Strategic Knowledge Gaps:
Enabling Safe, Effective, and Efficient Human Exploration of the Solar System

Integration of Analysis/Assessment Group Results

July 10, 2012
Presentation to the Small Bodies Assessment Group

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Status and Way Forward

♦ Based on the draft version of the Strategic Knowledge Gaps created by the Human Spaceflight Architecture Team (HAT)...
  • NASA will engage the external Science and Exploration communities to vet and refine the SKGs.
    – Lunar Exploration Analysis Group (Specific Action Team phase 2 results complete; report available on LEAG website)
    – Mars Exploration Program Analysis Group (Precursor Strategy Analysis Group, P-SAG, final report being vetted, interim report available on MEPAG web site)
    – Small Bodies Assessment Group (SKG-SAT in progress; final report due shortly)
  • NASA will establish traceability of the SKGs to its currently planned robotic missions, utilization of ISS, and known opportunities for Research and Analysis efforts, and exploitation of existing ground based assets. (In process)

♦ Next Step: Integrate results of LEAG, MEPAG, and SBAG using a Specific Action Team comprising membership from all three groups
  Begin following the delivery of analysis/assessment group final reports

♦ Schedule: To be negotiated with the SAT chair and the chairs of the analysis/assessment groups
International Coordination of Strategic Knowledge Gaps

- The Strategic Knowledge Gap Assessment Team (SKGAT) has been formed within the Exploration Roadmap Working Group of the International Space Exploration Coordination Group (ISECG) (Chaired by M. Wargo)

- It has begun the process of identifying, prioritizing and time phasing an “international set of SKGs” tied to the Global Exploration Roadmap mission scenarios, Asteroid First, and Moon First

- The NASA set of draft SKGs have been used as the starting point for the assessment

- The SKGs for Moon, Near Earth Asteroids, and Mars are being vetted by the team member agencies (CNES, CSA, ESA, JAXA, NASA)
  - For content
  - For alignment with existing and planned missions
International Coordination of Strategic Knowledge Gaps (cont’d)

- Prioritization criteria and methodology have been formulated
- Test cases for prioritization are being run based on the criteria to evaluate prioritization criteria

- The prioritized “international set of SKGs” will be incorporated into the next revision of the Global Exploration Roadmap
  - Work will be complete prior to the next ISECG meeting to be held at ESA/ESTEC October 9-12, 2012
Backup
Informing Exploration: Strategic Knowledge Gaps

♦ **To inform mission/system planning and design and near-term Agency investments**
  - Human Spaceflight Architecture Team (HAT) Destination Leads were asked to identify the data or information needed that would reduce risk, increase effectiveness, and aid in planning and design
  - The data can be obtained on Earth, in space, by analog, experimentation, or direct measurement

♦ **For some destinations, the needed knowledge is well identified**
  - Analysis Groups, such as LEAG and MEPAG, have identified pertinent measurements to gain the needed knowledge regarding the Moon and Mars
  - Significant advances in filling the knowledge gaps have been made (examples: LRO and MRO, and soon, MSL)

♦ **The Strategic Knowledge Gaps (SKGs) identified here represent an informed and systematic look at anticipated needs**
  - Inputs and comments from other agencies are welcome in order to provide for an international discussion during the January ISECWG Workshop

♦ **The SKGs will also form the basis for near-term NASA investments in robotic precursor missions through Announcements of Opportunity (AO), competed and secondary missions, etc. A few examples include:**
  - New Frontiers 4 AO
  - Discovery 13 AO
  - NASA Lunar Science Institute Cooperative Agreement Notice
  - LASER (Lunar Advanced Science and Exploration Research) and SALMON (Stand Alone Missions of Opportunity Notice) calls
  - Development of early flight opportunities
Common Themes and Some Observations

♦ There are common themes across destinations (not in priority order)
  • The three R’s for enabling human missions
    – Radiation
    – Regolith
    – Reliability
  • Geotechnical properties (Moon, NEAs, Mars)
  • Volatiles (i.e., for science, resources, and safety) (Moon, NEAs, Mars)
  • Propulsion-induced ejecta (Moon, NEAs, Mars)
  • In-Situ Resource Utilization (ISRU)/Prospecting (Moon, NEAs, Mars)
  • Operations/Operability (all destinations, including transit)
  • Plasma Environment (Moon, NEAs)
  • Human health and performance (all destinations, including transit)

♦ Some Observations
  • The required information is measurable and attainable
  • These measurements do not require “exquisite science” instruments but could be obtained from them
  • Filling the SKGs requires a well-balanced research portfolio
    – Remote sensing measurements, in-situ measurements, ground-based assets, and research & analysis (R&A)
    – Includes science, technology, and operational experience