

Short hops, clear air and the sweet spot for electric aircraft

Eviation

With an electric plane capable of traveling 1,000 km (620 mi) on each charge, you'd be capable of hopping between some pretty exotic destinations. A trip from London to Paris would leave you with battery to spare, as would flying from Paris to Barcelona. After a battery swap in the Catalonian capital, you could make it to Lisbon in Portugal, or even Florence in Italy if the mood strikes. This kind of emission-free air travel might sound like an environmentalist's pipe dream, but these distances, if not the destinations, are firmly in the sights of electric aircraft builders gearing up for test flights in the next few years.

Electric propulsion raises all kinds of possibilities for air travel, from hybrid planes that can improve the efficiency of existing routes to flying taxis that forge entirely new ones. But in what some consider a sweet spot for aviation are a new breed of electric planes powered by batteries alone, which could begin to cover the kinds of distances laid out above some time in the coming decade.

Among all the big names and shiny airframes of last month's Paris Air Show, there was a small prototype plane generating some big attention. Built by Israeli startup Eviation, this nine-seat electric aircraft goes by the name of [Alice](#), and is built for what its creators call middle-mile aviation.



A crowd gathers around the Alice electric plane at the Paris Air Show

Eviation

With a range of around 1,000 km and cruise speed of 240 knots (445 km/h or 276 mph), Eviation hopes its zero-emission plane can soon go to work servicing regional routes, and amid all the fanfare of the Paris Air Show it revealed its first customer. Cape Air is the largest independent regional airline in the US and has committed to buying an unspecified number of Alice planes as it looks to reduce its environmental footprint. It sees these kinds of planes playing a big role over the coming decade.

"As the technology and innovation surrounding this development evolves, it's fair to say that electric aircraft will be the norm by 2030, or would have provided the foundation for even further advancement in the industry," Cape Air vice president of public relations Trish Lorino tells New Atlas.

Lorino also points out that Alice is yet to be tested or certified and says that integration of the plane into its fleet is at least four to five years down the road. Eviation, meanwhile, tells us that the first test flights of Alice are due to begin in the US later this year, and that it is also in talks with "several countries and organizations who are interested in including Alice in their existing fleets."



Israeli startup Eviation is developing a nine-seat electric aircraft by the name of Alice

Eviation

However long it takes for Alice to get up and running, it seems that it won't be too long before it has some company. According to consulting firm Roland Berger, there were around 100 different electric aircraft programs in development around the globe midway through last year. As of May this year, it [said](#) that number had grown to 170, and could hit 200 by year's end.

Dr Jake Whitehead is a research fellow and transport scientist at Australia's University of Queensland, and like Lorino, expects that a decade down the track these kinds of aircraft will have an important role to play in how we get around.

"Prior to 2030 we will see electric planes used on short-haul routes, primarily on lower frequency routes," he tells us.

A problem of density

The reason experts see electric planes specializing in routes up to 1,000 km is closely tied to the limitations of the technology. More specifically, how much energy batteries can store and still be light enough to lift into the air and travel meaningful distances. As it stands, the density of these batteries pales in comparison to the way traditional planes store their energy, in rich and reliable kerosene-based jet fuel.

"The main hurdle for a completely electric plane is battery technology," Nikhil Sachdeva, who leads the electric propulsion team at Roland Berger, tells New Atlas. "Batteries need to be more energy dense, meaning they need to carry more energy per kilogram. Today's best in class batteries have a density of around 250 to 300 Wh/kg, compared to jet fuel which has a density of around 12,000 Wh/kg."

While plenty are waiting patiently for battery technology to advance and for the opportunities to open up, others see no need. Another example is Canada's Harbour Air, which as North America's largest seaplane airline services 12 routes around the Pacific Northwest, carrying around 400,000 passengers per year.



Harbour Air Seaplanes has pledged to become the world's first all-electric airline

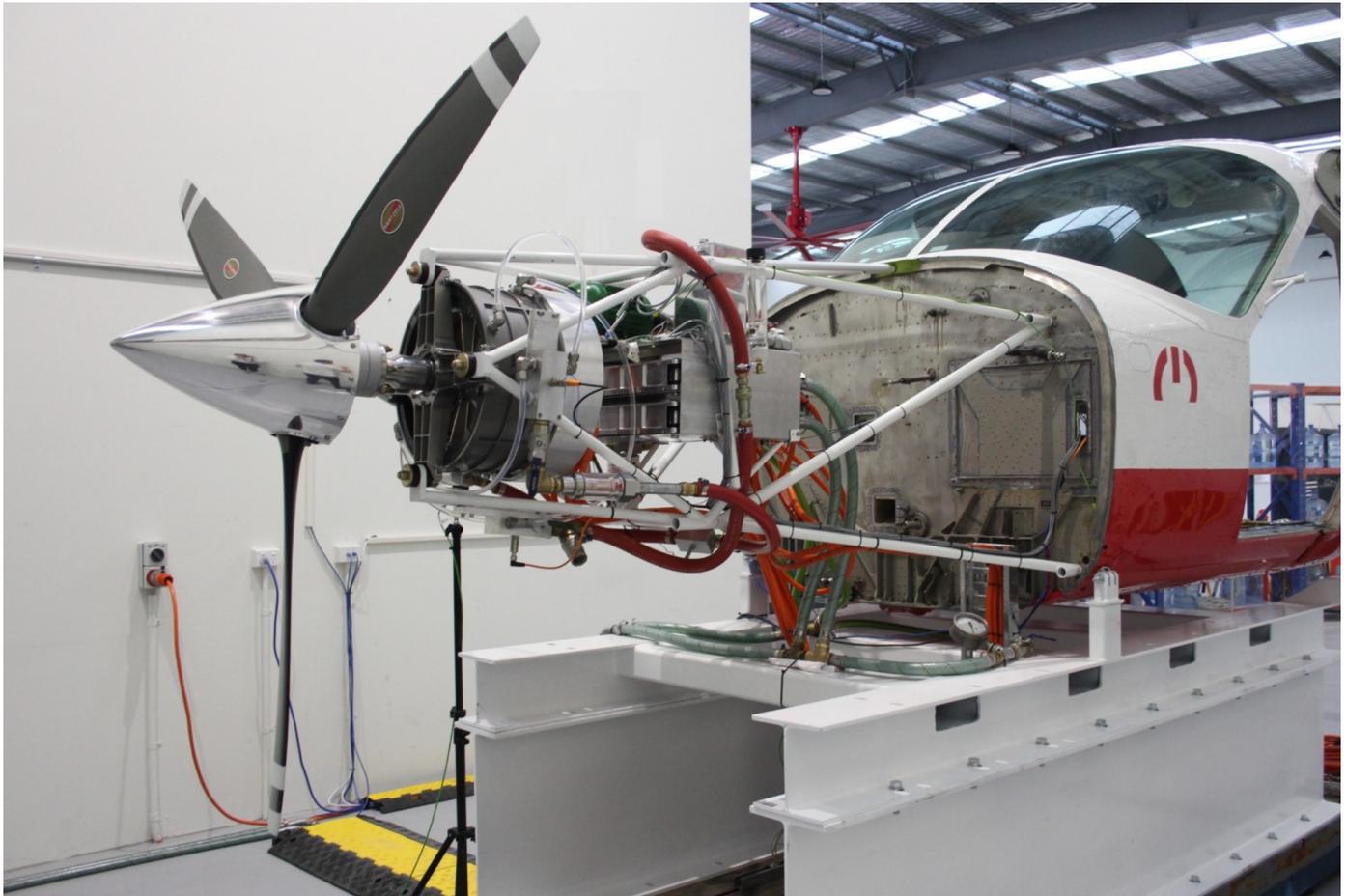
Magnix/Harbour Air

In March, it pledged to become the world's first all-electric airline. That means over the coming years it will start retrofitting its existing planes with electric propulsion systems, beginning with a six-seater commercial aircraft called the DHC-2 de Havilland Beaver that it plans to test fly this year.

"We believe that electrification and sustainable business practices are the way of the future, currently technology hasn't caught up to the current demands of the world's aviation and the tourism industries," Harbour Air President Randy Wright tells New Atlas. "Harbour Air is in a unique position,

due to our aircraft's size and flight times of our coastal routes, to leverage the current technology ... By 2030, we believe this will be the standard for seaplane travel."

The driving force behind the ambitions of Harbour Air and Eviation is, quite literally, an Australian company called MagniX. It develops the electric motors that both companies have selected to power its planes. Its CEO Roei Ganzarski says the main technical challenges in electric propulsion are the need to pack enough power into a motor that can do without elaborate cooling equipment and a speed reduction gear box, and is therefore able to travel light.



Australian company Magnix is developing the electric engines for the Alice plane

Magnix

"MagniX was able to address all three challenges in its propulsion development such that the magni500 motor delivers 750 hp (560 kW) and over 2,800 Nm (2,065 lb-ft) of torque in less than 300 lb (136 kg) of weight, turns at only 1,900 rpm thus offering direct drive to the propeller and uses a closed loop liquid cooling system that cools both the motor and inverter at the same time," he explains to New Atlas.

Imagining an electric future

Putting the environmental benefits to one side, electric planes would open up some very practical advantages, too. They could make fares significantly cheaper due to the lower fuel and maintenance costs (because of their simpler motors and drivetrain). They could improve the efficiency of major airports by handling the shorter trips and sidestepping movement caps on noisy planes that pump out pollution.

Perhaps even more importantly, and certainly more interesting, is the travel and transport opportunities they could open up. These light and low-cost aircraft could go places that it never made sense for traditional planes to go, opening up new high-speed transport routes through the sky (although they would fly slower, at least to begin with).

"These planes will make it economically viable to fly to many regions where it is currently not feasible to fly fossil fuel planes, and so the greatest potential beneficiaries of this technology in the near term are regional and rural residents," says Whitehead. "This technology can improve the connectivity of our regions, and if strategically planned and accounted for by policy-makers, can complement other transport modes, such as high speed rail."

Clearing the air

So, if electric planes do come to play the kind of roles imagined by Eviation, Harbour Air and the like, what does that mean for the environment? Short-haul flights certainly seem like a bit-part player in the grand scheme of things, but around half of flights around the globe every day are less than 1,000 km. Whitehead says this is "likely the upper limit for pure electric planes, until there is a step-change breakthrough in battery technology."

Total emissions from the aviation industry stand at around two to three percent, which would place them in the top 10 global emitters if they were a country. But this is expected to grow significantly over the coming decades, with the EU [projecting](#) that emissions will be around 70 percent higher in 2020 than they were in 2005. The International Civil Aviation Organization, meanwhile, forecasts that emissions will increase by somewhere between 300 to 700 percent by 2050.



Render of Eviation's Alice

Eviation

So, what role can these small aircraft play in applying the brakes to the industry's contribution to global carbon emissions? They won't be able to carry the same amount of passengers or travel as fast as today's airplanes do so their immediate impact will be limited, but technological advances could change that in due course. Paired with other forms of electric air travel, such as hybrid planes and flying taxis, they could help supplant other, dirtier forms of travel, while regulators too will have an important role to play.

"We have calculated that with a market-driven up-take of hybrid- and battery-electric aircraft, supported by effective improvements in air traffic control and airframe design, the share [of global carbon emissions] could be held down to five percent," says Sachdeva. "Further, if there is strong regulatory support to incentivize the uptake of electric aircraft, the share could even be kept at around two percent by 2050, even as other industries get greener. So electric aircraft can be really impactful, but a lot has to occur before such a significant impact can be created."

Some governments are already moving to usher in the era of electric aviation, such as Norway and Sweden, which have committed to 100 percent electric short-haul flights by 2040. Other industry giants are working on their own electric aircraft, such as EasyJet, which is developing a battery-powered plane with a 500-km (310-mi) range, and Airbus, which plans to test its hybrid aircraft by 2022. So, while it is a nascent industry with lots and lots of moving parts, it is one that is building some clean and clear momentum.

"There is a level of uncertainty about how quickly electric aircraft technology will be commercially rolled out, but certainly we should expect it to be widespread in the next 20-30 years, and form an important component of reducing global greenhouse gas emissions over that time

period," says Whitehead.