CoreAVI's Vulkan graphics and compute technology helps enable NASA to open up new possibilities for global supersonic air travel

PROBLEM:

As international demand for air travel continues to rise, the aviation industry is developing innovative technologies to accommodate the growing commercial market. Unmanned aircraft, single pilot operations, and windowless cockpits are just a few new innovations under development by airline manufacturers to expedite air travel and facilitate the rapid movement of people and goods worldwide.

While significant progress has been made on the product development side, convincing regulatory bodies of the benefits has been a challenge. How do you get more planes in the air travelling at faster speeds while mitigating the inevitable noise impacts on residents below? Aircraft travelling at Mach 1 - the speed of sound, or faster - were banned from flying in the National Air Space (NAS) by the Federal Aviation Administration in the 1970s because of the disturbance the resulting sonic boom caused for residents living within the flight path.

NASA is working towards a solution that will significantly increase the speed of commercial flights while reducing the sonic boom noise impacts on residents below.

THE FUTURE OF FLIGHT: X-59

NASA is in the process of building its experimental piloted aircraft – the X-59 QueSST - designed to fly faster than the speed of sound at Mach 1.4 without producing annoying sonic booms. Lockheed Martin has been contracted to assemble the aircraft, which features a windowless cockpit to help minimize the sonic boom and improve its aerodynamic qualities and fuel efficiency. A unique cockpit display system is being installed to compensate for the lack of forward-facing windows and allow the X-59 to safely and efficiently test its reduced sonic boom capabilities.

The windowless cockpit display system will incorporate CoreAVI's safety critical Vulkan®-based driver (VkCore® SC). This critical component will equip the cockpit display system with powerful graphics and compute capabilities, enabling cutting-edge sensor display technology, video processing, object detection, synthetic vision and various sensor fusion capabilities. The design will be proven to meet demanding, mission-critical flight safety and reliability standards.

Instead of having their usual view out of cockpit windows, the pilot will rely on a high-definition (4K resolution) monitor to 'see' out of the plane. This monitor is connected to a video system known as the eXternal Visibility System. This computer-vision system stitches together the input from two external video cameras as well as 3D synthetic terrain data to provide the pilot with an augmented reality view of the environment outside the aircraft. The cockpit is also equipped with side windows so the pilots can view the horizon line.

By utilizing the eXternal Visibility System powered by CoreAVI instead of front-facing windows, the X-59 designers are able to tailor the plane's configuration for low-boom aerodynamics, without concern for locating windows for the pilot. The cockpit is located in the middle of the plane, allowing the nose of the aircraft to be more pointed and elongated. It is this reshaping that turns the supersonic boom into nothing more than a gentle thump by spreading the sonic boom wave pressure throughout the body of the aircraft, thus reducing the noise impact on residents below.

The X-59 is designed to be capable of flying at Mach speed (925 mph) at a cruising altitude of 55,000 feet. It is estimated that the sonic boom will be approximately 75 Perceived Loudness in decibels, which researchers say will be acceptable for unrestricted superflight over land.

The X-59 aircraft will undergo a series of performance tests and flight trials inside the test range before it is deployed into the NAS and over predetermined U.S. communities. Data will be generated from sensors, as well as the public opinion of residents on the ground to gauge the impacts of supersonic travel over land. This data will then be used to help international regulators establish new rules to govern supersonic air travel.

RESULT:

CoreAVI's technology embedded in the X-59 will be instrumental in determining not only whether the regulations that prohibit supersonic flight over land can be lifted, but also the related paths to future flight certifications, which will open up new possibilities for air travel. These anticipated regulatory changes could significantly reduce flight times, making international day trips a routine occurrence.

The experience gained in the development and operation of modern supersonic aircraft will also facilitate new innovations in the commercial avionics industry for all aircraft.

While the X-59 will not be deployed for commercial air travel, the concept plane will be used to guide the development of future windowless planes designed for passenger travel that are lighter, faster and more fuel efficient. The technology used in the X-59 will likely be the basis of future systems deployed for commercial air transport system.