

**Motivation, Goal, Impact**

**Motivation**

Our inspiration for this project came from experience with helping loved ones in and out of cars; it can be challenging for them at an older age.

**Goal**

The goal was to restore elderly people's confidence getting out of cars with limited assistance

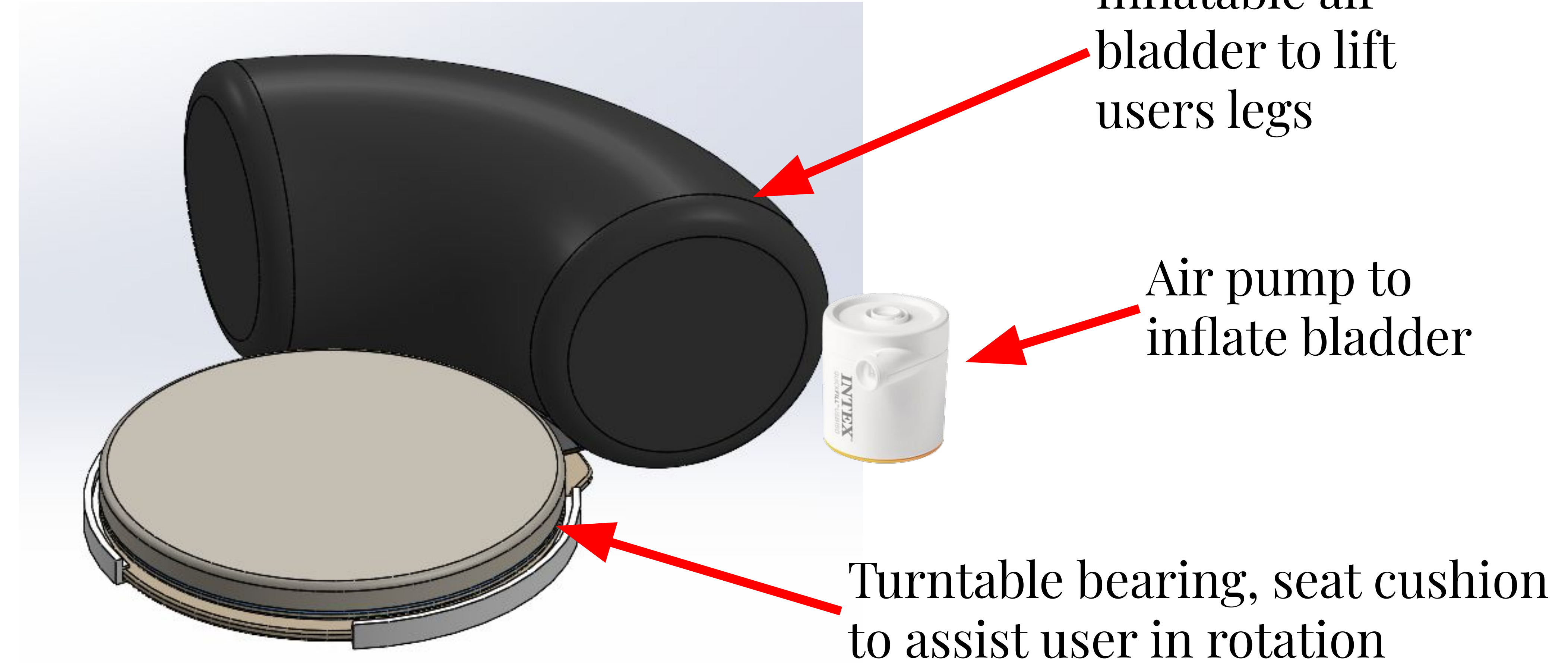
**Impact**

Our product assists the elderly or injured to quickly and safely exit the vehicle, when otherwise difficult.

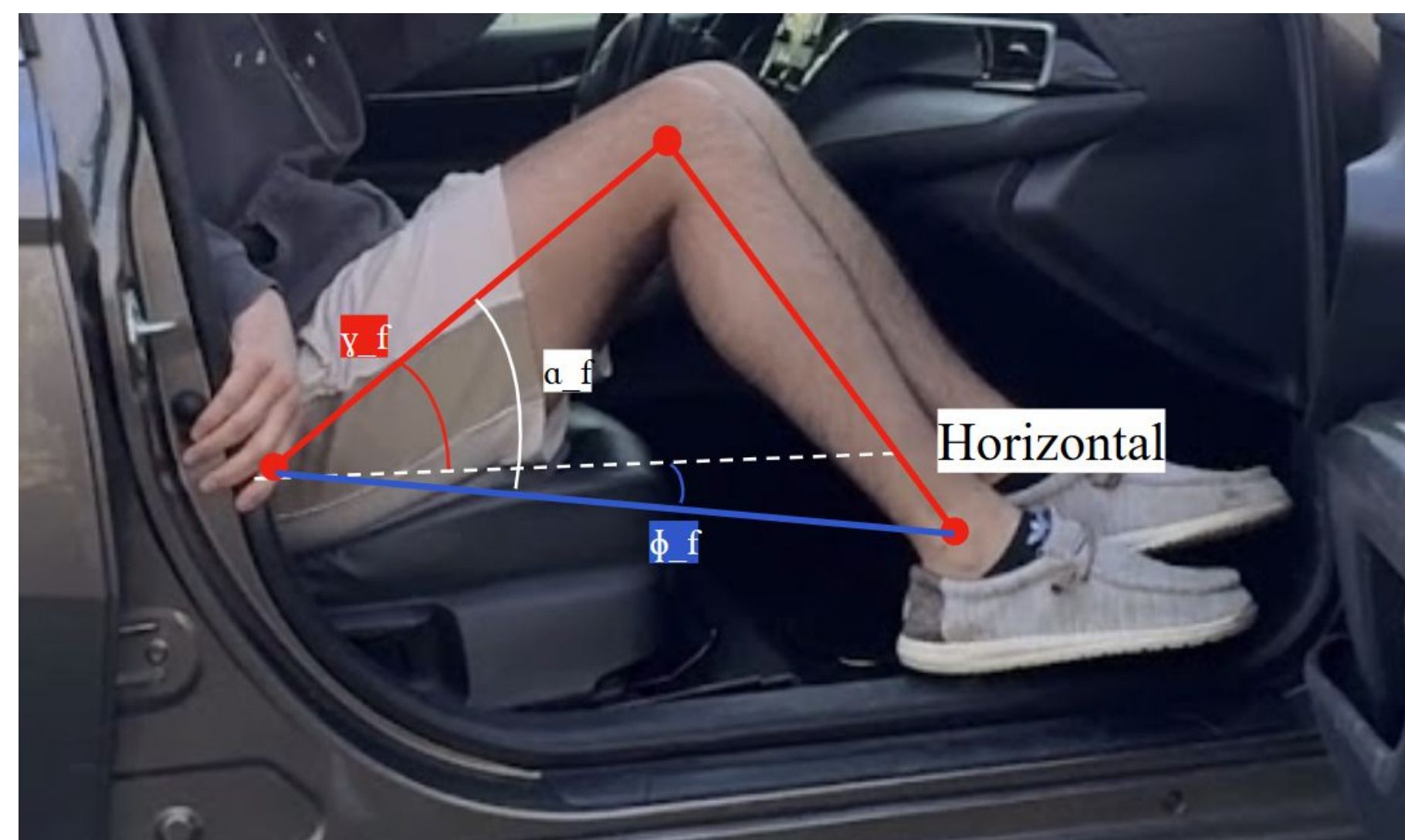
**Requirements**

1. **Swivel** - rotate user to face outside the door with less than 25 lbf required
2. **Lift** - raise feet a minimum of 6" to clear door frame
3. **Accommodation** - users of different sizes and shapes can use the device
4. **Portability** - weaker users can transport the device
5. **Comfort & Stability** - users are confident putting their trust in the device
6. **Speed** - less than 30 seconds of device use time required

**Final Design**



**Design Calculations & Decisions**

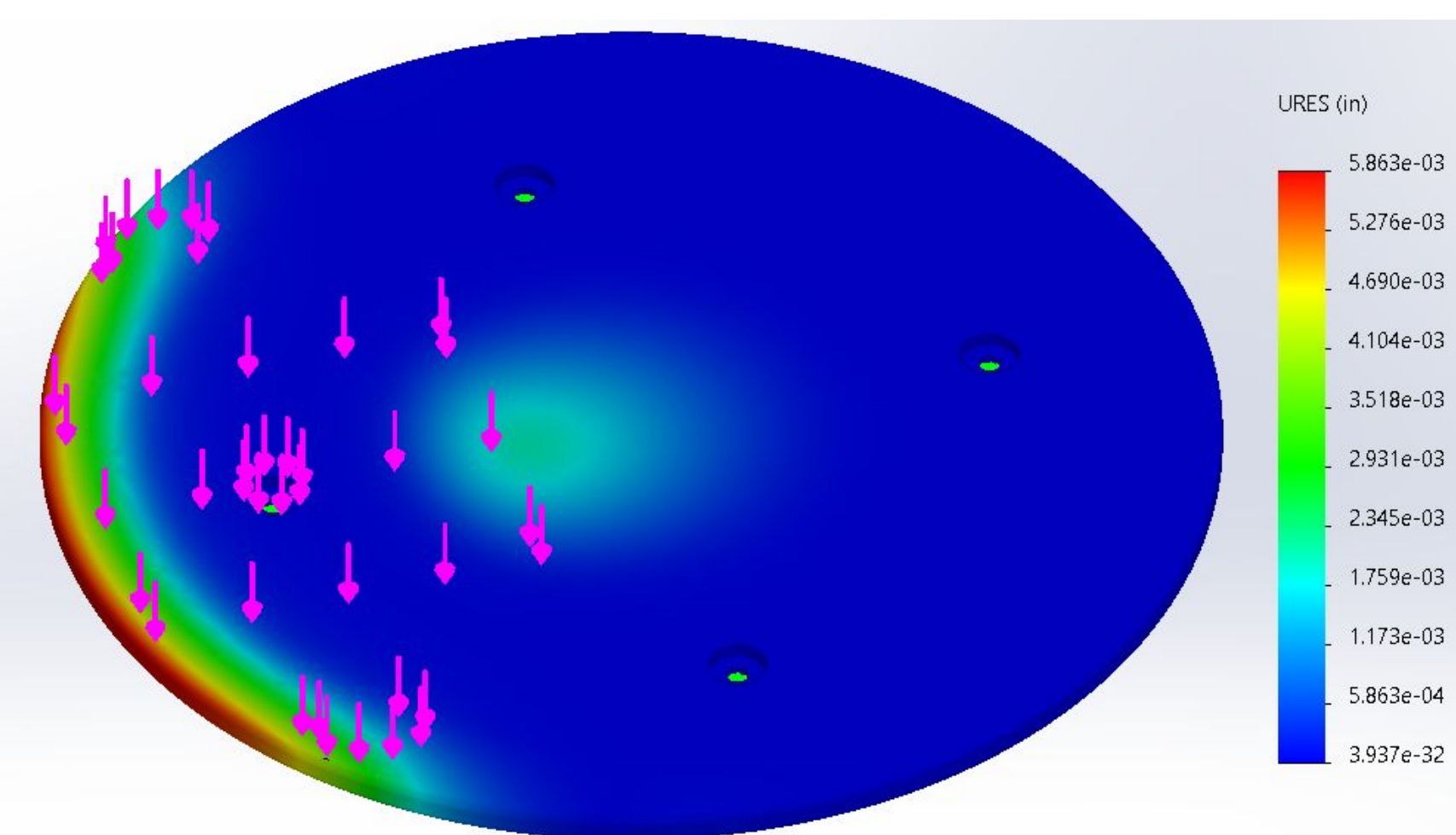


Calculated bladder height based on 95th percentile user, modeling legs as a 2D two-segment rigid linkage.

**Bladder Height**

$$h_{bladder} = h_{initial\ gap} + \Delta h_{thigh}$$

$$h_{bladder} = 3.80 + 6.40 = 10.20\ inches$$



Base plate deflection with simulated user load near edge

A 12.06" turntable bearing diameter was chosen to minimize deformation while keeping rotational friction within user strength limits.

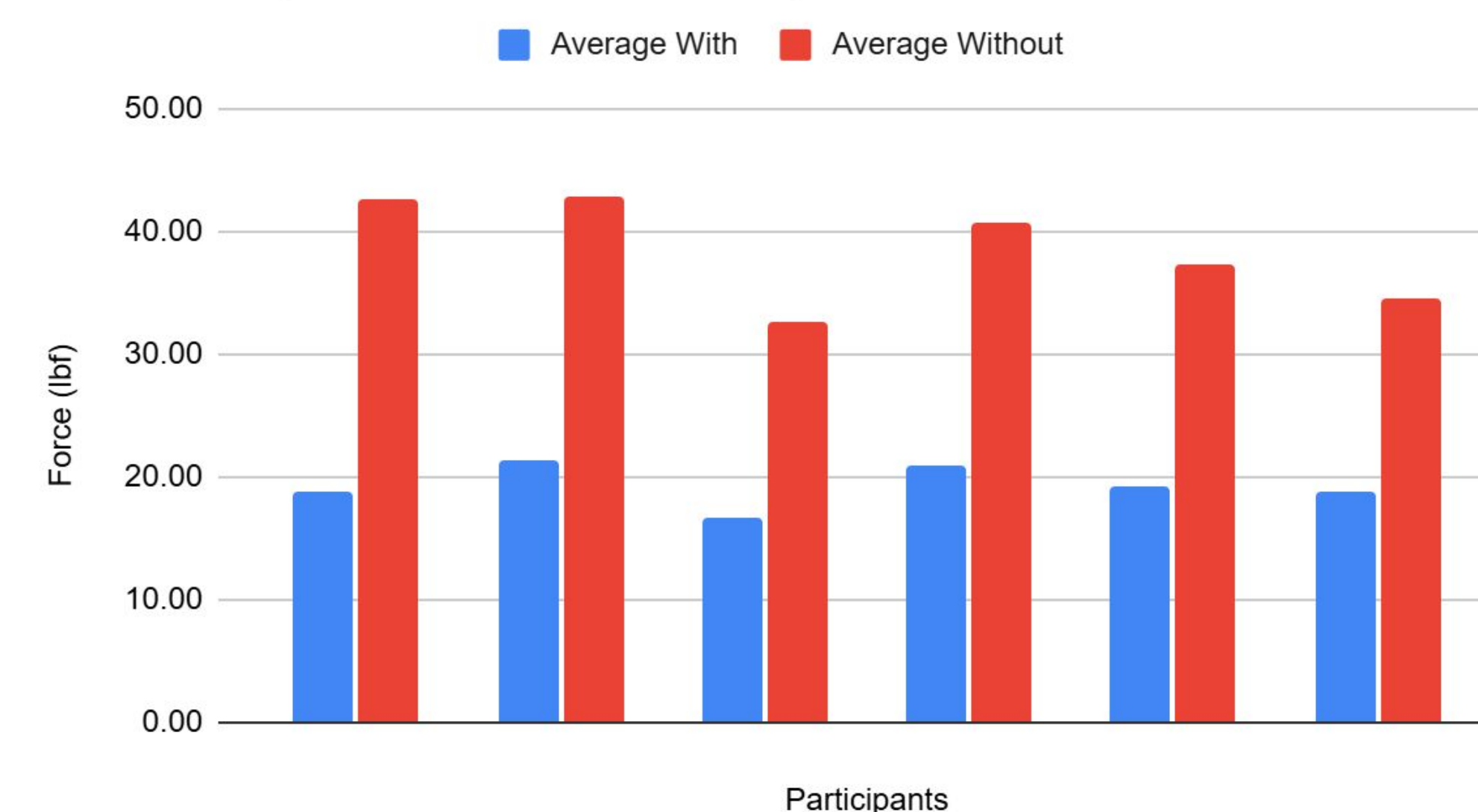
$$F_{user} = \frac{(300lb) * (6.03\ inch) * (0.05)}{12.65} = 7.1502\ lbf$$

$$\text{Factor of Safety: } F_{user} * SF = (7.1502) * (2)$$

$$F_{user} = 14.3004\ lbf$$

**Prototype & Test Results**

Force Required to Rotate Participants



**Test Results**

- 54% less force required to rotate user from facing forward to facing out of the car with device
  - Statistically significant difference with the device than without
- Air bladder lifts users legs up 6", enough to clear a sedan's door sill
- Tested across a range of body types: 110-210 lbs, 5'6"-6'4"
- Prototype weighs 5.2 lb, light enough for the average 65+ old adult