3D PRINTED FIREARMS: THE WILD WEST OF GUN CONTROL

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May 15, 2017

https://www.telegraph.co.uk/art/artists/carl-fredrik-reuterswrd-sculptor-of-knotted-revolver-peace-symbo/

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Intro

2017 marks the 30th anniversary of when the first 3D printer was commercialized by 3D Co Systems [1]. 3D printing has since sparked innovation in the architectural, industrial design, and biotechnology industries [2][3]. Now, it has developed in areas that were previously thought to be only possible in realms of science fiction, such as the creation of low-cost prosthetic limbs for children in war-torn countries [4]. While other technologies from the same era—CDs, cells phones, gaming systems—exploded into homes across America, 3D printing has not yet seen the significant commercial growth needed to bring it to the forefront of public discourse. Despite this protracted delay, the market as a whole is still predicted to reach $40 billion by 2020 [5]. The potential for technological innovation and financial gain has attracted international curiosity, and firearm enthusiasts and self-proclaimed crypto-anarchists are no exception. The intention of this paper is to broadly outline some of the concerns surrounding 3D printed firearms and to highlight new accounts of these weapons worldwide.

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Chronology

In 2012, an online open-source organization called Defense Distributed began 3D printing gun components. By 2013, the organization successfully fired the world's first 3D printed, single-shot pistol [6]. It was named the *Liberator* after the FP-45 Liberator, a single-shot pistol originally manufactured by the United States military during World War II [7]. The crude polymer design successfully fired live ammunition before falling apart. This was the first step in this area of technology, with reproductions and variations popping up across the world. In May 2013, Defense Distributed released a working blueprint for the *Liberator* handgun [8]. These blueprints were downloaded over 100,000 times worldwide in two days before the US Department of State requested that they be taken down [9].

In May 2013, a person only known as 'Joe' created the *Lulz Liberator*, at a fraction of the price of the original *Liberator.* From a development standpoint, the creator simply added rifling (spiral grooves inside the rifle to improve accuracy of the weapon) to the original design. Given the legal gray area he was treading on by designing the *Lulz Liberator*, 'Joe' elected not to make his weapon's design plans public. In 2013, Solid Concept Inc., a custom manufacturing company based in the United States that is now owned by Stratasys Direct, created the first metal 3D printed handgun. Named the *1911,* this handgun is capable of firing several rounds of ammunition without failure. It was commercially available, but the number of sales has not been disclosed [10].

Defense Distributed has also developed modular weapons, or guns with a core part that can be switched to give the weapons different capabilities. In 2014, Defense Distributed began to publicly sell Computer Numerical Control (CNC) milling machines named *Ghost Gunners*. US gun laws regulate the sale of the lower receivers by marking them with serial numbers on the firearm, as well as imposing background checks and waiting periods on those seeking to buy them. These CNC milling machines can grind particular parts of a legally-obtained inactive lower receiver to turn it into a functional component of a semi-automatic AR-15 rifle. The remaining parts of an AR-15 rifle can be legally and easily obtained in the United States. These firearms are known as *Ghost Guns* because they are untraceable [11].

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Concerns Surrounding 3D Guns

- **Undetectable** – The plastic composition of handguns, such as the

Liberator, means that these firearms do not trigger metal detectors. The firing pins are usually the only metal part of the gun, which can be too small to be detected. British journalists put this to the test in 2013 by successfully navigating the Eurostar train security checkpoints between London and Paris whilst carrying a 3D printed pistol, albeit without a firing pin or bullets [12]. Israeli TV journalists went a step further and succeeded in taking a functioning 3D printed pistol through security systems and into Israel's parliament building; however, this was also done without bullets [13].

- **Accessible** – The Computer Aided Design files—AKA the blueprints—for the *Liberator* were downloaded approximately 100,000 times and are now available on file sharing sites for worldwide access. This is evidenced by media reports of several cases of print and possession in countries like Finland, Japan, and the UK [14][15][16]. The costs of printers and materials has already dropped from when the *Liberator* and *Lulz Liberator* were created. It is clear that the cost and expertise required for production will drop, which in turn is likely to make 3D firearms more readily available. A functional 3D printer has now even been created from scrap hardware in Togo [17].

- **Untraceable** – 3D printers can manufacture firearms with cast markings to indicate the manufacturer name, country, or logo. However, this method does not provide unique serial numbers to differentiate between one 3D firearm and another [18]. The traditional methods of identifying steel weapons, such as stamping and laser marking, can be more easily erased on 3D printed firearms. Furthermore, these weapons can be melted down, leaving virtually no trace.

- **Fragile** – 3D firearms are still considered to be in the adolescent stage of development. They are composed of ABS, an inexpensive plastic commonly used for parts in the automobile industry. The weak nature of the plastic could result in the firearms exploding unpredictably and the disintegration of the weapon [19]. A single shot nevertheless can be fatal. There are no standards in manufacturing, so 3D firearms can be dangerous to the owners as well as to others**.**

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International Response

- Following the publication of the *Liberator's* blueprints, a number of countries took pre-emptive and cautionary measures to restrict 3D printed guns including the US, the UK,

Japan, Australia, Thailand, and Denmark. Not surprisingly, the US, a country that has a notoriously fierce opposition to gun control, has been slow to implement tough measures. In 2013, the Senate amended the Undetectable Firearms Act to restrict the possession or manufacture of guns that cannot be detected by metal detectors or X-ray machines. Adversaries of the bill point out the obvious flaw that people could print guns with detachable metal parts [20]. The US has failed to take effective national action in addressing the manufacturing of guns using 3D printers. Only a few state and local governments have taken any steps toward regulation. In 2013, in a pre-emptive measure, Philadelphia became the first US city to ban owning or making 3D printed guns. New York, Washington DC, and California have all attempted and failed to pass legislation banning the manufacturing or ownership of 3D printed guns [21]. In California, one does have to register a 3D gun, though [22]. The UK has taken a stronger approach by implementing strict regulations. In 2013, it passed legislation prohibiting the sale, possession and manufacture of 3D printed guns, with a maximum punishment of 10 years in prison [23]. In Japan, a country with strict anti-firearm policies, a man was arrested and sentenced to two years in federal prison after he posted videos on YouTube of a 3D printed firearm test-firing blank cartridges [24].

- Australia, a country that saw major gun law reforms in 1996, has taken advanced steps in addressing the 3D printed gun issue [25]. In 2013, the New South Wales Police created a 3D printed gun at a cost of $35 for materials with a $1700 printer using files downloaded from the internet [26]. As a result of the experiment, Australia has taken a firm stance against using 3D printers to manufacture guns. In 2015, the New South Wales Parliament approved the Firearms and Weapons Prohibition Legislation Amendment Bill which states, “A person must not possess a digital blueprint for the manufacture of a firearm on a 3D printer or on an electronic milling machine,” and possession of such blueprints is an offense punishable by a maximum penalty of 14 years in prison [27].
- A more robust approach was taken by Thailand in February 2016, when its government approved legislation stipulating that all imported 3D printing machines should be registered. Registration would also apply when ownership of the machine was transferred [28]. Critics believe this move will drive up the price of the machines and hamstring development in the industry [29]. Significant regulation and restriction on the use of consumer 3D printing machines could help to control the production, possession, and use of 3D firearms. Nevertheless, there is a significant risk that 3D printing will widen the economic gap between developing and developed countries because it is such fast-moving technology.
- In the private sector, Danish company Create It Real has developed smart 3D printer software that analyses the characteristics of the intended product, using their own database of firearm characteristics. If there is a match, the 3D printer will not print the part. While this is an intelligent way to tackle the problem, it is simply a failsafe to prevent children accidentally printing a firearm at home [30]. There are also means of bypassing the software and of modifying parts of the firearm to avoid

detection, in addition to the software being expensive [31].

United Nations Discussions

3D printed firearms were discussed in detail at the United Nations Second Meeting of Governmental Experts (MGE2) of the Programme of Action on Small Arms and Light Weapons in June 2015. It was noted that new technologies such as laser marking and micro-stamping, in conjunction with traditional marking methods, could help to uniquely identify these firearms and neutralize the threats they pose. UN High Representative for Disarmament Affairs Izumi Nakamitsu said in a 2017 address to the Security Council that policies must continue to update in order to keep up with new technologies like "unmanned aerial vehicles, 3D printers, and [sic] the so-called dark web [32]." These updates would hopefully bring 3D printed firearms in line with the International Tracing Instrument (ITI), which calls for each Member State to provide a unique mark to identify the manufacturer, the country of manufacture, and a serial number at the time of manufacture of each small arm or light weapon. An alternative proposal was that all manufacturers could insert a metal tag or plate in the polymer frame [33]. The Chair's summary at MGE2 concluded that the lack of affordable and available machines for producing reliable firearms gives some time for policy solutions [34].

3D printing was further discussed during the Sixth Biennial Meeting of States on the Programme of Action (BMS6) in July 2016. The resulting report echoed that of MGE2, stating, "States [should] undertake to apply the commitments of the International Tracing Instrument to all small arms and light weapons, regardless of the methods of manufacture, including three-dimensional printing [35]."

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Conclusion

The legislation currently in place to curb the dissemination of 3D printed firearms is unlikely to prevent their ever-growing production and possession. Criminals have figured out how to remove ITI-compliant markings, rendering them effectively useless in many cases [36]. The majority of the incidents in which 3D guns have come to the

attention of the police at a national level are either through blatant public use of the weapons—as was the case in the aforementioned incident regarding the YouTube video in Japan—or through unrelated police investigations that happened to stumble upon the illegal use of 3D printed firearms, as occurred in the United States in May 2015 and Australia in 2016 [37][38].

Not only can the markings on a 3D firearm be removed, but the polymer can more easily be destroyed entirely, leaving no trace at all [39]. Furthermore, the cost of laser marking is relatively high and could subject developing countries to higher hurdles than developed countries when trying to implement ITIs [40]. All of these are salient problems facing the international community as 3D printing technology only improves, and criminals looking to subvert regulations only get craftier.

It is important to remember that 3D printing technology as a whole is not to blame here, as it is also aiding in many humanitarian efforts, such as social sustainability in developing countries through the production of medical appliance components, prosthetic limbs, and housing projects. The use for civilian benefit gives incentives to try to find a middle path between open access to and complete prohibition of the technology.

Though MGE2 concluded that the issue of 3D printed weapons is not yet public enemy number one, we don't have much time. Copycat weapons such as the *Lulz Liberator* are being created at a cost of $25 for materials using a $1,725 3D printer. Given that basic 3D printers were created from recycled e-waste as early as November 2013, it doesn't require much imagination to think that they will soon be accessible to consumers. Recent trends of movie piracy have indicated that the spread of the blueprints will probably be far-reaching, one of the only means of significantly preventing the production of 3D firearms is to proactively develop counter-technology. Also, legislative bodies must keep up with the times and look toward the future to protect the public from the dangers of illegally printed firearms.

Recommendations

Restriction of 3D firearms requires a multi-pronged approach.

1. Industry experts need to be involved in sharing information, educating Member States and the public, and also developing means of tagging and tracing 3D firearms.

2. There should be a communal approach in favor of criminalizing the production, possession and use of 3D firearms. Legislation should go further, as it has done in Australia, to make it an offense to even download blueprints for 3D firearms.

3. Member States need to specifically target areas of the problem without significant side effects, such as hindering the economic growth of developing countries. One such example is that of the 3D printing company in Denmark that has developed software that compares the digital file requested by a consumer with a database of digital files of 3D firearms.

Endnotes

[1] https://www.3dsystems.com/our-story

[2] Dan Murphy, “This robot is learning how to print a human organ“, 2017, CNBC. Retrieved on 14 August 2017, from:http://www.cnbc.com/2017/06/23/advanced-solutions-develops-first-3d-human-tissue-printer-that-operates-on-six-axis-robot.html

[3] Emilie Chalcraft, "In the future we might print not only buildings, but entire urban sections", 2017, Dezeen. Retrieved on 14 August 2017, from: https://www.dezeen.com/2013/05/21/3d-printing-architecture-print-shift/

[4] Ian Birrell, "3D-printed prosthetic limbs: the next revolution in medicine", 2017, the Guardian. Retrieved on July 27, 2017, from: https://www.theguardian.com/technology/2017/feb/19/3d-printed-prosthetic-limbs-revolution-in-medicine

[5] ARR Invest, "ARK Disrupt Issue 65: Bitcoin ETF, Deep Learning, 3D Printing, CRISPR", 2017, ARK Investment Management. Retrieved on July 27, 2017, from: https://ark-invest.com/research/ark-disrupt-issue-65

[6] Andrew Zaleski, “CODY WILSON WANTS TO DESTROY YOUR WORLD”, 2015, Wired, Retrieved on July 28, 2017, from: https://www.wired.com/2015/03/cody-wilson-wants-to-destroy-your-world/

[7] Andy Greenberg, “3D-Printed Gun's Blueprints Downloaded 100,000 Times In Two Days (With Some Help From Kim Dotcom)”, 2017, the Guardian. Retrieved on July 28, 2017, from: https://www.forbes.com/sites/andygreenberg/2013/05/08/3d-printed-guns-blueprints-downloaded-100000-times-in-two-days-with-some-help-from-kim-dotcom/#4ada84e910b8

[8] Ibid

[9] Adam Popescu, “Cody Wilson: the man who wants Americans to print their own 3D guns”, 2017, the Guardian. Retrieved on July 28, 2017, from: https://www.theguardian.com/us-news/2016/jun/06/cody-wilson-3d-guns-printing-firearms-lower-receivers

[10] Sebastian Anthony, “The $25 Lulz Liberator: The first 3D-printed gun with a rifled barrel”, 2013, Extreme Tech. Retried on 14 August 2017 from: http://www.extremetech.com/extreme/156304-the-25-lulz-liberator-the-first-3d-printed-gun-with-a-rifled-barrel

[11] Andy Greenberg, “I Made an Untraceable AR-15 ‘Ghost Gun’ in My Office—and It Was Easy”, 2015, Wired. Retrieved on 14 August 2017 from: https://www.wired.com/2015/06/i-made-an-untraceable-ar-15-ghost-gun/

[12] Simon Murphy, “How Mail On Sunday 'printed' first plastic gun in UK using a 3D printer- and then took it on board Eurostar without being stopped in security scandal”, 2013, Mail on Sunday. Retrieved on 14 August 2017 from: http://www.dailymail.co.uk/news/article-2323158/How-Mail-On-Sunday-printed-plastic-gun-UK--took-board-Eurostar-stopped-security-scandal.html#ixzz4sNv28DvO

[13] Haaretz, “Israeli TV Program Sneaks 3-D Printed Pistol Into Knesset Without Being Detected”, 2013, Haaretz. Retrieved on 14 August 2017 from: http://www.haaretz.com/israel-news/.premium-1.533753

[14] Jyrki Richt, “'Liberator' 3D-printed handgun fails after single shot in Finnish test”, 2013, YLE. Retrieved on 14 August 2017, from: https://yle.fi/uutiset/3-6643536

[15] Brian Krassenstein, “Two Year Sentence Handed Down to Yoshitomo Imura in Japanese 3D Printed Gun Case”, 2014, 3D Print. Retrieved on 14 August 2017, from: https://3dprint.com/20019/sentence-imura-3d-printed-gun/

[16] Simon Murphy, “How Mail On Sunday 'printed' first plastic gun in UK using a 3D printer- and then took it on board Eurostar without being stopped in security scandal”, 2013, Daily Mail. Retrieved on 14 August 2017, from: http://www.dailymail.co.uk/news/article-2323158/How-Mail-On-Sunday-printed-plastic-gun-UK--took-board-Eurostar-stopped-security-scandal.html

[17] Rowan Moore Gerety, “A 3-D printer made from trash: Togo’s answer to the developed world’s e-waste”, 2013, Medium. Retrieved on 14 August 2017, from:

https://medium.com/african-makers/a-3-d-printer-made-from-trash-togos-answer-to-the-developed-worlds-e-waste-1a9c664da5a

[18] "Homemade Guns: Are They Legal? Must They Be Registered?" *www.criminaldefenselawyer.com*. N.p., n.d. Web. 28 July 2017. http://www.easybib.com/cite/view#

[19] Charles Arthur, "3D-printed guns: expert warns of threat to user" 2017, the Guardian. Retrieved on July 28, 2017 from: https://www.theguardian.com/technology/2013/may/09/3d-printed-guns-user https://www.theguardian.com/technology/2013/may/09/3d-printed-guns-user

[20]http://www.nbcnews.com/news/other/senate-extends-ban-undetectable-guns-nixes-tighter-restrictions-f2D11717122

[21] Alexis Kleinman "Philadelphia Is The First U.S. City To Ban 3D-Printed Guns." The Huffington Post. TheHuffingtonPost.com, 26 Nov. 2013. Web. 28 July 2017.

[22] https://www.pcmag.com/news/346460/california-to-require-registration-of-3d-printed-guns

[23] http://www.reuters.com/article/us-britain-guns-idUSBRE9B40OV20131205

[24]http://www.telegraph.co.uk/technology/news/11187481/Japanese-man-becomes-first-person-to-be-jailed-for-making-gun-with-3D-printer.html

[25] Melissa Davey "https://www.theguardian.com/world/2016/jun/23/australias-gun-laws-stopped-mass-shootings-and-reduced-homicides-study-finds" , 2016, The Guardian. Retrieved on 14 August 2017.

[26]http://www.huffingtonpost.com.au/2015/11/19/nsw-tightens-3d-printed-gun-legislation-as-expert-warns-theyre/

[27]http://www.legislation.nsw.gov.au/bills/5bb4f02b-1f1e-48b2-aa93-955574e699f6

[28]Limited, Bangkok Post Public Company. "Regulation Hits 3D Printers."Http://www.bangkokpost.com. N.p., n.d. Web. 28 July 2017.

[29] Ibid

[30] John Biggs, "Danish Company Creates Software That Will Stop You From Printing A Gun", 2013, Tech Crunch. Retrieved on 14 August 2017, from: https://techcrunch.com/2013/06/26/danish-company-creates-software-that-will-stop-you-from-printing-a-gun

[31]Michael Molitch-Hou, "Create it REAL Stops 3DP GUns becoming Real", 2013, 3D Printing Industry. Retrieved on 14 August 2017 https://3dprintingindustry.com/news/create-it-real-stops-3dp-guns-from-becoming-real-13765/

[32]"3D Printing, UAVs, and Dark Web Could Give Terrorists Access to WMDs, Says UN Official." *3ders.Org*, June 2017,www.3ders.org/articles/20170629-3d-printing-uavs-and-dark-web-could-give-terrorists-access-to-wmds-says-un-official.html.

[33]https://s3.amazonaws.com/unoda-web/wp-content/uploads/2015/03/2015-06-17-Chairs_Summary-MGE2.pdf

[34]United Nations Office for Disarmament Affairs (UNODA), Chair's Summary: Programme of Action on Small Arms and Light Weapons Second Open-ended Meeting of Governmental Experts 2015, Retrieved on July 27, 2017, from: https://s3.amazonaws.com/unoda-web/wp-content/uploads/2015/03/2015-06-17-Chairs_Summary-MGE2.pdf

[35]https://s3.amazonaws.com/unoda-web/wp-content/uploads/2016/04/N1617624_English.pdf

[36] Ibid

[37]John Hornick, "3D Printing New Kinds of Crime,"
http://www.policechiefmagazine.org/3d-printing-new-kinds-of-crime/

[38]Thomas Birtchnell, "How Real Is The Risk Of 3D Printed Guns In Australia?" *Gizmodo Australia*, Gizmodo Australia, 30 Nov. 2016, www.gizmodo.com.au/2016/11/how-real-is-the-risk-of-3d-printed-guns-in-australia/

[39]Gerald Walther, "Printing Insecurity? The Security Implications of 3D Printing of Weapons," 2014.
https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4656707/"

[40]https://spie.org/membership/spie-professional-magazine/sustainable-lasers-in-africa