



Restricted Earth Return for Astromaterials: Controlled Entry, Landing, and Containment Notional Architecture

**Astromaterials Acquisition and Curation Office
NASA Johnson Space Center
Houston, Texas USA**

**Michael J. Calaway, Jacobs (Presenter)
Andrea D. Harrington, NASA
Francis M. McCubbin, NASA**

December 2019

Astromaterials Acquisition & Curation Office

Our Past 52 years

Lunar

(est. 1969)

Apollo program lunar rocks and soils and a subset of Soviet Union Luna program lunar material (est. 1971)



Meteorites

(est. 1977)

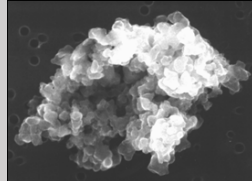
Antarctic Search for Meteorites (ANSMET) program



Cosmic Dust

(est. 1981)

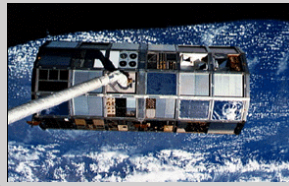
Cosmic dust grains collected in the Earth's stratosphere from high altitude aircraft



Microparticle Impact

(est. 1985)

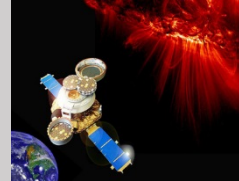
Space exposed hardware from science missions



Genesis

(est. 2004)

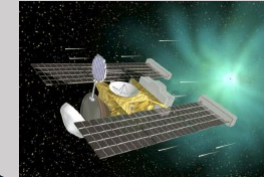
Genesis mission collected solar wind samples at Earth-Sun L1 point



Stardust

(est. 2006)

Stardust mission collected cometary and interstellar samples at Comet Wild 2



Hayabusa

(est. 2012)

Subset of samples collected from JAXA asteroid mission to Itokawa



Our Future

Hayabusa II

(Dec. 2020)

Subset of samples collected from JAXA asteroid mission to (162173) Ryugu



OSIRIS-REx

(Sept. 2023)

Asteroid sample return from (101955) Benu



Artemis

(~ 2024 +)

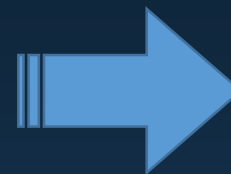
Human Spaceflight To the Moon



MSR

(~ 2029 +)

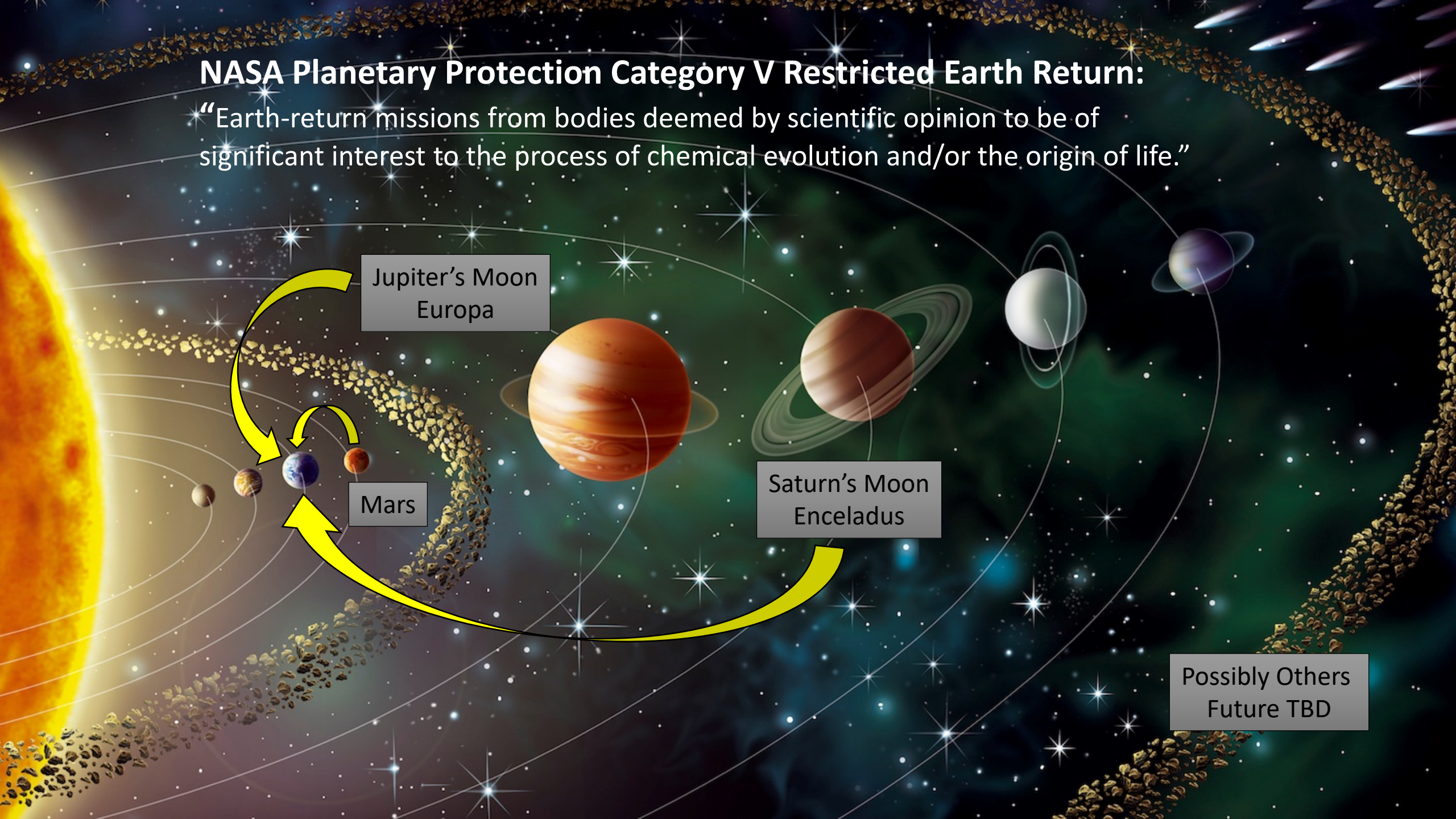
Mars Sample Return
Mars 2020 Launch



**Future
Solar System
Missions
(HEOMD & SMD)
Planets, Moons,
Asteroids, Comets,
Place Holder**

NASA Planetary Protection Category V Restricted Earth Return:

“Earth-return missions from bodies deemed by scientific opinion to be of significant interest to the process of chemical evolution and/or the origin of life.”



Jupiter's Moon
Europa

Mars

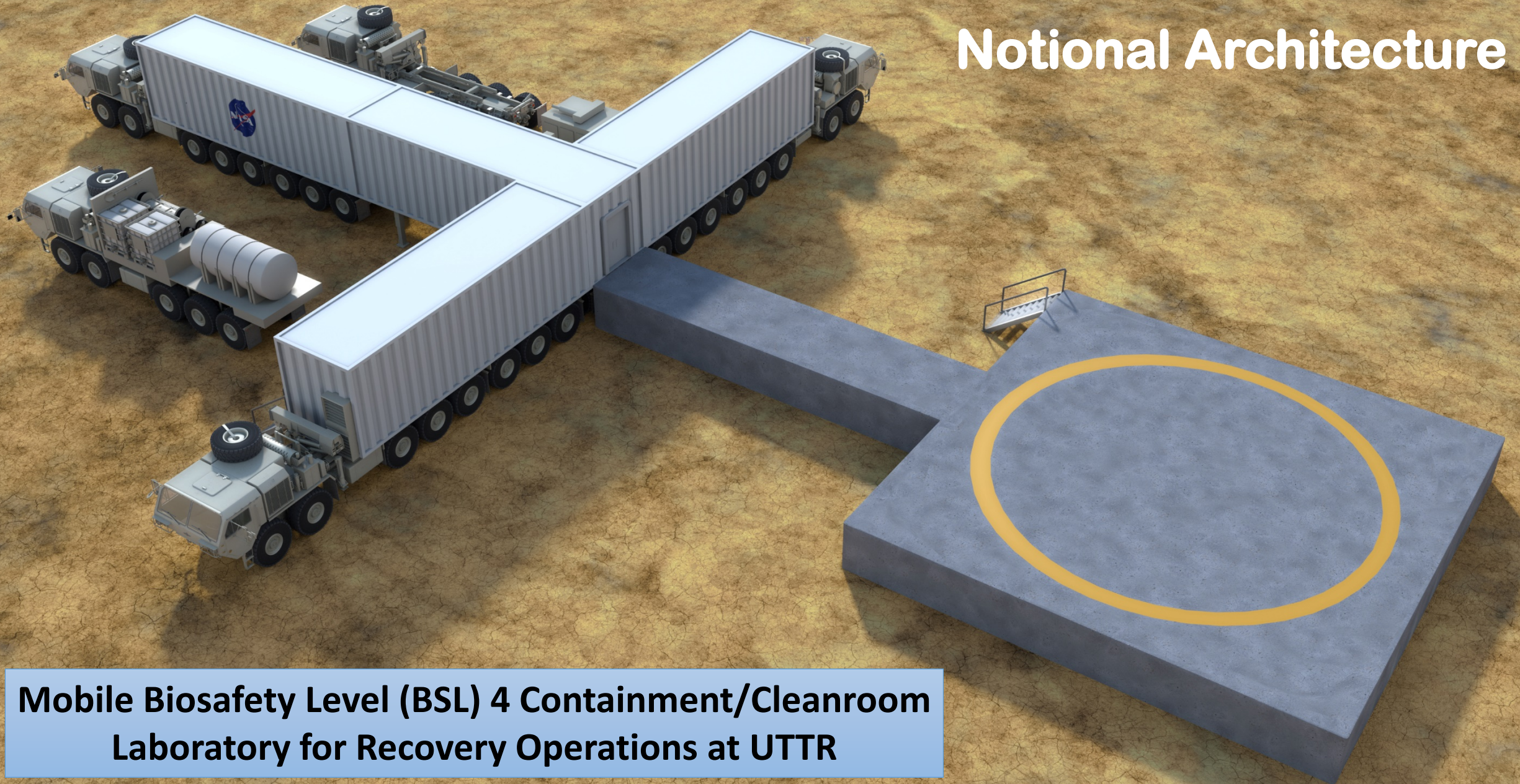
Saturn's Moon
Enceladus

Possibly Others
Future TBD

Utah Test and Training Range Landing Site . . .



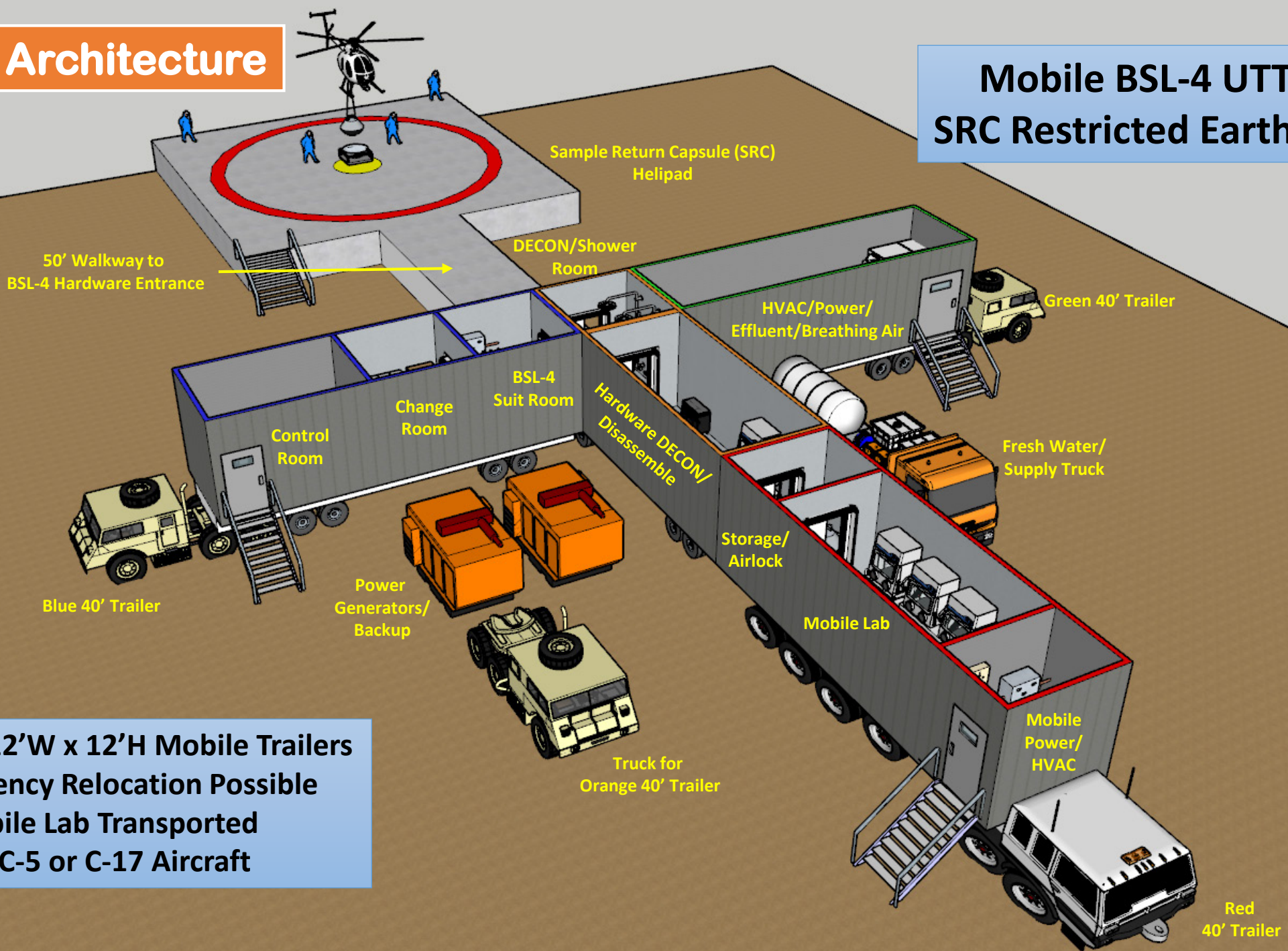
Notional Architecture



**Mobile Biosafety Level (BSL) 4 Containment/Cleanroom
Laboratory for Recovery Operations at UTTR**

Notional Architecture

Mobile BSL-4 UTTR OPS SRC Restricted Earth Reentry



4 – 40'L x 12'W x 12'H Mobile Trailers
Contingency Relocation Possible
Mobile Lab Transported
on C-5 or C-17 Aircraft

Insert 5 min. Movie

QUESTIONS

