Digital Advances Produce Improved Unmanned Aerial Vehicles

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One day on a gray-painted aircraft carrier tossed by turbulent seas, a grizzled Navy commander awaits the arrival of a new pilot. A teeny knock pings from the outside of the officer's watertight steel door. "Come in," the commander growls. The door swings open and a squat, cylindrical object negotiates itself over the threshold and then trundles into the officer's quarters.
In a metallic voice the robot cheerfully announces: "'R2-D2' reporting for duty, sir!" Already nauseated by the shifting ocean, the commander loses his lunch.

Although the scenario depicted above is imaginary, Defense Advanced Research Projects Agency researcher John S. Bay predicts that fully automated unmanned aerial vehicles will be commonplace in the not-so-distant future as human war fighters rely more and more on flying R2-D2s.

Bay said Defense Secretary Donald H. Rumsfeld and Air Force Chief of Staff Gen. John P. Jumper "have both set high goals for automation in UAVs."

An electrical engineer by training, Bay has for the past four years worked on a special DoD-endorsed project -- the Software Enabled Control program -- that marries cutting-edge computer technology with robotics to produce improved fixed- and rotary-winged unmanned aerial vehicles.

"The goal of the program is to improve the level of automation for air vehicles," to include unmanned and manned systems, Bay explained. This, he said, involves the implementation of "innovative control systems" that take advantage of recent breakthroughs in computer software.

SEC technology has already been applied to pilot "a UAV from the backseat of an F-15," Bay said. Lessons learned, he noted, likely will be used one day to produce "aerial robots" that like R2D2 of Star Wars fame, would act as "an automated wingman" for human pilots.

Bay said the new technology underwent a series of experiments in August 2004 at Fort Benning, Ga., using a Yamaha-sourced radio-controlled miniature helicopter, the type flown as a crop duster in Japan.

The Fort Benning trials were fully successful, Bay said, noting the 150-pound helicopter "completed all of the experiments without crashing." The flying capabilities of the little helicopter were improved by installing updated computing equipment and sensors, Bay said, as part of efforts to make it "behave more appropriately for military missions."

Those tasks, he noted, could include low-altitude reconnaissance work in urban environments, landing in confined or geographically challenged areas, rapid landings and takeoffs, "nap-of-the-earth" concealed flying tactics, and more.

"The control systems that we are building expand the flight envelope for the vehicle," Bay observed, noting SEC technology allows unmanned aerial vehicles "to fly closer to the ground at higher speeds with more aggressive maneuvers."

Although a human operator stood by as a fail-safe during the Fort Benning tests, the SEC-enhanced helicopter performed pre-programmed flights all by itself.

"It was totally automatic," Bay explained, noting, "We gave it a starting point and an ending point and told it to avoid things in between." Other SEC testing, he said, includes the use of a full-sized automated helicopter.

Bay explained that most military UAVs in use today are operated at higher altitudes "where there's nothing to run into." SEC-enhanced UAVs, he pointed out, can fly "around buildings" and "other vehicles."

Onboard sensors assist SEC-enhanced UAVs in avoiding buildings and helping with bad landings in difficult terrain, Bay noted.

Application of software enabled control technology, Bay said, will enable UAVs to conduct different types of reconnaissance tasks. It's also feasible, he added, that future UAVs may be used to pick up and deliver supplies or perform combat search-and-rescue missions to "pull a downed or injured pilot out of harm's way."

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