



# Meet Brian

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The 2009 Olin College IGVC Vehicle



# Today's Objectives

1. Present Overall Design

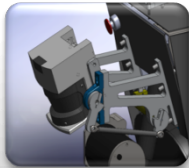
2. Highlight Innovation



# Today's Presentation



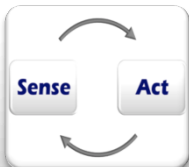
Hardware Design



Hardware Innovation



Software Design



Software Innovation



Acknowledgements



# Hardware Design

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# Mechanical Design



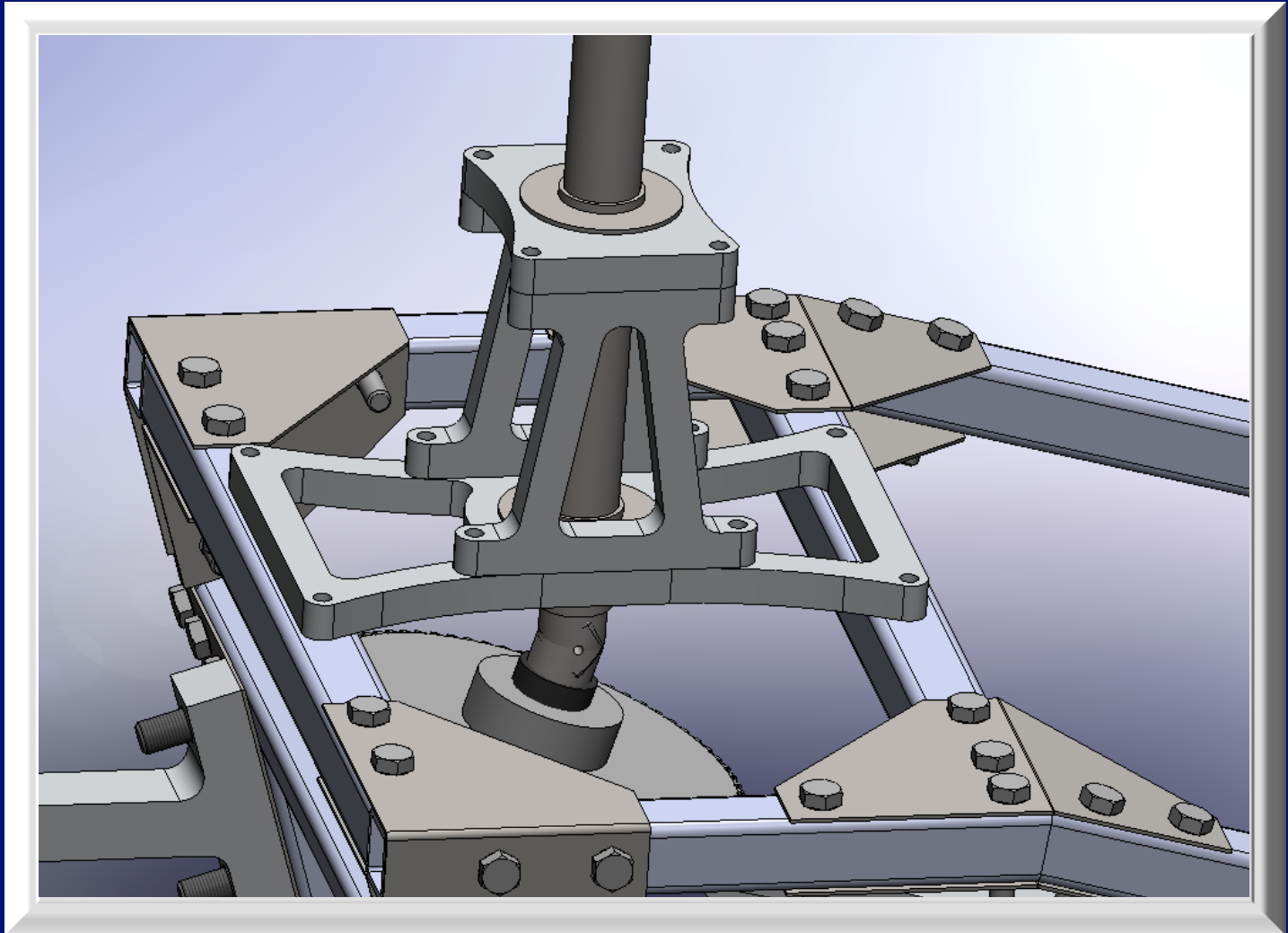


# Brian's Sensors



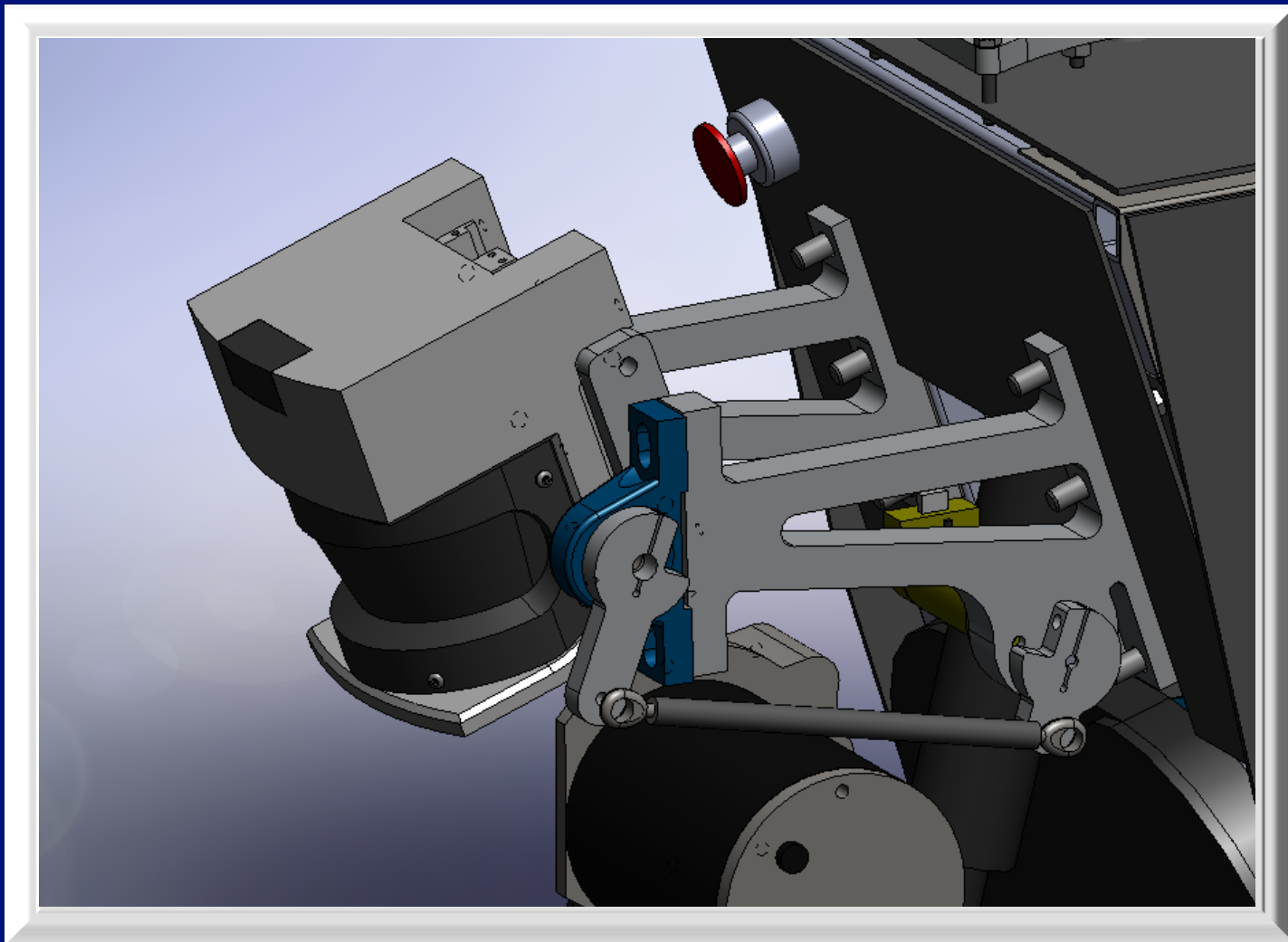


# Camera Mount





# LIDAR Mount



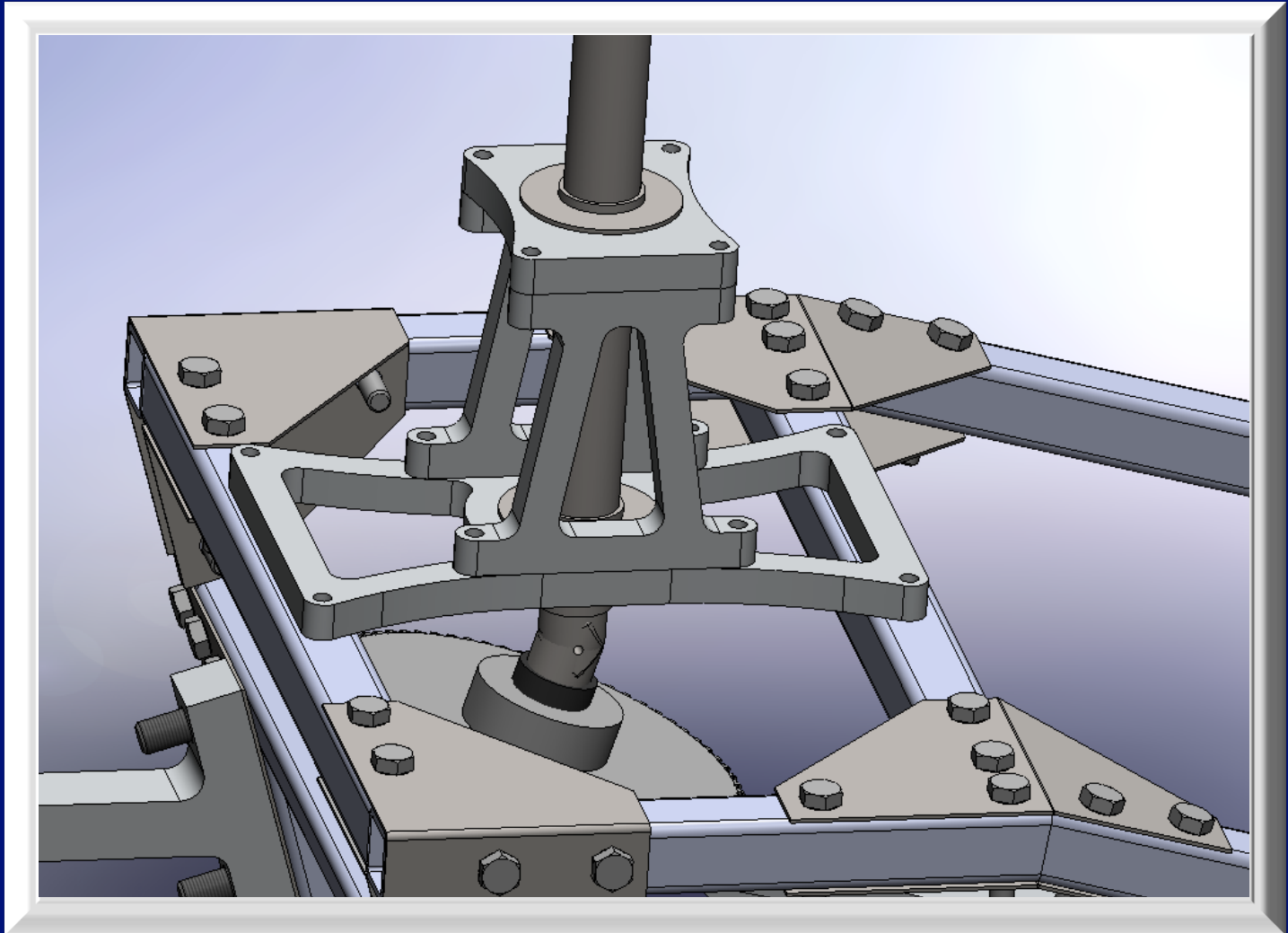


# Hardware Innovation

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# Camera Mount



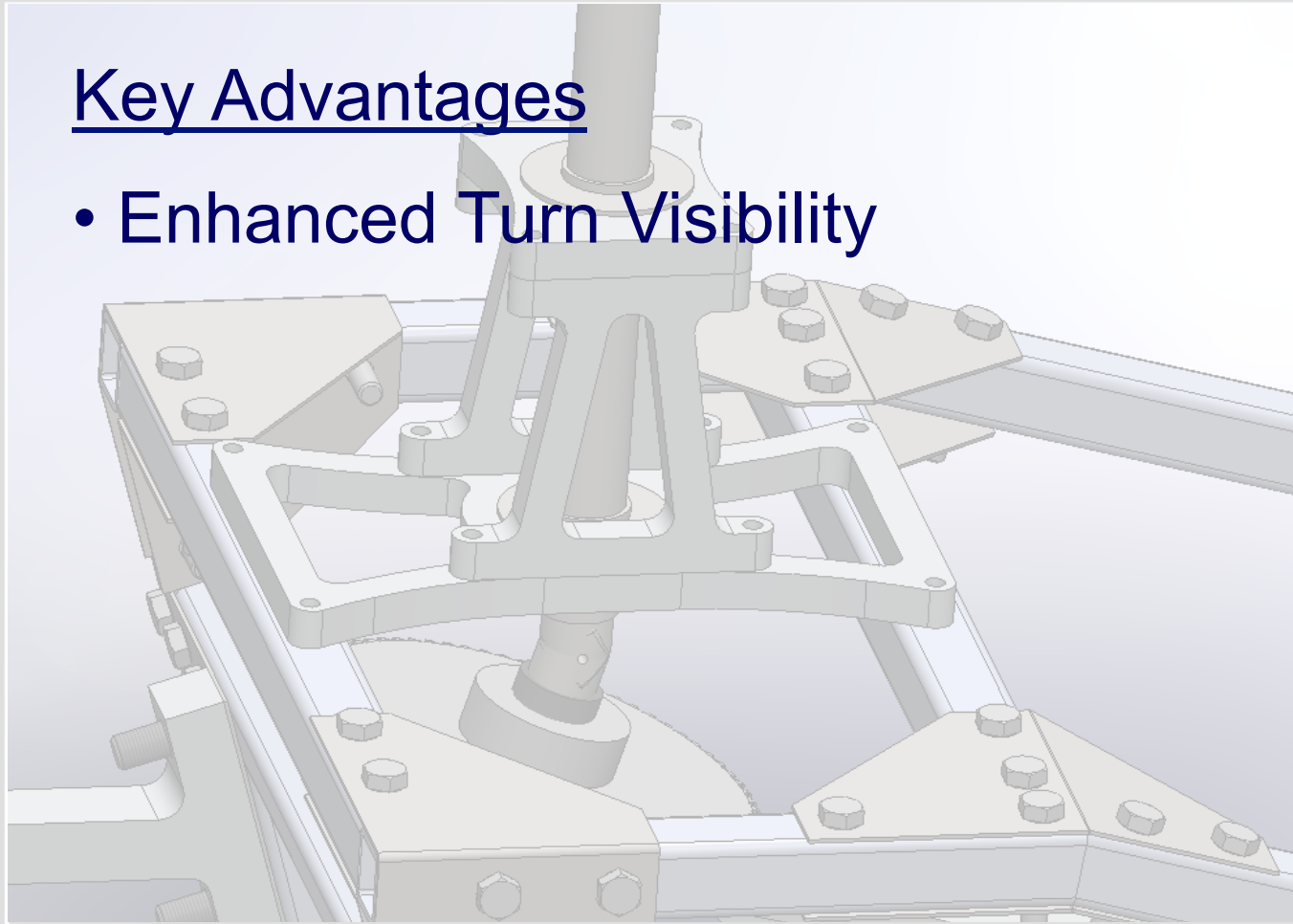




# Camera Mount

## Key Advantages

- Enhanced Turn Visibility

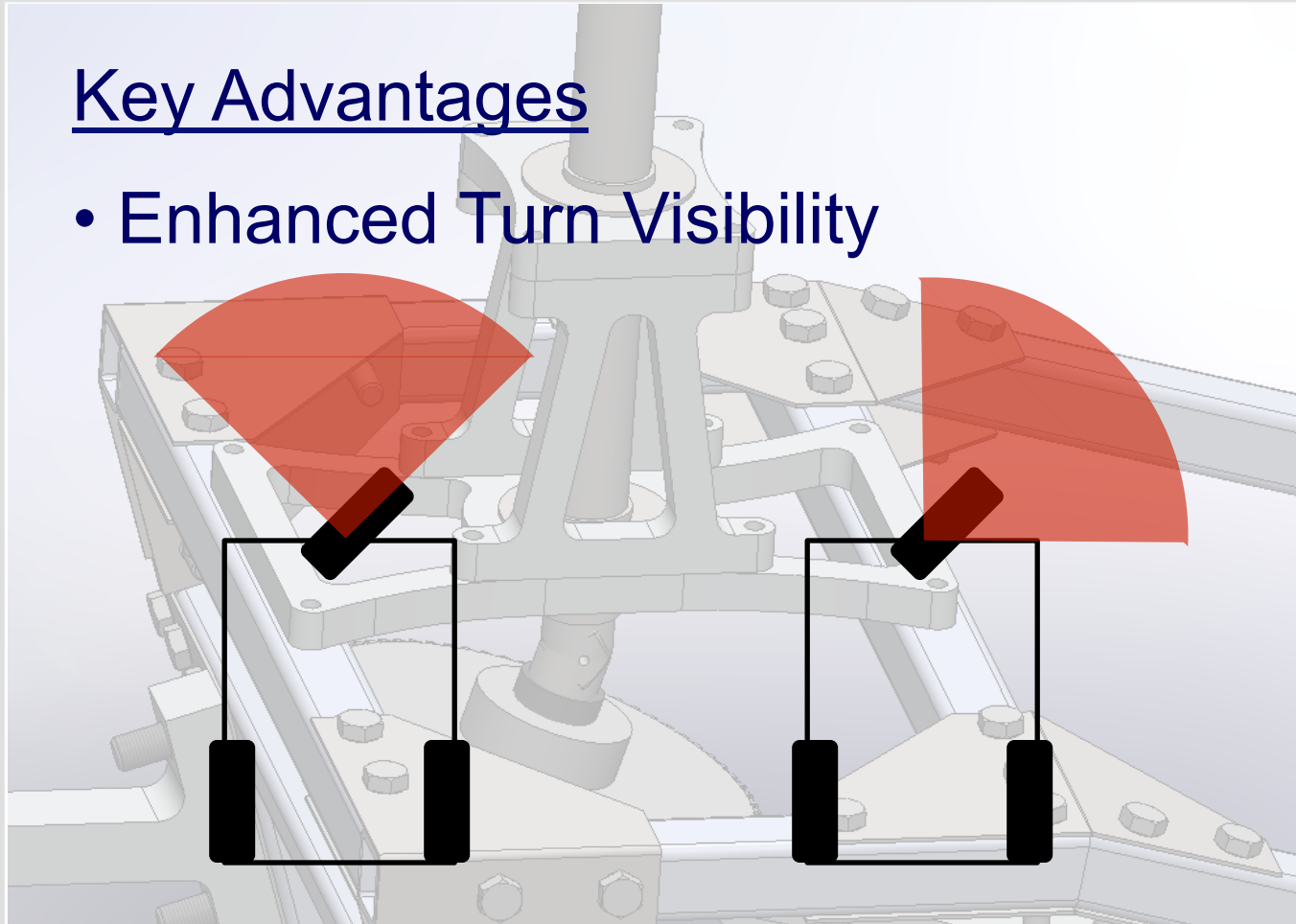




# Camera Mount

## Key Advantages

- Enhanced Turn Visibility



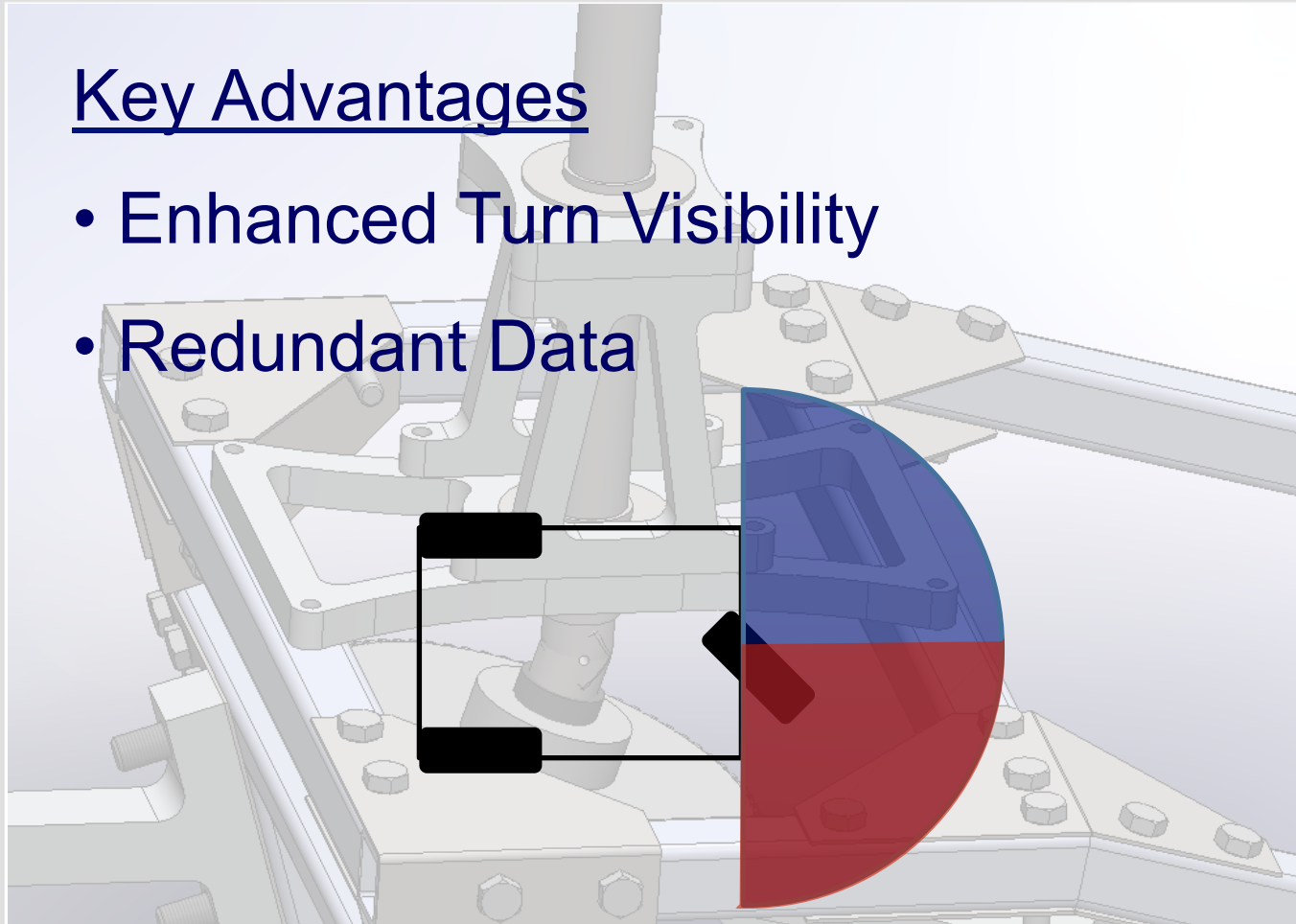




# Camera Mount

## Key Advantages

- Enhanced Turn Visibility
- Redundant Data

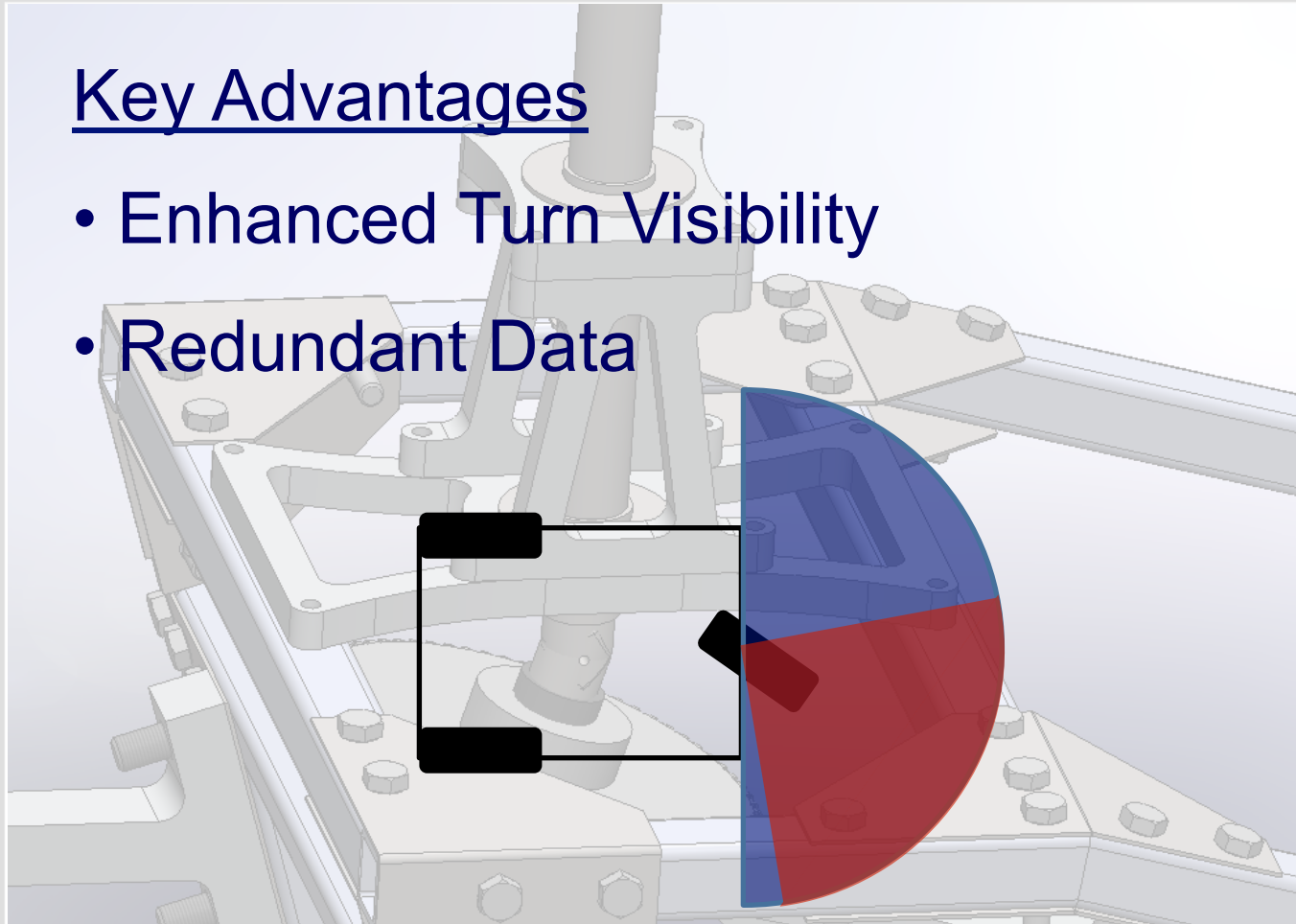




# Camera Mount

## Key Advantages

- Enhanced Turn Visibility
- Redundant Data

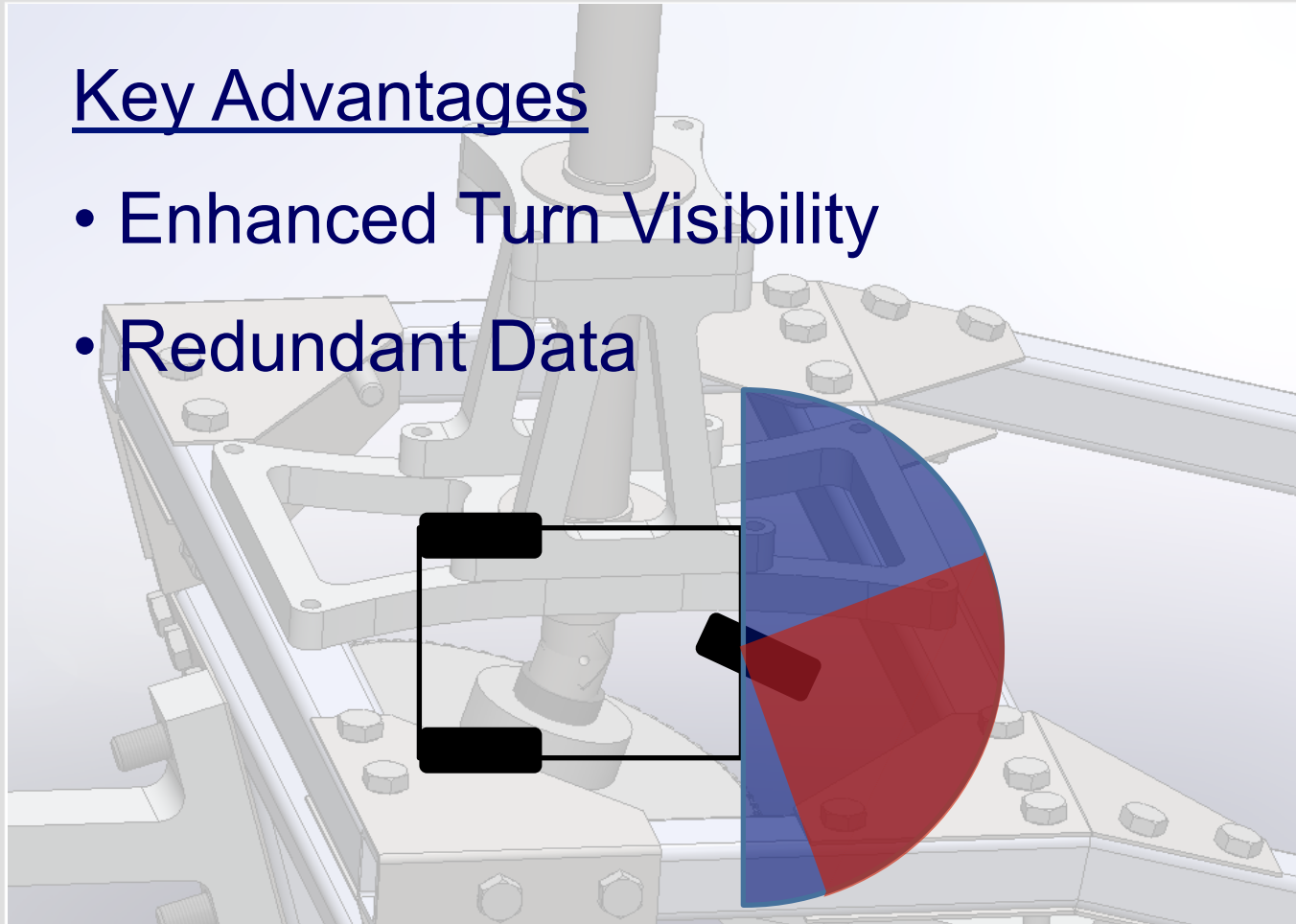




# Camera Mount

## Key Advantages

- Enhanced Turn Visibility
- Redundant Data

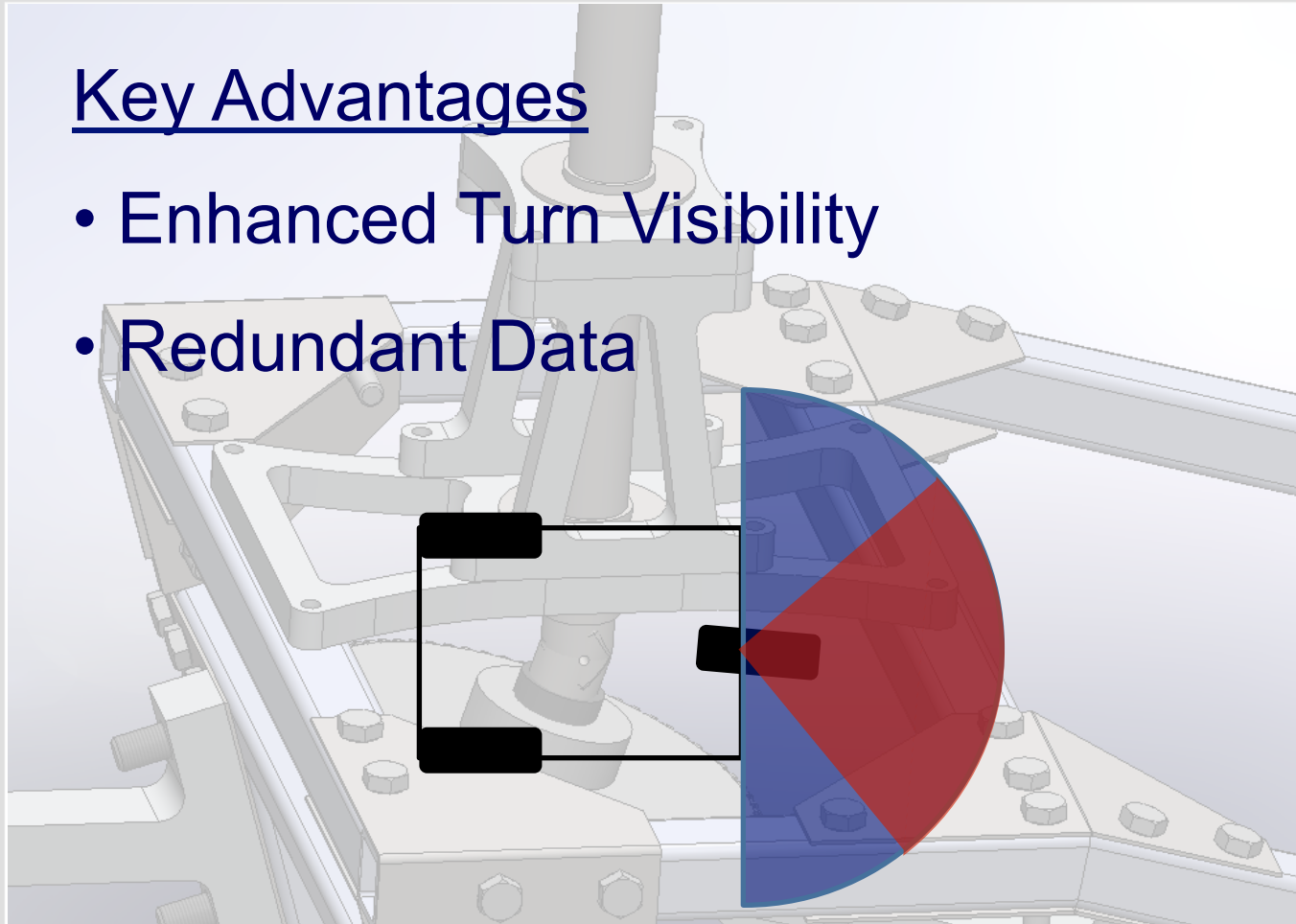




# Camera Mount

## Key Advantages

- Enhanced Turn Visibility
- Redundant Data

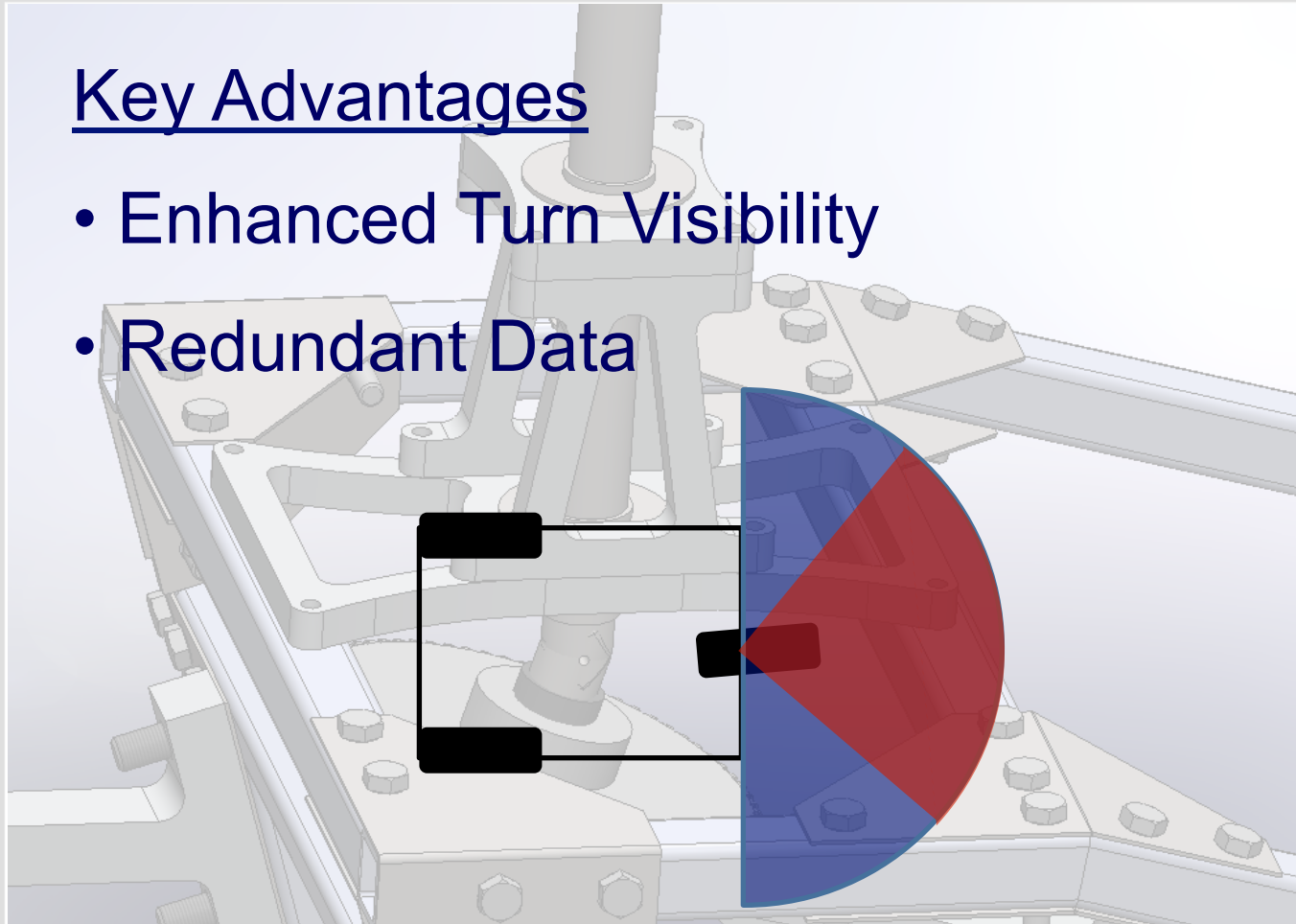




# Camera Mount

## Key Advantages

- Enhanced Turn Visibility
- Redundant Data

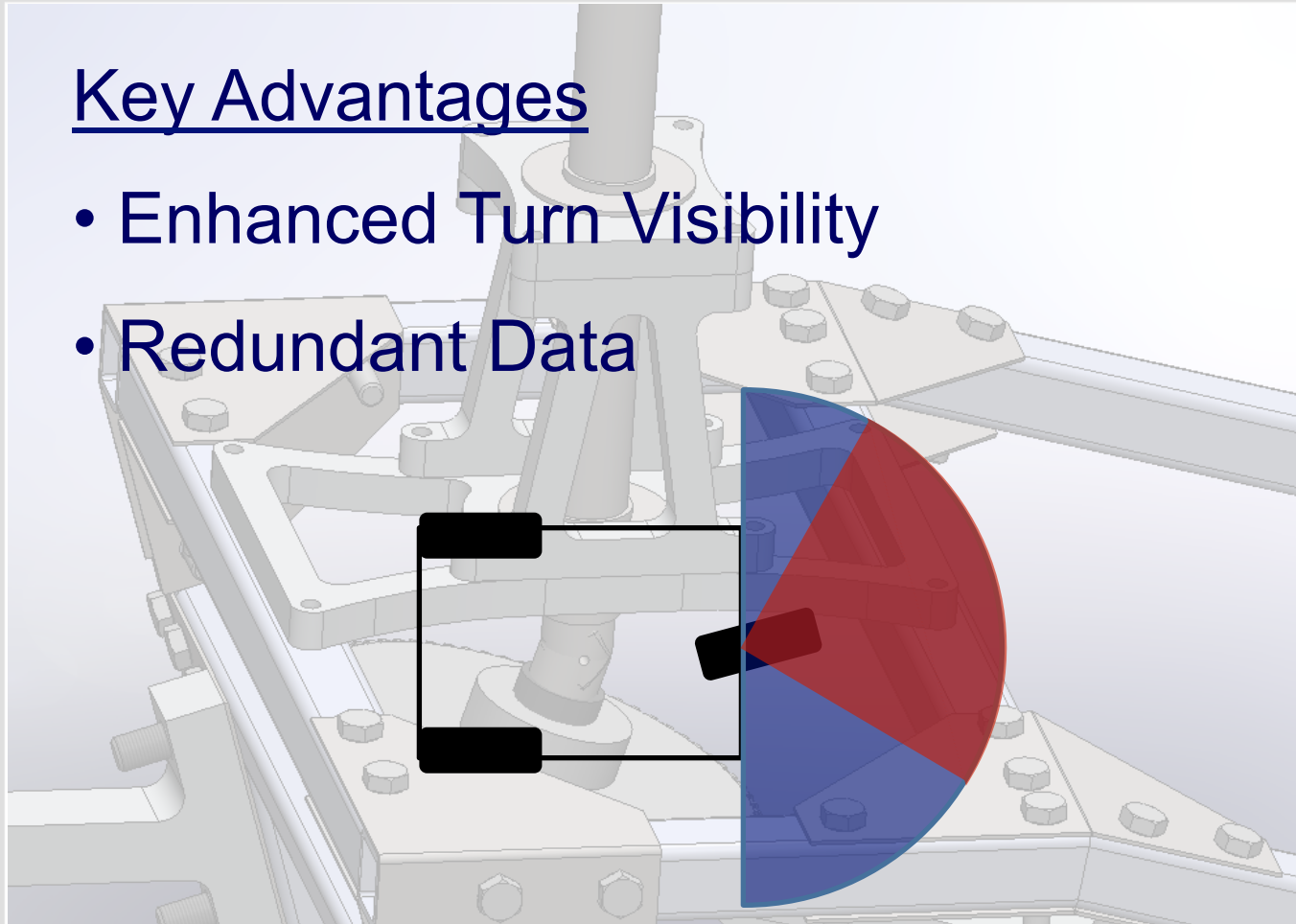




# Camera Mount

## Key Advantages

- Enhanced Turn Visibility
- Redundant Data

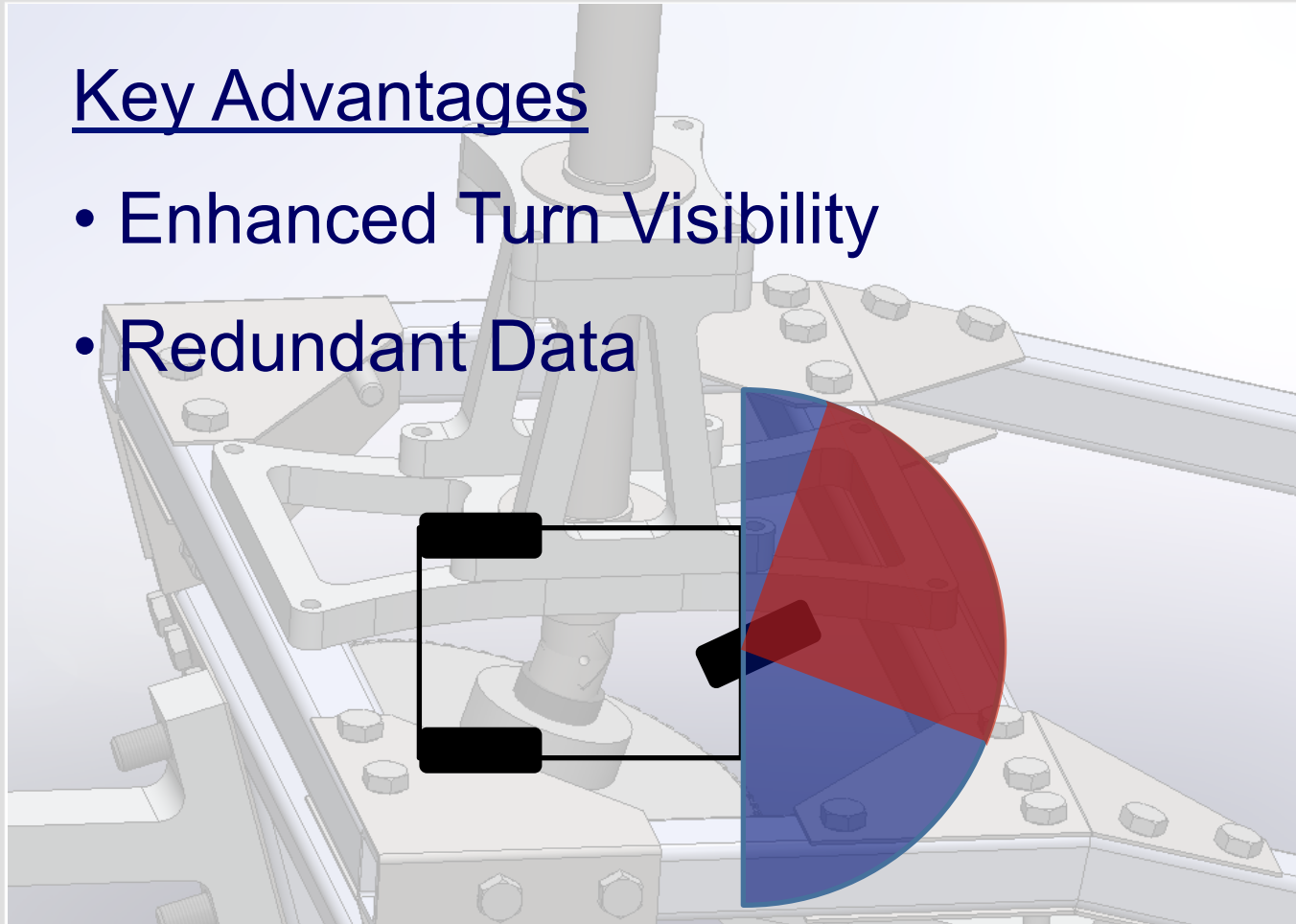




# Camera Mount

## Key Advantages

- Enhanced Turn Visibility
- Redundant Data

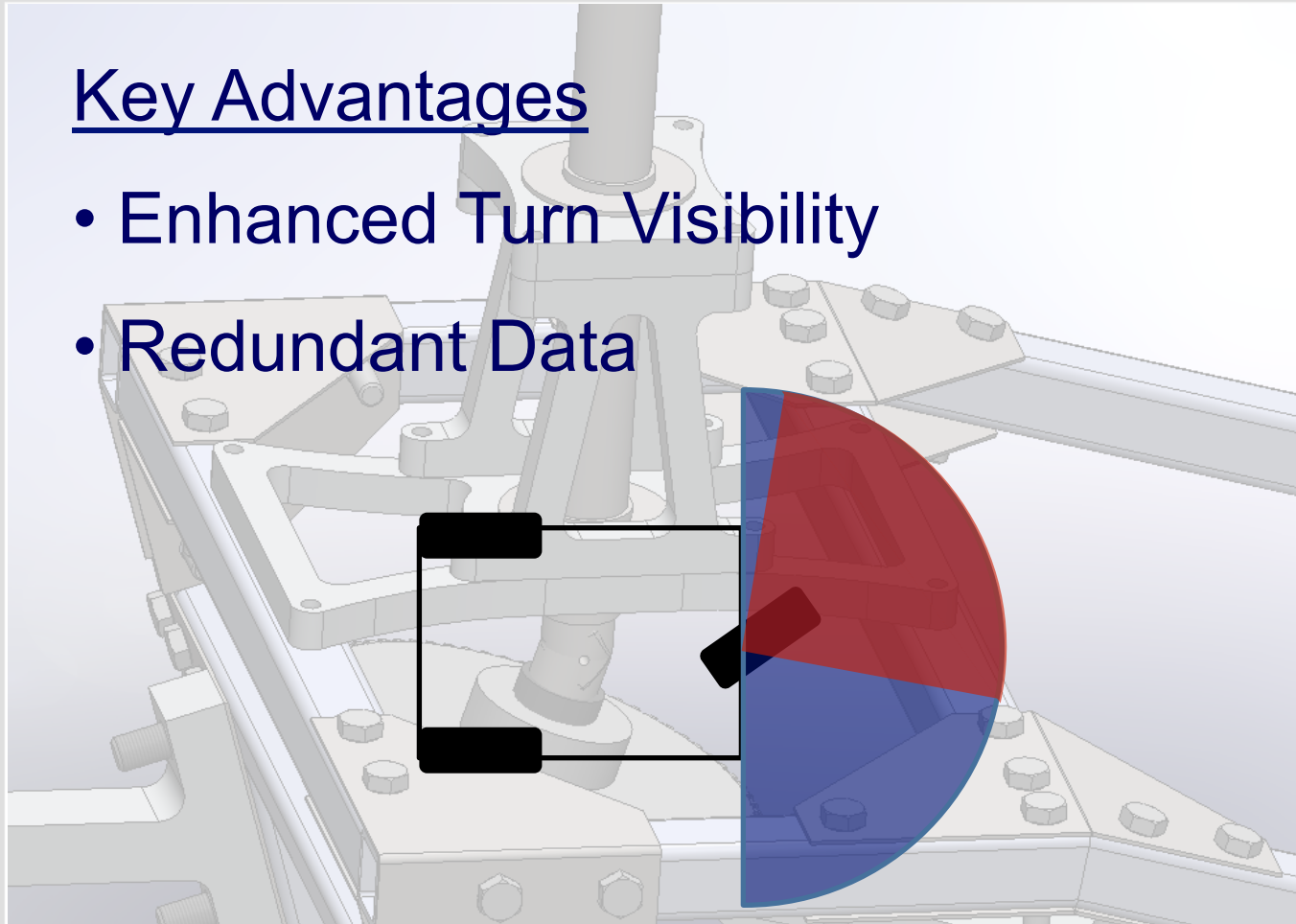




# Camera Mount

## Key Advantages

- Enhanced Turn Visibility
- Redundant Data



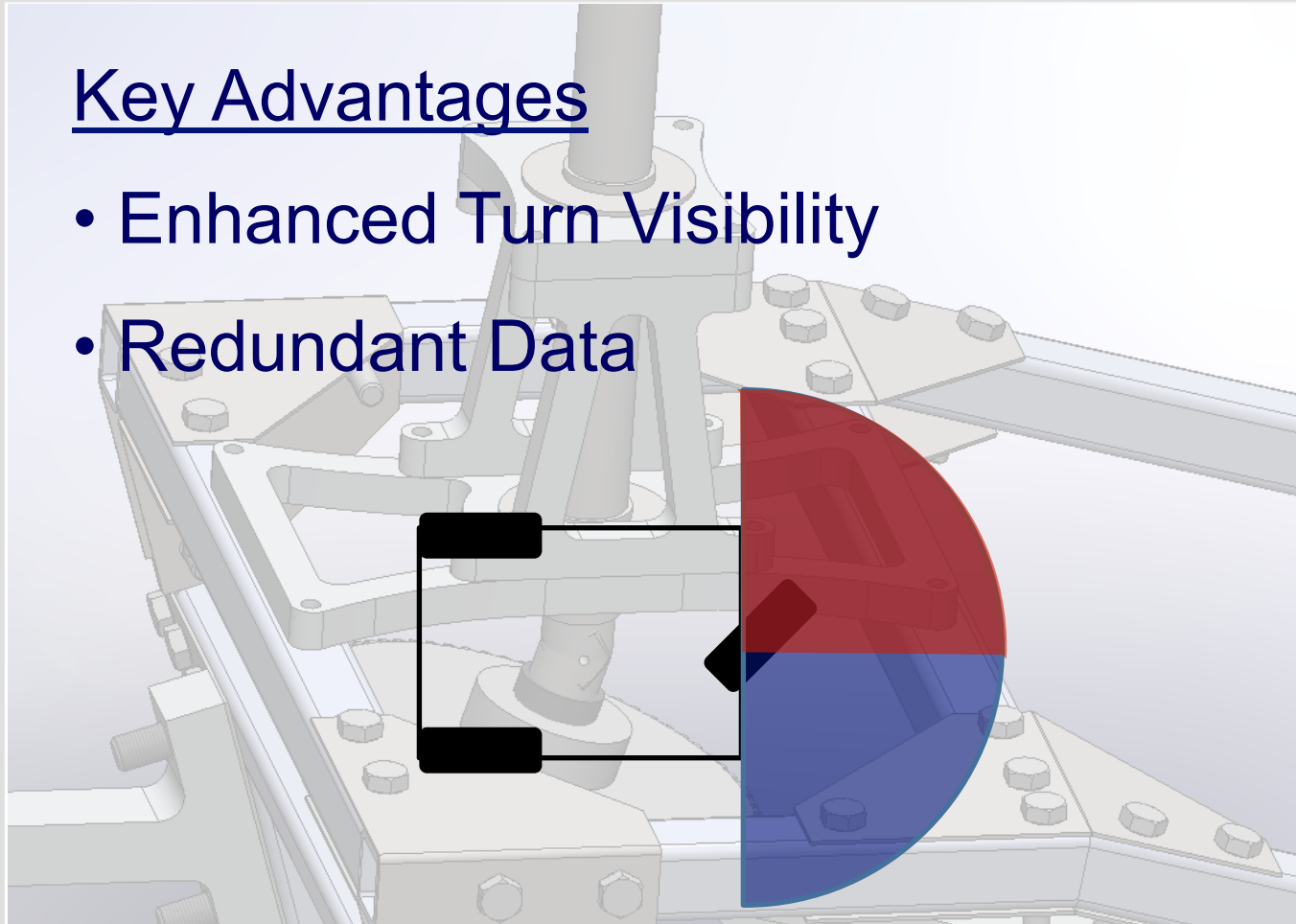




# Camera Mount

## Key Advantages

- Enhanced Turn Visibility
- Redundant Data

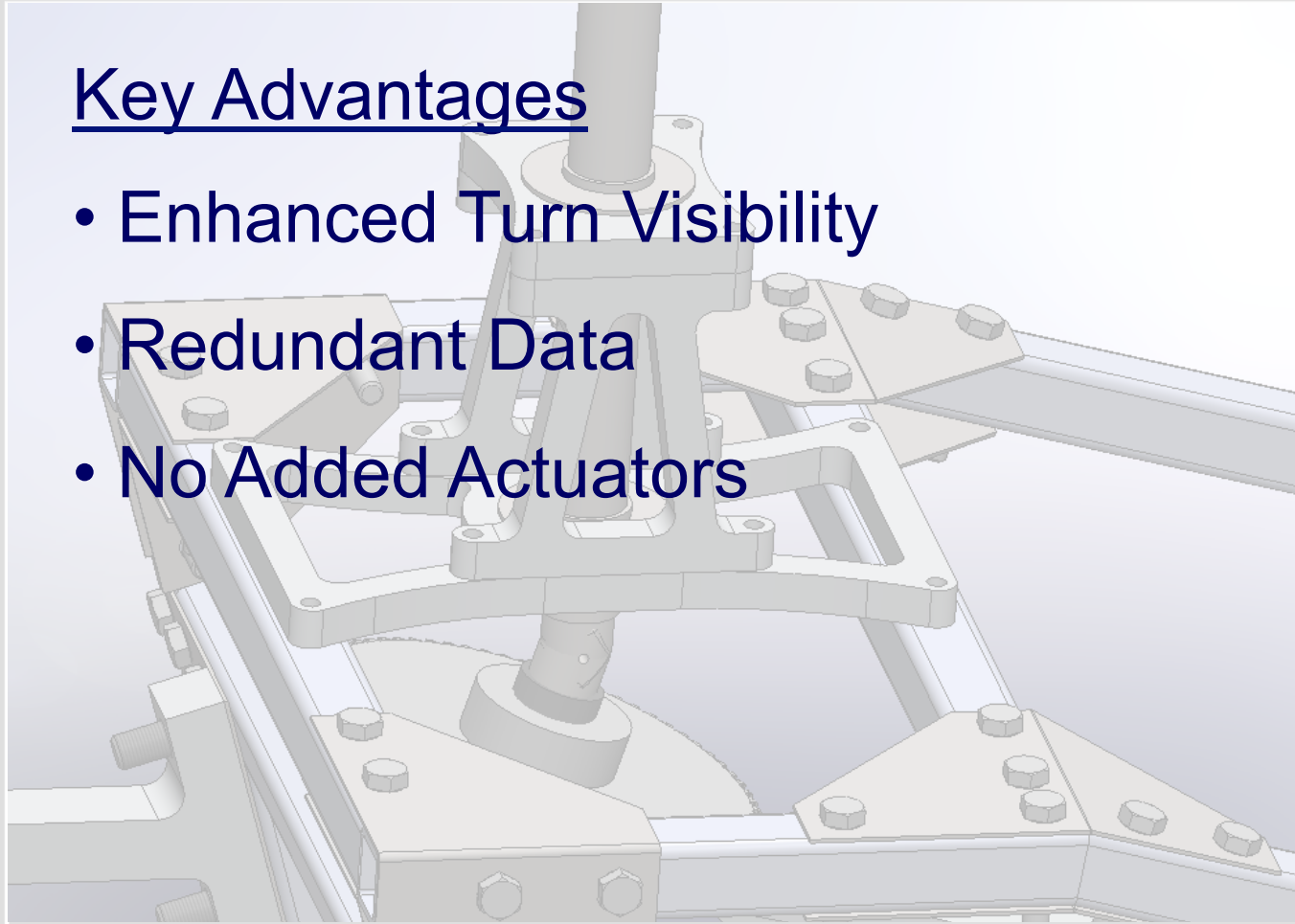




# Camera Mount

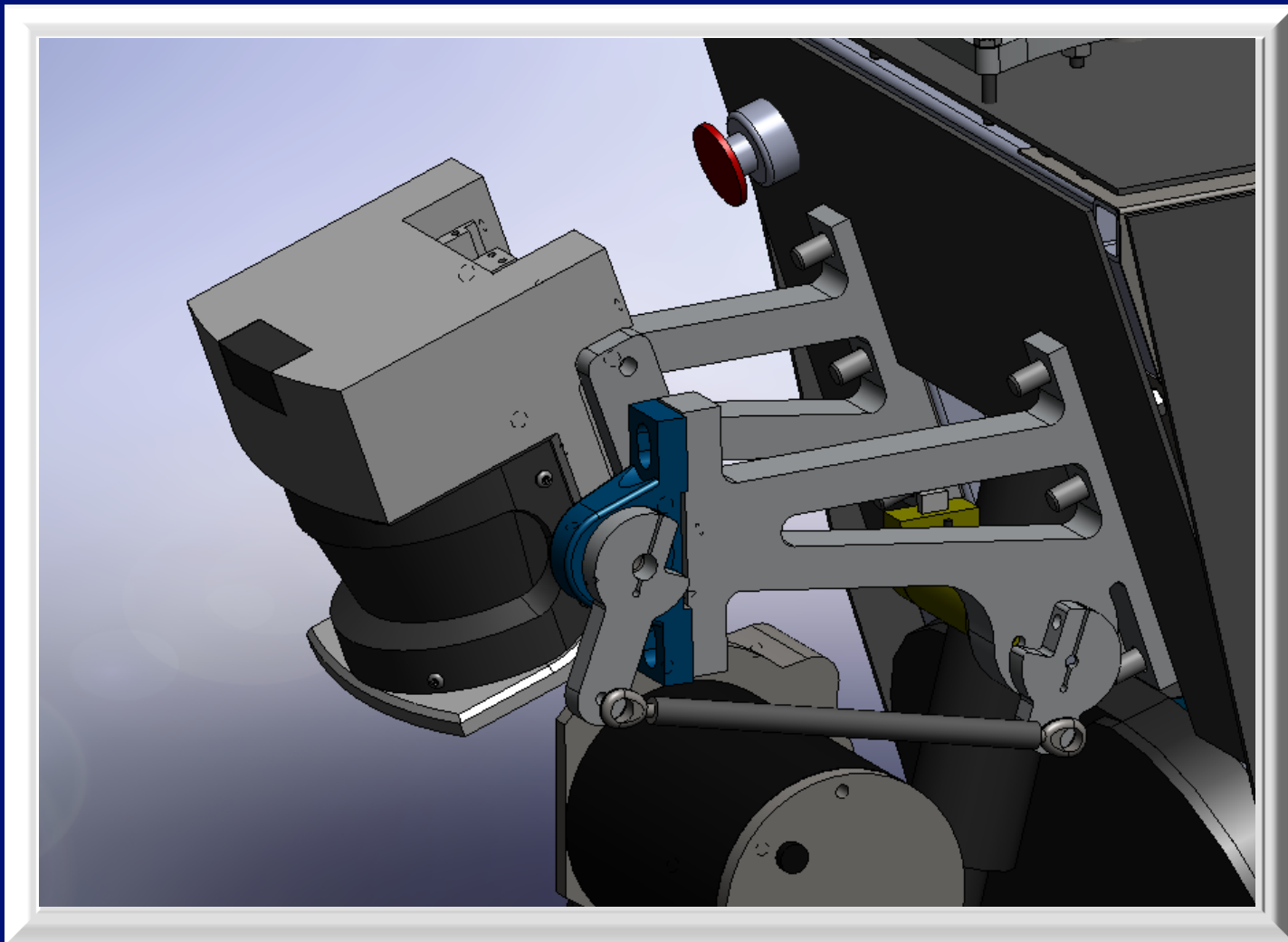
## Key Advantages

- Enhanced Turn Visibility
- Redundant Data
- No Added Actuators





# LIDAR Mount

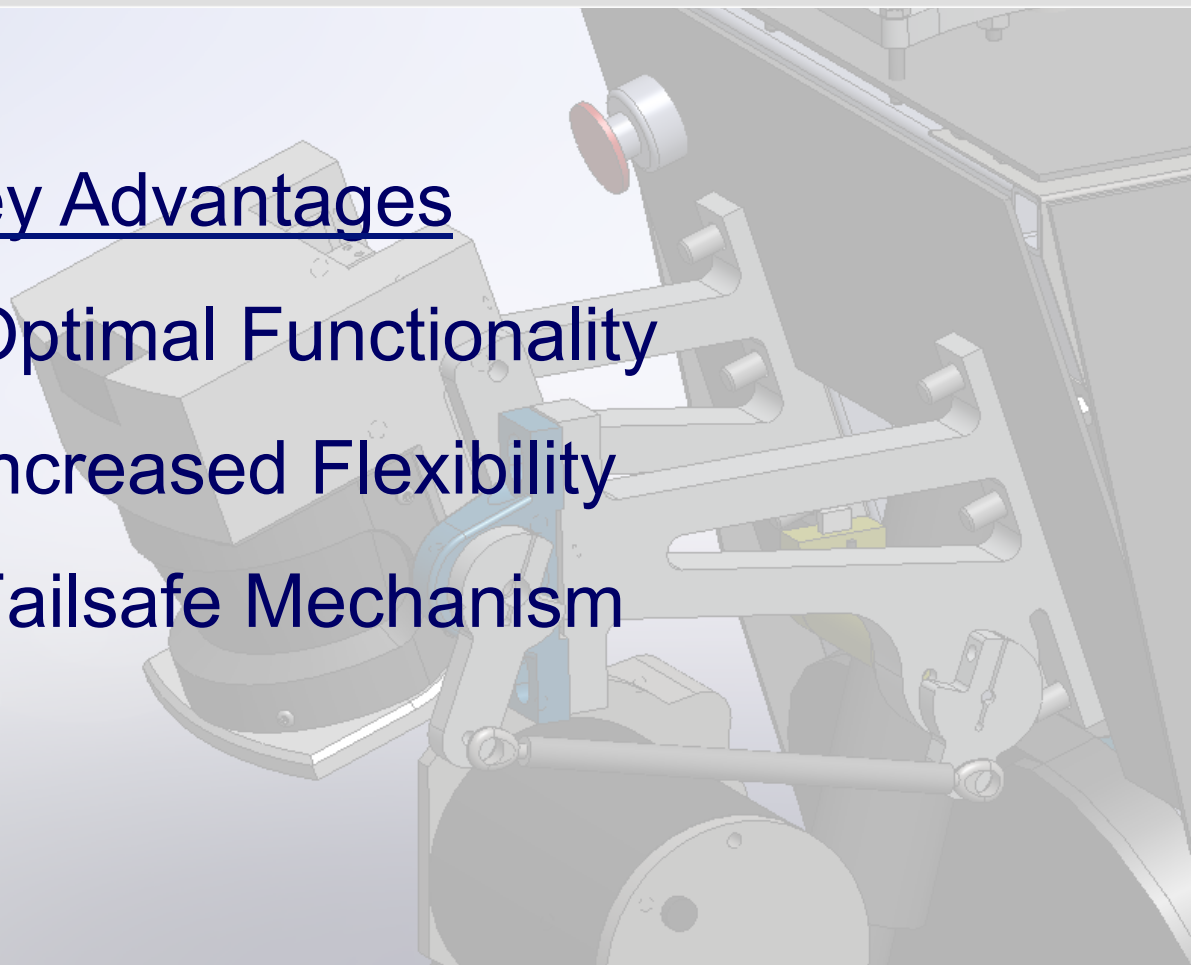




# LIDAR Mount

## Key Advantages

- Optimal Functionality
- Increased Flexibility
- Failsafe Mechanism



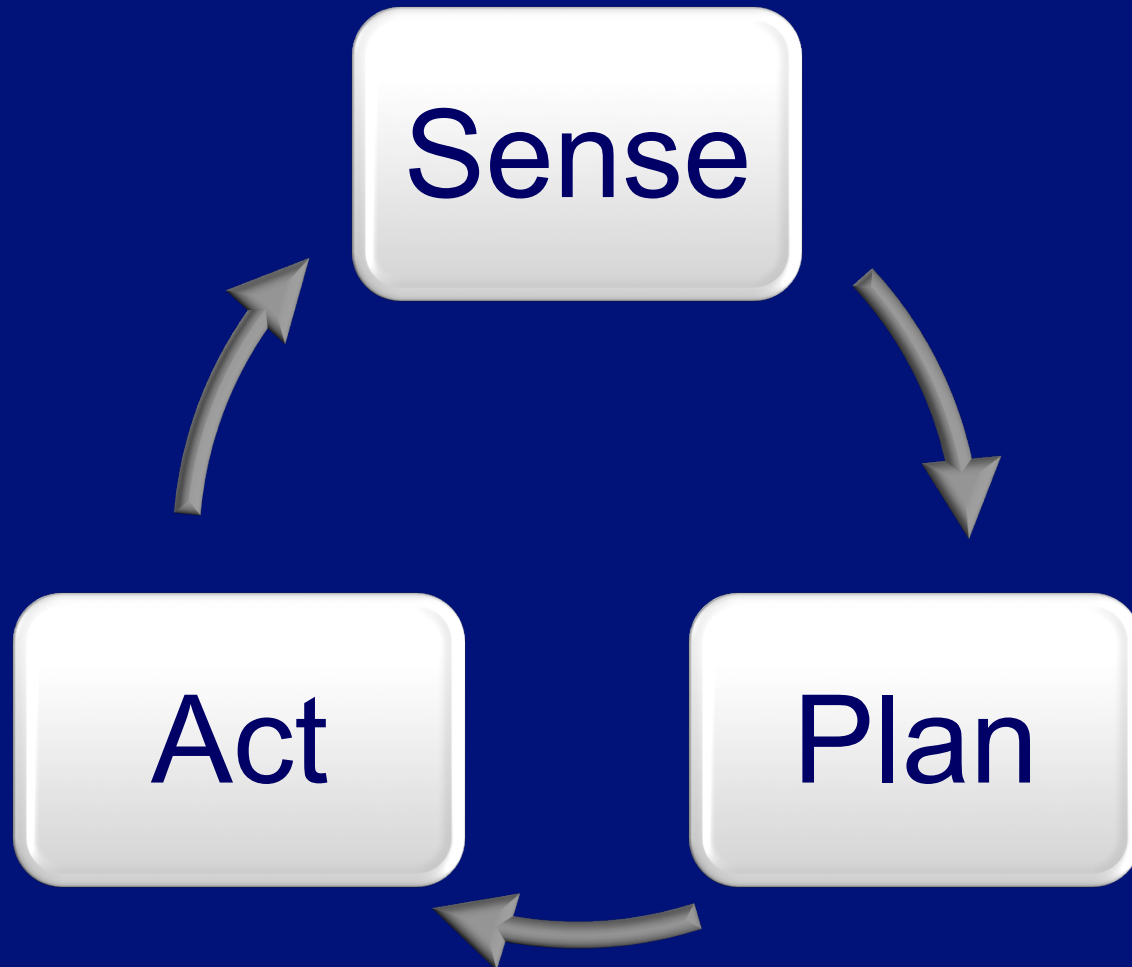


# Software Design

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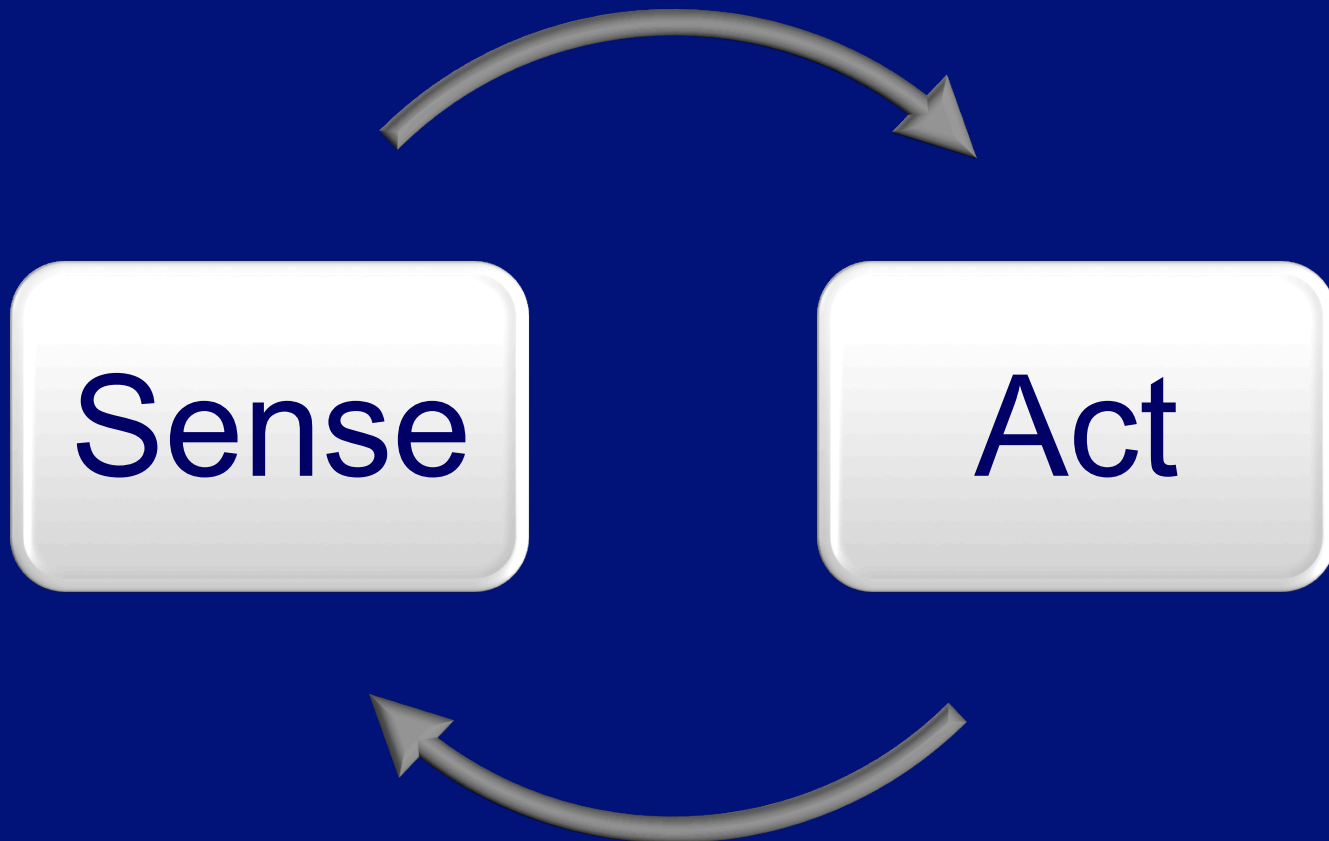


# Canonical Paradigm



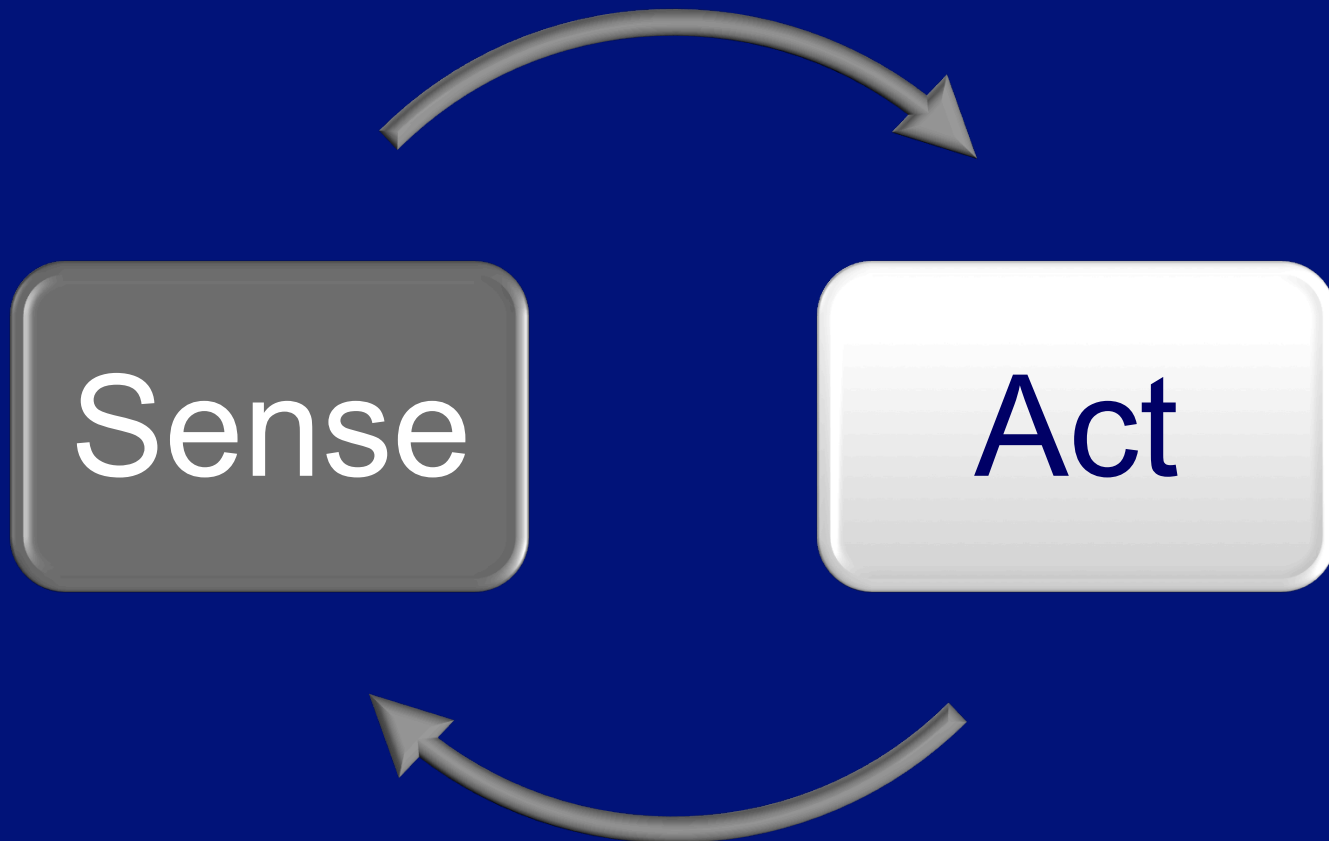


# Reactive Paradigm





# Reactive Paradigm







# Brian's Sensors

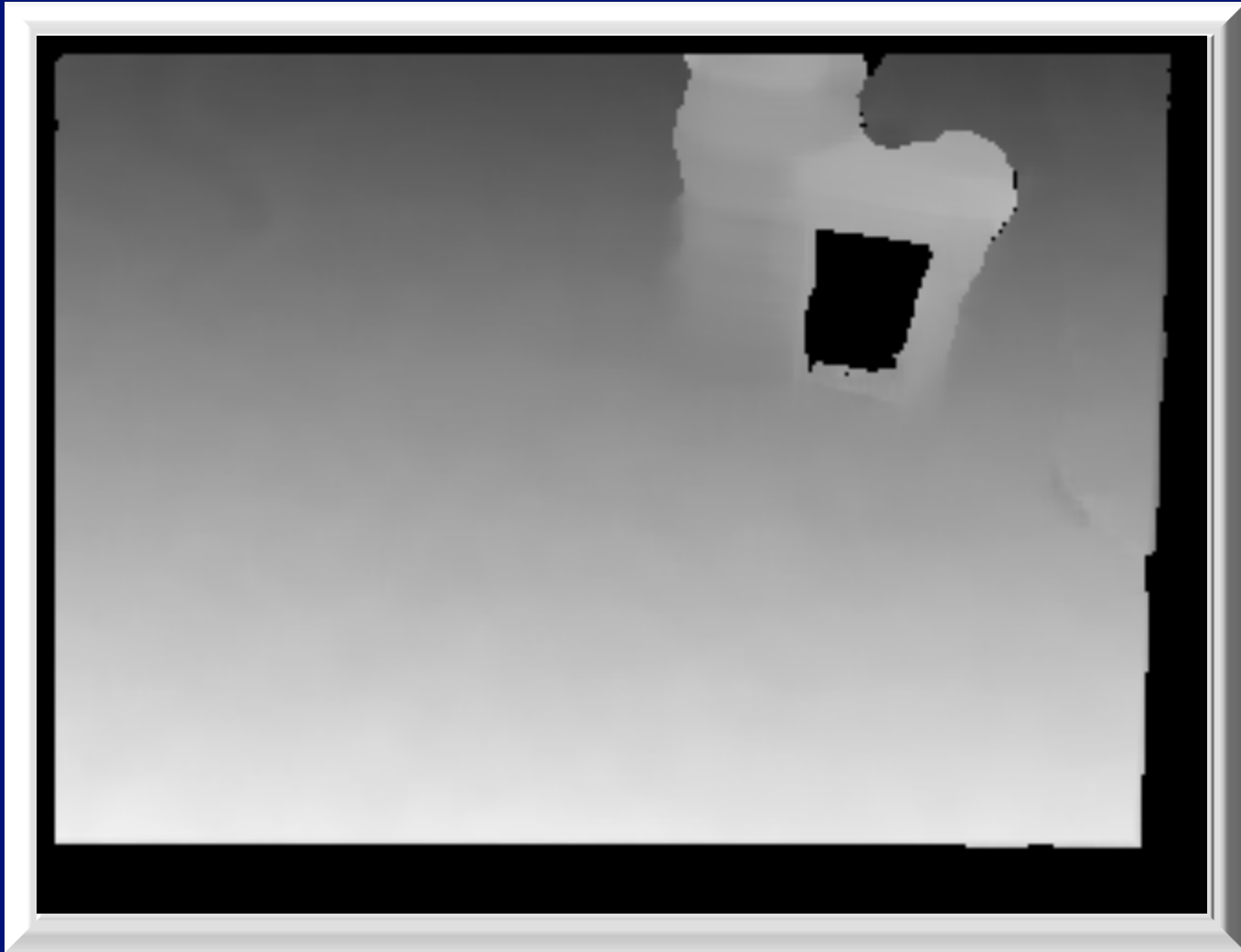


**Point Grey  
Stereo Vision**

**SICK LIDAR**



# Stereo Vision Camera



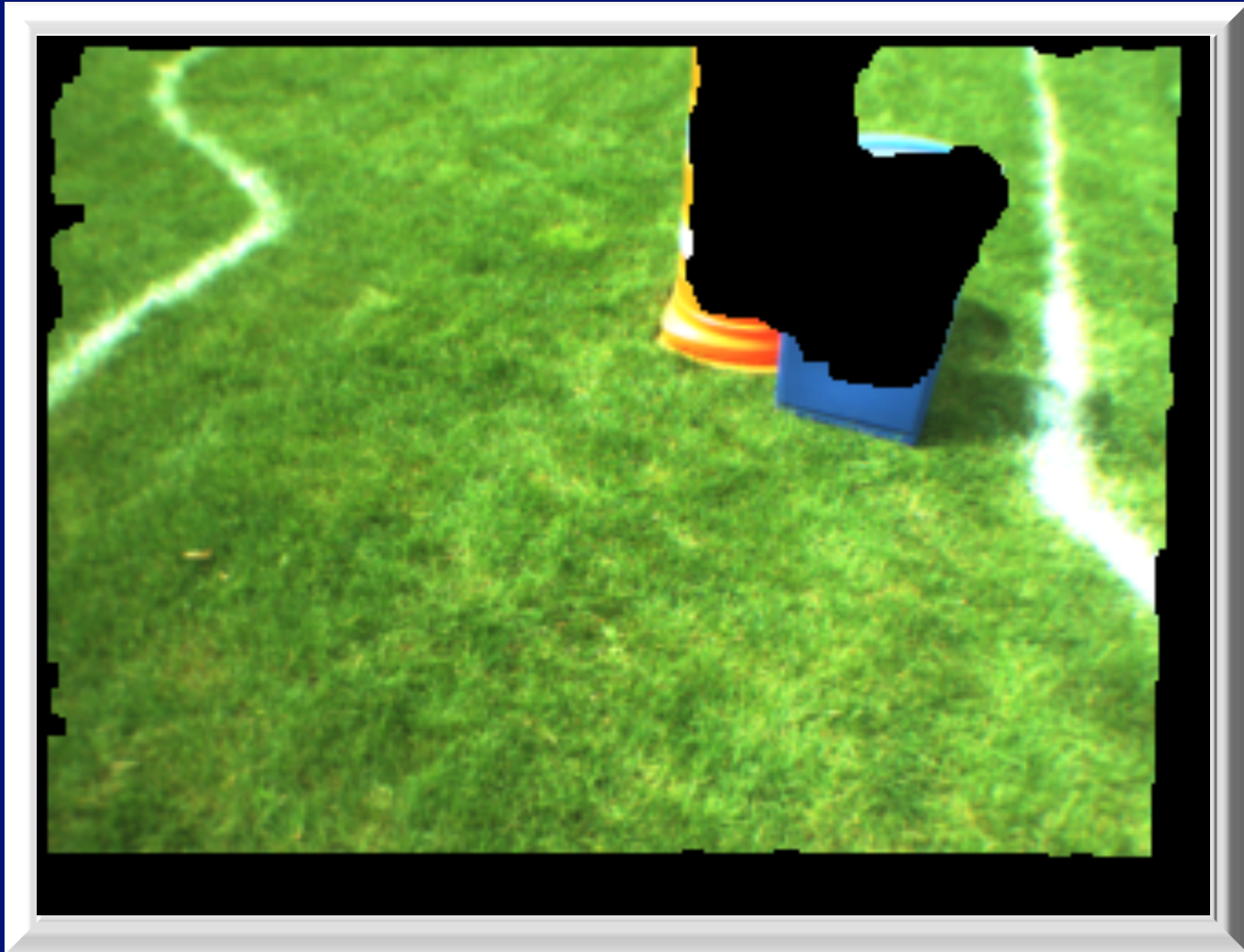


# Stereo Vision Camera



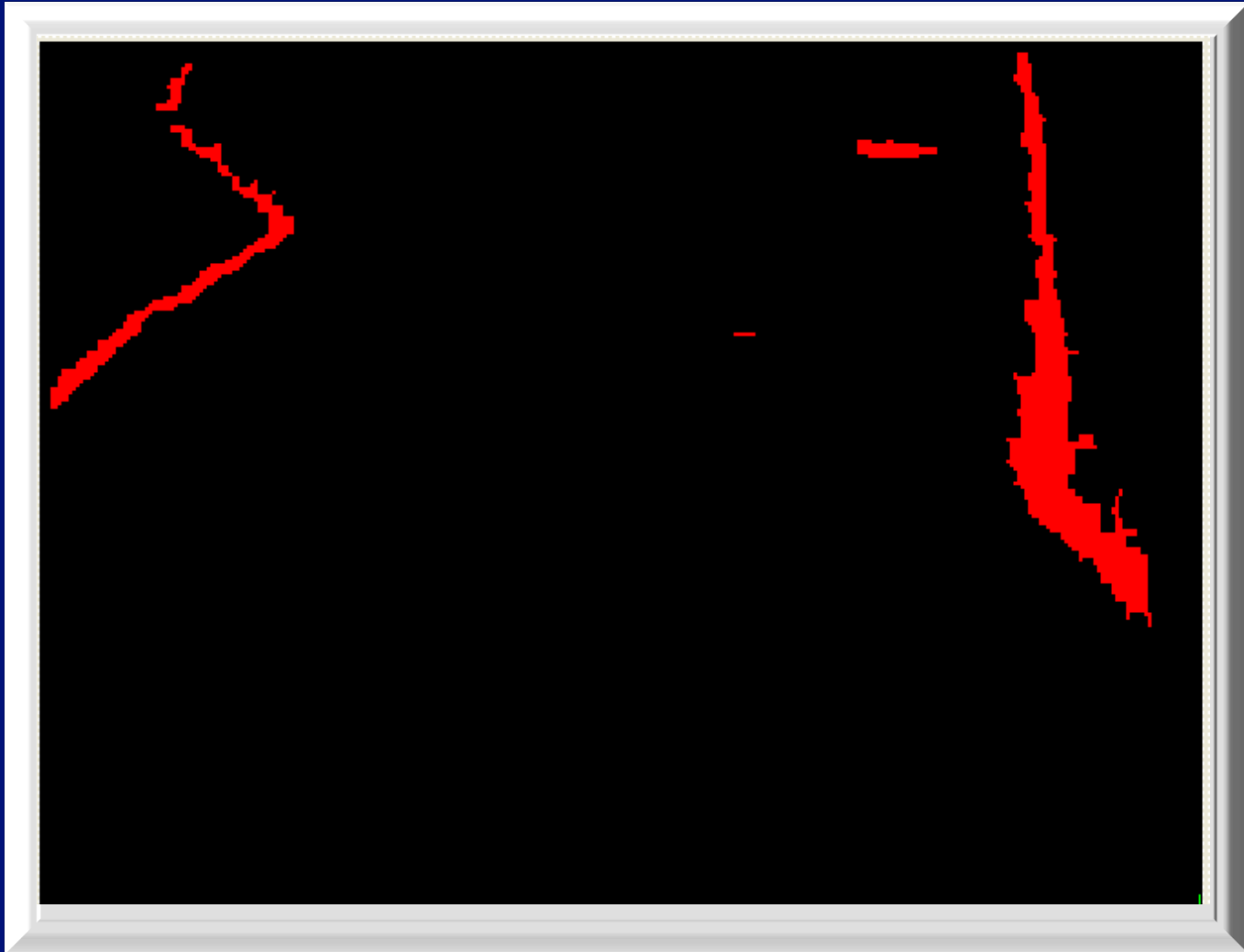


# Stereo Vision Camera



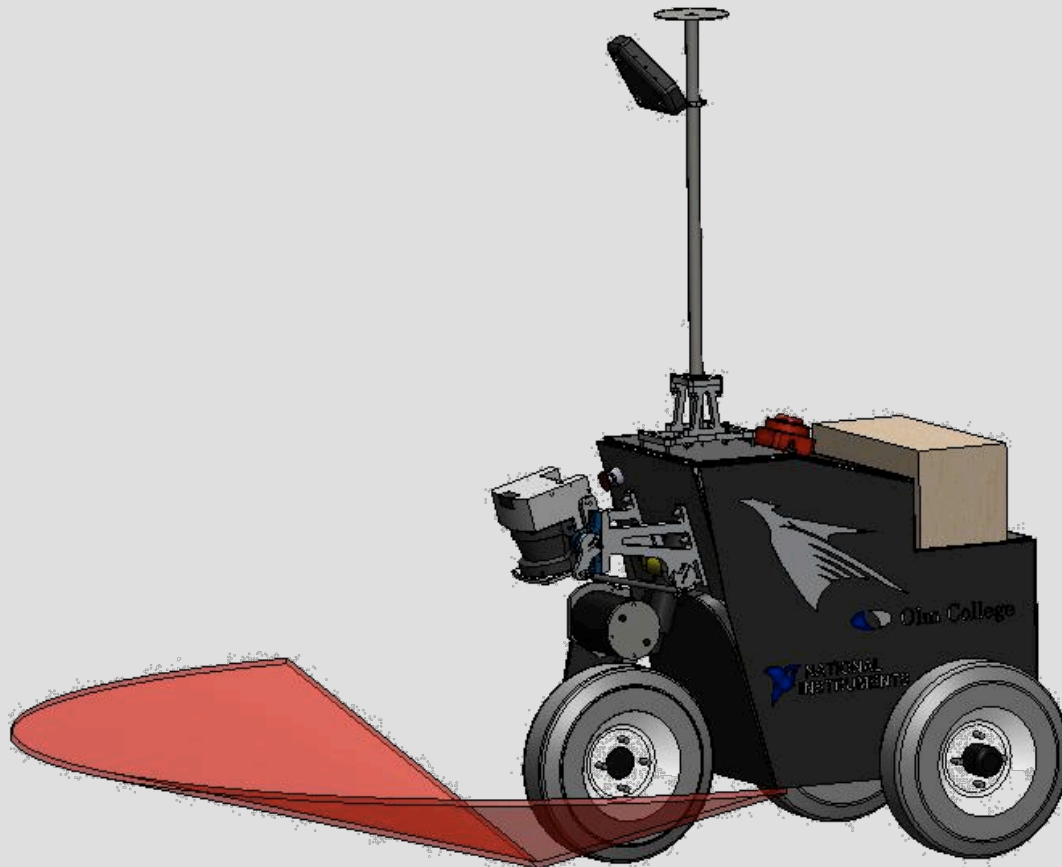


# Stereo Vision Camera



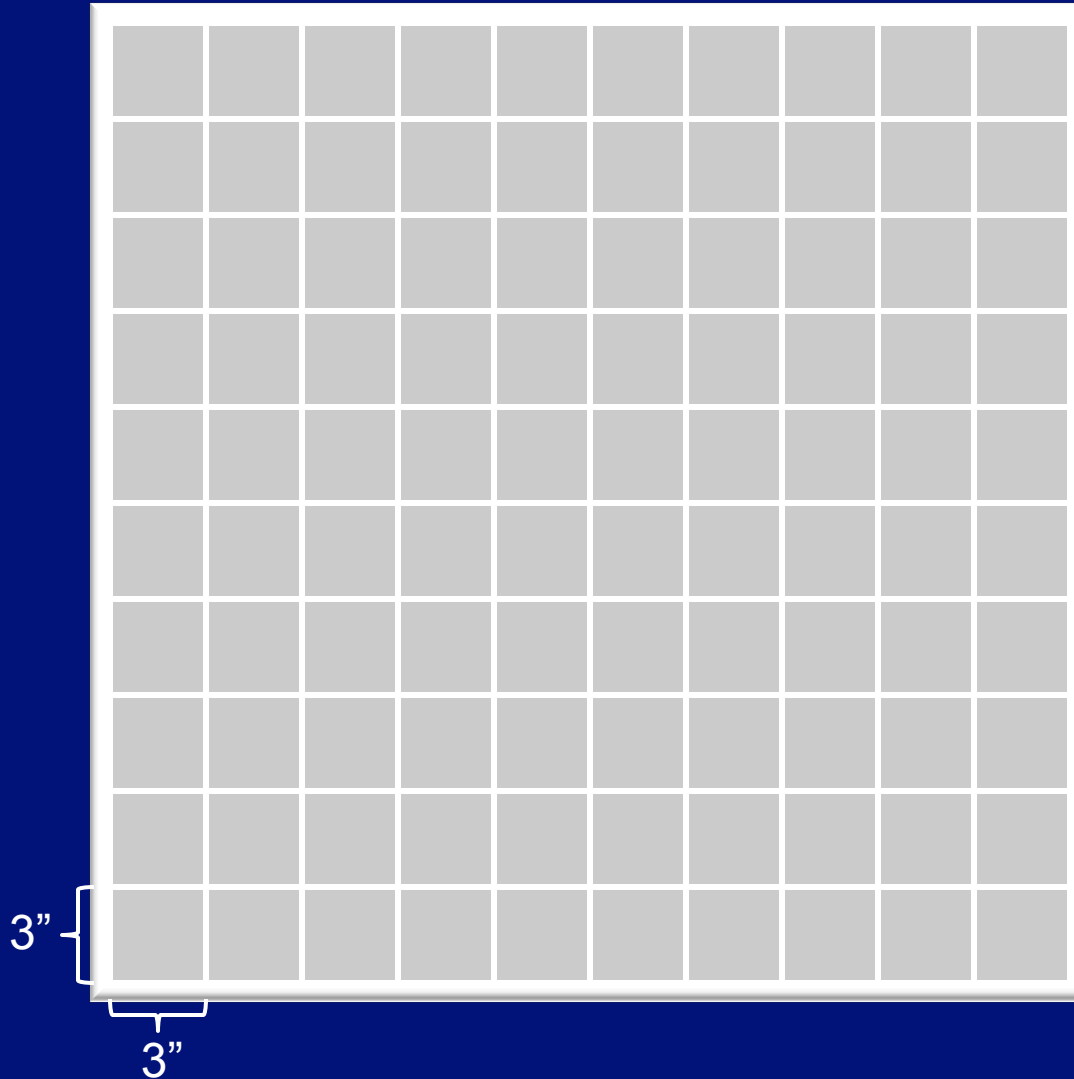


# LIDAR





# Occupancy Grid

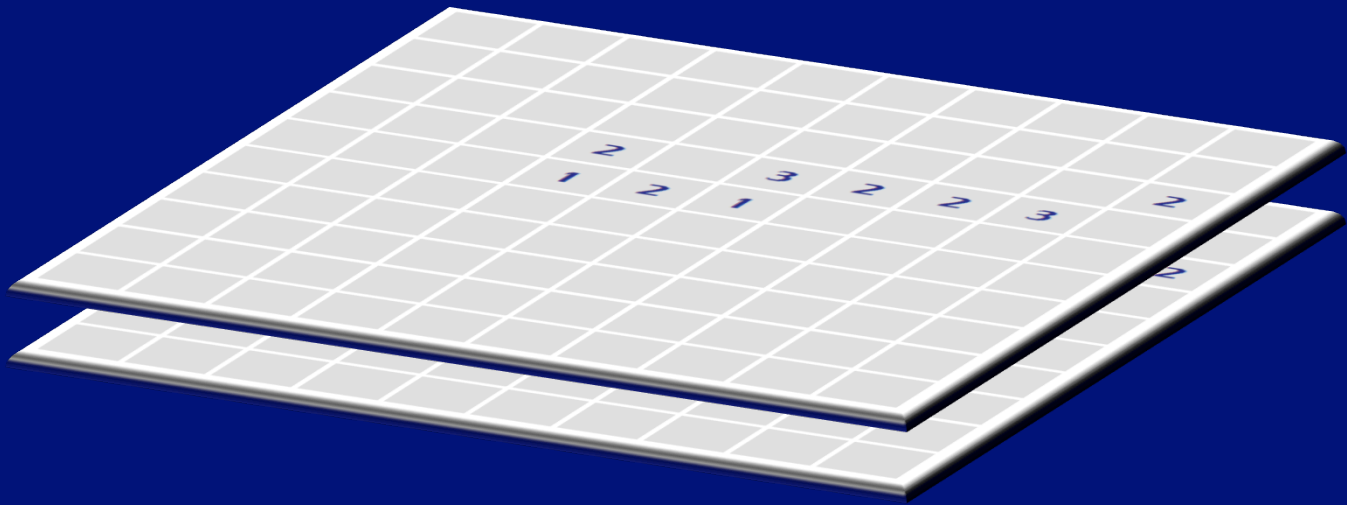






# Occupancy Grid

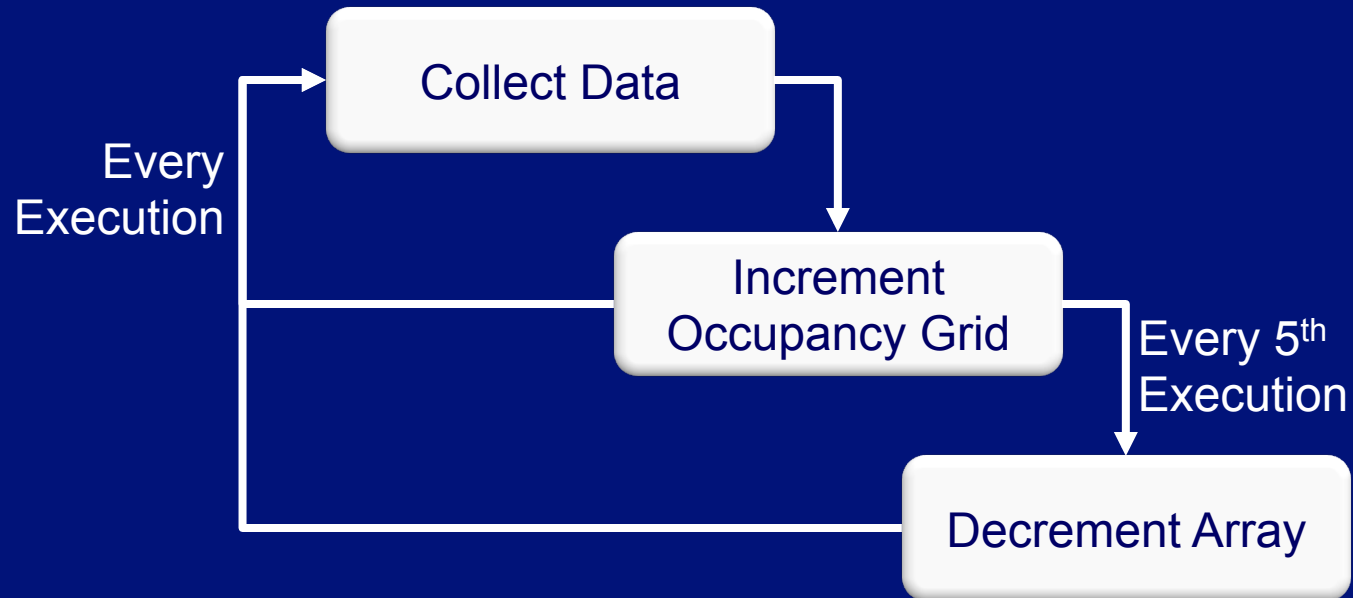
Obstacles  
Lines





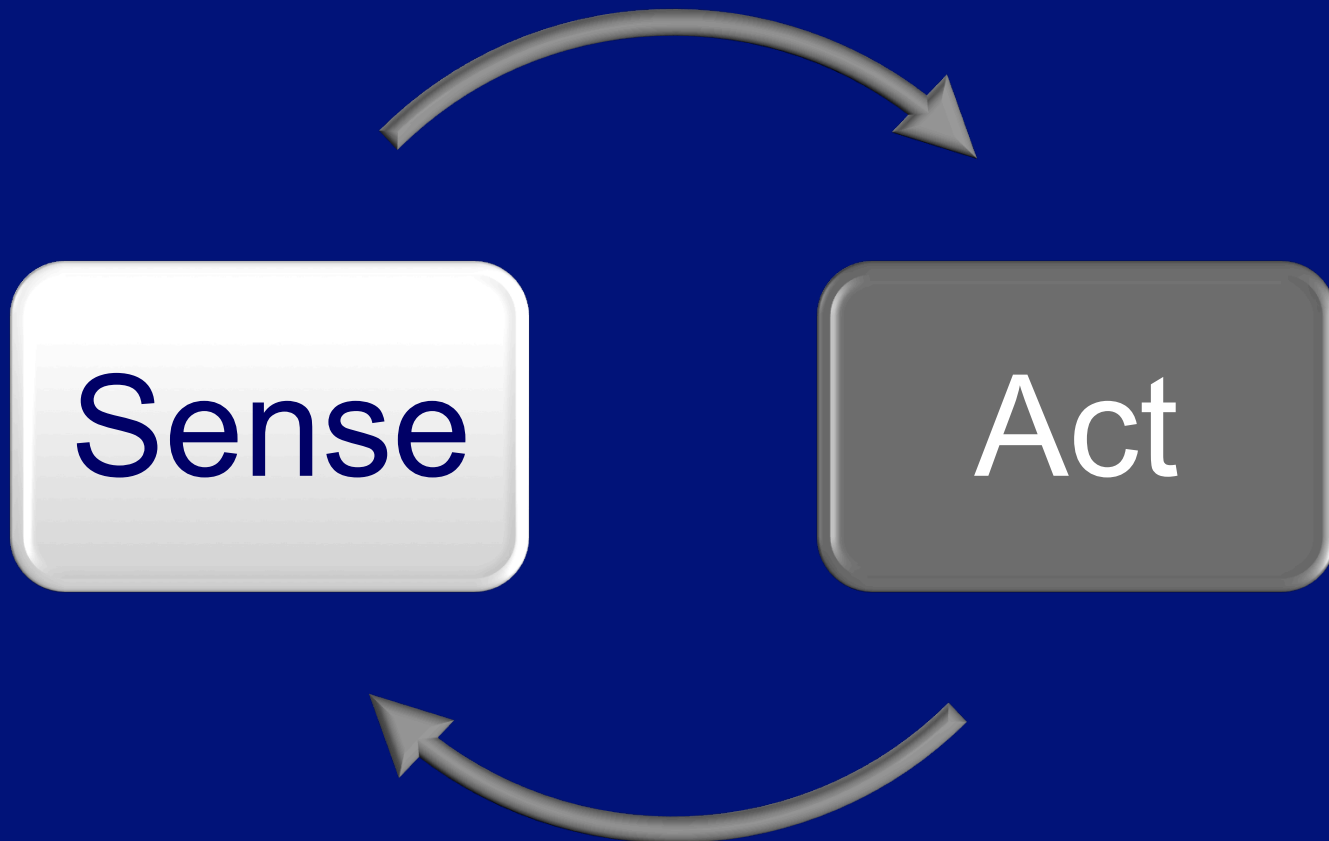


# Weighting & Aging





# Reactive Paradigm



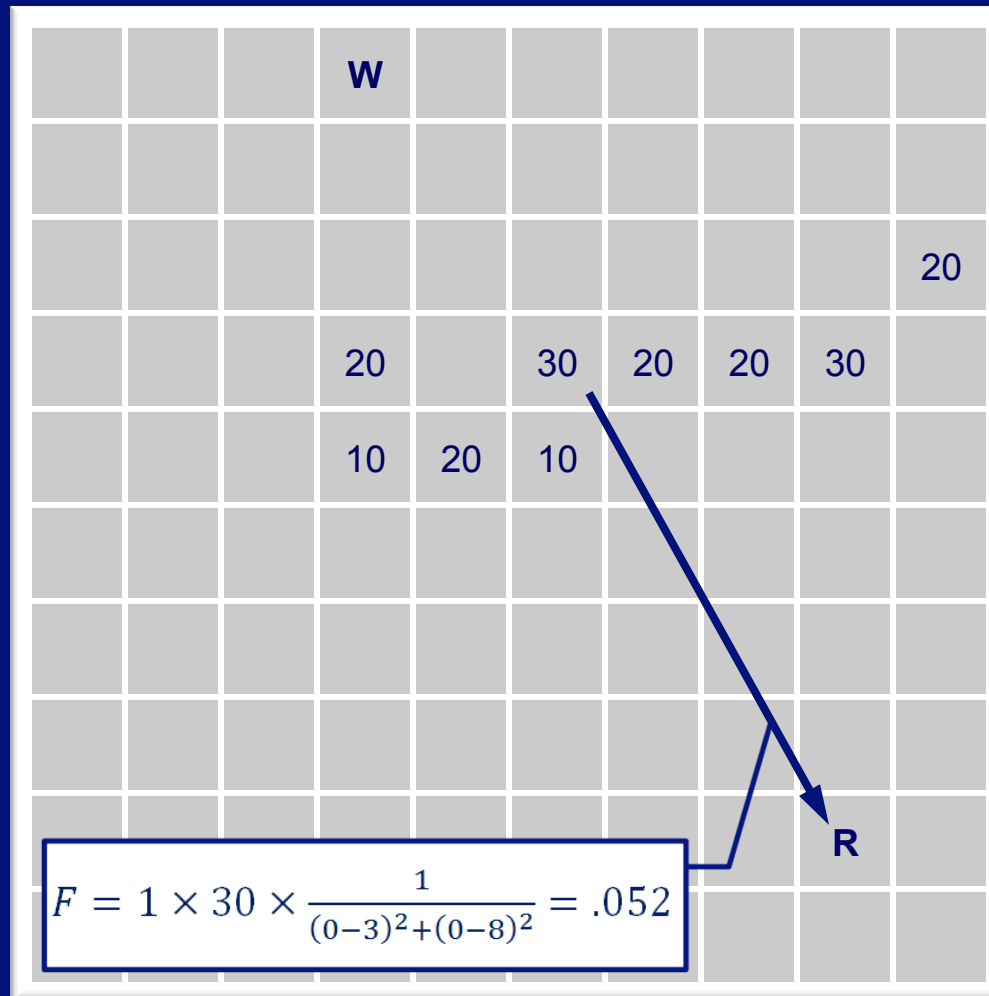


# Potential Field

$$\vec{F} = \sum_i \sum_j K C_{i,j} \frac{1}{d_{i,j}^2} \hat{d}_{i,j}$$

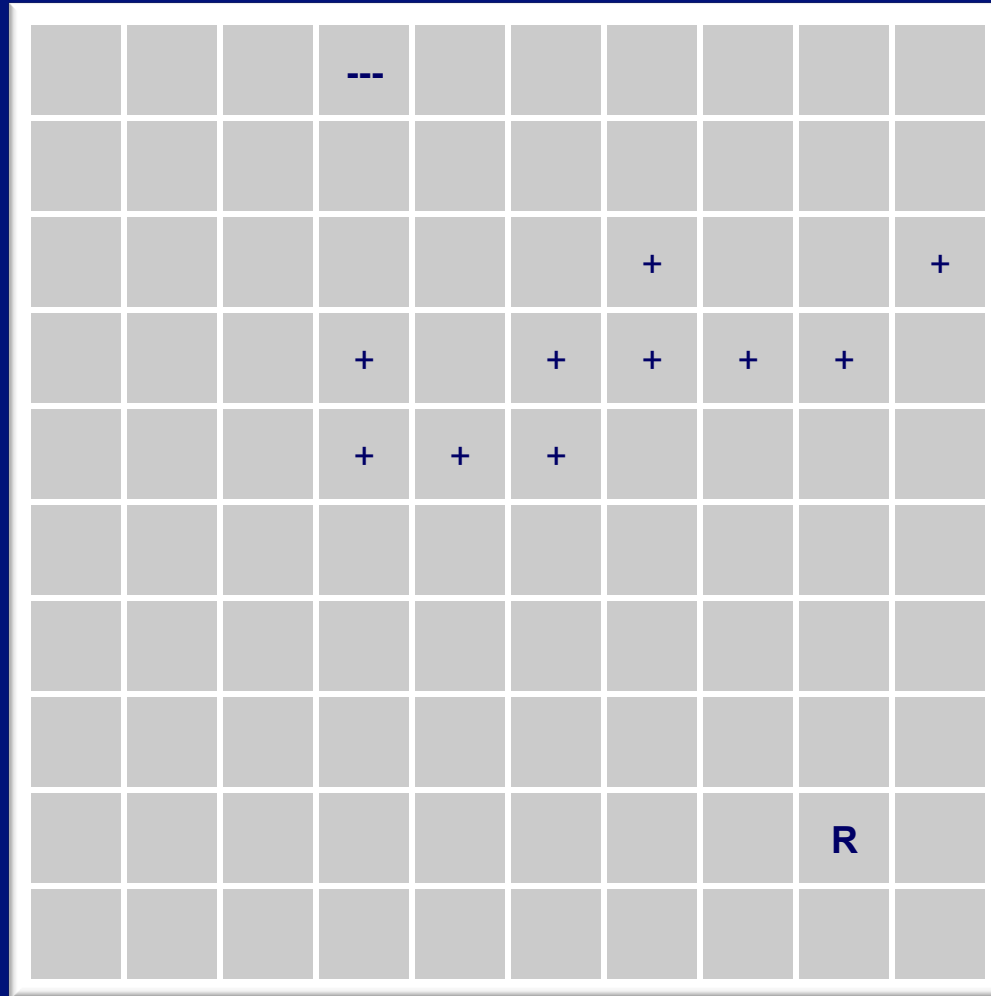


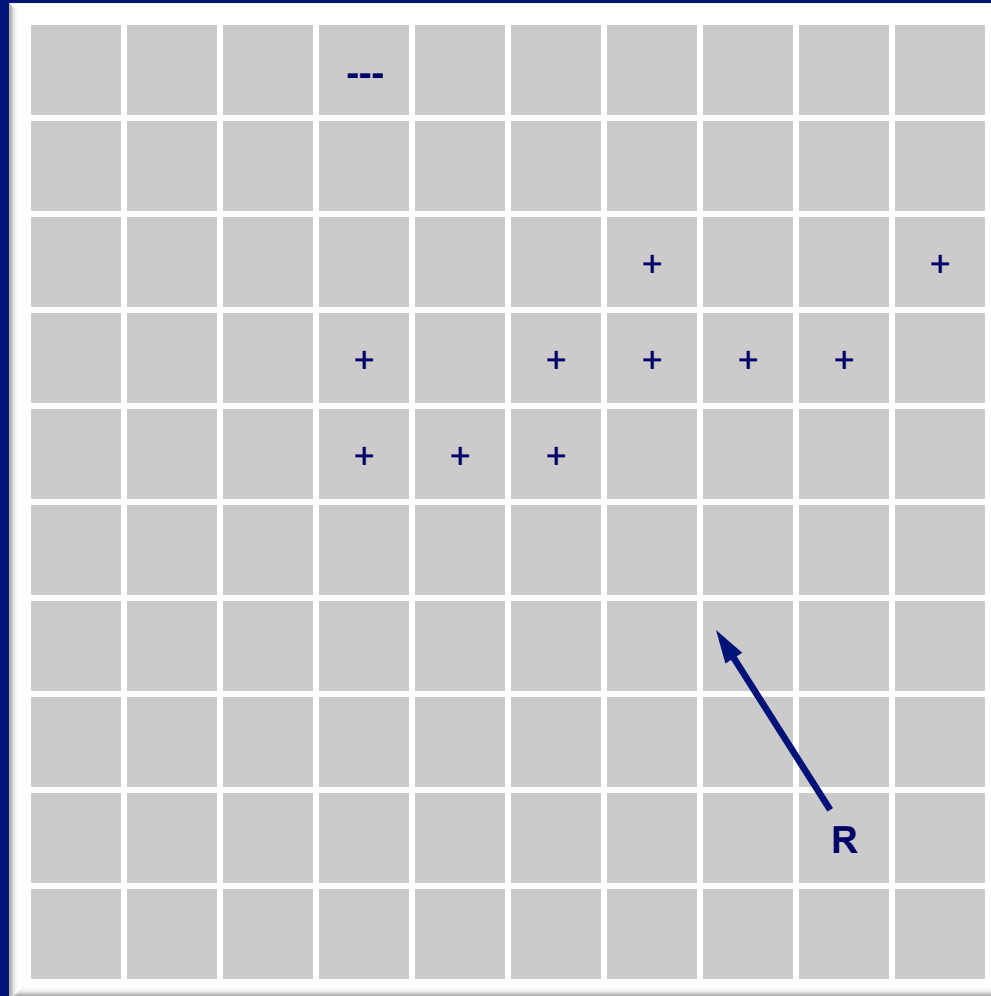
# Potential Field





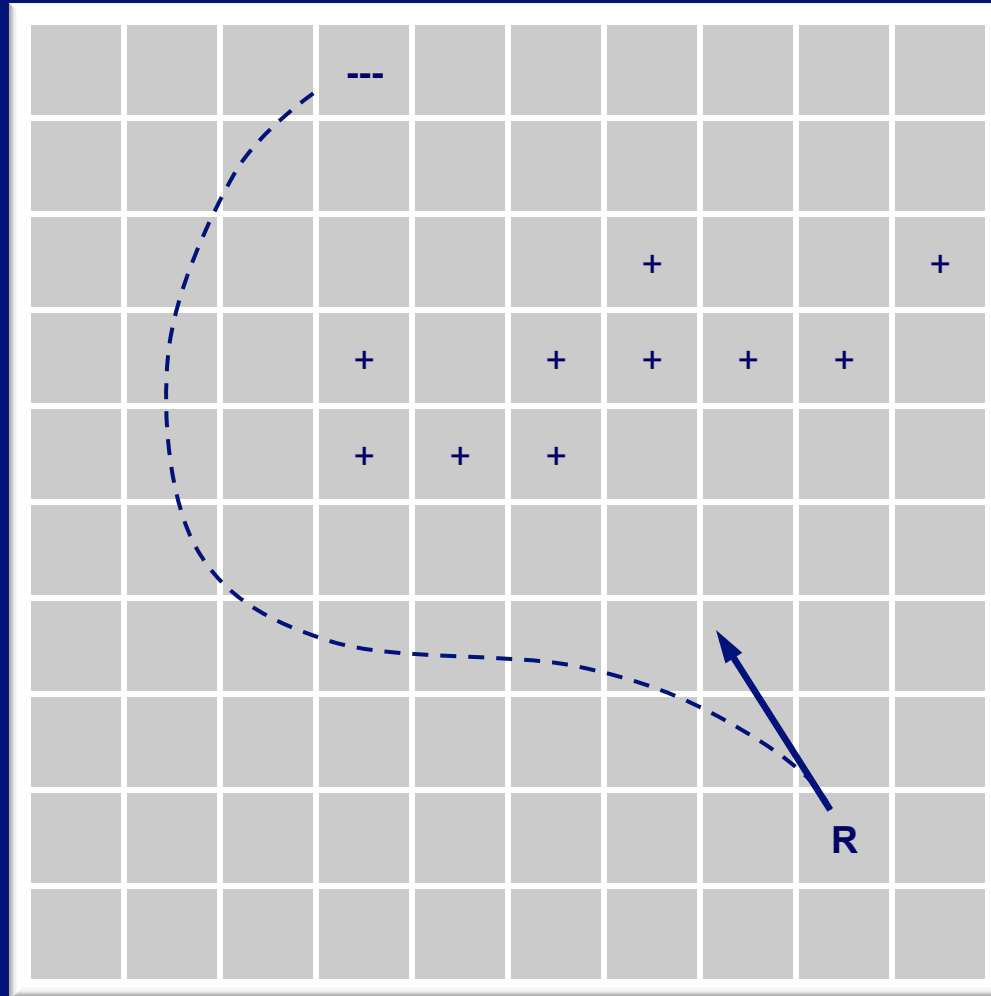
# Potential Field







# Potential Field





# Waypoint

Navigation

Waypoints  
Provided

Autonomous

Detect Lines

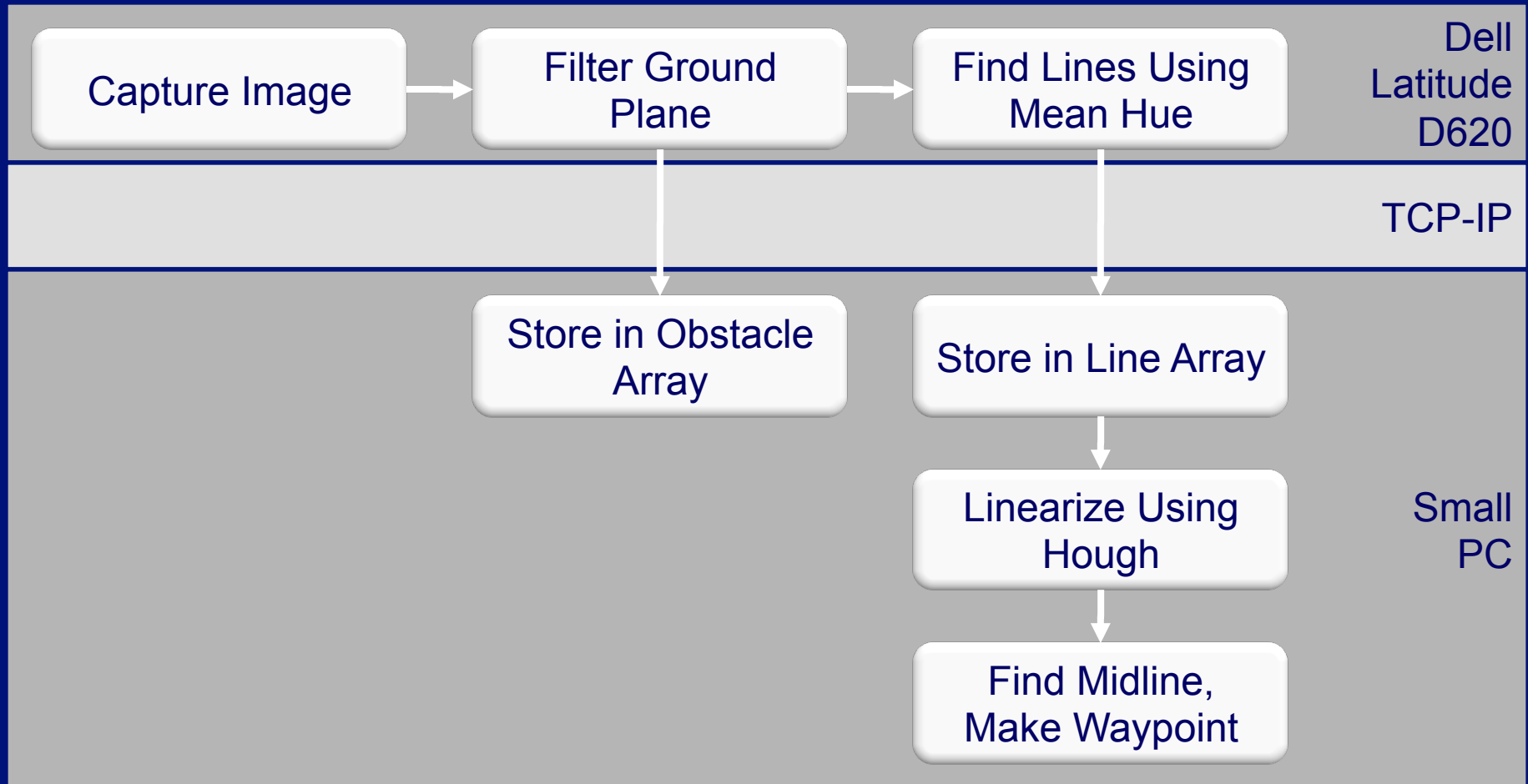
Find Midpoint  
Between Lines

Create  
Waypoint





# Waypoint





# Software Innovation

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# Reactive Paradigm

## Key Advantages

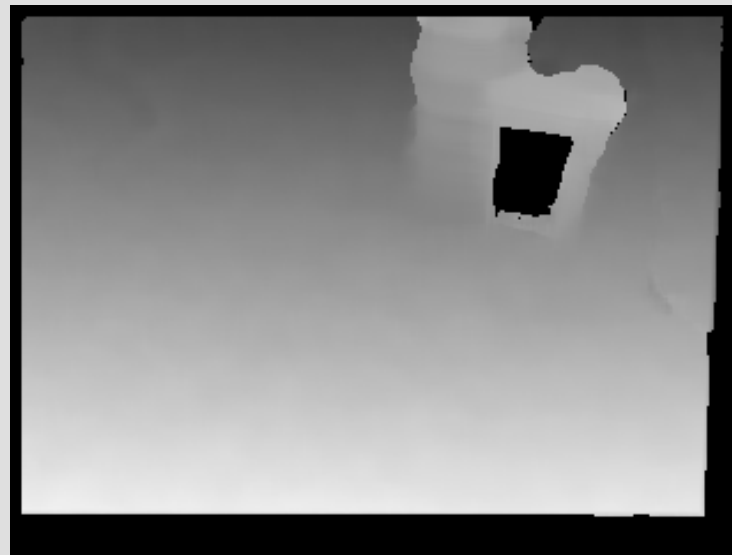
- Low Computational Cost
- High Refresh Rate (10Hz)
- Easy & Robust



# Image Processing

## Key Advantages

- Redundant Sensing





# Image Processing

## Key Advantages

- Redundant Sensing
- Rapid Ground Plane Detection
- Adapts to Light Conditions



# Acknowledgments

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# Thank You Very Much

- Dr. David Barrett





# Questions

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