LANDING HUMANS ON THE MOON AND RETURNING THEM SAFELY TO THE EARTH: LESSONS FROM A NEW TIME-CENTERED APOLLO 11 MEDIA ARCHIVE THAT UNCOVERS NEW INSIGHT INTO HOW THEY ACHIEVED THE GREATEST TECHNOLOGICAL FEAT IN HUMAN HISTORY AND PROVIDES A NEW CONTEXT FOR APOLLO 11 LUNAR SAMPLES. B. Feist[1] and N. E. Petro[2], [1]Jacobs (bf@benfeist.com), [2]NASA GSFC.

Introduction: Fifty years ago the Apollo 11 mission achieved President Kennedy's goal of landing a human on the Moon and returning him safely to the Earth [1]. This accomplishment famously required hundreds of thousands of contractors to build and test the hardware, hundreds of engineers to support the mission, and three well-trained crew members to pull it all off. However, this mission was largely an engineering mission, with science as a second-order requirement. Despite this, the mission returned the first extra-terrestrial samples which led to a new scientific era [e.g., 2]. Using thousands of hours of newly digitized audio tapes of mission control, and the technical infrastructure developed to contextualize the Apollo 17 mission [3]. This archive places the Apollo 11 mission, and the limited science the crew was able to perform, in a new, time-centered, context. Here we report on this archive, its importance to interpreting Apollo 11's science, and lessons for future exploration.

Engineering-Science Synergy: A feature of this new Apollo 11 archive is the availability of audio recorded in mission control during the mission, synchronized audio of each of the consoles as the mission unfolded. This audio allows us to conduct a detailed study in how the mission overcame technical challenges, what those challenges were, and how the entire team worked to accomplish the landing and return to Earth (Figure 1). While the phrase "science-engineering synergy" has become a trope in recent years to describe anytime scientists and engineers work together, this confluence of archival material clearly demonstrates how engineers worked to enable science, and how science maximized what was available.

Apollo 11 Science: The science return of Apollo 11, relative to subsequent Apollo missions, was small. However, that small volume of science ushered in a new era of science (not just planetary science). However, the samples collected by Apollo 11 were collected quickly and often without the context provided in subsequent missions. However, contextual clues provided by the crew offer an opportunity to place samples into the moment they were collected. For example, at 111:22:35 GET Neil Armstrong comments "I'm picking up several pieces of really vesicular rock out here, now." likely referring to samples 10017 and/or 10022.

This archive also reveals how much was accomplished in a limited time of actual work on the surface. Between ceremonial tasks, acclimation to the lunar surface, deploying hardware, and packing up in preparation to end the EVA, there was a limited amount of time with witch to actually collect samples. The Mission control audio provides new insight to the engineering and operations context in which the scientific tasks were undertaken.

Figure 1. View of the Mission Operations Control Room at 110:09:25 GET during Apollo 11. Audio from each console has been digitized and time synchronized for the first time. NASA image AP11-S69-39815HR.

Implications for Future Exploration: While the Apollo missions following 11 accomplished more, Apollo 11 represents an important first step in how humans explore other planets. While we would ideally pick-up where Apollo 17 left off [3], it is possible a return to the Moon will start with cautious first steps. In that sense, learning what worked well and what didn't

during Apollo 11, and allowing modern interpretation beyond the lessons learned at the time [4] should inform future planning.

Conclusions: Apollo 11 represents not only a major human accomplishment, it also provides an excellent case study of how science can be forced into engineering exercises. The new time-synchronized Apollo 11 archive affords, for the first time, the ability to explore the mission and observe how Mission Control enabled the success of the mission, and how the crew maximized the limited time to collect samples and make observations of the lunar surface.

References:

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