Welcome!

To The Restructured, Reconfigured, NASA Advisory Council!
NASA Advisory Council and Other Thoughts About the Future

Harrison H. Schmitt, Chairman

The Council’s Profound Thanks Go to the Science Mission Directorate for Organizing this Conference!
The NASA Advisory Council provides independent advice to NASA through the Administrator concerning the implementation of Presidential and Congressional policy directives.
Available After Dinner Tonight for Questions And Discussion About the Council
2006 Subcommittee Activities: Council Expectations

- **May Conference**
  - Get acquainted
  - Select a Vice-Chair
  - Trade Contact Info
  - Provide Guidance to SMD on R&A and Program Mix
  - Organize Sub-groups
  - Develop Draft Agenda for July Conference
  - Review TORs

- **July Conference**
  - Plan Fall Lunar Science Workshop
  - Draft Workshop Agenda
  - Desired Attendance
  - Invited Attendance
  - Invited Papers
  - Solicitation of Community Inputs
  - Determine Needed ESMD Inputs
Fall Lunar Science Workshop:
Council Expectations

- Consider Exploration Science, Lunar Science, and Lunar-Based Science for a Return to the Moon
- Develop Science Objectives and Priorities as Initial Guidance for Return to the Moon Program Planning, Spacecraft Design, Training, and Operations
- Consider Decadal Survey and other Strategic Inputs
- Historically Comparable to 1965 Woodshole Conference for Apollo
Context of NASA’s Return to the Moon

• Redevelop a Deep Space Operational Infrastructure and Discipline
• Define the Distribution of Potential Lunar Resources
• Establish an Infrastructure for Technical and Operational Testing of Architectural and Operational Options for Mars Exploration
• Answer Major Questions Related to Lunar Exploration Science, Lunar Science, and Lunar-Based Science
• Define / Answer New Science Questions
Lunar Science is Left to Do?

• Testing of Giant Impact Hypothesis
  (That We Know About)
• Age(s) of Extremely Large Basin(s)
• Testing of Impact “Cataclysm” Hypothesis
  – Calibration of Hadean (Earliest Pre-Cambrian)
  – Impact History of Earth and Inner Solar System
• Global Delineation of Internal Structure of the Moon
  – Extent of Magma Ocean
  – Distribution of Mg-Suite Parent Igneous Bodies in the Crust
  – Original Distribution of Magma Ocean Residual Liquid (urKREEP)
  – Structure / Compositional Details of Upper Mantle
  – Lower Mantle Characteristics / Mapping of Upper and Lower (Core) Boundaries
What Science is Left to Do?

• Timing of Lunar Core Formation and Dynamo Circulation

• Global Sampling / Remote Sensing Correlations of Major Geological and Geochemical Units

• Depositional History of Polar Cometary Volatiles

• Determination of Resource Distribution & *In Situ* Concentrations, Particularly at the Poles

• Testing of Mars Sampling Systems and Strategies

• Lunar-Based Instrumentation Networks
  – Seismometers / Retro-reflectors / Magnetometers / Etc.
Lunar-Based Science

Planetary Sciences

• Very Low Pressure Clathrate Experimentation (Europa And Mars)

• Martian Field Exploration Systems and Approaches

• Other?
Heliophysics

- Lunar-Based Instrumentation
  - Sun
  - Solar Wind
  - Solar Wind-Magnetosphere interaction
  - Solar Wind Lunar surface interaction
- Regolith and Ejecta Blanket Stratigraphy
  - Solar Wind Composition and Energy over Time
- Other?
Astrophysics

• Potential Role for the Moon as Observatory Platform
  – Radio-astronomy
  – Constant view Polar observations

• Information for Evaluation of Designs of Potential Lunar-based Observatories
  – Additional Characterization of Lunar Environment
    • Dust Migration / Precipitation / Rejection
    • Geotechnical Parameters for Construction
    • Seismic Stability
  – Protection of Critical Systems
    • Dust (Note Apollo Retro-reflector Stability)
    • Thermal Cycling
    • Vacuum
    • Radiation

• Galactic and Solar Radiation History
  – Regolith and Ejecta Blanket Stratigraphy

• Other ?
Earth Sciences

- Lunar-Based Instrumentation
  - Multi-spectral, Multi-sensor Global Observation
- Astrobiological Refinement of Bio-signature (e.g. “Red edge”)
- Magnetospheric Physics
- Educational Initiatives
- Other?
Planetary Protection

- Testing of Systems and Strategies in an Extreme Environment
  - Sample Container Sealing
  - Container Dust Containment
  - Microbe & Molecular Viability
  - Other?
Examples of Lunar Architecture Constraints

• Site Selection
• Payload “Envelope”
• Exploration Enhancement
• Mobility Enhancement

• (ESMD Working on the Return to the Moon Architecture)
Site Selection Considerations

- Pinpoint Landing Capability
- Future Location of Permanent Lunar Operations
- Resources Exploration
- Exploration Science
- Lunar Science
- Lunar-Based Science
- Mars Simulations
Payload “Envelope”

- Mass
- Stowage
- Power
- Stay-time
- Crew Skills

- Communications
- Computation
Exploration

Stay-Time

Suit / Glove Mobility and Capability

Crew Experience and Training

Robotics Integration

Work Cycles

Dust vs. Habitat

Long-term Physiological Adaptation
Mobility

Dust

Rover Consumables

Rover Analytical Systems

Radiation Protection

Lunar Flyers

Mars Rover Tests
Why Return to the Moon?

• Satisfy basic human instincts for exploration
  – Freedom, betterment, curiosity
  – New homelands, trade, and knowledge

• Continue over 150,000 years of exploration’s benefits
  – New homes, livelihoods, know-how, resources
  – Supported by both government and private initiatives

• Perpetuate exploration and settlement of space
  – Comparable to past migrations into a global habitat
  – Opportunity for the expansion of free institutions