Can This Autonomous Helicopter Improve Medevac Safety?

A full-size autonomous helicopter recently flew past low-level obstacles and safely touched down on its own. Is this autonomous vehicle a small step or a giant leap in taking some of the dangers out of medevac rescues?

By Michael Belfiore

A Boeing Little Bird helicopter, equipped with sensor pods for autonomous flight.

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In a first for autonomous helicopters, a Carnegie Mellon University Robotics Lab (CMU) and Piasecki Aircraft Corporation team has successfully flown a full-size helicopter past low-level obstacles to safe touchdowns in unimproved areas—completely autonomously.

Medevac rescues represent some of the most dangerous flying for helicopter pilots. The new system could help lower the risk with completely autonomous helicopters and enhanced autopilots.

Rotary-wing unmanned aerial vehicles, or UAVs, are nothing new—Boeing's A160 Hummingbird, for example, has been flying autonomously for years. But the CMU-and-Piasecki system is the first that allows a standard chopper to negotiate low-lying obstacles such as trees and high-tension power lines and pick its own landing sites independently of human control.

The team added a 3D-scanning LIDAR (essentially a laser-based radar system), GPS, inertial navigation system and a pair of quad core servers running the Linux Ubuntu operating system along with specialized software to Boeing's Unmanned Little Bird technology demonstrator for the tests in Mesa, Ariz. The chopper was already wired up for autonomous flight. A human pilot stayed onboard for the tests, ready to take control if the robotic system made a mistake.

The bird was able to pick out and autonomously avoid obstacles such as chain-link fencing, pallets only 4 inches high, an extended man lift, power lines and people on the ground to navigate to safe landing sites. The final tests last month went off without a hitch, and team co-leader and CMU research professor Sanjiv Singh couldn't have been more pleased. "Demonstrating that a full-scale robotic helicopter can safely take off, fly at low altitude and land heralds a new era," he said in a press release.

At the heart of the system is software that generates a 3D point cloud of the terrain below and ahead of the helicopter in real time as it flies along. From there, the system creates a plan to follow the best route to its objective, which in the real world might be a wounded soldier. Once it reaches the right coordinates, the system then has to verify that a suitable ground route exists from that location to a good landing site so that it can avoid landing on top of people, wounded or otherwise, on the ground.

CMU software lead Sebastian Scherer tells Popular Mechanics that his work on the university's winning entry for the DARPA Urban Challenge robot car race in 2007 gave him valuable experience for writing code for the helicopter. "There are a lot of little tricks in the software that are similar," Scherer says, but with some important differences. "For example, the obstacle detection has to be fully in 3D," he says. "Even though on the Urban Challenge there was 3D detection, [you could] just project it to 2D to do the planning, but [for an air vehicle] you have to do everything in 3D."

After two years of effort, which has been funded by the Army's Telemedicine and Advanced Technology Research Center, the research team is ready to take the technology commercial. The team envisions medevac applications as well as resupplying missions and guidance in the air for human pilots.

"You could just take, for example, the landing-site evaluation or the obstacle avoidance and put it into an interface," Scherer says. "You can give the pilot more situational awareness." Human pilots often have trouble selecting good landing sites, for instance, he says. "Many times you can't judge the slope and roughness from the air, so you basically have to touch town and look at your instruments," prepared to abort if the roll and pitch angles are too extreme. The robotic system can analyze such parameters from the air.

As UAVs driven by systems such as the one created by CMU and Piasecki become more capable, piloted vehicles and UAVs performing a variety of missions will increasingly share airspace. For now, FAA rules forbid UAVs from operating in nonrestricted airspace except on an experimental basis. That means no revenue-producing passengers or cargo onboard. But that's bound to change. In anticipation, the FAA last month opened a laboratory at the Atlantic City International Airport to explore, among other issues, how to successful integrate UAVs with piloted vehicles so that they can take off and land from the same airports.

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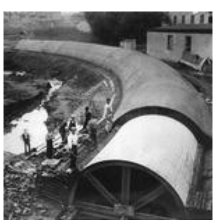

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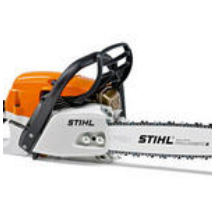

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