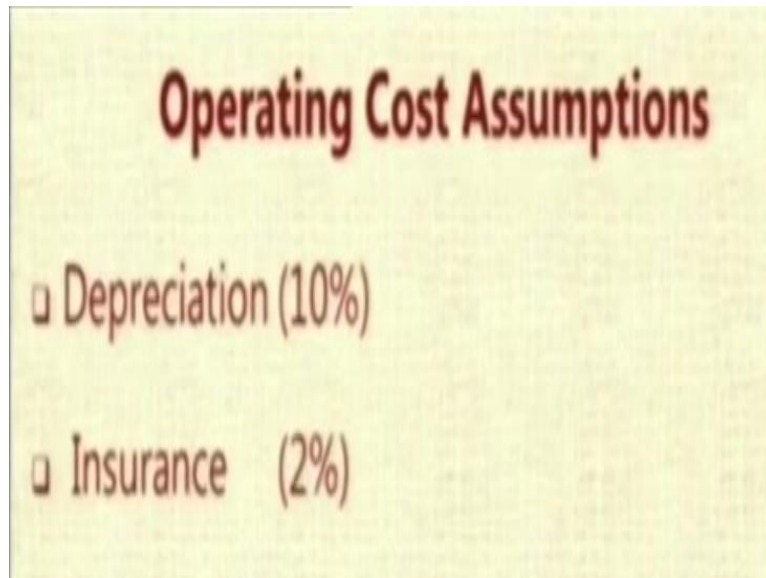


Lighter-Than-Air Systems
Prof. Rajkumar S. Pant
Department of Aerospace Engineering
Indian Institute of Technology - Bombay

Lecture - 90
Airships versus Helicopters – Part II

(Refer Slide Time: 00:16)



Now let us look at operating cost assumptions. Now the depreciation is basically the loss in the value of an item over the years because of it being old. So you buy an aircraft and if you do not use it much or not at all, when you sell it after some time, you will hardly get the same price. There will be some depreciation. So that was assumed to be 10%. This is a standard practice in helicopter operations.

Now, when you have to buy these items and you have to operate these items, you have to go for insurance. And the insurance varies in aircraft industry from half percent to one and a half percent of the cost of the item. An established airline pays around half percent premium. Half percent of the cost of the aircraft per year is paid to the insurance agency towards premium for third party damage and to cover all the liabilities.

In the case of airships, it is a new field, it is a new subject, people do not know about it, so we have assumed it to be 4 times more expensive, so 2%. Similarly, maintenance is going to be a recurring cost. This depends on the labor charges for doing the work as well as the cost of the

standard spares. Certain items in an aircraft or airship or helicopter have to be changed after so many hours of operation.

Certain items have to be changed or worked on after every flight or before every next departure. So all of that is standard and the data is available from the manufacturers. The next expenditure is the crew. Crew will consist of ground crew and the flight crew. So for the flight crew, we assume pilots and we assume here that the airship pilots will be as paid as the helicopter pilots. There is no reason for us to say that they are going to be paid more or less. And then the fuel costs.

(Refer Slide Time: 02:26)

DOC Comparison				
Operating Cost Table (in Million US \$)	TLG-A60+	US LTA 138S	Bell 206L-4	Bell 4
Acquisition Cost	2 100	3 338	1 640	1 91
Utilization per Month (hours)	296	338	163	140
Annual Insurance Premium	0 042	0 067	0 033	0 03
Annual Fuel Cost	0 130	0 208	0 107	0 10
Annual Maintenance	0 051	0 075	0 072	0 08
Annual Spares	0 090	0 132	0 249	0 28
Depreciation of Hull & Ground Support Infrastructure	0 210	0 334	0 164	0 19
Annual DOC (8 months)	0 923	1 216	1 025	1 10
Hourly DOC (in US \$)	388.96	448.88	783.49	985.0

So if you look at the direct operating cost comparison 2 airships and 2 helicopters look at the numbers. First of all, let us look at the money that we have to pay to buy it. So a helicopter will cost around 1.64 or 1.9 million dollars. Airship will cost 2 million dollars and 3 and half million dollars roughly. So the initial cost of the airship will be higher. The only reason for this as I said is less availability.

They are not available very easily as compared to helicopters. Therefore, their initial costs are very high. Now, the speed at which a helicopter can fly is more compared to the speed at which the airship can fly, therefore to cover the same distance we need more time. So the utilization number of hours it flies per month is going to be far more for airships compared to the helicopters. In this case we are using the same mission.

Let the number of people to be transported is fixed, and now in one case we use helicopters to do that particular job and in the other case we are using airships. You can notice that the insurance premium is 2% of the initial cost, it is more for airships compared to helicopters. Interestingly, the fuel cost for airships is larger. For TLG A60 it was 0.13 million and for Bell Helicopter was 0.107 million and for US LTA it is 0.2 million compared to 0.1 million, so double.

Now since the beginning I have been saying that airships consume less number of fuel, fuel costs are ignored, but what is the reality? The reality is that the fuel costs for airships are coming to be double that of the helicopters. But we know that the consumption of fuel in airships is far lower compared to consumption of fuel in helicopters. So what could be the reason for these costs to be double?

“Professor – student conversation starts.” Sir generally for air transport systems you compare two way pass for a passenger. Airships carry a lot more passengers than the reported. No, in this case all carry 5. All of them carry 5 passengers. All these 4 aircrafts, 2 airships, 2 helicopters are carrying 5 passengers per trip. Number of hour utilization. Utilization that is fine, but the number of passengers carried away is the same.

No but helicopters also consume a large amount of fuel. I am telling you this information that the volume of fuel consumed is far lower in the case of airship than helicopters. Type of fuel. Type of fuel that is the thing. Helicopters use a particular kind of fuel which is subsidized and available. Airships use a different kind of fuel which is not subsidized and not easily available.

“Professor – student conversation ends.”

So, the difference in the fuel pricing is only because of policies. It is only because of the current, now this can be easily changed if we make a case to the government that we are operating these airships to provide connectivity, so give us a subsidy on fuel or make available this fuel at that particular place at a lower price. So, even now for example people who fly a single seater or two seater planes, they use gasoline and then you have Avgas and then you have jet fuel.

So, the jet fuel is actually cheaper than the petrol if you buy for the automobiles. Today in India the jet fuel is cheaper. So, this particular difference in the fuel cost is just an anomalous situation. It is like there is a subsidy on diesel, therefore diesel is cheaper than petrol. But we

said that we cannot assume that overnight we can expect anyone to change rules in our favor. So, even though the volume of fuel consumed is much less, the cost of fuel is larger, so let it remain.

Annual maintenance cost for airships are much lower because helicopters have very large number of vibrating, oscillating parts. They have much higher wear and tear. The whole idea of producing lift is by rotary mechanism. So, the maintenance costs are much larger. In airships the maintenance costs are much lower. Similarly spares; spares are much lower compared to the helicopters.

You can notice helicopters has very high cost of spares. Depreciation of airships will be higher because the initial cost is higher, depreciation is 10%, so it is definitely higher. And if you look at all the numbers, you will find that the annual net operating cost if you add all these numbers together, it comes to be 0.926 million US dollars. But the hourly costs are lower because they fly for more hours.

So, this hourly cost is actually a misnomer, it is given here but it is a misnomer because you have two systems they do not fly at the same speed. So one of them flies let us say one and a half times more, therefore if you divide the cost per hour you are actually giving it an undue advantage. So, I will not worry about the last line which shows that the hourly DOC is more than half for airships that is because you can see the number of hours flown.

But look at the annual direct operating cost in 8 months how much money has to be spent. It comes to meet the requirement to fulfill the same transportation need of transporting so many passengers it is 0.9 million and 1.2 million as against 1 million and 1.1 million. So the answer is that they are almost as expensive as helicopters not too much more not too much less, but they can be made less if we allow it to get the fuel available at lower costs.

(Refer Slide Time: 09:34)

Key Results					
Name	Annual Usage (hr)	Annual DOC (in million US \$)	Annual Cost per Seat (in million US \$)	Hourly DOC (in US \$)	Hourly Cost per Seat (in US \$)
US-LTA 138S	2373	0.923	0.185	388.96	77.8
TLG A60+	2708	1.216	0.243	448.88	89.8
Bell 407	1308	1.025	0.205	783.49	156.7
Bell 206L-4	1121	1.104	0.221	985.01	197.0

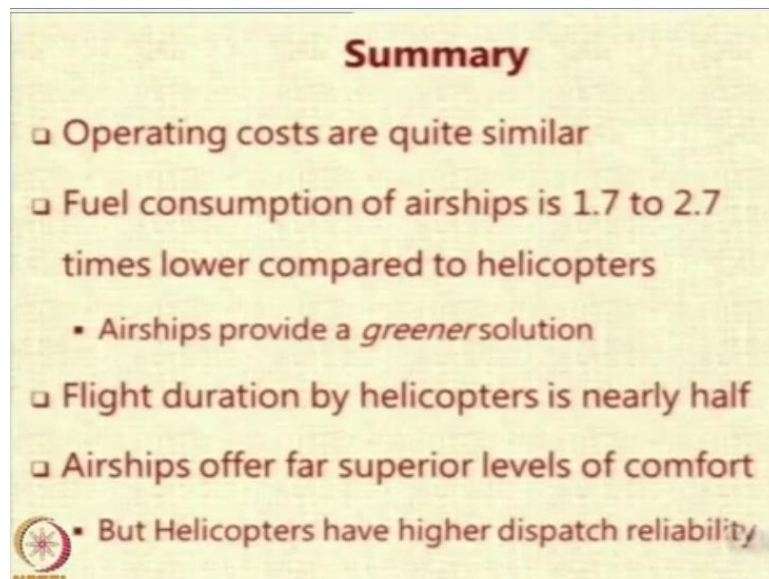
So, these are key results. **“Professor – student conversation starts.”** Yes. Whether the annual operating cost also referring to. Whether in the what trends? How much time are you operating the airship at this cost. It has been considered. See as I mentioned to you we have only assumed certain windows in which the aircraft will be able to fly. So I am not looking at an 8 hour a day window or something like that. I will looking only at 2 hours window in a day for it to fly. So, there will be one flight on each side.

So, these details are available in my paper which I will share with you. I will put it on a Moodle page for you to read through. **“Professor – student conversation ends.”** So, we have done a careful study in which we have not assumed that it keeps flying despite bad weather, 4 months in a year nothing flies. In the remaining months also there is only a very small time window in which barely only one operation takes place or one flight takes place.

So, if you look at cost per seat, now this is what I am saying. If you look at the cost per seat, I will not look at the hourly costs, I will look at the cost per seat. So, annual cost per seat is 0.185, 0.243 which is lower than the cost for the Bell helicopters. So, yes TLG A60 + is expensive because initial cost is very high that itself is a very big killer.

The depreciation is 10%, insurance is 2% of the initial cost that itself is very high. But if you look at US-LTA, the operating cost per seat per mile is 0.185, not per seat per mile sorry it is the annual cost per seat 0.185 against 0.205 and 0.221 for the helicopters.

(Refer Slide Time: 11:29)

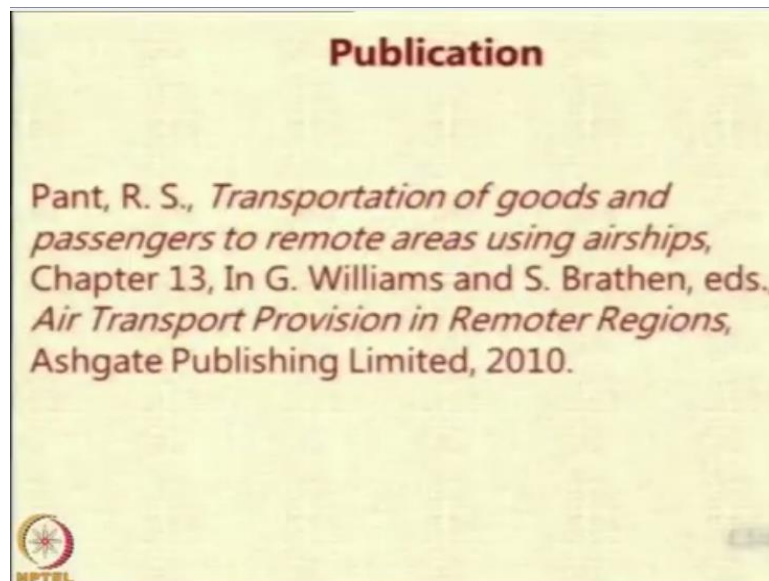


So, in summary operating costs are quite similar. They are not substantially lower. The fuel consumption of airships is actually nearly two or three times lower. So, I have not mentioned here by volume of fuel consumed. The volume of fuel consumed is one-third or half. So, that is a very big saving. The environmental costs of that are very attractive. It is a greener transportation system.

Similarly, the duration in which helicopters can fly is half. That means helicopters can get you there in half the time, airship will take double the time. But the competition is not between airships and helicopters actually. The competition is between airships and other modes and helicopters and other modes. Helicopters will travel faster, but they will cost more. Airships will travel double the time, but they will cost much less.

Both of them against the ground transportation will take far less time. A journey of one and a half days will become a journey over a couple of hours or 3 hours. So airships will offer a much superior level of comfort, but helicopters have a much higher dispatch reliability compared to airships. So this was the general conclusion of the first study.

(Refer Slide Time: 13:09)



And this study was published first as I presented a paper in an international conference. There was a conference which took place in Norway, Air Transport for Remoter Regions. So I presented this paper in that conference in April 2009. Subsequently, a book has come out called as Air Transport Provision in Remote areas by Ashgate Publications. In that book, this particular study has gone as a chapter. So, the book is available in our library.

And I have also kept one copy in departmental library and I can always mail and upload the article for you to read. Now, are there any questions or comments about the first case study before we go to the next case study, which is much more interesting by the way? Anybody has any questions? No queries? So when there are no queries that means either it is a bouncer which you could not hook or pull or everything is clear to you, crystal clear. So, I assume that things are clear, if not I am available for any clarification.