

Project Deliverable C: Design Criteria and Target Specifications

Wade Stanley, Jacob Thom, Samuel Cadotte, Ethan Zhang,
Ramya Patel

February 2nd, 2025

University of Ottawa

Table of Contents

1	Introduction	3
2	Prioritized Design Criteria	3
3	Target Specifications	4
4	Technical Benchmarking	5
5	References	7

1. Introduction

The criteria below is shaped by functional and non-functional requirements that the design must meet in order to be both effective and reliable for our needs. The following section (Prioritized Design Criteria) outlines the expectations for a system intended to operate within a tube for sample collection. Each part of the criteria is evaluated for its importance to ensure the success of the design, the priority system gives a higher number to critical aspects. These priorities will serve as a roadmap for the design process, ensuring that the final product meets all necessary specifications while remaining practical and efficient for the users.

2. Prioritized Design Criteria

Design Criteria	Description	Priority
Sampling Distance	Ability to obtain samples inside a tube 15 feet from the inlet	5
Tube Diameter	Designed to fit within specification of 4 inch diameter tube and can account for variability due to buildup of material	5
Tube Orientation	Design should work in both vertical and horizontal placement of tube	5
Sample Size	Design is able to collect consistent sample of between 30-80mg	5
Fail-Safe System	Incorporates retrieval of design without disassembly of tube in case of critical failure	4
Real-Time Updates	Design can communicate status of sample collection process to operator	4
Modular/Portable System	Design can easily be broken down for repair/transport	3
Ease of use	Can be operated with little knowledge of intricate details of design	2
Containment of Sample	Design seals or contains samples so that the operator does not have to interact with the sample	3

Design Criteria	Description	Priority
Power system	Design integrates its own power system to not require external power (120v) during operation	2
Durability	Design can account for environment and sustain operation for many cycles before maintenance is required	2

3. Target specifications

Design Specifications	Relation (=, < or >)	Value	Units	Verification Method
Functional Requirements				
1. Sampling Distance	>	15	feet	Test
2. Can be retrieved in an emergency	=	Yes	N/A	Test
3. Provides real-time updates	=	Yes	N/A	Test
4. Collects a sample without direct contact with operator	=	Yes	N/A	Test
Non-Functional Requirements				
1. Carried easily	=	Yes	N/A	Test
2. Can be operated with little background knowledge	=	Yes	N/A	Test

3. Can be used multiple times and is durable	=	Yes	N/A	Test
4. Internal Power System	=	Yes	N/A	Test
Constraints				
1. Sample Collection Size	=	30 to 80	mg	Analysis, final test
2. Orientation of Device	=	Vertical and Horizontal	N/A	Analysis, final test
3. Device Size: Height	<	4	inches	Analysis, final test
4. Device Size: Width	<	4	inches	Analysis, final test

4. Technical Benchmarking

Specifications Device	Weight	DT320 Mini Pipe Crawler	Casing Scraper	RX400 Pipe Crawler	SOLO Pipeline Inspection Robot	A-150 Pipe Crawler
Company		Deep Trekker	M&M Oil Tools	AIT Products	Redzone Robotics	PipeTrekker
Sampling Distance	5	5	5	5	5	5
Tube Diameter	5	1	5	3	5	0
Tube Orientation	5	0	5	5	3	3
Sample Size	5	2	4	0	0	2
Fail-Safe System	4	5	3	4	4	5

Real-Time Updates	4	5	1	4	4	5
Modular/Portable System	3	4	4	3	5	2
Containment of Sample	3	4	1	0	0	3
Ease of Use	2	5	3	2	5	1
Power system	2	1	3	3	5	5
Durability	2	5	5	4	3	4
Total		123	148	135	144	145

5. Conclusion

Our team defined design criteria and performed technical benchmarking to determine target specifications, which we will use in future stages of the project to help come up with ideas and start thinking about our final design.

6. References

1. MM Oil Tools. (n.d.). *Casing scrapers*. MM Oil Tools. Retrieved February 2, 2025, from <https://www.mmoiltools.com/tools/casing-scrapers>
2. Deep Trekker. (n.d.). *DT320 Mini Pipe Crawler for sale: Deep Trekker*. Retrieved February 2, 2025, from <https://www.deeptrekker.com/products/cctv-pipe-crawlers/dt320-mini>
3. Pipe Trekker. (n.d.). *A-150 pipe crawler*. Pipe Trekker. Retrieved February 2, 2025, from <https://www.pipetrekker.com/product/a150>
4. AIT Products. (n.d.). *RX400 Pipe Crawler - Robotic Pipe Inspection Cameras*. AIT Products. Retrieved February 2, 2025, from <https://aitproducts.com/collections/robotic-pipe-inspection-cameras>
5. RedZone Robotics. (n.d.). *SOLO® Pipeline Inspection Robot*. RedZone Robotics. Retrieved February 2, 2025, from <https://redzone.com/our-technology/solo/>