Implementing the Mars Science Laboratory Terminal Descent Sensor Field Test Campaign

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The Mars Science Laboratory (MSL) delivered a 900 kg rover to the surface of Mars in August 2012. MSL utilized a new pulse-Doppler landing radar, the Terminal Descent Sensor (TDS). The TDS employed six narrow-beam antennas to provide unprecedented slant range and velocity performance at Mars to enable soft touchdown of the MSL rover using a unique sky crane Entry, Descent, and Landing (EDL) technique. Prior to use on MSL, the TDS was put through a rigorous verification and validation (V&V) process. A key element of this V&V was operating the TDS over a series of field tests, using flight-like profiles expected during the descent and landing of MSL over Mars-like terrain on Earth. Limits of TDS performance were characterized with additional testing meant to stress operational modes outside of the expected EDL flight profiles. The flight envelope over which the TDS must operate on Mars encompasses such a large range of altitudes and velocities that a variety of venues were necessary to cover the test space. These venues included an F/A-18 high performance aircraft, a Eurocopter AS350 AStar helicopter and 100-meter tall Echo Towers at the China Lake Naval Air Warfare Center. Testing was carried out over a five year period from July 2006 to June 2011. TDS performance was shown, in general, to be excellent over all venues. This presentation describes the planning, design, and implementation of the field test campaign plus results and lesson learned.

Dr. Jim Montgomery received a B.S. in Computer Science from the University of Michigan in 1986 and a Masters and Ph.D. in Computer Science from the University of Southern California in 1992 and 1999, respectively. He received his dream job exploring the universe when he joined NASA’s Jet Propulsion Laboratory in 2000 and has been a member of the Mars Science Laboratory team since 2006.