Lighter-Than-Air Systems
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Lecture - 70
Nose Battens for Envelopes

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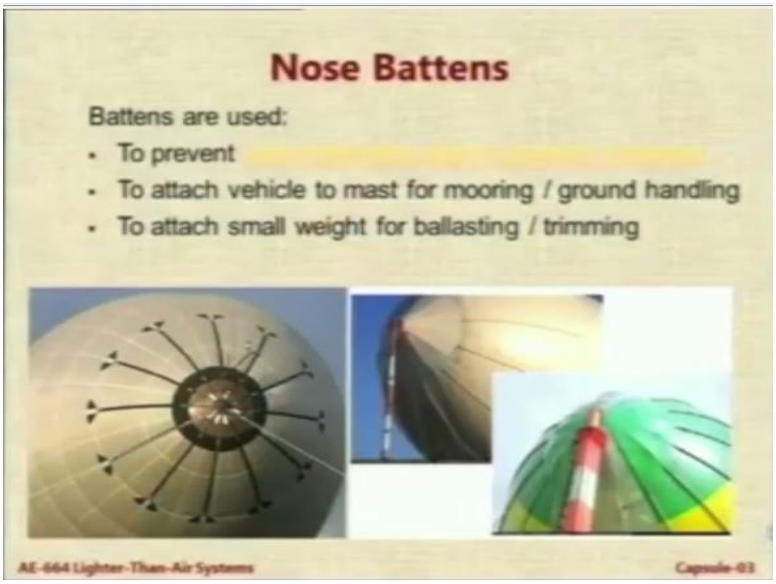

Nose battens, so we already know this. Nose battens are essentially used to attach the vehicle to the mast for mooring and ground handling. But one important aspect is to prevent the nose imploding due to the barometric pressure. So, I will show you that.

(Video Starts: 00:33) Watch the nose of this airship carefully as it flies. So we have just launched it. This is in Learning Center in Pune, 2003. We are practicing before we go for a demonstration, I am sorry December 2002 because we were supposed to go in Jan 2003 to demonstrate this airship. Observe the nose of the airship. You can observe now that the nose of the airship is flat. **(Video Ends 01:09)**

It is imploding because the dynamic pressure which is acting on this airship when it is trying to fly at some speed is more than what the internal pressure can handle.

So when pressure inside cannot handle the dynamic pressure plus the pressure outside, then obviously nose will move inside. This will create extremely high drag forces because now the nose is not rounded, it is actually like a flat plate, so it affects. Now in this airship as I said we do not have the luxury of putting any nose battens, but irrespectively we realized that unless

we do something about it I will not put the gas under higher pressure and we have to tell you the effect of pressure on the net lift.

It does not really help that much, but it will create structural loading. So during this testing we realized that the nose of the airship will implode unless you really provide something in the front. I run an interesting video which shows nose imploding. Let me try to locate that picture. That picture is not of our airship, but it is an airship made by the others. I do not know exactly but let us try. See the nose completely imploded.

(Video Starts: 02:48) Here go you see. You can see the nose. The nose is flat, right? So they have put a very very powerful motor in this airship. You can even hear it. It is very powerful motor and the reason why even with so much of power it is only flying so slowly is because the nose is imploding. **(Video Ends: 03:20)**

So, the nose battens are needed to provide structural rigidity in the front of the airship. We also need something to be mounted there so that the mast can be attached. And also there may be a need to add some weight in the front just for ballasting or for trimming the airship for central gravity control.

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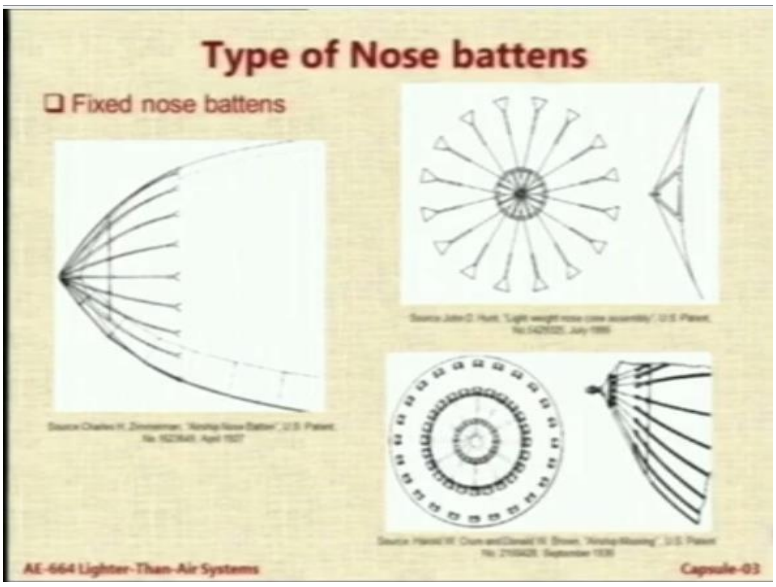

So these various types of nose battens buttons which you see in actual airships. There could be fixed nodes battens which are essentially a complete structure made externally and attached to the airship.

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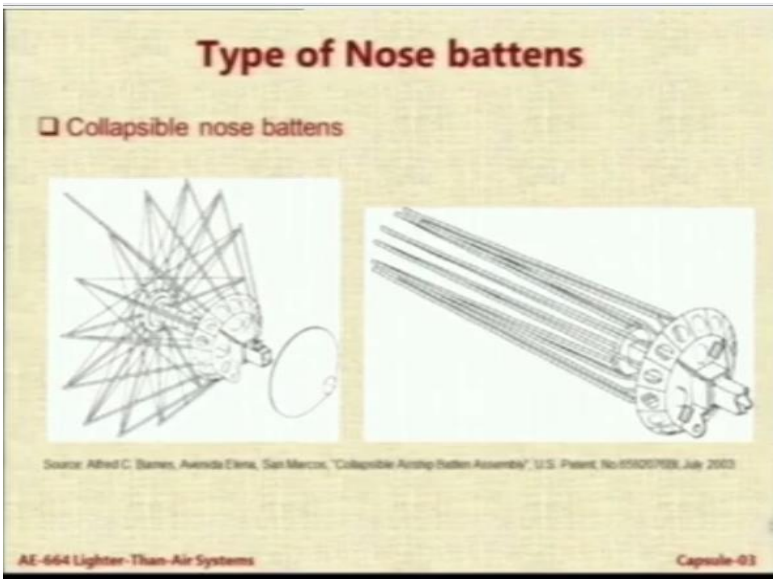

You could also have collapsable nose battens like the umbrella. We also made once nose batten type which is collapsible. This helps in transportation. You can take it out and transport it very easily. You do not require a big place to store it because if you have a fixed structure of that size, then you have to carry it like that only.

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So you can see these are our collapsable nose battens for indoor airships. We have used the cane material. In IDC there is a cane studio. There is a bamboo studio in IDC. There are two faculty members professor Rao and a junior faculty member who are experts in using bamboo and cane for various applications including structural applications. So, with their help and participation we have a very experienced mechanic there who can make almost any structure out of cane.

So, with his help we have got these collapsable nose battens for our small indoor airships, which can be simply attached to the envelope. So, as you can see we have inbuilt some flaps on the nose of the airship and we just push these nose battens inside and then we connect the end of them using a simple circular link. So, with that it does not come out. It is very lightweight and it does the job of tensing the nose and also allows it to be attached to the mast.

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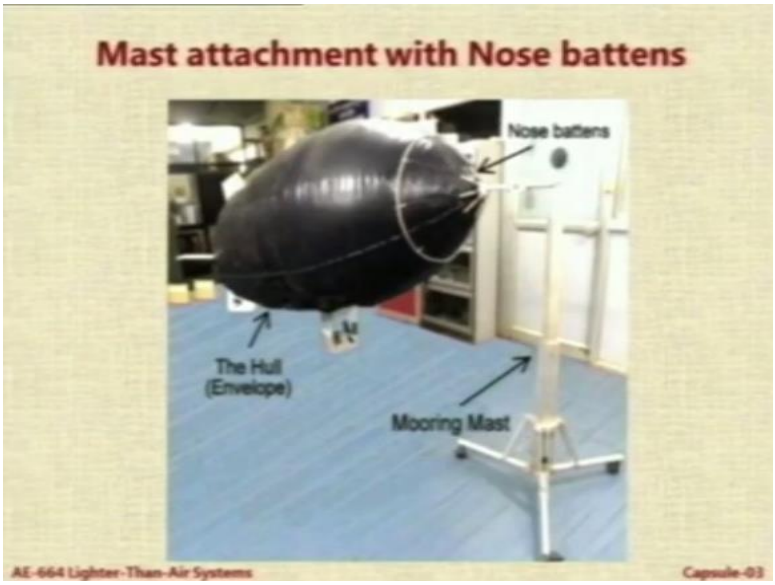

So, you can see the picture of our airship with the nose battens, circular ring attached to the mast. This picture was taken by Utsav Bhardwaj for a paper that he wrote to showcase his mast. His paper has appeared in a journal recently, which also I would like to share with all of you.

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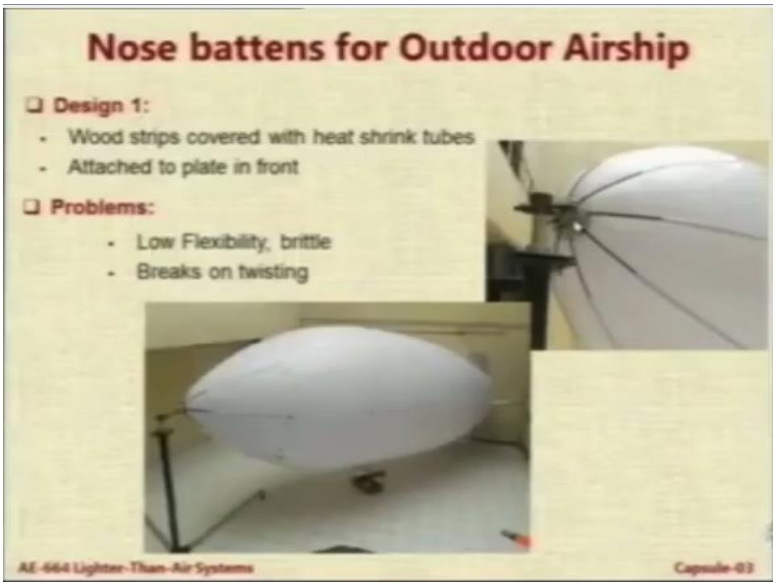

For outdoor airships, we have two designs. One was we use simple wooden strips, but we covered them with tubes which were heat shrunk. Now these tubes are going to give it a little

bit of softness, otherwise if you put sharp edge with the fabric it can create cuts and holes and in the front we attached a plate simple plate, but there are problems. Problem is that if the plate are a bit long it can break because it is a wooden strip which has a lower inertia.

So this is that particular picture. This is the airship in the aero foyer. So these are the wooden strips and you can see from here to here they are inside the envelope so you cannot see them. From here to here, they are outside the envelope so you can see that black color strip, the heating tube. This is a better picture of the same thing. So, we just took a classical dish from the mess, just a plate from the mess and we beat it into a flat plate and then created these attachments to the edges for the various nose battens.

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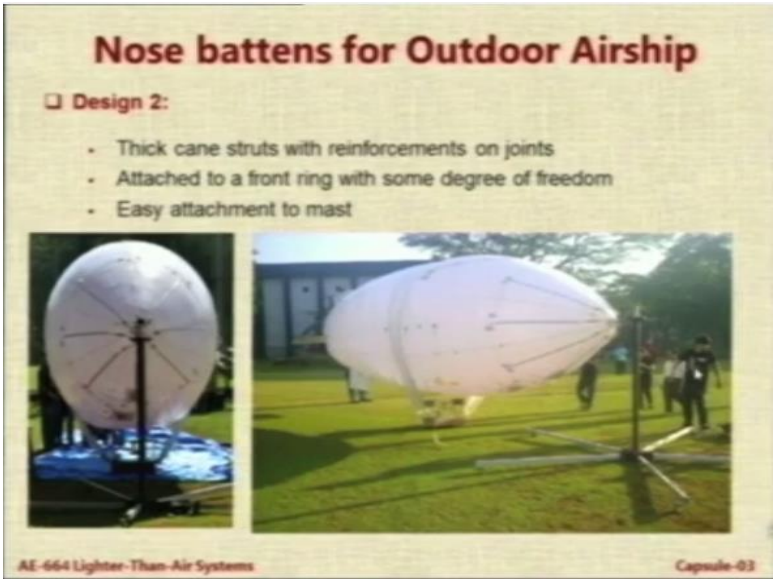

Then, the second design is this is not from service factory. The second design is again we went back to cane. So a thick cane but this time with some reinforcements on joints and some ring in the front for degrees of freedom and attachment to the mast. So you can see this is the final design that has been used. This particular design and fabrication was done by this person called Vishal Sharma. You will see him in this picture.

So he is the guy who is available in LTA lab. He is the one who has come up with this idea and gone for it fabrication and testing. So, these are the nose batten types which we are using. They are fairly lightweight and they do the job that is needed.