

Inquiry into the Use of Improvised
Explosive Devices and Their Impact
on the Humanitarian Space



Cranfield Defence and Security

This report constitutes the Centre for International Security and Resilience's (CISR) response to the All Party Parliamentary Group on Explosive Weapons' call for written evidence (dated 11 December 2015) into the use of Improvised Explosive Devices and their impact on the Humanitarian Space. The APPG expressed interest in three questions:

- What are the main groups using IEDs that operate around the globe today and what types of IEDs do they employ?
- What challenges do state governments and law enforcement agencies face in effectively monitoring and restricting the sale of dual use precursor materials used in making IEDs and the knowledge exchange between groups?
- The level and extent of humanitarian harm caused by IEDs around the world?

Background and expertise

This report was compiled drawing evidence from three broad areas within Cranfield's School of Defence and Security.

- **Centre for International Security and Resilience (CISR)**'s expertise in the field of Humanitarian demining was originally held by Cranfield Mine Action (now defunct). The Unit delivered numerous research projects and training programmes in the mine action sector. Activities included early needs analysis projects and were followed by extensive training and development on behalf of a wide range of organisations, institutions and government bodies including the United Nations, National Governments, Non Governmental Organisations and commercial companies. Now, CISR is the focal point for all Security and Resilience capabilities within Cranfield University; drawing upon our established expertise in international security, foreign and defence policy analysis, security studies, international law, conflict resolution, and environmental issues.
- **Cranfield Forensic Institute (CFI)** has extensive expertise and exceptional facilities in the field of Forensic Ballistics, Explosive and CBRN hazards, Forensic Engineering and Forensic Anthropology. It runs an MSc in Forensic Explosives and Explosion Investigations and some relevant modules are 'Forensic Investigation of Explosives and Explosive Devices', 'Hazardous Forensic Investigation' and 'Forensic Exploitation and Intelligence'. CFI also runs the Counter-IED capability short course. Currently the only course of its type, focused on the training of people working on combating IEDs across all the pillars of Counter IED.
- **Centre for Defence Chemistry (CfDC)** encompasses all aspects of research, consultancy and teaching in synthesis & formulation, testing & evaluation, safety & reliability, ageing & recycling, life & risk assessment of explosive, propellant and pyrotechnic materials. CfDC has extensive accredited analytical facilities for the testing and evaluation of explosives and explosive materials to a range of national and international standards. CfDC is the focus for the chemical sciences at Cranfield and makes a strong contribution to the teaching of explosives science and technologies, Chemical, Biological, Radiological and Nuclear (CBRN), fuel science, forensic engineering and general science. The Centre

works closely with governmental and commercial institutions for the prevention of proliferation and the detection of IEDs and other explosive devices.

The authors for this report are

- Laura Cleary, Senior Lecturer, Head of the Centre for International Security & Resilience
- Steve Johnson, Lecturer, Cranfield Forensic Institute
- Daniel McAteer, Research Fellow, Centre for Defence Chemistry
- David Turns, Senior Lecturer, Centre for International Security and Resilience
- Edith Wilkinson, Senior Research Fellow, Centre for International Security and Resilience

In principle, all are prepared to submit oral evidence subject only to their availability. All future correspondence should however be addressed to me.

Dr Laura R Cleary

Head of the Centre for International Security & Resilience
Cranfield Defence & Security
The Defence Academy of the United Kingdom
Shrivenham
SN6 8LA
United Kingdom
T: +44 (0)1793 785999
E-mail: L.Cleary@cranfield.ac.uk

Structure of the report

1. What are the main groups using IEDs that operate around the globe today and what types of IEDs do they employ?
 - The threat
 - Groups and tactics
 - Bomb/IED design

2. What challenges do state governments and law enforcement agencies face in effectively monitoring and restricting the sale of dual use precursor materials used in making IEDs and the knowledge exchange between groups?
 - Information sharing – knowledge exchange
 - Material – precursors - synthesis and formulation of explosives

3. The level and extent of humanitarian harm caused by IEDs around the world?

4. Improvised Explosive Devices and issues of international humanitarian law
 - Relevant treaty law
 - Scope of application
 - Substantive provisions
 - Combatting impunity
 - Personal status of IED users
 - Use of IEDs in the UK
 - Transfer of controls

1. What are the main groups using IEDs that operate around the globe today and what types of IEDs do they employ?

IEDs increased as the weapon of choice for global insurgents and terrorists as they are often constructed from commercially available and relatively inexpensive products. Afghanistan remains the context with the highest incident rate¹.

In the context of humanitarian operations or development programmes data shows that IED attacks, in particular on the road, are the most prevalent.

Data verified up to: December 31, 2014

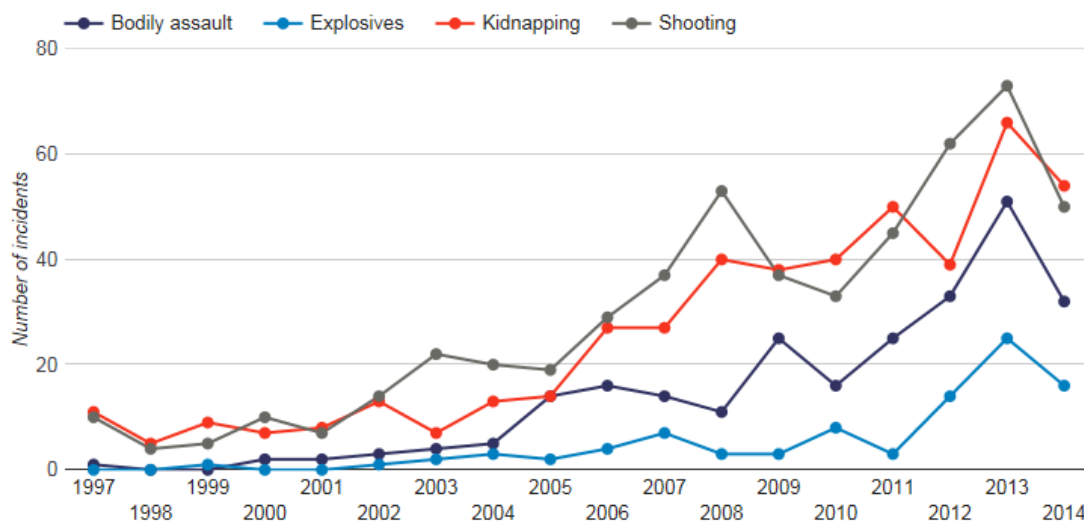


Figure 1: "Trends in tactics against aid workers– 1997-2014" - AWSD².

Device effectiveness and lethality continued to improve in diverse regions around the world.³ Between 2011 and 2013, some 4300 IED events recorded in 66 countries led to an estimated 65,400 casualties.⁴

¹ Aid Worker Security Database (AWSD) <https://aidworkersecurity.org/incidents/report/tactictrends>

² Aid Worker Security Database (AWSD) <https://aidworkersecurity.org/incidents/report/tactictrends>

³ Joint Improvised Explosive Device Defeat Organisation (JIEDDO) Annual Report 2010 p. 4

⁴ Small Arms Survey, 'Research Note Countering Improvised Explosive Devices', Oct. 2014. Available at: www.smallarmssurvey.org/fileadmin/docs/H-Research_Notes/SAS-Research-Note-46.pdf

Country	No. of IED incidents	Total casualties	Civilian deaths	Civilian injuries	Armed state, non-state, and security actor deaths	Armed state, non-state, and security actor injuries
Iraq	1,596	27,782	5,671	18,742	1,455	1,914
Pakistan	568	10,160	2,092	6,190	752	1,126
Afghanistan	932	8,005	1,911	3,540	1,371	1,183
Syria	218	5,586	1,233	3,347	721	285
Nigeria	107	2,101	687	1,182	143	89
Thailand	151	1,548	61	987	99	401
Yemen	70	1,407	140	380	410	477
Lebanon	17	1,330	101	1,198	5	26
Somalia	89	1,298	376	697	151	74
India	110	1,093	113	737	60	183
Totals	3,858	60,310	12,385	37,000	5,167	5,758

Figure 2: "Countries experiencing the highest number of IED casualties 2011-2016" – Small Arms Survey⁵.

- **Groups and tactics**

IEDs are used by both state and non-state armed groups (NSAGs) alike. North Korea, Myanmar and Syria, all non-signatories of the 1997 Mine Ban Treaty, have employed anti-personnel mines in their battles against NSAGs operating on their territory. In turn NSAGs have used IEDs as a counter measure against state forces. 2014- 15 witnessed a significant increase in use by NSAGs, with devices employed in Afghanistan, Colombia, Iraq, Libya, Myanmar, Pakistan, Syria, Tunisia and Ukraine.⁶

The tactics of state forces and NSAGs are analysed by a variety of organisations in order to identify trends in the use of IEDs. For example, IEDs have been employed by Ukrainian rebels to deny access to essential infrastructure and transport routes. Mines and booby traps have been used to prevent individuals from entering forested areas to collect fire wood, a key necessity now that gas and electricity supplies have been disrupted. Similar devices have been placed outside of urban allotments and farms, impacting the already stretched food chain. In countries like Afghanistan, Colombia and Iraq, IEDs are used to secure the perimeter of areas seized by the NSAG and to protect weapons caches.

The types of IEDs vary in form and include:

- BBIED: Body-borne IED
- RIED: Roadside IED
- VBIED: Vehicle-borne IED (unknown whether by remote control or suicide)
- VBIED-RC: Vehicle-borne IED (remote control detonation)
- VBIED-S: Vehicle-borne IED (suicide detonation)

⁵ Aid Small Arms Survey, 'Research Note Countering Improvised Explosive Devices', Oct. 2014. Available at: www.smallarmssurvey.org/fileadmin/docs/H-Research_Notes/SAS-Research-Note-46.pdf

⁶ International Campaign to Ban Landmines, 'Landmine Monitor 2015', Available at <http://www.the-monitor.org/en-gb/reports/2015/landmine-monitor-2015.aspx>.

The data below illustrates attacks by weapon type⁷ for the last 3 months:

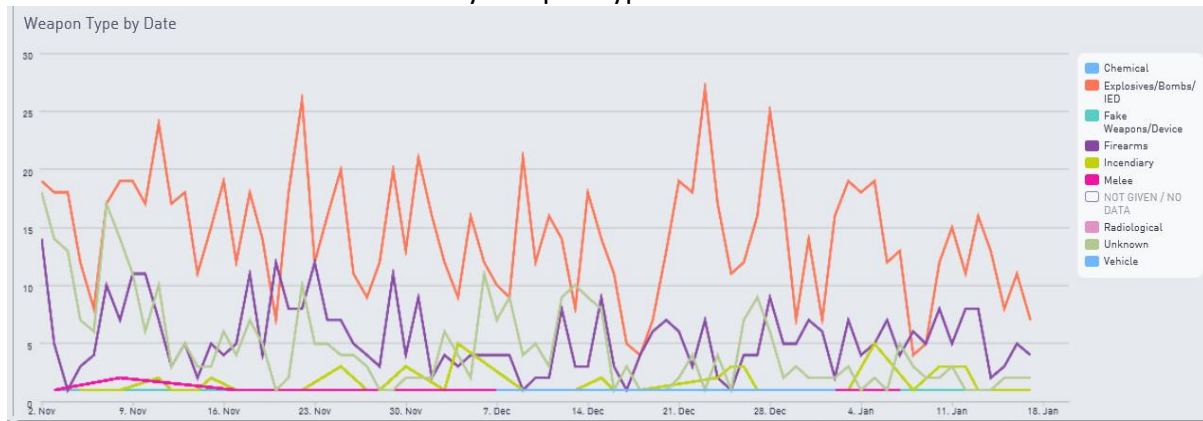


Figure 2 Rolling 3 month chart of terrorism incidents by attack type

As noted above, both state and non-state actors employ these weapons. Thus, determining which is the 'main group' to do so is challenging, for we need to define what is meant by 'main group'. Is this defined in terms of frequency of attacks? Lethality? Or greatest publicity? If the definition is based on a combination of frequency and publicity then the honour is likely to be ISIL's. They are renowned for their indiscriminate use of IEDs across captured urban and rural areas, using the devices as an obstacle to slow and deny ground to their opponents and also to destroy cultural heritage sites of non ISIL groups.

- **Bomb/IED design**

Much of our understanding of bomb and IED design is gained from research into headline cases of terrorist activity in the US and Europe. The IRA bombings, the World Trade Centre bombing (1993), Oklahoma City bombing (1995) and the Boston Marathon bombing (2013) are commonly drawn on as much of the information is in the public domain.⁸ Based on available research it is possible to determine a list of materials in use. In general, the materials come from the following origins⁹:

- Improvised explosives (materials readily prepared by the amateur chemist)
 - Triacetone triperoxide (TATP)
 - Hexamethylene triperoxide diamine (HMTD)
 - Methyl ethyl ketone peroxide (MEKP)
 - Ammonium nitrate (AN) and formulations containing AN such as ammonium nitrate/aluminium, ammonium nitrate/nitromethane, ammonium nitrate/fuel oil (ANFO)
 - Nitroglycerine (NG)
 - Ethylene glycol dinitrate (EGDN)
 - Erythritol tetranitrate (ETN)

⁷ IMSL-Stormcloud 2016 - More info at <http://intelmsl.com/>

⁸ Supplementary information is provided by the CfDC's contact with 11 EOD (www.army.mod.uk/logistic/regiments/24908.aspx)

⁹ It should be noted that this list is not exhaustive and much of it is available through online content such as the FBI published document, "Indicators and Warnings for Homemade Explosives" (<https://info.publicintelligence.net/DHS-HomemadeExplosivesGuide.pdf>).

- Gunpowder (charcoal, potassium nitrate, sulfur)
- Firework formulations
 - Flash powder (aluminium/potassium perchlorate)
- Commercial explosives
 - Pentaerythritol tetranitrate (PETN)
 - Cyclotrimethylene-trinitramine (RDX)
 - Cyclotetramethylene-tetranitramine (HMX)
 - Trinitrotoluene (TNT)

2. What challenges do state governments and law enforcement agencies face in effectively monitoring and restricting the sale of dual use precursor materials used in making IEDs and the knowledge exchange between groups?

- ***Information sharing – knowledge exchange***¹⁰

There are common elements of IED threat information for security and force protection that are required by military and civilian organisations alike whilst operating in hazardous areas. Both will require certain common elements to enhance security and force protection and these will include, *inter alia*, details of IED incidents relevant to the area of operations, details of types of IEDs used – placed at roadside or buried sub-surface, going maps, threat assessments, recommended counter measures and human terrain. For specific organisations there will be additional requirements to include technical data and human intelligence about IED supply chains and support procedures.

Information and capability-sharing amongst partners is currently seen as a positive way forward in the fight against the proliferation of IEDs and in enhancing security for government, military and NGO personnel.¹¹ Lessons learned in Iraq and Afghanistan are now being shared across NATO and between NATO and PfP member states. For example, US and UK short term training teams (STTT) are training Ukrainian armed forces in C-IED. With respect to the British Army's contribution to Defence Engagement (DE) through the Adaptable Brigade structure it is anticipated that the most frequent requests for assistance will focus on the requirement for C-IED training.

Another way in which the lessons from Afghanistan are being shared is through the AXON¹² programme. Launched in 2014 its aim is to allow IED event information to be captured and exchanged between nations seeking to collaborate against the proliferation of IEDs. The problem remains, however, that over classification of information will remain a fundamental barrier to effective information sharing.

¹⁰ Cranfield University (2010) report did not refer to precursor materials specifically but focused on information needs, availability and exchange.

¹¹ 'Improving the Sharing of Information on Improvised Explosive Devices, Landmines and other Explosive Remnants of War between the UK Military and Civilian Organisations in Conflict and Post-Conflict Situations' Cranfield University (2011) Unpublished.

¹² Convention on Certain Conventional Weapons (12 November 2014) Statement by the Australian Defence Force Counter-IED Task Force. <http://geneva.mission.gov.au/gene/Statement670.html>

- **Material – precursors - synthesis and formulation of explosives**

- Availability of open source information

In terms of synthesis and formulation of explosives the internet is the most effective source of information open to the public. A large number of synthetic techniques can be found on either hobbyist websites such as 'Science Madness'¹³ or on video-sharing sites such as YouTube and Vimeo.

- Availability of material

The major difficulty faced by law enforcement is that many of the materials used for the production of improvised explosives are readily available from retailers. They have legitimate non-explosive purposes (e.g. Agriculture and health) and are such simple chemicals that it is hard to find a chemical substitute. Significant starting materials such as acetone (TATP) and hexamine (HMTD) can be purchased in the form of nail varnish remover and solid-fuel tablets respectively. While it is possible to control the form of precursors, such as the limitation of commercially available concentrated hydrogen peroxide, the precursors may be purified or altered by individuals for their own use (e.g. Hydrogen peroxide is readily concentrated for use in improvised explosives syntheses by a number of routes.¹⁴) As a result, the limitations implemented have no real impact on an individual's ability to misuse a specific material.

- Concentration of materials

Restrictions on concentration or physical form (quills) only incur a delay for a terrorist rather than denying them.

- Requirement for a global approach

While home-made/improvised explosives are a threat, there is also a very significant hazard from the leakage of explosives, detonators and other explosive materials from legitimate factories and transportation. Some of the major manufacturers are located in the country of their largest customers (the mining industries). These countries have challenges in inventory control (e.g. South Africa, Pakistan, Brazil).

The World Customs Organisation has a long term initiative, Program Global Shield, which initially focused just on the monitoring of legitimate shipments of chemicals. It identified significant problems over identification – customs officers being unable to tell if a shipped chemical was what they said it was.

The EU has sought to address the issue through its CBRNE action plan, but the focus has been predominantly at a policy rather than operational level. UK schemes, such as 'know your customer', have been taken as best practice around the world.

3. The level and extent of humanitarian harm caused by IEDs around the world?

¹³ <http://www.sciencemadness.org/>

¹⁴ https://www.youtube.com/watch?v=n2K9SY9dj_Q

Increased frequency and lethality of IED attacks have wide-ranging implications for peacekeeping missions in terms of force protection, particularly the security of premises and the mobility of UN personnel.¹⁵

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Number of incidents	63	63	74	107	123	165	155	130	152	170	251
Total aid worker victims	143	125	172	240	220	278	296	254	309	277	460
Total killed	87	56	53	87	88	128	109	72	86	70	155
Total injured	49	46	96	87	87	90	94	86	127	115	171
Total kidnapped*	7	23	23	66	45	60	93	96	96	92	134
International victims	27	24	15	26	34	51	75	46	29	49	59
National victims	116	101	157	214	186	227	221	208	280	228	401
UN staff	31	11	27	61	39	65	102	44	91	60	110
International NGO staff	69	69	112	110	132	157	129	148	141	87	130
LNGO and RCS staff	35	43	28	55	35	46	55	47	77	105	191
ICRC staff	8	1	3	10	4	5	9	10	5	3	14

Figure 3 'Major attacks on aid workers: Summary statistics, 2003-2013' AWSD¹⁶

Concerns over safety have a direct bearing on the ability of the UK, IOs and NGOs to deliver stabilisation and development projects in conflict areas. Increasingly the emphasis in operations is on articulating '*how to stay*' rather than '*when to leave*'.¹⁷ There has been a noticeable trend in new risk management approaches ('the only way to deal with the risk is not to move') implying new design and protective elements of static security, including office compounds and residences and also increasing the inclination for 'bunkerisation'.

4. Improvised Explosive Devices and issues of international humanitarian law

To the extent that IEDs are generally associated with situations of armed conflict, the legal regime applicable to their use – which also has a bearing on the question of impunity for their use – is that of international humanitarian law (IHL). If sufficient provisions of IHL are identified as clearly applying to the use of IEDs it will be possible to address the issue of impunity by the affirmation of criminal offences defined in both international and domestic law. Although IEDs are explicitly covered by only one treaty instrument of IHL, there are also various principles of customary international humanitarian law that could be invoked in relation to their use.

- **Relevant treaty law**

The only expressly applicable IHL treaty instrument in relation to IEDs is Protocol II to the 1980 United Nations Convention on Certain Conventional Weapons (CCW), as amended in 1996. Amended Protocol II (APII) is concerned with prohibitions or restrictions on the use of

¹⁵ Lisa Sharland (2015): Counter-IED Technology in UN Peacekeeping: Expanding Capability and Mitigating Risks, International Peacekeeping, DOI: 10.1080/13533312.2015.1096368

¹⁶ Unsafe Passage: Road attacks and their impact on humanitarian operations.(2014) Aid Worker Security Report <https://aidworkersecurity.org/sites/default/files/Aid%20Worker%20Security%20Report%202014.pdf>

¹⁷ To Stay and Deliver (2011) UN-OCHA https://docs.unocha.org/sites/dms/Documents/Stay_and_Deliver.pdf

mines, booby-traps ‘and other devices’, into which latter category IEDs are understood to fall¹⁸. Although IEDs might well be thought of as another type of landmine, the 1997 Ottawa Convention on Anti-Personnel Landmines does not apply as such to them because they can be – and often are – used against vehicles or other inanimate objects, whereas the Ottawa Convention is limited in scope to mines used against people. Although APII expressly includes IEDs within its scope, it does not actually define them. If priority is to be given to tackling impunity for the use of these weapons, a good starting point would be to ensure that they are adequately defined in law: for although there are various offences in the 1998 Rome Statute of the International Criminal Court (ICC) that might be used to prosecute persons accused of responsibility for the use of IEDs, there is no specific war crime of using IEDs, as such.

- ***Scope of application***

APII applies in all armed conflicts, whether international or non-international in nature.¹⁹ This is important, as the conflicts in which IEDs have to date been used have been overwhelmingly non-international in nature, and prior to the mid-1990s international law did not attach individual criminal responsibility to the use of specific weapons in non-international armed conflicts. By the same token, the restrictions of the Protocol apply to ‘each party to the conflict’, i.e. to non-State actors as well as State forces.²⁰

- ***Substantive provisions***

The relevant substantive IHL prohibitions of APII are limited to the following:

- IEDs which are ‘designed or of a nature to cause superfluous injury or unnecessary suffering’;²¹
- IEDs which are ‘specifically designed to detonate the munition by the presence of commonly available mine detectors as a result of their magnetic or other non-contact influence during normal use in detection operations’;²²
- Any use of IEDs against individual civilians or civilian objects or the civilian population as such, whether in offence, defence or by way of belligerent reprisal;²³
- Any use of IEDs in an indiscriminate manner;²⁴
- Any use of IEDs in a manner which would constitute perfidy;²⁵
- Any use of IEDs in urban areas where ‘combat between ground forces is not taking place or does not appear to be imminent’, subject to precautionary measures being taken.²⁶

¹⁸ Article 2(5) defines ‘other devices’ as, ‘manually-emplaced munitions and devices including improvised explosive devices designed to kill, injure or damage and which are actuated manually, by remote control or automatically after a lapse of time’

¹⁹ Article 1(2)

²⁰ Article 1(3)

²¹ Article 3(3)

²² Article 3(5)

²³ Article 3(7)

²⁴ Article 3(8)-(9)

²⁵ Article 7(1). Perfidy is a war crime: it consists of such actions as taking advantage of internationally recognised protective emblems or persons hors de combat by reason of wounds or sickness, or dead bodies, medical facilities, children’s objects, food and drink, religious and cultural-historic objects or monuments, or animals or their carcasses, in order to deceive an enemy

²⁶ Article 7(3)

There are requirements to take all feasible precautions to protect civilians from the effect of IEDs²⁷ and to give effective advance warning of any emplacement of IEDs that may affect the civilian population, 'unless circumstances do not permit'.²⁸

These prohibitions and restrictions largely mirror those found in the 1977 Additional Protocol I to the Geneva Conventions, concerning the selection of targets and precautions in attack – rules which, according to the International Committee of the Red Cross and a great many States, have passed into customary international law. They include most prominently:

- The principle of distinction (which requires military operations at all times to distinguish between combatants and military objectives on the one hand, and civilians and civilian objects on the other, and to direct operations exclusively against the former categories; and
- The rule of proportionality, whereby any incidental collateral damage to civilians and civilian objects in the course of an attack on a legitimate military objective must not be excessive in relation to the military advantage anticipated from that attack.

Although IEDs could conceivably be used in such a way as to comply with these restrictions, e.g. by being used exclusively in areas where military opponents use the roads, or being detonated only under military vehicles or personnel, the actual pattern of their use in recent conflicts such as Iraq and Afghanistan clearly demonstrates that the party using them makes no effort at all at compliance. IEDs are typically placed at the side of heavily-used roads and detonate under civilians and their vehicles just as much as under military targets.

- ***Combatting impunity***

These rules and principles are in turn reflected in the ICC Statute²⁹ and thus attract individual criminal responsibility under international law. A difficulty, however, with prosecuting these particular offences in relation to IEDs is that the offences require the intention to commit the criminal offence, i.e. intending to attack civilians. Since those who use IEDs are often indifferent as to the identity of their eventual victims, it would be preferable to have a form of strict-liability offence in relation to IEDs, such that proof of merely making them and placing them in position would suffice for a conviction. This is the case, for example, in relation to the offence of using indiscriminate weapons,³⁰ which in fact would probably be the most useful charge to use against any captured persons suspected of having used IEDs.

The question must remain open as to whether the above-mentioned provisions of the ICC Statute and APII of the CCW would suffice as tools for combatting impunity,³¹ or whether an additional and more detailed specific treaty instrument might be contemplated to deal with IEDs – presumably this would take the form of another Protocol to the CCW. There is no evidence of an appetite on the part of States to proceed down that path as yet.

²⁷ Article 3(10)

²⁸ Article 3(11)

²⁹ E.g. Articles 8(2)(b)(i)-(iv), 8(2)(e)(i)-(ii)

³⁰ Article 8(2)(b)(xx)

³¹ Since they will only be of utility for States Parties to those instruments and will require implementation into domestic criminal law

- ***Personal status of IED users***

The issue of the personal status of persons (other than members of regular State armed forces or affiliated militias) who use IEDs is sometimes raised. In this connection it may be noted that civilians who make use of IEDs are directly participating in hostilities in terms of Article 51(3) of Additional Protocol I to the Geneva Conventions. This means that, while retaining their civilian status under IHL, they lose their entitlement to protection for such time as they are directly participating in hostilities and may accordingly be targeted and/or detained; in the latter case, they could be prosecuted by the Detaining Power if evidence is available that they have committed a war crime as outlined above. The main difficulty with using the direct participation in hostilities criterion would be the temporal element of the conduct: if an insurgent places a single IED in position and then moves to another area of operations, where s/he takes no further part in IED-related activities, would the placing of that one IED suffice for the rule to apply? In other words, would the direct participation in hostilities (and therefore the susceptibility to being targeted and/or captured) subsist until the IED eventually explodes, or would it end as soon as the placing of the IED was completed? There is no conclusive agreement and no final position on these types of questions.

- ***Use of IEDs in the UK***

The possibility has also been raised that, outside the immediate paradigm of armed conflict (of whatever nature), UK citizens – or, indeed, nationals of other countries – may return or come to the UK from conflict zones abroad (e.g. Iraq or Syria) and seek to use IEDs here, e.g. on mass transit systems like the London Underground. Such an eventuality would not fall to be prosecuted under IHL but under national territorial (i.e. English/UK) jurisdiction as a criminal offence under domestic law. There is ample provision for such offences in UK domestic law.³²

- ***Transfer controls***

A final point concerns the possibility of greater controls, possibly at the transnational level, on the transfer of components that are commonly used in the manufacture of IEDs.³³ Again, these would fall to be controlled primarily at the national level; however, the position of the UK as a permanent member of the United Nations Security Council could be used to advocate support at the high policy-making international level, e.g. by drafting and securing passage of a resolution under Chapter VII of the UN Charter that would commit to international enforcement action to interdict or restrict transfers of such materials (by analogy with embargoes on the transfer of nuclear materials in respect of North Korea, for example).

³² Notably under the Terrorism Acts 2000 and 2006

³³ E.g. certain contents of fertilisers, peroxide, nitroglycerine etc.