ME 476C Kinetic Sculpture 2018-2019
Team 18F02 Kinetic A

Presentation 3: Final Proposal

Holden Chapin, Joshua Glenn,
Dylan Lovato, Jonathan Walgren

Project Description

Holden Chapin
November 19, 2018
Kinetic Sculpture
Team 18F02 Kinetic A

- Sponsor/Client : Dr. Sarah Oman
- Create a kinetic sculpture that showcases different engineering characteristics
- Goal of sculpture: inspire future engineers, motivate current students, highlight engineering principles in a creative way

Design Description

Jonathan Walgren
November 19, 2018
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1. Power is input through the hand crank to lift up weight
2. Weight transfers power through a gear train
3. Power is then transmitted from worm gear to ring gear
4. Gear holder rotates bevel gear which turns through U-joint and turns Archimedes screw
5. Archimedes screw lifts fluid up to shelf where it cascades over gear system

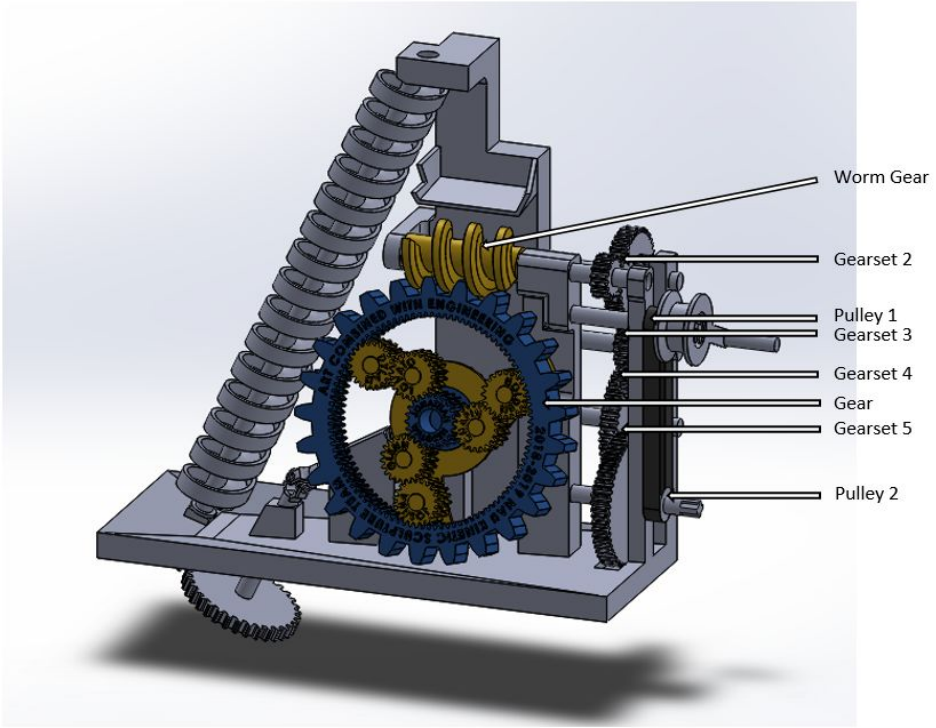

Figure 1: Full CADD Assembly

Design Description (Continued)

Jonathan Walgren
November 19, 2018
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Bill Of Materials:

Full Scale Prototype - $136.98
- 6 Rolls of 3D Printer Filament - $130.68
- Super Glue - $6.30

Foundry Construction - $102.59
- Perlite - $36.97
- Concrete - $9.97
- Trash Can - $21.77
- Home Depot Bucket - $10.62
- PVC Pipe - $3.90
- PVC Coupler - $4.34
- Eye Bolts - $5.25
- Trowel - $9.77

Aluminum Recycling Boxes - $21.94
- Cardboard Boxes - $7.25
- Trash Bags - $6.01
- Tape - $8.68

Initial Budget - $3,000

Budget Left - $2,738.49

Design Requirements

Dylan Lovato
November 19, 2018
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CR's

- Can fit through a door
- 2 people can safely transport
- Exemplify at least 3 engineering characteristics
- Safety
- Durable

Meeting CR's

- Sculpture contained within plexiglass, so it is easily carried and safe
- Gear ratios, belts, fluid mechanics, corrosion rates, manufacturing processes, surface treatments, material properties
- Corrosion analysis led to anodizing aluminum for durability

Schedule & Budget

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- Spent around $250 thus far (spent costs and planned near future costs below)
  - Prototype - $150 (spent)
  - Foundry - $100 (spent and awaiting Green Fund approval)
  - Casting - $50 (For propane, torch, etc...) (Future)
  - Safety Equipment - $50-$100 (Future)
- Type 3 anodizing w/ dyeing starts at $175 per piece
- Casting of aluminum will begin during winter break
- Anodizing will begin early-mid next semester

Proposed Budget: $3000

Schedule & Budget (Continued)

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The team is currently ahead of schedule.

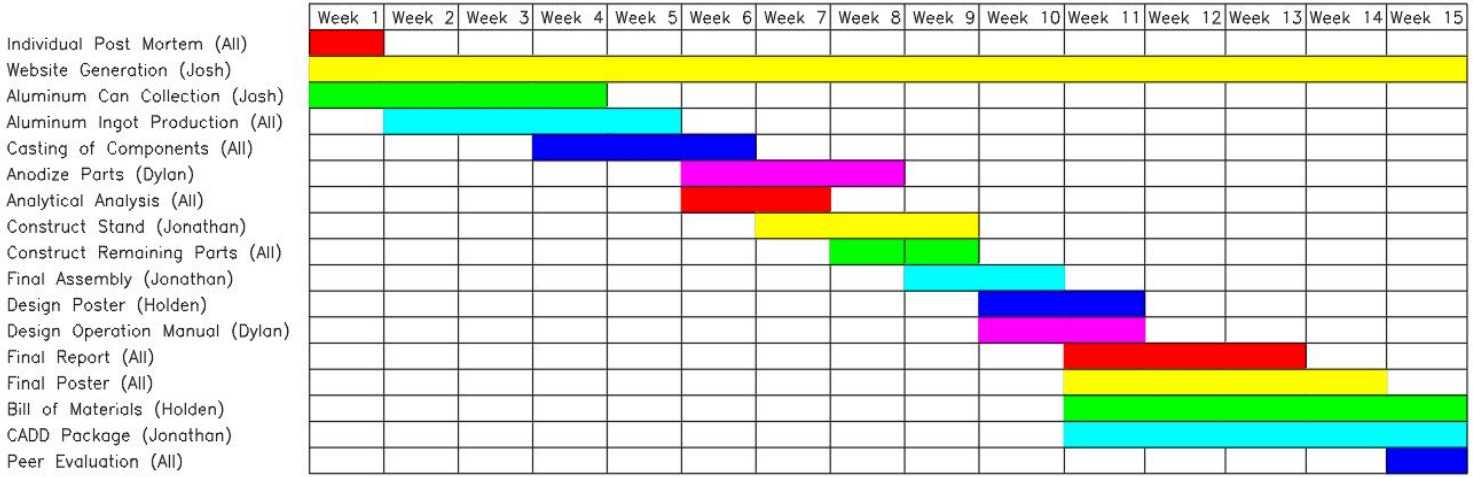

Figure 2: Gantt Chart for Kinetic Sculpture Team: Term 2

Future Work - Can Collection

Dylan Lovato
November 19, 2018
Kinetic Sculpture
Team 18F02 Kinetic A

- Collection bins are up around the Engineering and Business Building
- We need between 2000-3000 cans
- Expect 50% slag from used cans
- Cans collected will be our materials for our final project.
  - Al Alloy 3104-H19 or 3004-H19 (98% Al, 1% Mg, 1% Mn)

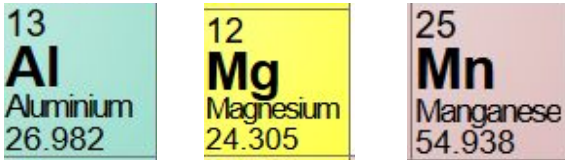

Figure 3: Elements of Aluminum Cans

Figure 4: Signs for Aluminum Collection

Future Work - Green Fund

Joshua Glenn
November 19, 2018
Kinetic Sculpture
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- Recycling Cans
  - Currently undergoing application process for sponsorship by NAU Green Fund
- Currently working with Dr. Jennifer Wade and Green Fund in order to get sponsorship for our project for our materials selection, collection, and casting process

Figure 5: NAU Green Fund

Future Work - Our Foundry and Casting Process

Jonathan Walgren
November 19, 2018
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- Foundry: 70% concrete and 30% pearlite
- Crucible: Currently researching

Figure 6: Pouring Perlite

Figure 7: Foundry Lid

Figure 8: Drying Foundry

Anodization (and Why We're Hiring Someone) Explained

Joshua Glenn
November 19, 2018
Kinetic Sculpture
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- An electrolytic process of surface treating an (usually aluminum) alloy through coating the metal with a protective oxide layer.
  - Steps for Type 3, Class 2, 2-Step, Inorganic Dyeing (Must Be Kept at 0°C Through Whole Process):
    1. Soak part in lye bath
    2. Soak part in degreaser bath
    3. Clean part with distilled water
    4. Soak part in sulfuric acid bath for ~45 minutes while running 100V through part
    5. Repeat step 3
    6. Repeat step 4 with dye in bath
    7. Repeat step 3

Anodization (and Why We're Hiring Someone) Explained (Continued)

Joshua Glenn
November 19, 2018
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- After discussion with NAU Chemistry Department and professors, we learned some sobering things.
  1. Temperature regulation is an extremely difficult process (especially at 0°C)
     a. Very expensive process (NAU does not have proper facilities)
  2. Due to 100V going through sulfuric acid, electrolysis will take place
     a. SO_2, H_2, and O_2 will be released into the air
        i. SO_2 (Sulfur Dioxide) is poisonous and harmful to environment
           - Must be captured and neutralized
        ii. H_2 and O_2 are extremely combustible
           - Live wire with 100V running through it
           - High explosive potential

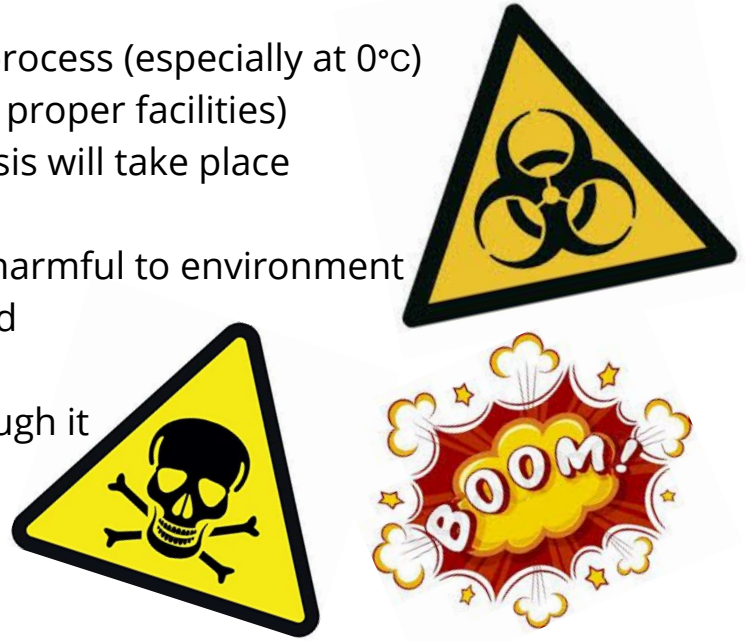

Figure 9: Danger Signs

Anodization (and Why We're Hiring Someone) Explained (Continued Again)

Dylan Lovato
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- ChemResearch Corporation - Phoenix, AZ
- Metal finishing company; aerospace, defense, medical
- James Buriss - President and CEO
- Dan Stensgard - Process and Business Development
- Currently pricing anodization and dyeing of ring gear, sun gear, and planet gears

Figure 10: ChemResearch Corp Logo [1]

Questions?

Special Thanks To:
Dr. Constantin Ciocanel, Dr. Stephanie Hurst, Dr. Michael V. Lee, Dr. Sarah Oman, Kay Pinto, Singne Slayton, Dr. Jennifer Wade

References

[1] “Anodize,” *Chemresearch*. [Online]. Available: https://chemresearchco.com/anodize/. [Accessed: 19-Nov-2018].