

Orbital Test Stand

Progress Report

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James Ellis, and Nicholas Garcia

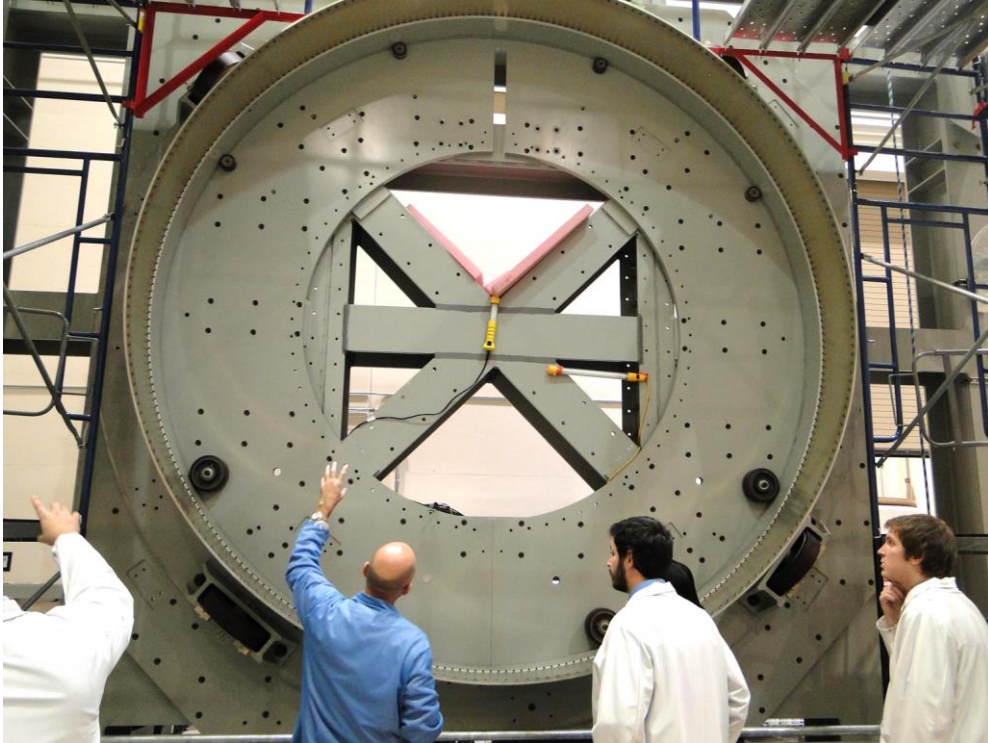
January 21, 2014



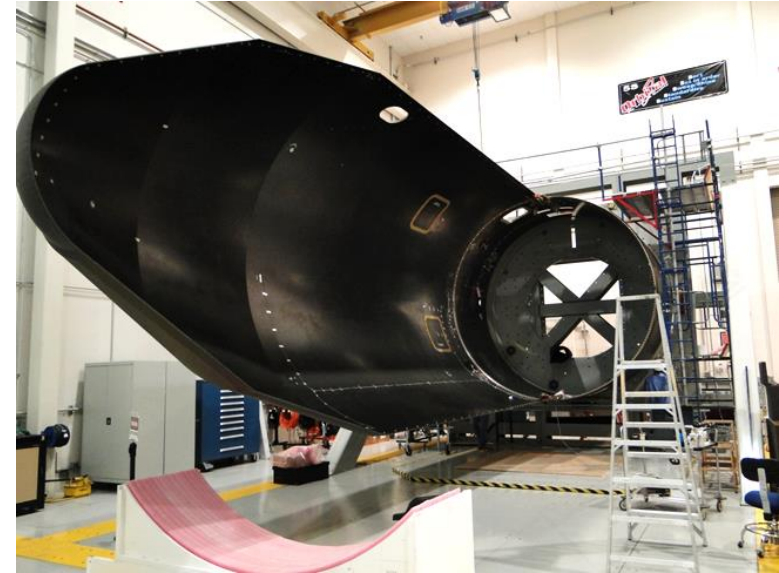
Overview

- Introduction
- Problem Definition Revisited
 - Customer Needs, Goals, Objectives, Constraints
- Wheels Design Revisited
 - Components
- Winter Break Progress
 - Implementation
 - Our concerns
- Spring 2015 Schedule
- Conclusion

Introduction



Orbital Test Stand with idea of scale



Test Stand with one 570-pound fairing loaded
Credit: Orbital

Calvin Boothe

Problem Definition

★ CUSTOMER NEEDS:

- The procedure for rotating launch vehicles on the test stand is inefficient and unsafe.
- Rotating launch vehicles on the test stand places Orbital engineers in a dangerous position.
- The setup time for testing is exhausted by the need to manually rotate the launch vehicles.



Calvin Boothe

Problem Definition

★ PROJECT GOALS:

- Easy to operate
- Easy to implement
- Easy to maintain
- Easy to inspect
- Meet customer requirements

Problem Definition

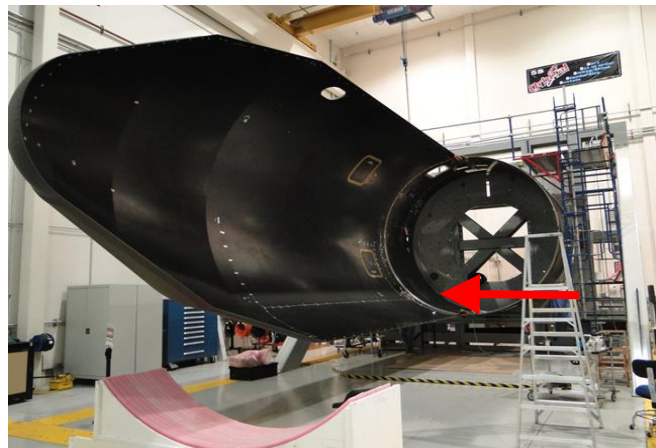
★ OBJECTIVES:

Objective	Measurement Basis	Units
Minimize time it takes to load launch vehicle onto test stand	Time to load launch vehicle with new mechanism in place compared to current procedure	minutes
Minimize costs associated with new design concept	New design cost compared to maintaining current procedure and other designs	dollars
Limit new modifications made to test stand	Cost of material for modifications	dollars
Handle the off-center loads of Antares payload fairings when loaded on stand	Strength	psi
Minimize space requirements	Square footage required by new mechanism	ft ²

Problem Definition

★ CONSTRAINTS:

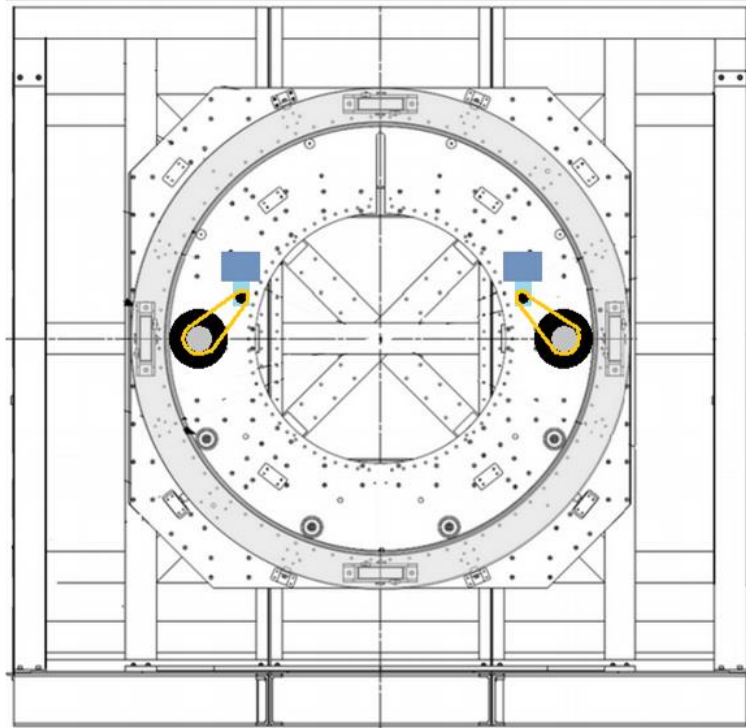
- Continuous rotation for +/- 360 degrees
- Rotational speed not exceeding 1 RPM
- Counteract off-centered load of **570 lb at 153 in**
- Minimal modifications



Credit: Orbital

Calvin Boothe

Wheels Design Revisited



Credit: Mary Begay

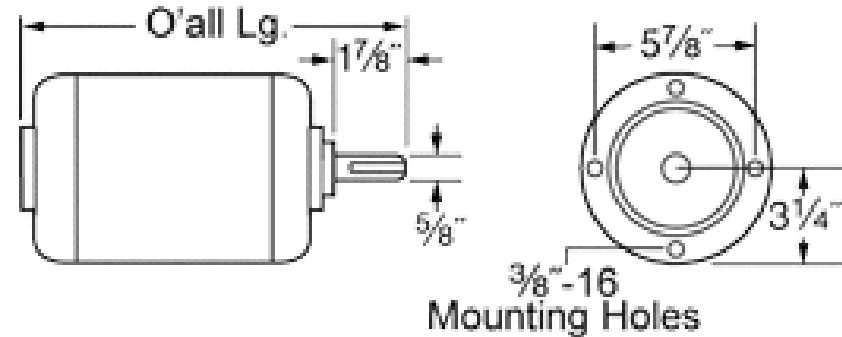


Credit: Pacifictrailers.com

Nick Garcia

Motor

- McMaster-Carr
- Part # 6135K79
- 1 Hp
- 1725 RPM
- Steel Housing
- Motor can directly be mounted to equipment
- Heavy duty applications with high starting torque

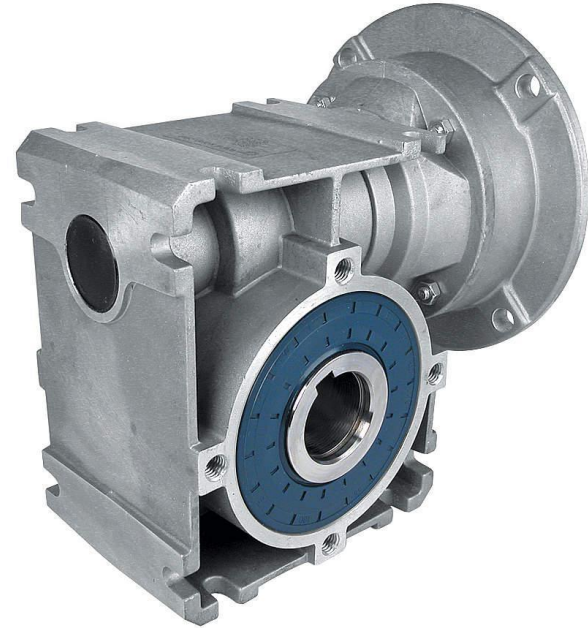


Credit: Mcmaster.com

Nick Garcia

Speed Reducer

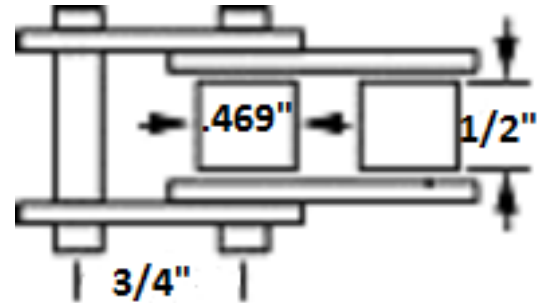
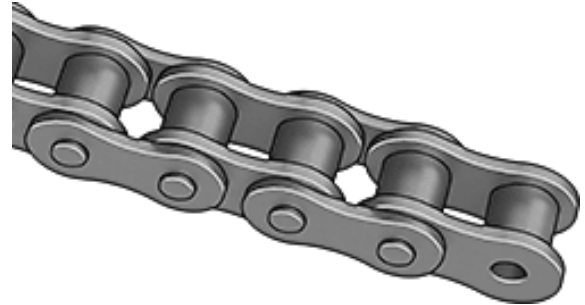
- Grainger
- Part # 29TL65
- 100:1 gear ratio
- 1 Stage - Reversible
- Nominal Output RPM - 18
- Max Torque - 1655 in-lb
- Aluminum housing
- Bronze alloy worm gear
- Hardened alloy steel worm pinion gear



Credit: Grainger.com

Roller Chain

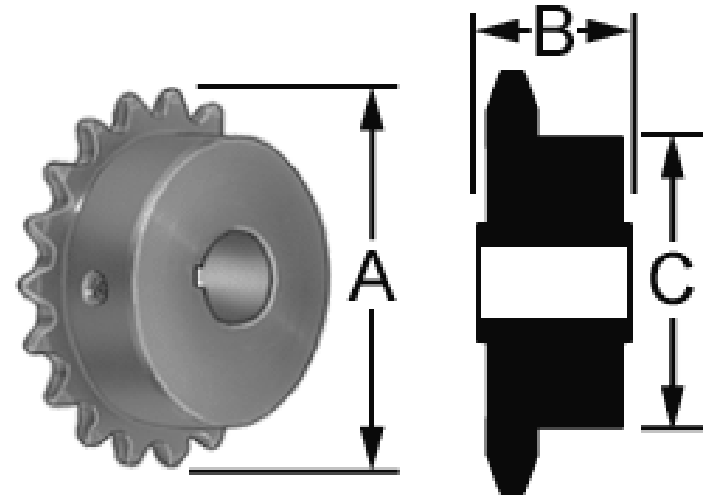
- McMaster-Carr
- Part # 6261K176
- Standard single strand
- Steel
- Working Load - 803 lbs
- Connecting link for lengths:
 - 1 - 20 ft
 - 50 ft
 - 100 ft



Credit: Mcmaster.com

Sprockets

- Gear Box
 - Part # 6280K479
 - 16 teeth
 - A - 4.22 in
 - B - 1.25 in
 - C - 3.06 in
- Wheel
 - Part # 6236K472
 - 32 teeth
 - A - 8.07 in
 - B - 1.25 in
 - C - 4.00 in



Credit: Mcmaster.com

Pneumatic Tires

- McMaster-Carr
- Part # 2181T31
- 16.1inch diameter
- J-Tread Type
- 4.7inch wheel width
- 590 lbf load rating
- 60 psi pressure rating
- Treaded tire has more load capacity vs smooth tire



Credit: Mcmaster.com

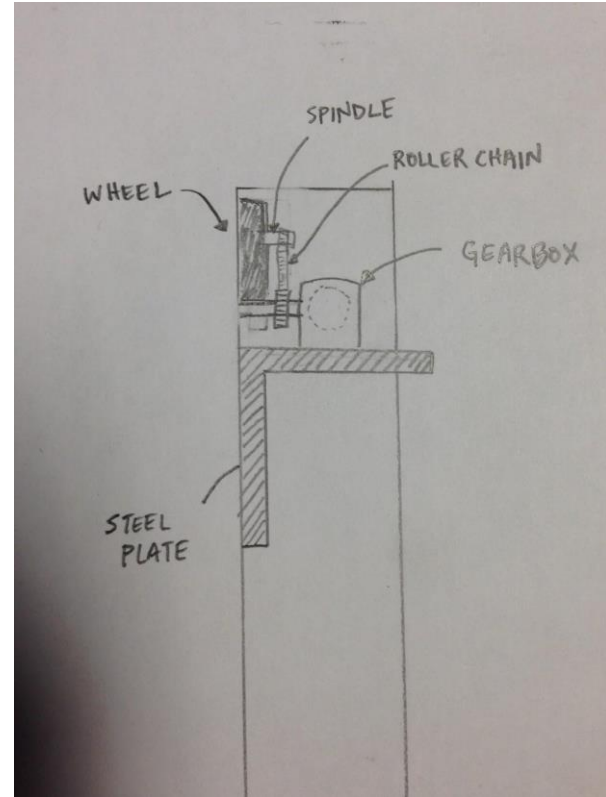
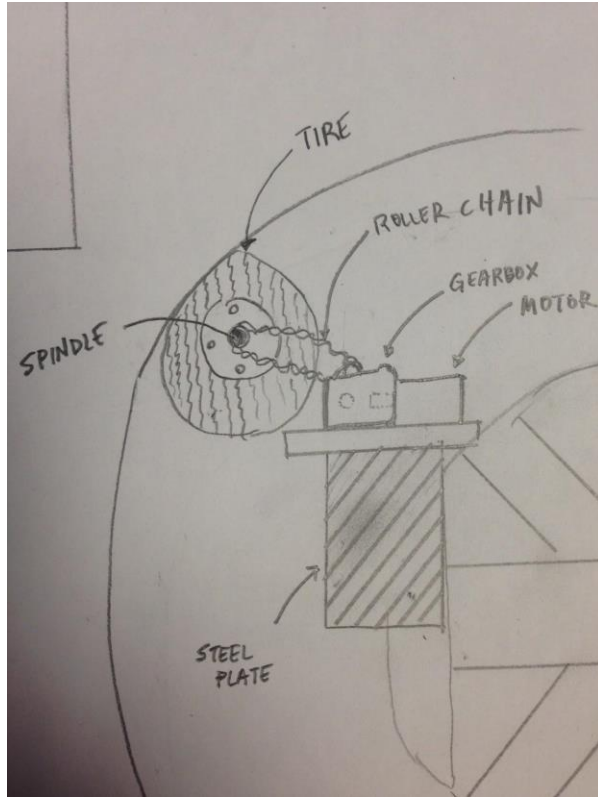
Spindle Assembly

- Gempler's
- 4 Hole Straight Spindle Stub Axle Assembly
- Option to weld onto flange or directly to mounting plate

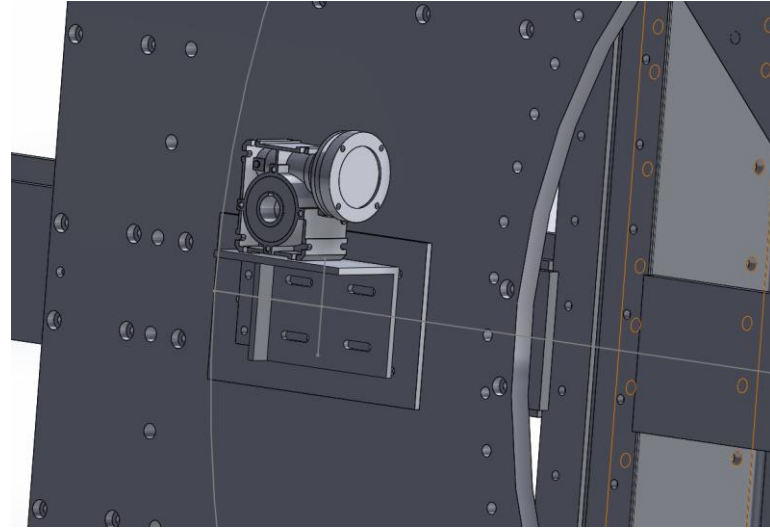
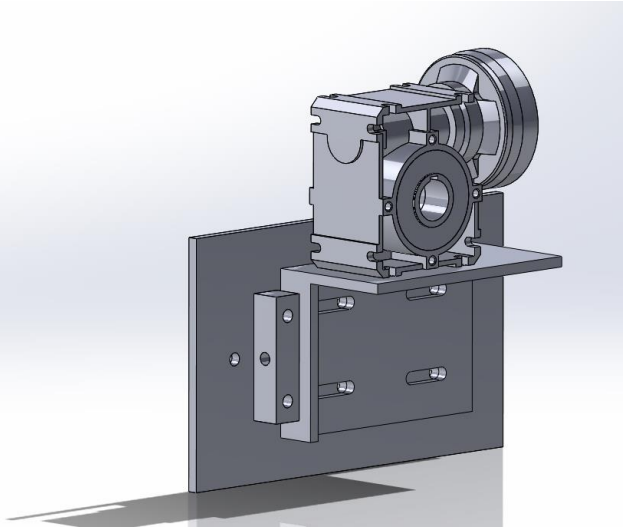


Credit: Pacifctrailers.com

Winter Break Progress



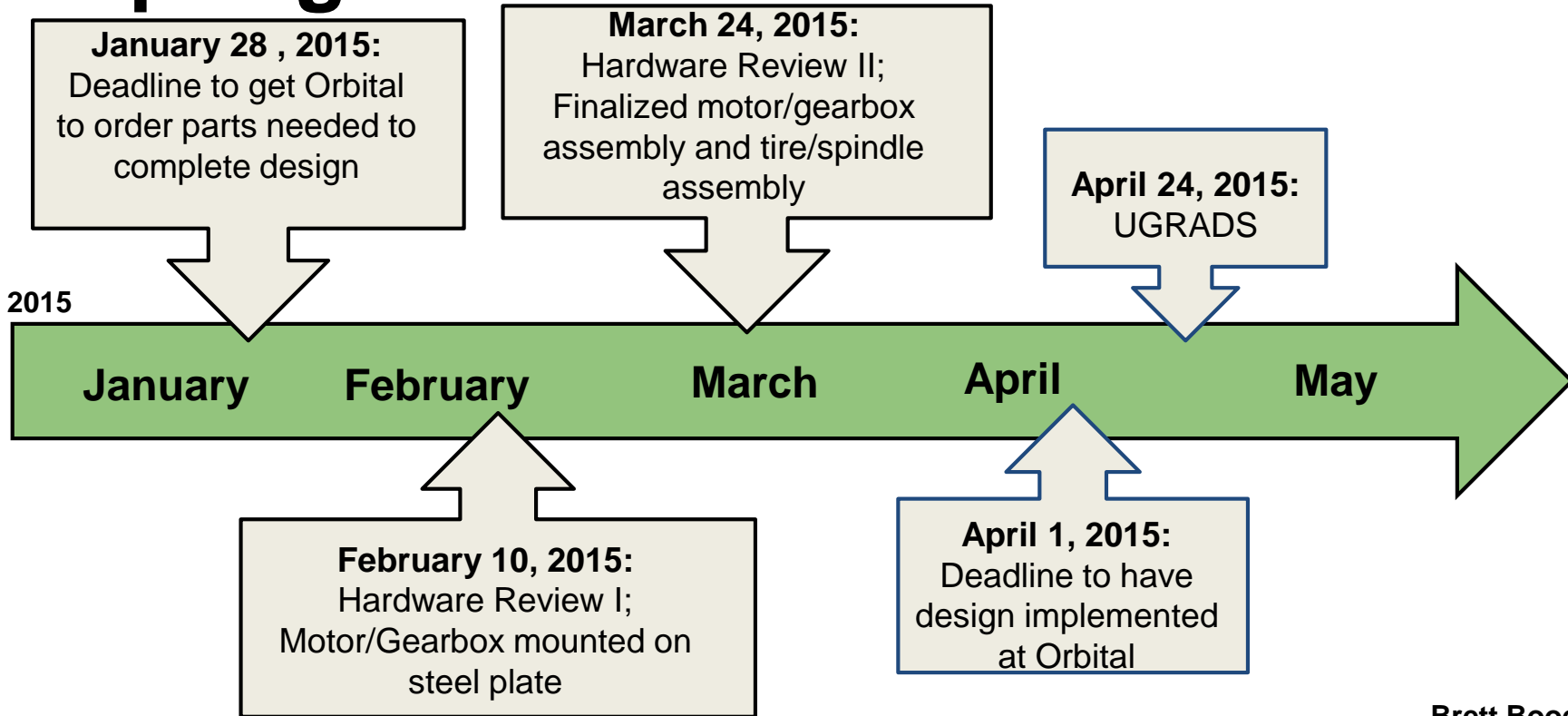
Adapter Plates & Assemblies



Our Concerns

- Steel plate mounting for the motor/gearbox assembly
- The 90-degree turn between motor and gearbox
- The drive shaft that comes out of the gear box
- Spindle mounting alignment
- Logistics for parts
- Potentially ordering parts that do not work
- Having design implemented by April 1, 2015

Spring 2015 Schedule



Conclusion

DONE:

- Completed final Wheel Design concept
- Established Spring 2015 schedule
- Set roles for team members

TO DO:

- Coordinate with Orbital to order parts in the next 4 to 5 days
- Finalize logistics plan by Friday for ordering, transporting, and storing parts
- Discuss \$4,015 budget with Orbital
- Ease remaining concerns by talking with Orbital



Orbital Test Stand

NAU Senior Capstone
Design Team

Left to Right:

James Ellis
Brett Booen
Calvin Boothe
Mary Begay
Nick Garcia