

# Tube Traversers Inc

Precision Sampling, Safely Delivered

## Problem

Develop a remote-operated sampling tool that can **safely** extract metal samples from inside a nuclear reactor pipe without compromising the structural integrity of the pipe or exposing workers to radiation.

## Solution

We used an extendable telescoping rod, and a drill bit to cut the metal. We also have a rope pulley-back system in case of an emergency. Our feedback system includes a load sensor that measures the output giving us the sample's weight so we can then extract it. (The automatic reeling mechanism was changed to user operated spool due to budget constraints, if we were to have a higher budget ideally this is how we would do it. That being said, spool mechanism would still be an option due to reliability and greater pulling support)

Customer values:

- Enhanced **safety**
- Increased efficiency
- Cost-effective solution
- Reliable data collection

## Client

- **Canadian Nuclear Laboratories (CNL)** is Canada's premier nuclear and science technology organization and they are asking us to obtain a metal sample from a horizontal or vertical tube at a large distance.

## Design Problem Statement

- **“High Radiation Low Access Environments”:**  
Design a tool that can **safely** collect a 30-80 mg

metal sample from 15 ft inside a 4-inch soft-steel tube.

**amazon**

The Amazon logo, featuring the word "amazon" in a bold, black, sans-serif font. Below the letters "a" and "m" is a thick, orange curved arrow that starts under the "a" and points towards the "n", resembling a smile.

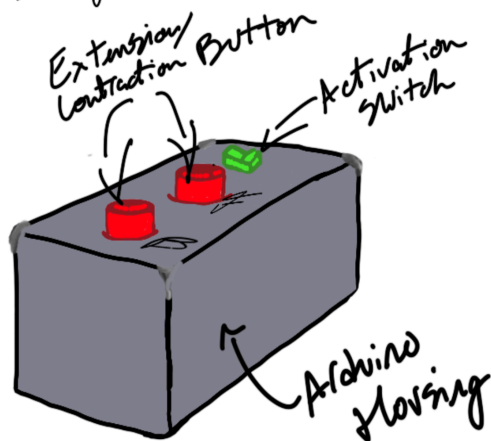


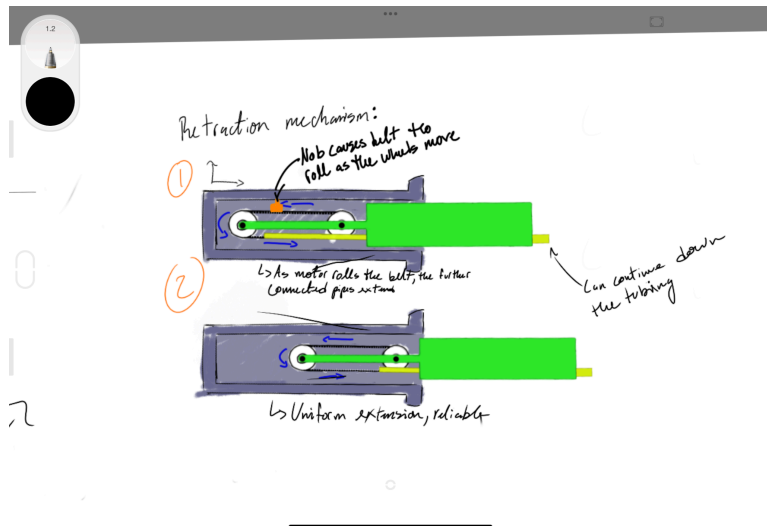


Front:

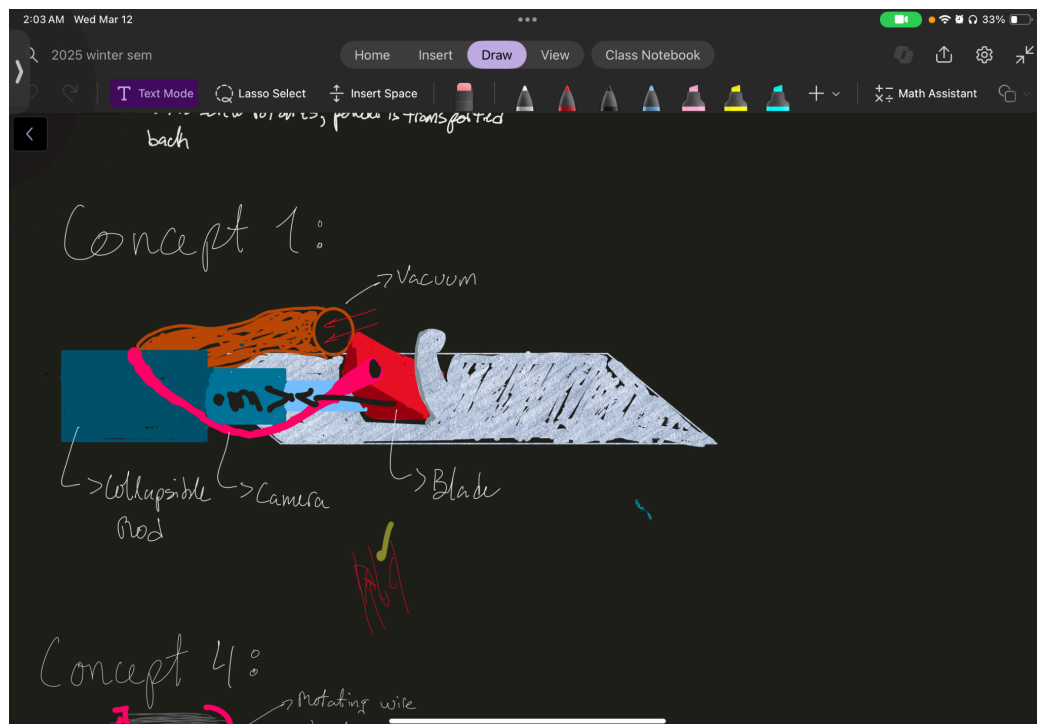


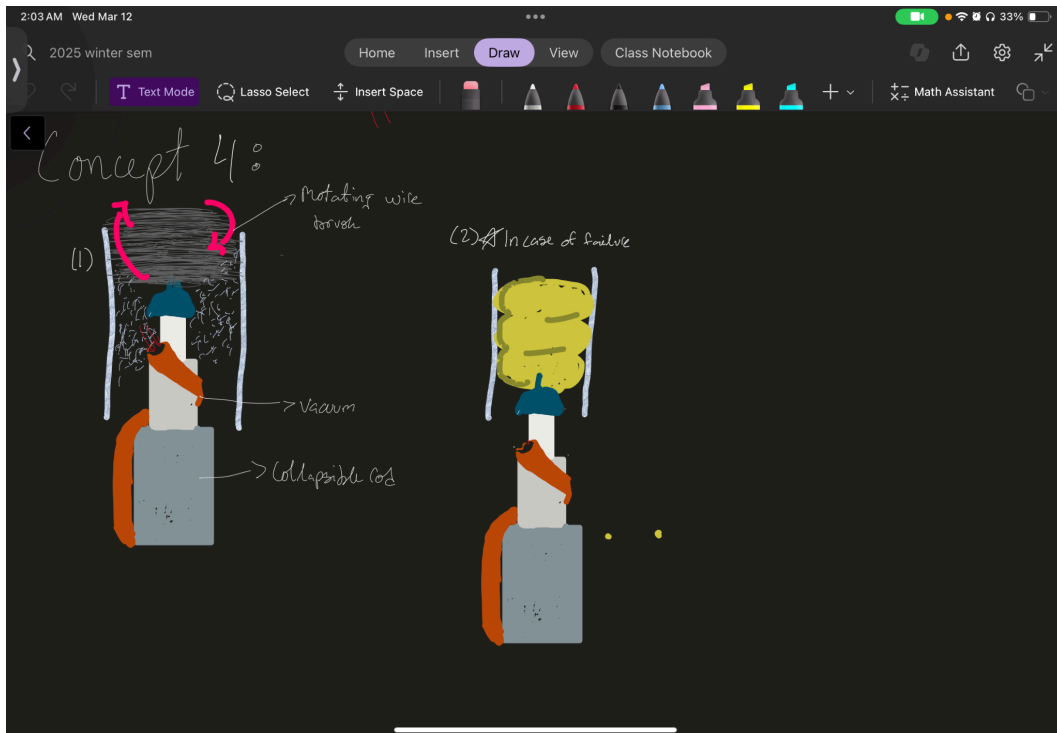
Operator Integration:



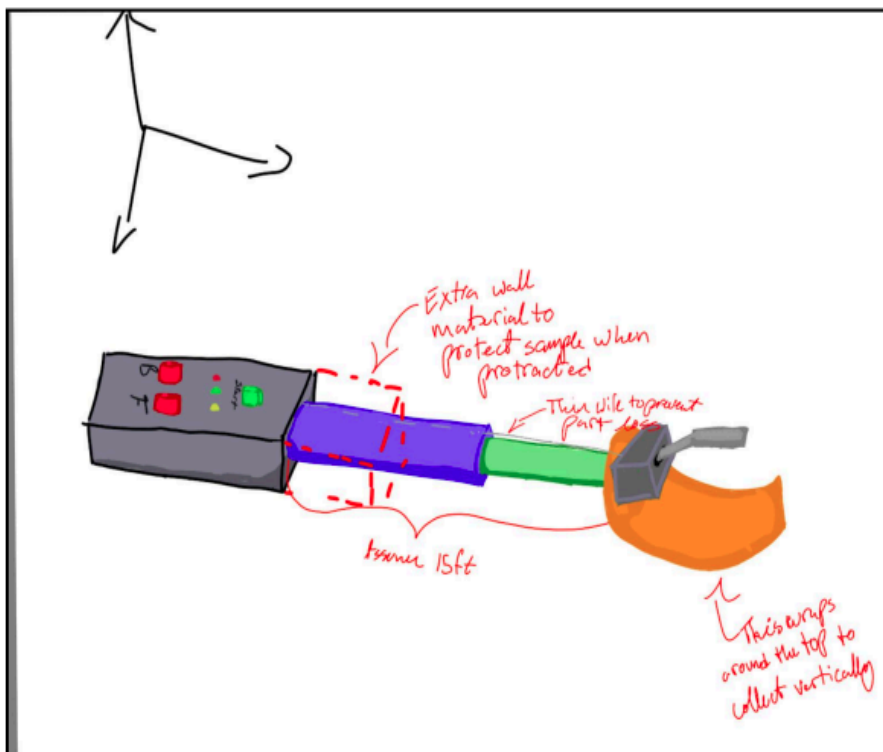


## Deliv. D: Subsystem Breakdown



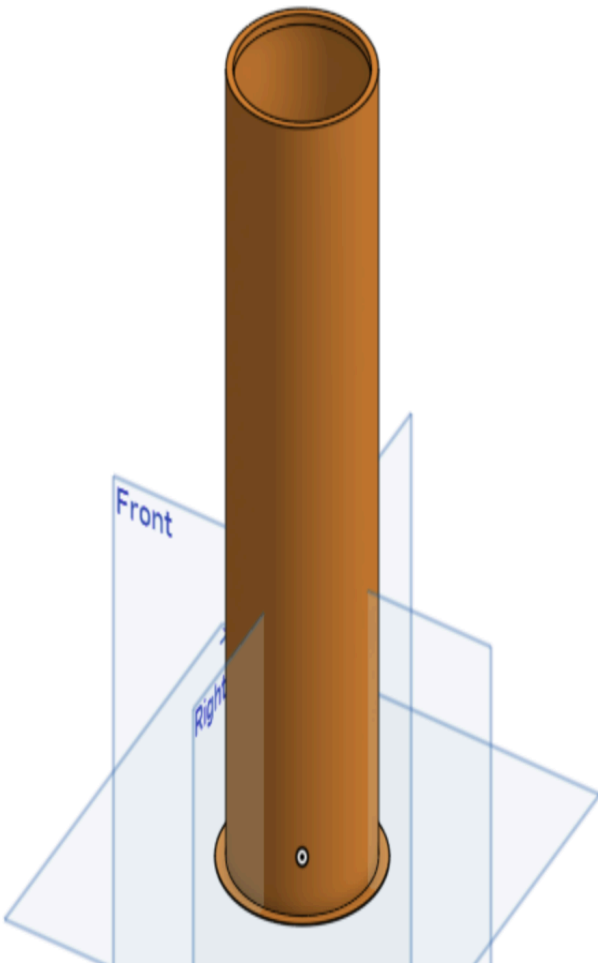
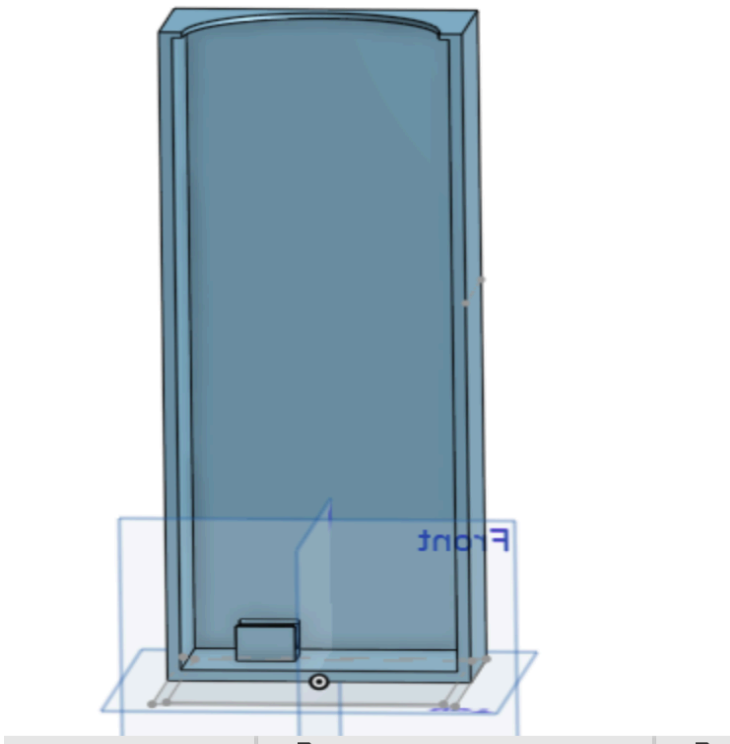


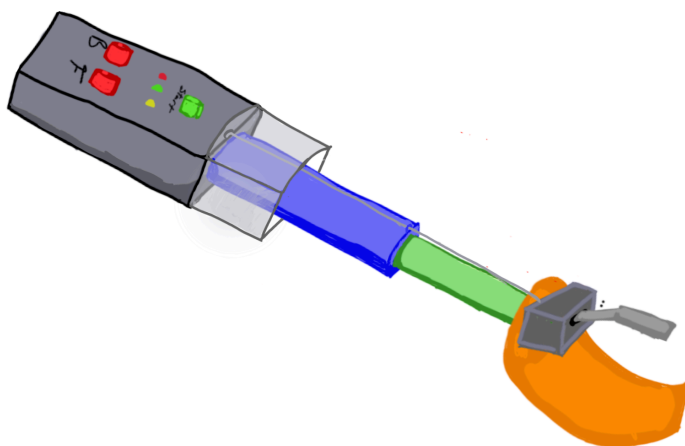
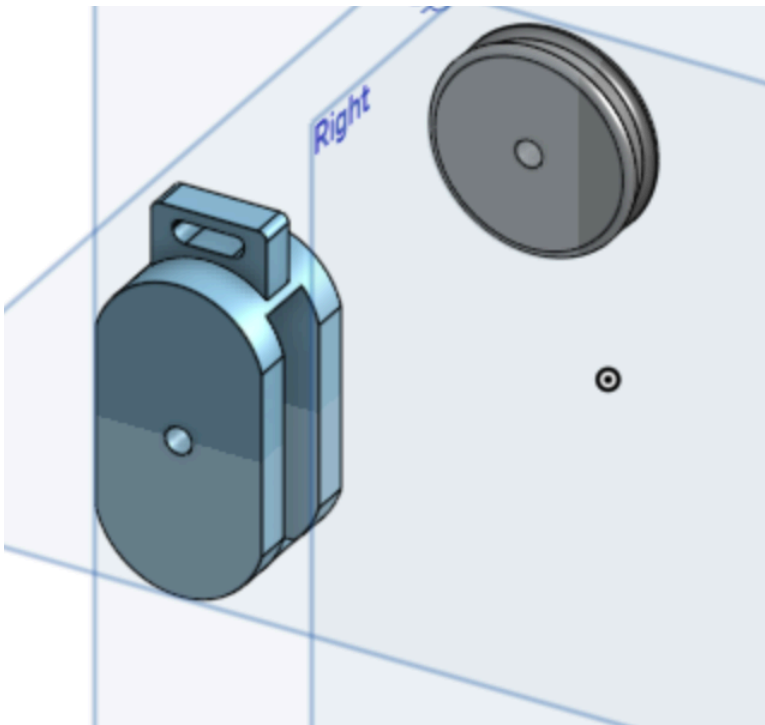
## Client Meet 2: Concept Idea Prototype



## Deliv. F/G: Client Driven Iteration







Deliv J.

# B.O.M

Component	Quantity	Supplier	Link	Price(\$)	Tax(\$)	Justification
Tungsten drill manicure drill bit	1	Amazon	<a href="https://www.amazon.ca/Manicure-Tungsten-Grinding-Polishing-Electric/dp/">https://www.amazon.ca/Manicure-Tungsten-Grinding-Polishing-Electric/dp/</a>	8.09	1.05	Tool used to scrape the pipe and collect the required amount
Breadboard	1	Makerlab		5	0.65	
Gearmotor	1	Makerlab	<a href="https://edu-makerlab.odoo.com/shop/gearmotor-2142?search=motor&amp;orde">https://edu-makerlab.odoo.com/shop/gearmotor-2142?search=motor&amp;orde</a>	4.5	0.59	Motor meant to move the drill bit to scrape the tube and coll
Piping	15ft	Marketplace	<a href="https://makerstore.ca/products/pia-filament?variant=50851782000696">https://makerstore.ca/products/pia-filament?variant=50851782000696</a>	43	0	Telescopic Rod - The telescopic rod will be made in multiple
Arduino Uno	2	Makerstore	<a href="https://edu-makerlab.odoo.com/shop/arduino-1930?search=arduino&amp;attr=5">https://edu-makerlab.odoo.com/shop/arduino-1930?search=arduino&amp;attr=5</a>	18	2.34	Necessary for constant feedback and determining the amou
Filament	1	Makerstore	<a href="https://makerstore.ca/products/pia-filament?variant=50851782000696">https://makerstore.ca/products/pia-filament?variant=50851782000696</a>	0.3	0.04	Collection platform - Necessary for collecting and storing the
STW Cable (Orange Outer Insulation, 18 Gauge, 2 Wires)	10 ft	McMaster	<a href="https://www.mcmaster.com/7394K31/">https://www.mcmaster.com/7394K31/</a>	7.4	0.96	Necessary for connecting the arduino uno to the sensors to ot
Bolts (M3, 11/14mm long)	20 (15 avail.)	Makerstore	<a href="https://makerstore.ca/products/bolts?variant=50851843637304">https://makerstore.ca/products/bolts?variant=50851843637304</a>	2	0.26	Necessary for secure assembly and component integration
Heat Inserts (M3, 6mm long)	10	Makerstore	<a href="https://makerstore.ca/products/threaded-brass-heat-inserts?_pos=1&amp;_sid=">https://makerstore.ca/products/threaded-brass-heat-inserts?_pos=1&amp;_sid=</a>	1	0.13	Used to attach the scraping tool to the mount that will hold it
Arduino IDE	1	Arduino	<a href="https://www.arduino.cc/en/software">https://www.arduino.cc/en/software</a>	0	0	Used to code the arduino, to perform the tasks
Fishing wire	15ft	Home Depot	<a href="https://www.homedepot.ca/product/look-15-ft-50-lb-max-invisible-hanging">https://www.homedepot.ca/product/look-15-ft-50-lb-max-invisible-hanging</a>	3.17	0.41	Used in the failsafe mechanism
Washers	30					
				Total Price	98.89	
Washers 16 Pin LCD	40 (30 ordered)		<a href="https://makerstore.ca/products/washers?variant=50852009541688">https://makerstore.ca/products/washers?variant=50852009541688</a>	1.5		

## Legal Considerations

- Adherence to material and design standards for industrial tools used in hazardous environments.

## Ethical Considerations

- Ensuring worker safety by reducing human exposure to radioactive environments through remote operation.

## **Safety Considerations**

- Clear operator instructions and training programs to ensure safe and effective use of the device.

### **Two Line Summary:**

Tube Traversers Inc. has developed a telescoping rod system equipped with a drill bit for precise metal sampling in confined spaces. A load sensor provides real-time feedback on sample weight, ensuring efficient and reliable extraction.

