The Boeing ecoDemonstrator Program

Commercial aviation’s relentless pursuit to enhance safety, improve efficiency and minimize its environmental footprint led Boeing to create the ecoDemonstrator program in 2010. Since then, Boeing and its industry partners have accelerated innovation by taking promising technologies out of the lab and testing them in the air to solve real-world challenges for airlines, passengers and the environment.

Six airplanes have served as flying test beds for the ecoDemonstrator program. Over the years, engineers and scientists expanded their scope of research beyond enhancing safety and operational efficiency to assess new features, services and approaches that can improve the entire aviation ecosystem. Projects include technologies that reduce fuel use, emissions and noise, and incorporate more sustainable materials. Other projects focus on cabin amenities that make flying more enjoyable for passengers, and features such as smart galleys, seats and lavatories that increase airline reliability and the efficiency of their fleets and crews.

Newly delivered Boeing airplanes and those already flying in commercial aviation’s global fleet include a number of technologies that were evaluated and proven on the ecoDemonstrator program:

- More aerodynamically efficient winglets on the 737 MAX.
- iPad apps that provide real-time weather and other information to pilots, 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 will enhance safety by helping pilots avoid ground obstacles.

Projects tested on the ecoDemonstrator program also benefit the industry as a whole. Each test-bed airplane conducts flights using sustainable aviation fuel, for example, which reduces life-cycle carbon emissions by up to 80% depending on the source used to make it. These flights demonstrate the viability of biofuel and provide data for the industry. The 2018 program used sustainable fuel throughout its testing and made history by conducting the world’s first commercial airliner flight flown on 100% biofuel.

A small, dedicated team of engineers and specialists works year-round on the ecoDemonstrator program, which is housed within Boeing Commercial Airplanes’ Product Strategy & Future Airplane Development organization. That team is augmented by technologists throughout Boeing and the industry who use the test platform to advance innovation for aviation while enriching their professional experience.

Together, the foundational team and the technologists focus on a singular motto — “innovate, collaborate, accelerate” — to ensure they’re supporting one another and the constant evolution of new ideas. Based on testing opportunities, airlines, suppliers, academia and other industry stakeholders collaborate on specific flying test beds. These have included a Next-Generation Boeing 737, 757, 777, 787 Dreamliner and an Embraer E170. Another 777 is serving as the test platform for 2019.

Since first taking flight in 2012, the ecoDemonstrator program has evaluated over 100 technologies. More than one-third of the projects have transitioned to implementation at Boeing or by program partners. Nearly half remain in further development. Testing on the other projects was discontinued or redirected after learnings were accomplished.

Two examples illustrate the diversity of the projects and highlight the ecoDemonstrator program’s broad industry participation:
• In 2018, a laser system that detects clear air turbulence was tested on the ecoDemonstrator 777 in collaboration with Mitsubishi Electric and the Japan Aerospace Exploration Agency. This system would enable pilots to warn passengers and cabin crew about turbulence in advance.

• The 2019 ecoDemonstrator 777 will test new vortex generators, which are small vanes on the wing that improve an airplane’s aerodynamic efficiency during takeoff and landing. Shape memory alloys developed in collaboration with NASA enable the vortex generators to retract into the wing during cruise when they’re not needed, improving fuel efficiency and reducing carbon emissions.

The 2019 program is testing 50 technologies on its 777-200 — more than in any other year. Among the projects are two that may enhance safety, reduce pilot workload and improve operational performance. One project involves sharing digital information simultaneously between pilots, air traffic controllers and an airline’s operations center to optimize routing efficiency and safety. An electronic flight bag application that uses next-generation communications to automatically reroute an airplane when weather conditions warrant will also be tested.

This year’s program will also evaluate a variety of connected cabin technologies that make galleys, seats and lavatories smart ... monitor cabin conditions such as temperature and humidity to facilitate automatic adjustments ... and use organic LED displays on bulkheads and in the ceiling to inform and entertain passengers.

More information about the 2019 ecoDemonstrator 777 and previous flying test-bed airplanes can be found at boeing.com/ecodemonstrator.

Contact:
Paul McElroy
Boeing Commercial Airplanes
Strategy & Technology Communications
paul.mcelroy2@boeing.com / 425-373-7775

September 2019