The Rise of 3D Printed Firearms and its Disruption of Legal Frameworks through the Case of Defense Distributed

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On my honor as a University Student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments

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Introduction

In 2019, Luigi Mangione was arrested in New Jersey for possessing a cache of untraceable, 3D-printed firearms—commonly known as "ghost guns." His case made headlines, not just for the weapons themselves, but for what they symbolized: the collapse of a long-standing barrier between theoretical design and physical production. Traditionally, what separated an individual hobbyist or designer from a major corporation wasn't creativity or intelligence, it was the ability to actually build complex products. Manufacturing, especially advanced designs, has historically required expensive tools, specialized knowledge, and access to industrial infrastructure. Subtractive manufacturing—machining components by cutting away from solid blocks of material—dominated the field for decades, particularly with metals. But the rise of plastics and additive manufacturing, or 3D printing, changed that landscape. Now, anyone with a digital model and a relatively cheap printer can build intricate components by layering melted material into nearly any shape, collapsing the distance between idea and reality.

3D printing has democratized manufacturing, making it possible for individuals to produce complex objects from their homes—both for innovation and, increasingly, for misuse. As the technology has advanced, printers have become more affordable and accessible, empowering everyday users to design and build items once limited to industrial settings. While this has accelerated breakthroughs in fields like aerospace, healthcare, and consumer products, it has also exposed gaps in regulatory oversight—particularly around firearms. In 1988, the Undetectable Firearms Act made it illegal to manufacture, sell, possess, and/or firearms that could bypass metal detectors (18 USC § 922(p)). Despite the legal framework controlling registration, tracking, and production of firearms in United States, it remains unequipped for 3D printed plastic weaponry. These weapons can be designed with just enough metal to technically

comply with the law while still evading its intent, revealing a troubling loophole in how we govern emerging technologies.

It is of utmost importance that society develops regulations and legislation for novel technologies. However, I aim to develop solutions capable of curbing technological misuse without stifling the development of further positive applications of additive manufacturing. It is best approached through a theoretical framework–technological politics. Coined by Langdon Winner, the theory views technology itself as political. Society has already come to deem guns as a political tool, but not the manufacturers. 3D printed weaponry cannot follow that same assumption and requires a deeper analysis into how the accessibility of manufacturing and the subsequent societal response shape technology and the political landscape that nourishes it. Governments and institutions currently face the changing landscape where additive manufacturing shifts the balance of power between themselves and the people.

Defense Distributed

Defense Distributed, a company founded by Cody Wilson, a former Texas law student, serves as the most notable example of the creation of dangerous 3D printed weaponry. In 2012, Cody Wilson established Defense Distributed with the explicit goal of making firearm blueprints accessible to the public. Defense Distributed operated under the philosophy that the right to bear arms should include the right to manufacture them without government oversight. Facilitating their philosophy, Wilson and his team developed DEFCAD, an online platform designed to host and share 3D-printed gun files with the public.

The company's first release that rattled the cages of the legal system came with their release of a 3D printable AR-15 standard capacity magazine in January 2013 (Daly 2017). Their

most notable creation, however, was the development of the blueprint for the "Liberator". A plastic 3D printed gun which came about thanks to crowdfunding, in May 2013, a fully functional 3D printable pistol shocked the country into realizing that this as a potential problem (Daly 2016). Upon the release of the Liberator, the Directorate of Defense Trade Controls (DDTC) deemed the release of weapon blueprint a violation of International Traffic in Arms Regulations (ITAR). It was stated that releasing files across the internet requires authorization since it constitutes as an "export" of Defense Articles (Doherty 2015). Initially, Defense Distributed complied with the cease and desist, but the government had no control over files already spreading throughout the internet. The Undetectable Firearms Act of 1988 requires any weapon to have a metal component and the Liberator required a metal firing pin. Additionally, homemade guns lacking serial/tracking numbers are unbound by the law unless there is intent to sell or distribute. The weapon itself bypassed most laws with the intent to restrict it because of the widespread accessibility of 3D printers and an internet connection.

While the legality of guns amongst civilians is a debatable topic, its position in society has maintained a relatively stable status quo. The Liberator's disruption of that status quo speaks to its political influence due to the government crackdown it received. Although in its infancy, 3D printing weaponry was brought to an immediate halt by the executive. The methods and reasoning used to enforce the cease and desist illustrate the lack of regulatory consideration for this technology. ITAR was a hasty response as it was deemed to closest regulation to fit.

Evolving Lawsuits

ITAR was effectively a threat backed by the fear of government imposition. Since legal action was only threatened, Cody Wilson concluded that "their [State Department] intention is not to ever move and hope this all goes away" (Doherty 2015, pg. 1). This realization was made

after 2 years of confusing bureaucracy following Defense Distributed's removal of the Liberator from their website. In 2015, Defense Distributed, backed by the Second Amendment Foundation (SAF), sued the United States Government. On the grounds of the 1st and 2nd Amendment infringement, Cody Wilson and his lawyers fought for the possibility of an injunction. They believed that the "State Department [was] acting beyond its delegated authority" with their ITAR threats and the freedom of speech and bear arms would serve as a secondary reinforcement to their case (Doherty 2015, pg. 1). In August of 2015, the motion was denied by US District Court Judge Robert Pitman. A major factor influencing Judge Pitman's decision was that it took 2 years for Defense Distributed to file an injunction. If their purpose was the protection of their rights, a visible lack of urgency weakened their case.

Later, Defense Distributed took their request for an injunction to the 5th Circuit Court of Appeals. In 2016, The Court upheld the prior decision and supported the State Department's claim to risk of national security. Specifically, the court weighed the *potential* of national security risk surrounding distribution of weapons manufacturing knowledge against the *possibility* that Defense Distributed's constitutional rights were being harmed. Such highly speculative wording within their decisions is further explained by the fact that this was "not a ruling about an underlying case". Instead, the State Department is being given a deferral until the "underlying arguments are fought over" (Shackford 2016, pg. 1). One of the 3 judges dissented, Judge Edith Jones, as she brought about concerns with the State Department's potential overreach in censorship. Her dissention claimed that the "vague invocation of national security interests" fails to honestly address First Amendment protections. She speaks to the novelty of the current target and worries about what the precedent will be to future targets such as drones, cybersecurity, etc. This case aimed the focus more towards 1st amendment rights and censorship

and shifted away from the 2nd amendment. The uncertainty of the case largely comes from the fact that sharing "technical data" is basically free speech. Teaching or spreading information in relation to technical education can be classified as "export" and violate ITAR depending on the severity of its impact, which is entirely determined by the State Department. Simply put, the case's trajectory was determined by the fact that a civil right was weighed against a potential threat to national security, where national security always wins. This sets a worrisome precedent that makes people unsure to what extent the government can extend its hand of censorship as long as the grounds are a claim towards national defense.

The distinction between free speech and national security is often ambiguous—less a clearly defined boundary and more a shifting line drawn based on precedent, rather than future possibility. The emergence of 3D-printed firearms challenged this boundary, forcing the government to rapidly determine whether this new capability fell under its jurisdiction. In doing so, the response became a clear case of technological politics: rather than treating the technology as neutral, the government's actions revealed an underlying intent to assert control over its direction and accessibility. These hastily formed decisions, driven by immediate risk rather than a long-term regulatory vision, further politicized the issue and stifled the potential for constructive collaboration between policymakers and the scientific community. Without a legal framework equipped to engage with such technological shifts, courts tend to get caught in semantic disputes—debating the classification of "technical data" or what qualifies as an "export"—instead of addressing the broader societal implications. In the end, the outcome risks favoring one of two positions: expanded state authority framed as security, or unrestricted dissemination framed as liberty. Both reflect not just legal arguments, but competing political visions of how technology should be governed.

Although the courts continually rejected Cody Wilson's appeals, the situation changed after the Directorate of Defense Trade Controls finally reached a settlement (DDTC) with Defense Distributed. For a fee of $39,510, Defense Distributed was allowed a license to publish their files freely in July of 2018. After years of legal struggle, the State Department seemed to change their tune, likely because the files were already circulating the internet following their initial release and policing them would do not good at this point. As per the original threat of ITAR, the settlement was made possibly due to a change in underlying export control reform within the United States Munitions List (USML). The State Department modified many of its export control rules for firearms under .50 caliber and subsequently shifted that regulation to the Department of Commerce, which can't police technical data (Greenberg 2018). Interestingly enough, the modification to the export control reform were stated to be "temporary modifications". There are numerous reasons that could explain the surprising settlement. Many of which are rooted in the change of administration in 2018. President Donald Trump and the NRA at the time did not believe that 3D printed plastic guns were a threat to public safety. In the technology's current state, the NRA believes that the costs and efforts to build these weapons are too much of a barrier be dangerous. (Krouse 2018). Additionally, plastic weapons are still required to have metal components to be legal according to the 1988 Undetectable Firearms Act. The State Department's spokesperson, Heather Nauert, stated that they were told by the Department of Justice that they "would have likely lost the case in court, based on First Amendment grounds." The original grounds of ITAR were more worried about foreign access to US defense technology, but the State Department is letting it go to a domestic gun control issue (Shesgreen 2018, pg. 1).

The reaction to the settlement was substantial at the state-level, where states like Pennsylvania and New Jersey immediately filed lawsuits against Defense Distributed. These lawsuits did successfully force Defense Distributed to temporarily prevent access to their files within those states. Many states also filed a suit against the State Department and DDTC regarding their modification to the USML. They argued that the DDTC failed to follow appropriate administrative procedure when changing the USML while failing to consider the public safety risks of their actions. In dealing with this legal triangle, the courts found merit in arguments from all sides. Firstly, the states had sufficient merit to sue the government for its temporary modifications to the USML as they violated the Administrative Procedure Act (APA). This agreement pushed the Washington court to grant an injunction that barred the government from implementing or enforcing said modifications. Although, those modifications allowed for Defense Distributed to resume their file uploads after the settlement. However, the court did believe that the Defense Distributed reserved their First Amendment right to distribute despite the hardships the injunction upon the government might impose. But the internet release of such files did still pose a substantial harm to the states' public safety. The culmination of the litigation in August 2018 prevented Defense Distributed from making its files open to the internet, but only under "export" conditions. The company is still within their rights to provide their files to individuals classified as "US Persons" within the country (Foster).

Aftermath

After their battle with the State Department came to a close, Defense Distributed maintained their business but under a modified business model. It turned into gun safety issue at the state level, as per a larger nationwide battle against "ghost guns." Ghost guns are legal firearms that are unserialized (making them untraceable) that are purchased as components and

assembled afterwards. Many believe that gun laws haven't matured enough to effectively curb the threat of untraceable firearms and the fear of it only worsens when provided the added ease of homemade production through 3D printing. The technology itself proved substantially disruptive to existing policy-making efforts, which caused the government to blow the national security whistle to restrict Defense Distributed for as long as they did. The lack of legal precedent and subsequent legal considerations within policy made for an unsteady case that eventually returned Defense Distributed to near complete operation after 2018. Cody Wilson himself, however, wound up in personal legal trouble later in 2018 when he was arrested in Taiwan for sexually assaulting a 16 year old girl. After pleading guilty, he went on to serve probation as a registered sex offender and needed to step down from the company, but he did eventually return (Fernandez 2019). After the State Department was instructed to throw in the towel and settle, the states themselves found much greater success in tackling the issue from a public safety standpoint. Separate from the Defense Distributed case, the 115th Congress did introduce a bill intent on making it "unlawful for any person to 'intentionally publish, over the Internet or by means of the World Wide Web, digital instructions… or other code that can automatically program' a 3D printer or similar device to produce or complete a firearm." Of course, First Amendment concerns make this legislation difficult to function, as seen with the Defense Distributed case, but the bill did have provisions aimed at making distinctions to untangle the issue. Whether this would eventually stand in court or not is a mystery since no further action was taken on the bill (Foster 2018, pg. 3-4).

Issues with Defense Distributed had not been settled yet, however. After a series of suits from multiple states against the State Department for its changes to the USML, they had won out when a federal judge granted a preliminary injunction in 2020. By stopping the USML rule

changes taking effect, US District Judge Richard A. Jones left the outcome to be decided by a lawsuit being led by the state of Washington (Brown 2020). On January 11, 2021, The 22 state lawsuits led to the Ninth Circuit Court eventually overturning Judge Jones' injunction with the conclusion that the courts "lacked authority to review the challenged rule changes." The 1976 International Security Assistance and Arms Export Control Act (and its later amendments) forbade judicial review of the State Department's decisions. One of dissenting opinions' primary points was about the oddity of the State Department "suddenly and secretly changed course" about 3D printed guns. From 2013 to 2018, they were fairly successful in the courts when enforcing their export control regulations, but then suddenly decided to permit the export of such files. Following this decision, the Biden administration did announce that the Justice Department would propose new rules restricting untraceable 3D printed firearms within a month (Iovino 2021, pg. 1).

The Biden administration did continue to tighten restrictions aimed that ghost guns and 3D printed weaponry over the next few years. In 2022, they announced a new regulation that definitionally placed 3D printed guns and assembly kits to be the same as traditional firearms. This forces ghost gun assembly kits to include serial numbers, which aims to improve traceability of these weapons and will branch out to be more considerate of 3D printer parts (Watson 2022). President Biden also introduced his new nominee to head the Bureau of Alcohol, Tobacco, Firearms and Explosives (ATF). In 2022, the ATF implemented more rules which required manufacturers of firearm kits to conduct background checks and add serial numbers. This was an effort to further increase the legislative similarity between ghost guns and traditional ones. These regulations alongside others faced legal pushbacks in lower courts and there are still ongoing legal debates (Figueroa 2024).

Due to federal laws remaining somewhat vague around regulating 3D printed weaponry, the closest they can come is by regulating them as similarly to traditional weapons as possible. As a response, individual states have taken up the challenge more strictly. For example, California has specifically banned the usage of a "three-dimensional printer to manufacture any firearm, including a frame or receiver, or any firearm precursor part, unless that person, firm, or corporation is licensed." Other states such as New Jersey, Massachusetts, and Rhode Island have taken equally robust legislation around the plastics and materials that make up these weapons, which is effectively acts as a ban all together in practice. All in all, around 15 states have laws that regulate 3D printed guns specifically. 8 of those states, in addition to 2 more not in the 15, have some form of ghost gun bans. Recent data also showing how ghost guns and specifically 3D printed guns are shifting to becoming a more noticeable concern. According to the ATF, between 2017 and 2021 law enforcement agencies had recovered a suspected 38,000 ghost guns. The first 6 months of 2023 saw 108 3D printed guns in arrest statistics alone (Listek 2023, pg. 1). There are significant limits to any possible regulation surrounding 3D printed weapons, mainly because of the legal position that traditional firearms hold at the federal level. This has pushed states to make significant strides on their own, legal battles are still on going and the public interest in the topic will only increase the utilization of 3D printing technology for weapons manufacturing.

Future Potential

The path forward for regulating ghost guns (and 3D-printed weaponry more broadly) is deeply unstable, shaped not only by technological advancement but by polarized political agendas. At the federal level, progress is inconsistent, with no clear legislative timeline or consensus in sight. What brought this issue to national prominence was not simply a surge in

homemade firearms, but the disruptive convergence of additive manufacturing and open-source ideology, epitomized by Defense Distributed. Their years-long legal standoff with the State Department highlighted a central truth: the U.S. legal system was—and remains—unprepared for the political consequences of decentralized manufacturing.

It is tempting to view 3D printers as neutral tools, and the weapons they produce as a matter of user responsibility. But Winner's theory of technological politics challenges this separation. Technologies are not passive artifacts; they are embedded with political properties. Inherent politics emerge when a technology's very structure or operation requires certain social or institutional arrangements. 3D printing, for example, inherently decentralizes production and bypasses traditional systems of oversight—undermining the regulatory authority long held by governments, licensed manufacturers, and even advocacy groups like the NRA, which favors conventional arms markets. This is not merely a question of what 3D printers can do, but what their widespread availability enables: a shift in power from centralized institutions to autonomous individuals.

More urgent, however, are the use politics of this technology and how it has been deployed to intentionally subvert established legal and political structures. Defense Distributed did not merely invent a novel firearm; they published blueprints explicitly to challenge export laws, test the limits of free speech, and provoke federal regulation. Their actions revealed how 3D-printed guns are not just weapons, but political instruments wielded to push constitutional boundaries. This intentional blurring of technical innovation and legal resistance transforms the 3D printer from a maker's tool into a site of political contest.

As the legal battles unfolded, the State Department's censorship was justified under the banner of national security—yet courts struggled to reconcile the First Amendment implications

of restricting the spread of digital files. Unlike traditional gun control, which typically invokes Second Amendment debates, this case centered on information as a form of power, and the state's authority to suppress it. The law's outdated framing of "technical data" and "exports" failed to capture the reality that once files are online, they are nearly impossible to control. The genie, as many noted, was already out of the bottle.

These developments have also forced existing institutions into a reactive posture. The federal government, once dismissive of the scale of the threat, now finds itself racing to adapt, while traditional manufacturers face competition from hobbyists capable of producing functional firearms without serial numbers or supply chains. Even the NRA is caught in a bind: supportive of gun rights in principle, but wary of technologies that threaten to destabilize the formal gun economy they help protect. In this way, 3D-printed weaponry exposes and reconfigures existing relationships of power between the state, corporations, advocacy groups, and citizens.

Conclusion

The problem remains unresolved, and the political trajectory of 3D-printed weaponry continues to evolve under active socio-technical shaping. Public awareness is growing, driven in part by real-world incidents like the Luigi Mangione shooting—an event that brought the issue out of courtrooms and into mainstream headlines. Now that the political implications of 3D printing have become tangible, surveillance and regulatory scrutiny are increasing. Yet while governments may be more alert, they are still grappling with the fact that the technology itself is not going away.

The reality is that 3D printing, like other decentralized digital technologies, will continue to grow in power and accessibility. As Winner suggests, we must move beyond reactive legal

strategies and confront the political nature of artifacts themselves. The goal is not simply to ban or permit technologies, but to understand how they reorganize power, challenge authority, and reshape society. Whether or not 3D-printed guns should be legal is a separate question. What matters here is recognizing that when technology redefines who holds the power to produce, regulate, and resist, the law must be prepared to respond—not just with policy, but with a deep awareness of the political structures embedded in the technologies themselves.

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