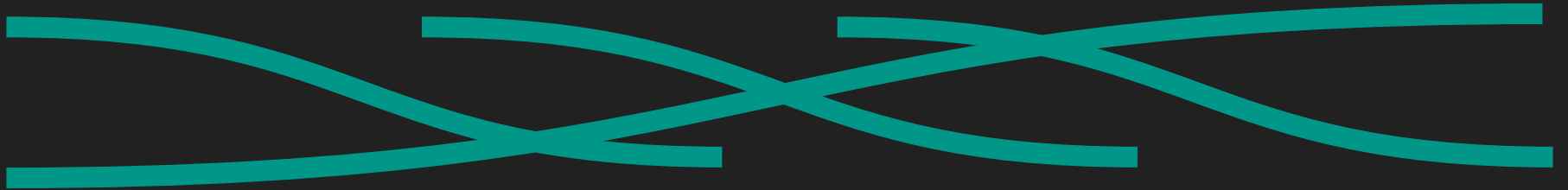


# Fetal Radiation Shield



Janae Lynch, Lauren Heinrich, Maura McDonagh & Emily Knott

Client: Dr. Zac Labby

Advisor: Dr. Beth Meyerand

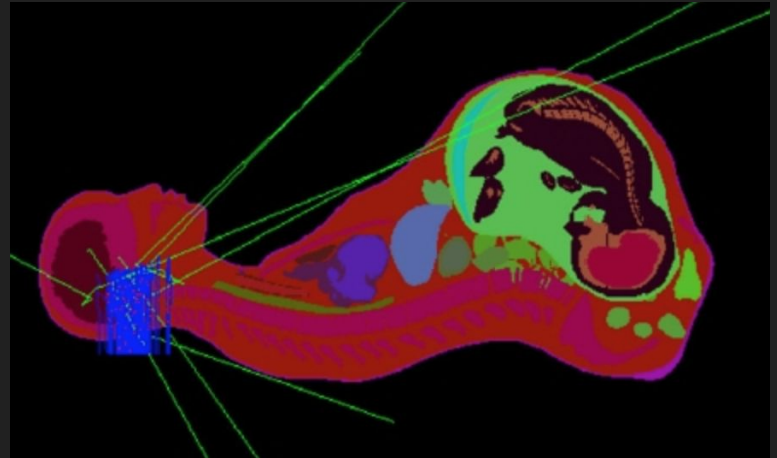
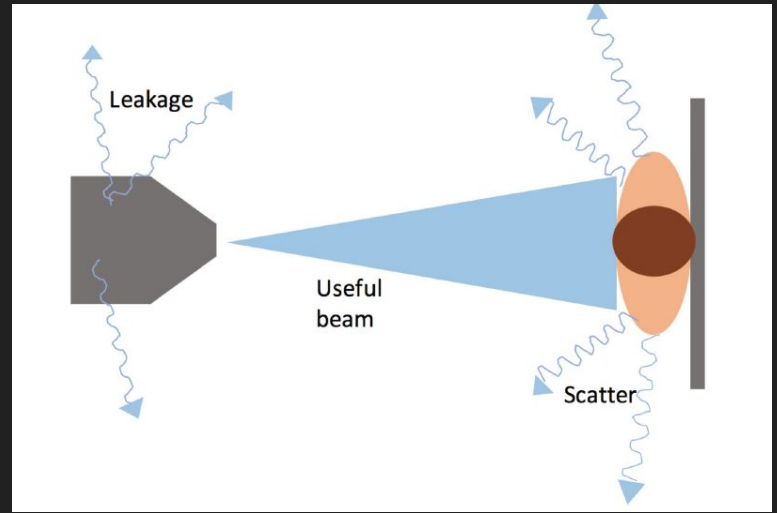
# Outline

- Background
- Problem Statement
- Alternative Solutions
- Design Requirements
- Design Alternatives
- Design Matrix
- Future Work
- References
- Acknowledgments



# Background

- 4000 women per year (U.S.)
- Brain and breast cancer
- Leakage and scatter
- Detrimental effects on fetus
- Appropriate shielding would include several hundred pounds of lead (5 cm thick)



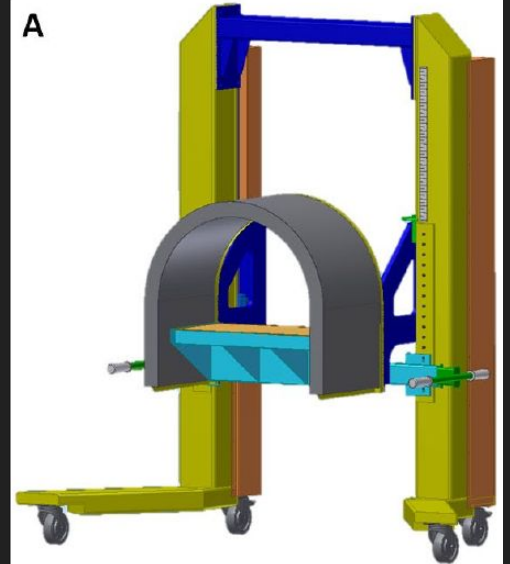
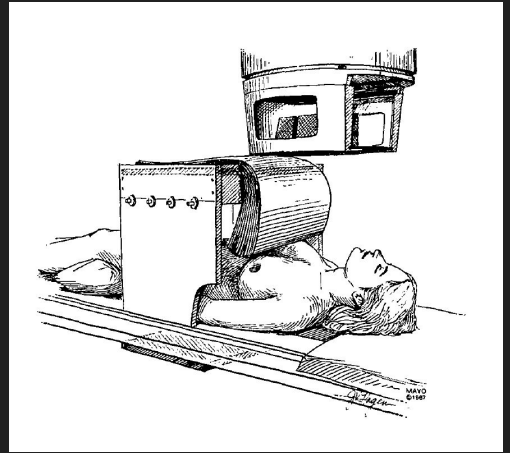
# Problem Statement

## Must be:

- **Safe:** for both technicians and patient
- **Effective:** block leakage and scatter
  - Reduce fetal dose by **50%** and **5 cm**-thick lead
- **Mobile:** between treatment rooms and storage
- **Accommodating:** various body types, physical constraints of room
- Fabricated for less than \$10,000

# Current Solutions

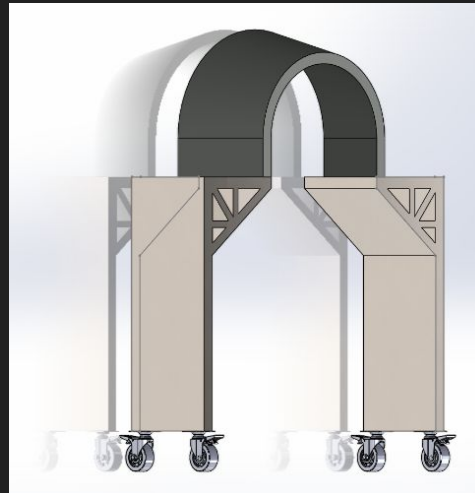
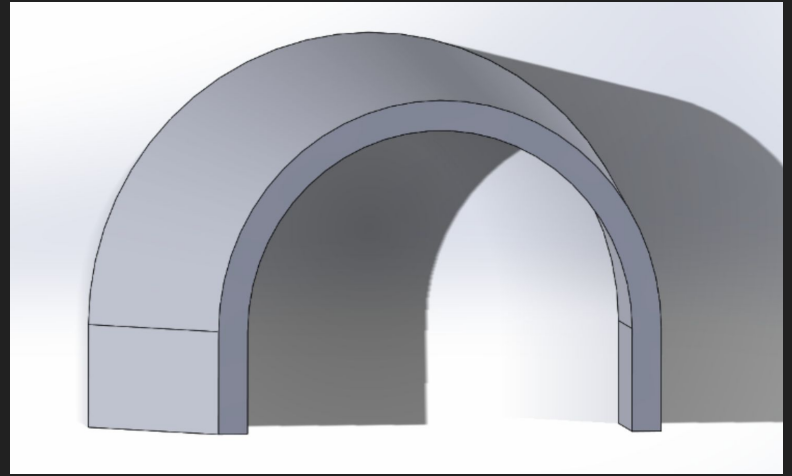
- Currently at UW-Hospital: alter treatment parameters
- Bridge over the patient with lead bricks or sheets
- University of Michigan: shield



# Past Design Work

*Fall 2017*

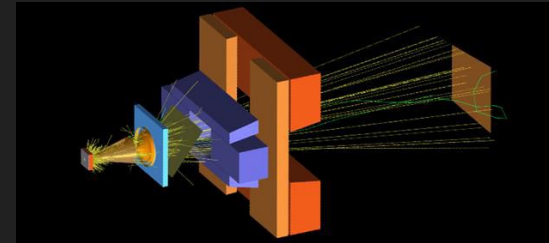
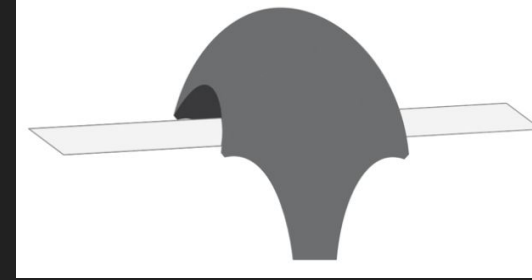
- Developed the shield shape
- “High-waisted skirt”
- SolidWorks stress testing
- Physical prototype



# This Semester's Goals

*Spring 2018*

- Additional testing of shield shape
- Examine possibilities for mobility
- Create fabrication plan
- **Determine lifting mechanism**



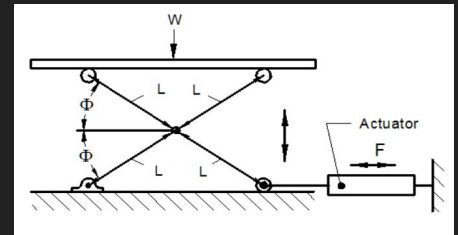
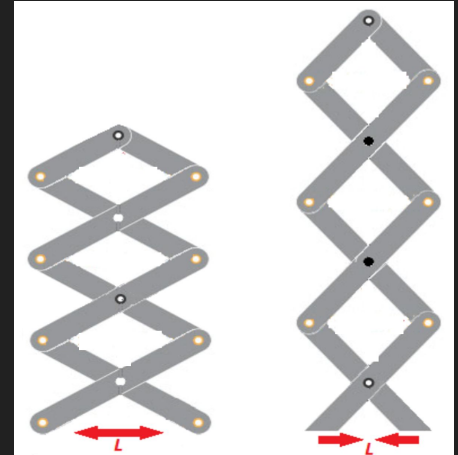
# Scissor Lift

## Pros

- Established mechanism
  - Pre-fabricated parts?
- Symmetrical lifting about central axis

## Cons

- Many moving pieces
- Potential slipping



Scissor Lift Diagram [1]



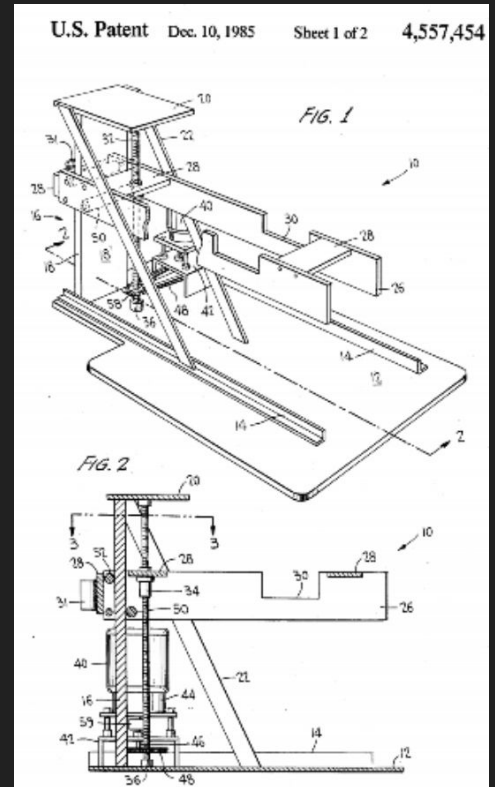
# Dentist Chair

## Pros

- Fewer parts: cheaper and simpler fabrication

## Cons

- Designed for lighters loads
- Weight would be uncentered



# Suspension

## Pros

- Symmetric (centered) lifting
- Small footprint

## Cons

- Swinging potential
- Designed for lighter loads



# Design Matrix

## **COST** Criteria/Considerations

Materials & fabrication

### **FABRICATION**

Outsourcing? TEAM Lab/Makerspace?

### **IMPLEMENTATION**

Hospital treatment room, storage place

### **USER OPERATION**

Control over movement, ease of manipulation

### **SAFETY**

Patient and hospital staff

# Design Matrix

	Scissor Lift	Dentist Chair	Suspension
Cost (5)	$4/5 = 4$	$3/5 = 3$	$2/5 = 2$
Fabrication (20)	$3/5 = 12$	$2/5 = 8$	$2/5 = 8$
Implementation (20)	$3/5 = 6$	$3/5 = 6$	$5/5 = 20$
User Operation (15)	$4/5 = 12$	$4/5 = 12$	$1/5 = 3$
Safety (40)	$5/5 = 40$	$5/5 = 40$	$1/5 = 8$
<b>TOTAL (100)</b>	<b>72</b>	69	41

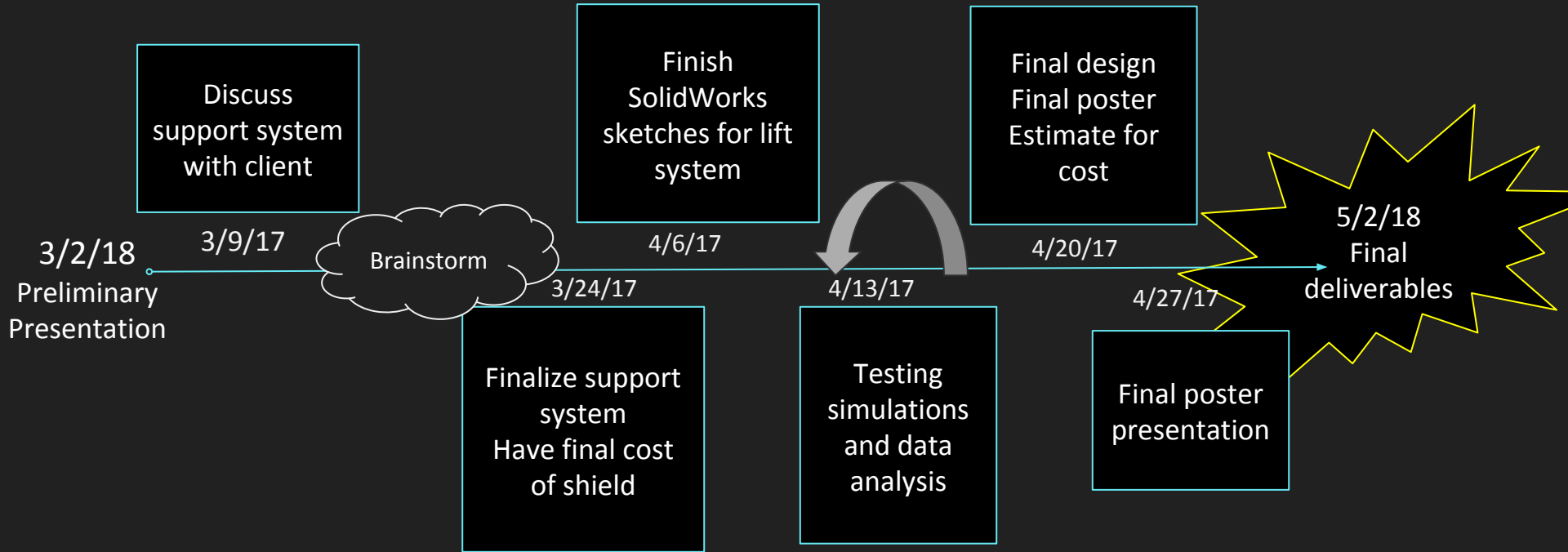
# Final Design - Scissor Lift

## DISTINGUISHING FEATURES

- Relatively simple design and fabrication
- Cheap(er)
- No physical guidance, more controlled
- Standard for industrial lifting



# Future Work



# Acknowledgements

Thank you to:

Our client **Dr. Zac Labby** with the UW Department of Human Oncology, our advisor **Dr. Beth Meyerand** and **Dr. Puccinelli** for their continued support and guidance with this project.

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# Questions?

