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Aiming higher

Philip Mason visits Swaledale Mountain Rescue in Yorkshire to find out more about its ongoing efforts to leverage satellite-enabled broadband for casualty care in the field

Swaledale Mountain Rescue is an organisation that we have included previously in the BAPCO Journal, due to its willingness to adopt new and innovative technology.

As long-time readers will remember, for instance, the team was the first of its kind in the UK to adopt DMR Tier III as its primary mode of radio communication (alongside TETRA, with handsets borrowed from the police service). This marked Swaledale out as a trailblazer, not only in terms of the technology itself but also for its willingness to experiment beyond prevailing operational mores.

With that in mind, in this issue we are focusing on another innovation currently being discussed by the organisation, this time in collaboration with telecommunications company SafeNetics. The solution involves the potential deployment of medical sensors in order to monitor casualties in real time, with broadband coverage facilitated by low Earth orbit (LEO) satellites.

GPS for dogs

Giving an overview of the project and its origins, SafeNetics' use-case manager Graham Worsley says: "Swaledale MRT got in contact with us, prompted by perceived vulnerability around their IP network [used to facilitate DMR Tier III]. It works very well, but there's not much redundancy in it. Plus, it's based on ISDN, which is going to be completely switched off by 2025."

He continues: "In the first instance, they were interested in replacing part of their existing network with 5G broadband, which was going to be provided by the North Yorks project as part of a broader roll-out across the area. The concept was originally to provide the backhaul via fixed wireless access, but for various reasons, the necessary infrastructure hasn't been fully rolled out yet.

"Along with the new network itself, Swaledale also had a variety of potential use-cases in mind to go along with it, such as drones and video. The big difference to what we originally had planned is the backhaul itself, which is now provided by a low Earth orbit satellite."

According to Worsley, the first conversations about the potential use of satellite-enabled broadband coverage actually took place when working with another DCMS rural 5G project, Live and Wild, which was using 5G for filming outdoor broadcasts. It leveraged the LEO satellite for backhaul and to support a Wi-Fi connection for use down a local 70-metre pothole known as Alum Pot.

Going into greater detail about the project infrastructure, Worsley describes the set-up as essentially being bespoke depending on the location of the incident being responded to. It includes mobile 4G/5G base stations (situated at a local hilltop pub known as The CB Inn in the tiny village of Langthwaite in Arkengarthdale), portable internet via Starlink satellite, as well as a server located in the house of one of the

"Bluetooth sensors can transmit patient information straight to a 5G phone and relay it anywhere"

SafeNetics team.

Worsley continues: "The radius of coverage is around 1.75km line of sight because of the terrain and the commercial frequencies being used; the LTE radio signal at 2650Mhz and the 5G NSA at 1850Mhz for data. The set-up is very low power, which is one of the conditions of getting the spectrum licence from Ofcom in the first place. You can't just whack the power up and see how far the signal would actually go.

"Swaledale Mountain Rescue has got a big area which it needs to cover, amounting to a big chunk of the Yorkshire Dales National Park. As you might expect, there are various places where the coverage just isn't very good, again because of location and the nature of the terrain."

As mentioned, several potential use-cases have already been discussed, leveraging the coverage that the proposed satellite solution would provide.

These have included the use of drones as well as video. SafeNetics originally also suggested that it might be viable to stream in real time from rescue dogs, until SMRT pointed out that you would have a lot of interesting footage of heather and not much else. The use of non-mission-critical push-to-talk is also in the conversation, leveraging a commercial app called Zello on ruggedised handsets.

"We've done a series of application developments," says Worsley. "These have included night-vision phones, smart glasses, as well as GPS for dogs, so you can keep track of rescue dogs and see where they've been."

The most viable use of the coverage, however, at least as far as Swaledale MRT is concerned, is in the use of Bluetooth-connected medical sensor patches to monitor and communicate the condition of casualties in the field.

Up hill and down dale

There have been several key personalities involved in the Swaledale project from the SafeNetics side. These include Worsley, as well as founder of the company David Lund (who readers will recall is also the co-ordinator of pan-European Broadway project, recently covered in these pages).

On the Swaledale side, meanwhile, core input has come from mountain rescue volunteer Graham Brown, whose professional background was in the development of medical technology for the Ministry of Defence. He has been particularly enthusiastic about the potential of the sensors mentioned above when deployed in the mountain rescue context.

Describing the project background from Swaledale's perspective, he says: "I was asked if there were any ways in particular that 5G might be able to help in medical situations. My suggestion was that it would be really good to have Bluetooth sensors located on the casualty themselves.

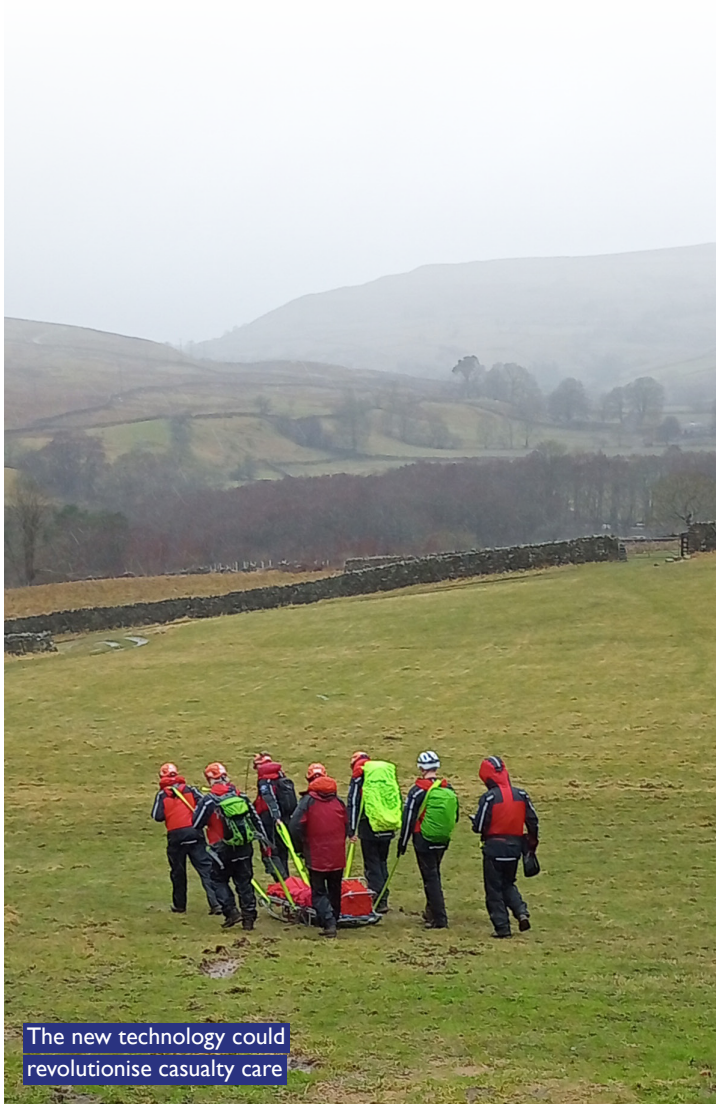
"These could then transmit patient health information straight to a 5G phone, which could in turn relay it basically anywhere – for instance, to a medical consultant – as live data. That was the question that I posed to SafeNetics, and I was sucked in."

He continues: "The company found a supplier of Bluetooth sensors in the US, so there was no issue in relation to supply of the kit. The problem was that while the sensors were type-approved for medical practice, they weren't for use in the mountain rescue environment.

"I actually took the sensors to work and used one of our test-beds to check the specifications.

"Some of the results were actually quite ➥

Swaledale Mountain Rescue has been featured on the BBC



The new technology could revolutionise casualty care

surprising, particularly the temperature sensor. According to the manufacturer's specifications, the sensor in question was only rated down to 34 degrees, which in the mountain rescue environment isn't any good, because hypothermia sets in from 35 down to 24. I put it on the test rig, and it turned out the lower you got from 34, the more accurate it became."

As with the Alum Pot trial, the potential for connecting on-patient Bluetooth sensors was also tested in the field, with the team venturing out in frankly horrendous conditions during Storm Eunice back at the beginning of this year. They were accompanied on the drill not only by volunteer medical 'casualties', but also a film crew from the BBC's technology programme, Click.

Discussing the trial, Brown describes the "major advantages" offered by the sensors, compared with traditional methods of triage taking place in the field.

As he says, without the sensors, medical personnel would need to use 'traditional' methods to monitor the casualty, such as stethoscopes, blood pressure machines, thermometers and so on. While the efficacy of this equipment is not in doubt, its use halfway up a mountain is hardly ideal, given that it not only needs to be carried by the team but also takes time to use.

"We got pretty good results from using the sensors in the field," says Brown. "The more traditional ways of monitoring the casualty are effective, but if you're moving them using a stretcher, you continually have to stop moving them in order to do it. It can take between five and 10 minutes to get those measurements, which is obviously disruptive to the operation.

"By contrast, the sensors are relatively small and have no wires coming from them, because they're transmitting over the air to a 5G phone. That means the casualty themselves generally don't know that they're there, while the casualty carer doesn't need to get near to the stretcher. They just stand nearby, holding the mobile phone."

According to Brown, there was also another sensor – a cardiac monitor – which, while originally in the conversation, was ultimately deemed unsuitable for a variety of different reasons.

The first of these was a general feeling that monitoring the heart is "a bit of a dark art", where results can be influenced by a variety of environmental factors. Just as concerning meanwhile was the potential danger to the patient when the sensor was deployed in close proximity to other equipment.

Elaborating on this, Brown says: "With heart monitoring, you're putting multiple electrodes on someone's chest, and if the chest isn't prepared properly or there's movement, it can cause electronic artifacts. At the same time, the sensor wasn't defibrillator-rated.

"In the mountain rescue environment, you have to ask 'Why am I putting the cardiac monitor on in the first place?'. The obvious answer is there might be a cardiac problem, and therefore potential for arrest, in which case you'd have to use a defibrillator. Applying high electric potential near a device with a lithium battery in it is not going to end well for the patient."

At time of writing, the provision of broadband to Swaledale Mountain Rescue is still an ongoing process without a potential timescale for completion. Regarding interoperability with existing radios for instance, although it now has the capability, the team hasn't actually tested re-broadcast on DMR from the 5G handsets, which makes it still a work in progress. At the same time, the medical sensors still also need to be officially certified for use in emergencies, an area where SafeNetics has been in discussion with the regulator, MHRA.

Having spoken to both SafeNetics and the service, however, there is obviously a real desire for the technology to be developed and deployed as quickly as possible. And once it is rolled out, it has the potential to be a genuine game changer.