# Flight Tests Confirm New Technologies Can Help Quiet The Skies

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According to recent flight tests involving NASA and corporate industry, new technologies can help silence jet aircraft, both in the passenger cabin and on the ground. The three-week flight test program, called the Quiet Technology Demonstrator 2, confirmed the effectiveness of a number of significant airplane noise reduction concepts.

The tests were a cooperative effort between NASA's Langley Research Center in Hampton, Va.; The Boeing Company, Seattle; Goodrich Corporation, Charlotte, N.C.; and GE Transportation Aircraft Engines, Cincinnati. All Nippon Airways, Tokyo, Japan provided one of its new 777 airplanes for the test.

"The team was pleased to see that concepts we had developed with computer simulations and in wind tunnels worked on a real airplane," said Charlotte Whitfield, NASA's Quiet Aircraft Technology manager of airframe system noise reduction. "Using microphone arrays and other measurement devices we were able to determine that the new engine nozzle chevron designs that take into account the air flow and acoustic differences that occur when the engine is installed on the aircraft can significantly reduce community noise."

Chevrons are scalloped or serrated edges that can be seen on some newer plane engines already in use. Flight test results also indicated the improved chevron that included asymmetrical scallops around the engine can do even better than previous state-of-the-art chevron designs in reducing community and cabin noise.

During flight tests at a remote Boeing facility in Glasgow, Mont., technicians fitted the plane with eight different noise reduction combinations between the landing gear and the engine inlet and exhaust combinations on the right wing. The production engine remained on the left wing.

The new fan and engine core chevron exhaust configurations achieved as much as a two decibel improvement in community noise. In addition, the low frequency rumble heard in the aft cabin by passengers at cruise altitude was reduced by as much as four to six decibels. The team had outfitted the cabin with advanced microphone systems to study the noise inside the plane.

Another technology development that proved successful was the "seamless" sound-absorbing liner, which is designed to keep sound waves from bouncing off the seams between treated areas in the engine inlet. The new inlet liner, built by Goodrich, reduced the fan tones heard in front of the aircraft by up to 15 decibels, so that they became almost inaudible. The design of the inlet liner was based on tests conducted at NASA Langley and industry acoustics facilities.

The NASA/industry team also tested a concept to help reduce noise on landing. Goodrich designed and built a toboggan-shaped cover, or fairing, for the 777's main landing gear that was designed to streamline the gear to make it less noisy. Researchers are still studying the flight test results to determine what impact the fairing had on reducing noise.

Earlier laboratory tests showed the cover may help reduce main landing gear noise as much as four decibels. NASA and Goodrich tested the concept in a wind tunnel at Virginia Polytechnic Institute and State University in Blacksburg on a 26-percent scale model of the 777 landing gear. NASA research indicates when air is rushing past the landing gear as aircraft are coming in on approach, the noise from the aircraft

structure, which includes the landing gear, is almost as loud as the noise coming from the engines.

The flight test was the culmination of an intense NASA and industry research effort into noise reduction concepts. Researchers are using the results of that research combined with the data from the advanced set of acoustic flight test instrumentation to improve the understanding of and prediction methods for aircraft noise. That could lead to future developments to make airplanes quieter.

Aircraft noise reduction research is part of the Fundamental Aeronautics Program in NASA's Aeronautics Research Mission Directorate. The program's goal is to advance breakthrough aerospace technologies.

Source: NASA