

sdmay19-15: Capacitor Gun

Week 4 Report

September 26 - October 4

Client: Max Balzer

Faculty Advisor: Mani Mina

Team Members

Grant Larson — *Test and Report Engineer*

Max Balzer — *Meeting Facilitator and Production Engineer*

Bret Tomoson — *Projectile and Power System Designer*

Brett Nelson — *Safety Engineer*

Mark Fowler — *Engineer, scribe*

Zachee Saleng — *Engineer designer*

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.

Past Week Accomplishments

- Sled research and project plan write up - Mark
 - Developed an equation to use for the sled measurements so it will work properly with whatever rail size is used, whether it be 1.5 inch or 2, etc.
 - Worked on various sections of the project plan including materials list and worked on the final summary and created a rough Gantt chart for the appendix.
 - Spoke with the metal shop contact to see the material and tools we have available to use and when would be a good time to meet him.
- Materials and projectile research and production- Max
 - I found multiple dimensions for our rails and projectile. We want to use the minimal amount of material to create the maximum surface area but still generate the most magnetic field we can.
 - Once Bret figures out the amount of capacitors we can afford he can figure out how much current they can produce. From that I will narrow my dimensions of the projectile and rails. This will allow me to find the minimum dimensions of the rails and projectile to decrease cost but keep the same magnetic field and force produced.
 - I found a guy who can help us cut our metal to create our rails and projectile. This is a crucial part in our production because we need to be able to precisely cut our metal rails and projectile if we want a tight fit between the rails.
 - I may have found a material that we can use to hold our rails in place. This is a continuing problem we have because we need a material that has a high temperature resistance and a high tensile strength so that it doesn't melt or give way when the rails want to move.
- Researched ways to solve our problems in the design- Brett
 - For the high temperature problem in the rails, a solution that was brought up was using some heat sinks.
 - Found that some aluminum heat sink might help out with for this problem
 - For the holding of the rails together, Max found a material that sounds it would be very good for our project.
 - Researched about the material, and that might be the best option to keep the rail in place.
 - Also tried to find the best option to make the base out of to make sure that it stands the high heat but also has to be non-conductive.

- Found out key capacitor data and talked with group about testing solutions - Bret
 - The capacitors that will be charging the circuit are an important part for deciding the dimensions of the rest of the components. The goal for finding the right capacitors is finding the highest short circuit current that can be applied to the rails when the projectile connects them. The best cost per power output are 450V capacitors at the highest capacitance/\$.
 - The group also discussed which material combinations need to be tested for the first phase of design.
 - The materials that will be used for the rails will be both aluminum and copper.
 - The projectile that we will be testing will have multiple simple designs with future improvements after flight testing.
 - The projectile shapes will be tested in aluminum and copper.

- Gathered dimensions to further final calculations for our design -Grant
 - Used our desired muzzle energy to calculate the current needed
 - Used the desired current to calculate how many capacitors of a certain size we needed
 - Used the current to estimate the energy and velocity of the projectile

- Studied the available written materials to find applicable formulas that will be used to define the cross section of the material. Researched magnetic fields and performed rough calculations giving us an approximation of the parameters to be used in our design. Worked on the project plan. Recorded the sources that were used to obtain valuation information.- zachee

Pending Issues

- We need to research which combinations of materials for rails and projectiles 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	We had a phone call with a metals expert who also owns a metal shop. We discussed our project design as well as the projectile design. Work was also done with final calculations on the muzzle energy, current through the rails, and projectile velocity. These calculations will give us rough limitations and estimations of what our design can yield.	5	8

Max Balzer	I found a metal guy who can machine our metals for us. This helps because we need some way to make our projectiles and rails. I also found dimensions for our rails and projectile, but I have to base it off of our maximum current output from our capacitor bank.	10	24
Bret Tomoson	Found the best capacitors for our budget. Finalized testing conditions of rails.	6	18
Brett Nelson	Worked on finding solutions to the different problems that are in the design.	7	21
Mark Fowler	Spoke with our metal shop contact. Will work on design document and project plan elevator speech.	6	18
Zachee Saleng	Researched potential formula on lorentz law and how much current a capacitor need to create the magnetic field. Elaborated some calculations to define the type of material that will be used and much magnetic field will could be created function of the current. I and Mark are still working on it.	11	23

Plans for the Upcoming Week

- In the coming weeks we will be working on: “on going”
 - 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 and design document - Mark
 - Finalize sled measurements so material can start being purchased
 - Look into the design document, see what needs to be done to complete that task and present to the rest of the group so all members know what needs to get done.
 - Finalize material list and schematics so they can be presented them to the metal shop and get a better idea what we can accomplish there.
- Material list - Max
 - Create a narrowed down list of dimensions for the rails and projectiles based on the current output of the capacitor bank.
 - We need to decide what projectile design will work best for maximum air resistance and maximum drag through the barrel to create the greatest amount of force.
 - We need to know the muzzle energy we need to produce so that we can make our project comparable to an existing weapon. We are looking at 3-4 Kilojoules but we are not completely sure yet.
 - We will get a meeting time with our metal shop guy so that we can start building our test demo.
- Continue to think about the overall design of the project, also take some time to work on our presentation for the 2nd lighting talks in class - Brett

- Try to discuss and finalize with everyone to figure out the size of the rails, the materials we are going to use, and the projectile.
 - Also need to keep safety in mind, and making sure that the design will be safe to use.
 - Will take some time to work on the presentation for the second lighting talk in class, while the others worry about other things.
 - Capacitor count and charging circuit design - Bret
 - Determine charging circuit components for 12V-450V.
 - Determine correct materials and quantities needed to test projectiles.
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Gitlab Activity Summary

Nothing to report.
