APOLLO 17 EVA-1 AND EVA-2 TASK DECOMPOSITION: PLANNING FOR ARTEMIS AND FUTURE MARS MISSIONS. N.C. Haney[1], T.G. Graff[1]. [1]Jacobs, NASA Johnson Space Center, Houston, TX 77058.

Introduction: A decomposition of the Apollo 17 mission extravehicular activities (EVA) tasks can be used to prepare for Artemis and future Mars missions. A categorized minute by minute breakdown of the astronauts' activites could be used to plan future EVAs and determine which scientific tasks or equipment may be prioritized. This is especially relevant in this critical stage for the upcoming Atemis missions and science activity planning. The infographics generated from the decomposition provide a higher level view of actual EVAs and could aid in making future EVAs more efficient and successful.

Materials and Methods:

The data was extracted from the EVA voice transcripts of the Apollo 17 astronauts, post-mission commentary, and live-feed videos [1][2][3].

The transcripts were analyzed minute by minute. Tasks completed by the astronaut, the equipment used to accomplish the task, any scientific samples collected, and length of time were recorded. If more than one task was accomplished during a one minute time span, the activity that required the most time to complete within that minute was recorded as the activity accomplished for that minute. For example, if within one minute, 10 seconds were spent taking a photograph but the astronaut was also driving in the rover for that minute, the activity recorded would be driving the rover.

Tasks were broken down into four main types: engineering (E), operational (O), scientific (S), and traverse (T). Engineering tasks were defined by activities that require mechanical or physical labor. Operational tasks were defined by transitional and descriptive activities. Scientific acitivities were defined by geology, sample collection, or photography acitvities. Traverse tasks were defined by traversing activites. Next, tasks were broken down by the specific activity, equipment, sub-equipment, tool, and sample (if available).

Results and Discussion:

EVA-1:

The first EVA is dominated by engineering tasks due to the amount of equipment deployment and setup after landing. The combined tasks for both astronauts show that the majority of the time spent during the first EVA was dedicated to unloading, deploying, and setting up equipment (Fig. 1). Additionally, describing the Lunar Module's location and test driving the rover took up a large portion of time. The equipment and tools that required the most time were the LCRA and the core drill.

Commander Gene Cernan's (Fig. 2) and Lunar Module Pilot Jack Schmitt's (Fig. 3) individual task breakdowns are very similar to the total task decomposition. This is due to the necessity of teamwork involved in initial equipment deployment and setup.

EVA-2:

The second EVA was remarkably different that the first EVA because it required less equipment set up (Fig. 4). Science acvities took much more precedent in this EVA and as a result required greater traverse times to get to each science station. The tasks for this EVA focused heavily on sample collection.

As the driver of the rover, Commander Gene Cernan's task individual breakdown shows a large traverse component along with a strong scientific component (Fig. 5). While Cernan was mostly focused on engineering tasks, like equipment checks, Schmitt was more focused on scientific activities, like geologic observations and sample collection (Fig. 6). As the first geologist on the lunar surface, Schmitt was given more responsibility over science related activites during the EVA with Cernan playing a more supportive role.

Conclusion: The types of activites accomplished during each EVA differ greatly in their magnitudes. EVA-1 is characterized by the largest time spent on equipment setup and deployment with nearly equal times spent on scientific, operational, and traverse activites. EVA-2 is characterized by mostly scientific tasks and traversing with minimal engineering and operational tasks. Operational tasks required almost the same amount of time for each EVA.

Abbreviations: ALSEP: Apollo Lunar Surface Experiments Package, CDR: Commander, CRD: Cosmic Ray Detector, EPT: Explosion Package Transporter, ETB: Equipment Transfer Bag, HFE: Heat Flow Experiments, HGA: High-gain Antenna, LCRU: Lunar Communications Relay Unit, LEAM: Lunar Ejecta and Meteorites Experiment, LGA: Low-gain Antenna, LM: Lunar Module, LMP: Lunar Module Pilot, LMS: Lunar Mass Spectrometer, LNP: Lunar Neutron Probe, LSG: Long-Period Surface Gravimeter, LSPE: Lunar Seismic Profiling Experiment, RCU: Remote Control Unit, RTG: Radioisotope Thermal Generator, SEP: Surface Electrical Properties, SEQ: Scientific Equipment, SLSS: Secondary Life Support System, SRC: Sample Return Container, TCU: Television Control Unit, TGE: Traverse Gravimeter Experiment, UHT: Universal Hand Tool .

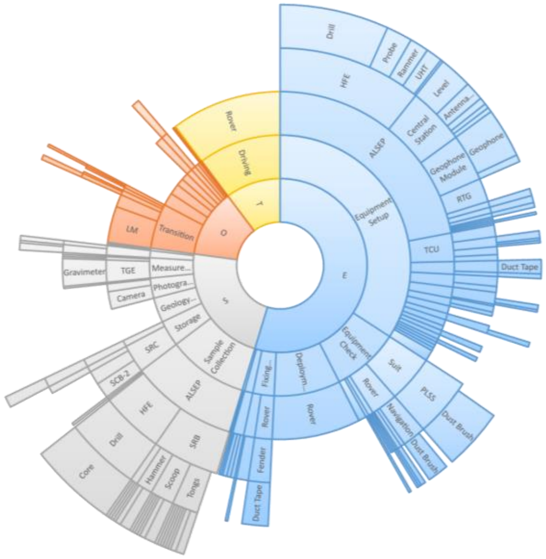

Fig. 1. EVA-1 Tasks for Commander Gene Cernan and Lunar Module Pilot Jack Schmitt.

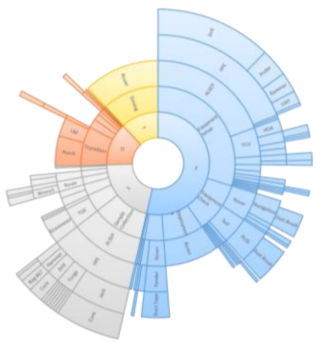

Fig. 2. EVA-1 Tasks for Commander Gene Cernan.

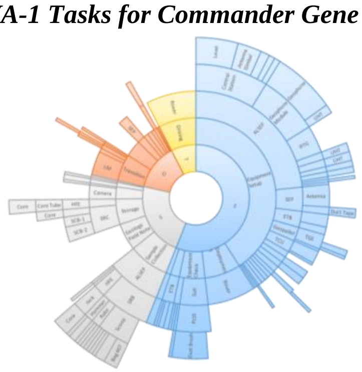

Fig. 3. EVA-1 Tasks for Lunar Module Pilot Jack Schmitt.

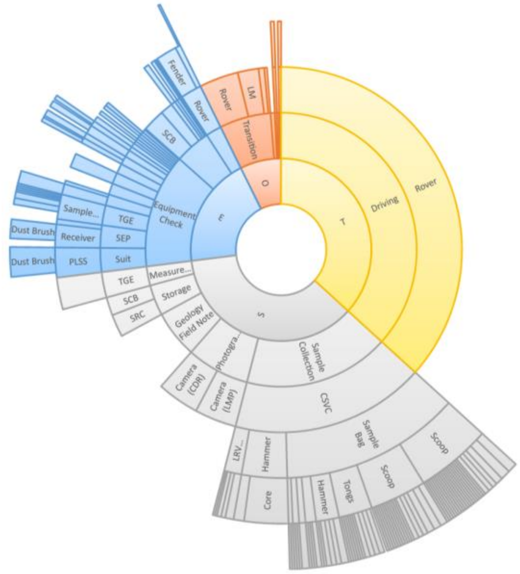

Fig. 4. EVA-2 Tasks for Commander Gene Cernan and Lunar Module Pilot Jack Schmitt.

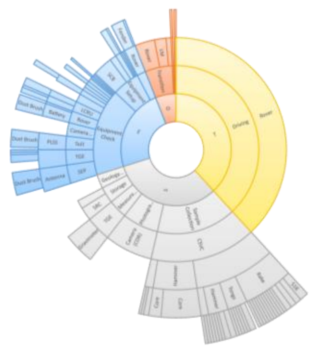

Fig. 5. EVA-2 Tasks for Commander Gene Cernan.

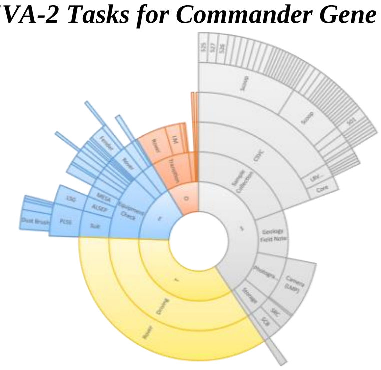

Fig. 6. EVA-2 Tasks for Lunar Module Pilot Jack Schmitt.

References: E.M. Jones. (1995). *Apollo Lunar Surface Journal*. [2] Lunar and Planetary Institute, USRA. (2019) Apollo 17 Mission. https://www.lpi.usra.edu/lunar/missions/apollo/apollo17/. [3] B. Fiest. *Apollo 17 in Real-time: The Last Mission to the Moon.* https://apollo17.org/.