Astrobiology strategy for Mars 2020. K. H. Williford[1] and K. A. Farley[2], [1]Jet Propulsion Laboratory, California Institute of Technology, Pasadena, CA 91109 USA, [2]California Institute of Technology, Pasadena, CA 91125.

Introduction: Mars 2020 will be the first NASA mission since Viking to seek signs of life on Mars. A critical distinction between Viking and Mars 2020, however, is that the Mars 2020 surface mission will seek evidence of *ancient*, rather than *extant* life, with an exploration strategy informed by the search for the most ancient signs of life on Earth. Sample selection and collection by Mars 2020 will also focus on the search for evidence of ancient life, although assays for extant martian organisms would be among the key investigations on Earth should the samples eventually be returned. Here we present an exploration strategy designed to address a primary astrobiological question: *did life ever emerge on Mars?*

Landing site selection: Eight potential landing sites are now under consideration for Mars 2020. Depositional models for these sites range from crater lakes to serpentinizing hydrothermal systems rooted in the oldest martian crust. Each category offers strengths and weaknesses relative to a site's potential to reveal signs of ancient life and planetary evolution, and settling upon the preffered exploration environment is a key near-term challenge for the scientific community and the Mars 2020 science team.

Fundamentally, the exploration process of a planetary rover mission involves identifying and acting upon distinctions observed at decreasing spatial scales from orbit to outcrops to individual grains. This process is already underway as landing site proposers interpret geomorphologic and mineralogic signatures of ancient environments from orbital data, working closely with the mission team at JPL to identify and prioritize ROIs and evaluate traversability of the terrain between them. This mapping effort will intensify upon ultimate landing site selection and may enable optimization of mission systems to specific characteristics of the site.

Balancing exploration and sampling: The first step toward possible Mars sample return, Mars 2020 represents an evolution in strategy from previous rover missions in which sampling supported exploration, to a mission in which *exploration supports sampling*. This evolution is analogous to typical geologic exploration on Earth, where early field observations support geologic mapping and lead to hypotheses eventually tested via focused sampling and laboratory analysis. Mars 2020 must establish geologic context using the scientific payload in order to support the simultaneous collection, and eventual interpretation of samples in the returnable cache. The history of Mars rover missions demonstrates that balancing mission requirements for driving, in situ analysis, data interpretation, and sampling requires landing with a science team capable of careful and constant strategic planning, discipline and flexibility, and a willingness and ability to make difficult, high stakes decisions on the basis of incomplete information. In other words, Mars 2020 requires *extraordinary operational efficiency*.

Exploration. Upon landing, and during initial systems checkout, the science team will prioritize multiple, km-scale ROIs previously identified from orbit, guided by the proximity of opportunities to efficiently access, investigate and sample materials with high biosignature preservation potential and geologic diversity. Exploration of each ROI will comprise multiple campaigns designed to test hypotheses generated from orbital data and progressively refined by surface observations. "Strategic" campaign planning, guided predominantly by orbital data, will proceed in parallel with "tactical" campaign implementation, guided predominantly by evolving interpretations of mission data.

Remote science instruments including Mastcam-Z, SuperCam, and RIMFAX will establish regional to outcrop-scale geologic context based on surface and subsurface stratigraphic relations, mineralogy, and elemental chemistry. Proximity science locations will be selected initially from orbit and refined based on remote science to enable the progressive identification of formation and alteration processes as revealed by rock textures, mineralogy, and chemistry observed in cross-cutting stratigraphic and petrologic context. Targeted deployments of PIXL and SHERLOC (including the WATSON imager) on natural and abraded surface targets will respond to the strategic necessity to maximize the potential of individual observations to test hypotheses emerging from science team discussions.

Sampling. Exploration and sampling are intimately related: in situ science observations will establish the geologic context for and provide the data necessary to select materials with the highest biosignature preservation potential. Informed by the search for early evidence for life on Earth, Mars 2020 will establish the formational and preservational context of an ancient environment, and determine whether the environment was once habitable. Textures, mineralogy, organic and inorganic chemistry indicating strong preservation potential, or perhaps the former influence of biology will further guide analytical target and sample selection. Spatially correlated morphologic and chemical disequilibria would represent particularly compelling potential biosignatures.