ECE 2800

Military Grade Laser Weapons

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24 April 2022

Background -

The military is an ever changing world so we need to continue to improve it in any way we can. The laser gun is a great way to start. It would be a directed energy weapon that the military has expressed interest in.``Recently, the Air Force Bioeffects Division announced it's exploring how radiation from non-lethal energy weapons can causes changes to the body at the molecular level.” [1] L4harris plans to develop a gun version of a Directed energy weapon that provides more power than the microwave Directed Energy Weapons with the convenience of a hand held weapon. This weapon would allow for more accurate hits on target as well as an improvement in portability and reusability for weapons.

Objectives -

The project includes three main phases: The battery, The gun, and the coolant for the weapon. We would first need to develop a batter that would allow for high voltages in short bursts over time without destroying the battery.

The battery is required to be recharged many times without losing effectiveness in order for long expeditions to bring only a few batteries.

Next up is the gun. It needs to be lightweight and portable. The gun will have to fit comfortably in the shoulder while keeping any metals that may get hot away from the arm of the operator of the weapon.

The coolant is a necessary aspect of this weapon. The high temperatures caused by lasers used in this weapon would lead to the gun overheating and malfunctioning. A button on the side of the trigger that can stream coolant through the areas highly affected by these high temperatures would greatly reduce the chance for malfunction and therefore improve the usability of this weapon. We need to develop a coolant that would be able to move fast throughout the gun and provide the appropriate cooling.

Specifications/Constraints -

The weapon will be modeled after a modern day assault rifle in shape and design but will be enlarged slightly to account for necessary equipment to be implemented. It will have a trigger pull similar to an assault rifle but rather than having a magazine release it will dispense a battery that can be recharged and put back in.

There will need to be tubes running around the gun in order for the developed coolant to properly be injected to spots in the gun that will be overheating.

The gun can not be much bigger than a modern day assault rifle due to complications with transport as well as issues with portability that may arise and defeat the main purpose of the development of the gun.

The gun must also have to be able to perform in hot temperatures as well as cold in order to withstand the variability that is present in modern day battle.

Feasibility Analysis

Although most definitely it comes off as an outlandish idea, the technology may not be there for handheld laser weapons, but laser weapons do exist. These weapons are very large and in the early prototype stage. [2] They are not in use in the military just yet, but some tests have been done showing that they are operational. These weapons are not efficient or compact, like our product aims to be. The technology that we are looking to implement into the weapons does seem physically possible, although definitely multiple decades away. The true problem lies in making the weapon such a mass quantity. Although we may be a few decades away from completely this technology, implementing it into the military seems impossible. The weapons would have to be cheap enough for the government to invest in and safe enough for the military to use without any sort of fear. Since this technology is in its infancy I believe that the project is possible but not necessarily feasible. Some sort of large discovery would have to be made in order for this plan to be successful.

Proposed Approach -

As aforementioned the technology required to implement handheld laser weaponry is decades away. As we are yet to mount lasers onto trucks, aircraft carriers, planes, or satellites which have less of a weight constraint by comparison to a handheld device. Due to the fact that many modern day proposed laser systems derive their massive energy usage from vats of chemicals, focusing our research into non-chemical lasers is a great use of our resources due to weight constraints. Lockheed Martin is producing a nose turret to mount on a boeing-747 frame but at a staggering weight of 14,000 lbs it is easy to see how difficult balancing weight with feasibility inevitably will be [4]. As a result, we will be focusing our research on the lightweight/portability aspect of laser weapon systems as it seems to present the most challenging task for the for forseeable future.

Non-Technical Aspects

The most obvious aspect of building weaponry is the moral dilemma that accompanies it. Building weapons whose main goal is to kill in the most efficient way possible comes with its issues. People may be hesitant to invest, knowing that their money will be going to something that will end someone's life. It is definitely a dark way to look at it, but this must be considered when making such a product. This also comes into play when hiring people. Not only do you need people who are supremely educated and qualified for the job, you need people who are willing to take on the moral dilemma. This is obviously a big issue, however it is one that I believe that can be overcome.

Another aspect of the weaponry that needs to be discussed is who is investing. We are not marketing the technology necessarily to the consumer, but to the government. The government has many more rules and regulations when it comes to money that we will have to overcome. Since the money from the government is the money of the taxpayer, there is much more public pressure to deliver on our promises. To refer back to the moral dilemma, not all taxpayers may support building these deadly weapons which will create more pressure and problems. These aspects of creating the laser weapons are not blatantly obvious or stated anywhere in a blueprint, but are still very crucial to investors and to us.

Schedule -

2022-2032

Test samples of the world's most effective cooling systems and replicate them on a smaller scale or develop and manufacture our own coolant/cooling system.

2022-2042

Investigate the feasibility of chemical versus non-chemical based laser weaponry to create a lightweight, mobile laser weapon.

2042 - 2052

Develop the most effective recharging method for our laser weaponry given its chemical or non-chemical structure.

2052+

Mass production

All events within the timeline are subject to change due to the rate of technical advancement we achieve.

Budget

First must be noted that the current military budget per year is $778 Billion (2022) [3]

Planned budget:

Total: $210 Billion

Research Development: $400 million

Manufacture Cost: $800 million

Distribution: $150 million

Facilities: $450 million

Wages: $300 million

Employee Count: 2000 salaried employees

References:

[1] Beckhusen, Robert. “Air Force Wants New Energy Weapons to Cause Non-Lethal 'Bioeffects'.” *Wired*, Conde Nast, 1 Apr. 2013, https://www.wired.com/2013/04/air-force-directed-energy/.

[2] Mizokami, Kyle. “The Navy's next Laser Weapon Is Basically a Real-Life Ray Gun.” *Popular Mechanics*, Popular Mechanics, 8 Oct. 2021, https://www.popularmechanics.com/military/weapons/a37791825/navy-cheap-machine-gun-sized-laser-weapon/.

[3] *Major Weapon Systems - U.S. Department of Defense*. https://comptroller.defense.gov/portals/45/documents/defbudget/fy2019/fy2019_weapons.pdf.

[4] McRae, C. (2022, April 22). *The promise and problems of Laser Weapons*. Air Force Magazine. from https://www.airforcemag.com/article/1201lasers/