



# First Landing Site/Exploration Zone Workshop for Human Missions to the Surface of Mars

SECOND ANNOUNCEMENT

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October 27 - 30, 2015  
Houston, Texas

Dear Colleagues,

You are invited to participate in the First Landing Site (LS)/Exploration Zone (EZ) Workshop for Human Missions to the Surface of Mars. The workshop will be held October 27 - 30, 2015, at the Lunar and Planetary Institute (LPI) in Houston, Texas.

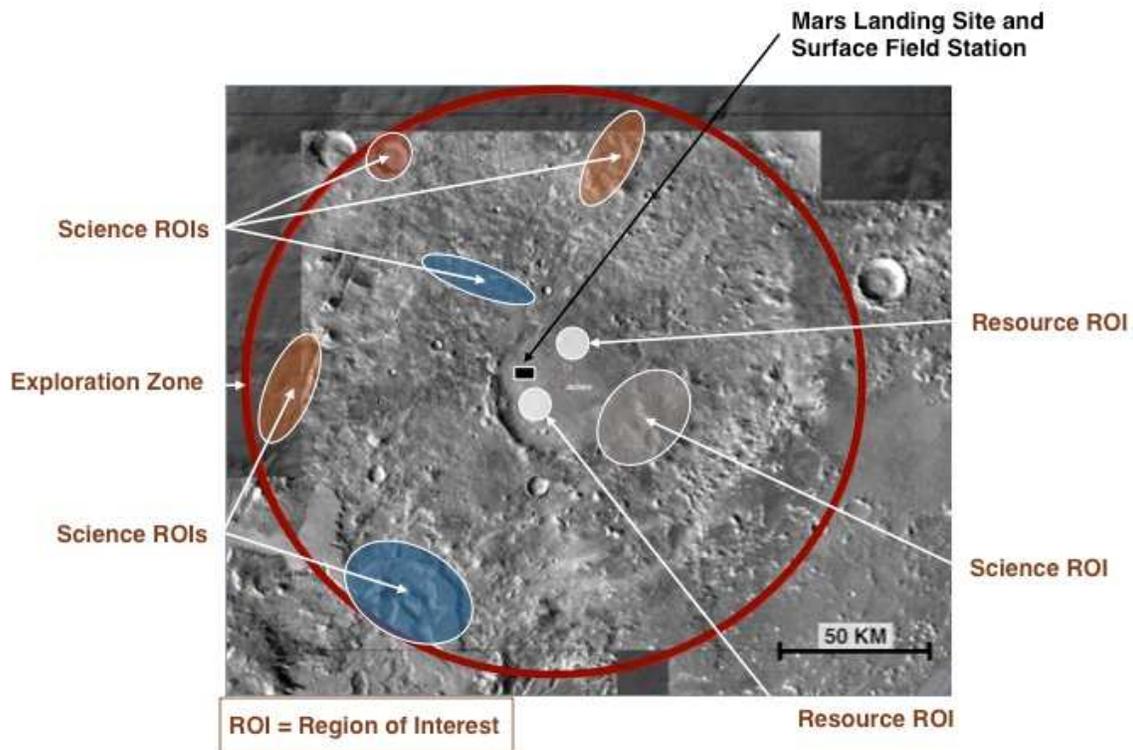
### **PURPOSE OF THE WORKSHOP**

The purpose of this workshop is to identify and discuss candidate locations where humans could land, live and work on the martian surface.

### **BACKGROUND**

We refer to such a location as an Exploration Zone (EZ). Given current mission concepts, an EZ is a collection of Regions of Interest (ROIs) that are located within approximately 100 kilometers of a centralized landing site. ROIs are areas that are relevant for scientific investigation and/or development/maturation of capabilities and resources necessary for a sustainable human presence. The EZ also contains a landing site and a habitation site that will be used by multiple human crews during missions to explore and utilize the ROIs.

## Exploration Zone Layout Considerations



These candidate EZs will be used by NASA's Human Exploration and Operations Mission Directorate (HEOMD) and Science Mission Directorate (SMD) as part of the multi-year process of determining where and how we would like to explore Mars with humans. In the near term, this process includes: (a) identifying locations that would maximize the potential science return from future human exploration missions, (b) identifying locations with the potential for resources required to support humans, (c) developing concepts and engineering systems needed by future human crews to conduct operations within an EZ, and (d) identifying key characteristics of the proposed candidate EZs that cannot be evaluated using existing data sets, thus helping to define precursor measurements needed in advance of human missions. Existing and future robotic spacecraft will be tasked with gathering data from specific Mars surface sites within the representative EZs to support these HEOMD and SMD activities.

*It is anticipated that funding and support for future calls will be available for teams of scientists and engineers to conduct detailed characterizations of the EZs that emerge from this workshop.*

## WHAT WE ARE TRYING TO ACCOMPLISH

We request information that can be used to construct candidate Mars EZs. Each EZ will have the following characteristics:

- A collection of diverse ROIs that are all within ~100 km of a single plausible landing site and accessible via traversable routes from that landing site
- There are two main types of ROI: science ROIs and resource ROIs. Specific criteria for science and resource ROIs are summarized below and described in detail on the First Landing Site/Exploration Zone Workshop website: (<http://www.hou.usra.edu/meetings/explorationzone2015>)
- Multiple crews will visit the same EZ, gradually expanding the amount and depth of exploration of that region. A science ROI might therefore be visited multiple times, if required, and resource ROI(s) should be of a scale that offers the potential to provide usable commodities for multiple crews
- A habitation site and a landing site located approximately in the center of the EZ

## WHAT WE ARE REQUESTING FROM YOU

We are asking the community to propose EZs and/or ROIs which would then be presented and discussed at the workshop.

An optimal submission would be an EZ that contains several science ROIs (of different types) as well as at least one potential resource ROI. However, all smaller-scale submissions (e.g. an EZ with just science ROIs) will be considered. The number of presentations at the Landing Site/Exploration Zone Workshop will be limited and we will give priority to those submitting ideas for an EZ exhibiting all of the desired characteristics. We will consider presentations of individual ROIs or groupings of ROIs that do have some, but not all, of the EZ features on a space-available basis.

Note: details regarding the viability of the identified “plausible” landing site and traverse routes will be assessed separately by engineering teams familiar with the systems being considered for these human missions. However, we do ask that you identify a **plausible Mars landing site** that has these characteristics:

- Located between +/- 50 degrees latitude
- Less than +2 km altitude (Mars Orbiter Laser Altimeter (MOLA) reference)
- An area of approximately 25 km<sup>2</sup> within which the terrain is generally level (slopes less than ~10 degrees) and significantly devoid of landing hazards (e.g., large and/or closely concentrated craters, mountainous terrain, broken/jumbled/chaotic terrain, extensive dune fields, etc.)
- Does not contain thick deposits of fine-grained dust (e.g., extremely low thermal inertia and high albedo)

Eventually, the goal of this effort is to identify potential EZs that have as a minimum the following types of ROIs:

## Science

- Access to 1) deposits with a high preservation potential for evidence of past habitability and fossil bio-signatures and/or 2) sites that are promising for present habitability
- Noachian and/or Hesperian rocks in a stratigraphic context that have a high likelihood of containing trapped atmospheric gasses
- Exposures of at least two crustal units that have regional or global extents, that are suitable for radiometric dating, and that have relative ages that sample a significant range of martian geological time
- Access to outcrops with morphological and/or geochemical signatures (with preference for sites that link the two) indicative of aqueous or groundwater/mineral interactions
- Identifiable stratigraphic contacts and cross-cutting relationships from which relative ages can be determined
- Other diverse types of ROIs are strongly encouraged

## Resources (including Civil Engineering)

- Access to raw material that exhibits the potential to (a) be used as feedstock for water-generating In-Situ Resource Utilization (ISRU) processes and (b) yield significant quantities (>100MT) of water. Raw material can be in the form of ice, ice/regolith mix, or hydrated minerals and the top of the raw material deposit should be as close to the surface as possible
- Access to a region where infrastructure can be emplaced or constructed. This region must be less than 5 km from a central landing site and contain flat, stable terrain. The region should exhibit evidence for an abundant source of cobble-sized or smaller rocks and bulk, loose regolith. Natural terrain features that can be adapted for construction purposes (e.g., to enhance habitat radiation protection) are considered beneficial
- Access to raw material that exhibits the potential to be used as metal or silicon feedstock for ISRU and construction purposes. Of primary interest are iron, aluminum, and silicon; titanium and magnesium are of secondary interest. Raw material should be as near to the surface as possible and be in a form that can be mined by highly automated systems

For this call, we are not expecting EZ submissions to have all of these ROIs. But we are looking for EZs that have as many of these ROIs as possible. We are also very interested in other types of ROIs. Since the human base will be a long term research station, access to significant and diverse ROIs is critical.

On our website: <http://www.hou.usra.edu/meetings/explorationzone2015>, we have supplemental papers which further describe the engineering constraints and ROIs mentioned above. These papers also include information on other types of lower priority

ROIs that we are nonetheless very interested in. Proposals for these additional types of ROIs are encouraged. Additionally, we welcome your proposals for any other types of ROIs that are not covered by these papers but which would take full advantage of human explorers being present.

An ROI can be of any size and can meet one or multiple criteria.

## **HOW TO PARTICIPATE**

The workshop will consist of oral presentations where teams will present information supporting their proposed EZs and/or ROIs. If you would like to present an EZ and/or ROI, then please submit an abstract on the NASA Landing Site/Exploration Zone Workshop website by August 25, 2015. Submissions will require latitude, longitude, and a brief rationale for the EZ and/or ROIs. A context image with the EZ and/or ROI(s) clearly identified with approximate dimensions graphically show will also need to be provided.

If you submit an abstract, please plan to participate in, or send a representative to, the workshop.

One month prior to the workshop, all proposed EZs and ROIs will be made available to workshop participants on the workshop website, for review prior to participating in the workshop.

Presentation viewgraphs will need to be brought to the workshop. A format for these presentations will be made available on the LPI website by August 20.

*If your team has a particular specialization (science, engineering, resource/In-Situ Resource Utilization (ISRU)) but would like to collaborate with a team with a different specialization, please contact us and we will facilitate such collaborations, as much as possible.*

## **WORKSHOP LOGISTICS**

The workshop will be held at the LPI in Houston, TX and there will be no registration fee, but registration will be mandatory for attendance.

NASA employees and contractors should note that this workshop is classified as a conference and therefore that NASA Conference Tracking (NCTS) rules apply.

Input from the science and human spaceflight communities is critical to identifying optimal landing sites for future human missions to the surface of Mars. We look forward to your involvement in these activities!

For more information, visit: <http://www.hou.usra.edu/meetings/explorationzone2015>  
Send inquiries to: [NASA-Mars-Exploration-Zones@mail.nasa.gov](mailto:NASA-Mars-Exploration-Zones@mail.nasa.gov)

Regards,



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