
Prototype I and Customer Feedback

Deliverable F

Client – Canadian Nuclear Laboratories

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GNG1103-F

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Introduction:

This report contains documentation on the prototyping plan of the design, as well as updated prototypes and Bill of Materials. It has been split into the Project Task Plan, Prototyping plan, followed by the feedback received in the meeting with PM's, and ending in the updated plans and designs for each subsection of the machine.

Project Task Plan:

Task Description	Estimated Duration (Days)	Owner
Gather materials	5	everyone
Construct extending pneumatic body	1	Dante, Connor
Test pneumatic body and record results	1	Fahad
Adapt body if failing tests	1	Fahad
Create prototype for drilling and collection	2	Fahad, Aymeric
Test drilling and collection, and record results	1	Dante
Adapt drilling and collection if failing tests	1	Dante
Update BOM and target specifications	1	Fahad, Dante
Create complete prototype (body and drilling) without complete feedback system	2	everyone
Test complete prototype and record results	1	Aymeric
Adapt complete prototype to pass tests	1	Aymeric
Fully implement feedback system	2	everyone
Test feedback system and record results	1	Connor
Adapt feedback System to record results	1	Connor
Update BOM and target specifications	1	Aymeric, Connor
Get feedback on final prototype	2	everyone
Create User manual and guide	1	everyone
Create final presentation and pitch	4	everyone

List Of Equipment Needed:

- 3D printer
- SolidWorks
- Onshape
- Laser Cutter
- Inkscape
- Hand Tools

Prototyping and Test Plans:

Test Number	Probable Critical Issue	Test Objective (why)	Test description (what)	Stop Criterion
1	Body can move up and down the tube	Testing for performance, Distance Travelled In how much time (feet/sec)	Extending the contraption to 15 feet and contracting it. Seeing how much weight it can push and pull	Body manages to push and pull the weight of the drilling mechanism
2	Controlled Drilling Mechanism	Performance, Management, Distance drilled (inches)	Drill into a material and test to see if device can make holes the same size consistently	Drilled hole sizes are consistent within the past 3 attempts
3	Collection Mechanism	Performance, Management, Amount of material collected (mg)	Drill a consistent hole into a material that will turn into powder, and measure how much the collection system collected in mg	The collected amount is consistent within 7 mg in the past 3 attempts
4	Test functionality of Fail Safe Mechanism	Risk Management	Removing the contraption from a tube utilizing the failsafe mechanism	Failsafe mechanism functions properly, used by multiple people

5	Testing if entire contraption works when assembled	Performance, Distance travelled (feet) Speed (feet/second) Hole size (inches) Material collected (mg)	Run through an entire material extraction process with the assembled complete prototype	When results equal results from tests 1,2 and 3
6	Feedback system test	Management, Risk management	Run through a material extraction process simulation	There is a clear feedback for when the prototype finishes extending, drilling and retracting

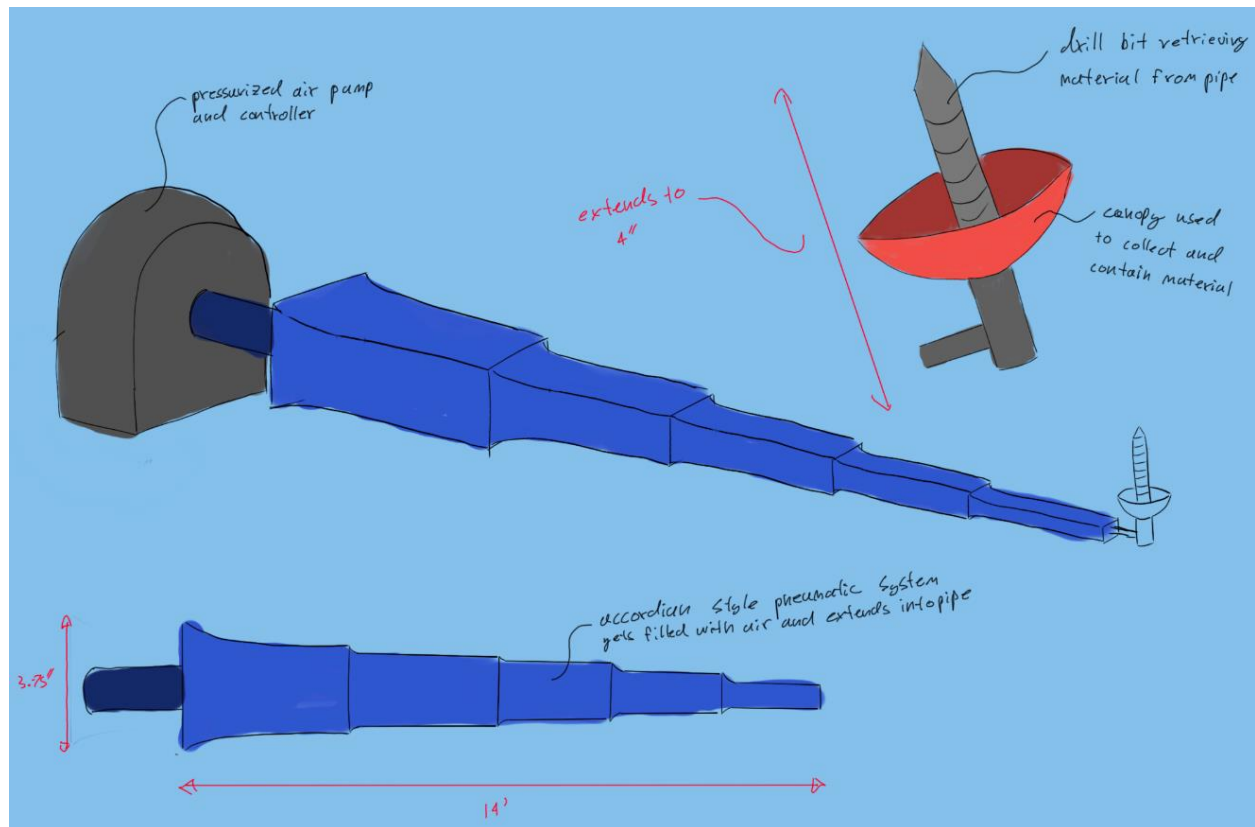
Project Risks:

Risks	Contingency plan
Prototype failing severely	<ul style="list-style-type: none"> - Change Implementation of the section - Or in extreme cases redesign the section entirely - Update Project Task Plan and timetable to account for added prototyping
Team Members not contributing	<ul style="list-style-type: none"> - Have a team reflection regarding the unfinished task - Align expectations with the group - Potentially meet with PM or TA - Provide support for teammate - Update Project Task Plan and timetable

BOM excel sheet:

[BOM - group 15](#)

Prototype Sketch:



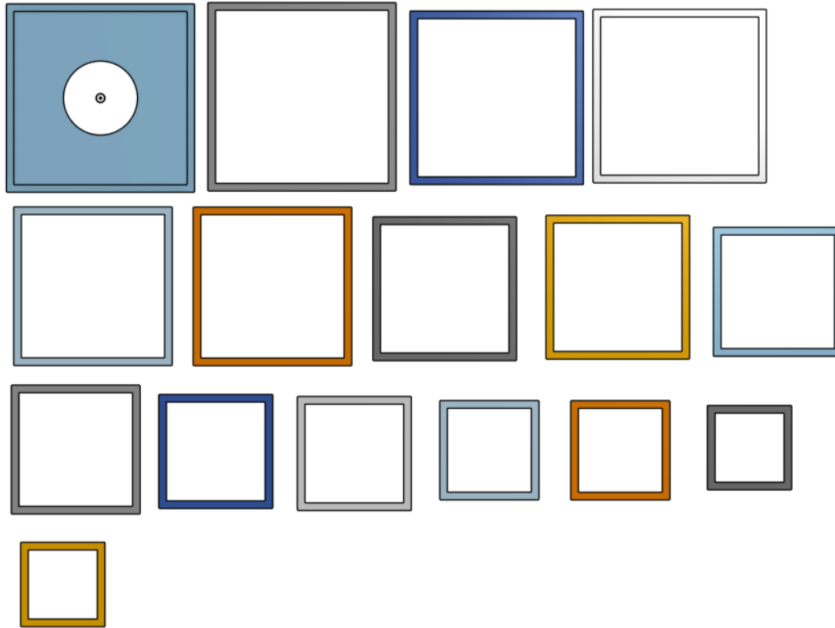
Feedback during meeting:

- Create a fail safe for when air is being leaked from the contraption.
- The drill should not be able to turn around or rotate inside the tube from its original position.
- How will we make sure the material does not spill (create a closing mechanism)
- How will the contraption be cleaned
- How will the pouch be manufactured
- Can the pouch collect enough material
- How will the failsafe work.
- Take into account the size of the tube. (15 ft is long)
- How will the PVC polyester will be closed so it is airtight
- Specify the gauges for 3d printing
- How much of one material are we using
- How will the contraption turn on

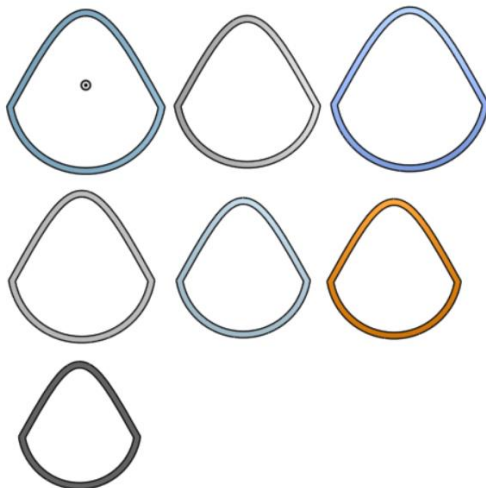
Prototypes:

Pneumatic System:

- To be printed:



- Alternative frame concept:

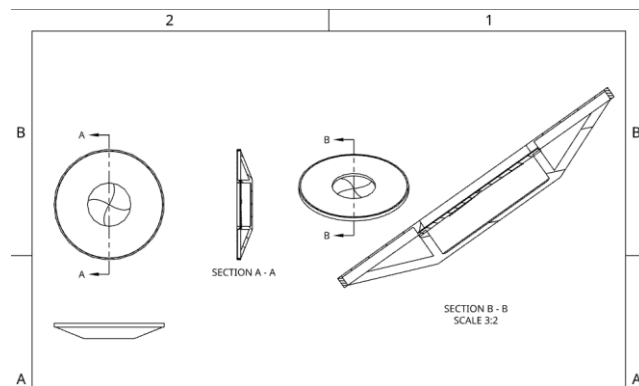
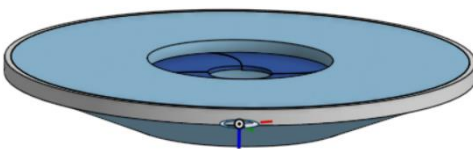


- Assembled concept:



- Explanation:
 - The frames will be connected with PVC coated polyester and will act as support for the inflating and deflation of the Polyester. The polyester will be enclosed on itself by means of sewing it together. Then will be attached to the frames with glue.
- PLA required – 60 grams
- Link to [OnShape](#):

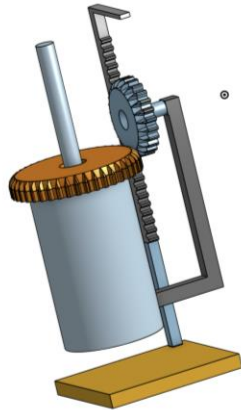
Collection System:



- Explanation:
 - A fully 3D printed container that attaches atop the motor and below the drill. It is constantly closed due to the lid being sloped inwards, and utilizes the centrifugal force generated by the spinning of the motor to open.
- Pla required: 30 grams
- Link to [OnShape](#)

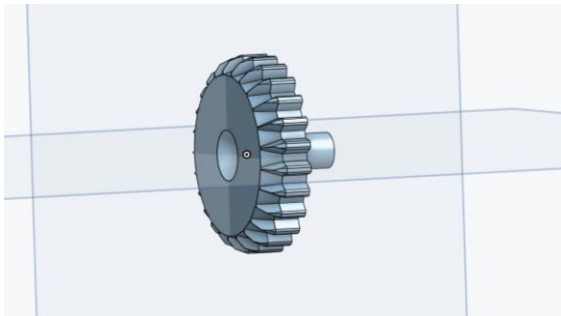
Drill and motor component:

Full assembly

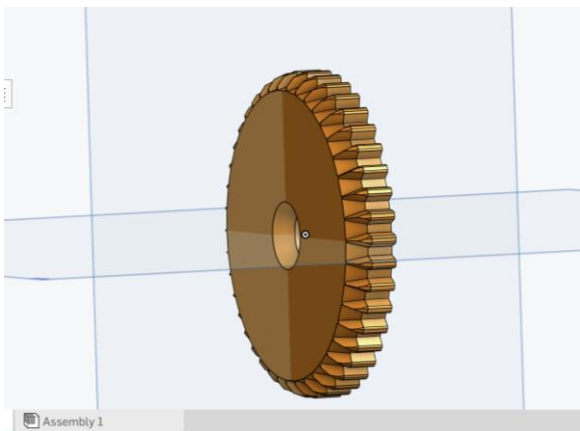


Individual parts

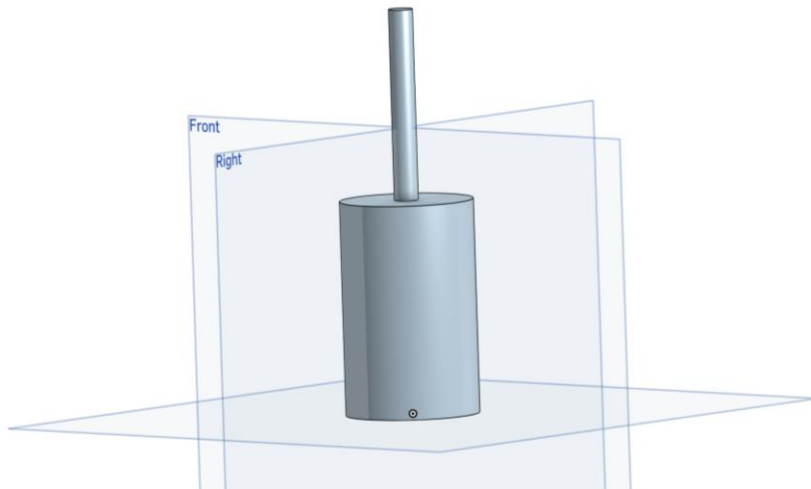
Gear 1:



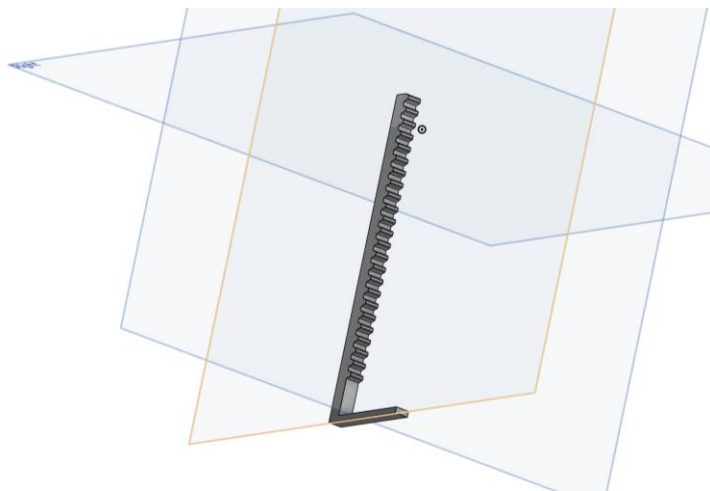
Gear 2:



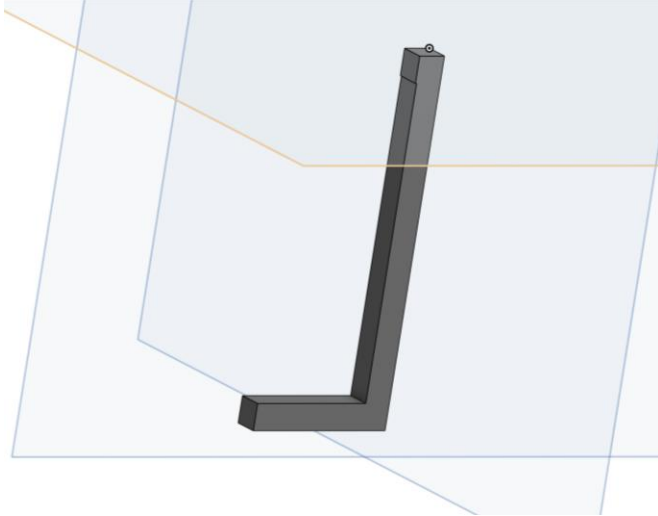
Motor and drill bit:



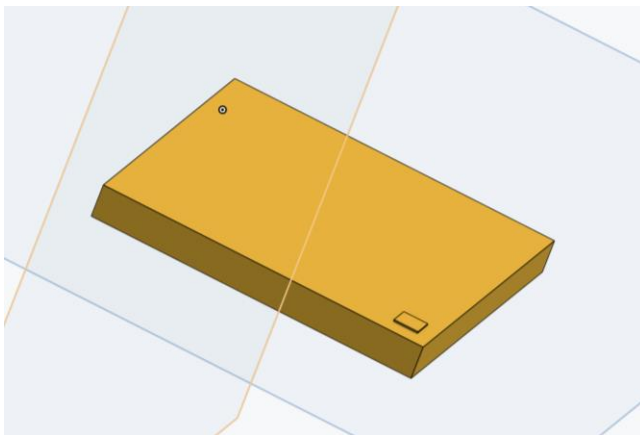
Gear track:



Connection:



Baseplate:



Explanation:

This Cad design represents the drill component that is attached to the end of our pneumatic system. This component oversees drilling to retrieve material.

To reach the walls of the drill we have included a gear system using bevel gears which aid with raising the drill motor with the drill but upwards. When the drill is spun gear two is also spun simultaneously. Gear 2 is connected to gear one which is connected to a gear track. When gear one is spun due to gear two the contraption is raised, and the drill bit can reach the upper wall of the tube.

Engineering Analysis:

- Current technical analysis is minimal and tests have not occurred, but critical errors that might occur are:
 - Tension in the expanding pneumatic mechanism causing mechanism to topple backwards.
 - Friction in Polyester of expanding mechanism causing tears or ruptures.
 - Drilling machine not having enough power to drill through material.
 - Air pressure not sufficient to push mechanism forwards.