is another area so many researches are going in the systems because the efficiency is higher and it is better with lithium-ion battery in comparison to that. To store same energy, lithium-ion battery you will need a big lithium-ion battery and whenever you will use a regenerative fuel cell the system or the battery weight will come down but it will cost more. It is another area.

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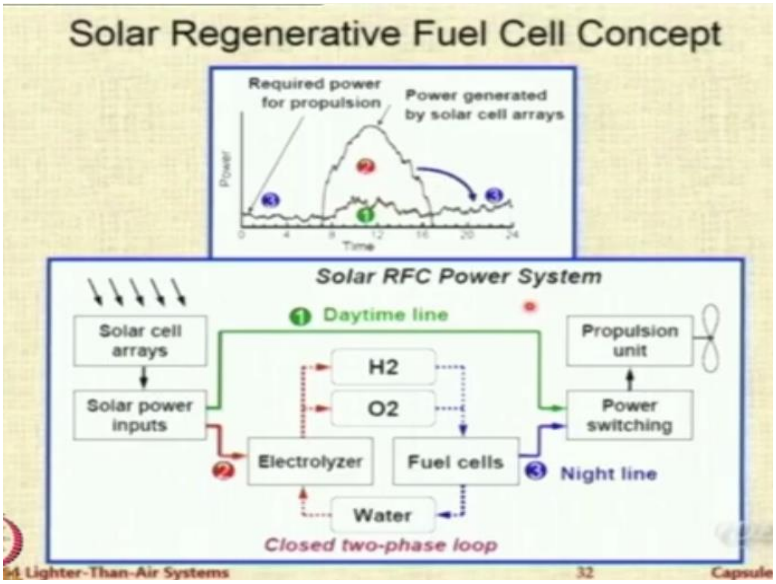

So, these are actually representation of solar regenerative fuel cell concepts. At the daytime, the power available is higher and you will need a direct power reload. The extra power which is 2 – 1 is basically stored for the night time which is 3 actually in both direction. And the concept is that you electrolyze the water, very simple at least in watching. It is you separate hydrogen and oxygen by electrolyzing and then after combination it will create energy which will be given to the propulsion unit and payload systems at the nighttime. So any doubt in this system? Fine, no?

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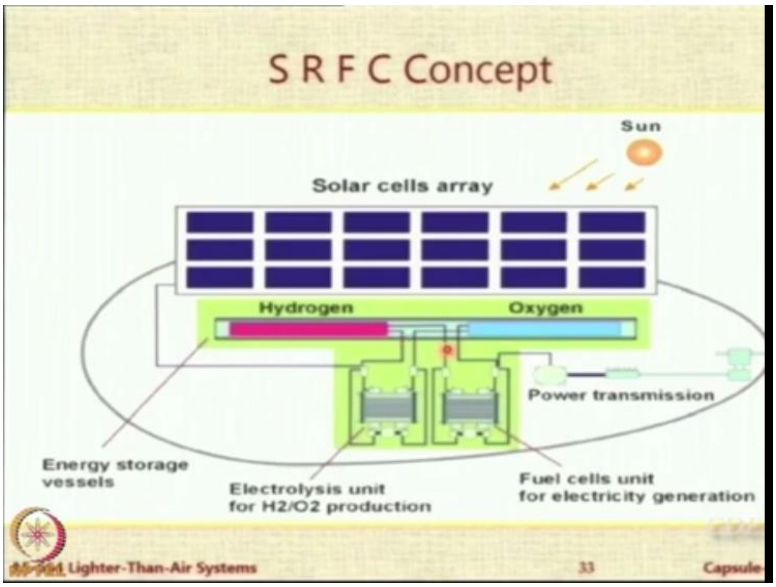

So, this is another pictorial representation. We separate hydrogen and oxygen may be using the energy at the daytime and the same stored energy you can get while combining hydrogen and oxygen which is recycling of hydrogen oxygen producing water, then again it will separate hydrogen and oxygen, it will go on.

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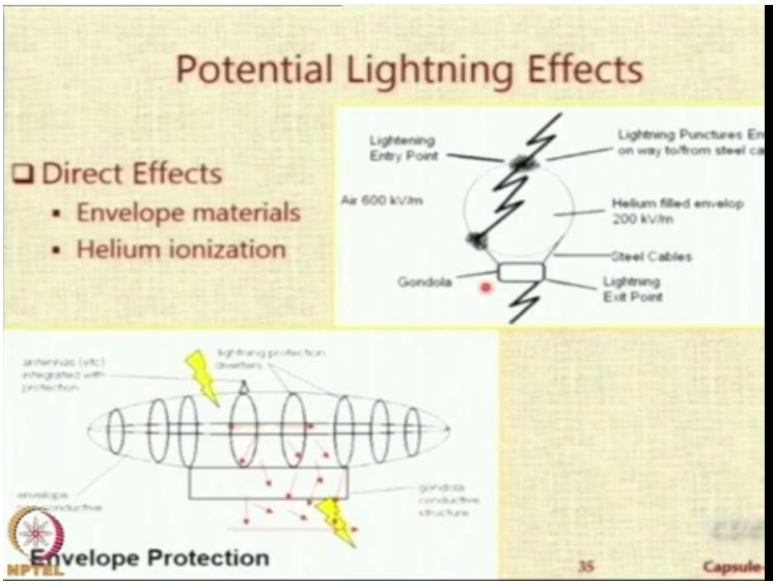

So, for the protection from lightning, there are methods and it should be withstand at that height because at stratospheric condition the protection of lightening will be there and it might damage our envelope. So the systems available to take care of that.

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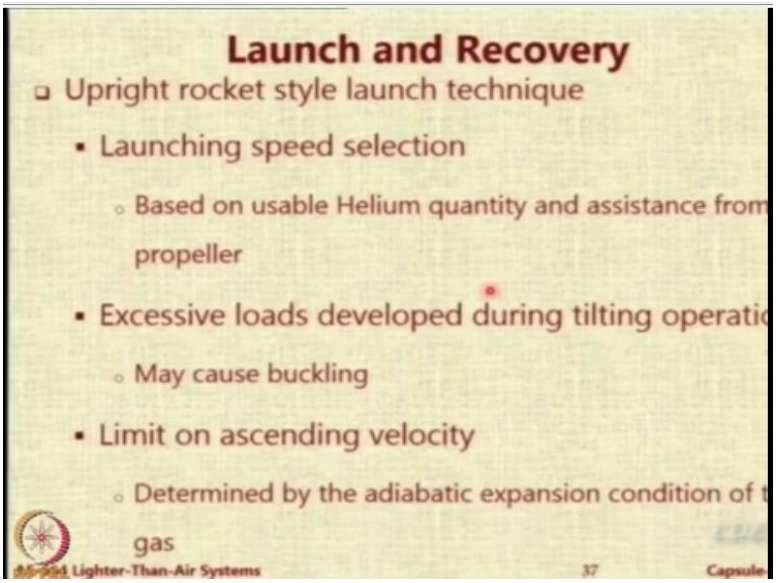

So launch and recovery and ground handling is another big problem because the size of such systems is very large. And to handle such systems which is fragile, you know if you will not properly take care, it might damage the envelope. And the recovery of such a big system is another issue and launch as well. So these are the proposed update upright rocket style launch technique for launching. Say another method by limiting the velocity.

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So, you can see while launching in a rocket mode. So, it is very clear by picture, actually no need an explanation.

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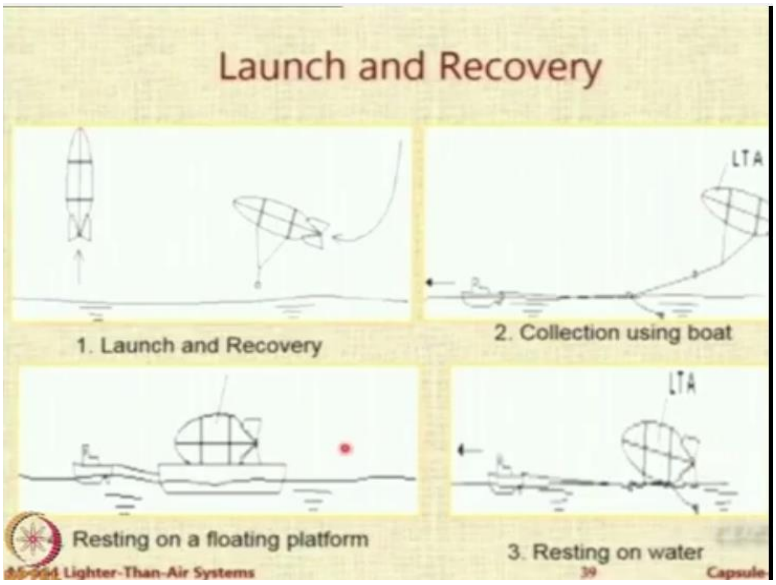

So, it is showing a recovery to take care of the payload systems by different methods, may be resting on the water directly or resting in a boat.

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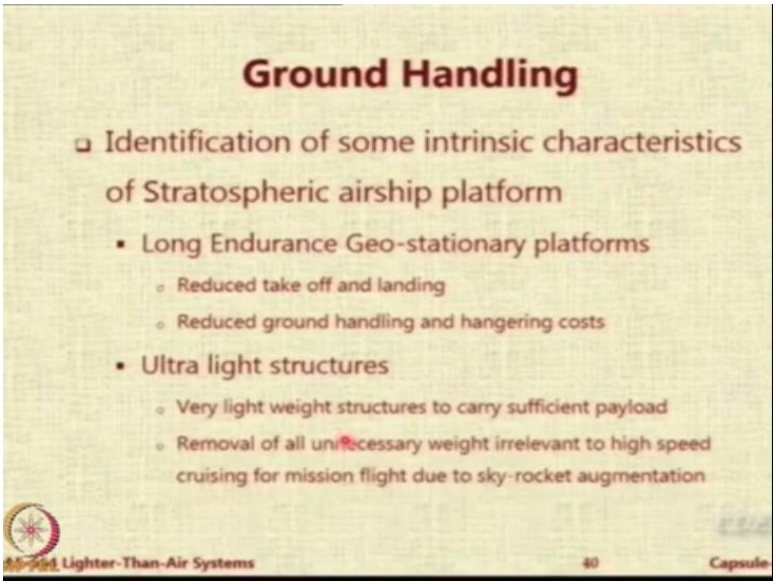

Ground handling is the big issue actually. You need a large infrastructure to handle these types of systems. And in later slides we will see how big actually there is a need infrastructure to handle these type of systems. And you are aware already that there used to be a mooring mast and winching systems. Otherwise it will get damaged. So, these are the requirements. I believe that you are aware with all the systems at the end of this course.

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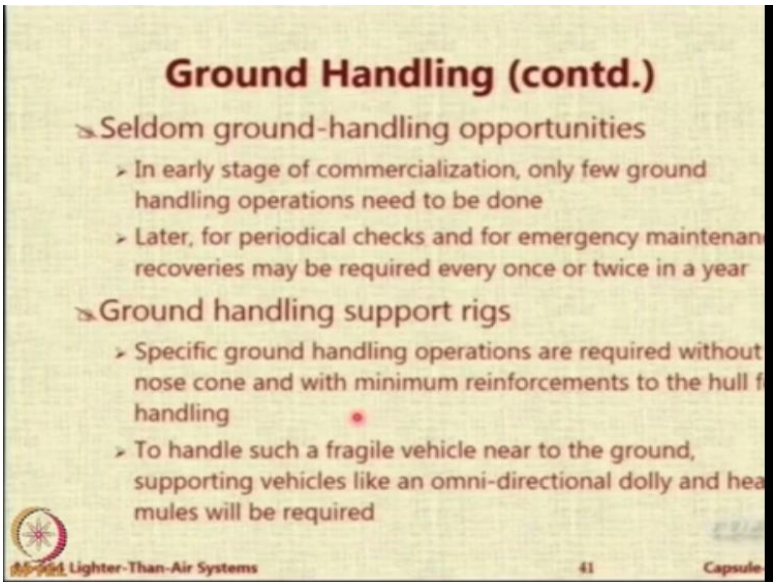

So these are the another requirements to handle such a fragile vehicle near to the ground that is obvious.

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you can see how big is the actual requirement to handle systems.

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And for Zeppelin hangar you can see the height of mens available with actually the system's size, you can compare how big is that. No, you can see the height and the height to mast.