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TITAN INVESTIGATOR

Abstract

This paper outlines the design of an entry, descent and landing mission onto the Saturnian moon, Titan. The spacecraft architecture is of mother-daughter configuration, with the mother serving as a host to support the landing probe during interplanetary travel. During flybys of the moon, the mother will also serve as a telecommunications relay and transmit data back to Earth while surveying the topology and subsurface of Titan using radar. The daughter landing probe will utilize two radioisotope thermal generators to enable a long-term mission lifespan. The primary objective of this mission is to determine the structure and properties of Titan's liquid methane lakes and weather system. The probe is designed to enter Titan's atmosphere at a velocity of 6 km/s at a flight path angle of -75 degrees. The entry will be ballistic from orbit, with peak heat rate and total heat load to be 66.27 W/cm^2 and 1171.11 J/cm^2 respectively. The probe utilizes a 4 m diameter disk-gap-band pilot chute that opens at Mach 1.32 and is used to separate from the back shield and consequently unfurl the 8.1 m main descent chute at Mach 0.25. The entry mass is 350 kg and the probe lands at 2.02 m/s after a descent time of 5.65 hours and downrange of 308 km. The lander itself is a cylindrical platform of diameter 3 meters and height 1.5 meters. This volume is more than sufficient to satisfy buoyancy requirements and house all the payload.