



technology opportunity

Improved Ground Collision Avoidance System

For use in general aviation, helicopters, unmanned aerial vehicles (UAVs), and fighter jets



Researchers at NASA's Armstrong Flight Research Center have dramatically improved upon existing ground collision avoidance technology for aircraft. NASA's system leverages leading-edge fighter safety technology, adapting it to civil aviation use as an advanced warning system. It offers higher fidelity terrain mapping, enhanced vehicle performance modeling, multidirectional avoidance techniques, more efficient data-handling methods, and user-friendly warning systems. The algorithms have been incorporated into an app for tablet/handheld mobile devices that can be used by pilots in the cockpit, enabling significantly safer general aviation. This will enable pilots to have access to this lifesaving safety tool regardless of what type of aircraft they are flying. The system also can be incorporated into electronic flight bags (EFBs) and/or aircraft avionics systems.

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Benefits

- **High-fidelity terrain mapping:** Uses digital terrain mapping technology with fidelity that is 2 to 3 orders of magnitude better than existing systems
- **Nuisance-free warnings:** Triggers alarms only in the event of an impending collision, reducing the risk of false alarms that may cause pilots to ignore the safety system
- **Multidirectional maneuvers:** Recommends not only vertical climbs but also multidirectional turns, making it appropriate for general aviation aircraft (GAA) and UAVs
- **Flexible platforms:** Can be used with a variety of aircraft, including general aviation, helicopters, UAVs, and fighters such as F-16s
- **Proven technology:** Has been tested on UAVs and a Cirrus SR22 and will be integrated into the U.S. Air Force's next generation F-16 fleet as a follow-on system

Applications

This technology can be incorporated into handheld/mobile devices, electronic flight bags (EFBs), or avionics systems that can be used in:

- General aviation (Part 23 small personal aircraft)
- Military aircraft (F-16 fleet)
- UAVs/Drones
- Helicopters
- Digital autopilots

Demonstrations/Testing

This improved approach to ground collision avoidance has been demonstrated on both small UAVs and a Cirrus SR22 while running the technology on a mobile device. These tests were performed to prove the feasibility of the app-based implementation of this technology. The testing also characterized the flight dynamics of the avoidance maneuvers for each platform, evaluated collision avoidance protection, and analyzed nuisance potential (i.e., the tendency to issue false warnings when the pilot does not consider ground impact to be imminent).

Armstrong's Work Toward an Automated Collision Avoidance System

Controlled flight into terrain (CFIT) remains a leading cause of fatalities in aviation, resulting in roughly 100 deaths each year in the United States alone. Although warning systems have virtually eliminated CFIT for large commercial air carriers, the problem still remains for fighter aircraft, helicopters, and GAA.

Innovations developed at NASA's Armstrong Flight Research Center are laying the foundation for a collision avoidance system that would automatically take control of an aircraft that is in danger of crashing into the ground and fly it—and the people inside—to safety. The technology relies on a navigation system to position the aircraft over a digital terrain elevation data base, algorithms to determine the potential and imminence of a collision, and an autopilot to avoid the potential collision. The system is designed not only to provide nuisance-free warnings to the pilot but also to take over when a pilot is disoriented or unable to control the aircraft.

The payoff from implementing the system, designed to operate with minimal modifications on a variety of aircraft, including military jets, UAVs, and GAA, could be billions of dollars and hundreds of lives and aircraft saved. Furthermore, the technology has the potential to be applied beyond aviation and could be adapted for use in any vehicle that has to avoid a collision threat, including aerospace satellites, automobiles, scientific research vehicles, and marine charting systems.

Patent

NASA has applied for patent protection for this technology.

Other Information

- Video: "Automatic Collision Avoidance Technology (ACAT)" available at: <http://www.nasa.gov/offices/ipp/centers/dfrc/technology/DRC-012-033-collision-avoidance.html>
- "Development and Flight Demonstration of a Variable Autonomy Ground Collision Avoidance System," by Mark A. Skoog and James L. Less. Presented at the annual meeting of the American Institute of Aeronautics and Astronautics (AIAA), Atlanta, Georgia, June 16–20, 2014.

Commercial Opportunity

NASA Armstrong's Technology Transfer Office seeks to transfer technology into and out of NASA to benefit the space program and U.S. industry. NASA is seeking industry partners to explore options for commercialization of this technology (DRC-012-033).

If you would like more information about this technology or about NASA's technology transfer program, please contact:

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