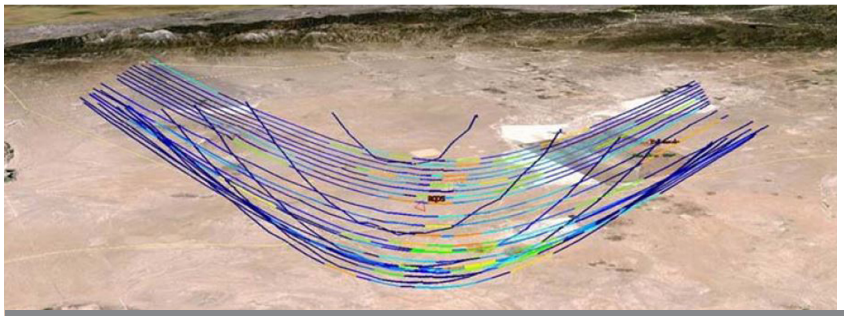

National Aeronautics and Space Administration

NASA

TECHNOLOGY SOLUTION

Aerospace

Interactive Sonic Boom Display

Provides Pilots with Real-Time Sonic Boom Information

Engineers at NASA's Armstrong Flight Research Center have developed a Real-Time Sonic Boom Display for aircraft that enables pilots to control boom placement. The system can be integrated into a cockpit or flight control room to help pilots place loud booms in specific locations away from populated areas or prevent them from occurring. Armstrong's sonic boom display system leverages existing tools co-developed and enhanced by the U.S. Air Force and NASA to predict sonic boom propagation to the ground. The technology can be used on current-generation supersonic aircraft, which generate loud sonic booms, as well as future-generation low-boom aircraft, anticipated to be quiet enough to be flown over land.

BENEFITS

- Works in cockpits and flight control rooms: The technology enables in-flight carpet boom predictions, control room flight planning and analysis.
- Reduces noise pollution: This tool allows appropriate placement of the boom to minimize its impact on the ground.
- Provides information in real time: The system uses real-time data, allowing pilots to respond to changes and make appropriate adjustments to minimize sonic boom exposure.

THE TECHNOLOGY

A supersonic shock wave forms a cone of pressurized air molecules that propagates outward in all directions and extends to the ground. Factors that influence sonic booms include aircraft weight, size, and shape, in addition to its altitude, speed, acceleration and flight path, and weather or atmospheric conditions. NASA's Real-Time Sonic Boom Display takes all these factors into account and enables pilots to control and mitigate sonic boom impacts.

How It Works

Armstrong's technology incorporates 3-dimensional (3D) Earth modeling and inputs of 3D atmospheric data. Central to the innovation is a processor that calculates significant information related to the potential for sonic booms based on an aircraft's specific operation. The processor calculates the sonic boom near a field source based on aircraft flight parameters, then ray traces the sonic boom to a ground location taking into account the near field source, environmental condition data, terrain data, and aircraft information. The processor signature ages the ray trace information to obtain a ground boom footprint and also calculates the ray trace information to obtain Mach cutoff condition altitudes and airspeeds.

Prediction data are integrated with a real-time, local-area moving-map display that is capable of displaying the aircraft's currently generated sonic boom footprint at all times. A pilot can choose from a menu of pre-programmed maneuvers such as accelerations, turns, or pushovers and the predicted sonic boom footprint for that maneuver appears on the map display. This allows pilots to select or modify a flight path or parameters to either avoid generating a sonic boom or to place the sonic boom in a specific location. The system also provides pilots with guidance on how to execute a chosen maneuver.

Why It Is Better

No other system exists to manage sonic booms in-flight. NASA's approach is unique in its ability to display in real time the location and intensity of shock waves caused by supersonic aircraft. The system allows pilots to make in-flight adjustments to control the intensity and location of sonic booms via an interactive display that can be integrated into cockpits or flight control rooms. The technology has been in use in Armstrong control rooms and simulators since 2000 and has aided several sonic boom research projects.

Aerospace companies have the technological capability to build faster aircraft for overland travel; however, the industry has not yet developed a system to support flight planning and management of sonic booms. The Real-Time Sonic Boom Display fills this need. The capabilities of this cutting-edge technology will help pave the way toward overland supersonic flight, as it is the key to ensuring that speed increases can be accomplished without disturbing population centers.

APPLICATIONS

The technology has several potential applications:

- Commercial supersonic vehicles: Companies are developing commercial aircraft that will require this kind of technology to ensure that sonic booms do not adversely affect the public.
- Federal Aviation Administration (FAA): Regulators will require this type of system to approve flight plans, monitor aircraft in flight, and review flight data
- Aerospace R&D: This system is helping NASA develop trajectories in aircraft simulators and increase test point efficiency to reduce boom noise.

PUBLICATIONS

Patent No: 8,145,366

Patent Pending

technology.nasa.gov

NASA's Technology Transfer Program pursues the widest possible applications of agency technology to benefit US citizens. Through partnerships and licensing agreements with industry, the program ensures that NASA's investments in pioneering research find secondary uses that benefit the economy, create jobs, and improve quality of life.

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More Information

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