

Notes from Excavation & Construction Monthly Meeting

September 2020

Notes from Discussion

Announcements ::refer to slides::

Fall LSIC Website ::refer to slides::

Presentation from RETH Institute (Shirley Dyke) ::refer to slides::

- Leslie Gertsch asked (via chat) has RETHi looked at ground stability modeling in underground mines
 - Shirley responded that while it's not her area of expertise, there's a member of the RETHi team who specializes in that.

Presentation from ICON (Jason Ballard) ::refer to slides::

- Braid Blair asked (via chat) if ICON is embedding sensors into structures for performance feedback as a function of time and event
 - Jason responded that they do that for their Earth based research, but haven't gotten there yet for off world construction.
- Morgan Gendel asked (via chat) if lavacrete habs for Moon or Mars are ECLSS ready, or if a liner is used
 - Jason answered that his current favorite method is a spray on liner, but that many are being investigated
- Jeffrey Bullard asked (via chat) if there was a materials formulation that didn't require a liquid-based binder
 - Jason responded that they're trying to use zero binder applications for lunar work, to melt or sinter directly using no additives
- Brian Joval asked (via chat) if it would be possible to 3D repair the habitat (linking to Shirley's presentation)
 - Jason responded that they are looking for a way to repair without requiring astronauts to suit up
- Athonu Chatterjee asked to confirm the lunar demo by 2025, and wanted to know who ICON would be flying with
 - Jason answered that they were planning to be ready when everyone else is, and wasn't sure yet who they'd be flying with, just wanted to be prepared to go.

- Morgan Gendel asked first what the mass and volume of the machinery would be, and second what the reliability was expected to be.
 - Jason answered that there would be a dedicated off-planet construction team (announcing 01 October). And he answered that reliability was constantly being improved, and that the current machine was about two tons
- Athonu asked if the machines were reusable
 - Jason answered that they could currently print up to three buildings at a time, and that they were reusable but wouldn't know how many times until testing on the lunar surface
- Leslie asked (via chat) what sort of site preparation was needed
 - Jason responded that they have had some successful terrestrial tests by meeting military requirements that included printing on unprepared ground, but seismic studies of the lunar surface would be needed
- Athonu asked if roofs could be built out of in-situ resources
 - Jason answered that if they can build walls they can build roofs
- Leslie asked (via chat) about uneven ground of load bearing capacity
 - Jason responded they wonder the same thing and are preparing the machine to work on uneven ground and deal with some amount of variables
- Jason Ballard also stated there was a big excavation initiative also underway with other folks also on the call, and that those results would be important for their work
- Tom Jones asked (via chat) if the two ton weight estimate included the machine being able to drive itself around, or if it would require human setup
 - Jason responded that the Earth-based system only requires three people to set up and operate, and are designing off world construction system for full autonomy

Presentation from McKean Defense (Tim Anderson) ::refer to slides::

Notes From Chat

Announcements

Focus group members can sign up for Confluence by emailing Andrea Harman at ams573@alumni.psu.edu

RETHi Presentation

- Leslie Gertsch asked if RETH Institute has looked at ground stability modeling in underground mines (regarding using lava tubes for habitat locations)
 - Nerma Caluk also asked Shirley's opinion on the location of lunar habitats, either on the ground, in an excavated area underground, in lava tubes, or elsewhere
 - Shirley answered that until they get further along she can't say if lava tubes are the way to go - NASA has to send in some robots
- Athonu asked if Shirley expects to get more data on moon quakes
 - Shirley answered that it would be helpful to get more data
- Josh Cahill asked if there were aspects of LGN that need to be addressed

ICON Presentation

- Morgan Gendel asked if lavacrete habs are ECLSS ready or if a liner is needed
 - Jason answered in discussion
 - Leslie asked what ECLSS stands for
 - Eamon Carrig answered Environmental Control and Life Support System (ECLSS)
 - Mike Fiske added that the assumption at MSFC is that a liner will be required, and they are under development
 - Mike Ching asked Mike Fiske if the liner research includes inflatable softgoods technologies
 - Michael McDaniel answered that yes, they were evaluating softgoods
 - Jason also answered that they were evaluating soft and inflatable approaches to interior finish out of lunar habs
- Jeffrey Bullard asked if ICON has a materials formulation that doesn't require a liquid-based binder
 - Jason answered in discussion
 - Michael McDaniel added that they're trying to avoid binder agents and do true ISRU
- Brian Joyal asked if it was possible to 3D repair the habitat
 - (Answered in discussion)

- Ryan Dubisher asked if any analysis had been done on the expected power required to operate an ICON system
- Athonu Chatterjee asked how much power would be needed for a standard lunar habitat
- Leslie Gertsch asked what the uniaxial to tensile strength ration was
 - Michael McDaniel responded that those tests are coming up, they only have completed compression testing to date
- Shirley Dyke asked how the materials scale
- Doyle Towles asked what the rough mass and volume of an ICON system to build a 500ft² habitat was
 - Jason answered that an order of magnitude for a fully enclosed 500 square foot structure is ~30,000 kg
- Brad Blair asked if ICON IP was protected with patents and trade secrets, and if so, what is the approximate ratio of patent to trade secret?
 - Michael McDaniel answered that they were protective of the IP with patents pending
 - Jason also responded that IP and trade secrets were aggressively protected
 - Brad Blair added that trade secrets offer enhanced protection esp. from US adversaries who don't respect patent protection
- Hunter Danque asked how walls or corners were connected
 - Jason answered that wall corners and walls are printed continuously
- Leslie asked what sort of site preparation is needed, and that she wondered about uneven ground of varying bearing capacity
 - (Answered in discussion)
- David Akin asked if roofs could be built out of in-situ resources
 - (Answered in discussion)
- Tom Jones asked if the 2 ton estimate for the current machine included the ability to drive itself to a new site, and what human setup was needed
 - (Answered in discussion)