



# Lunar Surface Innovation

C O N S O R T I U M

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## LSIC Excavation and Construction Focus Group

<http://lsic.jhuapl.edu/>

**October 30, 2020**

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# Friendly Reminders

- Slides, chat and recording will be posted in our website in 2-3 days.  
(<http://lsic.jhuapl.edu/Focus-Areas/Excavation-and-Construction.php>)
- Feel free to post your questions/suggestions in ‘chat’.
  - We can move the discussion to Confluence.
- Please mute yourself if you are not speaking.



# Focus Group Update

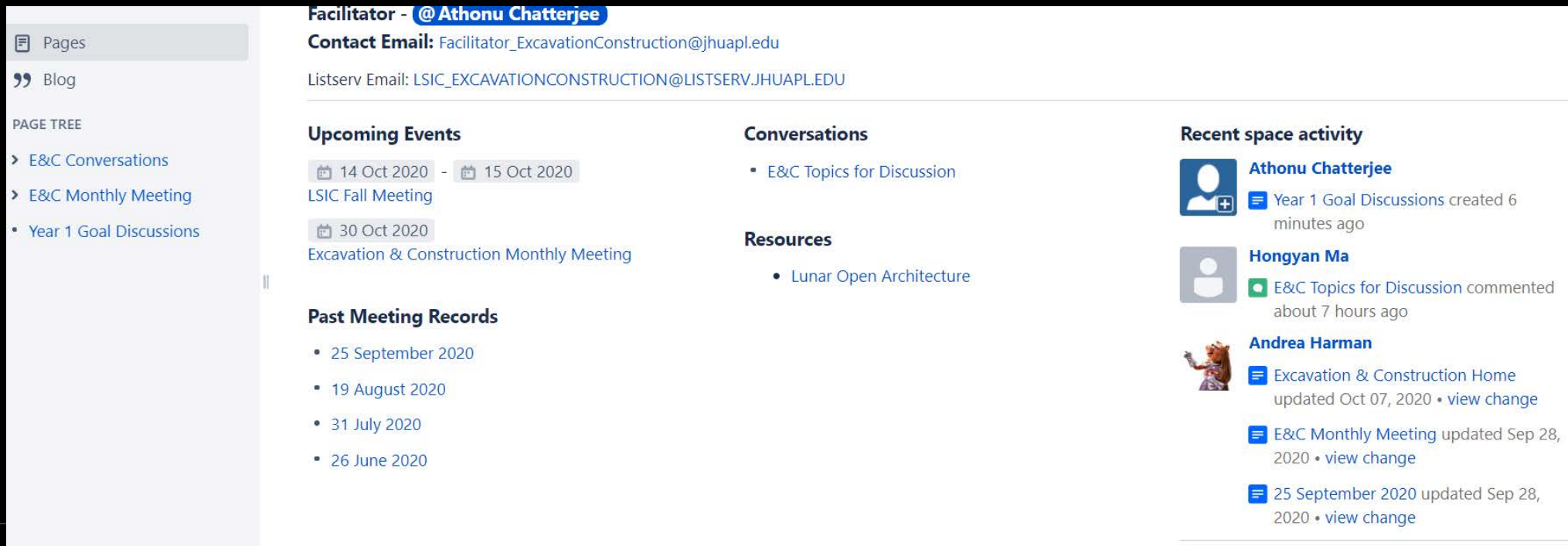
- November monthly meeting moved to December 4<sup>th</sup> (Friday).
- December meeting (falls on the 25<sup>th</sup>) cancelled.

# Focus Group Update

- We still need more representation from big equipment makers such as Caterpillar, John Deere, Volvo(USA), Komatsu(USA) etc.
  - **Request** : If you have relevant contacts in these companies please let us know.
- *Confluence* is up and running. Please sign-up and let us start using it regularly.
  - <http://lsic-wiki.jhuapl.edu/> (sign-up required)
- Andrea Harman is the LSIC Confluence Facilitator.
  - Contact Andrea for access: [ams573@alumni.psu.edu](mailto:ams573@alumni.psu.edu)
  - Training sessions available.

# Suggested Confluence Activities

- We will open discussions on popular topics raised in ‘chat’ during the monthly meetings.
- Share ‘**Resources**’ with the community via Confluence.
- Conversations on various E&C topics.
- Start conversation on focus group Year 1 Goal.



The screenshot shows a Confluence page for a meeting. The left sidebar contains a 'PAGE TREE' with links to 'E&C Conversations', 'E&C Monthly Meeting', and 'Year 1 Goal Discussions'. The main content area is titled 'Facilitator - @Athonu Chatterjee' and includes contact information: 'Contact Email: Facilitator\_ExcavationConstruction@jhuapl.edu' and 'Listserv Email: LSIC\_EXCAVATIONCONSTRUCTION@LISTSERV.JHUAPL.EDU'. Below this, there are three sections: 'Upcoming Events' with dates '14 Oct 2020 - 15 Oct 2020' for 'LSIC Fall Meeting' and '30 Oct 2020' for 'Excavation & Construction Monthly Meeting'; 'Conversations' with a link to 'E&C Topics for Discussion'; and 'Resources' with a link to 'Lunar Open Architecture'. On the right, a 'Recent space activity' section lists updates from 'Athonu Chatterjee', 'Hongyan Ma', and 'Andrea Harman'.

# Focus Group Goal

- The E&C FG is tasked to define a 1 year goal.
- Will collaboratively decide on a 1-year goal for us to work on as a group based on technology areas and driving questions (previous slides) arrived at by consensus.
- Goal needs to be
  - Actionable
  - Impactful
  - Address clear need of NASA
  - Can be accomplished with existing resources
  - Inspired by current issues
  - Beneficial broadly to all stakeholder
- Possible first-year goal topics:
  - Advanced technologies for excavation of dry and icy regolith.
  - Landing and Launch Pad development.
  - Habitat technology,
  - -----

Identify needs & gaps in E&C, provide recommendations to foster development, and create a roadmap for developing and fielding that technology

## Session: **WRKSHP-14, Sustainable Lunar Presence: Infrastructure to Stay**

Session Date & Time: November 17, 2020 from 3:00 PM to 6:00 PM EASTERN STANDARD TIME (EST/GMT-5)

Session Type: Workshop

Session Organizers: Dr. Bob Moses and Rob Mueller

Session Organizer Emails: [robert.w.moses@nasa.gov](mailto:robert.w.moses@nasa.gov) | [rob.mueller@nasa.gov](mailto:rob.mueller@nasa.gov)

<https://www.ascend.events/>

### Outline/Agenda of Session Activities:

**This workshop will focus on gathering a group of cross-disciplinary subject matter experts in order to brainstorm and define the necessary infrastructure needed for a sustainable human lunar presence in the context of environmentally appropriate architectural design and civil engineering robotic construction using locally available resources on the lunar surface.**

Emerging technologies and new materials are opening up new possibilities and economic opportunities. A short term presence can ignore infrastructure, but a long term presence must consider the infrastructure needs in order to provide for all stakeholder needs. The terrestrial construction and mining communities are well versed in running mega-projects for multi-billion dollar Earth based infrastructure such as power plants, city development, mines, transportation networks and more, with commercial motivation and positive cash flow outcomes.

# Small Instrument Challenge Judges Needed

- NASA is seeking potential reviewers for the “Honey, I shrunk the NASA Payload, the Sequel” Challenge (<https://www.herox.com/NASApayload/community>).
- Looking for reviewers with experience in instrument development for flight purposes. Reviews will happen between January 4 -25, 2021.
- Anyone who is interested in being a reviewer should contact Valerie Scott ([Valerie.j.scott@jpl.nasa.gov](mailto:Valerie.j.scott@jpl.nasa.gov)).



# Agenda

## Two ~20-minute presentations :

- (1) Morgan Gendel will talk about ***'HABOLITH': a lunar surface habitat that achieves game-changing efficiencies by maximizing use of in situ regolith without 3d printing.*** Morgan Gendel has written or produced 250 episodes of US TV series and won Science Fiction's esteemed Hugo Award for the "INNER LIGHT" episode of STAR TREK: THE NEXT GENERATION. He is the President of PLANETARY SHELTER, LLC.
  
- (2) Robert Mueller will talk about ***Lunar Landing & Launch Pads: Concepts, Criteria and Considerations.*** Rob Mueller is a senior technologist at NASA's Kennedy Space Center. He is the co-founder of the NASA Swamp Works innovation labs.



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<b>Habitat construction in lunar conditions. (Inflatable habitat, underground habitat, radiation shielding, multi-functional materials/structures)</b>	<b>70.5%</b>
Manufacturing processes for lunar construction. (Additive manufacturing, sintering, regolith fiber pulling)	63.6%
Excavation technology for hard regolith/icy material. (Drilling, mining, lightweight construction equipment)	61.4%
Autonomous vehicles and robots for E&C on lunar surface.	59.1%
Lunar surface structure development. (Landing pads, berms, roads)	54.5%
Increased autonomy of operations.	34.1%
Virtual lunar terrain simulation.	29.5%
Beyond additive technology.	22.7%
Long duration robust , easily maintainable robot design for industrial scale use (not science)	2.3%
Subsurface and interior imaging and composition analysis	2.3%
Compressed, sifted regolith as a building material	2.3%
Spacecraft refueling station development	2.3%

# LSII System Integrator - APL

*A key tenet of LSII is to implement a multitude of novel collaborations across industry, academia, and government in order to successfully develop the transformative capabilities for lunar surface exploration.*

## Origin of the APL Task

- NASA was investigating using a University Affiliated Research Center (UARC) to bring efficiencies to development
- LSII initiated a tasked APL, to assess system integration role for the Lunar Surface Innovation Initiative
- APL established a Lunar Surface Consortium with academia and industry representatives, as well as NASA experts, that span a broad range of capabilities to execute timely studies, tasks, and/or acquisitions

## The Consortium will assist NASA in

- Identifying lunar surface technology needs and assessing the readiness of relative systems and components
- Making recommendations for a cohesive, executable strategy for development and deployment of the technologies required for successful lunar surface exploration
- Providing a central resource for gathering information, analytical integration of lunar surface technology demonstration interfaces, and sharing of results

