Personal Hydroelectric Generator
Team 7

Design Review I

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Date: February 18, 2016

Presentation Overview

Project Background

- Project Definition
- Mechanical Overview
- Electrical Overview

Current State

- Testing Results
- Component Status Update
- Financial Update

Spring 2016 Forecast

- Gantt Chart
- Experimental Forecast
- Entrepreneurial Forecast
- Design / Assembly Forecast

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Background

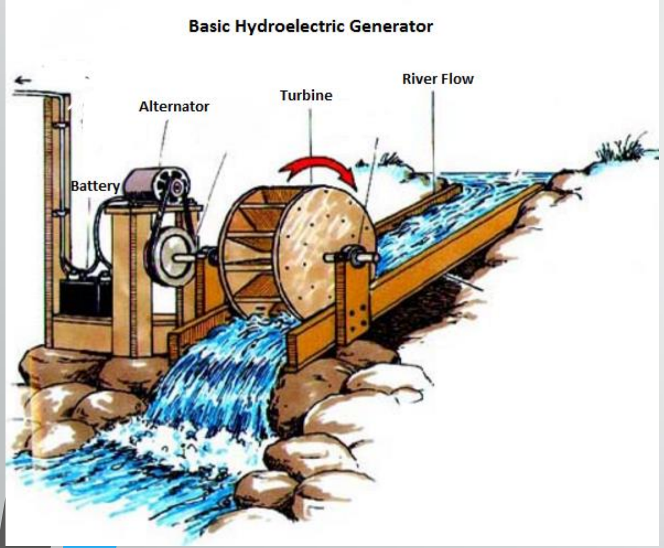

Fig. 1 – Basic Hydroelectric Generator

- Takes kinetic energy of flowing water and converts it to electrical energy
- Flowing water spins turbine which spins alternator to charge a battery
- Process is more environmentally friendly than traditional methods
- Better approach than building a hydroelectric dam which destroys the river below it
- Drawback is that not nearly as much electric potential is stored as in other methods

Problem Scope

This project will consist of creating a marketable power generation system that will harnesses power from flowing water as well as remain portable. This generator will create affordable and clean power in locations with a reasonable amount of flowing water.

Needs Statement & Goal Statement

- Need Statement:

"People in remote locations do not have access to electricity for powering their electrical devices."

- Goal Statement:

"Develop a portable device that transforms organic kinetic energy into usable electricity."

Target Market

American Red Cross

U.S.ARMY

Objectives

- Produce enough power to satisfy the need of our target consumers.
  - Supplemental emergency power generation
  - Environmentally conscious recreational camper
  - Companies in rurally indigenous locations
- Minimize weight to ensure portability
  - Modular design
- Environmentally friendly
- Fast and simple assembly and disassembly

Project Constraints

- **Weight**
  - <100lb
- **Noise Level**
  - <50 dB
- **Waterproof**
  - Protect electrical components
- **Safe and Reliable**
  - Little environmental and human impact
- **Generate Electricity**
  - In order to charge a battery

Current Design

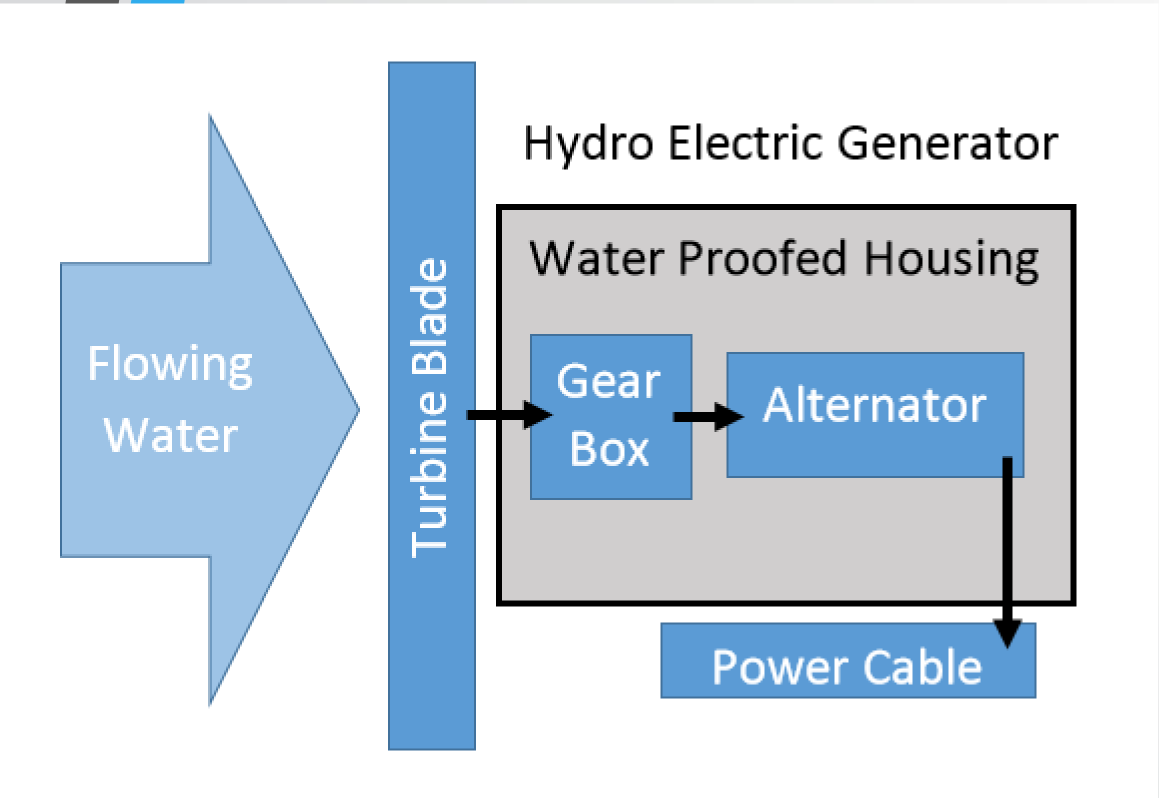

Fig. 2 – Revised Design Flowchart

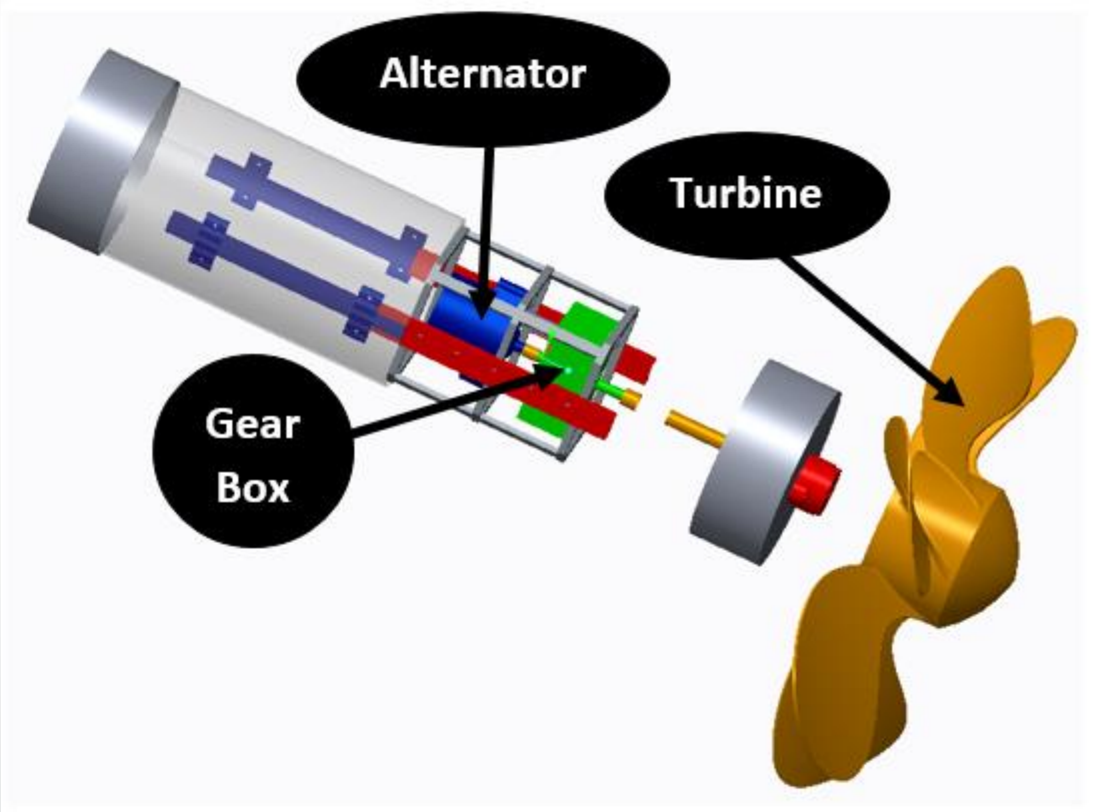

Fig. 3 – Revised Design Overview

Detailed CAD Schematic

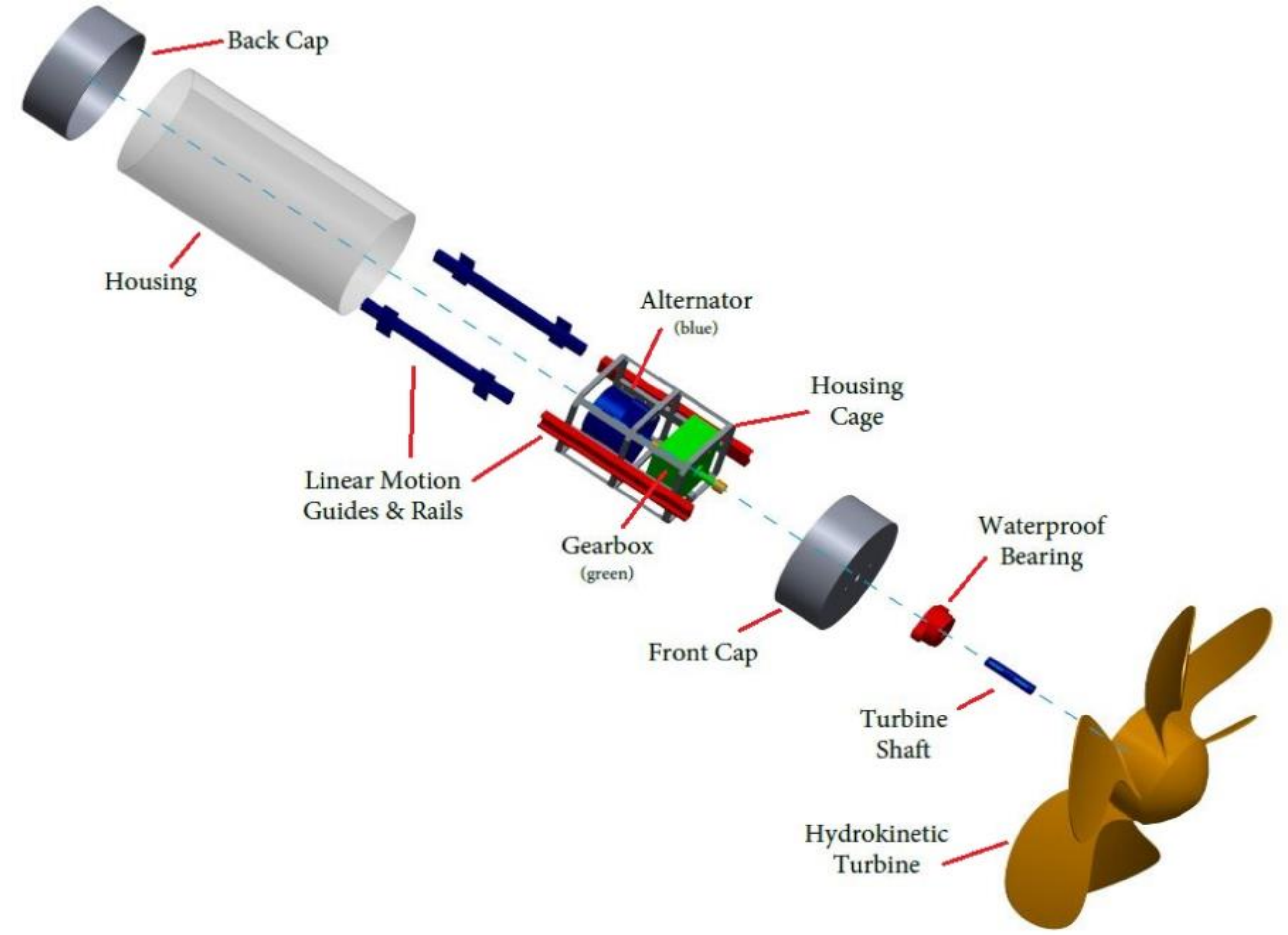

Fig. 4 – Hydroelectric Generator CAD

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Detailed CAD Schematic

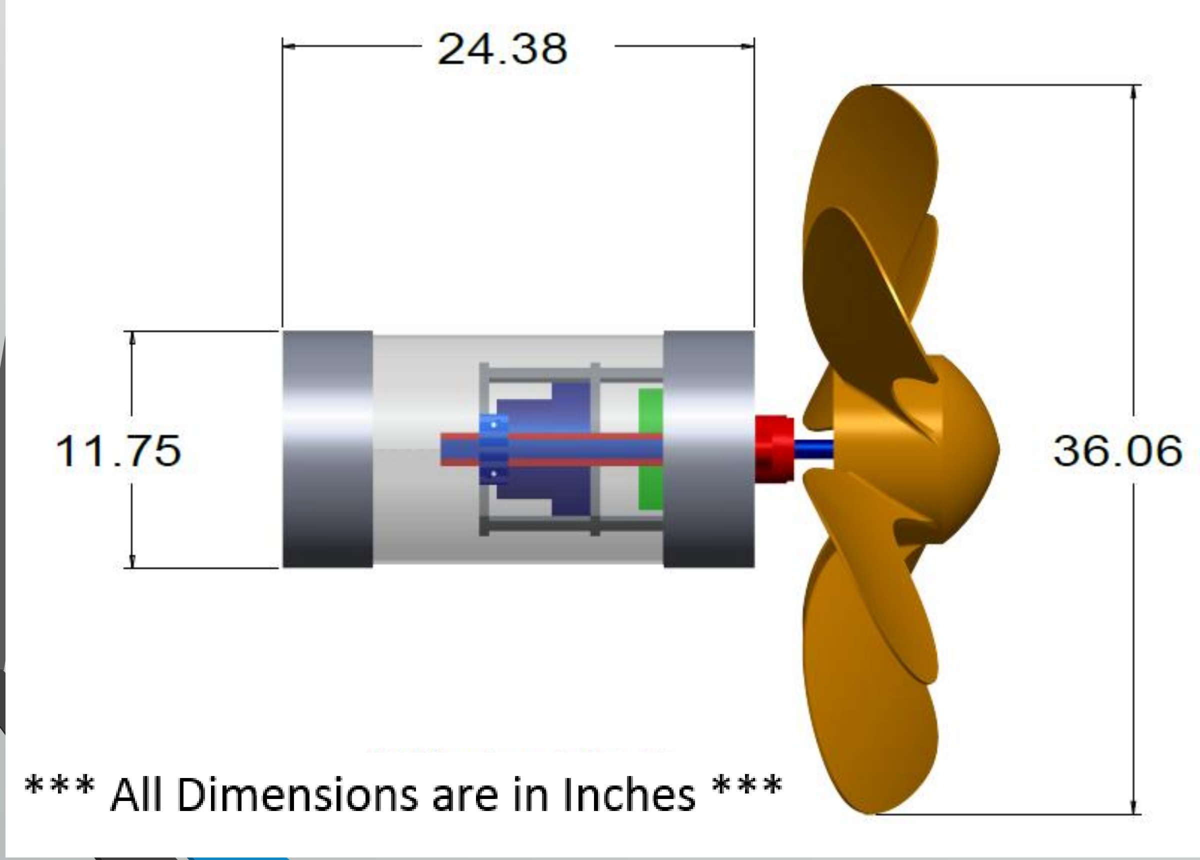

Fig. 5 – Hydroelectric Generator CAD with Dimensions Side - View

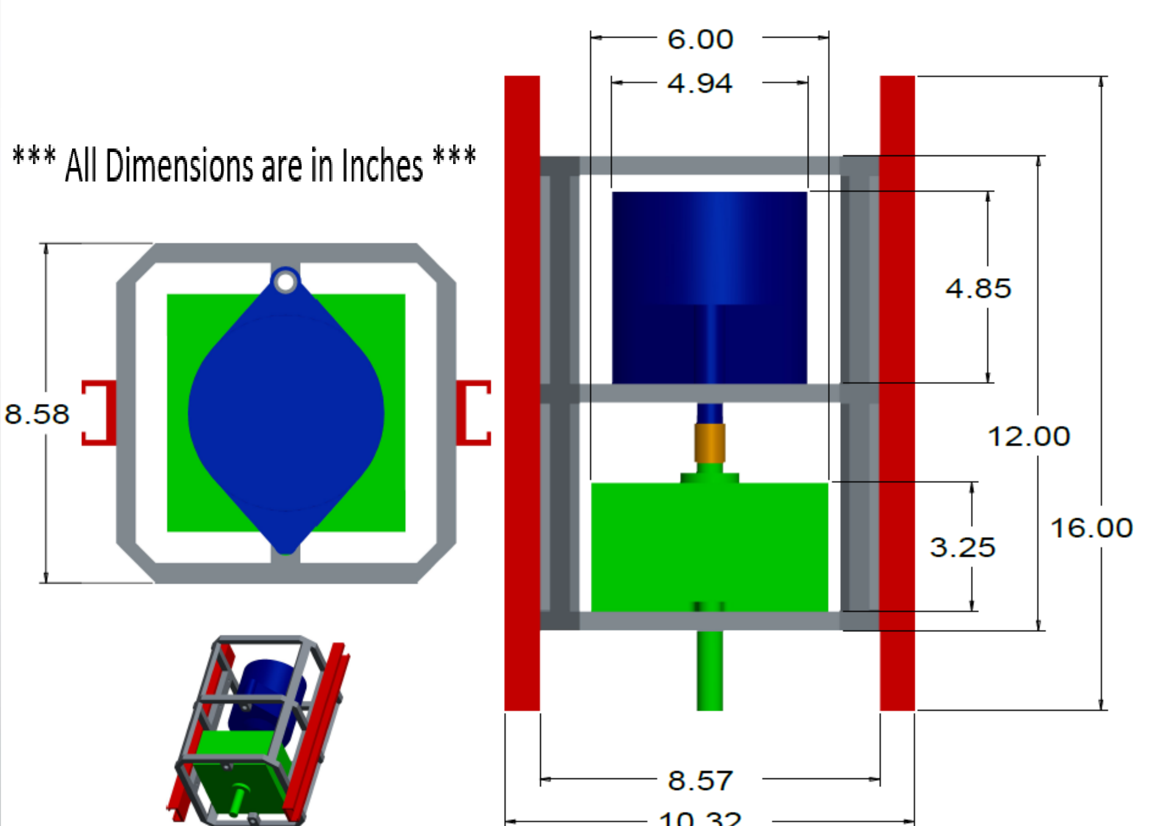

Fig. 6– Hydroelectric Generator Cross-Sectional View with Dimensions

Electronic Components – Overview

- 3 Phase DC-540 Alternator from Wind Blue Power
- 12 V / 25 A Charge Controller from Wind Blue Power
- LCD Display Wattmeter from Wind Blue Power

Table 1: Specifications of DC-540

Wind Blue Power	DC – 540 PMA
Voltage Production	14V @ 250rpm
Amperage Production	5A @ 250rpm
Energy Production of 1764kJ	7 Hours @ 250rpm

Electronic Components – Circuit Schematic

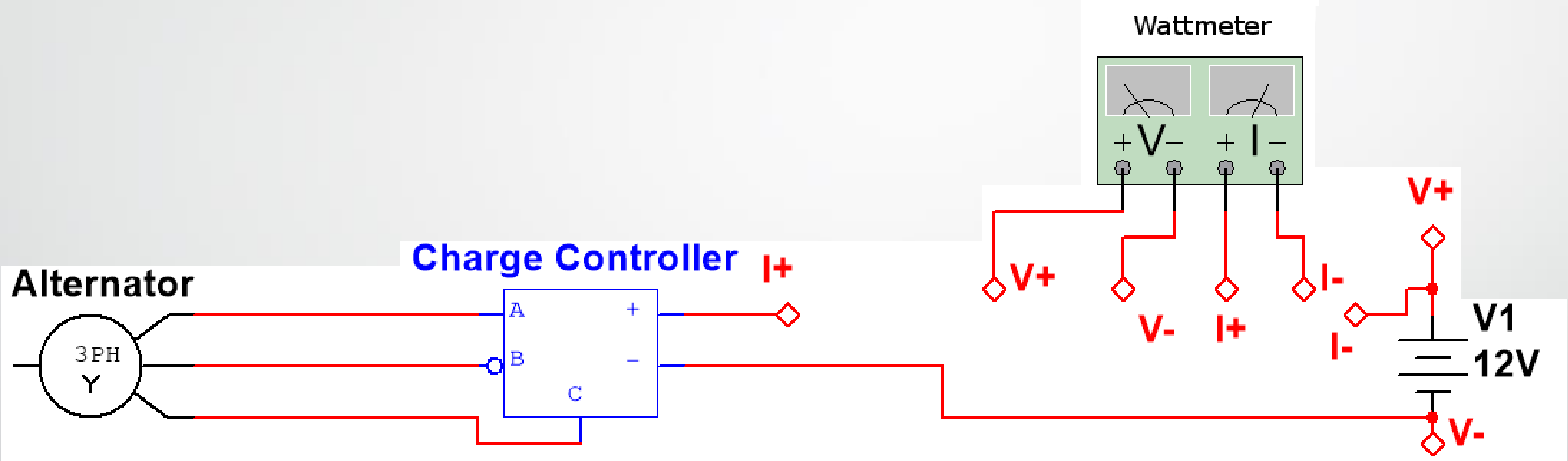

Fig. 7– Circuit Schematic

Electrical Components - Wiring

Fig. 8 – Vetco Extra Large Series 3 Pin Male Inline Waterproof Connector

Specifications	
Number of Pins	3
Voltage Rating	300V
Rated(40°C)	20 A
Max Wire Gauge	12 AWG
Operating Temperature	-45°C ~ 105°C

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Waterproof Testing and Results

- Experimental Procedure #1:
  - Clean edges of the PVC housing and attach end caps
  - Submerge the apparatus into cooler full of water for 5 minutes
  - Remove housing and check for introduction of water inside

- Results:
  - Housing was ≈75% full of water after 5 minutes

Waterproof Testing and Results

- Experimental Procedure #2:
  - Dry end caps from previous experiment
  - Fill end caps full of water on inside
  - Observe if water escapes through the crease of the cap

- Results:
  - End caps leaked through creases

Waterproof Testing and Results

- Conclusion:
  - Marine grade epoxy was added to creases
  - Additional methods of sealant will be used to make waterproof
  - A layer of PVA sponge will be added to the bottom of the housing as a fail safe for water leaks

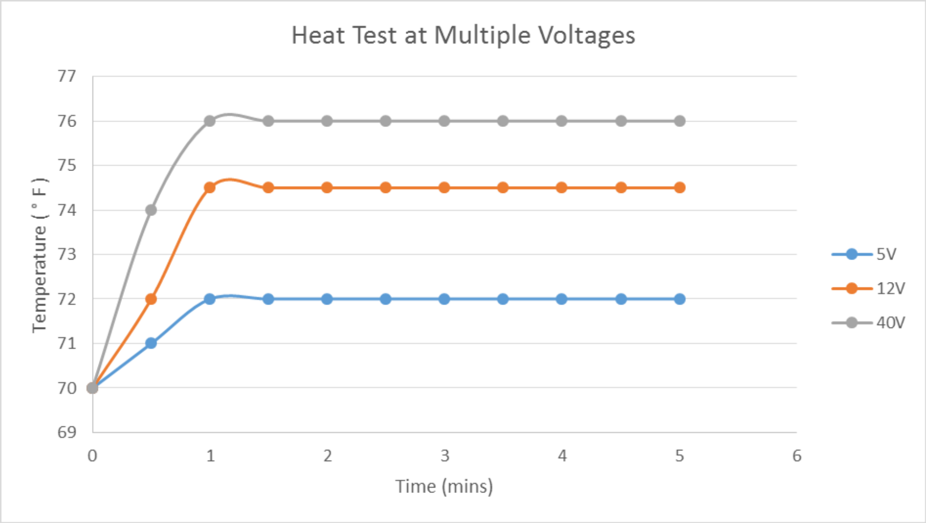
Fig. 10 – PVA sponge

Heat Dispersion Testing and Results

- Experimental Procedure:
  - Place the alternator within housing
  - Attach electric drill with socket and extension to the alternator's input shaft
  - Spin the drill at desired voltages to and take temperature with a temperature gun every 30 seconds for five minutes to observe temperature change

Heat Dispersion Testing and Results

- Results:

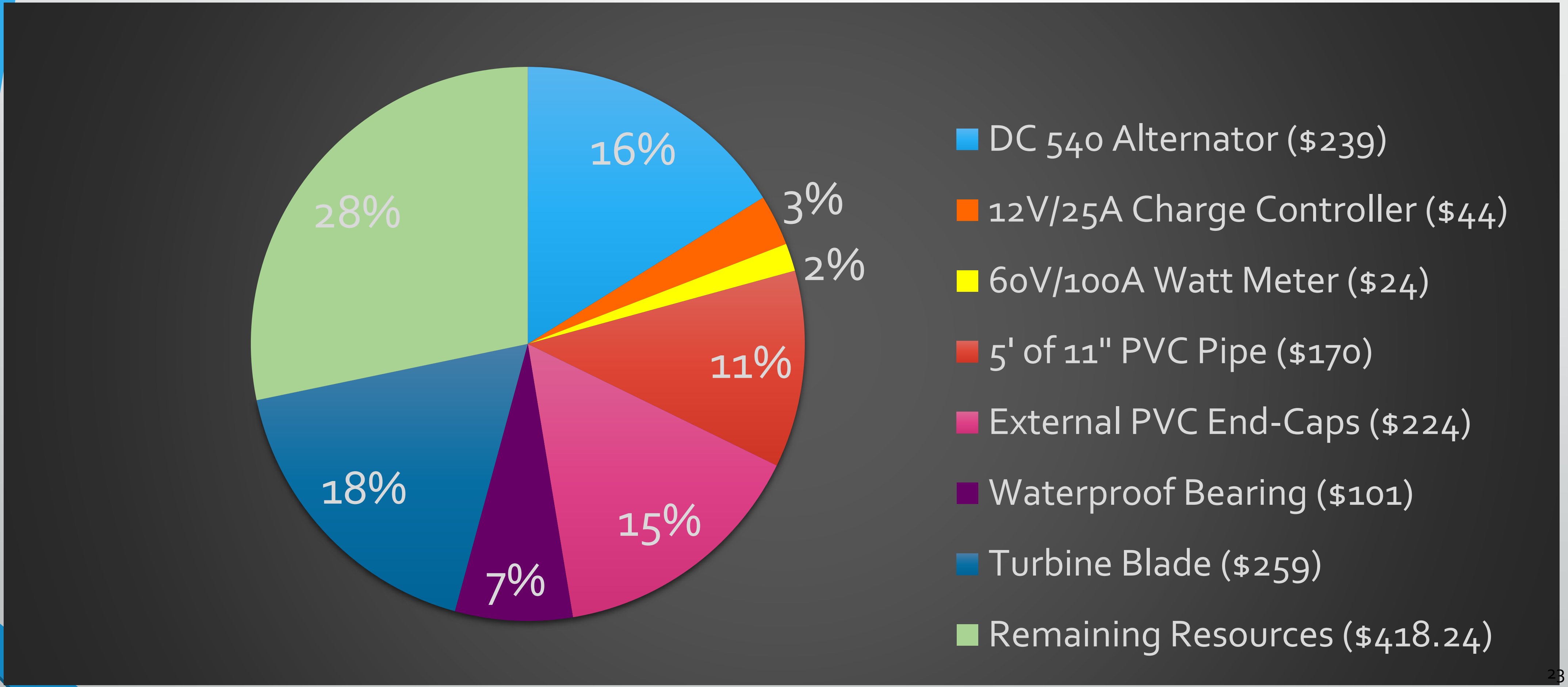


- Conclusion:
  - Heat should **<u>not</u>** be a problem
  - The heat had a max plateau of 76°F at 40V
  - The apparatus will be operating at 12V

Component Status Update

Component	Delivered	Ordered	Designed	Needs to be Addressed
DC 540 Alternator	X			
Charge Controller	X			
Watt Meter	X			
5' of 11" PVC Pipe	X			
PVC End-Caps	X			
Water-Proof Bearings		X		
Shaft / Shaft Couplings		X		
Gearbox Set				X
Anchoring System				X
Turbine Blade	X			
Internal Housing			X	

Allocated Resources (Total Budget – $1500)



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Potential Challenges

- Water contacting electrical components
- Achieving proper gear ratio for desired output
- Submerging the apparatus to desired depth
- Anchoring the system to withstand the necessary forces

Current Agenda

- Finishing assembling internal housing for alternator
- Testing of our device
  - RPM vs power output
  - Buoyancy and stability underwater
- Finalize Following Component Designs and Selections:
  - Anchoring System
  - Gear Box
- Investigate measures to protect turbine and user during operation

Design/Assembly Forecast

- Next step would be to put the system together and begin testing
- Device will be tested in the Wakulla River at Shadeville road at full functionality
- Readings from the wattmeter will be used to gather data
- Gathered data will be used to finalize other aspects of the design

Fig. 11 - Wakulla River

Gear Box

- Incomplete force analysis for water flowing over turbine blade
- Will be based upon data gathered from lone turbine testing
- The gearbox will increase the RPM output from the turbine to the necessary input level for the alternator
- Calculations will be performed in the coming week based of the heat dispersion test and average turbine speeds in order to determine the proper gear ratio

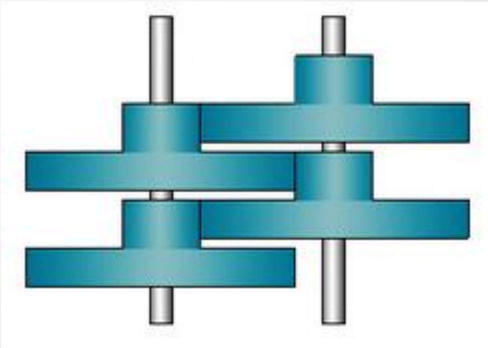

Fig. 12 - Gearbox

Scheduling

Task Name	Duration	Start	Finish
Order Remaining Components	5 days	Fri 1/8/16	Thu 1/14/16
Design Analysis	**17 days**	**Fri 1/8/16**	**Mon 2/1/16**
Design Internal Housing	3 days	Fri 1/8/16	Tue 1/12/16
Design GearBox	15 days	Tue 1/12/16	Mon 2/1/16
Manufacturing	**14 days**	**Mon 1/18/16**	**Thu 2/4/16**
Manufacture Internal Housing	14 days	Mon 1/18/16	Thu 2/4/16
Manufacture/Orde Gearbox	14 days	Mon 1/18/16	Thu 2/4/16
Manufacture Anchoring	6 days	Thu 1/28/16	Thu 2/4/16
Manufacture/Orde Turbine	14 days	Mon 1/18/16	Thu 2/4/16
Testing	**26 days**	**Mon 1/25/16**	**Mon 2/29/16**
Heat Dispersion	6 days	Mon 1/25/16	Mon 2/1/16
Waterproofing	6 days	Mon 2/1/16	Mon 2/8/16
Electrical Output	6 days	Mon 2/8/16	Mon 2/15/16
Turbine Blade	6 days	Mon 2/15/16	Mon 2/22/16
Anchoring	6 days	Mon 2/22/16	Mon 2/29/16
Assembly	**10 days**	**Mon 2/29/16**	**Fri 3/11/16**
Outside Housing	5 days	Mon 2/29/16	Fri 3/4/16
Internal Housing	5 days	Mon 2/29/16	Fri 3/4/16
Anchoring	7 days	Thu 3/3/16	Fri 3/11/16
Electronics/Wiring	7 days	Thu 3/3/16	Fri 3/11/16
Consumer Instruction Manual	12 days	Mon 2/29/16	Tue 3/15/16

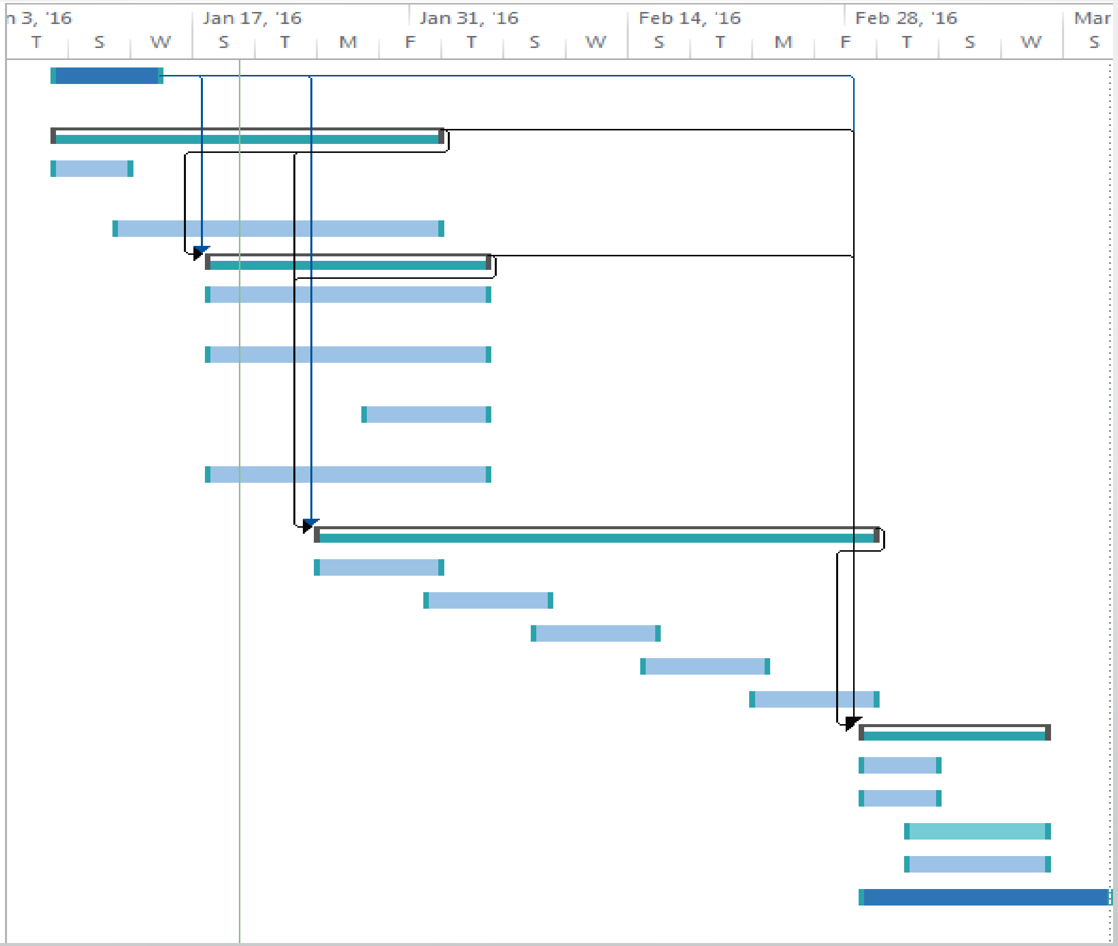

Fig. 13 – Gantt Chart

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ACC Innovation Overview

- April 5 – 6, 2016
- 15 universities competing
- Each nominating one undergraduate student
- Held at Georgia Tech this year
- Over a 2 day period students will pitch their innovations to a panel of judges
- Open to students without revenue or capital in excess of $100,000 and to those who haven't competed before

<u>Prizes</u>

1st Place Award $15,000

2nd Place Award $10,000

People's Choice Award $5,000

* There may also be opportunities for sponsor prizes, and venture funding. All participants are recognized at the awards ceremony, and on the event website.

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ACC Innovation Schedule

- Day 1 – Preliminary "quick pitch" round in front of a panel of judges (3 min. pitch followed by 5 min. of Q&A)
  - 6 finalists will be selected to continue
- Day 2 - Finalists pitch to a panel of judges in front of a live Audience as well as broadcast on PBS and streamed online (3 min. pitch and 3 min. of Q&A)

Competition for Spot in ACC Challenge

- Step 1: Submit invention and beginning stages of business plan online for review
  - ***Made top 11 out of 80 participants
- Step 2: Present invention, beginning stages of business plan, and current status of prototype followed by Q & A
  - ***Made top 3 out of 11
- Step 3: TBA, final choice of competitor

The Business Model Canvas

Team or Company Name: Personal Hydroelectric Generator

Date: 11/18/2015

[X] Primary Canvas

[ ] Alternative Canvas

Key Partners

- Payment service such as *paypal*
- Distribution partners –USPS, FedEx, etc.
- Suppliers – generators, alternators, and turbine components
- FSU – (senior design) supplies initial funding for the project
- Kickstarter – entry level fundraising
- Grants from competitions such as InNolevation Challenge

Key Activities

- R&D –improve on hydroelectric generator design
- effective sales team
- establish premium models with added features

Key Resources

- Brand name
- Product design
- Sales and support teams
- Sales of parts and expanded features

Value Proposition

- Provide a constant, clean energy source with enough power to supply a small home or cabin with electricity
- Utilize the power of flowing water in order to generate electricity
- Significantly quieter than its gasoline counterpart
- Portability

Customer Relationships

- Dedicated sales for large purchase accounts
- Support staff
- Automation (where possible)
- Periodic newsletter

Channels

- Global sales and support team
- Online website with product information
- Social media accounts

Customer Segments

- Developing countries – specifically villages and homes near bodies of water
- Humanitarian organizations
- Outdoorsmen – riverside camp sites
- Military

Fig. 14 – Business Model Canvas

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QUESTIONS?