Deployable Trainer Structure
Team 515: DR #5

Jarrod Darrow
Ryan Irwin
Kemuel Nelson
Christian Gonzalez

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Team Introductions

Kemuel Nelson

- Design & Test Engineer

Jarrod Darrow

- Quality & Test Engineer

Ryan Irwin

- Structural Engineer & Web Developer

Christian Gonzalez

- Project Manager & Performance Engineer

Sponsor and Advisor

Sponsor

Jeffrey Payne, PE
Staff Mechanical Engineer
Mission Systems & Training

Engineering Advisor

Patrick Hollis, PhD
Mechanical Engineering Professor

Jarrod Darrow

Background

The United States military conducts training exercises for operation of weaponized, ground vehicles via different modules of Lockheed Martin's Advanced Gunnery Training System (AGTS). Five configurations of the AGTS are available.

Tabletop

Deployable

Relocatable

Mobile

Permanent

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1. Meet the required weight specification
2. Require two people or less to carry
3. Assemble/Disassemble in a timely manner
4. Require a maximum of three cases for storage
5. Adjustable dimensions between seat and mounted simulator
6. Eliminate the need to source a chair/table

Objective

The objective of this project is to design a portable, configurable module that is readily available for operation and eliminates the need for the user to source a chair/table.

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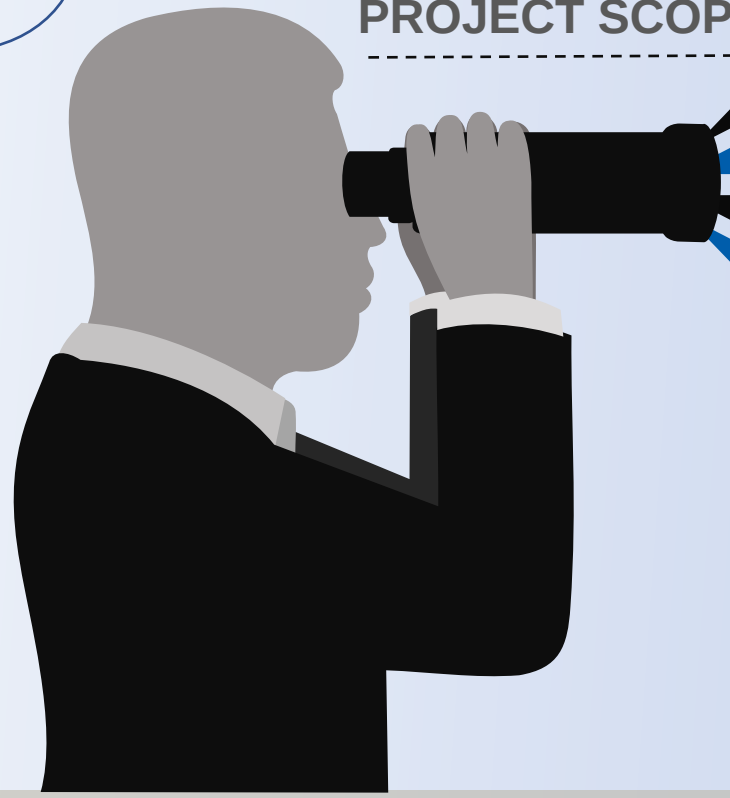
OUT OF SCOPE

ELECTRONICS

INCLINATION

PROJECT SCOPE



01 **Deflection**

Minimize deflection caused by the input force of the user operating the controls.

02 **Configuration**

Configure dimensions to accommodate individuals of various lengths and sizes.

03 **Portability**

Convenience of relocation and deployment.

04 **Fidelity**

Parallel operation with other AGTS modules in terms of functionality.

Project Breakdown

Customer Requirements

- 3 cases max and each (including contents) must weigh ≤ 88 lbs.
- Support a simulator weighing 60 lbs.
- Support an individual weighing ≤ 214 lbs.
- Configurable seat distance of 25.0 ± 3.0” relative to simulator
- Configurable seat height of 16.0 ± 3.0” relative to the ground
- Configurable mount height of 27.0 ± 2.0” relative to the ground

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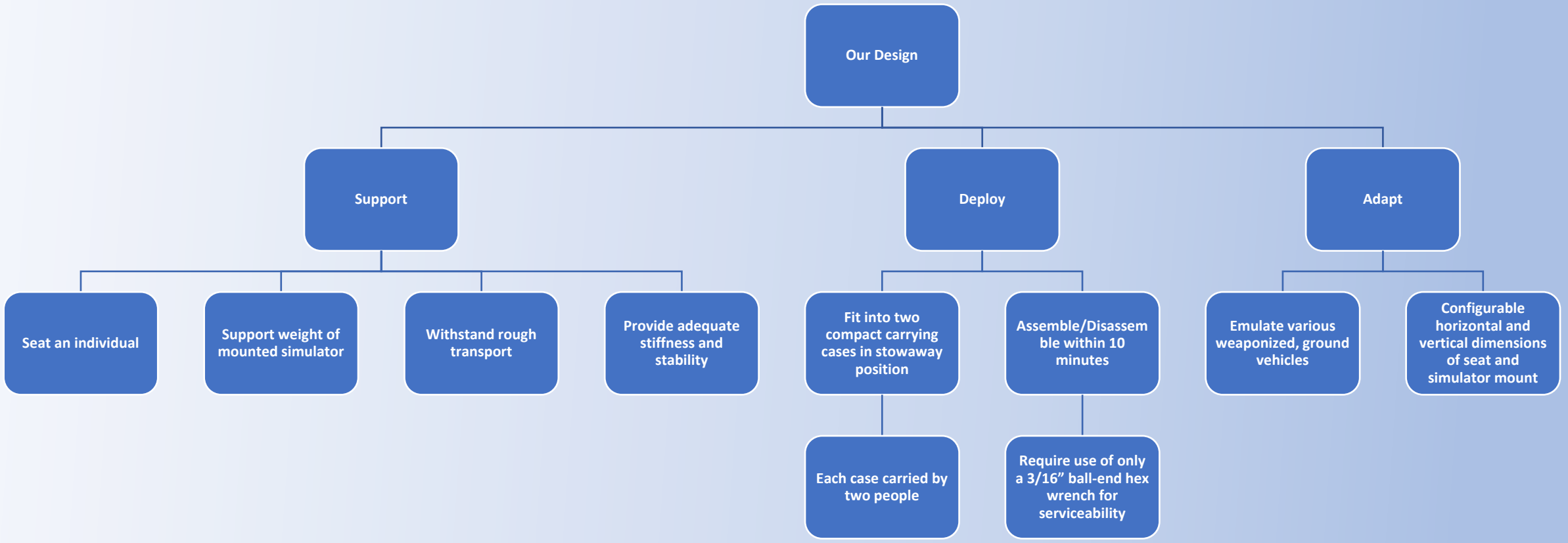
Functional Decomposition



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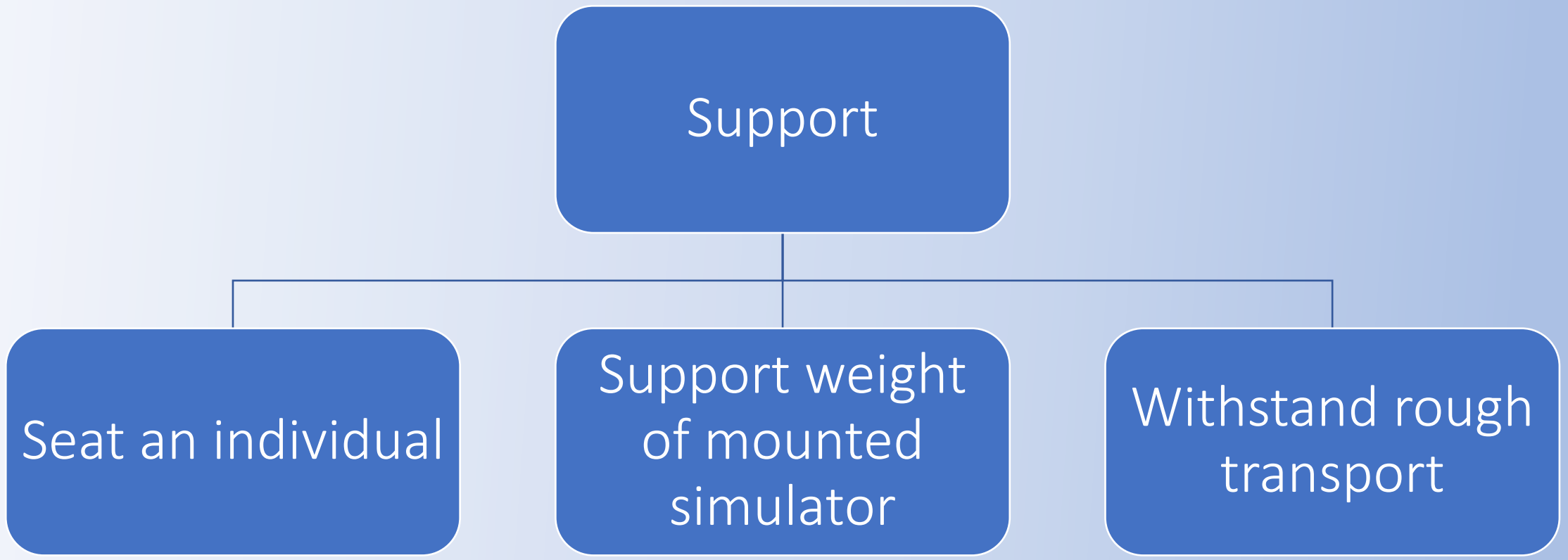
Functional Decomposition



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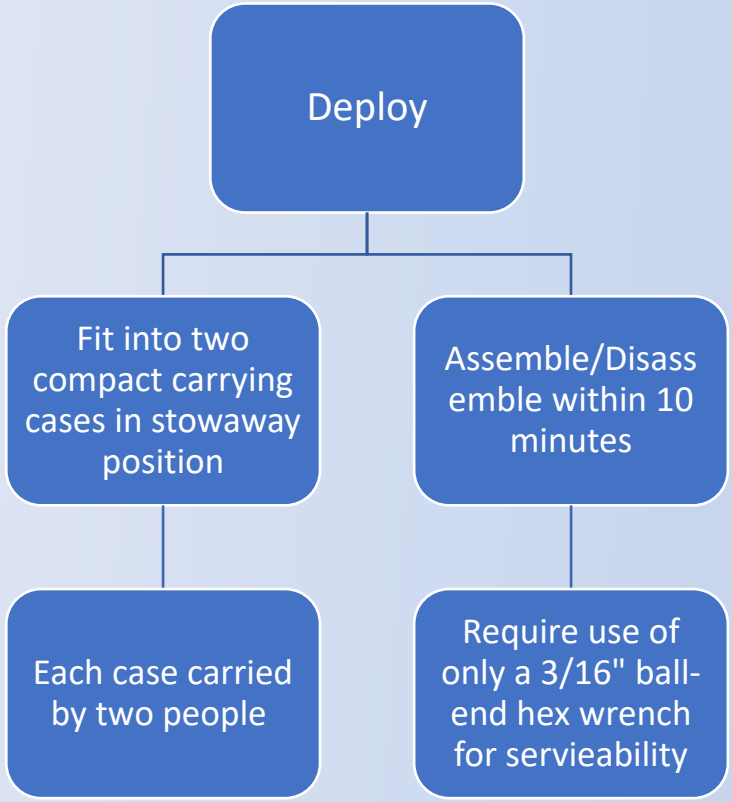
Functional Decomposition



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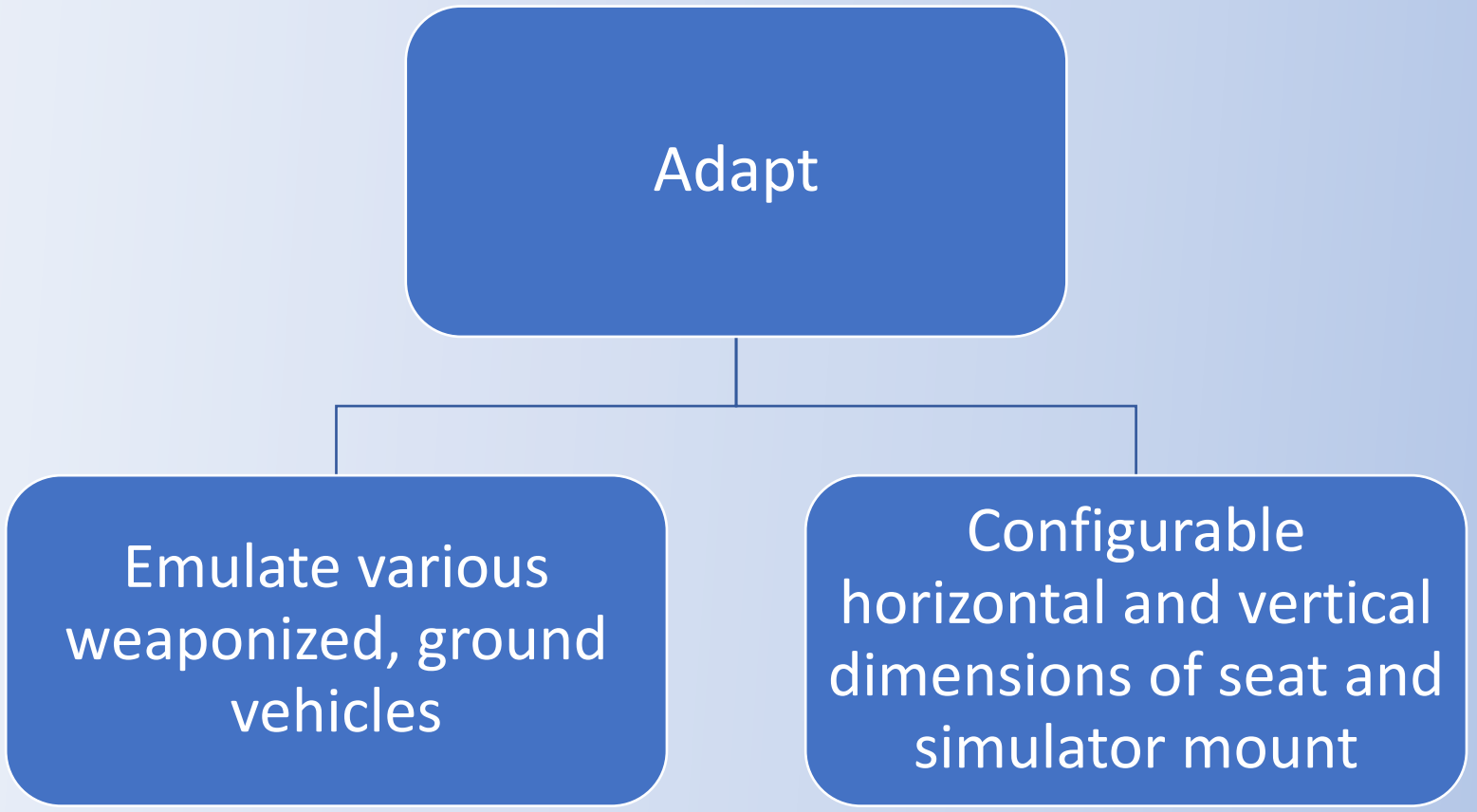
Functional Decomposition



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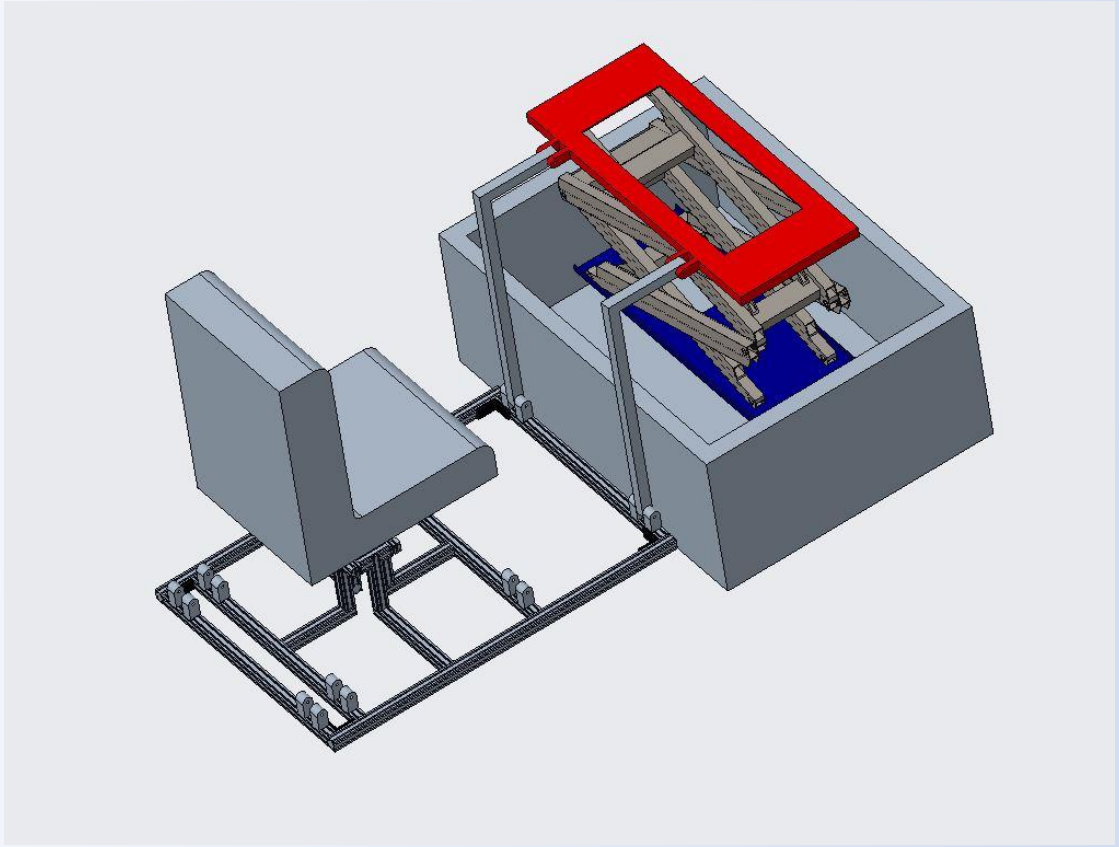
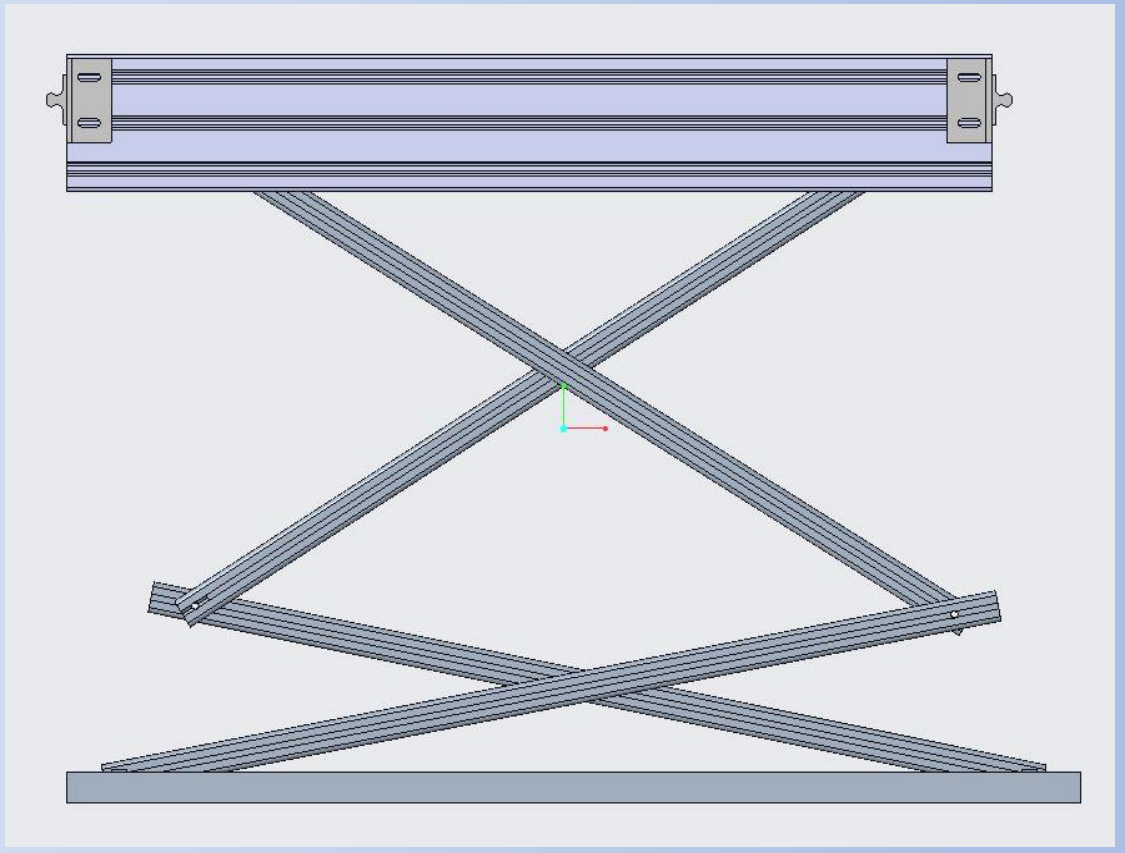
Old Design





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Old Design Issues

- Unable to fix the height of the scissor lift without creating an external component to set it.
- Did not provide a necessary, lightweight solution.
- Larger pinching hazards during setup and disassembly compared to newer design.
- The old design had a more complex motion than is necessary to set up the simulator mount.

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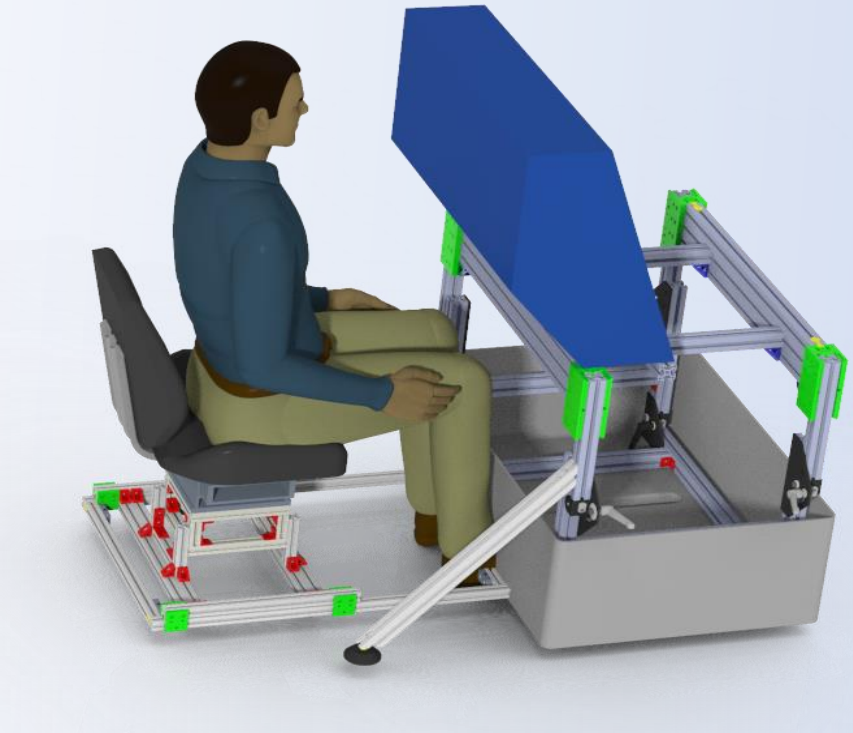
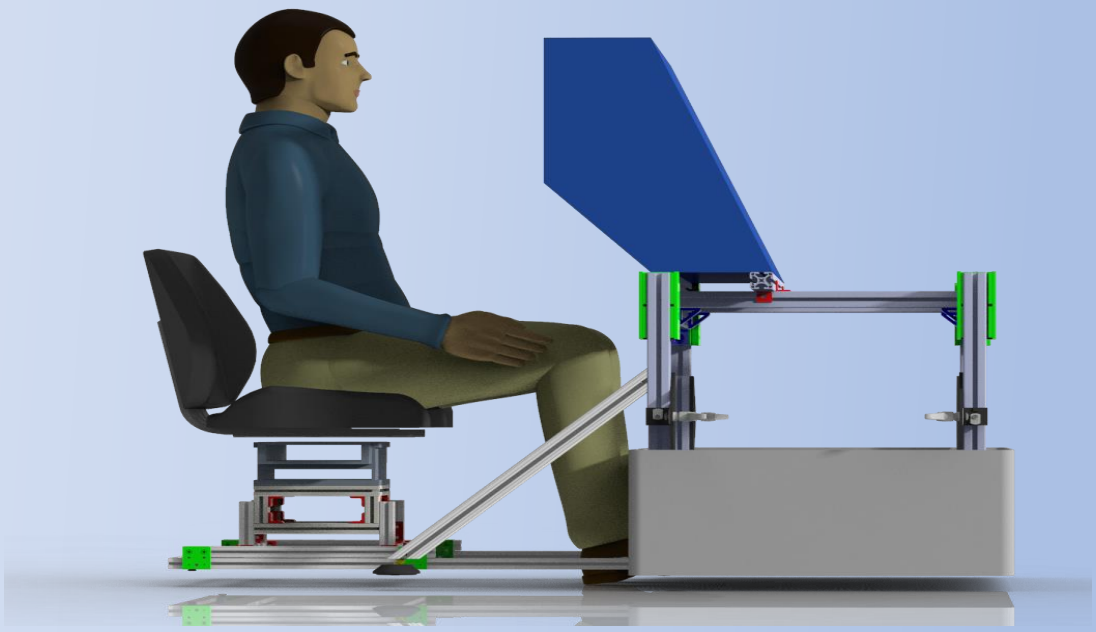
Design Progression

Current Design





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Improvements

- Current design uses space inside the case more efficiently.
- Geometry of the simulator-mounting bar results in smaller deflection away from the user.
- Modularity of the design has increased, allowing for further additions in the future.
- Magnitude of pinching hazards have decreased with the current design.

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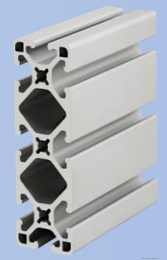
Major Components

Pelican 1730 Transport Case

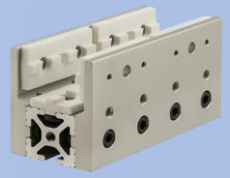
1.50” X 4.50" T-Slotted Profile



90 degree pivot

180 degree pivot

Linear Slider



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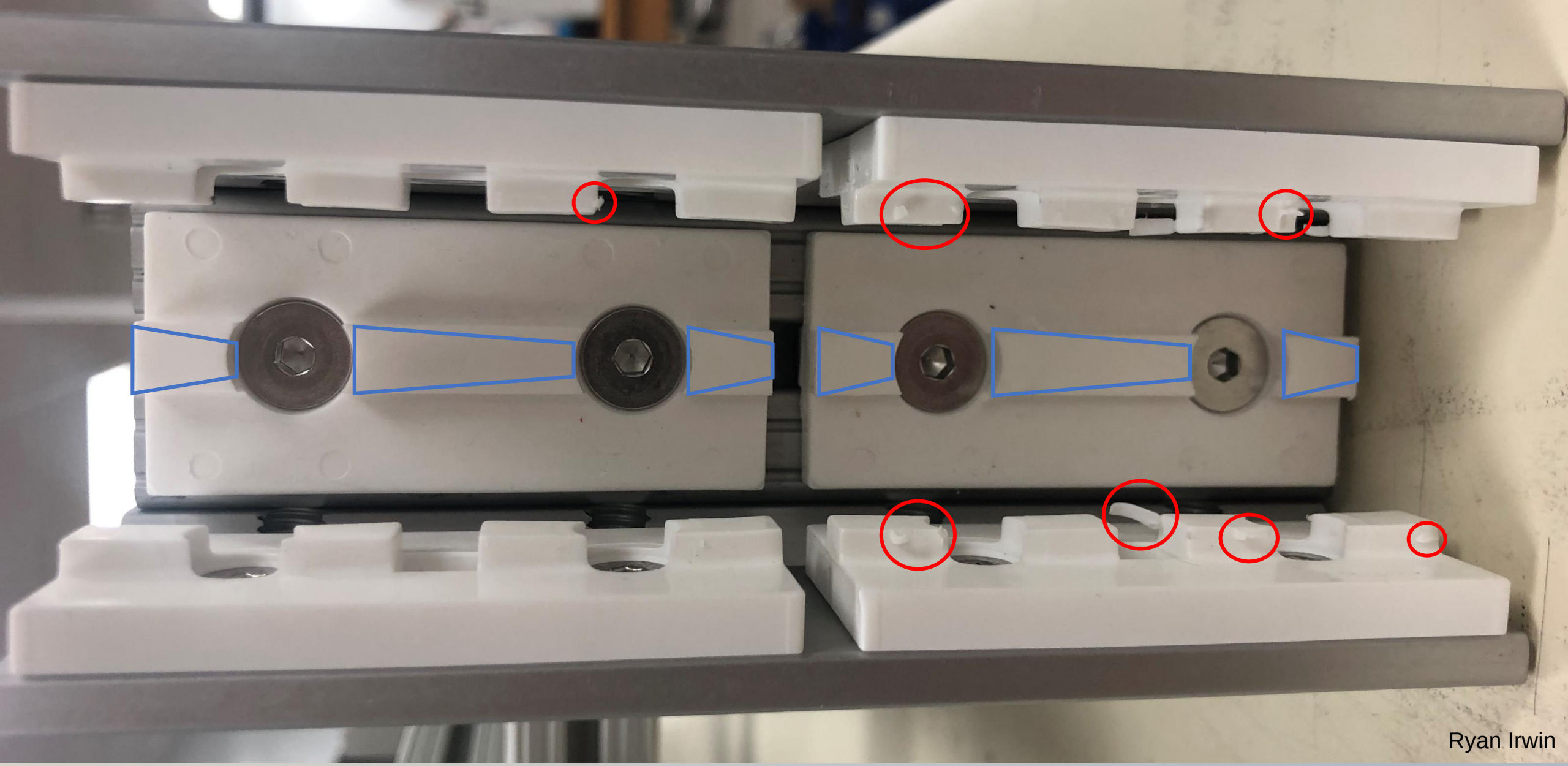

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VHB tape

- Bonds to a variety of materials such as metals and plastics
- Maintains high shear strength in extreme temperatures (-40°F - 200°F)
- Corrosion resistance makes it suitable for both indoor and outdoor applications
- Applications: Metal office furniture, large signs, HVAC, snowmobiles/ATV’s, metal fabrication

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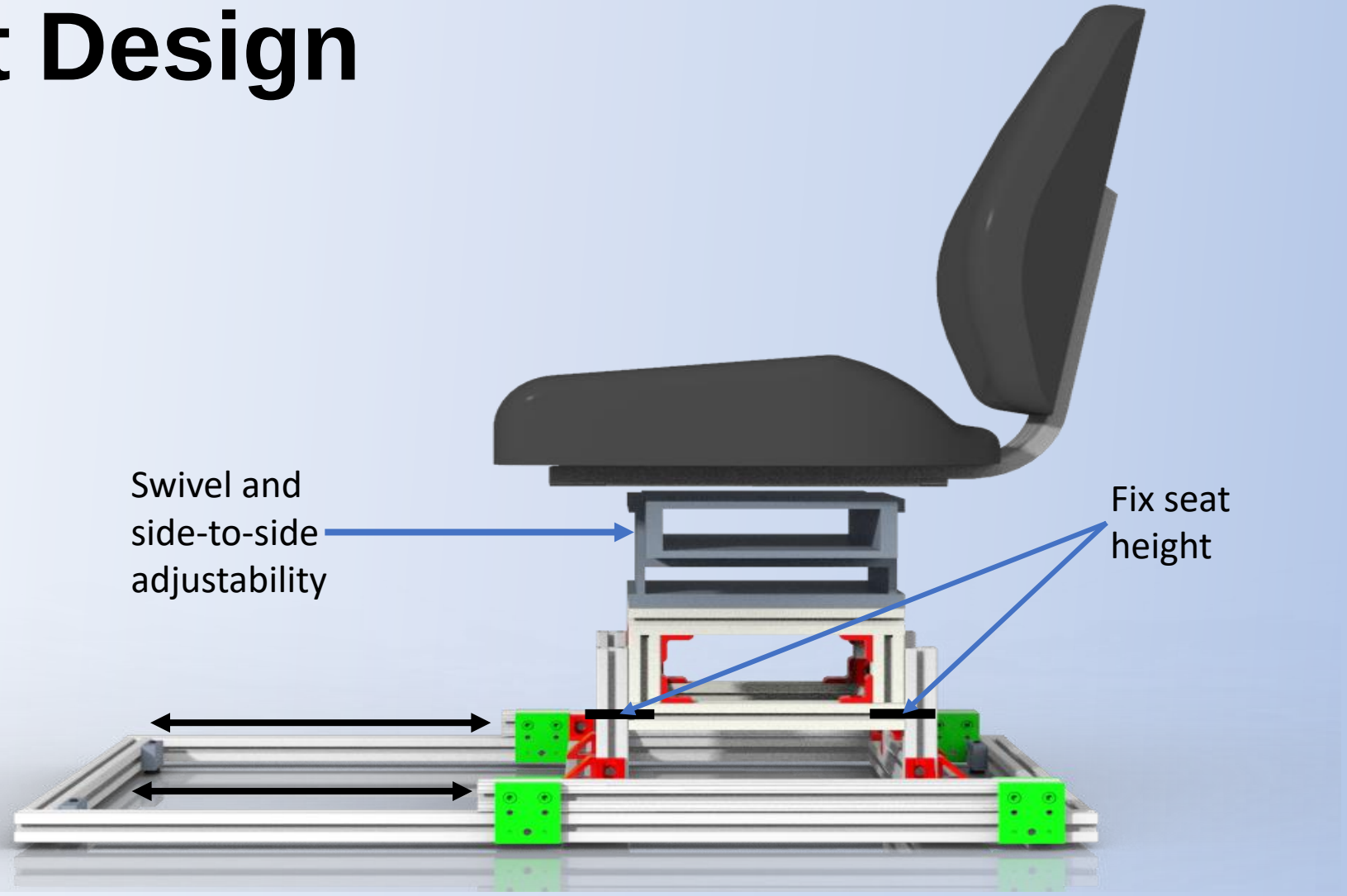
Seat Design



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Case Weight

Simulator Case Weight	Target Weight	Seat Case Weight
94.17 lbs.	88.00 lbs.	63.93 lbs.

- By category

Simulator Case Weight	Target Weight	Seat Case Weight
83.48 lbs.	88.00 lbs.	74.62 lbs.

- Tabletop mount in seat case and seat in simulator case

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Budget

	Simulator Mount Frame	Seat Frame	Total For Project	Total Remain From Budget
Percentage Of Parts Ordered	% 87.5	% 95.24	% 91.11	% 8.89
Percentage Of Parts Delivered	% 79.17	% 66.67	% 73.33	% 26.67
Percentage Of Parts Installed	% 58.33	% 0	% 31.11	% 68.89
Total Spent without Discount	$ 1,490.62	$ 1,133.93	$ 2,624.55	$ -624.55
Total Spent with Discount/ Free Parts	$ 1,359.21	$ 848.54	$ 2,207.75	$ -207.75

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Budget

- Received a 15% discount from Pelican Cases, saved $154.69
- Found all of the 8020 and fasteners needed for the seat frame, as well as 22 of the gussets in the senior design lab, saved $266.50
- Found several pieces of 8020 for the simulator mount in the senior design lab, saved $118.12
- Tax exempt
- Free Machining from COE machine shop

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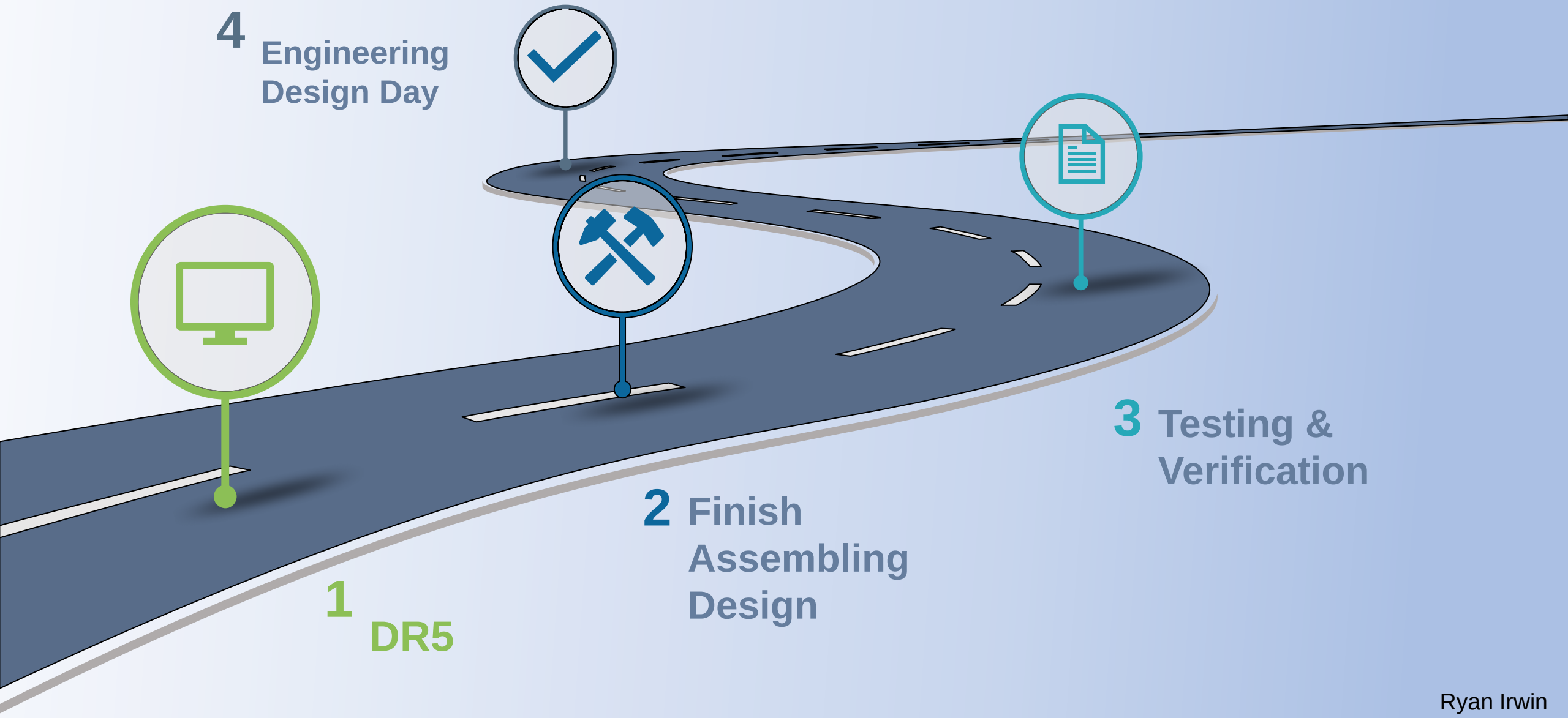
4 Engineering Design Day
3 Testing & Verification
2 Finish Assembling Design
1 DR5

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Future Work

- Once all parts have been received and the design has been assembled, testing will be carried out in the senior design lab
- A load will be applied incrementally to the simulator mount, up to 60 pounds
- A force of 2.5 pounds will be applied to the top of the simulator, and the deflection will be measured
- A load will be applied incrementally to the seat, up to 214 pounds
- Participants will be asked to assemble and disassemble the design, and the time will be measured

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References

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Contact Information

- **Ryan Irwin**
- rwi15@my.fsu.edu
- **Kemuel Nelson**
- kjn16@my.fsu.edu
- **Jarrod Darrow**
- jld15b@my.fsu.edu
- **Christian Gonzalez**
- cgg15b@my.fsu.edu

“The Pessimist Sees Difficulty In Every Opportunity. The Optimist Sees Opportunity In Every Difficulty.” – Winston Churchill