This project is funded by the European Union

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DISCUSSION PAPER ON 3D PRINTING AND FIREARMS

Introduction

Three-dimensional (3D) printing, also known as additive manufacturing (AM), is a technology by which successive layers of material are laid down on top of each other under computer control, with the end result being a three-dimensional object.[1] Since about 2010, 3D printers have been available on the market ranging in price from USD 1,000 to USD 1 million and have been used in a variety of industries including automotive, aerospace, architecture, defence, and medical replacements. Many of these systems were, and still are, used for rapid prototyping, before mass production methods are employed. More recently, however, the cost of 3D printers has been reduced to less than USD 1,000. As the price of 3D printers decreased, they naturally became more accessible for the self-manufacturing of various personal products, including firearms.

Over the last few years, the term 3D printing has also become known as a relatively easy method for producing firearms, raising concerns that this could lead to increased proliferation, insecurity and even fuel terrorism.[2]

As the Western Balkans have not registered any cases

1 What is 3D printing, http://3dprinting.com/what-is-3d-printing/ Retrieved 30 October, 2016
3D printing, http://explainingthefuture.com/3dprinting.html, Retrieved 30 October 2016.
What is 3D printing? The definitive guide to additive manufacturing. https://www.3dhubs.com/what-is-3d-printing, Retrieved 30 October 2016.

2 'How to Make A Gun at Home' The Wall Street Journal http://www.wsj.com/articles/how-to-make-a-gun-at-home-1477610554, 27 October 2016 (accessed on 1 November 2016)

of firearms or their components being manufactured using 3D printers thus far, the technology does not represent a significant and immediate threat for the region. However, with 3D printing technology rapidly developing, prices of 3D printers and consumables dropping, and new and improved materials appearing on the market, it is paramount for the authorities to become familiar with the capabilities of this technology and monitor the situation in order to be able to properly react in the future.

The purpose of this brief is to inform policy makers of the developments and challenges posed by 3D printing of firearms and to initiate discussion on necessary policy and legal changes to counter the current and potential threat. Furthermore, the brief aims to present and encourage discussion about examples that might be applicable to the Western Balkans with a view to anticipating necessary legal and policy changes.

Additive Manufacturing Methods and Technologies

The term 3D printing originally referred to methods that sequentially deposit material onto a powder bed with inkjet printer heads. More recently, the meaning of the term has expanded to encompass a wider variety of techniques such as extrusion and sintering-based processes. A large number of additive methods are now available. They mainly differ in the way layers are deposited to create parts and in the materials that are used. Technical standards generally use the term additive manufacturing for this broader spectrum of techniques.[3]

The quality and complexity of printer designs, as well as the quality of the finished products, varies greatly. Printers that work directly with metals are generally expensive. However less expensive printers can also be used to make a firearm.

Usually, 3D printable models are created with commercially available computer aided design (CAD) programs. Construction of a model can take from several hours to several days, depending on the method used and the size and complexity of the model. Once created in CAD, special software converts the digital 3D model into a series of thin layers and produces a digital file containing final printing instructions, tailored to the specific type of 3D printer. In other words, this software, which is supplied with a 3D printer, instructs the printer throughout the printing process.

3D printer development poses a number of challenges, such as controlling unlicensed firearm production, enforcing restrictions on the online firearm-related digital files, detection and traceability of 3D-printed firearms, limited application of forensic techniques etc.

3 For further details see: Christopher Barnatt, 3D Printing, 2 Edition, 7 November 2014, CreateSpace Independent Publishing Platform, 306 pages
3D Printing Also known as Additive Manufacturing (AM), http://www.onlineblueprintprinting.com/index.php/2016/08/23/3d-printing/, Retrieved on 1 November 2016.

Considerations regarding 3D printing and firearms

In 2012, a U.S.-based group *Defense Distributed* announced their plans to make design plans for a gun that could easily be downloaded and used to produce a gun on any 3D printer publicly available. Soon after *Defence Distributed* fulfilled its promise and made blueprints for the production of a 3D gun available on their website. The U.S. Government quickly responded, requesting that the blueprints be immediately taken down.[4] Although the U.S. government forced the company to take down the plans, they were still widely available via *The Pirate Bay* and other file sharing sites.

In most countries, the legal framework for the control or prohibition of unregistered firearms production is already in place, and only minor adjustments are needed in order to ensure easy and full incrimination of misuse of 3D technology.

In 2014, a young man from Japan became the first person in the world to be imprisoned for making 3D printed firearms. The reason for the arrest was the possession of 3D printed guns in violation of the Firearm and Sword Control Law. Namely, in Japan, the production of firearms without permission is illegal and violates the Ordnance Manufacturing Law. He posted blueprints and video instructions for the production of a gun online and was subsequently sentenced to jail for two years. Police found at least two guns in his household that could fire bullets.[5]

As 3D printers have become more accessible to consumers, their use in the production of firearms will most likely also increase. This development poses a number of challenges including those of controlling unlicensed production, enforcing restrictions on the firearm-related digital files over the Internet, traceability of 3D-printed firearms, limited application of forensic techniques, etc.

A number of websites allow users to access information on how to build a 3D printer, while others are dedicated to sharing 3D models. Social media forums host discussions on how to improve 3D print quality and exchange 3D printing news. This type of information sharing can ease and simplify the firearms production process. Additionally, 3D printing in combination with cloud computing technologies allows geographically independent firearms production.

4 Defense Distributed, DD History, https://defdist.org/dd-history/, Retrieved 1 November 2016.
Defense Distributed, DD History, https://defdist.org/ddvus/, Retrieved 1 November 2016.
Independen, James Legge, Friday 10 May 2013, http://www.independent.co.uk/news/world/americas/us-government-orders-cody-wilson-and-defense-distributed-to-remove-blueprint-for-3d-printed-handgun-8610842.html, Retrieved 1 November 2016.
Arstechnica, http://arstechnica.com/tech-policy/2016/09/court-groups-3d-printer-gun-files-must-stay-offline-for-now/, Retrieved 1 November 2016.

5 Xinhua, Japanese man arrested for possessing 3-D printer guns, 8 May 2014, http://www.shanghaidaily.com/world/Japanese-man-arrested-for-possessing-3D-printer-guns/shdaily.shtml, Retrieved 3 November 2016; and James Vincent, Japanese man jailed for two years for creating 3D printed guns, The Independent, 21 Ocober 2014, http://www.independent.co.uk/life-style/gadgets-and-tech/japanese-man-jailed-for-two-years-for-creating-3d-printed-guns-9807765.html, Retrieved 3 November 2016.

In May 2013, the U.S. Department of Homeland Security and the Joint Regional Intelligence Centre recognized this threat when they released a memo stating that "significant advances in three-dimensional (3D) printing capabilities, availability of free digital 3D printable files for firearms components, and difficulty regulating file sharing may present public safety risks from unqualified gun seekers who obtain or manufacture 3D printed guns".[6]

In terms of public safety and security, a possible serious challenge is related to **undetectable** plastic firearms and regulations requiring that all firearms have at least one major component that is detectable by typical metal detectors[7]. In the U.S., the law states that any firearm that is manufactured, bought, sold, or transported must have a specific amount of metal within it so that it is detectable by metal detectors. Therefore, 3D printed firearms could circumvent these control measures, increasing the threat.

The authorities are practically unable to control materials that 3D printers use in the manufacture of firearms since the same materials are used for the production of all other consumer products.

Legislative considerations

Currently there is no country in the world with a legal framework that is fully prepared for potential threats that are associated with 3D-printed firearms, raising questions about what can be changed in existing legislation.

In terms of **production**, proposed legislation in some countries banning 3D printing of weapons may discourage, but it cannot completely prevent their manufacturing. Even if the practice is prohibited by new legislation, control of online distribution of these digital files could be difficult, much like the control of illegally traded software or music files. Some U.S. legislators have proposed that **regulations on 3D printers** be introduced, in order to prevent them from being used for printing guns. However, 3D printing advocates have suggested that such regulations would not only be futile, but would also cripple the 3D printing industry, not to mention infringe on the right to free speech.

The question of 3D printed weapons can also be looked at from the perspective of **export/import legislation** and whether 3D-printed weapons should fall within the scope of export control lists, such as the Common Military List of the European Union.[8] This would mean that, regardless of the durability of the item made and the material used for its production (metal, plastics, ceramics), if a firearm produced using a 3D-printing process fulfils the parameters of a respective controlled category (such as the ML1 which controls smooth-bore weapons with a calibre of less than 20 mm and other arms and automatic weapons with a calibre of 12.7 mm or less), it would be covered by the Control List.[9]

6 Jana Winter, Homeland Security bulletin warns 3D-printed guns may be impossible to stop, FoxNews, 23 May 2013, http://www.foxnews.com/us/2013/05/23/govt-memo-warns-3d-printed-guns-may-be-impossible-to-stop.html, Retrieved 20 October 2016.

7 Some tests have shown that 3D-printed weapons, even when containing metal elements, have passed through traditional walk-through metal detectors, although they have been detected with X-ray scanners, used at airports. (Source: Chair's summary from Second Open-ended Meeting of Governmental Experts Programme of Action on Small Arms and Light Weapons 2015)

8 Common Military List of the European Union adopted by the Council on 14 March 2016; Official Journal of the European Union C122/2016, http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=OJ:C:2016:122:TOC , 6 April 2016.

9 Ibid.

It is also important to note that, from the perspective of **export legislation**, "technical data," for the production of a controlled weapon, is regulated by ML22 category related to technology in the Common Military List of the European Union[10]. According to the mentioned control list, **"technical data" may take various forms, such as: blueprints, plans, diagrams, models, formulae, tables, engineering designs and specifications, manuals and instructions written or recorded on other media or devices such as disk, tape, read-only memories**. In this respect, competent authorities should assess if their control list definitions adequately cover 3D printing technology. For the Western Balkans, the EU accession process means that authorities should closely follow developments at EU level and continue to align policies. Nevertheless, since the harmonisation process with the EU Common Military list tends to take anywhere from three up to nine months in the countries of the Western Balkans, it would be beneficial for regional authorities not to wait but to look for the most effective and efficient control mechanisms available in their jurisdiction.

According to the Common Military List of the European Union, "technical data" may take various forms, such as: blueprints, plans, diagrams, models, formulae, tables, engineering designs and specifications, manuals and instructions written or recorded on other media or devices such as disk, tape, read-only memories.

Last but not least, there is a very delicate issue regarding the possession of weapon-related "technical data". The only aspect under relative control in the area of 3D printing is the export-import of such data. Namely, all "technical data" necessary for the production of firearms not included on the list (i.e. smooth bore weapons used for hunting or sporting purposes) could easily be misused. In addition, it is clear that this aspect of control is not adequate for two more reasons. First, the EU Common Military list covers only the export and import of "technical data" of a controlled weapon, however, there is no control or incrimination should an innovator-entrepreneur develop and share "technical data" of even controlled weapons as long as the files are shared within the boundaries of the jurisdiction they are residing in. In such cases, if there are no grounds for proving the export-import of data, the person sharing the file is not committing an offence. Second, looking at the current legislation, the actual possession of "technical data" for the production of firearms is not criminal at all. In fact, until the perpetrator commits an offence by actually printing a firearm or using it, and gets caught in doing so, possession or sharing of "technical data", does not constitute a criminal offence, as long as the data does not cross a border/boundary. Therefore, the authorities of the region should make an effort to attempt to address this loophole.

10 Technology - Specific information necessary for the 'development', 'production' or operation, installation, maintenance (checking), repair, overhaul or refurbishing of a product. The information takes the form of 'technical data' or 'technical assistance'.

Key Observations for discussion

For the time being, **reliability** of 3D-printed firearms is not very high; the 3D-printed guns usually allow for only a few shots. Nevertheless, it should be noted that even single shot poses a threat. **Limited application of forensic techniques** and the simplicity of **disposing** of such weapons could also be a problem. Continuous progress in 3D printing capabilities, the ability to easily obtain free online digital 3D printer files for the production of firearms and their components, and the problem of **how to regulate file sharing**, may become a threat to public safety.

> **The only immediate form of control to be examined could be the possibility of incriminating possession, online posting or any kind of sharing of the "technical data" that could be used for printing a firearm, or parts thereof. Possession or distribution of such data could be considered as the publication of illegal information, and thus could be criminalised and adequately penalised.**

3D-printed firearms remain rare and their capabilities are limited. At the moment, weapon theft or purchase on the illicit market may require less effort and costs than the 3D-printing of a reliable weapon. Therefore, in the next few years, this technology is unlikely to be a significant source of illicit firearms. However, once production costs decrease and quality increases, 3D-printing could become a profitable alternative for illicit weapon manufacture in small quantities. Hence, in the relatively near future, the uncontrolled production, proliferation and illicit trafficking of 3D-printed firearms are very likely to become a serious threat. To counter this potential threat, the following four approaches can be considered:

1. Control of 3D printers used for the manufacture of firearms

Some of the international export control regimes, such as the Missile Technology Control Regime (MTCR) and Wassenaar Arrangement (WA), tried on several occasions to define the technical parameters of 3D printers that would represent a "threshold" above which such 3D printers would be under control. In other words, their export would be contingent upon an export approval from an authorized state body. All these attempts have not led to a final decision, but it is clear that these discussions and attempts will continue. It should be noted that this control will refer only to a very narrow circle of 3D printers with the highest technical specifications (i.e. just a few per cent). This means that **from the perspective of export control, the vast majority of 3D printers will remain uncontrolled. Given the fact that the majority of 3D printing was thus far not under control, and there are numerous printers already in widespread civilian possession, the risk of illegal firearms production is a threat, albeit limited to some degree**.

2. Control of materials from which such weapons are produced

3D printers can use a wide range of materials, including plastics, resins, metals, ceramics, etc. However, various polymers, from the well-known thermoplastics to rare photo-polymers, are preferred. There are a lot of powder processes which include metallic powders, as well as others which involve the use of paper and PVC sheets for manufacture purposes. **Authorities are practically unable to control materials that 3D printers use in the manufacturing of firearms since the same materials are used for the production of all other consumer products**.

3. Prohibition of production of such weapons

In most countries, the legal framework for the control or prohibition of unregistered firearm production is already in place, and only minor adjustments are needed in order to ensure easy and full incrimination of misuse of 3D technology. The situation is similar in the Western Balkans where the law prohibits the production of firearms without prior government approval. In addition, there are provisions that require that each firearm has to be tested and properly marked before being put on the market. **This means that in the existing legislation, the production and use of 3D firearms is already treated as illegal.**

4. Increased control of digital technical files based on which firearms are made

The last avenue to consider is the incrimination of "technical data" files, without which 3D printers cannot produce any firearm or part thereof. This is an area which the community should focus its efforts on, as a way of finding a satisfactory solution.

While this option sounds drastic, one should take into consideration that before 3D printing started flourishing, any other production of firearms required appropriate skills and experience, resources to be invested, and the necessary material. In most cases the combination of all of these requirements would hardly pass unnoticed once the production started. For the production of firearms by means of 3D printing no specific skill, resources or material, nor background knowledge is needed.

The only immediate form of control to be examined could be the possibility of **incriminating possession, online posting or any kind of sharing of the "technical data" that could be used for printing a firearm, or parts thereof.** Possession or distribution of such data could be considered the publication of illegal information, and thus could be criminalised and adequately penalised.

SEESAC is implementing the **EU COUNCIL DECISION 2013/730/CFSP**, in support of SEESAC Disarmament and Arms Control Activities in South East Europe - the EUSAC project. The European Union has been supporting SEESAC since 2002 and EUSAC is a part of SEESAC's SALW Control portfolio.

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This project is funded by the European Union

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