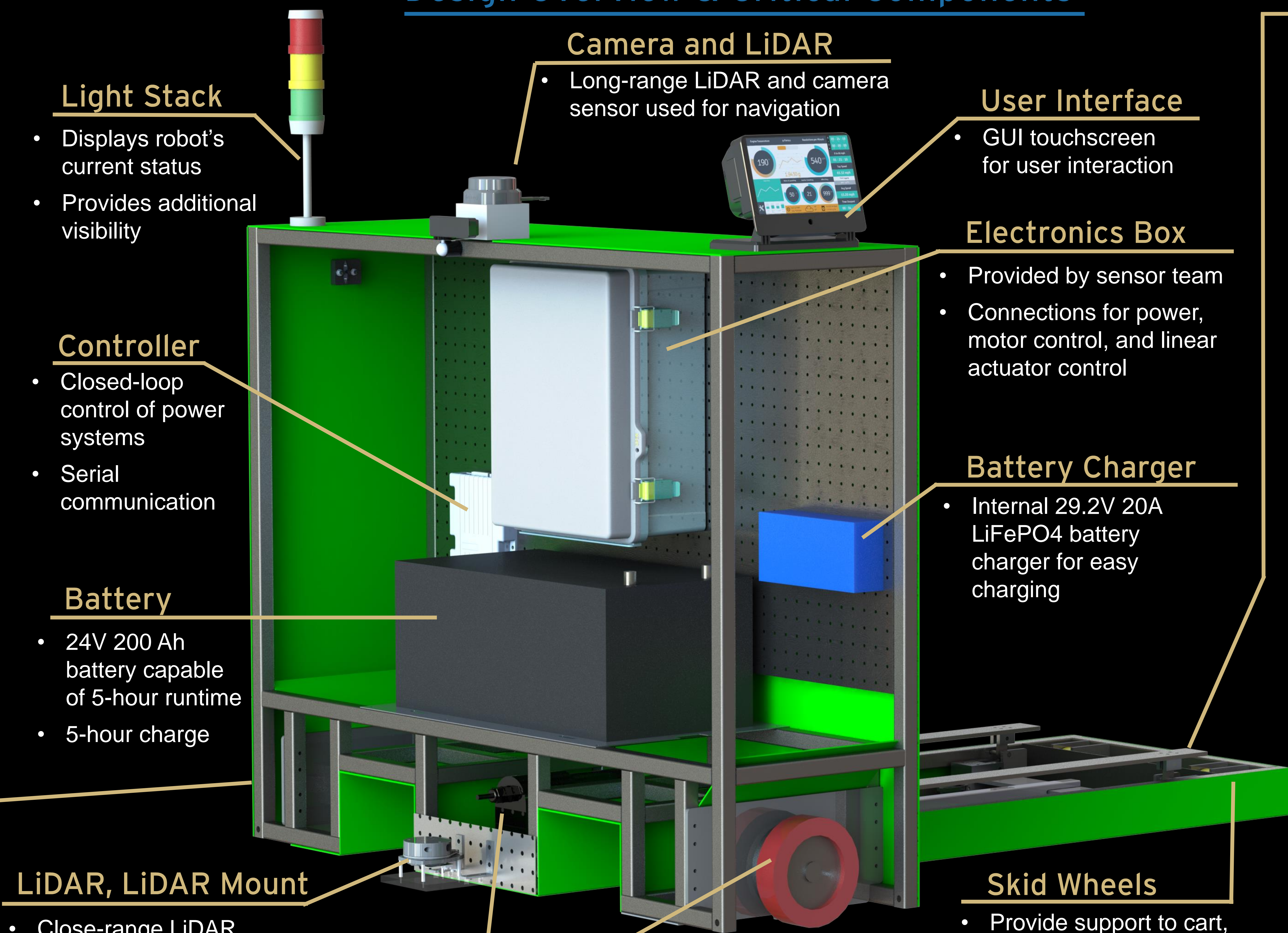


### Project Background

- Wanco is a 500,000 sq ft. facility composed of 3 large buildings
- Need robot to improve facility efficiency for repetitive material transportation



### Design Overview & Critical Components



#### Light Stack

- Displays robot's current status
- Provides additional visibility

#### Camera and LiDAR

- Long-range LiDAR and camera sensor used for navigation

#### User Interface

- GUI touchscreen for user interaction

#### Electronics Box

- Provided by sensor team
- Connections for power, motor control, and linear actuator control

#### Controller

- Closed-loop control of power systems
- Serial communication

#### Battery Charger

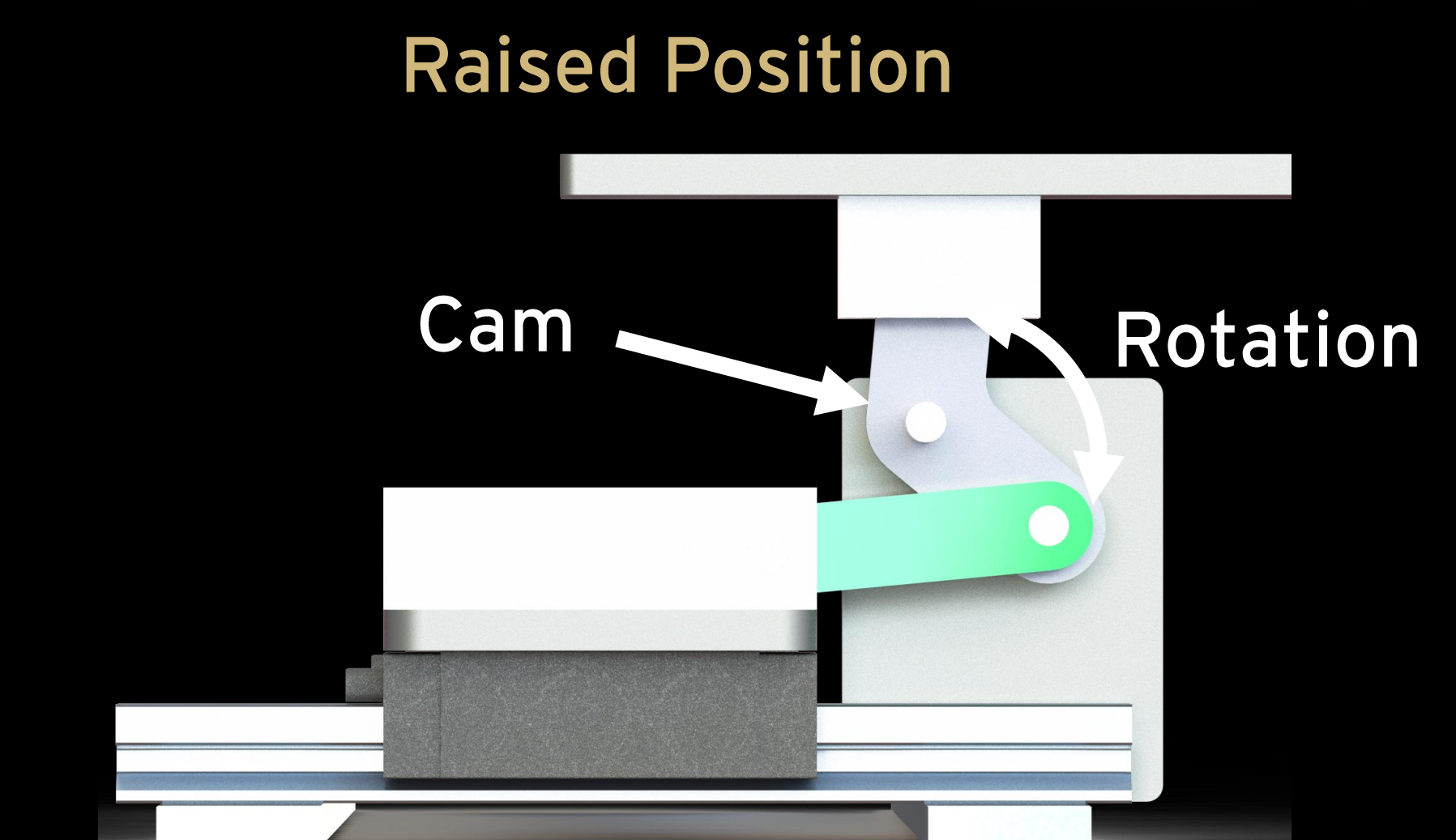
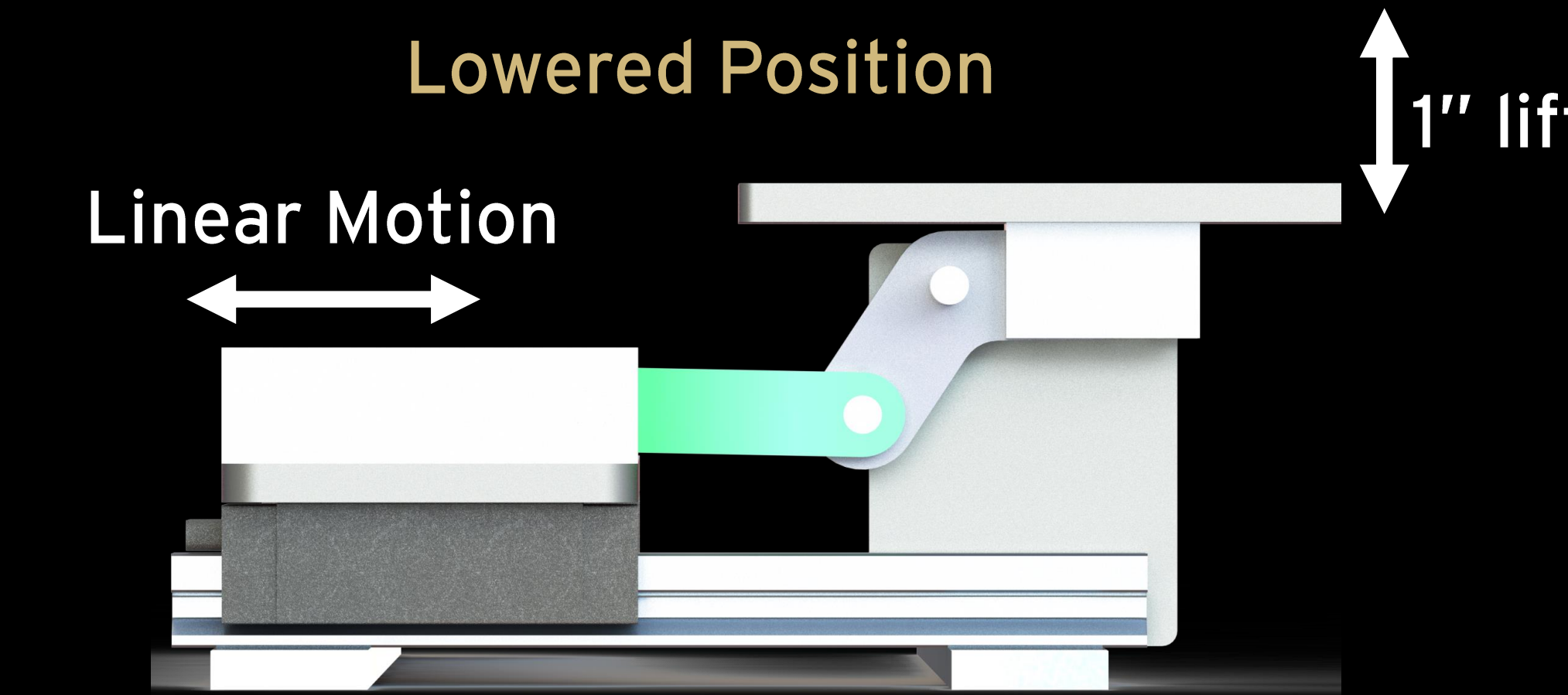
- Internal 29.2V 20A LiFePO4 battery charger for easy charging

#### Battery

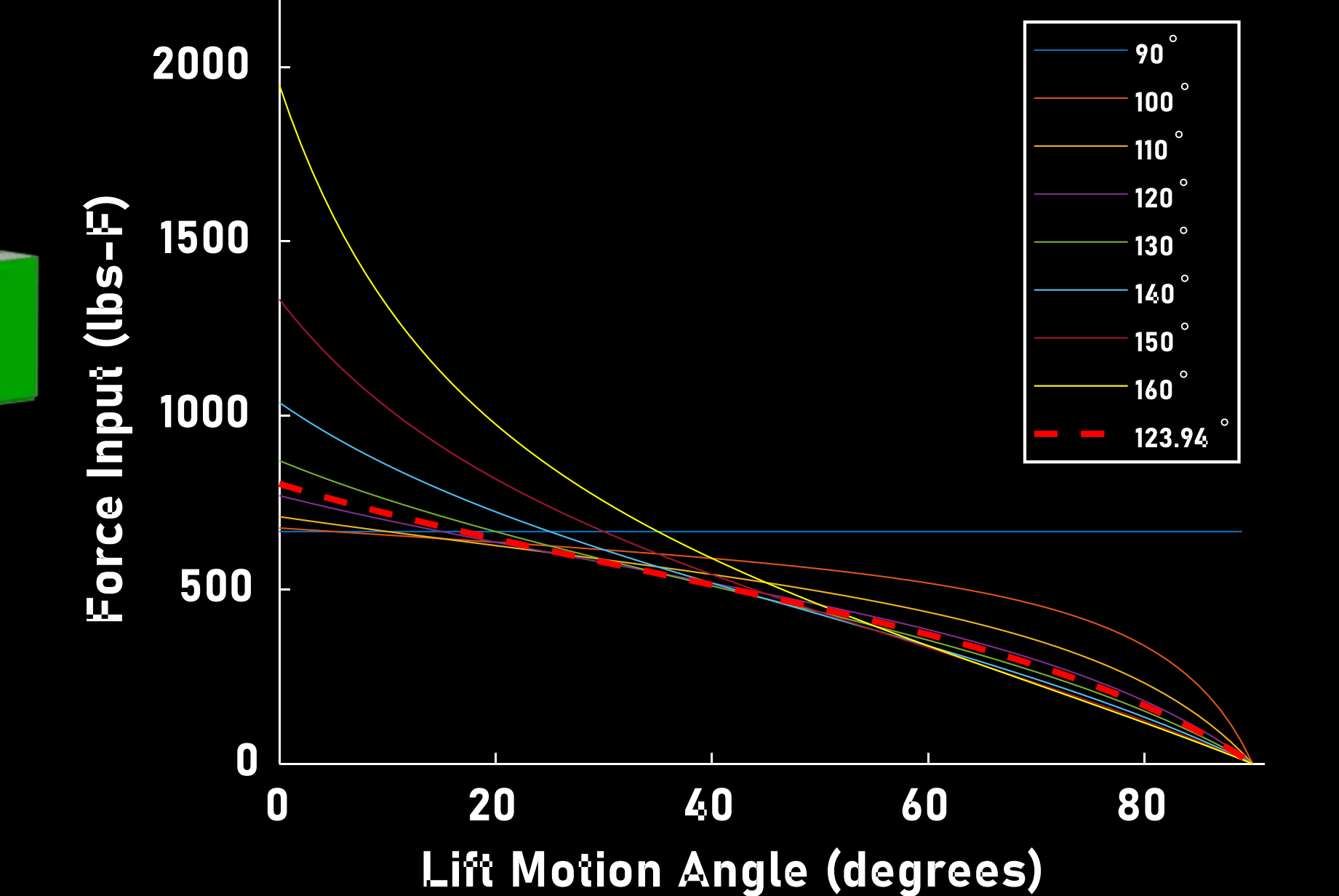
- 24V 200 Ah battery capable of 5-hour runtime
- 5-hour charge

### Lift Mechanism

- Fit within 2" envelope
- Raise cart a minimum of 1/2"
- Cam angle designed to minimize linear actuator work



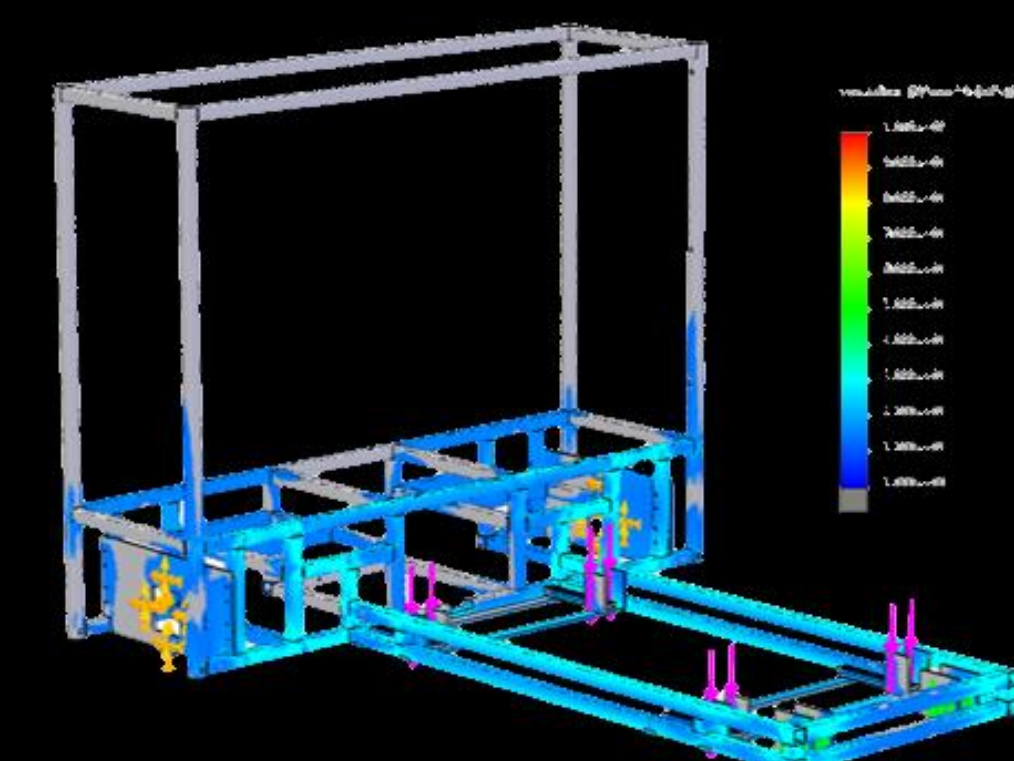
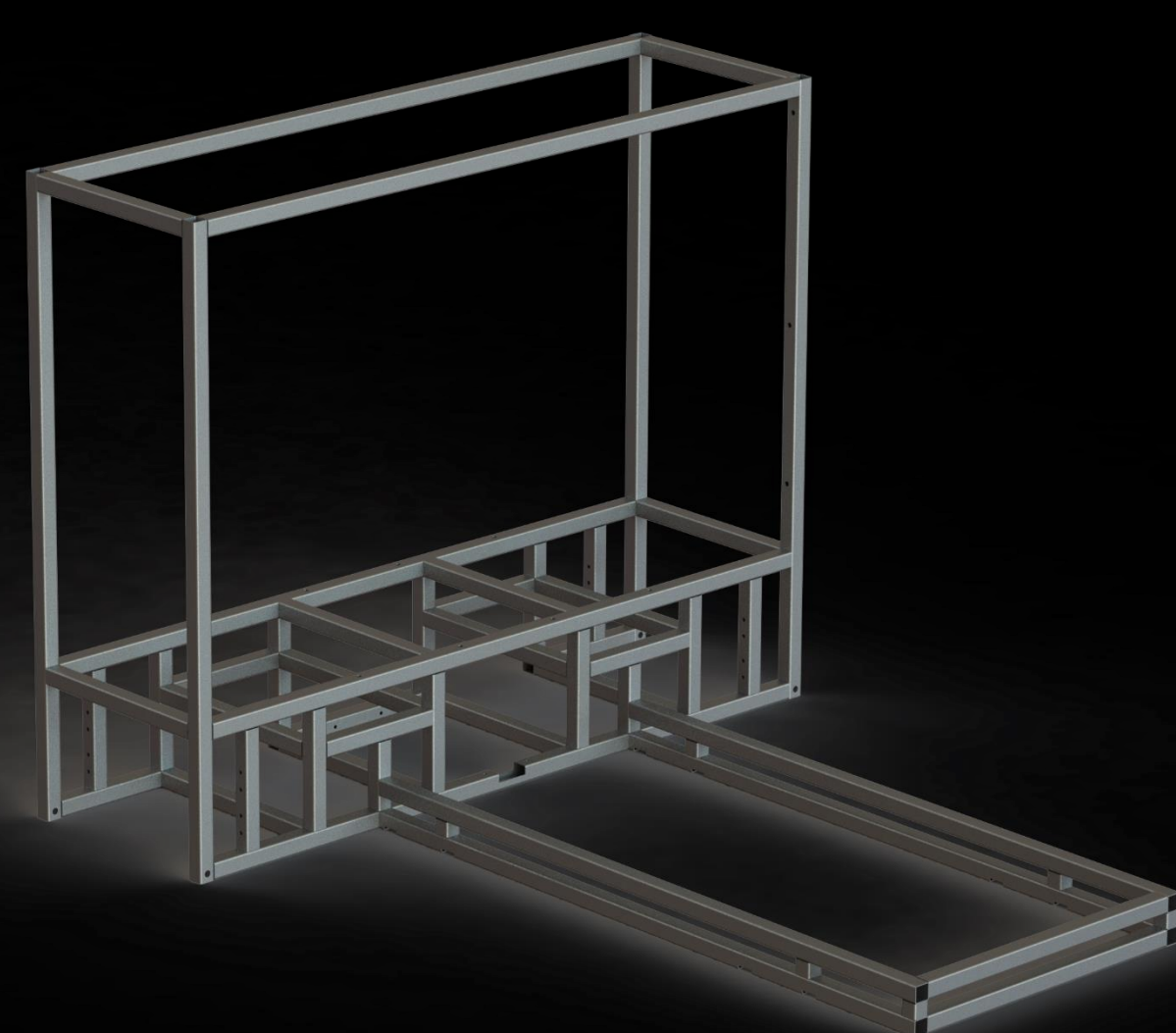
Lifting Force Requirements For Varying Cam Angles



### Design Objectives

- Safely deliver up to 400 lbs. of production material
- Narrower than a pallet in width
- Operate for a 5-hour shift
- Navigate obstructions on factory floor
- Travel at 3-4 mph

#### Chassis



- Designed to be fork-liftable in case of breakdowns
- 74 lbs., reduced from 280 lbs.
- Green paneling for visibility

#### LiDAR, LiDAR Mount

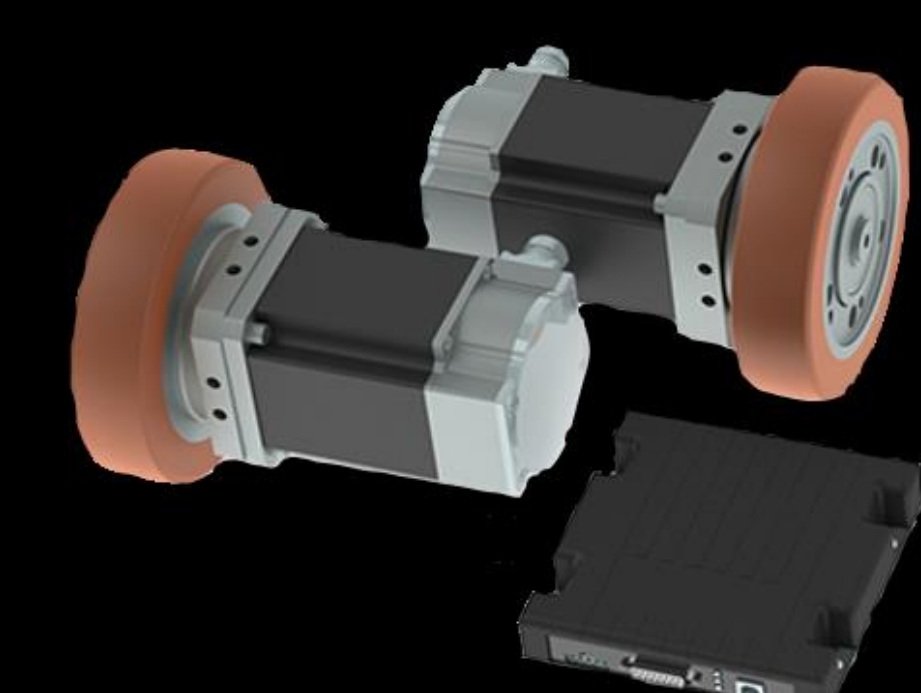
- Close-range LiDAR sensor used for obstacle detection

#### Linear Actuator and Mounts



- Capable of 2000 lbs. of force, need 800 lbs. maximum; 2.5 factor of safety
- Chassis required reinforcement to support forces from the linear actuator

#### AGV Drive Train Kit



- 24V motor kit
- 500 kg capacity at 6 mph
- Small enough to maintain clearance requirements
- Accurate encoding (1024 PPR)

#### Skid Wheels

- Provide support to cart, skid during turning

### Testing and Results

- ✓ Verified drivetrain and actuator functionality via controller testing
- ✓ Verified lift mechanism functionality
- ✓ Mobility and turn radius
- X 5-hour run time test
- X Water ingress and temperature limit testing
- X Integrated sensor testing

### Conclusions

- Capable design manufactured mainly from in-house materials
- Easily scalable final product capable of nearly double the specified weight capacity
- Potential for further features to be added within upper chassis
- Potential for swappable batteries in future iterations