Improvised Explosive Devices

A Recipe for Disaster

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Origin

Improvised explosive devices (IED) were again in the limelight after the 13/7 terrorist attack in Mumbai. A dual use chemical called Ammonium Nitrate, which is also the base for fertilizers, was believed to have been used as a explosive along with the cell phone as a trigger. In the recent past IEDs have become one of the major tools of destruction in asymmetrical warfare. It is being use effectively by terrorists, guerilla forces and commandos. They are in a way successor to the bobby traps laid by the land forces which are used in conventional warfare. An IED is a homemade bomb which is made with improvised material and constructed by trained amateurs. 'Homemade' only implies that it is not manufactured by professionals in a suitably equipped factory and in large quantities.

The Provisional Irish Republican Army made bombs from agricultural fertilizer and semtex smuggled from Libya to make remote-controlled bombs which they used very effectively against the British Army during their struggle to liberate Northern Ireland. The term IED originated probably from the British Army during this period. They were also used by the LTTE in Sri Lanka against the Sri Lankan Army as well as the Indian Army. They were used extensively in Iraq and are presently being used in Afghanistan. IEDs have become a weapon of choice for the insurgents. In Iraq they had caused 64% of the coalition casualties

till 2007. In Afghanistan they have caused over 66 per cent of the coalition casualties and 60 per cent of all civilian casualties till middle of 2011.The number of injuries were much higher.

In Afghanistan there were 12 counter IED teams in 2009 which has gone up to 130 to date and are patrolling on a daily basis. IEDs have caused such heavy casualties on the US Forces and their Allies that a movie 'Hurt Locker' was made in the US which featured the exploits of the US Army's elite Explosive Ordnance Disposal squad while seeking out and disarming IEDs in Baghdad. Thus IEDs became the main villain pitted against the hero which is the US Army.

What is an IED?

A typical IED has an explosive charge supported by a booster charge, a detonating device and a system to trigger the electrical charge that will ultimately cause the explosion. IEDs can be of many types containing a variety of initiators, detonators, penetrators, and explosives. They can be easily attached to artillery shells, mines, conventional bombs or improvised explosives. The design will depend upon the type of target like personnel, tanks or vehicles. For use in a crowded place against personnel, the explosive should be able to throw shrapnel to kill or maim for which nails or ball bearings or a mix would be most suitable. The IED in this case can be hidden in a scooter or in any object which should look natural in the environment it is being employed to avoid suspicion. For tanks or armored personnel carriers, they could have shaped or hollow charge.

The trigger can be by remote control, infra-red, magnetic, pressure-sensitive bars or trip wires. They can also be wired together like a daisy chain along the road to attack a convoy of vehicles. Components of the IEDs will depend upon the ingenuity of the designer. Mobile phone, cordless phones, washing machine timers, pagers, garage door openers etc could be used effectively as triggers. Victim-operated improvised explosive devices are triggered by the victim themselves by movement through tripwire, pressure mats, spring-loaded release, push, pull or tilt. The risk of using toxic chemicals like chlorine, biological and radioactive material being used in an IED looms large on any targeted environment and the nightmare of security forces.

Vehicle based. A vehicle based IED can carry larger amount of explosives and cause extensive damage. They can be triggered by a suicide bomber or by remote control. These are typically employed by suicide bombers, and can carry a relatively large payload. Such an attack took place on Hotel Marriott in Islamabad in Sep 2008. A large truck rammed the front security gates of the hotel.

A suicide bomber then detonated a small first explosion that sent the security guards fleeing momentarily. Subsequently an estimated 600kg of military explosives carried in the rear of the truck finally detonated. The blast created a 6m deep crater, and destroyed the entire front section of the hotel resulting in heavy casualties. Almost a year later similar IED attack took place against the Indian Embassy at Kabul but could not cause much damage to the embassy but was able to kill 17 locals.

Sri Lanka. These can also be triggered remotely as was done in Sri Lanka by LTTE where children connected the wires through a cell of the IED causing an explosion and damage to personnel and vehicles. The wires were laid under - ground, far away from the area under attack thus it was difficult to locate the source. The remote control can be through a radio link also.

Other Variations. There are many more possibilities like connecting an entire house with IED, jeopardising the life of the security forces that come to clear the house, etc. Boats full of explosives can attack ships causing damage. During World War II the Japanese used suicide attacks by boats to ram Allied ships. Suicide bombers used a boat-borne IED to attack the USS Cole during October 2000 is another example. Use of animals to carry IEDs and carcasses to conceal them is another example. Dogs were trained by the Soviets to carry explosives to tanks and other military targets, and used against German tanks in World War II. Initially the dogs were trained to leave the bomb and retreat so that the bomb would be detonated by the timer but this method failed and was replaced by an impact detonation method which killed the dog in the process. The US military trained anti-tank dogs in 1943 for use against fortifications, but never deployed them. Dogs strapped with explosives were also used unsuccessfully by Iraqi insurgents in 2005.

Another interesting version being developed by US in World War II was the Bat bomb which was a bomb-shaped casing with many compartments, each containing a Mexican Free-tailed Bat attached with a small timed incendiary bomb. When the Bat Bomb was dropped from a bomber, the casings would deploy a parachute in mid-flight and open to release the bats which would then roost in small dark places like caves, attics, under bridges, or abandoned buildings and would set fire to the wood and paper buildings of the Japanese cities. Unfortunately the project was not ready in time and moreover the use of the atom bombs by the US hastened the end of the war. A very simple device used in Iraq was the platter charge which was a rectangular or circular piece of flat metal with plastic explosives pressed onto one side of the platter. The explosive

would propel the platter into the target with an approximate velocity of 6,000 feet per second and with some degree of accuracy at 50 metres. Another one was the use of propane tanks packed with explosives and powered by 107 mm rockets similar to Provisional IRA's barrack busterr mortars.

Detection and Disarmament

IED as the name suggests are improvised thus there is no standing operating procedure which can be laid down for their detection and disarmament. However with experience in a particular terrain and enemy, certain guidelines can be laid down for explosive ordnance disposal (EOD) personnel to detect and disarm them. IEDs which have chemical, biological, radiological, or nuclear content require additional precautions. Some of the countries like India, US, UK and Israel have vast experience in dealing with IEDs and as such have developed many procedures to render them safe. Apart from technology; experience, training and rigid following of safety procedures are essential in defeating IEDs. In Afghanistan they have adopted a three pronged strategy which involves attacking the insurgent IED network, by finding and implementing new ways to defeat the device, and lastly by training the counter-IED force.

Counter Radio Controlled Improvised Explosive Device Electronic Warfare (CREW) systems

Remotely controlled IEDs can be jammed as compared to suicide bombers or IEDs connected through wires are difficult to counter. The wish list of the capability of a jamming device is that it should be able to locate and jam bombs, disturb GPS signals, provide signal intelligence and jam nav-attack systems of airborne objects. The simplest system is a radio frequency jammer which should be able to sweep likely frequencies of the IEDs. The information on IED jammers is highly sensitive in nature thus countries and companies will not easily part with them. Radio Controlled IED (RCIED) jammer systems are primarily communication systems which can operate from low power to 500Watts and have a frequency band from 20 to 8300 megahertz and are a part of CREW systems. These specifications can vary depending on the requirement. RCIED jammers either block the trigger signal of the IED or cause it to detonate prematurely at a safe distance. Jamming can be either active or reactive. In active jamming electromagnetic waves transmit continuously over a preset frequency band. In reactive jamming, a scan is made to discern the threat frequency and then jamming transmission is done on this frequency.

Such a jammer is most effective during a dense electronic environment however there is a delay element involved which may give the IED a window to explode which does not happen with active jammers. Such a system was used quite effectively in Iraq to jam proximity fused ammunition. Some examples of the CREW system are the IED Countermeasures Equipment and the Warlock. Warlock is the most common jammer employed in Iraq and Afghanistan, and has undergone many upgrades. Warlock Duke used a technique called "set-on" jamming in which it had a series of built-in jamming responses which were designed to fool very specific devices. If Duke heard a particular FM walkie-talkie, it would send out a specific FM spoof.

There are systems which transmit at high frequency such as the Joint IED Neutralizer and the Neutralizing Improvised Explosive Devices with Radio Frequency. CREW Vehicle Receiver/Jammer (CVRJ) quadrupled the number of simultaneous channels it could jam and doubled the spectral coverage of pre-existing systems. It could be reprogrammed not only for the frequencies it covered but also the specific responses it used to counter particular threats. Thus the CVRJ could target effectively the most advanced triggers like the latest mobile and long-range cordless phones. The new phones hopped between frequencies and spread their signal across the spectrum to overcome interference. Thus, they were more difficult to jam. However, they had to rely on software protocols to establish connections between transmitter and receiver which could be spoofed.

Some of the US Air Force and Navy electronic warfare aircraft are able to perform the same functions, but over a wider area. Such a system was most effective during combat where the electronic warfare aircraft could sanitize large areas of the combat zone against IEDs. US Navy's EA-6 Prowler could not only jam the IED trigger but also remotely detonate the bomb. Jamming has a side effect that it also jammed mobile phones and other electronic devices. The only way around the jammers was to set up the road side bombs through a wire connection but it also caused insurgent casualties. The ongoing improvements in CREW are to add new frequencies and reduced interference with other friendly emitters.

Afghanistan

The Afghan insurgents made the bombs from wood and fertilizer, thus making detection very difficult. The trigger was pressure, built by boots on the ground. The US military's new blast proof vehicles were made for Iraq's well-paved roads.

So the insurgents hid their explosives in the gullies and the mud paths, where the trucks were useless. The bomb-handling robots couldn't also handle the rough terrain. Unlike Iraq, Afghanistan has mountainous terrain. Thus all the systems developed for Iraq were hardly of any use. The environment favoured a low tech approach for jammers. As the fighting grew more intense, casualties also mounted from the IEDs. The Joint IED Defeat Organization (JIEDDO) thus shifted its focus to compensate for this by spending more on surveillance and intelligence analysts, trying to find ways to crack apart Afghanistan's IED networks.

Future

The US believes that the IED threat is here to stay and as such the planning has to be similar to any other weapon system. In due course Pentagon's IED task force became the Joint IED Defeat Organization (JIEDDO) with a $3.6 billion annual budget. The specialists at the Combined Explosive Exploitation Cells became good at analysing which frequency spectrum the insurgents were using resulting in quick matching of the jammers. The US military is developing a sort of universal jammer that could be used in any type of combat environment and in a long time frame called Joint Counter Radio-Controlled Improvised Explosive Device 3.3. There's a JCREW jammer is designed separately for vehicles, individual troops and to protect bases. All of the machines are meant to work together. It is supposed to be fully networkable and able to communicate over the military's wireless battlefield networks.

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