Lighter-Than-Air Systems
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Lecture - 89
Airships versus Helicopters – Part I

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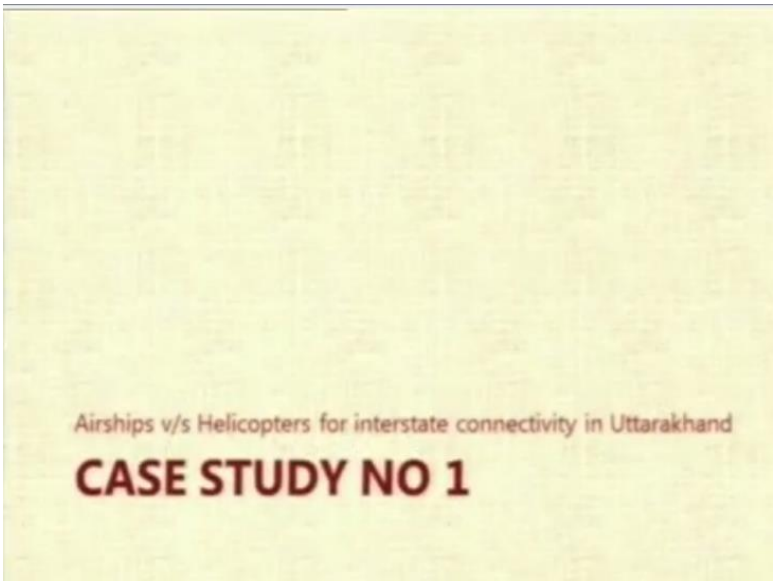

So let us look at the two case studies now. See more than the specific numbers that come in these studies you have to understand the areas in which these particular vehicles are more suitable. There are some very interesting observations in these studies as we will see. This first case study was carried out by us basically to answer a question that was raised by some senior official in the State of Uttarakhand.

It so happened that I was trying to pitch airships for operation in Uttarakhand and this official said but already we have purchased some helicopters. We already have them. So now please tell me as against helicopters how costly or cheaper are they? So I have no answer at that time. I said, I will tell you. So I came back and I spoke to some of my students. It so happened one of them were looking for a good B. Tech project.

So I gave that student this as a B. Tech project and the B. Tech project was further taken up by some students and we got a good case study done. So this case study is based on the requirements of a state called Uttarakhand. Many of you are aware of this state, but today we

will look for some time get familiar with this particular state. It is a state in Northern India and it is located in the Himalayan region. So it is located in lower Himalayas.

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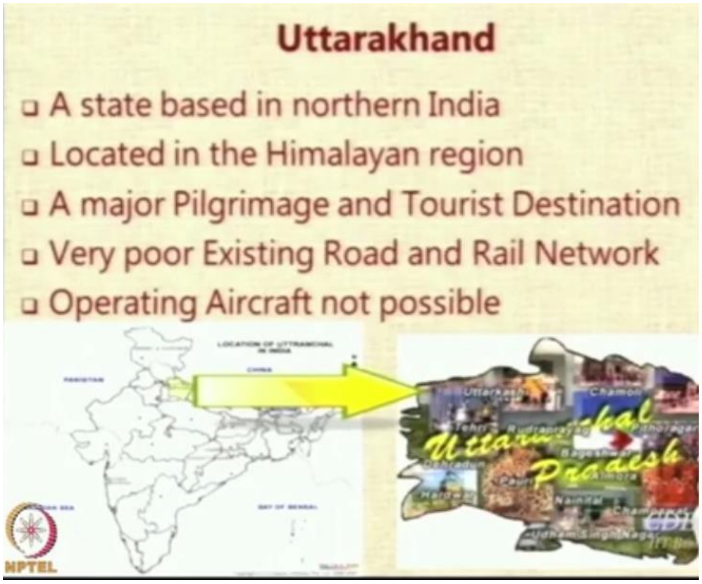

So this is the map of India and you can see this small state in the North, which has been carved out of Uttar Pradesh is Uttaranchal. It was called Uttaranchal, now it is called Uttarakhand. It is a major pilgrimage and tourist destination of India. And unfortunately, the existing infrastructure both road and rail is very poor. But no one is to be blamed because that is a natural situation. Operating aircraft is not so easy. I have written not possible. The reason is that there are only 2 airports in whole side of Uttarakhand.

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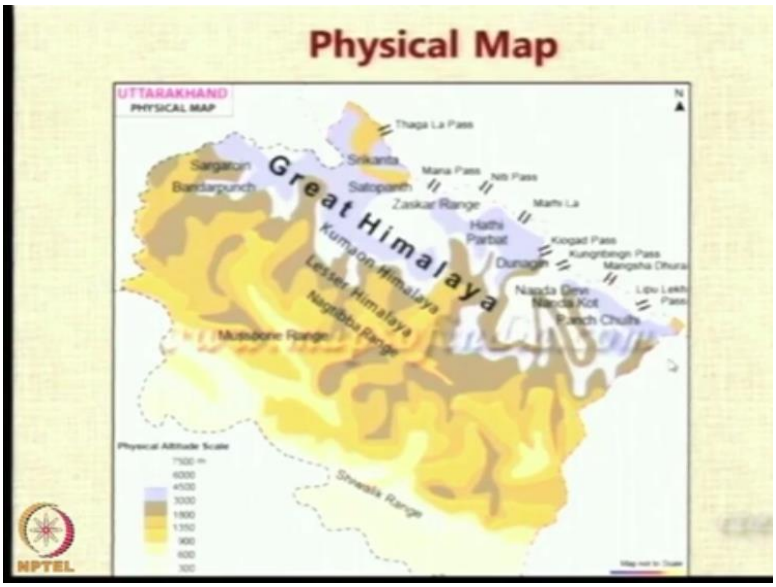

So, just to give you an idea why there is a problem this is the contour map. So, all the areas which are marked in white color are located or even grayish white color are located above 3

kilometer above mean sea level. So that is a very high altitude. So anything that you see which is white, now the ones which are marked in these dark brown color, all these places they are also above 1800 to 2000 meters.

This is also quite high for building infrastructure. So nothing is there in these areas to connect people. It is only in this plane areas in the Shivalik range and this plane area only here you can actually build some infrastructure or in some pockets like there is one small pocket here, there is some pocket here, only in these small pockets you have a reasonably flat area to construct conventional airport infrastructure.

And look at the number of passes that we have in this particular state which border with China. So you can imagine that because it is a part of the lower Himalayas it is very difficult terrain for you to build any conventional infrastructure.

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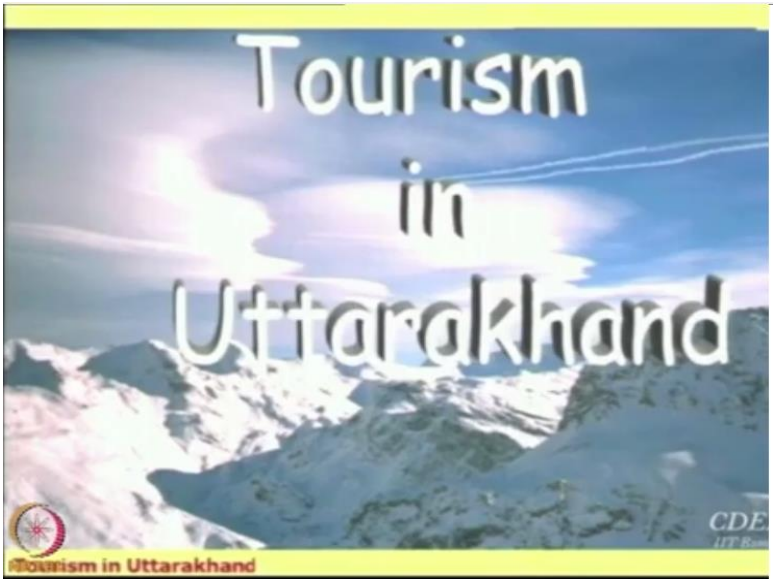

Now let us have a very brief look at tourism in Uttarakhand. Now this is a very general purpose a few slides about Uttarakhand in general. The purpose of these slides is that in the ensuing summer some of you might be motivated to go and enjoy in Uttarakhand.

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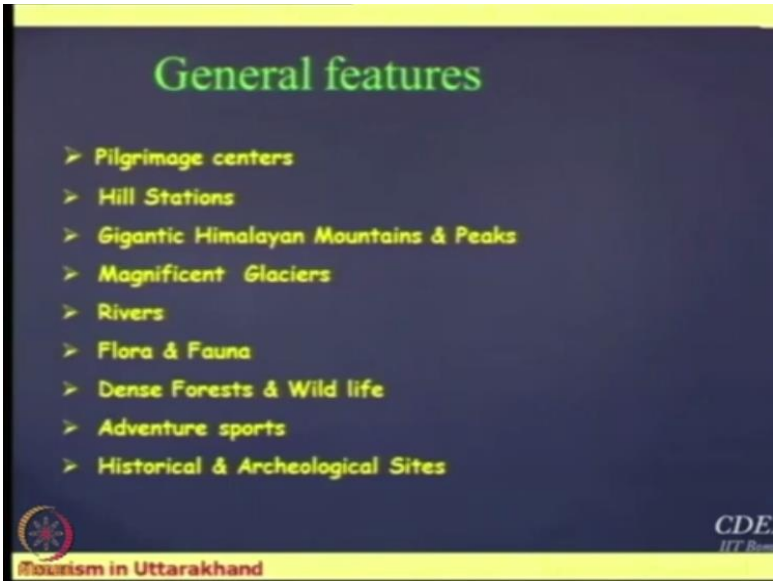

So, there are many features about this particular state and this is a huge list of various attractions that a tourism related person can have. You have everything that you can think of right from rivers to glaciers to mountains to hill stations to pilgrimage, flora, fauna, adventure and historical sites.

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So, more than 50% of the spots that were earlier belonging to Uttar Pradesh have now become a part of Uttarakhand that is a major tourism revenue is coming from Uttarakhand now. The annual business was 250 crores and this data is very old. This study was done by us in the year 2002. So, this number is 2002. Today it will be much larger. I do not know how much it is today. It is much larger than this.

So 30% of the total income of tourism from Uttar Pradesh was from the Uttarakhand region and every fourth foreigner who visits India would like to visit a part of Uttarakhand for various reasons as listed. So, it is a very popular place for people both national as well as international.

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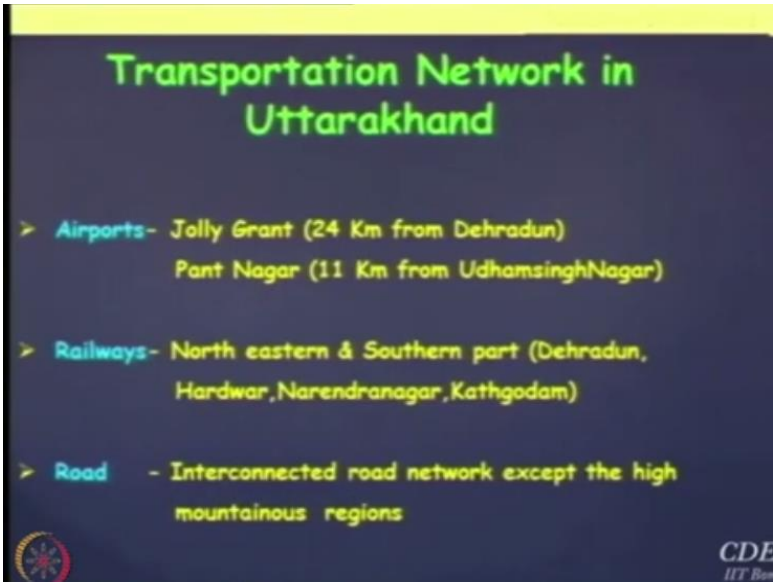

Now, look at the infrastructure. As I said there are just 2 airports. One is near Dehradun called as Jolly Grant and the other is at the place called Pant Nagar which is on a flat area. So, there are just 2 airports in the whole state. There is one more airport which has been built, I will call it an airstrip in a place called Pithoragarh. It is an airstrip. So it can be only used off and on to operate aircraft like Dornier 228, very small aircraft, big aircraft cannot go there.

Railways: So in railways there are 4 or 5 important railway heads. And by road there are good connections on the planer area, but in the mountainous area, there are very circuitous routes.

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So, here is the road network. You can see this is a road network of Uttarakhand. And you can notice that there is no motorable road in this entire region except these single roads which are you know these are the national highways. So few of them and that too mostly in the bottom part. So, if you have to go from a place somewhere here to somewhere here by a major road, you actually have to come all the way down here and go like this.

You cannot go from here to here. Yes, there is this road which is normally a one lane or two lane roads. So, there is a huge problem in transporting equipment, transporting medicines, transporting things to remote areas.

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Railway map is worse because railway map is very strongly affected by the terrain. Earlier there were very few railheads. Now, the government is building a few more of them. So, they

are trying their best to provide rail connectivity. Once again in the planar area of Haridwar, Udham Singh Nagar, Rudrapur there is not much problem, but as you go up you will find that the connectivity is very poor.

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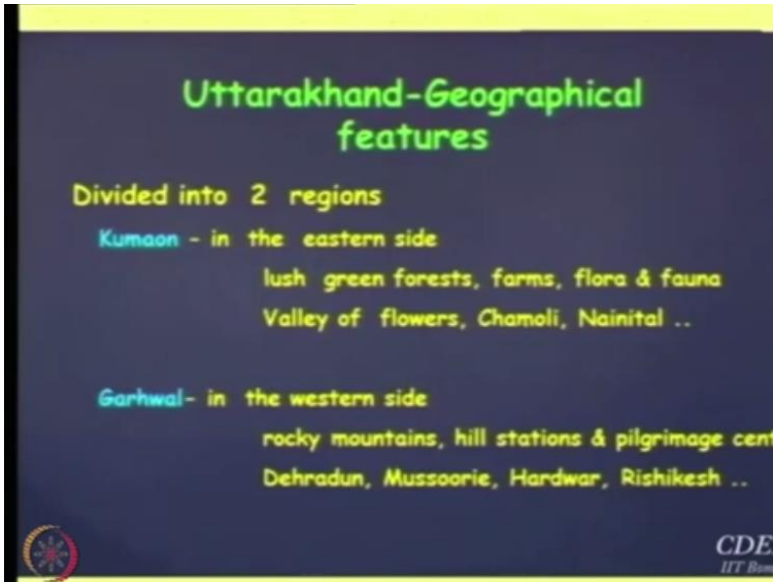

Now let us look at the geographical features. There are basically two regions. This state is consisting basically of two regions. One region is the Kumaon region. Now I belong to this region, Kumaon region, the eastern side although I have never lived there. But my ancestors came from this particular place. So it is lush green. It has flora, fauna, and valley of flowers. Few places which are famous Chamoli, Nainital, Almora, Ranikhet, etc.

Then there is a Garhwal side which is where my wife comes from. So this is the western side. And this area is more rocky. It is more having hill stations, pilgrimage stations. So the famous points are Dehradun, Mussoorie, Haridwar, Rishikesh. So, thus these are two parts of the same state.

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And you can see these interesting places or important places in this map. So, I would say this particular road is a kind of a division between Garhwal on the left side and Kumaon on the right side. So, the state has got two distinct regions, two subcultures, but there is a lot of requirement for intermingling and traveling between these two regions. And now since the government has created a new state, the state government has to cater to both the sides or both the regions.

So, there is a huge need for connectivity or interconnectivity between cities like Yamunotri or Uttarkashi, Dehradun, Haridwar on the Garhwal side and Pithoragarh, Almora, Nainital on the Kumaon side interconnectivity is very important. As you can see the roads are actually quite long. The roads are not really lateral, they are going more vertical and then turning. So the current road transportation takes a lot of time to travel.

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So let us look at the few things which are very important and very popular. You have pilgrimage. You have sightseeing and adventure. **"Professor – student conversation starts."** Sir. Yes. Pauri belongs to Garhwal? Pauri belongs to Garhwal side. You can see this is the area where Pauri is related, so it is on the Garhwal side. **"Professor – student conversation ends."**

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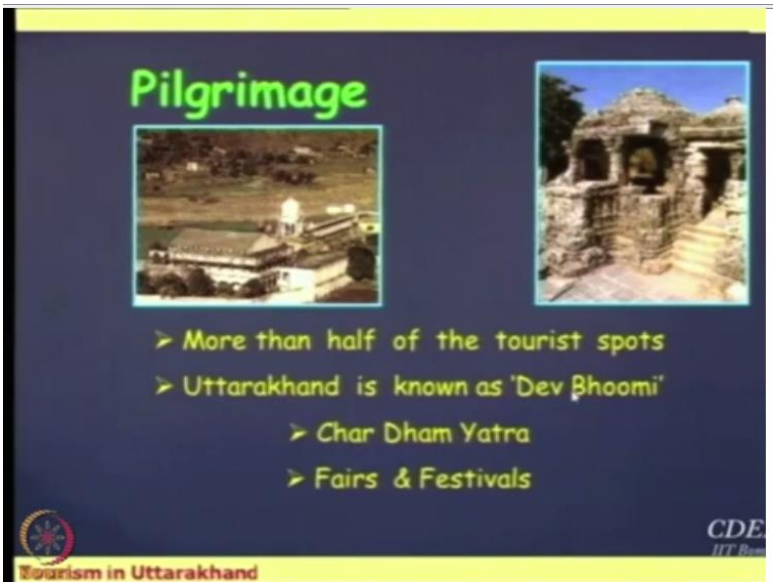

Then there are so many temples and so many other religious places in the state. Many people travel for that purpose only. And one very popular pilgrimage is the Char Dham Yatra above which we will see in more detail because the second case study is about Char Dham Yatra by airships, right.

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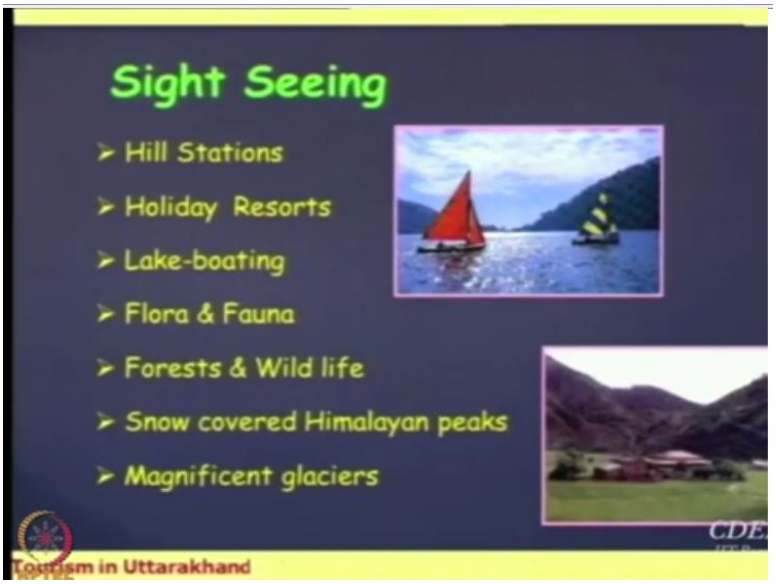

So, sightseeing already I mentioned to you there are several interesting options available for the tourism.

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And before I sound more like a salesman for Uttarakhand tourism, I will just come back.

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Important point is for any state or any place to have tourists, these are some of the factors which affect. The first factor is accessibility and accessibility is poor. Accessibility is limited. Climate is of course very salubrious, very nice during summer, so people like to go there. Accommodation is also available along the roads mostly. Transportation is also very poor because the connectivity is poor. Other things are alright.

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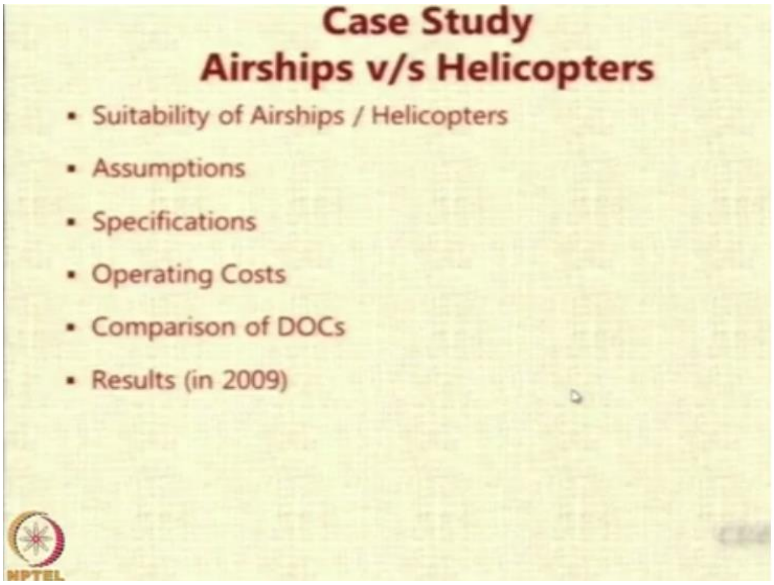

So, now we come back to look at the case study. So, this particular first case study is trying to look at transporting people from one area of Uttarakhand to the other area laterally. One option is helicopters. The other option is we are proposing as airships. So, these are the important points that we will study in this particular case.

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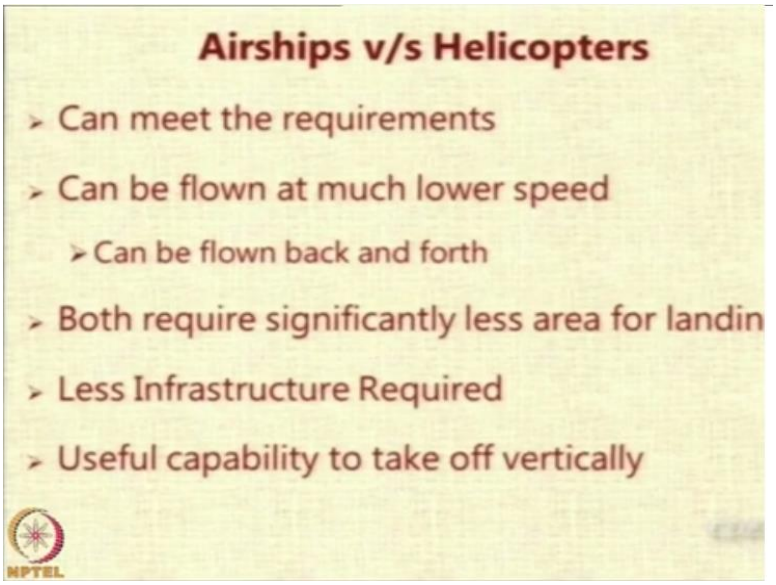

So, first thing is that both airships and helicopters can meet the requirements. So, we did a detailed study on 3 important locations on each side and can airships travel? The answer is yes they can travel. They can cover these places. And you do not have to really fly, there is no need to fly very fast. It is not necessary fly very fast because the alternative is through road which is very time consuming.

So, as the crow flies if you go as a distance it is far far less than as the road or the rail goes. Airships and helicopters both can be flown at low speeds and they can also be flown back and forth. This is very useful when you are going to maneuver it through the valleys. A fast moving aircraft will be difficult to operate because you have to follow the valleys when you fly in the mountain areas.

Both helicopter and airships require very small area for operating. Helicopters require a helipad and airship requires an airship port which is also not very large. And you also would not require a huge amount of infrastructure on the ground. Plus even in the vertical takeoff, they do have sufficient capability to carry payloads.

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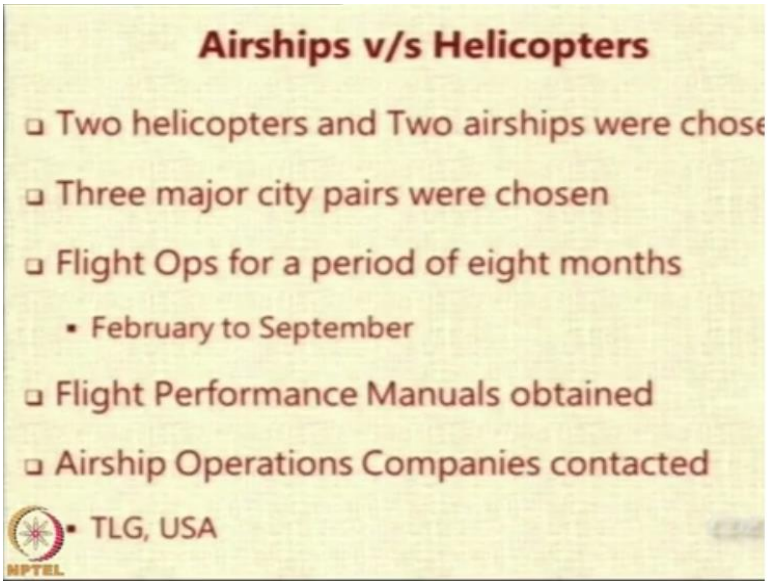

So, what we did is we took two helicopters, basically the ones they had procured then became our case study. And we took two airships which were commercially available at that time. The study is as I said 2002. Then we chose 3 major city pairs on each side and we assumed that for 4 months in a year neither helicopters nor airships can fly regularly with passengers because of the weather.

So, it is only 8 months in a year that you can think of connecting airships and helicopters or cities with these two modes of transportation. Then we obtained the flight performance manual of these helicopters and these airships. This took a lot of time because the manufacturers do not easily part away with this data. We have in our class a flight test engineer, flight performance engineer.

She knows that it is a closely guarded secret, it is not public information. But we managed to get it from them because we tried to convince them that there is a possibility that this will actually happen. So we got the data from the actual manufacturers and operators. So the Lightship group was the company which shared information with us for the airship information.

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So these are the 2 helicopters, BELL 206-L4 and BELL 407 which were taken as the candidate from the helicopters for the study. And these two airships one from USA from the US LTA 138-S and one from the Lightship group of UK. So these 2 airships became the contestants for these 2 helicopters.

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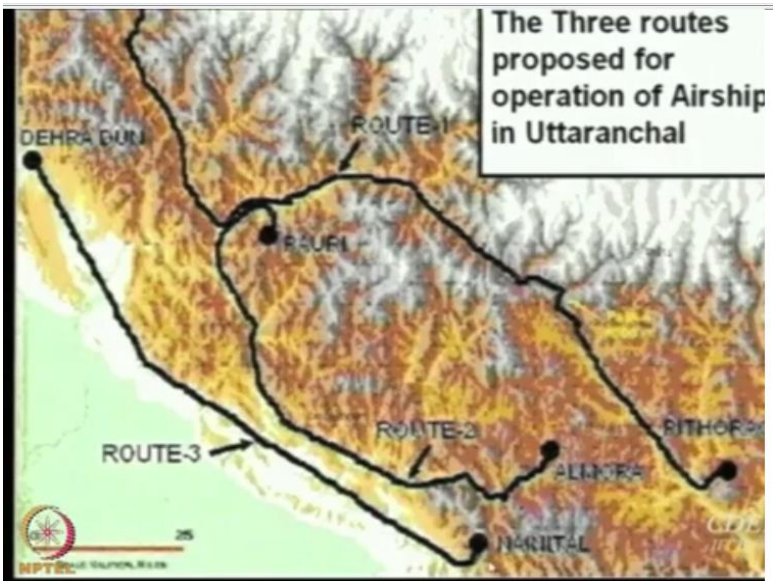

So now a very detailed study of the route which can be followed by airships and helicopters was done looking at the terrain map of Uttarakhand. So, you have these 3 cities Pauri, Dehradun and there is one more up there which is a little bit hidden and then there are these three Pithoragarh, Almora, Nainital. So they have to be connected. And these lines that you see are not some theoretical lines

These are lines which have been obtained by detailed study of the terrain map ensuring that the height of the helicopter or the airship is always below the operational ceiling with maximum payload. So, that is why there is a need to fly these kinds of routes and then this way and then come back because there are these valleys there which allow you to fly.

So three routes are there one which connects Almora to Pauri. The route one which connects Pithoragarh to one more city here Uttarkashi and then from Dehradun to Nainital.

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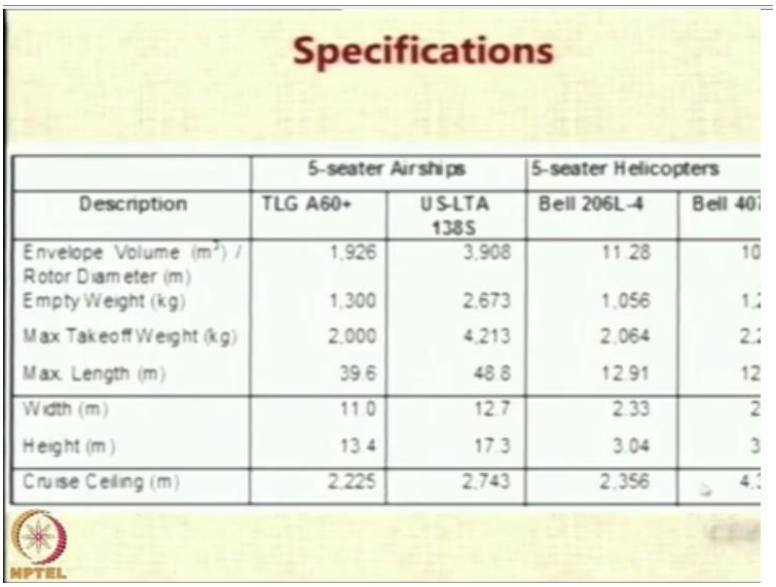

So, let us look at the specifications. Both airships and helicopters were 5 seaters. Passenger, 5 passengers can be carried. So, the airships the data is available about the envelope volume. So, one of them is 1926, the other is 3908. So, one is a little bit larger than the other. Helicopters are both around 11 meter rotor dia. Empty weight is 1300, 2600 so it is almost double the weight. Helicopters are around 1000 kgs, 1000 or 1200 kg.

And the maximum length of airship is of course two and a half times that of the helicopters. Helicopters around 13 meters in length. Airships are one is 40, the other is 50. So 40 meters is quite a lot and 50 meters means nearly 160 feet. But what you need is an area which is let us say twice the length or 1.2 times the length in very worst cases so that you can come down vertically.

But suppose you do not want to come down vertically, I would say twice the length and twice the width is sufficient for you to maneuver the airship to land. So twice the length twice the width means you need something like 100 meters wide I mean 100 meters length and perhaps

25 meters wide. So any football field that is available or any ground in any school or college is sufficient to handle the operations.

So we did actually a survey of how many places are available where you can build a temporary helipad or you can build a small blimp port allowing the airships to come in. As you know airships do not land typically like an aircraft. They are essentially brought down to the low altitude and then the handling lines are grabbed by people and you are attaching it to the mooring mast.

So, therefore even if you have slight grassy field, even if it is slightly uneven as long as people can run and grab and bring the vehicle you can use it. So there is no need to create perfectly flat and in aircraft you need to make a runway which has also got impact loading capability all that is not needed when you operate airships and helicopters. And you can see that the cruise ceiling is 2200, 2700, 2300, 4300. So we have to limit operations only to those altitudes which were less than 2000 meters so that we do not ever cross the ceiling.