EMP FOR AIR DEFENCE

MINI PROJECT REPORT

Submitted by

GANESH CHANDRA	**(730920101013)**
ROHIT KHUMUKCHAM	**(730920101036)**
VENUGOPALAN	**(730920101052)**
SYED SOHAIL	**(730920101311)**

In partial fulfilment for the award of the degree

of

BACHELOR OF ENGINEERING

In

AERONAUTICAL ENGINEERING

EXCEL ENGINEERING COLLEGE

Komarapalayam

APRIL- 2023

EMP FOR AIR DEFENCE

MINI PROJECT REPORT

Submitted by

GANESH CHANDRA	**(730920101013)**
ROHIT KHUMUKCHAM	**(730920101036)**
VENUGOPALAN	**(730920101052)**
SYED SOHAIL	**(730920101311)**

In partial fulfilment for the award of the degree

of

BACHELOR OF ENGINEERING

In

AERONAUTICAL ENGINEERING

EXCEL ENGINEERING COLLEGE

Komarapalayam

APRIL- 2023

EXCEL ENGINEERING COLLEGE: KOMARAPALAYAM

BONAFIDE CERTIFICATE

Certified that this project report "**EMP FOR AIR DEFENCE**" is the bonafide work of "**GANESH CHANDRA(730920101013), ROHIT KHUMUKCHAM (730920101036), VENUGOPALAN (730920101052), SYED SOHAIL (730920101311),** who carried out the project work under my supervision

SIGNATURE	**SIGNATURE**
Dr.S.P.VENKATESAN,Ph.D..,	**Mr.N.SREENIVASARAJA, ME.,**
HEAD OF THE DEPARTMENT	**SUPERVISOR PROFESSOR**
DEPARTMENT OF AERONATICAL ENGINEERING Excel Engineering college Komarapalyam, 637303.	DEPARTMENT OF AERONAUTICAL ENGINEERING Excel Engineering college Komarapalyam, 637303.

Submitted for the Mini project Examination held on _____

INTERNAL EXAMINER **EXTERNAL EXAMINER**

ACKNOWLEDGEMENT

We thank the almighty for endowing the immense blessing that helped us with each step of our progress successful competition and providing us with the necessary infrastructure to accomplish our project. We are greatly inducted to our chairman professor **Dr AK NATESAN.,M Com, MBA, M Phil, PH.D, FTA** and Vice chairman **Dr N MATHAN KARTHICK , MBBS, MHCS, PHF**. Excel group institutions for providing all necessary facilities made available in the institution.

We thank **Dr. S.P. VENKATESAN., Ph.D**. head of the department, Aeronautical Engineering for his guidance and constant inspiration. we express our gratitude to our guide **Mr. N. SREENIVASARAJA, M.E**., for their encouragement and dedicated guidance.

We take privilege to record our everlasting and loving thanks to our parents for their kind help and support which render in bringing our mini project in fruitful manner

ABSTRACT

Electromagnetic Pulse (EMP) is a burst of electromagnetic radiation that can disrupt or damage electronic devices and systems. In the context of defense, EMP can be a powerful tool for protecting electronic systems and infrastructure, as well as disabling or destroying enemy electronics and communication systems. This report will cover the various applications of EMP in defense, including disrupting enemy communication, countering missile threats, and protecting critical infrastructure. We will also discuss the potential risks and long-term effects of using EMP in defense, as well as the need for careful consideration and use. Overall, this presentation will provide a comprehensive overview of EMP as a tool for defense, highlighting its potential benefits and limitations in various defense contexts.

INDEX

CHAPTER 1

INTRODUCTION

In recent years, the use of unmanned aerial vehicles (UAVs), also known as drones, has become increasingly common in military operations, both for surveillance and as weapons. However, drones can also pose a significant threat to national security and military installations, especially when used in a coordinated swarm attack. Electromagnetic Pulse (EMP) technology has emerged as a possible solution for defence against drone swarms and drone strikes.

EMP can be used to disrupt or disable the electronic systems of drones, rendering them ineffective or causing them to crash. This is achieved by generating a burst of electromagnetic energy that can overload or damage electronic devices within a certain range. In air defence, this could be achieved through the use of EMP weapons or by hardening electronic devices against EMP.

Defending against drone swarms using EMP technology is a relatively new concept, but it has already garnered significant interest among defence professionals. The ability to disrupt or disable multiple drones simultaneously using EMP could significantly reduce the threat posed by drone swarms. Furthermore, the use of EMP could provide a non-kinetic solution to the drone threat, minimizing the risk of collateral damage.

EMP technology also has potential applications for defence against drone strikes. In this scenario, EMP can be used to

disable the guidance systems of the drones, causing them to miss their targets or crash. This could provide a more cost-effective and safer solution than traditional missile defence systems.

As the use of drones in military operations continues to grow, the development and implementation of EMP technology in air defence will become increasingly important. This report aims to provide a comprehensive overview of EMP's application in air defence, with a focus on defending against drone swarms and drone strikes.

CHAPTER 2

LITERATURE SURVEY

In addition to the studies mentioned above, there have been several other research efforts related to EMP technology in defence applications. One study published in the Journal of Electromagnetic Waves and Applications examined the impact of EMP on military communications systems and found that the effects could be severe enough to disrupt communication systems at significant distances.

Another study published in the Journal of Defence Electronics and Optoelectronics reviewed the use of EMP technology in electronic warfare and concluded that it could provide a valuable tool for the military. The study also noted that advancements in EMP technology could lead to more targeted and precise attacks, reducing the risk of collateral damage.

A third study, published in the Journal of Applied Physics, analysed the effects of EMP on electronic devices and found that the radiation could induce currents that would damage or destroy electronic components. The study also noted that the effects of EMP could vary depending on the design and construction of the electronic device.

Overall, the literature suggests that EMP technology has the potential to provide a valuable tool for the defence sector, particularly in electronic warfare. However, the use of EMP must be carefully considered to minimize the risk of collateral damage to friendly electronic devices. Further research and testing are needed to fully understand the capabilities and limitations of EMP technology, particularly in terms of its effects on human health and the environment.

CHAPTER 3

FABRICATION OF EMP SYSTEMS

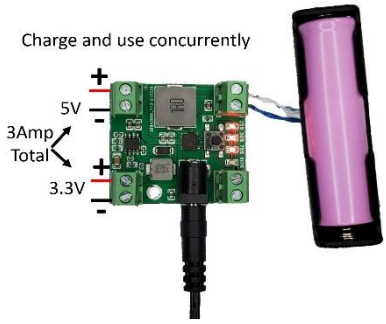
1.

Gather your materials. The construction of your handheld EMP device will go most smoothly if you have all the tools and components required for construction on hand. You will need:

AA battery

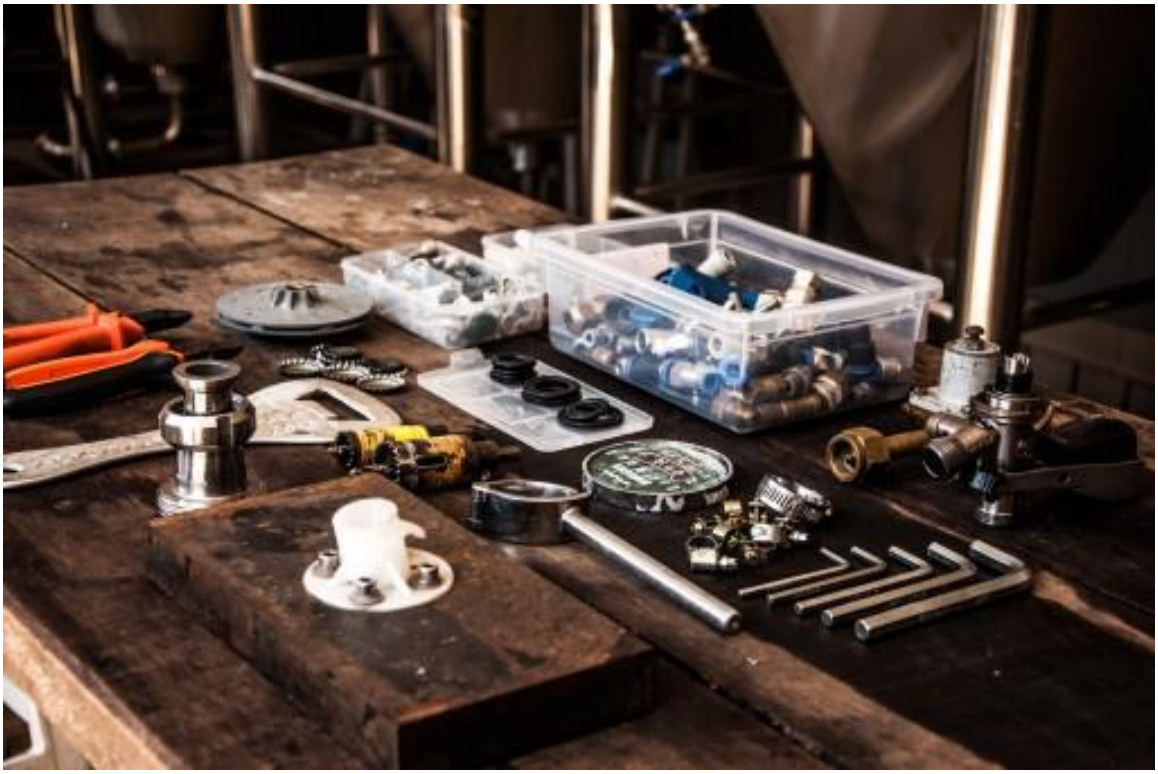
AA battery holder

Copper



wire

Cardboard



Disposable camera (with flash)

Electrical tape

Iron core (circular shaped preferred)

Rubber gloves (recommended)

Simple electrical switch

Solder and soldering iron

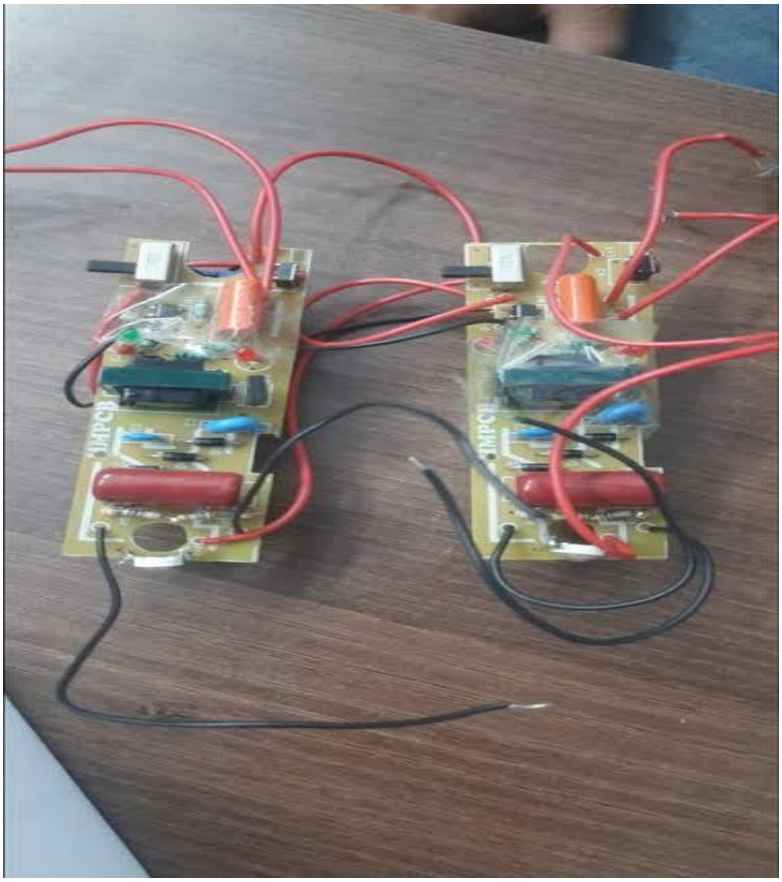
Walkie-talkie antenna[9]

Image titled Make an Electromagnetic Pulse Step 10

2.

Remove your camera circuit board. Inside your disposable camera, you will see a main circuit board that controls the functions of your camera. Remove the batteries first, and then remove the circuit board, taking note of the position of the flash capacitor.[10]

Wearing rubber gloves can save you from getting an electric jolt while handling your camera circuit and flash capacitor.



Capacitors generally look like cylinders attached to the circuit board with two prongs. This will be a necessary component for you EMP device.

Expend the charge in your capacitor by engaging the flash after removing the batteries from your camera. Any stored charge in your camera can result in an electrical shock.

Image titled Make an Electromagnetic Pulse Step 11

3..

Wind your copper wire around your iron core. Be sure that you have an adequate length of copper wire; your wrap should evenly and completely cover your iron core. You should also wrap your wire tightly, as a loose winding will negatively impact your EMP.[11]

Leave some excess copper wire at the ends of your winding. You will need this to connect the rest of your EMP device to your electromagnetic coil.

Image titled Make an Electromagnetic Pulse Step 12

4.

Insulate your walkie-talkie antenna. You walkie-talkie antenna will serve as the stock onto which you fix your electromagnetic coil and camera circuit board. Wrap the base end of your walkie-talkie antenna with electrical tape as a preventative measure for being shocked.

Image titled Make an Electromagnetic Pulse Step 13

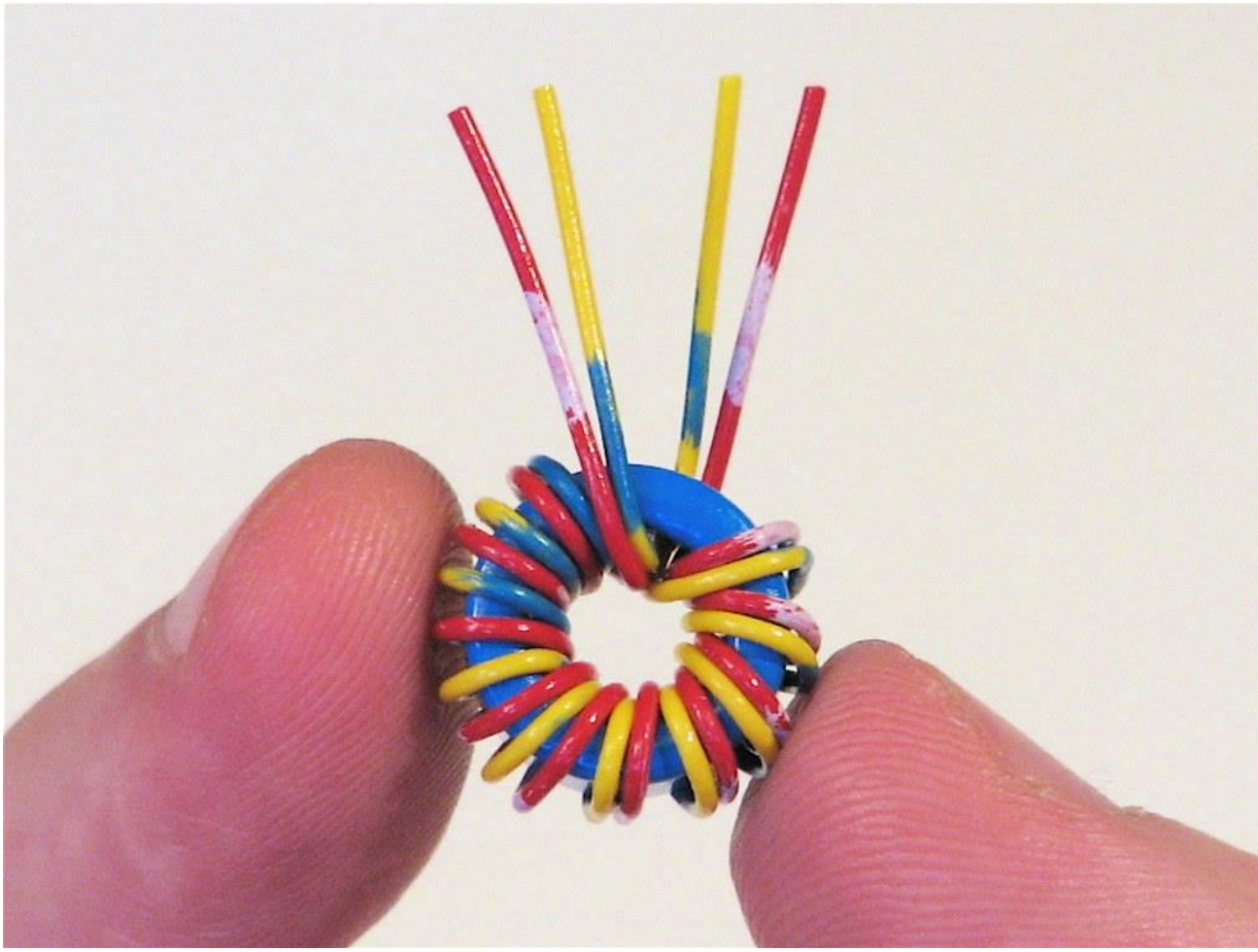
5.

Affix your camera circuit to a sturdy piece of cardboard. Your cardboard will serve as another insulator to prevent any unpleasant electrical shocks. Use your electrical tape, taking care not to cover any of the electric pathways of your camera circuit, and attach it to your piece of cardboard.

You'll want to attach your camera circuit face up so that the capacitor and its connection pathways aren't interfered with by the cardboard.

Your cardboard mount for your camera circuit should have some additional space for your AA holder.

Image titled Make an Electromagnetic Pulse Step 14



6.

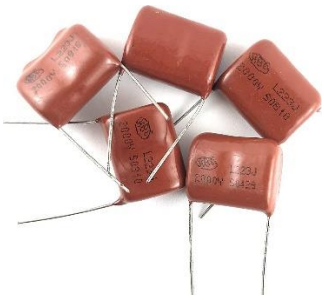
Attach your electromagnetic coil to the end of your walkie-talkie antenna. Since current will be running through your coil to create your EMP, it's a good idea to double insulate your antenna by putting another small piece of cardboard between your coil and the antenna. You can then use your electrical tape to attach your coil to the cardboard.

Image titled Make an Electromagnetic Pulse Step 15

7.

Solder your power source. Find the battery connector tabs on your camera circuit and connect them to the corresponding positive and negative ends of your AA battery holder.[12] This can then be attached to a free space on your cardboard camera circuit mount with electrical tape.

Image titled Make an Electromagnetic Pulse Step 16



8.

Connect your coil to your capacitor. The excess wire that you left at the beginning and end of your copper wire winding will need to be soldered to the electrodes of your flash capacitor. To control the flow of electricity between your capacitor and electromagnetic coil, you should tie in your electrical switch between these two components.[13]

You should wear rubber gloves during this portion of your EMP device assembly. Any remaining charge in your capacitor could shock you.

Image titled Make an Electromagnetic Pulse Step 17

9.

Attach your cardboard mount to your antenna. Use your electrical tape to firmly attach your cardboard mount and its component to your antenna. You should attach your

mount above the base of your antenna, which you should have already insulated with electrical tape.

Image titled Make an Electromagnetic Pulse Step 18

10.

Find a suitable test object and location. A simple, inexpensive calculator is ideal for testing your handheld EMP device. Depending on the materials and technique you used in the construction of your device, the range of your EMP field may include only the immediate vicinity of your coil, or it may reach up to several feet around the coil.

Any electronics caught in your EMP could be permanently damaged. Make sure you have chosen a location far enough away from electronics that you don't inadvertently do harm. You could be liable for any damage you cause with your EMP.

Image titled Make an Electromagnetic Pulse Step 19

11.

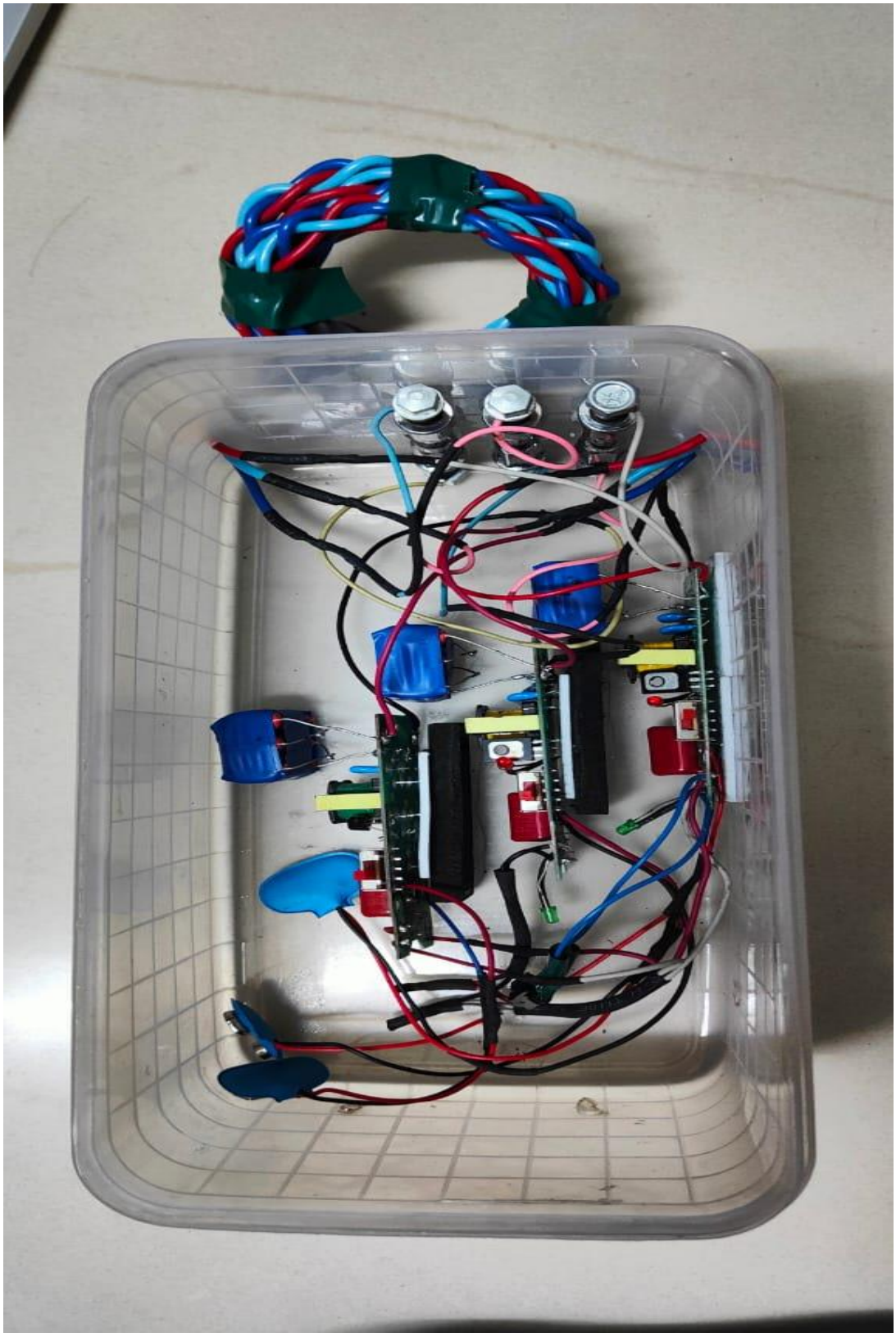
Test your handheld EMP device. Check that the switch for your device is set to off, and then install your batteries into the AA battery holder on your cardboard mount. Grasping your EMP device by the insulated base of the antenna, like a Ghostbuster Neutron Wand, hold your electromagnetic

coil toward your test object and flick your switch to the "On" position.

If you are not confident in your knowledge or construction of electrical components, you may want to wear a pair of rubber gloves when operating your device, as an added precaution.

If your device has successfully worked, your test object, and any other electronics caught in your EMP field, will not turn on.

Depending on the kind of flash capacitor you have used, the voltage required to charge your capacitor will be variable. The approximate capacitance for a disposable camera should be between 80-160 microfarads, and the voltage will likely be between 180-330 volts



CHAPTER 4

ANALSYS

The use of EMP technology in defence can provide a tactical advantage to the military, as it can disable enemy communication systems and disrupt their targeting and tracking systems. However, the use of EMP must be carefully considered to minimize collateral damage to friendly electronic devices. The placement and timing of EMP attacks must be carefully planned to ensure maximum effectiveness and minimum damage.

The use of EMP technology in defense applications has both benefits and limitations. The primary benefit is its ability to disable or destroy enemy electronic devices, including communication systems, weapons, and vehicles. This can provide a significant tactical advantage to the military by disrupting the enemy's ability to coordinate and communicate, track military movements, and engage in combat effectively.

However, the use of EMP technology also poses several challenges and limitations. The most significant concern is the potential for collateral damage to friendly electronic devices. EMP is a non-discriminatory weapon, meaning it can affect both enemy and friendly devices in the area of the burst. This can result in unintended consequences,

including the loss of critical communications, navigation, and targeting systems for friendly forces.

Another challenge with EMP technology is that its effects are not always predictable or controllable. The intensity and duration of the radiation can vary depending on the type of EMP weapon used and the environment in which it is deployed. This can make it difficult to determine the precise effects of an EMP attack and to control the extent of the damage caused.

In addition, EMP technology is still relatively new, and its long-term effects on human health and the environment are not well understood. More research is needed to fully understand the potential risks and unintended consequences of using EMP in defence applications.

CHAPTER 5

CONCLUSION

EMPs are a huge potential solution for drone defense that utilize electromagnetic energy to disrupt or disable electronic devices, including drones. However, further research and development are needed to improve their effectiveness and ensure they are not causing harm to friendly forces. EMPs may not be effective against all types of drones and can potentially cause collateral damage to other electronic devices but with the current rate of technological advancements its no doubt EMP’s hold a bright future in the defense sector

The use of EMP technology in defence applications is a promising area of research, with the potential to provide a significant tactical advantage to the military. However, further research and testing are needed to fully understand the capabilities and limitations of EMP technology. The use of EMP must be carefully considered to minimize collateral damage and ensure maximum effectiveness. With careful planning and execution, EMP technology can be a valuable tool for the defence sector.

CHAPTER 6

References

Citations

1. *^ Guttridge, Nick (30 July 2020). "Electromagnetic pulses in history". The Telegraph. Retrieved 12 February 2023.*
2. *^ "DHS Combats Potential Electromagnetic Pulse (EMP) Attack". Department of Homeland Security. 3 September 2020. Retrieved 3 May 2021.*
3. *^ Weiss, Matthew; Weiss, Martin (29 May 2019). "An Assessment of Threats to the American Power Grid". Energy, Sustainability and Society. **9** (1): 18. doi:10.1186/s13705-019-0199-y. ISSN 2192-0567.*
4. *^ Close, S.; Colestock, P.; Cox, L.; Kelley, M.; Lee, N. (2010). "Electromagnetic pulses generated by meteoroid impacts on spacecraft". Journal of Geophysical Research. **115** (A12): A12328. Bibcode:2010JGRA..11512328C. doi:10.1029/2010JA015921.*
5. *^ Chandler, Charles. "Meteoric Airbursts: General Principles". QDL blog. Retrieved 30 December 2014.*
6. *^ "EMPACT America, Inc. – Solar EMP". 26 July 2011. Archived from the original on 26 July 2011. Retrieved 23 November 2015.*
7. *^ Howard, J.; Uman, M. A.; Biagi, C.; Hill, D.; Rakov, V. A.; Jordan, D. M. (2011). "Measured close lightning leader step electric field derivative waveforms" (PDF). Journal of Geophysical Research. **116** (D8): D08201. Bibcode:2011JGRD..116.8201H. doi:10.1029/2010JD015249.*
8. *^ "A Basic Primer in Lightning Effects and Protection" (PDF). weighing-systems.com. Archived from the original (PDF) on 15 November 2015. Retrieved 8 September 2015.*
9. *^ "America's utilities prepare for a nuclear threat to the grid". The Economist. Retrieved 21 September 2017.*

10. ^ Kopp, Carlo (October 1996). "The Electromagnetic Bomb - A Weapon of Electrical Mass Destruction". USAF CADRE Air Chronicles. DTIC:ADA332511. Archived from the original on 5 October 2013. Retrieved 12 January 2012.
11. ^ Glasstone & Dolan 1977, Chapter 1.
12. ^ Glasstone & Dolan 1977, Chapter 11, section 11.73.
13. ^ Marks, Paul (1 April 2009). "Aircraft could be brought down by DIY 'E-bombs'". New Scientist. pp. 16–17.
14. ^ Younger, Stephen; et al. (1996). "Scientific Collaborations Between Los Alamos and Arzamas-16 Using Explosive-Driven Flux Compression Generators" (PDF). Los Alamos Science (24): 48–71. Retrieved 24 October 2009.
15. ^ "Fundamentals of Electrostatic Discharge", Compliance Magazine, 1 May 2015. Retrieved 25 June 2015.
16. ^ "EMP Data Wipe". newtechrecycling.com. Newtech Recycling. Retrieved 12 June 2018.
17. ^ Jump up to:[a] [b] Baum, Carl E. (May 2007). "Reminiscences of High-Power Electromagnetics" (PDF). IEEE Trans. Electromagn. Compat. **49** (2): 211–8. doi:10.1109/temc.2007.897147. S2CID 22495327.
18. ^ Jump up to:[a] [b] Baum, Carl E. (June 1992). "From the Electromagnetic Pulse to High-Power Electromagnetics" (PDF). Proceedings of the IEEE. **80** (6): 789–817. Bibcode:1992IEEEP..80..789B. doi:10.1109/5.149443.
19. ^ Reuben, Charles. "The Atlas-I Trestle at Kirtland Air Force Base". The University of New Mexico.
20. ^ "SUMMA Foundation – Carl Baum, Electrical and Computer Engineering Department, University of New Mexico". ece-research.unm.edu.
21. ^ "SUMMA Foundation – Carl Baum, Electrical and Computer Engineering Department, University of New Mexico". Ece.unm.edu. 17 January 2013. Retrieved 18 June 2013.
22. ^ "Protecting Personnel from Electromagnetic Fields", US Department of Defense Instruction No. 6055.11, 19 August 2009.
23. ^ Edd Gent-Live Science Contributor 11 (March 2021). "US Air Force is guarding against electromagnetic pulse

attacks. Should we worry?". livescience.com. Retrieved 2 May 2021.

24. *^ "Can America's Power Grid Survive an Electromagnetic Attack?". Bloomberg Quint. Retrieved 3 May 2021.*
25. *^ Yoshida, Reiji (8 September 2017). "Threat of North Korean EMP attack leaves Japan vulnerable". The Japan Times. Retrieved 3 May 2021.*
26. *^ Rakoff, Janet. 9 May 1981. "EMP: A Sleeping Electronic Dragon." Science News. Vol. 119. Page 300*
27. *^ Raloff, Janet. 16 May 1981. "EMP: Defensive Strategies." Science News. Vol. 119. Page 314.*
28. *^ Broad, William J. 1983 January/February. "The Chaos Factor" Science 83. Pages 41-49.*
29. *^ Burnham, David. 28 June 1983. "U.S. Fears One Bomb Could Cripple the Nation." New York Times. Page C1. [1]*
30. *^ Report Meta-R-320: "The Early-Time (E1) High-Altitude Electromagnetic Pulse (HEMP) and Its Impact on the U.S. Power Grid" January 2010. Written by Metatech Corporation for Oak Ridge National Laboratory. Appendix: E1 HEMP Myths*