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# Aircraft Synthetic Vision: Seeing What Pilots Can't

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On August 6, 1997 at 1:42 a.m., the pilots of [Korean Airlines](#) (KAL) Flight 801 were flying an instrument approach through heavy rain toward the Antonio B. Won Pat International Airport on Guam when their Boeing 747 smashed into Nimitz Hill three miles from the runway. The impact and fire, which burned for more than eight hours, killed 228 of the 254 people onboard.

According to the [National Aeronautics and Space Administration](#) (NASA), limited visibility is the largest contributing factor in fatal crashes involving airliners and general aviation aircraft. Every year, inexperienced pilots fly into cloud, become disoriented and spiral dive into the earth, or stall and crash. Even professional pilots have made errors while flying in low visibility, resulting in aircraft accidents.

When flying in cloud, pilots see only as far as the airplane's nose and wingtips. In rain, snow or sleet, visibility can be reduced to one-quarter of a mile—the distance covered by most aircraft on approach in five to seven seconds—or less.

Providing pilots with a clear view of terrain, bodies of water and obstacles such as towers regardless of the weather or time of day has been integral to the development of synthetic vision technology (SVT) since the 1970s. More recently, SVT has included a visual depiction of the location of other aircraft, which further enhances flight safety.



Honeywell Aerospace's Synthetic Vision System uses an Integrated Primary Flight Display to show pilots towers, rising terrain and other obstacles at any time (day or night) and in any type of weather. Credit: Honeywell Aerospace.

### Harnessing GPS and computer technology

In December 2000, Michael Lewis, director of NASA's Aviation Safety Program, said in relation to SVT, "With [Global Positioning System](#) signals pilots can now know exactly where they are. Add super-accurate terrain databases and graphical displays and we can now draw three-dimensional moving scenes that will show pilots exactly what's outside. The type of accidents that can happen in poor visibility just don't happen when pilots can see the terrain hazards outside."

SVT pictorially depicts on liquid crystal flat panel displays what pilots see poorly or not at all outside the cockpit, depending on the weather conditions and amount of light. The Global Positioning System (GPS) and advanced computer technology have made it possible for land, bodies of water, obstacles and other aircraft to be displayed on pilot flight displays (PFDs).

SVT uses terrain, obstacle, hydrological and other databases. Updates are issued to pilot-owners and flight departments every 28, 56, or 365 days, depending on whether the database is related to air navigation, runways, taxiways and other airport surfaces, or terrain and man-made obstacles.

On the ground and during flight, the aircraft's position is constantly updated via an onboard Global Positioning System (GPS) receiver that interfaces with the SVT system.

### Optional or standard equipment

Depending on the airplane manufacturer, SVT is either optional or standard equipment. In the case of [Cessna](#), [Gulfstream](#), [Bombardier/Learjet](#), [Dassault Falcon Jet](#), and [Embraer](#)—makers of private jets—SVT is optional. The cost starts at approximately \$250,000.

Various aerospace companies are in the process of obtaining FAA approval to retrofit turbine aircraft such as the [Beech King Air](#) 300 and [Canadair Challenger](#) 600 with SVT.

[Diamond Aircraft Industries](#) (DAI) announced in April that its single piston-engine DA40 Diamond Star airplane would be equipped with the [Garmin](#) G1000 SVT system for \$9,995.

Referring to the G1000 avionics, DAI said, "Land, water and sky are clearly differentiated with shading and textures that are similar to the topographical colors found on the multi-function display (MFD) moving map. SVT works seamlessly to alert pilots of potential ground hazards by displaying terrain and obstacles which pose a threat to the aircraft with appropriate TAWS [Terrain Alert Warning System] coloring. Other SVT features include a display of traffic on the PFD, obstacle displays which enlarge intuitively as the aircraft approaches them, and other useful tools like Pathways' 'flying rectangles' which help the pilot stay on course whether flying en route legs or on arrivals, departures and approaches."

Garmin's Vice President of Marketing, Gary Kelley, added, "Garmin's SVT brings an unprecedented level of integration and awareness to pilots of G1000-equipped aircraft. SVT transforms the cockpit by accurately displaying synthetic terrain, flight hazards, flight path marker and highway-in-the-sky on the PFD so that the pilot maintains excellent airborne situational awareness even when flying in conditions of reduced visibility or darkness. This results in reduced pilot workload and safer flying."

[Chelton Flight Systems](#) has developed SVT for various [Bell](#) helicopter models and [Boeing](#) has done the same for various types of military rotary-wing aircraft, including the CH-47 Chinook, AH-64 Apache and V-22 Osprey. Because of the significant benefits of SVT, synthetic vision systems are expected to become common in aircraft.

In June 2006, Randy Robertson, vice president of engineering for [Honeywell Aerospace](#), a major SVT manufacturer, said, "Flying with synthetic vision 10 years from now is going to be like flying with an HSI [horizontal situation indicator] today. It's going to be commonplace in general aviation and second nature for tomorrow's pilots."

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