

AM V Breakout Group 1

Sortie-Class Missions to Mars

COSPAR 2018

AM V

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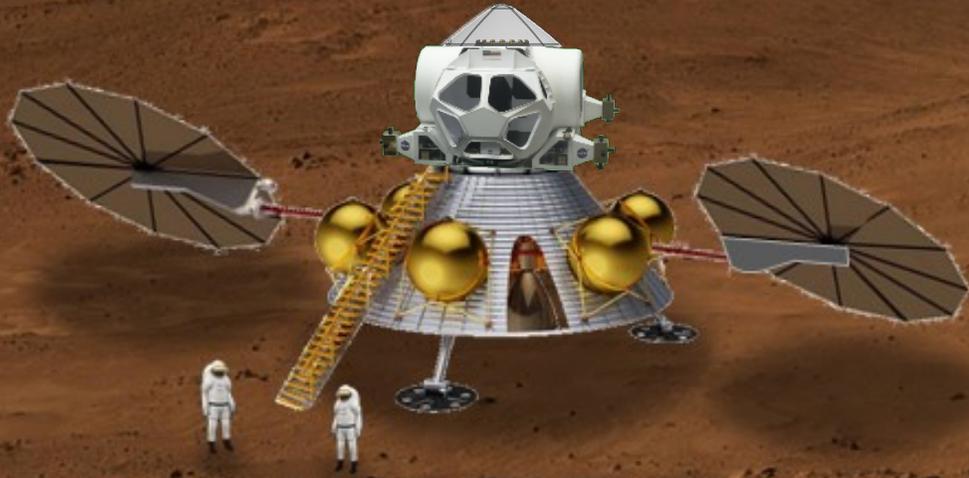
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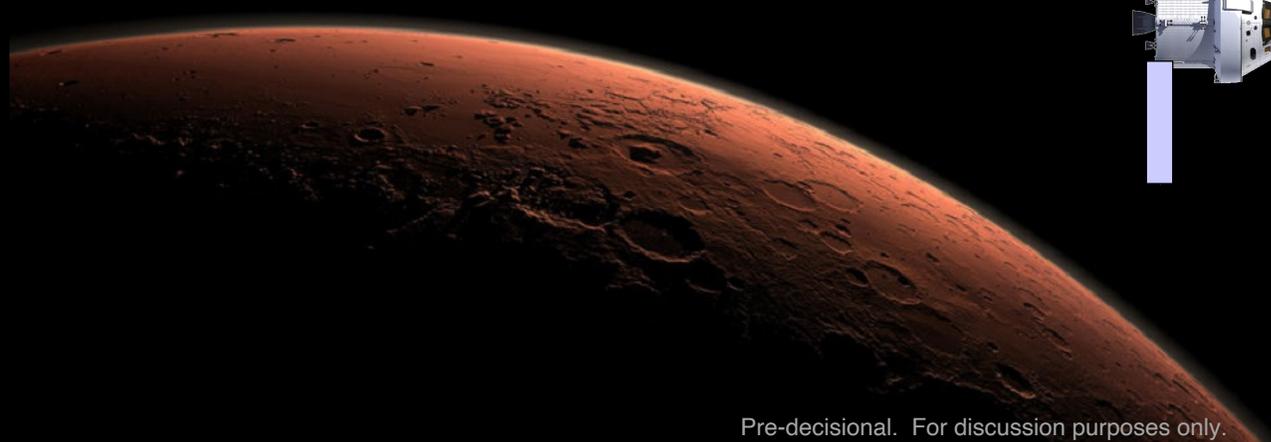
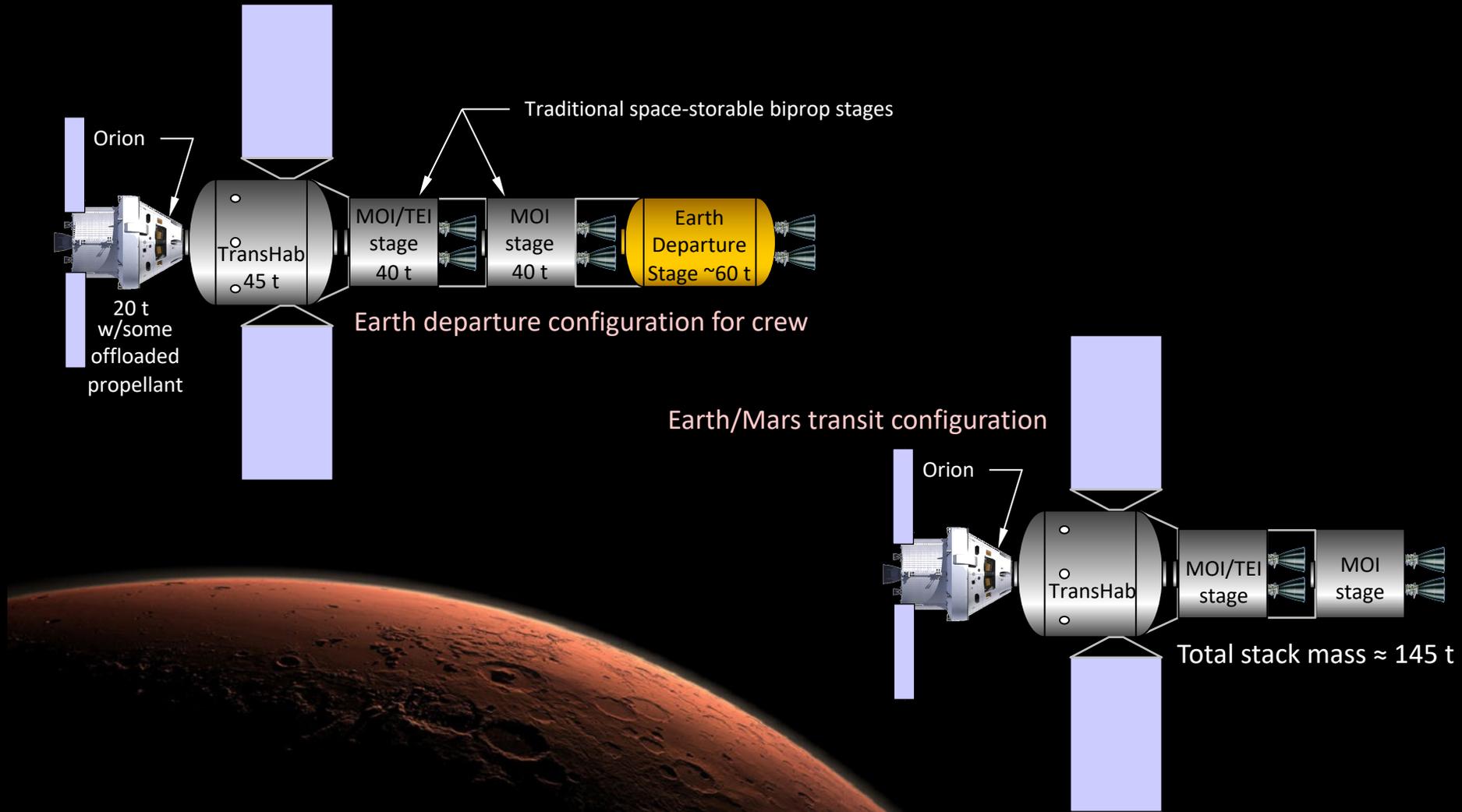
Mars Short Surface Stay Mission

First Crew on Mars



- Goal: A sortie-class mission in the 2030s to kick off crewed exploration of Mars
- Would be the pathfinder for a continuing series of crewed missions to Mars
- Would include a separate sky crane cargo lander with unpressurized rover and science equipment that would provide for crew surface transportation and could also be teleoperated from orbit.
- Would be significantly greater in

Notional Mars Transit Vehicle Configuration for AM V Architecture 1 - All-Up Departure Stack

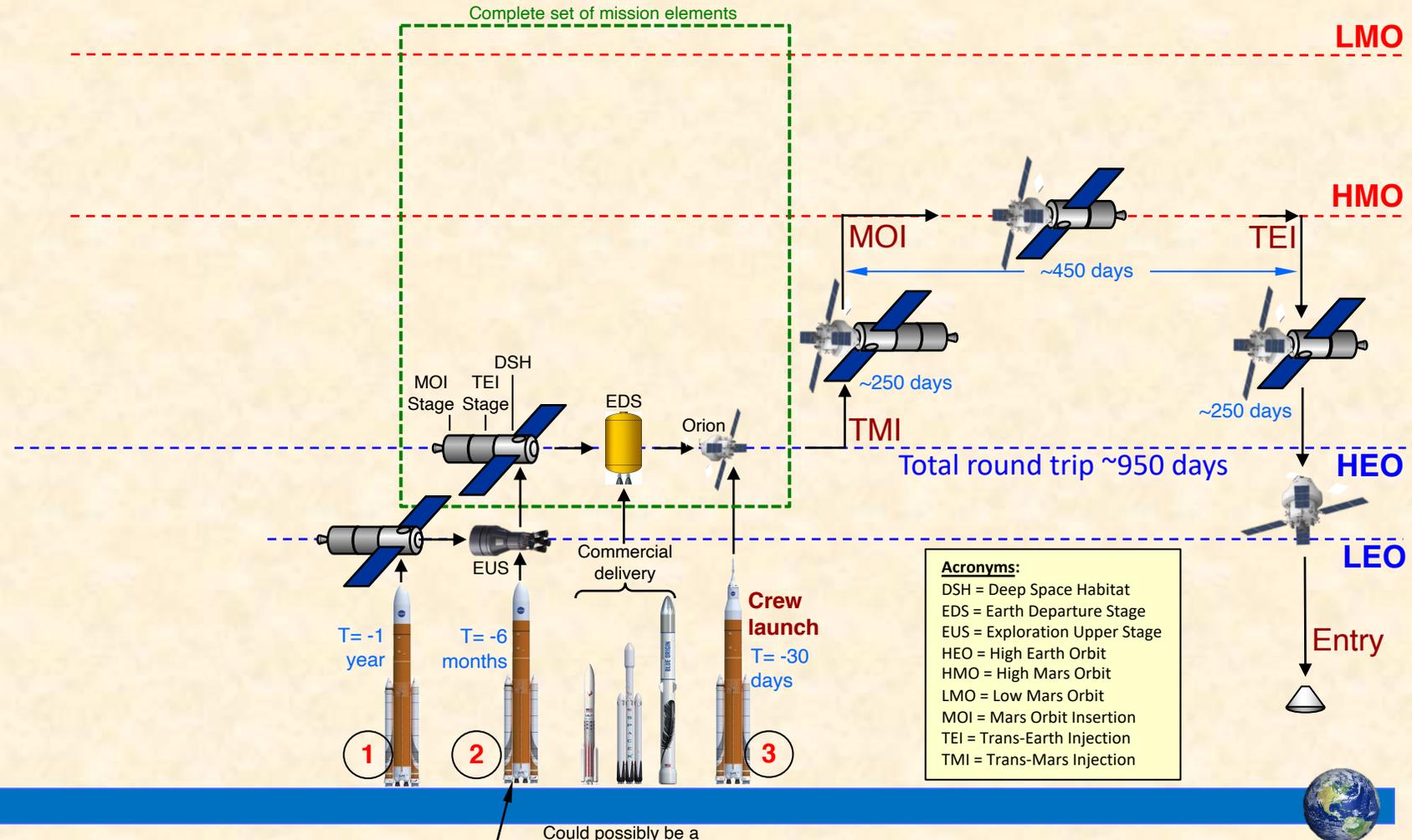


Mars Orbit Mission Concept

crew of 4; 3 SLS launches; ~4 commercial launches

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Mars



Earth

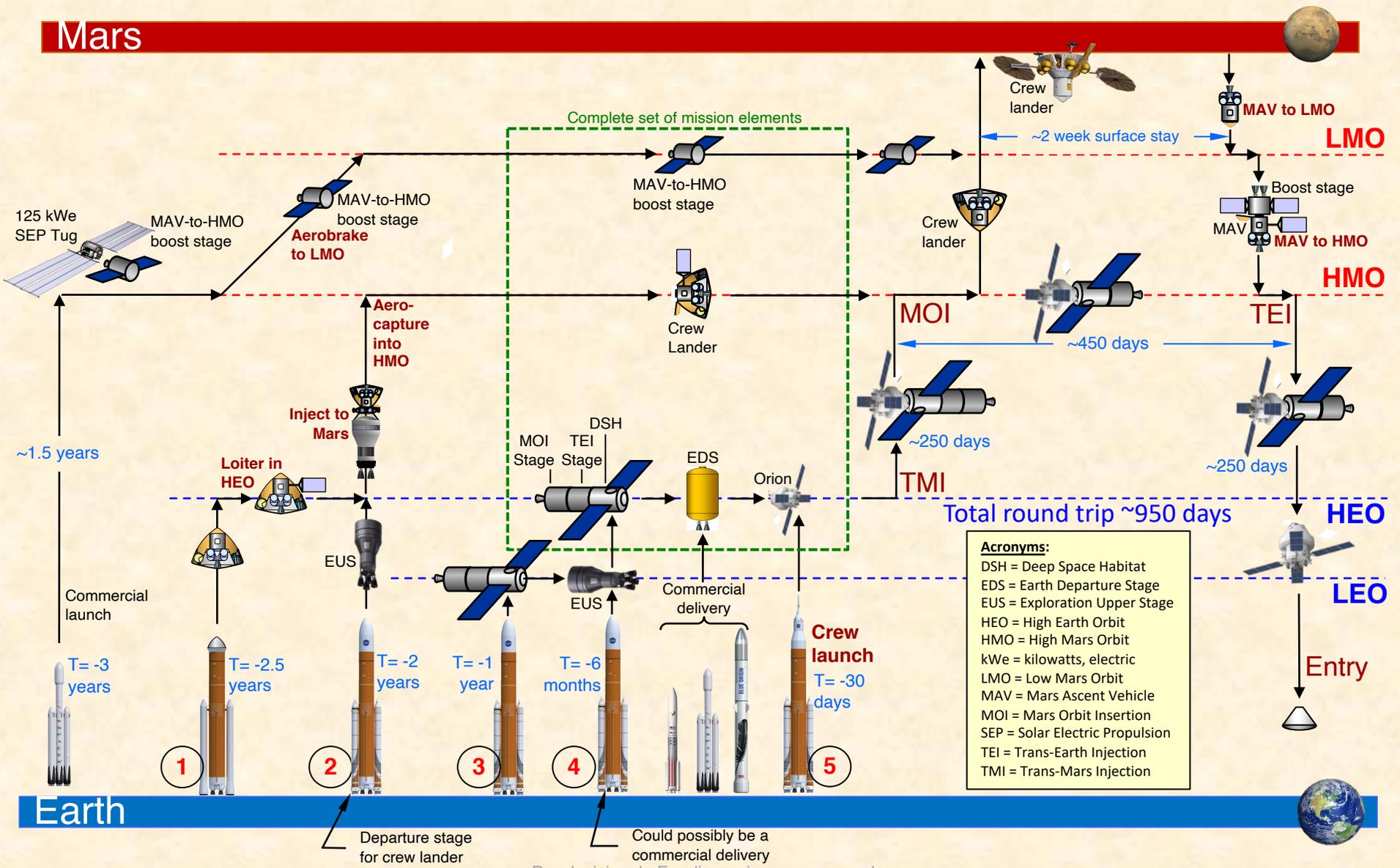
Could possibly be a commercial delivery
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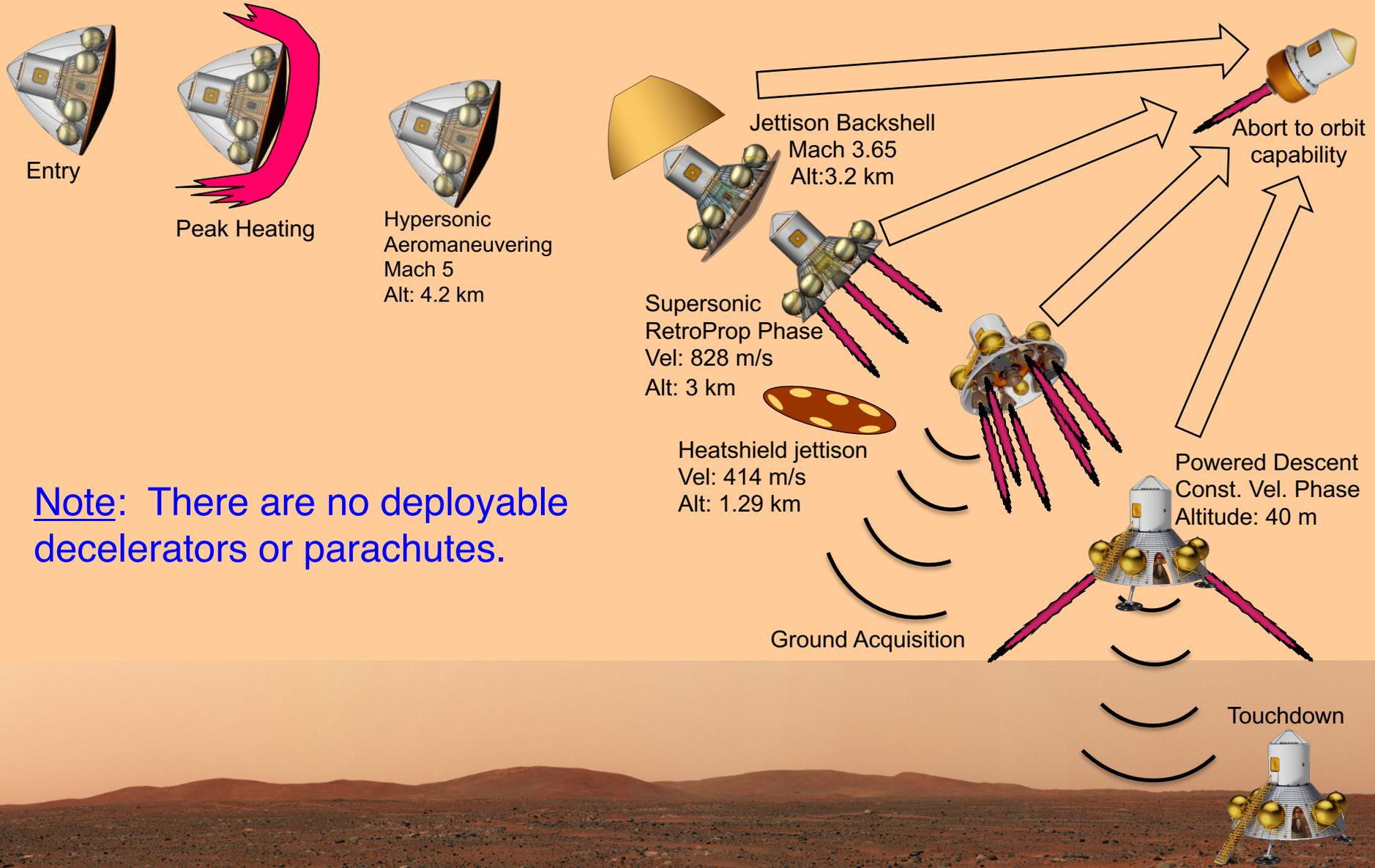
Two-Week Mars Surface Sortie Mission Concept

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crew of 4; 5 SLS launches; ~5 commercial launches



Entry, Descent, and Landing (EDL) Concept for Crewed Mars Lander

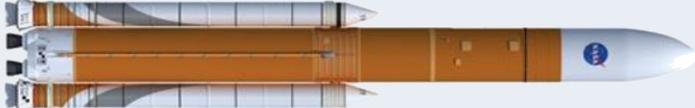
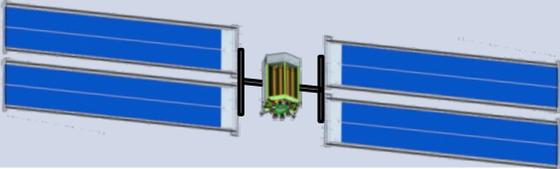
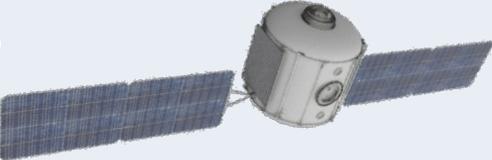
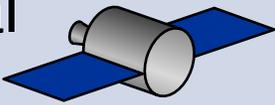
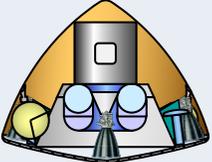


Note: There are no deployable decelerators or parachutes.



Six Vehicles to Enable Crewed Missions to Mars



Vehicles	# Vehicles per Mission	Production Rate	
Orion 	1	1 every 4 years	In development
SLS 	5	1.25 per year	In development
SEP Tug ~125 kWe 	1	1 every 4 years	Studies are on contract
Deep Space Habitat 	1	1 every 4 years	Studies are on contract
In-Space Chemical Propulsion Stage 	4	1 per year	Could be an international contribution
Mars Lander 	1	1 every 4 years	Development would need to start soon

Notional Mars Mission Sequence

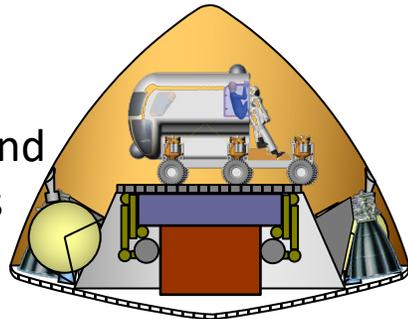
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- Mars orbit-only mission in 2033
- Separate robotic sky crane mission would deliver 1 t unpressurized rover with science equipment
 - Could be controlled from Earth for site characterization
 - Could be teleoperated from Mars orbit
 - Would serve as unpressurized rover for the landing crew
- 1ST two-week landing sortie in 2037
- 2ND two-week landing sortie in 2041
- 3RD and following missions could include cargo landers, habitats, and/or pressurized rovers and other equipment
- Flight rate could potentially be increased to a new crew every Mars opportunity
- Program could expand to add more cargo landers, have longer stays, on-ramp new technologies, and build up a base

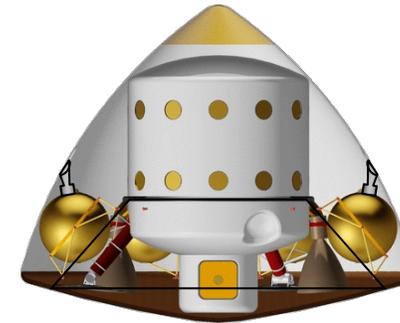
Long-Stay Surface Missions

- Would build on the short-stay architecture by adding a surface habitat, pressurized rover and science equipment
 - Cargo landers would carry the surface habitat, rover, etc.
 - Could build up infrastructure and on-ramp food production, ISRU, etc.

Cargo and logistics

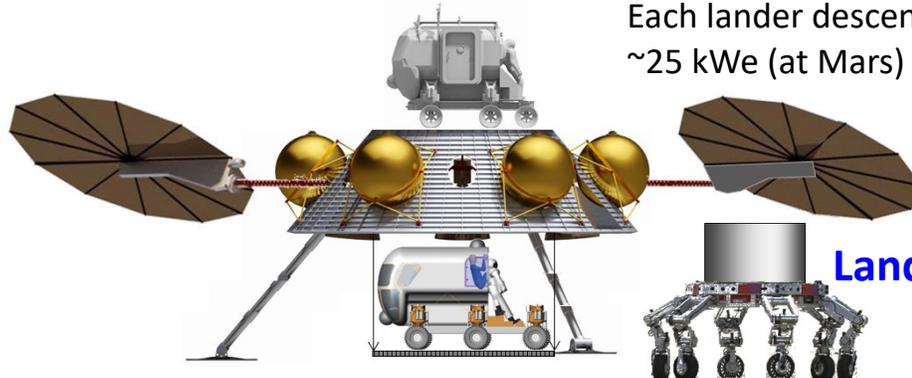


Entry Configurations

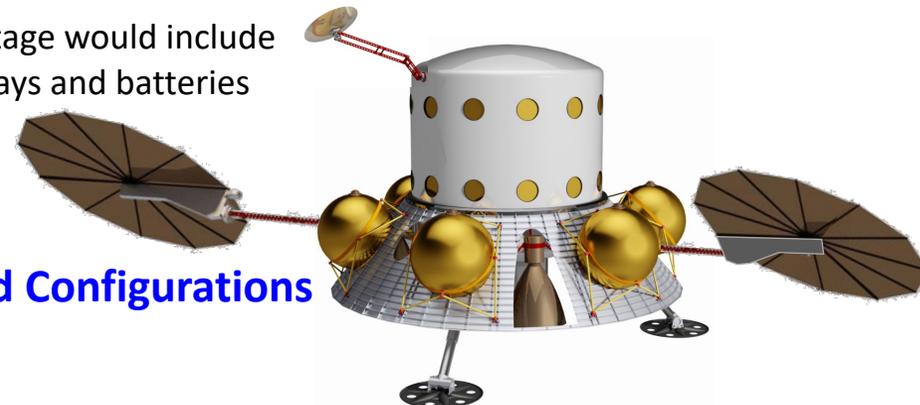


Surface habitat

Each lander descent stage would include ~25 kWe (at Mars) arrays and batteries

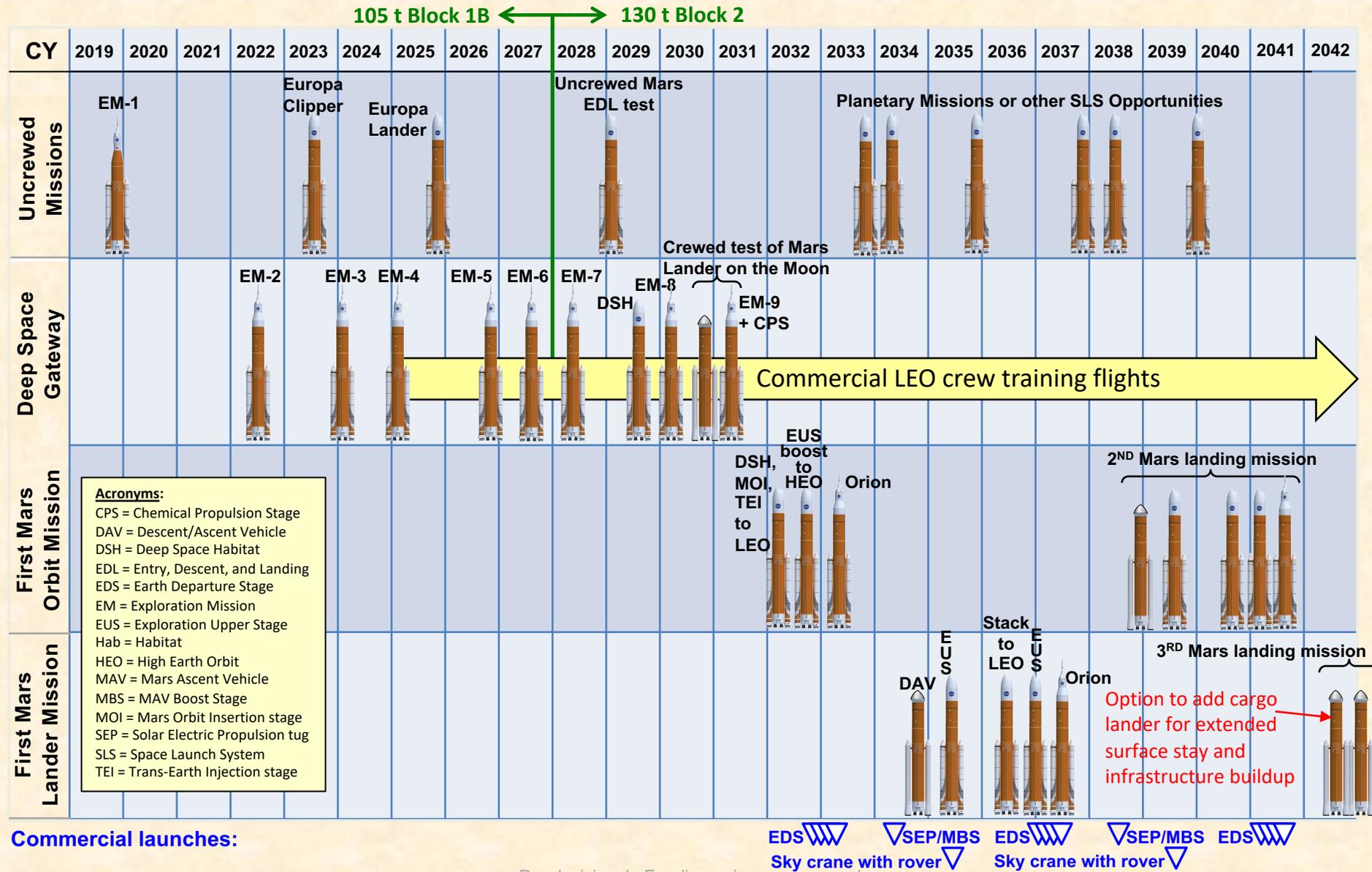


Landed Configurations



Notional SLS Flight Scenario

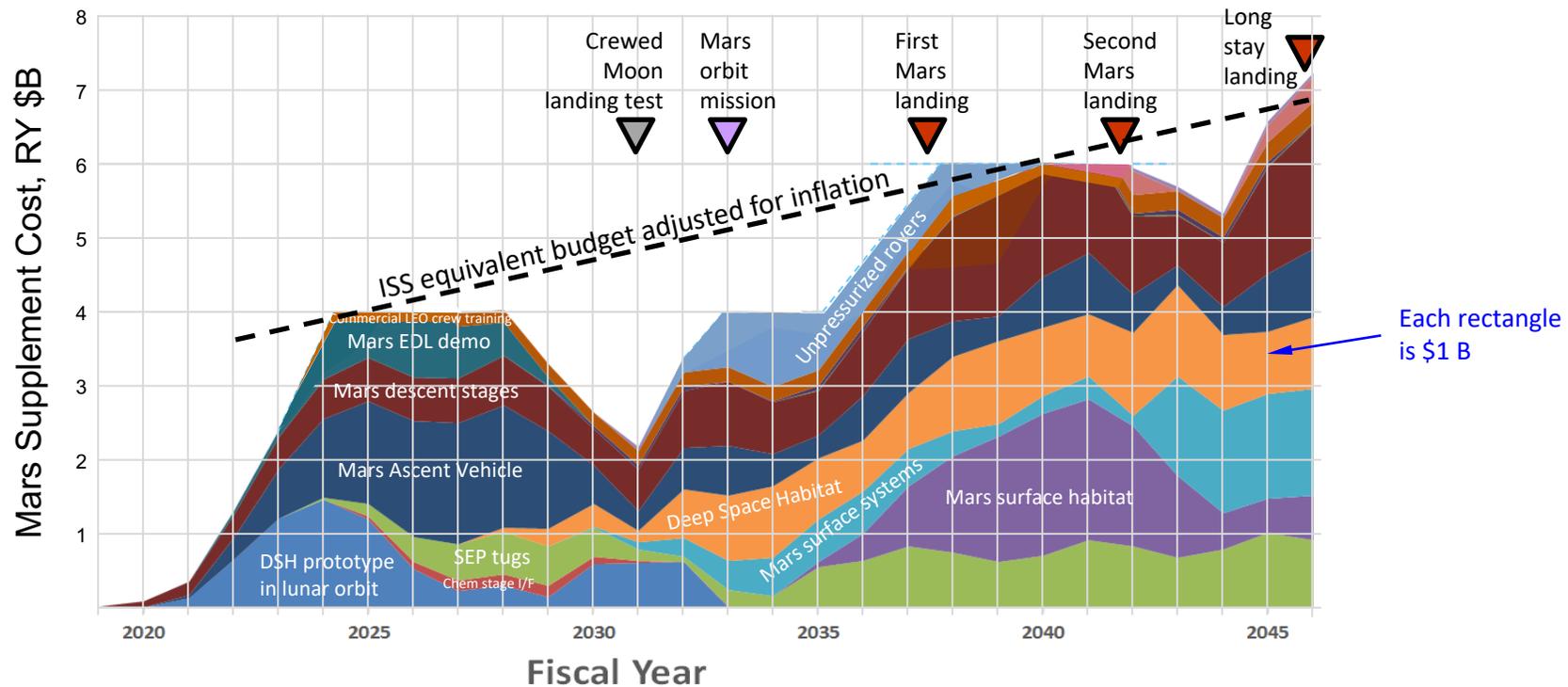
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AM V Group 1 Program Cost Estimate

Mars budget supplement only, in real year dollars (includes 2.6% inflation)
 Assumes SLS, Orion, and Gateway funded as separate budget items
 Assumes international partners provide in-space chemical propulsion stages

- Cost methodology developed by the Aerospace Corporation
- Same methodology as 2014 NRC “Pathways” and 2017 OIG report
- Results suggest a similar annual cost and total cost as ISS, over ~25 years, adjusted for inflation



The cost information contained in this document is of a budgetary and planning nature and is intended for informational purposes only. It does not constitute a commitment on the part of JPL and/or Caltech. Pre-decisional. For discussion purposes only.