PLANNING RELATED TO THE CURATION AND PROCESSING OF RETURNED MARTIAN SAMPLES. Francis M. McCubbin and Andrea D. Harrington, NASA Johnson Space Center, 2101 NASA Parkway, Houston, TX 77058. francis.m.mccubbin@nasa.gov.

Introduction: The Astromaterials Acquisition and Curation Office (henceforth referred to herein as NASA Curation Office) at NASA Johnson Space Center (JSC) is responsible for curating all of NASA's extraterrestrial samples. Under the governing document, NASA Policy Directive (NPD) 7100.10E "Curation of Extraterrestrial Materials", JSC is charged with "the curation of all extraterrestrial material under NASA control, including future NASA missions." The Directive goes on to define Curation as including "…documentation, preservation, preparation, and distribution of samples for research, education, and public outreach." Here we describe some of the ongoing planning efforts in curation as they pertain to the return of martian samples in a future, as of yet unplanned, mission.

Advanced Curation at NASA JSC: Part of the curation process is planning for the future, and we refer to these planning efforts as "advanced curation" [1]. Advanced Curation is tasked with developing procedures, technology, and data sets necessary for curating new types of collections as envisioned by NASA exploration goals. We are (and have been) planning for future curation, including cold curation, extended curation of ices and volatiles, curation of samples with special chemical considerations such as perchlorate-rich samples, curation of organically- and biologically-sensitive samples, and the use of minimally invasive analytical techniques (e.g., micro-CT, [2]) to preliminarily examine and/or characterize samples. Many of these efforts will be critical for successful curation of returned martian samples. However, to improve our ability to curate the astromaterials collections of the future and to provide maximum protection to any returned samples, it is imperative that curation involvement commences at the time of mission inception.

Importance of Contamination Knowledge: When curation involvement is at the ground floor of mission planning, it provides a mechanism by which the samples can be protected against project-level decisions that could undermine the scientific value of the returned samples. A notable example of one of the benefits of early curation involvement in mission planning is in the acquisition of contamination knowledge (CK). CK capture strategies are designed during the initial planning stages of a sample return mission, and they are to be implemented during all phases of the mission from assembly, test, and launch operations (ATLO), through cruise and mission operations, to the point of preliminary examination after Earth return. CK is captured by witness materials and coupons exposed to the contamination environment in the assembly labs and on the space craft during ATLO. These materials, along with any procedural blanks and non-flight, flight-like, and flown hardware, represent our CK capture for the returned samples and serves as a baseline from which analytical results can be vetted. Collection of CK is a critical part of being able to conduct and interpret data from organic geochemistry and biochemistry investigations of returned samples. The CK samples from a given mission are treated as part of the sample collection of that mission, hence they are part of the permanent archive that is maintained by the NASA Curation Office.

The Mars 2020 mission may represent the first step in a larger Mars Sample Return campaign. Consequently, we must treat the ATLO portion of that mission as any other sample return mission. Specifically, we will collect and curate CK samples so that contaminants can be distinguished from indigenous martian materials within the returned samples. The efforts to collect and curate CK related to Mars 2020 are ongoing, and details regarding the CK efforts are outlined in Harrington et al., [3].

Mars Sample Curation Facility: In the past, there has been a distinction made in the literature between a sample receiving facility and a sample curation facility [e.g., 4]; however, advances in technology over the last decade have demonstrated that the receiving facility may be a mobile facility that is deployed to the planned landing site (e.g., Utah Test Range). A mobile/modular BSL-4 receiving facility can meet all current standards and protocols, including redundant systems and critical biological containment/pressurization requirements [5]. This facility could serve as the containment facility for initial life-detection studies and preliminary examination of the samples. This mobile facility could be transported directly to the curation facility for permanent storage and processing once the samples are released. Future studies of sample receiving facilities that require BSL-4 containment may wish to include a comparison review of modern mobile/modular labs as an alternative construction option.

References: [1] McCubbin, F.M. et al., (2016) 47th Lunar & Planetary Science Conference. #2668. [2] Zeigler, R.A. et al., (2014) 45th Lunar & Planetary Science Conference. #2665. [3] Harrington. A.D. et al., (2018) 49th Lunar & Planetary Science Conference. #2599. [4] Allen C. C. and Beaty, D. W. (2016) 3rd International Workshop on Instrumentation for Planetary Missions. #4099 [5] Calaway M. J. et al., (2017) 48th Lunar & Planetary Science Conference. #1221