

## sdmay19-15: Capacitor Gun

### Week 3 Report

September 19 - September 26

### Team Members

Grant Larson — *Engineer*

Max Balzer — *Meeting Facilitator, engineer*

Bret Tomoson — *Projectile and Power System Designer*

Brett Nelson — *Safety Engineer*

Mark Fowler — *Engineer, scribe*

Zachee Saleng — *Engineer designer*

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### Summary of Progress this Report

We did a lot of work consolidating ideas into our design plan and other design documents. Also, research was done to a point that all issues could be discussed with knowledge on how to solve the problem.

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### Past Week Accomplishments

- Sled research and project plan write up - Mark
  - Working along with Zachee we researched equations to come up with some measurements for our sled. I found a formula that should give a pretty close approximation for what we need, some tweaks to the formula may need to be made to make it work.
  - Worked on various sections of our project plan including materials list and worked on the final summary and created a rough Gantt chart for the appendix.
  - Recorded the information that we have researched into the project plan.
- Materials research and project plan write up - Max
  - Worked on researching what materials will work best for the rails and projectile
  - Researched and calculated a way to find the minimal surface area of connection between the rails and projectile to keep the maximum amount of magnetic field between the rails
  - Design a few test designs for projectiles to determine what would be the best design to create minimal distance between rails, to get maximum rotation on projectile for air resistance, and produce the maximum amount of energy at the muzzle of the capacitor gun
  - Recorded all of the information we have gained and researched so far into the project plan so that we have deadlines and ideas of when we want to have all parts of the project complete by.
- Researched housing materials and project plan write up - Brett
  - Worked on finding different materials that would be suitable for our design with taking in factors we need to worry about
    - Ex. high heat the will be produced, and a material that is non-conductive
  - Worked on thinking about the safety of the device and how we need to be safe when operating it
  - Started to think about working with the smaller model first design
  - Helped put together the team's project plan by recording all of our information for the first weeks we have been doing this
- Researched charging circuit required for capacitor bank and worked on project plan - Bret
  - For our project we need to convert power from a 12V battery to a 450V capacitor bank which requires a specific charging circuit to operate safely
  - I found a reliable charging circuit design and am working on replacing the relevant components to meet the voltage and current requirements for our system.
  - I am looking in to unique ways that we can improve the safety of our system design.

- Work on the initial project plan took up the majority of the group time to ensure that the team was on the same page for all current design goals.
- Researched the material resistivity and price. Based on the research, I figured out the dimension of the cross-section. We elaborated some calculations to define the type of material that will be used (copper or aluminum) -zachee
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### Pending Issues

- We need to research which combinations of materials will be the most economically efficient
- The number of capacitors will determine the sizing of all electrical components and needs to be solidified to meet power and budget requirements
- The sizing of the rails will determine the strength and durability of the firing and must be researched

### Plans for Upcoming Reporting Period

Use our research and discuss what a realistic model of the project will include. This will require definite answers from the pending issues to drive all dimensions. Also a parts list will be needed for all auxiliary components that have been determined as necessary.

### Individual Contributions

Team Member	Contribution	Weekly Hours	Total Hours
Grant Larson	I spent most of my time this week working on the project plan. I wrote a few sections with the pros and cons of our design, potential hazards, what a consumer would be looking for, etc. We also discussed our final design idea and came to a consensus on what our goals were for it. Also researched materials a little.	5	8
Max Balzer	Spent most of the time working on our project plan. I also researched a little more into the design of our projectile and what materials will be best to use. We all think the best design for the projectile will be a solid piece of metal that has fins attached to the back for rotation and air resistance.	6	14
Bret Tomoson	Researched charging circuit materials for our design. Researched safe operation techniques. Wrote section of project plan v1.	6	12
Brett Nelson	I continued to research the design for the housing of the rail gun. I made some process trying to figure out the different materials we should be using. Now thinking about starting with the smaller scale model first and how	6	14

	that should be built and house to make sure that it is safe for us to use. I also worked on the project plan and filled in the areas that I was assigned to do.		
Mark Fowler	Worked on the project plan and continued research on sled design. Discussed with the rest of the team our design and materials that are needed to purchase in the next couple weeks.	6	12
Zachee Saleng	I studied the available written materials to find applicable formulas that will be used to define the cross section of the material. I also researched magnetic fields and performed rough calculations giving us an approximation of the parameters to be used in our design. I worked on the project plan. I recorded the sources that were used to obtain valuation information.	6	12

### Plans for the Upcoming Week

- In the coming weeks we will be working on:
  - Gathering materials for the capacitors
  - Investigating the capacitor bank and its connections
  - Defining the requirements for the solenoid used as a launching hammer
  - Sizing, using the standards, the bus bar - zachee
- Sled - Mark
  - Finalize sled measurements so we can start purchasing material
  - Work on finding good prices for the material
- Material list - Max
  - Get a complete list of materials we want to use for the rails and projectile
  - This will allow us to build our test demo to determine what material is best used for the rails coupled with the projectile to determine minimal degradation of the rails
  - Continue calculating total force at the end of the muzzle so we know how much current we need to put into the rails to equal the amount of force produced by a comparable gun
- Finalize what the small scale model should include - Brett
  - What materials should the housing be made out of
  - Include safety features
  - Find the prices for the materials so we are able to get to building it.
- Capacitor count and charging circuit design
  - I will finalize how many capacitors will be needed to reach the desired power and budget requirements
  - I will find what charging circuit components will be needed to meet the charging requirements

### Gitlab Activity Summary

Nothing to report.