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INSIGHT : THE FIRST INTERPLANETARY MISSION FROM CALIFORNIA

Abstract

The Interior Exploration using Seismic Investigations, Geodesy, and Heat Transport (InSight) mission has the primary objective of placing a science lander on the surface of Mars followed by the deployment of two science instruments onto the Martian surface to investigate the fundamental processes of terrestrial planet formation and evolution. The spacecraft will be launched in March 2016 from the Western Test Range at Vandenberg Air Force Base (VAFB) in California on an Atlas V 401 launch vehicle. This historical interplanetary mission profile will be a first for the worlds' space programs. The InSight spacecraft atop a United Launch Alliance Centaur upper stage will utilize a unique, low-altitude, high-inclination parking orbit and six trajectory correction maneuvers to reach its distant goal. The entry, descent, landing and deployment of the InSight suite of science instruments will require innovative trajectory optimization techniques to ensure these highly sensitive devices land safely. Mission unique techniques are discussed that range from planetary protection to sun angle requirements during all phases of the profile. Both the maneuvers of the upper stage and the cruise stage are presented along with injection accuracies and sensitivity analyses. Injection biasing issues unique to Mars, as well as mission drivers such as communications through TDRSS (Tracking Data Relay Satellite Service), DSN (Deep Space Network) and MRO (Mars Reconnaissance Orbiter) are considered. This overview of both the Atlas 5 rocket and centaur upper stage coupled with the navigational capabilities of the InSight platform establishes an exciting corridor between Earth and Mars from the west coast of the United States that will be used as a baseline for numerous NASA missions to come.