Safety in the Skies

Technology to help pilots see better

Air travel today is often complicated with a variety of issues. Too many passengers. New security procedures. Fees for everything. Lengthy delays.

It's not just passengers who have issues either.

For pilots, skies are over-crowded. There are close calls with other planes and obstacles. And, in some cases, even serious accidents.

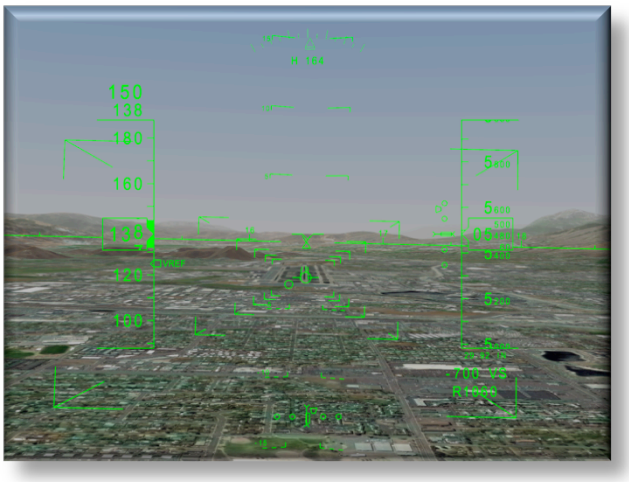
But, NASA and others are working on solutions to help make air travel more efficient and much safer.
Image on left: Air traffic over U.S.

Under the name "NexGen," which stands for Next Generation Air Transportation System, engineers are studying how to improve aircraft and how to make better use of our airspace.

As part of NASA's Aviation Safety Program (AvSP), researchers are investigating new methods to provide visual cockpit displays to pilots, regardless of what the visibility conditions are outside the aircraft. For the flight deck, they are building synthetic vision (SV) displays that provide a realistic view of the world, which makes flying easier for the pilot. A SV enhanced cockpit display is a flight instrument that is intuitive to interpret by the pilot as it provides identical information as looking out the window.

At NASA Langley Research Center, the Crew Systems and Aviation Operations Branch teamed with TerraMetrics, Inc. of Littleton, Colorado, through the Small Business Innovation Research (SBIR) Program, to develop new SV technologies for flight decks.

Under their SBIR contracts, TerraMetrics created a 3D terrain-rendering engine, called "TerraBlocks™." TerraBlocks™ uses the firm's proprietary compressed terrain datasets and block-based rendering technology.



According to President Greg Baxes, "Our unique compression scheme significantly reduces data size, yet it still provides high resolution 3D terrain depiction, at high frame rates."

One of the most novel features of TerraBlocks™ is its ability to render real-time, on-the-sphere terrain models. The data adheres to the earth's curvature, creating highly accurate imagery.

Image on left: On approach to Reno airport with TerraBlocks windowless aircraft NASA display concept

Baxes believes that the TerraBlocks™ technology closes the gap between existing synthetic vision terrain-rendering approaches and the required accuracy, performance, and platform demands for commercial and military applications.

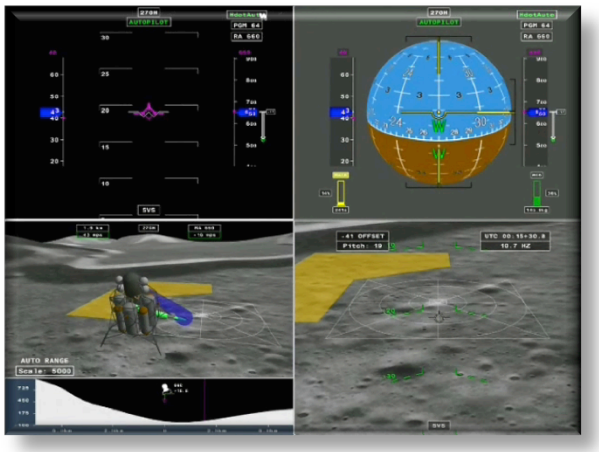
TerraBlocks™ works hand-in-hand with TerraMetrics' TruEarth® imagery and terrain data to provide a global base map of elevation draped with imagery. TruEarth®, which was an earlier product developed in house at the firm, is actually the global imagery baselayer for the Google Earth and Google Maps web-based geospatial products.

The product was successfully tested in Langley's flight simulators and is still being used today.

"We're still using the technology today for NextGen flight simulations," says Trey Arthur, an electronics engineers at NASA Langley.

In addition, TerraMetrics has provided a lunar database to NASA, which was used to expand SV research to space applications. Arthur and his team have done research showing the benefits of SV for landing on the surface of the Moon.

Image on right: NASA Altair Lunar Lander Synthetic Vision display concept using TerraBlocks engine



For its SBIR work, TerraMetrics proposed that its technology would be used in commercial applications on aircraft.

Today, the firm's product can be found on a number of in-flight entertainment systems that allow passengers to track their plane's progress from departure to arrival on a terrain map.

Image on left: TerraBlocks In-flight Entertainment (IFE) exo-centric aircraft view near Mt. Fuji, Japan

And, says Baxes, "One day, pilots will be seeing TerraBlocks on their flight displays as well as on their tablet-based electronic flight bags (EFBs)."