Transmissions are useless if they cannot reach their intended recipient in an intelligible form. **Claire Apthorp** examines the latest frontline receiver technology, which aims to keep voice and other channels open under all conditions.

LOUD AND CLEAR

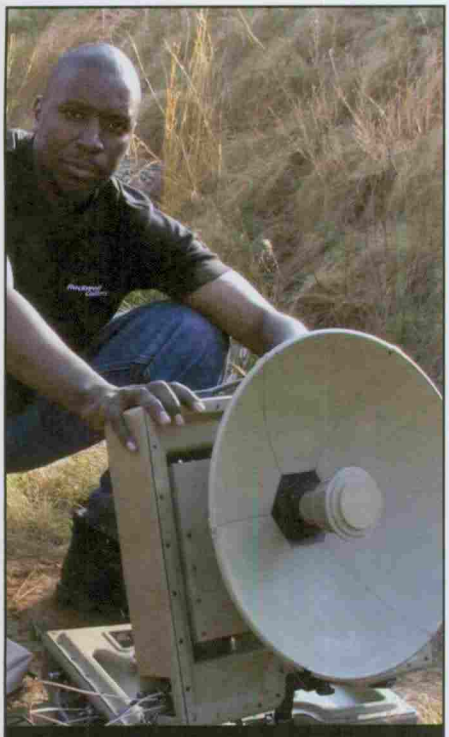
The ability of an armed force to carry out effective communications across the battlefield is paramount to successful operations. However, this ability is often limited by a number of constraints, both environmental and practical, that require ingenuity to overcome – a challenge currently being considered in the defence industry.

More than anything, it is the way that modern armed forces use communications receivers such as antennas that is driving forward their development. The increasing requirement for equipment that must be limited in size in order to carry out covert surveillance and transmissions without sacrificing range and reach is one example of the direction of technology development. Another driver is the need for equipment that can be used by small, mobile forward operating teams, who need effective communications when carrying out missions in hostile areas where terrestrial links may not be available.

UP IN THE AIR

On 29 December, US company Syntonics announced that it had been awarded a $7 million contract to produce and deliver 30 Fibre Optic Remote Antenna Extension (FORAX) High Antennas for Radio Communications (HARC) aerostat antenna extension payloads for the US Army. The contract is the most recent to have emerged from a longstanding relationship between the two parties, and the latest step towards the US military's 'aerial layer', a concept through which the army wants to create a wide-area network in the sky via the use of antenna-equipped aerostats at forward operating bases.

► US military aerostats with the FORAX HARC payload are being used as communications 'antenna towers'. PHOTO: US ARMY



► The miSAT system features a highly compact form factor.
PHOTO: ROCKWELL COLLINS

Based on Syntonics' proven FORAX 'radio frequency (RF) over fibre' product line, the FORAX HARC payload enables any tethered aerostat to effectively become a tall antenna tower, increasing line of sight and coverage of radio communications. Under the new contract, the company will delivery 30 six-radio HARC systems, each providing SINCGARS and Enhanced Position Location Reporting System (EPLRS) antennas on a tethered aerostat, with four SINCGARS and two EPLRS radios for the associated command post.

TACTICAL EVOLUTION

The Syntonics aerostat system is changing the way armed forces are able to carry out line-of-sight communications over long distances and in mountainous terrain, and is solving one of the greatest challenges to operational capabilities by reducing the impact of terrain and man-made obstacles (such as 'urban canyons' and skyscrapers) on military communications. Syntonics president Bruce Montgomery explained to *Digital Battlespace* how the FORAX product is changing the way the US Army thinks about battlefield communications.

'Before FORAX, the limitations of radio and antenna proximity were significant,' he said. 'The radio and the antenna had to be connected by coaxial cable, which meant that, at most, you were looking at a couple of hundred feet of distance between them.

'Move forward a bit and industry has created components that make it possible to transmit RF signals over optical fibre. The virtue of this is that the running loss of optical fibre is much less than copper, meaning you can now have your antenna and radio tens of kilometres apart. We have built special versions of our products that allow you to have closer to 80-90km between antenna and radio – at which point possibilities begin to emerge,' he continued.

'The kind of possibilities that began to come out of these products included the idea that the aerostats that were very popular in Iraq could do more than simply provide eyes in the sky for forward operating bases – that they could in fact become antenna towers 500-1,000m high in the sky.

'Those aerostats loaded with camera payloads are giving commanders the ability to see far beyond line of sight,' Montgomery explained. 'At which point a quick look at traditional army communications tells you a couple of things – namely that they use line-of-sight radios with antennas attached to the top of ground vehicles, meaning if those radio antennas can't see each other, they can't talk. At this point, you're talking maybe 20km of coverage on a good day. Put those antennas up in the aerostat and suddenly you are talking about over 100km, including over hills, and that's a pretty dramatic difference.'

By running an optical fibre through the aerostat tether – which is already in place for camera payloads – the FORAX system is delivering analogue over fibre with very little impact on the aerostat, other than slightly increased weight and power requirements. The system is being embraced strongly by the US Army, and Syntonics is currently building a number of systems to go into Afghanistan, as well as for customers in Canada and an unnamed non-US operator. The company has also had enquiries from Europe.

The change in communications capabilities with the FORAX HARC payload is also contributing to the US Army's 'aerial layer', as it enables aerostats to become part of the communications 'cloud' being built up through airborne surveillance platforms including Airborne Warning and Control System aircraft and UAS.

CONVENIENT SECURITY

The challenges of effective communications on the battlefield are greater than those presented by environmental and man-made obstacles. A major concern for any deployed soldier is carrying out covert communications in hostile territories. Aside from the electronic signature of antennas, the one of the biggest threats to the security of command posts is that they have traditionally been visually conspicuous. Products such as FORAX, however, in enabling the antenna to be physically removed from the command post itself, increase the security of personnel and equipment inside. Importantly, they also do not force a reliance on smaller antennas with increased covertness but reduced range.

'Let's assume that a group of commandos have established a base in the basement of a building,' Montgomery explained. 'They don't want to put an antenna up on top of that building because that just says "here we are" to hostile forces. But they can run a slender optical fibre to a position some distance away and put the antenna there, so as not to disclose their location.'

The US military has been a big early adopter of FORAX equipment in this capacity, according to Montgomery, particularly for use in secure compartment information facilities (SCIFs). These are bunkers that form an enclosed area within a building where sensitive intelligence is processed – light, sound and RF signals can neither pass in nor out.

'The problem is,' according to Montgomery, 'how do you put a radio inside a room like that? You can't connect it over coaxial cable, because that needs to penetrate the wall which would enable signals to leak in and out. The answer is you do it over optical fibre, which does not leak electronic signals. So now it is possible to put radios in these SCIFs and have the antenna somewhere else – and that's hugely useful and convenient.' ►