Overview of NASA's Entry, Descent and Landing Systems Analysis (EDL-SA) Effort

NASA senior management commissioned the Entry, Descent and Landing Systems Analysis (EDL-SA) Study in 2008 to identify and roadmap the Entry, Descent and Landing (EDL) technology investments that the agency needed to make in order to successfully land large payloads at Mars for both robotic and human-scale missions. This paper summarizes the motivation, approach, results, and plans for the overall study. Specifically, the paper will include top-level results from Year 1 of the study, which focused on landing 10–50 mt on Mars, but also included a trade study of the best advanced parachute design for increasing the landed payloads within the EDL architecture of the Mars Science Laboratory (MSL) mission.

Candidate technology areas were assessed against a set of eight *EDL-SA Architectures*, i.e., representative architectures (high-level designs) against which the benefits of the technology areas were evaluated. The Study used Design Reference Missions (DRMs), Ground Rules & Assumptions (GR&As) and Figures of Merit (FOMs) that were approved by the managers of the relevant NASA technology programs in May 2009, prior to the execution of the simulations and the evaluations of the FOMs. In evaluating the FOMs, the Study used simulation-based results whenever possible and subjective assessments otherwise. The major simulation-based result was the Mars Arrival Mass, i.e., the total mass of the payload plus the systems needed for Mars Orbit Insertion and Mars EDL. The recommended major technologies from the analysis to date are Aerocapture, Inflatable Aerodynamic Decelerators (both hypersonic and supersonic), Mid-L/D Rigid Aeroshells with Dual-Pulse TPS, and Supersonic Retropropulsion.