Backgrounder

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The Boeing ecoDemonstrator Program

Boeing launched the ecoDemonstrator program in 2012 to enable aviation's relentless pursuit to accelerate innovation, strengthen safety and efficiency and help mitigate the climate impact of our industry. With successive airplane platforms, the ecoDemonstrator program takes promising technologies out of laboratories and tests them in an operational environment to help solve real-world challenges for airlines and passengers.

A dedicated team of engineers and specialists supports the ecoDemonstrator program, which is part of the Boeing Commercial Airplanes Product Development organization. That team collaborates with experts throughout Boeing and the industry to select technologies to test onboard, which often takes years of preparation. Together, the team and technologists focus on a singular motto — "innovate, collaborate, accelerate" — to ensure they're supporting one another and the constant evolution of new ideas.

The Boeing ecoDemonstrator program has a legacy of bringing together customers, suppliers, government agencies, academia and other stakeholders to help test and advance sustainable technologies. Since the program's inception, engineers and scientists at Boeing and its ecoDemonstrator partners expanded the scope of research beyond reducing emissions and enhancing safety and operational efficiency, to assess new features, services and approaches that can improve the entire aviation ecosystem.

History

Twelve airplanes have served as flying test beds for the ecoDemonstrator program:

2012: American Airlines 737-800

2014: Boeing 787-8 Dreamliner

2015: TUI 757

2016: Embraer E170

2018: FedEx 777 Freighter

2019 Boeing 777-200

2020: Etihad Airways 787-10

2021: Alaska Airlines 737-9

2022-2024: Boeing 777-200ER (Extended Range)

2023: Boeing 787-10 Dreamliner (Explorer)

2023: Boeing 737-10 (Explorer), destined for United Airlines

2025: United 737-8 (Explorer)

Since the program began, the ecoDemonstrator program has evaluated more than 250 technologies – 28% have progressed onto our products and services, 52% are still being matured and 20% provided helpful learnings but were discontinued.

Many Boeing airplanes include technologies that were evaluated and proven on the ecoDemonstrator program, such as:

- More aerodynamically efficient winglets on the 737 MAX
- iPad apps that provide pilots with real-time weather and other information, enabling them to improve fuel efficiency and reduce emissions
- Custom approach path information to lower community noise
- Flight deck touch-screen displays and a camera system on the 777X that enhance safety by helping pilots avoid ground obstacles
- The program has pioneered alternative energy carriers.
    - Our 2012 ecoDemonstrator tested regenerative hydrogen fuel cell technology for onboard auxiliary power to the galley.
    - Our 2018 ecoDemonstrator conducted the first flight on a commercial airliner with 100% sustainable aviation fuel in both engines.

Other projects include technologies that reduce fuel use, emissions and noise, and incorporate more sustainable materials. ecoDemonstrator platforms have also tested cabin amenities that improve the passenger experience — features such as smart

galleys and UV disinfection – in addition to products that increase schedule reliability and the efficiency of airline fleets and crews.

ecoDemonstrator Explorers

In 2023, Boeing expanded the program with "Explorer" airplanes which focus on short-term testing of an individual technology or project. They also provide added flexibility to our flight testing.

- In June 2023, the first ecoDemonstrator Explorer was a Boeing 787-10 Dreamliner which supported multi-regional trajectory-based operations testing with air traffic management agencies in Japan, Singapore, Thailand and the U.S.
- In October 2023, the second ecoDemonstrator Explorer, a Boeing 737-10 destined for United Airlines, supported flight tests to analyze sustainable aviation fuel emissions and their impact on contrail characteristics.
- In October and November 2025, Boeing's third ecoDemonstrator Explorer, an in-service United Airlines 737-8, took flight to test a modernized data communication system designed to improve information flow between the flight deck, air traffic control and airline operation centers. Internet Protocol Suite aims to enhance operational efficiency and strengthen flight safety and security while reducing air traffic congestion, fuel use, cost and emissions.

Sustainable Aviation Fuel

The ecoDemonstrator program has significantly benefited the industry in testing and advancing the use of sustainable aviation fuel (SAF). SAF reduces life-cycle CO_2 emissions by up to 80%. Every ecoDemonstrator platform has flown on SAF. The 2018 Boeing ecoDemonstrator program, in partnership with FedEx Express, made history by conducting the world's first commercial airliner test flight flown on 100% SAF in both engines. In recent years, a 30/70 blend of sustainable aviation fuel and conventional jet fuel was purchased to cover all the flights of each test-bed airplane, reinforcing the value of sustainable fuel and providing data for the industry and partners.

Boeing has committed that all commercial airplanes it delivers will be compatible with 100% SAF by 2030. The company's progress in reaching this goal is based partially on the success of many flight tests by the ecoDemonstrator program.

In 2021, the program launched a multi-year partnership with the National Aeronautics and Space Administration (NASA) to collect and analyze data on SAF emissions, and the two partners began ground testing on engine particles and trace gas emissions with various blends of SAF on the 2021 ecoDemonstrator, an Alaska Airlines 737-9, conducted alongside a demonstration flight with 100% SAF in one engine. The following year, NASA and Boeing continued ground emissions testing with SAF on the 2022 ecoDemonstrator, a Boeing-owned 777-200ER (Extended Range) and a 787-10, as reported in Aviation Week. In 2023, the SAF emissions testing took to the skies with NASA's DC-8 Airborne Science Lab trailing behind the ecoDemonstrator Explorer, a 737-10 destined for United Airlines. The team of researchers measured emissions from 100% SAF and studied the fuel's impact on contrail characteristics, with the additional partners of the German Aerospace Center (DLR), GE Aerospace, and the Federal Aviation Administration.

More information about the Boeing ecoDemonstrator program and previous flying test-bed airplanes can be found at boeing.com/ecoDemonstrator, and Boeing's sustainability commitments and partnerships at https://www.boeing.com/sustainability.

Contact:
Elisa Hahn
Boeing Communications
+1 206-482-4872
elisa.alfstad-hahn@boeing.com
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