The Near Futurist: Flying and reducing carbon

SUMMARY KEYWORDS

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SPEAKERS

Guy Clapperton, Cristina Garcia-Duffy, Tom Grundy



Guy Clapperton 00:06

Welcome to Dividing Lines, a series of special programmes from the Near Futurist, where we will be bringing together respected innovators and thinkers to examine some of the most consequential debates in technology and society today. Dividing Lines is powered by Diffusionc an award-winning international PR agency on a mission to help tech innovators to take on the status quo and transform the future faster. My name is Guy Clapperton.



Guy Clapperton 00:35

We're starting to travel again from the UK where I live. Countries are coming off the Red List, they might go back, quarantines might be reduced or increased, I'm not claiming to know. What's certain is that flying for business and leisure is on the agenda once more. And that clashes nicely with the idea of reducing carbon emissions because we all know planes are terrible polluters, right? Actually, that might not be right. Or at least me It might be a bit of a dated concept because the idea of carbon neutral travel could be approaching. That might sound improbable but I have two guests here to discuss it. First of all, we have a guest who is the head of business management for BAE Systems' Tornado availability support service, was assistant chief engineer in BAE Systems unmanned aircraft development business and prior to that, he led programmes developing new AV mission system capabilities in BAE Systems Australia. He also worked on the Airbus A 380 and Eurofighter Typhoon programmes. He is now chief executive of Hybrid Air Vehicles, and his name is Tom Grundy.



Guy Clapperton 01:37

Our other guest has held various management positions at Leonardo Helicopters, previously known as Augusta Westland, and before this had research and teaching positions at two universities in the USA. She holds a PhD in aerospace engineering from Washington University in St. Louis, USA, and MSC and BSc with honours from St. Louis University USA. She is now the Aerospace Technology Institute's head of technology, strategy and integration. Her name is Dr. Cristina Garcia-Duffy, Welcome to you both.



Cristina Garcia-Duffy 02:07

Thank you Con

rnank you Guy.

Tom Grundy 02:08
Thank you, guy.

Guv

Guy Clapperton 02:09

You're more than welcome. So Tom, I started off making some fairly sweeping comments about air travel and pollution. So can you tell me a little bit about the work that Hybrid Air Vehicles actually does?

Tom Grundy 02:20

Well, Guy, at Hybrid Air Vehicles, we're developing a new category of aircraft called Airlander. And it's designed very differently. It's designed to be extremely efficient. So Airlander carries large payloads. It carries those payloads over very long ranges for long flight times for while using very little fuel. It's designed for key roles that can be served by what is a completely new type of aircraft. But it's really different to look at. And it's really different in operations to the stereotypical view that that we perhaps have all in our minds of first aircraft with two wings, two engines and a tail. So Airlander is different, it operates away from today's airport infrastructure. And critically, that efficiency makes it green. So as we bring our lander into service, we expect it will deliver 90% less emissions in flight than other aircraft for those same sorts of roles.

Guy Clapperton 03:19

Okay, just to clarify, I had a look at your website. And that's all the visuals led me to think about blimps rather than aeroplanes. I'm sure that's a gross oversimplification. Can you tell me where I'm going wrong with that?

Tom Grundy 03:32

Well, we use some technology from the lighter than air world, either blimps or dirigibles you could call them what you will, we are something called a hybrid aircraft. And the critical key difference is, whereas blimps or or airships float, Airlander, doesn't. Airlander is heavier than air. So simply, when we stop our engines, Airlander comes down and lands and sits on the ground while it's loaded and unloaded, fueled, de-fueled, maintained, as opposed to floating away at a mast there. And the reason that's really important is that we're designed to be able to take people or equipment to places of the world that are hard to reach. And when you get there, you don't really want to have to have those big masts and that big infrastructure in place to be able to handle the aeroplane. And of course, if your job is to go and deliver 50 tonnes of payload somewhere, once you drop that payload off, you in a traditional airship, your airship would really have 50 tonnes of excess buoyancy additional lift wanted to take it away from the ground, so it's really hard to handle. Whereas Airlander... to take that payload off Airlander stays on the ground, we can load and unload it easily turn the aeroplane around for his next flight.

Guy Clapperton 04:49

Okay, is this all theoretical? Or is it actually happening with vehicles in the sky? Where are we in terms of the real world here?

Tom Grundy 04:56

We've developed Airlander, flown it at full scale. It was flying in the UK as a full scale prototype aircraft a couple of years ago. And since then we've been working to take all that flight test data and turn that into the production standard of our aircraft. So we're now at a really exciting phase of our programme having developed the technology flown it got ready for production, we're now working to launch that production line and get the first Airlander aircraft into the market by the middle of this decade.

Guy Clapperton 05:29

If I could move to Cristina, I'm the furthest thing you'll get from an expert as you're probably gathered from the line of questioning. But I've always assumed it takes a heck of a lot of fuel. That's a scientific measure, they're "a heck of a lot" to get all that metal and people and goods into the sky. I'm just wondering if you could give us a bit of the scientific lowdown on what technological energy physical obstacles organisations wanting to lower carbon from air travel, whether through air land, or through any other means, actually have to overcome.

Cristina Garcia-Duffy 05:58

Sure Guy, and I guess "a heck of a lot" is a good way to put it! As Tom has mentioned, and this is beyond Airlander, if you look at other types of aircraft, it is not so much if you consider how many people are transported in an aircraft at the same time. If we do some calculations, the efficiency of current aircraft flying at full capacity per passenger per kilometre, is about the same as the efficiency of a modern compact car carrying one person per kilometre. So we've come a long way. Aircraft also move lots of passengers, up 4.5 billion passengers in 2019 alone. So that's more than half the world's population in terms of flying. They also carry people on goods long distances where power some other methods of transport cannot reach.

Cristina Garcia-Duffy 07:05

Having said that, the sector burned some 300 million tonnes of fuel in 2019. If you multiply this figure by three, about three, this is the amount of carbon dioxide put out in the atmosphere. So decarbonizing flight is the absolute top most priority for us right now as a sector. We have some various scenarios to decarbonize at global and local level in the UK. And we're now aiming to achieve net zero carbon emissions by the year 2050.

Cristina Garcia-Duffy 07:45

And what all of these scenarios have in common is that they include these three same pillars of technology. Pillar number one, we're looking at improving how aircraft fly. Under pillar number two, we're looking at improving the aircraft themselves so that they burn less fuel, and then therefore they produce less carbon. And lastly, pillar number three is looking at a whole heap of new alternative fuels and energy sources that produce lower or zero carbon emissions. You may have heard about synthetic aviation fuels. And we're also looking at new types of aircraft that use things like batteries or hydrogen instead of conventional fuel. I guess on the on the main challenges. If we look at the the broader economics, all of these, all of these solutions require large investments. And I'm talking in the area of billions, and in some cases, trillions of pounds over the next three decades.



Also, all of these changes and investments need to be made at a global level because aircraft are movable assets and they fly. They operate globally. So one single policy in a country is not going to make an impact at a global level. And lastly, all of these changes take a lot of time. An aircraft has a life of anything between 20 to 30 years when they're in service and they're operated. So the decisions we make now mean changing the system considerably takes decades to deliver.

Guy Clapperton 09:33

[music] Do you want to sound as confident as my interviewee in this episode? If you talk to the press or other media, are you worried you'll be misquoted although just publish their story and not yours? Clapperton Media Associates can help with coaching. drop me a note Guy at Clapperton dot co dot UK and we'll arrange a time for an exploratory call. Now, back to the podcast.

Guy Clapperton 10:09

I think those are very important points. And Tom, one of the things you'd be doing, I would imagine, is selling your offerings to market, it's already got a large installed base and indeed a very large installed infrastructure. If I put it like that you mentioned you're moving away from the traditional airports, and all the signalling and everything like that to get all that infrastructure everything. How can you actually make any inroads into this.

Tom Grundy 10:34

As we've said, as Airlander is a new category of aircraft, it operates in different ways, and it fills roles in ways that other aircrafts don't. So much of our market that we're taking Airlander to is actually either currently not served by or poorly served by or even worse, inefficiently served by today's aircraft. So, for example, think about freight, our options at the moment are air freight or surface transport. And many parts of the world are underserved by both.

Tom Grundy 11:08

Many people will have seen the programme Ice Road Truckers that deals with the challenges of moving equipment up in the north of Canada. But there are parallel challenges to that in many, many parts of the world. There are other parts of the world where we're a bit trapped or constrained by the congestion that we see in our ports in our airports on our roads. And the disruption that those are prone to we're seeing that all around us right now is that supply chains adjust to the pandemic and other other factors over the last 12 months. So with Airlander, we offer something that's complimentary to the existing installed base, and fits alongside and changes some of the ways that we manage people and freight and things around that network.

Tom Grundy 11:58

Now, some of our markets, and the example I'd give here is very short haul passenger transport that they do have installed basis of aircraft, such as, you know, regional jets, flying several, many of those sectors around the world. But again, because we don't have a full range of of options open to us, those regional jets are often used quite inefficiently. And one example of the you know, we've got lots of short sector travel that goes to and from islands, for example, and we need the air, we need the Air Flight because well, because of the water you've got tp cross, and

ferries and surface transport take a long time and the flights are very quick. But we're actually using aircraft designed for long sectors on short sectors there. And we can see now quite rightly, that action from society from government, it's happening all around us to make us aware of the carbon impact of those short but often necessary flights.

Tom Grundy 12:55

And so Airlander in those sort of sectors offers traveller journey times that are similar to the Air Flight. But our carbon footprint is often lower than making that same journey by road, rail or sea. And so in those markets, where there is an installed aircraft base, as Cristina said, the life cycle of aircraft and of course each aircraft's got embodied emissions in it long, but the aircraft are not always working at their most efficient on those sectors. And an option like airlander offers a step change in carbon impact. And that's how we're starting to address those markets.

Guy Clapperton 13:32

On the other hand, if you're going somewhere like Ireland, or I've got family in Scotland and I live in London, not only are their flights from Gatwick near and near where I am, or Heathrow, there are train stations of these places. So you know, getting to those airports is easy. Is that part of the sort of challenge that you're going to be facing in these markets?

Tom Grundy 13:54

Of course, we're blessed with quite a good selection of options here in the UK. And of course, in choosing your options, you you choose what speed, what price, what kind of journey, what kind of environment that you want to be in. And even in the UK, that leaves us with some sectors that take time, you know, the example of moving from the mainland UK to Northern Ireland is a good one where the ferry journey can be very long and the air journey is very short. That is carbon intensive.

Tom Grundy 14:23

Of course, if you look all around the world, there are many geographies where those options aren't all fully fleshed out. They're not all available, the environment or the geography makes those journeys by sea or by or by land very difficult. And that's where Airlander offers the opportunity to provide those services at a much lower impact. Now, infrastructure wise, again, you know, we're very used to the difference between going to an airport and going to a railway station or the difference between going to an airport and going and getting on the ferry and the environment of the the ferry And the train are operating from is different from the airport for lots of reasons, including the speed and the security requirements you need to put around fast aircraft. So for Airlander, perhaps a little bit more like thinking about going to a heli board, you'll get there, there'll be less less infrastructure needed at the airport and easier journey to get onto the aircraft itself. And then when you're on board, perhaps think of it more as a fast ferry or more like the experience you have when you're on a train, where you've got the ability to move around every seats accessible to the aisle, you're quiet, there's little vibration, you're able to work or relax or just enjoy the vision, the big windows, it's just a different way of travelling.

Guy Clapperton 15:44

Okay, Cristina, I've, we've already mentioned the idea of aeroplanes which run on batteries or alternative fuels, to the

existing fuels. I'm just wondering how far research is stretched into this and whether there are prototypes or whether there are actual flights happening at the moment or when we can expect them?

Cristina Garcia-Duffy 16:04

Yes, absolutely. And an alternative configuration is Tom's very own hybrid calling in this space. I'd say there's a huge amount of hype for zero carbon emitting aircraft. They're popping everywhere, particularly around the urban Air Mobility, advanced Air Mobility market. So these aircraft are aircraft that would use batteries instead of fuel. They're all electric car version for the skies. Batteries are still very heavy. They are large if you need large quantities of energy. So for now, their use is limited to very small aircraft. So air taxi type of aircraft, we indeed through the API programme, we provide funding in research and development for technologies on aircraft. And we're funding a number of technology developments for these aircraft types. If you want a couple of names for the UK, there's a company near Bristol called Vertical Aerospace who are working currently on a flying demonstrator for for these types of aircraft.

Cristina Garcia-Duffy 17:20

Many others are now also investigating the feasibility of aircraft that fly with hydrogen. Hydrogen can be a zero carbon fuel, provided you're using green hydrogen. So when it is used, you can use it in a fuel cell. And it can provide an advantage over batteries, allowing longer distances for these same air taxi type aircraft. Or they can be even scaled up for turboprop type aircraft carrying 20 passengers also out there in their earliest stages of development. So the jury's still out deliberating whether they will be feasible and where the limits on range and payload may be.

Cristina Garcia-Duffy 18:11

And I guess the big question now is will they be commercially viable. The great disrupter opportunity, though, is if you could burn hydrogen in an aircraft engine, so you could burn hydrogen to enable a larger aircraft, sort of a single aisle type aircraft or a turboprop type aircraft carrying a lot more passengers 100 or 200 passengers. But to be most efficient, this aircraft needs to be equipped with systems that can handle liquid hydrogen, which offers the best amount of energy in a given volume. And liquid hydrogen needs to be cryogenically cooled. So hydrogen is everywhere, it's in gaseous form. For it to be used as a fuel, it needs to be liquid. And for it to be liquid, it needs to be cooled and stored at some -250 degrees Celsius. So that is very cold. And you can imagine the technological obstacles of making this a reality. They're huge,

Guy Clapperton 19:24

So tempting to ask what you'd power a system like that with - just the cooling system alone, which I'm sure scientists will have already thought of that. So that's hydrogen and also other battery technologies. What other technologies should we be looking out for in the near future? And what are some of the pitfalls that people are encountering?

Cristina Garcia-Duffy 19:43

So in in the non civil lower carbon, we're always looking for aircraft technology efficiency, so making current aircraft more efficient. In the last 100 years or so every single next generation of aircraft is 20 to 25% more efficient. And that efficiency comes mostly from making engines more efficient. You may have seen that engines on aircraft keep

getting bigger and bigger. That's because they can have a higher bypass ratios. They have better combustion technologies, you can also improve efficiency with aerodynamic improvements. So you may have seen that aircraft wings have become much more sophisticated. We have devices like wingtips and so on. And the key word is Weight, weight, weight reduction. So any any technology, be it materials, and using those materials more efficiently so that we can reduce weight in your aircraft is going to give you a an advantage.

Cristina Garcia-Duffy 19:48

For the moment of course we're stuck with heavy batteries. As you say battery technology increases improves over time dramatically. Tom, can I get an idea from you of how long is likely to be before people like me, or indeed people like the military or indeed helicopter pilots can start reducing our carbon emissions other than by abstaining from flight completely?

Tom Grundy 21:23

Well, we aim for Airlander to be in service with its first customers by 2025. And our early customers are likely to use the aeroplane and a combination of military roles and and commercial roles of the sort that we've talked about here. I think so that's very near actually. But I think all of us in aviation and in the aerospace industry need to be careful not to over-promise where we're going to get to you know, as, as Cristina said, developing, implementing and scaling up new technologies for for rapid for you know, fast long haul aircraft without emissions.

Tom Grundy 22:02

That's that's a huge and it's a long term challenge. And I it's a personal view, but it is probably as hard as anything we've faced since the early days of flight. Were working on our part of the solution here. SoAairlander won't be your choice for your transatlantic flight from London to New York, we're a little slower than you might want for that. But we offer our passengers, we offer militaries, we offer shipping companies. And we offer helicopter pilots some really quick wins in our in our battle against climate change. And with those early quick wins that we can deliver, were already working to bring the next generation forward.

Tom Grundy 22:41

So Cristina, she talked about hydrogen technologies, they're really important to us as well. We're very interested in development of fuel cells, we're very interested in the scale up of green hydrogen technologies. We have electric motors, to be powered by those fuel cells in development, with Collins aerospace in the University of Nottingham here in the UK actually working with Cristina's organisation at AI to make that happen. And so from the from the start point that we've got here, we can use the efficiency of a platform like ours, to keep driving forward and move ourselves to zero emissions flight for the roles that we do. And I think also draw through technologies that have got wider applicability into other parts of the aerospace world as well as we all fight this challenge that we've got to get the carbon emissions out of flying.

Guy Clapperton 23:32

Christina starting to reach takeoff by 2025. Do you think that's realistic?

Cristina Garcia-Duffy 23:38

Yes, yes, I do.

Guy Clapperton 23:41

That's a very short and honest answer. That's excellent. Thank you. Final question, if I may. Can we find out more about both of you, and where we can find out more about you and your organization's perhaps, Tom, you could start us off?

23:54

Absolutely. You can find more about Airlander at our website, www.hybridairvehicles.com. And you'll find all the information there about what we've talked about today. Also our future Airlander 50 platform for large scale cargo flights. You can also join Airlander Club and keep in touch with us that way.

Guy Clapperton 24:16
Excellent. And Cristina?

° 24:18

And from our perspective, you can always contact us via www.ati.org.uk or feel free to contact me directly on LinkedIn and send through your request.

Guy Clapperton 24:35

Tom Grundy of hybrid vehicles and daughter Cristina Garcia-Duffy of the Aerospace Technology Institute, thank you very much.

Tom Grundy 24:42
Thank you.

Cristina Garcia-Duffy 24:43

Thank you guy.

Guy Clapperton 24:46

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