

Forward to the Moon with Commercial Partners

December 8, 2020
Webinar

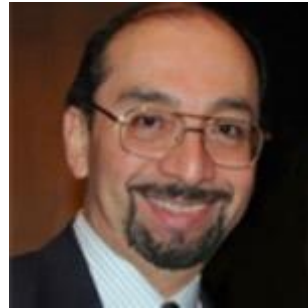
CME Webinar Co-Hosts



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Steve Barnett
Livingston, NJ

Co-Chair



INTRODUCTION

George Rodriguez
Morristown, NJ

Program Producer



INTRODUCTION

Ksenia Takhistova
East Brunswick, NJ

Co-Chair



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Next: 1/7 McKinsey: AI-powered digital transformation



MODERATOR

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McKinsey

Senior Knowledge Expert
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Marcelo De Santis
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Technology Leader
Ex-CIO Kraft Foods,
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Yoav Zingher
Launchpad.build

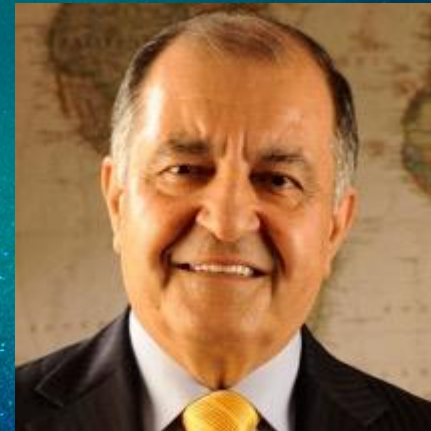
Chief Executive Officer
Founder of KiWi Power
UK Smart Grid

CME
STEM Leadership
AWARDS

CME SIGNATURE EVENTS

9th CME STEM
Leadership Awards™

December 7, 2021 – NY Metropolitan Club



Seifi Ghasemi

Air Products,
Allentown, PA

Chairman, President and CEO

Outstanding Global Growth



CME: Accelerating STEM Leadership

For Sustainable Innovation



NEXT IN THE CALENDAR

NASA: Forward to the Moon with Commercial Partners

December 8, 2020
Webinar



James Green
NASA
Chief Scientist



Doug Terrier
NASA
Chief Technologist



Cicely Shillingford
Ro, NYU graduate
Formulation Scientist

Recognizing the Merit of an Outstanding
CME STEM Young Leader



Agenda

01. CME STEM Young Leader Award

02. NASA Presentations

03. Open Q&A session



CME PRESENTS

CME STEM Young Leader Award

December 8, 2020



Outstanding Volunteer
and Leader

Cicely
Shillingford

Ro
New York

Formulation Scientist





STEM Young Leader AWARD

Cicely Shillingford, PhD

Chemical Marketing & Economics presents this award of merit in recognition of outstanding volunteer service and leadership in Science, Technology, Engineering & Mathematics fields harnessing the transforming power of chemistry.

December 8, 2020

A handwritten signature in white ink that reads "Steve Barnett".

Steve Barnett, Co-Chair

A handwritten signature in white ink that reads "Ksenia Takhistova".

Ksenia Takhistova, Co-Chair

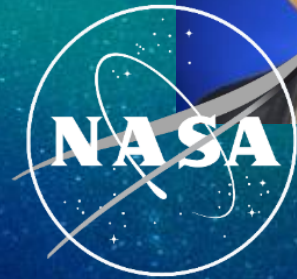
12/8 NASA Forward to the Moon



Doug Terrier

NASA

Chief Technologist



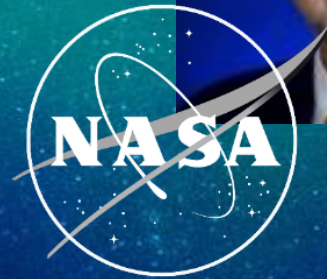
12/8 NASA Forward to the Moon



James Green

NASA

Chief Scientist





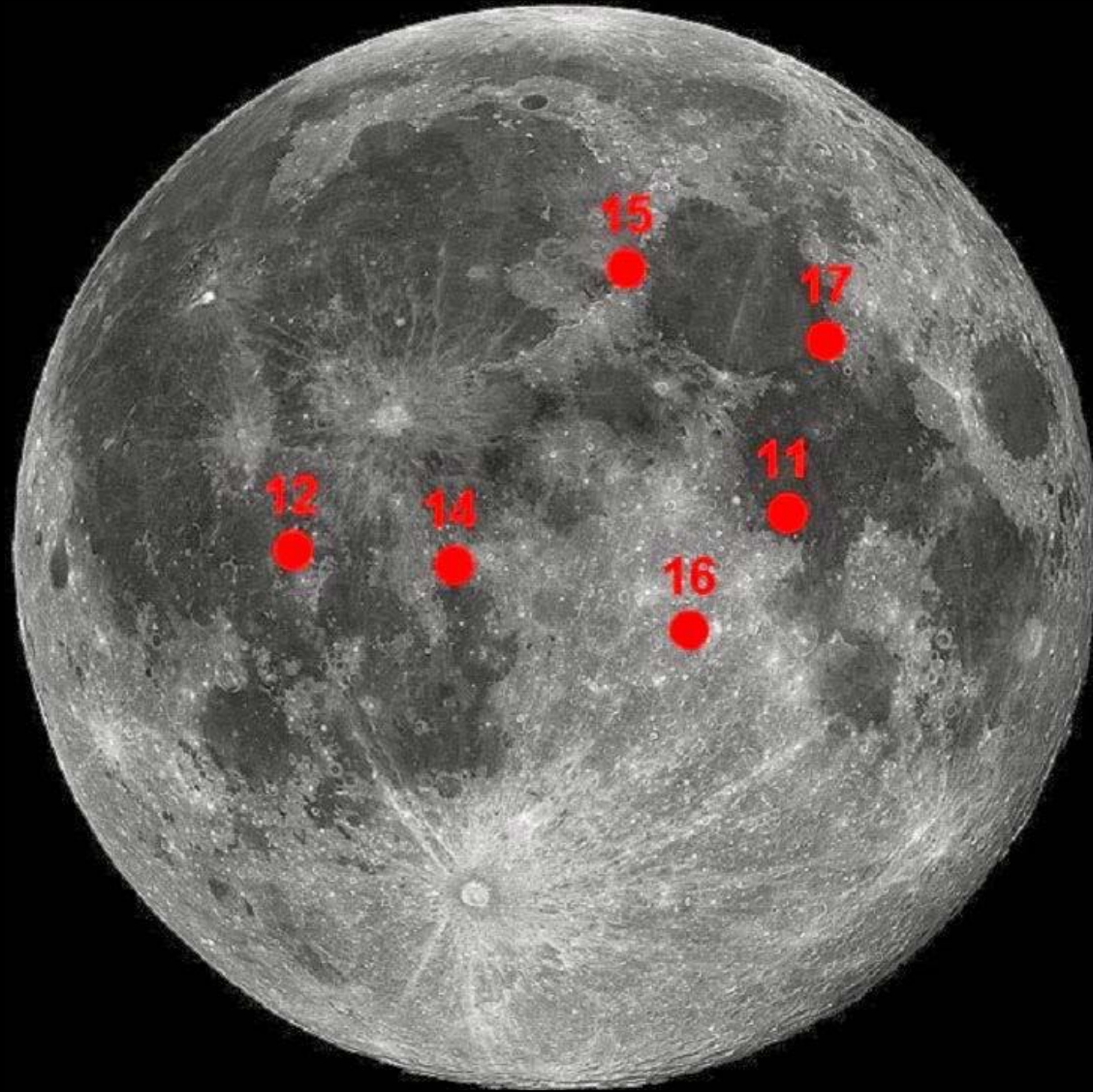
Forward to the Moon With Commercial Partners

James L. Green
NASA Chief Scientist

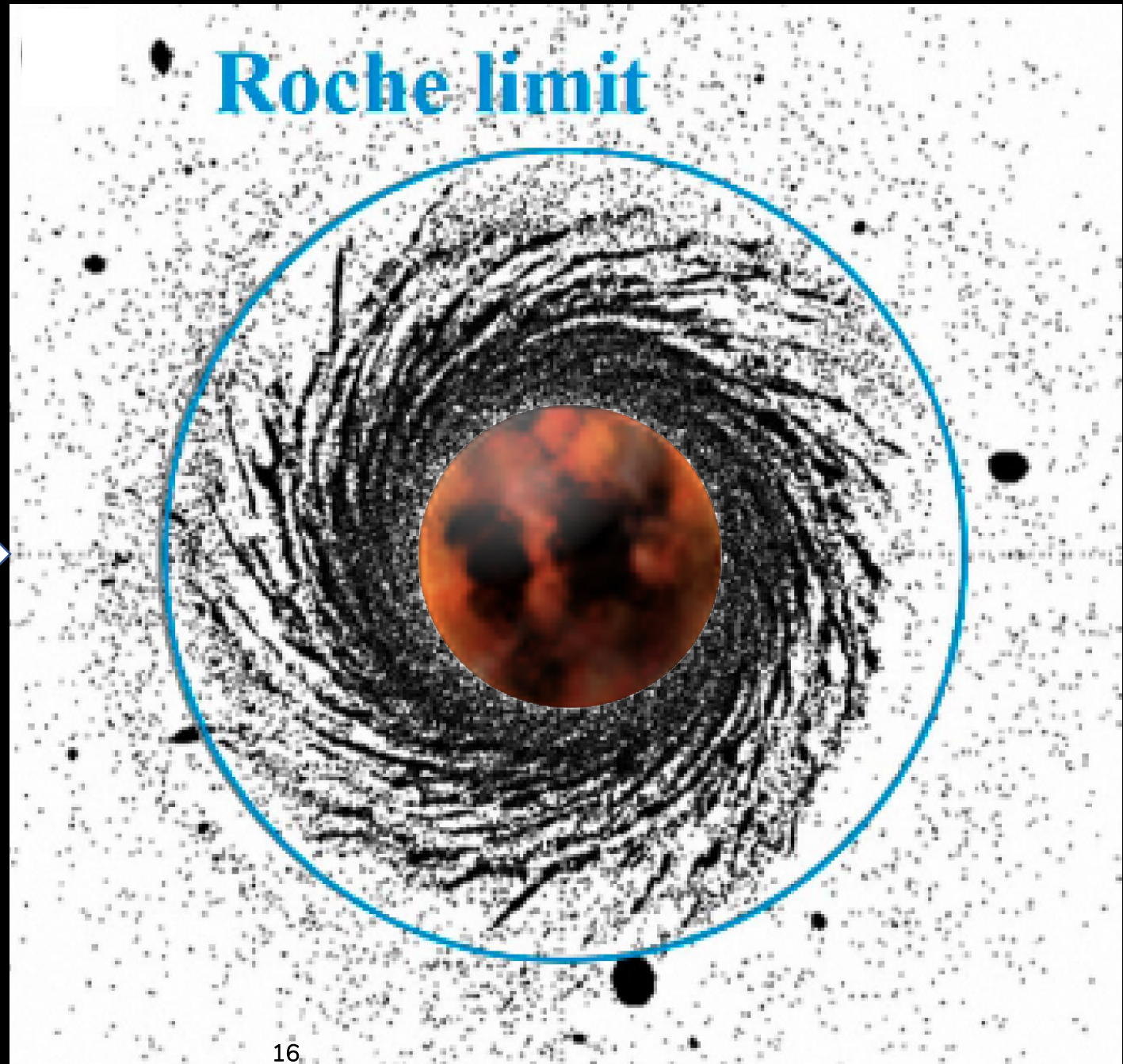
Douglas Terrier
NASA Chief Technologist

December 8, 2020

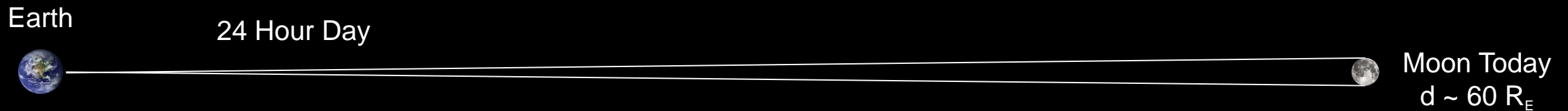
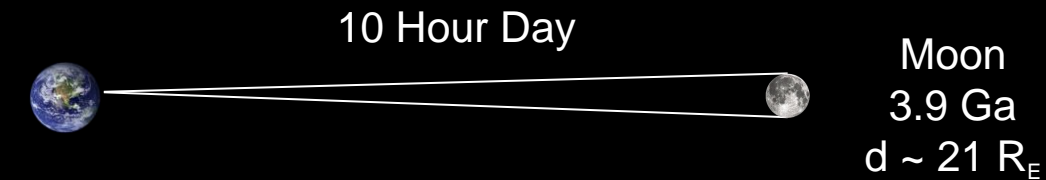
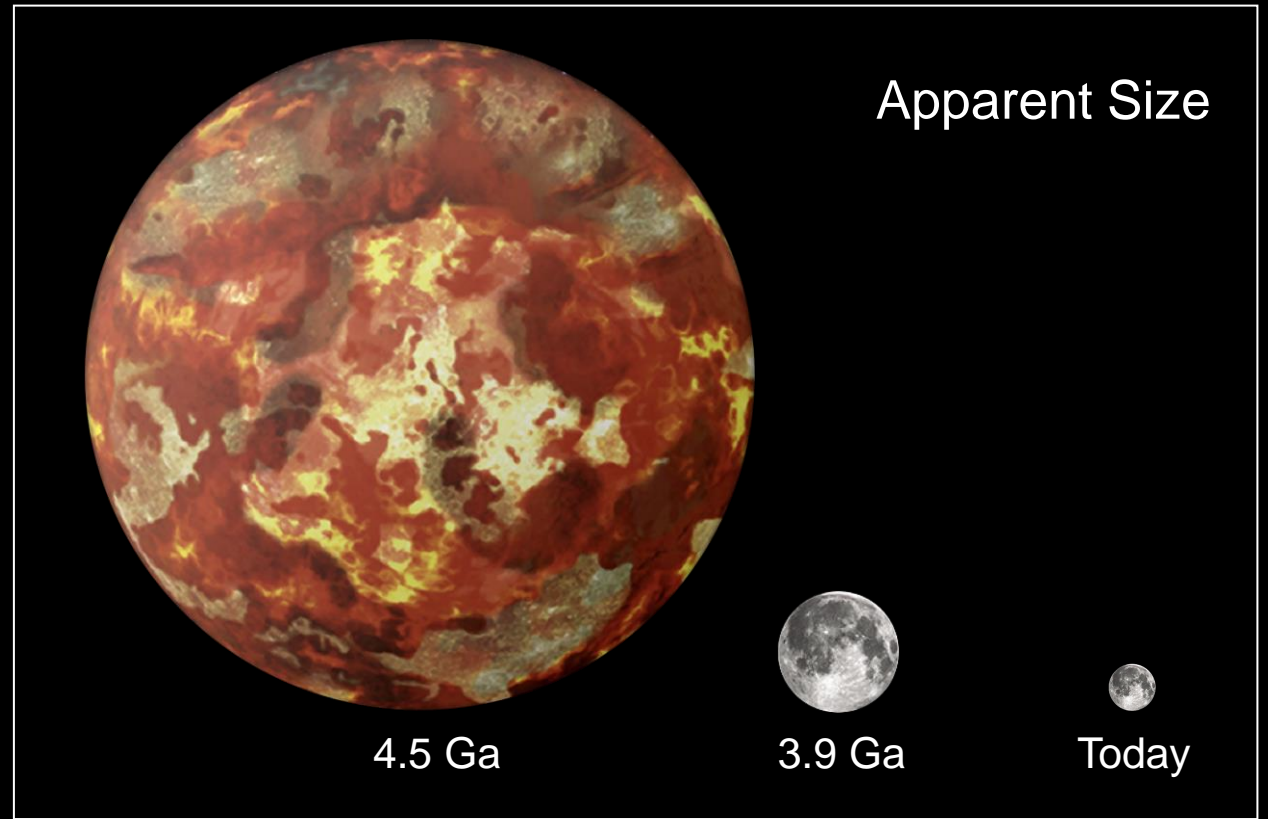
Apollo Lunar Exploration Program

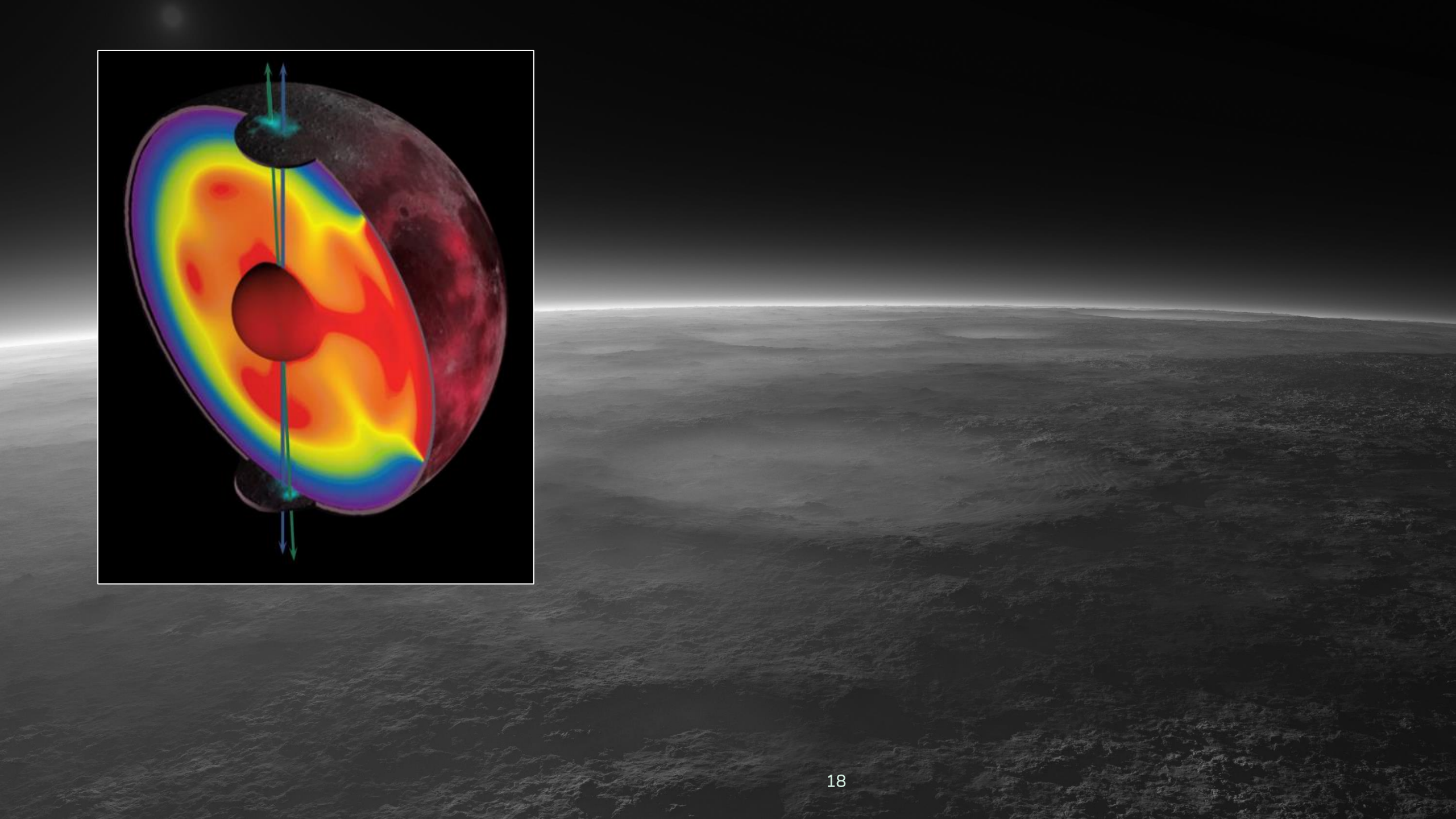
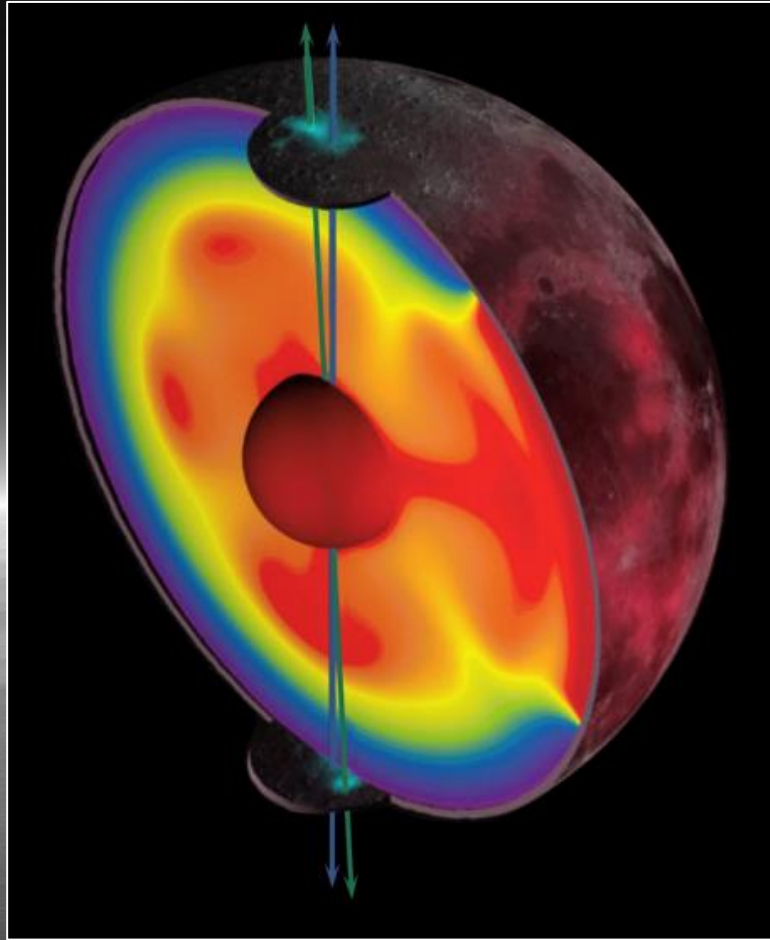


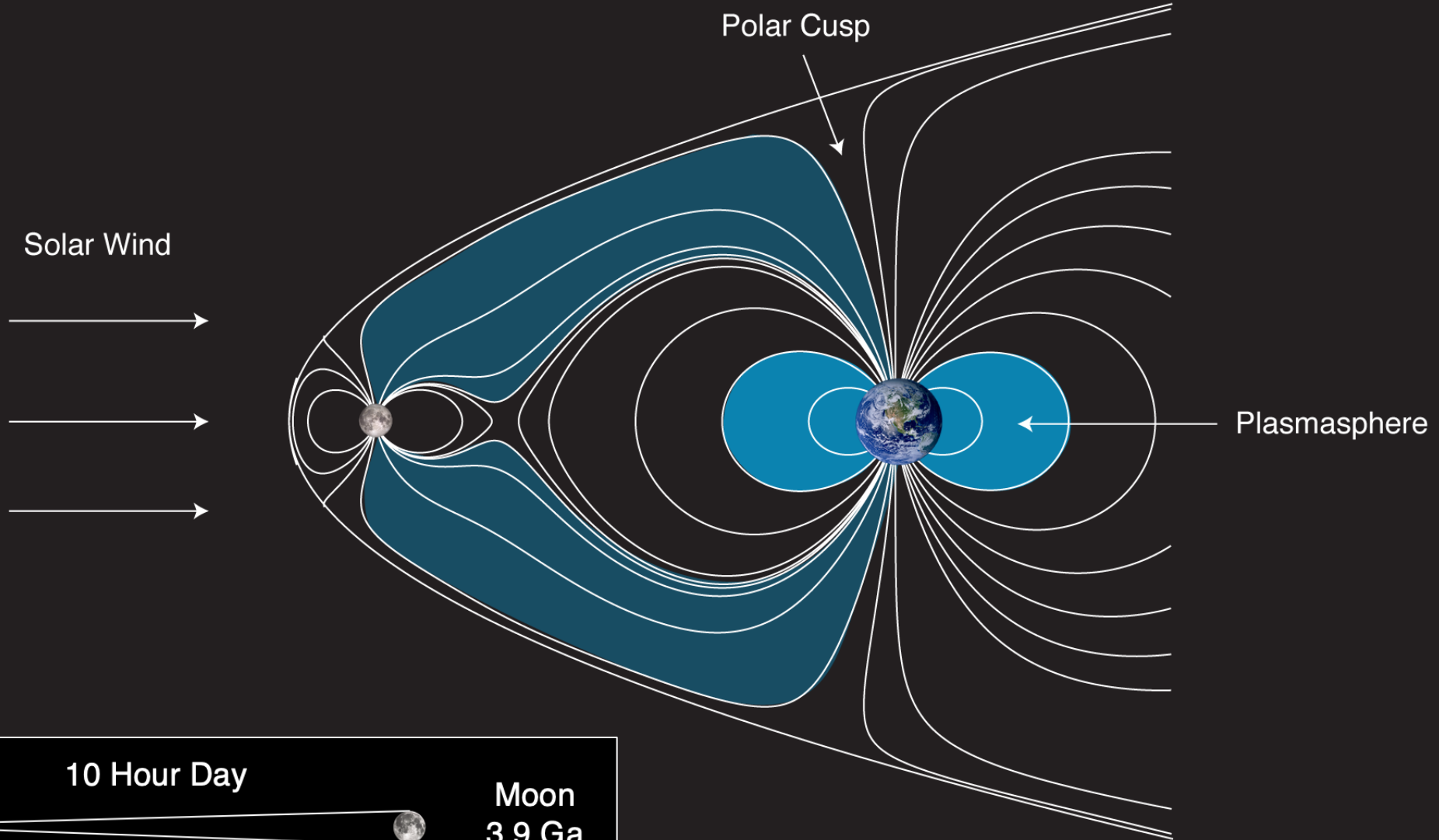
Giant impact hypothesis for origin of Moon



The Moon Stabilizes Our Spin Axis





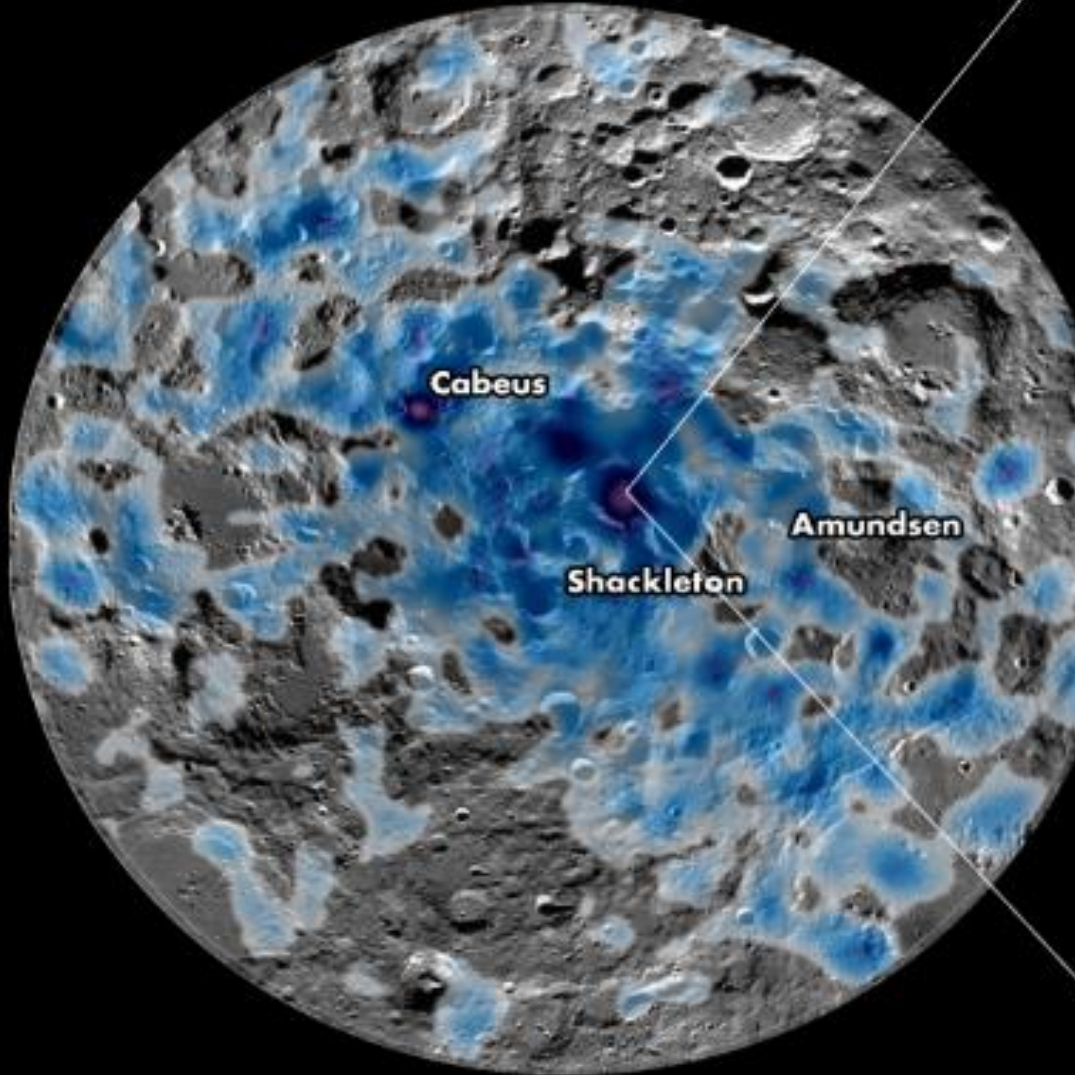


10 Hour Day

Moon
3.9 Ga
 $d \sim 21 R_E$



South Pole



Lunar Water Cycle
from
Micrometeorites

Earth
Atmospheric
Volatiles
N+ O+ O++

Lunar
Atmospheric
Volatiles
H₂O CO₂ CO SO₂
H₂S

Comet and
Asteroid
Volatiles

3.6 By - Present

4.0-3.6 By

4.2-3.9 By

4.5-4.2 By

Increasing Age with Depth





BLUE ORIGIN



SPACEX

*Commercial Lunar
Payload Services
(CLPS)*



ORBITBeyond
Delivering to the Moon

Working with industry to deliver science and
technology payloads to the lunar surface

DRAPER



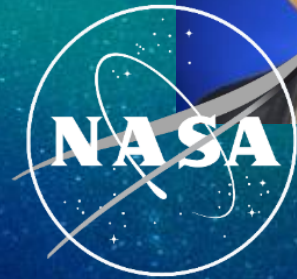
12/8 NASA Forward to the Moon



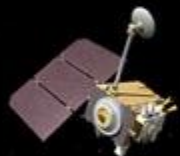
Doug Terrier

NASA

Chief Technologist



ARTEMIS



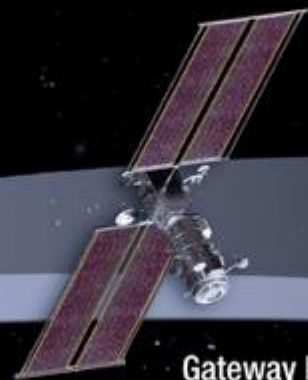
Lunar Reconnaissance Orbiter: Continued surface and landing site investigation



Artemis I: First human spacecraft to the Moon in the 21st century



Artemis II: First humans to orbit the Moon and rendezvous in deep space in the 21st Century



Gateway begins science operations in lunar orbit with launch of Power and Propulsion Element and Habitation and Logistics Outpost



Initial human landing system delivered to lunar orbit



Artemis III: Orion and crew dock to human landing system for crew expedition to the surface

Early South Pole Robotic Landings

Science and technology payloads delivered by Commercial Lunar Payload Services providers

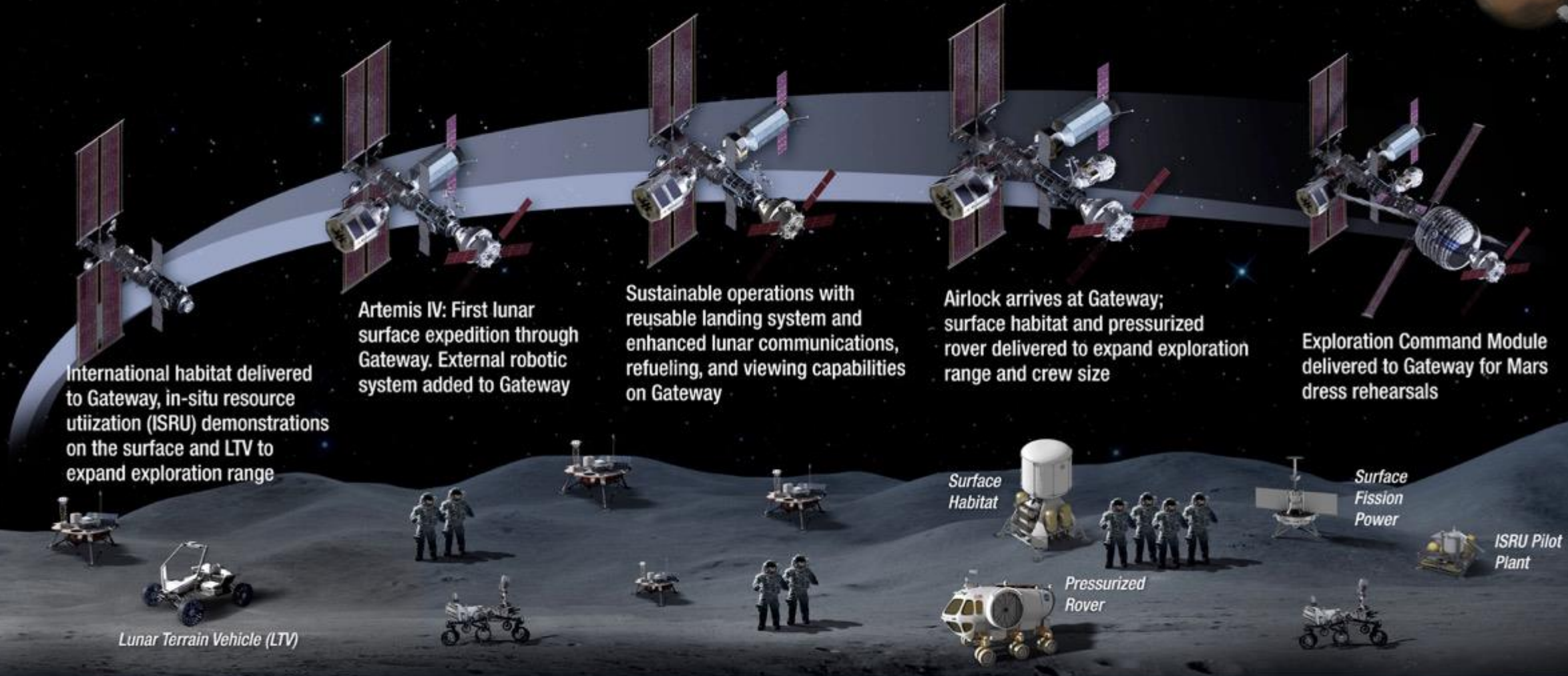
Volatiles Investigating Polar Exploration Rover

First mobility-enhanced lunar volatiles survey

Humans on the Moon - 21st Century

First crew leverages infrastructure left behind by previous missions

ARTEMIS : Living, Learning and Working on the Moon

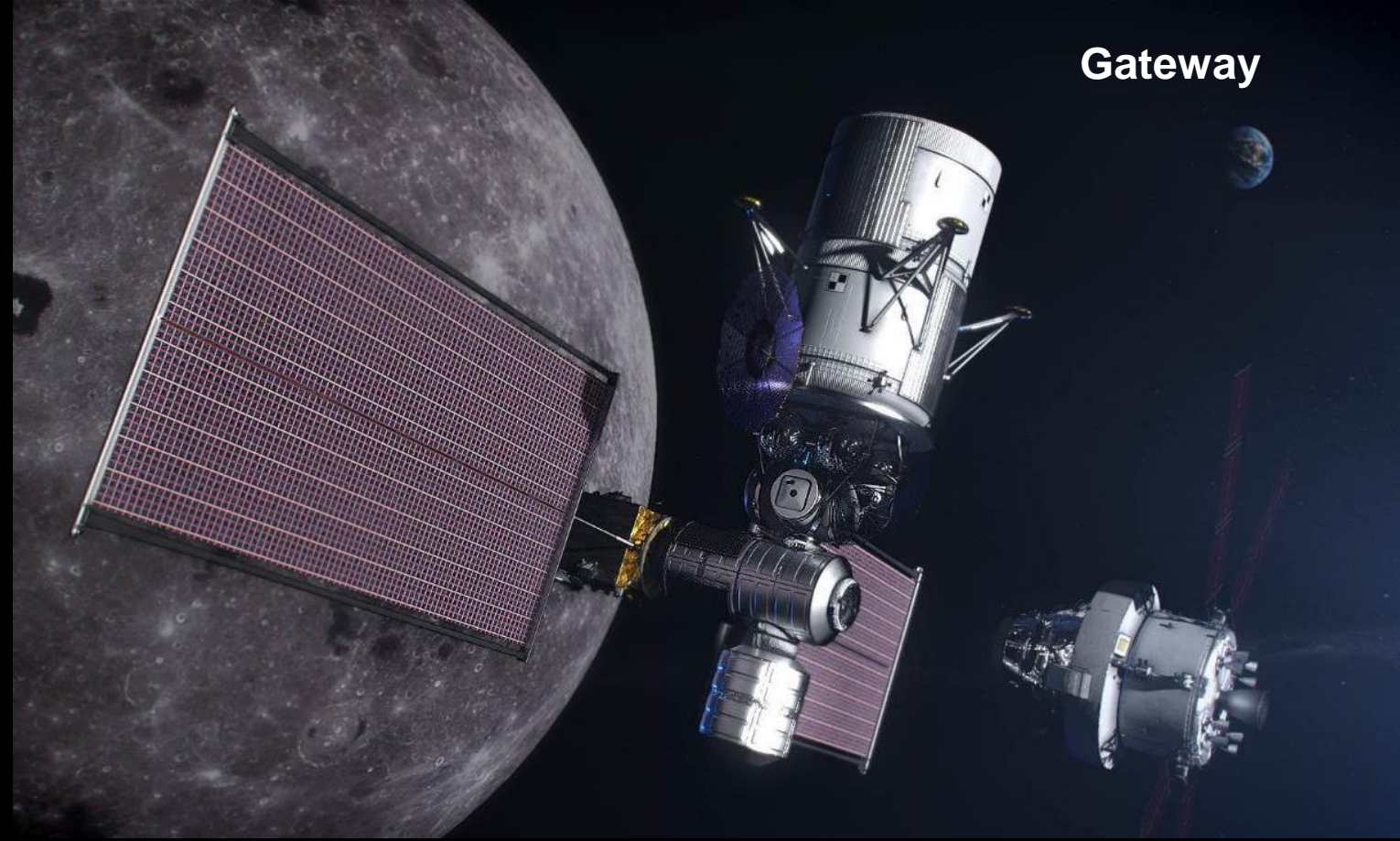


SUSTAINABLE LUNAR ORBIT STAGING CAPABILITY AND SURFACE EXPLORATION

MULTIPLE SCIENCE AND CARGO PAYLOADS | U.S. GOVERNMENT, INDUSTRY, AND INTERNATIONAL PARTNERSHIP OPPORTUNITIES | TECHNOLOGY AND OPERATIONS DEMONSTRATIONS FOR MARS



Space Launch System and Orion



Gateway



The Human Landing System

The Artemis Architecture

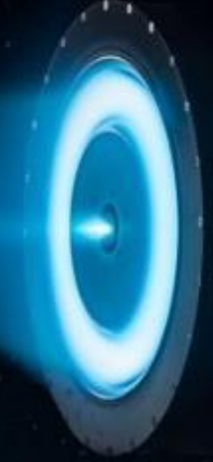


High
Performance
Spaceflight
Computing



Precision
Landing

Solar
Electric
Propulsion



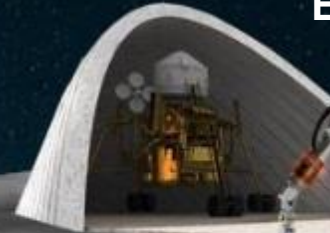
Space Technology for 2024 and Beyond



Cryofluid
Management



Lunar Dust
Mitigation



Surface
Excavation/Construction

In Situ
Resource
Utilization



Extreme Environments

Extreme Access



Lunar Surface
Power





Open Q&A

Use the Chat feature



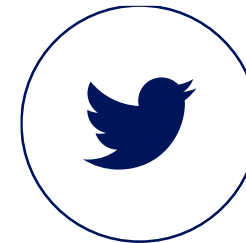
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1387 group members - interactive



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MODERATOR
Sam Samdani
McKinsey

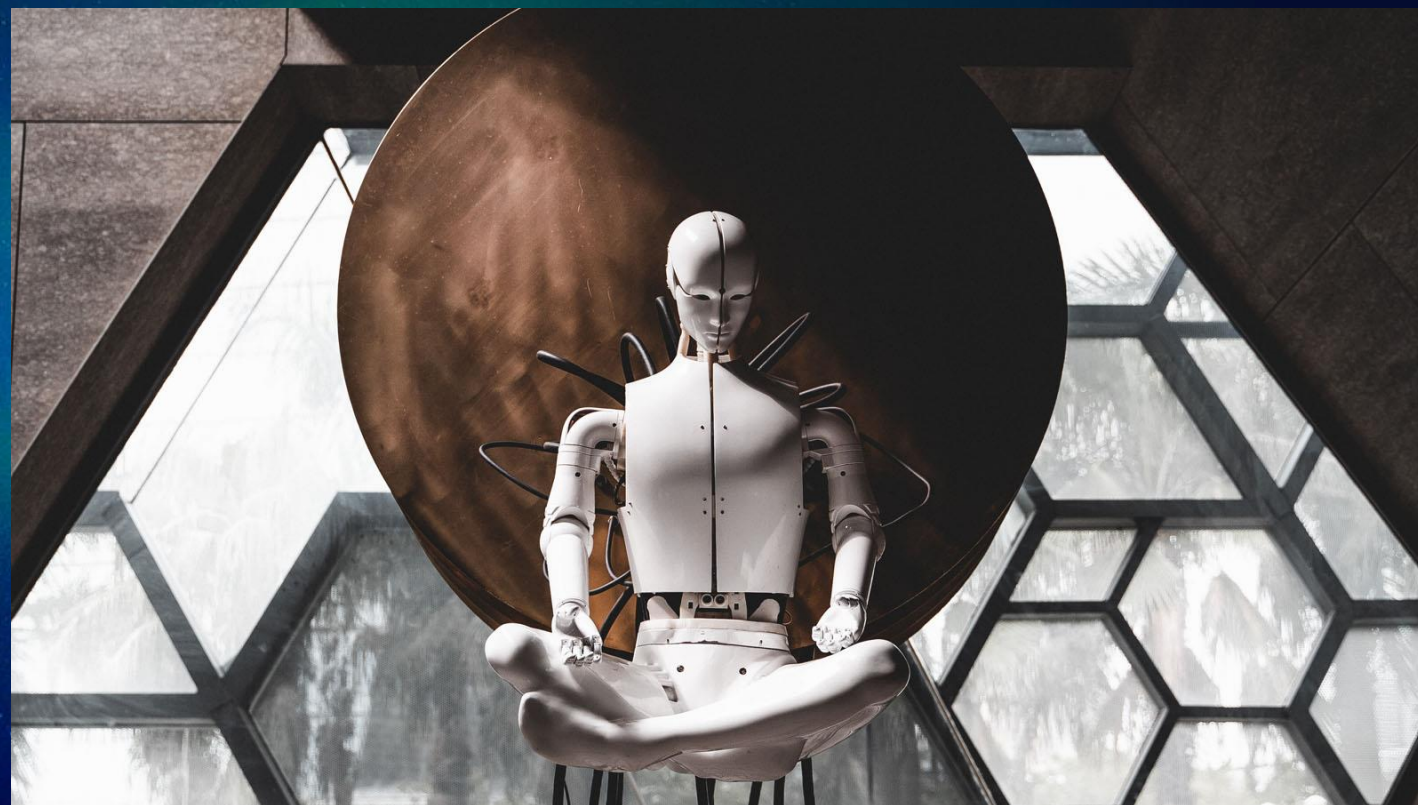


Marcelo De Santis
ThoughtWorks



Yoav Zingher
Launchpad.build

Next: 1/7 McKinsey: AI-powered digital transformation





Thank you

Chemical Marketing & Economics, Inc.

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