

## Introduction

### NINE YARDS STUDIO

Nine Yards Studio is a Charlottetown-based architecture and design practice on Prince Edward Island. Nine Yard Studio's great design influences all aspects of life



### PROJECT BACKGROUND

Nine Yard Studios tasked the design team with building a periscope for the public that can be used to see different views of the downtown Charlottetown area. Its use can be accommodated by individuals of all age groups.

## Materials and Physical Description

- ❑ Main structure of the periscope is a 9ft PVC pipe (Fig. 1)
- ❑ The top part of the pipe is enclosed with a 90° PVC elbow that encloses the camera. (Fig. 2)
- ❑ The bottom part of the pipe sits on a tee that encloses a display screen (Fig. 3)
- ❑ The pipe balances on another ring that allows 180° rotation of the periscope (Fig. 4)

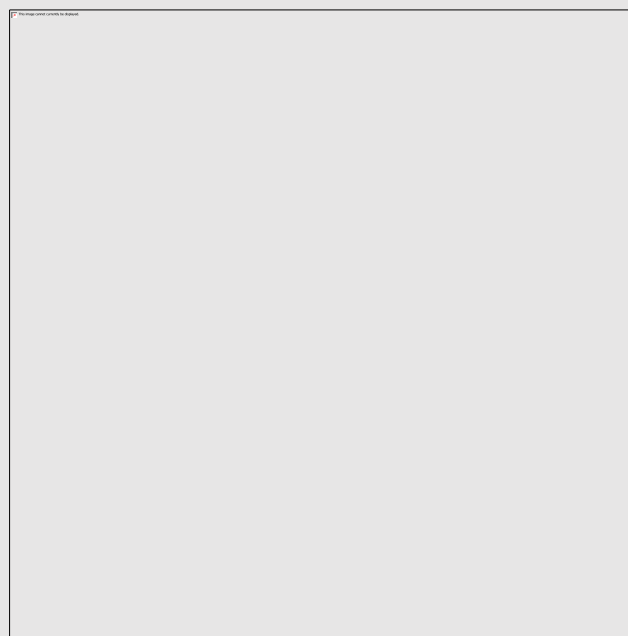


Figure 1

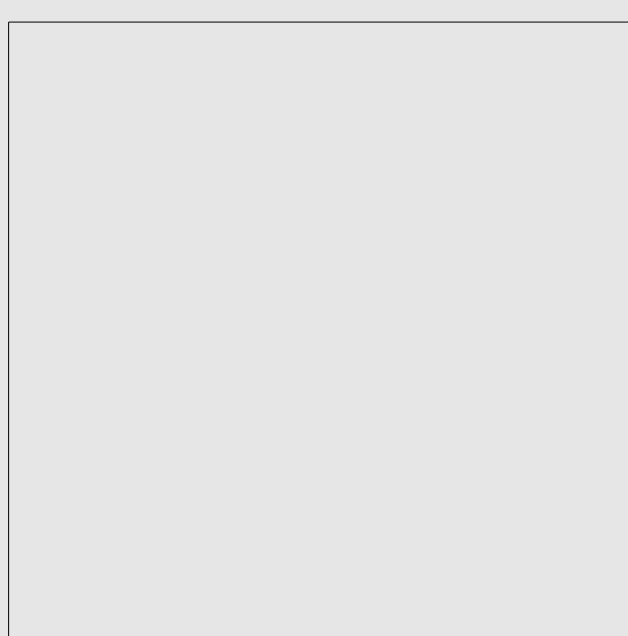


Figure 2

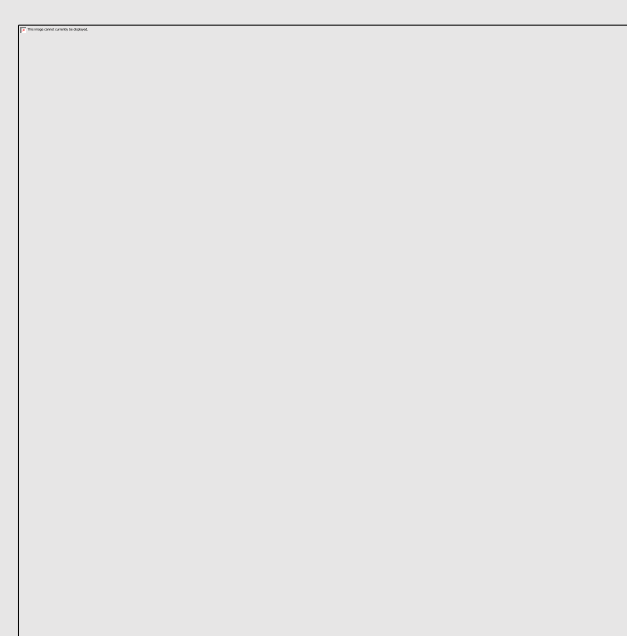


Figure 3



Figure 4

- ❑ The rotation of the periscope is controlled with the use of handle bars
- ❑ The vertical translation movement of the periscope was achieved with the aid of a gear rack and a pinion. (Fig. 5)
- ❑ A crank is used to control the altitude the periscope can reach when ascending via the gear rack and pinion. (Fig. 6)
- ❑ A fixed steel cylinder that aids with the connection of the support to the walls. (Fig. 7)
- ❑ Stainless steel gussets are provided to aid with the attachment of the periscope to a building wall
- ❑ The display screen that views the video transmission from the raspberry pi camera module. (Fig. 8)

- ❑ A raspberry pi camera module is the tool employed in the livestreaming section of this design. (Fig. 9)

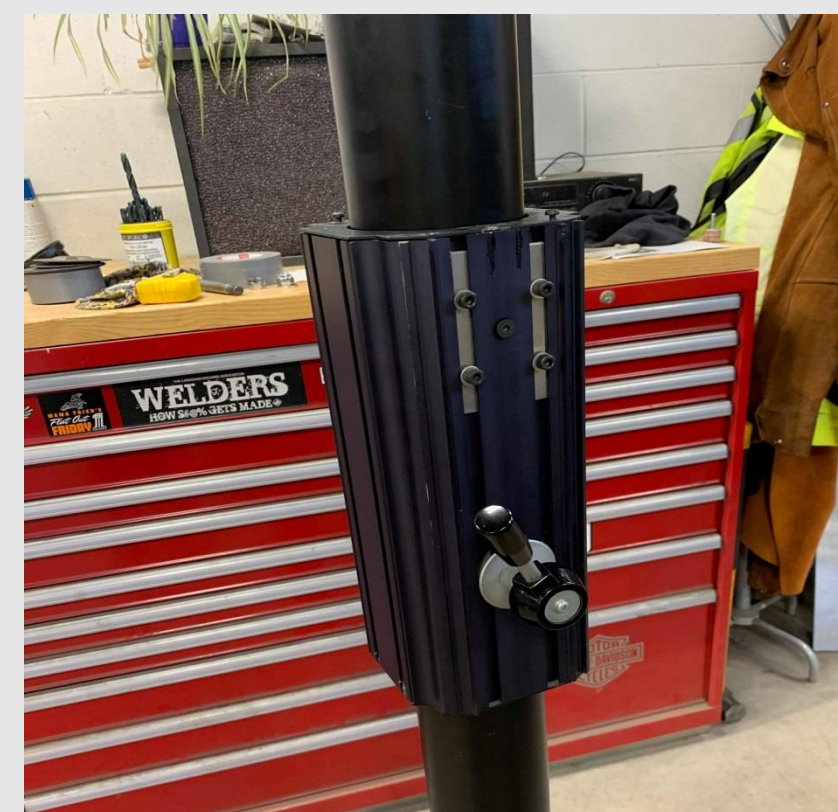


Figure 7

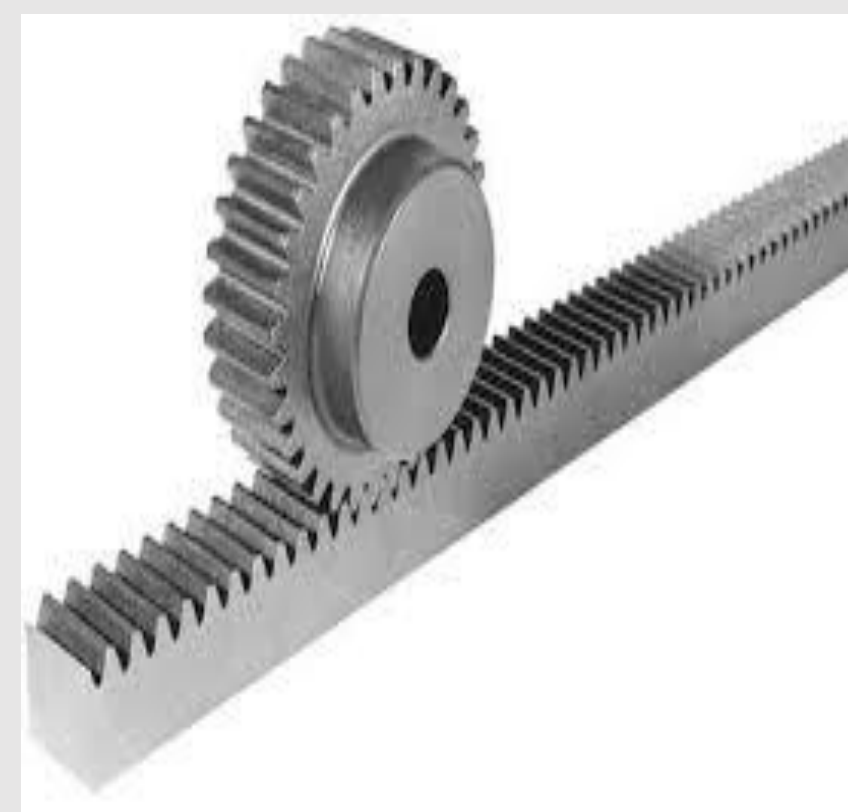


Figure 5



Figure 6



Figure 8



Figure 9

## CAD Description

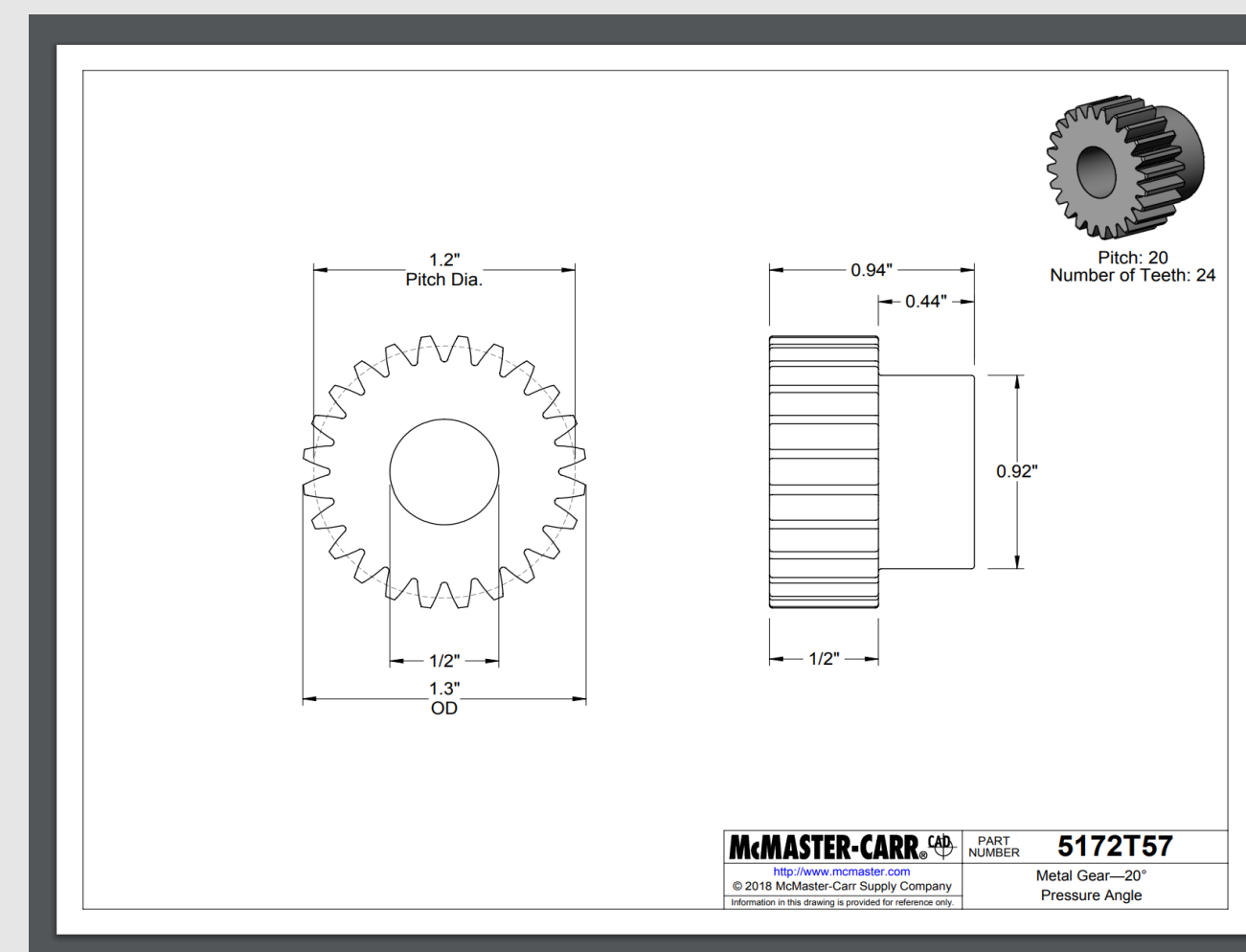


Figure 10

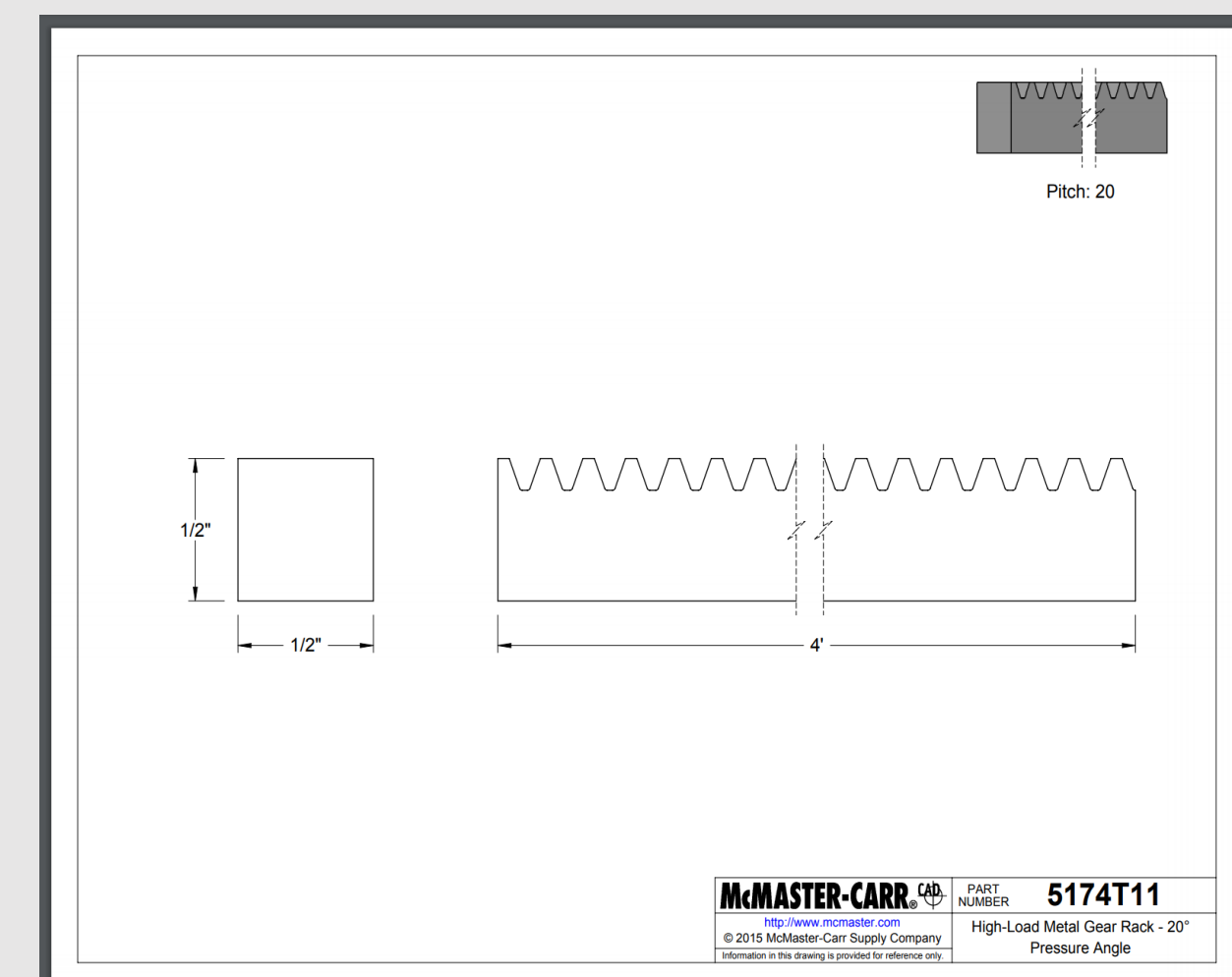


Figure 11

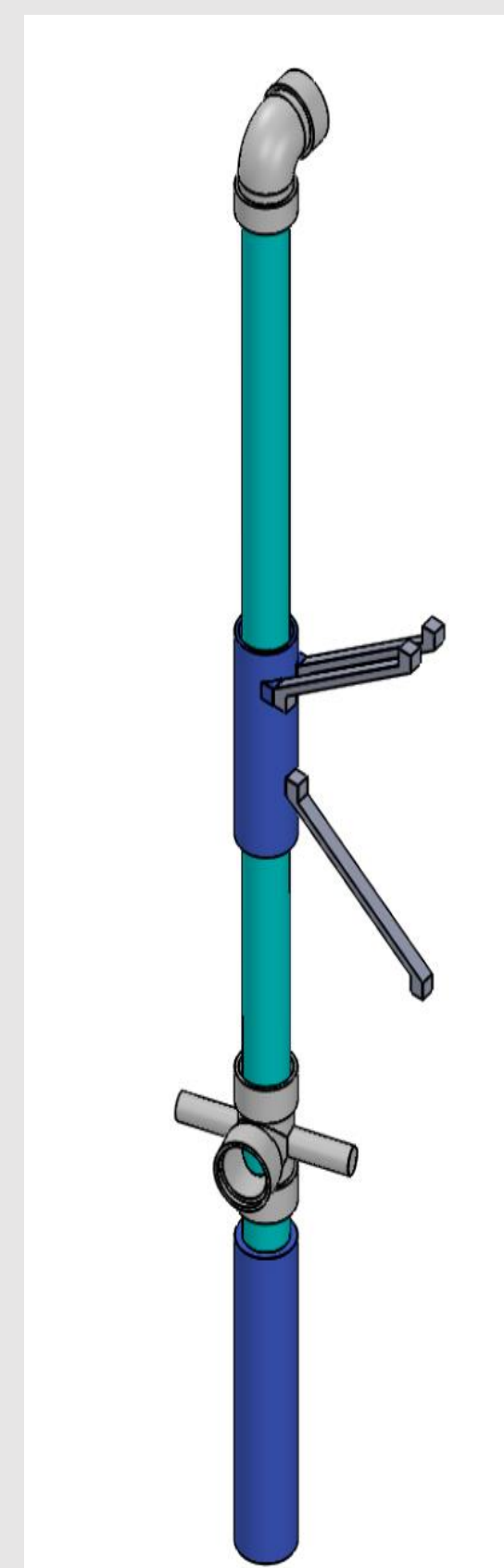


Figure 12

- ✓ Figure 10, Figure 11 and Figure 12 highlights the specific CAD drawings of the various sections of the periscope.
- ✓ The sections involved are the pinion (Fig. 10), the gear rack (Fig. 11). The following CAD Designs were to be made custom with the help of the waterjet in the FSDE.
- ✓ Figure 12 shows the full details of the periscope setup, the 90° elbow sits on the top part of the PVC.
- ✓ With the help of the gear rack and PVC there is an up and down movement whenever a user makes use of the crank.
- ✓ The crank (Fig. 6) is attached on the side of the periscope and its linked up to the pinion that moves the gear rack and the PVC

## Discussions

During the course of the project a tentative test plan was developed by the team. This test plan would be used to access various aspects of the periscope functions. The test plan is matched up with the requirements and constraints derived from the client's (Nine Yard Studio's) problem statement. See (Fig. 13)

Test			
	DESCRIPTION OF TEST	PASS	FAIL
REQUIREMENTS			
1. The body of the periscope will be made of reused materials that can withstand harsh weather conditions.	Choice of material is resistant to weather. Analyse PVC material and mobility of	<input type="checkbox"/>	<input type="checkbox"/>
2. The periscope prototype can be bolted to a building such that it can capture a nice view.	Bolt the periscope to a makeshift wall (this will be our stand).	<input type="checkbox"/>	<input type="checkbox"/>
3. The periscope will be used by different individuals of all age groups (children, teens, adults and the elderly).	Periscope is height-adjustable. Test functionality of height-changing mechanism.	<input type="checkbox"/>	<input type="checkbox"/>
4. The required height will be dependent on the location of choice.	Height unknown, testing impossible.	N/A	N/A
5. It should be required to see at least one nice view of Charlottetown.	Periscope is able to see views within a 180 degree angle range.	<input type="checkbox"/>	<input type="checkbox"/>
6. Maintenance should be minimal. Occasional maintenance will be basic cleaning and replacing standard parts.	Periscope will be left to run outside on direct power supply for a 24 hour span to test its self-sufficiency.	<input type="checkbox"/>	<input type="checkbox"/>
7. Periscope will rotate on bottom (and a rotating top is optional).	Test that the periscope can rotate 180 degree angle-range.	<input type="checkbox"/>	<input type="checkbox"/>
8. Periscope must be easy to take apart (this means the job can be quickly done by a single person).	Test whether the periscope can be disassembled with ease and as few tools as possible.	<input type="checkbox"/>	<input type="checkbox"/>
CONSTRAINTS			
1. There is a \$500 budget provided for the project.	\$500 budget was not exceeded.	<input type="checkbox"/>	<input type="checkbox"/>
2. The project is not limited to recycled materials but it is favoured.	Recycled materials were primarily used.	<input type="checkbox"/>	<input type="checkbox"/>

Figure 13

## Conclusions

- For future designs, the prototype could be remodelled to fit acceptable standard conditions. (height, weight)
- Provision of solar powered livestreaming device.
- Inclusion of safety base to accommodate weight constraints.
- Better movement mechanism (improved form of gear rack and pinion system)
- High camera quality, offering night vision and withstanding harsh weather conditions.
- Improved material for the body of the periscope.
- Higher budget results to improved upgrades.

## Acknowledgement

This project was made feasible with the help of Nine Yards Studio. Special thanks to Jacob Murphy for his creative contributions during the ideation stage of the project.

## References

CAD Drawing for gear rack - <https://www.mcmaster.com/5174t11>  
CAD Drawing for pinion - <https://www.mcmaster.com/5172t57>