Tech Expo, Spring 2026 – Team 18

Automated Vehicle Lifting System

Team: Buck Wright, James Ramich, Grant Anderson, Giovanni Pollina, Lucas Lomax, Andrew Shelley

Mentors: Sukesh Jagannathan Ranganathan

PURDUE UNIVERSITY
Polytechnic Institute

BraunAbility

Problem Statement

BraunAbility's vehicles are supported by dollies on a track that transport the vehicle across the manufacturing floor. Sensors verify that the dollies have entered the lift cell and have made proper alignment before raising the vehicle. The lift is designed to avoid interference with floor cutting operations while elevating/lowering the vehicle. The system is designed to improve efficiency, precision, and overall process reliability.

Customer Background

BraunAbility is the world's leading manufacturer of mobility transportation solutions, including wheelchair accessible vehicles, wheelchair lifts and seating, storage and securement products. Founded over 50 years ago by Ralph Braun, an entrepreneur who spent most of his life in a wheelchair, the company has grown into the most well-known and trusted name in the mobility industry, bringing independence to millions of individuals across the world.

Requirements

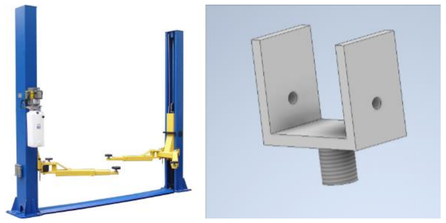
Constraints:

- Full System CAD Assembly for Design Validation
- System must raise vehicles 1 meter
- Minimum safety factor of 2 for all components
- Total budget of $32,000 allocated for design, prototyping, testing and manufacturing
- Automation controlled by PLC for production
- The system must be relocatable to accommodate future manufacturing floor layout changes

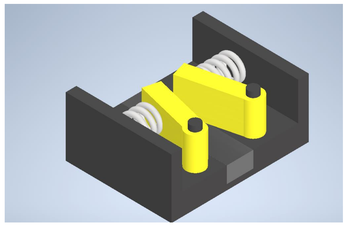
Current Production Line

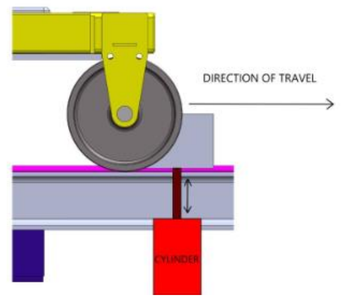
Experimentation and Concepts

Initial Arm Design



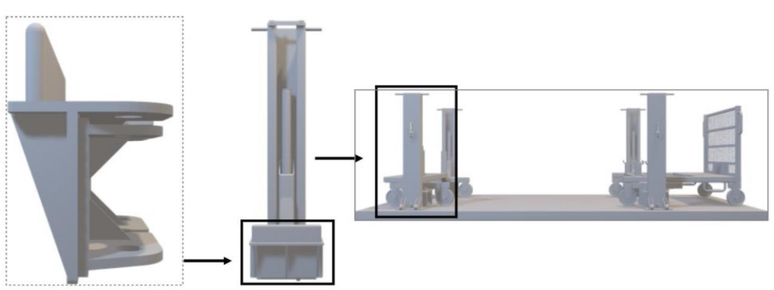
Wheel Stop





Final Design

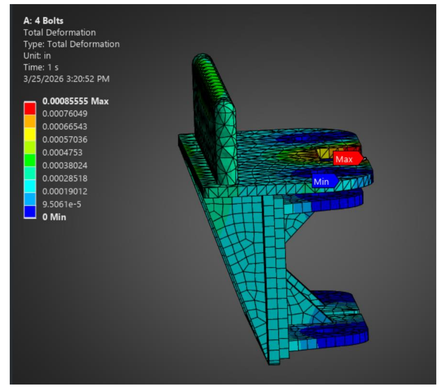
1. Dolly enters station and activates rear wheel stops (spring-loaded "shark teeth" ramp)
2. Front wheel brake (spring-loaded with side pressure) slows dolly for smooth rear stop engagement
3. After cycle, front lock allows dolly to roll forward through clamp
4. Dolly position triggers a Hall effect sensor → sends signal to PLC
5. PLC confirms dolly is in position for MaxJax M7K lift with custom arm
6. Lift begins rising
7. Locating arm pin engages slot → constrains dolly in X and Y axes
8. Lift plate contacts base → constrains Z axis
9. Dolly is lifted 1 meter
10. Lift locks to secure dolly in place
11. Robot performs laser cutting on vehicle chassis
12. After cutting, PLC signals system to unlock
13. Lift lowers dolly back to track
14. Pin disengages at lowest position
15. Hall effect sensor reactivates
16. Front lock opens → dolly exits system
17. Next dolly enters and cycle repeats



Custom Arm MaxJax Dolly with Custom Arm Full lift assembly (Lifts and Dollies)

Prototype Cell

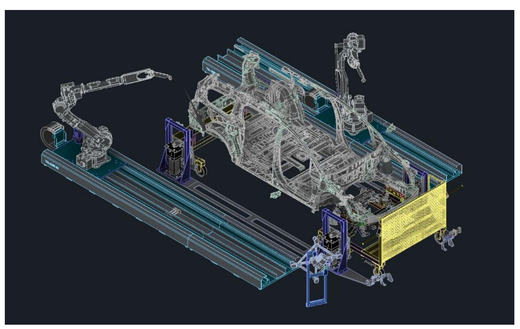
Testing and Results



Speed tests established consistent lift cycle times, while wheel lock testing confirmed reliable engagement of mechanical locks and the solenoid system. Tolerance and measurement testing verified proper fit and adequate clearance for laser integration. FEA analyses supported structural integrity, demonstrating the locating arm and revised dolly frame safely withstand applied loads, confirming overall design viability.

Results:

- Lowest height to top of lift arm = 9 3/4" - 10"
- Max Height to top of lift arm = 52"
- Drop time for lifts (w/ arms) = 3min19sec
- Drop time for lifts (w/o arms) = 4min30sec
- Raise time(w/o arms) = 1min30sec .
- 6000lbf load - 0.00085555 in Max Deformation



Future Production Line