ACTION ON ARMED VIOLENCE

AOAV

IMPROVISED EXPLOSIVE DEVICES:

PAST, PRESENT AND FUTURE

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This report was made possible by the generous assistance of the French Government and the United Nations Mine Action Service (UNMAS). Special thanks also goes to Alfred Jose Malaret Baldo at UNIDIR for his assistance in hosting a side event on this project on the 15th October, 2020.

Cover illustration: English ship IED, used in St Malo, France), 1693.

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INTRODUCTION

In his poem ‘Arithmetic on the Frontier’, Rudyard Kipling gave a stark warning of the dangers of imperial overreach by a colonial power. He wrote of “a scrimmage in a Border Station, A canter down some dark defile”, where an officer of the British Raj in India was killed by a local merchant.

“Two thousand pounds of education,” he wrote, “drops to a ten-rupee jezail.”

Kipling might have long fallen out of favour, but he was canny enough to note that a less powerful but committed adversary is able to level the playing field of war by relying on equipment with just as much firepower, but which requires far fewer resources.

Of all types of explosive weapons, none have been as cheap-to-make and have come as close to the level of harm or indiscriminate killing in recent years, than Improvised Explosive Devices (IEDs). State actors generally have access to much larger and more developed arsenals than their non-state counterparts, but IEDs, which can cost dollars, are easy to conceal and are just as deadly, have become the weapons of choice for insurgent groups such as the Taliban, ISIS, Al Shabab and Boko Haram. And in their wake, a mountain of civilian casualties has formed.

These homemade IEDs, put together from detonators, scrap metal, ball bearings, nails and all-too-often easily found precursor chemical materials, combined with greater knowledge of their terrain, and imperative ingenuity has enabled non-state actors to fight against much better-equipped opponents across the world.

To understand this hard reality, perhaps, one first needs to define what an IED is. The United Nations has it as “a device placed or fabricated in an improvised manner incorporating explosive material, destructive, lethal, noxious, incendiary, pyrotechnic materials or chemicals designed to destroy, disfigure, distract or harass” which “may incorporate military stores, but are normally devised from non-military components”.

Clearly, it is quite a wide-ranging definition and IEDs do not only vary in their components. They also display great variants in the way they are deployed, from hand-launched to air-dropped, mail-delivered to being strapped to a person, dog or even a donkey.

An explosion can also be defined, in its most simple form, as the production by the chemical process of a large volume of gas, from a solid, in a very short space of time. This very rapid increase in pressure can cause damage or project items at speed as the gas expands.

It is not surprising, then, that a wide range of definitions is available for IEDs, most of which are developed by actors that directly engage with such devices (like police departments, military divisions and security services), while other definitions are given by international organizations, national governments and policy makers. Each body’s definition largely varies based on which aspect it aims to focus on: composition, functioning, target, ignition, builder, delivery system.

Perhaps, though, the most useful definition is this: “an explosive device is considered an IED when any or all of the following—explosive ingredient, initiation, triggering or detonation mechanism, delivery system—is modified in any respect from its original expressed or intended function. An IED’s components may incorporate any or all of military-grade munitions, commercial explosives or homemade explosives. The components and device design may vary in sophistication from simple to complex and IEDs can be used by a variety of both state and non-state actors. Non-state actors can include (but not be limited to) terrorists, insurgents, drug traffickers, criminals and nuisance pranksters.”

Such IEDs, put together for pennies, have disabled equipment that costs hundreds of thousands of pounds and caused significant casualties. IEDs have also, arguably, caused better-armed troops to retreat from the field of battle, and spurred on the use of more drones and other forms of distanced warfare.

In these ways, IEDs have been transformative, and not just to the waging of war. All too often used against civilians, they have spread fear through communities, killed and injured thousands, and – through roadside checks, concreted defence systems and body scans, ultimately changed the face of modern life.

In response to this reality, this paper sets out to examine the IED in a wider global context. It will examine the evolution of IEDs, and why there has been such a rise in their use in recent years. It will, however, begin with the present, and examine the current and recent threat of this devastating weapon.

A DECADE OF GLOBAL IED HARM

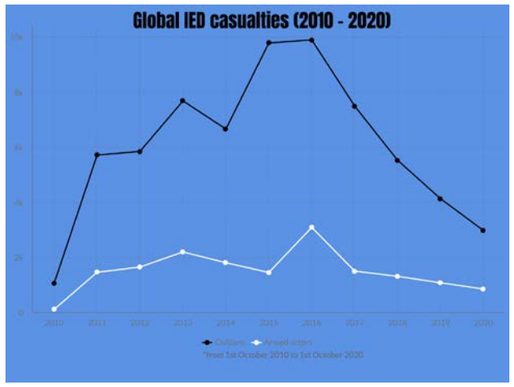
With the sole exception of the year 2017, IEDs have been responsible for more civilian deaths than any other explosive weapon type in each and every year in the last decade.

VICTIMS

Over the last decade – between October 2010 and the end September 2020, there have been **28,729** incidents of explosive violence, resulting in **357,619** casualties (263,487 civilians) recorded in English language media worldwide.

Of these, **171,732 people** were recorded as being from IEDs - a number that includes both civilians and armed actors. **48%** of all people killed or injured by explosive weapons globally, then, were harmed by IEDs.

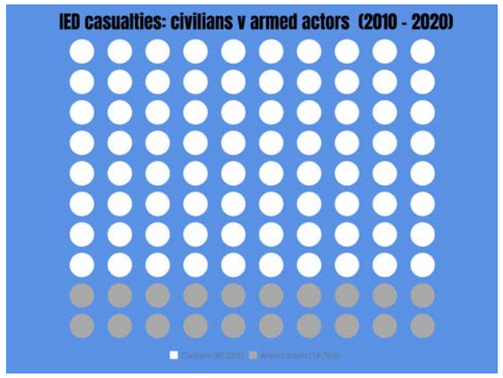
In that time there were reported some **11,971 IED** incidents worldwide. This means that, compared to a total number of all explosive incidents, IEDs constituted **42%** of all recorded and reported injurious explosive attacks (AOAV does not include attacks that harmed nobody).



ARMED ACTOR VERSUS CIVILIAN

What the data shows is that amongst the victims of a decade of IED attacks are far more civilians than military or security forces personnel. Some **136,669** of those casualties from IED attacks were civilians. This is compared to **35,063** armed actors and security personnel who have been killed or injured. **80%** of those harmed were civilians.

In other words, for every soldier or police officer harmed by an IED almost four civilians were wounded or killed. It works out as a stark average of 11 civilian casualties being killed or wounded per incident.



ARMED ACTORS

In terms of armed actor casualties, this report also examined the ways in which US and UK soldiers were killed during the war on terror.

In the US case, data collected from 'Honor the Fallen', a database created by the Military Times, shows that, of the 5,413 US soldiers killed on operation, where the cause of death was known, some 2,640 were killed by IEDs.

2,591 of these were male, 48 were female. In total, 1,790 troops died from IEDs in Iraq and 828 Afghanistan.

This means that 48.7% of total military deaths between the 9th September, 2011 and the 9th October, 2020 were attributed to IEDs; in Iraq, 52% of forces killed died from IEDs, in Afghanistan it was 48.2%.

The average age of US combatants killed by IEDs was 26. This means that, proportionally, troops were most likely to be killed by an IED aged between 22-29 (compared to 18-21 and 30+). Omitting incidents where the IED type was not reported, US service personnel, when killed by IEDs, were killed by roadside bombs (73%), suicide bombs (16%), and car bombs (11%).

In terms of UK military deaths, a review of deaths during the War on Terror (between 11/09/2001 and 09/11/2020), based on data from gov.uk and Statista, shows that - of a total of 634 UK service personnel killed, some 273 were attributed to IEDs. Of these, 270 were male and 3 female. 51 of these IED deaths occurred in Iraq and 222 happened in Afghanistan.

This means that, of all UK military deaths, 43% were attributed to IEDs. In Iraq, IEDs accounted for 32% of total deaths; in Afghanistan, IEDs accounted for 48% of total deaths. The next three most common causes of service personnel fatalities were enemy fire: 26.2% (22.5% Iraq, 26.9% Afghanistan); vehicle accident: 5.5% (11.2% Iraq, 2.9% Afghanistan); and helicopter accident: 4.3% (3.1% Iraq, 1.8% Afghanistan).

In the UK military, the average age of service personnel killed by IEDs was 26. British Forces were proportionally most likely to be killed by an IED if they were between 18-21 (compared to 22-29 and 30+).

The types of IEDs, where specified, that killed the most UK Forces were roadside bombs (71%), suicide attacks (21%), car bombs (5%) and makeshift mines (3%).

It is clear that, for both civilians and armed actors, the use of IEDs has been one of - if not the greatest - direct threat to life in modern conflict.

CHILDREN

Overall, English language media has reported that at least 3,540 children were casualties of IED violence since October 2010, with the countries registering the highest numbers of IED harm to children being Afghanistan with 1,409, Syria with 697 children, and Pakistan with 451 casualties. This number is likely lower than the actual harm suffered, as few reports list the age of the victims. Of the incidents where the number of child casualties was recorded, 17% of those killed or injured by IEDs were children.

Overall, the main perpetrators of all IED harm that caused child casualties were Taliban (454). ISIS (240), and IS in Afghanistan (144).

GENDER

Overall, English language media has reported that at least 2,194 women were casualties of IED violence since 2010, with the countries registering the highest numbers of IED harm to women being Afghanistan (782), Pakistan (397), Iraq (266) and Syria (226). It is likely, as with children, that this number is lower than the actual harm suffered, as reports rarely list the gender of the casualties.

Of the incidents where the number of female casualties was reported, women accounted for 14% of those killed or injured by IEDs.

LOCATION

In the past ten years, the threat created by IEDs on civilians and armed forces has not only expanded in conflict areas, but it has also increased in non-conflict countries. Overall, IEDs were found to have been used in the last decade in 100 countries.

Some 504 incidents with IEDs were registered across Europe and North America over the decade, causing some 5,702 civilian casualties. Though, of these, 192 occurred in Turkey (causing 3,142 civilian casualties) and 71 in Russia (causing 765 civilian casualties).

Some 74 suicide attacks have taken place across Europe and North America since October 2010. Turkey and Russia account for 25 each, leaving 24 across the rest of these regions. Of the 2,886 civilian casualties in these regions, Turkey and Russia accounted for 1,614 and 530 respectively.

Of the total 11,971 IED incidents, 6,889 took place in populated areas - some 58%. Indeed, when IEDs were used in towns and cities, perhaps predictably, the impact on civilians was far greater.

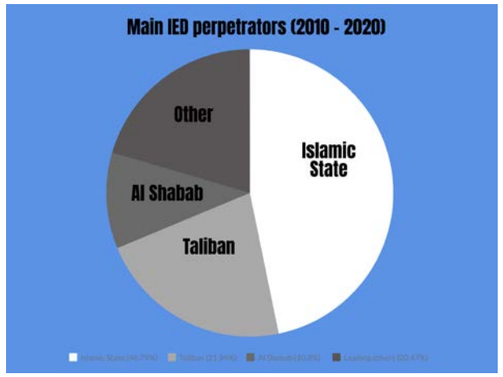
Of all casualties incurred by IED attacks in populated areas, some 136,156 people (90%) of them were civilians. This means that 123,198 civilians have been recorded killed or injured by largely non-state actors using explosive weapons in the last ten years. Furthermore, of the 39,842 people who died in IED attacks in populated areas, 90% of the victims were civilians (33,091).

397 places of worship were the scene of IED violence. 116 of these took place in Iraq, 63 in Pakistan, 56 in Afghanistan and 42 in Nigeria.

There were 184 IED explosions at schools, which resulted in at least 2,197 civilian casualties, including at least 406 children.

PERPETRATORS

The main perpetrators of IED harm were, predictably, armed non-state actors. The majority of them claim that they follow the principles of Islam and Jihadism – however much this might be denounced by the majority of Muslims who say that these attackers have nothing to do with their religion. Of all attacks by non-state armed actors, 1,079 were by IS, followed by Taliban (506), Al Shabab (249), Boko Haram (138), CPI Naxal (96), Pakistani Taliban (130), and PKK (108). Overall 75% of IED attacks in the past 10 years have unknown perpetrators.



WEAPON TYPES

Overall of the 28,729 incidents with explosive weapons, some 11,971 were caused by IEDs. This means that in almost the last decade, 42% of those reported killed or injured were harmed by improvised explosive attacks. Such a fact is central to why combatting the rising threat of the IED is so important on a transnational and international level.

In the same period, 7,908 harmful attacks were ground-launched, 7,519 were air-launched and 823 were from landmines.

The remaining harm was caused by explosives using multiple-launch methods, unclear launch methods or were naval-launched. Overall, then, the IED, is the ‘king’ of the battlefield, far surpassing the other category of manufactured weapons.

SPECIFIC TYPES OF IEDS

Within the weapon types of IEDs, specifically: 6,247 incidents were non-specific IEDs; 3,270 were roadside bombs; 2,341 were car bombs.

Of the different weapon types, the ones that caused the most civilian harm were non-specific IEDs (65,611), car bombs (55,414), air strikes (46,784), attacks using multiple explosive weapons (21,615), and shelling (14,265).

Victim-activated IEDs (VIEDs) were reportedly used in 1,237 events, causing 5,869 casualties. 547 of these explosions took place in populated areas with the highest number registered in urban residential areas. Only 11 attacks using a VIED was directed at an armed base, and six were planted in a place of worship. Where the perpetrator is known, ISIS was reported responsible for 234 of the attacks. Overall, 1,947 of the casualties inflicted by victim-activated IEDs were armed actors, while 3,922 were civilians. Of these, 592 were children. Overall, some 370 incidents took place in Afghanistan, 271 in Syria and 141 in India.

Incidents that have involved a suicide attacker see the highest general levels of casualties of any type of IED. Casualties per incident over the last decade, including the attacker, were an average 36 casualties per incident, of which 28 of them have been civilians.

Overall, suicide attacks killed 26,119 people and wounded 49,081. 19% of the 2,113 suicide attacks have taken place at armed bases, 11% at police stations and 8% at public buildings.

ISIS was named as the perpetrator in 251 attacks, the Taliban in 233, and Al Shabab in 109.

SUICIDE BOMBINGS

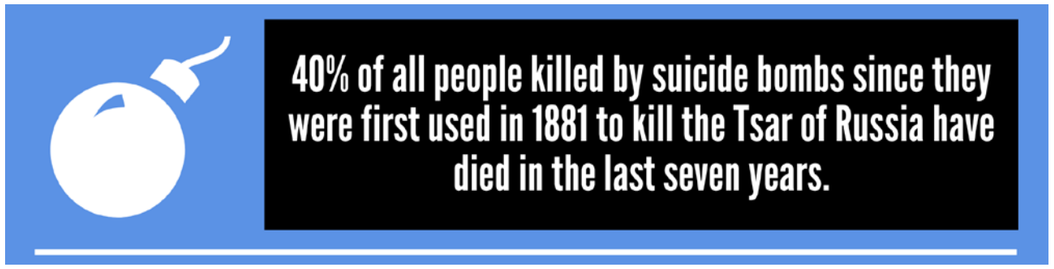
The 21st century has indisputably been the age of the suicide bomber. While they returned to modern warfare in the conflict between Israel and Lebanon in 1982 as a tactic of Hezbollah, until the 9/11 attacks and the war in Iraq it was much more limited in scope and organization. In 2015 there were around 600 suicide strikes, as opposed to no more than 20 in any year since the Second World War before the attacks on 9/11.

In the last decade, there were 2,113 suicide attacks in 47 countries. The five countries where suicide attacks were most frequent are Afghanistan (510), Iraq (507), Nigeria (208), Pakistan (178), and Syria (172).

AOAV’s previous reporting on this issue has noted “the cult of the suicide bomber is complex and almost paradoxical. In one sense, the bomber is lionised, eulogised and held up as a hero. In another sense, the bomber is an expendable resource. Suicide attacks carried out by jihadi organisations are often strategically calculated and planned by high commanders, a process in which the bomber does not take part until the very last stage.”

The highest number of suicide attacks was registered in 2015 with 161 attacks, but the last decade has seen more suicide bombings than at any time in history.

Indeed, 40% of all people killed by suicide bombings worldwide in the entire time between their first use in 1881 and 2020, died in the last seven years.



AFGHANISTAN: A CASE STUDY

Landlocked and mountainous, Afghanistan has suffered from such chronic instability and conflict during its modern history that its economy and infrastructure are in ruins, and hundreds of thousands of its people are refugees.

The Taliban, who imposed strict Islamic rule following a devastating civil war, were ousted by a US-led invasion in 2001 but have recently made a comeback. The internationally-recognised government set up following the adoption of a new constitution in 2004 has struggled to extend its authority beyond the capital and to forge national unity.

NATO-led foreign combat troops had the main responsibility for maintaining security after 2001, and the formal end of NATO's combat mission in December 2014 was followed by an upsurge in Taliban activity. The conflict in Afghanistan has been marked by the use of IEDs. These are often made using legacy-of-war materials or with readily available precursor materials that are often sourced from neighbouring Pakistan.

THE IMPACT OF IEDS IN AFGHANISTAN

IEDs have been the leading cause of conflict-related civilian death in Afghanistan every year since 2001 (excluding 2014 and 2016 when, according to UN data, there was a higher number of small arms casualties linked to fighting between Afghan forces and the Taliban). Such widespread IED usage has also risen and fallen in line with levels of Taliban military activity. The Taliban are responsible for the majority of IED attacks in Afghanistan in the last decade, with such attacks becoming wide-spread after 2009.

VICTIMS

There have been 27,539 civilian casualties from explosive violence in Afghanistan the past 10 years. Of these, 77% (21,637) were caused by IEDs. These were from some 2,288 IED attacks between October 2010 and September 2020. Some 6,625 civilians were killed and 15,012 were wounded by IEDs in Afghanistan in the last decade. Woundings from IEDs are likely under-reported in the national and international press, as AOAV's research has frequently pointed out.

A BRIEF RECENT HISTORY

1979 - Soviet Army invades and props up communist government. More than a million people die in the ensuing war.

1989 - Last Soviet troops leave. US- and Pakistan- backed mujahideen push to overthrow Soviet-installed Afghan ruler Najibullah triggers a devastating civil war.

1996 - Taliban seize control of Kabul and impose hard-line version of Islam.

2001 - US intervenes militarily following the September 11 attacks on the United States. Taliban are ousted from Kabul and Hamid Karzai becomes head of an interim power-sharing government.

2002 - NATO assumes responsibility for maintaining security in Afghanistan.

2004 - Loya Jirga adopts a new constitution which appears to provide for a strong presidency. Hamid Karzai is elected president.

2014 - Ashraf Ghani is elected president. NATO formally ends its combat mission in Afghanistan, handing over to Afghan forces. IED use rises rapidly. The government faces a growing insurgency.

2020 - Peace talks between the Afghan government and the Taliban begin.

ARMED ACTORS

In total, some 3,565 armed actors have been killed and 3,071 injured in the last decade. In total, 117 armed bases were targeted by IED attacks, but most strikes were road-side bombs (834 incidents).

In addition, there were over 500 suicide attacks, which saw 3,365 armed actors killed or injured.

Since the beginning of the conflict in 2001, there have been 829 US military personnel killed in Afghanistan by IEDs - some 42% of all American forces killed there during the war. In the same time-frame, 222 British troops were killed by IEDs, constituting 49% of all British military deaths in Afghanistan.

CHILDREN

At least 1,409 children were killed or injured by IEDs in the last decade in some 335 reported explosive incidents. Suicide attacks in Afghanistan led to 469 child casualties. Of all explosive incidents that saw children being injured or killed, 91 were by victim-activated IEDs. These caused 289 young victims.

GENDER

In Afghanistan, some 782 women have been harmed by IEDs in the last decade. Of a total number of 2,288 incidents, 242 reported women among the casualties. In these incidents, women accounted for at least 21% of the casualties. Many news reports in Afghanistan do not routinely record the gender of civilians harmed by explosive weapons.

LOCATION

In the last decade, 42% of all IED incidents in Afghanistan took place in populated areas. This minority of incidents, however, accounted for 82% of all IED-related civilian casualties in the last ten years.

PERPETRATORS

The main perpetrators of IED violence are non-state armed groups, but 75% of attacks have not been claimed. Where the perpetrator is known, 88% (504) of attacks have been attributed to the Taliban; 11% (65) to ISIS.

WEAPON TYPES

There were 370 VIEDs (victim-activated) in the last decade, killing some 1,076 civilians and injuring a further 703. VIEDs also killed 318 and injured a further 217 armed actors. Again, it is likely that in many VIED incidents woundings go under-reported. Non-specified IEDs were reported for 48% of overall IED harm in Afghanistan. Roadside bombs and car bombs represent 20% and 30% of IED attacks, respectively.

SPECIFIC TARGETS OF SUICIDE IEDS

There have been over 500 suicide attacks in Afghanistan in the past 10 years. The Taliban were named in 232 of these attacks by English language media. ISIS was responsible for 52 attacks. Suicide attacks caused 13,268 civilian casualties and 3,365 security personnel and armed actors woundings of fatalities. 70% of suicide attacks in Afghanistan in the last decade took place in populated areas. 2018 saw the highest number of suicide attacks - 74.

The main targets of suicide attacks were roads (usually targetting a convoy) with 78 incidents; armed bases (77 incidents); public buildings (71); and police stations (61). The attacks that caused the most civilian casualties were public buildings (2,552 civilian casualties); places of worship (1,729 civilian casualties); and public gatherings (1,491 civilian casualties.)

The last decade, as shown above, has seen a deluge of IED harm, with the vast majority of those killed or injured being civilians. But how did it come to this? What role have IEDs played in the not-so-recent past? And what lessons can be learned from their historic use? In this next section, we seek to look at the history of the IED, in part in an attempt to shine some light on the challenges of the now.

THE HISTORY OF THE IED EXPLAINED

IEDs are clearly not just a modern phenomenon - society has rediscovered the impact and efficacy of IEDs at frequent occasions over the centuries. They were once the first experiments with explosives to create a means of destruction. This points to a basic truth: that the main difference between the classification of IEDs and manufactured munitions that we see today is essentially a modern phenomenon, and such a distinction historically became possible only when large-scale production of explosive devices became the main means of production.

SERIES OF DEVELOPMENTS

Where did, then, explosives first emerge? About a thousand years ago it appears that gunpowder, in an early form, was developed in China. Possibly utilised as simple fireworks, gunpowder was held in a container of paper or bamboo and the effect, when lit, was of a loud crack. Over time, the key mix of saltpeter, sulphur and charcoal (often with other material) evolved, as did the realisation that confining the mix in a strong container - firstly wood and pottery, and later metal, increased the apparent effect of gunpowder.

It is important to understand that gunpowder is a “low explosive” - the chemical reaction of its components is caused by a burning effect moving through the mix, producing large volumes of gas very rapidly. This gas, when “confined”, builds in pressure and ruptures the container, projecting fragments by the rapidly expanding cloud of gas over a wide distance.

The development and refinement of the use of explosives continued - for it was found that not only could gunpowder rupture a container, but the expanding gas could also throw a projectile. So it was that the earliest firearms were invented. From being perhaps only of entertainment value, gunpowder started to be used on the battlefield: making noise, dispersing smoke and causing confusion, as well as creating damage and throwing projectiles.

Knowledge of this remarkable chemical mix and its associated technology spread through the world in fits and starts, firstly to the Arab world and eventually, perhaps in the late 13th century, to Europe. Here, as with any technology, it continued to be refined, improved and new uses were found for the phenomena of rapidly expanding gas. A typical example of an explosive device in this period would have been a pottery container, with a handful of gunpowder tightly packed inside and a fuse lit by the application of fire leading in through a small hole, designed to be thrown at an enemy. Lighting a burning fuse was also the technique used in the one of the early vehicle bombs, used in attempt to assassinate Napoleon in 1800.

MECHANICAL DEVELOPMENTS

For a few centuries, the method of igniting any gunpowder charge involved applying, by hand, a lighted match to gunpowder or a gunpowder-impregnated piece of string which led to the main volume of the charge. Basic European engineering skills also developed “matchlocks”: a spring mechanism which applied an already-burning match to the gunpowder charge. This mechanism could be used to initiate hand-held weapons and cannons but was rarely used in initiating large explosive charges.

This changed, however, in about 1500 when the “wheel lock” was invented. This small mechanical system enabled energy to be stored indefinitely in a spring. When a trigger was pulled, the spring turned a metal wheel which acted with friction on a substance that caused sparks to fly out. These sparks could then be used to initiate the gunpowder charge. This mechanical step enabled a range of wider applications, removing the need for a human applying a lit match at close proximity.

A typical example of this new device was a 16th-century weapon where the “trigger” of the wheel lock could be pulled at a safe distance to initiate the explosive at a time of choice for the perpetrator. More ingeniously the “pull” on a trigger could, in theory, be caused by a trip line; so it was that the first booby traps using mechanical systems were enabled. More ambitiously, a trigger could be actuated by a clock, so the first mechanical timed IEDs also became possible.

One of the most significant IEDs in history was such a device; in 1585 an entire ship, the “Hoop”, was filled with a large volume of gunpowder and set to drift against a temporary bridge erected by the invading Spanish army who had laid siege to the city of Antwerp. The charge was initiated by a clockwork timer, and the subsequent explosion killed up to 1,000 people; a devastating weapon for its time and indeed to today.

In the early 1600s, the wheellock, as a system, was superseded by the flintlock which required slightly less engineering skill and was therefore more easily and cheaply manufactured. In a flintlock a piece of flint is held against the action of a spring - when the trigger is pulled the spring acts on a lever which causes the flint to strike a steel pan, in which there is a small amount of gunpowder, igniting the main charge. Used extensively in hand-held firearms, the system was also applicable to improvised explosive devices and was more cost-effective than the wheellock. In the 1800s, the flintlock was superseded by percussion locks which themselves lead to the modern bulleted cartridge. This mechanism, using a fired bullet from a gun, still appeared as an IED initiator well into the 20th century.

An example of the firearm mechanism used on its own to initiate IEDs can be seen in a system developed in the US Civil War. The trigger mechanism was placed under a railway track so that a passing train caused the rail to deflect downwards, pushing on the trigger. A bullet was then fired into a charge of explosives, initiating it. This technique was subsequently used in the Franco-Prussian War, the Boer War and the First World War, there to attack Ottoman railways in Arabia.

ELECTRICAL INITIATION

Of course, technical innovation doesn’t occur in strict technological sequences. In parallel with mechanical innovation, other scientific developments became enablers for IEDs. The first electrical initiation of an explosive charge was achieved in laboratory conditions (possibly by Benjamin Franklin) in the latter part of the 1700s. By the mid-1800s, this system had evolved and began to be used by military engineers. Russian defendes against French and British attacks at Sebastopol in the Crimea use electrically initiated explosive charges and similar devices were used in the US Civil War. The poor availability of electrically-initiated detonators and practical batteries, however, did not really cause this method to be used very often in IEDs until the 20th century.

An assassination attempt using a vehicle bomb on Napoleon Bonaparte, 1800.

An early Chinese explosive device.

CHEMICAL DEVELOPMENTS

Over time there were also a series of key technological developments regarding the chemistry of explosives which resulted in “high explosives”. The first high explosives were discovered by alchemists working with exotic precursors in the 1600s, but such discoveries only really became ready for practical use in the 1800s. The key difference between low and high explosives is that the chemical reaction is not propagated by burning through a material, as in the former, but by a shock wave, as in the latter.

In general terms, high explosives release more energy at a faster rate than an equivalent amount of low explosives. The first high explosives were extremely sensitive and their successors today are used in very small quantities in detonators (aka blasting caps) to initiate larger volumes of less sensitive explosives. In the 1800s, a variety of chemical developments resulted in molecular explosives (firstly nitro-glycerine), then a range of others, being used extensively for military and engineering purposes. Molecular explosives are single compounds that react to external stimuli to decompose into gases with a significant amount of energy. TNT is another example, developed in 1863.

Explosive mixes were also developed. These were generally an intimate mix of some form of fuel (including powdered metal like aluminium, or simple fuel oil, with an oxidiser such as Ammonium Nitrate); today many IEDs use these mixes of easily available chemicals to create entirely practical high explosives. Their efficacy can be equally deadly - they explode in much the same manner as molecular explosives with pretty much the same effect, depending on the exact mix.

The evolution of the IED, then, was one driven by a variety of measures; technological discoveries, chemical developments and, as importantly, evidence of impact. In this way, history shows us that IEDs were frequently used by states - or by revolutionaries - in ‘conventional battle’. It was only, though, when states started to mass-produce arms and explosive devices for their armies, that the distinction between manufactured and IEDs became more salient.

ENCOURAGEMENT FOR THE USE OF IEDS BY REVOLUTIONARY POLITICS AND WAR

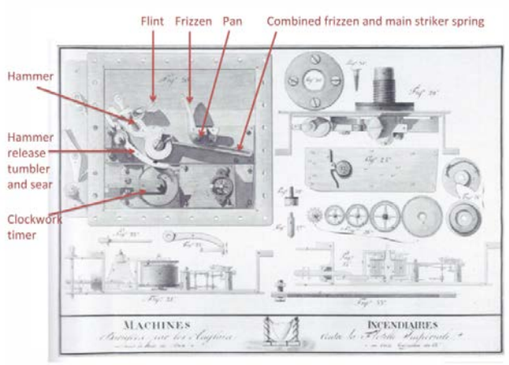
Political developments in the 1800s were also a key element in the increased utilisation of IEDs. The decade of revolution in the 1840s led to revolutionary politics and the potential of individuals to take violent political activity into their own hands - occurring in parallel with scientific development. There was a synergy between the politics and the technology available to “the people”.

An example of this was the European anarchist Johann Most, who brought about the concept of “Propaganda of the Deed” - the explosive charge used not only to cause harm but to garner media headlines too. Such propaganda - and the impact one blast could have on an entire society - soon spread the knowledge of IED manufacture and design.

As social pressures stirred the politics of the latter part of the 1800s and into the 1900s, revolutionary politics and the IED went hand in hand, literally. A number of wars, not least the US Civil War where there was extensive military use of IEDs, created hundreds of men trained in the use of explosives. Some of them went on to join revolutionary movements across the world, a transference of knowledge that resulted in the widespread use of IEDs in Russia, France, Spain, Italy, the UK, and the US.

Alongside this, war contributed other pressures. Occupying armies soon became the target of partisans and resistance forces, who were forced to develop their own weapons in whatever improvised means they could. Indeed, the 1890s was dubbed “the decade of the bomb” so often were there assassination attempts by revolutionaries. IEDs, often called “infernal machines”, were also deployed in a number of wars throughout the 1800s and 1900s, including the Crimean War, the US Civil War and into the world wars of the next century.

Just as now, there was a widespread concern then about the impact of IED use, its ease of availability and the consequences of such use. Perhaps it is worth contemplating that, in a sense, our concerns today are not new - history does have a habit of repeating itself.



A French technical analysis of an English IED, 1805.

INNOVATIVE DEVELOPMENTS IN IED USE

The history of IEDs is woven together not just with the military or revolutionary use of explosives, but with a history of human ingenuity. This ingenuity creates IEDs from unexpected components or applies them to function in clever ways. An early example of this was at the siege of Pskov in 1582 - the besiegers, under Stephen Báthory, sent, via an intermediary, an anonymous “jewelled casket”. It was a deadly trick - the casket was set to explode when the lid was lifted. Over the centuries there are too many examples to list - but it is axiomatic that many IEDs are ingenious in their design either by design, disguise or application.

One innovative application that has found, regrettably, much recent use is the suicide IED. Probably the first such event was the assassination of the Tsar in St Petersburg in 1881. Revolutionary terrorists obtained a number of sensitive explosives, and the nature of their plot required them to be present when the Tsar appeared as a target. They were so committed to t heir cause that they saw the sacrifice of their lives as worthy of that cause, and the concept of “propaganda of the deed” applied absolutely. Today, this concept continues and we have seen this concept applied to other revolutionary causes.

IEDs continue to be used in the spectrum of military or war operations throughout the 20th century. Not

surprisingly, the 20th century saw another rise in the use of IEDs, not only by non-state actors and revolutionary or militia groups as well as the military.

Within the 20th century, a wider range of IED attack types have been seen, firstly with the use of radio control systems, that allows the perpetrator to physically separate themselves from the device, giving a wider range of tactical opportunities.

More recently, the use of small commercial drone technology for IEDs provides the user with remarkable remote technology to deliver an IED remotely, without risk to themselves, to within an inch of its desired target. A typical IED user now has quite a range of attack methodologies available to him - roadside bombs, initiated by a mix of direct command and sensors, and large vehicle bombs which provide the user with disguise, volume and mobility. IED technology is also allowing sub-national groups to compete with superpowers on the battlefield and indeed deliver IEDs from great distances.

So it is that, even though the ‘War on Terror’ has seen a huge number of IEDs being used around the world against militaries and civilians alike, the IED has been with us for centuries, developing in line with technological changes in society, responding to the cultural and political realities of the age, and - in the end - evolving from being the most devastating weapon that states once had in their arsenals, to being the most devastating weapon that their non-state adversaries have today.

WHY ARE IEDS SO PROLIFIC TODAY?

IEDs have been used as weapons of war and protest for nearly as long as explosives have been in existence. Over the past quarter-century, IEDs have become the weapon of choice for insurgencies and violent extremist organisations, responsible for the death and injury of thousands of civilians annually. The reasons for the resurgence of IEDs are multiple, intertwined and overlapping. The first is a rise in extremism, facilitated by conflict, instability, state collapse, sectarianism and interstate competition. Second is the character of contemporary extremist movements, and how belief systems have led to a shift in the use of IEDs. Third is the nature of IEDs themselves, and the advantages offered by modern communications, global trade and technology that make IEDs a preferred weapons system today.

Extremism has fluctuated across the Muslim world over the past twenty-five years. The paths by which extremist groups have gained power and prominence varies between countries. In Afghanistan, Somalia, Iraq, Syria, Yemen, Mali, Libya, extremist groups have followed a similar pattern of exploiting civil conflict and state collapse. Extremism has been further aggravated by rising sectarianism across the Middle East. As States like Iraq, Syria and Yemen have failed, Sunnis and Shia have turned to family, tribe, sect and religion for identity and protection. Fear and hatred of the 'other' play into extremist teachings.[1]

In Central Africa, particularly Northern Nigeria and the Lake Chad basin, where IEDs have become increasingly prevalent, weak states struggle with limited authority over distant peripheral regions, lacking effective state institutions to respond to security challenges. Economic underdevelopment and poverty create conditions for instability to thrive. In some areas, the impact of climate change threatens traditional livelihoods, exacerbating long-running intercommunal fissures. Extremist groups have grafted themselves onto local dissident movements, conflating local grievances with the wider cause of global jihad.

Growing interstate competition has also contributed to the rise of extremist movements. Competition for regional hegemony between Iran and Saudi Arabia and the Gulf monarchies has complicated efforts to resolve the crises in which extremist groups thrive. Furthermore, states use extremist groups as proxy forces against rivals, sustaining extremist groups with covert support: money, equipment, expertise, as a means of fomenting instability and extending regional influence.[2]

Not all extremist groups are the same, and significant differences exist between various extremist groups' strategies, direction, and beliefs, tactics, targets and techniques. Nearly all, however, aim to return society to an unadulterated, funadmentalist form of Islam, governed by Sharia law, through fighting a violent jihad, or holy war, against perceived enemies.[3] Many Sunni extremist groups draw ideological inspiration from Salafi-jihadism, an ideological blend of fundamentalist Salafism and Sunni Wahabism. Like other radical ideologies of the past two centuries, Salafi-jihadism can be interpreted as an extreme response to the turbulence and upheaval of the modern world, and a violent rejection of modernity.[4] Whilst other ideologies have been secular in nature, Salafi-jihadism draws upon a literal and selective interpretation of religious texts to shape its worldview and justify its strategies and tactics. Like other ideologies, Salafi-jihadism draws rigid distinctions between adherents and those who deny or repudiate its doctrine, labelling them infidels and apostates, and therefore can be legitimately killed in the context of jihad.[5]

IEDs are not the invention of recent extremist groups. They have long been a preferred weapon of dissident groups, offering accessibility, deniability, ease of assembly and use. IEDs can be fabricated with relative ease from an assortment of household items, agricultural fertilisers, common chemicals, or by altering and adapting conventional weapons. One of the dramatic shifts of the past 20 years is the scale of IED production and use. Since the Iraq War, IEDs have been produced in far greater quantities, and at varying levels of technological sophistication, according to the resources available and required. Islamic State created a series of IED factories throughout their territory, where IEDs were produced on a quasi-industrial scale. A similar mass-production of IEDs has occurred in Yemen.[6] The ability to produce weapons reduces reliance on conventional weapons systems that require large supplies of ammunition, and whose trade can be more easily disrupted than that of seemingly innocuous consumer goods.

The mass production of IED has been facilitated by the global nature of trade. The acquisition of component materials is easier than ever before and makes the tracing and detection of component parts more challenging. In 2017, researchers from Conflict Armament Research (CAR) traced component parts back to over nine different countries, with suppliers unaware of the final destination of the products.[7] Porous borders and the collapse of customs and policing authority enable the passage of large quantities of goods to go undetected.

The ubiquity of component materials affords the perpetrator a degree of deniability, at least until extensive weapons forensic analysis can be undertaken on a sampling of IED remnants. During the Iraq War, Shia militias received technical support from Iran with the construction of relatively sophisticated IEDs, including explosively formed projectile IEDs and passive infrared sensors. In Yemen, IEDs used by Houthi rebels bore striking resemblance to those found in Iraq a decade prior. Upon examination, some of the component parts had serial numbers obscured to avoid tracing their precise origin.[8]

Part of the enduring appeal of IEDs is the propaganda of the deed – the impact of the act of violence being greater than the act itself. In the 19th century, when the phrase was first coined, news of IED attacks travelled by newspaper, telegraph or letter, reaching a public audience days or weeks after the event. Today, images of IED incidents can be beamed around the world almost instantaneously, via social media and 24/7 news coverage. Dramatic images of explosions spark fear and outrage, developing the notoriety and fearsome reputation of the perpetrators. Online platforms and secure messaging services have also facilitated the recruitment of thousands of disaffected young people, mostly men, often members of Muslim diaspora communities longing for a sense of belonging and purpose, who are drawn into extremist organisations.[9]

Beyond the propaganda impact, IED attacks can wield significant political effects. During the wars in Iraq and Afghanistan, IEDs were the preferred weapon against Coalition and ISAF troops, used in vast quantities and varying levels of technological sophistication. The numbers of IED casualties lead to calls for troop withdrawals and renewed domestic criticism of continued military engagement. The requirement to protect troops led to billions of dollars of investment into body armour, detection equipment, additional armour plating for existing vehicles, and the introduction of mine-resistant ambush-protected (MRAP) vehicles, produced with great speed and purchased at great cost. IEDs – often made of common household goods and readily accessible consumer items - could effectively counter the most sophisticated military forces in the world. In 2014, the Islamic state further demonstrated the destructive potential of IEDs. Combining conventional tactics with unconventional weapons, ISIS used IEDs as part of their campaign to gain territory throughout Syria and Iraq. Their battlefield success – albeit temporary – further evidenced the potential of IEDs to thwart conventional armed forces, confirming their contemporary utility as a weapon of war, as well as a tool of terrorism.

Extremist ideologies have expanded the targets of IED attacks. Political leaders, security forces, symbols of economic wealth and political power have long been targets for explosive violence, often as part of a campaign for concrete political or economic change. Civilians have also been killed by IEDs, though more often as collateral damage than deliberate targets.

1 International Crisis Group. "Exploiting Disorder: Al- Qaeda and the Islamic State." Crisis Group Special Report, 14 March 2016. https://d2071andvip0wj.cloudfront.net/exploiting-disorder-al-qaeda-and-the-islamic-state.pdf. Jun 2020)
2 Ibid.
3 Ibid.
4 Assaf Mogahadam, "The Salafi-Jihadi as a Religious Ideology." CTC Sentinel, Vol. 1, Issue 3. February 2008. https://ctc.usma.edu/the-salafi-jihad-as-a-religious-ideology/
5 Ibid.
6 Conflict Armament Research, "Mines and IEDs Employed by Houthi Forces on Yemen's West Coast," September 2018. https://www.conflictarm.com/publications/
7 Conflict Armament Research, "Weapons of the Islamic State," December 2017. https://www.conflictarm.com/publications/
8 Conflict Armament Research, "Mines and IEDs Employed by Houthi Forces on Yemen's West Coast," September 2018. https://www.conflictarm.com/publications/
9 International Crisis Group. "Exploiting Disorder: Al- Qaeda and the Islamic State." Crisis Group Special Report, 14 March 2016. https://d2071andvip0wj.cloudfront.net/exploiting-disorder-al-qaeda-and-the-islamic-state.pdf.

Some groups, such as the Provisional IRA, have attempted to mitigate civilian casualties through providing warning messages, alerting civilians and security forces to imminent danger. Over the past 20 years, we have seen a shift from more precise targeting to deliberate mass casualty events, beginning with the attacks on the World Trade Centre on 9/11. The pursuit of jihad as a means of attaining a utopian society has been used as justification for the deliberate killing of innocent civilians – in Iraqi marketplaces, at Afghan weddings, on Spanish trains and in a British concert arena. The widespread sowing of IEDs in Iraq, Syria and Yemen has prompted a humanitarian crisis, as devices must be cleared before populations can safely return to their homes.

The nature of IEDs - adaptable, versatile, easy to assemble and even easier to use - have made IEDs an ideal weapon for the radical extremism that has characterised the past twenty-five years. IEDs effectively counter militarily superior forces, generate fear and international media attention, thus enabling extremist groups to expand their profile and influence. The destructive capability of IEDs makes them attractive to organisations who embrace the tactics of mass violence to achieve strategic ends.

The growing use of IEDs over the past quarter-century is, however, merely symptomatic of the underlying causes of violence and violent extremist organisations: chronic and persistent instability, the breakdown of states and civil society across much of the Middle East, South Asia and North and Central Africa. IED attacks will not decrease until these roots causes of vehement discontent are effectively addressed.

The explosion of a English ship-borne IED in Dieppe, France, 1694.

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