Mars Science Laboratory Entry, Descent and Landing Overview

Jeffrey W. Umland
Jet Propulsion Laboratory

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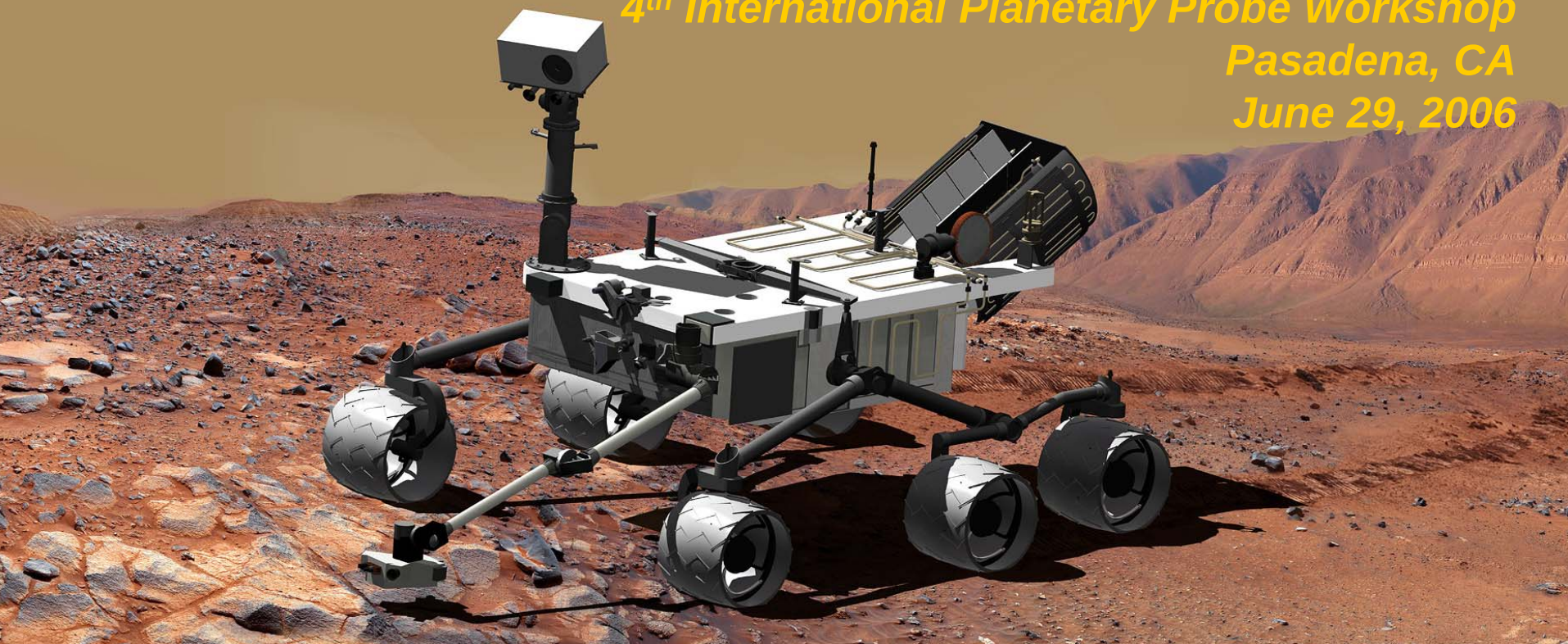
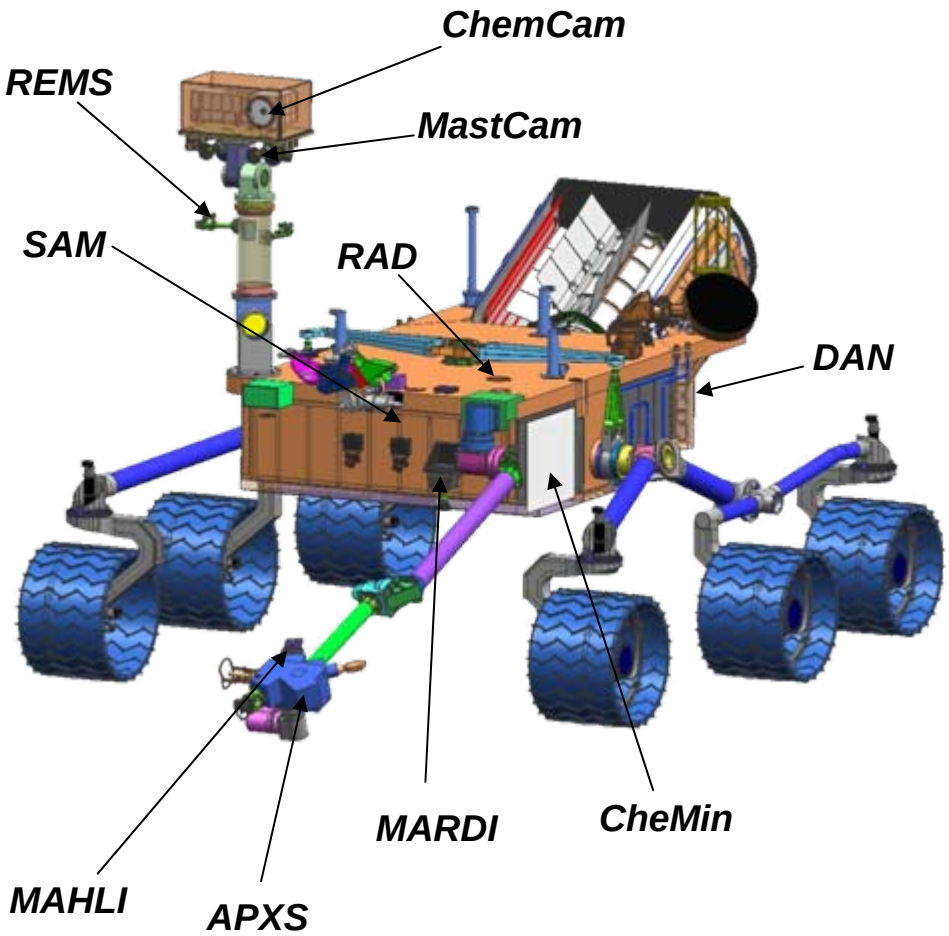


MSL Science Instruments



Remote Sensing (Mast)

ChemCam – Laser Induced Breakdown Spectrometer

MastCam - Color Stereo Imager

Contact Instruments (Arm)

MAHLI - Microscopic Imager

APXS - Proton/X-ray Backscatter Spectrometer

Analytical Laboratory (Front Chassis)

SAM - Gas Chromatograph/Mass Spectrometer/ Tunable Laser Spectrometer (Sample Composition / Organics Detection)

CheMin - X-ray Diffraction / Florescence (Sample Mineralogy)

Environmental Characterization (Body-mount)

MARDI - Descent Imager

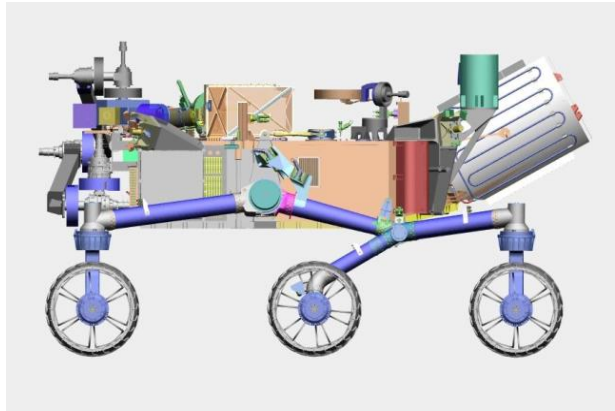
REMS - Meteorological monitoring

RAD - Surface Radiation Flux Monitor (future human health & safety)

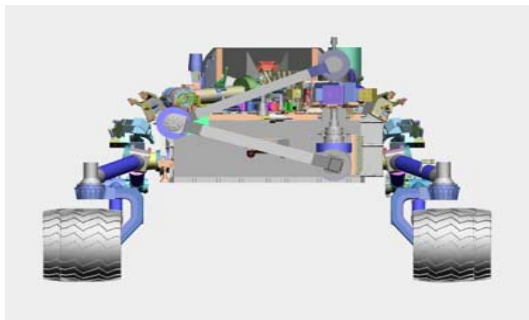
DAN - Neutron Backscatter subsurface hydrogen (water/ice) detection

MSL Size Comparison

2006 MINI Cooper S

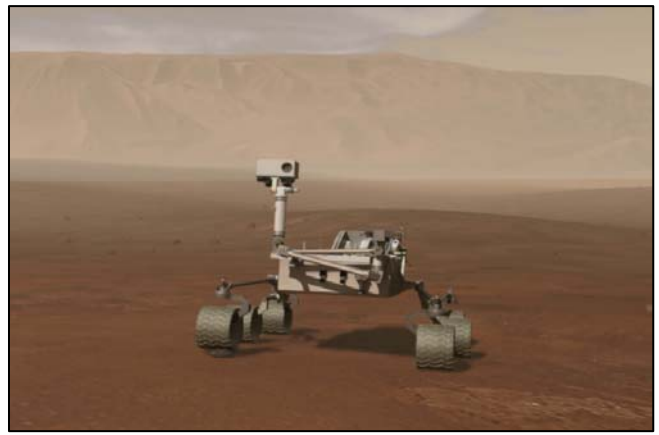


JPL 2009 MSL Rover



MSL Requirements

Key Driving EDL Requirements:



- Deliver 800 kg rover
- Landed altitude < [0 to 1] km (MOLA)
- Landing with a maximum error of 10 km from target

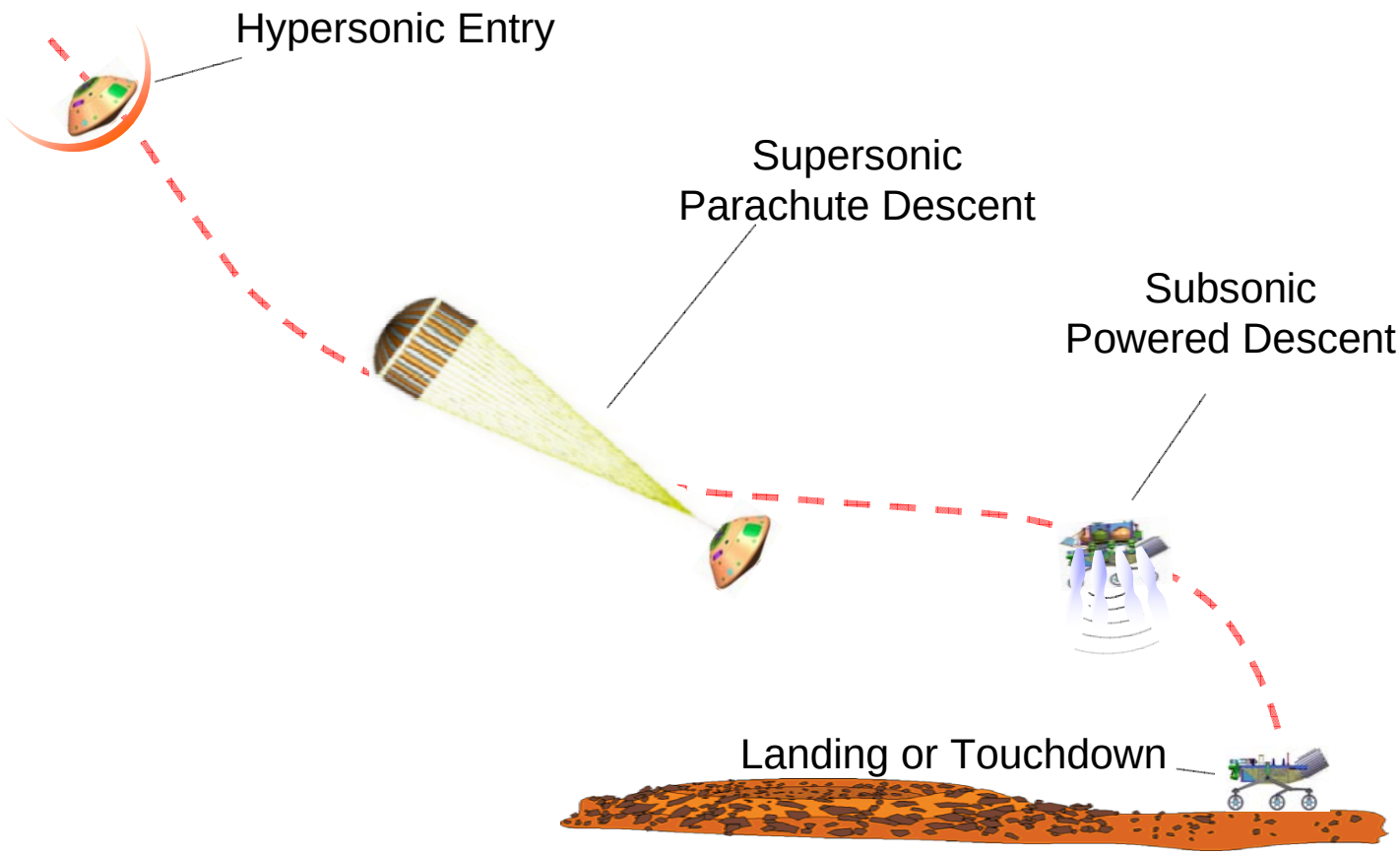
	Viking	*MPF*	*MPL*	*MER*	*Phoenix*	*MSL*
Landed Mass (kg)	603	360	290	540	364	1541*
Delivered Mass (kg)	603	360	290	173	364	800*
Entry Ballistic Coefficient (kg/m2)	63	62	71	88	71	121
Landing Altitude (km, MOLA)	-3.5	-1.5	+2.4	-1.3	-3.5	+[0 to 1]
Landing Accuracy (km)	420 x 200	100 x 50	75x 38	80 x 20	75 x 20	<10 x 10

* Includes required JPL practices 30% margin on allocation

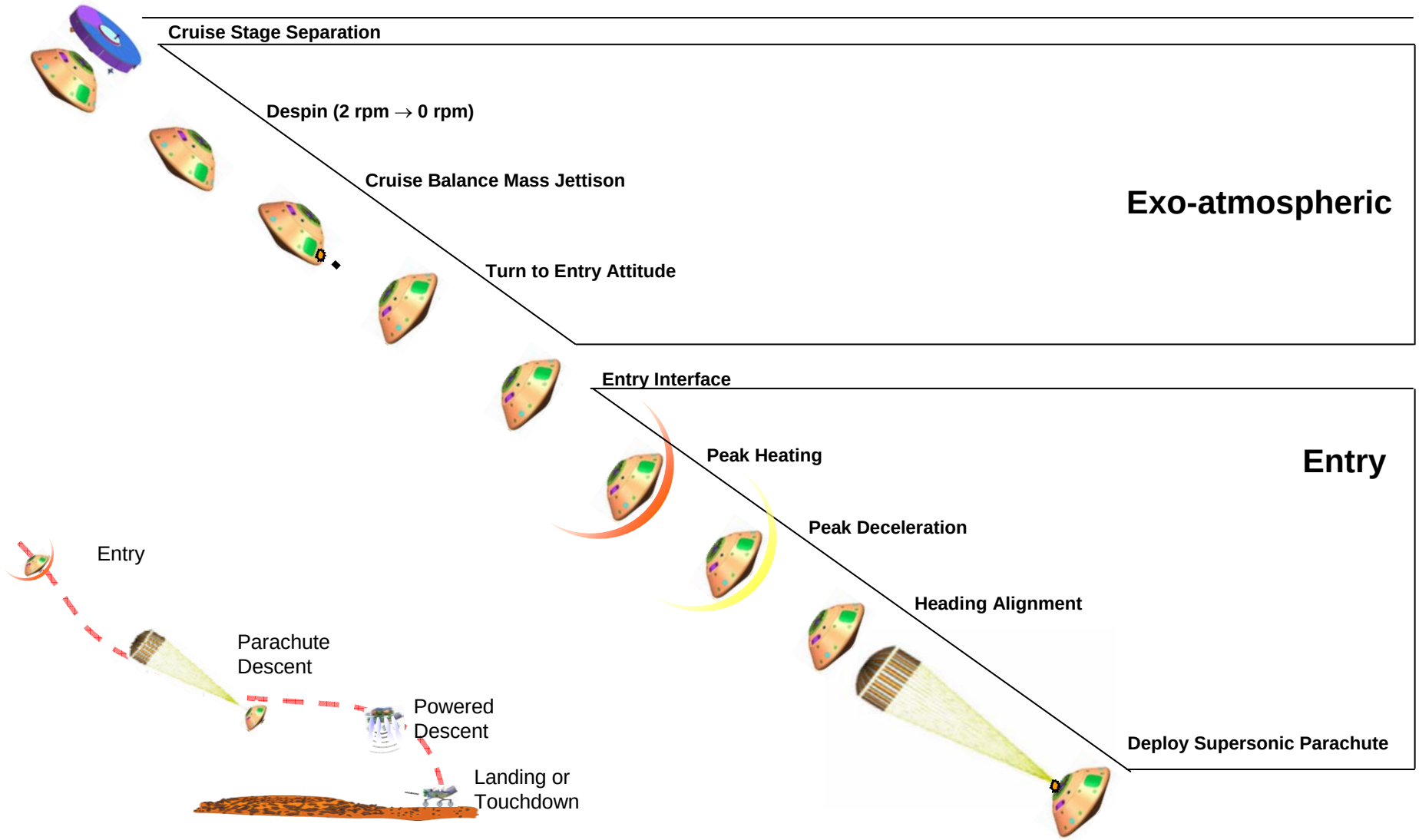
Martian Entry, Descent and Landing

Generic Martian Entry, Descent and Landing System:

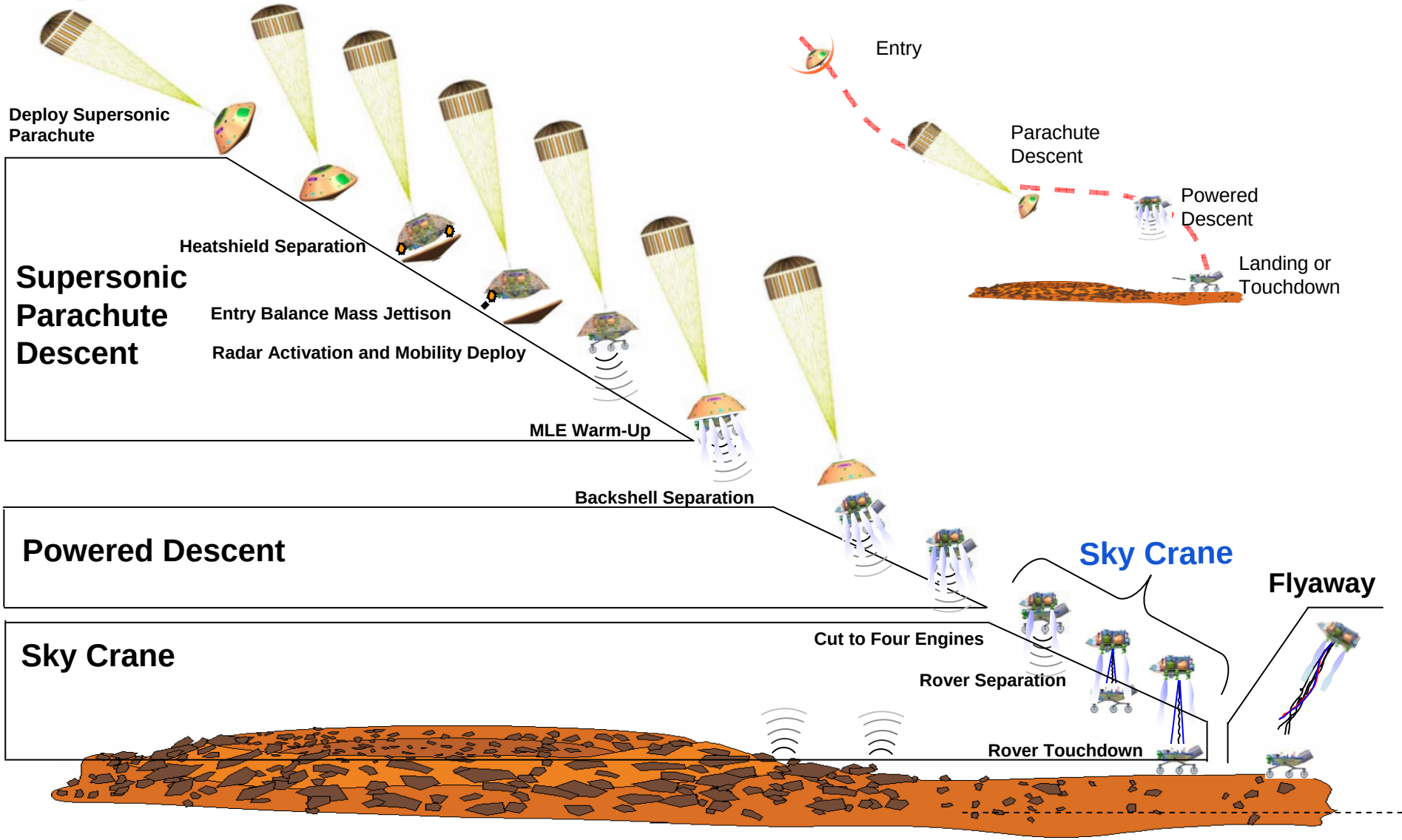
- Four Major Elements present historically for all large scale payloads
- MSL must incorporate improved performance for each EDL element



Event Timeline 1/2



Event Timeline 2/2

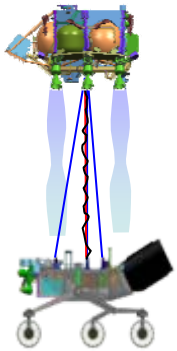


Sky Crane Touchdown

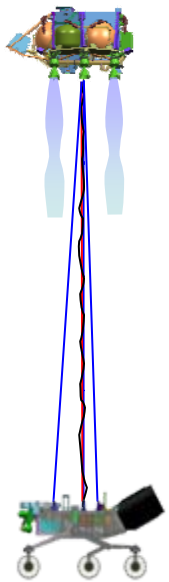
Descent Stage commanded to follow Reference Trajectory: $V_{Vertical}$ = 0.75 m/sec & $V_{Horizontal}$ = 0.0 m/sec

One-Body Phase
Duration = ~2 sec

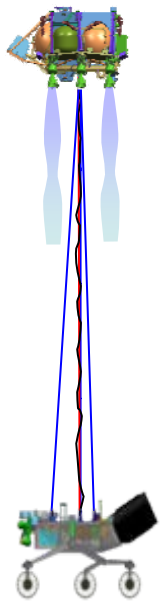
Deployment Phase
Duration = ~6 sec



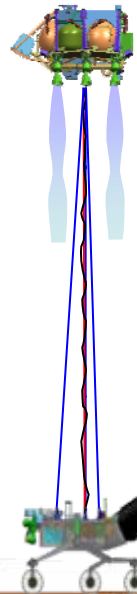
Post-Deploy Settling Phase
Duration = ~2 sec

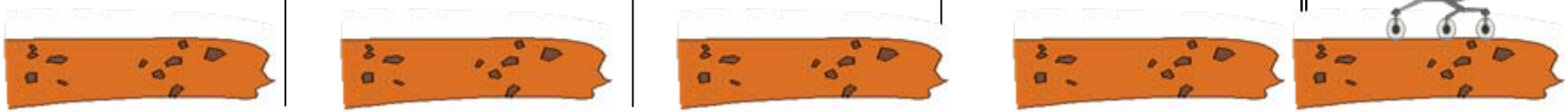


Ready for Touchdown Phase
Duration = 0-8 sec



Touchdown Phase
Duration < 2 sec





Skycrane Event Timeline