DOWNSELECTION OF LANDING SITES FOR THE MARS SCIENCE LABORATORY. M. Golombek[1], J. Grant[2], A. R. Vasavada[1], M. Watkins[1], E. Noe Dobrea[1], J. Griffes[2], and T. Parker[1], [1]Jet Propulsion Laboratory, California Institute of Technology, Pasadena, CA 91109, [2]Smithsonian Institution, National Air and Space Museum, Center for Earth and Planetary Sciences, Washington, D.C. 20560.

Introduction: Six landing sites remain under consideration for the Mars Science Laboratory (MSL) after discussion of over 30 general sites at the Second Landing Site Workshop and a subsequent project meeting. This abstract discusses the downselection process, defines the sites under consideration and describes subsequent activities to select the final landing site.

Second Landing Site Workshop: After the First Landing Site Workshop in June 2006, 33 general landing sites that incorporated 94 landing ellipses (multiple ellipses were proposed for some sites) [1] were targeted with Mars Reconnaissance Orbiter (MRO), Mars Odessey, and Mars Global Surveyor observations. Landing sites were proposed based on morphology (e.g., layered or deltaic deposits) and/or mineralogy (e.g., sulfates or phyllosilicates) indicative of aqueous processes. Most of the highest ranked sites are "go to" sites that have a safe landing site adjacent to the science target, requiring traversing outside of the landing ellipse to sample the materials of greatest interest.

Presentations at the Second Landing Site Workshop held in Pasadena, CA, on October 23-25, 2007 included updates on previously proposed sites and on new sites (over 30 sites that included a total of 51 ellipses across much of mid- and low-latitude Mars). The goal of the workshop was to trim the number of landing sites under consideration to approximately five. All sites presented were discussed and voted on to determine the subset that the science community felt best satisfied the MSL science objectives while meeting basic MSL safety and accessability criteria. Subsequent discussion attempted to pare the top sites while maintaining a diversity of science characteristics and level of risk. Possible "safe haven" sites (with larger ellipses at lower elevation) and "latitude bands" (associated with mission design for targeting and communication during entry, descent and landing) for the landing sites were also discussed as factors that might impact mission operations and performance.

Based on the presentations and discussions (all materials are posted at http://marsoweb.nas.nasa.gov/landingsites/ and http://webgis.wr.usgs.gov/msl), voting revealed the 11 highest priority sites based on science are: Nili Fossae trough (21°N, 74°E), Holden crater (26°S, 325°E), Mawrth Vallis (close to 25°N, 340°E), Eberswalde crater (23°S, 327°E), NE Syrtis (16°N, 77°E), Jezero crater (18°, 78°E), Chloride sites (12°S, 345°E; 18°S, 3°E), Terby crater (28°S, 74°E), Melas Chasma (10°S, 284°E), E Meridiani (0°N, 4°E), and Miyamoto crater (referred to as Runcorn crater or E and S Meridiani at the workshop) (3°S, 353°E).

Additional discussion that included consideration of engineering constraints and science diversity further trimmed the list to six: Nili Fossae trough, Holden crater, Mawrth Vallis, Jezero crater, Terby crater, and Miyamoto crater. Four sites from the top eleven that did not make the final list, but might satisfy the engineering constraints include Eberswalde, NE Syrtis, Chloride sites, and E Meridiani. These four sites were deemed of lesser priority, but might be considered among potential replacements if the final list of six is changed as a result of future issues or considerations.

Nili Fossae trough, Mawrth Vallis and Miyamoto crater sites expose phyllosilicate-rich materials (Miyamoto may also have sulfates and hematite bearing plains), Holden and Terby likely provide access to phyllosilicate-bearing lacustrine and alluvial sediments, and the Jezero and Eberswalde crater sites are deltaic settings within craters that provide access to phyllosilicates. It is important to note that these sites fall within two broad latitude bands for targeting the mission, with Holden, Terby and Eberswalde craters falling within the southern 15°S-30°S latitude band and Nili Fossae trough, Mawrth Vallis, Miyamoto, and Jezero craters falling within the northern 15°S-30°N latitude band. Uncertainties regarding how operations might be limited by the colder temperatures experienced in the southern latitude band made assessing inclusion of sites in this band difficult. If significant degradation to operations were known to occur in the south, it is possible that the group would have arrived at a different conclusion.

MSL Project Meeting: A subsequent MSL project meeting held on December 4, 2007 included a discussion of science potential, safety, engineering analysis, and programmatics of 11 sites. This included 10 of the 11 sites ranked highest at the 2nd workshop (minus Melas Chasma, for which an MSL ellipse can not be safely placed) plus an additional site, N Meridiani. Participants in the meeting included the Project Science Group (PSG), the Landing Site Steering Committee, site proposers, and key project personnel.

Six landing sites were recommended (Table 1): Nili Fossae trough, Mawrth Vallis, Holden, Eberswalde, Miyamoto and N Meridiani. This list is similar to that

from the 2nd community workshop with some exceptions. Jezero was subsequently found to have unacceptably high rock abundance. The MSL PSG recommended including Eberswalde for scientific reasons in place of Terby for which there are concerns about likely environmental conditions. Finally, N Meridiani was specifically added by the project to ensure a well characterized safe landing site composed of sulfates. It is recognized that each of these sites has potential liens due to various engineering, safety and operations concerns but all were accepted by the project engineering and management team for in-depth analysis.

Downselected Landing Sites: Table 1 is the list of the 6 landing sites being studied for landing MSL and a graphic (Figure 1) for each showing the location of the ellipse or ellipses being considered. For each site, the center latitude, longitude and elevation of the ellipse is listed as well as a possible safe haven ellipse. The yellow ellipse is the opening of the launch period and the black ellipse is the closing of the launch period. Prime ellipses are 20 by 25 km and safe haven ellipses are 32 by 35 km, both oriented along entry azimuths. Single prime ellipses are being considered at each of the sites, except Mawrth, which has 4.

Table 1: MSL LANDING SITES

NAME	LOCATION	ELEVATION	TARGET
Nili Fossae Trough	21.01ºN, 74.45ºE	-608 m	Noachian Phyllosilicates
Holden Crater Primary Safe Haven	 26.38ºS, 325.08ºE 26.25ºS, 325.21ºE	 -1940 m -2137 m	Fluvial Layers, Phyllosilicates
Mawrth Vallis Site 1 Primary Site 2 Site 2 Safe Haven Site 3 Site 3 Safe Haven Site 4 Site 4 Safe Haven	 24.65ºN, 340.1ºE 23.99ºN, 341.04ºE 23.95ºN, 341.11ºE 23.21ºN, 342.43ºE 23.12ºN, 342.20ºE 24.85ºN, 339.42ºE 24.88ºN, 339.78ºE	 -3093 m -2246 m -2254 m -2187 m -2268 m -3359 m -3355 m	Noachian Layered Phyllosilicates
Eberswalde Crater	23.86°S, 326.73°E	-1450 m	Delta
Miyamoto Crater Safe Haven	3.51ºS, 352.26ºE 3.09ºS, 352.59ºE	-1807 m -1958 m	Phyllosilicates, Sulfates?
N Meridiani Primary Safe Haven	 1.58ºN, 357.48ºE 1.48ºN, 357.55ºE	 -1289 m -1301 m	Layered Sulfates

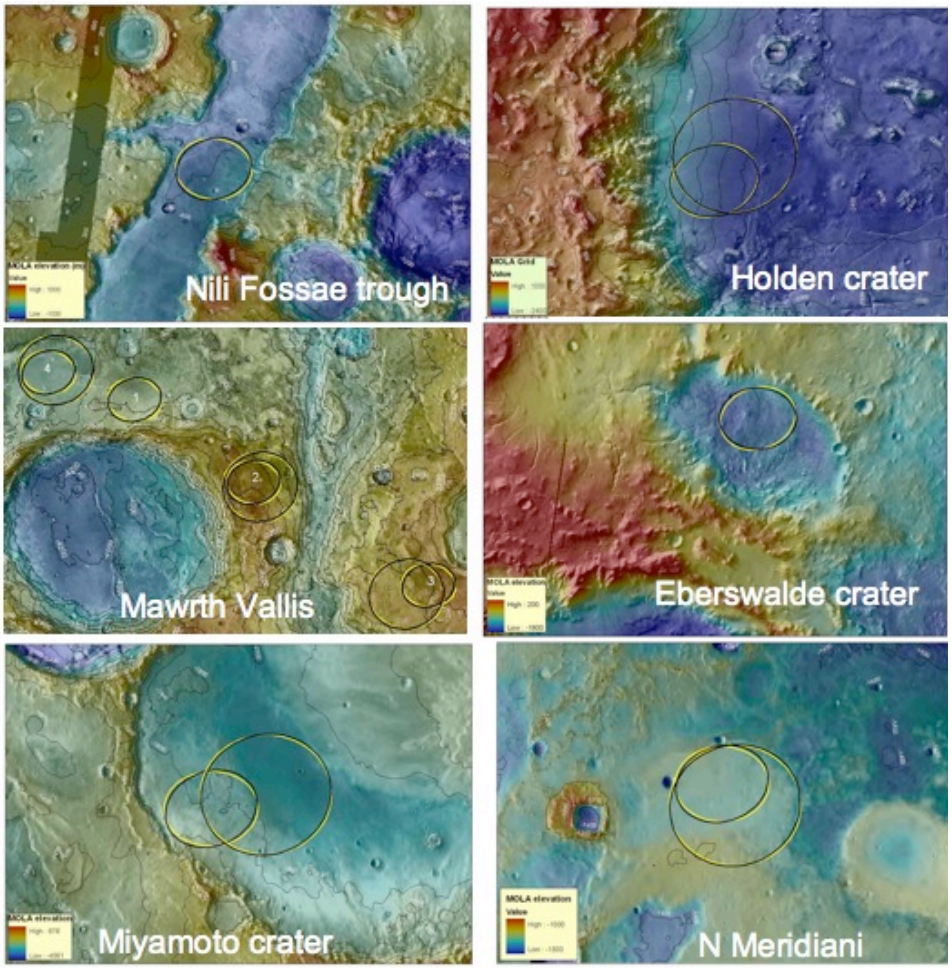

Figure 1: Landing sites under consideration for the Mars Science Laboratory. Primary ellipses are 20 km by 25 km and safe haven ellipses are 32 km by 35 km at coordinates in Table 1.

These sites will now become the focus of MRO image acquisition [2]. MRO will initially focus on covering the prime ellipses and then on completing stereo for generating topographic maps for evaluating small scale slopes (2-5 m). These requests include HiRISE, CTX and CRISM data.

Study of these sites will proceed until the 3rd MSL Landing Site Workshop scheduled for August 2008. At that workshop, contributions on any aspect of the science or safety of these sites will be solicited. This work will form the basis for a further downselection to a prime and safe haven that will lead to final site certification and selection just before launch (4th Landing Site Workshop scheduled for June 2009).

References: [1] Golombek et al. (2007) *LPS XXXVIII*, Abs. #1392. [2] Griffes et al. (2008) this issue.