Near Earth to develop techniques to improve reliability of autonomous guidance and navigation algorithms

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PITTSBURGH—The Department of the Navy, through its Naval Air Warfare Center, Aircraft Division, has awarded a contract to Near Earth Autonomy Inc. to develop and prove feasibility of test and certification techniques for autonomous guidance and navigation algorithms. The project, named "Test and Certification Techniques for Autonomous Guidance and Navigation Algorithms for Navy Air Vehicle Missions," will develop a certifiable and testable architecture, a rapid test case generation and benchmark approach, and a formal certification approach for the safety critical components that maximizes coverage with minimum effort. The testing and certification approach will be evaluated in case studies for ship-to-ship flight and cargo delivery missions. Dr. Sanjiv Singh, Near Earth's CEO and Chief Scientist, will lead the project, along with Dr. Sebastian Scherer, Near Earth's Senior Scientist, and Prof. André Platzer, from Carnegie Mellon University.

The work funded by the Navy will address three key challenges associated with operation of autonomous unmanned aircraft systems (UAS): (1) Current autonomy architectures for unmanned systems are not designed to facilitate testing and certification because they have non-deterministic behavior and their safety approach do not focus on certification issues; (2) a large body of motion planning algorithms exist that can potentially solve relevant missions, however, characterizing the performance trade-off and the applicability of these methods is not well understood. Additionally, a standardized, relevant, and easy-to-use test bench is not available, making effective evaluation difficult; and (3) Current autonomous systems have complex subsystems that deal with real valued symbols operating in field conditions that can vary tremendously. The product of possible system and environment conditions is so large that it makes exhaustive system performance validation and certification impossible. This challenge is compounded by the fact that some algorithms have nondeterministic behavior.

To solve these challenges, the team of Near Earth and Carnegie Mellon will design an autonomy architecture that is applicable to a large range of missions, facilitates testing, and enables certification of a wide range of algorithms; develop an automatic test case generation and benchmarking system to enable quick assessment of algorithm performance and relevance to Navy missions with large coverage; design a certification approach for autonomy that creates trust in the system, by ensuring coverage of the safety-critical components through formal methods; and evaluate the proposed system in several Navy-relevant scenarios and assess the coverage, effort required to setup, and relevant information gathered.

Near Earth (http://nearearth.aero) is a privately held, spin-off from Carnegie Mellon University. The company develops comprehensive solutions for manufacturers and users of low-flying aircraft that need to operate in all weather conditions, and in hostile unprepared environments. Near Earth bridges the gap between aerospace and robotics with complete systems that improve safety, efficiency, and performance and expands the types of missions where aircraft are used, enabling manned and unmanned operations. Currently, the company leads key efforts in perception, motion planning, and human-machine interfaces as applied to cutting edge programs developing next generation capabilities for aviation.