



ROBOTICS UPDATE

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Free-Flight Launch of iSTAR from MDARS-E

Allied Aerospace and SSC San Diego performed the first free-flight launch of an Unmanned Air Vehicle (UAV) from an autonomous Unmanned Ground Vehicle (UGV) on July 27, successfully concluding Phase I of this three-phase UAV/UGV integration effort.



iSTAR UAV launches from MDARS-E

In support of this project, a UAV flight-test capability has been added to the existing SSC San Diego ground robotics test area on Woodward Road. The new facility is equipped with two 80-foot utility poles supporting an overhead safety tether to ensure no damage to equipment or personnel during initial testing/

debugging of flight control software. A quarter-mile-wide free-flight zone extends north from this tethered-flight area approximately nine-tenths of a mile along the Pacific coastline, providing over-flight test conditions that encompass a rich variety of terrain features in the littoral zone.

Phase I commenced in February 2002. An initial feasibility test, conducted on March 14 at the Hotville Regional Airport, demonstrated a tethered take off of the 29-inch iSTAR ducted-fan UAV from a prototype fiberglass launch fixture attached to the MDARS-E platform. Limitations in this early three-spoke design created stability problems for the vertical-takeoff-and-landing air vehicle in the presence of strong crosswind components, necessitating an improved six-spoke fixture with a solenoid-actuated release mechanism. This approach allows the UAV to run its engine up to full power before launch, verify proper RPM and thrust, and then be physically released to accelerate more rapidly out of the transition



iSTAR UAV in free flight over SSC San Diego facilities

zone where crosswind effects are most pronounced. The modular launch fixture attaches to the standardized MDARS-E payload mount and is compatible with the existing connections for power and communications.

Phase II of this effort, which will address the automated recovery of the iSTAR UAV by the MDARS-E robot, is now underway. A novel (small and lightweight) *epoch-by-epoch* GPS system developed for SSC San Diego by Geodetics, Inc., will allow the UGV to serve as a DGPS master station for the flying vehicle, minimizing relative positioning errors between the two during the closed-loop

landing approach. Additional redundancy will be provided by a passive onboard vision system which tracks a cooperative target built into the launch/recovery fixture, yielding high-bandwidth translation, orientation, and altitude information.

The final phase of the UAV/UGV effort will incorporate automated launch, recovery, refueling, and re-launch functionalities into a fully integrated system. The two-stroke gasoline engine will be replaced by a rotary diesel engine, allowing fuel to be supplied directly from the existing MDARS-E fuel tank.

Target recipients of the modular UAV launch/recovery application package currently include the Defense Advanced Research Projects Agency (DARPA) PreceptOr Program headed by Dr. Scott Fish, and the Cooperative Unmanned Ground Attack Robots (COUGAR) Program headed by Robert Wade, Army AMRDEC.