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Ghost Controls Lock Mechanism
Design Review 5

Senior Design Team 510

February 18, 2025

Sponsor and Advisor

Engineering Mentor
Darryl Beadle
Head Engineer Ghost Controls

Academic Advisor
Shayne McConomy, Ph.D.
Senior Design Professor

Project Advisor
Simone Hruda, Ph.D.
Professor

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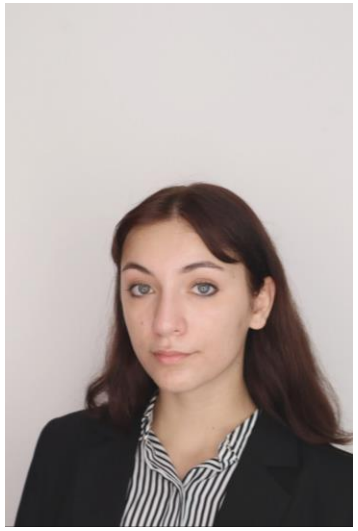
Team Introductions



Kayla Boudreaux
Project Manager

Jacob Brock
CAD Engineer
Presenter

Ernest Patton III
Manufacturing Engineer
Presenter

Dior Reece
Test Engineer
Presenter

Olivia Walton
Design Engineer

Bradley Wiles
Materials Engineer

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Objective

The objective of this project is to design an innovative gate latch receiver mechanism that effectively addresses current customer acclaimed issues with misalignment and improper latching of Ghost Controls' current system. Our goal is to develop a solution that ensures reliable engagement, enhanced durability, and ease of installation.

About Ghost Controls

- Local to Tallahassee
- Automatic Gate Openers
- Variety of Applications
- Designed for Do-It-Yourself (DIY) Installation

Current Product – Zombie Lock

- Latch-Pin Style
- Weather Resistant
- Easy for DIY Install
- Improves Security for Properties and Homes

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Customer Issues

- Latch misalignment due to gate sag
- Main cause of customer complaints

Project Focus - Receiver

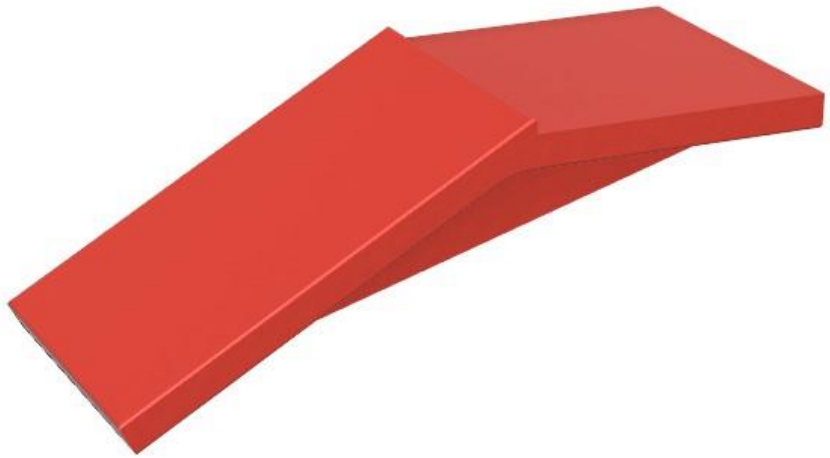
Customer Needs

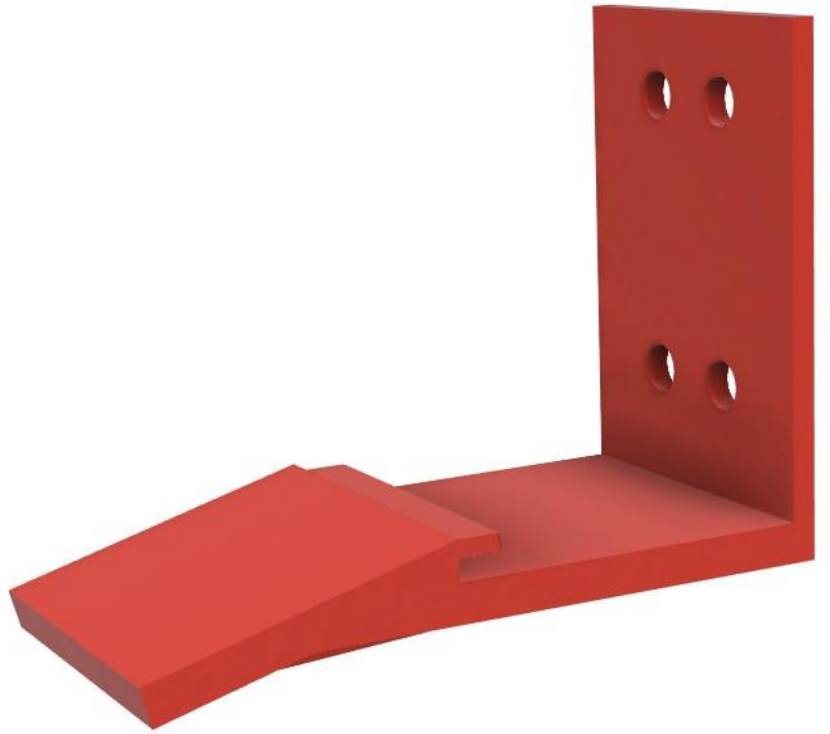
- Easy and convenient to use
- Withstands 50 lb of force directed at the lock
- Marketable design characteristics
- Performs in harsh environments
- Works for gates up to 20 ft in length
- Performs on swing gates of various configurations

Design Concepts

- Combined design concepts
  - Receiver ramp modification from High Fidelity Concept
  - Adjustable receiver plate inspired by Dr. McConomy

Prototyping - Ramp

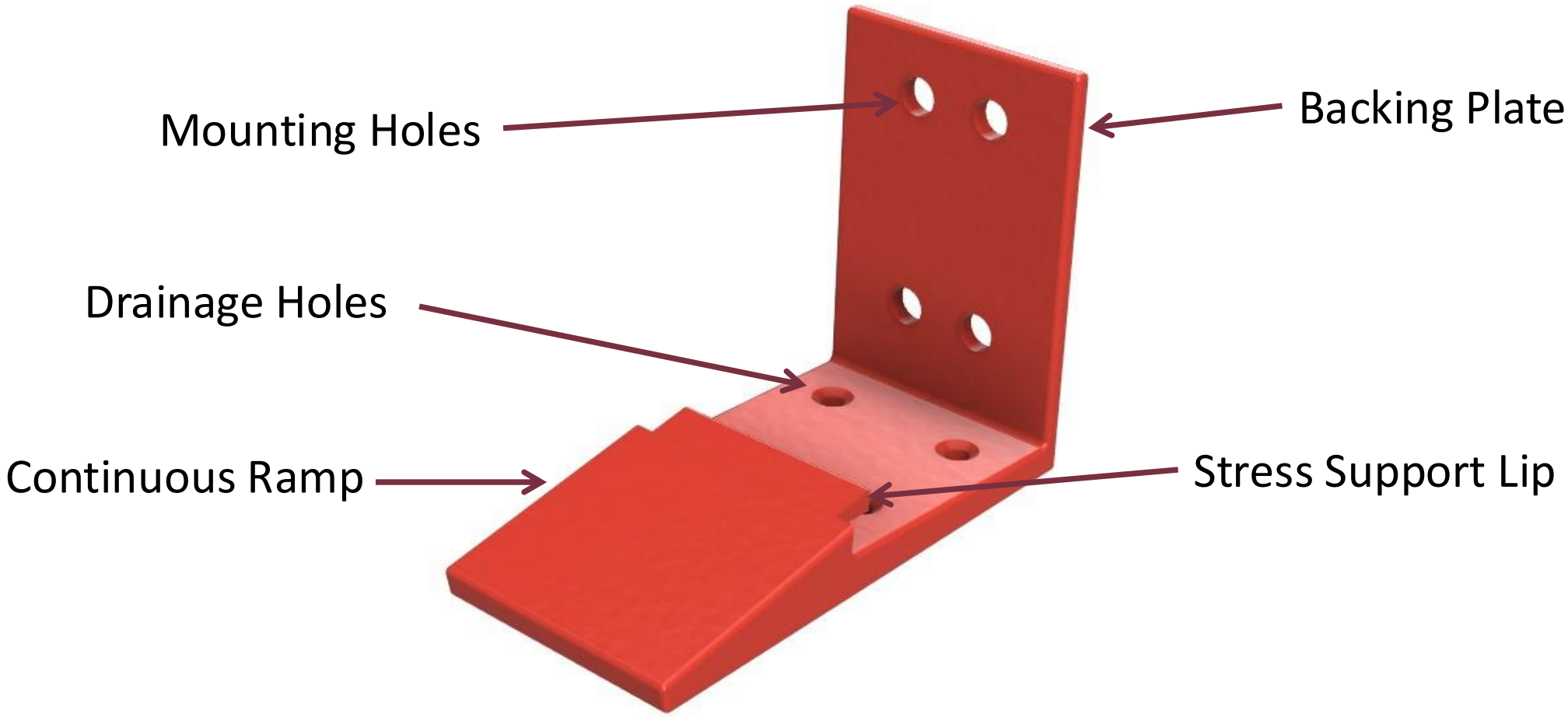




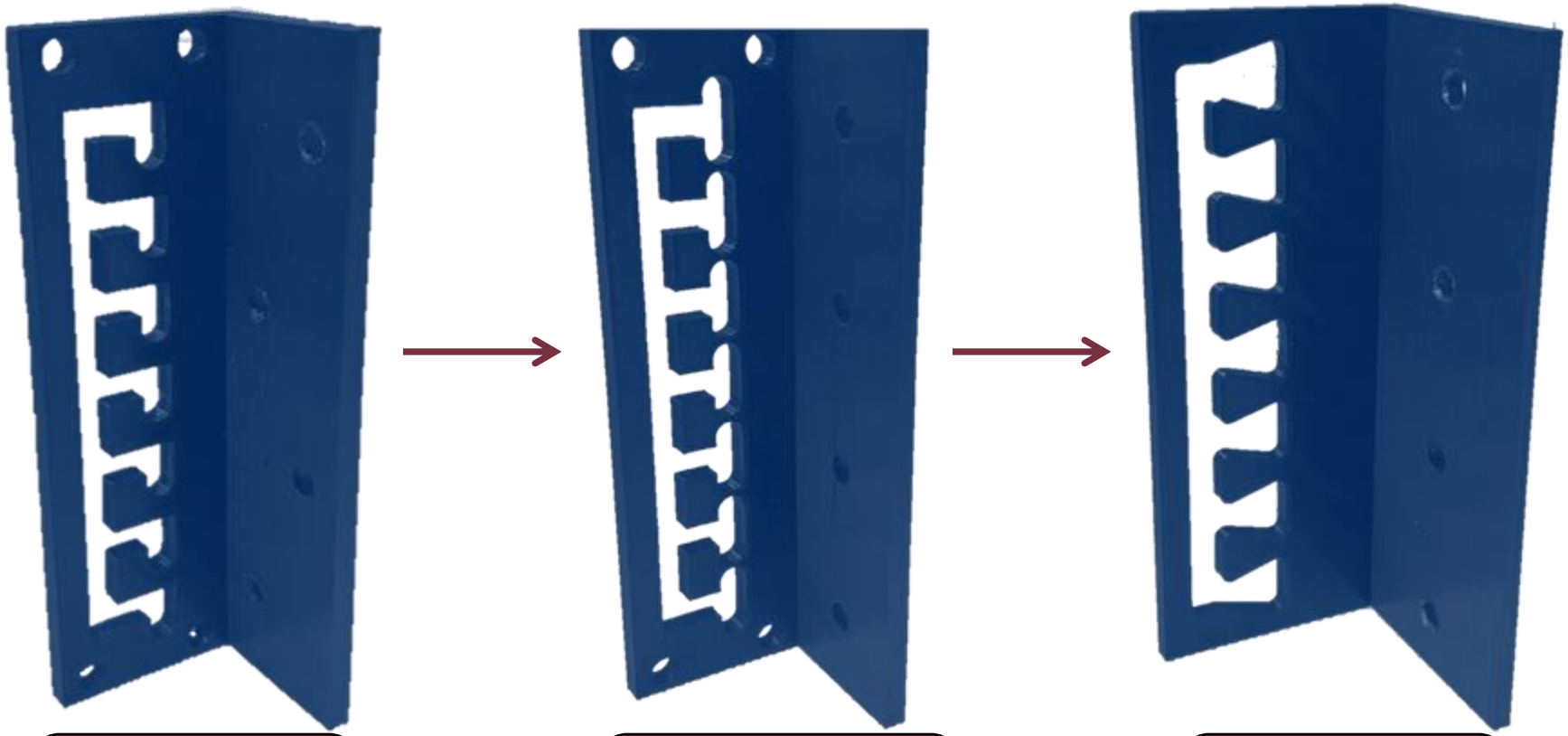
Original Design

Modified Design

Current Ramp



Prototyping - Adjustment Plate

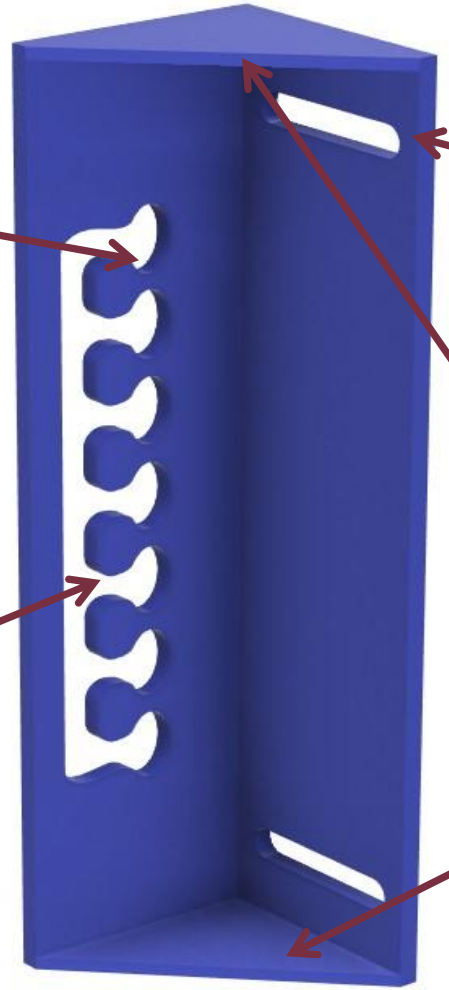


Original Design

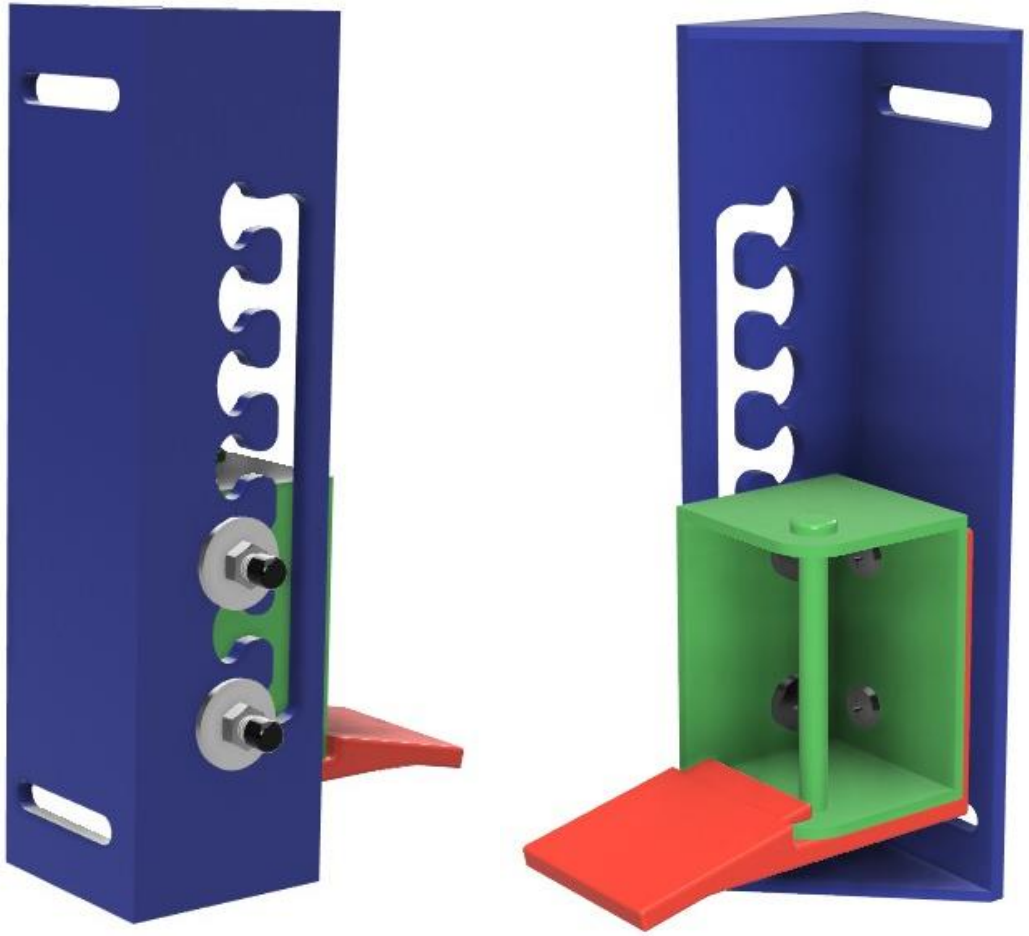
Slotted for Left and Right Closing Gates

Redesigned Slots for Strength

Current Adjustment Plate



CAD Prototype Assembly



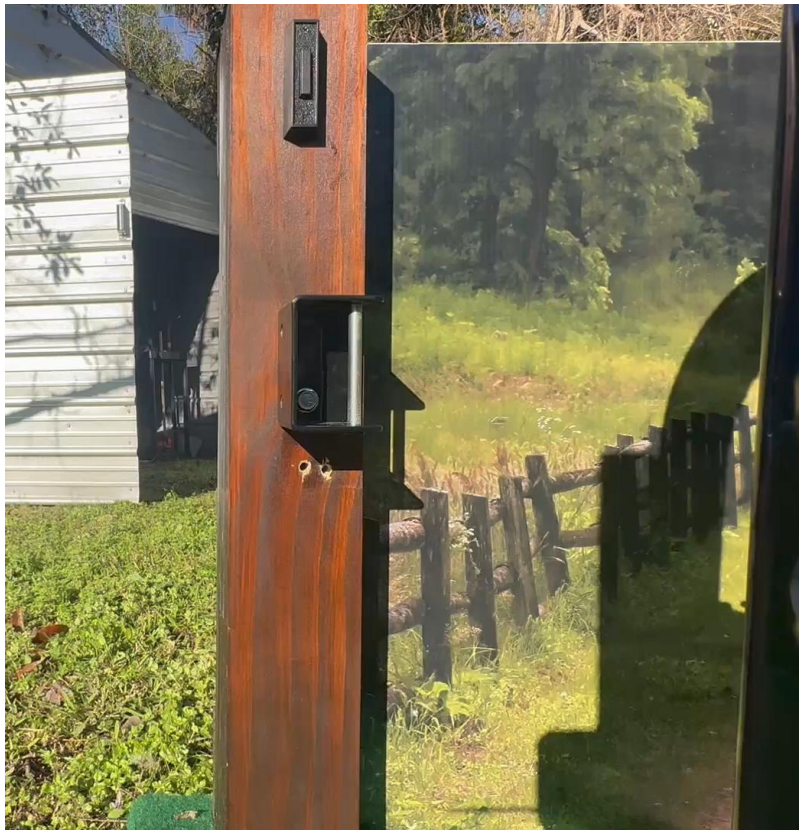
- Modification of the current receiver
- Receiver ramp is used to account for small misalignments
- Adjustment plate is used for larger misalignments

Physical Prototype Assembly

- Affords 3.5 inches of vertical adjustment
- Quick and easy to adjust, no tools required
- Boosts product reviews

Direct Comparison

Before



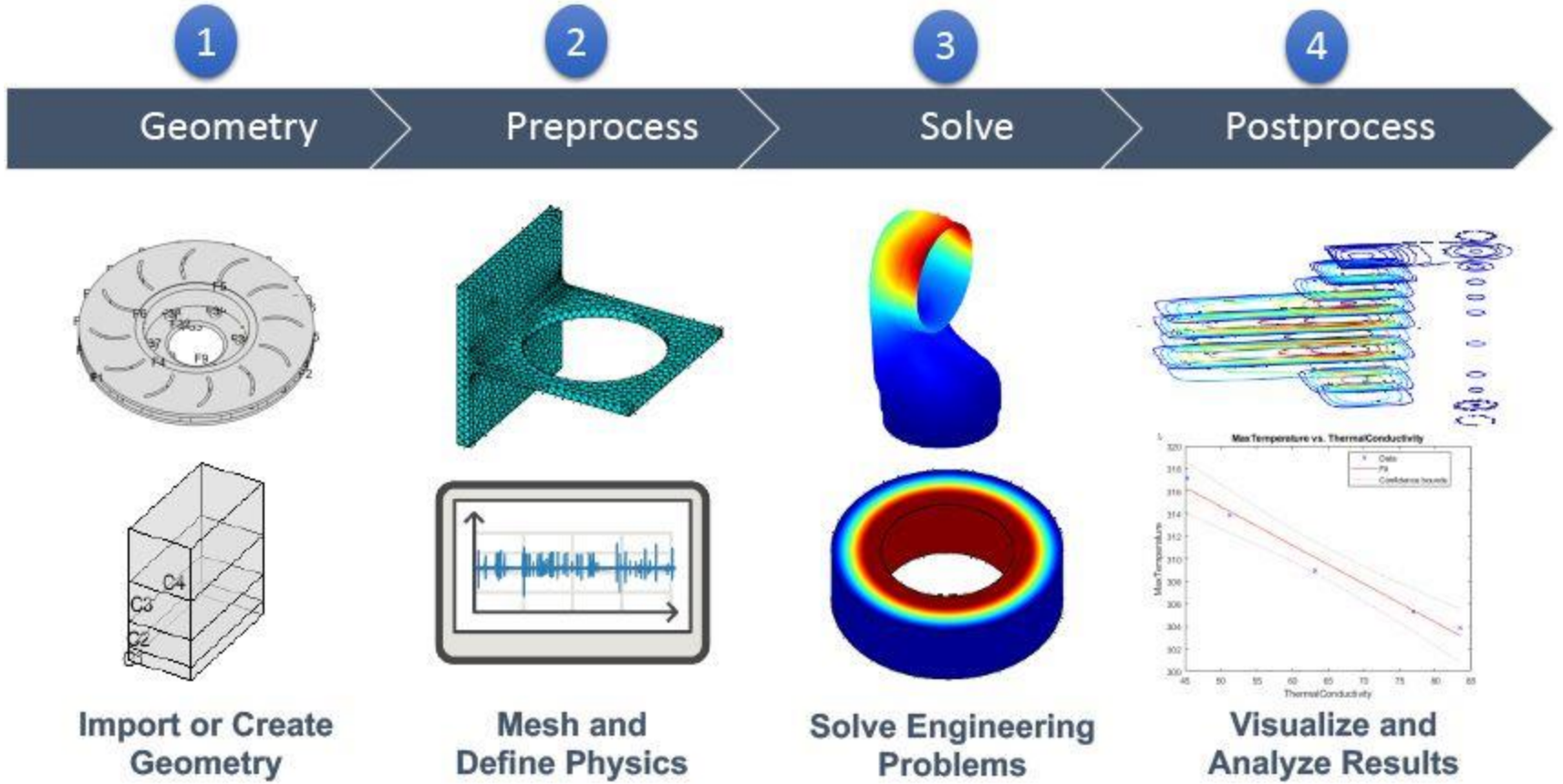
After

Short Gate Testing

Scuff produced on prototype → Powder coat finish to add durability

Large amount of deflection → Aluminum to increase rigidity

Finite Element Analysis



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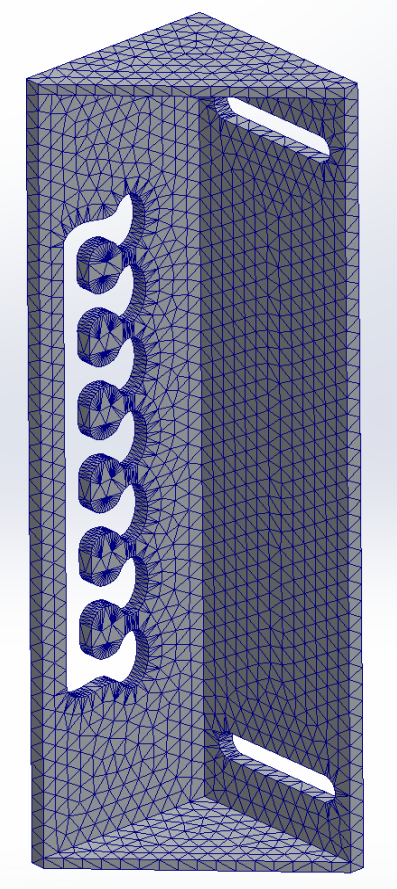
Finite Element Analysis Results



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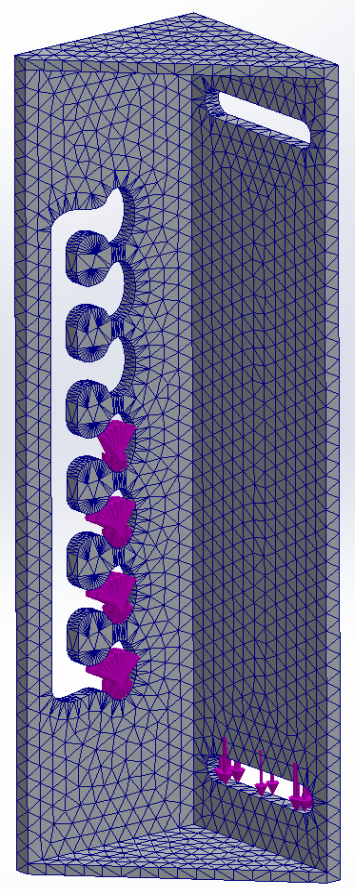

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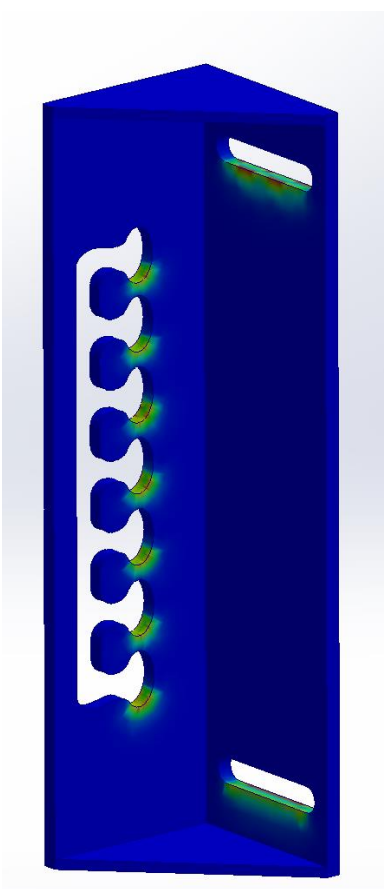

(3)

1. Mesh Quality Plot
2. Mesh with added forces – 15lbf
3. von Mises Stress

   Max stress: 2.377e05 N/m²

   Min stress: 5.153e-14 N/m²

   Yield Strength: 5.515e07N/m²

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Manufacturing

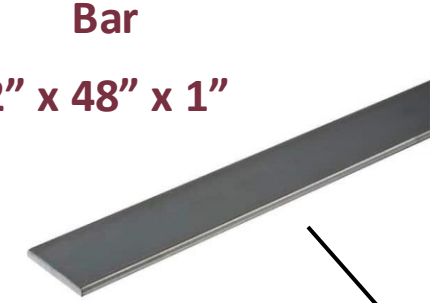
AL 6061

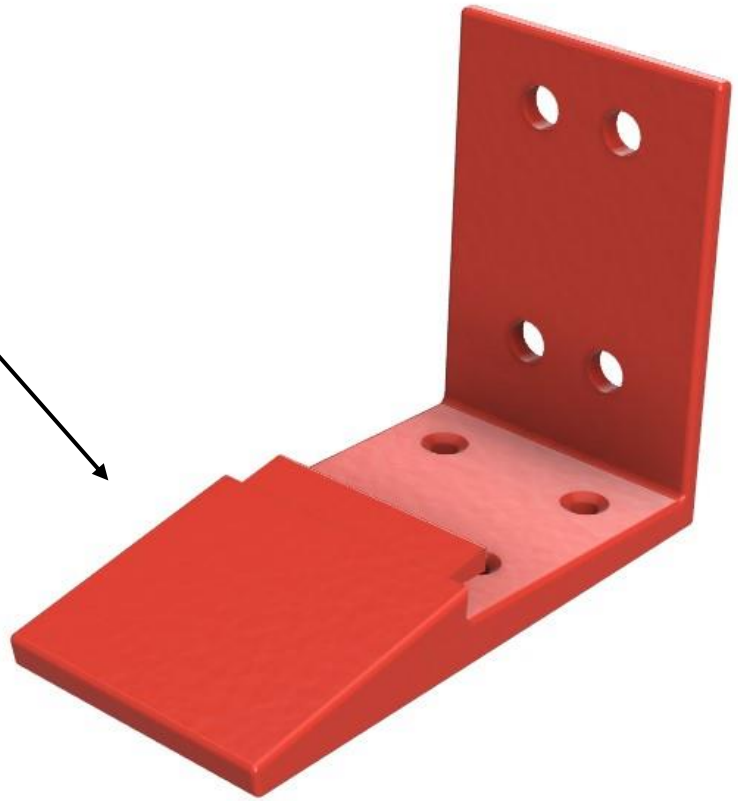
- Current material used by Ghost Controls
- Natural corrosion resistance
- Lightweight
- Cost effective
- Environmentally friendly

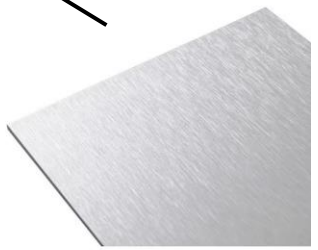
Manufacturing - Ramp

Bar

2” x 48” x 1”





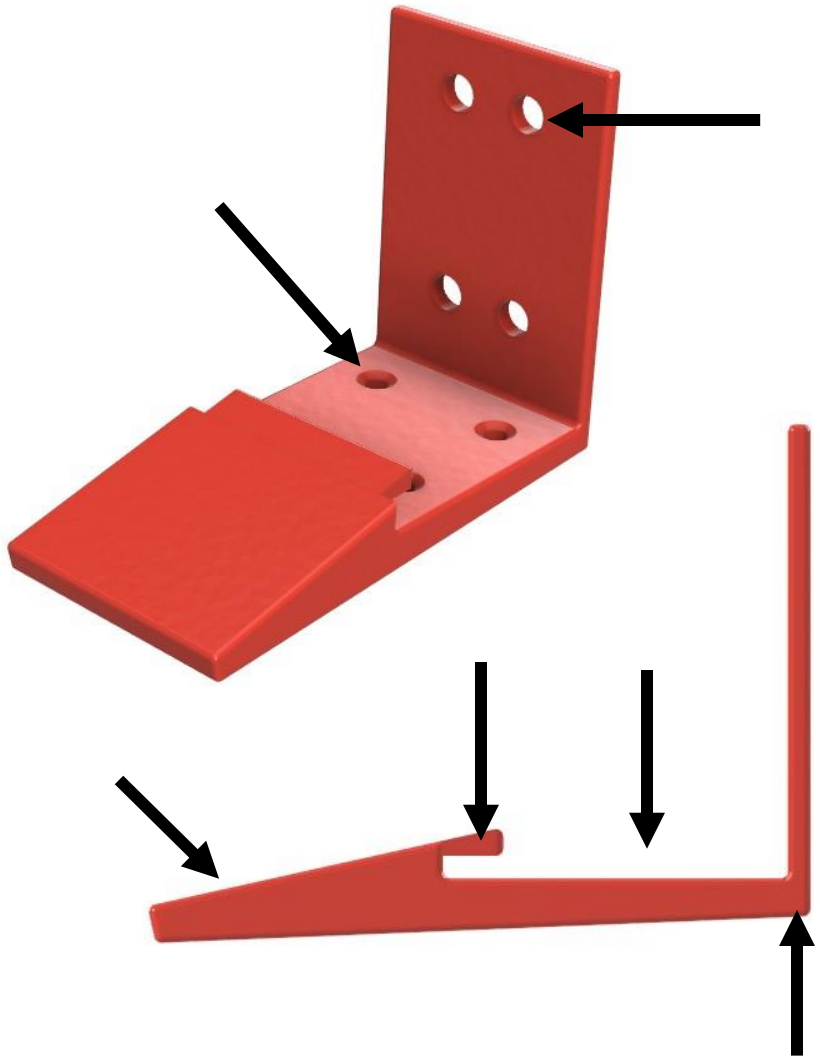


Sheet

16” x 16” x 1/8”

Manufacturing - Ramp

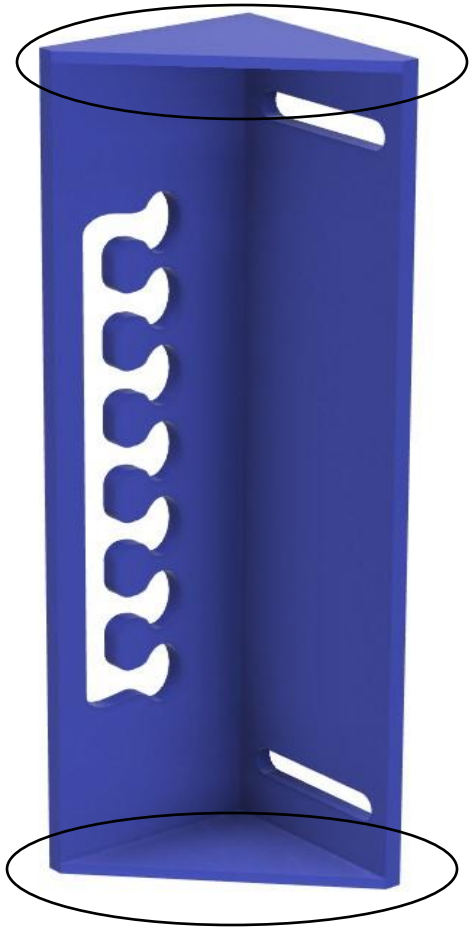
- End mill to cut away material from the top
- Ball mill to contour ramp shape
- Side cut notch under ramp
- Drill screw and drain holes
- Weld back plate to bottom ramp component



Manufacturing – Adjustment Plate

Sheet

16” x 16” x 1/8”



90° Angle Bar

2.5” x 2.5” x 4’ x 1/8”

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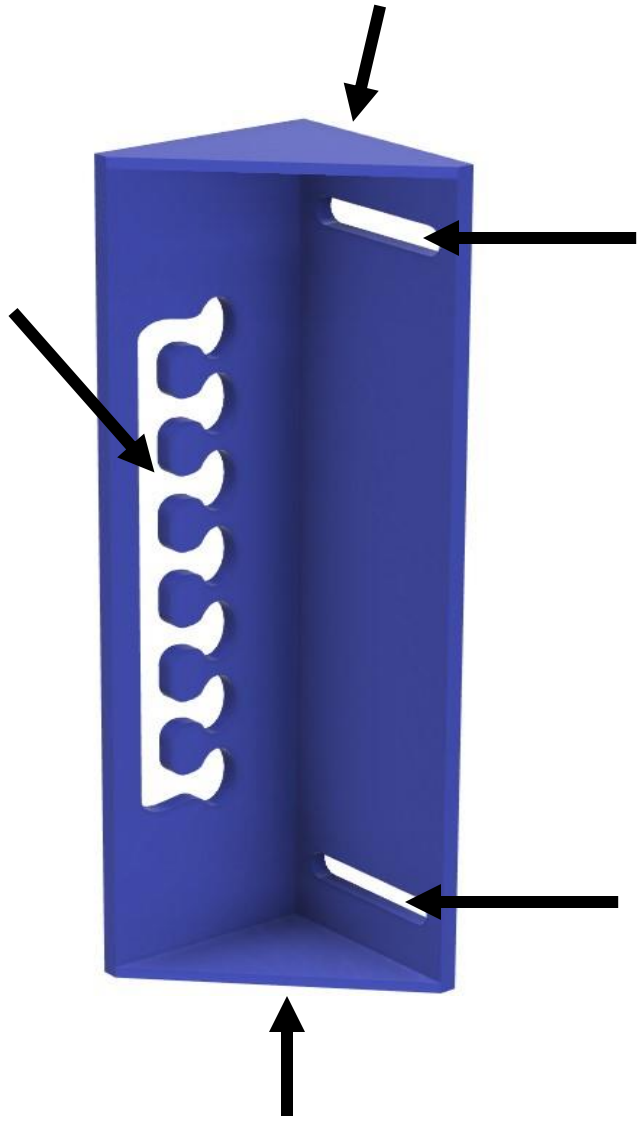
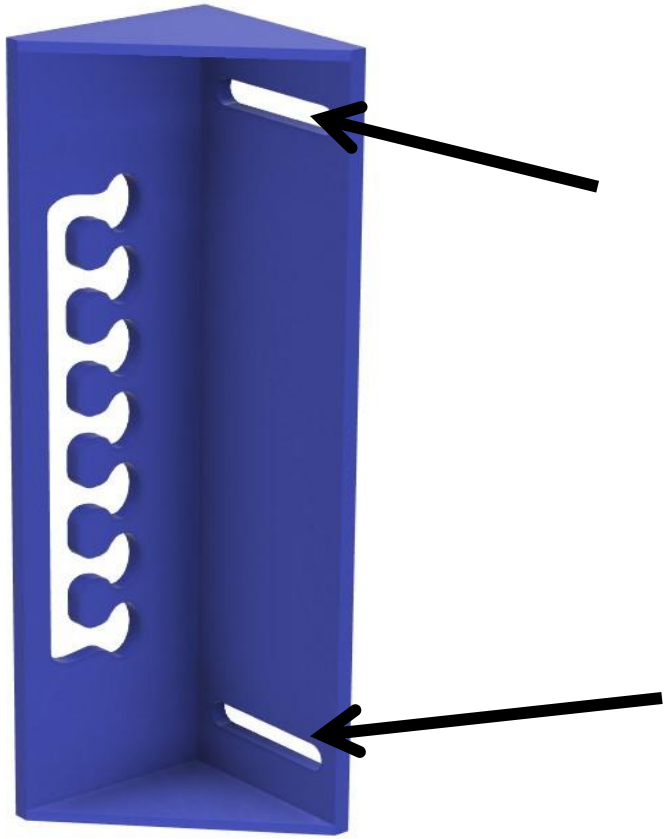
Manufacturing – Adjustment Plate

- Water jet adjustment track and screw slots
- Water jet gusset triangles
- Weld gusset triangles to angle bar



Manufacturing - Hardware

Adjustment Plate to Gate Post



- From Original ZombieLock
- Lag Bolts

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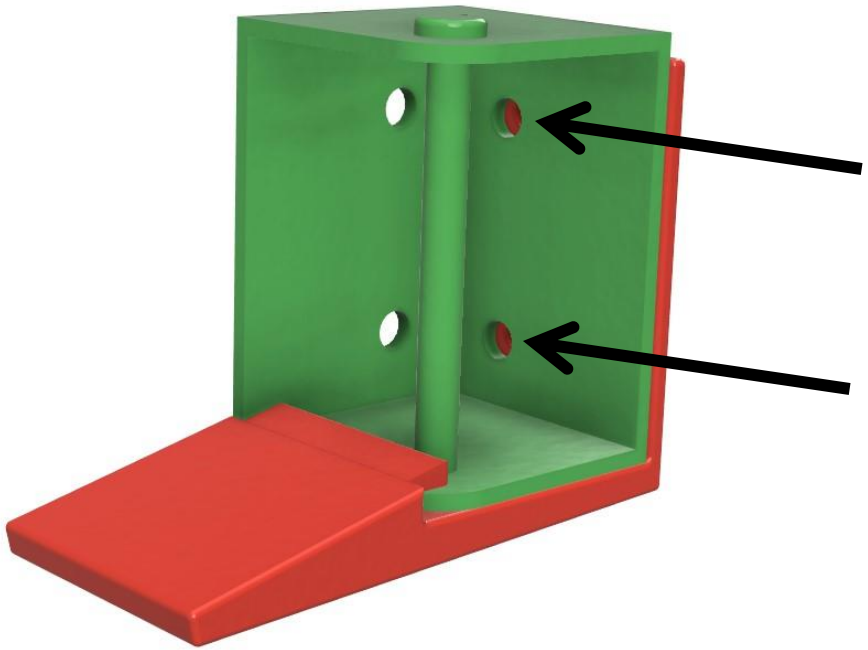
Manufacturing - Hardware

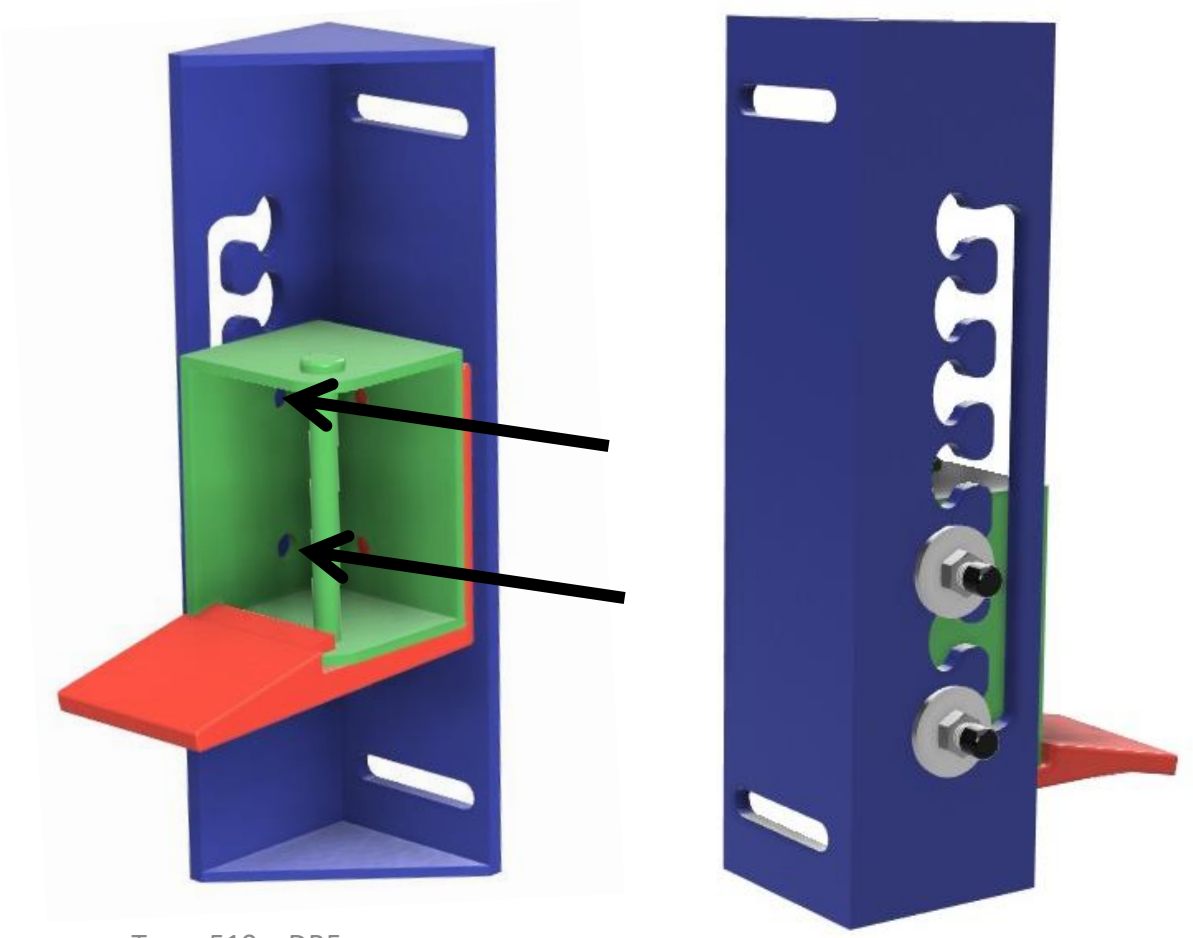
Receiver to Ramp



- Size M6x1.0
- 12mm in length
- Countersunk
- Black

Manufacturing - Hardware

Receiver and Ramp to Plate



- Size M10x1.0
- 25mm in length
- Countersunk
- Black
- Rubber end caps

Future Work

- FEA and Material Testing
- Material Machining & Powdercoating
- Hardware Purchasing
- Assemble First Metal Prototype
- Test Product on Gates

GHOST® CONTROLS

Questions?

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