

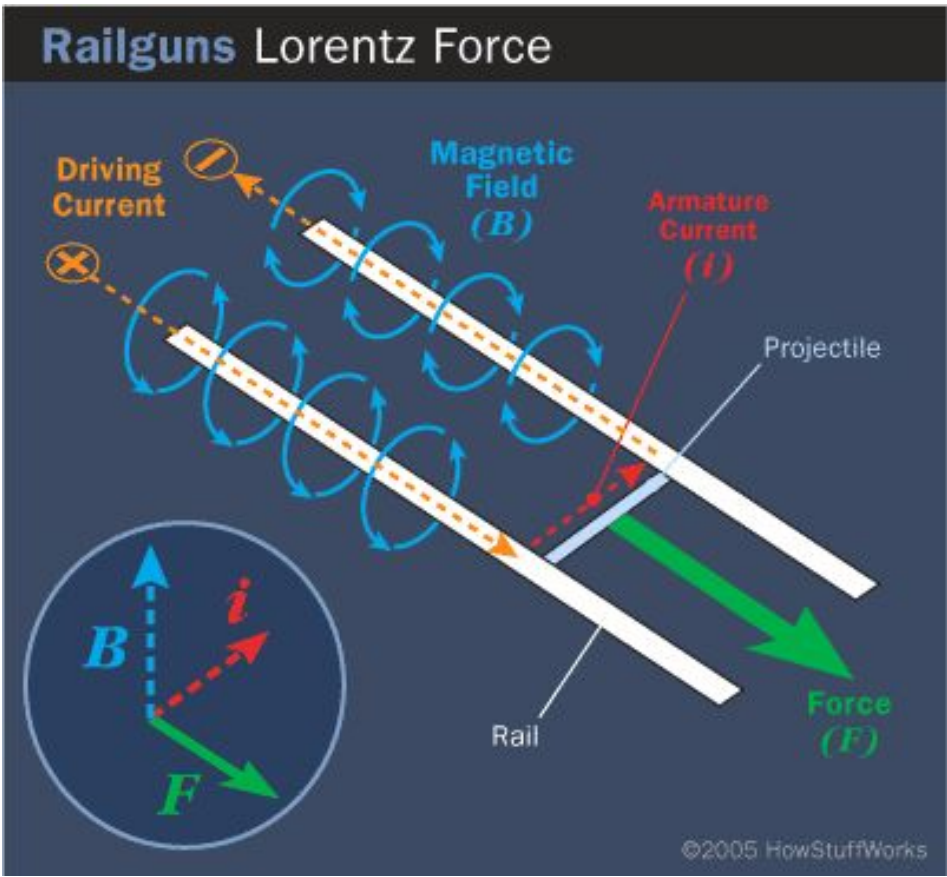
# RAILGUN

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### Summary and Design

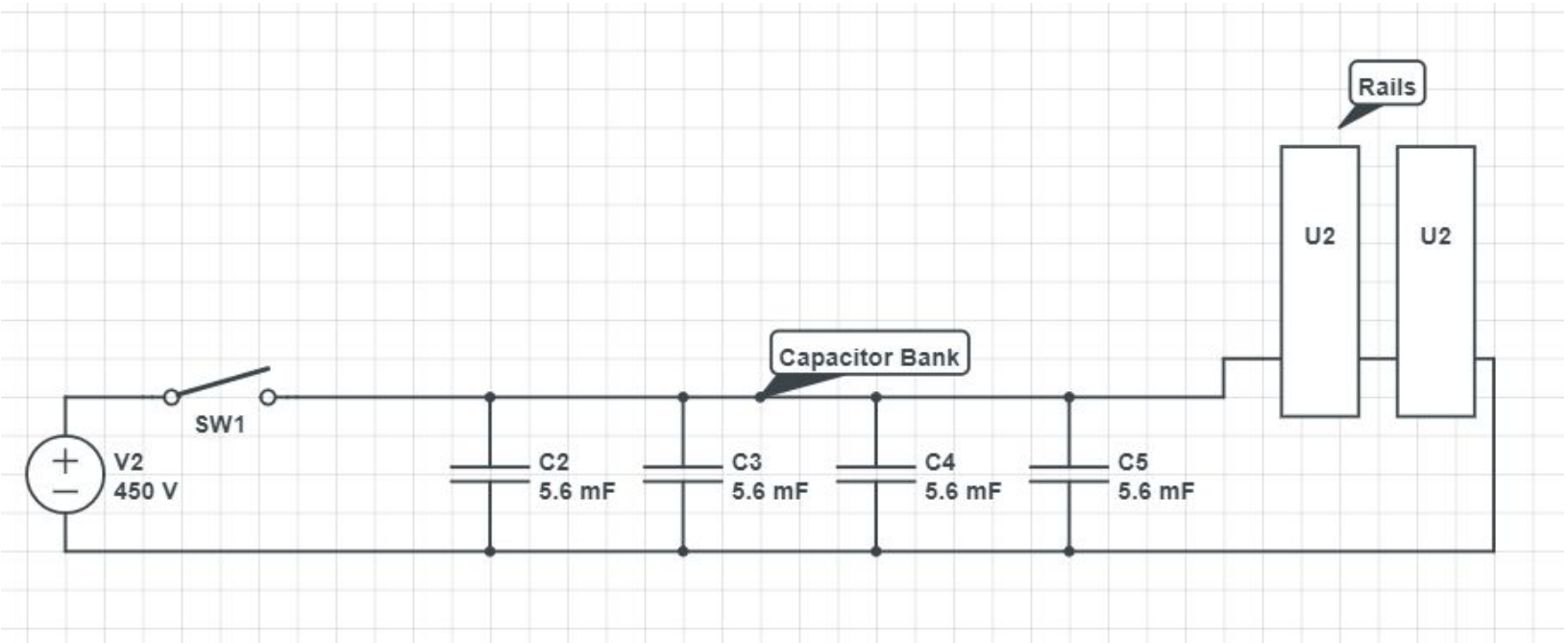
We built an electric railgun to fire a small metal projectile. Railguns utilize the Lorentz force to fire conductive projectiles (see diagram below). We used aluminum-7075, a strong aluminum/zinc alloy, for the rails and projectile to avoid welding. For our capacitor bank, we used 4 450V, 5600 $\mu$ F capacitors connected in parallel. Our rails are just under 2 feet long.



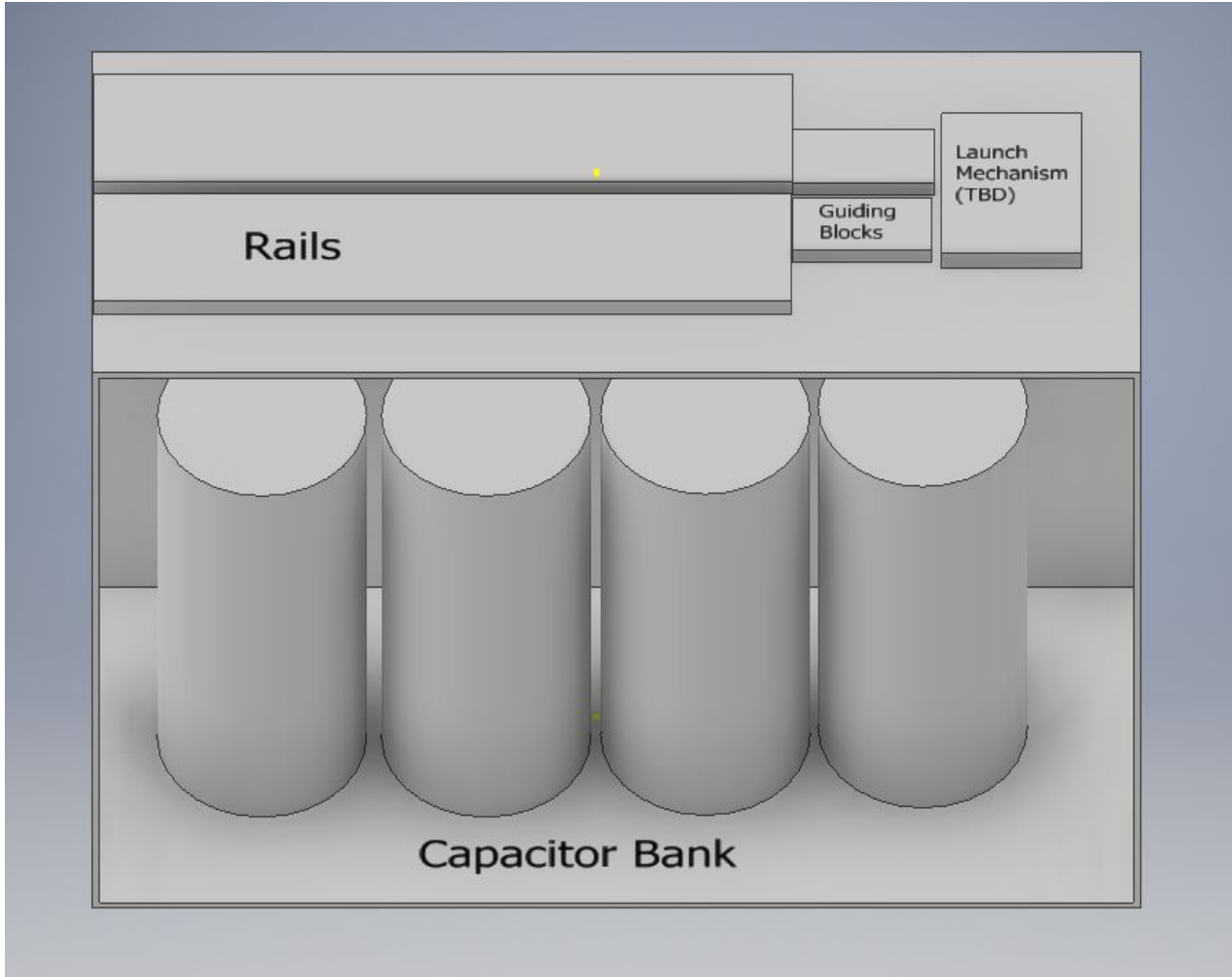
The Physics

### Circuit Diagram

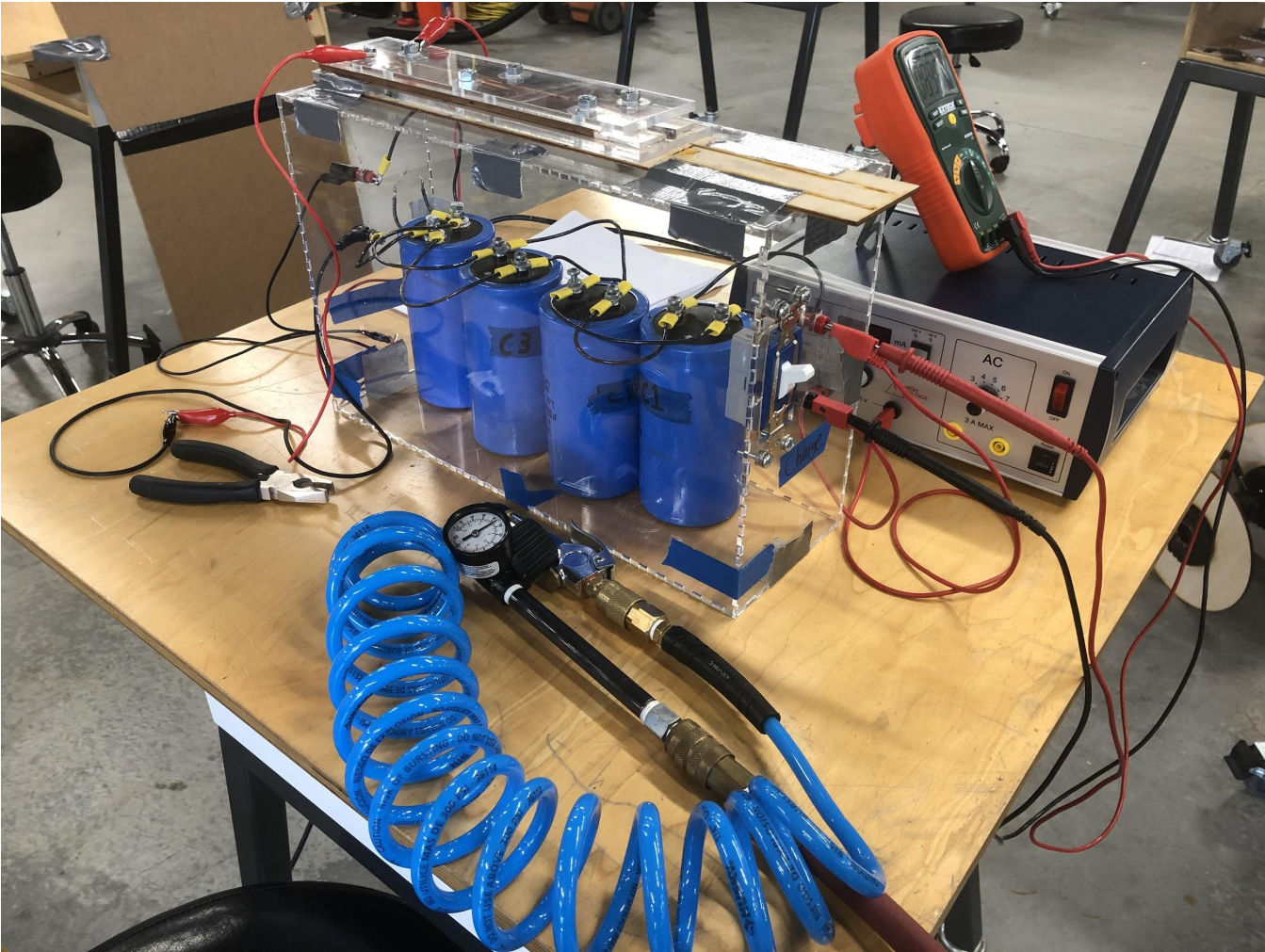
The circuit below depicts the setup of the capacitor bank and the rails. The projectile closes the circuit between the rails.



### Our Model



CAD



Copper prototype

### Conclusion

- Fires well
- Makes a lot of sparks
- Super dangerous, handling 450 V
- Learned that you can learn a lot from prototypes and testing
- Improved understanding of physics and E&M

### Next Steps

Next steps include adding more capacitors to the bank (some DIY railguns have used as many as 16 capacitors of the same size as ours!) and testing stronger materials (limited testing of titanium was promising, but expensive).



Hacksmiths

### References

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[3] Integrating Electromagnetic Railguns into the Navy of the Future. (n.d.). Retrieved from <https://www.dsac.org/resources/journals/dsiac/summer-2015-volume-2-number-3/integrating-electromagnetic-railguns-navy>

[4] Office of Naval Research Public Affairs. (2012, October 09). Navy.mil Home Page. Retrieved from [https://www.navy.mil/submit/display.asp?story\\_id=70058](https://www.navy.mil/submit/display.asp?story_id=70058)

[5] BAE Systems Datasheet. Retrieved from <https://www.baesystems.com/en-us/product/electromagnetic--em--railgun>

[6] Modular Multi-Mode Power Supplies for Naval Power Systems - ppt video online download. (n.d.). Retrieved from <https://slideplayer.com/slide/5885524/>

[7] Werst, M., et al. "Fabrication of a Compensated Pulsed Alternator for a Rapid Fire Railgun System." *IEEE Transactions on Magnetics*, vol. 22, no. 6, 1986, pp. 1812–1816.

To be perfectly honest, I'm fuzzy on the details of how exactly these compulsators work. I'll come in and discuss with you at some point to see if you have a simple way of explaining them.

[8] Pearson, Jerome. "Low-Cost Launch System and Orbital Fuel Depot." *Acta Astronautica*, vol. 19, no. 4, 1989, pp. 315–320.

Final Version (Aluminum)

