FAMU-FSU College of Engineering

Ghost Controls Lock Mechanism
VDR2

Senior Design Team 510

November 14, 2024

Sponsor and Advisor

Engineering Mentor
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Professor

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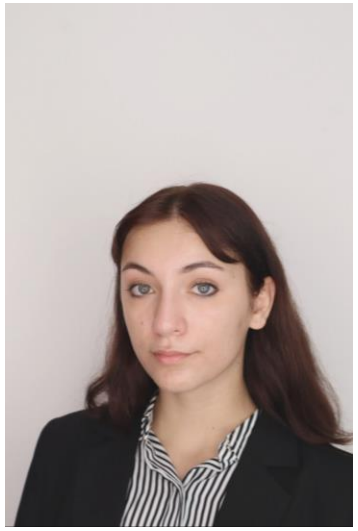
Team Introductions



Kayla Boudreaux
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Jacob Brock
Hardware/Software Engineer
Presenter

Ernest Patton III
Quality Engineer

Dior Reece
Test Engineer
Presenter

Olivia Walton
Design Engineer

Bradley Wiles
Materials Engineer
Presenter

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Objective

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

Background

Ghost Controls

- Tallahassee Based Company
- Automatic Gate Openers

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Current Design – Zombie Lock

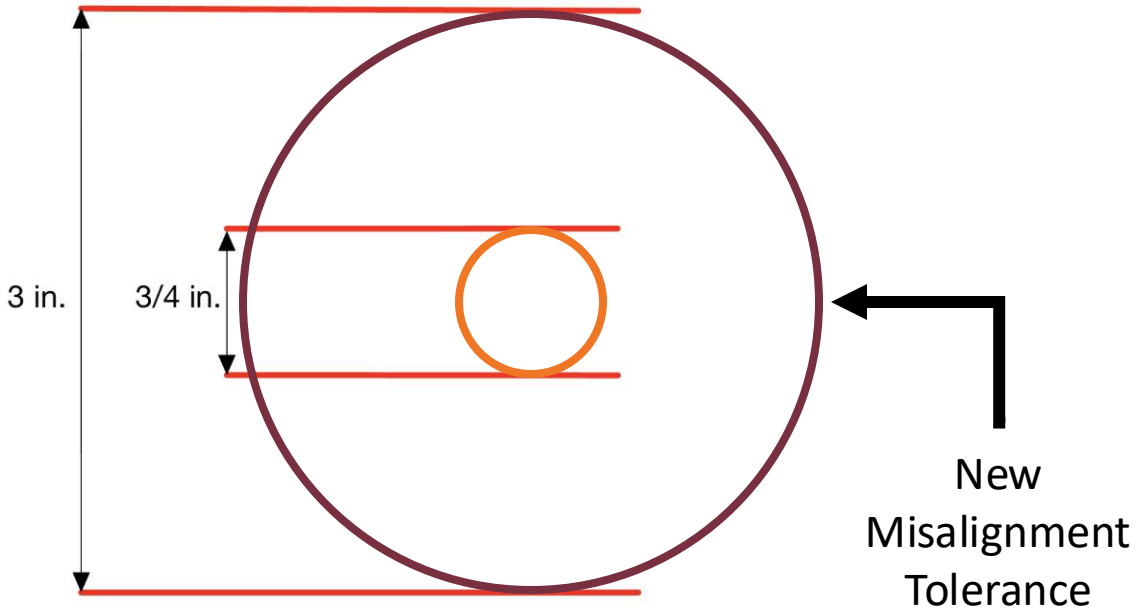
- Latch Style
- Weather Resistant
- Easy to Install
- Resists Force

Customer Issues

Current Misalignment Tolerance

- Only accounts for 3/4 inches of misalignment
- Main cause of customer complaints
- Customer must manually adjust receiver to correct

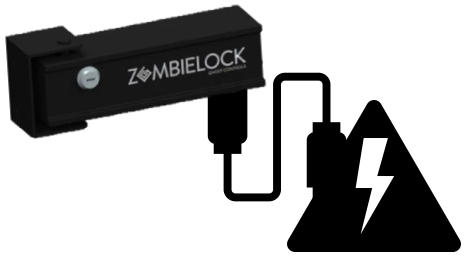
Customer Issues



- Increases misalignment tolerance to 3 inches
- Boosts product reviews
- Significantly extends the time before requiring manual adjustment

Targets and Metrics

Resistance	Lock Mechanism	Power	Compatibility



Resistance

Resist Environmental Factors → -5 – 160 [deg F]

Endure Extreme Temperatures → ≤ 100 Humidity [%]

Endure Extreme Temperatures → ≤ 50 Precipitation [in]

Lock Mechanism

Release Passively → ≤ 5 [sec]

Engage Lock → ≤ 5 [sec]

Power

Draw Power to Release Latch

Same Power Source as Gate Arm

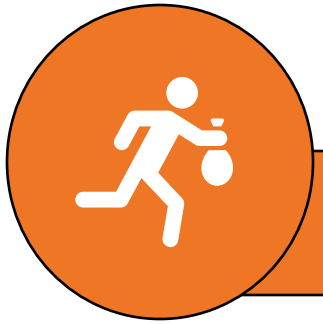
12 – 12.9 [V]

Compatibility

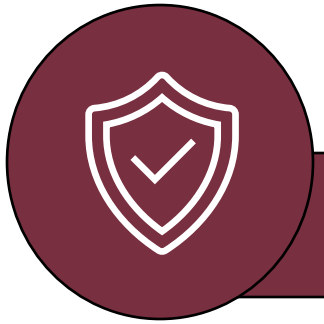
Account for Bounce in Vertical → 1 – 3 [in]

Attach to Any Gate → Tolerance of 0.31 in

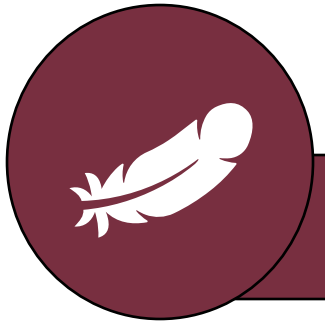
Additional Targets



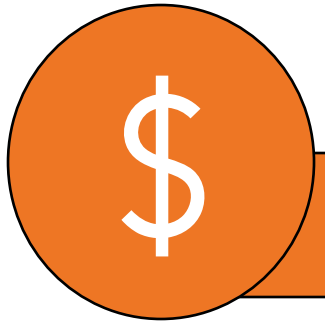
Security



Industry Compatible



Stay lightweight



Cost

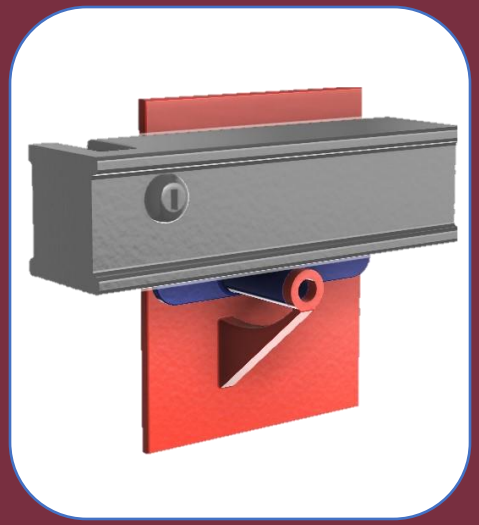
Concept Generation Tactics

SCAMPER
39 Concepts

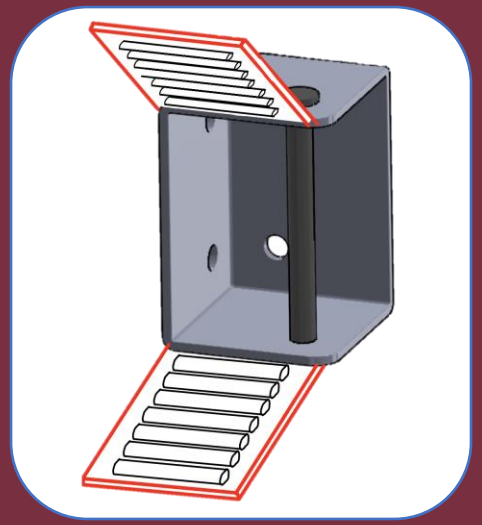
Crap Shoot
11 Concepts

Morphological Chart
50 Concepts

High Fidelity Concepts



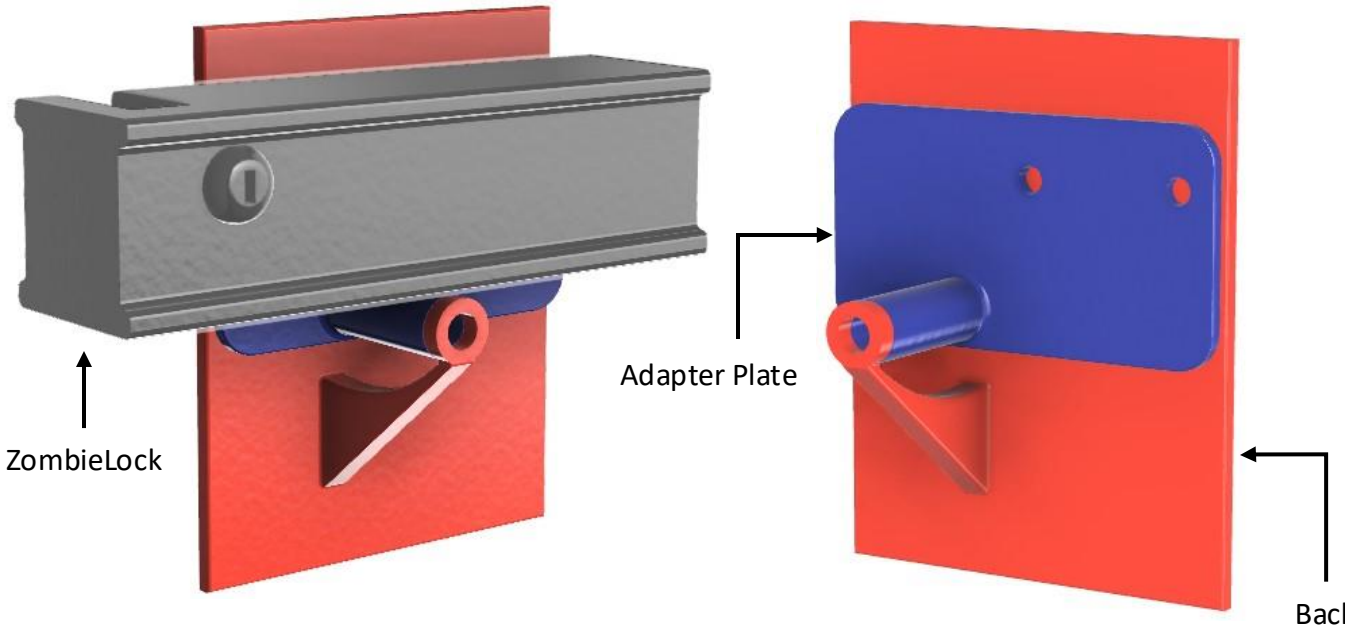
Concept 53: Pivoting ZombieLock



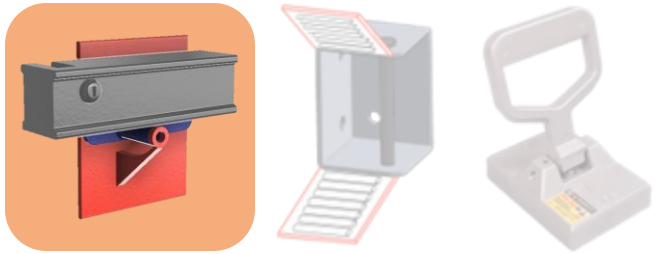
Concept 67: Receiver Ramp Modification

Concept 71: Magnet System

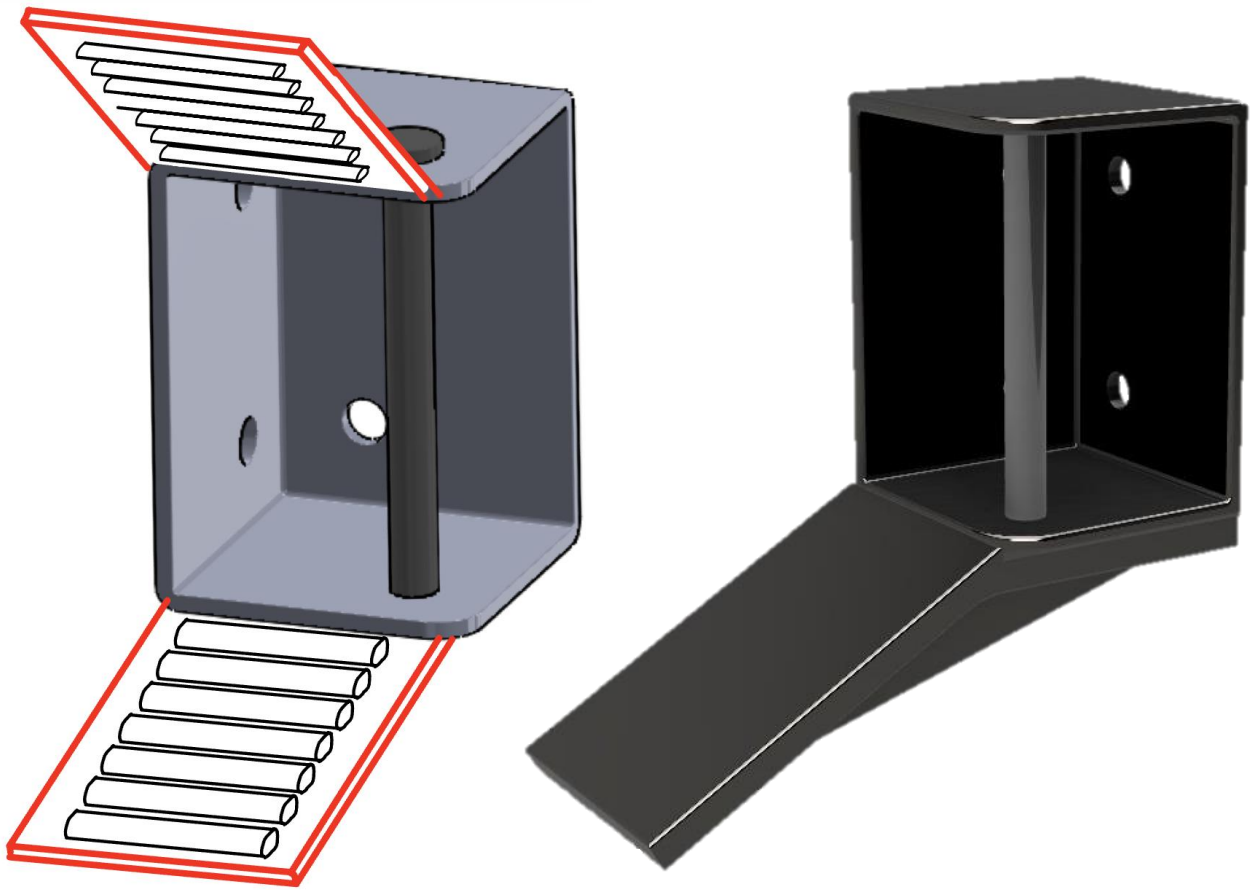
High Fidelity: Pivoting ZombieLock



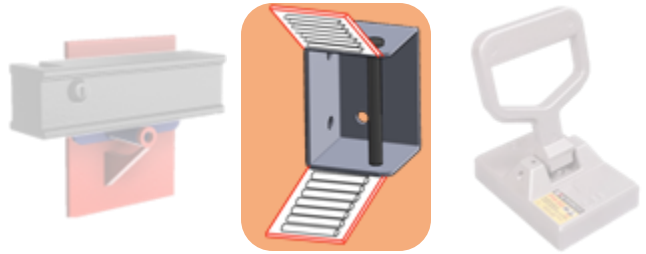
- Lock will not require modification
- Features an adapter plate and a backing plate
- A pivot point allows for more misalignment



High Fidelity: Receiver Ramp Modification

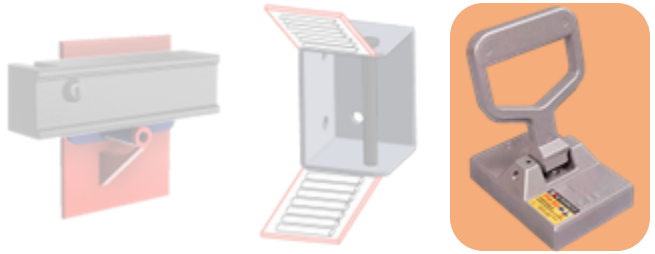


- Modification of the current receiver
- Ramps added to guide lock into position
- Rollers or coating to reduce friction
- Simple, cheap, and light



High Fidelity: Magnet Modification

- Magnet affords large amounts of misalignment
- Steel plate mounted to post
- DC stepper motor rotates magnet handle to magnetize



Concept Selection

Binary Pairwise

House of Quality

Pugh Charts

Analytical Hierarchy Charts

Final Selection

Binary Pairwise Comparison

Customer Needs	Score
Product is intended for no contact gates	1
Improvement to lock costs less than the current market competitors	1
Gate lock design can resist 50 lbs. of force	2
Mechanism works for lengths up to 20 feet	3
The gate performs in rugged environments	4
Product contains a fail-safe method of unlocking	5
Gate adjusts system to account for the sag	6
Gate can stay locked in the closed position after opener is used	7
Product must be mechanical in nature, but uses power to unlock	7

House of Quality

Engineering Characteristic	Ranking
Engage Lock	1
Release Passively	2
Keep Gate Closed	3
Cost	4
Volume	5
Account for Vertical Bounce	6
Account for Horizontal Bounce	7
Draw Power to Release Latch	8
Account for Thermal Expansion	9
Mount to Gate	10

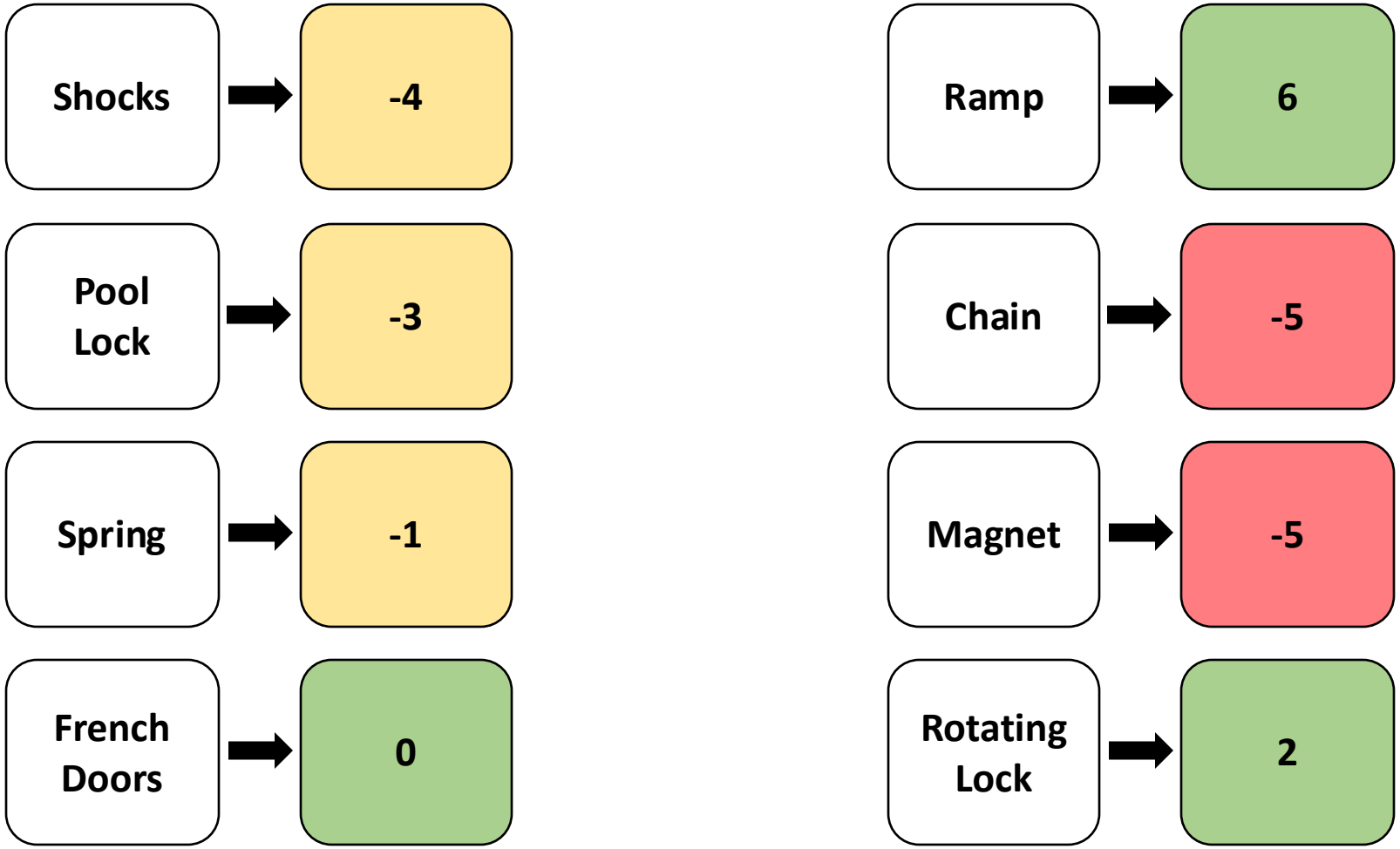
Pugh Chart- First Iteration

Datum:

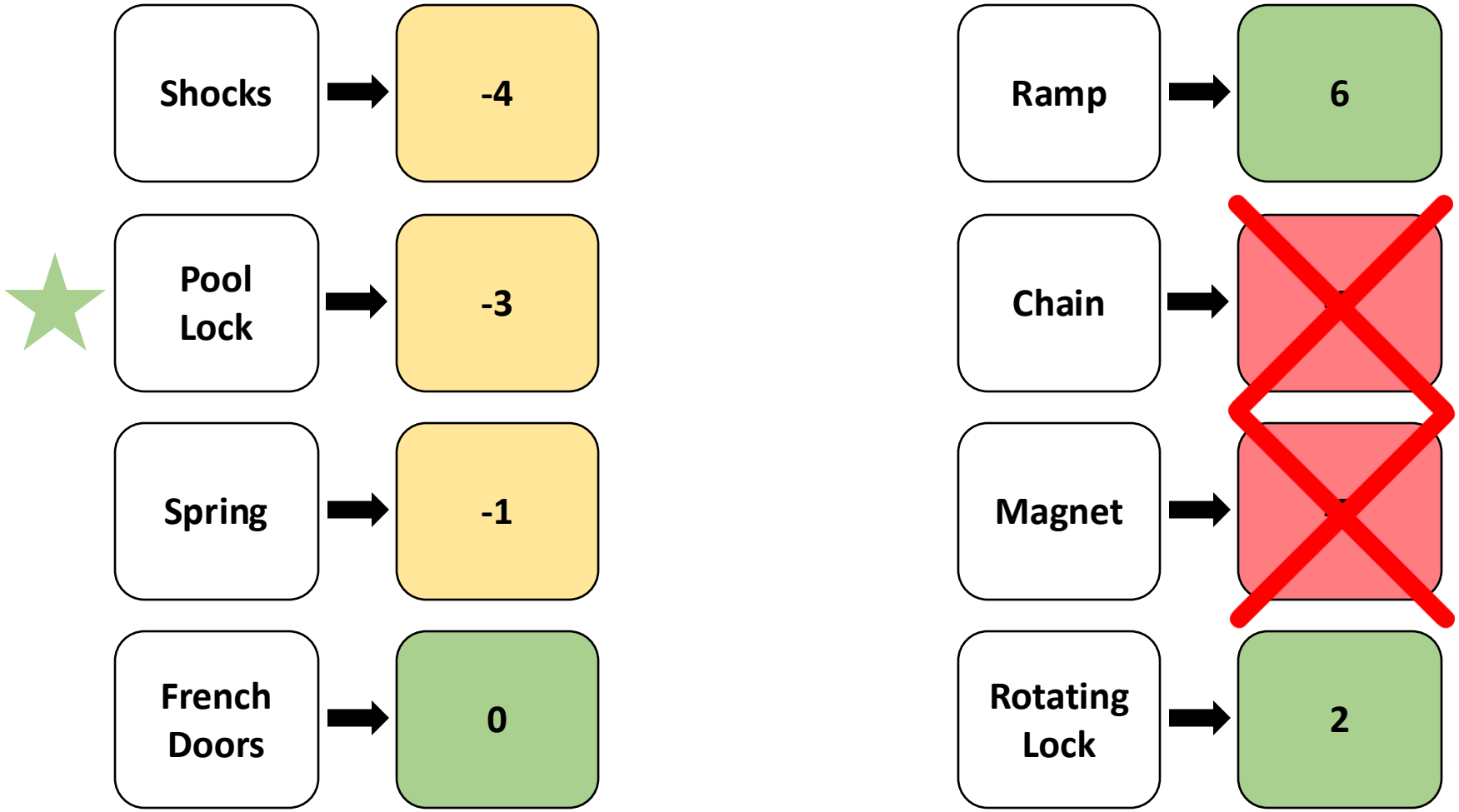
Selection Criteria:

- Engage Lock
- Release Passively
- Keep Gate Closed
- Accounts for Misalignments
- Volume
- Cost
- Draw Power to Release Latch

Pugh Chart- First Iteration



Pugh Chart- First Iteration



Pugh Chart- Second Iteration

New Datum:

Pool Lock

Kept Concepts:

Shocks

Rotating Lock

Spring

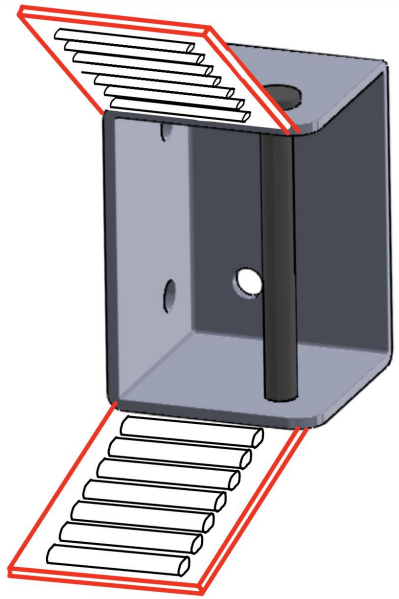
Ramp

French Doors

Pugh Chart- Second Iteration

Datum: Pool Lock

Engage Lock	S
Release Passively	+
Draw Power to Release	+
Keep Gate Closed	S
Accounts for Misalignments	S
Volume	+
Cost	+

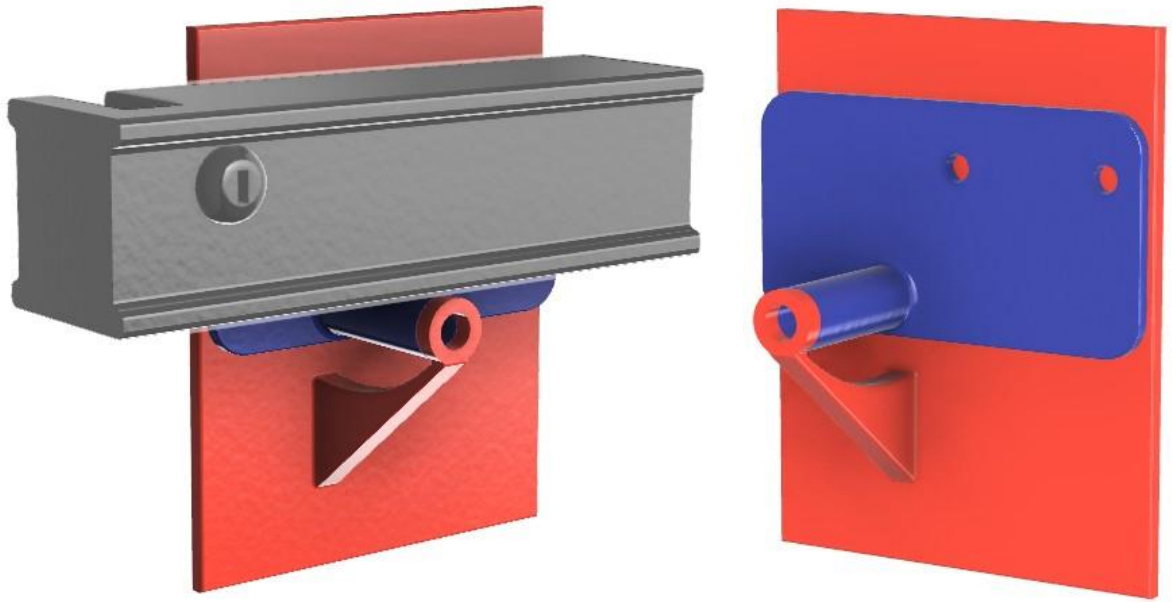


Ramp Concept

Pugh Chart- Second Iteration

Datum: Pool Lock

Engage Lock	-
Release Passively	S
Draw Power to Release	-
Keep Gate Closed	-
Accounts for Misalignments	+
Volume	+
Cost	+

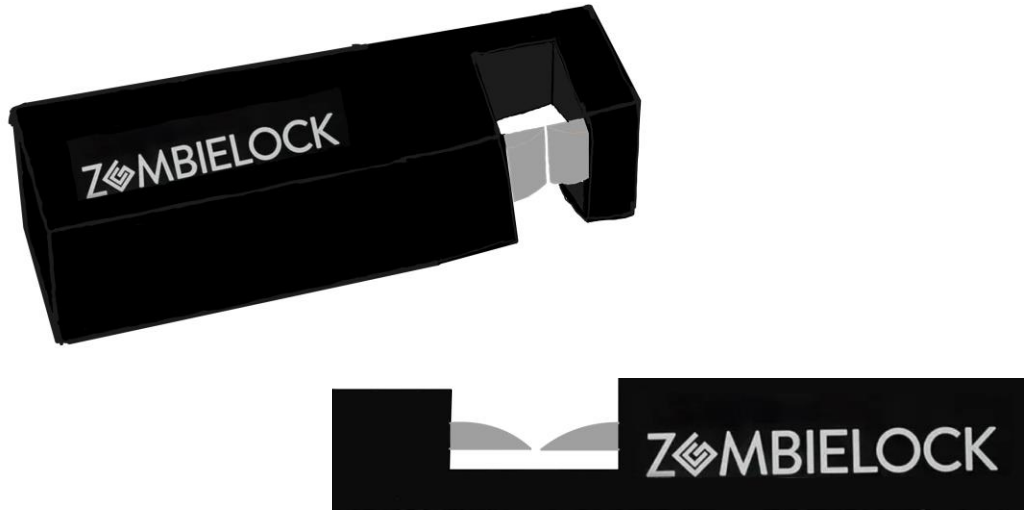


Rotating Lock Concept

Pugh Chart- Second Iteration

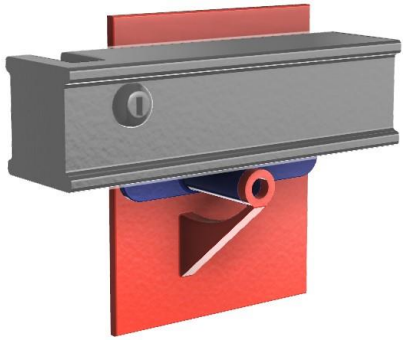
Datum: Pool Lock

Engage Lock	S
Release Passively	-
Draw Power to Release	-
Keep Gate Closed	S
Accounts for Misalignments	S
Volume	+
Cost	+



French Doors Concept

Analytical Hierarchy Process

Rotating Lock Concept		Alternative Value: 0.302
Ramp Concept		Alternative Value: 0.545
French Doors Concept		Alternative Value: 0.153

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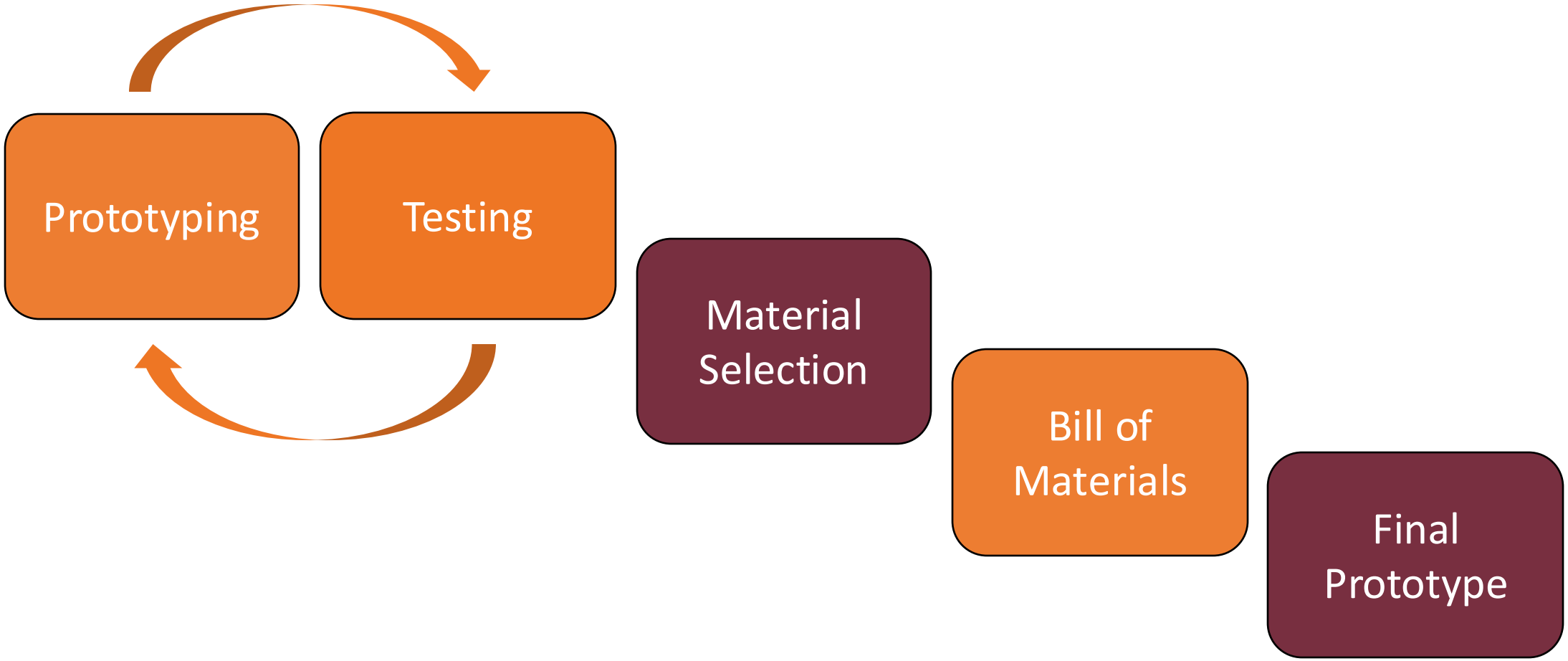
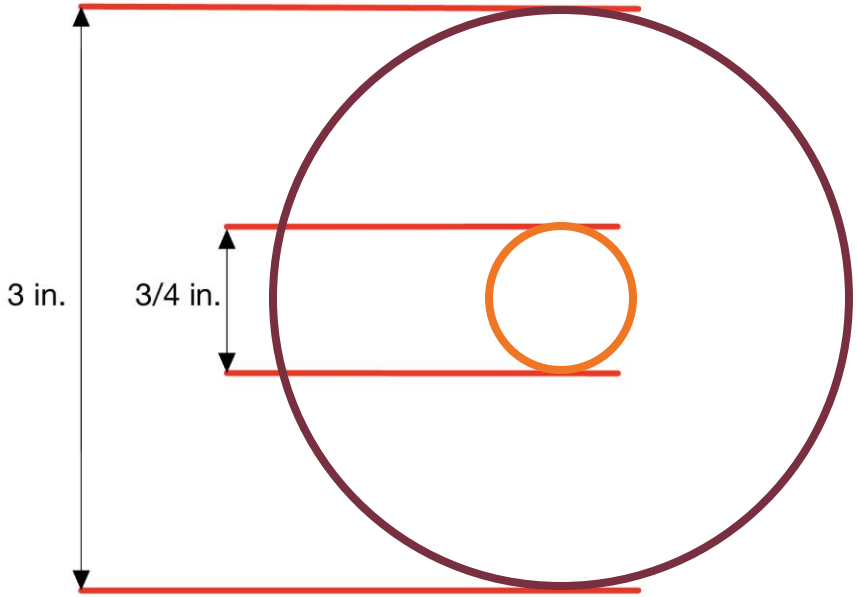
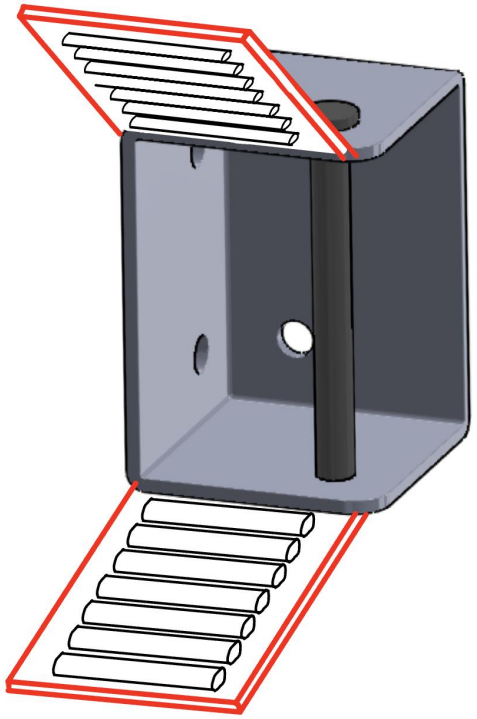
Future Work


Prototyping
Testing
Material Selection
Bill of Materials
Final Prototype





Questions?

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