

WHY THE MOON?

In 2004, President George W. Bush proposed a new set of goals for NASA which have since been formalized by Congress as the revised United States Space Policy. A major goal is to return humans to the moon by 2020. This prompted a world-wide discussion about what our goals in space ought to be.

In 2006 NASA surveyed potential stakeholders asking the question, “Why the Moon?”

Responses were received from over 1000 entities including business, industry, academia, and 13 other space agencies. This presentation reports the responses to that questionnaire, as well as current plans for how the return to the moon will be accomplished.

Why the Moon?



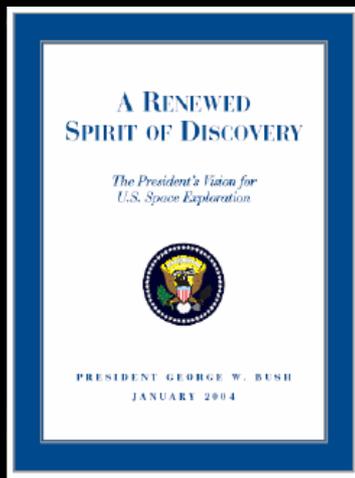
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NASA's Exploration Mandate

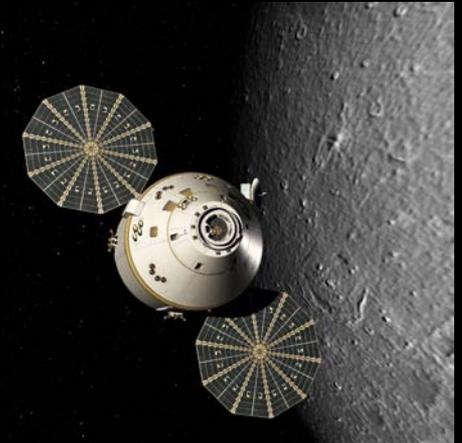
- Presidential Directive set the future course for NASA
 - January 2004
 - Later authorized by Congress
- No large budget increases
 - About 0.6% national budget
 - \$16B
 - Apollo budget > 3% national



- Complete the International Space Station
- Safely fly the Space Shuttle until 2010
- Develop and fly the Crew Exploration Vehicle no later than 2014 (goal of 2012)
- Return to the Moon no later than 2020
- Extend human presence across the solar system and beyond
- Implement a sustained and affordable human and robotic program
- Develop supporting innovative technologies, knowledge, and infrastructures
- Promote international and commercial participation in exploration

How Will We Get to the Moon?

- New class of human spacecraft
 - Orion
 - Apollo on steroids
 - Crew of 6 to ISS
 - Crew of 4 to moon
 - Altair
 - Similar to Apollo Lunar Module
 - Crew of 4 to lunar surface
- Two new launch vehicles
 - Ares I
 - Carries Orion to orbit (ISS)
 - Based on Shuttle SRB
 - Ares V
 - Carries cargo to orbit
 - Based on Saturn V engine



“Block 1A” Orion Replaces Shuttle

- Launched on Ares I
- Services the ISS
- Can transfer 3-6 crew
- Very limited cargo space
- Ballistic descent
 - Either land or water landing
 - Reused ~ 5 times
 - Service module is single use



“Block 2” Orion for Lunar Trips

- Altair launched to Earth orbit on Ares V
- Orion launched to Earth orbit on Ares I
- Orion rendezvous and docking to Altair
- Ares V second stage powers to lunar orbit



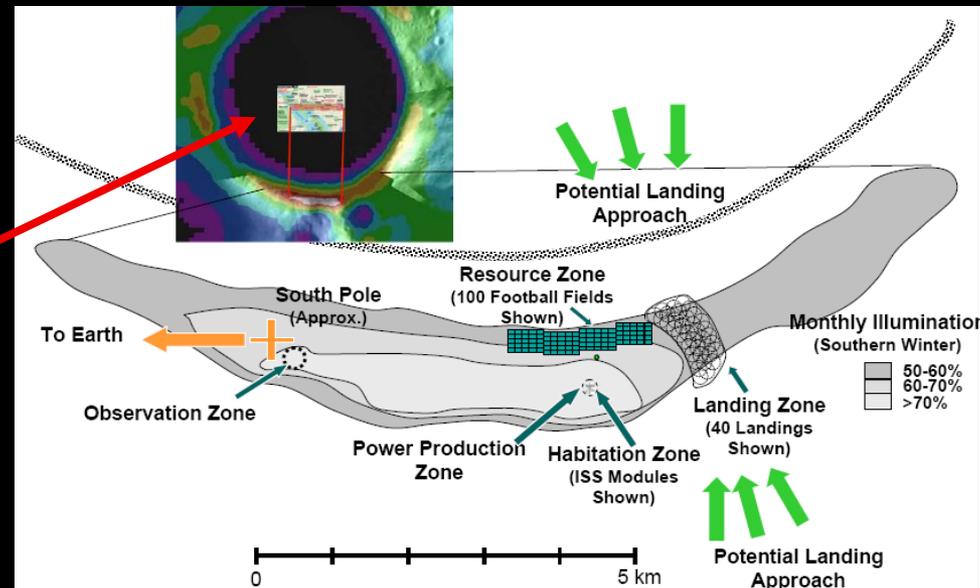
Altair Lands on Lunar Surface

- Ares V second stage brakes to Lunar orbit
- Entire crew transfers to Altair
- Altair descends to lunar surface
 - Orion robotically maintained in lunar orbit
- Initial crews stay 7-14 days on surface
 - After second year 6 month stays



Initial Landing at Polar Region

- Nominal site is rim of Shackleton crater
- Advantages of polar site
 - Nearly continuous solar power
 - Much shallower daily temperature swings
 - 70 °F instead of 540 °F
 - Permanently shadowed craters may have resources
 - Ice
 - Hydrogen



Crew Changeover

- Lunar outpost permanently inhabited
 - Second crew lands before first leaves
 - Cargo landers supplement Altair cargos
 - Separate power landers
- First crew leaves in minimal ascent stage
 - Rendezvous and docking with Orion
 - Orion engines powers back to earth
 - Capsule separates, lands ballistically



But Why Go to the Moon?

- Who decides what we do?
- NASA is government lead, but not the only stake holder
- Decided to poll the community
- More than 1000 responses
 - Business
 - Industry
 - Academia
 - 13 other space agencies
- Sifted through thousands of ideas
 - Organized into 6 themes
 - Identified 181 objectives
- Ongoing process
 - Working now to prioritize what to do first



NASA Exploration Lunar Activities addressing Themes



Human Civilization



Global Partnerships



Scientific Knowledge



Economic Expansion



Exploration Preparation



Public Engagement

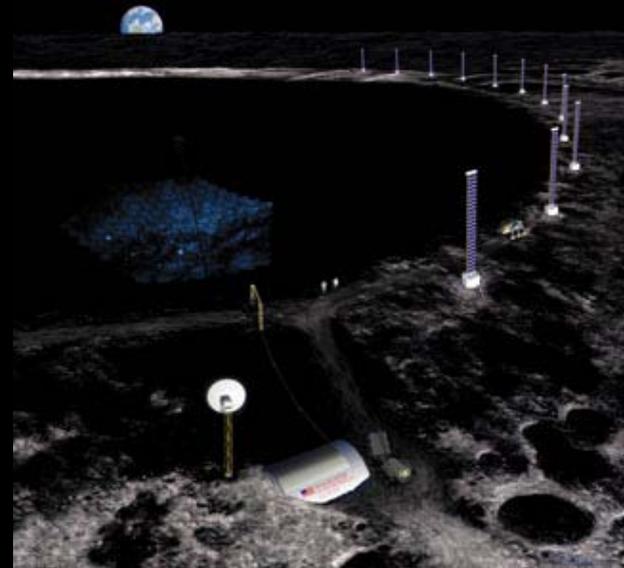
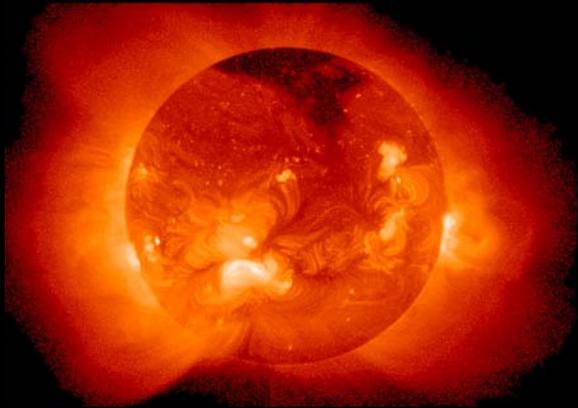
181 Things to Do on the Moon

- 24 classes of objectives
 - Most objectives fall into more than one of the themes
- Some specific areas of science
 - Geology, heliophysics,...
- Some infrastructure areas
 - Power, communication
- Some business oriented
 - Commercial opportunities
- Some education oriented
 - Public engagement, historic preservation



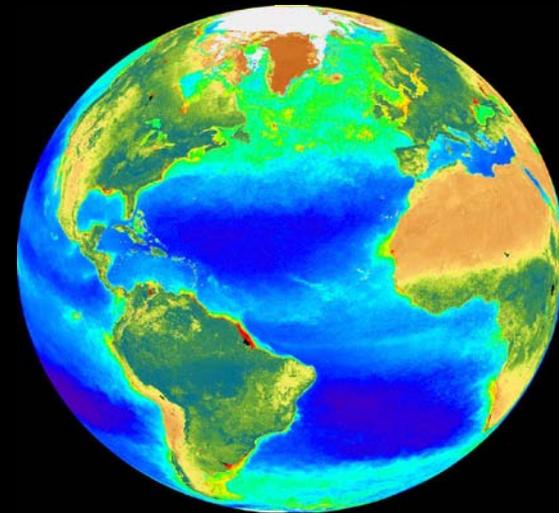
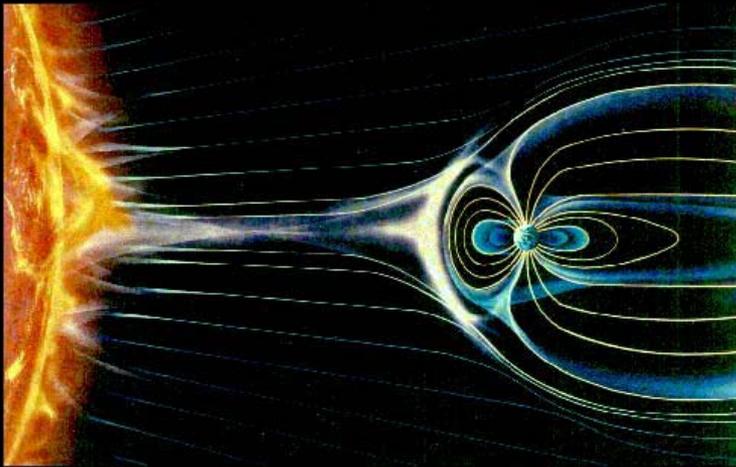
Astronomy and Astrophysics (15)

- Study the Universe
 - Moon as observational platform
 - Long baseline interferometry
- Study the sun (heliophysics)
 - Solar weather
 - Sun's role in climate change



Earth Observation (12)

- Use the Moon as a **remote sensing platform**
- Observe the **Sun-Earth system**
- Study **albedo and energy balance**
- Monitor Earth's **volcanic activity and lightning**



Lunar Geology (16)

- Study the **radiation record** left in lunar regolith
- Study the **evolution of the lunar crust**
- Study **lunar volatiles**
- Find potential **resources**
- Characterize the **meteor impact process**



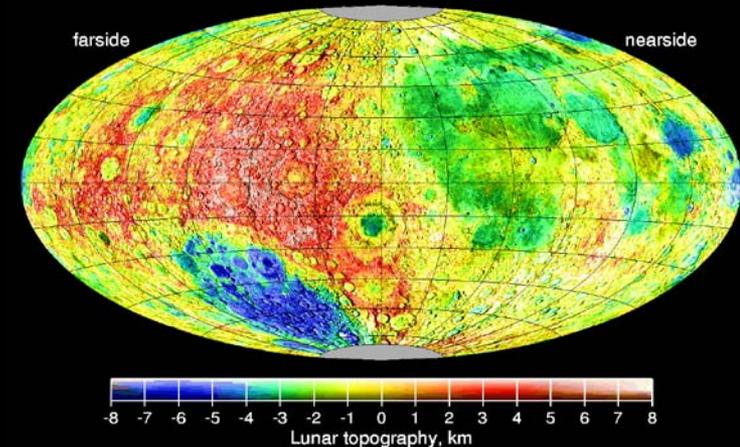
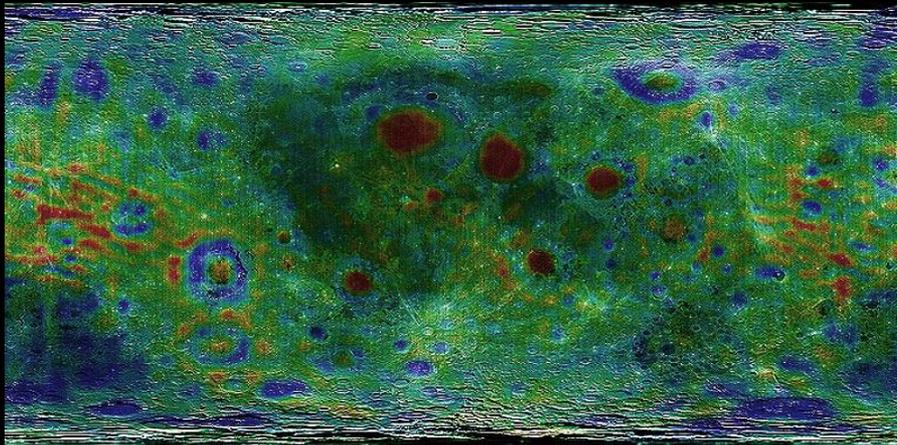
Human Health (8)

- Study **long-term lunar environment effects**
- Study effects of **partial gravity** on human performance
- Study the impact of **extreme isolation** on crew
- Study lunar environment effects on **terrestrial microbes**
- Deploy effective **remote health care systems**



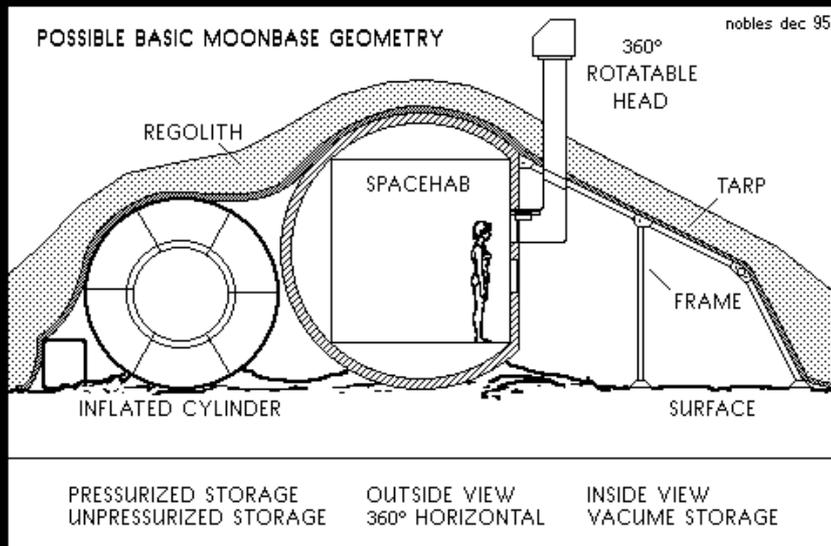
Study Lunar Environment (8)

- **Map the topography** of the Moon
- Understand **environmental interactions** of the Moon
- Study how environment affects space systems



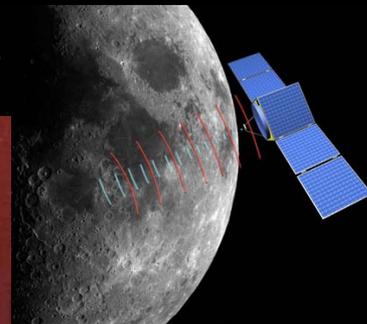
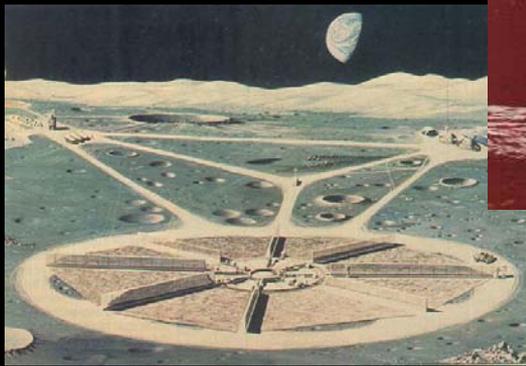
Living in Hostile Environments (16)

- Provide **safe and enduring habitation** systems
- Develop and deploy **closed-loop life support** systems
- Emplace **agriculture systems** to produce food
- Integrate **key plant and bacterial species**



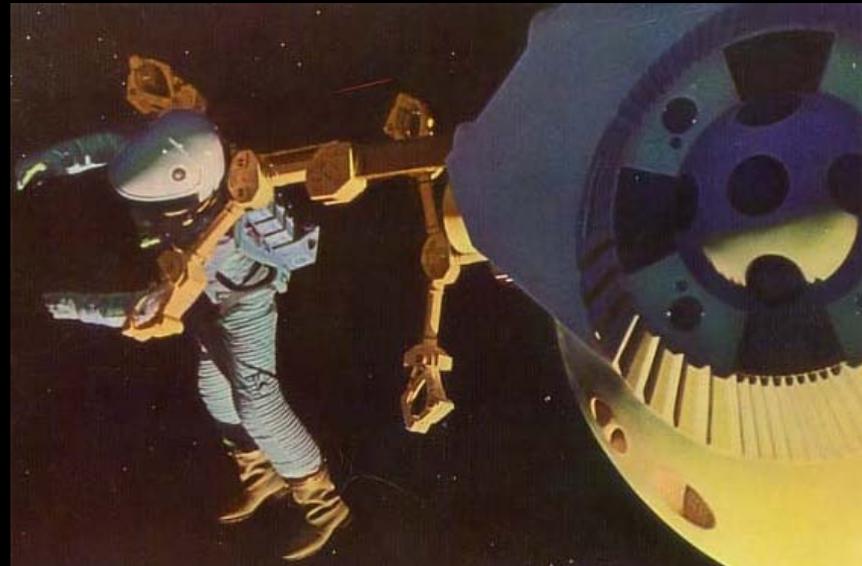
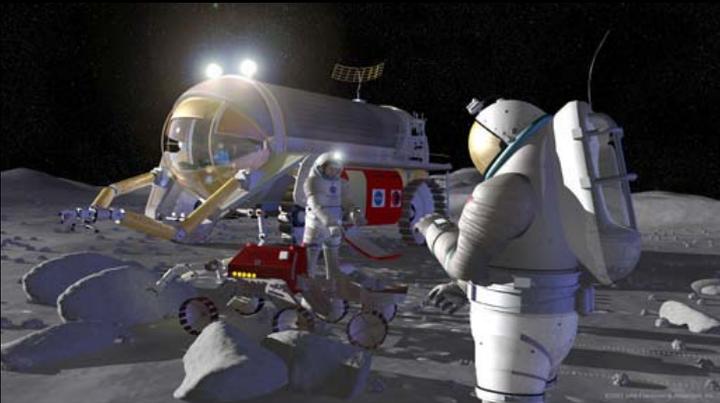
General Infrastructure (38)

- Emplace **power and communications utilities**
- Establish **daily autonomous operation**
- Deploy **Moon-based transportation systems**
- Establish **navigational aids**



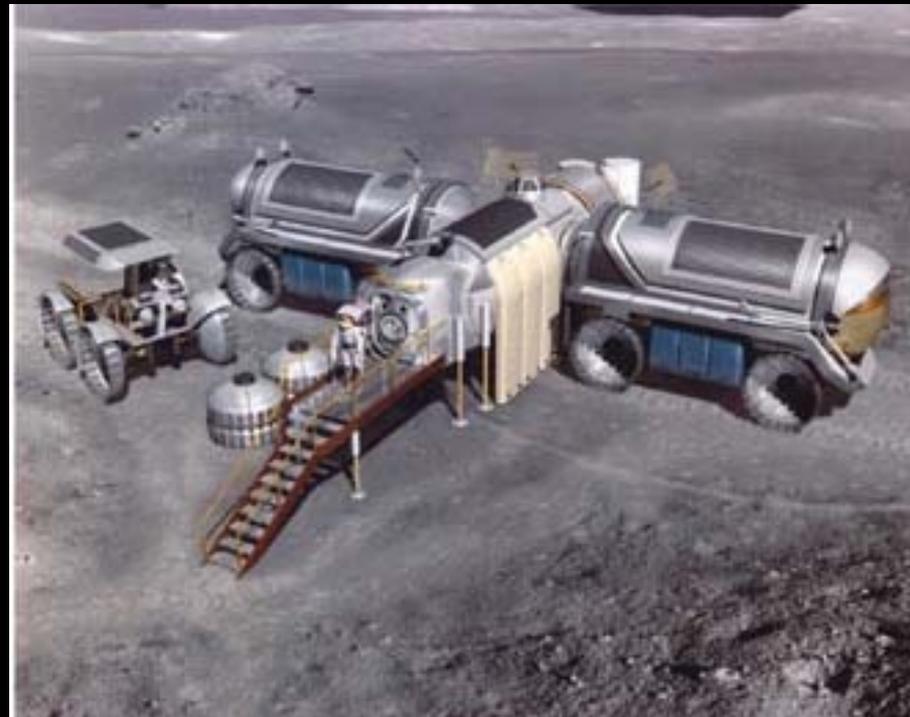
Crew Activity Support (14)

- Develop a **high performance EVA suit**
- Develop **robots to support outpost operations**
- Develop **tele-operation** capabilities



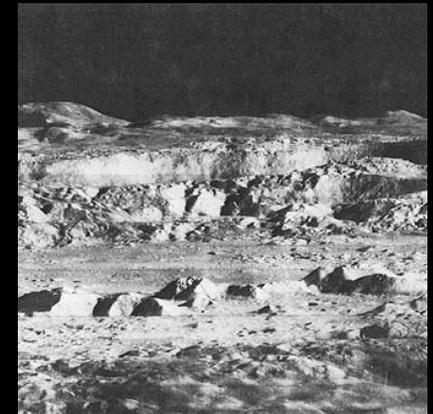
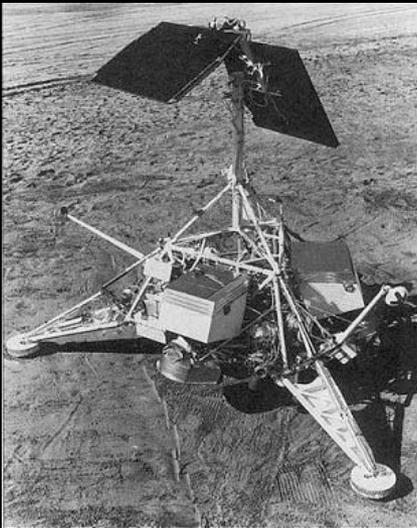
Lunar Resource Utilization (10)

- Develop **new products** utilizing lunar resources
- **Produce products and energy** for lunar base
- **Produce products and energy** for export



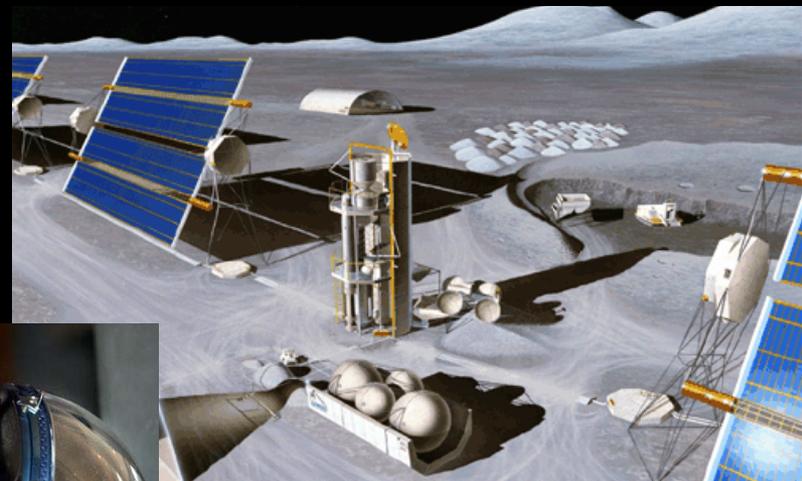
Historic Preservation (3)

- Create **international lunar heritage sites**
- Preserve an **archive of life on Earth**
- Preserve regions of the Moon in their **natural state**



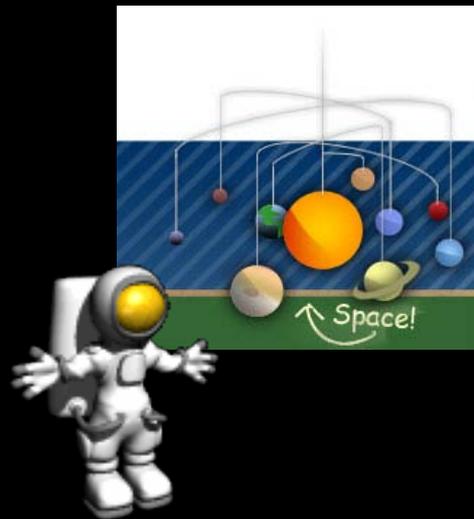
Development of Lunar Commerce (21)

- Engage the commercial sector in lunar activities
- Identify and enable commercial lunar markets
- Create a commercial astronaut corps
- Purchase private launch services to the Moon
- Host entertainment events on the Moon
- Sell tourist trips to the Moon
- Sell lunar products on the Moon and on Earth



Public Engagement and Inspiration (20)

- Enable **two-way interaction** with people on the Moon
- Establish a **global partnership framework**
- Provide opportunities to **educate students**
- Allocate space on missions for **academic payloads**
- Utilize **existing pro-space and student organizations**



CONCLUSIONS

- NASA is planning the return to the moon
 - Envisioned as a long term effort
- Conversation started as to why go to the moon
 - 6 themes identified
 - 24 categories of objectives identified
 - 181 objectives identified
- Prioritization of objectives has begun
- Ongoing process which will evolve

