

CONTACT

Action on Armed Violence

5th Floor, Epworth House

25 City Road

London EC1Y 1AA

T +44 (0)20 7256 9500

F +44 (0)20 7256 9311

E info@aoav.org.uk

www.aoav.org.uk

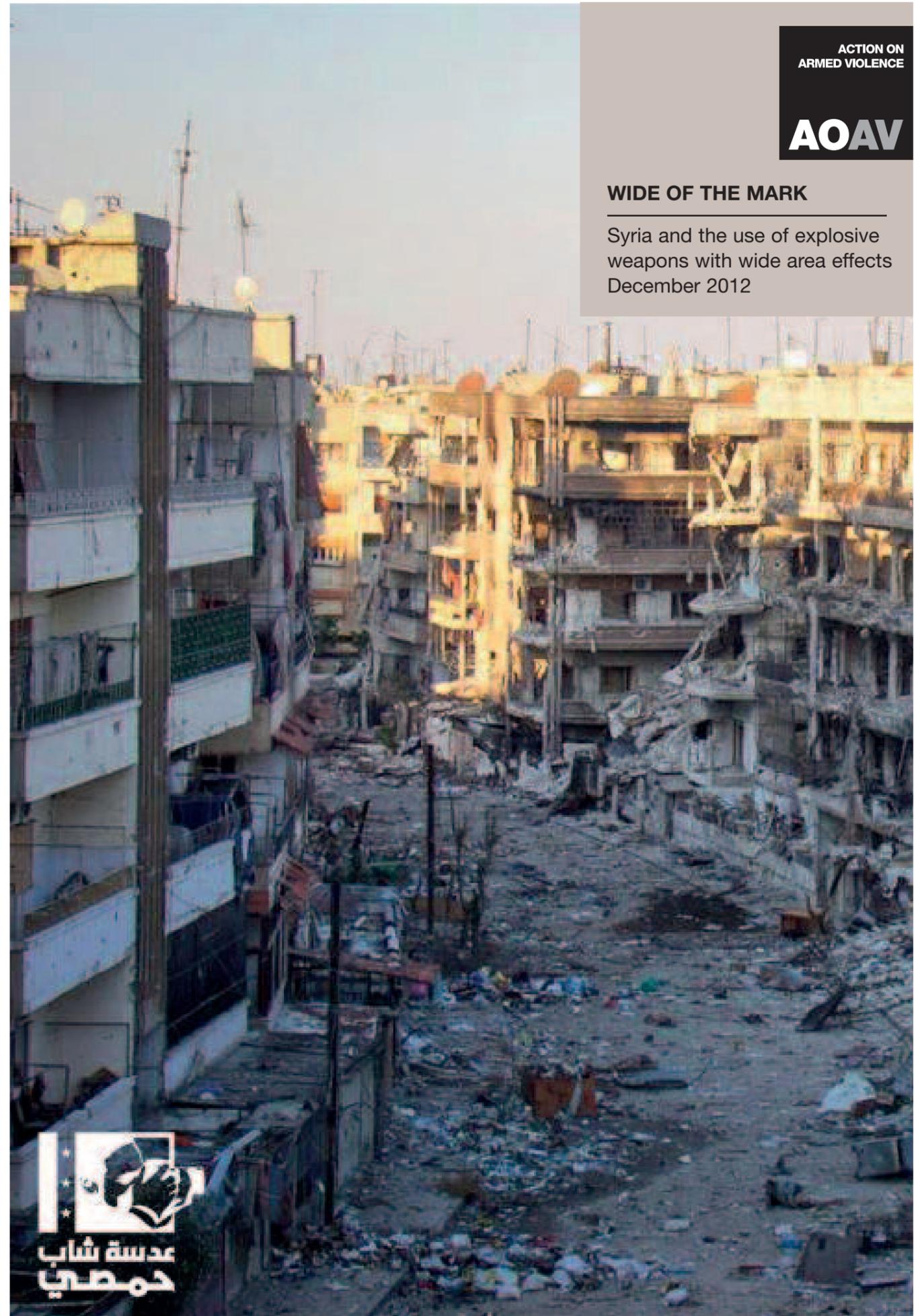
Cover photo-
Al Qussor district in the city of Homs,
Lens Young Homs, 31 October 2012
www.facebook.com/LensYoungHoms

ACTION ON
ARMED VIOLENCE

AOAV

WIDE OF THE MARK

Syria and the use of explosive
weapons with wide area effects
December 2012



INTRODUCTION

Explosive weapons, which cause death and injury by projecting blast and fragmentation effects from their point of detonation, have killed and maimed tens of thousands of civilians in Syria since fighting began there in early 2011. Over the course of 2012, the civilian death toll rose sharply, corresponding with a rapid escalation in the size of the explosive weapons being used and their increasing deployment in densely populated urban areas.

Global condemnation of violence in Syria in 2012 has made explicit the link between the dramatic worsening humanitarian situation and the deployment of powerful new weapons, from air strikes and makeshift high explosive barrel bombs, to cluster munitions.¹ Most recently, there have been allegations that inaccurate but extremely powerful Scud missiles were fired by Syrian government forces.²

In his 2012 report on the Protection of Civilians in Armed Conflict, the United Nations Secretary-General Ban Ki-moon expressed his concern at the humanitarian impact of explosive weapons, and particularly urged all actors to “refrain from using explosive weapons with a wide-area impact in densely populated areas.”³ The particular concern with the civilian harm caused in Syria by explosive weapons that affect wide areas is the focus of this paper and of AOA’s work as a founding member of the International Network on Explosive Weapons (INEW).

“Amongst the standards that may be developed, INEW believes that states and other actors should recognise that explosive weapons with wide area effects should not be used in populated areas. Such wide area effects may be caused by the scale of blast and fragmentation from an individual explosive weapon, the inaccuracy of the delivery of individual weapons, the use of multiple explosive weapons in an area, or a combination of these factors.”

International Network on Explosive Weapons

Explosive weapons may be considered as having wide area impacts based on a number of factors such as the size and scale of blast and fragmentation produced, inaccuracy of delivery, or when multiple explosive weapons are used in an area.

Many of the weapons that might be considered as meeting one, a combination, or all of these criteria for having ‘wide-area effects’ have been used in populated areas of Syria during fighting this year, and AOA’s Explosive Violence Monitoring Project (EVMP) has recorded high numbers of civilian casualties from their use.⁴

WEAPONS WITH A LARGE EXPLOSIVE CONTENT

Certain explosive weapons which contain a large quantity of explosive material produce a particularly devastating wide area effect by projecting blast and fragmentation across a broad scale. These ‘heavy’ weapons have a range of delivery methods and even when equipped with precision guidance systems, due to the inherently large blast radius, pose a threat to all buildings and people in proximity.⁵

This threat is compounded by the risk of being killed and injured not only directly by fragmentation and blast waves but also from collapsing buildings that cannot withstand the powerful explosive force. Damage to homes and civilian infrastructure in turn can have serious indirect and longer-term consequences, such as disruption to medical services, loss of homes and livelihoods, and damage or destruction of public transportation and sanitation infrastructure. These types of weapons should never be used in civilian populated areas.

Although sometimes difficult to identify the precise munition used in an attack, a number of incidents of explosive violence in Syria appear to have involved explosive weapons with large explosive content being fired or dropped into populated areas.

One of the most notable incidents was the firing of two air-dropped bombs from Syrian Air Force planes in the town of Azaz on 15 August 2012. The bombs killed 46 civilians and injured 200 others.⁶ One source reported that “so many were wounded that the local hospital locked its doors, directing residents to drive their injured to the nearby Turkish border for treatment on the other side.”⁷ One resident found a fragment of what he claimed was a 500-kilogram bomb that could potentially explain the scale of destruction.⁸

A Human Rights Watch (HRW) investigation shortly after the incident found that an entire residential block of around 70 square metres had been



A residential area in Azaz, that was hit by at least two bombs from a Syrian fighter jet on 15 August, 2012. (Rachel Beth Anderson for Human Rights Watch)

INACCURACY OF DELIVERY

flattened by the bombs. HRW condemned the incident arguing “weapons, such as aerial bombs with a large blast radius may be considered indiscriminate when used in populated areas.”⁹

There have also been reports of large shells and bombs being fired from ground-launched weapons like artillery and mortars. On 16 February, a video showed remnants of a 240mm F-864 high explosive mortar bomb found in the city of Homs.¹⁰ Used as part of the sustained bombardment on the Baba Amr neighbourhood, this munition is the largest mortar bomb known to be in production and weighs 130 kilograms including 32 kilograms of explosive material.¹¹ This weapon is primarily designed to demolish ‘fortifications and field-works’ due to the size of its explosive yield.¹² Such a weapon is clearly unacceptable for use in a populated area among civilian homes.

“Battlefield weapons and munitions – unguided bombs dropped from the air and imprecise artillery shells and mortars which have a wide impact radius and cannot be aimed at specific targets – are now being used daily against residential areas, significantly increasing the number of civilian casualties.”

*Amnesty International, 19 September 2012*¹³

Improvised explosive devices (IEDs) share characteristics common to all explosive weapons, and those that contain large quantities of explosives replicate the effects of other wide-area impact weapons.

In the largest single IED incident recorded by the EVMP in Syria, 55 people were killed and 372 were injured in an attack involving two car bombs in central Damascus on 10 May 2012.¹⁴ The Syrian Observatory for Human Rights claimed that the target of the bombing was the nearby military intelligence headquarters.¹⁵ However, the bombs appeared to have detonated close to a university facility while students were arriving for lessons. The size of the explosion was such that it destroyed 200 cars, caused the walls of buildings on both sides of the road to collapse, and left a crater which was three meters deep and six meters wide.¹⁶ Responsibility for the attack is still disputed.

“I was about 100 meters away from the house when I saw the airplane and heard the sound of the bombing and destruction. My three brothers lived here. I buried 12 of my family members today, including my father, my mother, and my sister – my brother’s wife as well. Walid, my brother was cut into pieces. We didn’t recognise him at first. We buried my brother’s children also. The youngest was 40 days old.”

*Ahmed, a resident of Azaz*¹⁷

An explosive weapon’s tendency to affect a wide area can also come from inaccuracy. If a user of an explosive weapon is unable to control how a munition behaves once fired then they are far less likely to be able to limit or define the area over which the weapon projects blast and fragmentation effects.

Inaccuracy of delivery is a common feature shared by many explosive weapons. The inability of a user to control and limit the impact of explosive weapons on civilians can be influenced by factors including; the range over which weapons are launched, the angle of their trajectory, whether they are guided or not, and whether there is a line-of-sight between a user and target. Of particular concern in this regard are ‘indirect fire’ weapons – those that do not require a clear line-of-sight between the weapon user and the intended target.¹⁸ Indirect fire weapons are recognised by many states as less likely to be accurate than their direct fire counterparts, and are therefore particularly problematic for use in populated areas.¹⁹ Mortars and long-range rockets are among the explosive weapons that can be fired indirectly.²⁰ Weapons such as these are unsuitable for use in populated areas where the consequences of missing an intended target by even a small margin would likely mean the death and injury of civilians living nearby.

Multiple launch rocket systems (MLRS), which last year caused widespread devastation in fighting in Libya, have also been used in Syria. These weapons function by firing large numbers of rockets simultaneously or in quick succession.²¹ On 26 July, 16 people were reportedly killed when a salvo of such rockets was reportedly fired from multiple launchers at an apartment block in the Damascus

suburb of Yalda.²² Five children and four women were among the dead.²³

Syrian government forces are known to have two principal types of MLRS in deployment, the most common of which is the 122mm BM21 ‘Grad’ rocket launcher.²⁴ In December 2012, it was reported that the increasing use of Grad rockets by Syrian government forces marked a distinct escalation in the conflict.²⁵

Grad rockets have a range of up to 20km and up to 40 rockets are fired from launchers over a period of twenty seconds. The basic Grad rocket is three metres long, weighs 60kg, and its warhead contains 2,280 fragments as it begins to explode.²⁶ It is unguided, and once fired, these high explosive rockets land in salvos across a wide area.²⁷ The M-21 OF warhead, which is the basic explosive section of a rocket, can cover a lethal area of 1,050 square metres.²⁸



Satellite image of Syrian military artillery, US Department of State, 10 February 2012

MULTIPLE EXPLOSIVE WEAPONS

The other prominent rocket launcher in the Syrian government's arsenal is the Type-63 which can fire up to 12 rockets at a time over a maximum range of 10km. At that maximum range, 80 per cent of the rockets fall within an area measuring 150 x 200m.²⁹ This is significantly larger than the dimensions of the average football pitch, and means that virtually two rockets in every salvo will fall wider than even that expanse. Each of the individual rockets contains a warhead that scatters more than 1,000 fragments across a lethal radius of 12.5m.³⁰

These rocket systems are not built with accuracy in mind as they are 'area-effect' weapons, designed to swamp massed infantry in an open battlefield.³¹ The individual rockets cannot be directed once fired and are notoriously inaccurate.³² The capacity of these weapons to shower powerful munitions over a wide area makes them entirely inappropriate for use in populated areas. US Field Manuals warn that "Rockets are inherently less precise than cannon projectiles [artillery shells (themselves of significant concern in this regard)]. They have a much larger CEP [Circular Error Probable] are therefore much less predictable. [sic]"³³ The US manuals explicitly state that MLRS should not be used within 2km of friendly forces, due to the danger of being hit as a result of the inaccuracy of the munitions.³⁴ In a review of declassified military doctrine, the US Center for Army Lessons Learned counselled in 2002 that this meant that MLRS launchers should not be positioned in 'built-up' areas.³⁵

While the use of long-range rocket launchers has been reported in the sustained shelling of areas of cities such as Homs and Aleppo, it is rare that these weapons have been reported in isolation or as the sole weapon used in incidents that have caused civilian casualties. Grad rockets

were clearly reported on 8 February 2012, when at least 50 people were killed in Homs in a barrage that also included heavy mortar fire, artillery, and tank shelling.³⁶ At least 23 buildings in the Baba Amr district were completely destroyed, and several medical staff were severely injured including a Red Cross worker who lost both legs in one explosion.³⁷ From media reporting, the pattern of rocket use in populated areas is strongly associated with the parallel use of mortars, artillery and tank shells, and similar explosive weapons, thus compounding their wide area effects.³⁸

"Since dawn the shelling has been extremely intense and they are using rockets and mortars. They have destroyed all infrastructure and bombed water tanks and electricity poles. The humanitarian situation is extremely dire and food is lacking."

*Omar Shaker, Homs resident and activist, 8 February 2012*³⁹

The use of explosive weapons with wide margins of error within populated areas should be of enormous concern wherever it occurs. The deaths and injuries of civilians in Syria demonstrate that inaccuracy of delivery translates to an inability to protect civilians by appropriately controlling the effects of explosive weapons. The threat to civilians of death and injury is far too high if these weapons cannot be directed with confidence towards their objective, and the implications of even a narrow miss of one explosive munition in a place filled with civilians and civilian buildings are likely to be dramatic and appalling.

Another common factor contributing to the wide area impact of explosive weapons is the firing of multiple munitions into an area. This can include both weapons like multiple launch rocket systems or cluster bombs which result in the firing of a group of munitions nearly simultaneously in order to saturate an area, or the tactic of using multiple different explosive weapons in combination, sometimes over a sustained period of time. The major cities of Damascus, Homs, Aleppo, and Idlib have all suffered from this tactic. The large numbers of munitions involved multiplies the risk of both immediate and long-term harm from blast and fragmentation effects.

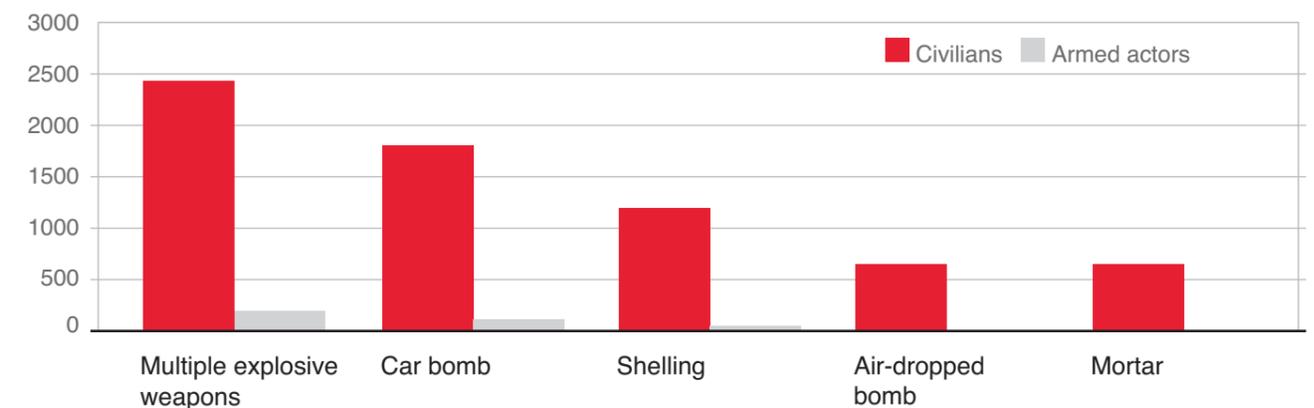
There is a general recognition of the danger that the use of multiple explosive weapons with wide area impacts poses to civilians and there is already an existing prohibition on attacks which involve 'bombardment' of a civilian area.⁴⁰ Cluster munitions, notorious for their wide-area footprint and ability to scatter large numbers of submunitions, have subsequently been banned by the international community as inhumane.⁴¹

Perhaps unsurprisingly, data collected by the EVMP on reports of explosive violence in Syria indicates that attacks described in media reports

as 'shelling' or as involving the use of multiple types of explosive weapons in a single incident were responsible for the most civilian casualties. Of those incidents involving multiple explosive weapons, 77% of civilian casualties were caused by ground launched explosive weapons like artillery, mortars, and rockets.

One of the most high profile incidents in Syria was the siege of the Baba Amr suburb of Homs in February this year. In one day alone on 21 February, 21 people were killed and 340 were wounded by an artillery barrage across Homs by Syrian government forces.⁴² The intensity of the bombardment was such that the Syrian Network for Human Rights said at least 250 shells and rockets had hit the suburb in one morning.⁴³ Omar Shaker, a local activist, reported that at one point shells were falling at a rate of around ten per minute.⁴⁴ Bombardment on such a scale took a horrific toll on residents of the city who will continue to suffer from its impacts. An analysis of satellite images (overleaf) of the neighbourhood of Baba Amr on 25 February found 640 buildings with visible damage, though the actual number is likely to be higher because the images do not show the sides of those buildings hit by explosive weapons.⁴⁵

Top five explosive weapons for civilian casualties in Syria



CONCLUSION



DigitalGlobe, Analysis by Human Rights Watch, 25 February 2012. Red circles indicate destroyed or damaged buildings, yellow circles represent impact craters.

“On February 23 I was in my house when the whole building shook as if an earthquake had happened. I looked outside the building and saw that a rocket went through the building adjacent to mine, completely demolishing the roof. Seconds later, another rocket hit the same building destroying the second floor, and a few seconds later, a third rocket destroyed the first and ground floor. In three to four minutes the building had fully collapsed. I directly went outside to see if anyone survived. I pulled one woman but she had no legs. Her legs were cut off. As I was trying to remove another wounded person, the building on the other side of the street was hit by a rocket. The rocket’s shrapnel injured my legs and neck. I was transferred to the field hospital but they couldn’t remove the shrapnel from my neck. So they transferred me to Lebanon.”

Resident of Baba Amr in Homs, interview with Human Rights Watch, 2 March 2012⁴⁶

The use of cluster munitions has been increasingly reported during the violence in Syria. In one particularly harmful incident at least ten children were killed in an air strike on the town of Deir al-‘Assafeer near Damascus. An analysis of a video of the incident suggested that at least three RBK- 250/275 AO-SCh bombs were used, each containing around 150 anti-personnel fragmentation bomblets. These bomblets create a destructive footprint of 4,800 square meters.⁴⁷ The danger posed by cluster munitions is increased by the

large quantity of unexploded munitions that they produce. One resident reported that up to 70 unexploded bomblets had been found after the attack.⁴⁸ Like MLRS, cluster munitions are primarily designed as ‘area-effect weapons’ for use against massed troops in open areas and are capable of saturating a wide area with blast and fragmentation effects.⁴⁹ Their use in populated areas where civilians are likely to be present or to return to is particularly inhumane, as the Syrian playground incident shows.

The ongoing violence in Syria demonstrates the importance of reconsidering the acceptability of using explosive weapons that have a wide area impact in civilian areas. The recent allegations of use of ballistic missiles by the Syrian government forces on their own population suggests a further deterioration of civilian security and yet another threat to their protection.⁵⁰

Given the harm of explosive weapons with a wide area impact documented in Syria there also are serious questions as to whether these attacks are illegal under international humanitarian law (IHL). Further research should be carried out to determine whether any of the incidents above are violations of IHL provisions around the use of explosive force; for example, if they either failed to take appropriate care to spare the civilian population from harm, treated an area containing a concentration of civilians as a single target, or failed to apply the principles of distinction and proportion.⁵¹ However, the demonstrated inability of the legal status quo to prevent this pattern of harm indicates the need to develop new standards around

the use of wide area explosive weapons and so greatly enhance civilian protection.

AOAV, as a founding member of the International Network on Explosive Weapons, calls on states and other actors to:

1. Acknowledge that the use of explosive weapons in populated areas tends to cause severe harm to individuals and communities and furthers suffering by damaging vital infrastructure;
2. Strive to avoid such harm and suffering in any situation, review and strengthen national policies and practices on use of explosive weapons and gather and make available relevant data;
3. Work for full realisation of the rights of victims and survivors;
4. Develop stronger international standards, including certain prohibitions and restrictions on the use of explosive weapons in populated areas.

Report by

Henry Dodd and Robert Perkins

Editor

Katherine Harrison

With thanks to

Steven Smith

Design by

Tutaev Design

Clarifications or corrections from interested parties are welcome

Research and publications funded by the Government of Norway, Ministry of Foreign Affairs

END NOTES

- 1 See for example, United Nations Office of the Special Representative for Children and Armed Conflict, "SRSG Zerrougui condemns the killing of Syrian children in Government airstrikes," 19 October 2012, <http://childrenandarmedconflict.un.org/press-releases/srsg-zerrougui-condemns-the-killing-of-syrian-children-in-government-airstrikes/> (accessed 18 December 2012); French Foreign Minister Laurent Fabius, cited in "Syrians say barrels of TNT are big new problem," *The Associated Press* posted by *The Guardian*, 17 October 2012, www.guardian.co.uk/world/feedarticle/10487332 (accessed 18 December 2012); United Nations Office for the Coordination of Humanitarian Affairs, "Emergency Relief Coordinator's Key Messages on Syria," 25 October 2012, Issue Number 8, <http://ochanet.unocha.org/p/Documents/ERC%20Key%20Messages%20on%20Syria%2025%20October%20Issue%20No.8%20MEDIA.pdf> (accessed 18 December 2012).
- 2 Michael R. Gordon and Eric Schmitt, "Syria Uses Scud Missiles in New Effort to Push Back Rebels," *The New York Times*, 12 December 2012, www.nytimes.com/2012/12/13/world/middleeast/syria-war-developments-assad.html?pagewanted=all&_r=1&page-wanted=all& (accessed 18 December 2012).
- 3 United Nations Secretary-General Ban Ki-moon, "Report of the Secretary-General on the protection of civilians in armed conflict," UN Security Council, S/2012/376, 22 May 2012, http://reliefweb.int/sites/reliefweb.int/files/resources/Full_Report_4150.pdf (accessed 18 December 2012).
- 4 See www.aoav.org.uk/changing-policy/the-impact-of-explosive-weapons-2/explosive-violence-monitoring-project/country-updates/syria
- 5 For a discussion of the overlap between heavy and explosive weapons see: Richard Moyes, Maya Brehm, and Thomas Nash, "Heavy Weapons and Civilian Protection," Article 36, 9 August 2012, www.article36.org/wp-content/uploads/2012/08/Heavy-weapons-and-civilian-protection.pdf (accessed 18 December 2012).
- 6 "Airstrike triggers exodus in Syria," *IOL News*, 16 August 2012, www.iol.co.za/news/world/airstrike-triggers-exodus-in-syria-1.1363999#.ULXuieRfWAq (accessed 3 December 2012)
- 7 Zeina Karam, "Airstrikes kills over 40 in northern Syria, watchdog group says," *Associated Press* posted in *The Christian Science Monitor*, 16 August 2012, www.csmonitor.com/World/Latest-News-Wires/2012/0816/Airstrikes-kills-over-40-in-northern-Syria-watchdog-group-says (accessed 3 December 2012).
- 8 Scott Bobb, "Azaz Residents Pick Up After Aerial Bombings," *Voice of America*, 16 August 2012, www.voanews.com/content/syria-azaz-residents-pick-up-after-aerial-bombing/1489892.html (accessed 3 December 2012). A variety of air-dropped bombs are suspected to have been used by Syrian government forces. There are reports of OFAB 250-270 bombs and OFAB 100-120 bombs being used by the Syrian air force. See "Evidence of Unguided Bombs Being Deployed by the Syrian Air Force," Elliot Higgins, 28 June 2012, <http://brown-moses.blogspot.ch/2012/06/evidence-of-unguided-bombs-being.html> (accessed 4 December 2012).
- 9 Human Rights Watch, "Syria: Fighter Jet Bombing Kills Over 40 Civilians," 16 August 2012, www.hrw.org/news/2012/08/16/syria-fighter-jet-bombing-kills-over-40-civilians (accessed 3 December 2012).
- 10 Robert Mackey, "Huge, Russian-made shells deployed to crush Syrian Resistance, Rights Group Says," *The New York Times*, 24 February 2012, <http://theede.blogs.nytimes.com/2012/02/24/huge-russian-made-shells-deployed-to-crush-syrian-resistance-rights-group-says/> (accessed 4 December 2012)
- 11 Human Rights Watch, "'Friends of Syria:' Push to End Indiscriminate Shelling," 24 February 2012, www.hrw.org/node/105299 (accessed 4 December 2012).
- 12 Human Rights Watch, "'Friends of Syria:' Push to End Indiscriminate Shelling," 24 February 2012, www.hrw.org/node/105299 (accessed 4 December 2012).
- 13 Amnesty International Briefing, "Syria: Indiscriminate attacks terrorize and displace civilians," 19 September 2012, www.unhcr.org/ref-world/docid/505c154c2.html (accessed 4 December 2012).
- 14 The EVMP defines an incident as the use of an explosive weapon causing a casualty in a period of less than 24 hours. Oliver Holmes and Mariam Karouny, "Syria suicide bombers kill 55, ceasefire in tatters," *Reuters*, 10 May 2012, www.reuters.com/article/2012/05/10/us-syria-idUSBRE84700020120510 (accessed 19 December 2012).
- 15 Haroon Siddique and Matthew Weaver, "Damascus hit by deadly explosions," *The Guardian*, www.guardian.co.uk/world/2012/may/10/damascus-hit-deadly-explosions?newsfeed=true (accessed 4 December 2012).
- 16 "UN condemns Syria bomb attacks after 55 killed," *AFP*, posted by *Google hosted news*, 11 May 2012, www.google.com/hostednews/afp/article/ALeqM5jllGiHp2Q3C-tgAHiaEQNtuPMzOQ?docId=CNG.2aac56872c3060f25517260a8c37baca.131 (accessed 4 December 2012). Responsibility for the attack is disputed, see: "At least 21 dead in Syria bomb blast," DPA, posted by *The Sydney Morning Herald*, 21 April 2012, <http://news.smh.com.au/breaking-news-world/at-least-21-dead-in-syria-bomb-blast-20120421-1xd6p.html> (accessed 4 December 2012) and "Assad's regime carried out deadly Damascus bombings: leaked files," *Al Arabiya*, 30 September 2012 <http://english.alarabiya.net/articles/2012/09/30/241008.html> (accessed 4 December 2012)
- 17 Human Rights Watch, "Syria: Fighter Jet Bombing Kills Over 40 Civilians," 16 August 2012, www.hrw.org/news/2012/08/16/syria-fighter-jet-bombing-kills-over-40-civilians (accessed 3 December 2012).
- 18 Indirect fire is defined by the UK Ministry of Defence as "an engagement in which the target cannot normally be seen by the firer; the delivery means is laid mechanically or electronically using data derived from tables or computation." UK Government, Ministry of Defence, "Handbook of Defence Land Ranges Safety, Volume IV, Glossary of Terms and Definitions," JSP 403 Volume 4, Edition 2, Change 3, April 2008, www.gov.uk/government/uploads/system/uploads/attachment_data/file/33907/JSP403_Vol4v2_3.pdf (accessed 14 December 2012).
- 19 The UK Ministry of Defence states for example that "A direct fire weapon aimed at the target, such as a rifle or a wire-guided anti-tank missile, is less likely to cause incidental damage than indirect fire weapons such as mortar or artillery rounds unless, of course, they miss the target and hit civilian property instead." *UK Ministry of Defence*, "The Joint Service Manual of the Law of Armed Conflict," Joint Service Publication 383, 2004 Edition, www.gov.uk/government/uploads/system/uploads/attachment_data/file/27874/JSP3832004Edition.pdf (accessed 17 December 2012). A more detailed discussion of existing standards on indirect fire weapons is available at Maya Brehm, "Protecting Civilians from the Effects of Explosive Weapons: An Analysis of International Legal and Policy Standards," United Nations Institute for Disarmament Research (UNIDIR), UNIDIR/2012/8, <http://unidir.org/pdf/ouvrages/pdf-1-92-9045-012-N-en.pdf> (accessed 14 December 2012).
- 20 The United Nations Register of Conventional Arms lists these weapons among Category III: Large-calibre artillery systems, which includes "Guns, howitzers, artillery pieces, combining the characteristics of a gun or a howitzer, mortars or multiple launch rocket systems, capable of engaging surface targets by delivering primarily indirect fire, with a calibre of 75 millimetres and above." The UN Register of Conventional Arms, www.un-register.org/Background/Index.aspx (accessed 17 December 2012).
- 21 Human Rights Watch, "Libya: Indiscriminate Attacks Kill Civilians," 17 April 2011, www.hrw.org/news/2011/04/17/libya-indiscriminate-attacks-kill-civilians (accessed 17 December 2012).
- 22 It is not reported precisely which multiple-launch rocket system was used in the attack. "Rocket fire kills 16 in south Damascus: activists," *Reuters*, 26 July 2012, www.reuters.com/article/2012/07/26/us-syria-crisis-rockets-idUSBRE86P12M20120726 (accessed 29 November 2012).
- 23 "Syria conflict: Troops 'mass before Aleppo battle'," *BBC*, 26 July 2012, www.bbc.co.uk/news/world-middle-east-18994124 (accessed 29 November 2012). This is also reported by the Center for Documentation of Violations in Syria (VDC), which reports 17 people killed in Yalda on 26 July 2012, see bit.ly/ZHNzKD (accessed 18 December 2012).
- 24 Anthony H. Cordesman, "Israel and Syria: The Military Balance and Prospects of War," Center for Strategic and International Studies, Working Draft, Revised: 15 August 2007, http://csis.org/files/media/working/pubs/070815_cordesman_israel_syria.pdf (accessed 11 December 2012). In addition it is claimed that longer-range Khaibar, Fahr and Ra'ad MLR systems exist in Syrian arsenals, see Soner Çağapty and Coşkun Ünal, "The Turkey-Syria military balance," *Janes Islamic Affairs Analyst*, May 2012, www.washingtoninstitute.org/uploads/Documents/opeds/CagaptyUnal20120531-Janes.pdf (accessed 11 December 2012).
- 25 Brown Moses Blog, "Grads Join Scuds and Incendiary Bombs in The Latest Escalation Of The Syrian Conflict," 12 December 2012, <http://brown-moses.blogspot.co.uk/2012/12/grads-join-scuds-and-incendiary-bombs.html> (accessed 17 December 2012).
- 26 Russian Federal State Unitary Enterprise, "M-21OF (9M22U) 122mm Unguided Rocket Projectile fitted with HE-Fragmentation Warhead," <http://splay.org/en/arms/grad/m22u.asp> (accessed 20 December 2012).
- 27 Human Rights Watch, "Libya: Indiscriminate Attacks Kill Civilians," 17 April 2011, www.hrw.org/news/2011/04/17/libya-indiscriminate-attacks-kill-civilians (accessed 17 December 2012).
- 28 Gander, Terry J., and Cutshaw, Charles Q. (Eds.), "Jane's Ammunition Handbook, Tenth Edition, 2001-02," 2001, p. 625
- 29 Jane's, "107mm Norinco rockets (China), Artillery rockets," *Jane's Ammunition Handbook*, 20 October 2009, <http://articles.janes.com/articles/Janes-Ammunition-Handbook/107-mm-Norinco-rockets-China.html> (accessed 11 December 2012).
- 30 Jane's, "107mm Norinco rockets (China), Artillery rockets," *Jane's Ammunition Handbook*, 20 October 2009, <http://articles.janes.com/articles/Janes-Ammunition-Handbook/107-mm-Norinco-rockets-China.html> (accessed 11 December 2012).
- 31 "9K51 BM-21 Grad(Hail) 9A51 Prima, Sakr-18 [Egyptian] 122-mm Multiple Rocket Launcher," undated, www.globalsecurity.org/military/world/russia/bm-21.htm (accessed 17 December 2012).
- 32 During the fighting in Libya in 2011 for example, Peter Bouckaert, the Emergencies Director at Human Rights Watch, said "*The Soviet-made Grad in particular is one of the world's most inaccurate rocket systems and should never be fired in areas with civilians.*" Human Rights Watch, "Libya: Indiscriminate Attacks Kill Civilians," 17 April 2011, www.hrw.org/news/2011/04/17/libya-indiscriminate-attacks-kill-civilians (accessed 17 December 2012).
- 33 "Chapter 3: Employment," Headquarters, Department of the Army, "Tactics, Techniques, and Procedures for Multiple Launch Rocket System (MLRS) Operations," Field Manual 6-60, 23 April 1996, http://library.enlisted.info/field-manuals/series-1/FM6_60/CHAP3.PDF (accessed 19 December 2012). Circular error probable (CEP) is one measure of a weapons' accuracy, defined by the UK Ministry of Defence as "an indicator of the dispersion of a weapon system and can be used as a factor in determining safety distances and the probable damage to a target. One CEP is the radius of the circle within which half of the weapons are expected to fall or have war-head event." The UK Ministry of Defence, "Handbook of Defence Land Ranges Safety Volume IV, Glossary of Terms and Definitions," JSP 403 Volume 4, Edition 2, Change 3, April 2008, www.mod.uk/NR/rdonlyres/60EDC138-7AEE-4749-ACDB-1689639C3CB9/0/JSP403_Vol4v2_3.pdf (accessed 5 December 2012).
- 34 "Chapter 3: Employment," Headquarters, Department of the Army, "Tactics, Techniques, and Procedures for Multiple Launch Rocket System (MLRS) Operations," Field Manual 6-60, 23 April 1996, http://library.enlisted.info/field-manuals/series-1/FM6_60/CHAP3.PDF (accessed 19 December 2012).
- 35 MAJ James E. Hutton (ed.), "Use of the Multiple Launch Rocket System (MLRS) in Military Operations on Urbanized Terrain (MOUT)," Center for Army Lessons Learned, www.dtic.mil/dtic/fulltext/u2/a397818.pdf (accessed 17 December 2012).
- 36 Michael Jansen, "Dozens die as Syrian tanks shell city of Homs," *Reuters*, posted by *The Irish Times*, 9 February 2012, www.irishtimes.com/newspaper/world/2012/02/09/1224311519794_pf.html (accessed 18 December 2012).
- 37 "Dozens dead in Syria as UN mulls observer mission," *AFP*, posted by *Google hosted news*, 8 February 2012, www.google.com/hostednews/afp/article/ALeqM5hQlt5aTjdE37sClwJbKaP-SYMDAQ?docId=CNG.1fb57797eecddeaaead14c623011e00.d1 (accessed 18 December 2012).
- 38 Of those incidents in Syria recorded by the EVMP as 'Multiple Explosive Weapons' (i.e. where a combination of different explosive weapons are used together and it is not possible from reporting to attribute casualties to each munition), rockets were clearly reported on 17 occasions. They were involved in 27% of the Multiple Explosive Weapons incidents recorded in Syria, which account for 41% of the civilian casualties caused in such incidents.
- 39 Omar Shaker activist and resident of Homs, quoted in "Dozens dead in Syria as UN mulls observer mission," *AFP*, posted by *Google hosted news*, 8 February 2012, www.google.com/hostednews/afp/article/ALeqM5hQlt5aTjdE37sClwJbKaP-SYMDAQ?docId=CNG.1fb57797eecddeaaead14c623011e00.d1 (accessed 18 December 2012).
- 40 ICRC, "Protocol Additional to the Geneva Conventions of 12 August 1949, and relating to the Protection of Victims of International Armed Conflicts (Protocol I)," 8 June 1977, www.icrc.org/ihl.nsf/full/470?opendocument (accessed 17 December 2012); Diplomatic Conference for the Adoption of a Convention on Cluster Munitions, "Convention on Cluster Munitions," 30 May 2008, www.icrc.org/ihl.nsf/INTRO/620?OpenDocument (accessed 18 December 2012).
- 41 ICRC, "Protocol Additional to the Geneva Conventions of 12 August 1949, and relating to the Protection of Victims of International Armed Conflicts (Protocol I)," 8 June 1977, www.icrc.org/ihl.nsf/full/470?opendocument (accessed 17 December 2012); 2008 Convention on Cluster Munitions, www.icrc.org/ihl.nsf/INTRO/620?OpenDocument (accessed 18 December 2012).
- 42 Lauren Williams, "Homs blitz prompts yet more calls for cease-fire in Syria," *The Daily Star Lebanon*, 22 February 2012, www.dailystar.com.lb/News/Middle-East/2012/Feb-22/164182-homs-blitz-prompts-yet-more-calls-for-cess-fire-in-syria.ashx#axzz1nCPbcMbv (accessed 11 December 2012).
- 43 "Homs assault kills many as Red Cross seeks aid way," *Reuters*, posted in *World Bulletin*, 21 February 2012, www.worldbulletin.net/?aType=haber&ArticleID=86127 (accessed 11 December 2012).
- 44 "Syrian forces shell Homs as troops mass," *Associated Press*, www.cbsnews.com/8301-202_162-57381518/syrian-forces-shell-homs-as-troops-mass/ (accessed 11 December 2012).
- 45 Human Rights Watch, "New Satellite Images Show Homs Shelling," 2 March 2012, <http://reliefweb.int/report/syrian-arab-republic/new-satellite-images-show-homs-shelling> (accessed 11 December 2012).
- 46 Human Rights Watch, "New Satellite Images Show Homs Shelling," hosted by *Reliefweb*, 2 March 2012, <http://reliefweb.int/report/syrian-arab-republic/new-satellite-images-show-homs-shelling> (accessed 18 December 2012).
- 47 "Syria: Evidence Shows Cluster Bombs Killed Children," *Human Rights Watch*, 27 November 2012, www.hrw.org/news/2012/11/27/syria-evidence-shows-cluster-bombs-killed-children-0 (accessed 18 December 2012).
- 48 Ruth Sherlock, "Syria: Damascus playground hit by cluster bombs," *The Telegraph*, 26 November 2012, www.telegraph.co.uk/news/worldnews/middleeast/syria/9702886/Syria-Damascus-playground-hit-by-cluster-bombs.html (accessed 18 December 2012).
- 49 The Monitor, "Cluster Munitions: The Issues," undated, www.the-monitor.org/index.php/LM/The-Issues/Cluster-Munitions (accessed 18 December 2012).
- 50 Use of such weapons was described as "a stunning, desperate and a disproportionate escalation," by Jay Carney, the White House spokesman. Jonathan Marcus, "Scud: 'Entry level' ballistic missile," *BBC*, 13 December 2012, www.bbc.co.uk/news/world-middle-east-20712241 (accessed 18 December 2012).
- 51 Jean Marie Henckaerts and Louise Doswald-Beck, "Customary International Humanitarian Law, Volume 1: Rules," ICRC, 2005, www.icrc.org/eng/assets/files/other/customary-international-humanitarian-law-i-icrc-eng.pdf (accessed 18 December 2012). For a detailed discussion of Existing legal and policy standards around the use of explosive weapons see: Maya Brehm, "Protecting Civilians from the Effects of Explosive Weapons: An Analysis of International Legal and Policy Standards," UNIDIR, 2012, www.unidir.org/pdf/ouvrages/pdf-1-92-9045-012-N-en.pdf (accessed 18 December 2012).