

March 2022

Using drones in search & rescue operations

EVOLVE
DYNAMICS



CATAPULT
Connected Places



Drones enable a significant enhancement in Search and Rescue (SAR) operations. A potential life-saving tool in SAR operations, drones provide critical support to SAR teams to reduce risk to humans, enable quicker search and supply aerial support during incidents.

This case study outlines the safety, economic and environmental benefits of using drones compared to current methods of SAR. The applications of drones outlined within this document will demonstrate just how other emergency service sectors will benefit, understand the capabilities and potential opportunities for using drones in their organisations.

Key takeaways

Connected Places Catapult organised a drone capability demonstration to highlight how Buxton Mountain Rescue has future plans to maximise the benefits of drones within search and rescue.

- Showcased the use of The Sky Mantis all weather drone capable of flying in rain and high winds.
- A simulated incident response demonstrated the benefits of drones in a dangerous location and rescue approach planning.
- Ease of access to difficult to reach areas of the mountainside, providing real-time situational surveillance.
- The key benefits of drones include saving time in first responder attendance, critical in the safety and wellbeing of those requiring assistance.
- Drone potential within the SAR and other similar sectors is evolving and new opportunities become available as technology develops, and regulations allow further use of drone technology in industry applications



The case for drones in SAR operations

Challenges	How drones can help
<p>Reduced risk SAR operations are carried out in locations that are difficult and dangerous to access and pose significant risk to SAR team members.</p>	<p>Drones are an excellent tool for SAR operations. They allow access and quicker visibility into places such as steep ground and cliffs, to be searched with minimal risk to SAR team members.</p>
<p>Faster search Speed is often an essential element in search and rescue operations, as teams are often racing against a rapidly collapsing time frame within which a positive outcome for the casualty or missing person can be secured</p>	<p>Drones enable much larger areas to be covered in a shorter period of time, which can mean the difference between life and death. Some Mountain Rescue Teams report that drones can drastically reduce search times by up to 50 per cent.</p>
<p>Improved Efficiency SAR operations mostly involve large areas of land and water to be searched for missing persons. The difficult terrain and harsh environment in mountainous regions involving fog, dense vegetation and darkness offer significant challenges to SAR teams.</p>	<p>Drones provide aerial intelligence on the whereabouts of the missing persons and provides SAR teams critical real-time information on the search area. With even small drones now capable of carrying high quality thermal cameras, large areas of land and water can be searched with impressive efficiency. The thermal imaging when combined with infra-red cameras, drones allow to penetrate through fog, darkness and vegetation. The results in an improved efficiency to be able to search areas more quickly, with fewer numbers, thus being able to stand our volunteers down more quickly.</p>
<p>Adverse weather operations Many SAR operations occur in adverse weather conditions.</p>	<p>While most drones are designed to be operated in favourable weather, they cannot be operated in rain or snow conditions. However, certain drones can be used in adverse weather conditions.</p>
<p>Cost effectiveness Mountain SAR teams are charitable organisations, run by volunteers, hence raising the funds to invest in new technology takes time.</p>	<p>Drones cost are cheaper to procure and operate than traditional air support, making them accessible to even small voluntary SAR teams.</p>
<p>Carbon emissions Traditional air support for SAR operations is all based on fossil fuels.</p>	<p>Drones are fully electric thereby have lower impact on the environment they operate within.</p>

Buxton Mountain Rescue current operations overview

The Buxton Mountain Rescue Team (BMRT) is one of 49 voluntary Mountain Rescue Teams within England and Wales and one of seven teams within the Peak District region. The team was first established in 1964 following the Four Inns tragedy, which claimed the lives of three young rover scouts while they were taking part in a planned walking event in bad weather.

While the number of incidents the team attends annually has increased, the types of incidents have become more varied and the equipment used has advanced significantly. The team's charitable goal has always remained the same 'Saving Lives in Wild and Remote Places'.

Today the team has around 60 highly trained volunteers, four emergency response vehicles, two bases and attends around 100 incidents a year. Incidents include: going to the aid of unwell or injured persons in the hills, searching for lost or vulnerable, rescues from height, providing assistance at major incidents such as floods and even helping to patch up the odd collapsing dam wall.



In March 2019, BMRT formally began its journey into using drones for SAR. They became the first team in England and Wales to gain a then 'PfCO' from the Civil Aviation Authority (CAA). From that point onwards the team began utilising two DJI Mavic Drones during missing person searches. The team were also pleased to be donated a DJI Mavic 2 Dual by Derbyshire Constabulary, which has proved an excellent addition to the fleet with its thermal capability, allowing searches during the night.



In January 2020, an ambitious three phase strategy was implemented to look at advancing BMRT's use of drones further:

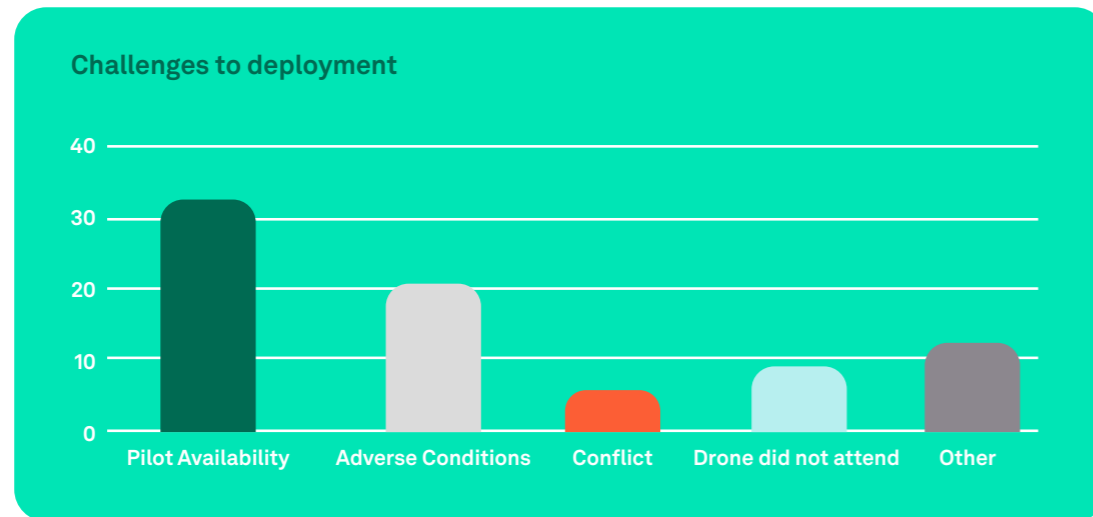
- Phase one: Routinely carrying the drones and obtaining data to highlight any barriers to deployment of drones
- Phase two: Training further pilots, this is the phase the team currently sit within
- Phase three: Focus on obtaining a new higher spec drone to resolve challenges identified in the early phases. The team hope to move to this phase later in 2022

During phase one data was collected from every incident the team attended, specifically focused on drone usage.

It has become clear that drones are not only an excellent tool for search but can also assist hugely in other areas of SAR. For example, during phase one the team assisted with monitoring moorland fires recording damage and identifying sources of water. They were also deployed during a multi-agency training exercise to provide overwatch enhancing the situational awareness of commanders on the ground.



Some challenges to the deployment were also identified:



With pilot availability already being addressed under phase two, the next most notable and probably unsurprising challenge is adverse weather. BMRT's operations often occur when the weather is poor and while the DJI Mavic series drones are excellent pieces of equipment, they are simply not designed to operate in adverse weather.

Once in the air the next challenge is being able to reach the missing person or incident location.

The team currently operate within the Specific Category under PDRA 1 and so are required to keep the drone within visual line of sight, while the rationale behind this is understood, this hugely limits the effectiveness of drones.



Connected Places Catapult & Buxton Mountain Rescue demonstration overview – how drones benefit S&R operations

The BMRT was pleased to have the opportunity to work with Connected Places Catapult as part of the Department for Transport's Drone Pathfinder Catalyst programme to organise the demonstration day.

On the day of the demonstration, we were joined by drone leads from the statutory emergency services, other voluntary emergency services and drone industry innovators.

The day began with presentations showcasing the benefits and discussing the challenges of drone use within mountain rescue. Alongside input from Connected Places Catapult on its work and from Evolve Dynamics explaining the evolution of their all-weather drone, The Sky Mantis.



After the presentations, all involved headed out to 'Chrome Hill', a small yet steep hill within the Peak District. The scenario, loosely based on a previous incident was introduced- two walkers had got into difficulty on the steep slopes and needed urgent assistance.

The objectives for this demonstration were set based on learnings from phase one:



1. Demonstrate to the public, regulators and mountain rescue community the potentially life-saving applications of drones within a mountain rescue setting when the right equipment is used.

During the demonstration, an Evolve Dynamics all weather Sky Mantis drone was deployed to locate the 'walkers in difficulty'. Given the very challenging weather conditions on the day it simply would not have been possible to fly with a drone from BMRT's existing fleet. It was very helpful to see a drone with excellent all-weather capabilities and endurance operating within in a real-world environment and scenario. This experience will be taken forward as BMRT consider a choice of new airframe in phase three.



2. Highlight to regulators where existing regulation is holding us back and challenge them to find safe affordable solutions to allow us to unlock the full life saving potential of drones.

It was clear how the all-weather drone could be utilised within BMRT's SAR setting, with the drone very rapidly locating two walkers in a dangerous scenario. Thanks to the live feed from the drone, those in control could easily see that one of the walkers was trapped on very steep ground. This meant they were able to deploy appropriate resources immediately to assist them without having to wait for personnel on foot to reach the scene and provide a report.

The location used in this demonstration was specifically picked as the entire search area was within 500 meters of easy road access and a safe take off site. This meant that VLOS could be easily maintained throughout. However, this is not the case for a great number of locations the BMRT is frequently called to. Search areas and incidents sites are often more than 500 meters from a vehicle access point. Meaning carrying drones over sometimes difficult terrain and ultimately delaying the benefits they bring once airborne.

Emergency service exemptions

The CAA have previously exempted emergency services from the VLOS rule in certain short-term reactive situations, where there is an immediate risk to human life or during declared major incidents.

An example of such scenario is provided within the notes of the exemption 'missing person scenarios where it is clearly evident that swift action is required'. This carries with it a number of 'checkpoints' where the operator and commanders must make a positive decision to proceed based on risk assessment.

However, this exemption only applies to a 'United Kingdom Police, Fire or Ambulance Service', so it does not extend to Mountain Rescue Teams or other voluntary SAR responders.



With the number of Police forces which now see their own drone teams increasing, it would be reasonable to ask why mountain rescue teams would want their own independent drone capability? There are a number of answers to that question:

UK emergency services are always under pressure, so having independent drone capability not only lightens some burden on them, but also ensures that when a drone is needed, BMRT has immediate access to one.

Local knowledge; BMRT pilots have unrivalled knowledge of the local area, knowing all the best access points, accident hotspots and places a vulnerable person may conceal themselves.

Even with exemptions for BVLOS, deploying a drone in a mountain rescue setting may well mean a challenging journey in a four-wheel drive. Followed by a steep walk and having all the associated navigational knowledge and the equipment to do that safely is essential.

It is worth highlighting that the environments mountain rescue teams operate in vary across the country, but all are generally remote. In the Peak District for example, there are vast areas of relatively flat Moorland Plateaus and large bodies of water where an exemption for BVLOS could be hugely beneficial. Mountain Rescue Teams typically have excellent existing relationships with other users of the lower airspace, such as the Coastguard, Air Ambulances and Glider clubs all of whom they frequently come into contact with. Finally, the dynamic management of risk is something all SAR teams are well accustomed to.

The team has explored use of the 'Certified Category' to expand permissions however the expense and complexity involved appears to make this option currently out of reach.



Benefit and cost analysis:

Analysis of the known benefits & costs applicable to the SAR sector is outlined below:

- BMRT is a charitable organisation; it depends on the police and NPAS for their air support during searches and for the payment for any air support services. Only a few questions are asked by helicopter “owners” before dispatch.
- Average of about 100 call outs per year

Normal search radius is 2km with 20-30 search party members.

- Manpower during searches is predominantly on a voluntary basis.

Traditional:

- Helicopter costs: £900¹ - £1050² per hour for models operated by NPAS

Drone-enabled:

- Use of drones will likely have an impact on the number of volunteers required for a search, but the impact is unclear and depends on the size of the search area.



Political

There are no known political issues but there is significant public support for the use of drones within a SAR setting’ some issues regarding wildlife or privacy, but significant consideration is made to search & rescue operations.

Economic

Police services will benefit from cost savings. BMRT is using secondhand drones with thermal capabilities and good image resolution, but these can’t fly in adverse weather.

Legal

Despite close connections with “blue light” services, BMRT is still limited to Visual Line of Sight (VLOS)

Environmental

No environmental issues to speak of, other than a few relating to wildlife areas. Drones have a far lower environmental impact than traditional manned air support.

Social

Popular public support for making BMRT more effective is high, so there are no negative social issues.

Technological

Off-the-shelf drones are not suitable, as many searches are conducted in inclement weather. Different types of pre-flight checks increase the time required to deploy drones; faster setup times would become necessary.

What is next for the Buxton Mountain Rescue Team and similar sectors?

BMRT will now take the learnings from this demonstration forward into the third phase of its drone development strategy, as the team looks to obtain a drone with better capability in adverse weather.

The team had an excellent insight into the impressive capabilities of the Sky Mantis during this demonstration, but at this stage, they would still welcome approaches from other suppliers and manufacturers if they think they have an airframe that would suit BMRT's needs well.



As a small charity, cost will always be a factor. However, if a supplier or manufacturer is willing to work with the team, it can offer them the unique opportunity to be part of a potentially lifesaving journey... the marketing benefits of being the first to supply a Mountain Rescue Team with an all-weather drone also certainly shouldn't be overlooked.

It is intended that the new higher spec drone will be made available for incidents across the Peak District region and to neighbouring ALSAR teams when required.

The BMRT are aware that the exemption to the Visual Line of Sight rule that has previously been afforded to statutory emergency services, has been withdrawn and is currently undergoing review. BMRT along with Mountain Rescue England and Wales's national lead would be keen to be included in discussions as part of that review process. Careful consideration around risk mitigation would be needed and safety would always remain our top priority.

Once the team has sourced an airframe better suited to the conditions it operates within, the likely next steps will be looking at the sensors the drone is equipped with and automating search activity.

BMRT, Rod Stordy, said:

"The use of drones within Mountain Rescue allows us to maximise the chance of locating and safely recovering a casualty or missing person, by searching large and challenging areas of land quickly. While minimising the risks I have to expose my team to."

For more information on how drones can benefit your organisation, or to learn more about the Drone Pathfinder Catalyst Programme please visit our webpage:
cp.catapult.org.uk/project/pathfinder/



Follow us on Twitter
@CPCatapult



Follow us on LinkedIn
Connected Places Catapult

Email us
drones@cp.catapult.org.uk