SLAM Vehicle

An asteroid sample return mission

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Design Objectives

- Maximize sample mass
- Reliability
- Trip Duration

Requirement	Success
Optimize sample mass obtained per trip	• bringing back 20.0kg per trip
Ensure vehicle is as reliable as possible	• 0.982
Minimize trip time to increase efficiency	• 139.84 days (under half of allotted time)

Mission Parameters

Description	Reliability	Mass
Units	-	kg
Value	0.982	1860
Limits	0.95	3000

Cost	Sample
$	kg
$2,986,500.00	20.00
$3,000,000.00	

Trip Time	delta-V
d	m/s
139.84	20454.51
365.25	

Power Generation	Power Required
W	W
3500.00	3200.00

- High reliability with relatively low mass
- Within budget
- Half of required duration and relatively high delta V
- Generating excess power

Vehicle Subsystem Breakdown

Propulsion: Electrothermal

- Specific impulse = 600 s, Mass = 720 kg
- Higher power to expedite mission

Power storage: **LiSO2**

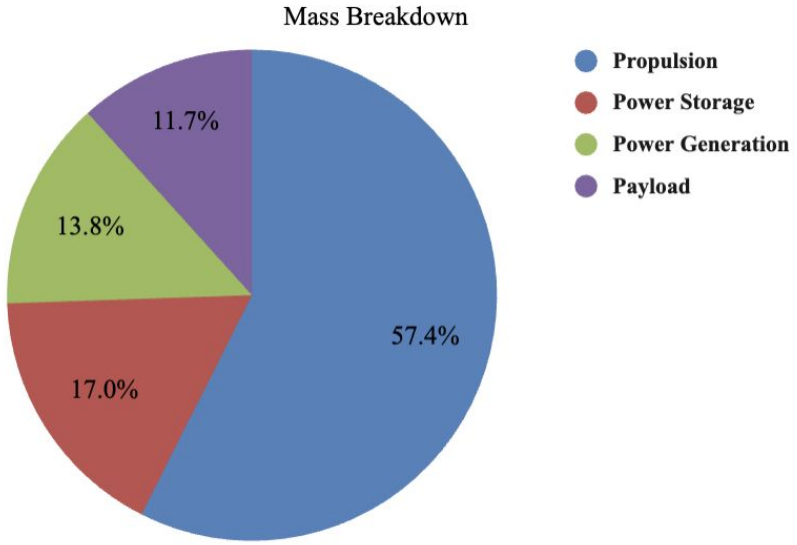
- Specific energy = 120 Wh/kg, Mass = 300 kg

Power generation: Solar Thermal Dynamic

- Specific power = 14 W/kg, mass = 260 kg
- Generates 3500 W compared to required 3200 W

Payload: De-Spin & Anchor

- Sample mass 20.0 kg, mass = 220 kg
- Budget allowed for high cost & power requirement

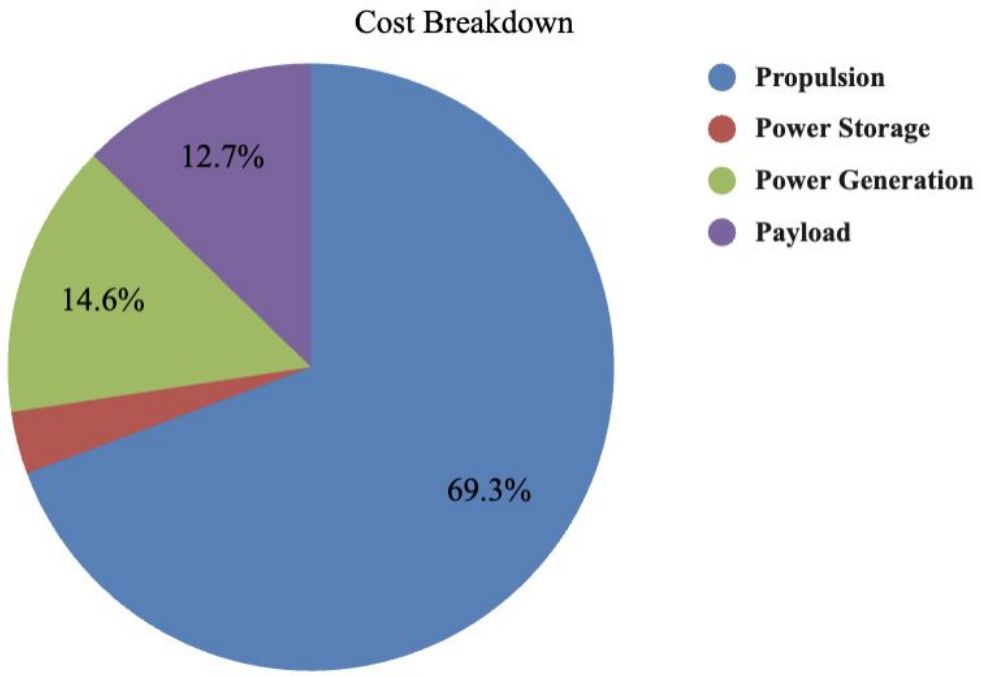


Design Cost

- Cost breakdown reflects mission priorities while staying under the $3 million budget
- Vehicle design incorporates reliable components able to return with a large asteroid sample

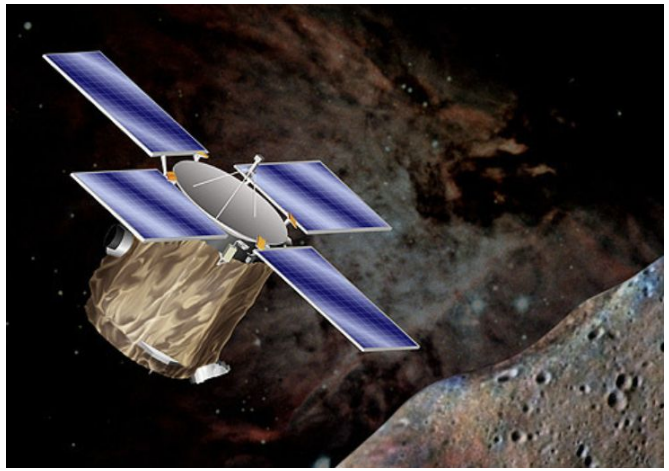
Cost Breakdown

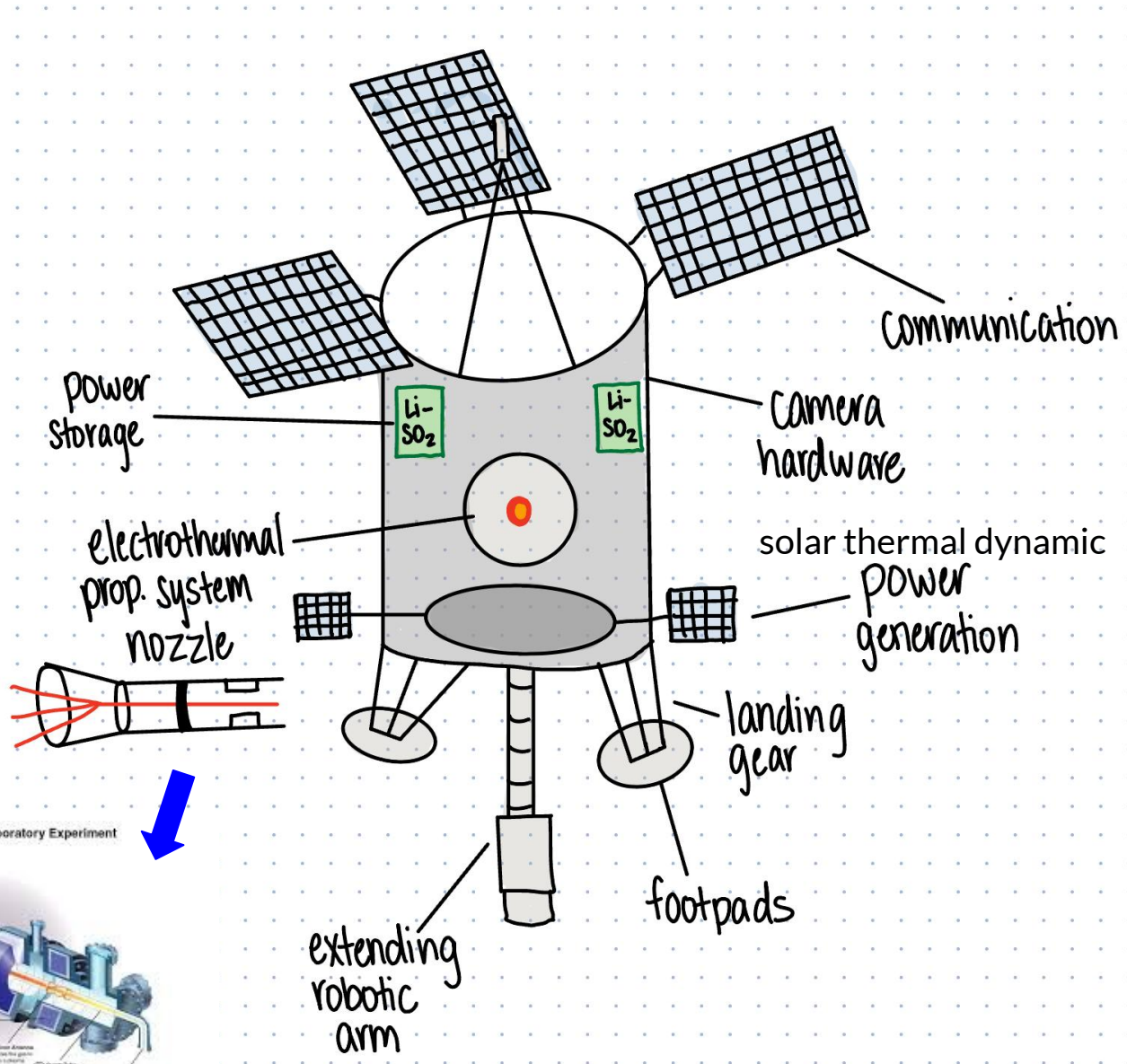
Subsystem	Value
Propulsion	$2,070,000.00
Power Storage	$99,000.00
Power Generation	$437,500.00
Payload	$380,000.00



Vehicle Sketch & Build Plan

- Took inspiration from the NASA NEAR Shoemaker spacecraft, designed for an asteroid sample return mission
- Incorporating footpads for landing gear and a robotic arm for anchoring & scoop sample collection





Closing Thoughts

- The SLAM vehicle is designed to return up to 20 kg of an asteroid sample with a mission duration of ~139 days, under half of the required duration.

- Prioritizing efficiency of the vehicle’s subsystems yields a higher cost, yet allows for a more reliable mission and sample collection.