As Nato forces shift their focus from operational engagement to operational preparedness in 2014, Chris Hunter looks at the evolution of explosive ordnance disposal tactics and technology over the last 13 years in Afghanistan

THE IED

Rendering safe an improvised explosive device (IED) is often dirty, unpleasant and brutal work. One minute you're dripping with sweat, the next you're freezing with cold. You often won't know precisely what is going on or where your adversary is; and you certainly won't know what he is going to do next, or what his full capabilities are. Indeed, you often don't even know where your own people are or what they are going to do next. In short, bomb technicians have to operate in conditions of fatigue and fear, uncertainty and ignorance, and often in isolation; and nowhere is that more prevalent than in the killing fields of Afghanistan – the world's primary asymmetric conflict-zone.

The IED has become one of the most dangerous and effective weapon systems ever faced, and has become the insurgents' weapon of choice across the globe. In recent years, IEDs have replaced artillery as the leading cause of death on the battlefield. This rudimentary device, ubiquitous throughout Afghanistan's landscape, is deployed and hidden in places limited only by the imagination of the terrorist. According to figures published by the Joint IED Defeat Organisation, the IED accounts for more than 60 per cent of all casualties sustained by Coalition forces in the country.

Over the course of the 13-year campaign, the Taliban's tactics have varied substantially from place to place, depending on the geography, demographics, and the concentrations of Coalition forces. The fighting in the unforgiving mountains of northern Kandahar and Zabul has differed significantly from combat operations seen in the lush, fertile valleys along the Helmand River and Southern Kandahar.

Some villages have witnessed repeated ambushes; while others have remained completely unaffected. Suicide bombings are common in the major cities, whereas in the affected rural areas traditional guerrilla tactics are the preferred norm. Taliban guerrillas have frequently conducted large-scale massed attacks where the Coalition's presence is limited, while in other parts of the country their footprint is virtually non-existent.

What has remained constant, however, is the continual evolution of Taliban tactics throughout the course of the campaign. From 2002 to 2005 the Taliban tended to operate in small groups in remote areas, carrying out infrequent hit-and-run attacks on isolated patrols. By late 2005 they began upping the ante, massing in large numbers near population centres where they carried out audacious frontal assaults on heavily fortified positions. But by 2006, in part, due to the Coalition's advanced intelligence, surveillance, target acquisition and reconnaissance (ISTAR) technology, which offers enhanced capability to see would-be attackers – and target them – the Taliban began taking heavy casualties and ultimately failed in its aim of defeating the Coalition. As a result, many Taliban commanders dispersed their forces, encouraging them to use IEDs in remote ambushes against strategic points such as bridges and supply convoys. Their logic was simple: their fighters didn't have to be present when an attack occurred and, therefore, would not become targets themselves.

The following years saw a meteoric rise in Taliban IED and suicide attacks. In 2008 and 2009, roadside IEDs claimed the highest number of coalition casualties to date: in 2008 almost 4,000 IEDs were detonated or found, a 45 per cent increase on 2007. There were more than 7,228 IED incidents in 2009, resulting in 6,037 deaths and injuries. During that year, an estimated 80 per cent of all Coalition casualties were caused by IEDs incorporating technologies that took Western bomb-makers decades to evolve. Command wire IEDs, well-camouflaged radio-controlled bombs and shallow-buried victim-operated booby traps such as pressure plates incorporating metallic saw blades soon became the norm.

And so an inevitable measure/counter-measure race began. Jammers were rapidly introduced into service across the Coalition to counter the threat of RCIEDs, and other devices such as highly sophisticated metal detectors were deployed to locate the high metal content booby traps hidden in the ground. But within weeks of them being brought into service, the Taliban bomb-makers began replacing the metal components in their IEDs with plastic ones, making the devices all but impossible to detect.

As well as the rapid introduction of search and detection capabilities, including a return to more traditional methods such as the use of explosives search dogs, the Joint IED Defeat Organisation (JIEDDO) alone spent more than $6bn on countermeasures such as robotics and jammers in order to defeat the Taliban's crude but effective IEDs. Other Coalition partners have spent significantly more. According to academic and counter terrorism expert Andy Oppenheimer, at one point, JIEDDO was running 150 service-specific training programmes, including the use of vehicle-based mine-roller kits and man-portable radio-frequency jammers. The UK Government subsequently promised a further £150m for EOD and a 200-strong specialised force for Afghanistan to address the controversial shortcomings highlighted following the deaths of several UK ATOs – apparently due to lack of equipment.

In addition to the concerted efforts by the Coalition

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to enhance its search and detection capabilities, by early 2008 there was a huge emphasis on force protection methods including the introduction of the mine-resistant ambush-protected (MRAP) vehicle to protect troops against armour-defeating IEDs. These new vehicles were deemed ideal for C-IED protection, owing to the fact they sit higher off the ground, have a V-shaped hull to deflect explosions, and have thicker armour to protect against fragmentation. These troop-carrying vehicles are also equipped with a number of additional specialist countermeasures, but the inevitability that the Taliban will build bigger and more powerful bombs is palpable. Prior to 2008 the majority of IEDs emplaced in Afghanistan contained less than 12kg of high explosive. Since that time they have grown to in excess of 500kgs of bulk explosives – their sole purpose: to destroy these new generation of MRAPs.

In short, success in terms of IED defeat cannot rely on rapid technological change alone – an understanding the context in which an IED has been deployed is also essential. It is about "shooting the archer, not the arrow", which involves gaining a thorough insight into the mind and intentions of the bomb-maker, who may just as easily have designed an IED attack as a deliberate "come-on" for the EOD operative as any number of other civilian, police or military targets. For that reason, EOD render safe procedures (RSP) have necessarily had to evolve over the course of the Afghan campaign too.

Understandably, EOD RSPs are generally protected from public dissemination in order to deny the enemy the opportunity to use them against us, and most importantly to hinder an adversary's development of new anti-handling devices or other similarly sinister technologies.

Numerous techniques have been developed in recent decades, and refined in Afghanistan to render safe an IED. Which technique is used depends on a number of variables; the role of the Coalition's EOD operators is to complete the RSP remotely wherever possible. Some IEDs can generate blast overpressure s of up to 200 atmospheres, which is powerful enough to destroy a main battle tank. For that reason, only in an extremely life-threatening situation would an operator render-safe a device by hand. As such, the most popular tool in the EOD operator's inventory is the remotely controlled vehicle (RCV). Fitted with a suite of cameras, microphones, hand-like manipulators and other weapon systems, these robots have saved countless peoples' lives.

Sadly, however, an operator cannot rely exclusively on the use of remote means for all scenarios. Clearly, there are still circumstances when a robot isn't suitable, and a technician will still often need to put himself at risk by personally approaching the bomb. In such cases the technician will don a specialised protective suit, incorporating flame and fragmentation-resistant material. Some suits have advanced features such as internal cooling, amplified hearing and communications back to the control area. This suit is designed to increase the odds of survival for the technician should the munition or bomb

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Deadly device: IEDs have progressively become more powerful during the conflict, causing greater damage to vehicles

function while they are near it.

For such scenarios, the operator's inventory has grown to include devices similar to the X-ray used by medical personnel, as well as high-performance sensors that can detect and help interpret sounds, odours or even images from within the IED. Once the bomb tech has determined what the device is, and what state it is in, he can then formulate a procedure to disarm it. Preferably, this will be accomplished remotely once the technician has retired to an uninhabited area to complete the neutralisation. Only once the device has been rendered safe will the bomb tech remove the remaining parts and exploit the device so the area can be returned to normal.

Such RSPs can take a great deal of time and in recent years this, coupled with local topography and the tactical situation on the ground, has resulted in increased attacks on the security forces manning the cordon positions while the bomb techs conducted their lengthy RSP. Additionally, between the beginning of July 2009 and the end of March 2010 – the period when Taliban bomb production soared – 109 British soldiers were killed, and of those 83 died in IED blasts. Understandably, a more novel approach was required. Rather than removing bombs from the ground without blowing them up, so that they could be forensically analysed, such devices would now be simply destroyed in situ. The rationale of the senior officers was that this new "Assault IED Defeat" tactic to destroy rather than always exploit IEDs would be quicker and safer. Indeed, all six British bomb disposal operators killed in Helmand since 2006 apparently died while attempting to remove improvised explosive devices (IEDs) from the ground so that they could be examined and subsequently "exploited" by intelligence staff.

In short, on conventional EOD operations, the more "permissive" nature of the operating environment means remote attack, the observation of mandatory soak times, disablement by disruption, the minimum time at target and a single-man risk have become text-book principles. But in the "non-permissive" assault IEDD environment, the tactics are based on trying to achieve a balance between destroying bombs in order to allow greater freedom of movement for troops and gathering intelligence to target the Taliban networks which build and plant IEDs. Such information can then be used by Counter-IED teams specialising in forensics and evidence collection – to get "left of the boom" and either capture or prosecute those responsible.

And so, throughout the 13-year conflict to date, the evolution in the IED threat has been a continual measure/countermeasure race. As the Taliban introduced new devices – coupled with rapid advances in their tactics, techniques and procedures – Nato has necessarily had to learn to exploit intelligence recovered from IEDs, create post-IED blast procedures to collect technical and forensic evidence, develop techniques to render IEDs safe, and technologies to defeat the bombs and protect its forces on the ground. As we plan and prepare for complex conflicts in the future, the challenge now is to identify an appropriate way to preserve these capabilities and to provide commanders of tomorrow with the guidance required to leverage them.

Chris Hunter QGM is a leading bomb disposal specialist, counter-terrorism consultant and author of the best-selling memoirs E*ight Lives Down* and *Extreme Risk*. During his 17-year career in the British Army he served in a variety of operational improvised explosive device disposal (IEDD) appointments and saw active service in numerous high threat theatres including Colombia, Northern Ireland, Iraq and Afghanistan.