Explosive Devices
The evolution of the threat
Overview of the historical trends and technical analysis of the propaganda materials

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Summary

Improvised Explosives Devices (IED) have long been, and remain, the weapon of choice for terrorists and insurgents due to the ease of their manufacture, employment, and destructive potential, as shown by the attacks that have occurred around the world in the past few months.

Driving the increased threat is the amount of terrorist propaganda material available on the internet and on the social media, which include instructions and “recipes” to manufacture IEDs and provide tactical advice on how to deploy them.

Since 1970 there have been manuals and books about the bomb-making, produced by controversial individuals at that time who wanted to give their support to anti-government movements. Some of today’s IED manuals descend directly from those bomb-making “recipes”, even if they have had ideological arguments added to them with the aim of mobilizing fighters all over the world.

The result is that today anyone can perpetrate quite a sophisticated attack and even people with no practical experience can manufacture an IED in their kitchen, whereas previously anyone who wanted to fight had go to a terrorist training camp, exposing himself to the danger of being detected by police and security forces.

This report provides a general overview of the IED threat, analyzing what IEDs are and how they are made. Further, in the report, the evolution of IEDs has been analyzed from two different points of view:

- Using the data reported by the Global Terrorism Database from 1970 to 2017, a statistical analysis has been undertaken to highlight the peculiarities of the threat related to the IEDs;
- An in-depth study on the propaganda materials has been created to analyze in detail the technical instructions on bomb-making provided by the available manuals.
What is an Improvised Explosive Device

The NATO glossary defines an Improvised Explosive Device (IED) as: “A device placed or fabricated in an improvised manner incorporating destructive, lethal, noxious, pyrotechnic or incendiary chemicals and designed to destroy, incapacitate, harass or distract”, specifying, “It may incorporate military stores, but is normally devised from non-military components”.

Typically, IEDs have four key components: a main charge of explosives, a detonator, a power source, and a switching mechanism (Fig.1).

![Fig. 1 Typical structure of an Improvised Explosive Device](image)

The switching mechanism and the power source may be joined or separated components, depending on the case:

- in the case of remote-activated IEDs, the switching mechanism usually includes the power source, and is made with cell phones, alarm clocks, or motion sensors;
- in the case of suicide IEDs, the switching mechanism is usually made with a manual switch and a separate battery pack acting as the power source.

The detonator is made with a small amount of primary or initiating explosives (Lead Azide, Picric Acid, Acetone Peroxide, etc.) and it may be of different types.

The choice of the detonator depends on several factors, such as the main charge and the chosen switching mechanism.

The different types of detonators mostly used in the construction of IEDs include:

- conventional mechanical detonators;
- conventional electrical detonators;
- improvised mechanical detonators;
- improvised electrical detonators.

There are little differences between conventional and improvised detonators, since they may differ in packaging, but the components remain the same.
The main charge can be made of:

- military explosives: designed, produced, and used primarily for military offensive or defensive operations. A few examples of military explosives are HMX\(^1\) and RDX\(^2\);
- commercial explosives: designed, produced, and used for commercial or industrial applications, such as demolition and mining. A few examples of commercial explosives are TNT\(^3\) and ANFO\(^4\);
- homemade explosives (HME): combinations of commercially available ingredients, technically known as “explosives precursors”, combined to create explosive substances. An example of homemade explosives is triacetone triperoxide (TATP)\(^5\), notwithstanding many commercial and military explosives can also be “made at home”.

If possible, the terrorists prefer to use military or commercial explosives because the homemade explosive mixes are highly unpredictable. Friction, impact, static electricity and heat can all cause them to explode, killing or wounding the maker. However, HME are more likely to be used by the terrorists to design and produce IEDs because it is relatively easy to acquire large quantities of explosive precursors, since they are common consumer goods, like cleaning products, fertilizers, and paint removers.

HMEs can be produced in two different ways:

- blending is the simplest form of manufacture since it requires only physically mixing the precursor chemicals, with at least an oxidizer and a fuel (Tab. 1);
- cooking is a more complicated form of manufacture since it requires some chemical reactions between precursors to form an explosive material (Tab. 2).

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\(^1\) HMX, also called octogen, is a powerful and relatively insensitive nitroamine high explosive. The molecular structure of HMX consists of an eight-membered ring of alternating carbon and nitrogen atoms, with a nitro group attached to each nitrogen atom.

\(^2\) RDX is an organic compound with the formula \((O_2NNCH_2)_3\), widely used as an explosive. A more energetic explosive than TNT, it was used widely in World War II and remains common in military applications. It is often used in mixtures with other explosives and plasticizers; it is the explosive agent in C-4 plastic explosive. RDX is stable in storage and is considered one of the most energetic and brisant of the military high explosives.

\(^3\) Trinitrotoluene (TNT) is a chemical compound with the formula \(C_6H_2(NO_2)_3CH_3\). It is one of the most commonly used explosives for military, industrial, and mining applications.

\(^4\) ANFO (or AN/FO, for ammonium nitrate/fuel oil) is a widely used bulk industrial explosive. It consists of porous prilled ammonium nitrate (\(\text{NH}_4\text{NO}_3\)) (AN), which acts as the oxidizer and absorbent for the fuel, and fuel oil (FO).

\(^5\) Triacetone triperoxide (TATP) or tri-cyclic acetone peroxide (TCAP) is the trimer of Acetone Peroxide (APEX) and is an organic peroxide and a primary high explosive, produced by the reaction of acetone and hydrogen peroxide.
### Oxidizers
- Chlorate Salts (Na⁺/K⁺)
- Hydrogen Peroxide, Concentrated (CHP)
- Hypochlorite Salts (Ca²⁺/Na⁺)
- Metal Peroxides (Ba²⁺/Na⁺)
- Nitrate Salts (Ca²⁺/Na⁺'/K⁺'/NH₄⁺'/Ca²⁺NH₄⁺)
- Nitrite Salts (Na⁺'/K⁺')
- Perchlorate Salts (Na⁺'/NH₄⁺'/K⁺')
- Perchloric Acid
- Potassium Permanganate

### Fuels
- **Organic Materials**
  - Diesel
  - Kerosene
  - Mineral Oil
  - Motor Oil
  - Sawdust
  - Vaseline
- **Inorganic Materials**
  - Aluminum, Powder/Paste
  - Antimony Trisulfide
  - Charcoal
  - Magnalium Powder
  - Magnesium Powder
  - Red Phosphorous
  - Sulfur
  - Titanium Powder
  - Zinc Powder
- **Food Products**
  - Artificial Creamer
  - Black Pepper
  - Black Seed
  - Cinnamon
  - Cocoa
  - Cumin
  - Flour
  - Honey
  - Icing Sugar
  - Powdered Drink Mix
- **Energetic Organic Compounds**
  - Nitrobenzene
  - Nitromethane

### Oxidizers

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<thead>
<tr>
<th>Oxidizers</th>
<th>Fuels</th>
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<td>Hydrogen Peroxide</td>
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<td>Energetic Organic Compounds</td>
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**Tab. 1 List of chemical precursors used to produce blended HMEs**

<table>
<thead>
<tr>
<th>Acetone</th>
<th>Strong Acids</th>
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<tr>
<td>Aspirine</td>
<td>Sulfuric Acid</td>
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<tr>
<td>Erythritol</td>
<td>Hydrochloric Acid</td>
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<tr>
<td>Ethylene Glycol</td>
<td>Nitric Acid</td>
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<tr>
<td>Glycerol</td>
<td>Weak Acid</td>
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<tr>
<td>Hexamine</td>
<td>Citric Acid</td>
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<td>Hydrazine</td>
<td>Acetic Acid</td>
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<td>Hydrogen Peroxide,</td>
<td>Ascorbic Acid</td>
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<tr>
<td>Dilute</td>
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<td>Mannitol</td>
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<td>Methanol</td>
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<td>MEK</td>
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<tr>
<td>Phenol</td>
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<tr>
<td>Sodium Azide</td>
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<tr>
<td>UAN Solution</td>
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**Tab. 2 List of chemical precursors used to produce cooked HMEs**

ANFO and flash powder are examples of blended mixtures, while TATP, urea nitrate, and ethylene glycol dinitrate (EGDN) are examples of cooked HMEs.
Trends in the use of the Improvised Explosive Devices

The use of IEDs against an enemy has been known and practiced since the late nineteenth century. It is, however, in the second half of the twentieth century that IEDs became most widely used.

Focusing on the years from 1970 to 2017, using data from the Global Terrorism Database, the IED threat has been analyzed in relationship with the trends in terrorism.

To simplify the analysis, based on the terrorism studies, terrorism as a phenomenon in the period from 1970 to 2017 can be divided into five phases:

- 1970 to 1978 was a period characterized by the typical activities of organizations such as the Palestine Liberation Organization/Al-Fatah, the Popular Front for the Liberation of Palestine, the Red Brigades and other organizations that had political purposes.

- 1979 to 1990 were years of profound political changes for Middle Eastern countries, characterized by the flourishing of jihadist organizations dedicated to the imposition of sharia in their respective countries.

- 1991 to 2001 was the period in which Al-Qaeda emerged among the jihadist organizations with multiple attacks against the United States.

- 2002 to 2013 was a period characterized by the wars in Afghanistan and Iraq and the destabilization of various states rocked by popular rebellions, expanding the geographical area for the decentralization and the widening of Al-Qaeda.

- 2014 to 2017 was an unprecedented moment, characterized by the rise of the Islamic State, spreading new forms of jihadist propaganda.
The IED threat between 1970 and 1978

Referring to the period from 1970 to 1978, the Global Terrorism Database reports 7,252 events, of which 3,262 are associated with the use of explosives (Fig. 2).

The events related to the use of explosives are mostly concentrated in Western Europe (1,426), North America (930), Middle East & North Africa (405), and South America (272) (Fig. 3).
In the same period, the most affected countries were the United States (883), United Kingdom (383), Italy (319), Spain (261), and Turkey (257) (Fig. 4).

The explosive attacks between 1970 and 1978 were mostly perpetrated by the Irish Republican Army (IRA) (281), Fuerzas Armadas de Liberacion Nacional (FALN) (91), Euskadi Ta Askatasuna (ETA) (90), New World Liberation Front (NWLF) (78), Fighters for the Liberation of the Turkish People (47), and Ulster Volunteer Force (UVF) (46).
The IED threat between 1979 and 1990

Referring to the period from 1979 to 1990, the Global Terrorism Database reports 37,655 events of which 16,926 are associated with the use of explosives (Fig. 6).

![Fig. 6 Pie chart of the terrorist attacks reported from 1979 to 1990 classified by type](image)

The events related to the use of explosives are mostly concentrated in South America (5,391), Western Europe (3,543), Central America & Caribbean (2,588), and Middle East & North Africa (1,921) (Fig. 7).

![Fig. 7 Pie chart of the explosive attacks reported from 1979 to 1990 classified by region](image)
In the same period, the most affected countries were Peru (2,398), El Salvador (1,773), Chile (1,495), Spain (1,044), and Colombia (963) (Fig. 8).

The explosive attacks between 1979 and 1990 were mostly perpetrated by the Sendero Luminoso (SL) (1,699), Farabundo Marti National Liberation Front (FMLN) (1,191), Euskadi Ta Askatasuna (ETA) (702), Irish Republican Army (IRA) (613), Manuel Rodriguez Patriotic Front (FPMR) (611), and African National Congress (ANC) (393).
The IED threat between 1991 and 2001

Referring to the period from 1991 to 2001, the Global Terrorism Database reports 28,595 events of which 10,872 are associated with the use of explosives (Fig. 10).

![Fig. 10 Pie chart of the terrorist attacks reported from 1991 to 2001 classified by type](image)

The events related to the use of explosives are mostly concentrated in South America (2,268), Western Europe (2,163), Middle East & North Africa (1,907), and South Asia (1,645) (Fig. 11).

![Fig. 11 Pie chart of the explosive attacks reported from 1991 to 2001 classified by region](image)
In the same period, the most affected countries were the Colombia (2,398), France (1,773), India (1.495), Peru (1,044) and Turkey (963) (Fig. 12).

The explosive attacks between 1991 and 2001 were mostly perpetrated by the Sendero Luminoso (SL) (447), Liberation Tigers of Tamil Eelam (LTTE) (302), National Liberation Army of Colombia (ELN) (293), Irish Republican Army (IRA) (256), and Farabundo Martí National Liberation Front (FMLN) (217).

Fig. 12 Pie chart of the explosive attacks reported from 1991 to 2001 classified by country

Fig. 13 World heatmap of the explosive attacks reported from 1991 to 2001
The IED threat between 2002 and 2013

Referring to the period from 1991 to 2001, the Global Terrorism Database reports 51,780 events of which 28,602 are associated with the use of explosives (Fig. 14).

The events related to the use of explosives are mostly concentrated in Middle East & North Africa (11,551), South Asia (10,722), Southeast Asia (1,960), and Sub-Saharan Africa (1,445) (Fig. 15).
In the same period, the most affected countries were Iraq (8,502), Pakistan (4,461), Afghanistan (3,222), India (2,115), and Thailand (974) (Fig. 16).

The explosive attacks between 2002 and 2013 were mostly perpetrated by the Taliban (1,494), Revolutionary Armed Forces of Colombia (FARC) (518), Al-Qaeda in Iraq (501), Communist Party of India - Maoist (CPI-Maoist) (447), Therik-i-Taliban Pakistan (TTP) (443), and Al-Shabaab (370).

Fig. 16 Pie chart of the explosive attacks reported from 2002 to 2013 classified by country

Fig. 17 World heatmap of the explosive attacks reported from 2002 to 2013
**The IED threat between 2014 and 2017**

Referring to the period from 2014 to 2017, the Global Terrorism Database reports 56,355 events of which 28,593 are associated with the use of explosives (Fig. 18).

The events related to the use of explosives are mostly concentrated in Middle East & North Africa (15,124), South Asia (7,700), Sub-Saharan Africa (2,299), and Southeast Asia (1,659) (Fig. 19).
In the same period, the most affected countries were Iraq (9,697), Afghanistan (2,925), Pakistan (2,650), India (1,527), and Syria (1,077) (Fig. 20).

The explosive attacks between 2014 and 2017 were mostly perpetrated by the Islamic State (ISIS) (3,360), Taliban (1,370), Al-Shabab (847), Boko Haram (594), Houthi extremists (Ansar Allah) (555), and the Kurdistan Workers' Party (PKK) (431).
**Do-It-Yourself: IEDs in the terrorist propaganda**

Since 1970, dozens of manuals for the manufacture of the IEDs have been published but none of those issued until 1998 could be attributed with any certainty to a terrorist organization. In most cases, the authors were controversial people who tried to give support to the radical movements in the counterculture era.

In 1998, this changed when the “Mujahideen Explosives Handbook” was circulated on the web in the name of the “Organization for the Preparation of Mujahideen”. In the preface to the book, signed by Abdul Muntagim, it said that “by utilizing modern computer communication methods, this encyclopedia will, *inshallah* (God willing), be distributed the world over; continuously being updated”.

![Fig. 22 Front cover of “The Mujahideen explosives handbook”](image)

The “Mujahideen Explosives Handbook” is very accurate and detailed, and it contains instructions for the manufacture of more than forty explosive substances. Moreover, it describes how to set up a safe laboratory for the manufacture of the HMEs and to perform experiments with the explosive substances.

Among the substances listed by the “Mujahideen Explosives Handbook” there are:

- Lead Azide;
- Acetone Peroxide;
- Ammonium Nitrate;
- Potassium Chlorate;
- Sodium Nitrate;
- RDX;
- TNT.
In 2008, an Arabic manual entitled “Easy Explosives – The Fourth Edition” was been published on the web.

Like the “Mujahideen Explosives Handbook”, the “Easy Explosives” manual describes how to manufacture a lot of explosive precursors. It also contains sections on the detonators, remote controls, and electrical circuits.

“The Explosives Course”, published in 2010, is very similar to the “Mujahideen Explosives Handbook”. It was distributed by the Global Islamic Media Front in different languages, including English, Hindi, and Indonesian.
In 2015, jihadi supporters online issued two “tactical” manuals. The first 2015 volume was entitled, “How to Survive in the West: A Mujahid Guide”. The foreword explained,

“This book is a guide for the Muslims who are living in a majority non-Muslim land, or a country where the rulers are harsh towards the believers. It will explain to you the different scenarios you may get into and how to react. It will teach you how to be a secret Agent who lives a double life, something Muslims will have to do to survive in the coming years.”

It gives practical instructions on how to:
- Conceal an extremist identity;
- Earn money;
- Maintain internet privacy;
- Manufacture or acquire weapons;
- Make bombs;
- Escape for safety.

In the section “Bomb making at home”, the author describes how to manufacture six different types of improvised devices:
- Petrol bomb: an incendiary device manufactured using petrol and sugar;
- Nail bomb: an explosive device manufactured using batteries, flammable items, and nails;
- Portable pressure cooker bomb: an explosive device similar to the nail bomb. It is assembled using a pressure cooker filled up with flammable spray, gun powder, and nails;
Mobile phone detonator: an improvised remote controller. It could be used to trigger an explosive device.

The second “tactical” manual issued in 2015 was “Muslim Gangs: The Future of Muslims of the West”. The author’s preface to “Muslim Gangs” said:

“The aim of this book is to give Muslims a starting point on how to make their own gangs and grow them into a Jihadi movement which can recruit and become a force of strength in the West”.

Fig. 26 Front cover of “Muslim Gangs. The Future of Muslims of the West”

In the section “Making weapons” the book gives instructions on how to assemble different types of improvised devices:

- Non-electric soda can grenade;
- Pressure cooker bomb;
- Light bulb bomb;
- Cellphone detonator;
- Suicide belt.

There have been other manuals in the last ten years, with some terrorist organizations regularly publishing online magazines conveying ideological arguments and tactical instructions. Of all of these publications, Inspire, the flagship of Al-Qaeda in the Arabian Peninsula (AQAP) between 2010 and 2017, was the only magazine regularly providing on bomb-making instructions to “inspire the believers to fight”.

Using photographs and eye-catching graphics, Inspire debuted with an issue containing an article under the title “Make a bomb in the kitchen of your mom” which is a “recipe” on how to manufacture an IED.

It lists all the ingredients without providing any information on the exact amount required. Moreover, the “recipe” describes step-by-step how to prepare:
- The explosive device, including the container, the detonator, and the homemade explosive;
- The electric circuit, including the power source and the timing device.

In the later issues, *Inspire* provided instructions on how to make:
- Acetone Peroxide, using chemical explosive precursors;
- Remote detonator, using a radio controller;
- A “Hidden Bomb”, to be detonated on an airplane.

![Fig. 27 Pages from the different issues of “Inspire” providing instruction about the manufacturing of IEDs](image)

Over time, manuals and magazines have been superseded and recently jihadists have been transmitting their instructions for bomb-making capacity via training videos. Between 2008 and 2009, a series of fifteen videos circulated on the web under the title “Breaking the cross”, clearly inviting attacks against Christians. The fifteen videos were filmed in Arabic without subtitles, but they showed the process step-by-step of manufacturing certain explosive precursors or explosive substances, including:
- Acetone Peroxide;
- Urea Nitrate;
- Ammonium Nitrate;
- Picric Acid;
- Nitrocellulose;
- Nitroglycerine;
- Blasting Gelatin.
The last video of the series contains the instructions to make electrical improvised detonators. Even if the explanation was incomprehensible to those who do not speak Arabic, the videos are finely detailed showing any step of the manufacturing process. In 2013, a video of considerable importance was officially released by ISIS’s Wilayah ar-Raqqa. It was originally filmed in Arabic and then was circulated with different translations for the subtitles, including Italian and other European languages. In the video there is a man explaining and showing how to manufacture a complete IED, in which the main charge is made up of Acetone Peroxide, the detonator is electrical, and the trigger is a radio controller.

The jihadists have published a very large amount of propaganda on explosives, both text and other media, over the last decade, but they are not the only ones to do this. Anarchist organizations have created two of these manuals that have been important, not least because they can be easily found on the web. “The Anarchist Cookbook” is in many ways the original of this genre, produced in 1971, and “The Terrorist’s Handbook” came about in 1999. Despite being created by ideologues, these books are largely technical documents, containing no extensive ideological statement. More recently some articles providing technical instruction to manufacture an incendiary device was published in the anarchist magazine “La Bomba”.
Conclusions

The study highlighted some peculiarities of IED threat. IEDs remain the terrorist weapon of choice due to their destructive potential, and psychological impact. As shown by the trends that emerged from an analysis of the Global Terrorism Database, in the five intervals about the 50% have been executed using explosive devices.

![Chart of the rate of terrorist attacks classified by type](image)

**Fig. 30 Chart of the rate of terrorist attacks classified by type**

Focusing on the lethality of attacks, it emerged that some terrorist organizations, such as ISIS, Al-Qaeda, and other jihadists, are deadliest than the others, with a higher rate of victims killed or wounded in the explosive attacks. However, this is not related to the technologies and the devices they employed, but the targets they select, notably crowded civilian areas.

The analysis of the terrorist propaganda materials and the manuals which were circulated on the web in the last ten years highlighted some other issues that need to be faced. These manuals provide technical information and instructions that could be understood by anyone, even people with no practical experience or a strong technical background. Furthermore, the manuals describe how to manufacture various type of devices from off-the-shelf materials, such as the solvents, detergents, and some food ingredients.
Some concern should arise from the words used in the article “Make a bomb in the kitchen of your mom”:

“Here are the main qualities of this bomb:

- Its ingredients are readily available.
- Buying these ingredients does not raise suspicion.
- It is easily disposed of if the enemy searches your home. Sniffing dogs are not trained to recognize them as bomb making ingredients.
- In one or two days the bomb could be ready to kill at least ten people. In a month you may make a bigger and more lethal bomb that could kill tens of people.”

Even if some of the “recipes” listed in this report are not effective, since the exact amount of ingredients is missing in many cases or some commercial substances might not meet the requirements of the original author, the Internet is full of sources to search for more effective and reliable methods of production of IEDs and this threat needs to be continuously being monitored.

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