SIGNIFICANCE OF MISSION CONTROL SCIENCE DOCUMENTARIAN IN THE KRASH LUNAR ANALOGUE MISSION. S. Blain[1], M. M. Mader[1], L. L. Tornabene[1], G. R. Osinski[1] and ILSR team [1]. [1]Centre for Planetary Science and Exploration, Dept. of Earth Sciences, University of Western Ontario, 1151 Richmond Street, London, ON, Canada, N6A 5B7 (sblain22@uwo.ca).

Introduction: The Centre for Planetary Science and Exploration at the University of Western Ontario and partners have conducted a series of analogue missions in support of future robotic and human lunar sample return planetary missions [1]. The 2011 Kamestastin Research Analogue Site for Human exploration (KRASH) was a lunar analogue mission where tests for both human and robotic exploration of the Moon were conducted. The mission consisted of two large groups working in separate areas: 1) a field team, including two "astronauts" and a robotic rover, working at the Mistastin Lake (Kamestastin) impact structure in Labrador, and 2) a group of scientists making up mission control in London, Ontario (see [1] for more details).

Conducting a successful analogue mission requires months of planning and organization. Mission procedures and the individual personnel positions must be planned ahead of time. One of the key elements influencing the mission's productivity is the role assigned to each team member, which are vital to support mission activities. The mission control structure evolved throughout the two weeks of operations. The final configuration consisted mainly of a large science back room team and a smaller tactical team (see [2] for details of the evolution and description of mission control structure). The science back room performed planning, interpretation and processing functions as a group and led science discussions with the astronauts before and after their EVAs. The Tactical process was tasked with directly supporting astronaut EVAs. It was led by a Flight Director assisted by a team of personnel to monitor communications with the astronauts, manage their resources and decide modifications to the day's plan.

An overarching process, which coordinated the recording of how the analogue mission was conducted, was the Evaluation process. Specific evaluation roles were embedded within all mission control and field teams.

One key role, emphasized herein, is the Science Documentarian (SciDoc) role. This position broadly consisted of documenting daily operations and discussions that took place within the science backroom team. The documentarian notes served as a key resource during the mission and continued to serve as a resource after the mission.

SciDoc Responsibilities: Responsibilities of the SciDoc include documenting and recording events within the science room and between science team members, such as: 1) daily timelines of science operational activities, 2) dialogue between the mission control science team and "astronauts", 3) meeting minutes, and 4) the decision making process (i.e., how decisions were made) during science discussions. This information was chronologically documented and captured electronically through typed notes. The notes were put together using a standardized template with detailed headings and summaries where needed. These notes were then made available to the entire mission control KRASH team providing them with a detailed record of the daily science operations.

Value of the SciDoc Role: The notes taken by the mission control SciDoc are a multipurpose resource.

Traverse progress and planning: SciDoc notes were used to keep track of astronaut progress. Documenting the astronaut activities was especially invaluable when communications between mission control and the field was of low quality or down due to technical difficulties or poor weather conditions. The only new source of information received during these periods in mission control were few, intermittent messages from the "astronauts". Therefore, the incoming messages had to be properly recorded. Information such as UTM coordinates, sites visited and brief sample descriptions were documented in the SciDoc notes. This information would then be used during the mission to keep track of the scheduled plan, verify hypothesis' put forth by the science team, and plan the next set of field instructions bearing in mind that plans for the next traverse are subject to change depending on the data received [3]. Without any records of the incoming messages, the science team would be unable to determine the astronauts' progress and plan more specific future traverses.

Science Interpretation: This role was also vital for the science process itself. One of the major responsibilities of the mission control SciDoc consisted of recording decisions made by the science team. Recording how these decisions came about and the scientific ideas that were discussed were just as important as the final decision.

Throughout the mission, daily group discussions were conducted within the science team to decide the next set of operations necessary to test science

hypotheses and meet mission objectives. During these discussions, numerous suggestions were put forth and the debate could move along rapidly. Therefore, having an individual solely to record all the arguments, whether it was for or against a certain decision, was essential in order to capture all the ideas mentioned, and especially if they needed to be readdressed in light of new data. Moreover, the final decision was more meaningful with the reasons supporting it. Having a documentarian ensured that the discussions were thoroughly recorded so that the details of the decision making process were captured.

These detailed notes are essentially an archive of scientific discussions and of ideas generated throughout the mission. Detailed notes recording a team decision making process is invaluable to the team, with numerous ideas bouncing back and forth, it can be very difficult for each individual team member to recall all the details of the discussion. The documentarian notes served as a reminder of why a certain operation was accepted or rejected. The science team would be taking steps backwards if a decision that was previously discussed and rejected was approved in a later discussion. Therefore, the SciDoc notes improved mission time management by ensuring that the same arguments were not repeated in future discussions.

Science Long Term Planning: Long term planning consisted of making a list of possible sites and samples to investigate in future operations. The list was then ordered from high to low priority. To prioritize the items, members in the science team discussed the pros and cons of each item. The notes previously taken during the science discussions contained key arguments that could also be applied to the long term planning discussion. Therefore, documenting the different arguments served as a starting point for prioritizing the next set of instructions.

Analogue Mission Evaluation: An overarching purpose of conducting analogue missions is to identify and record key lessons learned in order to advance planetary mission design and creation of new strategies. To do this, it is essential to understand what the goals were, what was done well, and what was not in the simulation.

The Scidoc notes are an essential resource for this process. Although upon completion of the analogue mission, the operational part of the mission is over, the evaluation process continues afterwards. The science documentarian notes are, in general, a play-by-play of each day. This includes the problems and advances encountered during the mission. Therefore, the notes provide an essential foundation for analogue mission evaluations.

Summary: There are many other means of recording the dialogue in mission control such as an automated voice recording. However, during the KRASH mission, we found that having a designated person as documentarian was necessary, rather than relying on an automated system. Essential skills for this role included: objective observation, active listening, efficient recording of information, ability to quickly summarize group discussions and maintain focus over an entire 8 hour shift.

Since the SciDoc had the responsibility of keeping track of all the activities in the science team, they were able to inform any team member on missed information if they were absent for a part of the mission. The SciDoc was also able to organize and summarize the notes while an automated recording system would have recorded endless amounts of information. Therefore, the SciDoc notes were more practical and easier to understand.

Overall, having a complete record of the events in mission control is especially important during analogue missions as they are test runs for real missions. The SciDoc notes are useful for keeping track of the successes and failures of the analogue mission in order to provide valuable lessons for future space missions.

References: [1] Marion et al. (2012) LPSC XXXXIII (this meeting), [2] Moores et al. (2012) LPSC XXXXIII (this meeting) [3] Kerrigan et al. (2012) LPSC XXXXIII (this meeting).

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