Air Force Research Lab conducts second successful robot refueler test

TYNDALL AIR FORCE BASE, Fla. (AFNS) -- The test of a robotic refueling system by researchers at the Air Force Research Laboratory's Materials and Manufacturing Directorate in late July 2010 marks the second successful test of technology that could dramatically change the way the U.S. military services its aircraft.

The prototype device connects a single-point refueling nozzle to a mock-up based on the F-35 Lightning III, although program officials say they are not currently developing anything for a specific platform.

"With modifications to this technology, the system will work on many other aircraft, including fighters, tankers, cargo aircraft, helicopters and unmanned aerial vehicles," said Mike Sawyer, a contractor with the AFRL Robotics Research Team.

The system will provide a feasible alternative to manual refueling by reducing the number of people needed near each aircraft during "hot-pit refueling," or refueling with engines running, improving safety and efficiency, he said.

While aircraft ground refueling equipment has improved, it's still a manual process that involves Airmen handling the fuel supply hose or pantograph, attaching and then detaching it.

With the new system, a crew chief will marshal the aircraft and oversee the refueling operation, but an operator at an operational control unit will run the actual refueling and may be several hundred feet away from the aircraft. Video and data links will guide the robot and its operator. In the future, the system may be adapted to allow crews to operate in a closed environment while protected from possible chemical or biological risks, without mission-oriented protective posture gear.

Researchers in AFRL's Airbase Technologies Division Robotics Research Team at Tyndall Air Force Base, Fla., received a request from Air Education and Training Command and the Air Force Petroleum Agency officials to develop an automated system to refuel aircraft while on the ground.

Vision and proximity sensors observe the aircraft's location, and a guidance system aligns the robot with the fuel door. The robot opens the fuel door, attaches itself to the single point refueling adapter and begins refueling. A fuels operator will observe and confirm the robot's actions throughout the process. Currently, the prototype performs dry runs, but in a fully functional system, a fuel hose or piping will attach the robot to a fuel hydrant.

The Robotics Team first successfully demonstrated the prototype in April 2010 and followed that with a second successful test in July. The prototype robot has a

manipulator arm mounted on a low-profile, wheel-drive platform vehicle. A 30-foot metal truss connects the vehicle to a pivot point on the ground. As each experiment started, the vehicle drove to the mock-up of the F-35 maintenance interface panel, following a 90-degree arc on the ground.

The robot used a camera and a laser range finder to determine the aircraft panel's orientation and to re-orient itself accordingly. A specially designed tool then opened the panel door. A separate arm held the door open while the robot switched to a second tool built from a commercially available fuel nozzle. The robot attached the fuel nozzle to the single point refueling adapter inside the panel. The nozzle's operating lever/shaft rotated to push the poppet valve and open the flow path. After a pause to simulate fuel flow, the system reversed the steps until the door was closed and latched.

Following these successful demonstrations, researchers will add additional functionality including electrical bonding, checking the fuel status lights, and ensuring software compatibility with Joint Architecture for Unmanned Systems. After these upgrades, the system will be prepared for field testing.

(Courtesy of the 88th Air Base Wing Public Affairs)