Comprehensive Design I - MECH 4240 Final Fall 2008

Eric Kamber
Harry Gooden
Josh Westmoreland
Billy Rigdon

SOL of AUBURN

- Overview
- Projects
  - Body and Panel Mounting
  - Exhaust
  - Hood Array Stage 1
  - Hood Array Stage 2
  - Belly Pans
  - Door & Trunk Hinges
  - Firewall
- Conclusion

Outline

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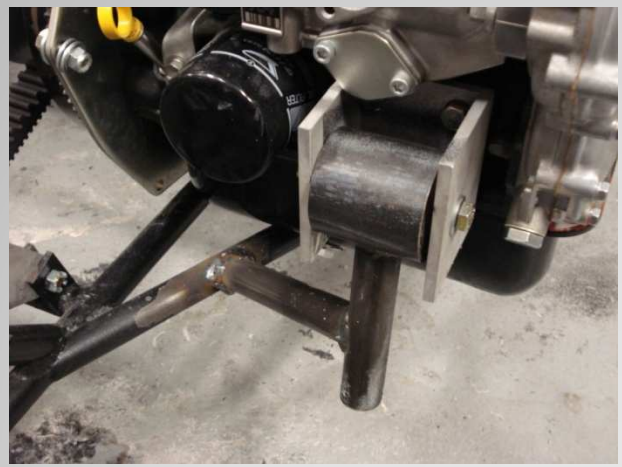
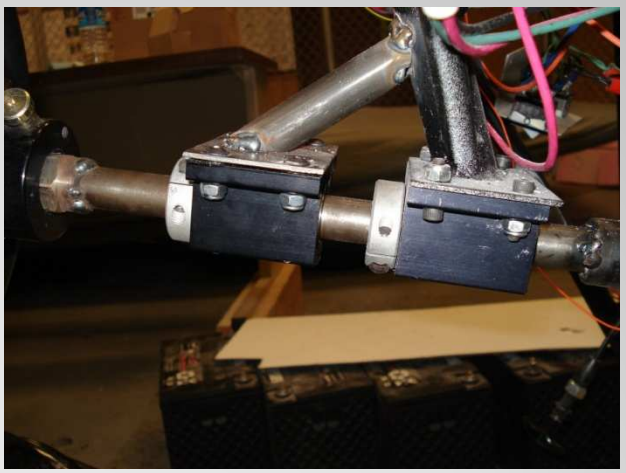
Outline

- Effectively Solve Design Problems With Major Systems in the Car and Get Main Systems of Car in Basic Working Order
- Finish Design of Many Subsystems
- Test Car Under Basic Driving Conditions and Get a Baseline of Data
- Effectively Communicate with Present Team Members and Provide the Future Good Records

Overview
Goals for Semester

- Engine Remount
- Steering Assembly
- All completed and tested successfully





Overview

Midterm Overview

- Overview
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  - Exhaust
  - Hood Array Stage 1
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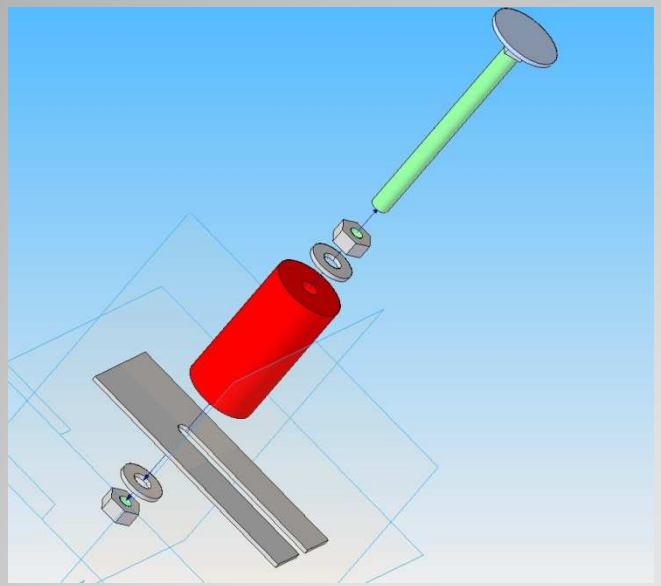
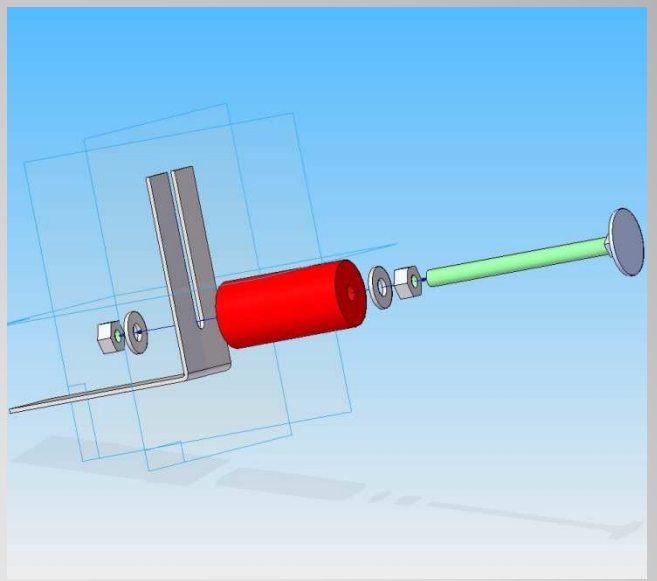
Outline

- Non-Permanent Mounting
- Isolation
- Minimal Parts
- Ability to Adjust Position
- Back Panel Will Have Special Needs

Body and Panel Mounting

Design Considerations





Body and Panel Mounting

Design – Configurations

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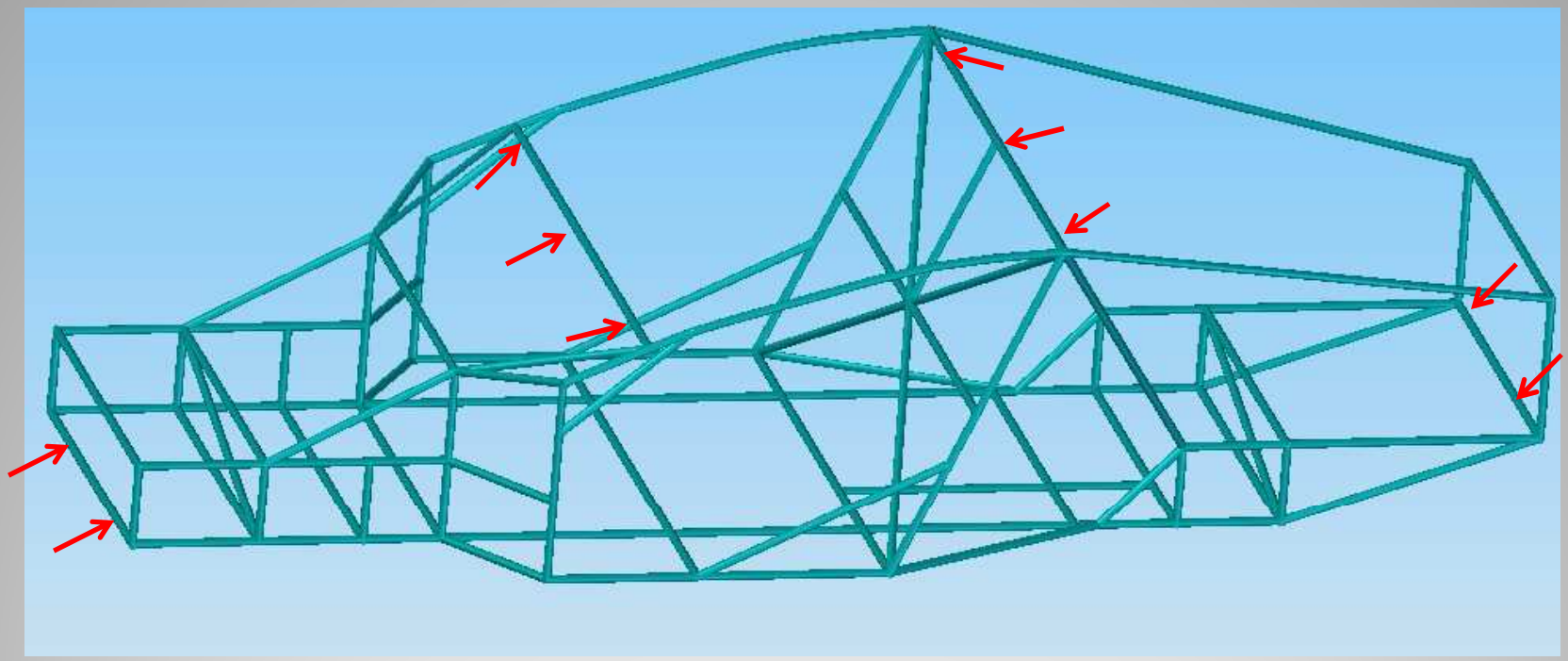

Body and Panel Mounting

Design – Locations

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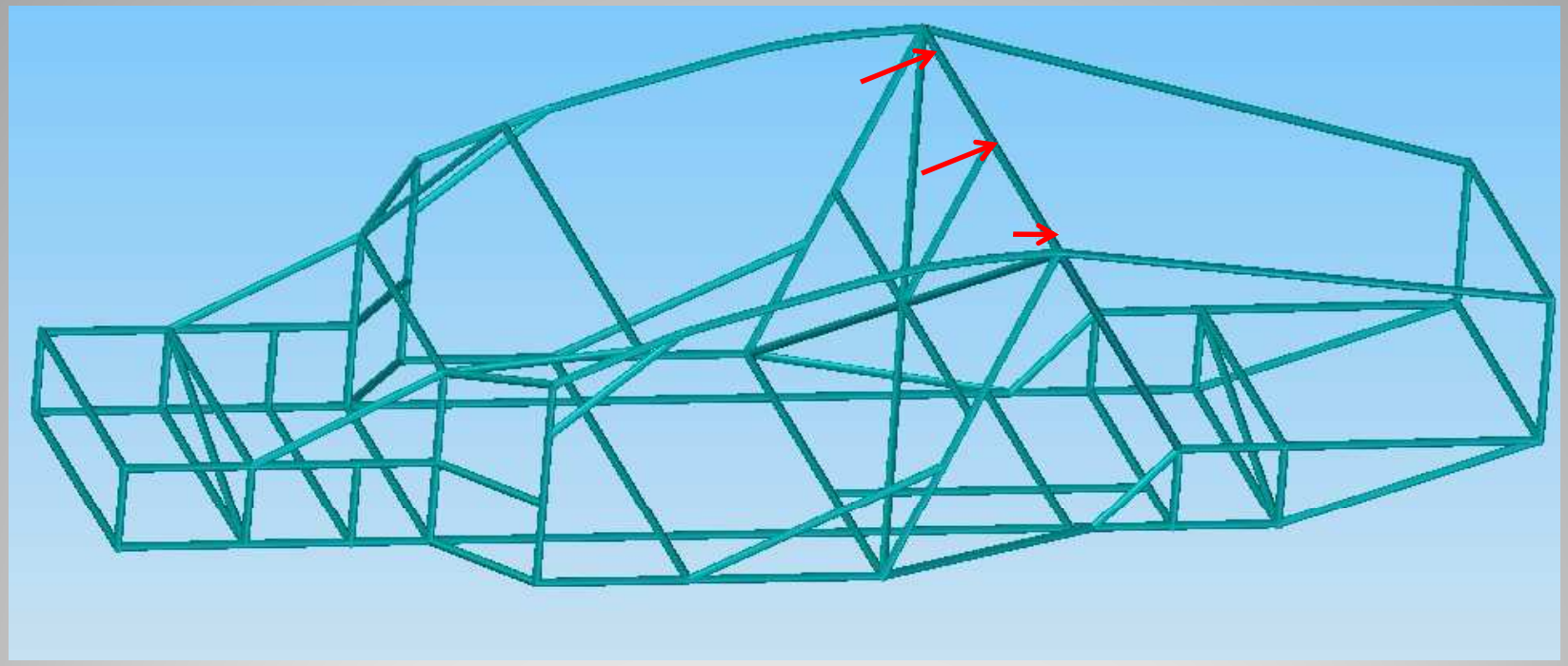

Body and Panel Mounting

Design – Location Changes

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- Belly Pans
  - Similar Mounting To Body Shell
  - Leading and Trailing Edge Will Need Special Consideration Due to distance from frame

Body and Panel Mounting

Other Panels

- Overview
- Projects
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  - Hood Array Stage 1
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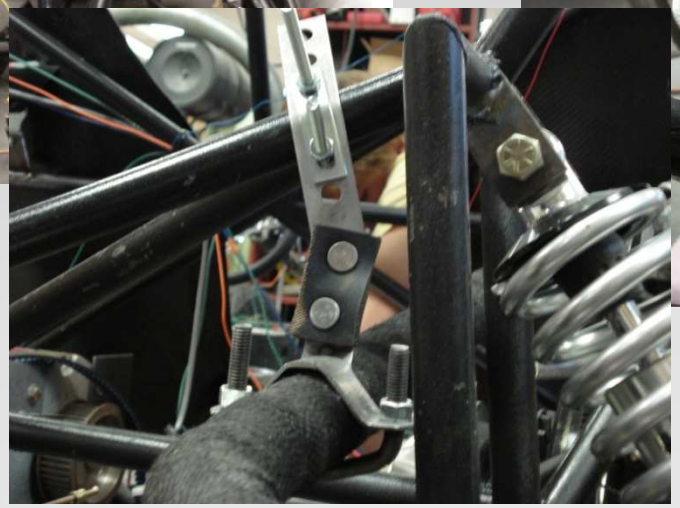
Outline

- Guide exhaust so that it does not enter Passenger cabin.
- Avoid overheating any (i.e. cables, tubing, etc.)
  - Will use a fiberglass insulation wrap
- Use tubing and muffler that was provided by Wolf Muffler

Exhaust
Considerations

- Straight down, beside engine
  - Shortest, easiest route
  - Possibility of exhaust entering the car while idling
- Wheel well
  - Short, but complicated route
- Rear of Vehicle
  - Longest route, directs fumes the best

Exhaust
Concepts



Exhaust
Fabrication

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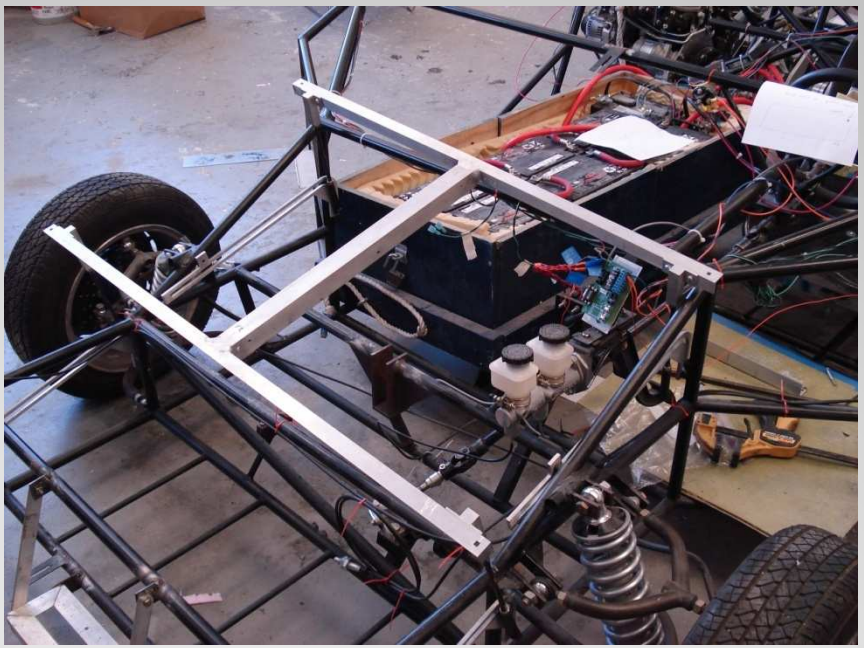
Outline

- Current Hood Deployment System
- Key Components: Linear Actuator and Track Assembly



Array Deployment

Stage 1– Current System

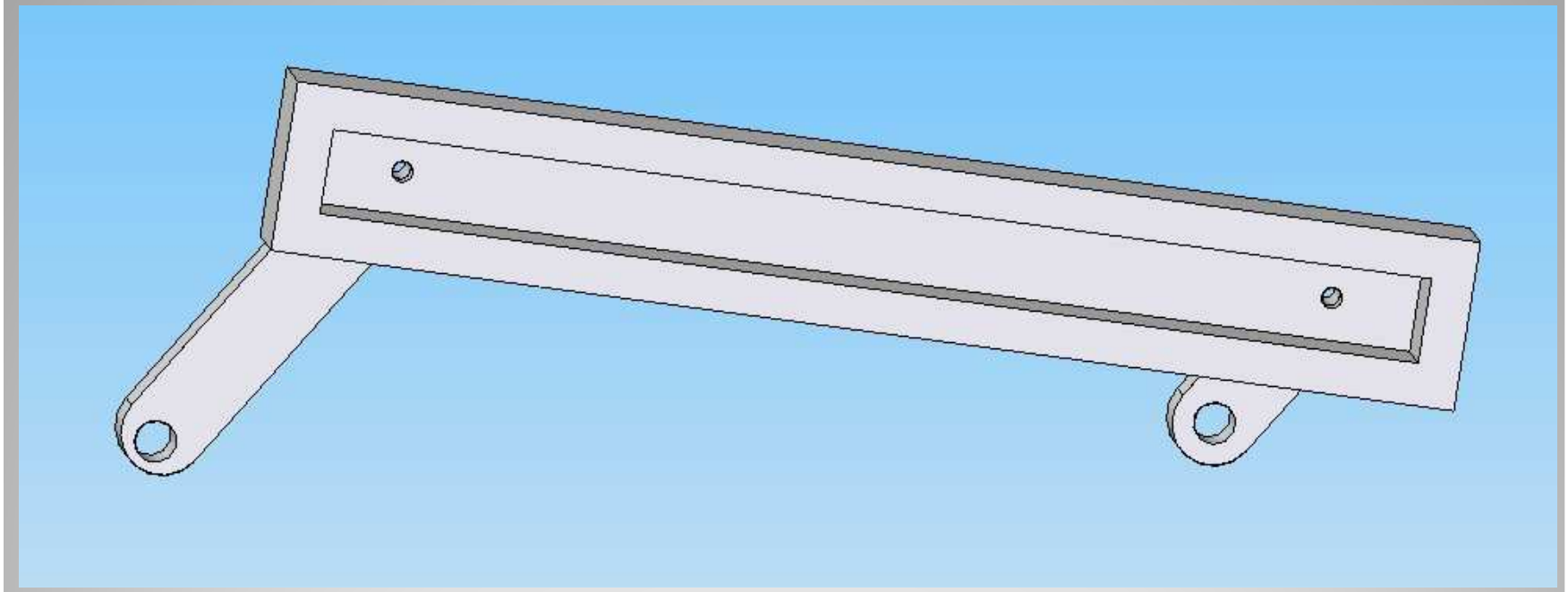
Key Errors:
•Positioning of the linear actuator
•Improper connection between the tracks and hood support tray

Array Deployment
Issues

- Corrections?
  - New Bushings?
  - More Rigid Structure?

- New Design For Stage 1
  - Four-Bar Mechanism
  - Drawer-slider Type Assembly
  - Linear Actuator

Array Deployment
Stage 1 Redesign



Array Deployment

Four-Bar

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- 3D Model To be Finished
- Design Confirmed By Presentation to Team
- Drawing package Finished
- Parts Manufactured
- Assembly and Testing

Array Deployment

1st Stage Outlook

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- 4-Bar Mechanism Design Reconsidered
  - Complicated
- Brainstorm… Simple Rotation Required
- Trunk Hinges Utilized for Hood

Array Deployment
1st Stage – New Design

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- Consideration of Design
  - Constraints of Area
  - Proper Alignment with Body
  - Proper Selection of Slides
  - Attachment Points
  - Operation for Success

Array Deployment
1st Stage – New Design

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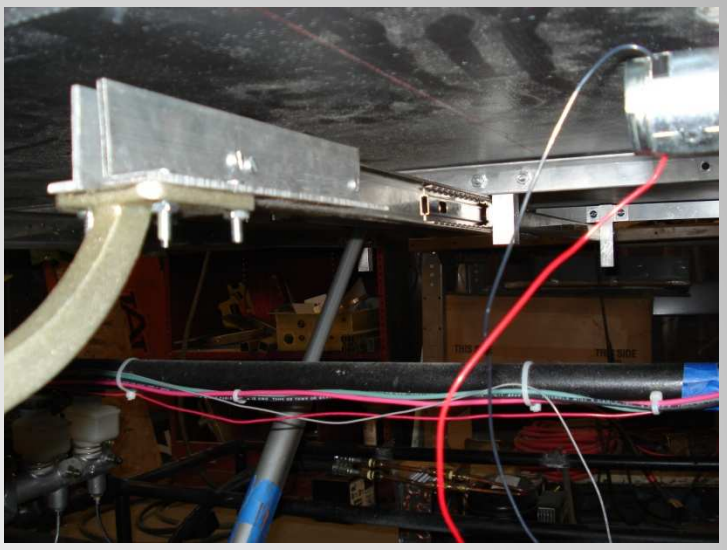
- Assembly Design and Connections
  - Hinge to Drawer Slides
  - Drawer Slides to Array Tray
  - Array Tray to Hood



Array Deployment
1st Stage – New Design

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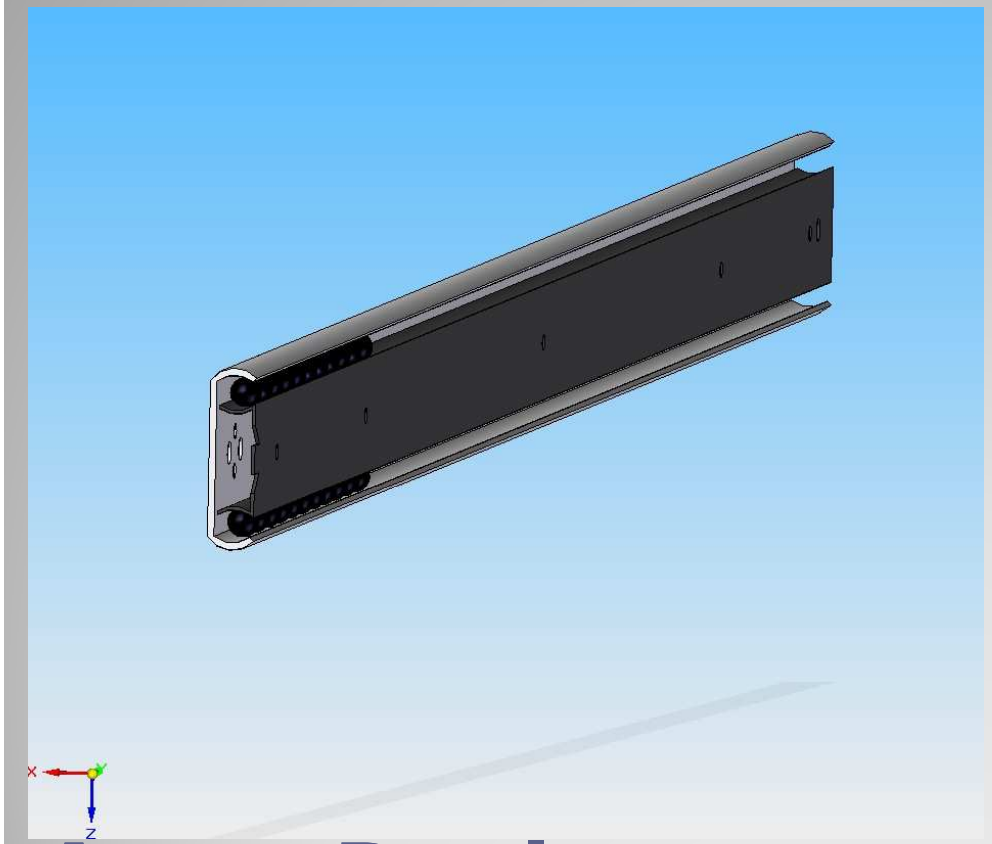
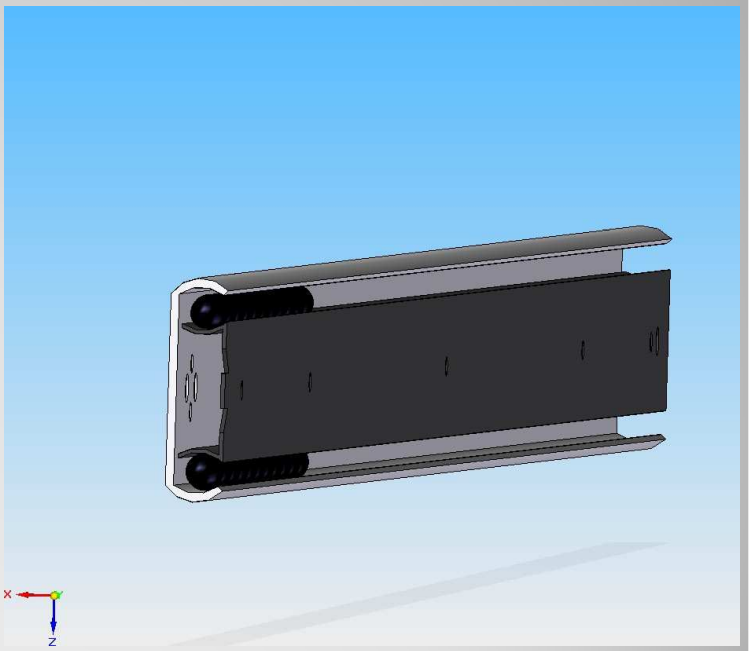
- Drawer Slides Selected and Purchased





Array Deployment
1st Stage – New Design

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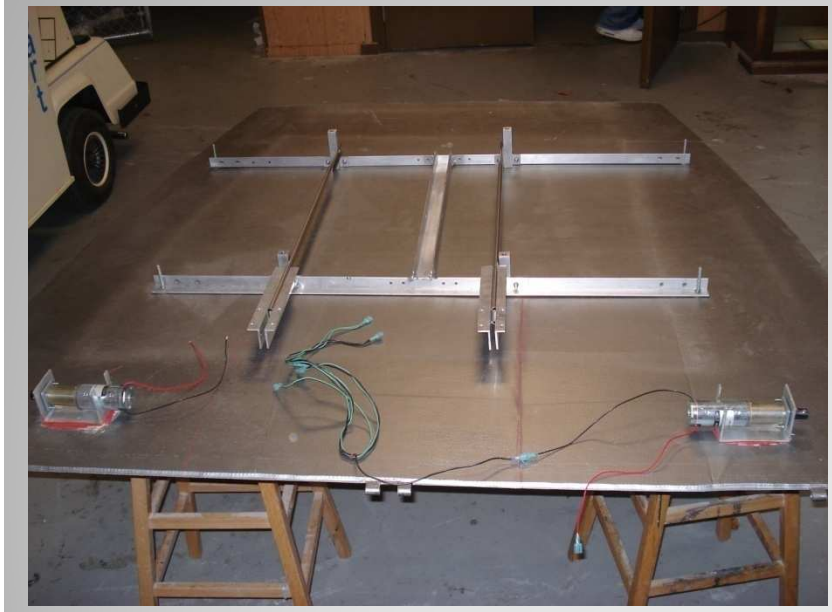
- Installation and Performance
  - Primary Installation is Complete
  - Initial Testing Commenced



Array Deployment
1st Stage – New Design

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Array Deployment

1st Stage – New Design

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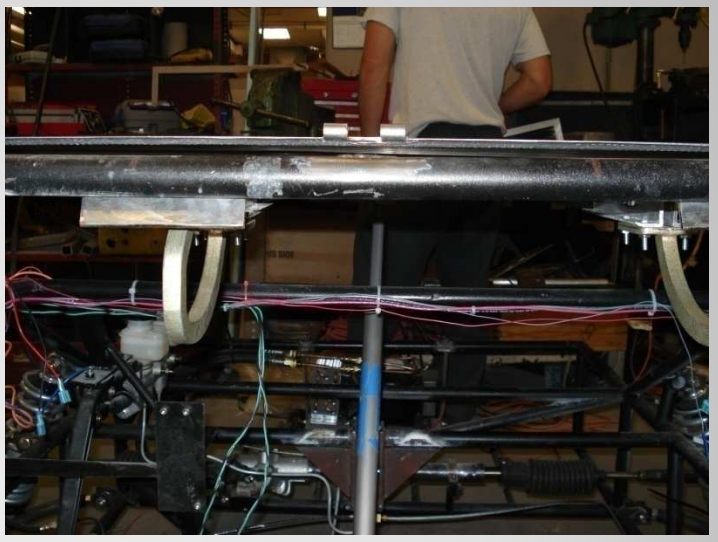
- Future Considerations
  - Body Alignment
  - Spring Mechanisms
  - Stabilization of System
  - Refinement of System



Array Deployment
1st Stage – New Design

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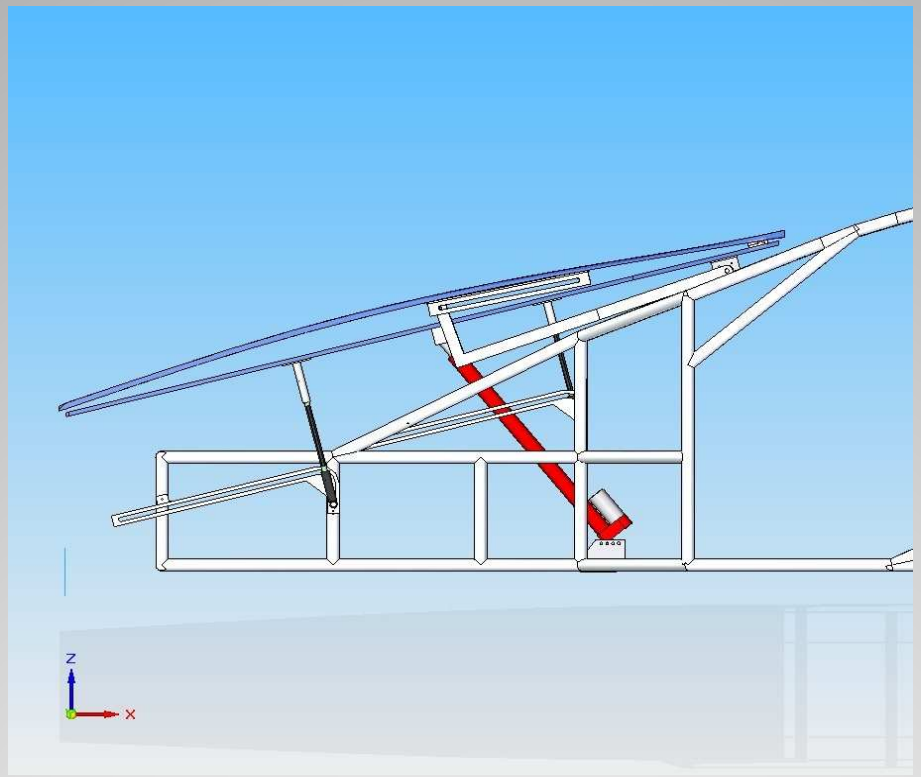
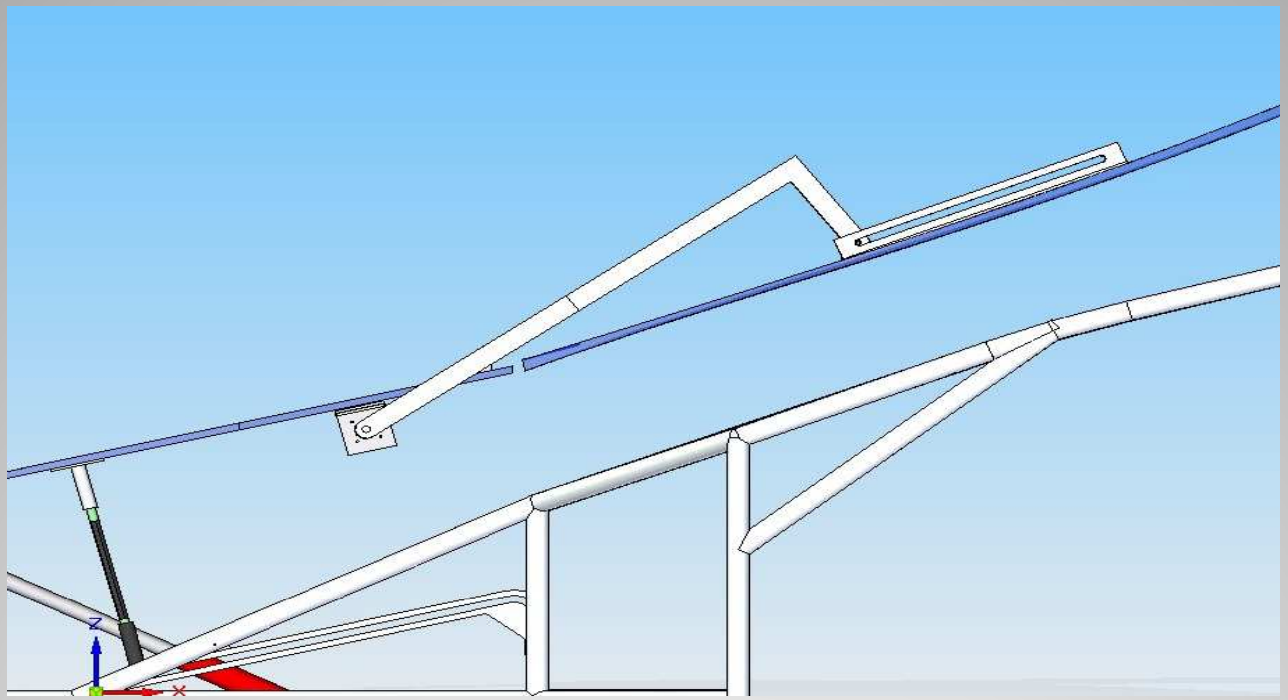
Outline



- Two motors mounted to the bottom hood piece.
- Two arms which twist to open the top hood piece and reveal the solar panels.

Array Deployment

2nd Stage Mechanism



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Array Deployment

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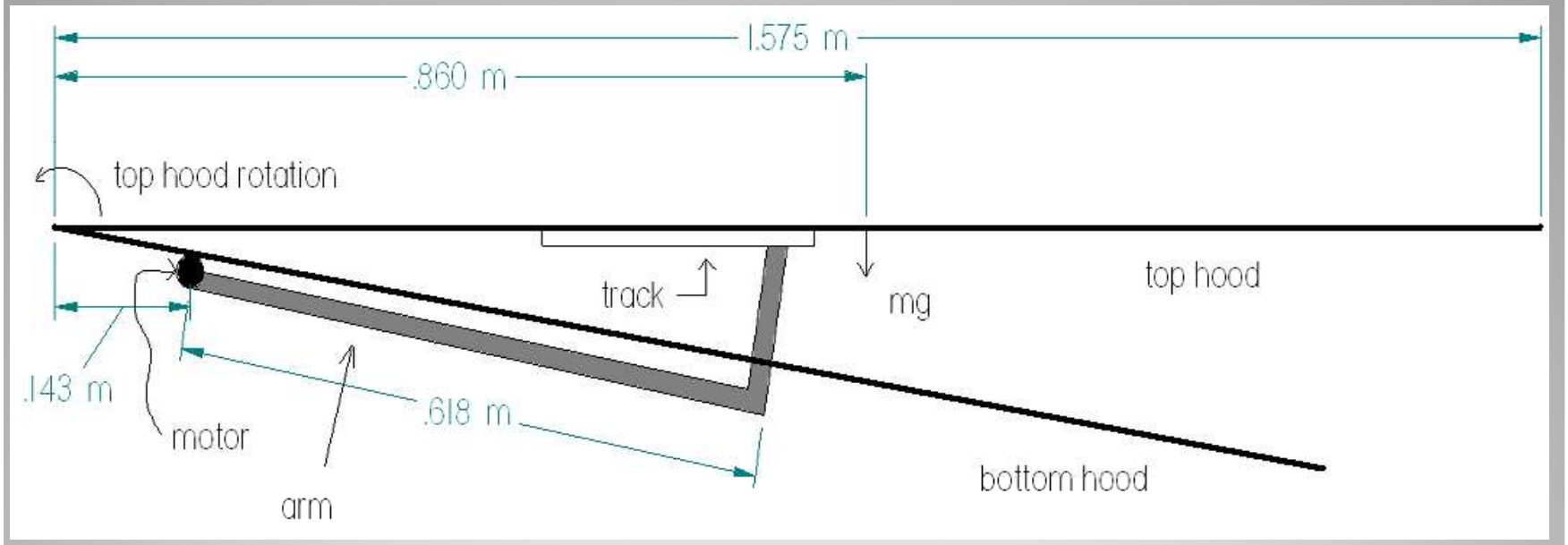
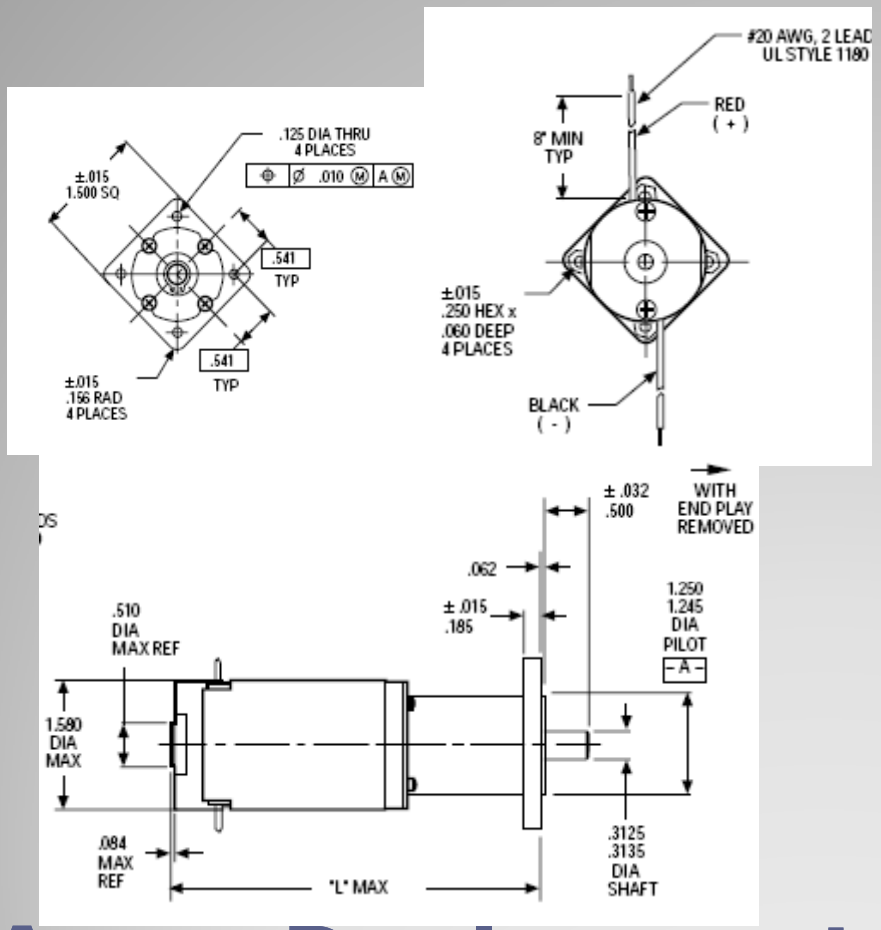


Calculations Can Be Found In the Report

Array Deployment
Dimensions



Array Deployment

Motor Information

- **IM-15 GEARMOTORS**

- **Torque rating:** Up to 1,250 oz. in.
- **Weight:** 14 to 21 ounces depending on ratio and motor
- **Gears:** Precision manufactured and heat treated for reliable performance and long life
- **Shaft:** Precision-ground No. 416 nitrided stainless steel
- **Backlash:** Varies with ratio but average backlash is 3°
- **Gear inertia:** 1.2 x 10-5 oz. in. sec.2 @ input max
- **Cover:** Steel housing, zinc plate
- **Mounting flange:** Die-cast zinc
- **Bearings:** Motor output shaft is supported by life-lubricated sleeve bearings

- The maximum torque needed is 79.3Nm. @ initial opening point.
- The current motors (409A6051-2) have a maximum torque of 68.59 Nm, which is not ample power to open the hood.
- The new motors (409AXXXX) have roughly three times more power, which is more than enough power.

Torque @	409A6051-2	409AXXXX
2.4 rpm	1.91 Nm	5.8 Nm
1.4 rpm	28.57 Nm	87.27 Nm
0.15 rpm	68.59 Nm	207.04 Nm

Array Deployment

Globe Motors 409A Series

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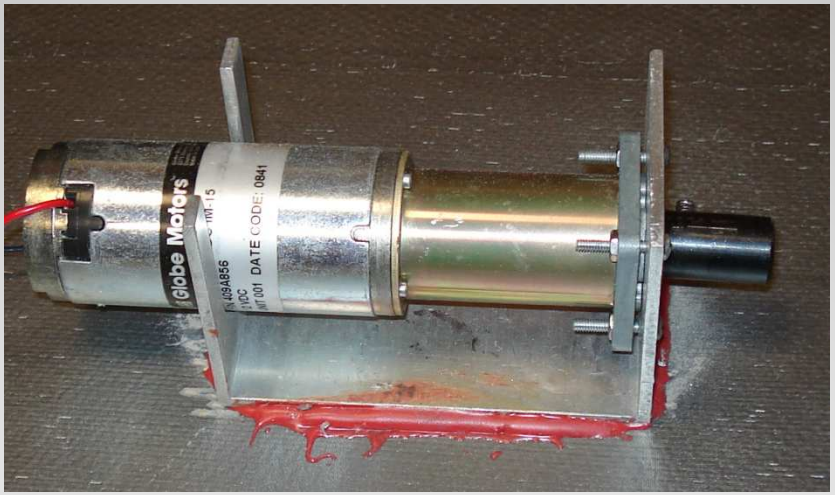
- New Motors Have Been Delivered
- They have been mounted and tested.
- The initial test had some malfunctions.



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2nd Stage Progress

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Problems Found While Testing

- The shaft was not strong enough for the amount of torque applied
- The pins holding the arm to the shaft either broke or deformed.
- The motors were not strong enough to lift the hood on their own.

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2nd Stage Progress (Testing)

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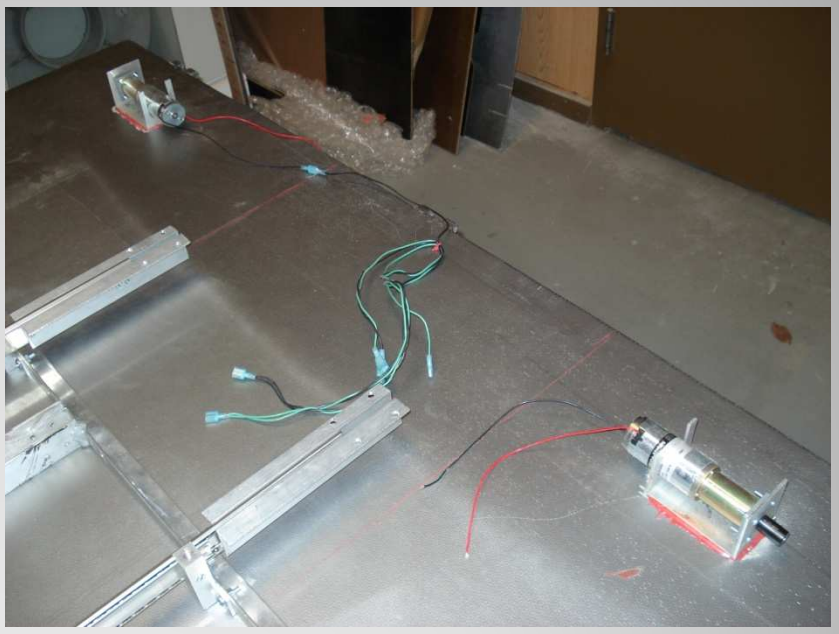
Solutions for Testing Problems

- A stronger shaft was purchased
- The shaft was welded to the collar
- A 1/8” hole was drilled through the arm and shaft, a steel rod was inserted for more rigidity
- These solutions should solve the torque loss issue



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2nd Stage Progress (Solution)

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Outline

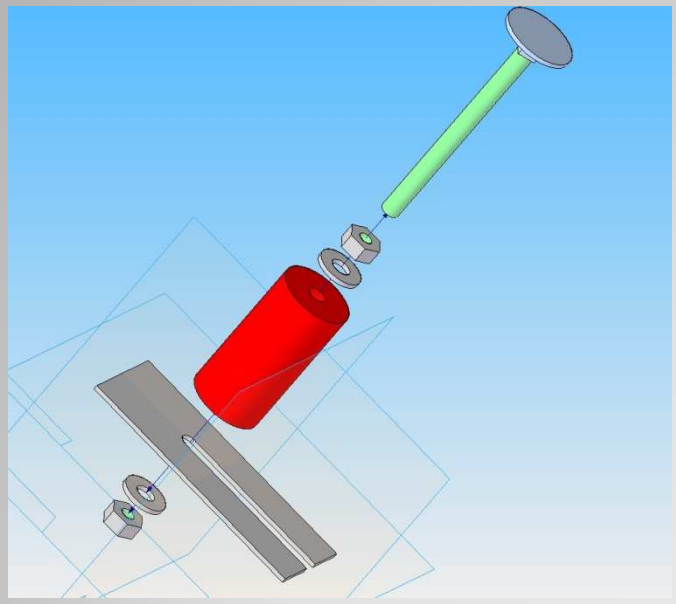
- The progress on the belly pans is at a stand still and will continue next semester.
- This is due to the body not being mounted and the belly pans must be aligned to the body before being mounted.
- The next step are displayed on the following slides.
- At this time the belly pans have had the initial cuts made and are ready to move on to the final cut and to be mounted.

Belly Pans

Plan For Next Semester

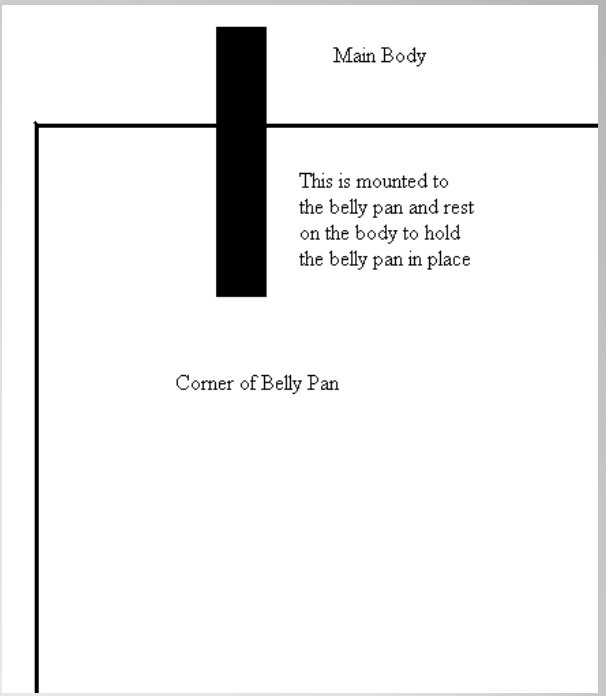
Mounting Brackets

- Same bracket system as the rest of the body
- Slider system for easy mounting and placement



Flush Mounting System

- Using a pin mounted to the corners of the car on the belly pan pieces to hold it at the correct position.



Belly Pans
Mounting

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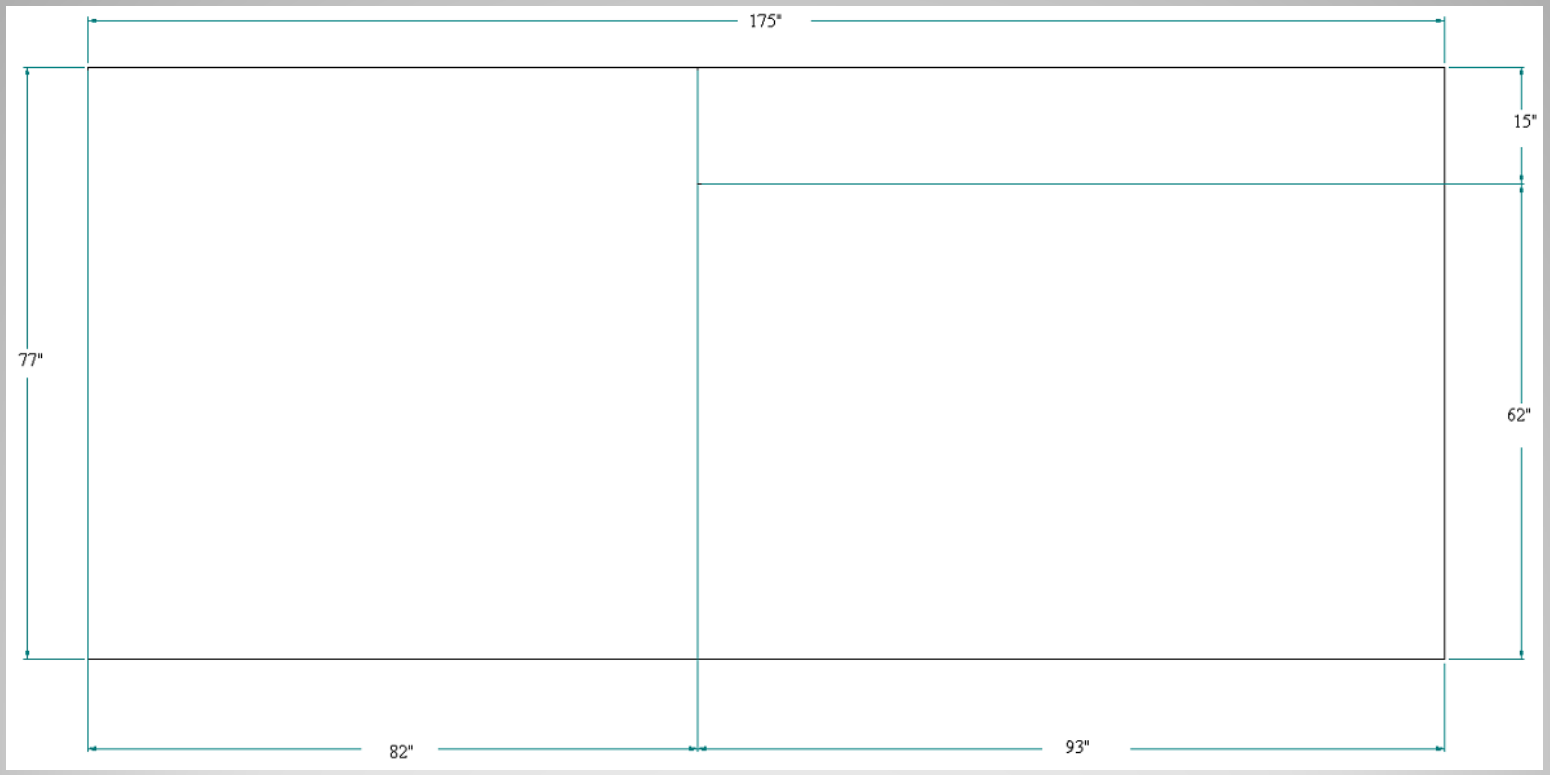
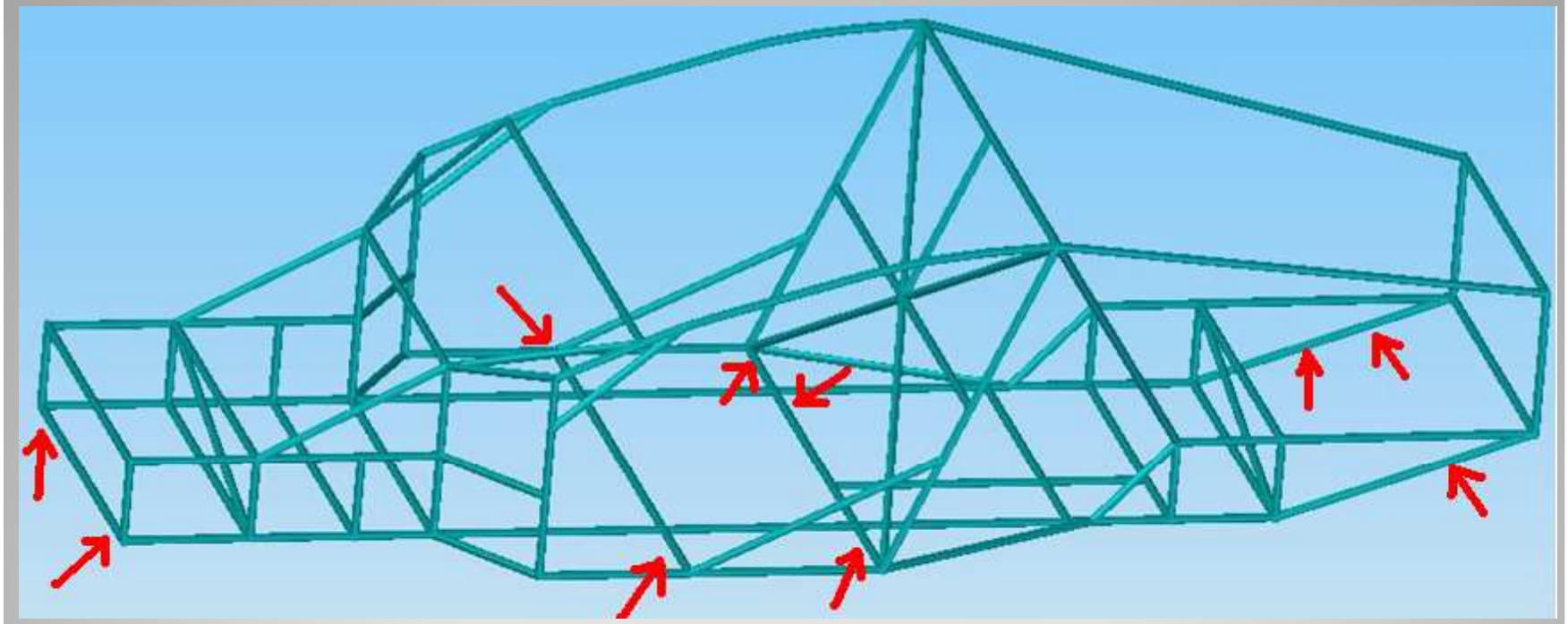
- This is the arrangement of the three pieces from front to back



Belly Pans

Layout of Pieces



Belly Pans

Mounting Positions

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Door Hinge

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Door Hinge location

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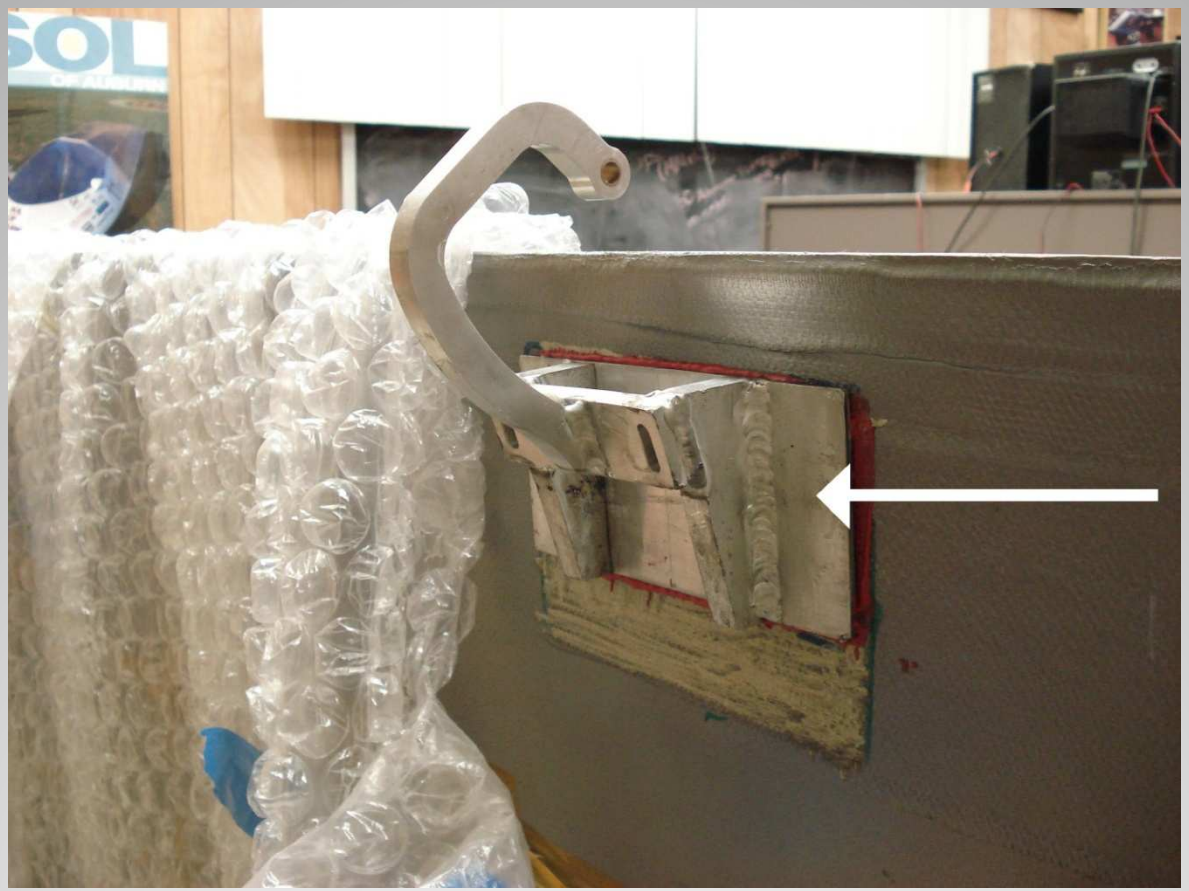

Trunk Hinge

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Trunk Hinge Location

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Outline

- Will prevent heat from motors from entering cabin
- Provide a sound dampening barrier between the occupants and the diesel engine
- Consist of eight sections
  - 4 inner, 4 outer
- Carbon Fiber Insulation

Firewall

Design Concepts

Interior Firewall Cut Out

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Outline

- Solving Engineering Design Issues In Almost Every Major System
- Next Steps:
  - Finish Troubleshooting Major issues
  - Finish Redesign of Components
  - Repair and Test Drive Systems
  - Create, Install and Test New System Designs

Conclusion

- Projects
  - Body Mounting - Josh
  - Belly Pan Mounting - Eric
  - Engine Mounting - Josh
  - Front Array Deployment
    - Stage 1 – Harry
    - Stage 2 - Eric
  - Steering Assembly - Billy
  - Door & Trunk Hinges - Billy
  - Firewall- Billy

Questions?

Responsibilities