Fire-starting drone could aid grassland conservation efforts, fire prevention

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Sebastian Elbaum (from left), Dirac Twidwell and Carrick Detweiler have developed a new patent for setting range fires with small drones. The drone injects a liquid into plastic spheres to start a delayed fiery process that allows the balls to fall to the ground before igniting. Elbaum and Detweiler are holding flaming tennis balls similar to those carried by the drones. Credit: Craig Chandler/University Communications

A new drone under development at the University of Nebraska-Lincoln could change the way wildfires are fought—and encourage the use of prescribed burns for conservation purposes.

The Unmanned Aerial System for Fire Fighting is under development by a multidisciplinary team of UNL experts in drone technology, fire ecology, conservation and public policy.

The Great Plains, California and other places around the world are seeing an increasing number of bigger and more intense wildfires in recent years, said Dirac Twidwell, a team member and a range ecology expert and faculty member in the department of agronomy and horticulture.

The trend results from land management practices, such as declining human use of fire for ecosystem management, as well as exotic species invasions, drought and climate change.

"Unmanned aerial devices have the potential to carry out key resource management strategies and could help us deal with something as big as the international increase in severe wildfires," Twidwell said. The drones could be a tool to battle Eastern Red Cedar, an invasive tree species viewed as one of the region's most serious ecological threats. It causes local extinctions of grassland plants and birds, collapses forage production important to the beef industry and contributes to dangerous wildfires.

Drone researchers Carrick Detweiler and Sebastian Elbaum said such drones also might be used in placed of manned aircraft and hotshot firefighting teams in some wildfire-fighting situations.

The aerial robot would have the ability to ignite and monitor fires in remote areas. Novel technology would allow it to operate in harsh

environments with limited supervision, enhancing the capabilities of fire management personnel.

"The idea is to provide a safe mechanism for people to perform fire management tasks with less risk and higher efficiency," said Elbaum, a computer science and engineering professor and drone researcher.

The team has successfully performed indoor tests on a prototype. Detweiler, a faculty member in computer science and engineering, said researchers hope to have authorization from the Federal Aviation Administration and fire departments for a field test of the fire-starting drone as early as March.

Prescribed burns, where grasslands are burned off according to a predetermined plan, are widely recognized as an effective conservation tool that eliminates invasive species, restores native plants and reduces the risk of wildfire. However, they are underutilized because of perceived safety concerns.

While a recent study from Twidwell's lab shows prescribed fires are actually less risky to landowners than other commonly used management techniques, using drones would further reduce the risks posed by lighting prescribed burns by hand and using all-terrain vehicles and suppression vehicles in rough and remote areas.

Many federal agencies use helicopters to ignite such areas, but it's too costly to use helicopters on private lands.

Elbaum and Detweiler built upon their research as co-founders of the Nebraska Intelligent Mobile Unmanned Systems (NIMBUS) Laboratory to design aerial robots small enough to fit in a firefighter's backpack, yet smart enough to safely interact with the environment.

The drones carry a cargo of pingpong-like balls filled with potassium permanganate powder. Before being dropped through a chute, each ball is injected with liquid glycol, creating a chemical reaction-based flame after 10 to 45 seconds.

The drones would have the ability to drop the balls in a precise pattern over the landscape – on the perimeters and interior of a rectangular plot, for example. Detweiler said the robots could be programmed so they don't fly into areas that are too hot or windy for safe use.

The research team is seeking grant funding to develop the next generation prototype with more sophisticated sensing and actuation capabilities, including the ability to operate as a swarm.

Provided by University of Nebraska-Lincoln