



Planetary Protection Subcommittee November 2013 Meeting

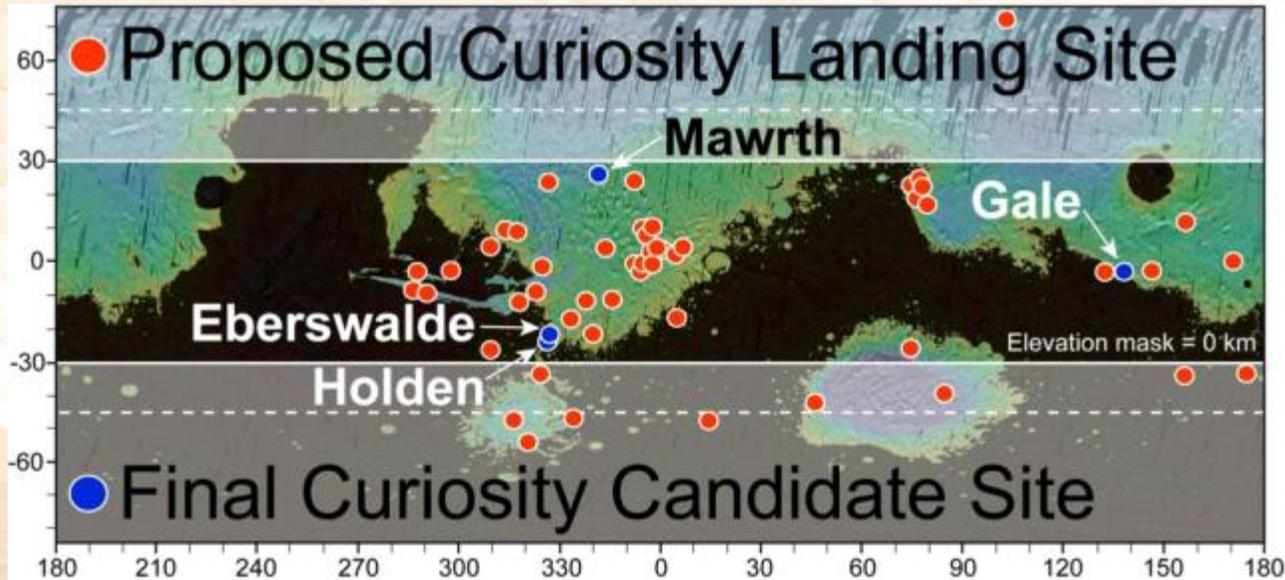
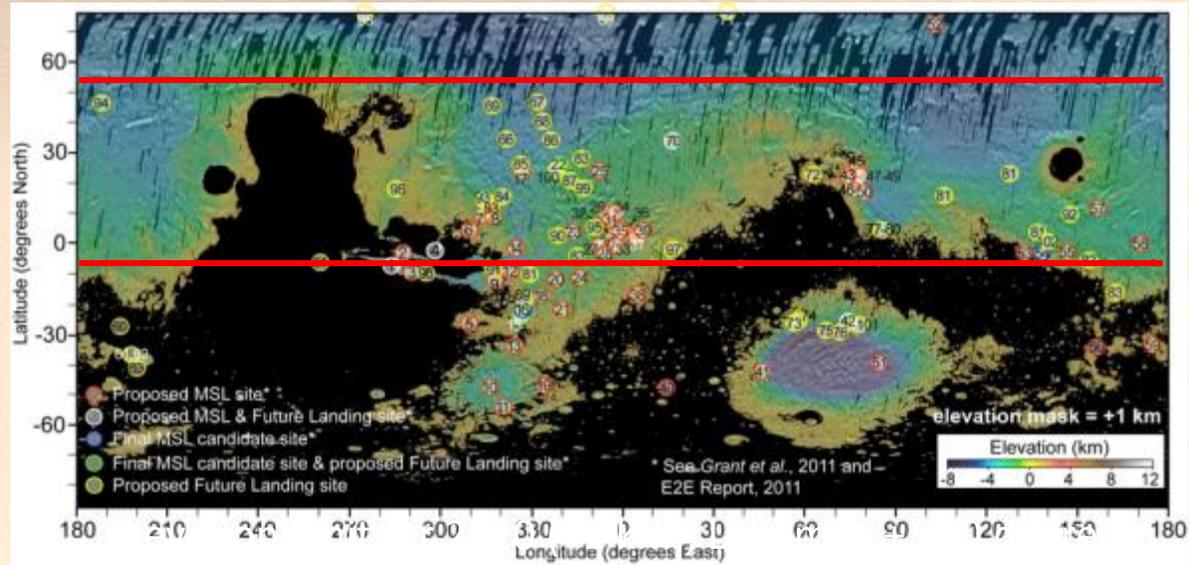
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Criteria for Selecting 2020 Reference Field Sites:

- Emphasis is on the requirement that the field site include access to an “astrobiologically relevant ancient environment”, consistent with the Charter.
- Having access to both astrobiologically relevant materials and unaltered igneous rocks might elevate the perceived value of a site, but this dual access was not viewed as a requirement for assignment as a Reference Site for 2020.
- The increased emphasis on accessing astrobiologically relevant rocks is geared towards having a sufficient starting population of candidate sites (>60 for MSL, >150 for MER) to ensure that the highest priority samples (per E2E-iSAG) can be accessed and cached after science and engineering constraints evolve.
- Access to the MER and MSL field sites must be preserved for the 2020 rover given the astrobiologically relevant results from these missions.



Candidates for 2020 Reference Sites:



Proposed 2020 Mission Reference Field Sites

Reference Landing Site	Stressing Parameter	TRN [†] Required	THA [†] Required	Notes
Holden Crater	Latitude (-26° S)	Maybe – land closer to layers	No	Pushes southerly lat limits, TRN might enable “land on”
Jezero Crater	Rock Abundance	No	Yes	>1% failure without THA
Nili Fossae	Elevation (-0.6 km)	Yes	Yes (No if smaller ellipse)	Landing ellipse ranges up to 0 km elevation, 6% area scarps
E Margaritifer	Inescapable Hazards	Yes	Probably Not	>3% of landing ellipse is inescapable, 99% success with 300 m divert
NE Syrtis	Scarps	Yes	Maybe	>4% ellipse scarps, 99% success with 300 m divert
Melas Chasma	Landing Ellipse Size Wind	Yes	Probably	Constrains Ellipse Size In V. Marineris – Likely Wind and Relief Issues?

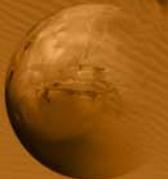
Finding 7-9: Six Reference Sites are identified as “stressors” on landing capabilities and encompass a sufficiently large population of candidate sites (>60, see preceding Table) as to ensure high priority candidates remain as constraints evolve. These sites accommodate prior MER and MSL landing sites and only differ from E2E-iSAG reference sites in southerly latitude extent.

[†] *TRN = Terrain-Relative Navigation; THA = Terminal Hazard Avoidance.*

Statement on Access to Special Regions

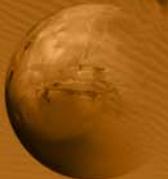
- There are two types of PP special regions on Mars: A) naturally-occurring special regions (i.e. those where the threshold conditions are violated naturally); and B) induced special regions (places where a heat source could cause the threshold conditions to be violated). These apply to areas where water or water-ice is suspected to be present within ~1m of the surface
- From the 2020 charter: “Explore an astrobiologically relevant ancient environment on Mars”.
- Special regions are so named because of what they represent in the **modern environment** (e.g., recurring slope lineae or RSL), so they do not apply to the M2020 mission objectives.
- However, there may be landing sites where the primary science targets are accompanied by landforms suspected to harbor ice, or other deposits that could comprise an induced special region in the presence of a heat source associated with a rover.
- An example may be the Ismenius Cavus Reference Site from the E2E-iSAG where the presence of lobate debris aprons flanking some hills could represent local ice deposits within or near the proposed landing ellipse.
- A review of candidate sites proposed for MSL and possible future opportunities reveals that many suggested field sites appear to involve no complications related to

Finding 7-17: The 2020 mission has no need to go to a naturally-occurring or induced Special Region; per the charter of the 2020 SDT, the 2020 rover would explore an ancient environment, and there are many such candidate sites that do not include special regions.



Call for Candidate Mars 2020 Landing Sites

- In response to the recent release of the Mars 2020 mission Announcement of Opportunity, we are soliciting imaging targets for candidate landing sites for the Mars 2020 rover mission. Candidate landing sites should be proposed based on their potential to satisfy the objectives of the 2020 mission as detailed in the recent mission Science Definition Team (SDT) report (Mustard et al., 2013). This call relates to targets for new candidate landing sites as well as additional targets for candidate landing sites proposed to prior calls. Targets for sites satisfying the requirements will be provided to the Mars Reconnaissance Orbiter (MRO) and Odyssey missions for imaging.
 - Persons wishing to propose a candidate site should complete the abstract template found on the website below, which provides further details on the science objectives of the 2020 mission, engineering constraints on landing sites, possible enhancements to EDL, planetary protection constraints, and the information needed to identify a landing site and define the requested images.
 - Candidate landing sites should be submitted to both Matt Golombek (mgolombek@jpl.nasa.gov) and John Grant (grantj@si.edu) by November 15, 2013.
 - For details see: <http://marsnext.jpl.nasa.gov/index.cfm>
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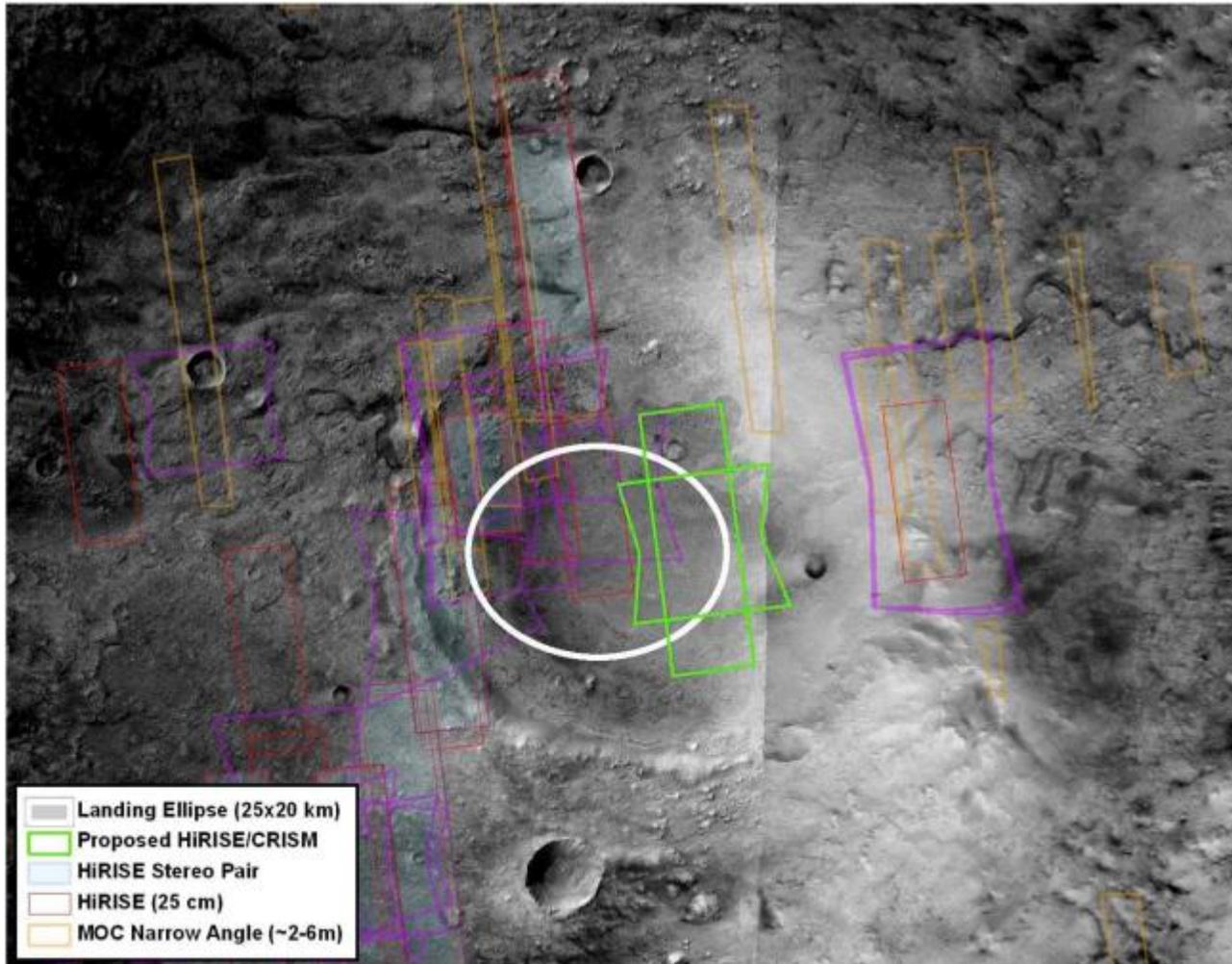


Engineering Constraints

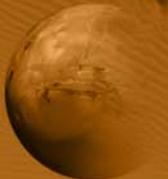
- **Elevation:** Below +0.5 km MOLA elevation, with respect to the MOLA geoid.
- **Latitude:** Within 30° of the equator.
- **Landing Ellipse:** Like MSL, the 2020 mission has a nominal landing ellipse of about 25 km by 20 km, oriented roughly east-west. A potential improvement under investigation, called range trigger, would allow landing within a 18 km long by 14 km wide ellipse. It may be possible in the future that the range trigger ellipse could become as small as 13 km by 7 km.
- **Terrain Relief and Slopes:**
- **Rocks:**
- **Radar Reflectivity:**
- **Load Bearing Surface:**



Example Submission



Example 25 km by 20 km ellipse on HRSC image at Jezero crater. In green are the requested HiRISE image (rectangle) and CRISM image (hourglass shape) centered at 18.365° N, 77.719° E.



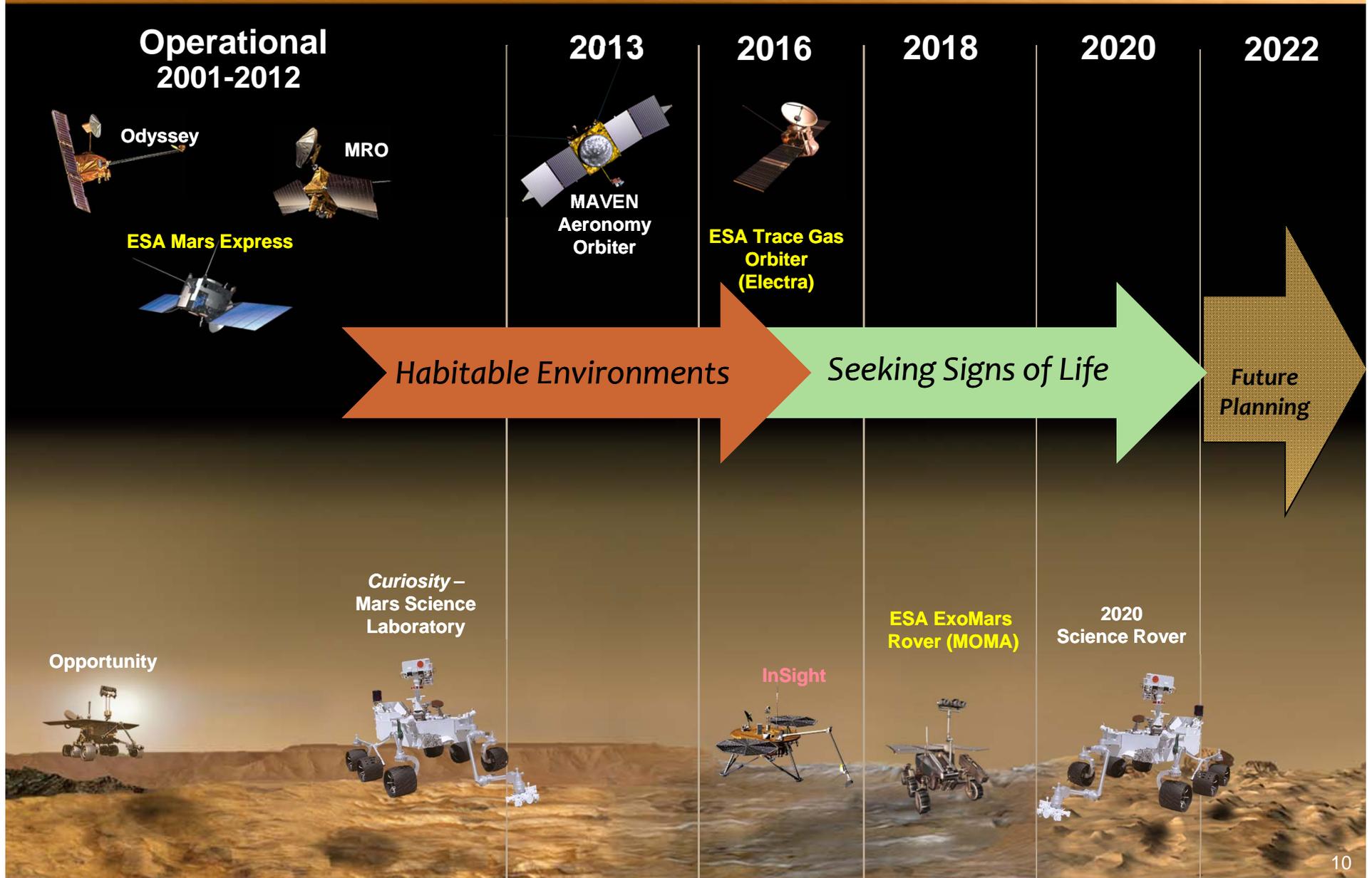
Landing Site Selection Timeline

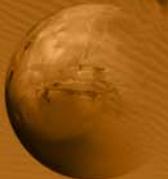
4-5 Workshops, 4-5 Years, Possible Selection L-2 or L-1 yr

Date	Title	Comments/Description	# of Sites
7/13	SDT report	<ul style="list-style-type: none">Preliminary engineering constraints	
4/14	Instrument selection	<ul style="list-style-type: none">PSG formed	
5/14	LSW 1	<ul style="list-style-type: none">Sites prioritized into thirds by science meritTop 3rd to be characterized for safety and TRN need by LSW 2	~25
6/15	LSW 2	<ul style="list-style-type: none">Identify 4-5 selectable sites- Are there enough non-TRN sites of sufficient science merit?- If not, is TRN required? Define TRN attributes needed	~4-5 “selectable” ~8 total
1/17	LSW 3	<ul style="list-style-type: none">~Middle of Phase C	~4
6/18	LSW 4	<ul style="list-style-type: none">Final planned workshop	~1
7/18	Site selection	<ul style="list-style-type: none">Decision dependent on number of high priority sites, clustering of sites, programmatic factors	
7/19	LSW 5, if necessary	<ul style="list-style-type: none">Opportunity for LSW 5 if final site wasn't selected in 2018	
7/20	Launch		



Mars Exploration in This Decade





Conclusion

- The process for determining scientifically compelling and safe landing sites for the Mars 2020 rover has just begun.
- There are already multiple promising landing sites and more are expected to be proposed.
- Although there are concerns about Special Regions, naturally occurring or induced, we are not ruling out any candidate landing sites because of potential planetary protection concerns.

