



## Human Landing Sites Study (HLS<sup>2</sup>) Newsletter – May 4, 2016

Hello all:

Continuing to build on your Workshop feedback, we will be prototyping a series of lectures/briefings that will help us better understand the factors needed for the human landing sites selection and to identify key areas of future work. Below is the tentative schedule for the initial prototype lectures:

<b>Mars Water ISRU Feedstock Options</b>	<b>Tuesday, May 24 from 1 pm – 2 pm EST</b>
<b>Rover (Robotic and Human-Class) Operational Considerations on Mars</b>	<b>Thursday, June 30 from 1 pm – 2 pm EST</b>
<b>Environmental Considerations for a Human Base on Mars (e.g. Dust, Thermal, etc.)</b>	<b>Thursday, July 28 from 1 pm – 2 pm EST</b>

These interactive lectures will be conducted via Google+ Hangouts and will be recorded and made available online. We will soon send you calendar invites for the events. We hope that you will be able to join us.

### Status of Mars Reconnaissance Orbiter (MRO) Imaging Requests



HiRISE image of a crater near Sirenum Fossae in Mars' Southern Highlands. A sharp rim, steep inner slopes, and well-preserved ejecta indicate the crater is fresh on a geologic scale. (NASA/JPL/University of Arizona)

MRO is making progress on HLS<sup>2</sup> sites. Out of the 73 requests that have been entered through HiWish, 45 are for CRISM (Compact Reconnaissance Imaging Spectrometer for Mars) and 28 are HiRISE-led targeted observations. To date, 13 requested images have been acquired and their status is available through the [HiWish](http://HiWish.org) website.

Currently, CRISM is scheduling several targets in its current bi-monthly “cold” cycle (i.e., when the cryocooler is powered to get infrared spectra with good signal-to-noise). This two-week cycle started May 1, 2016. The CRISM team is working on setting up a website to enable requesters of these data to get status and you will be notified when the site goes live.

## Mars Water ISRU Planning (M-WIP) Overview

In response to the first Landing Site/Exploration Zone Workshop (HLS<sup>2</sup>), the Mars Water ISRU Planning (M-WIP) Study began January 2016 and ended in April. The M-WIP study began with a compilation of candidate resource classes proposed at the HLS<sup>2</sup> workshop, and considered the pathways by which it might be possible to upgrade each of them to “reserves”. This entails 1.) Conceptualizing candidate engineering approaches for the extraction of water from those sources; 2.) Understanding the sensitivities of the different approaches for water extraction to several key physical characteristics of the Martian ore/environment. These differences can have significant impacts on the cost, complexity, mass, and power requirement of the In-Situ Resource Utilization (ISRU) system; 3.) Planning for the ways in which the knowledge needed, to within reasonable risk standards, could be acquired using future missions. The M-WIP study concludes with a number of suggestions for future work that could engage technology developers, Mars scientists, strategic planners, ISRU experts, and others. View a PDF of the study here: [http://mepag.jpl.nasa.gov/reports/Mars\\_Water\\_ISRU\\_Study.pdf](http://mepag.jpl.nasa.gov/reports/Mars_Water_ISRU_Study.pdf).



NASA's Phoenix Mars Lander's Surface Stereo Imager showed sublimation of ice in the “Dodo-Goldilocks” trench in 2008. (NASA/JPL-Caltech/University of Arizona/Texas A&M University)

## Next Mars Orbiter Update

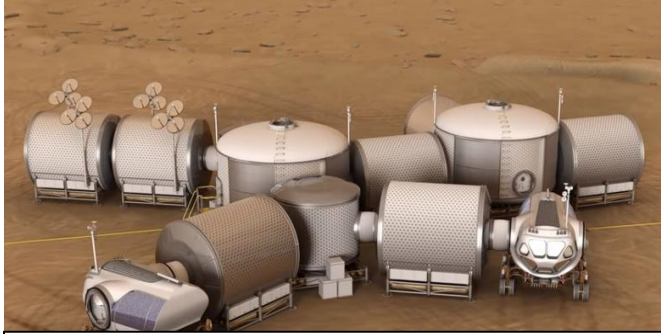
As was noted in the HLS<sup>2</sup> Workshop summary results, there is a strong need for next generation resource reconnaissance at Mars. After the workshop, The Mars Exploration Program Analysis Group (MEPAG) completed a preliminary study of what would potentially be needed in such an orbiter and that report is available at the following link: [http://mepag.nasa.gov/reports/NEX-SAG\\_draft\\_v29\\_FINAL.pdf](http://mepag.nasa.gov/reports/NEX-SAG_draft_v29_FINAL.pdf). In the President's fiscal year 2017 budget proposal to Congress, 10 million dollars is proposed to further study such an orbiter. An Objectives and Requirements Definition Team (ORDT) is now anticipated to be launched this summer. While the orbiter is not an approved program yet, the ORDT would be a critical next step. Congress is currently in the process of reviewing the President's budget.

## Announcement of Opportunity

As was discussed at the Workshop, we are working to develop an Announcement of Opportunity to support Exploration Zone proposal development. We anticipate starting this in fiscal year 2017 and we hope to have more definitive news on this in our next newsletter.



This sunrise view covers about 130 degrees of the inner wall of Gale Crater. The telephoto lens on the Curiosity Mars rover's Mastcam took the component images on Sol 1,284 during a period of little dust and haze in the atmosphere. (NASA/JPL-Caltech/MSSS)



Concept art showing an Exploration Zone with habitation modules and human-class rovers. (NASA)

## Evolvable Mars Campaign (EMC)

The Evolvable Mars Campaign is an ongoing series of architectural trade analyses to define the capabilities required to sustainably expand human presence from low-Earth orbit, into deep space, with the goal of an extended human presence on the surface of Mars.

Given that many of the proposed landing sites at the HLS<sup>2</sup> workshop in October 2015 were at higher latitudes, EMC is performing trade

studies to look at the impact of landing at higher latitudes on the overall architecture including their potential EDL systems. Additionally, EMC is looking at power generation, particularly if we are using solar arrays until we can develop compact nuclear fission reactors. These trade-offs between EDL capabilities, power generation and access to resources will be key as we go forward in the landing site selection process. EMC is continuing to assess the impact of having access to significant quantities of water to their overall architecture.

## Graphical Interface Support (GIS) Options for Supporting Human Landing Site Selection Process

HLS<sup>2</sup>, in coordination with NASA's EMC program, is exploring Graphical Information System (GIS) options to support landing site selection for the first human Mars mission. Proposed Exploration Zones from the October 2015 HLS<sup>2</sup> workshop will be included with supporting data (e.g., Mars Orbiter Laser Altimeter [MOLA], Thermal Emission Imaging System [THEMIS], CRISM, HiRISE, and Thermal Emission Spectrometer [TES]). Future development will invite participation from the HLS<sup>2</sup> Community (e.g., through surveys and design reviews) to ensure utility and usability; and thereby foster continued contributions by, and discussion among, these valuable subject matter experts.

## Upcoming Events of Interest

- Biosignature Preservation and Detection in Mars Analog Environments conference – May 16-18, 2016 in Lake Tahoe, Nevada: <http://www.hou.usra.edu/meetings/biosignature2016/>
- The Humans to Mars (H2M) Summit – May 17-19, 2016 in Washington, DC: <http://h2m.exploremars.org/>
- June 7-9 2016 – Space Resources Roundtable in Golden, Colorado: <http://www.csmspace.com/events/srr/>
- 6<sup>th</sup> International Conference on Mars Polar Science and Exploration – September 5-9, 2016 in Reykjavik, Iceland: <http://www.hou.usra.edu/meetings/marspolar2016/>
- International Workshop on Instrumentation for Planetary Missions – October 24-26, 2016 in Pasadena, California: <http://ssed.gsfc.nasa.gov/IPM/index.html>

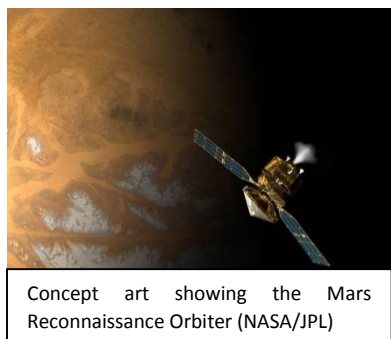
If you know of other events that may be of interest to the HLS<sup>2</sup> community, please let us know.

## Other News of Interest

International space agencies are developing or considering developing Missions to Mars:

- Japanese Aerospace Exploration Agency (JAXA) is developing a sample return mission to Phobos. NASA will announce a solicitation for proposals for an instrument aboard the spacecraft. More info here on the [NASA NSPIRES](#) site. Mission info can be found in this [press link](#).
- United Arab Emirates' climate and atmospheric orbiter Hope is scheduled for a 2020 launch. Visit the [mission website](#).
- France and India will jointly develop Mangalyaan 2, a mission with plans to send a lander to the Martian surface by 2021. More info can be found in this [press link](#).

The Mars Institute, in partnership with Jules Verne Adventures, is doing advance screenings of "Passage To Mars", a documentary film on the Mars Institute and NASA's Northwest Passage Drive Expedition in the Arctic (part of the NASA-supported Haughton-Mars Project on Devon Island). "Passage To Mars" will open at Laemmle Theaters in Los Angeles, California, on May 31, 2016. More info and the trailer can be found on this website: <http://www.laemmle.com/films/40657>.



### Ten years of MRO

This [remarkable video](#) courtesy of NASA's Jet Propulsion Laboratory highlights MRO's decade of discovery.

Since its arrival at Mars on March 10, 2006, the orbiter has revealed changes on the Martian surface, dust in the atmosphere, and evidence of liquid water on the surface of Mars. With its suite of cameras and scientific instruments, MRO plays an instrumental role in the Exploration Zone selection process, greatly contributing to HLS<sup>2</sup>.

## Other Resources and Links

A valuable source of resources is the MEPAG website <https://mepag.jpl.nasa.gov/>. Their May newsletter is now online at [http://mepag.nasa.gov/newsletter/MEPAG\\_Newsletter\\_05-16.pdf](http://mepag.nasa.gov/newsletter/MEPAG_Newsletter_05-16.pdf). To receive a copy of this newsletter in the future, fill out their online form at <http://goo.gl/forms/WilmhP1M9V>.

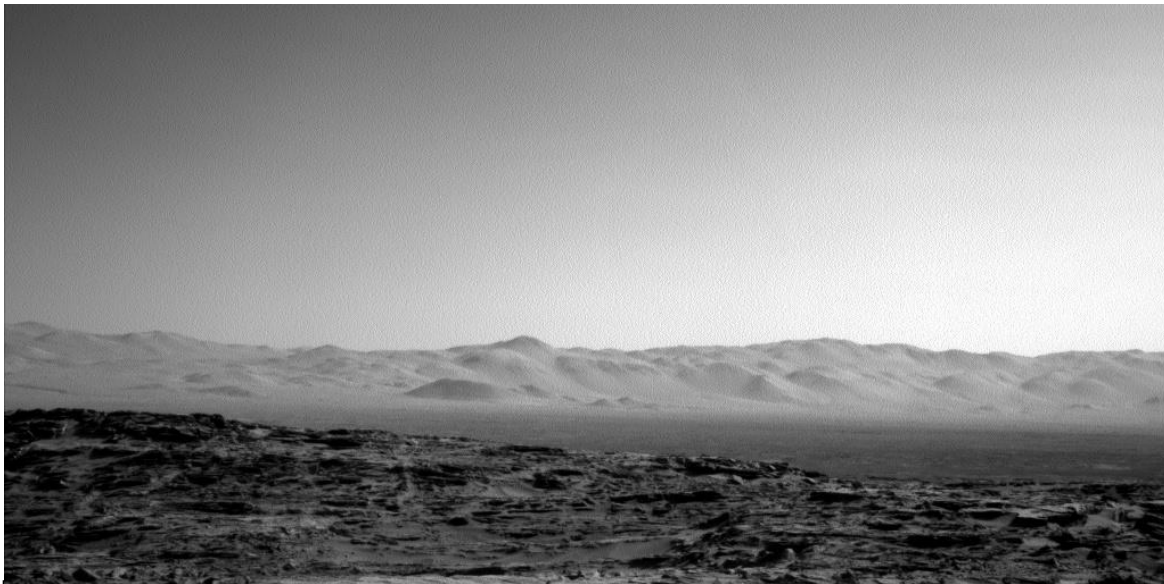
As a reminder, more HLS<sup>2</sup> Workshop resources can be found on our website: <http://www.nasa.gov/journeymars/mars-exploration-zones/>. These include:

- HLS<sup>2</sup> Workshop Statement: <http://go.nasa.gov/1SPj4fi> (PDF)
- Digital image of proposed Exploration Zones: <http://go.nasa.gov/1TjpsJp> (JPG)
- Workshop presentations: <http://go.nasa.gov/1Tjpb9j>
- YouTube videos of each workshop presentation: <http://go.nasa.gov/1Tjplxx>

Your inputs and contributions to HLS<sup>2</sup> are invaluable and we look forward to hearing more from you. If you know of others who would like to be on our HLS<sup>2</sup> distribution list, please email us at [NASA-Mars-Exploration-Zones@mail.nasa.gov](mailto:NASA-Mars-Exploration-Zones@mail.nasa.gov).

Many thanks,  
HLS<sup>2</sup> Steering Committee





Mosaic of Gale Crater's Nauyflatt Plateau taken by NASA's Curiosity Mars rover, Sol 1309. Gale Crater was one of the proposed Exploration Zones at the first HLS2 Workshop in October 2015. (NASA/JPL-Caltech/MSSS)



This 360-degree panoramic image taken by the Curiosity Mars rover's Mastcam shows the surface of Nauyflatt Plateau. At right, Mt. Sharp is visible, as well as part of the rim of Gale Crater in the distance. (NASA/JPL-Caltech/MSSS)