

Lighter-Than-Air Systems
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Lecture - 71
Need for Airship Design Methodology

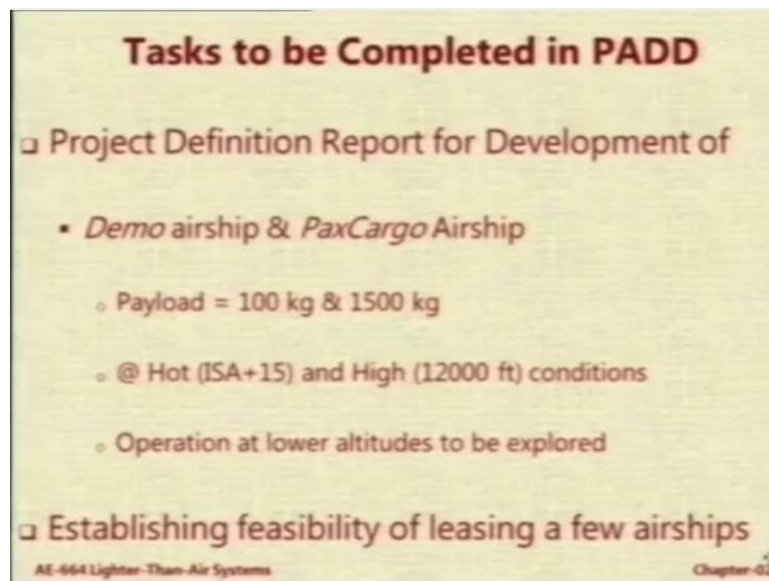
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So today's talk or the lecture is basically going to showcase something that we have done as part of our project on our program on airship design and development. This presentation of this slide I have already shown you before. Many of you are aware of this PADD. Its aim was to establish the feasibility of operating, designing and developing airships in India. And also we were mandated to go around the country and talk to people and promote the usage of airship Plus develop the technological base already available in the country for aerostats, parachutes, for airships and to explore the avenues for joint development. But the question that arises is that when you go and talk to somebody for joint development, then they should also have some respect for you. You should know something and you can get a good bargain or a good deal in joint development only if you can show that you can do it yourself.

But we are doing it jointly to save money and time for both the parties. So, therefore before we actually went and talk to people, we first wanted to develop our own skills and knowledge base in this area. Remember none other team members at that time in this project including me had any formal education about airships because a course like this was not available to us. So, we had to learn all the things virtually on our own.

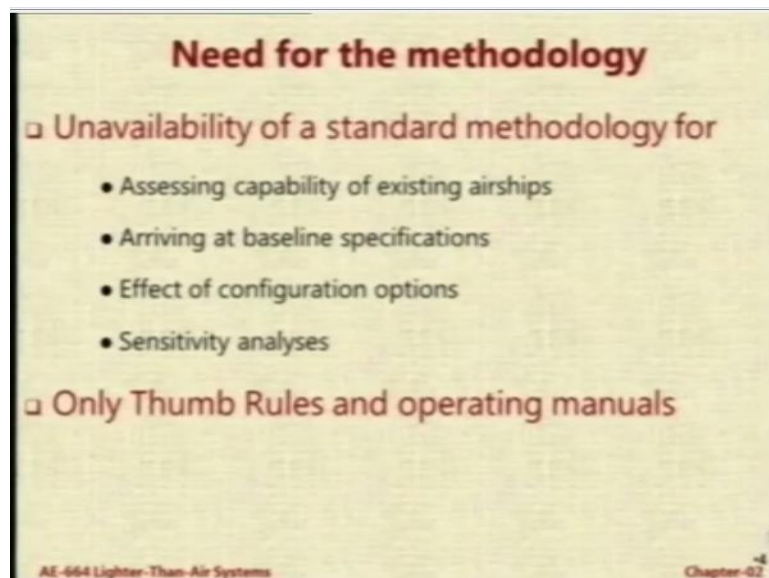
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So, the tasks to be completed in PADD was essentially to deliver the project definition report for the development of two airships are Demo airship which was essentially for demonstration purposes and a PaxCargo airship which was a kind of replacement for a mini truck of 1.5 tonnes by an airship. So, the first one was 100 kg payload and the second one was 1500 kg payload, but both were expected to operate under what are called as hot and high conditions.

Hot ISA + 15, high is 12,000 feet on above operating altitude and then of course we had to look at leasing which was a separate task.

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Now, while doing this task we the team members felt that there was a need for a formal methodology for carrying out conceptual design and sizing of an airship. The problem was

created because in open literature at that time there was no scheme available for assessing the capability of existing airships. So, if someone says we have an airship, this is the operating manual or the technical manual, we have no way of assessing it.

We have to go by what they said. Suppose someone says here are the specifications of the airship, design one or do a conceptual sizing, we had no methodology available. If during our discussion, we wanted to investigate whether it should be diesel engine or petrol engine or any other configurational issues, we had no way of doing it. And very important point is we have no way of figuring out the sensitivity of various parameters like purity of the helium gas.

I am saying helium because this is the manned airship and manned airship by law cannot carry hydrogen. So it is assumed that we will talk about only helium. And what we had available to us; now this work was done more than a decade ago in the year 2002, 2001-2002. So, at that time we did not have anything other than some thumb rules like 7% loss in payload with every 1000 feet altitude.

And some operating manuals given by a few manufacturers who showed interest in collaborating with us or leasing airships to us. So with this information, we undertook this task of developing a methodology. So today, I am going to simply showcase the methodology. I do not have the time here to derive each and every expression. But what we have done is we have done all that documentation in the form of two papers.

One which was presented in the conference and then an enhanced version which was presented in a journal. So those two are available online, I can put them on Moodle page. I will show you the key features of the methodology which will help you in understanding the methodology. So please understand this is basically a trailer, the movie is actually in the papers. So you are only going to get an overview.

And it is expected that you are going to read those papers, follow the procedure given there, maybe write your own simple code for it. So, this is what I plan to give you as the next assignment. The next assignment will be developing a methodology for airship sizing. And what you could do is you could use the same formulations as what I was given, but it will be nice if you can upgrade by making some improvements.

So those improvements and upgrades are what are going to be looked at special editions in your submissions. Now, I must first of immediately inform you that this methodology is not developed by me. I was only a part in the discussions. The creator of this methodology is Professor S. D. Gogate. Unfortunately, he passed away in 2010. He was a faculty member of our department teaching aircraft design like me and he took early retirement in 1999.

We hired him as a consultant and he along with a team of 4 or 5 interns, students, etc., did this work which I am going to showcase to you.