

THE ELUSIVE “WHY” OF SPACE EXPLORATION

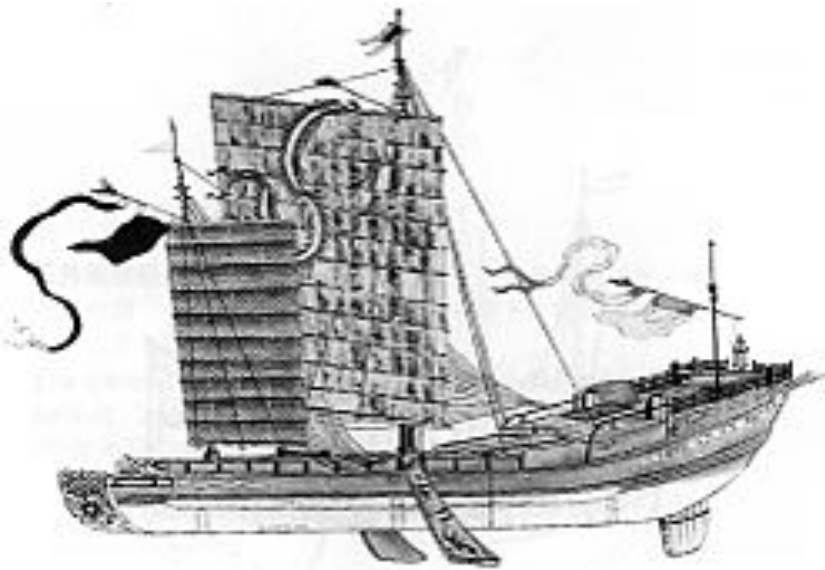
(based upon a SpaceNews article
co-authored with Sandra Magnus)

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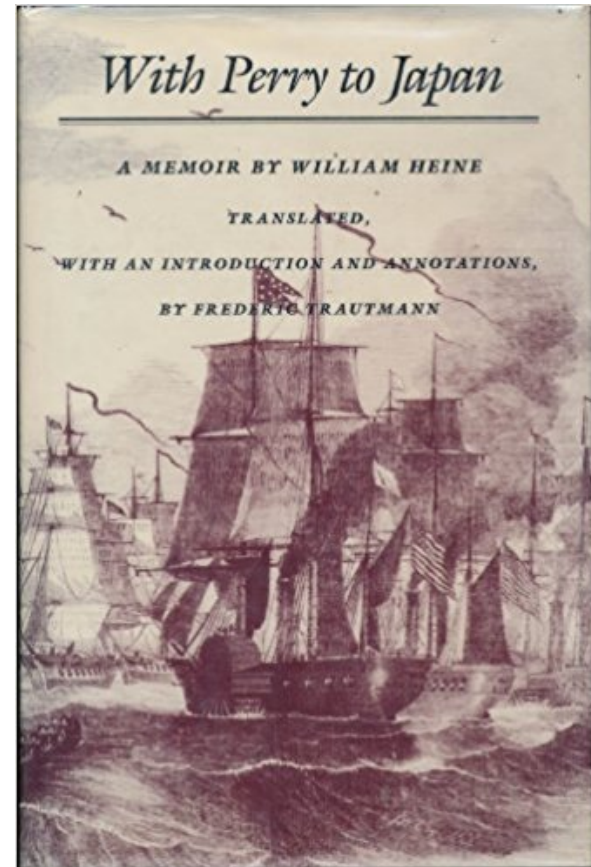
Network for Exploration
and Space Science

Jack Burns
University of Colorado Boulder

Historical Perspective on Exploration



A Song Dynasty junk ship, 13th century;
Chinese ships of the Song period featured
hulls with watertight compartments.

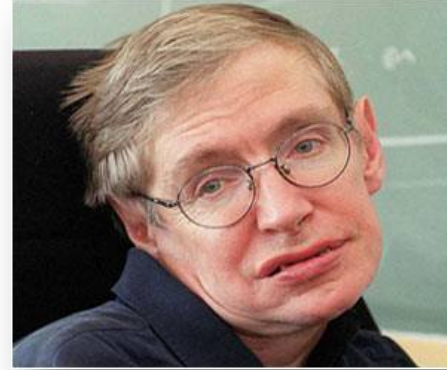


U.S. Commodore Perry “visit”
to Japan opened a new age of
technology & exploration.

Why Do We Explore Space?



John F. Kennedy at
Rice University, 1962



"The situation today is like Europe before 1492. Spreading out into space will completely change our future but won't solve immediate problems."
Stephan Hawking

How do we explore space?

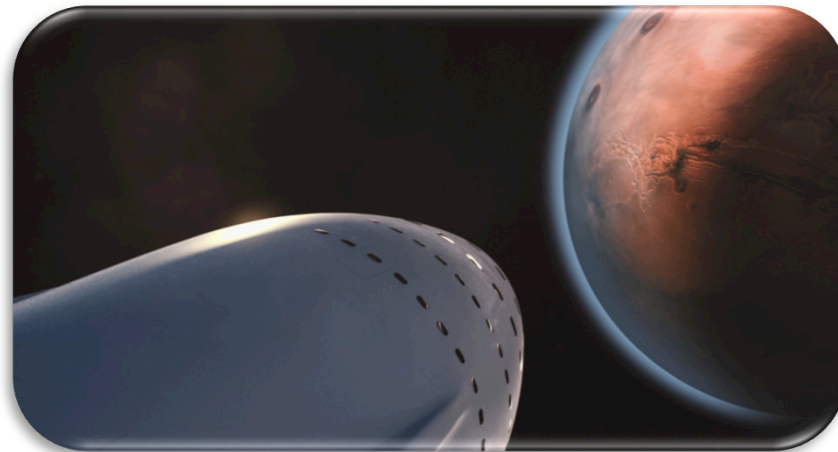
NASA's Orion + SLS



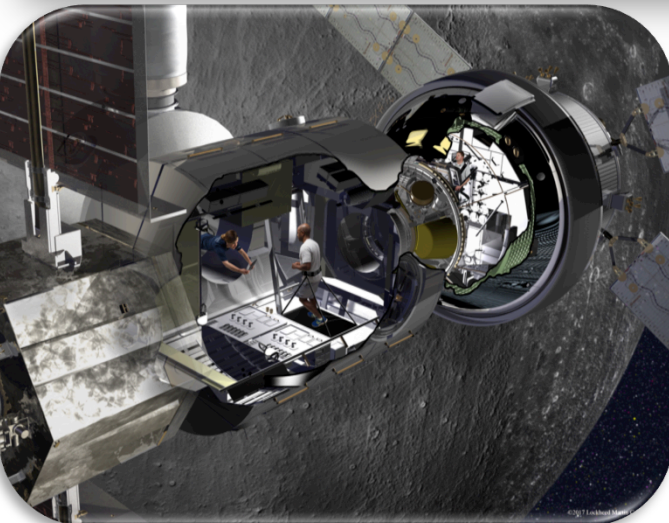
SpaceX's Falcon



SpaceX's Red Dragon at Mars



Lockheed Martin's concept of *Deep Space Gateway* in cis-lunar space

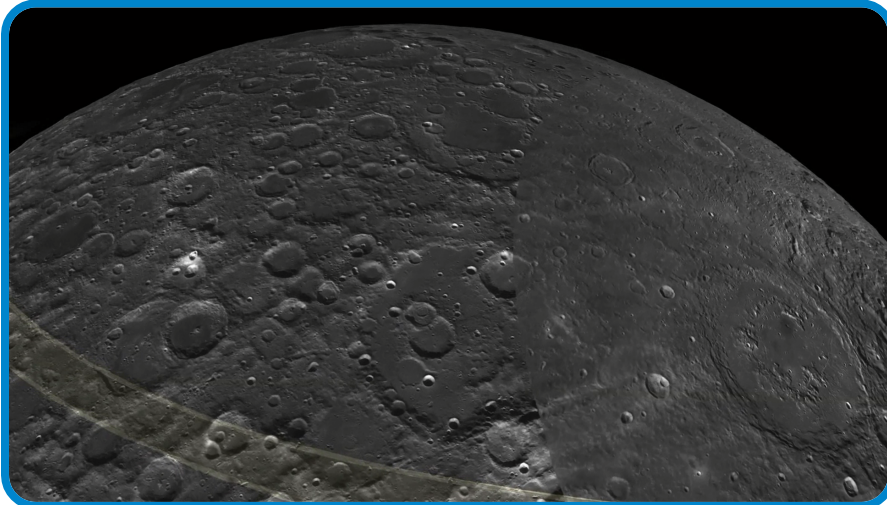


Where do we explore?

The Moon & Its Farside

“Return of multiple rock samples from the South Pole-Aitken (SPA) basin” (e.g., Schrödinger basin): *Planetary Science Decadal Survey*.

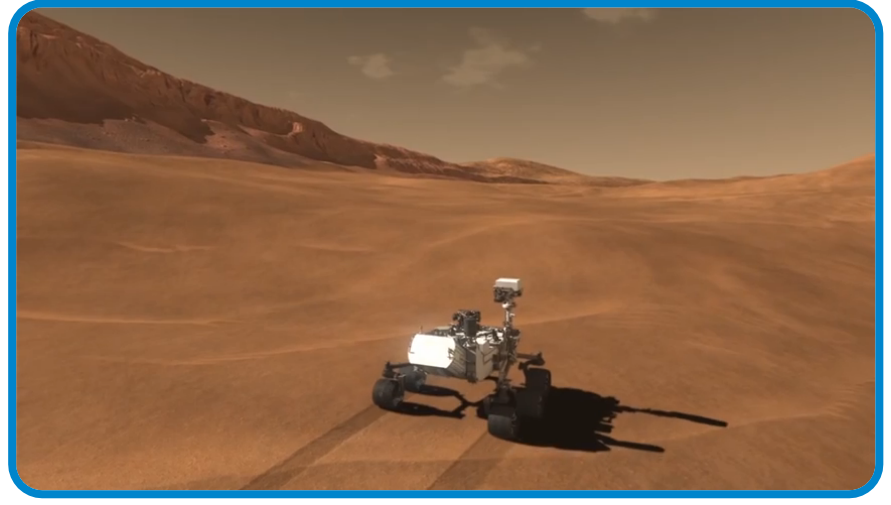
Potts, Kring et al. 2015, *Ad. Space Res.*, 55, 1241.
Burns, Kring et al. 2013, *Ad. Space Res.*, 52, 306.



LPI Video – D. Kring

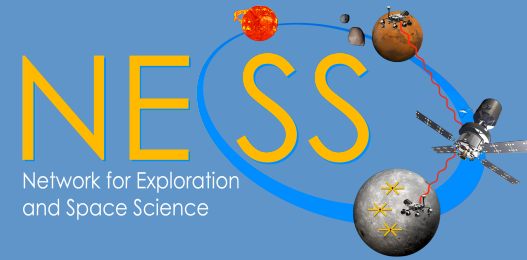
Mars & the Search for Life

“Highest-priority flagship mission for 2013-2022 is the Mars Astrobiology Explorer-Cacher which will begin a NASA-ESA Mars Sample Return campaign extending beyond 2022”: *Planetary Science Decadal Survey*. Mars 2020 is 1st of 3 missions.



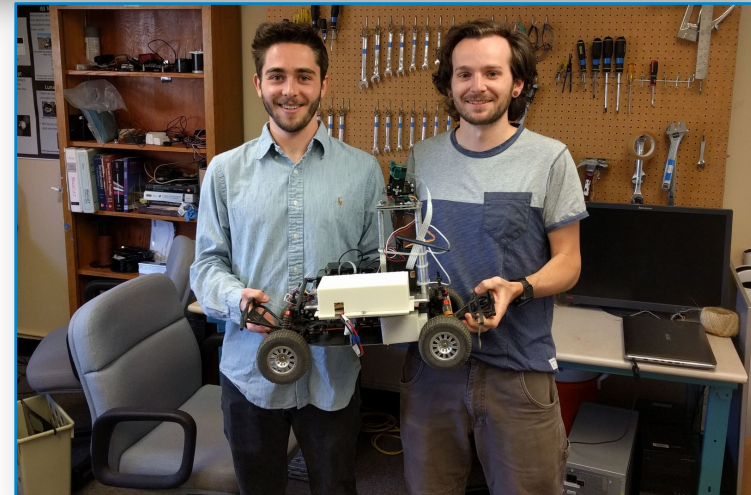
NASA Video

What are the tools for Exploration?



Astronaut Luca Parmitano (Italy) orbiting Earth on the ISS teleoperates the K10 rover at NASA Ames to simulate deploying a lunar farside radio telescope.

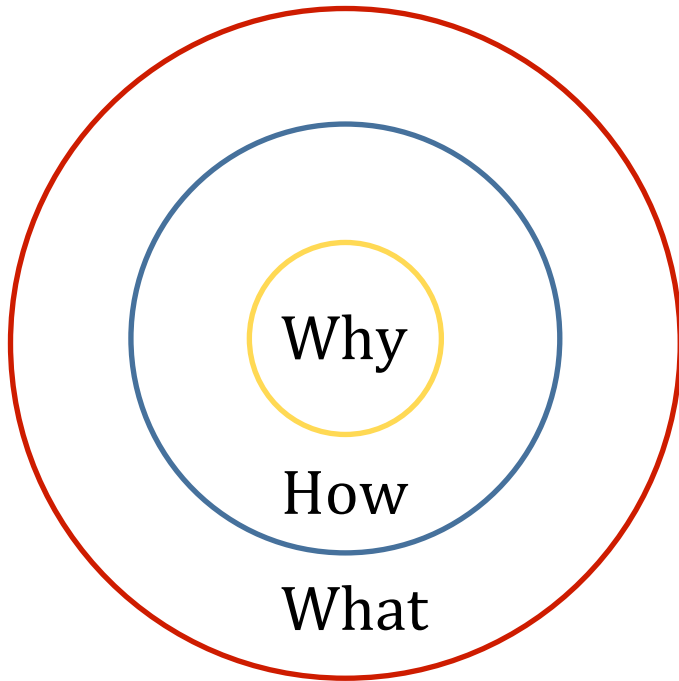
Burns, Fong, Kring et al. 2017, IAA Symposium on Space Exploration, arXiv:1705.09692.



Colorado students Ben Mellinkoff & Matt Spydell

But, it's about the why!

The Golden Circle – following Simon Sinek



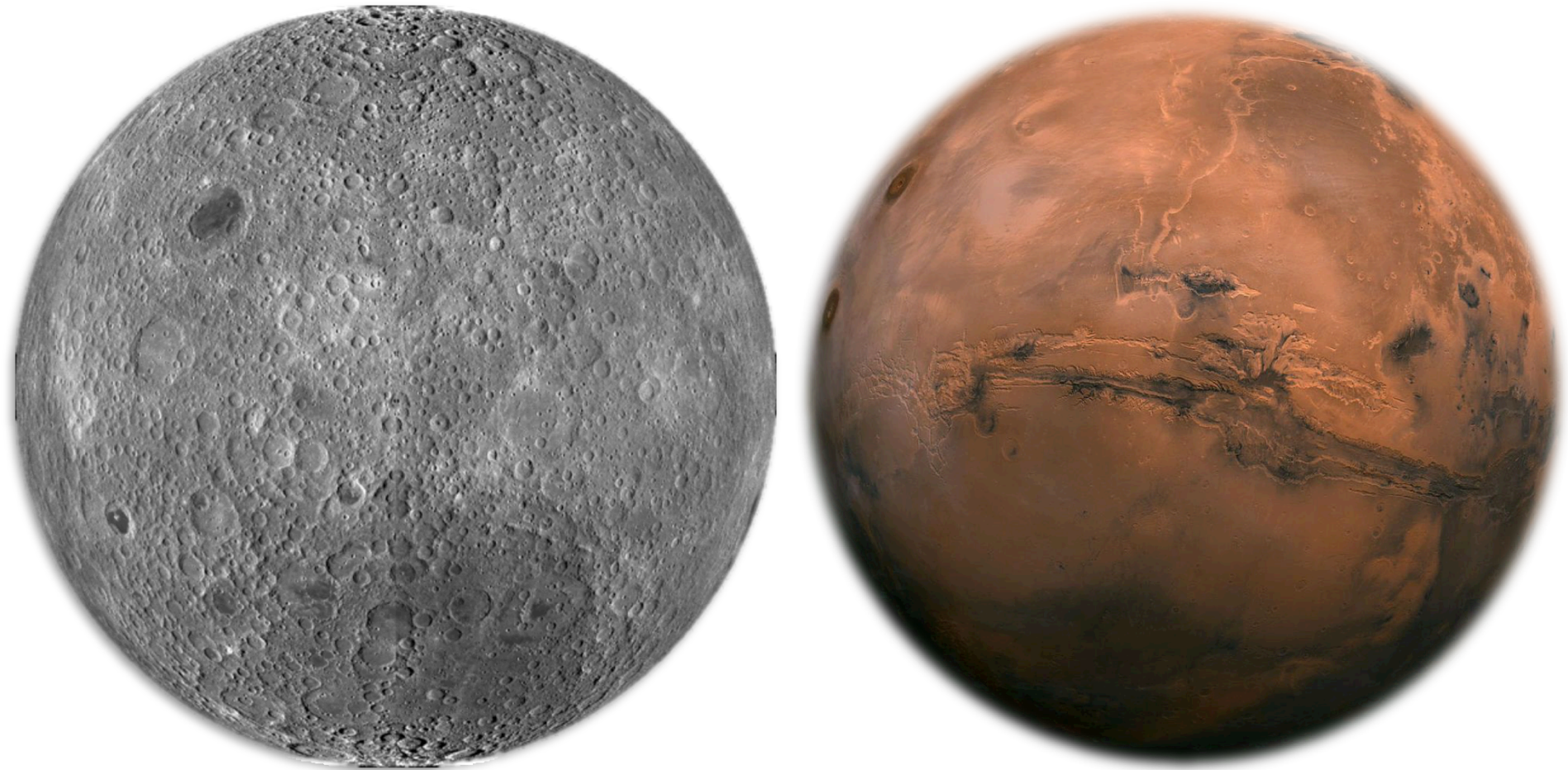
- Very few organizations know why they do what they do. What's its purpose? Why does the organization exist?
- Example of thinking differently – Apple.
- How about America's Space Program?

So, let's be inspirational

- Humans are meant to explore. It is at our core. We explore to gain knowledge, satisfy our curiosity. Space is that next frontier. It is a simple answer to why we explore.
- Next, what should we explore? A single destination is not sufficient nor sustainable. The Moon or Mars alone are dead ends. The destinations need to evolve and expand with the scientific questions and technological capability.
- Ultimate question: is there other intelligent life in the Galaxy?

A Sustainable Space Program

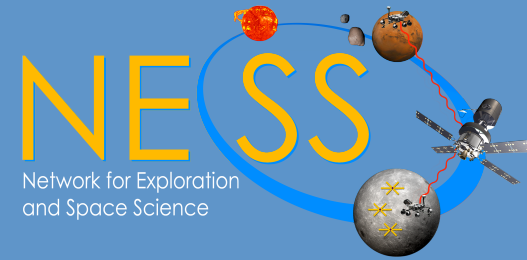
The Moon **AND** Mars



Europa



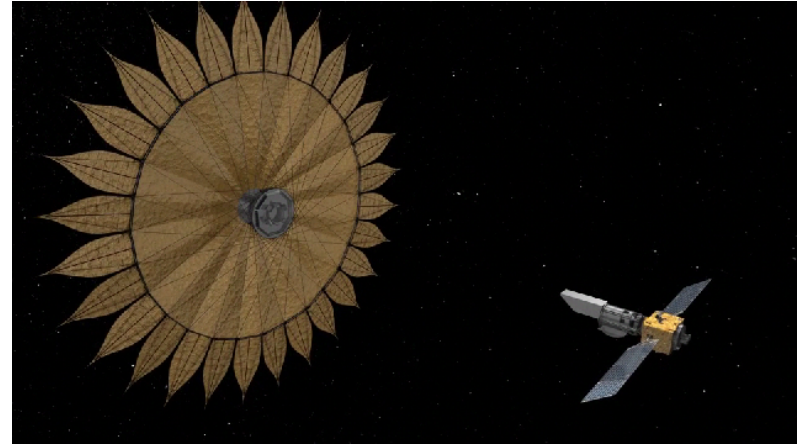
Exoplanets



Explore first with Space Telescopes



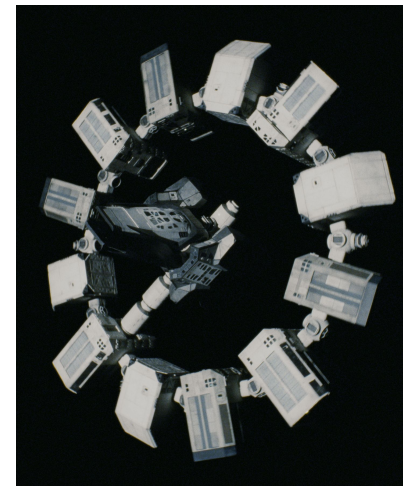
Extreme Extrasolar Space Weather in M-Dwarf Systems



Starshades to characterize exoplanets

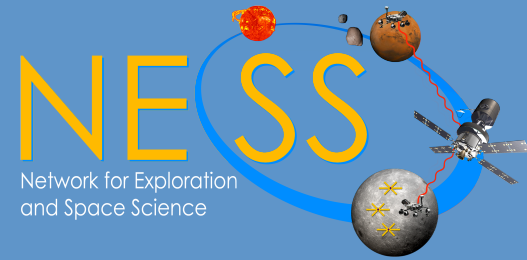


Lunar farside low frequency radio telescope to observe exoplanetary space weather



Interstellar travel in the next century?

Closing Thoughts



Ideally, a well-designed and executed, inspirational, sustainable space program will

- Drive advances in science and technology;
- Expand opportunity for everyone, everywhere in space;
- Enhance and expand knowledge, education, innovation, and economic vitality;
- Advance our understanding of Earth and develop technologies to improve the quality of life on our home world.

We must begin with the *Why* which leads to the *How* and the *What* of space exploration. There is room for everyone!