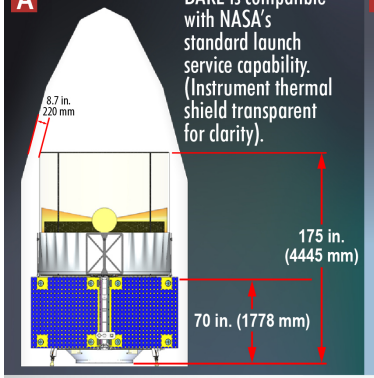
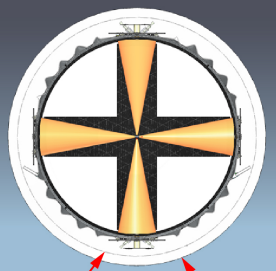
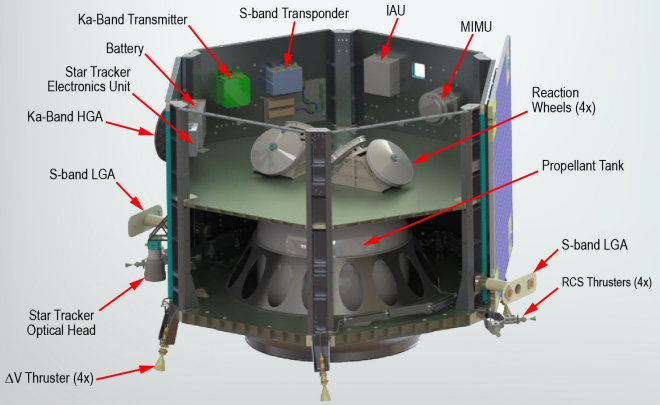
A DARE is compatible with NASA's standard launch service capability. (Instrument thermal shield transparent for clarity).



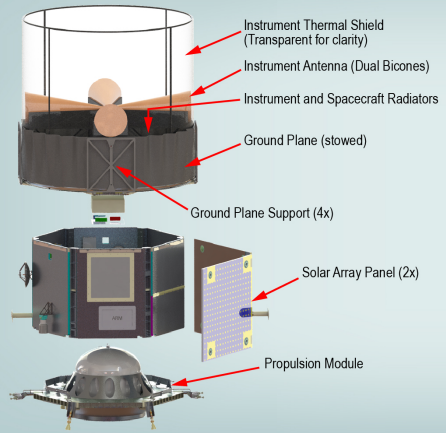
B Top view of DARE in the LV Fairing.



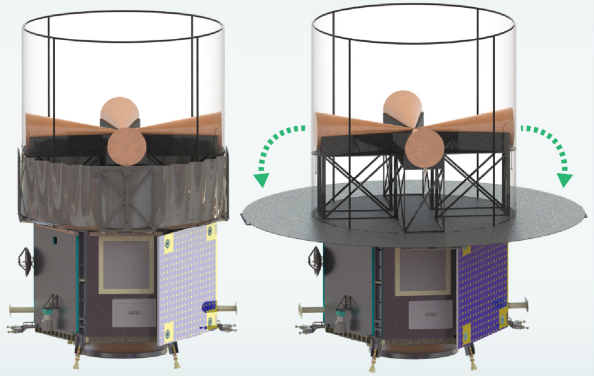
C Internal View of S/C Bus Components



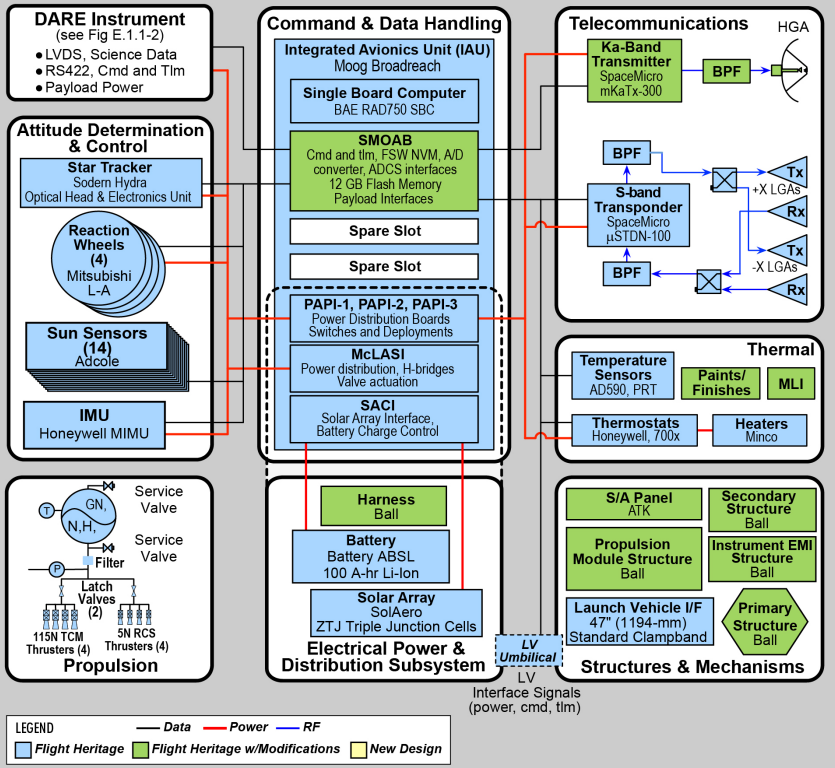
D DARE Observatory (Instrument thermal shield transparent for clarity)



E DARE Ground Plane Deployment: Pre-Deployment (left), Post-Deployment (right) (Instrument thermal shield transparent for clarity)



F The DARE spacecraft is simple & high heritage.



G S/C Bus Features Support DARE's Science Objectives

Spacecraft Key Characteristics	
Operational Lifetime	< 2 month transit followed by 2 years of science operations at the moon.
Orbit Parameters	Launch into Earth Phasing Orbit, inject into 50x125 km, <3° inclination circular science orbit at moon.
LV Compatibility	Compatible with Standard LV defined in PSD 03 – MIDEX 2016 ELV Summary info.
ADCS Architecture	3-axis stabilized, stellar inertial with IMU backup. 0.5° knowledge and control requirement during science with tracker off for 28 minutes.
Redundancy	Mainly single string with safe mode and selective redundancy (class C mission).
Electrical Power	Direct Energy Transfer. 3.9m² active area, body-fixed array. 100 Ah battery sized for 4.9 hour total lunar eclipse (2/year).
Thermal Control	Passively cooled with two 72 cm² radiators on top deck.
Telecomm	S-band omni LGAs to NEN for cmd/tlm during all mission phases. Ka-band HGA to NEN for science data downlink at the moon. 6 GB/day of science and SOH data.
Propulsion	Blowdown monoprop system using four 115-N delta-V thrusters and four 5-N RCS thrusters for momentum control. 1,260 m/s delta-V budget.
Avionics	Moog-Broad Reach Integrated Avionics Unit with RAD750 processor.
EMI	EMI quiet bus. Faraday cage design with gasketed seams provides significant shielding over standard MIL-STD-461F emissions.
Structure	Heritage aluminum cornerpost, aluminum honeycomb panel design with EMI gasketing
End of Life	Controlled Lunar impact

H Mass growth contingencies & margins are large

DARE Flight System Element	Mass CBE (Kg)	Contig. (%)	MEV (Kg)
Structures and Mechanisms	183.0	16%	212.3
Thermal	10.3	23%	12.8
Power	47.5	6%	50.2
Wiring Harness	15.8	30%	20.5
Attitude Determination and Control	51.4	3%	52.9
Propulsion	53.7	6%	57.1
Telecommunications	11.5	6%	12.2
Command and Data Handling	5.4	3%	5.6
Spacecraft Bus	**378.5**	**12%**	**423.6**
Payload Total	**126.4**	**30%**	**164.3**
Flight System - Dry	**504.8**	**16.4%**	**587.9**
Propellant and Pressurant	355.2	16.4%	413.6
Flight System - Wet	**860.0**	**16.4%**	**1001.5**
Standard Launch Performance	C3 = -2.78 km²/s²		1590.0*
Margin on launch mass capacity			588.5
Margin on launch mass capacity %			58.8%

* from MIDEX 2016 ELV Summary Info

I DARE performance margins are substantial in all areas

Requirements and Margins	Requirement	Performance	Margin
Flight System Wet Mass	1590 kg	1001.5 kg	58.7%
Data Storage Capacity (Science + SOH)	6.02 GB	12 GB	99%
Data Downlink	5.5 Mbps	12 Mbps	118%
Power Generation During Science	378W	496W EOL	31%
Pointing Control - downlink (3σ / per axis)	0.1°	0.03°	233%
Pointing Control - science (3σ / per axis)	0.5°	0.289°	73%
ΔV margin (on statistical maneuvers) 1260 m/s -1150 m/s deterministic	28 m/s	110 m/s	290%
Propellant Load (Tank capability)	410	454	11%
EMI – RE 102 (dB μV/m)	Fig F.2.3-1	Fig F.2.3-1	41% avg

J Power margins are adequate for all mission phases

Subsystem	Science Ops (W)	Safe Mode (W)
Command and Data Handling	36.8	36.8
Telecom	13.3	7.2
Thermal Control	36.5	46.6
Attitude Determination & Control	177.5	143.0
Power	21.6	12.6
Misc	2.1	2.1
Total Payload (CBE plus 30% contingency)	90.3	10.5
Total Observatory Loads with Losses	**378.0**	**258.7**
BOL Orbital Average Solar Array Capability	550.8	613.4
EOL Orbital Average Solar Array Capability	496.1	552.5
EOL Margin: (Allocation - MEV)/MEV * 100	**31%**	**114%**

Notes:
- Values include contingency ranging from 5% to 30% based on component maturity
- Array capability assumes 20 deg off point, 47min orbital eclipse period, and no sun during one 30min downlink every 4 orbits
- Battery sized at 100 Ah for maximum total lunar eclipse of 4.9 hours (2/year). Avg DOD <10% per orbit.