Technology Flies High on Boeing 737

Imagine waiting in the terminal for your flight to depart San Francisco International Airport when suddenly, a thick blanket of fog rolls down from the bay and envelops the airport. Visibility is cut to 300 feet (91 meters). The word "delayed" starts to scroll across departure monitors. Your flight on a Boeing Next-Generation 737, however, leaves on time, thanks to state-of-the-art flight deck technology.

At a time when increased security screenings lengthen the time it takes to travel, The Boeing Company continues to develop new technologies that promise to reduce flight delays and enhance safety and flight-crew efficiency. Nowhere is that more apparent than on the Next-Generation 737.

The airplane is the most popular commercial jetliner ever built. More than 4,000 737s have carried about 7 billion people -- more than the equivalent of the world's population. In fact, every 5.3 seconds a 737 takes off or lands somewhere in the world.

The newest members of the 737 family -- the 737-600/-700/-800/-900 models -- entered into service just five years ago after a technology makeover. The digitally designed 737s are outfitted with larger wings and more powerful engines, which allow them to fly higher, faster and farther than previous models and its competitor. In addition, the new flight deck features advanced programmable software and liquid-crystal flat-panel displays, not available on competing models.

Cutting through the fog

A Boeing Next-Generation 737 equipped with the Head-Up Display (HUD) flight deck system allows the airplane to fly when others cannot. Some regulatory standards require a minimum of 600 feet (182 meters) of visibility before an airplane is allowed to takeoff. Airplanes with HUD can takeoff in visibility conditions as low as 300 feet (91 meters).

An example of the 737's leading-edge technology is a sophisticated system called Head-up Display or HUD. Although HUD has been used on military aircraft for several years, the 737 is the only large commercial jetliner produced today with this capability.

HUD uses a transparent glass display positioned between the pilot's eye and the flight deck window to show critical information such as airspeed, altitude, attitude and flight path. During takeoffs and landings, an image of the runway is superimposed over the actual view out the window.

The technology can eliminate flight cancellations, diversions and delays caused by restricted visibility. It also provides an extra margin of safety by allowing a pilot to keep his or her eye "on the road," rather than looking down at the instrument panels. The ability to present data in real-world context makes it easier for pilots to take in information and fly the airplane, according to 737 Chief Pilot Ray Craig.

"As a pilot, it can be somewhat difficult to land at an airport at night or during low-visibility conditions with a high workload," Craig said. "Without having to do any extra calculations, I have all the important data I need to fly an approach under those conditions. That allows me to focus on landing the airplane safely."

This extra margin of safety allows a HUD-equipped airplane to fly when others cannot. Some regulatory standards require a minimum of 600 feet (182 meters) of visibility before an airplane is allowed to takeoff. Airplanes with HUD can takeoff in visibility conditions as low as 300 feet (91 meters).

Alaska Airlines was the first to incorporate HUD across its Next-Generation 737 fleet.

"We fly into many destinations where fog, reduced visibility and strong winds combine to restrict our system schedule," said Captain Paul A. Majer, Alaska Airlines System chief pilot. "The HUD technology enhances our capability to depart an airport with reduced visibility and helps us get our passengers to their destinations as scheduled. HUD has been a tremendous benefit to safety overall and, specifically, our ability to operate safely despite reduced visibility conditions."

I can see for miles and miles

Pilots get a clear view of the airplane's current and predicted flight path with the Boeing Next-Generation 737's new Vertical Situation Display, which is shown in the lower part of the screen. The system constantly monitors the airplane's flight path, calculating the airplane's altitude, speed and position, and portrays the information in an integrated and easily understood graphical display. The airplane is represented by the triangle in the display.

Another advancement in the flight deck is Vertical Situation Display (VSD). This high-tech marvel builds on the

Enhanced Ground Proximity Warning system and gives pilots a clear view of the airplane's current and predicted flight path.

The ability to see the predicted flight path provides an earlier warning of conflicts with terrain or an overshoot of the runway. The same data exists in flight decks today, but the pilot needs to mentally integrate the data from several sources. VSD does this automatically and instantaneously.

The system constantly monitors the airplane's flight path, calculating the airplane's altitude, speed and position, and portrays the information in an integrated and easily understood graphical display. Traditional flight deck displays give pilots a bird's-eye view of an airplane's position relative to the rest of the world.

"VSD gives the pilot a side view of the world, because people think in those terms. It adds a normal perspective for a pilot and increases situational awareness," said Ken Hiebert, Boeing Product Marketing regional director.

Earlier this year, Australian carrier Virgin Blue became the first airline to use VSD.

"The Next-Generation 737 is one of the best, if not THE best aircraft in the world in terms of technology," said Capt. Steve Knudsen, Virgin Blue's Flight Operations technical manager. "The new Vertical Situation Display provides pilots with yet another tool to monitor the aircraft's flight path. It is a valuable safety enhancement."

Re-writing air traffic rules

But predicting the flight path is not just important for avoiding mountaintops. VSD can provide an assurance that the airplane will be at a certain point in space at a certain point in time. That degree of accuracy can help rewrite air traffic rules and increase air space capacity, something that is desperately needed in crowded skies over Europe, the United States and other parts of the world.

In today's air traffic system, airplanes approaching airports tend to stack up in the sky, waiting to get to the gate. It's similar to cars slowing down as they approach a traffic light. If cars have to start slowing down two blocks away, traffic slows to a crawl. Essentially, the same thing happens in the sky. Because today's system can't ensure an airplane's precise position, air traffic controllers require a certain amount of time and distance between airplanes. VSD can change all that.

"VSD should enable us to shrink the air space between airplanes and increase air space capacity because you can count on airplanes being exactly where they are supposed to be. And if we can move airplanes through air space more efficiently, we can add more flights and passengers will have more choices," Craig said.

Highway in the sky

Another flight deck system that enhances the ability of the pilot to monitor the precise position of an airplane and its relation to the desired flight path is called Navigation Performance Scales (NPS). The system incorporates global positioning satellite technology to pinpoint and display the precise position of the airplane in an easily understood graphical display.

Boeing 737 Chief Pilot Ray Craig views critical flight information on the transparent glass Head-Up Display (HUD), which is positioned between the pilot's eye and the flight deck window. The technology can eliminate flight cancellations, diversions and delays caused by restricted visibility, and it allows a pilot to keep his or her eye "on the road," rather than looking down at the instrument panels.

Think of a traffic lane in the sky. NPS can tell you how close you are to the edge of the lane within 15 feet. With such accuracy, an airplane can safely navigate through crowded skies, mountainous terrain and noise sensitive areas. Like VSD, the NPS also opens up air space around airports.

"We're setting a new standard for graphic depiction and situation awareness," Hiebert added. "When the world goes to a tighter airspace system, you don't want pilots trying to figure out the airplane's position while moving at 450 knots. While you're trying to calculate that, you can move miles. NPS can tell you where you are instantly."

Technology earns its wings

The most obvious piece of advanced technology rests outside of the 737 -- on the wings to be more specific. Visually distinctive blended winglets gently curve out and up from the wings. Unlike traditional winglets that attach at abrupt angles to the wing, the 8-foot (2.4 meters) high blended winglets add about 5 feet (1.5 meters) to the airplane's total wingspan.

Blended winglets reduce aerodynamic drag and allow the 737 to fly farther and quieter while burning up to 6 percent less fuel. Given the price of fuel these days, the blended winglets provide airlines significant savings,

which can be passed along to the passenger in the form of lower ticket prices.

More than 28 airlines currently fly nearly 300 737s equipped with blended winglets, and more are on the way. Southwest Airlines, one of the most successful carriers in the world, will begin installing the sleek winglets on its newer 737s this fall.

"Southwest, the industry's low-cost provider, is keen on finding innovative ways to keep our operating costs in check so we can continue to provide low fares to millions more Americans," said Laura Wright, Southwest's vice president of Finance. "This technology is one way we can gain efficiencies in our operation and save money while we grow."

Besides lowering operating costs, blended winglets help airplanes fly from hot climate airports like Phoenix International Airport, where temperatures can climb to 110 degrees Fahrenheit (43 Celsius), or from high-altitude airports like La Paz in Bolivia, which is 13,320 feet (4,060 meters) above sea level. Both high and hot conditions can limit the number of passengers or cargo boarding a flight.

Just how do blended winglets help? Quite simply, airplane engines, like human lungs, need oxygen to work effectively. For an engine, the thinner the air -- as is the case at high altitudes or in extremely hot weather -- the harder it is to create combustion or power. To compensate, you need to create more lift with a bigger wing. Without more lift, an airline is sometimes forced to restrict the number of passengers or the amount of cargo on the flight. Because blended winglets add more surface area and greater lift on the 737, all passengers get on the airplane and get to where they are going non-stop.

Back to the future

Blended winglets and flight deck systems are just a few of the new technologies available on the modern family of 737s. More are on the way, and lest one thinks all these bells and whistles are for show, Craig quickly dispels that notion.

"The Boeing philosophy on the 737 is not technology for technology's sake. We have the most successful and advanced airplane in the world, and Boeing is committed to continually investing in technology that gets people to their destinations safely and efficiently," he said.

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