

UC Aerial Robot System Can Save Firefighter Lives

A system built by University of Cincinnati experts around an unmanned aerial vehicle has faced a real-world test in a West Virginia controlled forest burn, and proved its usefulness.

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Wildfires kill and, too often, fatalities are caused by a lack of situational awareness, said Kelly Cohen. Timely information can prevent wildfire deaths, especially among first responders, said Cohen, associate professor of aerospace engineering & engineering mechanics at the University of Cincinnati.

Cohen supervises a project known as SIERRA (Surveillance for Intelligent Emergency Response Robotic Aircraft) which integrates small, unmanned aircraft with global positioning systems, environmental data, video and fire-prediction software to give real-time information about where a fire is burning, and where it is moving.



Kelly Cohen, flanked by Manish Kumar and Rob Charvat flew a robot airplane over a controlled forest fire in West Virginia to demonstrate a computerized system to get data to firefighters.

learning away from the classroom and labs.

“This test was a clear demonstration of the potential for this technology to limit wild land fire damage by saving money, lives and land,” Charvat said.

The SIERRA system, Cohen said, is designed to assist firefighters overcome a major handicap during a wildfire – the inability to see the whole fire. Wildfires not only burn through rugged terrain marked by hills and valleys but, even on relatively level ground, obscure their extent by screens of smoke.

“What we are designing is a complete system,” Cohen said. “It is low-cost and low-risk. That is important for this application because, while the technology is ready, firefighters are not quick to adopt new technologies. We can show that this works.”

To gain the confidence of working firefighters, the graduate student who serves as SIERRA team leader, Robert Charvat, participated in firefighter training in West Virginia.

The SIERRA team tested the system in [Coopers Rock State Forest](#), West Virginia, with a small, contained fire on Nov. 5, 2011, in collaboration with the West Virginia Division of Forestry. The UC team present at this test included five graduate students and three undergraduates who experienced a valuable day of

“If I am coordinating response efforts,” Cohen said, “I require information to determine what resources I need, where I must deploy those resources, and where I must be ready to move. This system uses the information gathered and allocates resources.”

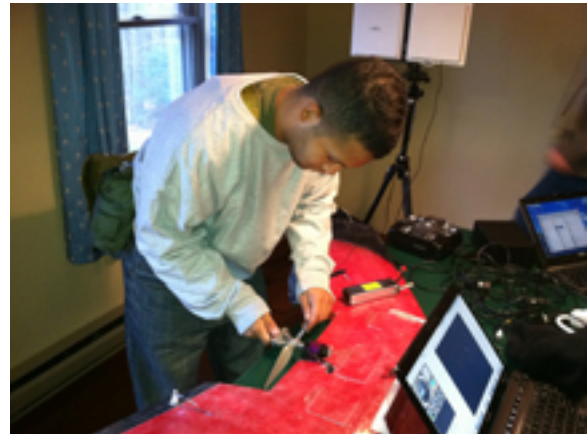
The SIERRA system is built around a small, unmanned aerial vehicle from [Marcus UAV Inc.](#) The five-pound vehicle has a 54-inch wingspan and the ability to fly faster than 35 miles per hour to altitudes of 10,000 feet on flights lasting approximately an hour. While in the air, the vehicle can transmit video while it navigates using GPS.

“For our purposes, the vehicle flew no higher than 500 feet,” Cohen said. “It was a successful demonstration of tactical unmanned aerial system technology for use in wild land fire events.”

At the fire command center, the in-flight data is merged with Google Earth images, NOAA weather data and fire-prediction software to make informed and effective decisions by the incident commander.

Although the West Virginia demonstration focused on firefighting, the integrated system Cohen has developed along with Manish Kumar of UC’s Cooperative Distributed Systems Lab, has applications beyond wildfire response.

“A similar decision-making need arises in many disasters,” Cohen said, “including floods and earthquakes.”



Rob Charvat prepares the robot plane.

The system can even be modified for use for simulation based training for first responders.

“As we execute this work,” Cohen said. “We are continually reviewing additional areas in which our unmanned aerial vehicle based systems and algorithms may provide a benefit. One such area is air traffic management while effectively integrating unmanned aerial vehicles into the national airspace.”



Cohen confers with the SIERRA Team at the test burn site.

Support for the SIERRA project was provided by NASA through the Ohio Space Grant Consortium with the University of Cincinnati providing more than 50 percent of the cost share.