The Air-15: A Case For an Open-Source Big Bore Air Rifle

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Abstract: The weakest link in an open-source distributed personal defense project is ammunition because raw materials may be expensive, regulated, and difficult or even dangerous for the average individual to manufacture. I will make the case that Pre-Charged Pneumatic (or PCP for short) Air Rifles at least deserve a place alongside the open-source distributed firearm.

I respectfully ask that this topic be pinned to every possible related forum with an included link to the Twitter & Article / Git Repository (links below). *Pay particularly close attention to the* **BITCOIN BOUNTY.**

i. A Brief History Lesson

The 100% 3D Printed Liberator Pistol [1] was released on May 6, 2013 by Cody Wilson [2] through a project now known as Defense Distributed [3] shortly after he had successfully produced and test-fired a fully functioning AR-15 lower receiver in 2012. The pistol's name was a hat-tip to the FP-45 Liberator Pistol [4] which was an inexpensive stamped-metal, single shot firearm mass-produced by General Motors on behalf of the United States government during the Second World War. It was intended as an insurgency weapon to be air-dropped behind enemy lines, primarily for resistance fighters and to help free prisoners held in concentration camps. Unfortunately, of the half million produced, less than 25,000 ever found their way out of the comic-book-like instruction box, and nearly all were destroyed after the war.

Following in the footsteps of other political activists, libertarians, patriots, free-marketers, malcontents, improvised firearm producers, and authors such as P.A. Luty [5], Defense Distributed's 3D Printed Liberator Pistol was an important next step in expanding what was previously an extremely small community. While the wiki-weapon remains highly impractical for numerous reasons, it clearly had an immense psychological effect on the political elite who suddenly found a new reason to fear their constituency. So much so, that the US State Department quickly slapped Defense Distributed with a Cease and Desist Order under the guise of illegally exporting firearms technology to foreign nations. However, within the short period of time in which downloads were enabled, someone was kind enough to upload the CAD files along with instructions in alternate languages to the Bit-Torrent [6] network, thus making it difficult if not impossible to censor without shutting down the entire internet.

In 2015, Defense Distributed left much of the future development of the 3D Printed / Laser Cut firearms projects to the FOSSCAD [7] community, and in an attempt to pay mounting legal fees shifted its efforts to producing a low-cost open-source desktop, lubricant-free CNC mill entitled "Ghost Gunner" [8] which put the ability to finish non-serialized 80% lower receivers [9] as well as more complex milling projects well within reach of the average individual, thus creating a technology and community surrounding it that may in fact now be well positioned to produce the *World's first open-source air rifle*, as the GMG-22 [10] never fully came to fruition.

Air rifles are extremely quiet even when compared to their suppressed firearm counterparts, and have been used throughout history during various conflicts. There were several documented cases of resistance fighters using air rifles to complete difficult missions during the Second World War and refilling them in the field with modified bicycle pumps [11]. The Girandoni Repeating Air Rifle [12], which was used for protection during the Lewis and Clark Expedition, had a 20 round magazine capacity containing 210 grain .46 caliber round-ball ammunition and was capable of killing medium-to-large game at 100 yards with a high degree of accuracy. Developed in 1779, the Girandoni existed nearly 8 years before the drafting of the US Constitution, and more than 12 years before the final draft of the US Bill of Rights.

ii.   Introduction

Owning a gun for the purpose of personal defense against the loss of life, liberty, or personal property is clearly a natural right [13]. A free state requires Economic / Political / Religious Freedom, the protection of Private Property Rights, and extremely Limited Government. Private ownership of guns provides defense from those who seek to strip us of those rights, regardless of their good intentions. I will expend no further effort in this text to make that case, nor to debate that fact.

Guns are merely tools. Each tool in a tool box fulfills a specific function. Air Rifles are simply a valuable tool missing from most gun owner's collections. Perhaps their value has been overlooked because many of us played with small caliber air rifles in our youth and despite fears of lost eyes or BB's lodged under the skin they were dismissed as relatively harmless by most of our parents. *However*, big bore / large caliber air rifles are **not toys**. They are deadly weapons capable of taking down large game within 50 to 200 yards depending on the weapon and the caliber of the ammunition, and should be treated with no less respect or safety precautions than a firearm when handling them (ie: Jeff Cooper's Rules of Gun Safety [14]). It is also important to note that air rifles come with their own specific set of safety requirements. For instance, tasks such as ejecting un-spent or lodged rounds becomes more difficult due to a lack of shell casings.

iii.   Supply, Demand, and Deterrence Theory

While nothing new politically, the Obama Administration clearly sought to restrict the rights of legal gun owners, but did so in a historically unprecedented fashion. When the legislative process proved to be difficult, they turned to natural market forces. As *future price expectations* are a determinant of both supply and demand [15], the Obama Administration quickly and ingeniously realized that by publicly placing an extraordinarily large order for 1.6 billion rounds of ammunition, regardless of whether or not that order was ever actually filled or even later canceled, it could increase the global equilibrium market price for popular calibers 5-fold within a matter of months, which was a devastating blow to the average gun owner, lasted for years to come, and was ironically funded by the very taxpayers who's rights they sought to restrict. After all, a 3D printed gun is merely a threatening hunk of plastic when the supply of brass, lead, primers and powder completely dries up. Because of this, many gun-grabbing politicians seem to have shifted their efforts to making ammunition harder to obtain, rather than the firearm itself. More recent legislation, such as the proposed H.R.5103 bill of 2018, sought to impose extraordinarily large taxes for the private sector on ammunition through amendments to the internal revenue code.

Nonetheless, scarce resources need not actually be devoted to the production of weapons. The mere idea that those weapons *may* exist, in itself might have the desired effect of what is known in game theory as "deterrence theory" [16]. The reaction to the Defense Distributed project and 3D printing in general by the political elite has highlighted this possibility. The fear that common citizens, for less than the average current market price of a weapon itself, can simply purchase or build an open source 3D printer or CNC mill with widely available parts (most of which can even be 3D printed with other 3D printers) and conjure an AR-15 into existence, completely bypassing the regulated sale of firearms and high capacity magazines is a very powerful idea. However, as recent political uprisings in Hong Kong and Venezuela have shown, it is only as powerful as the availability of the ammunition, or more specifically as the propellant and/or casing of that ammunition. Protestors have resorted to the use of primitive weapons such as bows & arrows, as well as rocks and petrol bombs.

iv.   Propellants and Filling Tanks

When researching alternate propellants and casings I came across many attempts to re-purpose household items such as match heads for shotgun re-loads [17], several bulky, complex, and weak railgun-like designs [18-19], and a number of alternative controlled-explosion solutions, such as case-less ammo [20] which contains the primer, explosive charge, and bullet all within a plastic-explosive-like cartridge. Case-less propellant can be ignited in a number of ways (ie: electronically) and is completely consumed when the weapon is fired. With promises of the reduction of weight, relying less on the use of precious metals, and lack of ejected casings, many global military powers throughout history have dabbled with this technology since the mid-1800's, but scaled production and reliability problems along with its general sensitivity to heat and shock have led to its abandonment for the time being. While this is an intriguing approach, it also opens up an even greater set of problems. It requires an even larger set of skills to manufacture using chemicals that may be heavily regulated or difficult to obtain in times of war or economic despair, not to mention it may be difficult for the average person to produce without blowing themselves up in their own kitchen, which is the antithesis of this particular project.

While other creative solutions may exist, and I hope this paper inspires the community to seek them out, I currently believe that Pre-Charged Pneumatic Air Rifles offer the most balanced solution to the propellant and legal problems created by firearms, and are now within reach of the average individual by using simple and open sourced desktop CNC mills, 3d printers, laser cutters, or perhaps even 3D metal printers when they become less expensive. Standardized tanks are already widely available for use in paintball, air rifles, scuba, home health care, or even personal soda and beer dispensing devices, and those tanks can be filled or adapted using a variety of methods. Countless YouTube videos can be found on the subject.

Many types of private and commercial tanks / adapters for Nitrogen, Oxygen, C02, and compressed air are globally available, however C02 or compressed air are probably preferred for this purpose. C02 tanks can be filled from your local paintball supply, or by simply removing the valve from the tank, carefully crushing the dry ice [21] found in your internet grocery delivery orders into small pieces, filling the tank, and replacing the valve. While *compressed air tanks* cannot be easily filled with household air compressors, they can be filled in the field using a simple hand pump or small scuba tank. This probably makes *compressed air* the most

desirable medium. Less expensive electric pumps are also popping up in popular online marketplaces.

It's important to note, one must be careful when handling dry ice, and never attempt to fill a C02 tank with compressed air as they are designed for different pressurized contents. Safety precautions and warnings should be taken seriously when dealing with compressed gases, as a ruptured canister may cause serious injury or even death.

v.   Ammunition

A wide variety of calibers that are specifically designed for use in air rifles are readily available on most online marketplaces for reasonable prices. Common calibers include 0.177, .22, .25, .30, .357 / 9mm, .45, and .50. Anything larger than .30 caliber is generally considered suitable for medium to large game. However, the larger the caliber, the slower the projectile will travel, the farther that projectile will drop, the fewer rounds the pneumatic source will provide, and the larger the effective range will drop. For the sake of this project, I would probably recommend .22, .25, or .357 / 9mm as they are more readily available and offer a balance of stopping power, speed, and conservation of precious compressed gasses while in the field.

While air gun ammunition is specifically tailored for the sport, there is nothing inherently special about it. Lead slugs can be adapted from firearm ammunitions, or cast using traditional methods [22]. Arrows [23] are becoming another popular form of ammunition for air gun enthusiasts, and with the advancement of Desktop CNC mills and a growing number of new 3D printing materials coming on to the market, we will continue to see exciting alternatives to traditional lead-cast methods, further adding value to the idea of an open-source air rifle.

vi.   Legal Matters

While the 3D Printed Liberator Pistol strikes fear into the average gun-grabbing politician, it has yet to be used for any crime other than simply being in possession of one.
3D Printed Guns (and air rifles for that matter) are simply impractical weapons for committing crimes. They are merely a political deterrent. Cheap firearms are readily available and don't require 24 hours of print time or countless failed-prints to create. Despite unsubstantiated fears, not a single 3D printed firearm has been used by a terrorist since its conception. In fact, Lithium Ion cell phone batteries pose a far greater threat to travelers [24].

In 2014, Yoshitomo Imura [25], a Japanese National, became the first person (and arguably political prisoner) to be arrested and jailed for possession of a 3D printed firearm after posting updates he had contributed to the DEFCAD project online which converted the Liberator Pistol into a single-action revolver, and posting YouTube videos containing his face while testing the *firearm* with blanks.

As such, *firearms* tend to be heavily regulated, and even more-so outside of the United States. However, thriving communities of air gun enthusiasts exist around the world. In many legal jurisdictions, there are no laws prohibiting the possession or sale of an air rifle, even by formerly convicted criminals. Furthermore, several of these jurisdictions do not prohibit fully-automatic air rifles [26] or suppressors as long as they are permanently fixed to the weapon. However, this document is intended to present the case for the need of an open source air rifle, and not to give legal advice. You should check with your local authorities to determine production, hunting, and possession laws, *should you choose to obey them.*

vii.   Conclusion / Practical Use

The existence of an open-source air rifle is not meant to supplement firearms, but rather to compliment them. Air Rifles can provide an inexpensive and reliable means of food or self-defense when traditional ammunition propellants are scarce for whatever reason. Unlike traditional ammunition, air rifle ammo is not susceptible to moisture and does not degrade over time. Depending on the caliber, they are effective at distances greater than 200 yards, making them adequate for hunting purposes, and more than adequate for personal defense of life, liberty, and private property when engaging at close ranges.

Generally speaking, one can expect 5 to 150 shots per fill depending on the size of the tank, type of pneumatic gas, and caliber size… as well as how efficiently the rifle is set up. Extra tanks can be easily swapped in the field much like magazines, or even larger tanks worn as a back pack. While additional tanks may add carrying weight in the field, the lack of primer / powder / casing weight somewhat makes up for that, not to mention the added bonus of eliminating spent casings from the equation for both forensic and cleanup reasons.

viii.   Requirements / Submission / Contact

Lucius Fox and the corresponding e-mail address (Air15.LuciusFox@ProtonMail.com) were intended as a one-time-use handle that I chose specifically for this project, and any relation to other persons using the same handle (past, present, or future) on the internet or throughout any other publication is purely coincidental. I have chosen to hide my identity not only for potential legal reasons, but also because I want no personal credit, monetary reward, or fame for the completion of this project. If others choose to do so, they do so their own discretion and risk. Never forget the lessons that Cody Wilson, Yoshitomo Imura, P.A. Luty and many others learned the hard way *for you*. Please learn from both their successes and their mistakes.

Having been inspired by Satoshi Nakamoto's [27] Bitcoin White Paper [28] and the Cypherpunk [29] community at large, this bounty (see below) is merely my gift to the world. I saw a need and I wanted to play an integral part in doing something about it. I am *not* an air-rifle expert by any stretch of the imagination. I am merely a student on a life-long journey of educating myself with a strong desire to be uninhibited in my travels, free of any state oppression or reliance upon on others.

While researching this project, I quickly realized that I did not have the background or technical skills as an engineer to produce what I considered to be an acceptable end-product. That is why I am opening this project up to the free market. More specifically, to those capable of producing a prototype using a set of required specifications that the community can further build upon. Those current specifications are as follows:

1. The weapon must be open-source and reproduced reasonably easily using **globally available parts**, *or* any widely available open source 3D printer, laser cutter, *or* desktop CNC mill (such as the Defense Distributed Ghost Gunner). Ideally, the CAD file(s) would consist of a receiver that could adapt to parts from other popular platforms, such as the AR-15. CAD files for 3D printable or laser cut jigs must also be provided if necessary for milling. *Keep in mind that availability of these parts, and what defines a "firearm" varies a great deal throughout the world.* (continued...)

At the very least, please keep citizens from various global legal jurisdictions, namely *Hong Kong*, and their ability to obtain needed parts (ie: barrels) in mind, especially those whom are subjected to strict gun regulations. However, the ability to 3D print or mill the other required parts may make this a non-issue.

2. The weapon must be chambered in at least .22 caliber, however .357 / 9mm or the ability to adapt to other calibers through barrel changes is preferred. Please avoid .30 cal. as it is a less popular air-gun caliber.

3. The weapon must use compressed air or C02, and adapt to commonly threaded tanks. Compressed air is greatly preferred over C02 for this application for the reasons provided above. Tanks must be affixed to the weapon, or easily worn in a backpack.

4. The weapon can **not** be single-shot. That is, it must be belt, magazine, gravity, spring, or cylinder fed etc. Bolt or lever action is acceptable, however semi or fully automatic is preferred. All needed belts / magazines / cylinders must be easily milled, laser cut, 3D printed, **or** at the very least adapted from widely available parts.

5. The weapon must be easily constructed and assembled by an individual with average technical skills and contain detailed step-by-step instructions for the layman. This will be largely up to my own discretion. If in doubt, feel free to ask.

6. The weapon must be capable of achieving comparable velocities / shots-per-fill to its professionally manufactured counterparts. For the purpose of this bounty, I will set forth acceptable calibers, velocities, and shot-per-fill requirements as follows:

.22	→	>1000 fps	→	>15 shots-per-fill	
.25	→	>900 fps	→	>12 shots-per-fill	
.30	→	>750 fps	→	>10 shots-per-fill	*Please avoid this caliber.*
.357	→	>750 fps	→	>8 shots-per-fill	
.45	→	>700 fps	→	>6 shots-per-fill	
0.50	→	>600 fps	→	>5 shots-per-fill	
Arrow	→	>450fps	→	>5 shots-per-fill	*In addition to one of the above rounds.*

7. The weapon must be able to fire at least 5 rounds at or greater using the above specifications without the need to change magazines / belts / cylinders, or tanks.

8. ***The weapon must appear to be intimidating***. The simplicity of a few common plumbers fittings is fine if it gets the job done, but it needs to look like a real gun. This may mean a 3d printed shroud over some very simple parts. Remember, half of this battle is psychological. It must produce comparable results **and** have the look of its firearm counterparts.

ix.   BITCOIN BOUNTY

Once completed, the design and all instructions for production must be submitted to ***Air15.LuciusFox@ProtonMail.com*** / GitHub (see below) for attempted assembly & verification. Once verified, the private key to the Bitcoin address listed below will be provided to the winner, and the results / designs will be posted publicly on GitHub and seeded on the BitTorrent network.

BITCOIN ADDRESS: bc1qjpvhk55cdtl2p3j4rujl3mfezcjnj67mhm6r3j

As Bitcoin continues to become global money, the above bounty will likely increase in purchasing power more than 50+ fold over fiat currencies within the near future. Please feel free to donate to the above address in order to sweeten the pot. As funds become available, I will try to do so as well. I will publicly document additional donations on the project's GitHub / Twitter.

If you do decide to donate, it's ***highly recommended*** that you don't send funds associated with you personally, and to use best opsec practices when posting / communicating with myself. I suggest purchasing BTC from a third party and / or washing them through Wasabi (www.WasabiWallet.io) / CoinJoin before sending them.

It's *important* to note that if no serious effort or advancement of this project by the community has been made by December, 31st 2020, I will consider this to have been a failed effort and re-appropriate the funds elsewhere in order to further advance the idea of an open-source air-rifle / Wiki-Weapon *as I see fit.*

x.   Official GitHub / Source Files / Announcements

Official Git Repository / White Paper: https://github.com/LuciusFoxAirRifle/Air15
Official Twitter: https://twitter.com/LuciusFoxAir15
Official E-Mail: Air15.LuciusFox@ProtonMail.com

NOTE: If my official channels are ever compromised or my identity is ever doubted, I will attempt to re-establish proper channels elsewhere and will be able to prove my identity by signing messages from the public PGP address below and / or provided Bitcoin Address above.

FOR NON-PROTON MAIL USERS:
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Version: OpenPGP.js v4.6.2
Comment: https://openpgpjs.org

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xi. References

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   *** there's a lot of useful information contained within this article ***

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