Octocopter helps forestry research take flight

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Dr. Sorin Popescu, Texas A&M AgriLife Research scientist in College Station, works with Ryan Sheridan, a Texas A&M University doctoral student, to equip an octocopter for their forestry projects. Credit: Kay Ledbetter

(Phys.org) —Dr. Sorin Popescu is developing a unique way to get up close and personal with forests.

Popescu, a Texas A&M AgriLife Research scientist in College Station, is working with a team to build an octocopter or unmanned air vehicle complete with a camera stabilization platform, autopilot and cameras

with multispectral capabilities.

He said there is a growing interest in unmanned air vehicles or unmanned air systems, called UAVs, that can be used in many areas, from mapping floods to fires and monitoring them in real time from low altitudes without exposing aircraft or people to dangerous situations. Also, it helps with repeated data collection tailored to specific needs and monitoring in many fields, including forestry.

Popescu's teaching in Texas A&M University's ecosystem science and management department and his research centers on using remote sensing to study forests. However, until now, data availability for his research has been limited by the aerial equipment he could rent and the random timing of satellite images.

The eight-rotor vehicle was selected because it allows for the added payload of the cameras and other equipment. Once his retrofitted octocopter is completed, he will be able to go where he needs to and when he wants to gather information.

"There is quite a strong momentum in developing systems and applications for UAVs," Popescu said. "Many systems are fixed wing, but we chose the octocopter because it allows us to fly from small openings to get above the tree canopy instead of having a runway for the fixed wing."

Popescu's UAV program, a three-year project started about two years ago, is funded by two sources: a National Science Foundation grant and a NASA grant, both of which support hardware and graduate students.

On the National Science Foundation project, he is a co-investigator with two professors in Texas A&M's mechanical engineering department, and they are looking to assess the risk of forest fires and mapping fuel loads.

With the NASA project, Popescu said they are looking at mapping forest biophysical parameters like biomass and carbon, which relate to climate studies. They will also monitor how trees respond to climate change, how much carbon they sequester and how much growth occurs.

"The goals we want to accomplish with this system are multiple, but all related to studying forests, forest health and forest three-dimensional structure," he said. "The UAV allows us to collect data in a highly customized way, unlike other airborne systems we had to hire out.

"The advantage of the UAV system is that we can collect data when we want it, depending on our needs, and how we want it, customized to our

needs, and in a cost-effective manner, without having to spend on aerial or airborne acquisitions or on satellite data."

Popescu said it is "a really cost-effective way of acquiring highly specialized and customized research data that we can use with our other projects, such as calibrating remote sensing observations from space or airborne platforms."

The UAV was purchased in three components – octocopter, camera stabilization platform and the autopilot. The next thing is to add on the sensors – cameras that have multispectral capabilities and laser scanners, also known as lidar.

He said they added auto pilot to the octocopter, which allows them to type in specific GPS coordinates and have it fly to the location by itself. They've also added a gimbal that has a three-point axis on it and allows them to take vertical aerial photos to help with three-dimensional information extraction.

Ryan Sheridan, a doctoral student on Popescu's team, said, "Using software on the computer, we can do flight planning depending on what camera we have on it and its focal length. We can establish a flight height, and it will actually calculate, based on how much overlap we want, where it needs to fly and where it needs to hold to take a picture, so we can get stereo photos."

"We have spent time also on processing the data that would be collected and are developing algorithms," Popescu said. "We have a terrestrial laser scanner and use it also, so we can develop applications with the two and show the forest service and industry the capabilities."

The biggest challenge left, he said, is to work with the Federal Aviation Administration to determine the rules and regulations for flying UAVs.

Texas A&M University-Corpus Christi is one of six federally approved test sites for unmanned aircraft systems. The recent FAA test site designation is expected to expand research on new applications and safe integration of unmanned aerial technology into the national airspace.

"We need to be at low flying altitudes, but we're not sure if flying it needs permission, and that process can be complicated," Popescu said.

He said the Texas A&M Forest Service is interested in the project, especially with the autopilot, because it responds to their need to take pictures at established locations.

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