Brandon Cook

Miriam Deschine

Daniel Edmonds

Joshua Smith

OVERVIEW

- Project Scope
- Project Updates
- Hardware Review II
- Upcoming tasks

PROJECT SCOPE

This project consists of the design, manufacturing, and testing of a launch vehicle enclosure for Orbital ATK. The primary purpose of the enclosure is to provide launch vehicles protection from the elements during launch pad processing.

STATE OF CURRENT PROTOTYPE

Figure 1. Open Position of Prototype

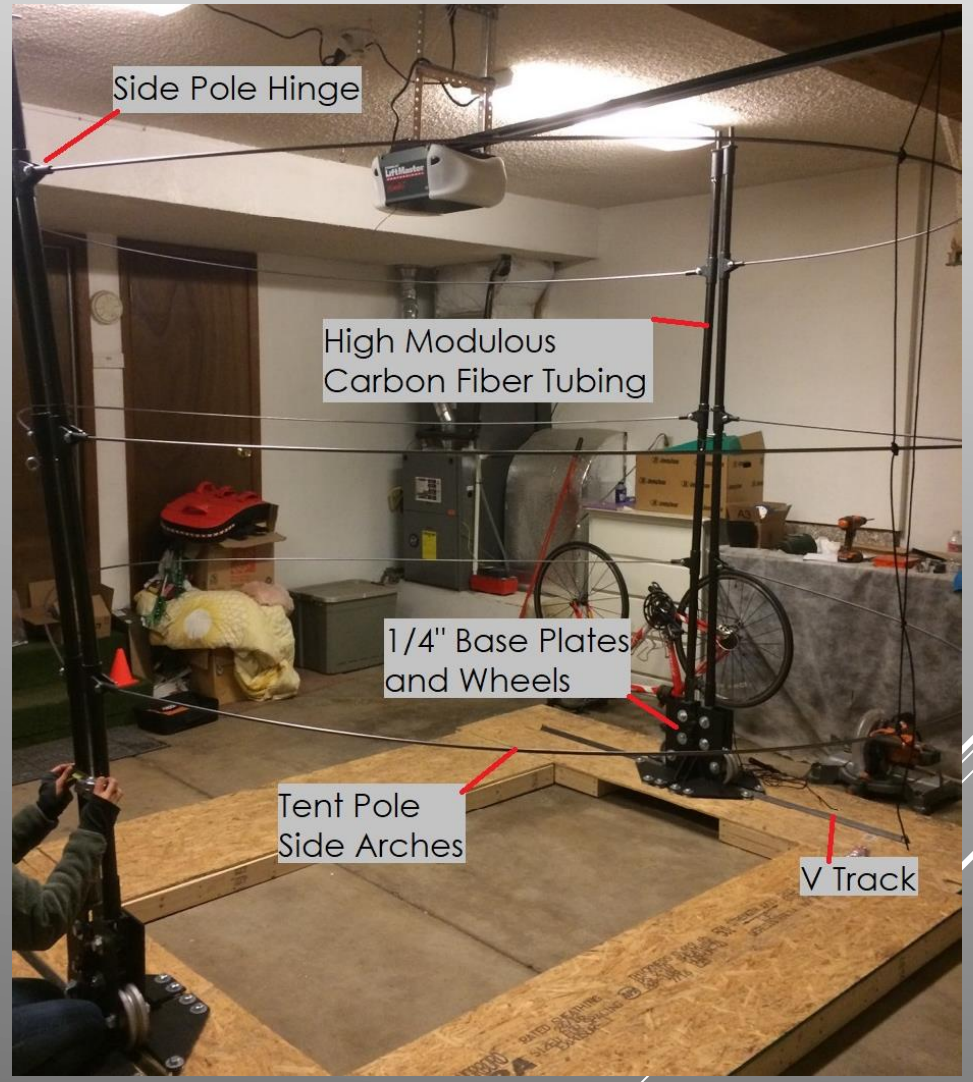

Figure 2. Upright Position of Prototype

UPDATES & DESIGN CHANGES

- Since Last Time:
  - CDR Presentation with Orbital ATK
  - Build Process
  - Design Testing Preparation
- Design Changes:
  - Hydraulic Rams to Pulleys
  - Open Bottom
  - Fabric Latch
- Manufacturing Process:
  - Sewing of the Fabric

HEAT TRANSFER ANALYSIS

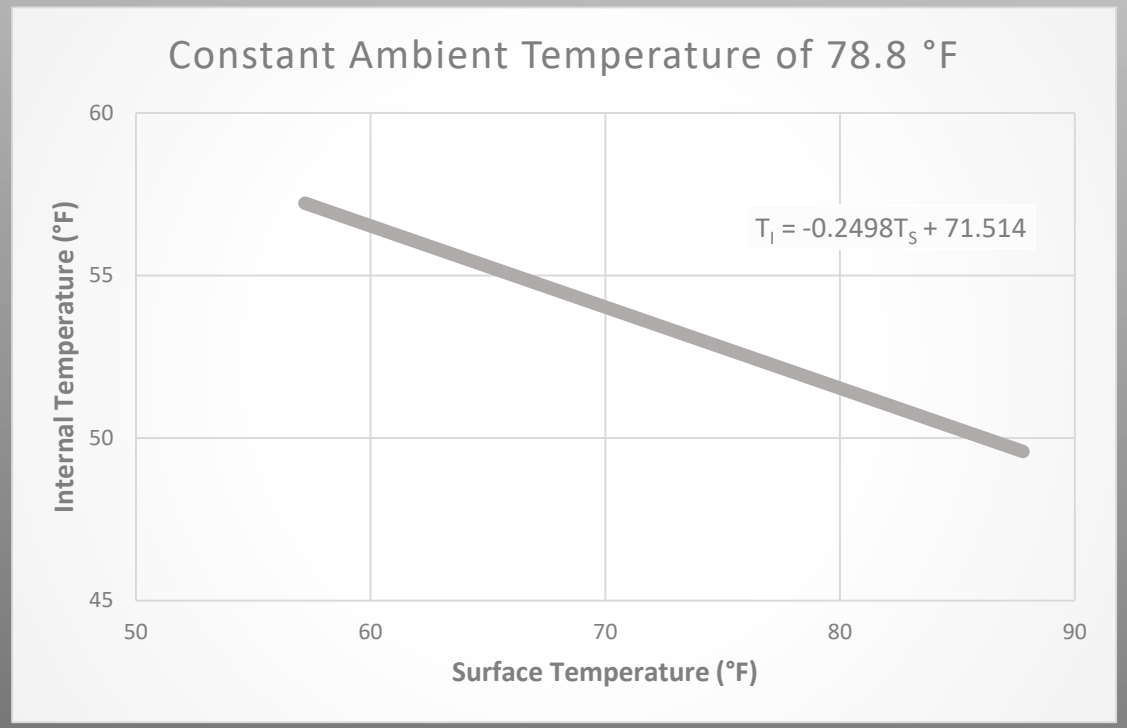

Figure 3. Heat Transfer analysis at constant ambient temperature

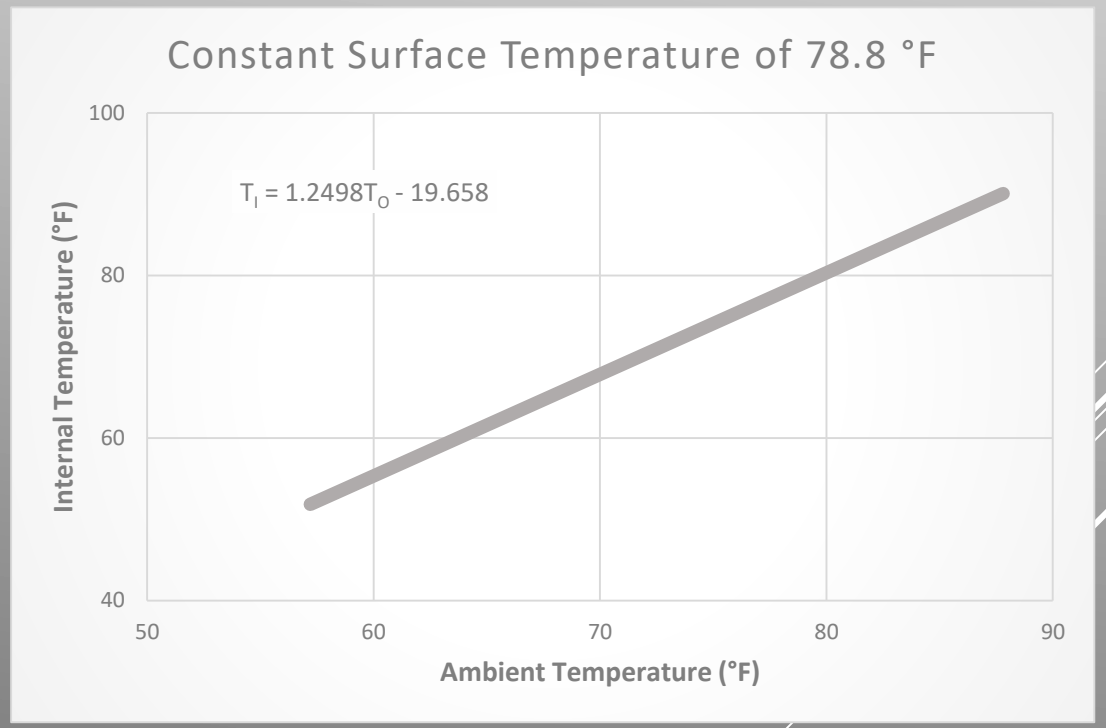

Figure 4. Heat Transfer analysis at constant surface temperature

STRESS ANALYSIS

- RISA 3D used for getting reaction forces
- Reaction forces used to calculate shear and bearing stress
- Ultimate shear and tensile strength used to get factor of safety

Table 1. Factors of Safety from RISA 3D analysis

Part	Yeild Factor of Safety	Failure Facture of Safety
Hinge Bolt		15.2
Hinge Plates	3.56	6
5/8" Base Plate Pin		3.24
Base Plates 5/8" Hole	2.82	4.75
Base Adaptor Plate 5/8" Hole	5.17	8.71
3/4" Base Plate Pin		4.67
Base Plates 3/4" Hole	3.39	5.7
Base Adaptor Plate 3/4" Hole	6.21	10.45

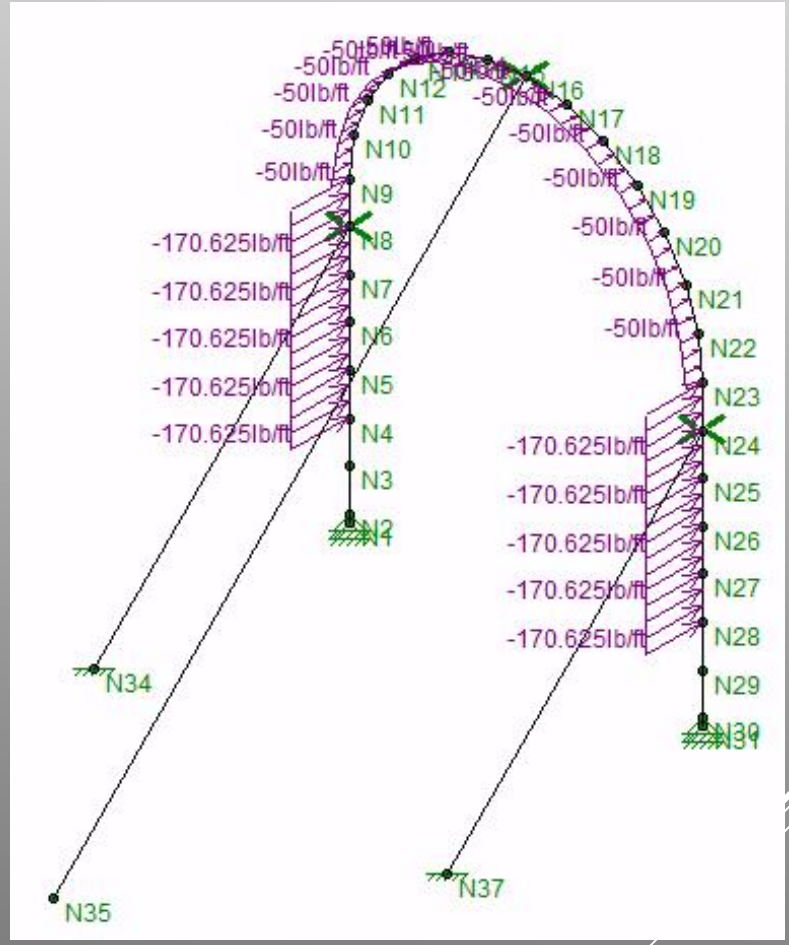

Figure 5. RISA 3D analysis

FLEXURAL ANAYLSIS

- Double Integration Method: $\theta(x) = \int \frac{M(x)}{EI} dx \ \& \ \Delta = \iint \frac{M(x)}{EI} dx$
- Fibers will snap prior to major deflection

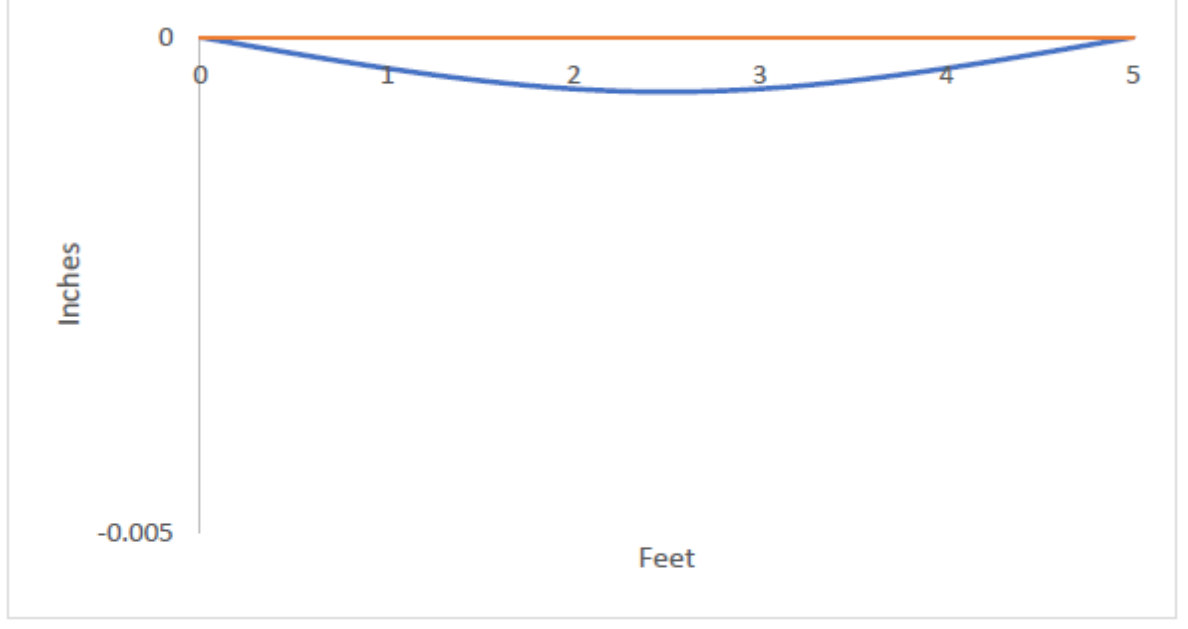

Figure 6. Flexural Analysis of 5 foot Carbon Section

WIND ANALYSIS

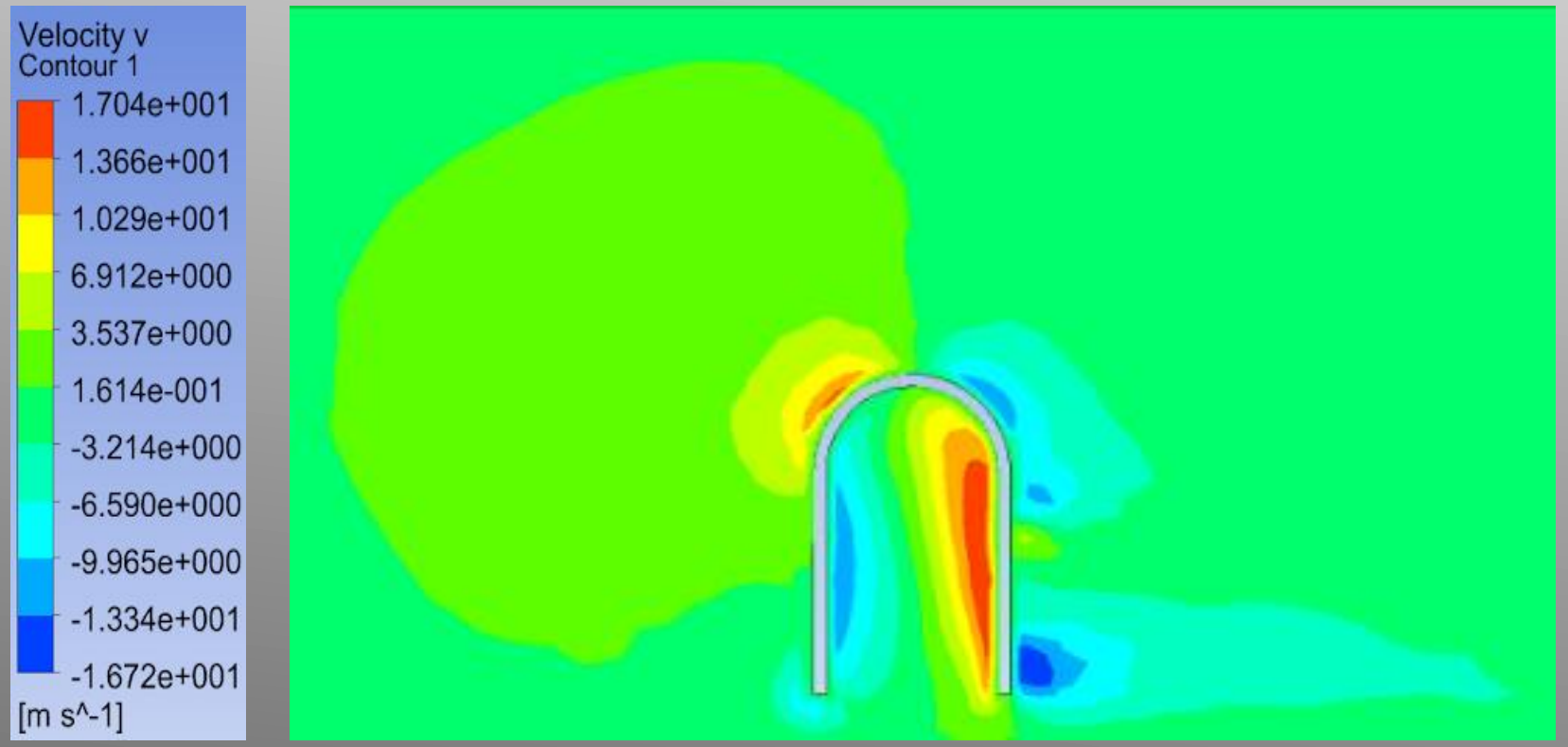

Figure 7. Vertical Velocity Components

STATE OF MANUFACTURING

Figure 8. Side Pole Hinge and Pulley

Figure 9. Open Position of Base Plates

STATE OF MANUFACTURING

Figure 10. Carbon Fiber Sections with Coupler

Figure 11. Connected Carbon Fiber Sections

STATE OF MANUFACTURING

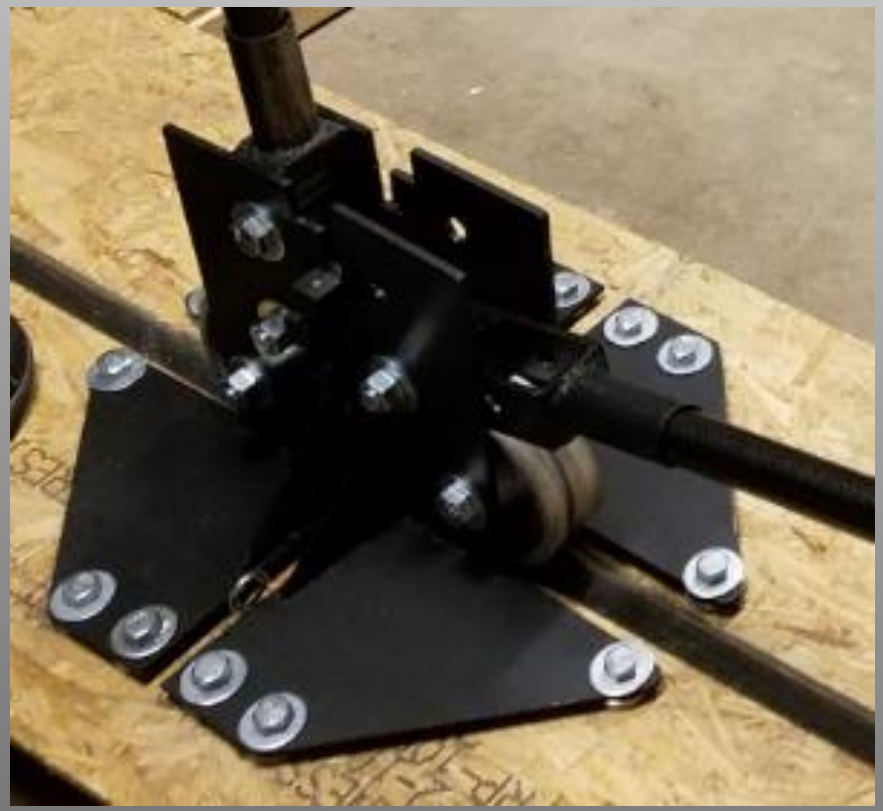

Figure 12. Half Open Position of Prototype at Base Plates

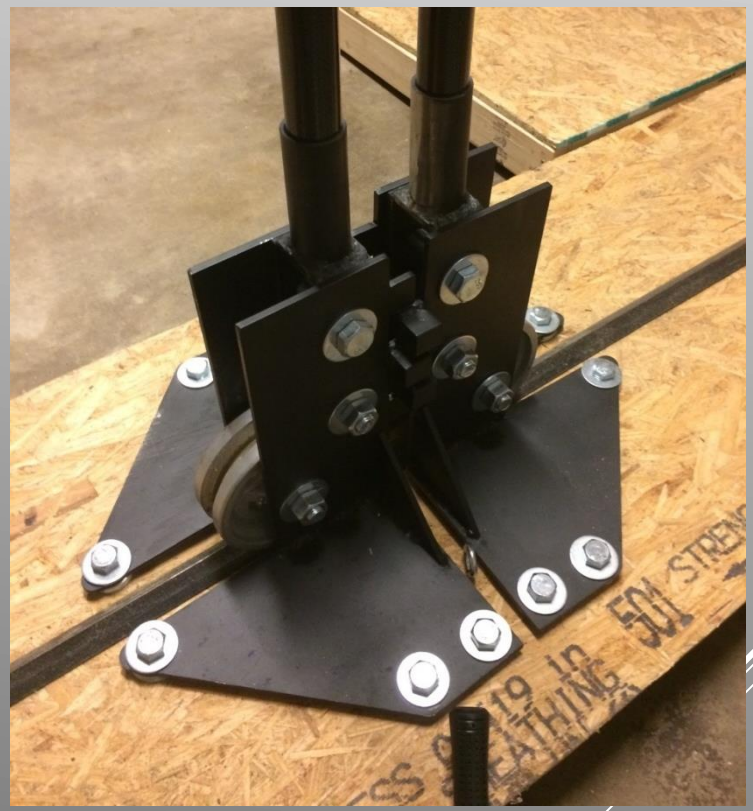

Figure 13. Closed Position of Prototype at Base Plates

BUILD SCHEDULE

Table 2. Major action items for the remaining of the project

Display Week:			1			Week 27				Week 28					Week 30							Week 32					Week 33			Week 34			Week 35			Week 36			Week 37			
						3 / 5 / 18				3 / 12 / 18					3 / 26 / 18							4 / 9 / 18					4 / 16 / 18			4 / 23 / 18			4 / 30 / 18			5 / 7 / 18			5 / 14 / 18			
	Task	**Lead**	**Start**	**End**	**Done**	T	F	S	S	M	T	W	T	F	M	T	W	T	F	S	S	M	T	W	T	F	M	T	W	M	T	F	W	T	F	M	T	W	M	T	W	T
4	**Phase 3: Spring 2018**																																									
4.03	Construction	Team	Fri 216/18	Mon 3/26/18	96%																																					
4.04	Midpoint Presentation	Team	Sun 3/11/18	Tue 3/13/18	100%																																					
4.05	Midpoint Report	Team	Fri 2/16/18	Fri 3/16/18	95%																																					
4.06	Hardware Review II	Team	Tue 3/13/18	Tue 3/20/18	95%																																					
4.07	Permability Testing	Miriam/Joshua	Fri 3/30/18	Fri 3/30/18	0%																																					
4.08	Heat Transfer Testing	Joshua	Sat 3/31/18	Sat 3/31/18	0%																																					
4.09	Flexural Testing	Miriam	Thu 3/29/18	Thu 3/29/18	0%																																					
4.1	Operational Testing	Brandon	Sun 3/11/18	Sat 3/31/18	50%																																					
4.11	Assembly Testing	Team	Sun 3/11/18	Sat 3/31/18	50%																																					
4.12	Internal Flow Testing	Team	Sat 3/31/18	Sat 3/31/18	0%																																					
4.13	Final Product Testing Proof	Team	Sun 3/11/18	Fri 4/13/18	20%																																					
4.14	UGRADS Practice	Team	Mon 4/16/18	Thu 4/26/18	0%																																					
4.15	UGRADS	Team	Fri 4/27/18	Fri 4/27/18	0%																																					
4.16	Final Report & CAD Package	Team	Fri 3/16/18	Fri 5/04/18	60%																																					
4.18	Peer Eval II	Individual	Fri 3/30/18	Fri 3/30/18	0%																																					
4.19	Peer Eval III	Individual	Tue 5/08/18	Tue 5/08/18	0%																																					
4.21	Website Check II	Dan	Fri 3/30/18	Fri 3/30/18	0%																																					
4.22	Website Check III	Dan	Tue 5/08/18	Tue 5/08/18	0%																																					
4.23	Assembly Manual	Team	Fri 3/16/18	Fri 4/20/18	0%																																					
4.24	Obital University Presentation (Tent.)	Team	Thu 5/17/18	Thu 5/17/18	0%																																					

TESTING PROCEDURES

- Permeability
  - Small prototype with HDPE skin
  - Span nozzle
  - Record flow rate – Bucket-Timer Method
  - Collection and measurement
- Flexural Strength
  - 3 Point Bend
  - Confirming Manufacturer's PDS
- Operations
  - Abnormal Wear of Components
  - Proper Functions

TESTING PROCEDURES

- Analysis of Temperature Effects
  - Launch vehicle temperature
  - Interior/Exterior
  - J-Type Thermocouples
- Assembly
  - Record steps of assembly
  - Scale time
  - Estimate final time
- Internal Flow
  - Circulation Within Enclosure
  - Abnormal Upward Forces
  - Ventilation

COST OVERVIEW

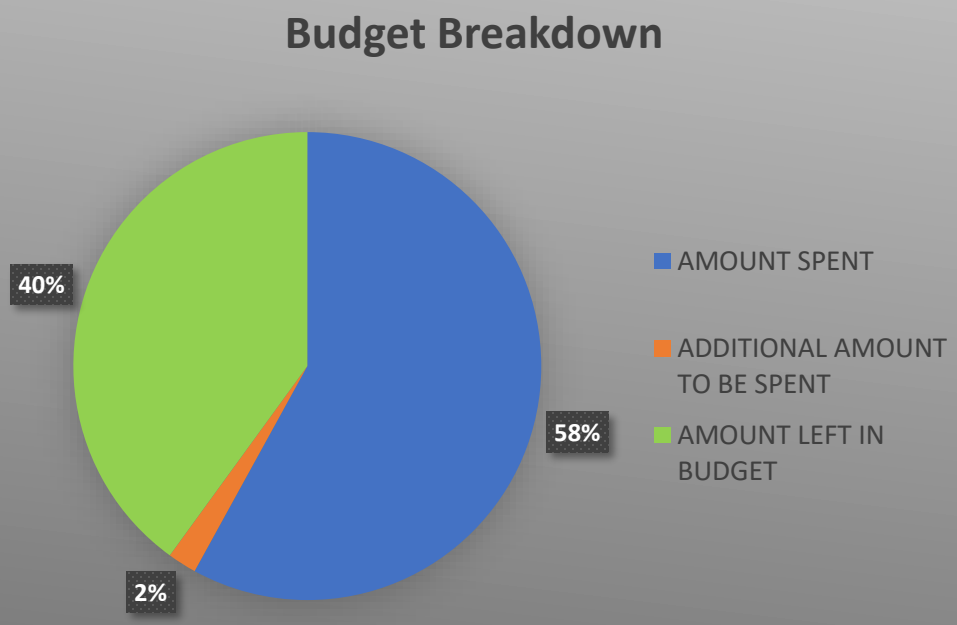

Figure 14. Budget Breakdown

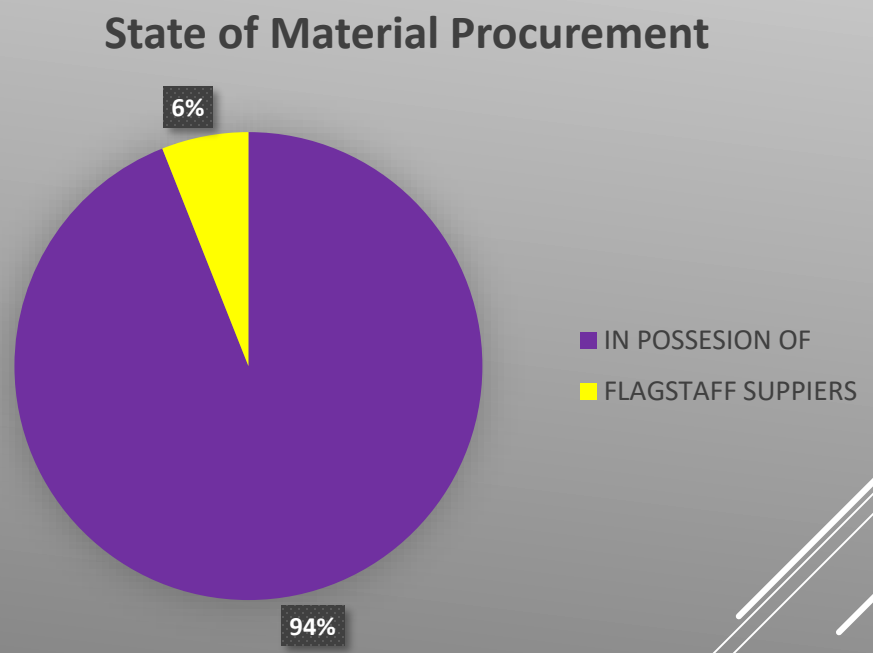

Figure 15. State of Material Procurement

COST OVERVIEW

Table 3. Prototype Bill of Materials and Status Excerpt

	Project Name			Orbital ATK Launch Vehical Enclosure			
	Team			Team D3: Brandon Cook, Miriam Deschine, Daniel Edmonds, Joshua Smith			
Parts and Materials	Vendor	Item #	Part Name	Qty	Description	Cost Per Unit ($)	Total Cost ($)
	Motion Industries	1	V-Grooved Wheel	4	Heavy Duty Track Guided Wheel	$51.55	$206.20
		2	Tax and Shipping	1		$23.59	$23.59
						Total:	$229.79
	Vendor	Item #	Part Name	Qty	Description	Cost Per Unit ($)	Total Cost ($)
	RockWest Composites	5	Carbon Fiber Poles	6	Main Vertical Beam Components	$283.79	$1,702.74
		6		1	Shipping and Handling	$32.09	$32.09
						Total:	$1,734.83
	Vendor	Item #	Part Name	Qty	Description	Cost Per Unit ($)	Total Cost ($)
	Amazon	7	Tent Poles	5	Arch Components	$22.99	$114.95
		8		1	Shipping, Handling and Tax	$0.00	$0.00
						Total:	$114.95
	Vendor	Item #	Part Name	Qty	Description	Cost Per Unit ($)	Total Cost ($)
	Arizona Sun Supply	34	ERCIAL 95™ 340 SHAD	3	HDPE material	Donated	$0.00
						Total:	$0.00
						PROJECT TOTAL:	**$2,888.20**

COST OVERVIEW

Table 4. Full Bill of Materials Excerpt

	Project Name			Orbital ATK Launch Vehical Enclosure			
	Team			Team D3: Brandon Cook, Miriam Deschine, Daniel Edmonds, Joshua Smith			
Parts and Materials	Vendor	Item #	Part Name	Qty	Description	Total Cost ($)	URL
	Hamilton	HA001	V-Grooved Wheel	4	Heavy Duty Track Guided Wheel	$282.36	www.hamilton.com
		HA002	Caster Axle	4	Bolt and nut for V-Grooved Wheel	$162.00	
					Total:	$444.36	
	Vendor	Item #	Part Name	Qty	Description	Total Cost ($)	URL
	Rock West Composites	RWC001	Main Vertical Beam	28	Main Vertical Beam Components	$12,000.52	www.rockwestcomposites.com
		RWC002	Side Pole	510	Interlocking Poles for Side Components	$11,928.90	
		RWC003	Top Arch	28	Main Top Arch Components	$7,324.52	
					Total:	$31,253.94	
	Vendor	Item #	Part Name	Qty	Description	Total Cost ($)	URL
	Discount Steel	DS001	ASTM A500 Bare Steel Pipe (3" SCH 80)	1	Side Pole Adaptor Sleeve pipe	$159.96	www.discountsteel.com
		DS002	ASTM A36 Hot Rolled Steel 3/4" Plate	1	Base Plate	$345.41	
		DS003	ASTM A36 Hot Rolled Steel 3/4" Plate	1	Base Plate	$180.17	
		DS004	ASTM A36 Hot Rolled Steel 1/4" Plate	1	Anchor Plate	$20.42	
		DS005	ASTM A36 Hot Rolled Steel Round Bar	1	Side Pole Adaptor	$22.87	
					Total:	$728.83	
Fabrication	Vendor	Process		Hrs	Description	Total Cost ($)	URL
	Eagar Welding	Surfacing		5	Finishing surfaces after welding parts together	$450.00	http://eagarwelding.com
		Welding		10	Welding plates together, adaptor parts	$900.00	
		Powder Coating		3	Finish coating after surfacing for rust resistance	$270.00	
		Stamping		10	Cutting Steel Plates	$900.00	
		Estimated Hours			Total:	$2,520.00	
					PROJECT TOTAL:	**$52,606.39**	

QUESTIONS?