



Jet Propulsion Laboratory  
California Institute of Technology

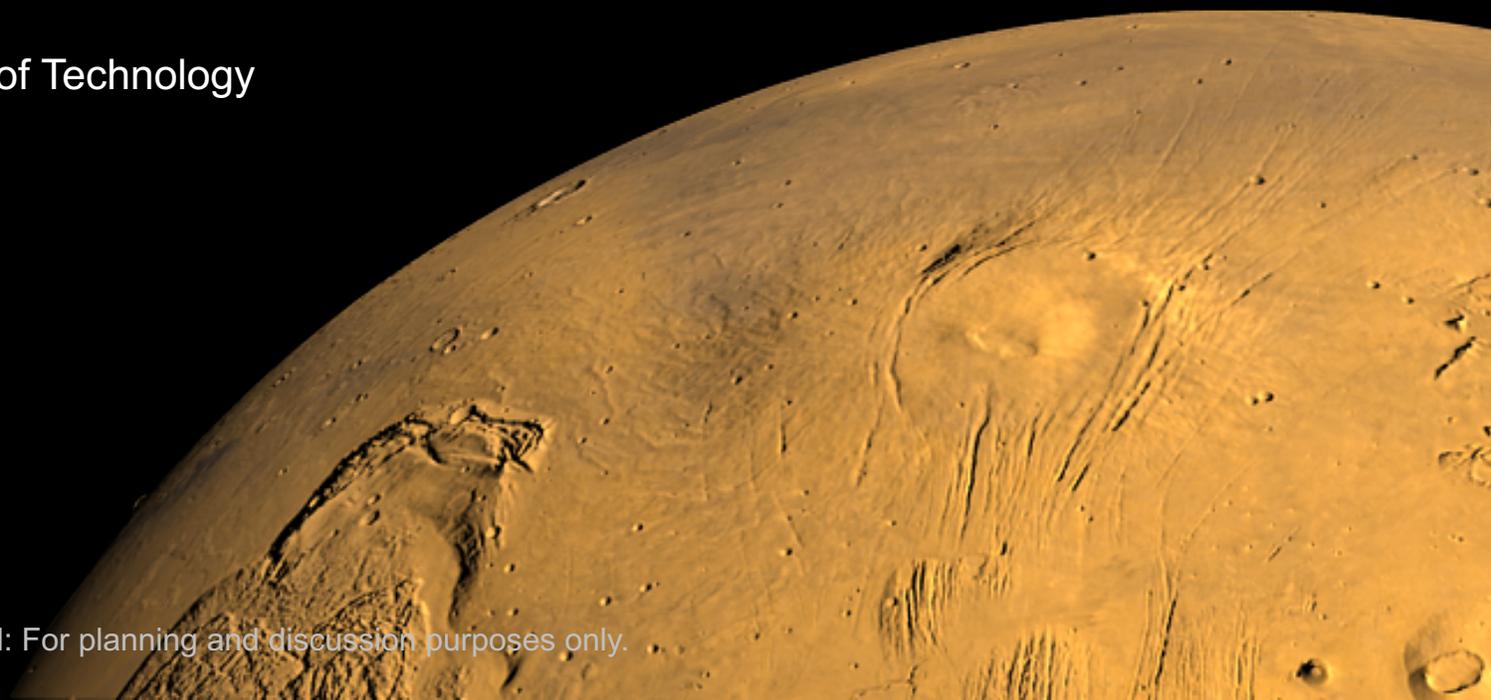
# New Methods to Access Mars

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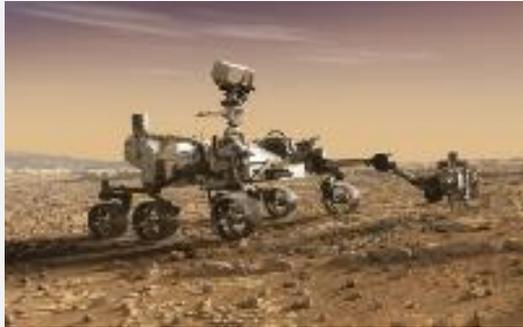
Pre-Decisional: For planning and discussion purposes only.



## Seeking access to Mars...

- ...here on Earth (planning for Mars Sample Return)
- ...in extreme terrains
- ...at the poles
- ...beneath the surface (remote sensing, drilling)
- ...at low cost (concepts for smallsat orbiters and landers)

# Notional Mars Sample Return Architecture



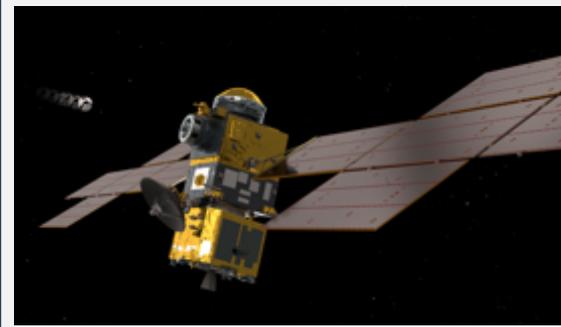
**Sample Caching Rover  
(Mars 2020) Operations**

- *Sample acquisition/caching*
- *Sample (subset) delivery*



**Sample Retrieval Lander  
Concept**

- *Fetch Rover*
- *Orbiting Sample (OS)  
container*
- *Mars Ascent Vehicle*



**Earth Return  
Orbiter Concept**

- *Capture/Containment  
System*
- *Earth Return Vehicle*



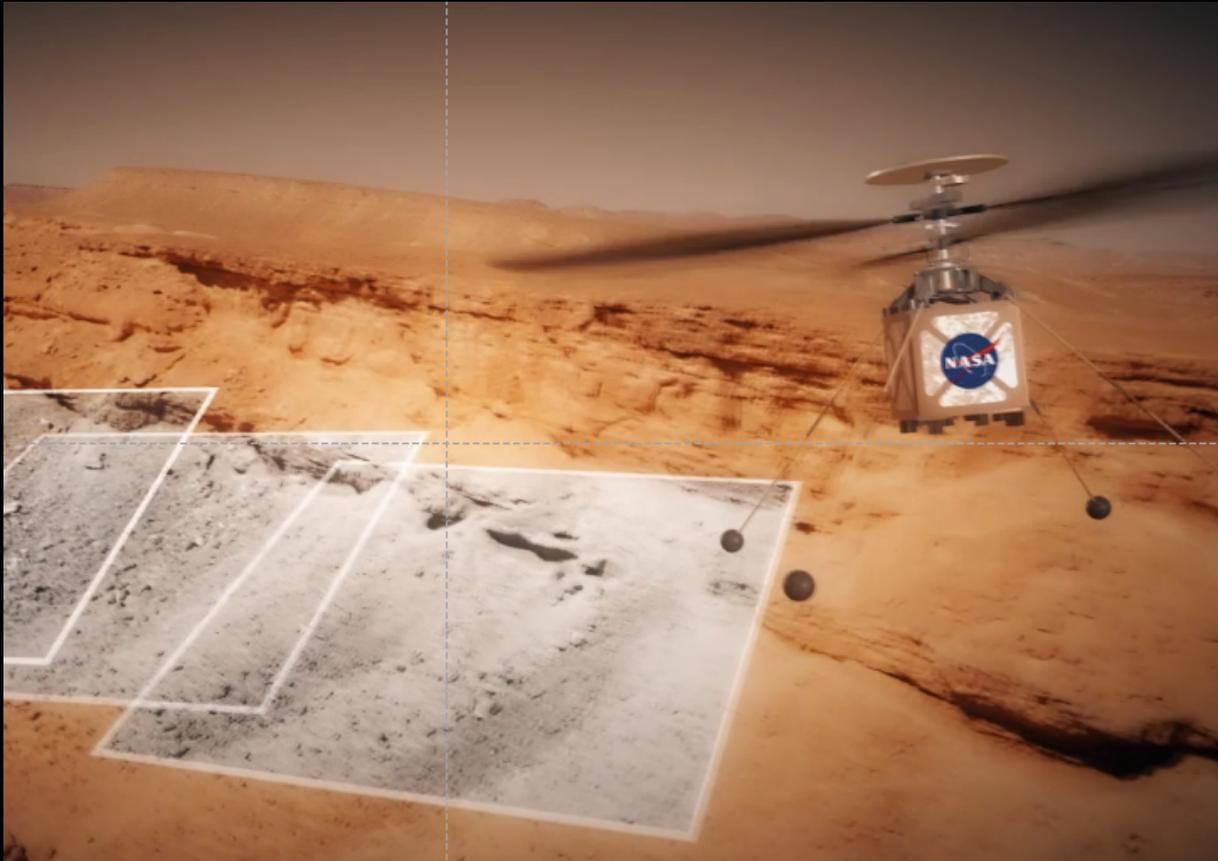
**Mars Returned Sample  
Handling**

- *Sample Receiving Facility*
- *Curation*
- *Sample science  
investigations*

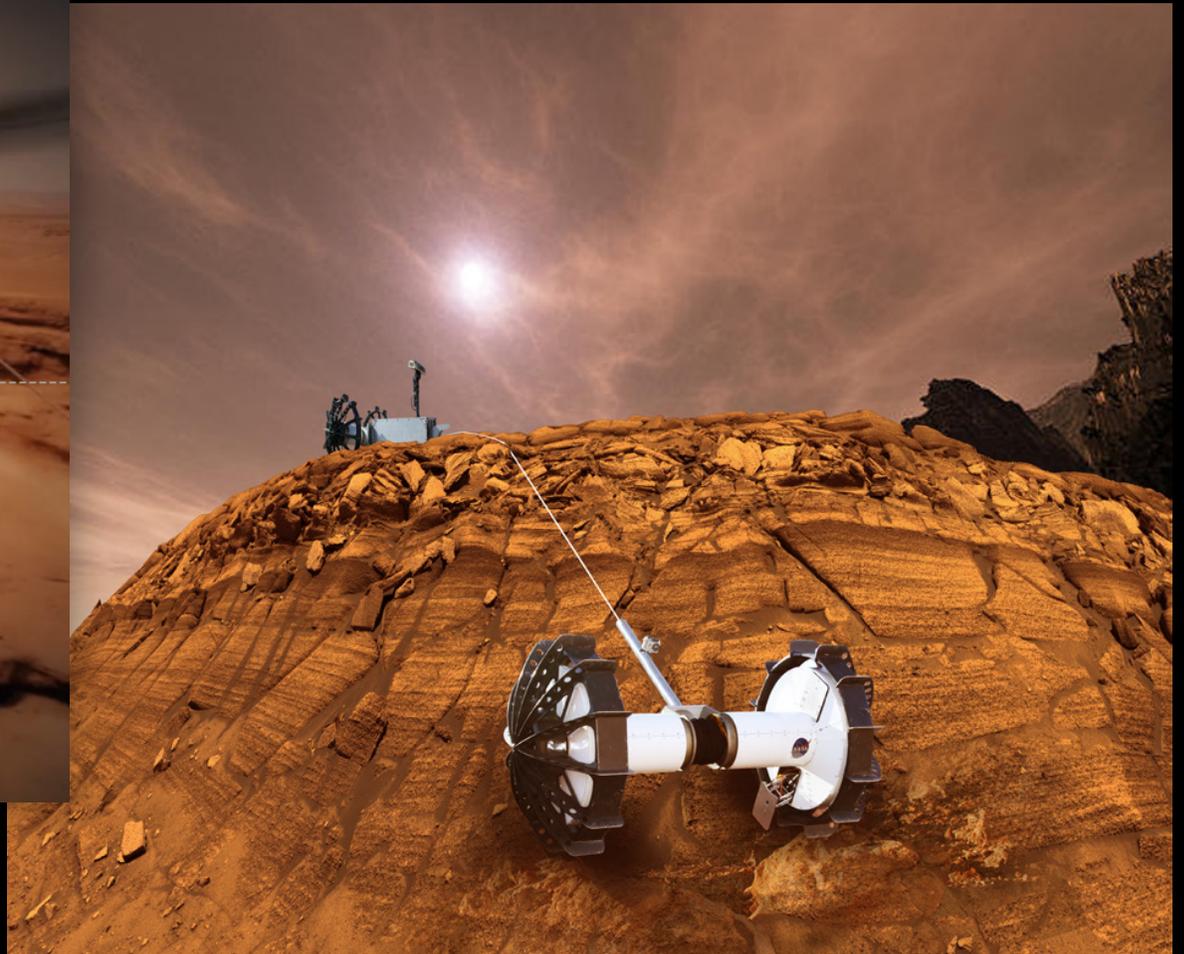
Flight Elements

Ground Element

# Extreme Terrain Access

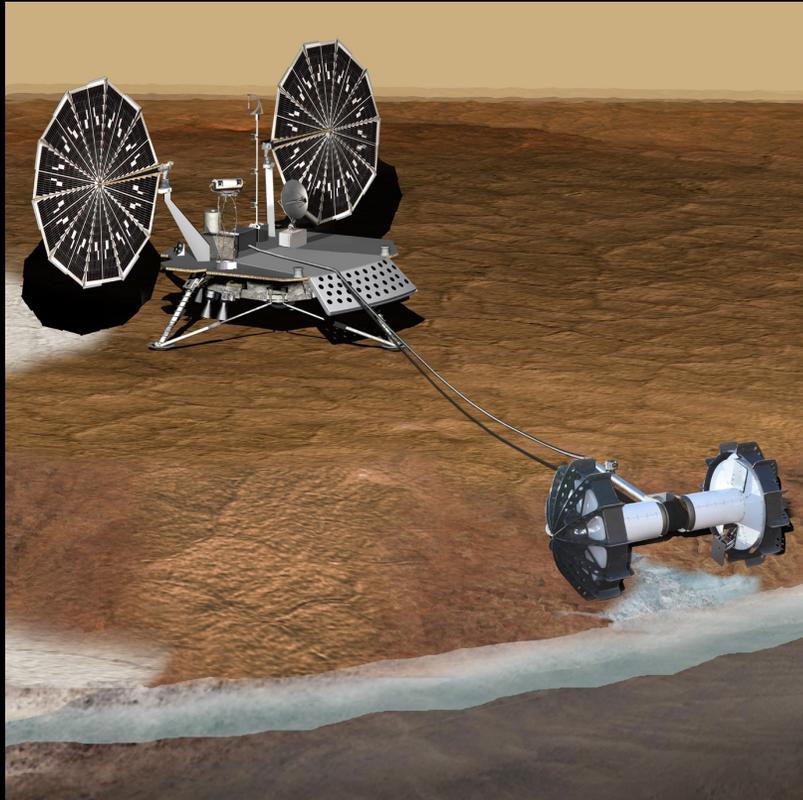


*Mars Helicopter (planned for delivery by Mars 2020)*

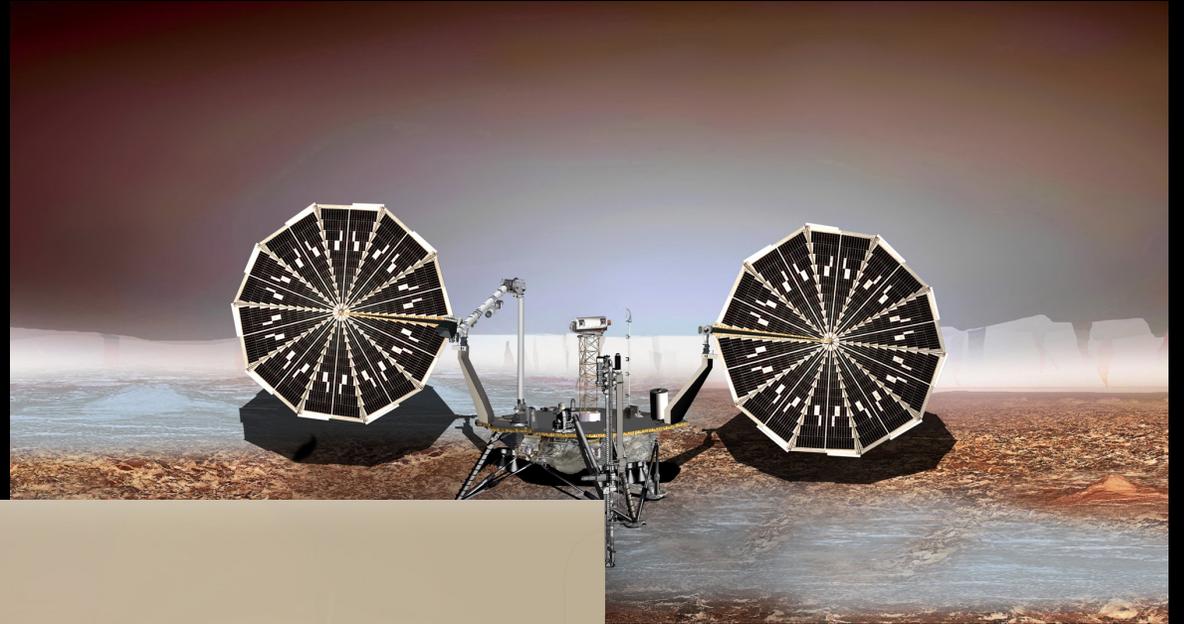


*AXEL Rover Concept*

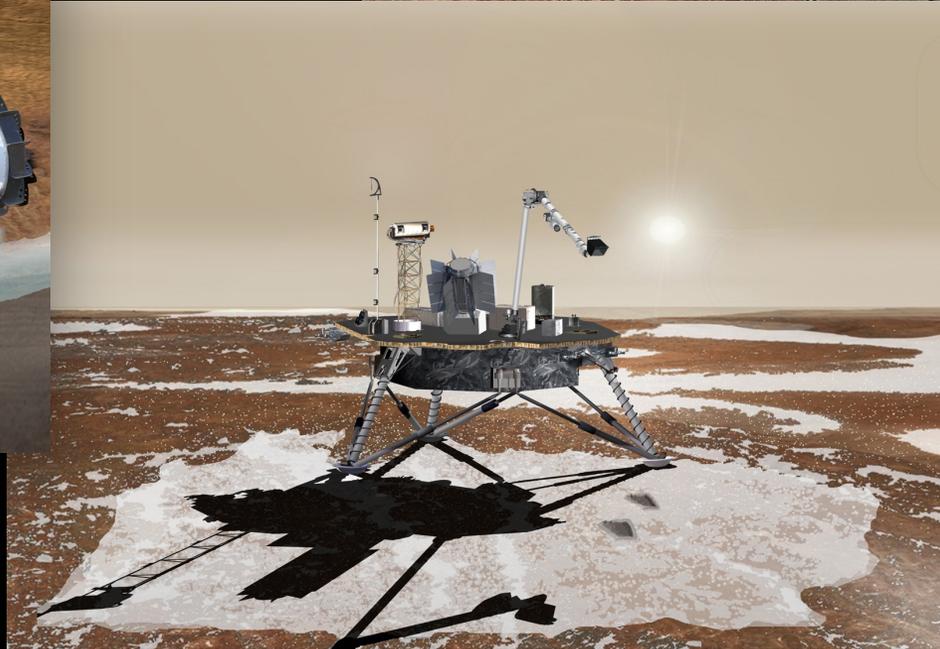
# Polar Access



*Polar GPR mission concept*



*Shallow ice drilling mission concept*

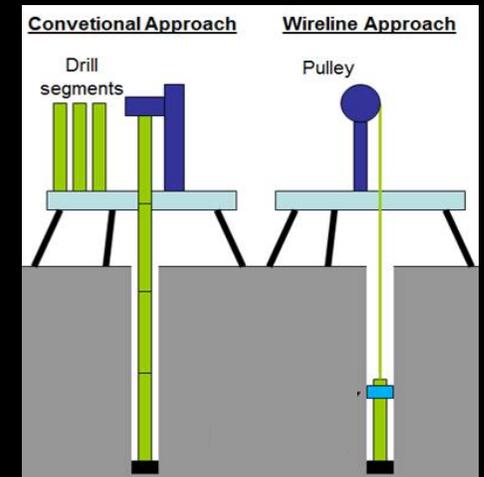
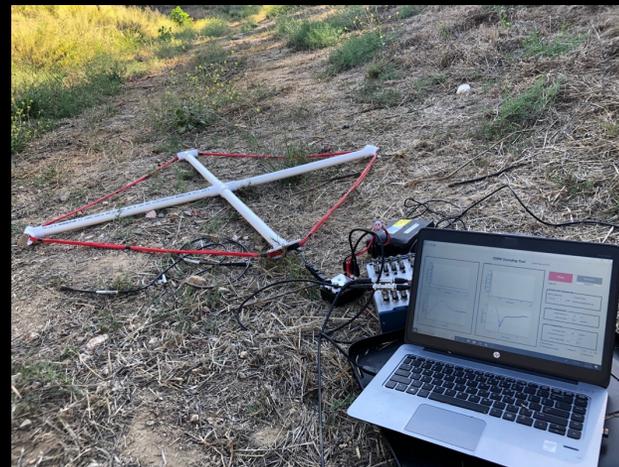
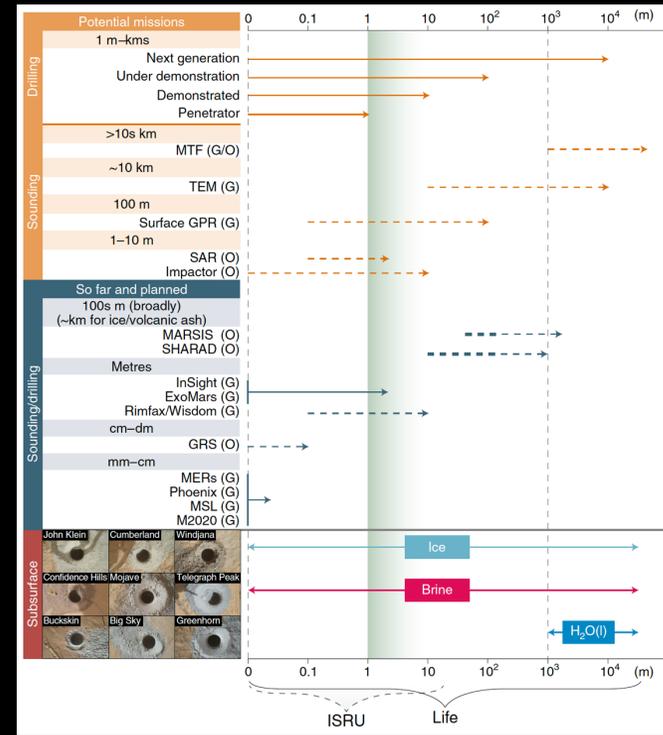


*Polar frost processes mission concept*

# Subsurface Exploration

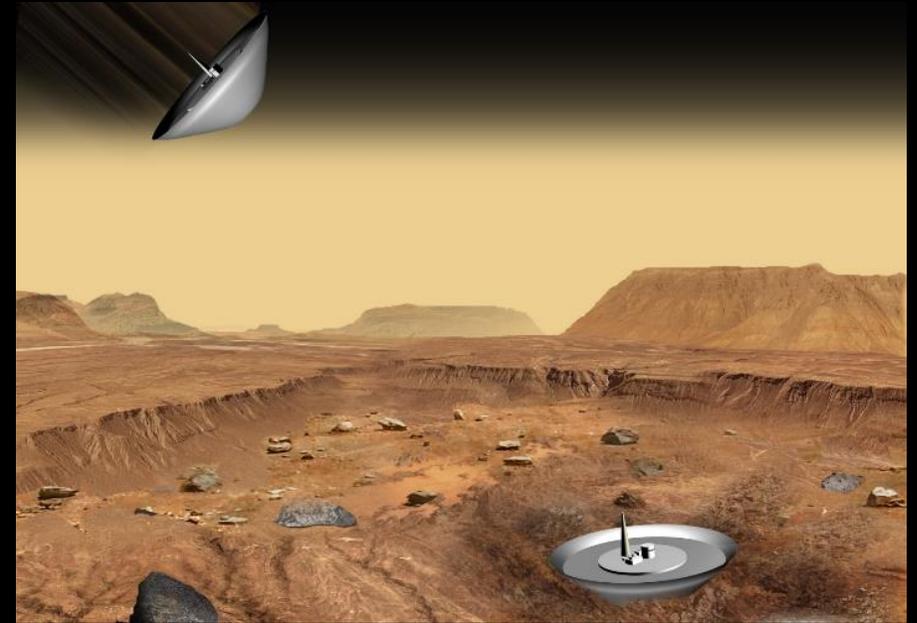
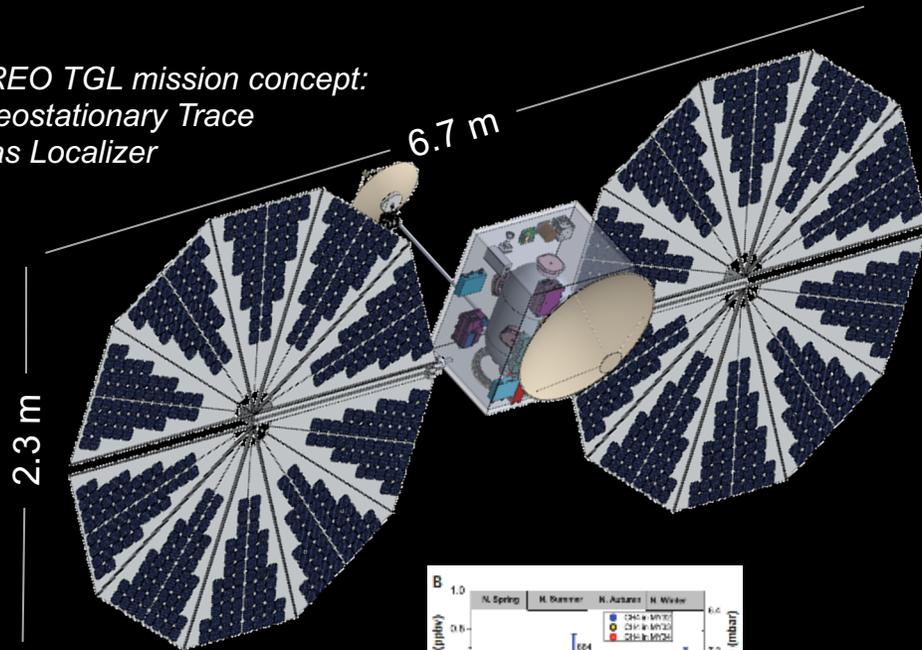


VALKYRIE (Volatiles And Life: Key Reconnaissance & In-situ Exploration) mission concept

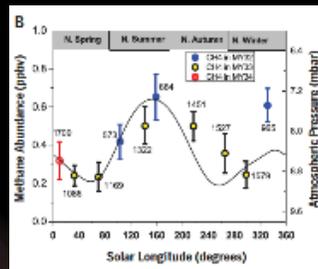


# Low-Cost Smallsats for Mars

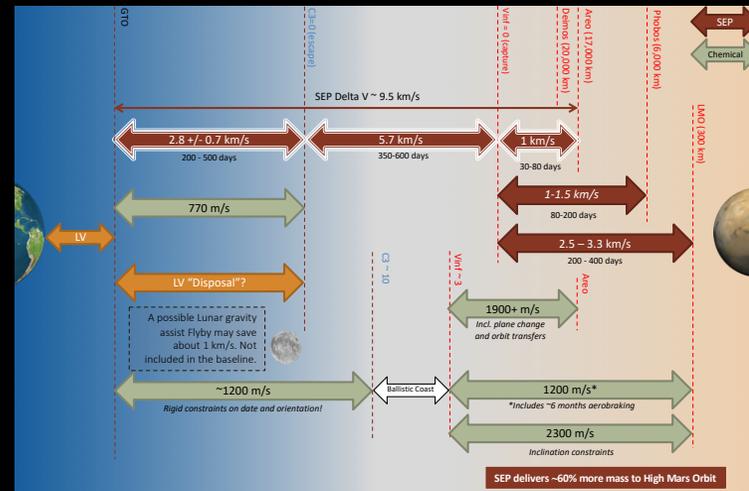
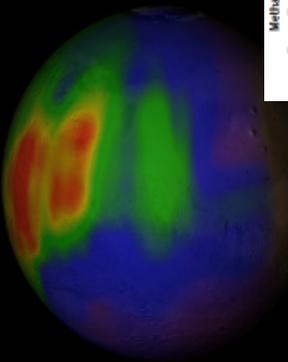
AREO TGL mission concept:  
Areostationary Trace  
Gas Localizer



SHIELD mission concept: Small High Impact Energy Landing Device



Methane release:  
Northern summer





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