Explosive Weapons - Factors that produce wide area effects

There is broad agreement that wide area effects from explosive weapons result from three main characteristics, either individually or in combination. These effects are cumulative, with blast and fragmentation effects always present and with inaccuracy of delivery and the use of multiple warheads, where applicable, extending those effects across a wider area. As well as increasing the likelihood of direct civilian deaths and injuries, the combination of these effects also results in the destruction of civilian property and infrastructure vital to the civilian population, with longer-term implications for public health and development (sometimes called 'tertiary' or 'reverberating' effects).

This table highlights some common types of explosive weapon systems that have caused grave civilian harm. It does not aim to be exhaustive.

TYPES OF EXPLOSIVE WEAPONS

	Examples	**LARGE BLAST OR FRAGMENTATION RADIUS** *A large amount of explosive substance can create a powerful blast wave. Fragments (pieces of the casing and debris) can be projected over a long distance*	**INACCURACY OF DELIVERY** *An explosive munition may land anywhere within a wide area*	**MULTIPLE WARHEADS OR FIRINGS** *A number of explosive munitions is fired or released and spreads to cover a wide area*
Air-dropped bombs 	• Unguided Mk82 (500lb) • BLU-117 (Mk84) • Guided GBU-12 • GBU-43/B (MOAB) • FAB-1500 (3307lb) • FAB-3000 (6614lb)	Certain air-dropped bombs have a very high explosive yield that can create a powerful blast effect, which can lead to the collapse of entire buildings. Because of this power they may, in certain situations, create blast and fragmentation effects beyond the intended target even if they land in the intended place.	Unguided gravity bombs, dropped from an aircraft, can be difficult to place accurately on a target. Many factors influence where the bomb will land, meaning that there is a subtantial chance that it detonates somewhere in the area around the intended target.	To counteract uncertainty about hitting the target, amongst other reasons, an aircraft may release multiple bombs in what is called a 'stick'. This extends the area effects of these weapons still further.
Missiles 	• Tomahawk • Scud • 9K720 (Iskander)	Missiles can carry various warheads, including explosive or fuel-air explosive warheads with a powerful explosive yield. As such the concerns they raise can be similar to air-dropped bombs as described above.	Because they are usually guided to their target inaccuracy is not usually a primary problem with respect to modern missiles. However, older variants without guidance may be extremely inaccurate.	Some missiles may have multiple warheads, though it is more common that they have a unitary warhead and are fired individually at a target.
Rocket Artillery, especially Multi-Barrel Rocket Launchers (MBRL)  	*MBRL* • BM-21 (Grad) • BM-30 (Smerch) • M270 MLRS • M77 (Oganj) • TOS-1-MRL • M-87 (Orkan) • T-122 (Sakarya) *Single tube* • M-71 (Partizan) • 9P132 (Grad-P) • Qassam	Individual rockets each create a blast and fragmentation effect over a certain distance depending on the explosive yield of the warhead and other factors, with some common systems having a lethal radius of approximately 15m and fragmentation effects extending beyond that. However, it is the challenge of applying that effect to the actual target that is the primary concern with rocket artillery.	Unguided rockets, typically used in indirect fire mode, are generally less accurate than normal artillery. MBRLs tend to have a very long firing range, which reduces accuracy, and their propulsion during flight adds an additional element of variation. A US field manual gives a safety distance of 2,000m from the intended impact for the M270A1, a type of MBRL - suggesting a substantial uncertainty regarding where warheads will land.	Rockets are sometimes fired in groups or 'salvos', creating additional inaccuracy and significantly increasing the area effects that will be created. Multi-barrel rocket launchers are designed to fire salvos of rockets over long distances. With up to 40 rocket tubes on the launch vehicle, they can produce multiple warhead detonations across a very wide area.
Mortars 	• CARDOM • Soltam K5 and K6 • L-16 • 2B14 (Podnos) • 60mm M-224 • MWS-81	Mortars come in a range of calibres. The common 120mm mortar has a lethal radius of 30m from the point of impact, and has been given a 10% probability of 'incapacitation' at 100m.	Mortars are typically used as indirect fire weapons. They fire projectiles from a launch tube into the air that then impact at a location that might be several kilometres away. For some common types at a distance of 7km, the chance of a projectile landing within 100m from the target might only be just over 50%.	Because of their inaccuracy, mortars will sometimes be used in 'mass fires', with multiple mortars firing shells from separate firing section locations to enhance the chance of striking the intended target, thereby extending the area effect.
Tube artillery (guns and howitzers) 	• 2S4 (Tyulpan) • M110 • M198 • 2S7 (Pion)	Tube artillery comes in a range of calibres. A common M795 155m high explosive howitzer shell will generally have a 'kill radius' of 50m, with fragmentation spreading significantly further.	Tube artillery guns are typically used to provide indirect fire support for armour and infantry forces over long distances. Such weapons have significant limitations of accuracy and a wide range of operational factors can limit accuracy still further. The 'danger close' range of a 155mm howitzer at maximum range is 450m from the intended impact, according to the US field manual.	A number of artillery guns (a 'battery') is typically used to deliver multiple rounds at a target. Because of uncertainty of individual firings, multiple firings might be necessary to have confidence of affecting the intended target. As multiple firings slightly change the gun's temperature and placement this can further extend the area effects.
Case studies of harm		On 10 July 2014 - without warning - the house of the Al Hajj family in Gaza was bombed, killing all 8 residents, including women and children. The explosion completely destroyed the house and damaged several houses nearby, causing injury to 19 people. The Human Rights Council (HRC) states that the attack was likely aimed at one of the residents of the house, and was carried out with a **500lb or 1,000lb aircraft bomb**. Read more in the report by the HRC: *https://bit.ly/2JtBozn*	On 17 March 2011 at least six projectiles were fired by pro-government forces on and around a market in Abidjan, killing at least 25 people and injuring even more. It was reported that these projectiles were **81mm mortar shells**. The attack was aimed at the Abobo neighborhood, loyal to the recently elected winner of the presidential election Alassane Ouattara. Read more in the report by the United Nations: *https://bit.ly/2sMojqs*	On 24 January 2015 31 people were killed in a **BM-21 Grad** strike on the city of Mariupol in Ukraine. Within two minutes a salvo of almost 100 rockets struck the city, striking i.a. schools, markets, shops and homes. The area covered by the attack was 817 metres across and 1380 metres wide. A checkpoint manned by Ukrainian government forces, which lay over 400 meters from the closest residential building, was identified as the possible target. Read more in the report by AOAV: *https://bit.ly/2JtOjkL*

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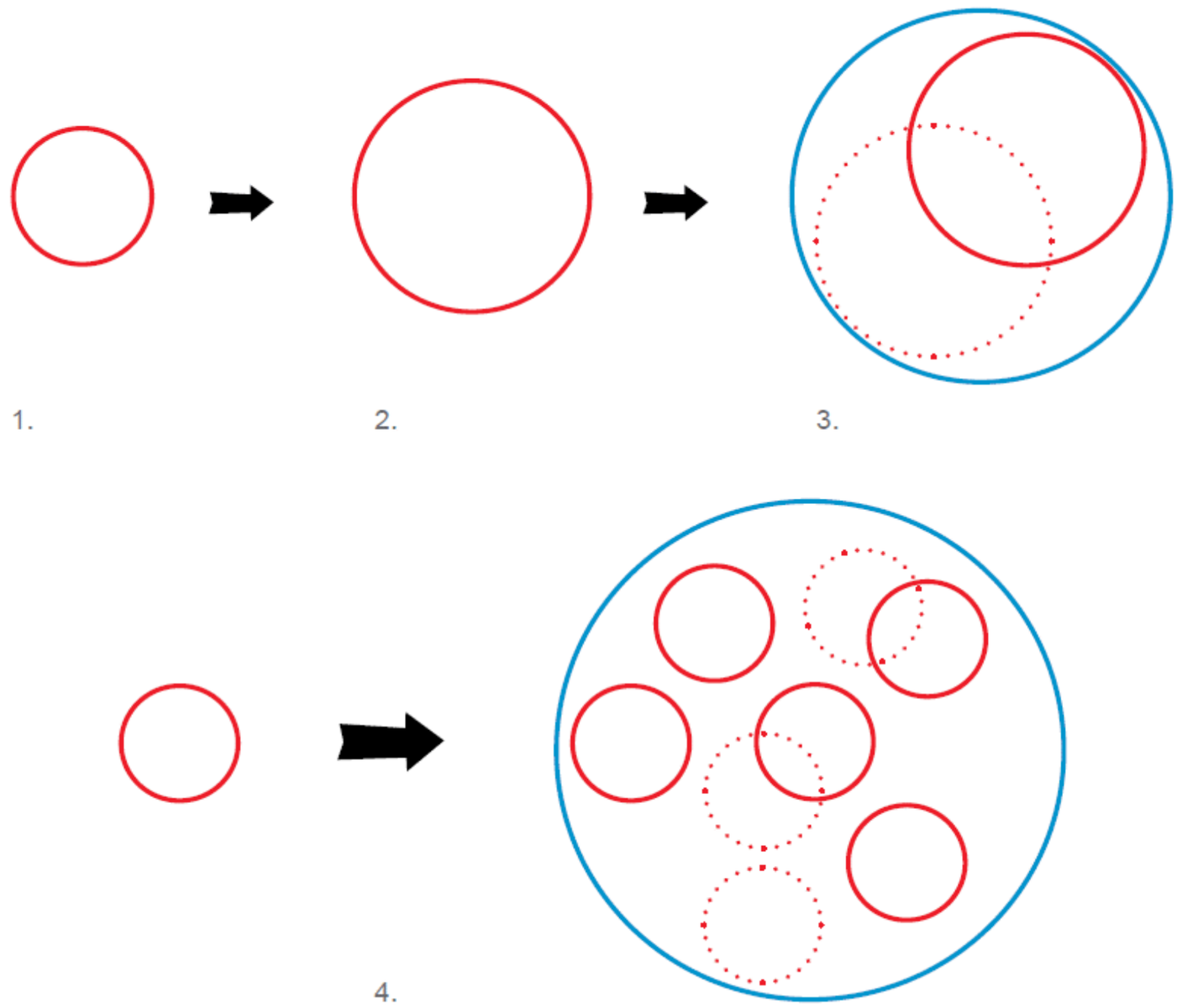
Figure 1.
Basic structure of wide area effects



1. Combined blast and fragmentation radii of a single explosive weapon centred where the weapon actually detonates.

2. Blast and fragmentation radii are greater for a weapon with larger explosive content.

3. Inaccuracy of delivery means those blast and fragmentation effects will occur somewhere within a larger area. Where within the wider area the actual effects will occur cannot be precisely controlled. Repeated firings will land in slightly different locations.

4. Where multiple warheads are used, even weapons with smaller individual blast and fragmentation radii can create effects over a wide area.

Recommendations

As a humanitarian priority, we call upon states to draw up an international political declaration to reduce harm from the use of explosive weapons in populated areas, based on the following key elements:

- A commitment to stop the use of explosive weapons with wide area effects in populated areas;
- A commitment to assist victims of explosive weapons and affected communities;
- A commitment to gather and share data on the use and impact of explosive weapons in populated areas, including the recording of casualties, and to share policy and practice aimed at enhancing civilian protection;
- A commitment to translate the key elements of such a political commitment into national policy and action.

About

About Article 36
Article 36 is a UK-based not-for-profit organisation working to prevent the harm caused by certain weapons. Article 36 undertakes research, policy and advocacy and promotes civil society partnerships to respond to harm caused by existing weapons and to build a stronger framework to prevent harm as weapons are used or developed in the future. www.article36.org

About PAX
PAX means peace. Together with people in conflict areas and concerned citizens worldwide, PAX works to build just and peaceful societies across the globe. PAX brings together people who have the courage to stand for peace. Everyone who believes in peace can contribute. We believe that all these steps, whether small or large, inevitably lead to the greater sum of peace. www.paxforpeace.nl

Version of June 2018

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Conclusion

Increasing political constraints on the use of explosive weapons that have wide area effects in populated areas would be a major step forward for the protection of civilians in armed conflict. Establishing an expectation that greater restraint should be applied in the use of explosive force in such contexts will help prevent the bombing and bombardment of people in their homes, schools and hospitals. Whilst fighting in populated areas will always put civilians at risk, the use of explosive weapons with wide area effects in these contexts makes harm to civilians almost inevitable. A political commitment to curb such use is operationally practicable and would be fully consistent with the purpose and rules of international humanitarian law.

Actors that take the protection of the civilians seriously would not use wide area explosive weapons in areas where civilians are concentrated. Despite the variety and complexity of technologies and circumstances involved, such a policy denotes a simple position that speaks directly to the key technological characteristics that put civilians in harm's way. Promoting such a policy will also promote restraint even amongst those actors that refuse to endorse such a position directly. Such restraint is desperately needed by civilian populations worldwide, now and in the future.