AN EVOLVING MARS TELECOMMUNCATIONS NETWORK TO ENABLE EXPLORATION AND INCREASE SCIENCE DATA RETURN, Chad Edwards, Tomas A. Komarek, Gary K. Noreen, and Gregory R. Wilson, Jet Propulsion Laboratory, Pasadena, CA 91109-8099 (chad.edwards@jpl.nasa.gov)

The coming decade of Mars exploration involves a variety of unique telecommunications challenges. Increasing spatial and spectral resolution of in situ science instruments drive the need for increased bandwidth. At the same time, many innovative and low-cost in situ mission concepts are enabled by energy-efficient relay communications. In response to these needs, the Mars Exploration Program has established a plan for an evolving orbital infrastructure that can provide enhancing and enabling telecommunications services to future Mars missions. We will present the evolving capabilities of this network over the coming decade in terms of specific quantitative metrics such as data volume per sol and required lander energy per Gb of returned data for representative classes of Mars exploration spacecraft.

The early elements of this network are realized by adding UHF relay payloads to science orbiters. In the coming year, Mars Global Surveyor, Mars Odyssey, and Mars Express will provide UHF relay support to the 2003 Mars Exploration Rovers and the Beagle 2 Lander. The 2005 Mars Reconnaissance Orbiter will add to this infrastructure, flying the next-generation Electra Proximity Link Comm/Nav Payload. This strategy of carrying a relay payload on each science orbiter offers a low-cost means of building capability; however, their low orbit altitude fundamentally limits their visibility to surface assets and hence their data return potential. Nonetheless, this initial network offers increased science return for MER-class landers relative to direct-to-Earth (DTE) links, and enables a number of scout-class mission concepts for which DTE links are not practical.

Further breakthrough increases in coverage and data return are achieved with the deployment of the Mars Telesat Orbiter (MTO) in 2009. This first dedicated planetary telecommunications orbiter will utilize an orbit optimized for its telecom role, with a higher altitude to greatly increase contact times and resulting data return. Supporting for the first time X-band directional surface-to-orbiter links, MTO offers more than two orders of magnitude increase in potential data return from the 2009 Mars Science Laboratory and similar MSL-class landers. In addition, MTO will serve as a pathfinder to demonstrate optical communications, and will demonstrate key technologies related to locating an orbiting sample canister, supporting possible future Mars sample return concepts.