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Using Small Unmanned Aircraft (SUA) in HMA

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Field Notes

Using Small Unmanned Aircraft (SUA) in HMA

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With the growing use of **unmanned aerial vehicles** (UAV) within humanitarian mine action (HMA), the need for standardized training is becoming increasingly important to mitigate factors that may otherwise inhibit their wider use. The first formal training course for people in HMA to qualify as **small unmanned aircraft** (SUA) pilots served as an opportunity to pursue this goal and was held at the MAT Kosovo training centre in September 2017.[1] The instructors were from a U.K. company training to U.K. Civil Aviation Authority (CAA) standards for commercial SUA pilots.[2,3] Although **drone** and UAV are popular terms to describe all umanned aircraft, the term SUA is used by some civil aviation authorities to describe specifically lightweight models.[4,5]

Those in attendance included trainees from across the HMA sector: field workers from Libya and Syria, dog handlers, serving soldiers, and researchers. One trainee was a qualified explosive ordnance disposal (EOD) technician and also a software developer who attended in order to benefit interdisciplinary research. Some students had extensive flying experience, while others had none, but all learned a great deal from the professional instructors over five intense days that included many testing flights.

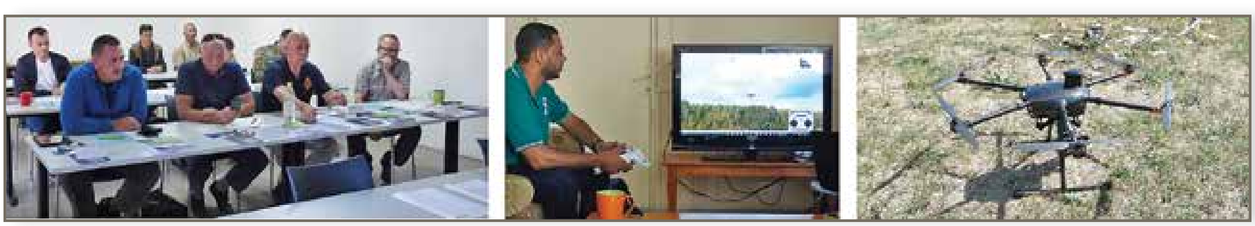
The course was offered because national and supranational civil aviation authorities around the world are increasingly controlling the use of unmanned aircraft of all sizes and require pilots to have demonstrated proficiency.[6] The main drivers behind this are air safety, privacy, and security concerns; these same concerns also apply in HMA. During the training, many who attended helped contribute to the first, generic SUA standard operating procedures (SOP) for HMA, which the author was there to draft.[7] The SOP is intended to ensure that safety, privacy, and security concerns are addressed in ways that give national mine action authorities the confidence to authorize the controlled use of SUA in HMA.

Image 1. Taken from a quadcopter, this photograph shows the people attending the training course in Kosovo.
Image courtesy of Training Solutions - Unmanned Aviation Services.

Safety, Privacy, and Security

The uncontrolled use of any unmanned aircraft raises safety, privacy, and security concerns in every country. Civilians wanting to use unmanned aircraft commercially in the United Kingdom must be registered with the CAA and demonstrate an appropriate level of training for the category of aircraft that they will fly. Remote pilot certification is granted for a category of aircraft and a maximum take-off weight.

Safety. Wherever HMA operators work, concerns about aircraft safety—terrestrial and in the air—can be addressed via the imposition of best practice pilot training requirements and aircraft deployment rules that are imposed by the relevant civil aviation authorities. However, when the relevant national



Images 2-4. Training took place in the classroom, on simulators, and in the air with a range of SUA.
Images courtesy of the author.

Image 5. Part of an ISIS, fixed-wing-SUA factory after its capture in 2017.
Image courtesy of Conflict Armament Research at http://www.confictarm.com.

authority is inoperative or has yet to publish requirements, the adoption of those published by internationally respected civil aviation authorities can be the next best option for anyone concerned with showing that they have done everything possible to manage risk.

Privacy. While privacy concerns may be covered in relevant civil aviation authority flight restrictions, HMA operators should also respect the concerns of the people in the flight path, particularly when flying with a downward facing camera. Ignoring local concerns about personal privacy can be a risk to both the aircraft and its pilot, so good community liaison and response is usually required in HMA.

Security. Broader than the invasion of privacy involved in camera overflights, security concerns involve even the smallest category of unmanned aircraft, the SUA, which can be readily adapted for weapon delivery. In Syria, for example, the Islamic State of Iraq and Syria (ISIS) has manufactured many SUA for uses ranging from combat reconnaissance to flying an explosive payload directly into a target. Notably, ISIS has purchased commercially available SUA, overcome their software restrictions, and adapted them to carry and release bombs. Security concerns are legitimate and the weaponizing of SUA is a concern that must be recognized, respected, and answered by those using SUA as tools in HMA, especially in regions where combat may be ongoing.

HMA Experience with SUA

Despite the fact that the concept of **eye in the sky** has yet to be fully explored, it is no surprise that the pilot training course hosted by MAT Kosovo was well attended because the utility of SUA in HMA has already been proven. From the early iterations of the large Schiebel Camcopter to today's battery powered SUA, there have always been obvious advantages in gaining a low-altitude overview of the working area.[9] Aerial imagery is widely used in HMA. Image 9 is a screenshot showing destroyed ammunition storage bunkers at the Waddan weapons storage site in Libya made in 2012. Even high-level images like this were a great help when trying to assess the extent of the problem faced at that time.[10] The resolution in Image 8 is low, does not show the target from all angles, and is not as up-to-date as an image recorded minutes ago.

Some international nongovernmental organizations (INGO) have used commercially available SUA when identifying high-risk areas and planning deployments for years. Norwegian People's Aid (NPA), for example, reported on the use of a commercial quadcopter camera system in Iraq during 2014. The SUA was used for basic task planning and to closely inspect possible hazards during pre-deployment survey. Since the pictures in image 9 were taken, automatic mapping systems and support software have improved dramatically, and the list of potential uses has grown.

SUA Utility for HMA

During the pilot training at MAT Kosovo, participants compiled the following list of ten generic uses for SUA within HMA:

1. Close visual inspection.
2. Inspecting vehicles.
3. Mapping.
4. Non-technical survey.
5. Placing disruption/demolition systems.
6. Placing lightweight hook and line equipment.
7. Pre-deployment survey. *(continued on page 48)*

Images 6-8. This commercially available SUA has been adapted to carry and release the small multi-purpose bombs shown. The bombs were manufactured in an ISIS factory.
Images courtesy of Conflict Armament Research at http://www.confictarm.com.[8]

Image 9. Screenshot of destroyed ammunition storage bunkers at the Waddan weapons storage site, Libya.
Image courtesy of GoogleEarth.

8. Progress mapping, quality assurance, and quality control.
9. Training and testing.
10. Visual survey in building interiors.

Achieving everything on this list would require developing SUA technology so that it is able to perform the same tasks as small EOD robots. Also, SUA would need to be capable of making detailed, interior-camera surveys without retaining line of sight (autonomously or by control signal enhancement). However, while many of the uses would benefit from technical developments and/or software add-ons, it is apparent that all have immediate potential.

Apart from conventional and infrared cameras, no complete, functional mine-detection systems for small SUA have been proven in the field. The ability to detect near-surface or hard-to-discriminate targets by enhanced analysis of visual imagery and/or the use of hyperspectral and thermal sensors may prove valuable, but their use parameters have not yet been defined. Moreover, it is unclear whether the existing technology can be made reliable enough for humanitarian use.

Other unexplored examples worth pursing include using a SUA camera to monitor explosive detection dogs during complex searches or in regular oversight during manual or mechanical deployments. Whenever an operative is obliged to work entirely alone, an SUA could provide extra information and allow the operative to receive informed, remote advice or oversight. During demolitions in which the author was recently involved, using a SUA to inspect the outcome proved useful, often saving time with no reduction in safety. It is probable that the controlled use of SUA during demolitions will quickly become routine.

A Cautionary Endnote

There has not been a new technology so useful to HMA since the development of ground compensating metal detectors.

Image 10. Quadcopter photo of Iraq in 2014.
Image courtesy of Ed Rowe, Norwegian People's Aid (NPA), Iraq 2014.[11]

Image 11. Screenshot from a video captured by an SUA overflying demolitions.
Image courtesy of John Fardoulis.[12]

Better still, as well as increasing efficiency, the effective use of SUA should have immediate safety advantages by increasing the information available to the operative. However, as with all new tools and procedures, the industry must not ask too much of the technology. Safety in HMA is primarily about the safety of the people who will use the land. An absence of visible hazards cannot prove that there are no hazards present, so the temptation to release land based on evidence from a camera overflight alone must be avoided.

See endnotes page 67

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A.V. Smith (AVS, Andy Smith) was working part time with the University of Genoa in Italy when this was written. He is a member of the Explosive Knowledge Centre (EKC) in Brussels and is involved in several field and research projects. He has worked in demining for twenty years, starting as a personal protective equipment (PPE) designer in 1996 and rapidly becoming a deminer/surveyor, then a Technical Advisor, trainer, program manager, and UNDP country chief technical advisor (CTA). He served as an elected and then invited member of the IMAS Review Board for 11 years. The founder and keeper of the Database of Demining Accidents (DDAS), he has also developed and put into production (as free technology transfer) the most popular PPE used in HMA. See: www.nolandmines.com and www.ddasonline.com.

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1. National database IMSMA for Gray Area managed by iMMAP.
2. Unmanned Aviation Services. Resource Group, United Kingdom, email: mark.jones@resourcegroup.co.uk. Accessed 25 October 2017. http://bit.ly/2i3An0t.
3. Global Drone Regulations Database. Accessed 25 October 2017. http://bit.ly/2zOwowy.
4. The acronym UAV is widely used but the word **vehicle** implies transportation of some kind; not all SUA have the capacity to transport a payload. In Britain at the time of writing, SUA is defined as covering any unmanned aircraft up to 7 kg (15.4 lbs) in take-off weight, whatever its design purpose.
5. The term **drone** is avoided because it has unhelpful associations in some contexts.
6. International Civil Aviation Organisation (ICAO), Convention on International Civil Aviation (Chicago Convention). Accessed 25 October 2017. http://bit.ly/2zfTegw.
7. Standing Operating Procedures for the use of Small Unmanned Aircraft (SUA) in Humanitarian Mine Action. Accessed 25 October 2017. http://bit.ly/2h9dSYd.
8. These pictures are published in the 2017 document *Islamic State's Multi-role-IEDs* at http://bit.ly/2zP5pRD. Permission to use these pictures was granted by Damien Spleeters, Head of Regional Operations, Conflict Armament Research (spleeters@conflictarm.com).
9. Schiebel Camcopter is an early development with Humanitarian Mine Action Research & Development funds from U.S. Army CECOM NVESD in 1999.
10. The author was seconded to the Libyan Mine Action Centre (LMAC) by Norwegian People's Aid to serve as Chief Technical Advisor in 2012 when Google Earth images were widely used by many INGOs in country.
11. Contact Ed Rowe at edrowe2006@yahoo.co.uk for more detailed information about this use. Ed is currently with the Norwegian Peoples' Aid program in Vietnam.
12. John Fardoulis is a specialist in using unmanned aerial systems (UAS) to map hazardous environments, currently working as a researcher at the University of Bristol, United Kingdom.