Payload Separation System

Problem Formulation and Project Plan

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Overview

Payload Separation System

Clients/Stakeholders

Need/Goal Statement

Objectives

Requirements

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Quality Function Deployment

Working Environment

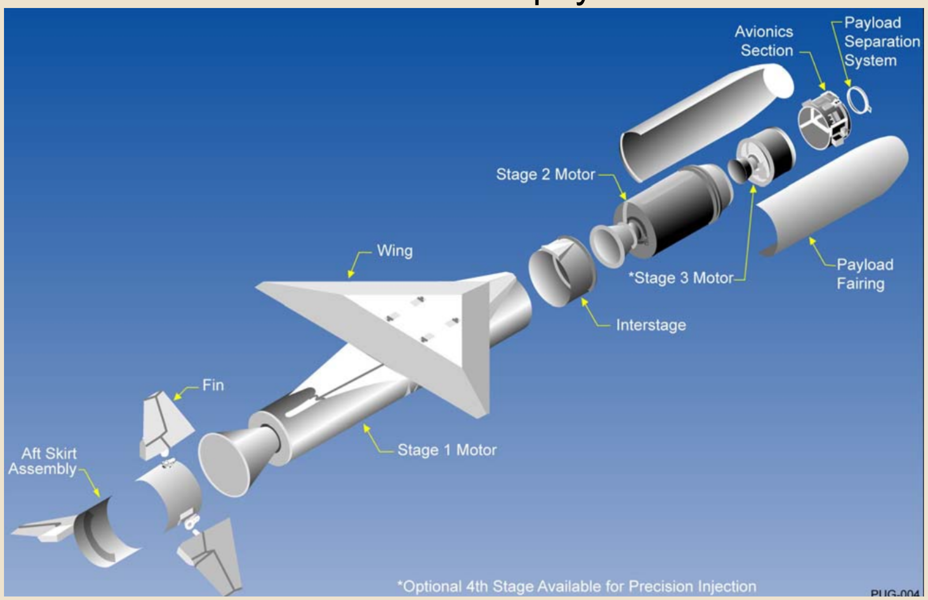
Gantt Chart

Conclusion

References

Payload Separation System

Design, analyze, build, and test a payload separation system that delivers payloads into orbit with minimal shock to the payload.



http://www.orbital.com

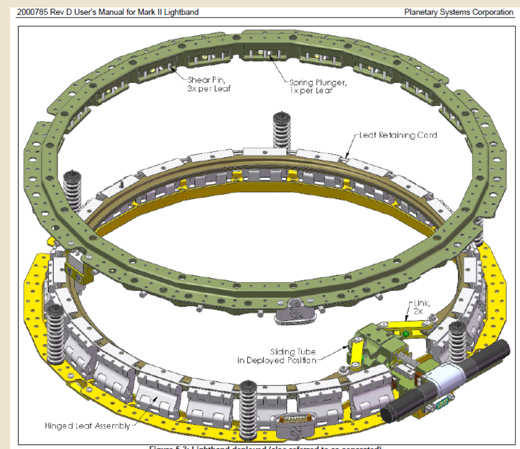


Figure 5-3: Lightband deployed (also referred to as separated)

http://www.planetarysystemscorp.com

Orbital Sciences Corporation

Client:

Orbital Sciences Corporation
- Mary Rodgers
  - Electronic Packaging and Actuators Manager

Stakeholders:
- Companies/Agencies whom contract with Orbital

Need and Goal Statement

Need:

The payload separation systems today are too expensive and put a large vibrational shock on the payload.

Goal:

Design a less expensive payload separation system that can separate consistently on command with little to no impact to the payload.

Objectives

Objective	Measurement Basis	Unit
No Debris	Number of fragmented pieces at separation	n/a
Reliable	Percent complete separation during test trials, with timely separation	%
Manufacturability	Realistic feasibility of manufacturers	n/a
Minimal Shock	Impact force	N
Remain Intact	Material properties	eds
Light-weight	Minimal load factor to rocket	kg
Simplicity	Number moving and stationary parts	n/a

Major Requirements

Weight

Cost

Parts of the payload separation system

Separation Reliability

Material Properties

Damage (deflection)

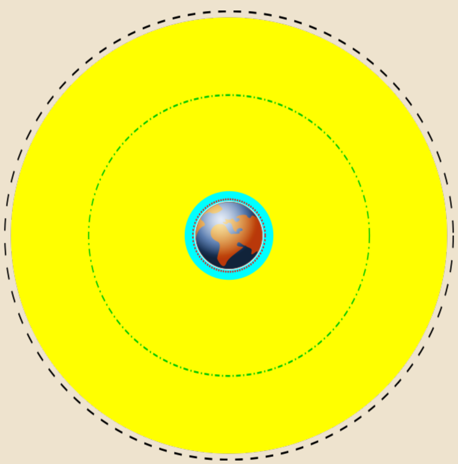
Quality Function Deployment

			Engineering Requirements					
Scale 1, 3, 6, 9 (best)	Ojectives	Customer Weights	1. Weight	2. Cost	3. Parts (PSS)	4. Separation Capability	5. Material Properties	6. Damage (deflection)
	1. No Debris	6			3	6	6	9
	2. Reliability	9			6	9	9	9
	3. Manufacturability	6	3	9	9			
	4. Shock	9				9		6
	5. Remain Intact	6			9			
	6. Light Weight	3	9		3		3	
	7. Simplicity	6		9	9	3		
		Raw Score	45	108	**243**	**216**	126	189
		Relative Weight [%]	4.85%	11.65%	**26.21%**	**23.30%**	13.59%	20.39%
		Unit of Measure	lb	$	**ul***	**ft**	lb/ft^2	in
		*ul = unitless						

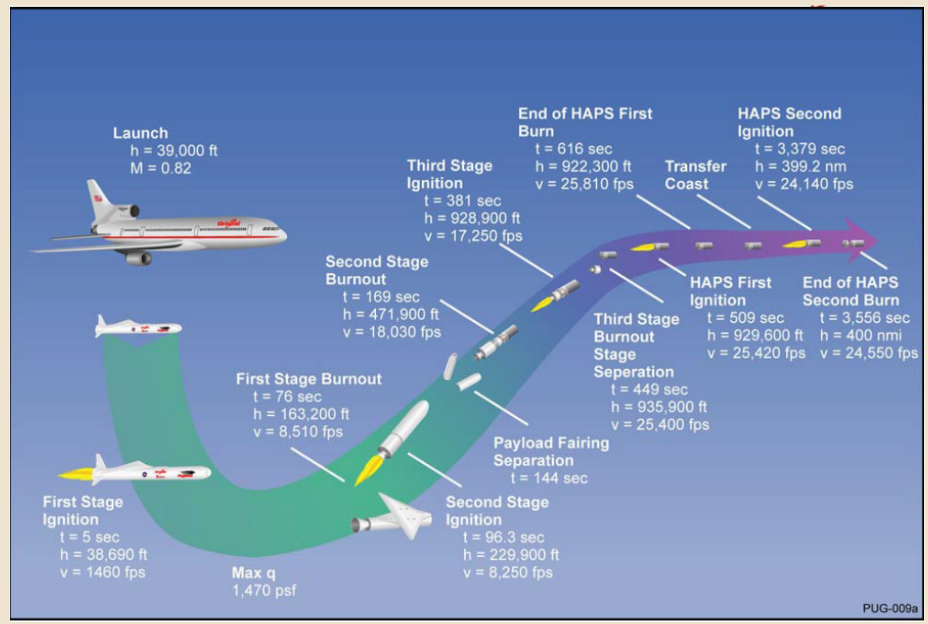
Working Environment

Orbit:

- Geocentric orbit = 35,786 kilometers
- GPS Satellites



http://en.wikipedia.org



http://www.orbital.com/

Constraints

Materials must withstand:

- Mach Number >1 (supersonic speed)
- Height (h) = 400 nmi
- Velocity (v) = 24,550 ft/s
- Lateral frequency > 20Hz
- Weight of payload > 126 kg (can withstand a max load of 485 kg)

Constraints continued…

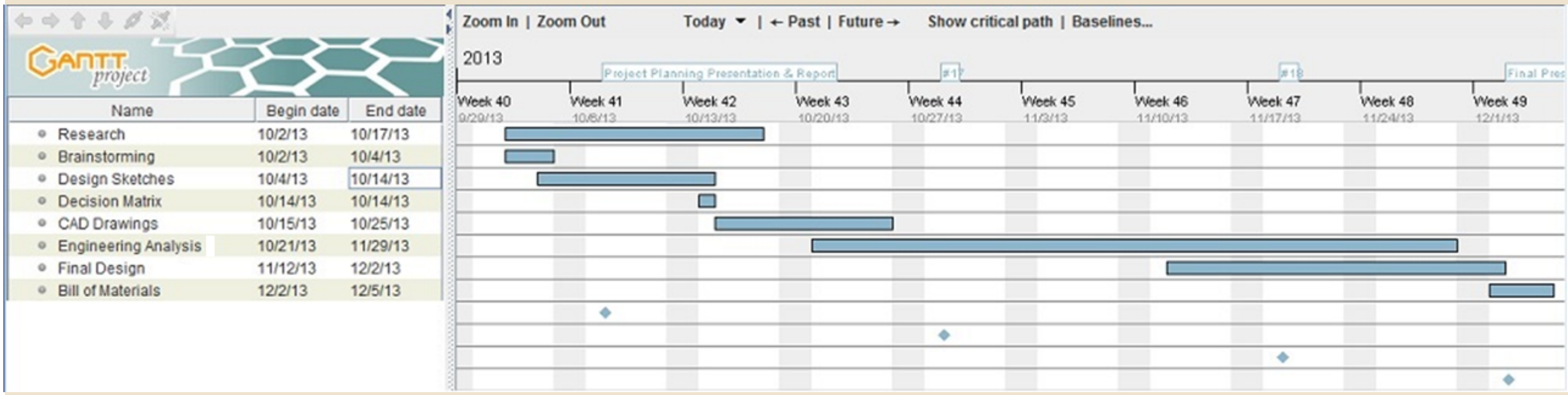
Low profile

Less expensive

Want to improve on weight, given the payload diameter:

Adaptor Diameter	Weight of Adaptor
23 in (59cm)	6.0 lbm (2.7 kg)
38 in (97cm)	8.7 lbm (4.0 kg)

Gantt Chart



Name	Begin date	End date
Research	10/2/13	10/17/13
Brainstorming	10/2/13	10/4/13
Design Sketches	10/4/13	10/14/13
Decision Matrix	10/14/13	10/14/13
CAD Drawings	10/15/13	10/25/13
Engineering Analysis	10/21/13	11/29/13
Final Design	11/12/13	12/2/13
Bill of Materials	12/2/13	12/5/13

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Walter, Holmans. N.p.. Web. 7 Oct 2013. <http://www.planetarysystemscorp.com/

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

Wikipedia. “Satellite.” Web. 7 Oct 2013 <http://en.wikipedia.org/wiki/Satellite#Orbit_types>

Thank you for listening,

QUESTIONS?