From the moon...
<table>
<thead>
<tr>
<th>Start</th>
<th>Event</th>
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<tbody>
<tr>
<td>8:05 am</td>
<td>Welcome&lt;br&gt;Chris Hansen - EVA Office Manager</td>
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<tr>
<td>8:25 am</td>
<td>Guest Speaker&lt;br&gt;Dan Hartman - Gateway Program Manager</td>
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<tr>
<td>8:45 am</td>
<td>Strategic Roadmap&lt;br&gt;Brian Johnson - EVA Office Associate Deputy, Exploration&lt;br&gt;Overview of the workshop content &amp; objectives including updates since July 2019, including major milestones.</td>
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<tr>
<td>8:45 am</td>
<td><strong>EVA Artemis Planning Topics</strong></td>
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<tr>
<td>10:45 am</td>
<td>Networking Break &amp; AR/VR Demo (10:15 am - 10:45 am)</td>
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<tr>
<td>10:45 am</td>
<td>Topic 2: EVA Planetary Science&lt;br&gt;Kelsey Young - Exploration Scientist, Trevor Graff - Exploration Scientist &amp; John Swatkowski - EVA Exploration Engineer&lt;br&gt;Overview of planetary science gaps &amp; how current analogs are structured &amp; utilized to influence mission planning &amp; Lunar surface drivers for EVA activities.</td>
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<tr>
<td>1:00 pm</td>
<td>Lunch &amp; AR/VR Demo (11:45 am - 12:55 pm)&lt;br&gt;Guest Speaker - Drew Feustel, NASA Astronaut</td>
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<td>2:00 pm</td>
<td>Topic 4: Preparation for Lunar Training &amp; Execution&lt;br&gt;Alex Kanelakos - EVA Operations Chief Engineer, Trevor Graff - Exploration Scientist, Daren Welsh - xEVA Operations Test Lead &amp; James Montalvo - xEVA Flight Controller&lt;br&gt;Training &amp; execution considerations are key components to reduce risk to astronauts &amp; mission objectives for Lunar 2024.</td>
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<tr>
<td>3:15 pm</td>
<td>Networking Break &amp; AR/VR Demo (2:45 pm - 3:15 pm)</td>
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<td>3:15 pm</td>
<td>Topic 5: Initial Artemis Geology Sampling Tools&lt;br&gt;Adam Naids - EVA Geology Tools Deputy Project Manager&lt;br&gt;Status of tool development plan to support Lunar 2024 Artemis missions including unique lunar challenges.</td>
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<td>4:05 pm</td>
<td>Topic 6: xEVA System Status&lt;br&gt;Jesse Buffington - xEVA System Development Lead&lt;br&gt;Overview of xEVA System with latest status on flight hardware development for xEMU, interface equipment with HLS Landers, &amp; upcoming milestones for Exploration EVA hardware progress supporting Artemis III/2024 human lunar landing.</td>
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<tr>
<td>4:35 pm</td>
<td>Topic 7: EVA Technology &amp; Knowledge Gaps&lt;br&gt;Brian Alpert - EVA Exploration Strategic Planning &amp; Architecture Lead&lt;br&gt;Updates to the EVA system maturation team hardware gap mitigation plan &amp; post Lunar 2024 priorities.</td>
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<tr>
<td>5:05 pm</td>
<td>Day 1 Closing Remarks (5:05 pm - 5:15 pm)</td>
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<tr>
<td>5:30 pm</td>
<td>Reception - Sponsored by Collins Aerospace&lt;br&gt;Space Suit Gallery (5:30 pm - 7:00 pm)</td>
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</table>
### Wednesday, February 19th, 2020

#### Registration & Networking Breakfast (7:30 am - 8:00 am)
- **Welcome**
  - Chris Hansen - EVA Office Manager

#### 8:00 am

#### Open Forum Presentation 1: Integrated Belt System for Load Distribution Between Suit & Astronaut for Analog Training Activities
- **Neil Jaschinski** - Applied Rocket Technology

To support a variety of different tasks during lunar exploration, including the possibility of space tourists, a new belt has been proposed that will support human capabilities. The belt system allows for a more realistic load distribution & accommodates for both internal & external points of adjustment.

#### 9:00 am

#### Open Forum Presentation 2: Scientific Physical & Operations Characterization (SPOC) - Capturing Physical Terrestrial Fieldwork in Context with Wearable Sensor Technology
- **Dr. Rachel Vitali** - University of Michigan

Prior to developing a strategic & scientific approach to terrestrial exploration, it becomes necessary to thoroughly understand the work demands & expectations of activities performed on earth. Through activity classification, biomechanical & motor control performance metrics, & tool usage different strategies can be investigated when discussing interplanetary terrestrial exploration.

#### 9:40 am

#### Open Forum Presentation 3: Drawing on Traditional, as well as the Extended Collins Aerospace Expertise to Support the xEMU
- **Gary Spexarth** - PMP, P.E. Collins Aerospace

Lunar 2024 has rekindled interest from the aerospace community, engineers & scientists. This allows for newcomers to the human exploration scene to become involved in the mission, allowing for entities to address agency needs where they might not have in the past.

#### 10:30 am

#### Open Forum Presentation 4: NASA’s International Space Station: A Testbed for Planetary Protection Protocol Development
- **Dr. Aaron Regberg** - Geomicrobiologist, Planetary Protection Lead, Astromaterials Acquisition & Curation Office

Given the environment that is currently available in the ISS, the study of micro-organisms can begin. Not only will this address identified gaps, it will also inform exploration-class life support & suit design.

#### 10:50 am

#### Open Forum Presentation 5: Scientific Physical Operation Characterization (SPOC) – Assessing Operator Kinematics & Injury Risk in situ Using State-of-the-art IMU-Based Motion Capture Techniques
- **Tim McGrath** - Massachusetts Institute of Technology

Future missions will no longer support the previous model of an EVA being closely monitored by a ground station, they will require more autonomy from the astronaut & with limited communications to ground control. In order to minimize injury risk, the collection of kinematic data is required that is free from the constrained laboratory environments. To bridge this knowledge gap, small wearable inertial measurement units (IMUs) will be used along with the SPOC project.

#### NASA SBIR/STTR Successes, Opportunities, & Pathways for EVA
- **Cinda Chullen** - EVA Topic Manager

The NASA Small Business Innovation Research (SBIR) Program has served as a beneficial funding vehicle to both US small technology businesses & the Federal Agencies that participate in the program. This presentation will discuss the many EVA SBIR & STTR (SBIR Technology Transfer) successes in the recent history of the NASA Johnson Space Center (JSC). It will also highlight current awardees & briefly cover the process by which small business & universities can get involved.
Wednesday, February 19th, 2020 (Continued)

<table>
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<tr>
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| 11:10 am       | **Open Forum Presentation 6:** Training Astronauts & Testing Surface Operations for Geological Exploration on the Moon: The ESA PANGAEA Program  
Loredana Bessone - European Space Agency  
*Planetary exploration has not occurred since the Apollo era, indicating that there will be a gap in scientific expertise in the current astronaut corps regarding these activities. This presentation will provide an overview of the Planetary Analogue Geological & Astrobiological Exercise for Astronauts (PANGAEA) currently being used by ESA.* |
| 11:30 am       | **Open Forum Presentation 7:** The Moon Analogue Facility LUNA at European Astronaut Centre  
Dr. Matthias Maurer - European Space Agency  
*Preparing for a lunar presence, ESA seeks to build a facility which would support the complexities of astronaut training when considering the lunar surface. This proposed analogue facility would support the development & testing of new technologies.* |
|                 | **Augmented Realities**                                              |
| 1:10 pm        | **Open Forum Presentation 8:** The XR Lab at European Astronaut Centre  
Dr. Matthias Maurer - European Space Agency  
*The ESA-EAC XR Lab allows for the testing of new immersive & virtual realities which will aid in training. This allows for multiple innovative training environments which will address new exploration challenges related to missions in LEO & beyond.* |
| 1:30 pm        | **Open Forum Presentation 9:** Taking VR Simulators from Commercial Diving to Space & EVA  
Dr. Felix Gorbatsevich - PaleBlue  
*Companies in the oil & gas industry have been invested in augmented reality technologies for training purposes for decades, utilizing these virtual environments to aid in the training of complex tasks. This presentation will address the training technology transfer from oil & gas to space & the environments for EVA currently in developed by PaleBlue & ESA.* |
|                 | **Innovative Interfaces**                                           |
| 1:50 pm        | **Open Forum Presentation 10:** Interpersonal Interaction Design for Long-Duration Extra Vehicular Activities  
Avner Bendheim - International Space University  
*Nonverbal cues are integral in interpersonal communication & collaboration, these physical cues are not available to astronauts regarding their coworkers during an EVA. Technology that can address lack of facial cues, as well as other identified gaps in nonverbal communication between astronauts, can break this existing paradigm.* |
| 2:10 pm        | **Open Forum Presentation 11:** Astronaut Smart Glove: A Human-Machine Interface for EVA on the Moon, Mars & Beyond  
Pascal Lee - Mars Institute & SETI Institute & NASA Ames Research Center  
*Interplanetary exploration will require humans to interact with a wide range of robotic systems, something that is cumbersome & restrictive while in pressurized suits. The “Astronaut Smart Glove” (ASG), a human-machine interface, was developed & tested, illustrating a promising approach to creating an ergonomic solution for EVA & IVA.* |
| 2:30 pm        | **Open Forum Presentation 12:** A Proof-of-Concept Demonstration of an Astronaut Spoken Language Interface Using Alexa/Lex Technology  
Dick Stottler - Stottler Henke Associates & Sean Bartlett Stottler Henke Associates  
*Spoken language interface technology, such as Alexa/Lex, has increasing popularity & application. This presentation will include a demonstration of a proof of concept for a spoken language interface for astronauts which can be used while in the EVA suit.* |
|                 | **Networking Break (3:00 pm - 3:30 pm)**                            |
| 3:30 pm        | **Collaborative Forum 1:** Bridging the Gaps  
Facilitators: Brian Alpert - EVA Exploration Strategic Planning & Architecture Lead & Kevin Wells - EC5 Branch Chief  
*The collaborative forum will provide an opportunity for a detailed review & discussion of EVA gaps with NASA & the extended EVA community. EVA gaps fall into many categories including: strategic, knowledge, hardware, systems & human health & performance based.* |
|                 | **Closing Remarks (5:05 pm - 5:15 pm)**                             |

Topics 6 & 7
### Thursday, February 20th, 2020

#### Registration & Networking Breakfast (7:30 am - 8:00 am)

**Welcome**  
Brian Johnson, *EVA Office Associate Deputy, Exploration*

**Collaborative Forum 2: Science Considerations for Lunar Operations**  

The collaborative forum will provide an opportunity to discuss science considerations for EVA lunar operations with a focus on environmental factors.

#### Networking Break (9:35 am - 10:00 am)

**Collaborative Forum 3: Suit Sizing for Optimal Fit**  
Facilitators: Elizabeth Benson - *ABF Laboratory Contractor Lead*, Richard Rhodes - *xPGS Deputy Lead*, Han Kim - *Ergonomics Discipline Lead & Dr. Rachel Vitali - Post-Doctoral Student University of Michigan Mechanical Engineering Program*

The collaborative forum will provide an opportunity to discuss current suit sizing methodologies, including a focus on planning for fit vs. actual fit & function. The discussion will continue with a focus on gaps & challenges regarding sizing for exploration including modeling for injury & risk.

**Topic 3**

#### Lunch (11:45 am - 12:30 pm)

**Collaborative Forum 4: Developing Hardware & Systems with an Operations Focus**  

The collaborative forum will provide an opportunity to discuss hardware system needs for operations training & execution. The discussion will focus on areas where current gaps have been identified looking specifically at reducing risk to the EVA crew & mission objectives.

**Topic 2, 4 & 5**

#### 2:05 pm

**Collaborative Forum 5: Developing Lunar Tools With Dust, Environment, Material, Contamination & Science In Mind**  

The collaborative forum will provide an opportunity for attendees to discuss challenges in designing & testing lunar tools based on environment constraints & science objectives. The goal is to engage workshop attendees in an active discussion informing potential future tool considerations & broaden the conversation surrounding challenge solutions.

**Topic 5**

#### Networking Break (3:30 pm - 3:45 pm)

**Collaborative Forum 6: NASA/JSC eXtended Realities**  

The collaborative forum will offer a glimpse into how VR/AR technology has been used to support hardware & operations, what is in development today for future use & engage participants in a discussion regarding ways that VR/AR could/should be used to lean forward.

**Topic 5 & 7**

#### Closing Remarks (5:20 pm - 5:30 pm)
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KBR

Thanks to our host facility

In collaboration with

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NASA

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