R³ Engineering announces the first ADS-B Fully Autonomous Collision Avoidance Demonstration for UAS

R³ Engineering LLC (R³E) announces the first ADS-B (Automatic Dependent Surveillance – Broadcast) based, fully autonomous collision avoidance sequence, executed by a sense and avoid system installed on an unmanned aircraft system (UAS).

PRLog - ***Oct. 23, 2012 - LUSBY, Md. --*** R³ Engineering (R³E) announces the first ADS-B *Fully Autonomous* Collision Avoidance Demonstration for Unmanned Aircraft

Lusby, Maryland -- R³ Engineering LLC (R³E) announces the first ADS-B (Automatic Dependent Surveillance – Broadcast) based, *fully autonomous* collision avoidance sequence, executed by a sense and avoid system installed on an unmanned aircraft system (UAS). On Friday August 10th, 2012, an AWSAS™ (R³E's **All Weather Sense and Avoid System**) installed on a research UAS, with no external command or control inputs, commanded the UAS's auto-pilot to depart from its programmed flight path, execute an internally computed maneuver to avoid a potential collision, and then return to the original planned flight path when well clear of the intruder.

ADS-B messages received and processed by the AWSAS™' internal computer indicated that the aircraft was on a collision course with another ADS-B equipped target. The AWSAS™' embedded SAA (Sense And Avoid) algorithm analyzed the flight tracking data; determined that a potential breach of the aircraft's "collision volume" was imminent; determined an optimum collision avoidance maneuver; and sent commands directly to the autopilot. The UAS's auto-pilot responded to the commands, turning the aircraft away from the intruder; and, when clear of the conflict, returned the aircraft to its preprogrammed flight path. This entire sequence was *autonomous,* with no command or control inputs from outside the unmanned aircraft. The *autonomous* flight test was conducted at the former Naval Base in Argentia, Newfoundland, in cooperation with Memorial University of St. John's Newfoundland, following an increasingly complex series of flight tests that took place in Florence, AZ, San Diego, CA and Grand Forks, ND. The tests are demonstrating the ADS-B based AWSAS™' capability to develop target tracks from data it receives, project potential conflict(s) at a future time, compute and recommend to the ground based remote pilot maneuvers such as course or speed change that will maintain safe separation; and if absolutely necessary, send collision avoidance maneuvers directly to the aircraft autopilot. The test series included potential collision scenarios between the UAS and stationary hazards, moving ground hazards, and between two UAS aircraft. The flight test series is scheduled to expand with testing later this year in Restricted Airspace that will incorporate non-cooperative target data from sensors such as radar and EO/IR into the AWSAS' SAA process. R³E's team of researchers and engineers is led by Test Director and design team leader, Dr. V. Michael Contarino, a retired senior scientist from NAVAIR. Development and initial testing of the AWSAS prototypes has been funded by the Office of Naval Research, the Department of Defense's DSOC (Defense Safety Oversight Council) Aviation Safety Technologies program, and NAVAIR.

What is AWSAS?

The AWSAS, a combination of Field Programmable Gate Array and Digital Signal Processor technologies, has been developed by R³E with funding from the Office of Naval Research. The program started in 2009; and the AWSAS hardware is manufactured by Appareo Systems of Fargo, North Dakota. The AWSAS weighs less than 1 pound, and is a low cost, open-architecture, dual band (1090 MHz-in and 978 MHz-in/out) ADS-B radio, coupled with a robust digital processing capability that develops tracks from received target data, computes maneuvers necessary to maintain safe separation between own aircraft and other aircraft or obstacles, and, when necessary, directly commands an autopilot to maneuver to avoid a collision.

Part of AWSAS' 978 MHz Universal Access Transceiver (UAT) is based on a licensed MITRE design that has been upgraded to the current configuration. The system can simultaneously monitor many targets – in simulations, as many as 200 contacts were simultaneously tracked and analyzed for potential loss of safe separation – and computes optimum separation maneuvers to avoid creating new conflicts while avoiding one. Data logging is included for post-flight analysis and/or replay. In addition to "moving" targets such as other aircraft, AWSAS can store "non-moving" obstacle information such as terrain data, locations of wires and towers and tall buildings, along with "virtual obstacle" information

such as “no fly” zones and international borders that should not be crossed. The AWSAS’s ADS-B cooperative target capability covers approximately 95% of all aircraft; and when coupled with a suitable ground or air based non-cooperative sensor such as a radar or camera system, it can be a powerful tool for enhanced situational awareness in any airspace. The AWSAS also receives weather and traffic information that is broadcast as part of the FAA’s NexGen air traffic management system.

About R³ Engineering LLC

R³ Engineering, LLC, was founded in 2009 and is based in Lusby, Maryland. Its principals are engineers with considerable experience in Naval Aviation, including system safety. The AWSAS is R³E’s first product and was developed for the purpose of enabling unmanned aircraft to safely operate in cooperative airspace; and when augmented by appropriate non-cooperative sensors, to operate safely in any airspace. R³E’s design for the AWSAS includes an open architecture that accepts SAA software from any source; and the ability to function on any platform, with any autopilot or any ground display. R³E will be showcasing the AWSAS at the TAAC Conference on 4-6 December in Albuquerque, NM; and will be conducting a webinar on November 19th for anyone interested in discussing AWSAS technology.

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