

Dragonfly Sessions at SciTech'26





EDL Concept of Operations for the Dragonfly Rotorcraft Mission to Titan

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Outline

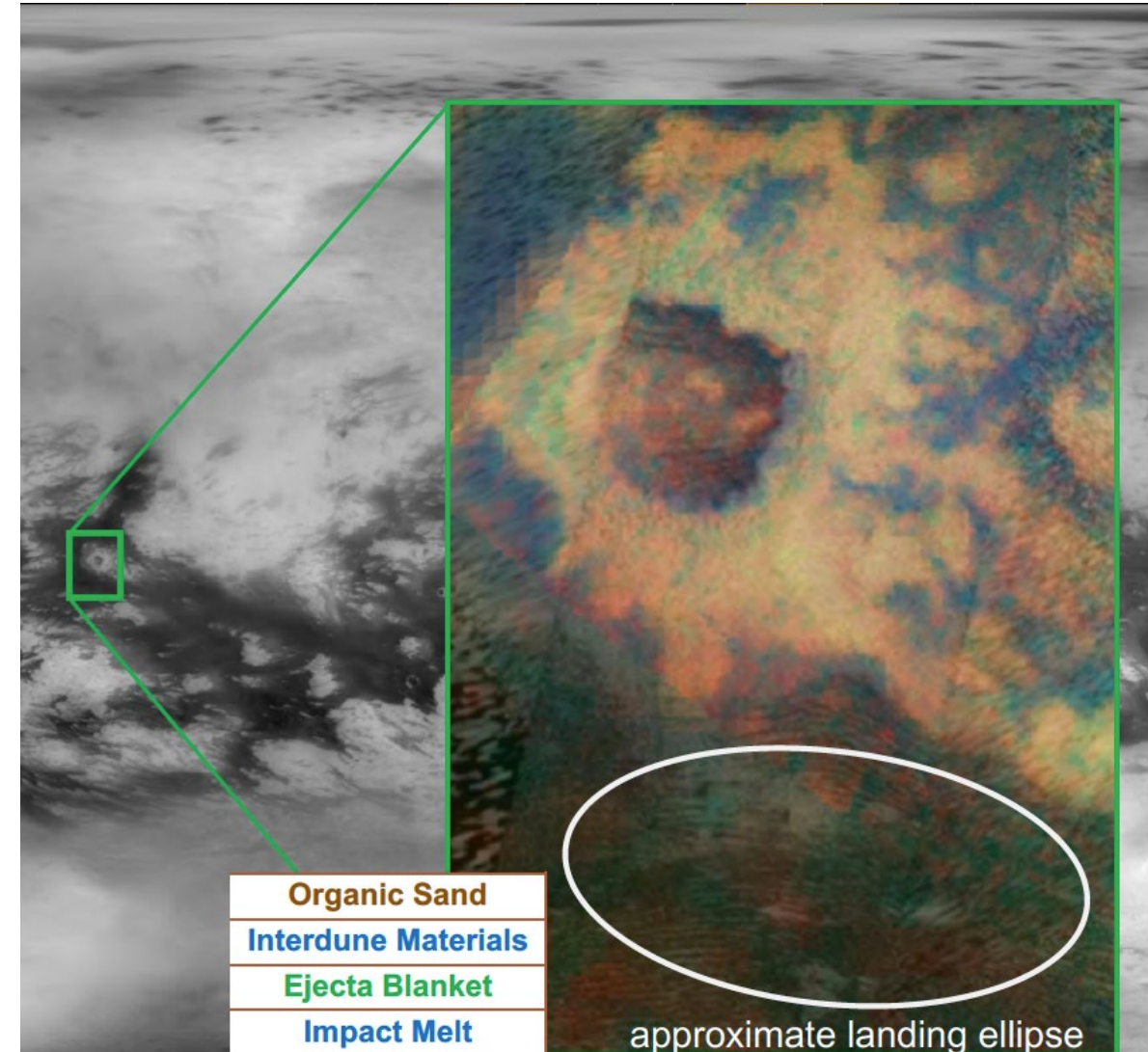


- Dragonfly 101
- Entry, Descent and Lander Release
- First Flight

Dragonfly 101



- **Fourth NASA New Frontiers mission (APL-led)**
- **Explore the Selk Crater region of Titan via a “relocatable lander”**
- **Launch in 2028, Titan arrival 2034**
- **Currently a year past CDR, rapidly approaching I&T**



The Spacecraft



- **Three major components:**

- Cruise Stage (interplanetary transfer)
- EDL Assembly (aeroshell and associated hardware)
- Lander

Cruise Stage

- **EDL Assembly Overview:**

- 4.5 meter diameter, 60° sphere cone geometry
- Biconic backshell (scaled from Genesis probe)
 - See talk by Eric Stern this afternoon for TPS details
- DrEAM EDL instrumentation package
 - see talk by Aaron Brandis this afternoon

EDL Assembly

Lander

Lander & Payload

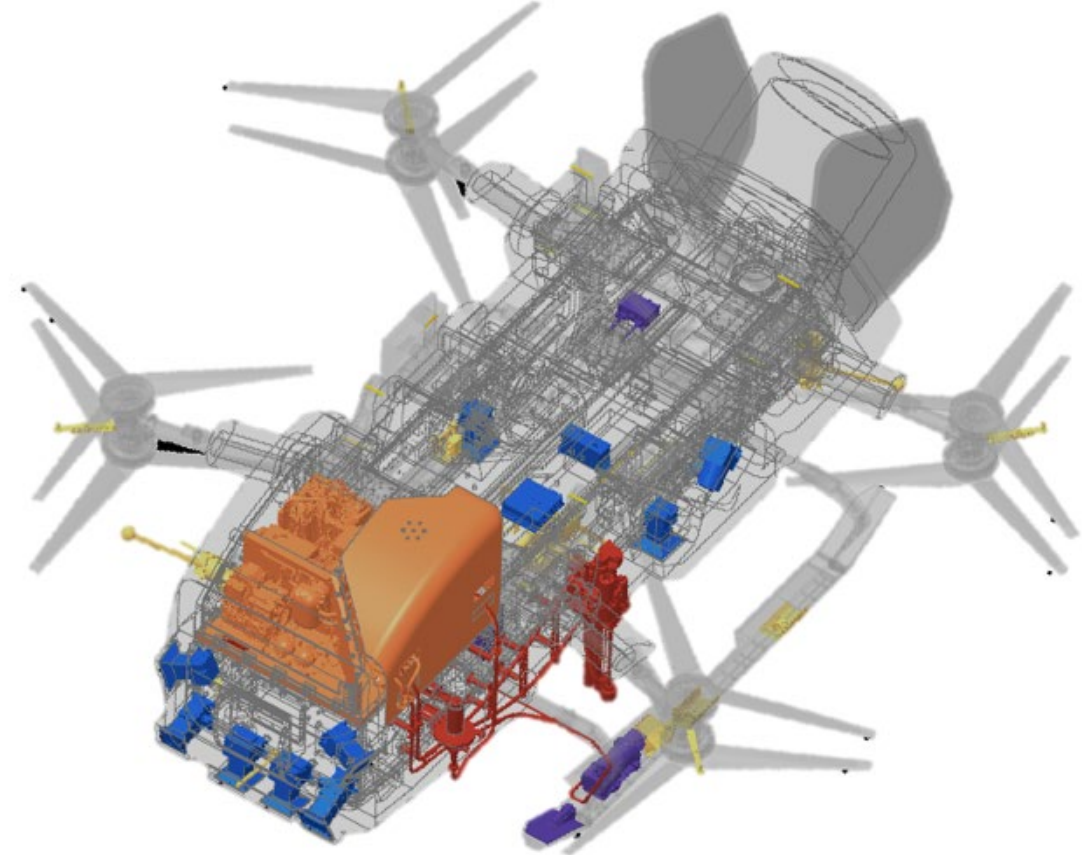


- **Lander**

- Capable of autonomous flight and operation on Titan
 - Baseline of one flight (~30m duration) every 1-2 Titan days
- 8 total three bladed rotors
- MMRTG supplies heat and energy (battery charging)
- Flight computers, avionics, and sensors

- **Science Package**

- DraGMet: Geophysics & Meteorology Package (APL, JAXA)
- DraMS: Mass Spectrometer (GSFC, CNES)
- DrACO: Drill for Acquisition of Complex Organics (Honeybee Robotics)
- DragonCam: Camera Suite (APL/MSSS)
- DraGNS: Gamma-ray Neutron Spectrometer (APL, LLNL)



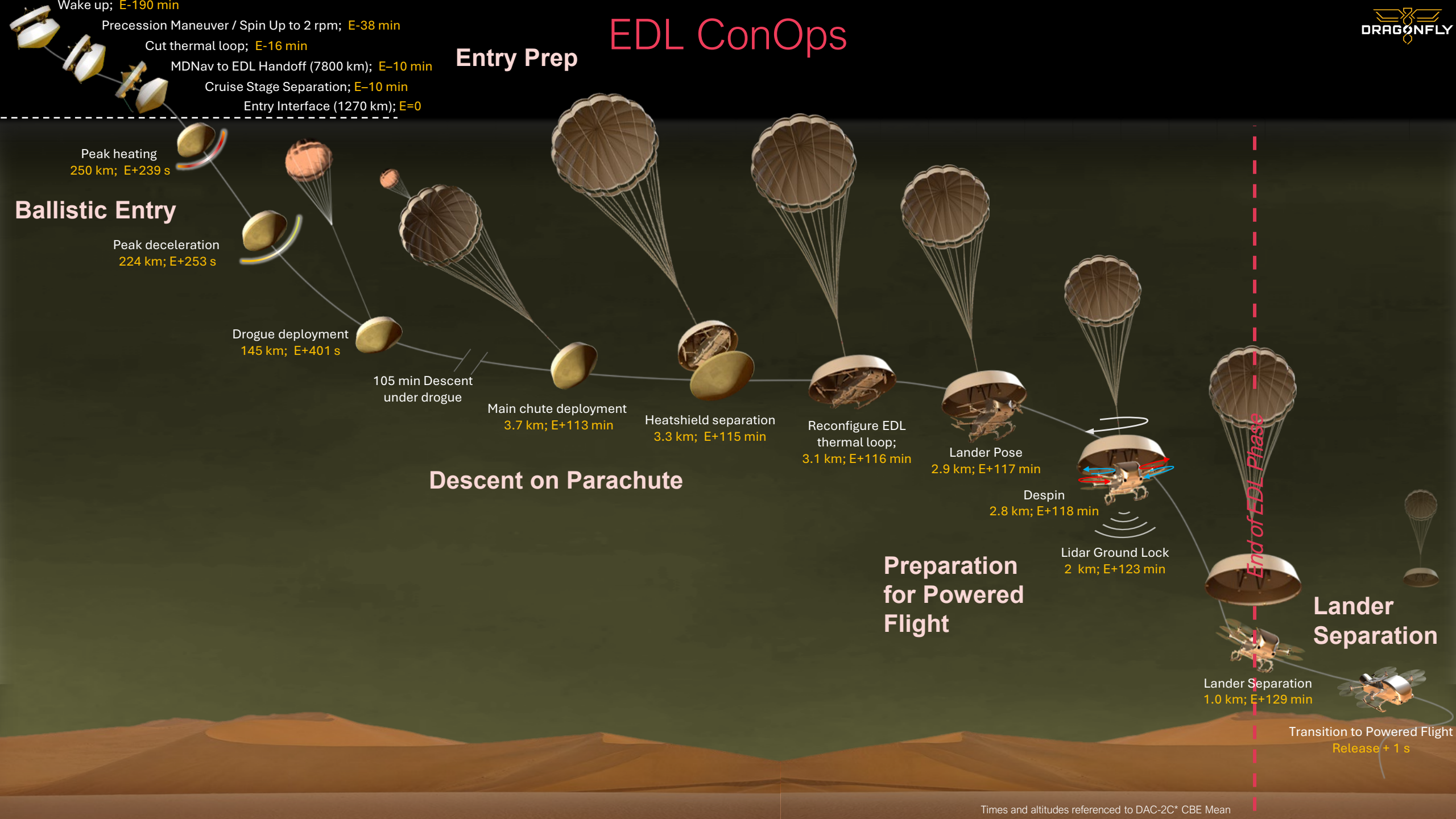
Entry, Descent and Lander Release (EDL)



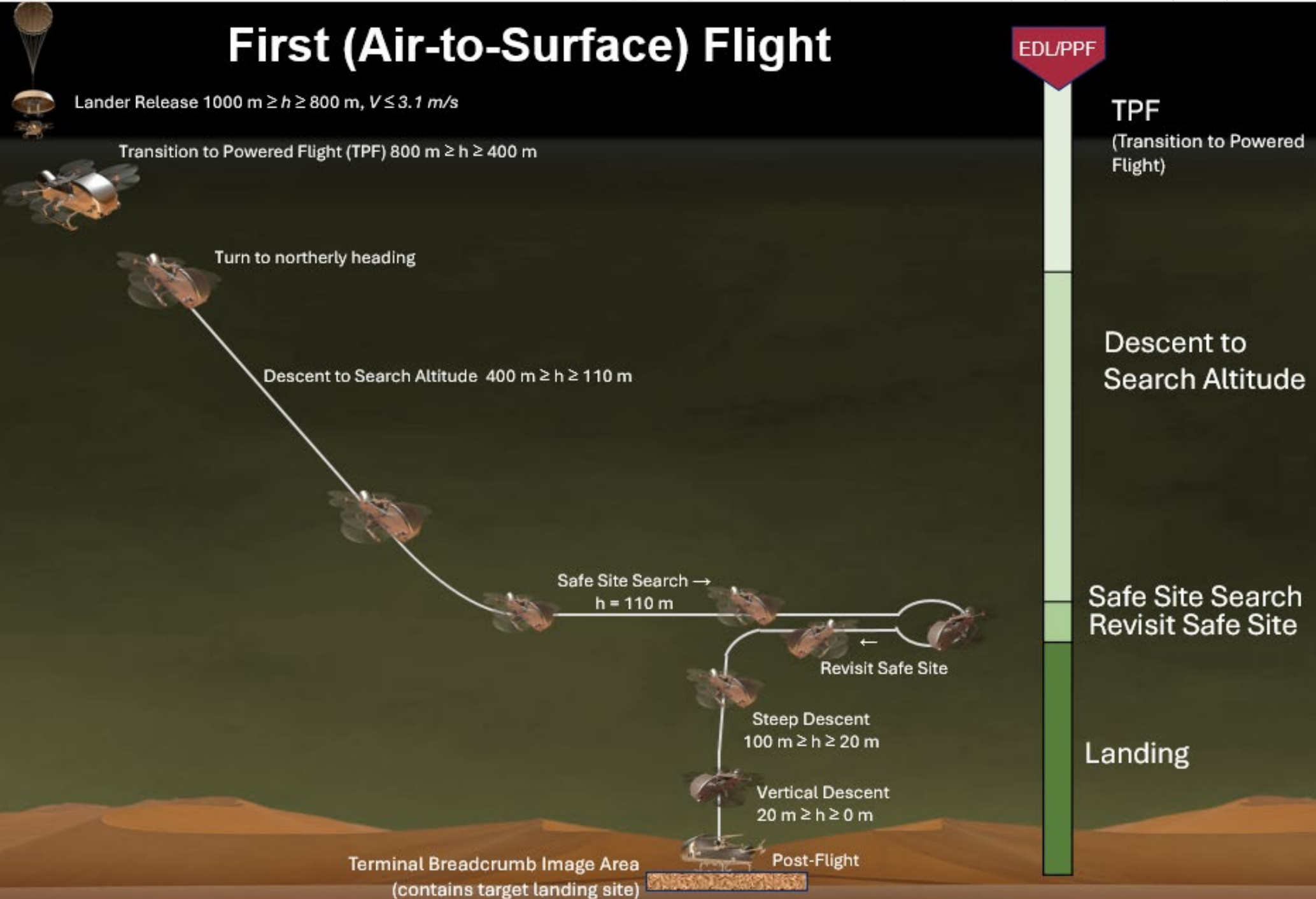
- **Defined as a unique “phase” for Dragonfly**
 - Other phases include cruise, Titan arrival, vertical flight and surface operations
- **EDL is divided into five sequential “sub-phases” with varying degrees of mission heritage**

	Level of Flight Heritage				
- Entry preparation					
- Ballistic entry					
- Parachute descent					
- Preparation for powered flight					
- Lander separation					

EDL ConOps



First (Air-to-Surface) Flight



Conclusions



- **Dragonfly EDL combines an open-loop unguided entry system with a closed-loop aerial mobility system with a mid-air deployment**
- **The entire EDL sequence requires about 6 hours, almost half of which is intra-atmosphere**
- **Significant challenges**
 - Radiative heating and thermal protection (see talks by Aaron Brandis & Eric Stern)
 - Long descent time / dynamic behavior (see talks by Bruce Owens, Eli Shellabarger & Rick Winski)
 - Thermal management
 - Poor knowledge of Titan surface conditions



EDL Telecom Strategy

