

Supporting Mars science with
Dell EMC Unity flash storage

Tom Stein

August 8, 2018

Dell EMC Unity All-Flash



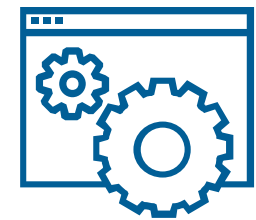
UNIFIED BLOCK AND FILE



SIMPLE TO USE



EFFICIENT



Secure

Complete security feature set and certifications



Editor's Choice

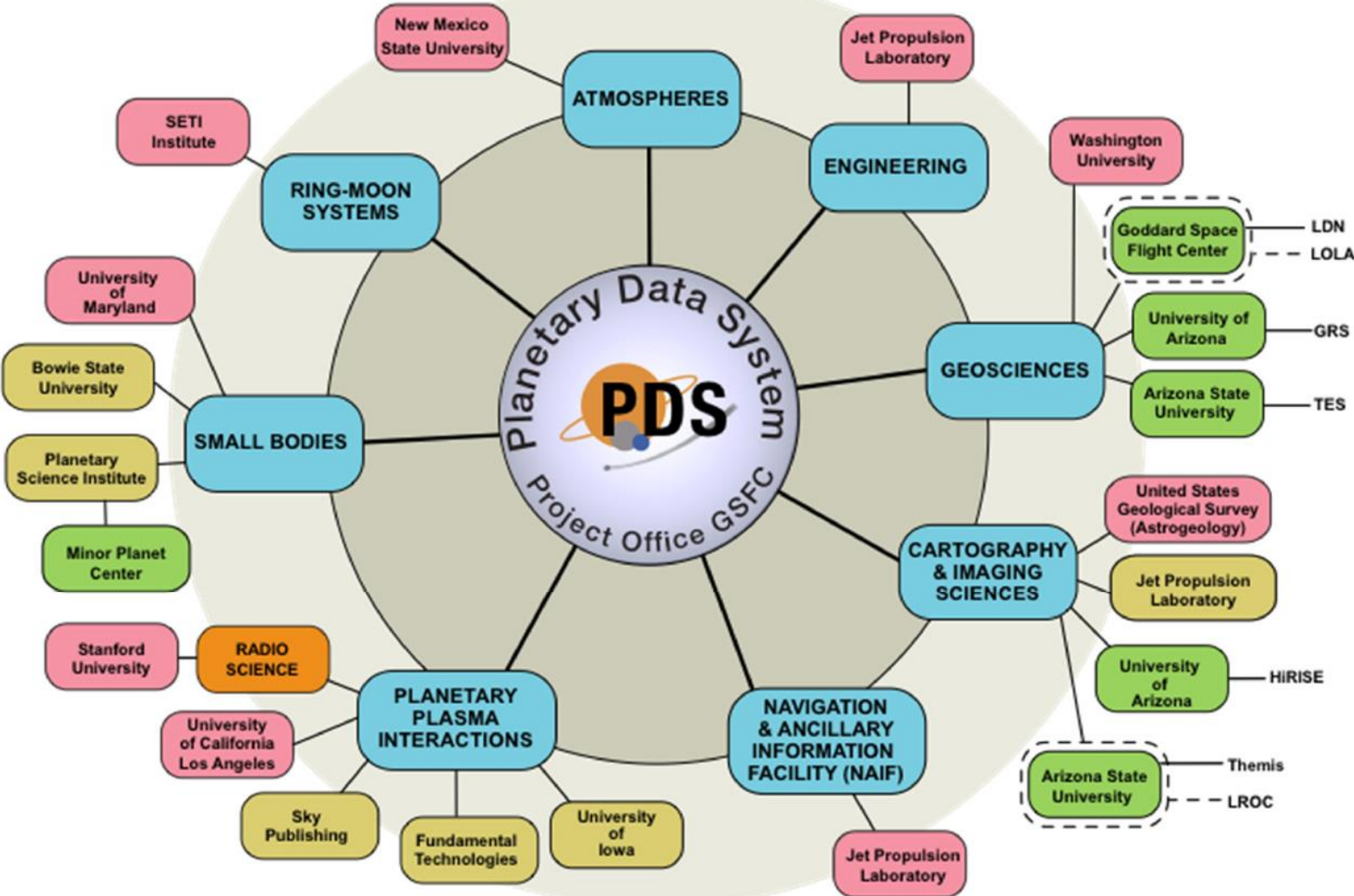
2018



1+ Exabyte
Flash

Shipped since May 2016

NASA Planetary Data System – “PDS”



OFFICIAL
NASA
DIAGRAM





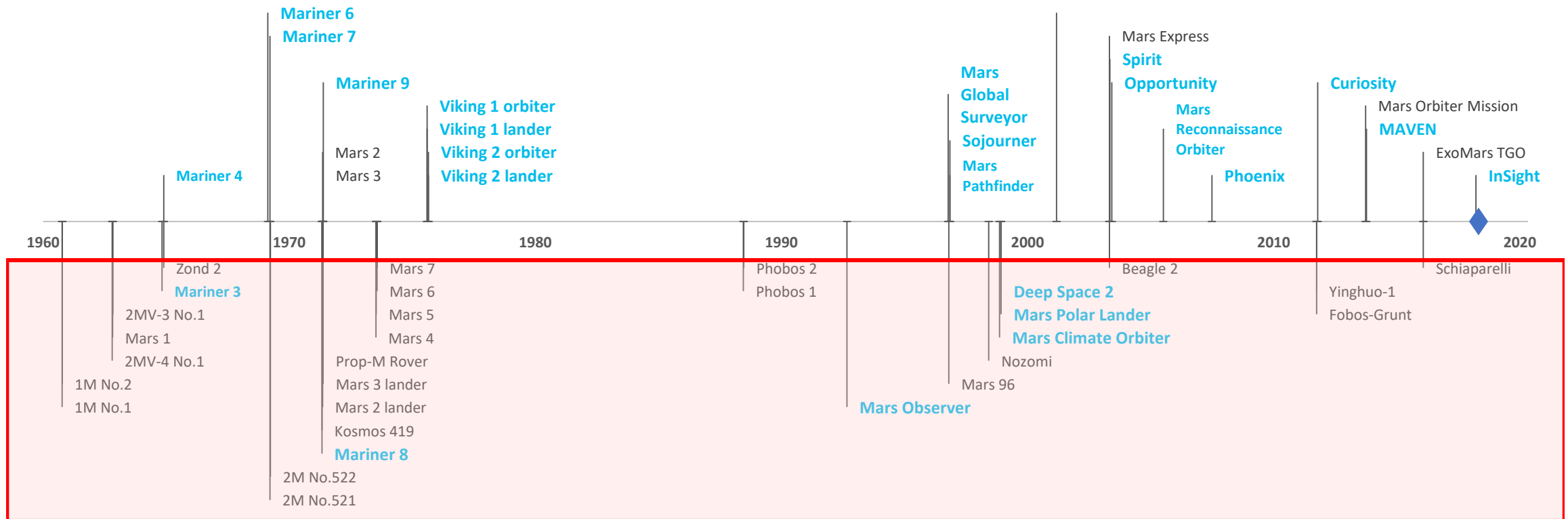
Finding IT solutions

If all you have is a hammer,
everything looks like a nail

— MARK TWAIN, but probably not



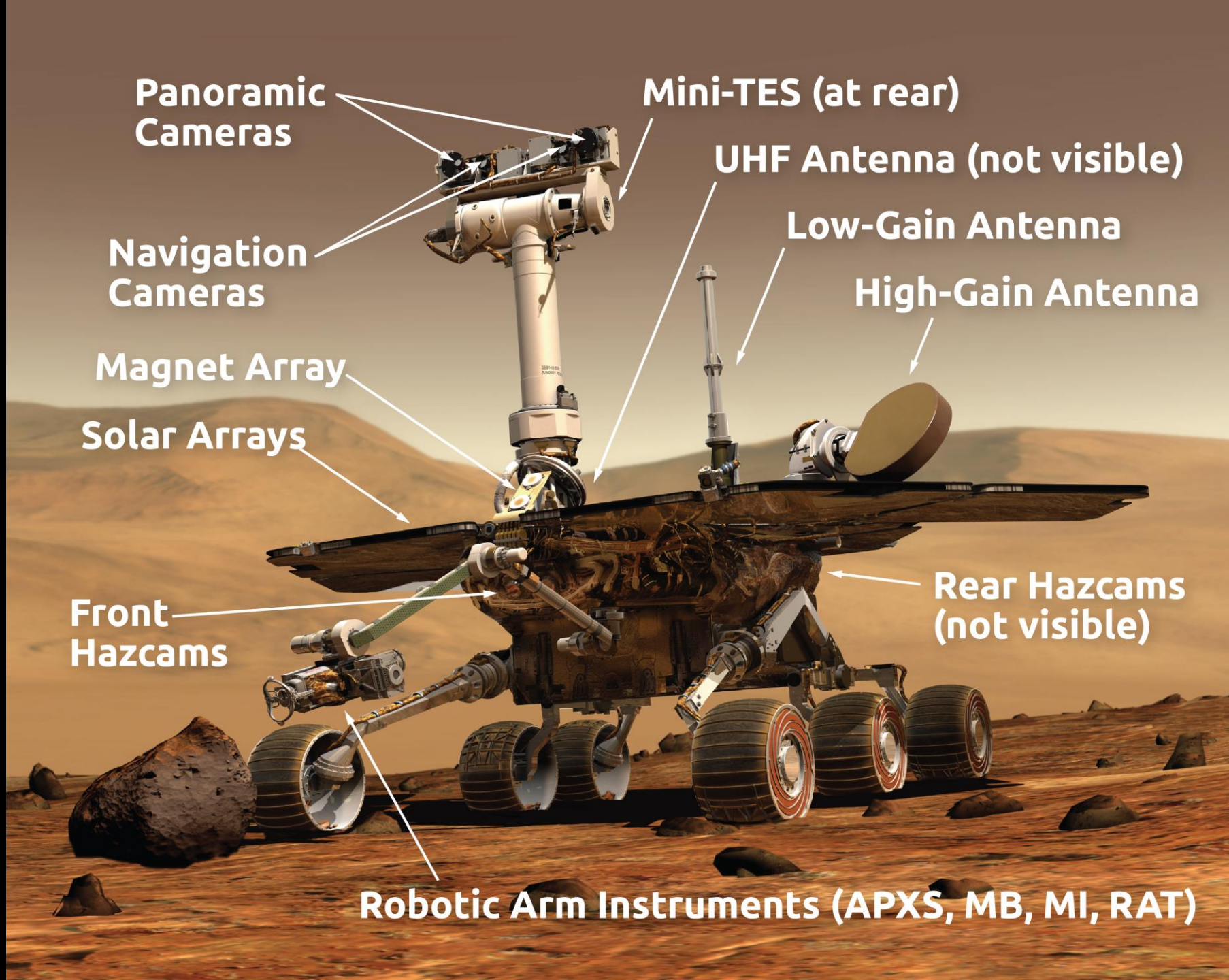
Missions to Mars





Mars Exploration Rovers: follow the water

- Life ever on Mars?
- Climate of Mars
- Geology of Mars
- Human exploration



**Panoramic
Cameras**

Mini-TES (at rear)

UHF Antenna (not visible)

**Navigation
Cameras**

Low-Gain Antenna

High-Gain Antenna

Magnet Array

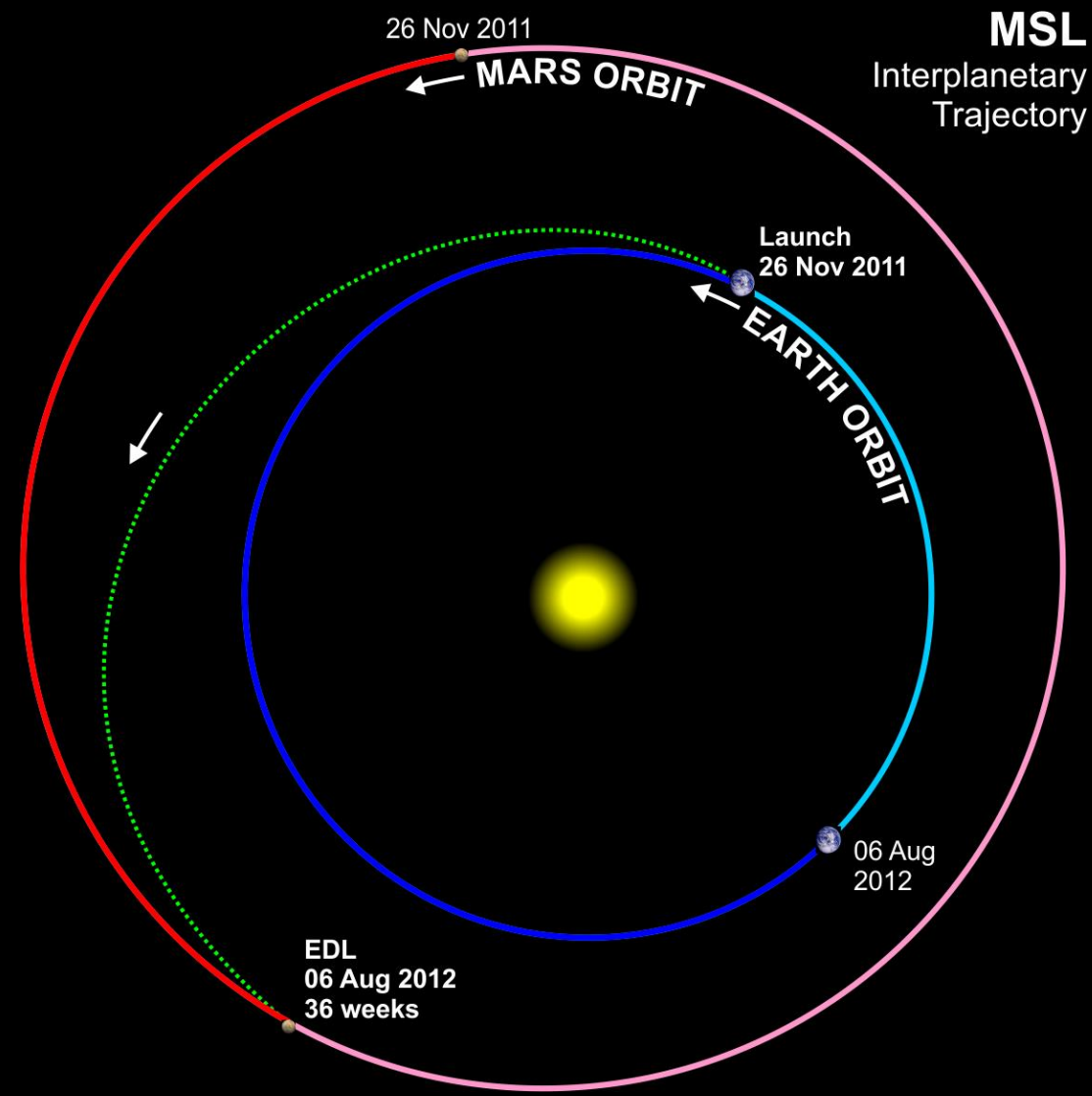
Solar Arrays

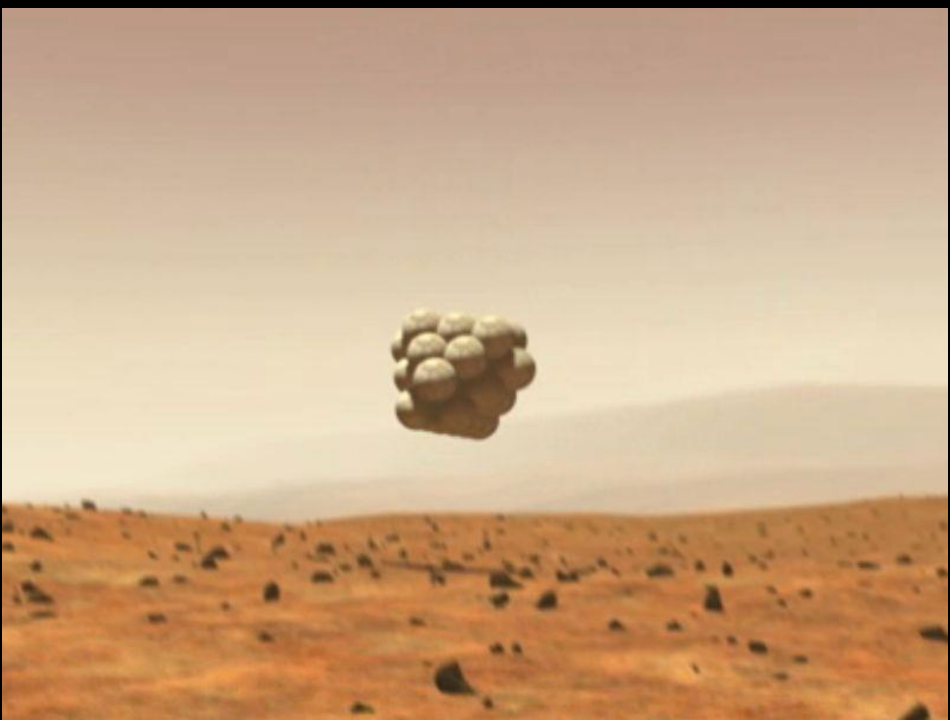
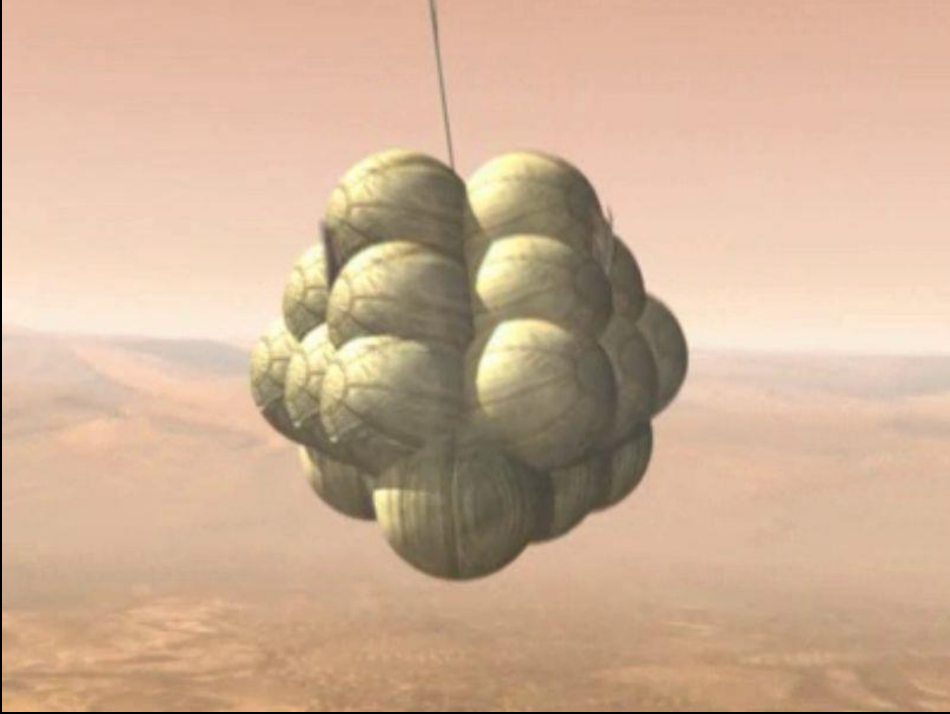
**Front
Hazcams**

**Rear Hazcams
(not visible)**

Robotic Arm Instruments (APXS, MB, MI, RAT)







10 Cruise Stage Separation: E-15 min

Entry: E-0 s, 125 km, 5.6 km/s planet-relative

Peak Heating/Peak Deceleration: E+102 s, 6.2 Earth g

Parachute Deployment: E+244 s, 9.5 km, 430 m/s

Heatshield Separation: E+264 s

Lander Separation: E+274 s

Bridle Descent Complete: E+284 s

Radar Ground Acquisition: 2.4 km AGL

DIMES Images Acquisition: 2.0 km AGL

Start Airbag Inflation: 0.5 s prior to RAD Firing

RAD/TIRS Rocket Firing: ~120 m AGL

Bridle Cut: ~12 m

Landing: E+355 s

Bounces, Rolls: Up to 1 km

EDL Communication via
UHF to MGS Orbiter

EDL Direct to Earth Communication
with MFSK tones

Spirit landing

Backshell

Parachute

Heatshield Impact Location

○ First Bounce

DIMES "First Bounce" Estimate □

○ Second Bounce

○ Third Bounce

○ Fourth Bounce

Other Bounces

Lander/Rover

○ Surface Feature Localization

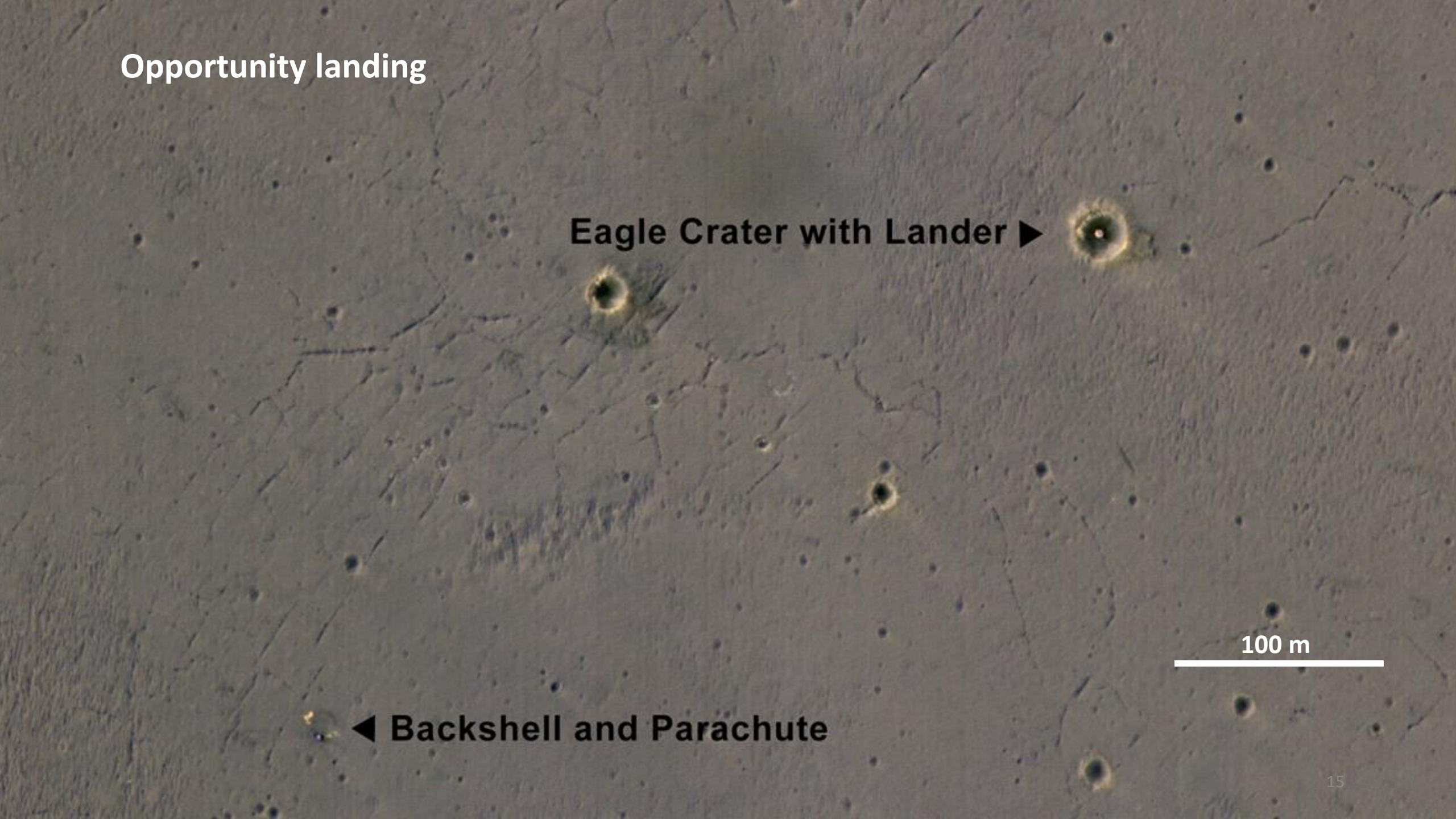
100 m

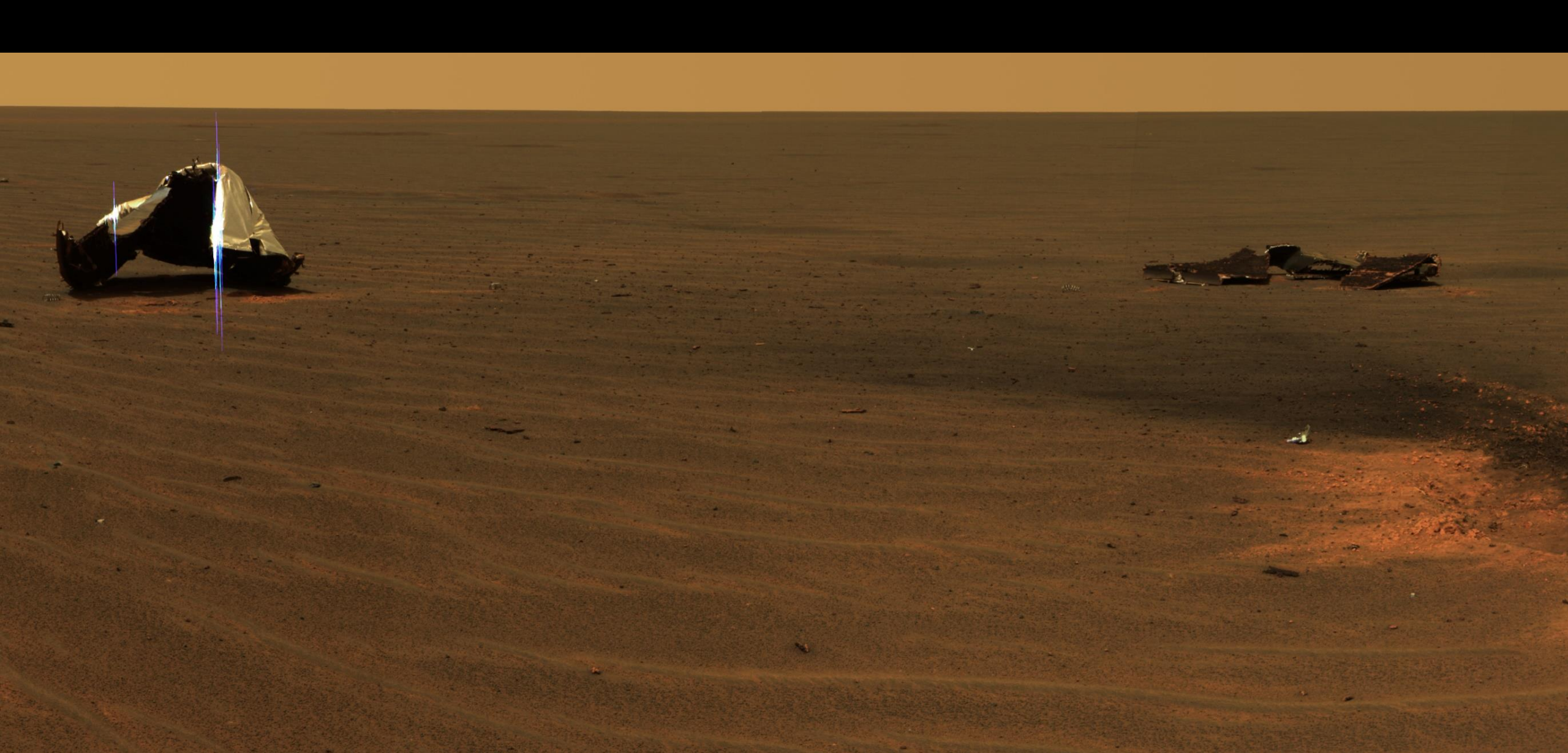
Opportunity landing

Eagle Crater with Lander ▶

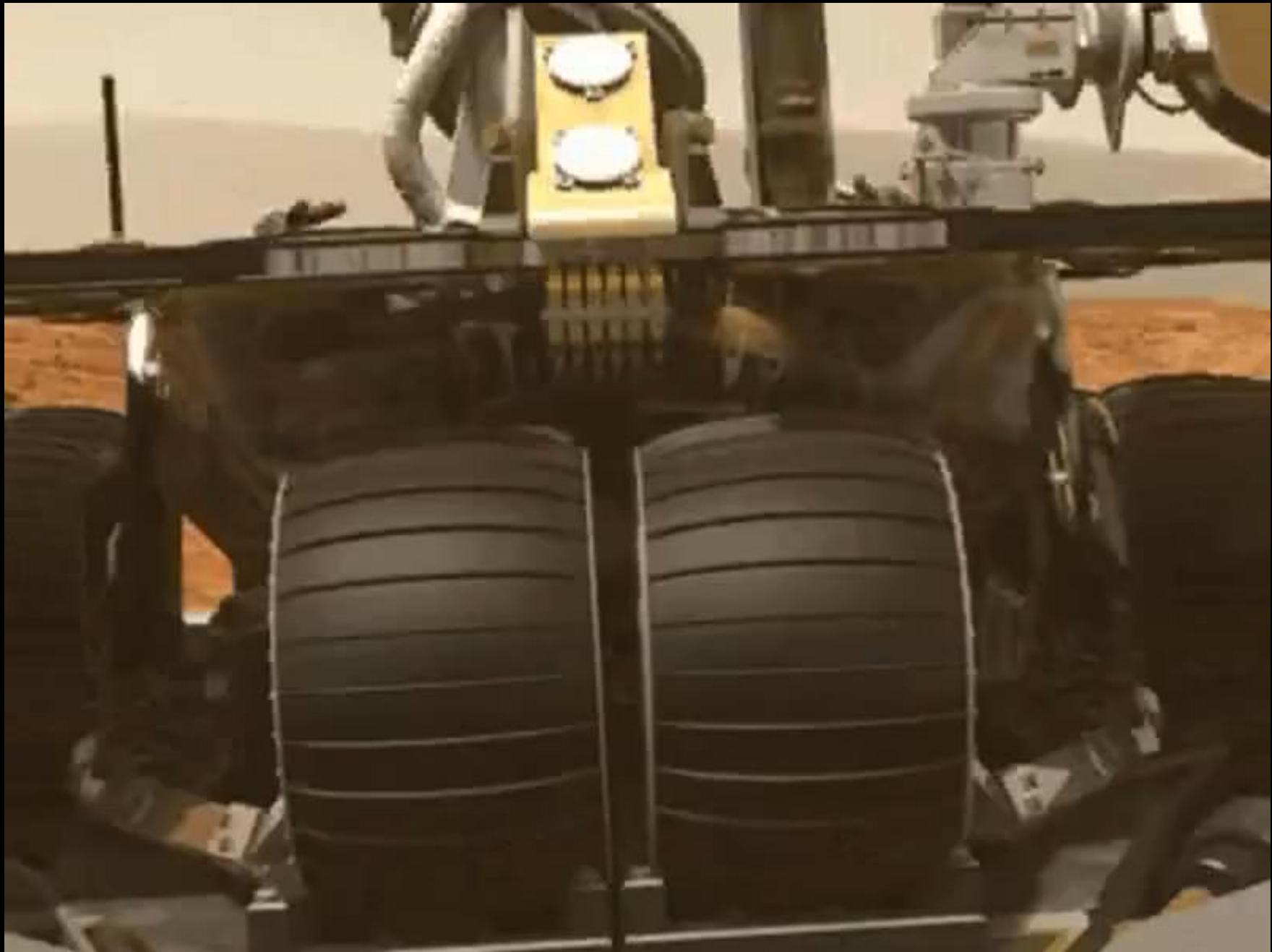
◀ Backshell and Parachute

100 m




























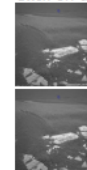








Activities








-  **Activity** APXS_Off
-  **Start time** 2004-03-15T08:22:07
-  **Activity** CPU_ON
-  **Start time** 2004-03-15T10:13:12
-  **Activity** Sol_50_Xband_Pass_1
-  **Sequence** be0055.06b
-  **Start time** 2004-03-15T10:19:12
-  **Activity** PLACEHOLDER_ENG
-  **Start time** 2004-03-15T10:48:57
-  **Activity** Sol_50_Nominal_Blip
-  **Start time** 2004-03-15T10:50:13
-  **Activity** none_PLACEHOLDER_placeholder_for_interferograms_MTES_TI_AM__chem_
-  **Observation** [MTES_TI_AM__chem_](#)
-  **Start time** 2004-03-15T10:57:11
-  **Activity** p3626_MTES_ti_AM_MTES_TI_AM__chem_
-  **Sequence** p3626
-  **Observation** [MTES_TI_AM__chem_](#)
-  **Start time** 2004-03-15T10:57:11
-  **Purpose** Mini-TES thermal inertia measurement on same surface as 11pm observation on sol 49.
-  **Notes** This observation should be acquired between 10:30-11:30 LST. Acquire interferograms with all TI.
-  **Data** [Click on a data product to open it in new window:](#)




 1T 132620352 RDR 06 02 P3626 N0 A1











 1T 132626376 RDR 06 02 P3626 N0 A1

-  **Activity** p3519_MTES_Elevation__30_degrees_Mini_Mini_TES_Sky_AND_Ground_Anytime__atm_
-  **Sequence** p3519
-  **Observation** [Mini_Mini_TES_Sky_AND_Ground_Anytime__atm_](#)
-  **Start time** 2004-03-15T11:00:44
-  **Purpose** long term monitoring of atmospheric profile (dust, T(z), ice, water vapor). Characterize environment.
-  **Notes** Any Azimuth.
-  **Data** [Click on a data product to open it in new window:](#)



 1T 132620492 RDR 06 02 P3519 N0 A1

-  **Activity** DELETE_DATA
-  **Start time** 2004-03-15T11:05:00
-  **Activity** p3506_MTES_Elevation__20_degrees_Mini_Mini_TES_Sky_AND_Ground_Anytime__atm_
-  **Sequence** p3506
-  **Observation** [Mini_Mini_TES_Sky_AND_Ground_Anytime__atm_](#)
-  **Start time** 2004-03-15T11:06:28
-  **Purpose** Determine surface temperature
-  **Notes** Any Azimuth. This activity gets a surface temperature needed for interpretation of scattering.



OWN
NOTES

OWN
NOTES

OWN
NOTES

NO
NOTES

OWN
NOTES

OWN
NOTES

Welcome to the Analyst's Notebook for the August 2002 FIDO Field Test! [Online help](#) is available.

Data

Data Summary by Sol

08/09/02 Sol 6	08/15/02 Sol 17 Sol 18
08/10/02 Sol 7 Sol 8	08/16/02 Sol 19 Sol 20
08/11/02 Sol 9 Sol 10	08/17/02 Sol 21 Sol 22
08/12/02 Sol 11 Sol 12	08/18/02 Sol 23 Sol 24
08/13/02 Sol 13 Sol 14	08/19/02 Sol 25 Sol 26
08/14/02 Sol 15 Sol 16	All Sols

Data Summary by Instrument

V Rover commands	ö Moessbauer Spectrometer
I IR Point Spectrometer	N Navcam
T Mini-TES	FH Front Hazcam
A APXS	RH Rear Hazcam
M Microscopic Imager	B Bellycam
P Pancam	
I N IPS - Navcam - Target Relationship	

ANB Timeline *(requires frame support)*

Sol [1](#) [2](#) [3](#) [4](#) [5](#) [6](#) [7](#) [8](#) [9](#) [10](#) [11](#) [12](#) [13](#) [14](#) [15](#) [16](#) [17](#) [18](#) [19](#) [20](#) [21](#) [22](#) [23](#) [24](#) [25](#) [26](#)

Documentation

Field Test Documentation

Daily Documentarian Report

Sol [1](#) [2](#) [3](#) [4](#) [5](#) [6](#) [7](#) [8](#) [9](#) [10](#) [11](#) [12](#) [13](#) [14](#) [15](#) [16](#) [17](#) [18](#) [19](#) [20](#) [21](#) [22](#) [23](#) [24](#) [25](#) [26](#)

Mission Manager's Report

Sol [1](#) [2](#) [3](#) [4](#) [5](#) [6](#) [7](#) [8](#) [9](#) [10](#) [11](#) [12](#) [13](#) [14](#) [15](#) [16](#) [17](#) [18](#) [19](#) [20](#) [21](#) [22](#) [23](#) [24](#) [25](#) [26](#)

Additional Documentation

- [Mission Summary Table](#)
- [Field Test Location](#)
- [Sol Summary Posters](#)
- [Justin Wick Summaries](#)
- [EPO Products](#)
- [Mission Highlights Presentation](#)
- [FIDO Atmospheric Results Slides](#)
- [Christensen's Mineralogy Presentation](#) (11823 kb) [\[htm version\]](#)
- [Post-test Field Site Write-up](#)
- [Field Sample Image References](#)

Field Test Resources

[Training Material](#)

[Orbital Images](#)

AN Documentation

[Online help](#)

AN Alerts and News

08/18/02 **Full-quality image data** are available from the AN via ftp. See the [online help](#) for more information.



www.zerochan.net/2081828

Old school cool
or Blunder years?

End of page



This page updated 01/02/03 01:44:25 PM and is maintained by the [Geosciences Node](#) of NASA's [Planetary Data System](#). Comments should be addressed to webmaster@wunder.wustl.edu. [Web statistics](#) for this site.

[Back to top](#)



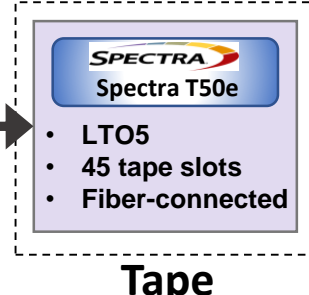
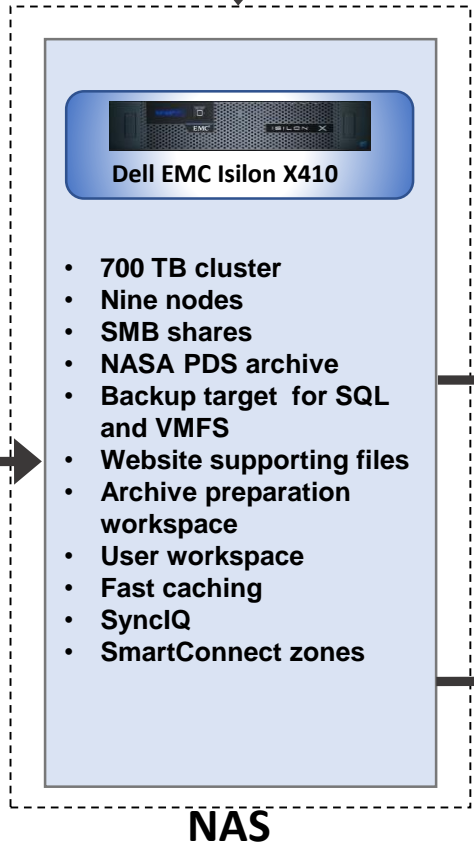
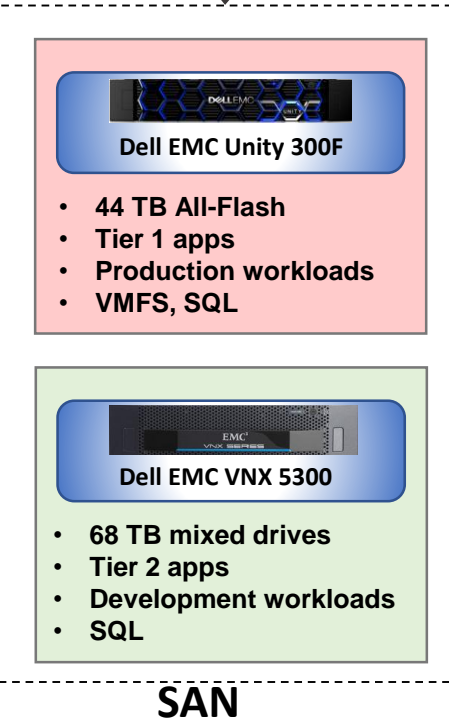
System diagram, 2003

	PLANNED	ACTUAL
Duration	180 sols	7376 sols
Sites visited	8	346
Drive distance	600 m	52891 m
File count	5000	30 million
Data volume	64 GB	4.7 TB
End date	July 2004	Still active



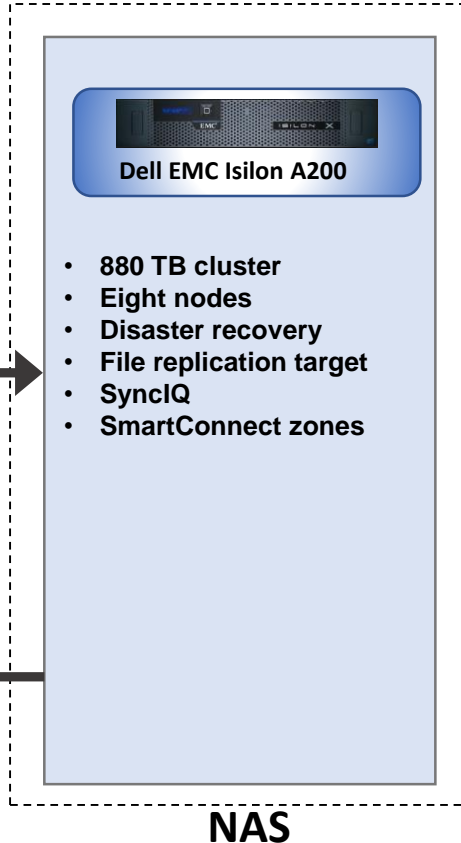
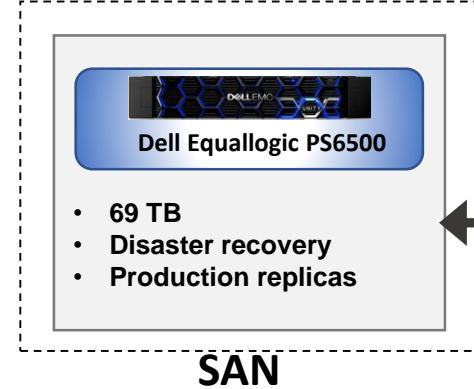
Storage Diagram

NASA PDS Geosciences Node
Washington University in St. Louis
July 2018



(Primary Site) (Secondary Site)

Daily Cluster Synchronization (SyncIQ)



Dell EMC Unity All-Flash

- Dual configured for both block and file
 - We use block storage for our VMDKs, SQL databases, and thin client hosting
 - We use file level storage for mapping services and high availability images
- Scalability
 - Ease of expansion
- Administration
 - Real time performance monitor other software tools built in



Helping users find what they want

**geodata.rsl.wustl.edu - /mer/mer1-m-pancam-3-radcal-rdr-v1
/mer1pc_1xxx/data/sol0004/**

[\[To Parent Directory\]](#)

Wednesday, September 29, 2004 3:18 PM	2142208	lp128532760rad0200p285114c1.img
Wednesday, September 29, 2004 3:18 PM	50048	lp128532760rat0200p285114c1.img
Wednesday, September 29, 2004 3:18 PM	2142208	lp128532801rad0200p285115c1.img
Wednesday, September 29, 2004 3:18 PM	50048	lp128532801rat0200p285115c1.img
Wednesday, September 29, 2004 3:19 PM	2142208	lp128532843rad0200p285116c1.img
Wednesday, September 29, 2004 3:19 PM	50048	lp128532843rat0200p285116c1.img
Wednesday, September 29, 2004 3:19 PM	216320	lp128532898rad0200p285114c1.img
Wednesday, September 29, 2004 3:19 PM	50176	lp128532898rat0200p285114c1.img
Wednesday, September 29, 2004 3:19 PM	216320	lp128532950rad0200p285115c1.img
Wednesday, September 29, 2004 3:19 PM	50176	lp128532950rat0200p285115c1.img
Wednesday, September 29, 2004 3:19 PM	216320	lp128533003rad0200p285116c1.img
Wednesday, September 29, 2004 3:19 PM	50176	lp128533003rat0200p285116c1.img
Wednesday, September 29, 2004 3:19 PM	50148	lp128534453rad0203p2600r8c1.img
Wednesday, September 29, 2004 3:19 PM	41814	lp128534453rad0203p2600r8c1.img
Wednesday, September 29, 2004 3:19 PM	50432	lp128534453rat0203p2600r8c1.img
Wednesday, September 29, 2004 3:19 PM	50432	lp128534453rat0203p2600r8c1.img
Wednesday, September 29, 2004 3:20 PM	2142208	lp128534493rad0203p2850r8c1.img
Wednesday, September 29, 2004 3:20 PM	2142208	lp128534493rad0203p2850r8c1.img
Wednesday, September 29, 2004 3:20 PM	50432	lp128534493rat0203p2850r8c1.img
Wednesday, September 29, 2004 3:20 PM	50432	lp128534493rat0203p2850r8c1.img
Wednesday, September 29, 2004 3:21 PM	2142208	lp128534537rad0203p2850r8c1.img
Wednesday, September 29, 2004 3:21 PM	2142208	lp128534537rad0203p2850r8c1.img
Wednesday, September 29, 2004 3:21 PM	50176	lp128534537rat0203p2850r8c1.img
Wednesday, September 29, 2004 3:21 PM	50176	lp128534537rat0203p2850r8c1.img
Wednesday, September 29, 2004 3:21 PM	74752	lp128534568rad0203p2610r6c1.img
Wednesday, September 29, 2004 3:21 PM	50048	lp128534568rat0203p2610r6c1.img
Wednesday, September 29, 2004 3:21 PM	75520	lp128534606rad0203p2610r6c1.img
Wednesday, September 29, 2004 3:21 PM	74752	lp128534606rad0203p2610r6c1.img

Dealing with new types of users

- Scientists Researchers
- Citizen scientists
- College students
- Conspiracy theorists

Mars isn't flat, either

MER Analyst's Notebook - Spirit - Netscape

File Edit View Go Bookmarks Tools Window Help

MER Analyst's Notebook SPIRIT MER-A

Rover Home Sol Summaries Navigator Search Resources Help

Introduction Documentation Product Overview Final Activity Plan

Quick Links

Click on an icon to select summary reports for a specific sol.

Legend

- Documentation
- Product Overview
- Slow to load
- Activity Plan

001					
002					
003					
004					
005					
006					
007					
008					
009					
010					
011					
012					
013					
014					
015					
016					
017					
018					
019					

Sol 1 Data Product Summary

This table summarizes the product counts for each instrument. The colored instrument icons represent the rover instruments.

Summary	A	B	D	E	FN	M	N	P	RH	T
Total Products	0	0	0	9	33	0	938	96	31	0
Unique SCLK Values	0	0	0	3	1	0	31	9	1	0

Primary Products

The "highest resolution" EDR for each product is listed below. Click on the image to preview the product, or click on one of the icons described in the options table.

Options

- View product in preview window
- Open product in web browser window
- Download the product
- Download the detached label

001		2 E 126462398 EDN 00 00 F0006 NO M1			
001		2 E 126462401 EDN 00 00 F0006 NO M1			
001		2 E 126462405 EDN 00 00 F0006 NO M1			
001		2 N 126467960 EDN 00 00 P1500 LD M1			

Preview Window

This is a downsampled preview of product 2 P 126471476 BFP 00 00 P2303 L2 C1.
Click on the image to see a full-size version of the product.

The MER Analyst's Notebook is produced by the [PDS Geosciences Node](#) at Washington University in St. Louis. Send comments to meran@wunder.wustl.edu.

Site Sol 390 More ?

Site 30 / 484 / 6

Items open . Change using "More" menu item above.

- Sol 572 Drive toward "Kimberley" Target, MAHLI Wheel Imaging, and Re
 - 78 Data AP CC CM DN FH MC MD MH NC RH RD RM SM SP
 - 2 Documents 0 Plans 0 Targets 23 Mosaics
- Sol 573 Remote Sensing
 - 65 Data AP CC CM DN FH MC MD MH NC RH RD RM SM SP
 - 2 Documents 0 Plans 0 Targets 3 Mosaics
- Sol 574 Drive toward "Kimberley" Target, MAHLI Wheel Imaging, and Ta
 - 98 Data AP CC CM DN FH MC MD MH NC RH RD RM SM SP
 - 2 Documents 1 Plan 4 Targets 11 Mosaics

Sol 574 overview

Sol 574 data products (98)

- ChemCam (54)
- DAN (8)
- Front Hazcam (3)
- Mastcam (38)

Add checked items to cart Clear all Check all

Traverse map

7 locations found

Click on a location below to load details.

- Site 30 / 484 / 6 Sols 572-574
 - 255 Data AP CC CM DN FH MC MD MH NC RH RD RM SM
 - 6 Doc 1 Plan 5 Targ 23 Mos 0 Spec
- Site 30 / 484 / 12 Sol 574
 - 1 Data AP CC CM DN FH MC MD MH NC RH RD RM SM
 - 2 Doc 1 Plan 5 Targ 8 Mos 0 Spec

East: 8144604.56, North: -274202.61

HIDE

Reload by: most recent | Auto refresh on | More

Items open on this page. Change using "More" menu item above.

- 1504MH 000170000 0304818 R00_DRCX Sol 1504 Site 59 / 0 / 24
- CX01352MR0541610 F517508843VA Sol 1352 Site 54 / 1610 / 28
- Target Dondo Sol 1416 Site 56 / 1122 / 0
- Label for the Planetary Data System Data Dictionary file PDSDD.LBL
- CR0_488665553PRC_F0481570CCAM02027L1 Sol 1027 Site 48 / 1570 / 86
- N_L000_0785_ILTO 44CVP_S_0036_UNCORM2 Sol 785 Site 44 / 36
- N_L000_1514_ILTO 59POL_S_1998_UNCORM1 Sol 1514 Site 59 / 1998
- N_L000_1514_ILTO 59VRT_S_1998_UNCORM1 Sol 1514 Site 59 / 1998
- N_R000_1514_ILTO 59CVP_S_1998_UNCORM1 Sol 1514 Site 59 / 1998
- N_L000J1513XRNM0 59CYL_S_1596_A0653M1 Sol 1513 Site 59 / 1596
- Target Whale_Rock Sol 796 Site 44 / 568 / 0
- Target cand2 Sol 1000 Site 48 / 1570 / 0
- 1513ML 007700000 0604211 C00_DRCX Sol 1513 Site 59 / 1596 / 8
- NLB_523208642RAD LF0561122NCAM00207M1 Sol 1416 Site 56 / 1122 / 37
- 0387MH 000171000 0104361 R00_DRCX Sol 387 Site 15 / 998 / 4
- FLA_398742695RAD LF0030004FHAZ00200M1 Sol 14 Site 3 / 4 / 4
- CX01032MH0481600 F489104626VA Sol 1032 Site 48 / 1600 / 36
- CX00198MR0060000 F415054968VA Sol 198 Site 6 / 0 / 2

FH Rad-corrected absolute radiance units, integer
Sol 14 FLA_398742695RADLF0030004FHAZ00200M1

Group views | Product views | Actions

File | Draw | Measure

DRAWING (0)

LOCATION (4)

Coordinate frame: Site

Loc #	Pixel		Location (m)			Rover dist (m)	Az (deg)	El (deg)
	i	j	x	y	z			
1	281	378	0.56	4.40	0.25	4.44	70.06	-28.27
2	449	356	-1.09	4.62	0.21	4.75	94.38	-27.78
3	72	442	1.60	3.49	0.28	3.85	49.61	-30.27
4	871	355	-5.13	2.74	-0.04	5.82	154.72	-20.87

Add new location

DISTANCE (1)

PROFILE (1)

Prof #	Segment	From Loc #	To Loc #	Dist (m)	Bearing (deg)	Ave slope (deg)
1	1	3	4	6.79	186.41	-2.70

Add new profile

Profile 1 (from location 3 to 4)



Windows

- CR0_488665553PRC_F0481570CCAM02027L1 Sol 1027 Site 48 / 1570 / 86
- Label for the Planetary Data System Data Dictionary file PDSDD.LBL
- Dondo Sol 1416 Site 56 / 1122 / 0
- CX01352MR0541610 F517508843VA Sol 1352 Site 54 / 1610 / 28
- 1504MH 000170000 0304818 R00_DRCX Sol 1504 Site 59 / 0 / 24
- Activity plan Sol 1416
- FLA_398742695RAD LF0030004FHAZ00200M1 Sol 14 Site 3 / 4 / 4

Back 3 sols Sol 1416 Next 3 sols More ?

HIDE

3 products : A0 L0 R0

- NC RAD Sol 1415 SCLK 523117224
Seq ncam00560 Site 56 / 1122 / 8
8 products : L0
- MC D Sol 1415 SCLK 523117643
Seq mcam06929 Site 56 / 1122 / 8
2 products : L7 R7
- MC E Sol 1415 SCLK 523117775
Seq mcam06930 Site 56 / 1122 / 8
3 products : L0 R0
- NC RAD Sol 1415 SCLK 523117819
Seq ncam00543 Site 56 / 1122 / 8
8 products : R0

Sol 1415 documents (2)

Sol 1415 targets (3)

Sol 1416 overview

Sol 1416 data products (242)

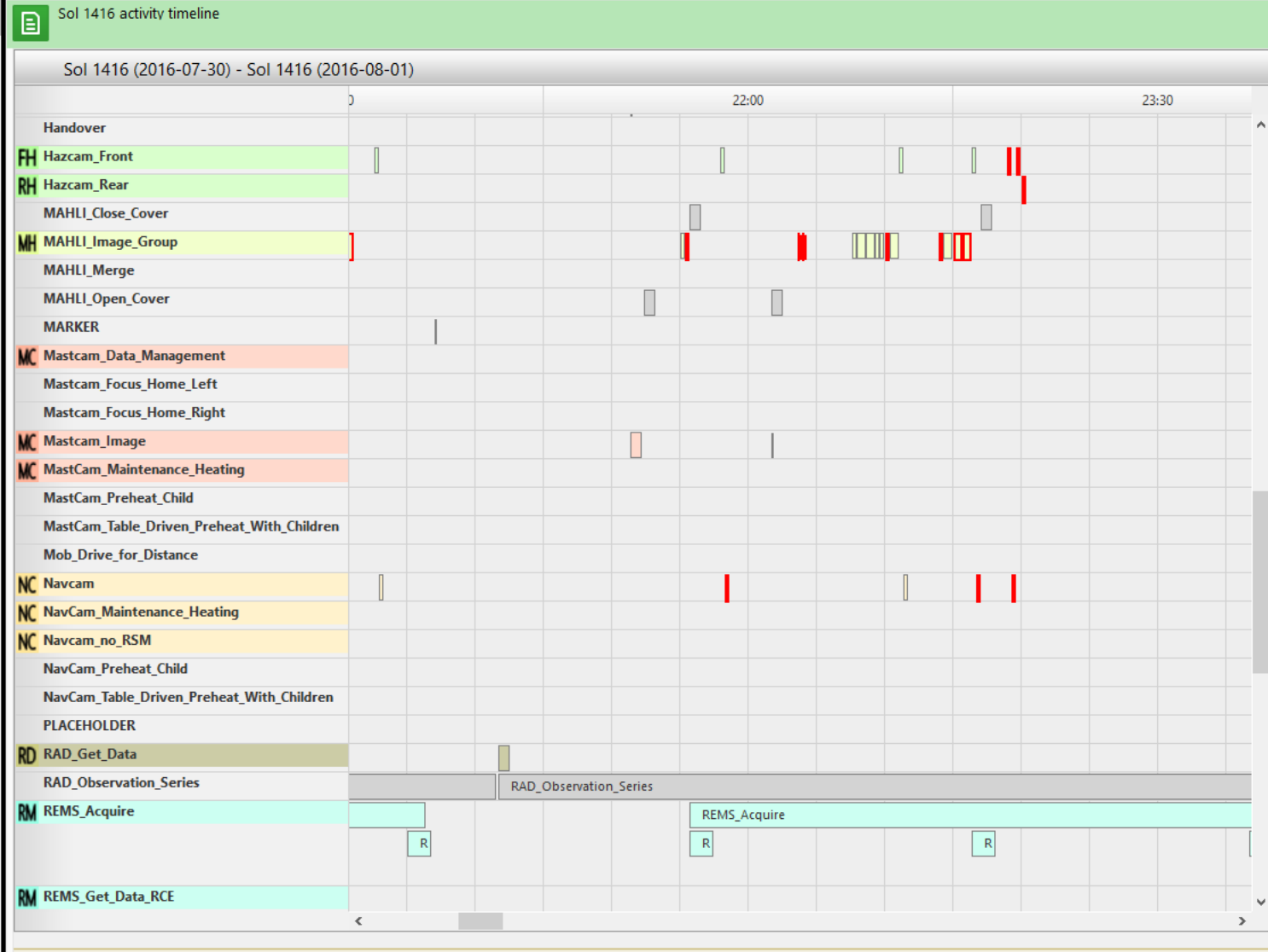
Sol 1416 documents (2)

Sol 1416 plans (1)

- Sol 1416 Activity Plan (post engineers) - View as list
- Sol 1416 Activity Plan (post engineers) - View as timeline

Sol 1416 targets (18)

Chibia
Defined Sol 1416 on an image from site 56, drive 1122 and found on 102 other images



QUICK START

Using the timeline

The timeline shows the activity plan for a given sol. Activities are grouped by activity type. Hover over an activity to see the full name. Click on an activity to see the details. Activities outlined in red are associated with one or more data products.

Contents of this help page

- [What the timeline shows](#)
- [About the details view](#)
- [About the activities plan](#)
- [Interface tips](#)

About the timeline

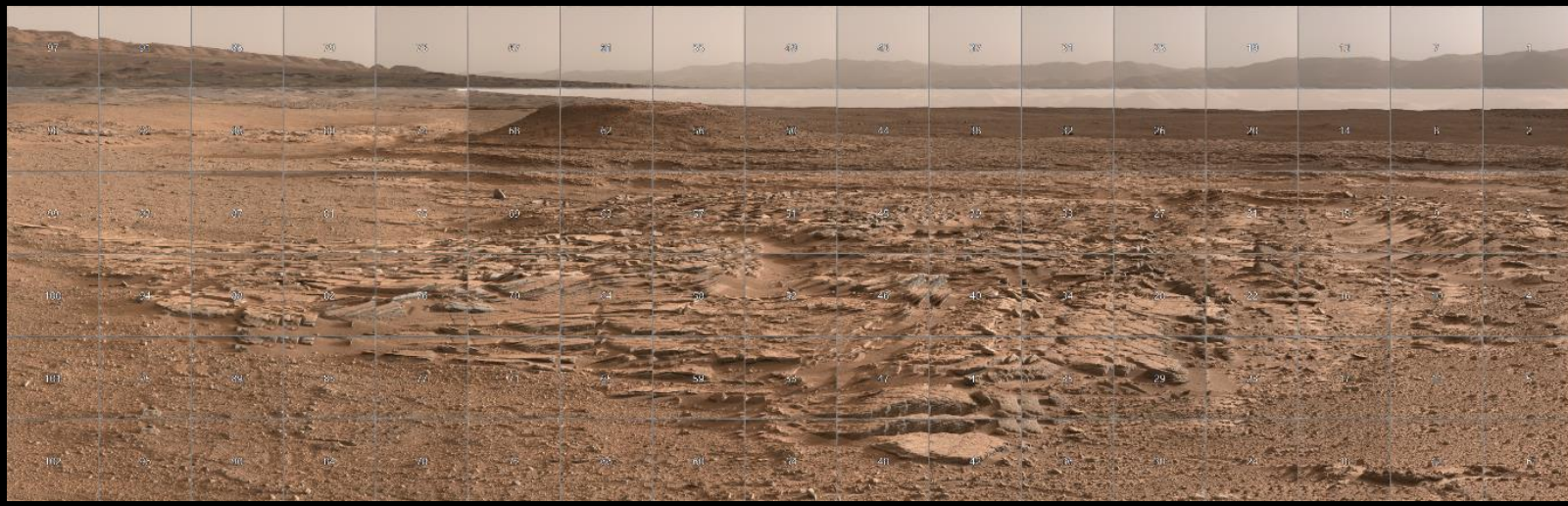
What the timeline shows

The timeline is a time-ordered representation of a one-sol activity plan. Each activity is shown as a bar, positioned and sized based on the activity start and end times. Activities outlined in red are associated with one or more data products. Activities are grouped name, thus the time ordering of sol's activities in the chart is not strictly top to bottom, left to right.

Accessing activity details

Click on an activity to see details in the right hand window. You can hover over an activity in the timeline to see the full name (for systems supporting mouse hovering).

Timeline settings Time interval 15 Minutes Width Standard Reload Show help





HIDE



Filter ▾ Options ▾ Reset ? ▾

New feature! You can filter, sort, and manage your history in detail by selecting Options > Manage history in the menu above.

Showing top 100 of 545 items.

		1352_CRC_CCAM01352_Tsongoari Sol 1352	×
		Target Big_Sky Sol 1114 Site 50 / 592 / 0	×
		Traverse map	×
		FLB_486175319RAD_LF0481570FHAZ00323M1 Sol 999 Site 48 / 1570 / 54	✎ ×
		SOWG Documentarian uplink report Sol 20	×
		CX01500ML0582394_F530660450VA Sol 1500 Site 58 / 2394 / 8	×
		Search results: Mosai(c)s N_L000_1628_ILT061POL_S_1332_UNCORM	×
		N_L000_1628_ILT061POL_S_1332_UNCORM1 Sol 1628 Site 61 / 1332	×
		NLB_542035319RAD_LF0611332NCAM00276M1 Sol 1628 Site 61 / 1332 / 8	×
		NLB_542035319ARM_F0611332NCAM00276M1 Sol 1628 Site 61 / 1332 / 8	×
		Search results: Data product(s) NLB_542035319	×
		FLB_554728843RAD_LF0642790FHAZ00341M1 Sol 1771 Site 64 / 2790 / 12	✎ ×
		Label file MODRDR6.FMT	×
		RME_563188290RMD_1867000000____P1 Sol 1867	×
		CR0_517512449PRC_F0541610CCAM01352L1 Sol 1352 Site 54 / 1610 / 28	×
		CR0_517511824PRC_F0541610CCAM01352L1 Sol 1352 Site 54 / 1610 / 28	×
		N_R000_1500_EDR0_58CYPTS02394_DRIVEM1 Sol 1500 Site 58 / 2394	×
		0020MR_000052002_0100259_C00_DRXC Sol 20 Site 3 / 78 / 6	×

Target Big_Sky
Target defined on Sol 1114 Site 50 / 592

Target ▾ Actions ▾ ? ▾

What's on this page?

The literature references below are pulled from **LPSC 2015-2016 abstracts** and are generated by an automated process. If you find an error, please [let us know](#).

Mentions in literature

Mentions A bibliography of all literature mentions found for this target.

Compositional references

Element References to elemental composition of this target, with relevant excerpts

[Aluminum](#) [Fluorine](#) [Magnesium](#) [Silicon](#)

Mineral

References to mineral composition of this target, with relevant excerpts

[Hematite](#) [Magnetite](#) [Phyllosilicate](#) [Sulfates](#)

Search links

Search Links to searching for other targets with similar compositional references.

Mentions in literature

Target Big_Sky was referenced in the following documents. Excerpts related to compositional characteristics are listed subsequently.

Sort by author

Forni et al. (2016) "[Fluorine In The Pahrump Outcrop, Gale Crater : Implications For Fluid Circulation And Alteration](#)", Lunar and Planetary Science Conference, Abstract #1990.

Frydenvang et al. (2016) "[Discovery Of Silica-rich Lacustrine And Eolian Sedimentary Rocks In Gale Crater, Mars](#)", Lunar and Planetary Science Conference, Abstract #2349.

Gasda et al. (2016) "[Potential Link Between High-silica Diagenetic Features In Both Eolian And Lacustrine Rock Units Measured In Gale Crater With MSL](#)", Lunar and Planetary Science Conference, Abstract #1675.

Johnson et al. (2016) "[ChemCam Passive Reflectance Spectroscopy Of Recent Drill Tailings, Hematite-bearing Rocks, And Dune Sands](#)", Lunar and Planetary Science Conference, Abstract #1155.

Compositional references - Element

Aluminum

Forni et al. (2016) "[Fluorine In The Pahrump Outcrop, Gale Crater : Implications For Fluid Circulation And Alteration](#)", Lunar and Planetary Science Conference, Abstract #1990.

"Those two observation are strongly correlated with Si, Mg, Al and alkalis, suggesting a phyllosilicate."

Fluorine

Forni et al. (2016) "[Fluorine In The Pahrump Outcrop, Gale Crater : Implications For Fluid Circulation And Alteration](#)", Lunar and Planetary Science Conference, Abstract #1990.

"Fluorine is detected in the Big Sky drill hole as well as in the surroundings targets but the highest fluorine content was located on the dark vein Alvard Mountain with value up to 1.2 wt % [11]."

ChemCam RMI contour image
Sol 1352 1352_CRC_CCAM01352_Tsongoari

product ▾ Actions ▾ ? ▾

Product overview 1352_CRC_CCAM01352_Tsongoari

ChemCam RMI mosaic

This product is part of a ChemCam RMI mosaic. [View all related products.](#)

Mosaic 1352_CRC_ CCAM01352_Tsongoari	Contour image 1352_CRC_ CCAM01352_Tsongoari <i>Current product</i>	Planning target Tsongoari	5 LIBS points identified View list

[Download zip file](#) with RMI mosaic 1352_CRC_CCAM01352_Tsongoari and related files.

1352_CRC_CCAM01352_Tsongoari



This image is not the actual data product.

[full resolution image](#)

[Quick download](#) ▾

Site Sol 1865 More ?

Sol 1837 data products (66)

- DN** DAN (3)
- FH** Front Hazcam (3)
- MC** Mastcam (8)
 - MC E** Sol 1837 SCLK 560573300 Seq mcam09631 Site 66 / 1332 / 6 1 product : LD
 - MC E** Sol 1837 SCLK 560573318 Seq mcam09631 Site 66 / 1332 / 6 1 product : LD
 - MC E** Sol 1837 SCLK 560573331 Seq mcam09631 Site 66 / 1332 / 6 1 product : LD
 - MC E** Sol 1837 SCLK 560573353 Seq mcam09631 Site 66 / 1332 / 6 1 product : LD
 - MC E** Sol 1837 SCLK 560573368 Seq mcam09631 Site 66 / 1332 / 6 1 product : LD
 - MC E** Sol 1837 SCLK 560573382 Seq mcam09631 Site 66 / 1332 / 6 1 product : LD
 - MC E** Sol 1837 SCLK 560573475 Seq mcam09632 Site 66 / 1332 / 6 2 products : LD R0
- MD** MARDI (1)
- NC** Navcam (51)
- RD** RAD (1)
- RH** Rear Hazcam (3)
- Sol 1837 documents (2)**
 - Mission Manager - Downlink (1)
 - SOWG Documentarian - Uplink (1)
- Sol 1837 mosaics (25)**
 - NC** Cyl persp A v1 Sol1837 Site 66 / 1332 1 frames Sources from sol 1837

Add checked items to cart Clear all Check all

MC Undefined Sol 1500 CX015

Traverse map

Group Pro

DRAW

Target Big_Sky
Target defined on Sol 1114 Site

Target Actions

Data

ChemCam data at this target

Literature references

View 4 literature references

Big_Sky

Image **NLB_496221644ED**

0 50 100m

Big_Sky tailings

8 locations found

Click on a location below to load details.

Site 66 / 1332 / 6	Sols 1837-1838
133 Data	AP CC CH DN FH MC MD MH NC RH RD RM SM
4 Doc	1 Plan 20 Targ 25 Mos 0 Spec
Site 66 / 1332 / 12	Sol 1838
26 Data	AP CC CH DN FH MC MD MH NC RH
2 Doc	1 Plan 20 Targ 0 Mos 0 Spec

East: 8143335.66, North: -279524.43

6.00 8.00 10.00 12.00
Distance along profile (m)

