Tuesday, October 10, 2017
OVERVIEW
8:30 a.m. USRA Conference Center

Chairs: **Samuel Lawrence**
Clive Neal

8:30 a.m. Lawrence S. J. *
Welcome

8:35 a.m. Neal C. R. *
LEAG Update

8:50 a.m. Crusan J. *
Advanced Exploration Systems

9:10 a.m. Williams G. *
HEOMD Update

9:30 a.m. Bussey B. *
ISECG White Paper, KPLO

9:45 a.m. Suzuki N. *
Lunar Volatiles Initiative

10:00 a.m. DISCUSSION

10:15 a.m. *Break*

10:30 a.m. Abbud- Madrid A. *
The 2017 Space Resources Roundtable and New Space Resources Graduate Program at Colorado School of Mines **[#5091]**
For eighteen years, SRR has brought together interested individuals from the space exploration community, the mining and minerals industries, and the financial sector to discuss issues related to the ISRU of lunar, asteroidal, and martian resources.

10:45 a.m. Conley C. *
Planetary Protection and the Moon

11:00 a.m. Ju G. *
Korean Space Program Update

11:15 a.m. Carpenter J. D. *
ESA's Journey to the Moon **[#5009]**
To assure future access to the fundamental capabilities needed to get humans to the Moon in a sustainable way, ESA is developing technologies, planning missions, and building international and public-private partnerships.

11:30 a.m. Hipkin V. J. * Picard M. Haltigin T. Gonthier Y. Lange C. Jean P.
Canadian Space Agency Activities and Science Priorities Related to Lunar Surface Exploration **[#5054]**
Canadian Space Agency activities: Canadian science priorities for lunar surface exploration, rover technology development, mission concept study for rover element of lunar sample return.

11:45 a.m. Wang Q. Xiao L. *
China's Lunar Exploration Programme **[#5092]**
Update on China's lunar program.

12:00 p.m. Masuda K. Sato N.
Japanese Space Program Update **[#5093]**
JAXA's overall moon exploration scenario, including the water utilization.

12:15 p.m. *Lunch*

Tuesday, October 10, 2017
ONGOING AND PROPOSED MISSIONS
1:30 p.m. USRA Conference Center

Chairs: **Noah Petro**
Dana Hurley

1:45 p.m. Petro N. E. * Keller J. W.
The Lunar Reconnaissance Orbiter: A Focused Study of Fundamental Solar System Processes at the Moon **[#5045]**
The LRO mission is midway through a two-year extension, to study the fundamental processes recorded on the Moon. LRO's instruments are measuring processes that operate at the Moon and throughout the solar system, especially on airless bodies.

2:00 p.m. Keller J. W. * Petro N. E.
Building on the Cornerstone Mission: Focused LRO Workshops to Support Science Team Synergies **[#5049]**
During the Cornerstone Mission, the LRO instrument teams have identified a number of key science themes that drive their observations during the extended mission. These themes serve as a basis for the identification of the thematic workshops.

2:15 p.m. Blewett D. T. * Hurley D. M. Denevi B. W. Cahill J. T. S. Klima R. L. Plescia J. B. Paranicas C. P. Greenhagen B. T. Tunstel E. W. Anderson B. A. Korth H. Ho G. C. Nunez J. I. Hibbitts C. A. Stanley S. Jozwiak L. Daly T. Johnson J. R. Zimerman M. I. Brandt P. C. Westlake J. H.
Science from the Surface of the Moon: A Rover Traversing a Crustal Magnetic Anomaly **[#5013]**
An in situ investigation of a magnetic anomaly would directly address major sets of questions in planetary magnetism, space plasma physics, lunar geology, space weathering, and the lunar water cycle, as well as human exploration SKGs.

2:30 p.m. Kramer G. Y. *
Science Enabled by Getting to a Swirl **[#5027]**
The bright, optically immature, curvilinear, magnomaphile surface features known as lunar swirls should be the target of the next lunar mission.

2:45 p.m. Cohen B. A. *
The Onset of the Cataclysm: In Situ Dating of the Nectaris Basin Impact Melt Sheet **[#5051]**
The impact history of the Moon has significant implications for solar system dynamics and evolution. We are working on a potential Discovery mission concept that would directly constrain the onset of the cataclysm by dating the Nectaris Basin.

3:00 p.m. Anderson F. S. * Levine J. Whitaker T. J.
Pb-pb Dating for Miller Range 05035, La Paz Icefield 02205, and Northwest Africa 032 Using CODEX **[#5082]**
We have produced new Pb-Pb dates of Miller Range 05035, La Paz Icefield 02205, and Northwest Africa 032 using CODEX, illustrating how in-situ dating can assess age and isotopic reservoirs.

3:15 p.m. Radebaugh J. Archinal B. * Beyer R. DellaGiustina D. Fassett C. Gaddis L. Hagerty J. Hare T. Laura J. Lawrence S. Mazarico E. Naß A. Patthoff A. Skinner J. Sutton S. Thomson B. J. Williams D.
MAPSIT and a Roadmap for Lunar and Planetary Spatial Data Infrastructure **[#5053]**
We describe MAPSIT, and the development of a roadmap for lunar and planetary SDI, based on previous relevant documents and community input, and consider how to best advance lunar science, exploration, and commercial development.

3:30 p.m. *Break*

3:45 p.m. Clark P. E. * Malphrus B. McElroy D. Schabert J. Wilczewski S. Farrell W. Brambora C. Macdowall R. Folta D. Hurford T. Patel D. Banks S. Reuter D. Brown K. Angkasa K. Tsay M.
Lunar Ice Cube: Development of a Deep Space Cubesat Mission **[#5021]**
Lunar Ice Cube, a 6U deep space cubesat mission, will be deployed by EM1. It will demonstrate cubesat propulsion, the Busek BIT 3 RF Ion engine, and a compact instrument capable of addressing HEOMD Strategic Knowledge Gaps related to lunar volatiles.

4:00 p.m. Hibbitts C. A. * Blewett D. Brandt P. Burke L. Clyde B. Cohen B. Dankanich J. Hurley D. Klima R. Lawrence D. Patterson W. Plescia J. Sunshine J. Westlake J.
The Lunar Water Assessment Transport Evolution and Resource (WATER) Mission Concept Study **[#5031]**
We will describe the Lunar Water Assessment Transport Evolution and Resource mission concept study that is funded under the NASA PSDS3 program.

4:15 p.m. Lucey P. G. * Petro N. E. Hurley D. Farrell W. Sun X. Green R. Greenberger R. Cameron D.
The Lunar Volatiles Orbiter: A Lunar Discovery Mission Concept **[#5048]**
The Lunar Volatiles Orbiter is a discovery-class mission concept which leverages the spacecraft design and operations experience of LRO. LVO is aimed at understanding the current state of volatiles on the Moon with an emphasis on current dynamics.

4:30 p.m. Elphic R. C. * Colaprete A. Andrews D. R.
Resource Prospector, the Decadal Survey, and the Scientific Context for the Exploration of the Moon **[#5076]**
The ISRU-focused Resource Prospector mission will address key questions about lunar polar volatiles set out in the Decadal Survey, as well as goals in the Scientific Context for the Exploration of the Moon.

4:45 p.m. Colaprete A. * Elphic R. Andrews D. Trimble J. Bluethmann B. Quinn J. Chavers G.
Resource Prospector: Evaluating the ISRU Potential of the Lunar Poles **[#5025]**
This talk will provide an overview of the Resource Prospector mission with an emphasis on mission goals and measurements, and will provide an update as to its current status.

5:00 p.m. MacDowall R. J. * Burns J. O.
Science and Antenna Array Trade Studies for Low Frequency Radio Observatories on the Lunar Surface **[#5062]**
A “low-frequency” radio astronomy observatory on the lunar surface would serve to address science goals that cannot be achieved by ground-based observatories. We describe status and plans for such an observatory.

5:15 p.m. DISCUSSION OF PRELIMINARY FINDINGS

Tuesday, October 10, 2017
LEAG ANNUAL MEETING POSTERS
5:30 p.m. USRA Education Gallery

Gaddis L. R. Boardman J. Malaret E. Besse S. Weller L. Edmundson K. Kirk R. Archinal B. Sides S.
The Status of Restoration of Moon Mineralogy Mapper Data **[#5074]**
We present an update on the status of our geometric and geodetic restoration of the Moon Mineralogy Mapper data.

Nagihara S. Nakamura Y. Williams D. R. Taylor P. T. McLaughlin S. A. Hills H. K. Kiefer W. S. Weber R. C. Dimech J.-L. Phillips D. Nunn C. Schmidt G. K.
Recent Achievement by the SSERVI ALSEP Data Recovery Focus Group **[#5017]**
We report recent research progress made by the SSERVI ALSEP Data Recovery Focus Group.

Horchler A. D. Cunningham C. Jones H. L. Arnett D. Fang E. Amoroso E. Otten N. Kitchell F. Holst I. Rock G. Whittaker W.
Field Test of Route Planning Software for Lunar Polar Missions **[#5041]**
A novel field test paradigm has been developed to demonstrate and validate route planning software in the stark low-angled light and sweeping shadows a rover would experience at the poles of the Moon. Software, ConOps, and test results are presented.

Livengood T. A. Chin G. Mitrofanov I. G. Boynton W. V. Harshman K. P. Litvak M. L. McClanahan T. P. Sagdeev R. Z. Sanin A. B. Starr R. D. Su J. J.
Constructing Lunar Neutron Flux Maps with LRO/LEND Sensor Field of View **[#5078]**
Neutron instrumentation is essential to characterize the quantity and location of hydrogen-rich deposits in lunar regolith as well as iron-group elements. Accurate mapping requires incorporating the spatial resolution of the detection system.

Farrell W. M. Killen R. M. Delory G. T. DREAM2 Team
DREAM2 Studies in Support of Human Exploration of the Moon **[#5036]**
We describe some of the exploration-enabling activities of the DREAM2 team.

Tallaksen A. P. Horchler A. D. Boirum C. Arnett D. Jones H. L. Fang E. Amoroso E. Chomas L. Papincak L. Sapunkov O. B. Whittaker W. L.
CubeRovers for Lunar Exploration **[#5060]**
CubeRover is a 2-kg class of lunar rover that seeks to standardize and democratize surface mobility and science, analogous to CubeSats. This CubeRover will study in-situ lunar surface trafficability and descent engine blast ejecta phenomena.

Ichikawa R.
ispace and the Lunar Missions Ahead **[#5088]**
The presentation will introduce ispace's three-step vision beyond GLXP, the technology that ispace is developing for lunar exploration, and opportunities for the scientific community throughout our mission.

Bhaskaran S. Hopkins J. K.
Astrobotic: Peregrine Lunar Lander Technical Program Update **[#5019]**
This paper describes the latest developments in Astrobotic's lunar lander mission program. Topics addressed here include program updates, technical updates, and a summary of our approach.

Vidra N.
Viability of a Reusable Lunar Lander **[#5004]**
This abstract talks about the viability of a reusable lunar lander and my start-up, Lunar8.

Harris T. H. S.
Transfer and Parse Orbit Momentum Management System Architecture **[#5085]**
Delta V conservative mass transport using orbital tethers at the Moon delivers science and human infrastructure payload mass without need for expendable propulsion as part of the payload platter.

Datta L. V. Guven U. Goel E.
A New Approach Towards Deployment of Far Side Lunar SETI Using a Tethered Link to a Near Side Antenna **[#5040]**
Keeping in pace with the recent growth in interest in deployable space telescopes for detection of extra-solar objects, we suggest a feasible approach to make a lunar far side SETI mission a reality with the technology.available today.

Cahan B. B. C.
A Space Commodities Futures Trading Exchange to Grow the Lunar Economy **[#5008]**
This paper proposes to establish a Space Commodities Futures Trading Exchange in order to define and trade essential commodities that, when traded on an open exchange, improve availability, quality, price discovery, financeability, and equal access.

Blair B. Parr J. Diamond B. Pittman B. Rasky D.
Measuring the Value of AI in Space Science and Exploration **[#5080]**
FDL is tackling knowledge gaps useful to the space program by forming small teams of industrial partners, cutting-edge AI researchers and space science domain experts, and tasking them to solve problems that are important to NASA as well as humanity's future.

Tomic A. Authier L. Blanc A. Foing . H. Lillo A. Evellin P. Kołodziejczyk A. Heinicke C. Harasymczuk M. Chahla C. Hettrich S.
Growing Plants at a MoonMars Base or/and Dedicated External Space **[#5087]**
We developed an experiment growing plants for the human use, as a food or/and additional oxygen/energy source, that could be adapted on a Moon lander.

Goel E. G. Guven U. G.
The Future Lunar Flora Colony **[#5016]**
A constructional design for the primary establishment for a lunar colony using the micrometeorite rich soil is proposed. It highlights the potential of lunar regolith combined with Earth technology for water and oxygen for human outposts on the Moon.

Guven U. G. Goel E. G.
Interaction of Space Radiation with Agriculture on the Moon **[#5015]**
This paper proposes to understand the effects of GCR and SEP on the plants and agriculture, which is the primary step to colonization at any celestial site. This paper is dedicated to achieve this understanding to aid plantation missions on the Moon.

Poppe A. R. Farrell W. M. Halekas J. S.
Charged Particle Weathering Rates at the Moon as Determined from ARTEMIS Observations **[#5007]**
We use a combination of ARTEMIS ion measurements and SRIM simulations to compute the mean ion flux to the Moon and the associated rates of amorphous silicate rim formation on lunar grains. We compare to previous observational and laboratory results.

Hudson D. De Amici G.
Low-Frequency Moon-Based Radio-Interferometer for Earth Studies **[#5059]**
We suggest that the concept of a Moon-based array of microwave antennas and up-gradable electronics, facing the Earth, to measure soil moisture, sea surface salinity, etc. be matured.

Runyon K. D.
Geological Spacesuit Testing **[#5005]**
Adapting terrestrial field geology techniques for use in a spacesuit is a science-exploration synergistic goal that I am able to support as a qualified spacesuit test subject and geologist.

Authier L. Blanc A. Foing B. H. Lillo A. Evellin P. Kołodziejczyk A. Heinicke C. Harasymczuk M. Chahla C. Tomic A. Hettrich S. PMAS Astronauts
MoonMars Astronaut and CapCom Protocols: ESTEC and LunAres PMAS Simulations **[#5071]**
ILEWG developed since 2008 a Mobile Laboratory Habitat (ExoHab) at ESTEC which was tested during a short simulation in July. It was a foretaste of the PMAS mission on 31 July–14 August in LunAres base at Pila, with mission control in Torun, Poland.

McCandless R. S. Burke E. D. McGinley V. T.
Leveraging Virtual Reality for the Benefit of Lunar Exploration **[#5026]**
Virtual reality (VR) and related technologies will assist scientists with lunar exploration and public engagement. We will present the future exponential impact of VR on lunar activities over the coming decades.

Blanc A. Authier L. Foing B. H. Lillo A. Evellin P. Kołodziejczyk A. Heinicke C. Harasymczuk M. Chahla C. Tomic A. Hettrich S.
Logistics for MoonMars Simulation Habitats: ExoHab ESTEC and LunAres Poland **[#5072]**
ILEWG developed within EuroMoonMars research programme since 2008 a Mobile Laboratory Habitat (ExoHab) at ESTEC. Its organization led to logistic concerns our team had to work on. We contributed also to the installation of LunAres in Poland.

Kołodziejczyk A. M. Rudolf A. Gocyła M. Młyńczak M. Wierzejska E. Waśniowski A. Davidova L. Konorski P. Słonina M. Budzyń D. Kuźma J. Ambroszkiewicz G. Harasymczuk M. Foing B. H.
Scientific Outreach of the Lunar Expedition I.0 in the Lunares Habitat in Poland **[#5069]**
Lunares is a chronobiological laboratory to perform advanced studies on humans in controlled MoonMars conditions. Results from The Lunar Expedition I.0 reveal unique properties of the base for future human spaceflight investigation.

Foing B. H. Lillo A. Evellin P. Kołodziejczyk A. Heinicke C. Harasymczuk M. Authier L. Blanc A. Chahla C. Tomic A. Mirino M. Schlacht I. Hettrich S. Pacher T. Maller L. Decadi A. Villa-Massone J. Preusterink J. Neklesa A. Barzilay A. Volkova T.
ILEWG EuroMoonMars Research, Technology, and Field Simulation Campaigns **[#5073]**
ILEWG developed since 2008, "EuroMoonMars" pilot research with a Robotic Test Bench (ExoGeoLab) and a Mobile Laboratory Habitat (ExoHab) at ESTEC. Field campaigns were e.g. in ESTEC, EAC, at Utah MDRS, Eifel, and LunAres base at Pila Poland in 2017.

Evellin P. Foing B. H. Lillo A. Kołodziejczyk A. Authier L. Blanc A. Chahla C. Tomic A.
2017 EuroMoonMars Analog Habitat Preparation at ESTEC **[#5075]**
The 2017 EuroMoonMars analog habitat aims at testing viable concepts of laboratories and habitats to optimize the scientific results of the first crew members of the MoonVillage. The focus is made on developing and testing breakthrough experiments.

Lillo A. Foing B. H. Evellin P. Kołodziejczyk A. Jonglez C. Heinicke C. Harasymczuk M. Authier L. Blanc A. Chahla C. Tomic A. Mirino M. Schlacht I. Hettrich S. Pacher T.
Remote Operation of the ExoGeoLab Lander at ESTEC and Lunares Base **[#5079]**
The ExoGeoLab Lander is a prototype developed to demonstrate joint use of remote operation and EVA astronaut work in analogue lunar environment. It was recently deployed in the new analogue base Lunares in Poland and controlled from ESA ESTEC center.

Neklesa A. Foing B. H. Lillo A. Evellin P. Kołodziejczyk A. Jonglez C. Heinicke C. Harasymczuk M. Authier L. Blanc A. Chahla C. Tomic A. Mirino M. Schlacht I. Hettrich S. Pacher T.
Live from the Moon ExoLab: EuroMoonMars Simulation at ESTEC 2017 **[#5083]**
Space enthusiasts simulated the landing on the Moon having pre-landed Habitat ExoHab, ExoLab 2.0, supported by the control centre on Earth. We give here the first-hand experience from a reporter (A.N.) who joined the space crew.space crew.

Snyder K. Amoroso E. Kitchell F. Horchler A. D.
Robust Navigation for Autonomous Exploration of Extreme Environments from a Free-Flying Platform **[#5043]**
Free flying vehicles have the mobility to explore scientifically interesting extreme environments, such as permanently shadowed regions and lava tubes, but require robust and precise navigation to operate safely and autonomously.

Cheetham B. W.
Development of Mission Enabling Infrastructure — Cislunar Autonomous Positioning System (CAPS) **[#5064]**
Advanced Space, LLC is developing the Cislunar Autonomous Positioning System (CAPS) which would provide a scalable and evolvable architecture for navigation to reduce ground congestion and improve operations for missions throughout cislunar space.

Indyk S. Benaroya H.
Structural Members Produced from Unrefined Lunar Regolith Simulant **[#5032]**
This topic will present data analysis and findings from experimental results from sintered lunar simulant testing for material properties.

Shirley K. A. Glotch T. D. Ito G. Rogers A. D.
Enabling Mid-Infrared Spectral Analysis on the Lunar Surface **[#5033]**
Mid-infrared spectroscopy is a powerful tool in identifying areas of scientific or exploratory interest. Here we demonstrate the necessity of a simulated lunar environment spectral database to be used in conjunction with handheld MIR instruments.

Liu Y. Retherford K. D. Greathouse T. K. Hendrix A. R. Cahill J. T. S. Mandt K. E. Gladstone G. R. Grava C. Egan A. F. Kaufmann D. E. Pryor W. R.
The Far-UV Wavelength Dependence of the Lunar Phase Curve as Seen by LRO LAMP **[#5038]**
In this study we discuss the Far-UV wavelength dependence of the lunar phase curves for sample mare and highlands as seen by the LAMP instrument, and we report current derived Hapke parameters at Far-UV wavelengths for the study areas.

Raut U. Karnes P. L. Retherford K. D. Davis M. W. Patrick E. L. Liu Y. Mokashi P.
Far-Ultraviolet Bidirectional Photometry of Apollo Soil 10084: Laboratory Studies in the Southwest Ultraviolet Reflectance Chamber (SwURC) **[#5050]**
We present new far-ultraviolet bidirectional reflectance spectra of Apollo soil 10084. The FUV spectra this mare soil is featureless, though with a small blue slope. Increased reflectance at high phase imply the grains forward-scatter FUV photons.

Chi P. J.
Magnetic Field Measurements on the Lunar Surface: Lessons Learned from Apollo and Science Enabled by Future Missions **[#5067]**
We discuss the science to be enabled by new magnetometer measurements on the lunar surface, based on results from Apollo and other lunar missions. Also discussed are approaches to deploying magnetometers on the lunar surface with today's technology.

Deitrick S. R. Lawrence S. J.
Integrating Diverse Datasets to Assess Approaches for Characterizing Mare Basalts **[#5039]**
This research utilizes new LROC data to re-evaluate the composition of the mare basalt flows in the Marius Hills Volcanic Complex to provide new insights about the relative ages of the low shields and surrounding flows.

Sehlke A. Kobs Nawotniak S. E. Hughes S. S. Sears D. W. Downs M. T. Whittington A. G. Lim D. S. S. Heldmann J. L.
The Anatomy of the Blue Dragon: Changes in Lava Flow Morphology and Physical Properties Observed in an Open Channel Lava Flow as a Planetary Analogue **[#5057]**
We present the relationship of lava flow morphology and the physical properties of the rocks based on terrestrial field work, and how this can be applied to infer physical properties of lunar lava flows.

Rader E. L. Heldmann J. L.
Lunar Volcanic History from In-Situ Morphological Analyses **[#5056]**
We present a new method requiring no sample collection to assess the thermal evolution of lunar volcanic deposits, providing key information on eruptive history of volcanic areas on the Moon.

Curran N. M. Bower D. M. Cohen B. A.
Near-Surface Age Distribution of Lunar Impact-Melt Rocks **[#5030]**
Grouping impact-melt rocks from Apollo 16 double-drive tube in preparation for age determination of these samples. The study uses a combination of major-element chemistry, mineralogy, and age to understand impact history of Apollo 16 lunar site.

Bower D. M. Curran N. M. Cohen B. A.
Determining the Mineralogy of Lunar Samples Using Micro Raman Spectroscopy: Comparisons Between Polished and Unpolished Samples **[#5047]**
Raman spectroscopy is a versatile non-destructive analytical technique that provides compositional and contextual information for geologic samples, including lunar rocks. We have analyzed a suite of Apollo 16 samples using micro Raman spectroscopy.

Saxena P. Killen R. M. Petro N. E. Airapetian V. Mandell A. M.
Modeling Sodium Abundance Variations in the Lunar Crust: A Likely Proxy of Past Solar System History and a Potential Guide to Close-In Rocky Exoplanets **[#5034]**
The initial sodium budget of the Moon may have been depleted/transported from the surface post-formation. Abundance variations in crustal samples may be a powerful tool towards exploring conditions on the Moon's surface through solar system history.

Creel R.
Coping with Exposure to Temperature Extremes and Dust for Renewed Lunar Exploration **[#5094]**
Based on thermal experiences during previous Apollo Lunar Roving Vehicle missions, this poster addresses two primary challenges for renewed lunar exploration: coping with lunar temperature extremes and lunar dust.

Wednesday, October 11, 2017
SCIENCE-EXPLORATION-COMMERCIAL SYNERGIES
8:30 a.m. USRA Conference Center

Chairs: **Ryan Watkins**
Georgiana Kramer

8:30 a.m. Sampson M. S. *
Launch Services for the Moon **[#5020]**
One of the next frontiers is the Moon. United Launch Alliance (ULA) has extensive experience with launching delicate, exquisite payloads throughout our solar system, including the Moon. ULA's ACES/XEUS provides lunar surface delivery.

8:45 a.m. Hendrickson D. B. * Thornton J. M.
Astrobotic's Payload Delivery Services Enables Lunar Surface Activities **[#5012]**
This paper describes Astrobotic's lunar payload delivery service, along with the latest program developments toward the company's first demonstration of service.

9:00 a.m. Kitchell J. F. * Horchler A. D. Snyder K. Amoroso E.
Astrobotic Research and Development: New Technology for Lunar Science and Exploration **[#5042]**
Astrobotic will present recent work on a range of space robotics technologies relevant to the lunar science and exploration communities.

9:15 a.m. Spudis P. D. * Richards R. D.
The Robotic Architecture of Moon Express: Exploration, Resources, and Delivery **[#5035]**
Moon Express has recently released a planetary exploration architecture that describes a variety of spacecraft configurations that may be combined and configured to carry out a variety of missions to the Moon and in cislunar and deep space.

9:30 a.m. Zuniga A. F. * Turner M. F. Rasky D. J.
Building an Economical and Sustainable Lunar Infrastructure to Enable Lunar Science and Space Commerce **[#5006]**
A new concept study was initiated to examine and analyze architecture concepts for an economical and sustainable lunar infrastructure system that can extend the life, functionality, and distance traveled of surface mobility missions.

9:45 a.m. Kapoglou A. *
Building the Foundations for a Large-Scale, Cross-Sector Collaboration for a Sustainable and Permanent Return to the Lunar Surface **[#5061]**
This presentation will describe how to build the foundations needed for a large scale, cross-industry collaboration to enable a sustainable and permanent return to the Moon based on system leadership, cross-sector partnership, and inclusive business.

10:00 a.m. *Break*

10:15 a.m. Zacny K. * Indyk S.
Technologies for Lunar Exploration **[#5065]**
Honeybee Robotics, with its partners, developed numerous technologies for lunar exploration. Most of these technologies are at high TRL and have been designed for small landers, rovers, as well as astronauts. This abstract presents several of these technologies.

10:30 a.m. Roux V. G. * Roth M. C.
Developing and Testing Lunar Technologies in a Controlled Simulation Lab Using Simulants Built from the Particle Level Up **[#5029]**
Off Planet Research replicated the natural formation processes on the Moon and then fully characterized regolith formation at the particle level, including agglutinates, so these simulants are very close approximations of true lunar regolith.

10:45 a.m. Pittman R. B. * Rasky D. J.
Commercial Enabled Science **[#5010]**
New commercial space capabilities offer the potential to enable new lunar science and space science missions that can be developed quickly, fly frequently, and at greatly reduced cost.

11:00 a.m. Watkins R. N. * Runyon K. Caswell T. E. Ostrach L. R. Jawin E. R. Meyer H. M. Mitchell J. L.
Strategies for Enabling Lunar Exploration: A NextGen Perspective **[#5003]**
The NextGen is passionate about and committed to continued lunar exploration. Here we outline strategies that NextGen believes are important for enabling future lunar exploration, and what role the NextGen will play in these activities.

11:15 a.m. Green J. *
Planetary Science Division Update

11:35 a.m. DISCUSSION

12:00 p.m. *Lunch*

Wednesday, October 11, 2017
RESOURCES AND THE LUNAR ECONOMY
1:30 p.m. USRA Conference Center

Chairs: **Lisa Gaddis**
G. Wesley Patterson

1:30 p.m. Plescia J. B. *
Lunar SKGs: What's Really Needed and What Do We Already Know? **[#5077]**
The distinction between enabling and enhancing SKGs must be maintained. The key unknown is the species, form, and distribution of H in polar regions and it can only be addressed by in situ exploration. The commercial role in resource SKGs is unclear.

1:45 p.m. Blair B. *
Modeling PPP Economic Benefits for Lunar ISRU **[#5081]**
A new tool is needed for selecting the PPP strategy that could maximize the rate of lunar commercialization by attracting private capital into the development of critical infrastructure and robust capability. A PPP model under development for NASA-ESO will be described.

2:00 p.m. Greenblatt J. B. *
Quantifying Elements of a Lunar Economy Based on Resource Needs **[#5018]**
We model a simplified lunar economy from human life support, Earth materials consumption, and energy and propulsion requirement estimates, constrained by lunar elemental abundances; estimate likely imports/exports and "gross interplanetary product."

2:15 p.m. Ho K. * Chen H.
Space Transportation Network Analysis for Cislunar Space Economy with Lunar Resources **[#5089]**
This work provides a transportation network analysis of lunar exploration architecture and cislunar mission design with lunar in-situ resource utilization (ISRU).

2:30 p.m. Schmitt H. H. *
Drilling Regolith: Why Is It So Difficult? **[#5028]**
The Apollo rotary percussive drill system penetrated the lunar regolith with reasonable efficiency; however, extraction of the drill core stem proved to be very difficult on all three missions. Retractable drill stem flutes may solve this problem.

2:45 p.m. Paulsen G. Zacny K. * Kleinhenz J. Smith J. Quinn J. Kim D. Mank Z. Wang A. Thomas T. Hyman C. Mellerowicz B. Yaggi B. Fitzgerald Z. Ridilla A. Atkinson J.
Development and Testing of a Lunar Resource Prospector Drill **[#5066]**
We present update on development and testing of a sampling drill for the Resource Prospector mission.

3:00 p.m. Jordan A. P. * Wilson J. K. Schwadron N. A. Spence H. E.
Synthesizing Surface and Subsurface Measurements of Water Ice in the Polar Regions of the Moon **[#5022]**
Though surface and subsurface data may disagree about the location of water ice near the lunar poles on small scales, we show they are well-correlated on very large scales, with water ice being distributed down to about ±70 degrees latitude.

3:15 p.m. *Break*

3:30 p.m. Cataldo R. L. * Kleinhenz J. E. Sanders G. B.
Technology Demonstration of Extended Operations for Volatile Prospecting and Processing in Lunar Permanently Shadowed Regions Enabled by Advanced Radioisotope Power **[#5063]**
An extended demonstration mission for the purpose of validating advanced radioisotope power system in concert with ISRU systems in a permanently shadowed region.

3:45 p.m. Wilson J. K. * Schwadron N. A. Jordan A. P. Looper M. D. Zeitlin C. Townsend L. W. Spence H. E. Legere J. Bloser P. Farrell W. Hurley D. Petro N. Stubbs T. J. Pieters C.
Diurnal Variation of Lunar Albedo Proton Yield and Hydrogenation **[#5037]**
The quantity of hydrogen or hydrogen-bearing molecules in the top ~10 cm of lunar regolith may vary significantly with local time, according to albedo proton data collected by LRO/CRaTER.

4:00 p.m. Mandt K. E. * Mazarico E. Greathouse T. K. Byron B. Retherford K. D. Gladstone G. R. Liu Y. Hendrix A. R. Hurley D. M. Stickle A. Patterson G. W. Cahill J. Williams J.-P.
LRO-LAMP Observations of Illumination Conditions in the Lunar South Pole Permanently Shaded Regions **[#5023]**
LRO-LAMP is able to observe scattered sunlight within the south pole PSRs. We compare these observations to illumination models and other LRO datasets.

4:15 p.m. Patterson G. W. * Carter L. M. Stickle A. M. Cahill J. T. S. Nolan M. C. Morgan G. A. Schroeder D. M. Mini-RF Team
Mini-RF S- and X-Band Bistatic Radar Observations of the Moon **[#5046]**
Mini-RF is operating in concert with the Arecibo Observatory and the Goldstone DSS-13 antenna to collect bistatic radar data. We will provide an update on science questions being addressed by the Mini-RF team in the current LRO extended mission.

4:30 p.m. Li S. * Lucey P. G. Milliken R. E.
Water in Pyroclastic Deposits and Cold Traps on the Moon: Possible Resources for Future Exploration **[#5055]**
We propose two types of water reservoirs for future exploration of the lunar resources. Both advantages and challenges of exploring the two types of water reservoirs are analyzed.

4:45 p.m. Jawin E. R. * Head J. W. Cannon K. M.
Spectral Unmixing Modeling of the Aristarchus Pyroclastic Deposit: Assessing Eruptive History and Exploration Potential of Glass-Rich Regional Lunar Pyroclastic Deposits **[#5052]**
Spectral modeling of the Aristarchus pyroclastic deposit shows that the Moon's largest explosive volcanic deposit is rich in high-titanium volcanic glass. This lunar pyroclastic deposit is of importance for both scientific and exploration purposes.

5:00 p.m. Kring D. A. *
Conducting Subsurface Surveys for Water Ice Using Ground Penetrating Radar and a Neutron Spectrometer on the Lunar Electric Rover **[#5014]**
Teleoperation of the Lunar Electric Rover can survey large areas of the Moon for subsurface volatile deposits in permanently shadowed regions such as Cabeus and Amundsen craters.

5:15 p.m. DISCUSSION OF PRELIMINARY FINDINGS

Thursday, October 12, 2017
SAMPLE RETURN AND SURFACE ACTIVITIES
8:30 a.m. USRA Conference Center

Chairs: **Kelsey Young**
Kirby Runyon

8:30 a.m. Neal C. R. * Lawrence S. J.
A Moon Sample Return Campaign Will Advance Lunar and Solar System Science and Exploration **[#5068]**
Using private commercial companies to initiate a lunar sample return campaign funded by NASA Planetary Science Division that will advance lunar and solar system science and exploration.

8:45 a.m. Young K. E. * Graff T. G. Bleacher J. E. Coan D. Whelley P. L. Garry W. B. Kruse S. Reagan M. Garrison D. Miller M. Delgado F. Rogers A. D. Glotch T. D. Evans C. A. Naids A. Walker M. Hood A.
Supporting Future Lunar Surface Exploration Through Ongoing Field Activities **[#5011]**
We present results from several ongoing field deployments that are working to explore 1) lunar surface trafficability, 2) radiation shielding, and 3) lunar habitat, life support, and mobility.

9:00 a.m. Heldmann J. L. * Lim D. S. S. Colaprete A. Garry W. B. Hughes S. S. Kobs Nawotniak S. Sehlke A. Neish C. Osinski G. R. Hodges K. Abercromby A. Cohen B. A. Cook A. Elphic R. Mallonee H. Matiella Novak A. Rader E. Sears D. Sears H. Team FINESSE. Team BASALT.
Geologic Exploration Enabled by Optimized Science Operations on the Lunar Surface **[#5024]**
We present detailed geologic field studies that can best be accomplished through in situ investigations on the Moon, and the associated recommendations for human and robotic mission capabilities and concepts of operations for lunar surface missions.

9:15 a.m. Kendall J. D. *
Asymmetric Ejecta Emplacement from South Pole-Aitken Basin: 3D Hydrocode Modeling Results **[#5044]**
Using high-resolution 3D impact hydrocodes, we model the ejecta emplacement from the South Pole-Aitken basin-forming impact. We find the Moon's upper mantle material is likely exposed in close proximity to the basin's north rim and farside highlands.

9:30 a.m. Volkova T. V. * Bannova O. K.
Safety and Comfort for Moon and MARS Habitats: Key Design Considerations **[#5086]**
Safety requirements are critical in designing for any extreme environment and especially for habitats in space and on Moon or Mars. But safety alone is not enough when designing for long-term missions in extreme environments on Earth and in space.

9:45 a.m. DISCUSSION

10:00 a.m. *Break*

10:15 a.m. DISCUSSION AND FORMULATION OF FINDINGS

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Dell'Agnello S. Currie D. Ciocci E. Contessa S. Delle Monache G. March R. Martini M. Mondaini C. Porcelli L. Salvatori L. Tibuzzi M. Bianco G. Vittori R. Chandler J. Murphy T. Maiello M. Petrassi M. Lomastro A.
Lunar, Cislunar, Near/Farside Laser Retroreflectors for the Accurate: Positioning of Landers/Rovers/Hoppers/Orbiters, Commercial Georeferencing, Test of Relativistic Gravity, and Metrics of the Lunar Interior **[#5070]**
We developed next-generation lunar, cislunar, near/farside laser retroreflectors for the improved/accurate: Positioning of landers/rovers/hoppers/orbiters, commercial georeferencing, test of relativistic gravity, and metrics of the lunar interior.

Teodoro L. F. Colaprete A. Roush T. Elphic R. Cook A. Kleinhenz J. Fritzler E. Smith J. T. Zacny K.
Numerical Models of Volatiles Loss During Lunar Resource Prospector Mission Sample Acquisition **[#5058]**
In the context of the NASA's Resource Prospector, we developed new numerical models of the volatiles transport in lunar regolith.