The current transition platform for ACAS is the Fire Scout unmanned air systems, shown in the red area above. The Office of Naval Research is developing technology suitable for smaller, evolving UAS platforms such as the small tactical unmanned air system in development by PMA-263. Using ACAS, the UAS maintains awareness of all other air vehicles in its vicinity and will maintain a safe separation of 3-5 kilometers from them. If an aircraft invades a safe separation distance—200 feet of altitude or 1000 feet in azimuth—the ACAS will generate more aggressive avoidance maneuvers to provide collision avoidance. The two sensor inputs required to perform this function must operate over 24/7 and in all weather conditions.

The cooperative system is the Automatic Dependent Surveillance-Broadcast (ADS-B), which uses GPS information to establish the aircraft’s position before broadcasting this information to all other aircraft in the vicinity. ADS-B is currently mandated for all aircraft operating in the National Airspace System by 2018, with pending legislation that would move its introduction up to 2015. The sensing capability for noncooperative platforms (non-functioning ADS-B) had to accommodate the full spectrum of weather for flight operations, which drove the selection of a radar-based approach. This presents several challenges from a performance and size, weight and power perspective.

The radar should provide spherical coverage—at a minimum full frontal hemisphere—in spite of obscurations like wings, propellers and other platform structural elements. It must provide this coverage out to long ranges (e.g., 5-10 kilometers) and provide accurate tracks of multiple aircraft simultaneously. ACAS must provide all the algorithms and processing required for sensing and avoidance, and must interface with the UAS autopilot to effect self-separation and avoidance maneuvers. These functions will need to be performed automatically such that the UAS can autonomously avoid collisions.

Research Challenges and Opportunities:
- Miniaturizing ADS-B so it is compatible with all UAS platforms
- Developing a radar with the necessary performance and size, weight and power
- Developing high-reliability sense-and-avoid algorithms
- Integrating sensors, algorithms and autopilots to demonstrate effective and robust sense-and-avoid

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