Welcome to the 4th Landing Site Workshop for the Mars 2020 Rover

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The science process for selecting the landing site for the 2020 Mars rover

John A. Grant [a,*], Matthew P. Golombek [b], Sharon A. Wilson [a], Kenneth A. Farley [c], Ken H. Williford [b], Al Chen [b]

[a] Center for Earth and Planetary Studies, National Air and Space Museum, Smithsonian Institution, 6th at Independence SW, Washington, DC, 20560, USA
[b] Jet Propulsion Laboratory, California Institute of Technology, 4800 Oak Grove Drive, Pasadena, CA, 91109, USA
[c] Division of Geological and Planetary Sciences California Institute of Technology, Pasadena, CA 91125, Pasadena, CA, 91125, USA

ABSTRACT

The process of identifying the landing site for NASA's Mars 2020 rover began in 2013 by defining threshold mission science criteria related to seeking signs of ancient habitable conditions, searching for biosignatures of past microbial life, assembling a returnable cache of samples for possible future return to Earth, and collecting data for planning eventual human missions to the surface of Mars. Mission engineering constraints on elevation and latitude were used to identify candidate landing sites that addressed the scientific objectives of the mission. However, for the first time these constraints did not have a major influence on the viability of candidate sites and, with the new entry, descent, and landing capabilities included in the baseline mission, the vast majority of sites were evaluated and down-selected on the basis of science merit. More than 30 candidate sites with likely acceptable surface and atmospheric conditions were considered at a series of open workshops in the years leading up to the launch. During that period, iteration between engineering constraints and the evolving relative science potential of candidate sites led to the identification of three final candidate sites: Jezero crater (18.4386°N, 77.5031°E), northeast (NE) Syrtis (17.8899°N,77.1599°E) and Columbia Hills (14.5478°S, 175.6255°E). The final landing site will be selected by NASA's Associate Administrator for the Science Mission Directorate. This paper serves as a record of landing site selection activities related primarily to science, an inventory of the number and variety of sites proposed, and a summary of the science potential of the highest-ranking sites.

1. Introduction

The Mars 2020 rover and its payload of seven science instruments will evaluate surface materials to achieve the science objectives established by the National Aeronautics and Space Administration (NASA). These include: exploration of an ancient astrobiologically relevant environment that preserves information to constrain the geological record, including past habitability and biosignature preservation potential; searching for potential biosignatures; and caching samples for possible future return to the Earth (Farley and Williford, 2017) (Table 1).

Rigorous selection of a landing site for the 2020 rover plays a crucial role in the success of the mission because it guides the rover to a location on Mars where the science objectives can be best achieved. This paper emphasizes activities related to the assessment of the science merit for each proposed 2020 landing site against scientific criteria derived from the mission science objectives (Table 2). This process was informed by an unprecedented variety of orbital datasets from multiple instruments across a number of Mars missions that were synthesized to characterize each candidate landing site from the standpoint of science and safety. The objective of all landing site activities is to maximize the probability of landing safely with access to high-priority science targets. Because the rover and "sky crane" entry, descent, and landing (EDL) system are evolved from those of the preceding Mars Science Laboratory (MSL) *Curiosity* rover (Bernard and Farley, 2016), many of the engineering constraints are comparable (Table 3). The higher atmospheric density expected on arrival at Mars in 2021 (Golombek et al., 2015) and inclusion of new EDL navigational capabilities on the 2020 rover (Golombek et al., 2015, 2016; Coombs, 2016; Farley and Williford, 2017), however, enables a smaller landing ellipse at higher elevation and provides access to locales where surface relief precluded landing by *Curiosity* (Table 3).

Science and engineering assessment and characterization of the candidate landing sites emphasizes data from the Mars Reconnaissance Orbiter (MRO) Compact Reconnaissance Imaging Spectrometer for Mars (CRISM) (Murchie et al., 2007), High Resolution Imaging Science Experiment (HiRISE) (McEwen et al., 2007), and Context Camera (CTX) (Malin et al., 2007) instruments. Data from the Mars Odyssey Thermal Emission Imaging System (THEMIS) (Christensen et al., 2004) instrument, Mars Global Surveyor (MGS) Mars Orbiter Camera (MOC) (Malin et al., 1992) and Mars Orbiter Laser Altimeter (MOLA) (Zuber et al., 1992), Mars Express Observatoire pour la Minéralogie, l'Eau, les Glaces et l'Activité (OMEGA) (Bibring et al., 2004) spectrometer, and High Resolution Stereo Camera (HRSC) (Jaumann et al., 2007) were also

* Corresponding author.
E-mail address: grantj@si.edu (J.A. Grant).

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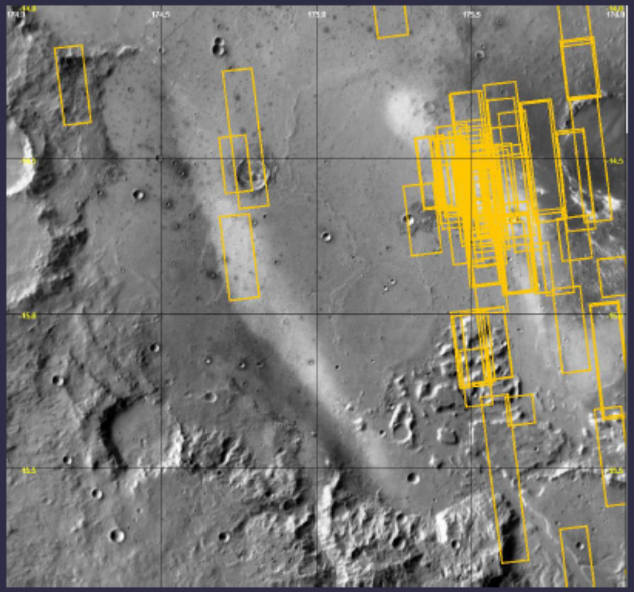
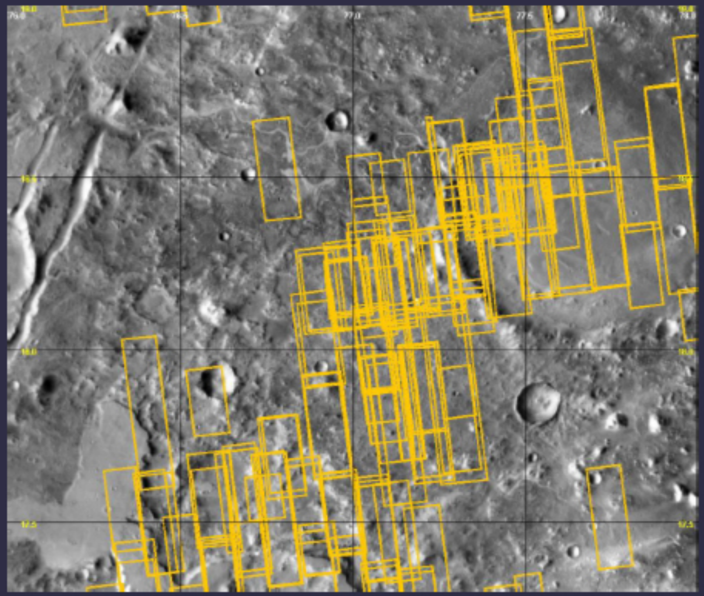
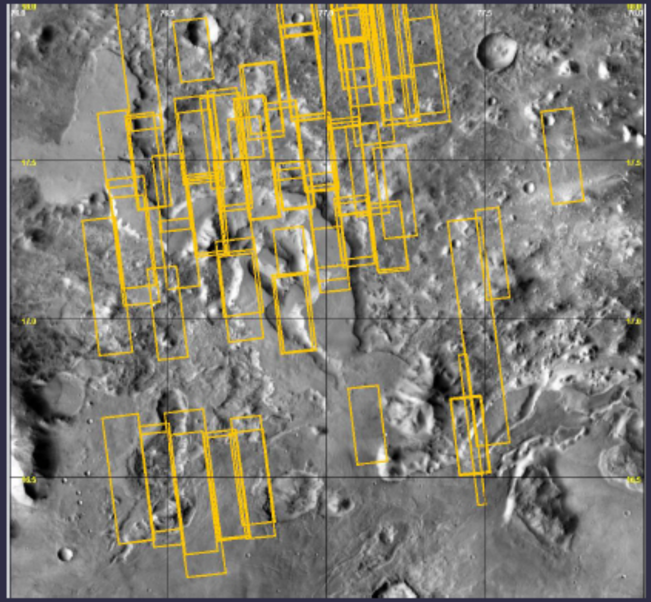
Extensive Imaging by Orbital Assets – >200 HiRISE, >150 CRISM - Thank You!



Columbia Hills



Jezero & Midway



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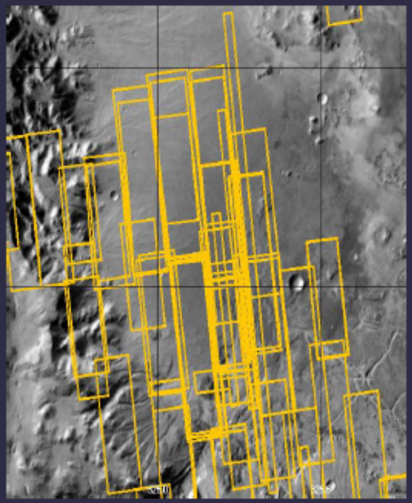
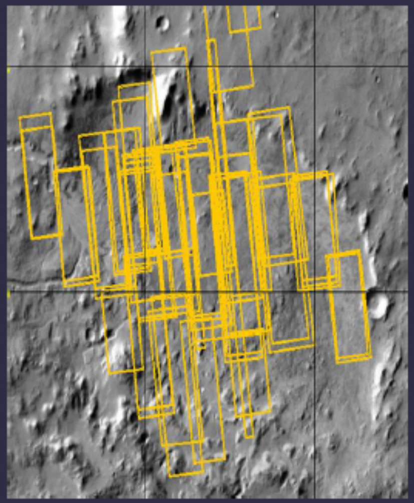


Holden



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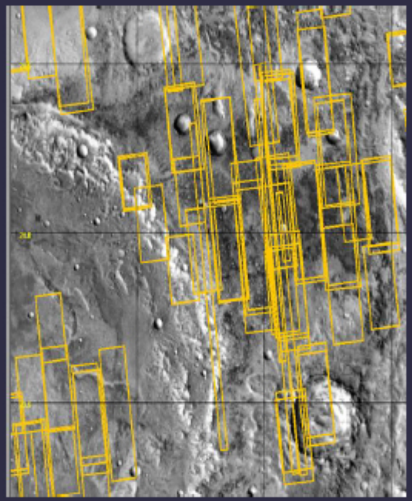
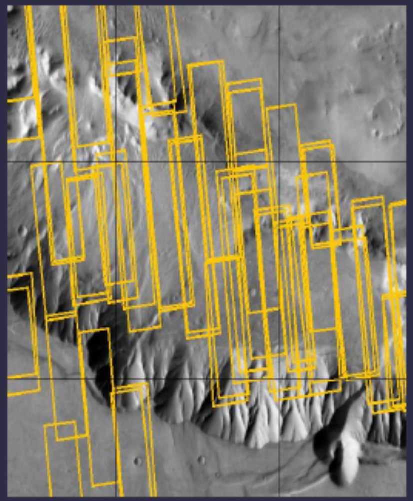
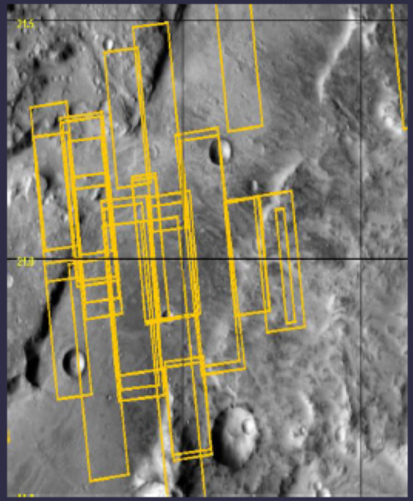


Mawrth



SW Melas



Nili Fossae

Community Assessment on Thursday

Quad Charts and Mission-Specific Criteria

You must be present at the Workshop to participate in the Assessment

The Program is Completely Full –

Speakers Will be Kept to Their Allotted Time

Make Sure to Get to make your points!