Project Deliverable E: Project Schedule and Cost

GNG 1103

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February 25, 2024

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1. Introduction

Canadian Nuclear Laboratories explores various aspects of nuclear science and technology in Canada. They study a variety of materials to help improve design features, however using new material comes with uncertainty and potential challenges. The goal of this project is to help alleviate some of this uncertainty in materials testing by creating a device that can be used to test the degree to which erosion parameters affect a given material/part. This report discusses the finalised concept to meet the needs of the client and how we intend on making and testing the device.

2. Summarised Chosen Concept

Container:

Based on the previous client meetings, we know that the client would like the device to be able to test a cylindrical part; this led to us deciding that the container for the device would be a cylinder. The container would need to be durable as well to ensure the erosion testing does not erode the container itself. Based on this criteria and the limited funds, we decided that a metal container would give the best results.

Loading Apparatus:

From previous meetings with the client, we know that the device should be able to test a variety of materials and cylindrical parts; therefore, our loading design would need to be adjustable. We decided that the best design to fit this criteria would be a threaded shaft equipped with two washers to hold the part in place.

Motor:

From previous meetings with the client, we understand that the speed should not be an erosion parameter that the device tests; therefore, our motor only needs to provide a consistent speed for the time it would be running. Since the device will be running for a relatively long time, the motor also needs to be robust enough to handle this. Overall, we decided to use a DC motor that will provide a consistent torque and capable of being controlled using Arduino.

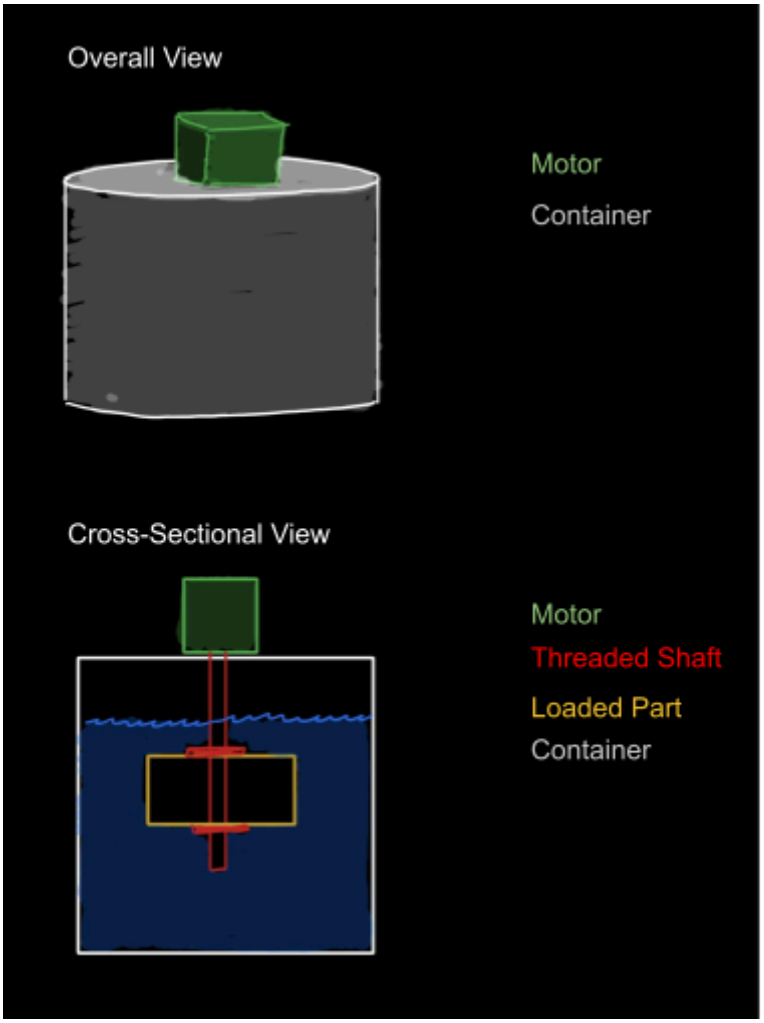
Parameters for Erosion:

Canadian Nuclear Laboratories would like us to explore more than one method for accelerated erosion. We have decided that the parameters that we will be testing are abrasive size, and concentration.

Overall:

Overall the design will look like Figure 1 where the motor would be situated at the top of the container and the shaft will extend from it into the container, which will have fluid inside. The motor will spin the part once the device is running

Figure 1: Sketch of Final Concept



3. Outlined Plan and Schedule

Outlined plan and schedule							
Week of	SUN	MON	TUE	WED	THU	FRI	SAT
25-Feb	DUE DELV E.	PROTOTYPE 1			TEAM MEETING	WORK ON DELV F	
3-Mar	DUE DELV F.	PROTOTYPE 2			TEAM MEETING	WORK ON DELV G	
10-Mar	DUE DELV G.	PROTOTYPE 3			TEAM MEETING	PROTOTYPE 3	
17-Mar	WORK ON PROTOTYPE 3			PRESENTATION MAKING	TEAM MEETING	WORK ON DELV H	
24-Mar	DUE DELV H.	FINAL PRODUCT		DESIGN FREEZE	TEAM MEETING	WORK ON DELV I / FINAL PRODUCT TOUCH-UP	
31-Mar	FINAL PREPARATION / PRODUCE RESULTS				Design day		

4. Bill of Materials

Erosion Testing Device Budget					
BUDGETED AMOUNT	TOTAL COSTS	DIFFERENCE			
$100.00	**$123.17**	**-$23.17**			
Description	**Material**	**Type**	**QUANTITY**	**COST**	**TOTAL**
Paint Container **[1]**	Metal (aluminum)	Container/Housing	1	$7.99	$7.99
Motor **[2]**	Metal	Torque Mechanism	1	$37.99	$37.99
Threaded Shaft **[3]**	Metal	Loading/Shaft	1	$11.27	$11.27
CaOH **[4]**	Calcium Hydroxide	Abrasives	1	$16.50	$16.50
Fine Sand **[5]**	SiO2 (commonly)	Abrasives	1	$11.99	$11.99
Gaskets **[6]**	Rubber	Leakage Prevention	12	$0.52	$6.29
Nuts **[7]**	Metal	Material Security	4	$0.27	$1.08
Washers **[8]**	Metal		4	$0.16	$0.64
Arduino UNO R3 **[9]**	Electronics	Electronic Hardware	1	$15.25	$15.25
SUB TOTAL					**$109.00**
TOTAL					**$123.17**

5. List of Equipment

Equipment (software or hardware) needed to build a prototype:

1) Container (Metal Paint Container)
2) Motor
3) Threaded Shaft: Metal
4) Abrasives: CaOH & Sand
5) Gasket
6) Nuts/Washers
7) Arduino uno
8) Laptop
9) Tablet (displays)
10) Arduino IDE
11) CodeBlocks
12) Power Supply (outlet)

6. Prototyping Test Plan

ID	Objective	Test and Description	Results to Collect	Duration
1	Leakage: As leakage is unpleasant and could damage electronics, this test checks whether the basic design could lead to leakage and if yes, at which amount	- Prototype 1 with tap water (lowest viscosity) - Check for leakage while the device has water but is not working - Check for leakage while the device is working at designated RPM - Find the volume of leakage in both cases by measuring the volume of water in the container before and after the process - Locate where the leakage originated	- Specific leaking origin on the device → reinforce that specific part - Volume of leaked fluid → Visualization of how severe the leakage is → Might consider a different design	- Duration: Less than one day - Start date: - Dependencies: Functional final version of Prototype 1
2	Stability: As the working motor could create considerable vibration and fluctuation, this test checks whether the design is stable enough	- Prototype 1 with different types of fluid (ascending viscosity) - Let the motor work with each type of fluid, under designated RPMs - Note for each scenario whether the device: slightly vibrates, moderately fluctuates, severely fluctuates or totally collapses	- Scenarios where the device severely fluctuates or totally collapses → reinforce the base or consider a different design	- Duration: Less than one day - Start date: - Dependencies: Functional final version of Prototype 1
3	Loading capacity: This checks for the maximum possible weight of sample the loading mechanism (motor and attached rod) can support	- Prototype 1 with different types of sample (ascending weight) - Let the device work for each scenario - Note for each scenario whether the loading mechanism is: ‘worked & undamaged’ or ‘can not function / damaged’	- Scenarios where the loading mechanism is damaged → reinforce the loading mechanism or consider a different design	- Duration: Less than one day - Start date: - Dependencies: Functional final version of Prototype 1
4	Loading capability: This checks for the maximum viscosity of fluid the loading mechanism (motor and attached rod) can support	- Prototype 1 with different types of fluid (ascending viscosity) - Let the device work for each scenario - Note for each scenario whether the loading mechanism is: ‘worked & undamaged’ or ‘can	- Scenarios where the loading mechanism is damaged → reinforce the loading mechanism or consider a different design/motor	- Duration: Less than one day - Start date: - Dependencies: Functional final version of Prototype 1

		not function / damaged’		
5	Software: This checks whether the chosen motor, programming language and accompanying electronics work well together	- Prototype 1 with accompanying electronics and software - Connect the motor and other electronics to a personal laptop → run the program - Check whether the motor works as planned	- Scenario when the motor does not work as planned → Fix the code / choose different programming language and accompanying electronics	- Duration: Less than one day - Start date: - Dependencies: Functional final version of Prototype 1

7. Conclusion

We have outlined the steps we plan on taking to produce the product in the report. We intend on requesting more funds for the project since the budget is insufficient.

Trello Link: https://trello.com/c/Tpi616UP

8. References

[1] "BEAUTITONE Empty Paint Can - with Lid & Handle, 4 L", https://www.homehardware.ca/en/4l

[2] "24V DC Permanent Magnet Electric Motor Generator 250W 2750RPM for Wind Turbine, Scooter Drive Speed Control", https://www.amazon.ca/Permanent-Electric-Generator-2750RPM-Turbine/dp

[3] "Paulin 3/8-16 x 72-inch Fully Threaded Steel Rod - Zinc Plated - UNC", https://www.homedepot.ca/product/paulin-3-8-16-x-72-inch-fully-threaded-steel-rod-zinc-plated-unc/1000149703

[4] "Calcium Hydroxide, Powder, L/G, 500g", https://www.westlab.com/calcium-hydroxide-powder-l-g-500g

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[6] "MOEN Fibre Faucet Gaskets - Assorted Sizes, 12 Pack", https://www.homehardware.ca/en/12-pack-fibre-faucet-gaskets-assorted-sizes/p/3303286

[7] "Paulin 3/8-16-inch Finished Hex Nut - Zinc Plated - Grade 5 - UNC, https://www.homedepot.ca/product/paulin-3-8-16-inch-finished-hex-nut-zinc-plated-grade-5-unc/1000123459

[8] "Paulin 1/4-inch Bolt Size Flat Washers - Hot Dipped Galvanized", https://www.homedepot.ca/product/paulin-1-4-inch-bolt-size-flat-washers-hot-dipped-galvanized-1pc/1000141551

[9] “Arduino UNO R3”, https://makerstore.ca/shop/ols/products/arduino-uno-r3-clone