

Feasibility of a Dragon-derived Mars lander for scientific and human-precursor missions

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A minimally-modified SpaceX Dragon capsule launched on a Falcon Heavy rocket presents the possibility of a new low-cost, high-capacity Mars lander for robotic missions. We have been evaluating such a "Red Dragon" platform as an option for the Icebreaker Discovery Program mission concept.

Dragon is currently in service ferrying cargo to and from the International Space Station, and a crew transport version is in development. The upcoming version, unlike other Earth-return vehicles, exhibits most of the capabilities necessary to land on Mars. In particular, it has a set of high-thrust, throttleable, storable bi-propellant "SuperDraco" engines integrated directly into the capsule that are intended for launch abort and powered landings on Earth. These thrusters provide the possibility of a parachute-free, fully-propulsive deceleration at Mars from supersonic speeds to the surface, a descent approach which would also scale well to larger future human landers.

We will discuss the motivations for exploring a Red Dragon lander, the current results of our analysis of its feasibility and capabilities, and the implications of the platform for the Icebreaker mission concept. In particular, we will examine entry, descent, and landing (EDL) in detail. We will also describe the modifications to Dragon necessary for interplanetary cruise, EDL, and operations on the Martian surface. Our analysis to date indicates that a Red Dragon lander is feasible and that it would be capable of delivering more than 1000 kg of payload to sites at elevations three kilometers below the Mars Orbiter Laser Altimeter (MOLA) reference, which includes sites throughout most of the northern plains and Hellas.