Electrification of Air Transportation — Q&A

Q: What are the battery development targets for eVTOL? Is there any interest in solar thin film on the skin of aircraft?

Borda: Generally, the industry has been targeting battery energy density of something over 450Wh/kg at the pack level. As a comparison, the battery in a Tesla Model 3 today is, I think somewhere on the order of 240Wh/kg. In addition to energy density, fast charge and discharge, thermal stability, and lifespan are all important for the industry. Battery development is an exercise in trade-offs.

As Mr. Takano points out below, the leading eVTOL manufacturers are going into certification today with the batteries they have. They have been working with battery vendors for several years now to optimize for their aircraft. But there will continue to be opportunities for improvement.

I have not looked into solar generation onboard for these aircraft, but my impression is that even with the most efficient thin film available today, the surface area on the aircraft is so small and the power draw is so large that solar would not make a significant contribution. The Solar Impulse aircraft was famously powered by solar, but it had a very large wingspan and surface area and flew at higher altitude than is envisioned for eVTOLs today. That said, innovative aircraft developers are always looking for solid technologies if they can make a difference.

Q: To what level has battery technology reached today, and what batteries are currently available that will enable the operations that Archer, Joby and Lillium are targeting? Are the batteries that Archer, Joby, and Lilium are targeting available now or do you expect to develop the technology in the future? Will fast charging be the norm for batteries? Or will replaceable batteries be the norm?

Takano: Personally, I see the current situation is that manufacturers are developing their vehicles using currently available technologies, which include performance of batteries.
I am not an expert of battery technologies, but I can see activities for improved battery performance and many experts say it's coming. Of course, improved performance provides the operators like ANA the flexibility of operations such as serving longer routes, higher utilization associated with less needs for recharging, and so on, and it will be highly welcomed.

Borda: Regarding battery swapping, some aircraft manufacturers have explored this possibility. My understanding is that the early leaders expect fast charge between flights.

Q: Has ANA already decided on a specific aircraft manufacturer for the launch of the service? You mentioned multicopter type and tilt type, are you thinking of operating more than one aircraft, similar to operating Airbus and Boeing at the same time?

Takano: The current plan is to operate 4 passenger aircraft with the range of more than 150 km, and it leads to winged vehicles which are of tilt-rotor or lift+cruise type, because the current limitations of multicopter type airaft, capacity and range in particular, leads to difficulties to make viable business cases in our views.

I cannot mention names of specific manufacturers now, and hope we can make the announcement in the near future.

For the question about using several types of vehicles, it will be a nice option for the operators. Many airlines use various type or configurations of airplanes mainly according to the characteristics of the market, and why not for the UAM?

Q: How much would it cost if I fly from Osaka city to KIX?

Takano: I can only mention that the cost estimates by Archer and Joby may provide ideas for the price of future travels.

- Archer: https://s27.q4cdn.com/936913558/files/doc_presentations/Investor-Presentation.pdf
- Joby: https://drive.google.com/file/d/1KVilZufQAZ7Q8T7vh79VluHVW-nZp3CN/view

Q: I understand that wind must be a big issue for a small air vehicle for urban use. So, what do you think the wind data is used for? To flexibly change the flight path? Or to control the attitude of the vehicle?

Borda: You could probably think of using micro-weather data both tactically and strategically.

Right now we just don't know what low altitude wind patterns look like in many places. It's a problem that can affect small planes landing at airports today. A single weather station at the airport may not be enough to tell a pilot that they're going to encounter a surprise cross-wind over the building tops near the end of the runway as they descend. Technologies like wind lidar can enable 3D visualization of winds, and that information can be very helpful for pilots and operators to fly safely. I don't know that anyone is feeding weather observation data into flight control systems in-flight, but it could be a useful input as automation progresses (something we did not discuss in the panel).

More strategically, fleet operators can also use this kind of micro-weather data to change routes as needed and to increase their tempo of operations when it is safe to fly. Today operators lose efficiency (and revenue) when they lack granular weather information and have to cancel operations.