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AE 4342 – Lab 6

What is the mass ratio for each of the three burns?

Equation is: $\frac{m_i}{m_f} = e^{\frac{\Delta v}{I_{sp} g_o}}$

Isp = 350s

g_o = 9.81

Burn 1 Δv = 250m/s

➔ Mass ratio = 1.0755

Burn 2 Δv = 200m/s

➔ Mass ratio = 1.0600

Burn 3 Δv = 500m/s

➔ Mass ratio = 1.1568

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What is the percent mass margin? Is the mass margin too high, too low, or about right given the fidelity of your analysis? Explain why.

Mass margin = 100*1006.14/3250 = 31%

The mass margin of 31% is about right assuming the project in is pre-phase A or phase A, as projects should keep between 25%-35% at that stage of the project lifecycle, as derived from previous mission in LEO. The analysis has good fidelity however it could be improved by adding further subcomponents under each of the spacecraft bus main components. The fidelity could also be improved by increasing amount of iterations, however, 100 iterations seems to be enough for this MBS.

	Level 2			Level 1
	CBE	Cont.	Allocated	
1.0 Payload				594.50
1.1 Probes (x2)	450	15%	517.50	
1.2 Probe Mounting Hardware	70	10%	77.00	
2.0 Spacecraft Bus (dry)				1106.96
2.1 Propulsion	44.74	10%	49.21	
2.2 ADCS	91.58	10%	100.74	
2.3 Communications	30.53	10%	33.58	
2.4 C&DH	76.32	10%	83.95	
2.5 Power	320.53	10%	352.58	
2.6 Structure	412.11	10%	453.32	
2.7 Thermal control	30.53	10%	33.58	
3.0 Spacecraft dry mass				1701.46
4.0 Consumables				0.00
5.0 Propellant				447.41
6.0 Loaded Mass				2148.86
7.0 Kick stage				0.00
8.0 Injected mass				2148.86
9.0 Launch vehicle adapter				95.00
10.0 Boosted mass				2243.86
11.0 Margin				1006.14
12.0 Total LV Capacity				3250.00

m1	2148.864
dm1	150.9027
m2	1997.962
m3	1772.962
dm2	100.324
m4	1672.638
m5	1447.638
dm3	196.1799

Table of vehicle mass and amount of fuel used between each stage of the mission