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
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