National Aeronautics and Space Administration

Briefing to the Committee on Biological and Physical Sciences in Space

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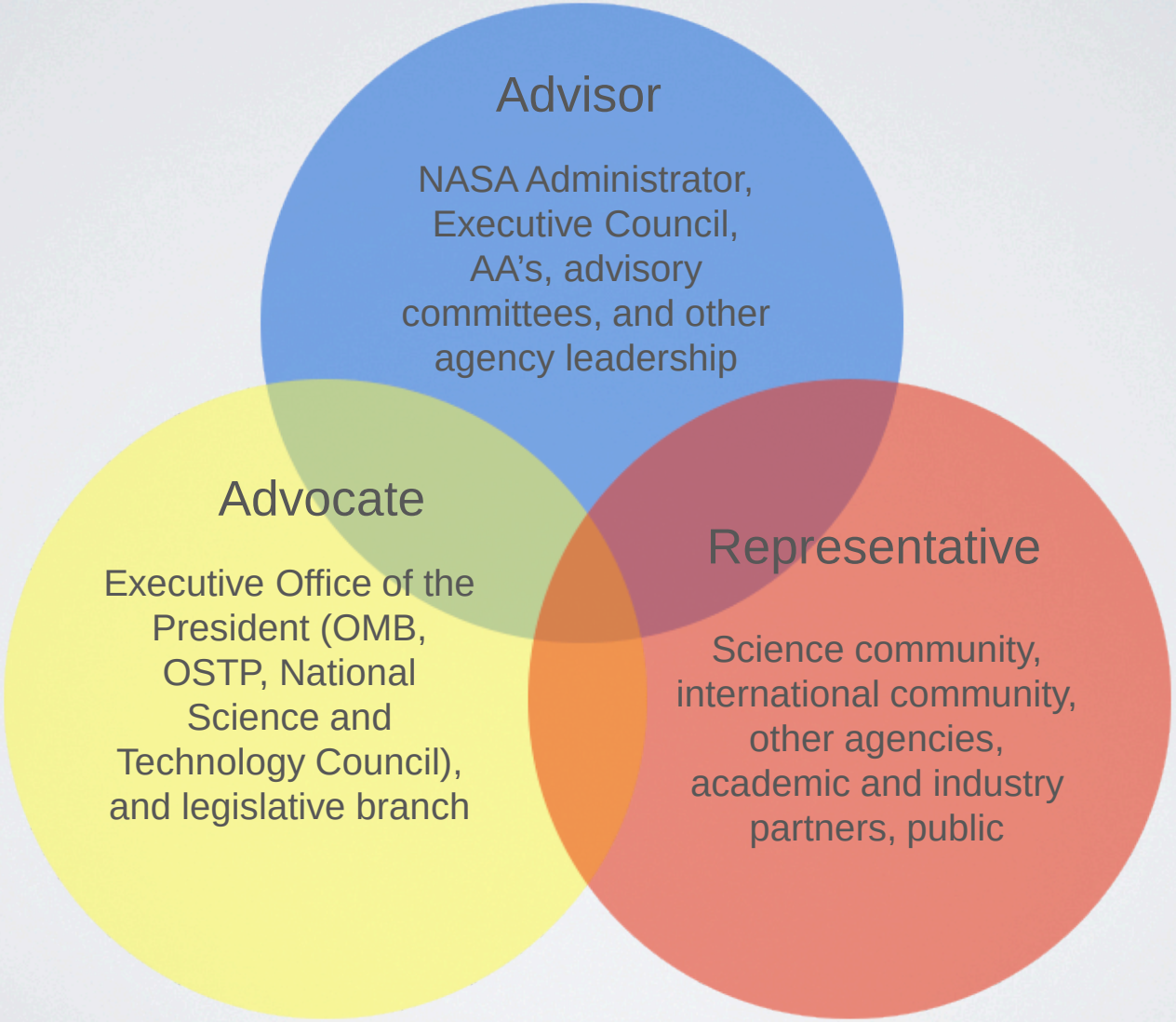
Topics

- Role of Chief Scientist at NASA
- Status of Office of the Chief Scientist
- Office of Science and Technology Policy
- Lunar Science Workshop Update
- 45- Day Report to the National Space Council

Role of the Chief Scientist



INTRA-DEPENDENCE
- INTERNAL -

• Working with Office of the Chief Technologist to ensure science requirements and technology development are tightly coupled

• Working with center and HQ leadership to preserve scientific integrity across all NASA funded research

• Working across directorates to ensure opportunities for leveraging dollars across all science disciplines are identified and implemented

• Working with the Communications Coordinating Council to communicate the value of NASA science, and build bridges to ensure all science disciplines are highlighted

• Serving on the NASA Executive Council making cross-cutting decisions on budget and portfolio content across the Agency

•Advising the NASA Administrator on strategic investment decisions

INTERDEPENDENCE
- EXTERNAL -

• Work with OSTP on issues related to public access to federally funded scientific research data and results, digital data management, and government-wide science policies

• Participate on National Science and Technology Council committees on topics including federal use of ISS, synthetic biology, and scientific collections

• Interface with the science community to communicate and listen to concerns regarding NASA's plans toward implementation of decadal surveys

• Interface with the international community to communicate NASA's overall science strategy and encourage collaboration

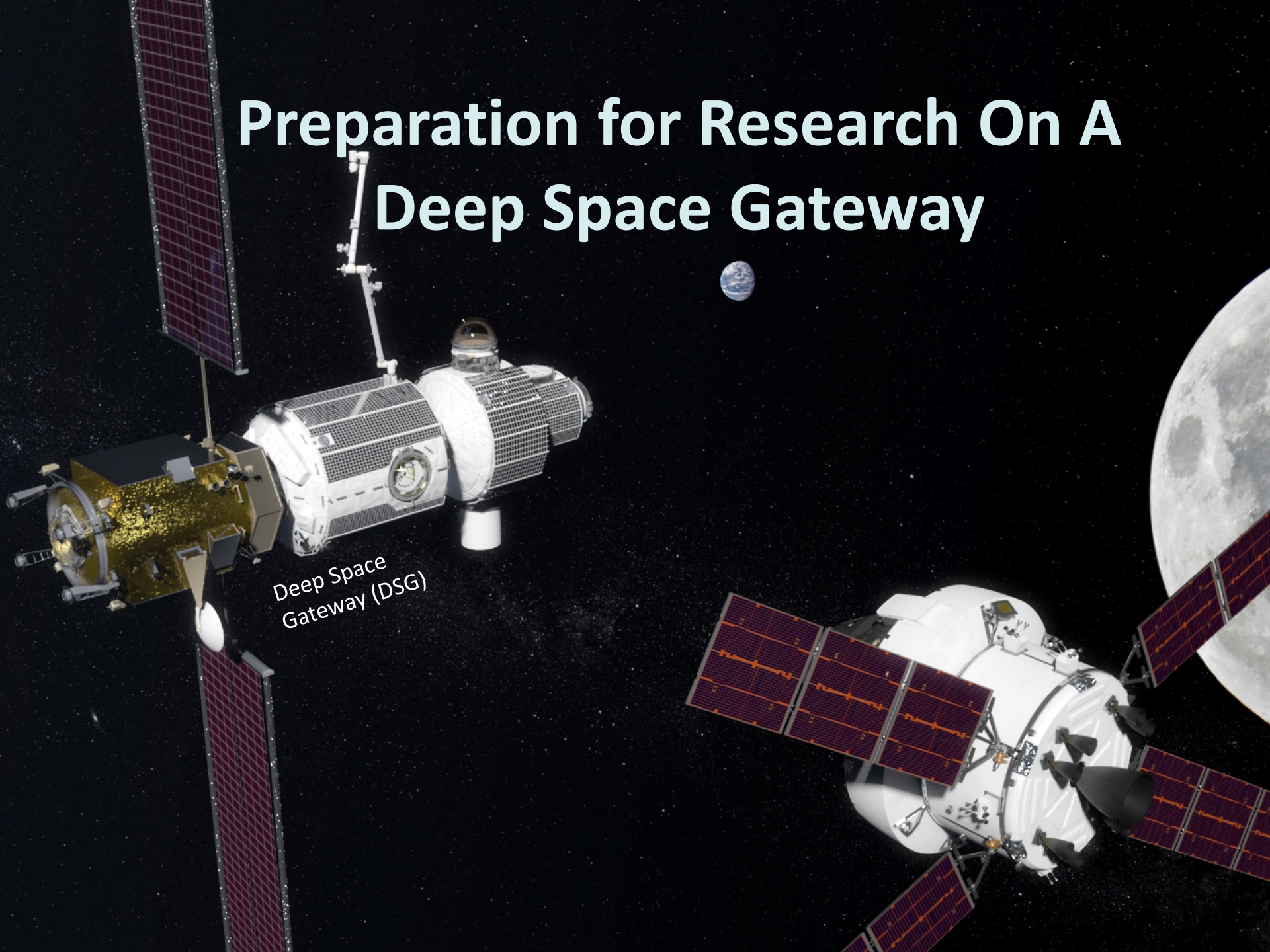
• Listen to and interfacing with the public to understand where public interest, concern and support lie for NASA's science investments

- **Status of the Chief Scientist Office**
  - Chief Scientist and Chief Technologist are selected by the Administrator
  - OCS office staff of six
  - In meantime –
    - Included diversity and inclusion statement in all solicitations
    - Updated policy directive to emphasize D&I in research
    - Benchmarked other agencies and provided NASA with recommendations to improve the peer review process including ‘just in time’ unconscientious bias training (video) and using post docs for executive secretaries to gain experience and increase the pool
    - Implemented agency-wide demographic survey and drafted first report on demographic survey results wrt grant selection
    - Updated policy directive on scientific integrity
    - Provided recommendations to Acting Administrator on placement of Planetary Protection Officer
    - Co-chaired internal study on long-term research demand in LEO

Office of Science and Technology Policy and Committees

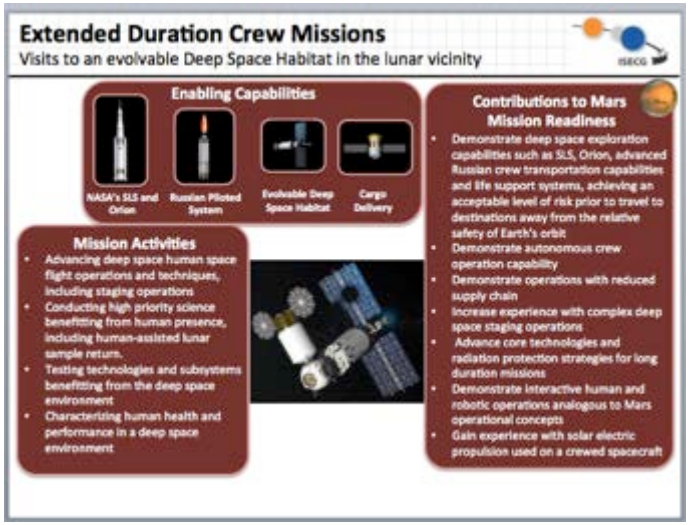
- **Beginning build up of OSTP (135 under prior Administration; currently at 41)**
- **The National Science and Technology Council (NSTC) (charter renewed)**
- **Not clear on committees of the NSTC like Committee on Science, Committee on Technology and their subcommittees such as Life Sciences (LSSC) and Physical Sciences (PSSC)**
  - LSSC meeting in September decision was to allow the charter expire in December
  - IWG drafted microbiome and expect to publish it soon
- The subcommittee overseeing U.S. Global Change Research Program charter was extended for six months (Oct 2017)

Preparation for Research On A Deep Space Gateway



Science Enabled by Humans at a Deep Space Gateway in the Lunar Vicinity

- **Lunar Surface Science using Telerobotics**
  - Facilitate access to challenging regions by low-latency telerobotics (e.g. permanently shadowed crater floors)
  - Set up surface instrumentation
- **Human-assisted lunar sample return**
  - Increased return through more and improved selection of lunar samples
  - Only need to get samples to the Deep Space Habitat, not all the way to Earth. They are returned with the crew in the Orion
- **Staging post for human/robotic missions**
  - Could provide repeat access with a reusable lander
  - Can act as a fuel/maintenance depot
- **Understand combined effects of radiation/fractional-gravity**
- **Additional Science Opportunities**
  - Astronomical Observations
  - Fundamental Physics
  - Collecting Interplanetary Material
  - Heliophysics
  - Monitoring Earth's Atmosphere
  - Deep Space Habitat as a Comm Relay
    - Enables government/commercial farside exploration
    - Lowers the bar for improved cubesat exploration



The lunar vicinity may not be the "ideal" location for all types of science instruments, yet the presence of humans and their associated infrastructure provides opportunities can yield Decadal relevant science

Human Exploration and Operations

Deep Space Gateway Functionality

- Assumptions
  - Deep Space Gateway provides ability to support multiple NASA, U.S. commercial, and international partner objectives in Phase 1 and beyond
  - The Gateway is designed for deep space environments
    - Supports (with Orion docked) crew of 4 for total mission up to 42 days
    - Supports buildup of the Deep Space Transport
- Emphasis on defining early Phase 1 elements
  - Gateway Power Propulsion Element
  - Gateway Habitat
  - Logistics Strategy
- Future work to refine later elements; early feasibility trades complete
  - Airlock
  - Deep Space Transport

External Instruments

- DSG can enable discoveries in a wide variety of scientific disciplines by facilitating the use of externally mounted instruments
  - Earth Science, Heliophysics, Astrophysics, Lunar Science, Dust/Particle Collection
  - Depending on the Goals instruments will need to look in multiple directions

- *Potential Resources:*
  - Multiple mounting points in a variety of look directions
  - Mounting points need to provide power, data etc
  - Constraint not to contaminate regions around the instruments
  - Ability to satisfy a TBD vibration requirement
    - Possibly handled by the mounting mechanism

Instruments Inside the DSG

- DSG can facilitate science by hosting instruments inside the pressurized modules
- Location of DSG outside the Val Allen belts enables research not possible on ISS
- Can study the combined effects of deep space radiation and fractional gravity

- *Potential Resources:*
  - Dedicated volume for instruments
  - Optical quality window
  - Varying amounts of power/data etc
  - Potentially other resources such as vacuum line, or certain gases
  - Crew time for either set up and/or operation

Ability to Receive & Store Planetary Samples

- DSG can facilitate science by having the ability to receive and ingress samples from outside the DSG
- Samples could be collected/delivered robotically
  - Lunar/asteroid/Mars
- Samples could be acquired at the DSG
  - Long-duration exposure collectors for interplanetary particles
- Lunar polar samples might be cryogenic
- Mars samples would have planetary protection requirements

- *Potential Resources:*
  - Airlock large enough to ingress sample-return containers
  - Robotic arm in proximity to airlock
  - Volume space within the DSG to store samples
    - Potentially with cryogenic or planetary protection constraints
  - Capability to return samples to Earth

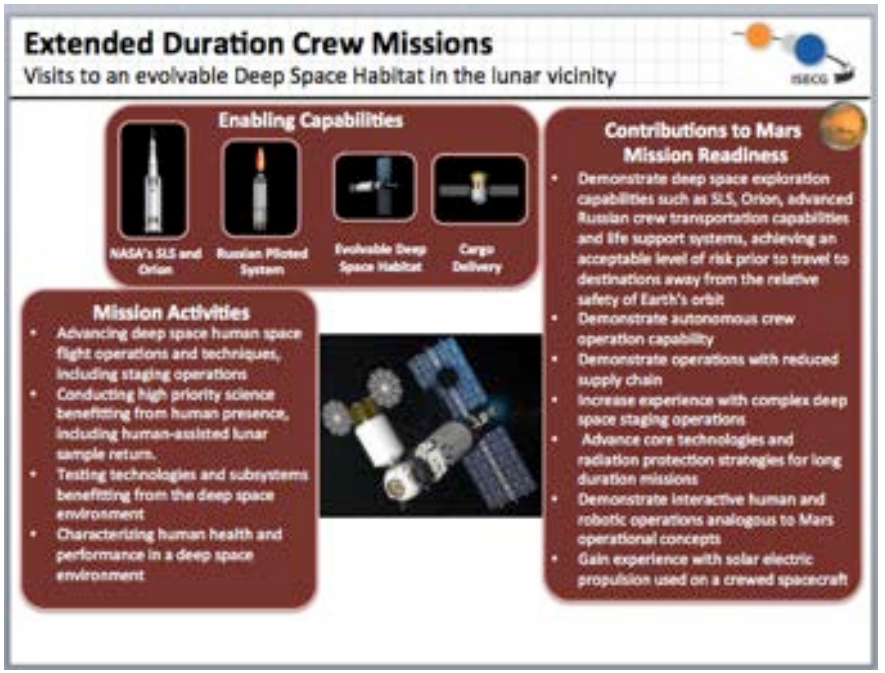
Using DSG Infrastructure

- Cubesat Deployer
  - Take advantage of time-critical events
- Communication relay for cubesats, surface assets
  - Reduce cubesat comm requirements
  - Act as farside relay for surface missions
- Low-latency Telerobotics
  - Human-assisted lunar sample return
  - Telescope construction/servicing

- *Potential Resources:*
  - Steerable high-data rate communications systems
  - Ability to store, and forward, large amounts of data
  - Internal telerobotics infrastructure
    - Screens, joysticks, etc

Deep Space Gateway (DSG) Science Study

- We are conducting a study to determine in more detail what high-quality science can be conducted from a DSG, and what level of resources are required
  - Study consists of NASA personnel from NASA centers as well as scientists from academia
- Revisit the considerations addressed in the internationally developed Science White Paper from a broad NASA perspective
  - Consider what Decadal science can be achieved by research on a DSG
  - What Strategic Knowledge Gaps (SKGs) can be closed
- Consider all relevant scientific disciplines
  - Astronomical Observations
  - Collecting Interplanetary Material
  - Heliophysics
  - Earth's Atmosphere
  - Fundamental Physics
  - Life Sciences
  - DSG as a Communications Relay
    - Enable lunar cubesats
  - Lunar Surface Science Using Telerobotics
    - Roving or instrument setup
- Instrument Scope
  - Scale of resources that instruments need?
- Community Workshop Format



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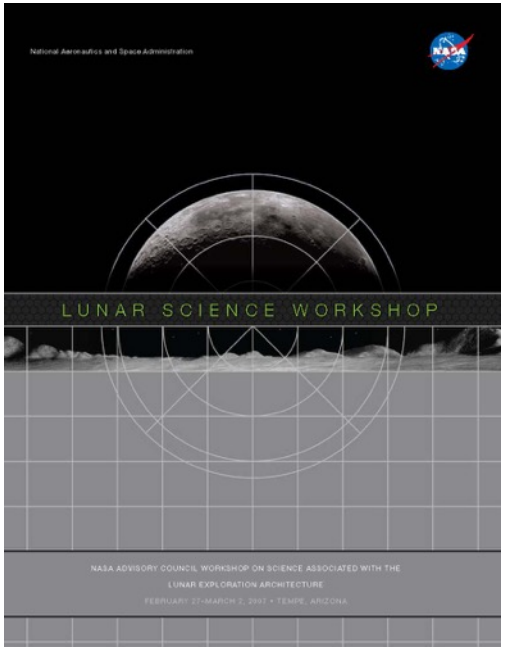
Workshop Format

- Based on the successful Tempe Lunar Science Workshop held in 2007
- Attendance will be by invitation only based on an open call for presentations
  - Scientists, engineers, program managers, and decision/policy makers from NASA, academia, industry, and international organizations
- Two types of sessions: discipline-focused splinter sessions and group discussions
  - The bulk of the workshop will consist of parallel discipline-focused splinter sessions, during which potential science areas enabled by exploration are presented, discussed, and eventually synthesized to instrument concepts
  - Also have cross-cutting sessions, e.g. cubesats
  - Final plenary session to summarize results and discuss the next strategic steps for how workshop content will be captured and disseminated



Tentative Schedule and Logistics

It will be a working meeting; a few briefings and a lot of discussion

Invitation only

Date: February 27 – March 1

Where: Denver Area

Format:

- **Five Parallel Breakout Sessions (~ 40-50 attendees per session)**
  - Earth Sciences
  - Heliophysics
  - Astrophysics
  - Planetary Sciences
  - Space Life and Physical Sciences
- **Questions To deliberate**
  - How will the DSG enable your research?
  - What resources are needed (power, crew time, etc)?
  - Use of cubesats

National Space Council 45 Day Report

- NASA is working on a plan for an innovative and sustainable program of exploration with commercial and international partners to enable human expansion across the solar system, returning humans to the Moon for long-term exploration and utilization, followed by human missions to Mars and other destinations.

- Led by NASA, but is broader, and leverages private sector initiatives as much as possible.

- The direction builds on the work we have already been doing on the Space Launch System rocket and Orion spacecraft

- Enhances our existing cooperation and coordination between science and exploration efforts

- We also are studying how an orbital gateway or outpost, and lunar robotic activities could support a sustained cadence of robotic and human missions, as well as ensuing human missions to the lunar and Mars surfaces, and other destinations.

Thank you!