Drones could be used to detect dangerous 'butterfly' landmines in post-conflict regions

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Drones could be used to detect dangerous "butterfly" landmines in remote regions of post-conflict countries, according to new research from Binghamton University, State University at New York.

It is estimated that there are at least 100 million military munitions and explosives of concern devices in the world, of various size, shape and composition. Millions of these are surface plastic landmines with low-pressure triggers, such as the mass-produced Soviet PFM-1 "butterfly" landmine. Nicknamed for their small size and butterfly-like shape, these mines are extremely difficult to locate and clear due to their small size, low trigger mass and, most significantly, a design that mostly excluded metal components, making these devices virtually invisible to metal detectors. Critically, the design of the mine combined with a low triggering weight have earned it notoriety as "the toy mine," due to a high casualty rate among small children who find these devices while playing and who are the primary victims of the PFM-1 in post-conflict nations, like Afghanistan.

Researchers at Binghamton University have developed a method that allows highly accurate detection of "butterfly" landmines from low-cost commercial drones. Assistant Professor of Energy Geophysics Alex Nikulin and Director of the Geophysics and Remote Sensing Laboratory Timothy de Smet used mounted infrared cameras to remotely map the dynamic thermal conditions of the surface and recorded unique thermal signatures associated with the plastic casings of the mines. During an early-morning experiment, they found that the mines heated up at a much-greater rate than surrounding rocks, and they were able to identify the mines by their shape and apparent thermal signature. Results indicate that this methodology holds considerable potential to rapidly identify the presence of surface plastic MECs during early-morning hours, when these devices become thermal anomalies relative to surrounding geology.

"We believe our method holds great potential for eventual wide-spread use in post-conflict countries, as it increases detection accuracy and allows for rapid wide-area assessment without the need for an operator to come into contact, or even proximity of the minefield," said Nikulin. "Critically, once further developed, this methodology can greatly reduce

both costs and labor required for mine clearing operations across post-conflict regions."

The use of cost- and time-efficient remote sensing techniques to detect plastic MECs such as the butterfly mine from unmanned aerial vehicles has enormous potential that warrants further study, wrote the researchers.

"We are actively pursuing this project further and are in the process of field testing and calibrating our methodology," said De Smet. "Ultimately, we hope to develop a fully autonomous multi-drone system that would require minimum input from the operators."

The peer-reviewed paper, "Catching "butterflies" in the morning: A new methodology for rapid detection of aerially deployed plastic land mines from UAVs," was published in the May 2018 issue of *The Leading Edge*.

More information: Timothy S. de Smet et al, Catching "butterflies" in the morning: A new methodology for rapid detection of aerially deployed plastic land mines from UAVs, *The Leading Edge* (2018). DOI: 10.1190/tle37050367.1

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