Robotic Arm Platform

Team Victory Lap

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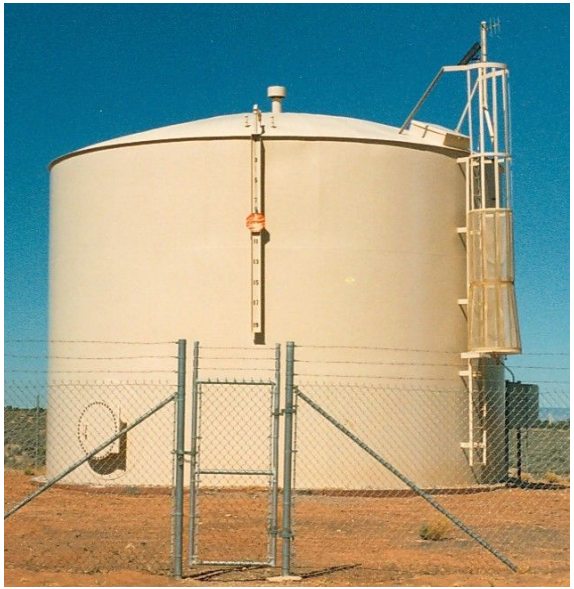
Introduction

- Suez Water Advanced Solutions is a water service provider that focuses on providing clean drinking water and wastewater management
- Provides water services to 7.5 million people
- Maintain over 6,000 water tanks to provide service



suez

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Problem Statement

The current process for sandblasting and painting water tanks is inefficient and costly to the company.

SABRE's autonomous sand blasting arm provides an opportunity to reduce cost and downtime associated with cleaning the water tanks.

There is no current way to support and mount the autonomous arm rendering the robot useless to Suez.

Capstone Project: Suez Water Advanced Solutions requires a stable platform to support SABRE's autonomous robot arm while the machine is sandblasting. The platform should be able to be repositioned, via remote control, in order to sandblast the floor and vertical walls of the tank.

Customer Requirements and Specifications

- Requirements
  - Support 25kg robotic arm
  - Resist movement and rotation
  - Easily assembled/maneuvered
  - Vertical reach to higher elevation
- Constraints
  - Must fit 24” diameter entry hatch
  - Powered by 120V single phase generator (if applicable)

Human Factors

Requirements

- Parts must fit through a 24” diameter hole
- Assembled by 3 man team

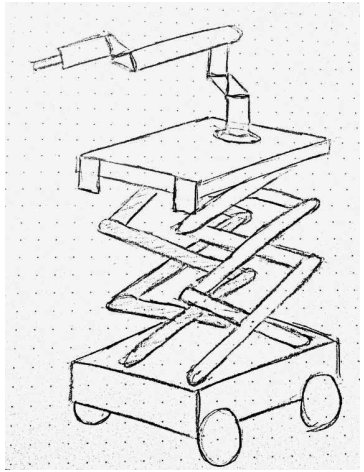
Material Selection

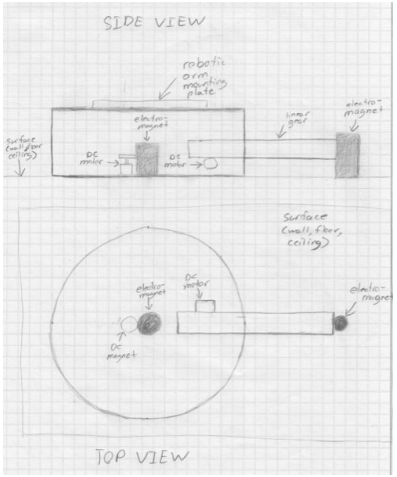
- lightweight, structural materials
- 6061 aluminum

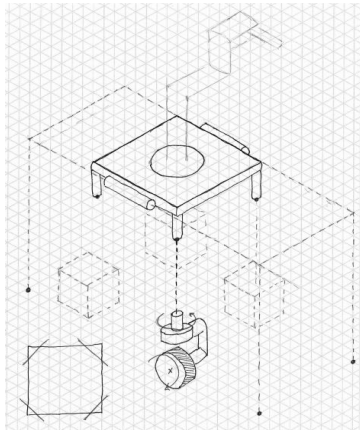
Subassemblies

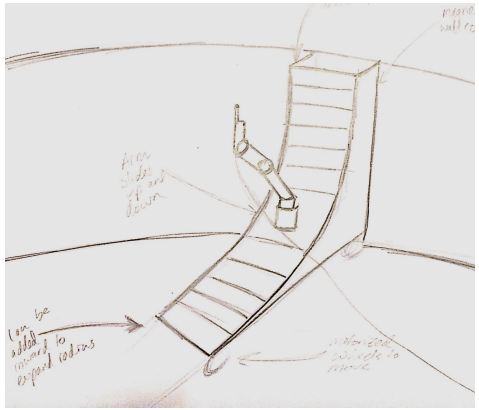
- <50 lbs per OSHA recommendation
- Suez company policies
- Ergonomic lifting solutions for heavy objects

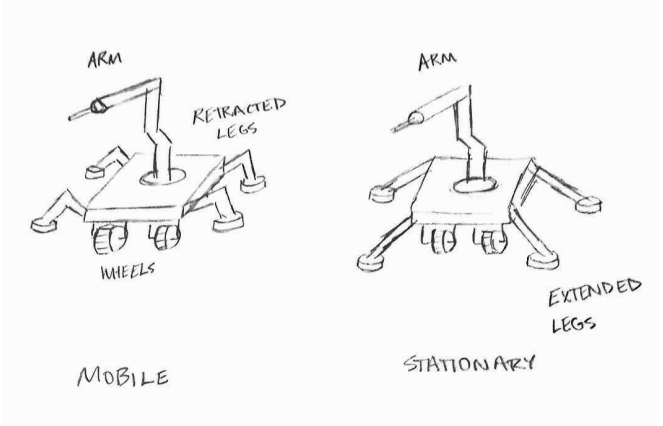
Ideation











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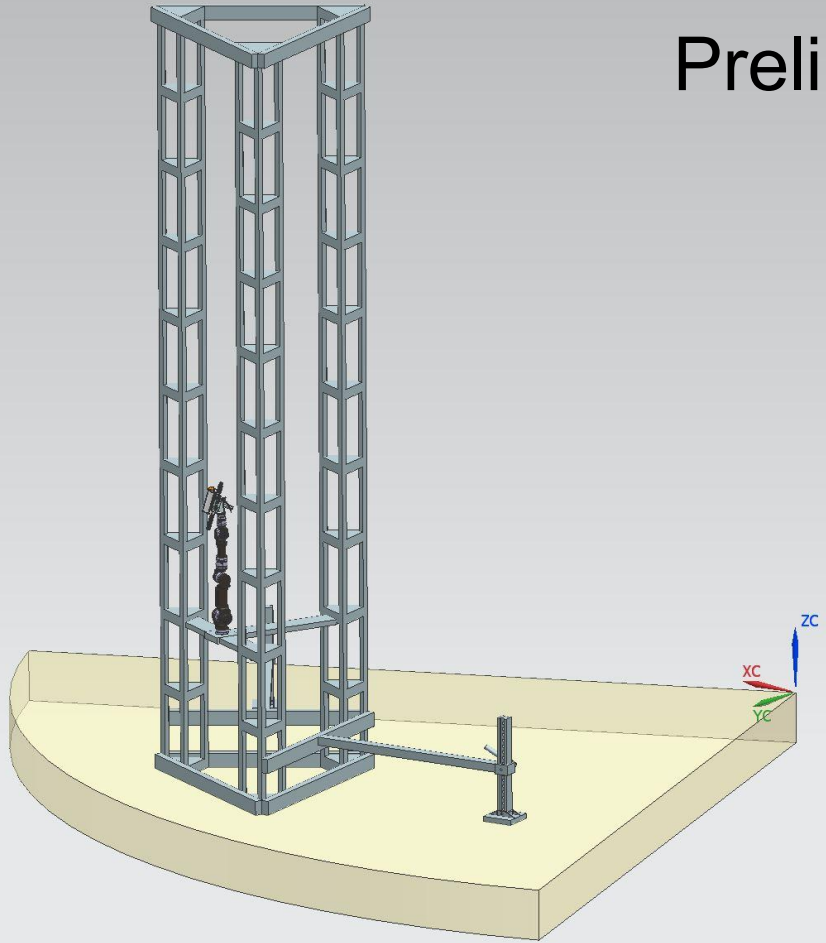
Preliminary Design



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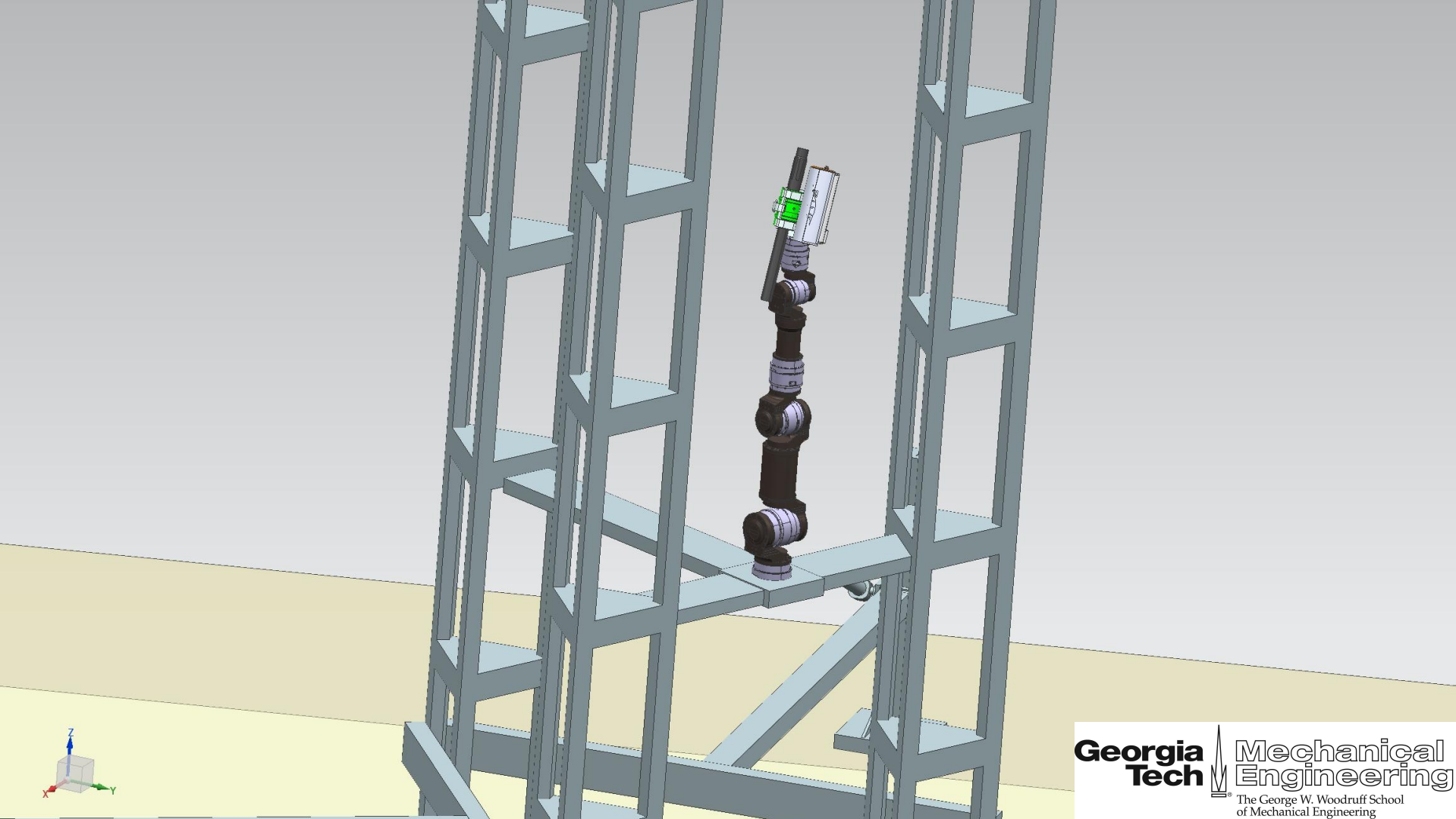

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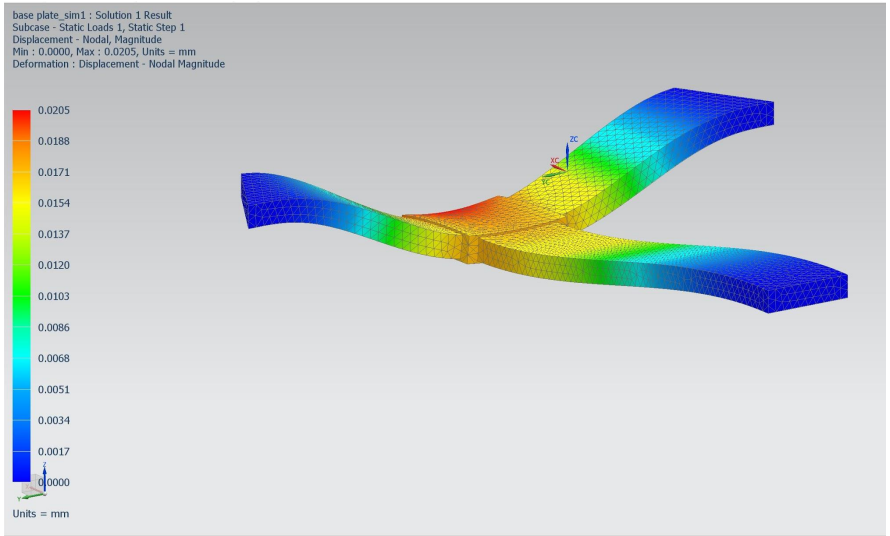
Details

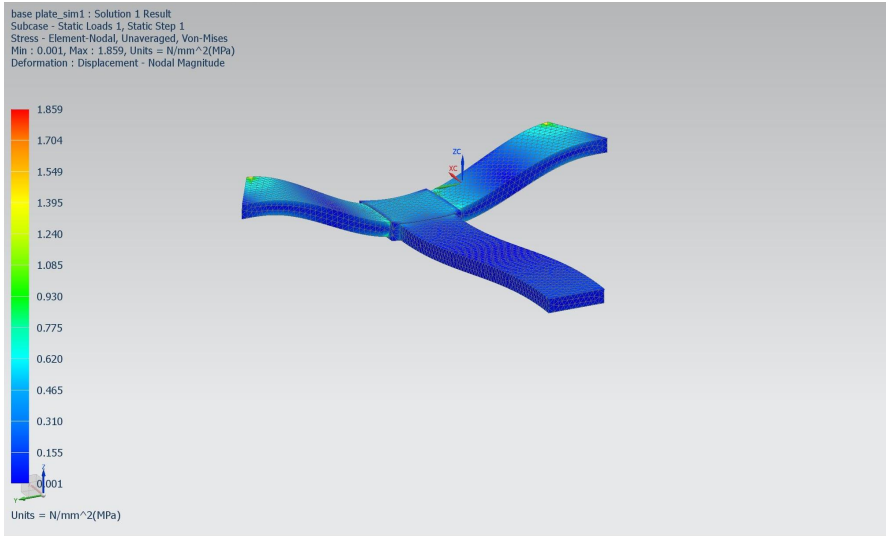
- Triangular design for geometry of tank
- Outriggers for added stability
- Mechanism for moving the arm different heights
  - Chain
  - Alternatives
    - Cable
      - Allows the platform to bounce if forces exceed gravity
    - Rack and pinion
      - Requires the motor to be mounted on the platform increasing the center of gravity
    - Screw drive
      - Will be difficult to mate when extending structure
- Material - Aluminum 6061

Initial FEA

Displacement



Von Misses Stress



Bill of Materials

Qty.	Item	Manufacturer	Supplier	Notes
6	FT43 triangular aluminum truss	Truss Aluminum Factory	Truss Aluminum Factory	3.5m sections
9	FT43 ladder truss 60 deg. corner	Truss Aluminum Factory	Truss Aluminum Factory	For tower support
8	FT43 ladder truss – straight segment	Truss Aluminum Factory	Truss Aluminum Factory	2m sections
1	FT43 ladder truss – horizontal 3-way connection	Truss Aluminum Factory	Truss Aluminum Factory	For arm mounting plate
3	FT43 ladder truss – straight segment	Truss Aluminum Factory	Truss Aluminum Factory	1m sections
2	Electric vertical lift winch	Unknown	McMaster Carr	120 Volts AC
6	2 ½" high-load track rollers	Unknown	McMaster Carr	For arm platform rolling
TBD	Truss clamps - various	Truss Aluminum Factory	Truss Aluminum Factory	Various
3	Vertical jack with footplate	REESE	Haydocy Airstream	Outrigger lifting mechanism

Conclusion

- Finalize CAD
- Final truss/lifting selection
- Advanced FEA
- Scaled prototyping

References

- Jason Saylor
  - Suez Engineering Director
- Water tank picture:
  - https://www.google.com/url?sa=i&rct=j&q=&esrc=s&source=images&cd=&cad=rja&uact=8&ved=0ahUKEwiZ-o2E1J7PAhXHJiYKHQj-ASQQjB0IBg&url=http%3A%2F%2Fnavajopublicwater.org%2Fpublic_notification&psig=AFQjCNEBbuwuHPxV64BAdjf2Sc8b_tQFDg&ust=1474485308571289