Timothy Compston weighs-up the logic of deploying EOD (Explosive Ordinance Disposal) robots or RCVs (Remotely Controlled Vehicles) in dangerous scenarios

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EOD robots have changed beyond all recognition since they were first deployed in environments like Northern Ireland during 'the Troubles' both in terms of the capabilities they offer and ability to deal with suspicious items in more confined spaces than was possible before.

Colonel Bob Seddon – formerly the British Army's most senior bomb disposal officer, before leaving the service in 2011 – gives his take on the role of EOD robots, having been well placed to track their development over the best part of three decades, from the perspective of first a user and then a procurer: "As principal ammunition technical officer I was the competent army authority responsible for all bomb disposal and over the years I have had a keen interest in the use of RCVs, even destroying a couple in my time. Personally I think that doing bomb disposal with those things is a very good idea".

In terms of how EOD robot or RCV technology was deployed in the early days, Colonel Seddon admits the 'Mark 1 Wheelbarrow', rolled out by the British Army in Northern Ireland, had more in common with an agricultural piece of machinery. "It was really just about remote reconnaissance and then delivering a single EOD disruptor to deal with the device". He tells me that, after the lessons learnt in Northern Ireland, one of UK bomb disposal's defining principles is 'remote attack where possible': "1972 was a very bad year and that really accelerated the development of robotic systems. In circumstances where we have not been able to use these – like in Afghanistan – we, sadly, took more casualties". One of the things that Colonel Seddon is quick to underline is that not being there is one of the best counter measures: "Bomb disposal conducted at one 100 metres is always more forgiving than bomb disposal conducted at 15 centimetres".

Asked about whether it is possible, thanks to more capable systems, to work at longer ranges than before he replies in the affirmative: "With large devices, particularly with vehicle-borne IEDs [Improvised Explosive Devices] – the sort of devices that we are seeing in places like Iraq, Syria and North Africa – you definitely don't want to be too close to those because you are talking about thousands of kilogrammes of explosives. The improvements in technology allow greater stand off in some circumstances, but for most small devices you are talking about normally being within 100 to 200 metres of the device. In urban areas if you go much beyond that it becomes very difficult to effectively cordon off and evacuate".

On the question of what operators were actually able to see from a remote vantage point with the earliest EOD robots, Colonel Seddon replies that back then visualisation was very limited, but as time has gone on things have become progressively more sophisticated. "Now you are looking at quite sophisticated robotics – some variants have eight or nine cameras, multiple weapon systems, remote visualisation and even haptic feedback so you can actually feel through the controller what you are doing to a device or target. The technology has

A bomb disposal operator uses the HOBO

©Irish Defence Forces Army Bomb Disposal Team

come a long way and it is really the improvements in communication and computer technology that have underpinned this," he claims.

Discussing the topic of simulation, Colonel Seddon notes that simulation and synthetic environments are undoubtedly becoming more important: "A great deal of research has been conducted in this area in the USA and it is now starting to feed into a number of practical RCV products. We are now at a turning point where advances in simulation, computer display and haptic feedback will lead to the introduction of more capable robotic systems".

Mark Kauchak from Northrop Grumman Remotec feels that the capabilities of EOD robots have been enhanced thanks to a number of key technology changes: "The increases in computing power, the improvements in motors, and communications... Maybe 10 years ago what was available drove robots towards a certain type of design, but now with various advances they enable you to do more, and different, things for the end users".

Interestingly, Kauchak says that one of the major changes, at least from Remotec's perspective, has been radio technology: "Prior to that if the operators were going into or around buildings, typically they ended up using fibre so they had a tethered system which presented issues as far as mobility, if the fibre broke or it caught up in the tracks. The main reason was that radio technology really wasn't that dependable back then in that kind of environment". As a result of moving to fibre, he says there is more freedom to manoeuvre inside buildings and around buildings, such as parking garages: "It has given them [the bomb disposal technicians] a wider envelope for robot operations where, perhaps in the past, they might have had to make an entry with a bodysuit on".

Looking in more detail at some of the EOD robot solutions that are coming down the track, Padraig O'Connor the managing director of Irish firm Reamda Ltd explains more about the rationale behind the development of new machine the Reacher for the Irish Defence Forces. The Reacher made its first public appearance at DSEI (Defence and Security Equipment International) in London last September.

According to O'Connor the name Reacher reflects the next-generation machine's added functionality over predecessors: "The particular model of EOD robot that the Irish Army is operating at the moment is called the HOBO and we were responsible for the entire electronic upgrade of that machine's systems. About two years ago we got the contract to replace that machine in its entirety. They [the Irish Army] did extensive research on what they reckoned they needed and this was basically the entire functionality of the old machine plus numerous extra features".

Drilling down to how things have moved on for the better with the Reacher and the compatible RDP (Remote Disruptor Platform) it carries, O'Connor says that one consideration was the fact that pipe bombs are a relatively cheap method that terrorists and criminal gangs are increasingly employing: "They use them as car bombs, putting them under the foot well and things like that, where they can create the most harm. The problem if you have a big EOD machine – even the new Reacher, which can get very far under a car because it is designed to do that – is that if the car is parked beside another vehicle or in a tight spot it is very difficult to access. Basically they [the Irish Army] came to us and said that they needed a solution for these tight spots and to move under cars". According to O'Connor, the solution Reamda came up with was to design a small machine called the RDP for disarming pipe bombs with a ballistically powered water cannon. "This dislodges the pipe bombs, shreds them and destroys the electronics that are involved in detonation," he explains.

Returning to the Reacher itself, one feature which O'Connor feels is industry-leading is the idea of having a payload bay that can carry things like the RDP: "In the past, machines were made and

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An army bomb disposal team with a Cutlass remote controlled vehicle at the Didcot 'Site A' Power Station

everything that went on to them… you had to either strap it to the outside or carry it with the manipulator claw. That is fine but the machine might have to cross some very rough terrain and you don't want it dropping an X-ray panel made of amorphous silicon, which can crack. So now your valuable stuff is safe in the bay until you reach where you are going". This also means that your claw is free to open doors or move obstacles.

Another aspect of the Reacher O'Connor is keen to spotlight is the sliding turret: "The turret in our machine is different because it allows you a lot of access when space is restricted because you can shift the turret to a different position and it also allows you, because the arm is quite heavy, to shift the machine's centre of gravity when you are climbing. On stairs, steps or hills you can shift the weight backwards or forwards. Another big problem with machines and claws is getting them to grab things automatically because they have so many degrees of freedom it makes it difficult when all the errors in all those degrees of freedom are added up. We have designed it so the arm is almost in its folded position when accessing the payload bay to reduce the errors to a manageable level".

The Irish Defence Forces bomb disposal teams who will soon be welcoming the new Reapers are being kept extremely busy at the moment. Defence Force figures show that in 2015 the teams were called out to 145 explosive ordnance disposal (bomb squad) incidents, making safe 25 viable devices. This level of incidents seems to show no sign of dropping off. In fact on one night alone at the end of February, the bomb disposal teams found themselves attending three separate incidents across Ireland – from the M7 motorway in County Laois to Tallaght and Dublin – to deal with suspected improvised explosive devices (IED), firearms and IED components.

Army bomb disposal experts and their robots can find themselves tackling a wide range of scenarios, beyond just bomb disposal. A case in point was the Royal Logistic Corps (RLC) from the British Army which was recently (February) deployed to the site of Didcot power station in support of fire and rescue, urban search and rescue and search dog teams to help search for missing persons trapped beneath the tonnes of twisted steel, pipes and concrete in the remains of the collapsed Didcot 'Site A' power station.

To conclude, there is little doubt that EOD robots of all shapes and sizes are now well placed to offer a stand-off capability for the military and police forces, to identify and disrupt suspect devices at a safe distance, so reducing the well-documented risks faced by today's bomb disposal teams.

Timothy Compston is a journalist and PR professional who specialises in security issues. He studied International Relations and Strategic Studies at Lancaster University, is PR director at Compston PR and a previous chairman of both the National PR Committee and CCTV PR Committee of the British Security Industry Association (BSIA).