

Lunar Commercialization Workshop



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Lunar Commercialization Workshop Agenda

- **Overview and workshop description**
 - ◆ 20 minutes
- **Development of Business Plans**
 - ◆ 120 minutes
- **Presentation of business plans to panel**
 - ◆ 60 minutes - split evenly among the teams
- **Wrap-up and discussion**
 - ◆ 10 minutes



Lunar Commercialization Workshop Description

- **Goals**

- ◆ **Explore viability of using public-private partnerships to open space frontier**

- **Rules**

- ◆ **Form 3 teams - each team represents a space entrepreneurial company**
- ◆ **Create innovative business plans for commercialization of the Moon**
 - ☞ Business concept description, market strategy
 - ☞ Return on investment, pricing, schedule
 - ☞ Competition and other impediments
 - ☞ Operations and management plan
- ◆ **Present plan to panel - scored against each of the four elements**
- ◆ **Best plan awarded prize**

Lunar Commercialization Workshop - Scoring

- **Create an innovative business plan**

- ◆ **Business concept description, market strategy**

- ☞ Describe the product/service
 - ☞ Describe the customer profile
 - ☞ What is your marketing strategy?
 - ☞ What is your business model?

- ◆ **Return on investment, pricing, schedule**

- ☞ What services would you provide and what are their cost to you
 - ☞ What do you charge for the services?
 - ☞ What is your return on investment - over what time period?

- ◆ **Competition and other impediments**

- ☞ Who is your competition?
 - ☞ What are your major risk areas?

- ◆ **Operations and management plan**

- ☞ What facilities/infrastructure needs?
 - ☞ Who is your management team and what is their experience?

Public-Private Partnerships

- **Government procures what it needs from private industry instead of developing and operating the mission on its own**
- **Benefits to Government**
 - ◆ Usually cheaper over the life cycle
 - ◆ Government does not have to conduct operations and maintain infrastructure
 - ◆ Ability to leverage resources with commercial sector
- **Benefits to Industry**
 - ◆ Gain expertise, helps develop new sector
 - ◆ Develop infrastructure and retire risk
 - ◆ Commercial success is critical to opening the space frontier

Open Architecture: Infrastructure Open for Potential External Cooperation

- **Lander and ascent vehicle**
- **EVA system**
 - CEV and Initial Surface capability
 - Long duration surface suit
- **Power**
 - Basic power
 - Augmented
- **Habitation**
- **Mobility**
 - Basic rover
 - Pressurized rover
 - Other; mules, regolith moving, module unloading
- **Navigation and Communication**
 - Basic mission support
 - Augmented
 - High bandwidth
- **ISRU**
 - Characterization
 - Demos
 - Production

- **Robotic Missions**

- LRO- Remote sensing and map development
- Basic environmental data
- Flight system validation (Descent and landing)
- **Lander**
- Small sats
- Rovers
- Instrumentation
- Materials identification and characterization for ISRU
- ISRU demonstration
- ISRU Production
- Parallel missions

- **Logistics Resupply**

- **Specific Capabilities**

- Drills, scoops, sample handling, arms
- Logistics rover
- Instrumentation
- Components
- Sample return

**** US/NASA Developed hardware**

Implementing the Vision

Lunar Commercialization

- **Lunar Commercialization complements national Lunar objectives**
 - ◆ **Early, small scale Lunar transportation enabled by private sector**
 - ☞ Commercial delivery system -- “FedEx Lunar”
 - ◆ **Near-term technology demonstrations on the Lunar surface**
 - ☞ Constellation technology risk reduction
 - ◆ **Early start to Lunar science campaign**
 - ◆ **Enable more commercial opportunities relative to the moon**
 - ☞ Commercial Lunar communications, navigation



Possible Lunar Commercialization Elements

- Utilize emerging commercial capability to land payloads on the Moon
- Includes lunar data purchase and/or agency lunar instrument delivery
- Cost to agency that is less than a dedicated NASA robotic mission (\$100M+ if conducted by Agency)
- Operations could begin in 2010 timeframe
- Small payloads (\$100M or less)
- Frequent, multiple flights
- Commercially-leveraged: Open Competition for lunar transportation services
- Fixed price service
- Industry provides the “Fed-Ex” to the surface



Lunar Commercialization

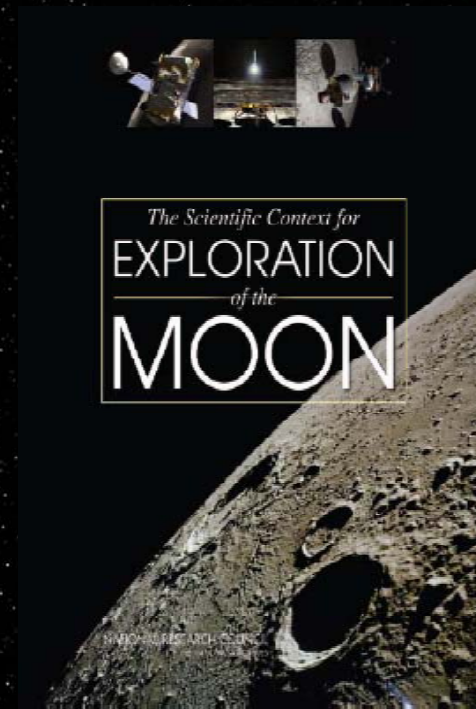
● Exploration Demand

- ◆ The Constellation Program Office has identified lunar data needs, of which a subset would require in-situ measurement
 - ☞ Dust characterization & mitigation
 - ☞ Landing site reconnaissance
 - ☞ Lunar model validation (tie to ground truth)
 - ☞ Local radiation measurement
 - ☞ Spacecraft charging evaluation
 - ☞ Regolith handling/site preparation
 - ☞ ISRU characterization and demonstration
 - ☞ Hydrogen form and location characterization
 - ☞ Lighting perspective (permanent low incidence at poles)
- ◆ Technology demonstration
 - ☞ Communications (surface mobile comm)
 - ☞ Mechanisms (1/6G performance, dust impact on lifetime)
 - ☞ Materials (dust compatibility)
 - ☞ Thermal (surface influence, radiator dust exposure)
 - ☞ Navigation and guidance (Precision Landing)
 - ☞ Propulsion (system performance, plume interaction)
 - ☞ Mobility (traction, dust impact)
 - ☞ Power (Re-charging mobile robotic assets, fuel cell tech)
 - ☞ Avionics (Open architecture, Rad hard)
 - ☞ Cryo handling & storage (test demo)
 - ☞ ECLSS (water loop performance in 1/6g, dust filters)



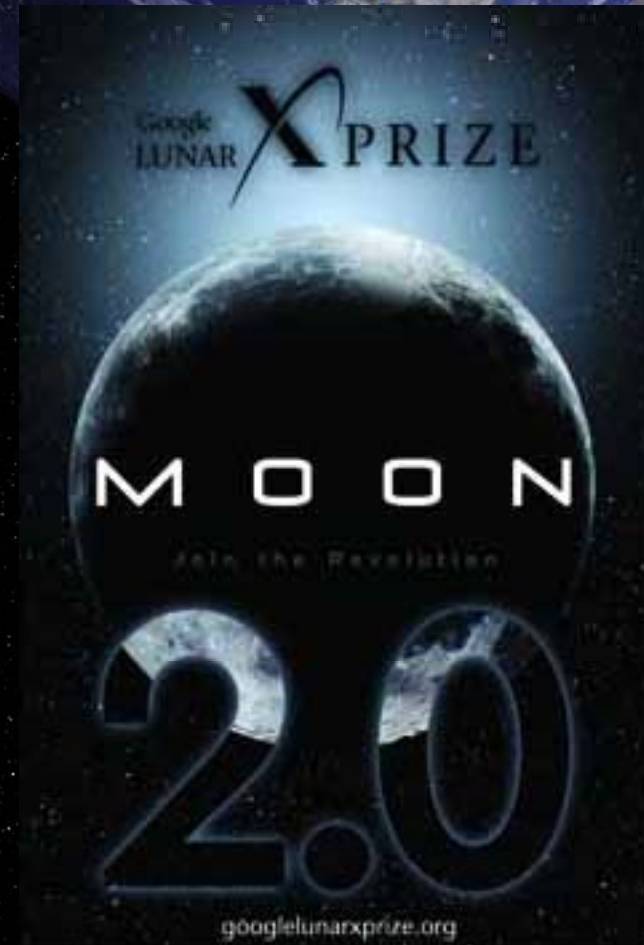
Lunar Commercialization

- **Science Demand**
 - ◆ **Exploration of the South Pole-Aitken Basin remains a priority**
 - ◆ **Diversity of lunar samples is required for major advances**
 - ◆ **The Moon may provide a unique location for observation and study of Earth, near-Earth space, and the universe**



Commercial Capability

- Market Supply side - transportation
 - ◆ Google Lunar X-Prize (GLXP):
Astrobotic Tech, Odyssey Moon, others
- Individual instruments delivered near term at an estimated cost on order of \$1M to \$3M dollars per kilogram
- Launch is clearly a large expense, and a significant portion of the total mission costs
 - ◆ Falcon 9 / Minotaur V class
 - ☞ \$25M - \$35M
 - ☞ TLI: 465 kg (1025 lbm)
 - ◆ Possible to fly as secondaries
 - ☞ Secondary payload adapter (ESPA)
 - ☞ 180kg
 - ☞ ~\$2M



Good Luck



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