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Seventh Mine Action Technology Workshop: A Space for Innovation

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SEVENTH MINE ACTION TECHNOLOGY WORKSHOP
A SPACE FOR INNOVATION

By Arsen Khanyan and Inna Cruz [GICHD]

The 7th edition of the Mine Action Technology Workshop, a biennial event organized by the Geneva International Centre for Humanitarian Demining (GICHD), took place from 7 to 8 November 2019 in Basel, Switzerland. Titled Remote Sensing and Robotics in Mine Action, the workshop welcomed 165 participants from forty-nine countries, representing eighty-five organizations. It offered a platform to discuss and share ideas and experiences that promote the efficient use of innovation and technology in humanitarian mine action (HMA).

This unique event is aimed at bringing together mine action professionals, manufacturers, national authorities, operators, and representatives from the United Nations as well as other international organizations. It focuses on the vital role technological innovation plays in increasing efficiency and effectiveness in emergency response, humanitarian aid, and development.

TECHNOLOGICAL INNOVATION RESHAPES HMA

Innovation is reshaping HMA, bringing about fundamentally new and potentially much more efficient approaches to our work. The changes represent a real opportunity for the mine action sector to learn about new, more effective, and safer ways of working. For example, remote sensing is now used in mine action, not only to assist in planning, monitoring, and evaluating clearance operations, but also to support the land release process and help measure impact.

Initially developed for military purposes, unmanned aerial systems (UAS) have rapidly gained traction in civilian sectors, and increasingly so in humanitarian aid and development assistance. In HMA, UAS are currently used as one of many tools to support operations to tackle the most important challenge—human safety. Numerous presentations given during the workshop were testament to the fact that information gathered from the use of UAS in HMA adds value across a wide range of different applications in planning, implementing, and impact-assessing activities.

LESSONS FROM THE FIELD

During the workshop, mine action operators, technology developers, and researchers showed examples of how UAS can support mine action operations in the field. They presented innovative applications for close inspection, direct and indirect evidence detection, ground penetrating radar (GPR) potential, and the use of multispectral and hyperspectral sensors for evidence records. The workshop also illustrated how HMA organizations are currently using or testing UAS in their operations.

The HALO Trust presented several case studies where UAS were being used in mine-affected countries and territories (Angola, Cambodia, Colombia, Georgia, Guinea-Bissau, Lao PDR, Somaliland, Sri Lanka, and the West Bank) to support various mine action activities, such as pre-deployment planning, remote monitoring of operations, terrain inspection, and impact assessment. The evidence for using UAS in operational planning was also presented by (MAG) Mines Advisory Group, who have used UAS in northeast and northwest Cambodia. High-resolution images were used by MAG for terrain and vegetation analysis to plan task sites prior to clearance and to provide a better overview for deploying various mine clearance assets (mechanical, animal, and manual detection systems).

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Norwegian People’s Aid (NPA) has been testing UAS in Bosnia and Herzegovina and in Montenegro since 2018, using red-green-blue (RGB) color and thermal cameras to assist in drawing more precise boundaries of suspected hazardous areas (SHAs) and assess the environmental characteristics of SHAs. UAS are also able to more accurately locate evidence that was previously found using other techniques.

The presentation made by the GICHD covered several aspects of UAS use in mine action and described the UAS module available on the GICHD e-learning platform. The platform contains case studies that explore how UAS imagery enhances land release activities as well as how UAS provide practical advice and guidance on UAS operations.

Mobility Robotics and Humanity and Inclusion (HI) presented on the Odyssey 2025 project and discussed their trials in Chad. This project further demonstrated how UAS and remote sensing could be used in pre-deployment planning, cartography, and operational research. In particular, it has been demonstrated that an infrared camera was able to geolocate anti-vehicle mines buried in sandy soil, thus facilitating manual demining activities.

UAS pose multiple challenges for HMA operators, who cite legal and regulatory issues as the most common, particularly individual countries’ UAS regulations and importation/customs restrictions. The main challenges are listed in Figure 2.

### RESEARCH AND DEVELOPMENT

Several organizations and research institutions presented their work on integrated remote sensing technologies:

The project SAFEDRONE, presented by the Counter Improvised Explosive Devices Centre of Excellence (C-IED COE), aims to develop and test an enhanced system for improvised explosive device (IED) detection using a high-resolution GPR mounted on board an unmanned aerial vehicle (UAV) that is being developed in cooperation with the University of Oviedo (Spain). The methodology is based on a synthetic aperture radar technique, high positioning accuracy (< 2 cm), and a deep and broad processing of signals by means of groups of coherent algorithms and artificial intelligence. Field tests of the system are planned to begin in October 2020.

In their presentation on the development and tests of the SeaTerra unexploded ordnance (UXO) survey drone system, UXO survey and clearance company SeaTerra summarized the different criteria to keep in mind when deciding to purchase and use drones; these included price, weight/payload, data, stability, sensors, positioning, and battery life.

Cobham Aerospace Connectivity presented their product, Amulet UAS, a medium-sized UAV that carries a GPR capable of searching for explosive ordnance (EO) in areas that would otherwise be too high-risk or inaccessible for human deminers.

The Urs Endress Foundation presented on the FindMine project, which has been running since 2016, in collaboration with Swiss and German universities, to develop a UAV-based system for mine detection. The system consists of a multirotor UAV with a ground penetrating synthetic aperture radar$^2$ as its prime sensor for mine localization. The system will be further developed by integrating additional sensors and by increasing flying capabilities in suspect buildings, dense forests, and jungles.
UNIQUE CHALLENGES: URBAN AREAS

The participants of the technology workshop also discussed the significance of technological innovation in urban areas. Due to changes in the characteristics and nature of conflicts and widespread use of IEDs in urban areas, traditional clearing operations have become increasingly difficult in cities. UAS have been used to check roofs and inside buildings. In this context, the consulting and engineering firm Tetra Tech presented on the use of UAS in urban environments and presented UAS trials to address passive infrared threats in Syrian and Iraqi cities. To help assess the threat inside the IED-suspected buildings, Tetra Tech employs relatively small drones that are commonly used in urban areas. Numerous mine action operators are investigating the use of UAS platforms and sensors during technical survey for IED clearance in urban areas.

SIGNIFICANCE OF COLLABORATION AND KNOWLEDGE EXCHANGE

Feedback from workshop participants during and after the event indicate that the Mine Action Technology Workshop will continue to be crucial for the sector. Workshop attendees emphasized that the full potential of remote-sensing technologies can only be achieved through close collaboration between national operators and research institutions by exactly defining field needs, adapting technology to field conditions, and testing in the field. One of the main benefits of such an event is to provide a platform for product developers and end users to meet and exchange experiences and opinions. This serves to provide insight into the practicality, limitations, and achievements of the various technologies that are being developed and used to enhance HMA. This is not only on an operational level but also from an information management, planning, and decision-making perspective.

If you have any comments or questions, please contact the GICHD technology team at technology@gichd.org.

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In the context of the technology workshop and the field study, several technologies have been presented that address the unique challenges of urban areas. One of these technologies is the landmine detection system “Penta Mag” using eight rotors, a coaxial configuration multirotor UAV used for ordnance detection with magnetic sensors. The Penta Mag system contains five fluxgate sensors in horizontal alignment and is particularly developed for use on a multirotor.

RPS Energy Ltd. presented an overview of their remote aerial multidiscipline survey system that consists of a small unmanned aircraft fitted with various payloads to collect geodetic, remote sensing, and instrument data sets to aid in the identification of EO. To assist in the data processing phase, RPS has developed bespoke artificial intelligence software programs that can quickly analyze large data sets and present their findings as a level-of-certainty percentile.

Ukrainian Multirotor Technologies (UMT) presented the results of a field study to remotely detect and identify the most common rocket-launched ordnance, relying on rapid, wide-area scanning by a UAV-based, microfabricated, atomic magnetometer mounted on a UMT Cicada-M hybrid-powered UAS platform.

SENSYS presented the MagDrone R4, an ultralight-weight magnetometer survey kit with multiple sensors to allow either large area coverage per flight time or high-resolution area scans. Due to its reduced weight of less than 4 kg and unique folding mechanisms, SENSYS suggested that it could be used with inexpensive commercial drones/UAVs.

Khanyan and Cruz: Seventh Mine Action Technology Workshop

A panel discussion on remote sensing and IMAS.