


Today's Class: Science on the Moon

- Read about the history & evolution of the Moon in Sections 8.2 and 9.3 in Cosmic Perspective.
- Homework #4 will be distributed on Wednesday.



Astronomy 2020 – Space Astronomy & Exploration


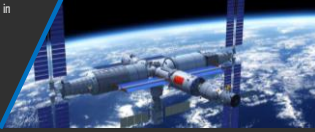
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China selects 18 new Taikonauts in preparation for space station launch

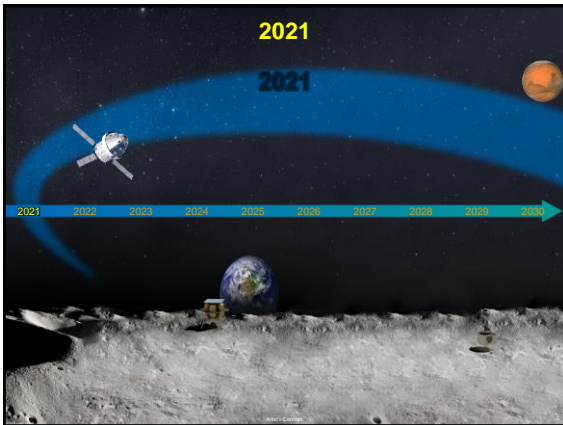
- 17 Men, 1 Woman
- Seven spacecraft pilots
- Seven spacecraft engineers
- Four mission payload specialists
- Tiangong (Heavenly Place) will begin assembly in 2021
- Fully operational around 2022 for 15 years

Was it a good idea for the United States to ban China from the ISS? How different are each country's ambitions in space?

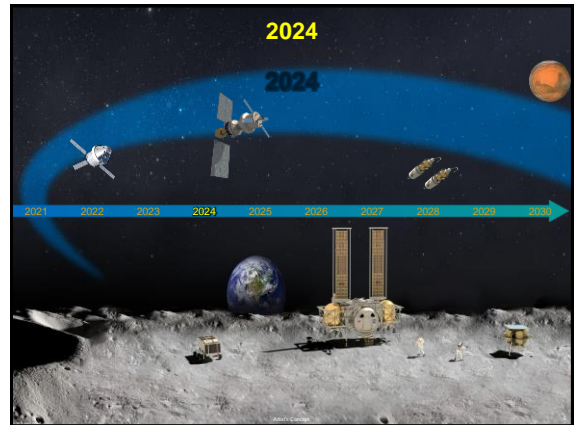
Ben McHugh – Space in the News Oct 11th

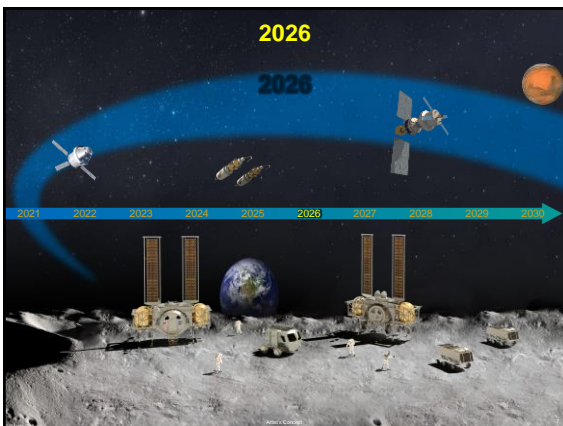
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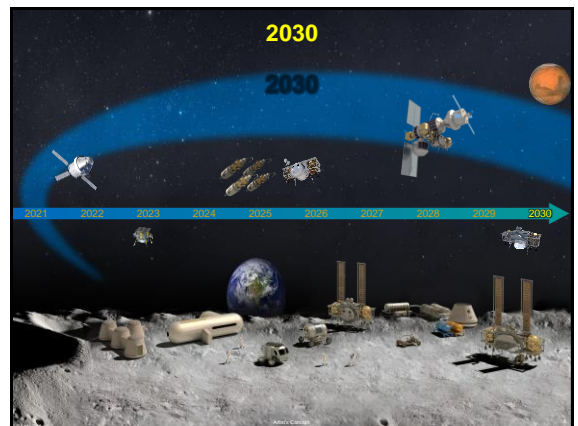
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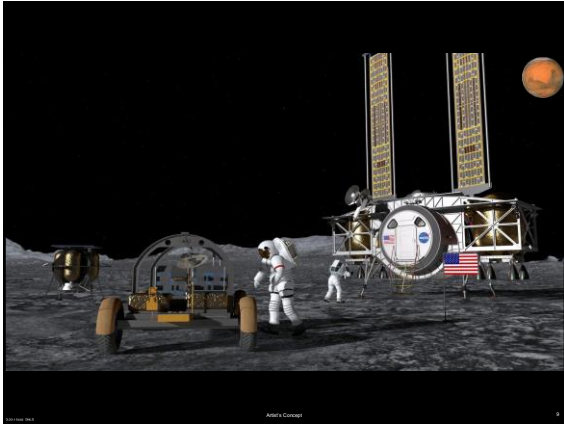
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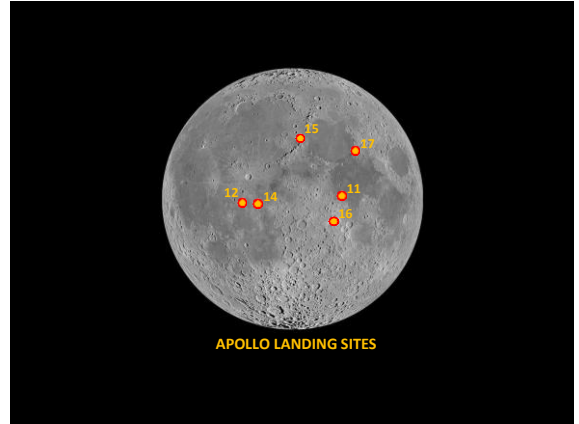
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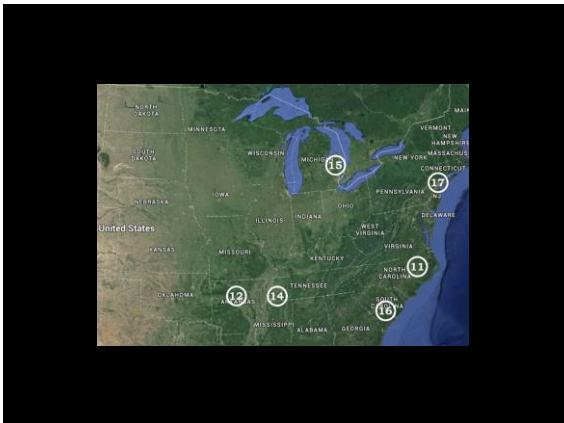
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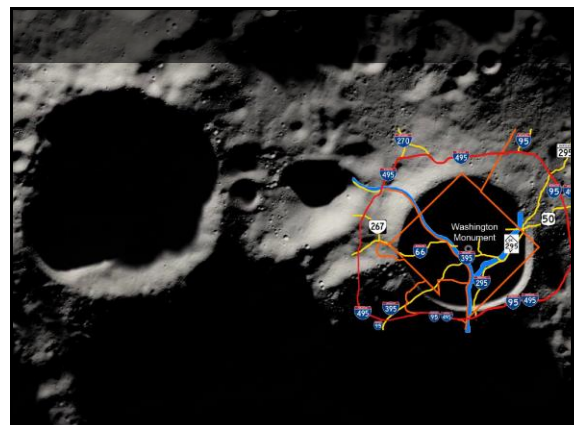
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Class Exercise

The House of Representatives Science Committee voted recently against a public-private model for the Human Landing System. They prefer an all-governmental program similar to Apollo. Are they right or wrong?



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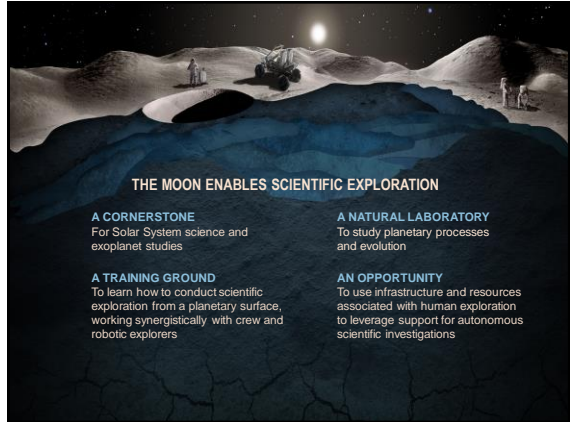


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Lunar Rovers

<p style="text-align: center;">Lunar Terrain Vehicle (LTV)</p>  <p style="text-align: center;">Human-rated, to move two suited astronauts across the lunar surface</p>	<p style="text-align: center;">Lunar Surface Science Mobility Systems (LSMS)</p>  <p style="text-align: center;">Robotic vehicles to transport instruments across the lunar surface</p>
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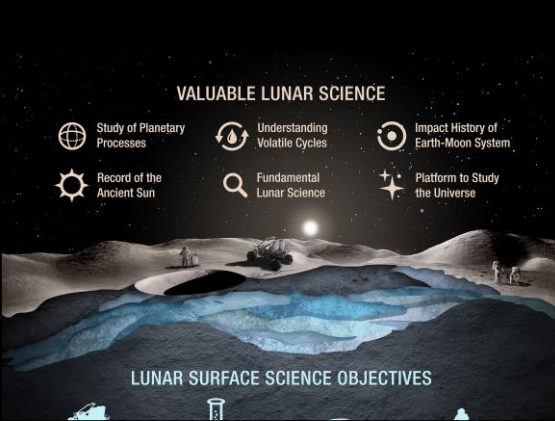
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





THE MOON ENABLES SCIENTIFIC EXPLORATION

<p>A CORNERSTONE For Solar System science and exoplanet studies</p> <p>A TRAINING GROUND To learn how to conduct scientific exploration from a planetary surface, working synergistically with crew and robotic explorers</p>	<p>A NATURAL LABORATORY To study planetary processes and evolution</p> <p>AN OPPORTUNITY To use infrastructure and resources associated with human exploration to leverage support for autonomous scientific investigations</p>
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VALUABLE LUNAR SCIENCE

 Study of Planetary Processes	 Understanding Volatile Cycles	 Impact History of Earth-Moon System
 Record of the Ancient Sun	 Fundamental Lunar Science	 Platform to Study the Universe

LUNAR SURFACE SCIENCE OBJECTIVES

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UNDERSTANDING VOLATILE CYCLES



EXPLORATION REQUIREMENTS

- Access to persistently shadowed terrain
- Sealed collection canisters designed for cold sample curation

1 Moon represents a diversity of sources and sinks of water in the Solar System

2 Comets and asteroids impact the lunar surface and leave volatiles behind

3 The lunar surface is directly exposed to space, so volatile loss occurs by sublimation, UV ionization, sputtering, and micrometeorite impact

4 Solar wind (H) interacts directly with lunar surface (O in silicates), creating water molecules

5 Lunar samples contain tiny amounts of primordial volatiles that trace the history of Earth-Moon system formation

6 Lunar poles harbor extremely cold environments that may trap water and other volatiles

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IMPACT HISTORY OF EARTH-MOON SYSTEM



EXPLORATION REQUIREMENTS

- Collection of several walnut-sized rocks for chronological analysis
- Identification of and collections of rocks from outcrops and boulders

1 Craters are erased on the dynamic, eroded surface of Earth. The Moon retains this record

2 Both Earth and Moon reside at 1 AU, recording the impact and providing an absolute chronology that anchors the impact history of the inner Solar System

3 Impact Extinction? K-Pg impact 65 My ago wiped out 85% of all fossil species. Incomplete statistics suggest such impacts may occur periodically

4 The Moon's impact record can be recovered and interpreted in terms of Earth-Moon history

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PLATFORM TO STUDY THE UNIVERSE



EXPLORATION REQUIREMENTS

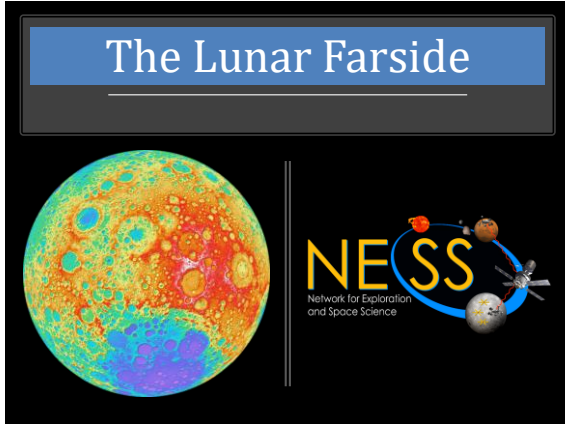
- Dexterity to deploy delicate instrumentation
- Characterization of the local environment (dust, RF, plasma)

1 The lack of atmosphere allows the full electromagnetic spectrum to be visible from the lunar surface

2 The farside of the Moon is the only known place in the Solar System permanently shielded from Earth's radio noise

3 Opportunistic astronomy leveraging surface infrastructure

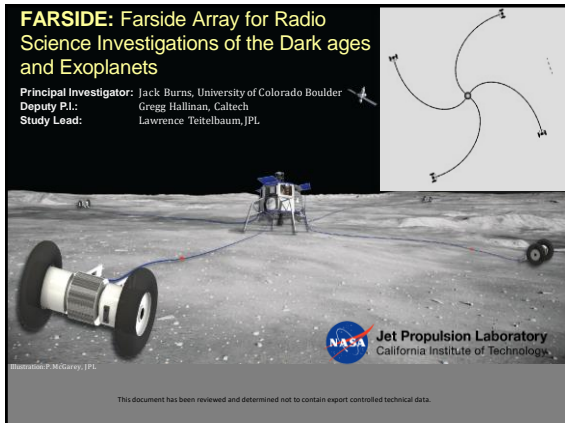
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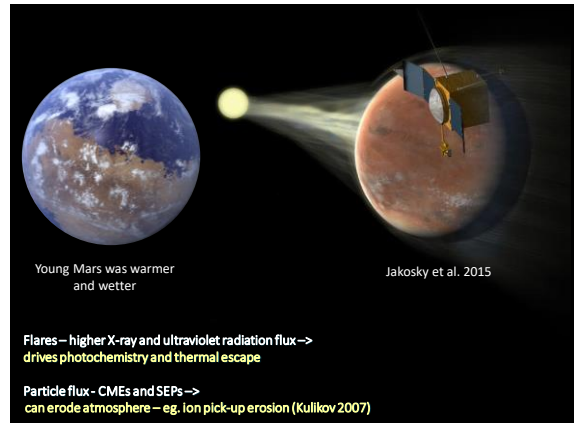
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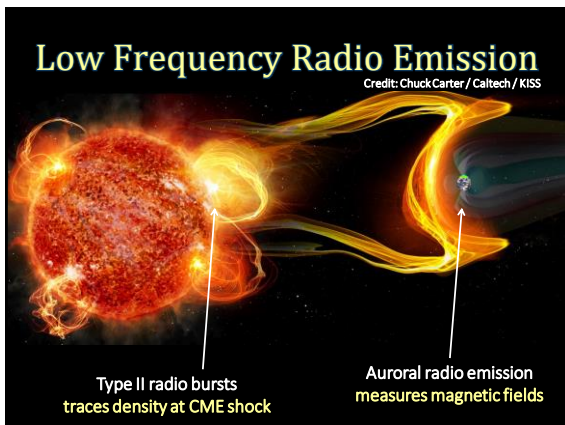
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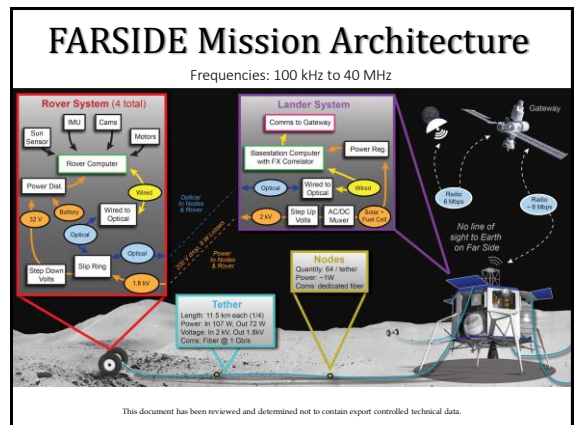
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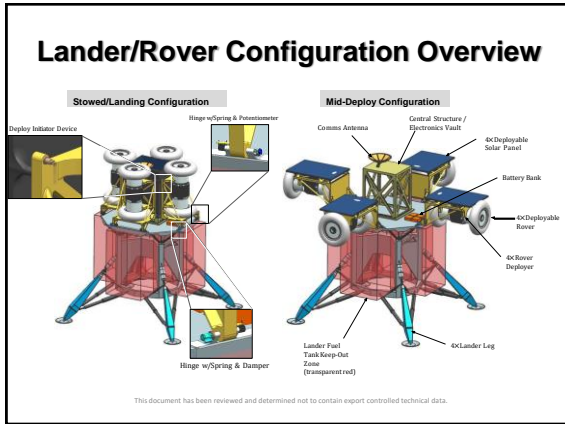
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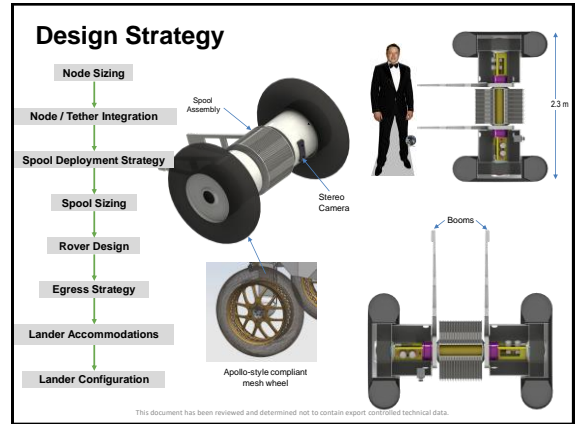
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