

# What the Green Airplane of The Future Could Look Like

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*Boeing and its Brazilian manufacturers have unveiled the Embraer E170*

[Donna Bowater](#), Rio de Janeiro

The green airplane of the future will tackle some of aviation's biggest environmental challenges including fuel efficiency, noise and plane washing.

New developments in technology will make it quieter, cleaner and cheaper, allowing it to fly more frequently and burn less fuel.

The Embraer E170 is the prototype unveiled by Boeing and its Brazilian manufacturers in the latest phase of its ecoDemonstrator programme to develop sustainable solutions and reduce the environmental impact of air travel.

The aircraft will test five new technologies that could improve performance during 14 to 20 test flights at the end of August.

“As leaders in the sector, Boeing and Embraer have the unique opportunity to invest in tests and in technologies that stimulate the development of aviation,” says John Tracy, chief technology officer for Boeing.

Among the advances is [the use of Brazilian biofuel](#), comprising 10pc bio-kerosene and 90pc fossil kerosene. All test flights will use the eco-friendly substitute.

“Many airlines around the world use biofuels fuels on regularly scheduled commercial flights. The age of biofuels is already with us,” Dr Tracy says.

“Our job is to make sure that we give them the best products that can create the most value for them and allow them to have the most efficient operations in the world.”

The Boeing vice president said the aviation industry had made an “incredible advance” on fuel efficiency but that fuel remained airlines’ biggest expense, leading to constant demand for improvement.

Studies have suggested that biofuels emit 50pc to 80pc less carbon and the findings from the ecoDemonstrator could help airlines meet new global standards for carbon emissions.

But while both Boeing and Embraer engineers believe they will eventually see planes running on 100pc biofuel, there is no single short-term solution.

“Our work is to make sure there are many options because here in Brazil, sugar cane might be a very good choice but in other places around the world, there might be no sugar cane but maybe there’s some local crop that’s sustainable that doesn’t negatively impact the food or water supply,” Dr Tracy adds.

“The biofuels that we’re developing are what we call ‘drop-in fuels’, and they can be used in existing engines, in existing airplanes.

“We believe that one per cent of aviation fuel can be replaced by biofuel and we’re talking about 10 conversion technologies. As the production volumes go up, we are very confident that the price will be in the right range to allow the airlines to have economically viable, environmentally-friendly solutions.

The most [developed of the innovations is ice-phobic paint](#), which could be rolled out “very quickly” after the tests and could protect planes from icing and bug residue, meaning less anti-freeze and less need to wash planes, reducing water use.

Compared to Rain-X surface treatments for cars, it was the first of the technologies to be installed on the ecoDemonstrator.

“It’s very interesting. It has to be durable to be able to fly and stay on at 500 miles an hour,” says Doug Christensen, coordinator of the ecoDemonstrator for Boeing. “It resists the water droplets and ice particles from forming on the surface and they’re just shed.”

The ecoDemonstrator will also test new slat designs on the wings that could reduce the noise during take-off and landing, which could pave the way for airlines to extend their flight schedules.

Reduced airframe noise is key in meeting new noise levels around airports.

“If you can reduce the noise, airports are more willing to allow you to land at better hours and so it’s all about making it fuel efficient and quiet,” Mr. Christensen adds.

Other concepts being developed include autonomous devices that measure airflow characteristics around the plane as well as Lidar technology that uses lasers to measure ranges and air molecules, which could help in the detection of turbulence.

During flights to test this technology, which is at an earlier stage of readiness, the plane will be flown at a range of heights and in various conditions.

Launched in 2011, the ecoDemonstrator program has tested more than 50 technologies but the latest phase is the first to involve another manufacturer.

The partnership began with an agreement between Boeing and Embraer in 2012.

Mauro Kern, executive vice president of operations, says the joint venture is “historic”, adding that achieving industry targets of halving emissions by 2050 would be impossible without collaboration.

“It’s an enormous challenge, a gigantic challenge,” Mr. Kern says. “It’s building the future through innovation and technology. Collaboration is essential.

“By integrating and testing different technologies in one single plane in Brazil, we contribute to the consolidation of a powerful instrument of support in technological development and innovation.”

Last year, the two companies launched a joint centre of biofuel research in São José dos Campos, in São Paulo.

Boeing’s Mr. Christensen says of Embraer: “They have a perspective on their technologies and we have a perspective on ours. They’re very innovative, they’re very lean, and they have an ability to accelerate technologies quickly. And I think that’s exactly the mindset we’re looking for on the ecoDemonstrator.”

He said a small team of engineers would test the technologies over a block of two weeks after the Olympic Games, which take place from August 5 to 21, before analysing the results.

Previous phases of the program tested blended biofuel while in 2014, Nasa used Boeing’s ecoDemonstrator to test its ASTAR system to more accurately space planes when landing.

In December 2014, Boeing used “green diesel” on a test flight for the first time and last June, the company tested solar-powered dimmable windows to reduce wiring, weight and fuel use.

Environmental pressure groups welcomed the latest phase of the ecoDemonstrator initiative but said significant returns on the research were needed for it to make an impact.

Tim Johnson, director of the UK-based Aviation Environment Federation (AEF), says: “The ecoDemonstrator project recognises two of the biggest environmental challenges for aviation – noise around airports and under flight paths, and greenhouse gas emissions that contribute to climate change.”

He says developments that reduced aircraft noise needed to be significant enough to mitigate the increase in the number of flights.

And he adds that simply replacing aviation fuel for biofuel was not sufficient.

“Any aviation biofuel must have lower ‘lifecycle’ emissions than conventional fuel in order to reduce emissions, not all biofuel does,” he says.

“In addition, the fuel should contribute to sustainable development in terms of having a positive social and economic impact on communities and the natural environment where the feedstock is obtained.

“The real challenge for aviation biofuel is how production can be scaled up to make even a small dent in the industry’s consumption of fuel that generated nearly 750 million tonnes of carbon dioxide last year worldwide.”

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