3D-Printed Guns: Keeping New Zealanders out of the Firing Line

1. Introduction

New Zealand is reasonably safe. We feel secure knowing that only 1.4% of our crime involves firearms.[1] However, the rise of 3D-printing risks this safety by rendering our gun restrictions no longer so restrictive. Already our gangs, premeditated criminals, and high risk individuals are able to print plastic pistols at home. Give this technology a few years and these firearms and accessories will only become cheaper and more deadly. New Zealand legislators need to bite the bullet now before the situation gets out of hand.

2. Locked and Loaded: The viability of 3D-printed guns now and in the near future

In 2013 organisation Defence Distributed[2] released the world's first working 3D-printed pistol CAD file[3], entitled the "Liberator"[4] (named after weapons airdropped to French and Chinese rebels during World War Two[5]). This firearm was entirely 3D-printed aside from the firing pin, which was a normal at-home nail[6]; it has become the central example of a 3D-printed gun. The CAD files were online for 2 days before a United States court ordered it down, but it had 100,000 downloads in that short time.[7] Since then, a man has received a two year prison sentence in Japan for printing the guns in 2014, and in 2016 Australian police discovered a sophisticated 3D-printed gun facility.[8]

There have been no instances of violent crime involving a 3- printed firearm reported anywhere in the world[9], as they remain low in reliability and quality. Firing a Liberator bullet

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[1] Megan Sutherland "Police concerned over gun discoveries following incidents in South Canterbury" (30 June 2017) Stuff.co.nz <www.stuff.co.nz.>.
[2] An organisation that designs 3D-printed guns within US laws, apparently "in the public interests". See Defence Distributed <www.defdist.org>.
[3] CAD stands for computer aided design. These files are the most commonly used files from which an object can be 3D printed. See Autodesk "CAD Software| 2D and 3D Computer-Aided Design" <www.autodesk.co.nz>
[4] Tyler Koslow "2018 3D Printed Gun Report = All You Need To Know" (1 August 2018) All3DP <www.all3dp.com>.
[5] Danton Bryans "Unlocked and Loaded: Government Censorship of 3D-Printed Firearms and a Proposal for more Reasonable Regulation of 3D-Printed Goods" (2015) 90 IndLJ 901.
[6] lawless.tech Editorial Board "Lock, Stock and a Printed Barrel: Legal Adventures of DIY Firearms" (5 September 2018) lawless.tech <www.lawless.tech>.
[7] Andy Greenberg "3D-Printed Gun's Blueprints Downloaded 100,000 Times In Two Days (With Some Help From Kim Dotcom)" (8 May 2013) Forbes <www.forbes.com>.
[8] Koslow, above n 3.
[9] Koslow, above n 3.

takes 21,500psi[10], whilst the strongest plastic at-home 3D printers use only handles 5800 psi.[11] Police in New South Wales printed their own Liberator in 2013 on a cheap printer and found that the firearm successfully fired a bullet, but shattered in the process.[12] Since then, 3D-printing technology has hardly advanced in terms of strength[13], meaning printed firearms are unappealing to potential criminals for now.

However, the general consensus is that with recent advancements in printers and the upcoming viability of printing with stronger resins[14] flawless plastic firearms will become part of mainstream crime in the near future.[15] They are also becoming cheaper and more accessible, with the original Liberator printer's price dropping by 80% over the last five years[16].

There are three main concerns with the Liberator and its inevitable successors. The first is the ability for criminal organisations to stockpile weapons without any risk of alerting authorities. The next is the ability to sneak plastic firearms through metal detectors into secured areas, such as courts and airports. The last is the terrifying new ease of obtaining a firearm privately in one's own home, raising additional concerns around domestic violence.

3. Safety Locks: Current gun regulations in New Zealand

New Zealand's current firearms regulations come largely from the Arms Act 1983 and the Arms Regulations 1992. The Aramoana massacre was the last time our regulations had any meaningful change[17]; before the threat of 3D-printing emerged. These regulations have worked until now, with firearm deaths in New Zealand decreasing over the last 20 years.[18]

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[10] 'psi' is Pounds per Square Inch, a common unit for pressure. See Anne Marie Helmenstine "What is PSI? – Definition of Unit" (24 July 2017) ThoughtCo. <www.thoughtco.com>.
[11] Luke Appleby "You can now 3D-print a DIY pistol in New Zealand for just a few hundred dollars- should we be worried?" (3 September 2018) TVNZ <www.tvnz.co.nz>.
[12] Koslow, above n 3.
[13] Appleby, above n 10.
[14] Appleby, above n 10.
[15] Jessica Berkowitz "Computer-Aided Destruction: Regulating 3D-Printed Firearms Without Infringing on Individual Liberties" (2018) 33 BTLJ 53 at 54; Katie Fleschner McMullen "Worlds Collide When 3D Printers reach the Public = Modeling a Digital Gun Control Law After the Digital Millennium Copyright Act" (2014) 2014 MichStLRev 187 at 189; and Charlie Osborne "Guns are already on UK Streets. 3D printing could make things far worse" (21 August 2018) ZDNet <www.zdnet.com>.
[16] Appleby, above n 10.
[17] Kelly Buchanan "Firearms – Control Legislation and Policy: New Zealand" (14 October 2015) Law Library of Congress <www.loc.gov>.
[18] Buchanan, above n 15.

3D-printed firearms easily fall under the Act's "anything from which any shot, bullet, missile, or other projectile can be discharged by force of explosive" definition of a firearm.[19] It is currently illegal for anyone to possess a firearm without a license.[20] However, a licensed person is able to legally obtain as many firearms as they like (barring certain categories) without registration. Dealers must be licensed to sell or manufacture for sale any firearm.[21]

There are additional restrictions on pistols, which includes the Liberator. License holders need another endorsement to own pistols[22], require a permit to procure any, and must provide the police the details of the particular pistol they want. [23]

All guns have minimum storage standards, but police only check these once every 10 years.[24] This has contributed to the recent unease within New Zealand police towards our firearm regulation, describing it as "possibly the most concerning issue facing policing in New Zealand in 2017".[25] An increased threats of 3D-printed guns may be enough to force police to arm themselves on duty, and the increased number of guns in a society leads to increased gun-related deaths.[26]

4. Shooting Ourselves in the Foot: How 3D-printing guns bypass our regulations

Our legislation almost entirely covers the ownership of 3D-printed guns without a license. However, with the new aforementioned three threats of 3D-printed firearms (stockpiling guns, their undetectable nature and ability to be obtained easily at home), we need to consider further pre-emptive regulations to cover these problems.

The first is a hole in the Arms Act. As stated, section 6 of the Arms Act only requires those manufacturing firearms **for sale** to get a dealer's license.[27] This means that firearms license holder may legally manufacture and stockpile as many firearms as they like in their own home, with no chance to raise police suspicion. This does not apply to pistols, such as the

[19] Arms Act 1983, s 2.
[20] Section 20.
[21] Section 5.
[22] Section 29.
[23] Arms Regulations 1992, reg. 24.
[24] Dave Nicoll "Police Association president says gun laws need tightening" (30 June 2017) Stuff.co.nz <www.stuff.co.nz>.
[25] Sutherland "Police concerned about gun discoveries following incidents in South Canterbury", above n 1.
[26] German Lopez "The battle to stop 3D printed guns, explained" (27 August 2018) Vox Media <www.vox.com>.
[27] Section 5.

Liberator, as a permit is required for each one procured. There are currently no CAD files modelling functioning firearms that are not pistols, but this will come with increasingly viable 3D-printed firearms. It is unlikely that legislators intended to allow this, but such easy, inexpensive firearms where unimagined in 1989.

There are also discussions surrounding whether our law currently prohibits downloading CAD gun files. New Zealand firearms lawyer Nicholas Taylor has acknowledged that the courts may find section 16 of the Arms Act, prohibiting importation of guns or their parts, covers this downloading as well.[28] This would require the courts to find 'import' includes downloading and 'part' includes the CAD files, which Mr Taylor believes would never happen. I am inclined to agree. The only instance of an 'import' including downloading in New Zealand is in the Customs and Excise Act 1996. There it explicitly states that importation "includes the arrival of the electronic publication… by transmission by any means"[29], and this definition exclusively applies to that Act's section 54(1)(aa). Parliament makes it clear when they include 'download' as an importation, making the courts unlikely to stretch the definition of 'import' so far without such indication.

5. Pulling the Trigger: Finding regulations for 3D-printed firearms

New Zealand has a slim margin of time to regulate the threat of 3D-printed guns before they become fully viable. Many other countries have already taken regulatory measures to cover 3D-printed firearms. However, they are not all equal in practicality or projected effectiveness.

a. The United Kingdom and clarifying current legislation

The UK has similar gun legislation to New Zealand, requiring certificates rather than licenses.[30] However, the UK Home Office released a guide in 2016, in which it clarified that 3D-printed firearms absolutely fall within the Firearms Act's firearm definition.[31]

[28] Appleby, above n 10.
[29] Customs and Excise Act 1996, s 2.
[30] Firearms Act 1968 (UK), s 1.
[31] UK Home Office "Guide on Firearms Licensing Law" (April 2016) UK Government at [3.25] to [3.26].

Although this prevents confusion, this guide will not solve the outlined three new issues. The UK already has issues with illegal firearms[32] (like New Zealand[33]), and 3D-printing will exacerbate this. They will need to take further remedial action soon. Additionally, New Zealand regulators have already accepted that 3D-printed firearms are not exempt from current regulations.[34] This is no real solution for New Zealand as our threat is not whether current laws apply but that we cover new concerns.

b. The United States and file sharing

The US has, until one month ago, responded to the threat of 3D-printed firearms by preventing all CAD firearm model sharing. This was an urgent measure taken after the Defence Distributed release in 2013.[35] Defence Distributed argued through the US legal system that the Department of State was infringing on their 1st Amendment[36] right to freedom of speech, and were very recently found to be allowed to sell the CAD files online.[37] The focus on this case has only skewed analysis of regulations for 3D-printed guns, with most focussing on the legality of CAD file sharing over how to minimise the threat of these guns.[38] Whilst this debate has continued the CAD files have been shared all worldwide and are now easily found on thepiratebay.org, the deep web[39] and for sale on Defence Distributed's defcad.com.[40] The US's attempts to prevent these files becoming available have proven futile.

In theory, this solution would solve all three outlined problems with 3D-printed guns. If potential criminals cannot access the CAD files then they cannot produce firearms. However, while this solution may be effective, it curtailing file sharing has been proven by the film, music and publishing industries to be a Sisyphean task. As STEAMporio's[41]

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[32] Osborne, above n 14.
[33] Sutherland "Police concerned about gun discoveries following incidents in South Canterbury", above n 1.
[34] United States Constitution, Amendment 1 1791.
[35] Koslow, above n 3.
[36] Appleby, above n 10.
[37] Koslow, above n 3.
[38] Appleby, above n 10.
[39] Jon Stokes "The boring truth about 3-D printed guns" (8 August 2018) Los Angeles Times <www.latimes.com>.
[40] Defence Distributed <www.defcad.com>.
[41] A company providing 3D printers to schools. See Josh Hersh "This is how you 3D print a gun in your living room" (10 August 2018) Vice <www.video.vice.com>.

Alfredo Orejuela put it "to think that you can control or stop the flow of data on the internet, it's absolutely ludicrous."[42]

It is acknowledged that attempts to restrict CAD file sharing will at least increase the obscurity of 3D-printed firearms. This would particularly affect the volatile demographic of domestic abusers and mentally ill persons who may not sustain the motivation or desire to use the weapon long enough to locate the CAD files. However, the cost to New Zealand of trying to monitor the online file sharing community alone would likely be inordinate. Online monitoring schemes that achieve any level of success, such as child pornography measures, only succeed through international cooperation.[43] The U.S. seems set to allow the release of these files without any restraint, leaving New Zealand alone in our attempts. This makes any attempt to limit CAD files online costly, impractical and with relatively limited benefits.

c. The United States and the Undetectable Firearms Act

The US also relies on the Undetectable Firearms Act of 1988. This outlaws any gun that does not have at least 3.7 ounces (105 grams) of stainless steel in its construction so that the gun will be detected by a basic walk-through metal detector. [44] In contrast, the UK has no such law and reporters for the Daily Mail were able to easily and legally sneak a Liberator through metal detectors onto the Eurostar train from London to Paris in 2013, despite the UK Transport Department claiming "one of the strictest transport security regimes in the world".[45]

Outlawing undetectable "ghost guns" is a practical measure for New Zealand that could be implemented immediately. Without this law police can only take action to remove these guns within the tiny time window between sneaking the gun into a secured area and committing a heinous crime. Outlawing undetectable guns entirely will allow police to confiscate these weapons the moment they are found, no matter the circumstances. This is no perfect solution as this legislation would not solve the risk of criminals stockpiling

[42] Hersh, above n 39.
[43] Megan Levy "348 arrested in global child porn investigation" (15 November 2013) The Sydney Morning Herald <www.smh.com.au>.
[44] Undetectable Firearms Act 1988 (USA), section e (p)(2)(C)(i).
[45] Simon Murphy and Russell Myers "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" (12 May 2013) Daily Mail <www.dailymail.co.uk>.

guns or volatile situations in private homes. However, increasing the window before a crime is committed for police to discover and remove these gun will only increase public safety, so this regulation is not the whole solution, but it may be part of it.

d. Australia and illegal gun file possession

Regulators in New South Wales have chosen to limit 3D-printing gun by equating possession of the relevant CAD files with possession of a firearm- so even those with a firearms license may not download the files.[46] This is the most prominent example of regulations directly targeting 3D-printing guns in the Anglosphere.

However, in its specificity these regulations are overreaching and harsh. A prime example of this is the first and only person who has faced prosecution over this is Sicen Sun, a "silly, naïve 'fanboy'".[47] Sicen downloaded and printed models of guns featured in videogames for his cosplay[48] hobby, and was soon facing 14 years in prison. These guns could not be loaded or fired.[49] This case indicates that this legislation is overreaching, and sinks money into prosecuting acts that were never a safety concern. Neither is it particularly effective Sicen was only caught because he posted his replicas online to exhibit their craftsmanship.[50] Potential criminals would never disclose their possession so practically monitoring who has these files would be as difficult as monitoring possession of pirated films and music now.

e. Preventative software on 3D printers

Commentators on emerging technologies have discussed the possibily requiring all 3D printers sold tocontain a patch that recognises CAD gun files and does not print them.[51] Similar technology is used by Adobe Photoshop to recognise counterfeit currency.[52] 3D printer manufacturers seem likely to comply, as one manufacturer has already developed

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[46] Koslow, above n 3.
[47] Georgina Mitchell "'Silly, naïve': Fanboy faces jail over 3D-printed guns" (6 August 2018) The Sydney Morning Herald <www.smh.co.au>.
[48] Cosplay is a hobby in which enthusiasts dress up as their favourite fantasy characters, whether they be from film, videogames, comic books etc.
[49] Mitchell "'Silly, naïve': Fanboy faces jail over 3D-printed guns", above n 46.
[50] Georgina Mitchell "Sicen Sun given 12-month suspended sentence for 3D-printing prop guns" (21 August 2018) The Sydney Morning Herald <www.smh.co.au>.
[51] Josh Blackman "The 1st Amendment, 2nd Amendment, and 3D printed guns" (2014) 81 TennLRev 479 at 519; and
[52] Lopez, above n 24.

the software for this patch[53] and the manufacturers of the original Liberator printer repossessed the printer Defence Distributed used to distance their technology from such use.[54] Additionally, this patch would protect the public from the risk of 3D printed firearms without over-limiting the enormous potential of the technology'.[55]

However, there is doubt that a patch would serve its function. Technology commentator Jon Stokes argues that the limitless possibilities will allow for firearms of any shape to be printed, making it impossible for any software to reliably recognise them.[56] Building on this, a gun's parts could be printed from separate CAD files, each part so nondescript that software would never associated it with a gun. Lastly, this software could be easily 'jailbroken'.[57] Passionate gun enthusiasts and programmers would likely do the same with gun-block software, rendering it entirely ineffective.

f. Regulating ammunition

New Zealand already regulates ammunition; only license holders can purchase it.[58] However, unlicensed people may possess ammunition, allowing potential criminals to legally possess ample ammunition before printing and using a firearm. This legislative loophole can easily lead to safety threats and likely needs to be remedied. Additionally, Jon Stokes[59] and the University of Hong Kong's Kwak Ka Wai[60] both argue that we should lookaway from regulating guns themselves and instead to ammunition. This would not only allow us to keep track of who is using firearms, but the extent to which they will use them. A Boston University study found that some ammunition regulations can decrease firearm mortality risks by 81%.[61] This study was performed in the US, where

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[53] Blackman, above n 50, at 519.
[54] Robert Beckhusen "3-D Printer Company Seizes Machine From Desktop Gunsmith" (1 October 2012) Wired <www.wired.com>.
[55] Canada seems particularly focussed on this. See Tesh Dagne and Gosia Piasecka " The Right to Repair Doctrine and the Use of 3D Printing Technology in Canadian Patent Law" (2016) 14 CJLT 263.
[56] Lopez, above n 24.
[57] Jailbreaking is the process of using software to break through the limitations of a device that have been programmed into it by the manufacturers. Apple struggled with this and their iPhone software for 10 years; individuals wanted to work outside of the software restrictions so programmed jailbreak software. See Chris Hoffman "Jailbreaking Explained: What You Need to Know About Jailbreaking iPhones and iPads" (26 July 2016) How-To Geek <www.howtogeek.com>.
[58] Arms Act 1983, s 43B.
[59] Lopez, above n 24.
[60] Koslow, above n 3.
[61] The Lancet "The Lancet: Universal background checks for purchasing guns and ammunition could substantially cut gun deaths in the USA" (10 March 2016) EurekAlert! <www.eurekalert.org>.

there are no limits on people obtaining firearms, but 3D printers can soon make this a practical (albeit illegal) reality in New Zealand too. We may soon be in a position of needing this 81% decrease.

Regulating ammunition will likely impair unlicensed 3D-printed gun users and has dominated optimistic conversations surrounding regulation[62], but in 2013 3D-printed bullets were already being used effectively.[63] All working evidence of these bullets is out of standard metal guns.[64] However, the success of this ammunition indicates that once the quality of 3D-printed guns reaches parity with that of traditional firearms corresponding printed bullets will soon follow. Legislating against unlicensed possession of ammunition will be another safeguard against potential Liberator users for now, but it seems likely to become obsolete in the medium term.

g. Regulating gunpowder

Most commentators acknowledge that we are on the cusp of 3D-printing technology allowing functional and powerful 3D-printed guns and ammunition.[65] However, at home printers that can manufacture gunpowder are still a long way off.[66] This notion is not widely discussed, but has significant potential in holding off the threat of unregulated guns until technology has advanced to an inconceivable point.

Gunpowder tends to come in the traditional 'black powder', or modern nitrocellulose amalgamations.[67] Nitrocellulose is incredibly volatile and impossible to safely process at home.[68] Black powder can be made with products used for cleaning and elemental sulphur used in gardening, but is far less effective.

Although gunpowder currently falls under the Arms Act's definition of an 'explosive'[69], there are limited regulations over who can procure it. This means anyone with a 3D-

[62] Koslow, above n 3; and Bryans, above n 4.
[63] Victoria Woollaston "Is this the first 3D-printed BULLET? YouYube shows a range of homemade ammunition being fired" (23 May 2013) Daily Mail <www.dailymail.co.uk>.
[64] Woollaston, above n 62.
[65] Small Arms Survey "Behind the Curve: New Technologies, New Control Challenges" (February 2015) Occassional Paper No. 32 at 55; and Appleby, above n 10.
[66] Berkowitz, above n 14, at 60.
[67] Editors of Encyclopaedia Britannica "Gunpowder" Britannica.com <www.britannica.com>.
[68] New Jersey Department of Health "Hazardous Substance Fact Sheet: Nitrocellulose" (February 2010) The Official Website for the State of New Jersey <www.nj.gov>.
[69] Section 2.

printed firearm at home can easily obtain the final ingredient necessary for destruction. WorkSafe New Zealand restricts some powders[70], but a simple search proves there are still powders that can be used in firearms freely on the market.[71]

New Zealand could regulate more strictly that only firearms license holders may purchase gunpowder. This would substantially reduce the threat of easy access to functioning firearms through 3D-printing, and alleviate concerns for potential aggressors obtaining firearms at home. Additionally, it would make the stockpiling of weapons by dangerous groups pointless, as the purchase of gunpowder would be closely monitored and large quantities would raise suspicions. The only concern gunpowder regulation could not effectively monitor would be the risk of undetectable guns passing through metal detectors.

Lastly, there are other concerning gun manufacture methods. Metal 3D-printing and CNC milling[72] are also new methods for amateur gun manufacture.[73] Restricting gunpowder will be helpful in that it's not overly specific, and will limit people using any of these at-home gun manufacturing methods

Although it is relatively easy to entirely outlaw the more powerful nitrocellulose gunpowder, black powder and its ingredients have non-firearm related uses. Black powder is the usual found in fireworks[74], whilst its key ingredient (elemental sulphur) is used for gardening.[75] This is where the legislature how strictly it would regulate gunpowder.

Personally, I argue that stricter regulations will be worthwhile. Although black powder is the less desirable gunpowder to firearms users, it still shoots powerfully. Sulphur is only used to control fungi and acidify soil, and other products can be used to achieve this.[76] Additionally, there is already debate over whether the value of fireworks is worth the

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[70] WorkSafe New Zealand "Licensing Requirements for Class 1 Explosives" (November 2017) <www.worksafe.govt.nz>.
[71] See Reloaders Supplies Ltd. "Powder" <www.reloaders.co.nz>.; and Outdoor Supplies "ADI Gunpowder" <www.outdoorsupplies.co.nz>.
[72] Computer numerical control milling uses computer programmes to mill metal, making it more precise than human manufacturing. See Plouse Precision Manufacturing "Definition of CNC Milling" <www.plousemanufacturing.com>.
[73] Koslow, above n 3.
[74] Editors of Encyclopaedia Britannica, above n 66.
[75] Doug Penney "Gypsum And Elemental Sulphur: When And How Much?" (6 December 2010) Grainews <www.grainews.com>.
[76] Penney, above n 72.

environmental costs[77], with legislators already arguing for them to be outlawed[78]. Fireworks will now come with additional safety costs, which I feel is enough to render them disadvantageous overall. So between the ability to substitute sulphur, and the comparative disadvantages of fireworks, stricter regulations on black powder are advisable and would go a long way towards protecting people's safety.

h. Recommendation

There is no one solution that will protect New Zealanders from the threat of 3D-printed firearms. However, a combination of regulations will plug current loopholes and future proofing existing regulations.

In response to the issue of undetectable firearms, I recommend that we follow the U.S. in criminalising undetectable guns. This will create a larger window for police to discover and confiscate high risk weapons.

To solve the issues of criminals stockpiling weapons and easily accessing guns in their own homes, I recommend that our legislators place strong restrictions on ammunitions and gunpowder. This will make it impossible for anyone to lawfully obtain a firearm without a license. Within this, it is recommended that the police have an online system that keeps closer track of how much ammunition or gunpowder is being purchased by each license, and closely oversees who the 'bulk buyers' are and whether they need further supervision. These should be good ways for the police to ensure firearms are not being used by people who may abuse them or being stockpiled for violent acts.

This is not a perfect solution. The already suspicious black market[79] will inevitably find workarounds and printed airguns may be unexpectedly developed. However, these laws will at the least diminish the three risks we can currently predict 3D-printed guns might pose before they gain prevalence. This will allow legislators more time to identify and remedy unanticipated issues.

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[77] Terrapass "Fireworks: Their Impact on the Environment" <www.terrapass.com>.
[78] Simon Maude "Auckland Council to consult over private fireworks ban" (22 February 2018) Stuff.co.nz <www.stuff.co.nz>.
[79] Sutherland "Police concerned about gun discoveries following incidents in South Canterbury", above n 1.

6. Conclusion

3D-printed guns will soon pose a huge threat to all New Zealanders. However with correct pre-emptive measures, starting with these recommendations, we can maintain safety. Legislators must work hard, in tandem with our police, to recognise unprecedented threats early and be flexible in how we deal with them. No solution is bulletproof, but it’s better than nothing.