SDSU San Diego State University





C.A.S.P.E.R. Mission Collect, Analyze, Store, Process & Explore Rover Sean Brucker, Ruby Cave, Álec Delgado, Kyle Enriquez, CJ Flores, Sebastian Gonzalez, Noah Noxon, Jose Reyes



STRUCTURES

Requirements: The system must withstand combined launch and descent forces acting on a 2100 kg rover-lander assembly and avoid resonating with the launch vehicle's vibrational profile **Solution:**

- Material: Aluminium 7075-T6
- Analysis using Varying launch durations (90–120 s) acceleration profiles (4.84–6.46 g)
- Confirms loading cases remained below yield strength: maximum Von Mises stresses under 62 MPa and minimum factors of safety above 8.2.

Time Elapsed During Launch (s)	Acceleration (m/s^2)	Total Force (N)	Max Von Mises Stress (MPa)	Min F.S.	G-Force Acceleration (g)		
120	47.50	99,750	45.92	11.00	4.84		
110	51.82	108,822	50.06	10.09	5.28		
100	57.00	119,700	55.05	9.17	5.81		
90	63.33	133,000	61.17	8.26	6.46		

THERMAL

Requirements: The rover must maintain operational temperatures during extreme lunar conditions, including sustained exposure to 75 K in permanently shadowed crater regions. Solution: Thermal simulations were conducted in SolidWorks, and Radioisotope Heater Units (RHUs) were integrated to passively maintain survivable internal temperatures and ensure rover temperatures remain above 168 K



COMMUNICATION

Requirements:

- The rover needs 5 Mbps to communicate with the lander
- The lander needs 20 Mbps for telemetry and data collection with Earth or the Lunar Reconnaissance Orbiter (LRO).
- **Components:**
- X-band Transmitter (20 GHz)
- UHF Radio
- Low-gain antenna (.5 Meters)
- **Solution:** Link Budget Analysis with a .5 meter
- antenna, 10 W Power draw, 20 Mbps at 20 GHz

	MISSION SUMMARY				
Subsystem	Mass	Power	Costs		
Rover	123 - 189 kg	77 - 105 W	\$107 - \$250 million		
Lander	1,300 - 1870 kg	220 - 360 W	\$366 - \$438 million		
Total	1,423 - 2,059 kg	290 - 465 W	\$473 - \$688 million		

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