

# NG Super Sonic Rocket

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Figure 1: Two stage rocket  
University of Sheffield [1]

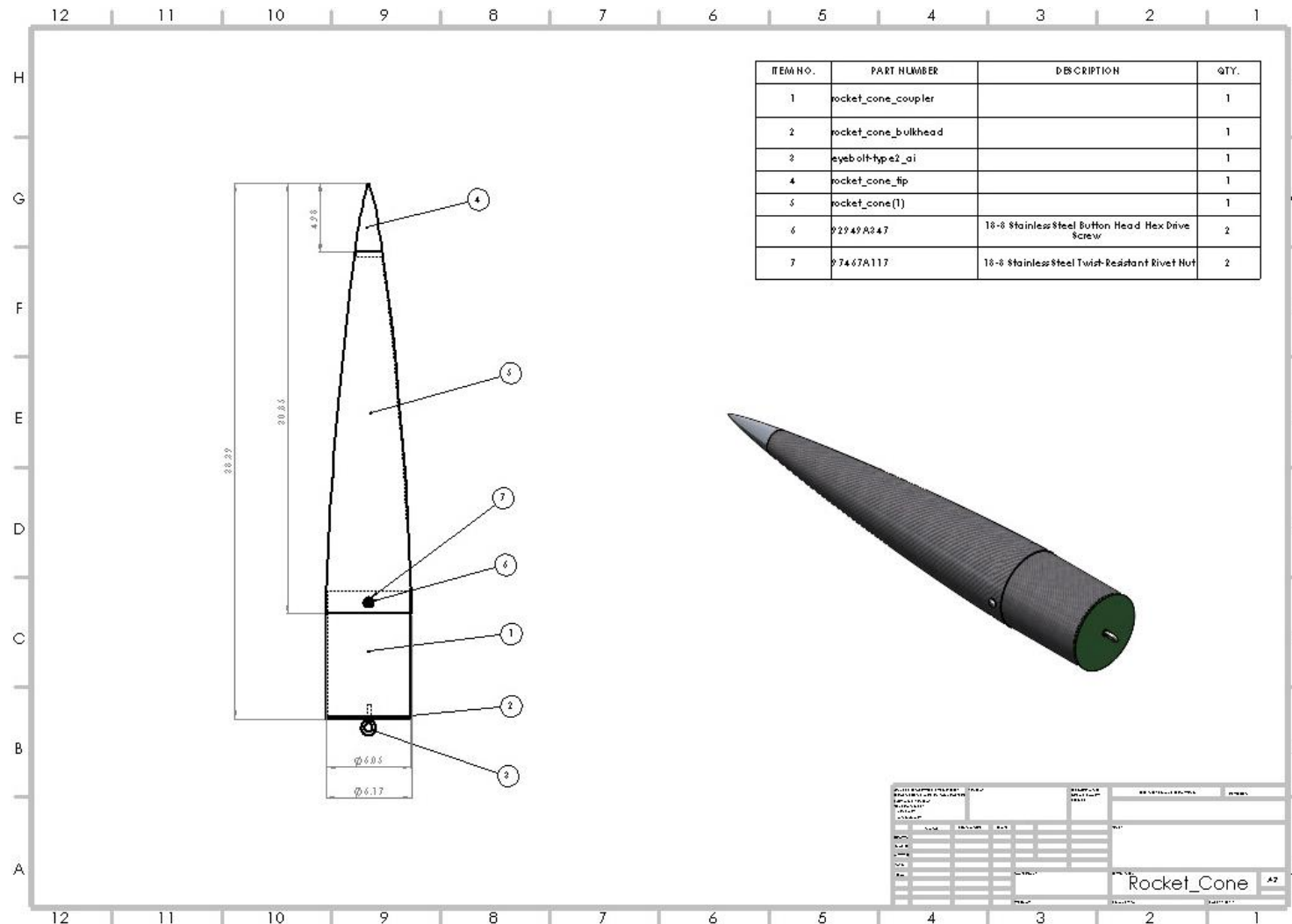
# Project Description

- Our team is building a two-stage supersonic rocket out of Carbon Fiber Materials. The goal is to meet a set of advanced requirements no other Capstone Team. These include an altitude of 40,000ft, a sustained speed of Mach 2, and hold a 10 lb. payload. The budget for this project is \$7,000 and the team expects to use every dollar to achieve this goal.
- Stakeholders
  - Northrop Grumman

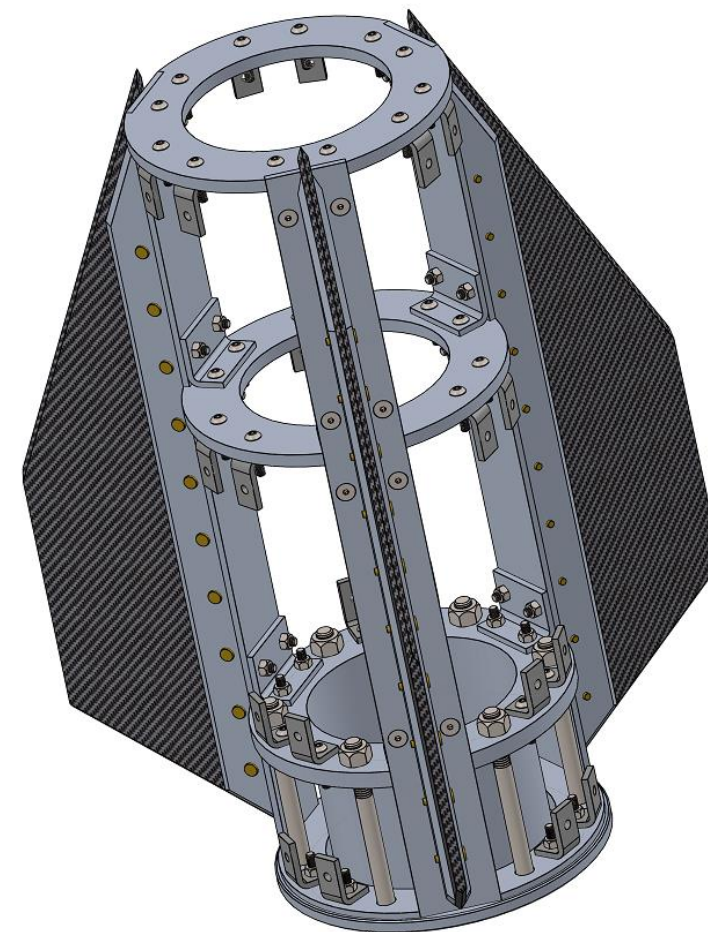
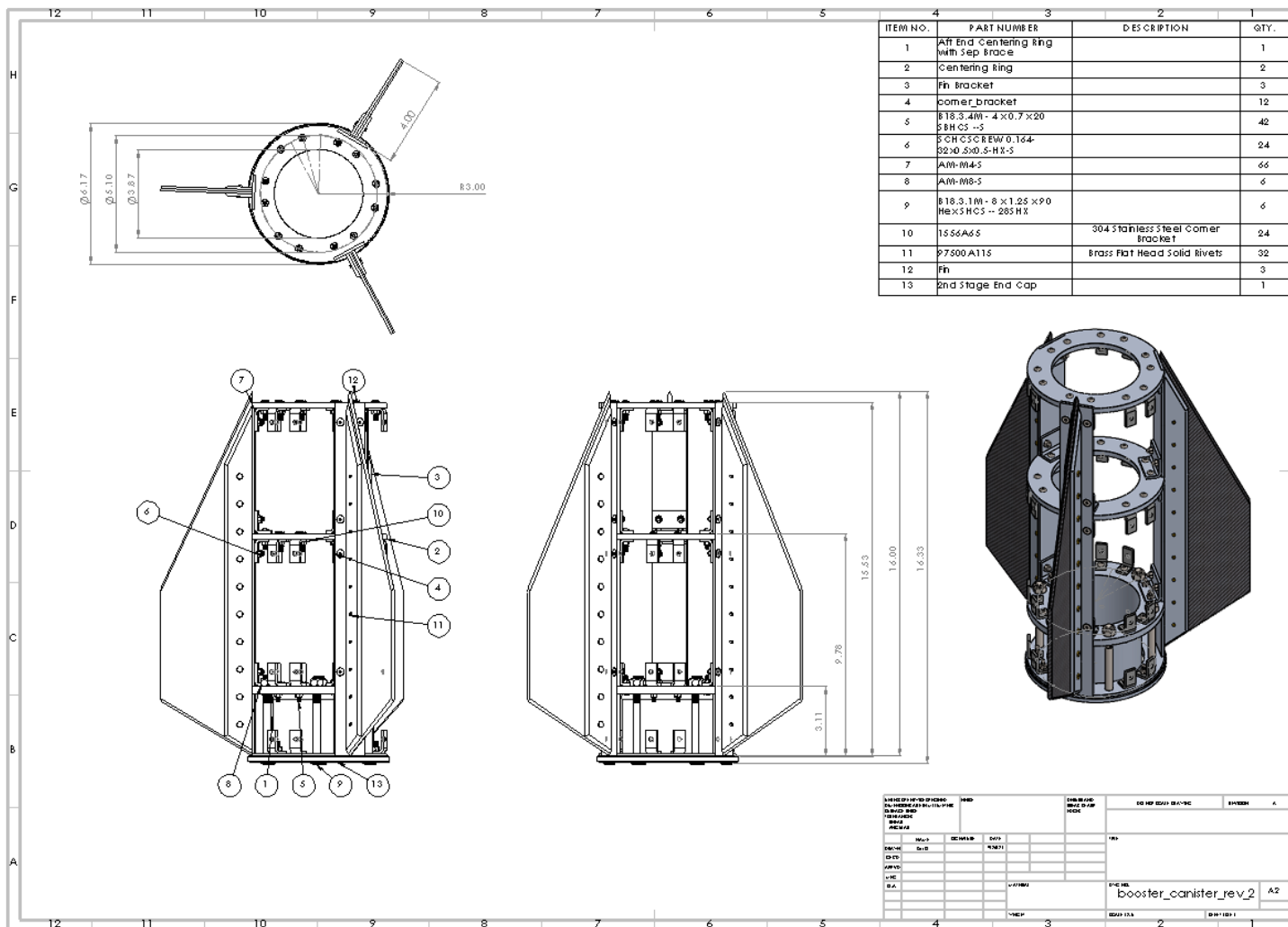
# Design Effort

- Fin Canisters
  - Fully Designed
  - Hardware included
- Separation System Design
  - 95% Designed
- Full Vehicle Design is 90% Completed

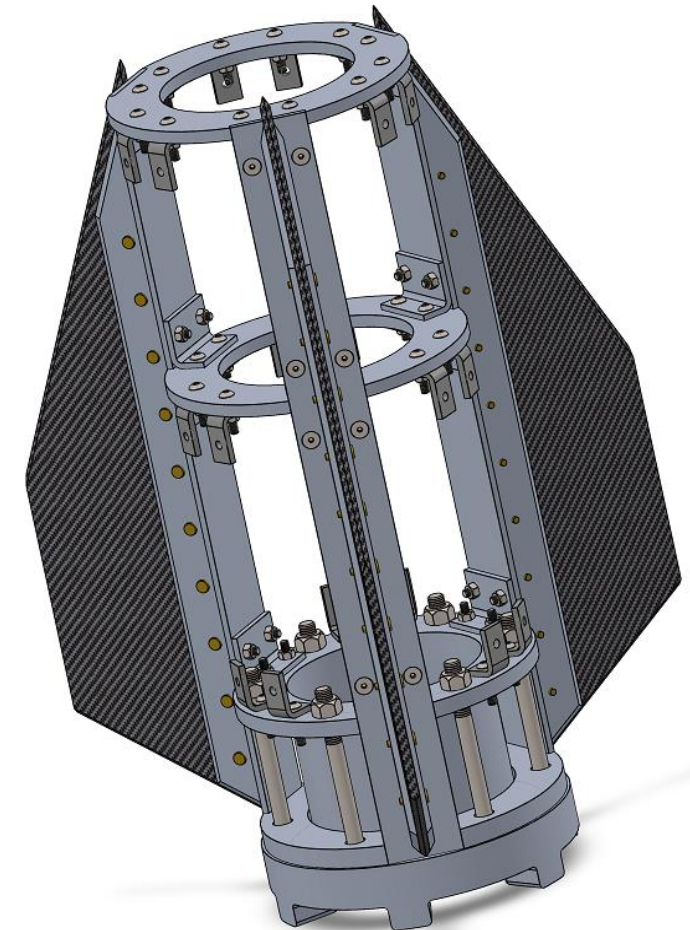
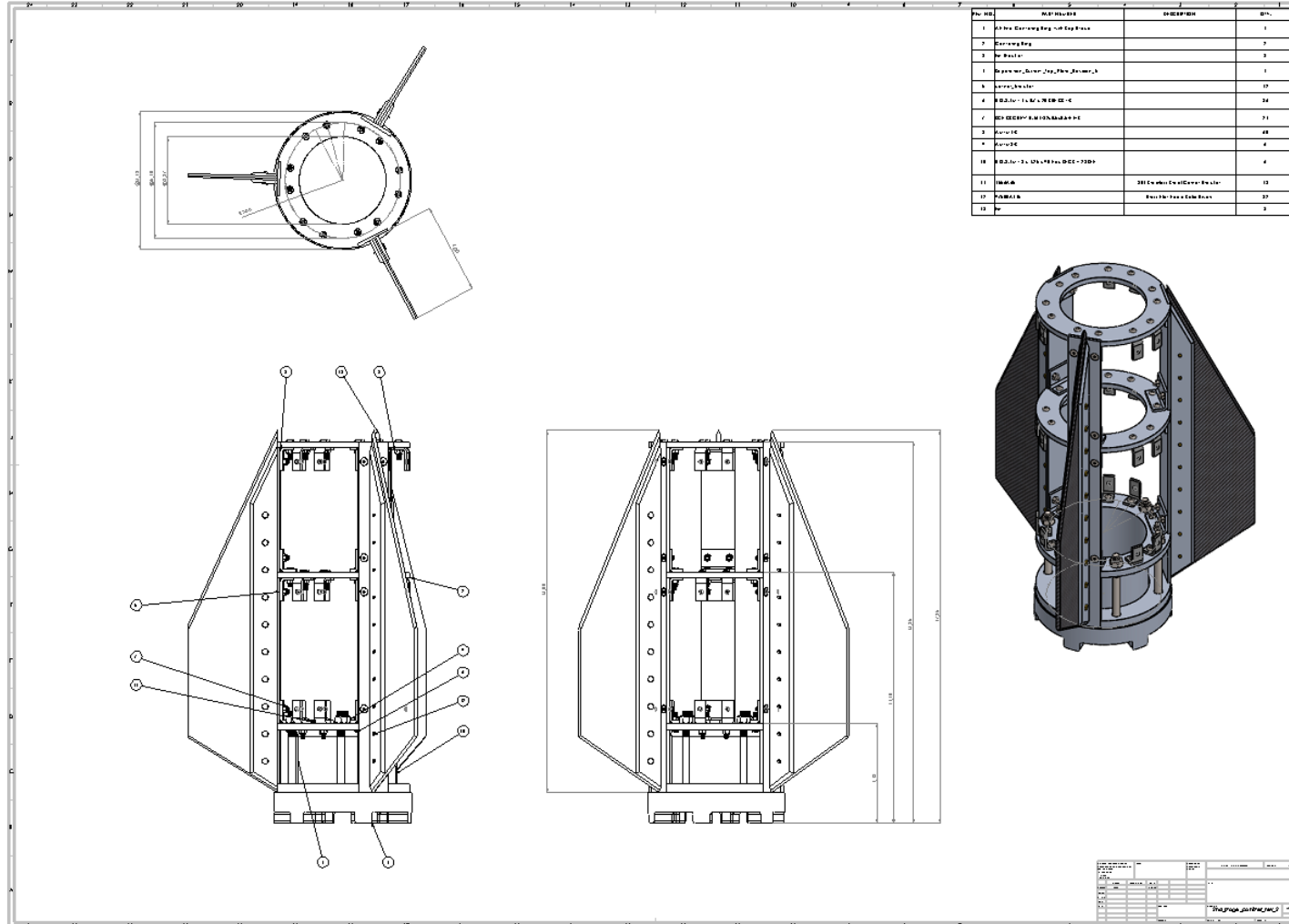
# Nose Cone Assembly



# Booster Fin Canister



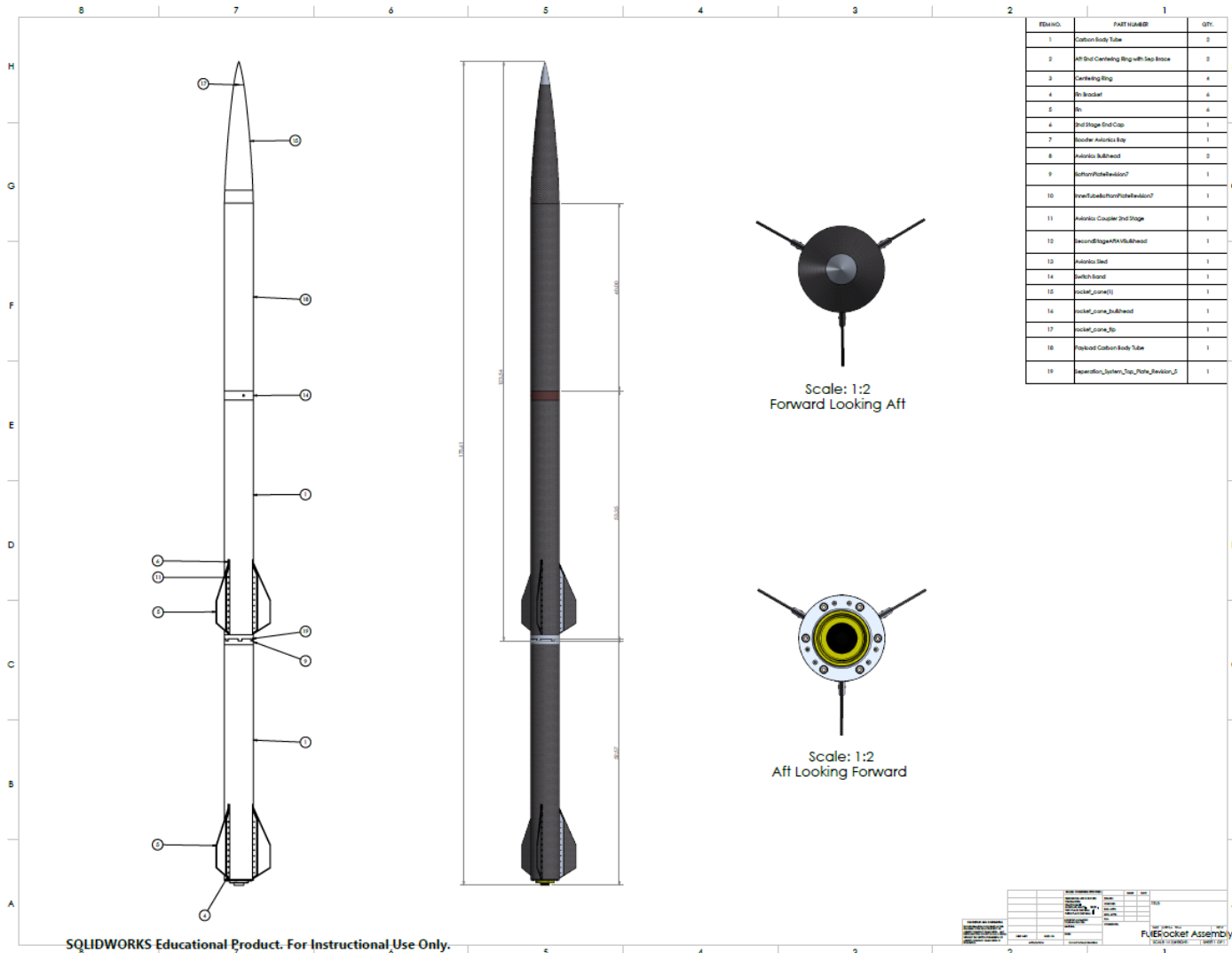
# Second Stage Vehicle Fin Canister



# Sep System

- Due to NDA Restriction cannot show design.
- 95% designed
- Ready for more testing
- Ready to finish engineering drawings
- Ready for manufacture

# Full Launch Vehicle Design





# Bill of Materials (BOM)

SUBSYSTEM	ITEM NO.	PART NUMBER	DESCRIPTION	MATERIAL	QTY.	PRICE (\$)	TOTAL PRICE (\$)	ACQUISITION METHOD	PRIMARY VENDOR
NOSECONE	1	1	Nose Cone Shell	Carbon Fiber	1	N/A	N/A	Manufacture	NovaKinetics
	2		Nose Cone Coupler	Aluminum	1	N/A	N/A	Manufacture	
	3		Nose Cone Bulkhead	Aluminum	1	N/A	N/A	Manufacture	
	4		eyebolt-type2_ai	Steel	1	N/A	N/A	Donated	
	5		Metal Nose Cone Tip	Steel	1	N/A	N/A	Manufacture	
	6	92949A347	Button Head Hex Drive Screw	18-8 SS	2	\$0.76	\$1.52	Order	McMaster Carr
	7	97467A117	Twist-Resistant Rivet Nut	18-8 SS	2	\$3.07	\$6.14	Order	McMaster Carr
BODY	8		2nd Stage Body Tube (50in. X 6.17in.)	Carbon Fiber	1	N/A	N/A	Manufacture	NovaKinetics
	9		Payload Body Tube	Carbon Fiber	1	N/A	N/A	Manufacture	NovaKinetics
	10		Lower Body Tube	Carbon Fiber	1	N/A	N/A	Manufacture	NovaKinetics
FIN CANISTERS	11		Aft End Centering Ring with Sep Brace	Aluminum	2	N/A	N/A	Manufacture	
	12		Centering Ring	Aluminum	4	N/A	N/A	Manufacture	
	13		Fin Bracket	Aluminum	6	N/A	N/A	Manufacture	
	14		Corner Bracket	Aluminum	24	N/A	N/A	Manufacture	
	15	92095A196	M4 Button Head Hex Drive Screw	Passivated 18-8 Stainless Steel	78	\$8.69	\$17.38	Order	McMaster Carr
	16	91263A516	Hex Drive Flat Head Screw	Zinc-Plated Alloy Steel	48	\$8.82	\$17.64	Order	McMaster Carr
	17	94645A101	M4 Nylon Lock Nut	Zinc-Plated Steel	126	\$14.05	\$28.10	Order	McMaster Carr
	18	94645A210	M8 Nylon Lock Nut	Zinc-Plated Steel	12	\$11.16	\$11.16	Order	McMaster Carr
	19	91292A213	18-8 Stainless Steel	Stainless Steel	12	\$7.94	\$23.82	Order	McMaster Carr
	20	1556A65	Stainless Steel Bracket	Stainless Steel	42	\$2.59	\$2.59	Order	McMaster Carr
	21	97500A115	Brass Flat Head Rivet	Brass	64	\$10.62	\$10.62	Order	McMaster Carr
	22		Fin	Carbon Fiber	6			Manufacture/Donated	NovaKinetics
	24		2nd Stage End Cap	Aluminum	1			Manufacture	

# Bill of Materials (BOM)

AVIONICS	25		Avionics Coupler 2nd Stage	Steel	1	N/A	N/A	Donated	NAU Rocket Club
	26		Avionics Bulkhead	Aluminum	2	N/A	N/A	Donated	NAU Rocket Club
	27		flat washer type a narrow_ai	Aluminum	12	N/A	N/A	Donated	NAU Rocket Club
	28		eyebolt-type2_ai	Steel	2	N/A	N/A	Donated	NAU Rocket Club
	29		Avionics Sled (3D Printed)	3D Polymer	1	N/A	N/A	Donated	NAU Rocket Club
	30		Raven 4 v9		2	N/A	N/A	Donated	NAU Rocket Club
	31		GPS Tracker v15		1	N/A	N/A	Donated	NAU Rocket Club
	32	92001A321	18-8 Stainless Steel Wing Nut	18-8 SS	8	N/A	N/A	Donated	NAU Rocket Club
	33	90322A657	High-Strength Steel Threaded Rod	Steel	4	N/A	N/A	Donated	NAU Rocket Club
	34		Switch Band	Copper	1	N/A	N/A	Donated	NAU Rocket Club
	35		hex thick nut_ai	Steel	2	N/A	N/A	Donated	NAU Rocket Club

\*SEPERATION SYSTEM OMITTED DUE TO NDA BUT INCLUDED IN FINAL CALCULATIONS BELOW\*

				<b>Total Parts Needed</b>	512		\$342.29	<b>Total Parts Received</b>	74
				<b>Total Spent</b>			\$217.12	<b>Parts Required (%)</b>	14.45%
								<b>Assembled (%)</b>	14.45%








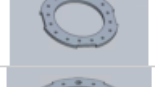

# Purchasing Plan

ITEM NO.	PART	DESCRIPTION	QUANTITY	PRICE	TOTAL UNIT PRICE	VENDOR	STATUS	RESOURCE
1	92949A347	Button Head Hex Drive Screw	2	\$ 0.76	\$ 1.52	McMaster Carr		<a href="https://www.mcm">https://www.mcm</a>
2	97467A117	Twist-Resistant Rivet Nut	2	\$ 3.07	\$ 6.14	McMaster Carr		<a href="https://www.mcm">https://www.mcm</a>
3	92095A196	M4 Button Head Hex Drive Screw	78	\$ 8.69	\$ 17.38	McMaster Carr		
4	91263A516	Hex Drive Flat Head Screw	48	\$ 8.82	\$ 17.64	McMaster Carr		
5	94645A101	M4 Nylon Lock Nut	126	\$ 14.05	\$ 28.10	McMaster Carr		
6	94645A210	M8 Nylon Lock Nut	12	\$ 11.16	\$ 11.16	McMaster Carr		
7	91292A213	18-8 Stainless Steel	12	\$ 7.94	\$ 23.82	McMaster Carr		
8	1556A65	Stainless Steel Bracket	42	\$ 2.59	\$ 2.59	McMaster Carr		
9	97500A115	Brass Flat Head Rivet	64	\$ 10.62	\$ 10.62	McMaster Carr		
10	Avionics Bulkhead		2	N/A	N/A	Donated		NAU Rocket Club
11	Avionics Coupler 2nd Stage		1	N/A	N/A	Donated		NAU Rocket Club
12	flat washer type a narrow_ai		12	N/A	N/A	Donated		NAU Rocket Club
13	eyebolt-type2_ai		3	N/A	N/A	Donated		NAU Rocket Club
14	Avionics Sled	3d Printed Avionics Sled	1	N/A	N/A	Donated		NAU Rocket Club
15	Raven 4 v9	Flight altimeter	2	N/A	N/A	Donated		NAU Rocket Club
16	GPS Tracker v15		1	N/A	N/A	Donated		NAU Rocket Club
17	92001A321	18-8 Stainless Steel Wing Nut	8	N/A	N/A	Donated		NAU Rocket Club
18	90322A657	High-Strength Steel Threaded Rod	4	N/A	N/A	Donated		NAU Rocket Club
19	Switch Band		1	N/A	N/A	Donated		NAU Rocket Club
20	Hex thick nut_ai		2	N/A	N/A	Donated		NAU Rocket Club
21	Carbon Fiber	Total sqft	109	N/A	N/A	Donated		NovaKinetics

\*Majority of purchased parts are for the Separation System\*

				Total Required:	\$ 342.29	Percent Purchased:	65.24%
				Total Purchased:	\$ 223.32	Percent Donated:	8.3%
				Total Items:	460	Total Percent Aquired:	16.09%
				Total Aquired:	74		

# Manufacturing Plan (1/2)

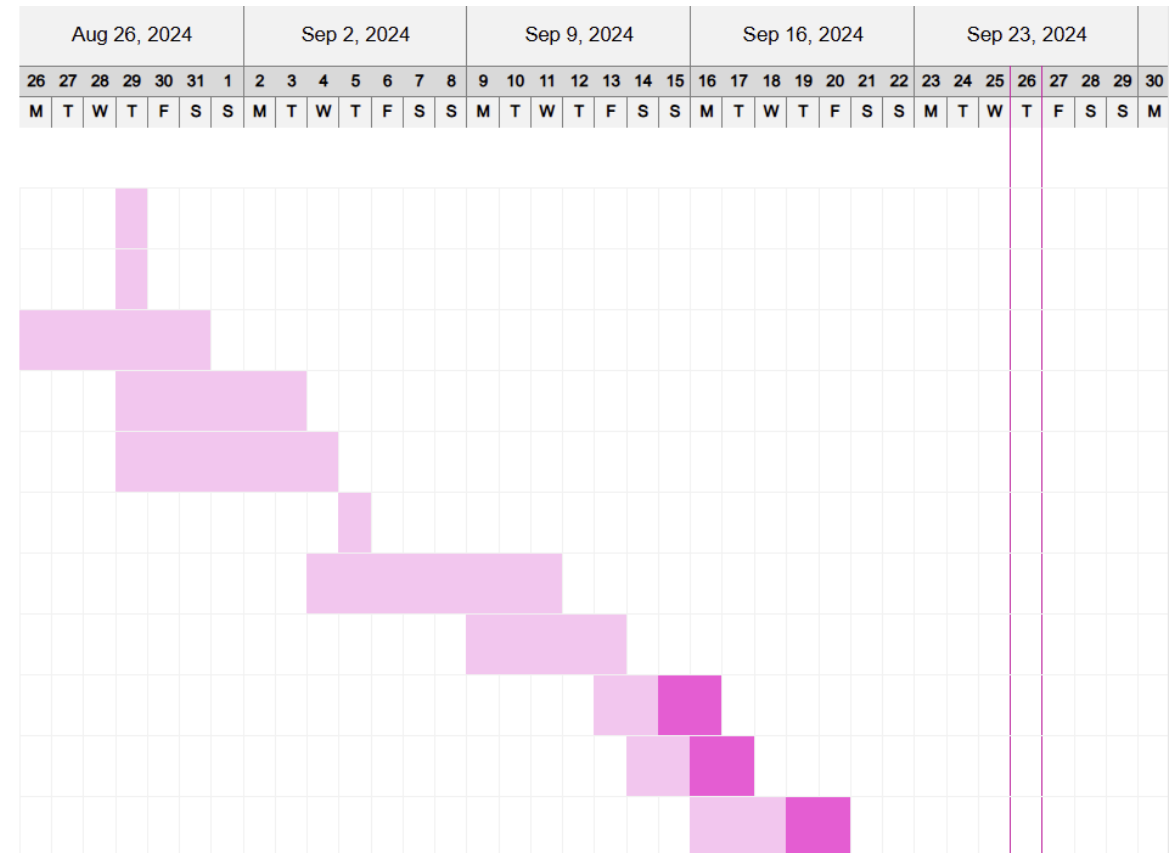
SUB-SYSTEM	ITEM NO.	DESCRIPTION	MATERIAL	MANUFACTURING LOCATION	MACHINIST	TIME (hr.)	IMAGE	QTY.	TOTAL TIME	QTY COMPLETED	COMPLETED TIME
Nose Cone	1	Nose Cone (26 in. x 6.17 in.)	Carbon Fiber	Novakinetics	Lindsey Dineyazhe/ Koi Quiver	3		1	4	0	0
	2	Nose Cone Tip	Steel	Engineering Workshop	Lindsey Dineyazhe/ Koi Quiver	1		1	1	0	0
Body	3	2nd Stage Body Tube (50 in. x 6.17 in.)	Carbon Fiber	Novakinetics	Koi Quiver/ Avery Charley	4		1	4	0	0
	4	Payload Body Tube (40 in. x 6.17 in.)	Carbon Fiber	Novakinetics	Koi Quiver/ Avery Charley	4		1	4	0	0
	5	Lower Body Tube (50 in. x 6.17 in.)	Carbon Fiber	Novakinetics	Koi Quiver/ Avery Charley	4		1	4	0	0
Fin Canister (2nd & Booster)	6	Fins	Carbon Fiber	Novakinetics	Koi Quiver/ Avery Charley	3		8-6	2	0	0
	7	Fin Brackets	SS (6061)	Engineering Workshop	Koi Quiver/ Avery Charley	3		8-6	4-3 hr.	0	0
	8	Aft End Centering Rings	SS (6061)	Engineering Workshop	Koi Quiver/ Avery Charley	1		1	1	0	0
	9	Centering Ring	SS (6061)	Engineering Workshop	Koi Quiver/ Avery Charley	1		4	2	0	0
	10	2nd Stage End Cap	SS (6061)	Engineering Workshop	Koi Quiver/ Avery Charley	1		1	1	0	0

# Manufacturing Plan (2/2)

SUB-SYSTEM	ITEM NO.	DESCRIPTION	MATERIAL	MANUFACTURING LOCATION	MACHINIST	TIME (hr.)	IMAGE	QTY.	TOTAL TIME	QTY COMPLETED	COMPLETED TIME
	11	Corner Bracket (1)	SS (6061)	Engineering Workshop	Koi Quiver/ Avery Charley	0.5		24	12	0	0
	12	Corner Bracket (2)	SS (6061)	Engineering Workshop	Koi Quiver/ Avery Charley	0.5		36	18	0	0
Avionics	13	Avionics Bulkhead	SS (6061)	Engineering Workshop	Austin Paothatat/ Koi Quiver	0.5		4	2	4	2
	14	Avionics Sled	3D Print	Engineering Workshop	Austin Paothatat/ Koi Quiver	0.25		2	0.5	2	0.5
	15	Avionics 2nd Stage Aft Bulkhead	SS (6061)	Engineering Workshop	Austin Paothatat/ Avery Charley	1		1	1	0	0
							Total	94	102.5	6	2.5
							Completed Machining (%)	6.38%			
							Machining Time (%)	2.44%			
							Completed Build (%)	6.38%			

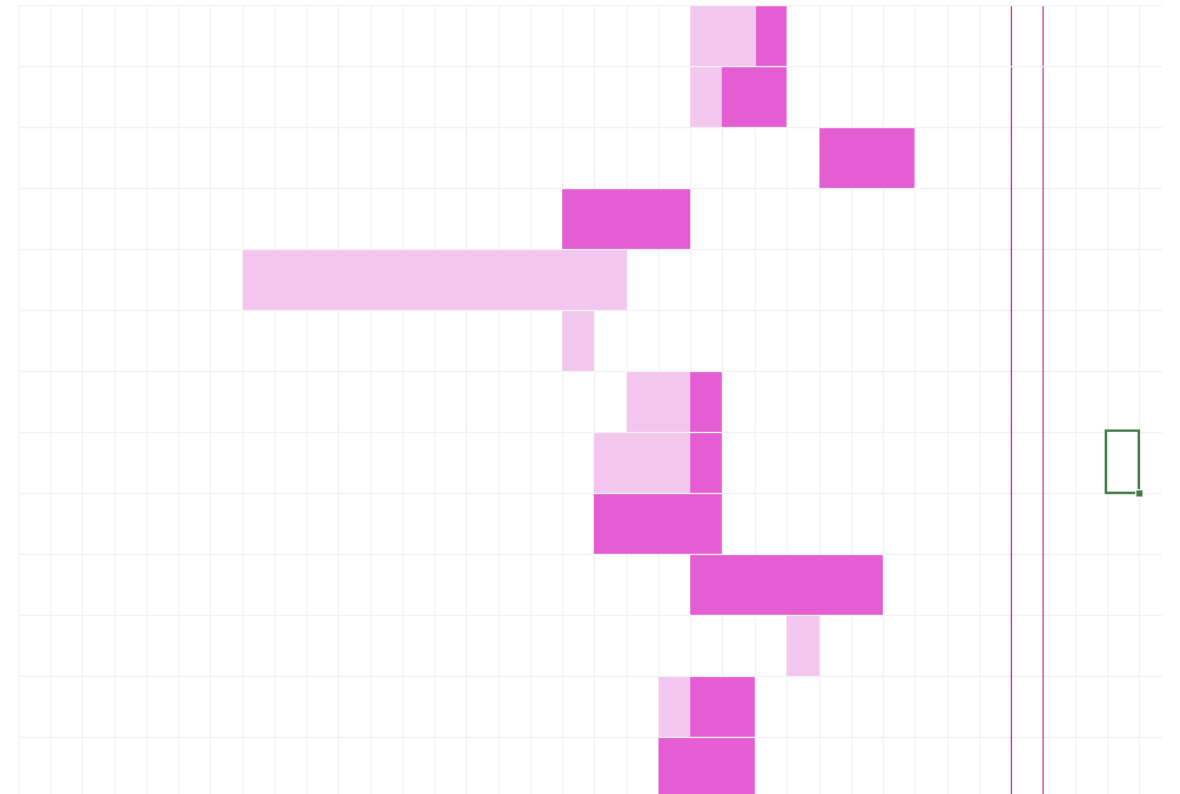
# Gantt Chart Updates

TASK	ASSIGNED TO	PROGRESS	START	END
<b>Stage 1</b>	Team		8/26/24	
Kickoff Meetings (team/staff) 1	Team	100%	8/29/24	8/29/24
HW 00	Individual	100%	8/29/24	8/29/24
Project Management Assignment	Team	100%	8/26/24	8/31/24
Sep. Sys. Rev 5 update	Avery, Austin,Koi	100%	8/29/24	9/3/24
Fin Canster Rev 2 update	Koi	100%	8/29/24	9/4/24
Team/Staff Meeting 2	Team	100%	9/5/24	9/5/24
Engineering Calculations Summary	Team	100%	9/4/24	9/11/24
Sep. Sys. Testing Pass/Fail	Koi, Austin	100%	9/9/24	9/13/24
Sep. Sys. Testing Plan Rough Draft	Koi	50%	9/13/24	9/16/24
Body Tube Rev 2 update	Koi, Lindsey	50%	9/14/24	9/17/24
BOM Update - 50%	Lindsey	75%	9/16/24	9/20/24



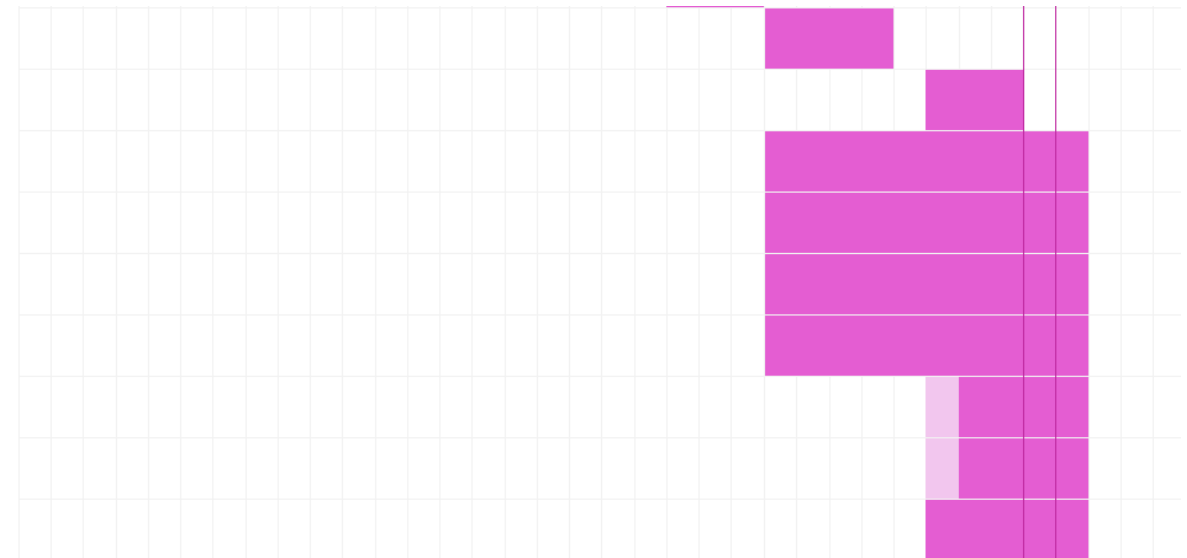
# Gantt Chart Updates

Sep. Sys. Rev 5 Drawing update	Avery, Koi	80%	9/16/24	9/18/24
Fin Canster Rev 2 Drawing update	Koi, Lindsey, or Avery	50%	9/16/24	9/18/24
Coupler Design Rev 2 update	Austin	0%	9/20/24	9/22/24
ANSYS Fluid Flow Model - Full Rocket	Koi	10%	9/12/24	9/15/24
Self Learning or Individual Analysis	Individual	100%	9/2/24	9/13/24
Team/Staff Meeting 3	Team	100%	9/12/24	9/12/24
Manufacturing Plan - Body Tubes	Avery, Lindsey	80%	9/14/24	9/16/24
Mandrel Parts Procurement	Austin	90%	9/13/24	9/16/24
Nose Cone Mold Procurment/Machine	Lindsey	0%	9/13/24	9/16/24
Material Procurement - 50%	Lindsey, Avery	0%	9/16/24	9/21/24
Team/Staff Meeting 4	Team	100%	9/19/24	9/19/24
Mandrel Construction	Austin	50%	9/15/24	9/17/24
Nose Cone Mold Construcion	Lindsey	0%	9/15/24	9/17/24



# Gantt Chart Updates

Sep. Sys. Test Plan - Final	Koi	0%	9/18/24	9/21/24
Flight Computer Order	Austin, Lindsey, Avery	0%	9/23/24	9/25/24
Fin Construction	Team	0%	9/18/24	9/27/24
Body Tube Construction	Team	0%	9/18/24	9/27/24
Nose Cone Construction	Team	0%	9/18/24	9/27/24
Coupler carbon construction	Team	0%	9/18/24	9/27/24
BOM Update - 100%	Avery, Lindsey	25%	9/23/24	9/27/24
Hardware Status Update - 33% Build	Team	25%	9/23/24	9/27/24
Peer Eval 1	Team	0%	9/23/24	9/27/24





# Conclusion

Thank you!

Questions?

