Payload Separation System

Concept Generation and Selection

Benjamin Dirgo, Mark Majkrzak, Jason McCall,
Matthew Mylan, Kate Prentice, Alen Younan

October 29, 2013

Overview

- Client/Stakeholder/Problem Statement
- Updated QFD
- 5 Initial Design Concepts
- Decision Matrix
- Final Design
- Gantt Chart
- Conclusion
- References

In Review (Payload Separation System)

- Problem Statement:
  - Design, analyze, build, and test a less expensive payload separation system that delivers payloads into orbit with minimal shock to the payload.

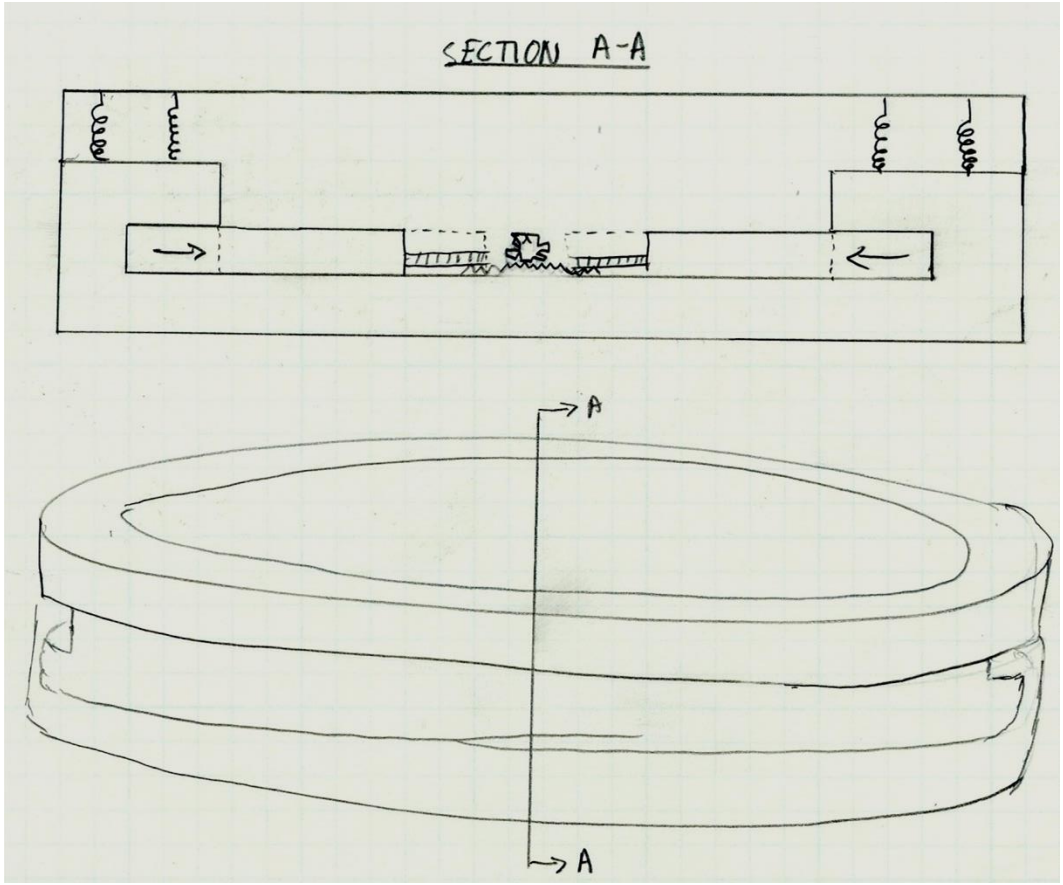
- Client:
  - Orbital Sciences Corporation
    - Mary Rogers: Electronic Packaging and Actuators Manager
    - Stakeholders: Companies/Agencies whom contract with Orbital Sciences

Updated QFD

			Engineering Requirements			
Scale 1, 3, 6, 9 (best)	Ojectives	Customer Weights	1. Minimum Tolerances	2. Cost	3. Part Count	4. Lead Time
1.	Separate Payload	9	9	9	3	
2.	No Debris	9			6	
3.	Minimal Shock	6		9	1	
4.	Structural Capabilities	9	6	6		
5.	No Re-contact	9		3		
6.	Light Weight	6		6	9	1
7.	Fit Pegasus Demensional Constraints	9	9	1	3	3
8.	Ease of Assembly	3	9	6	9	1
9.	Special Tools to Assemble	3	9	9		9
10.	Mass Added to Payload	9			1	
11.	Mass of Entire System	9		3		
		Raw Score	270	333	204	63
		Relative Weight [%]	**31.03%**	**38.28%**	23.45%	7.24%
		Unit of Measure	**+/- mm**	**$**	ul*	min
		*ul = unitless				

Alen Younan

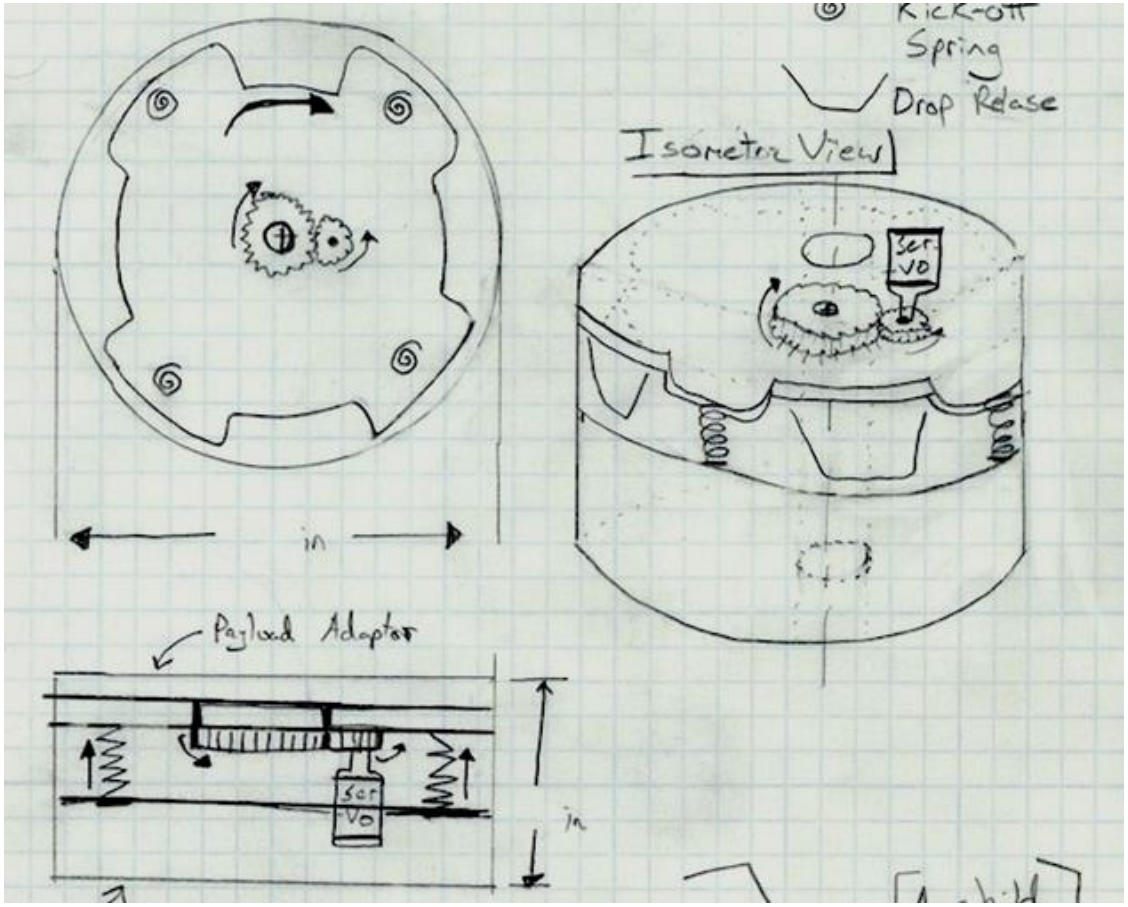
Design Concept 1: Interlock



- Motor driven panels
- Spring loaded

Alen Younan

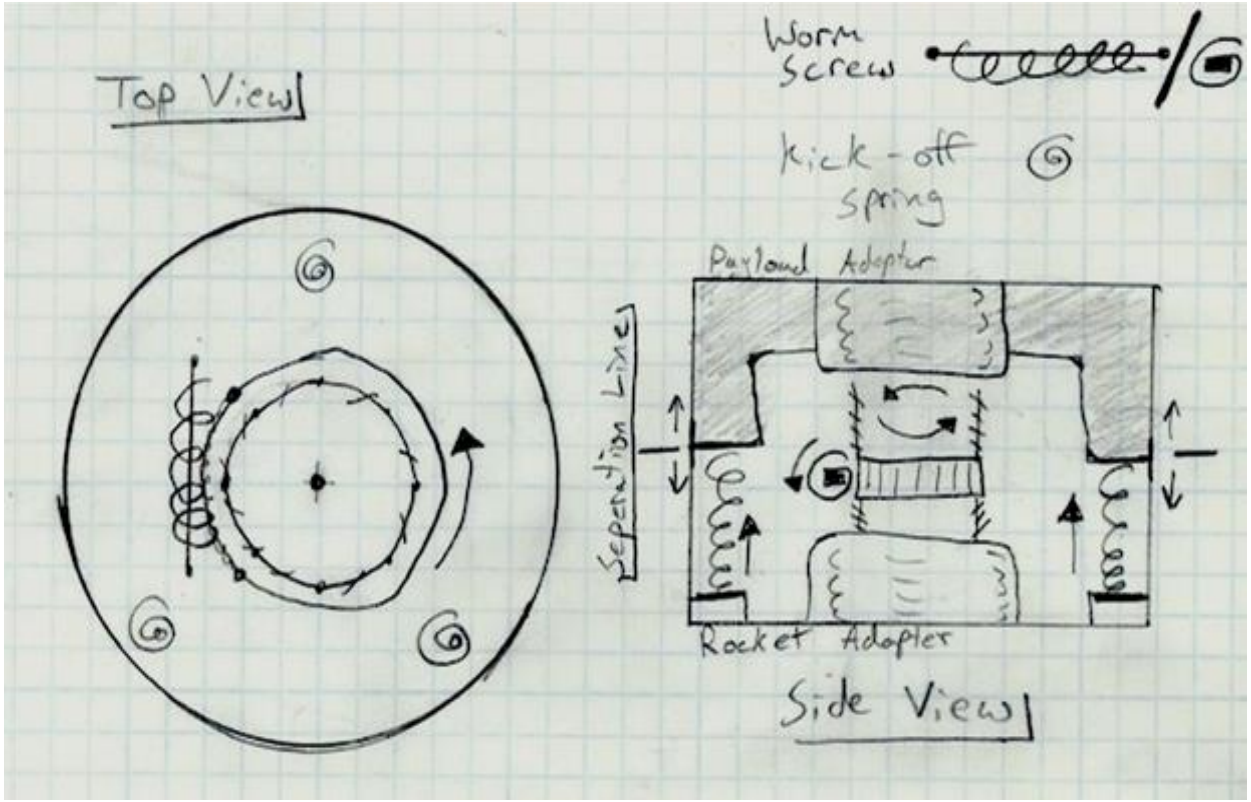
Design Concept 2: Blender



- A four toothed gear rotates via servo
- Once gears in position, springs are free to separate payload

Jason McCall

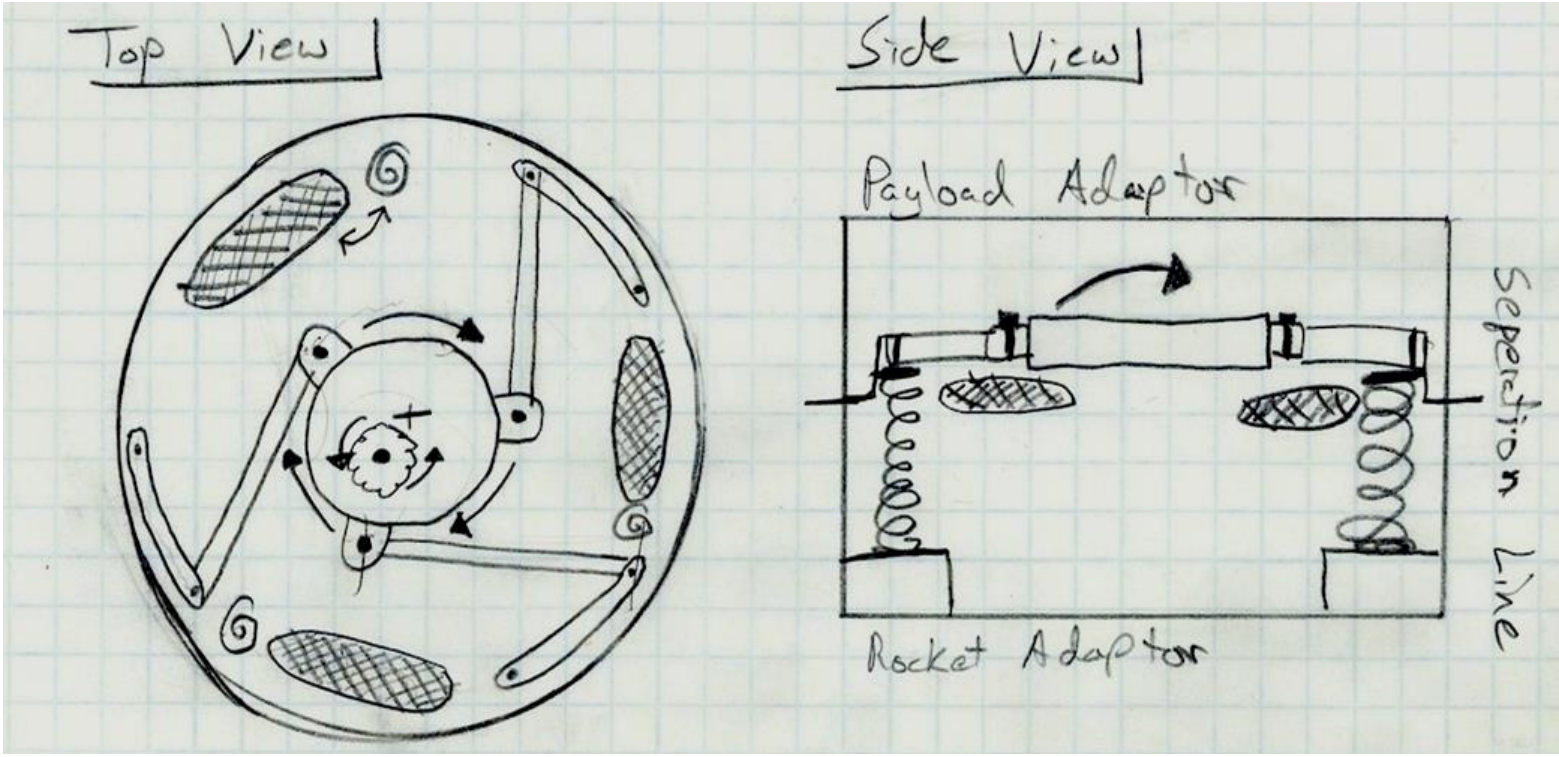
Design Concept 3: The Worm



- Two sided worm bolt holds the payload to the rocket
- Worm bolt rotates until threads are free of payload
- Preloaded springs separate payload from launch vehicle

Jason McCall

Design Concept 4: Tangent Spoke

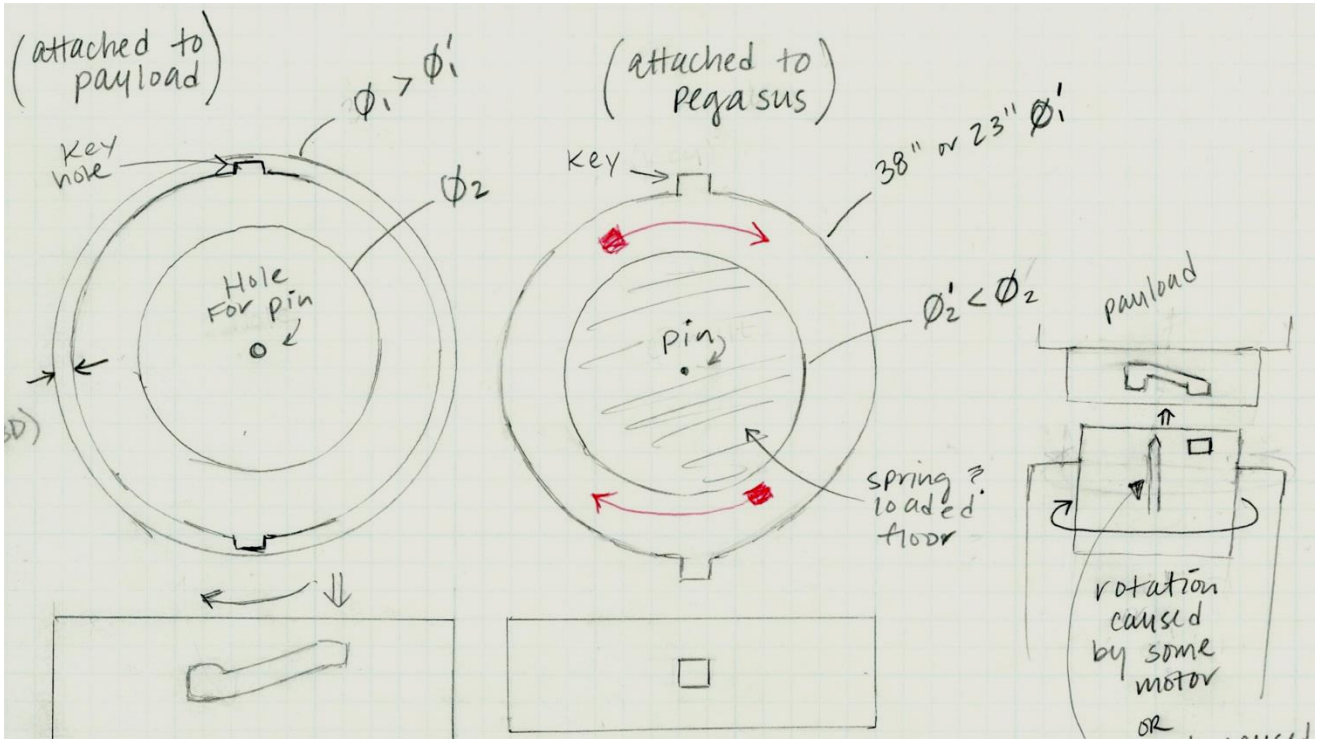


- Servo motor turns center shaft

- Spokes travel along slots until the plate has rotated in position for the springs to separate payload

Ben Dirgo

Design Concept 5: BNC



- Motor rotates inner cylinder releasing larger cylinder attached to the payload

- Preloaded springs under floor push away the payload

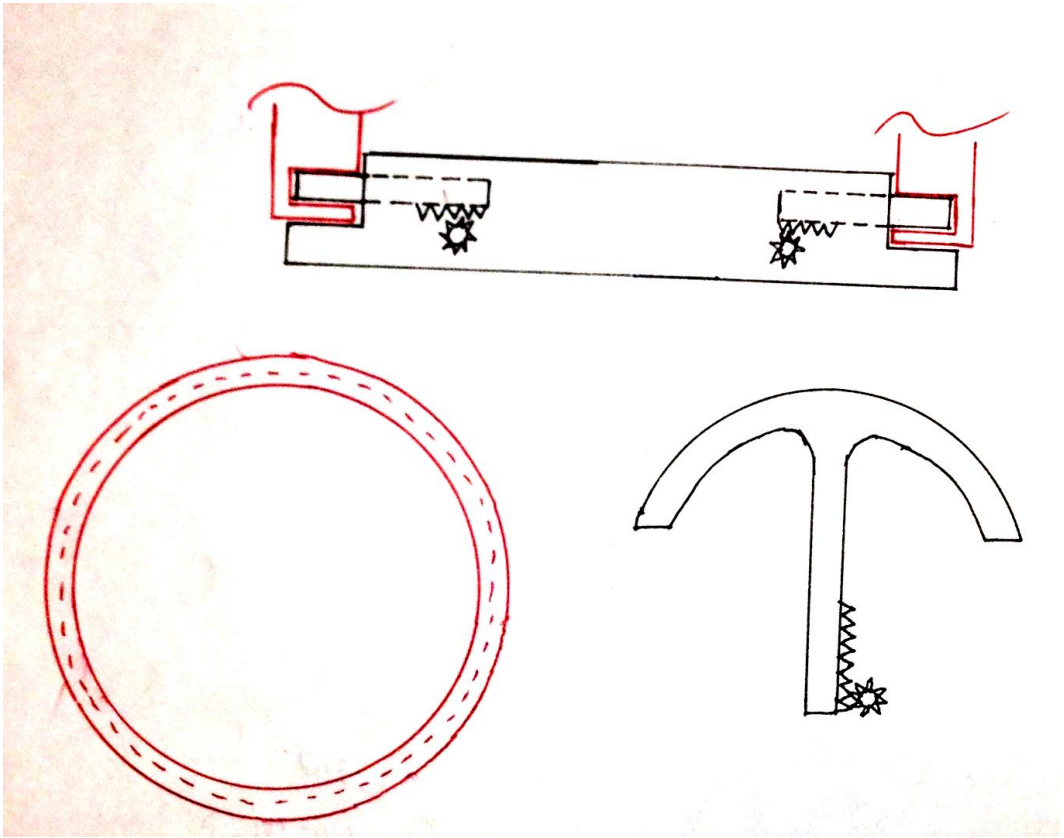
Ben Dirgo

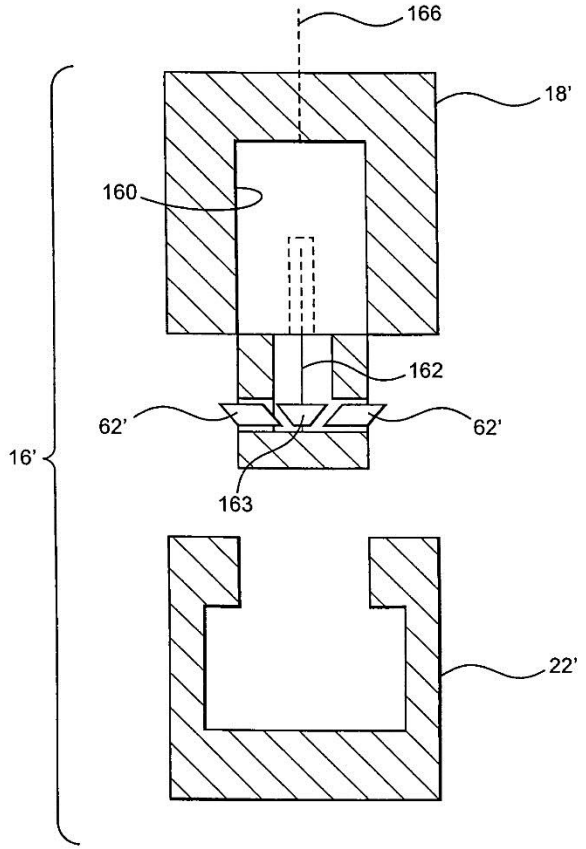
Decision Matrix

scale 1, 3, 6, 9 Best	Weight	Interlock Solution 1	Blender Solution 2	The Worm Solution 3	Tangent Spoke Solution 4	BNC Solution 5
Part Count	6	6	9	3	1	9
Minimal Shock	9	3	3	6	1	1
Cost	6	6	3	1	3	6
Manufacturability	6	9	9	1	1	9
Debris	9	9	9	6	9	9
Separate Payload	9	9	3	9	6	9
Weight	3	6	1	6	6	3
Ease of Assembly	3	6	9	6	3	6
Structural Capability	9	6	6	6	6	6
Mass Added to Payload	9	9	1	3	9	1
	Score	**486**	354	336	336	405

Mark Majkrzak

Payload Separation System: Final Design

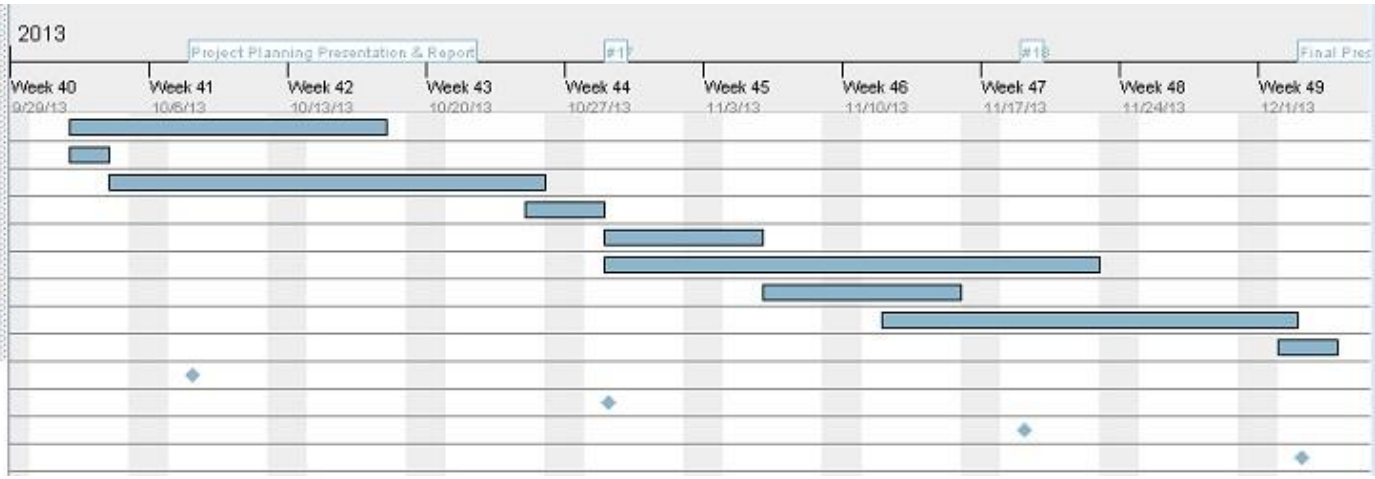




Mark Majkrzak

Gantt Chart

Name	Begin date	End date
Research	10/2/13	10/17/13
Brainstorming	10/2/13	10/3/13
Design Sketches	10/4/13	10/25/13
Decision Matrix	10/25/13	10/28/13
CAD Drawings	10/29/13	11/5/13
Engineering Analysis	10/29/13	11/22/13
Prototype	11/6/13	11/15/13
Final Design	11/12/13	12/2/13
Bill of Materials	12/2/13	12/4/13



Matt Mylan

Conclusion

- We are designing a Payload Separation System for Orbital Sciences and Mary Rogers is our contact.
- The QFD had been updated post meeting with Mary Rogers.
- The team created 5 initial design concepts and concluded on a final design using a decision matrix.
- The final design is tentative due to further analysis and complexity.

References

- Baldwin, Bryan. "Orbital." *Orbital Pegasus Guide*. Orbital, n.d. Web. 7 Oct 2013. <http://www.orbital.com/NewsInfo/Publications/Pegasus_UG.pdf>.

Thank you for listening,

QUESTIONS?