ADVANCED CURATION: SOLVING CURRENT AND FUTURE SAMPLE RETURN PROBLEMS. M. Fries[1], M. Calaway[2], C. Evans[1], F. McCubbin[1]. [1]NASA Astromaterials Acquisition and Curation Office, ARES, Johnson Space Center, Houston, TX. [2]Jacobs, NASA Johnson Space Center, Houston, TX. Email: marc.d.fries@nasa.gov

Advanced Curation is a wide-ranging and comprehensive research and development effort at NASA Johnson Space Center that identifies and remediates sample related issues [1-9]. For current collections, Advanced Curation investigates new cleaning, verification, and analytical techniques to assess their suitability for improving curation processes. Specific needs are also assessed for future sample return missions. For each need, a written plan is drawn up to achieve the requirement. The plan draws while upon current Curation practices, input from Curators, the analytical expertise of the Astromaterials Research and Exploration Science (ARES) team, and suitable standards maintained by ISO, IEST, NIST and other institutions. Additionally, new technologies are adopted on the bases of need and availability. Implementation plans are tested using customized trial programs with statistically robust courses of measurement, and are iterated if necessary until an implementable protocol is established.

Upcoming and potential NASA missions such as OSIRIS-REx, the Asteroid Retrieval Mission (ARM), sample return missions in the New Frontiers program, and Mars sample return (MSR) all feature new difficulties and specialized sample handling requirements. The Mars 2020 mission in particular poses a suite of challenges since the mission will cache martian samples for possible return to Earth. In anticipation of future MSR, the following problems are among those under investigation:

- What is the most efficient means to achieve the <1.0 ng/cm^2 total organic carbon (TOC) cleanliness required for all sample handling hardware?
- How do we maintain and verify cleanliness at this level?
- The Mars 2020 Organic Contamination Panel (OCP) predicts that organic carbon, if present, will be present at the "one to tens" of ppb level in martian near-surface samples. The same samples will likely contain wt% perchlorate salts, or ~1,000,000x as much perchlorate oxidizer as organic carbon. The chemical kinetics of this reaction are poorly understood at present under the conditions of cached or curated martian samples. Among other parameters, what is the maximum temperature allowed during storage in order to preserve native martian organic compounds for analysis?
- What is the best means to collect headspace gases from cached martian (and other) samples? This gas will contain not only martian atmosphere but also off-gassed volatiles from the cached solids.

References: [1] Allen C.C. et al. *Chemie der Erde* **71** (2011) 1-20. [2] Allen C.C. *et al Eos* **94**,29 (2013) p.253. [3] Allen C.C. *76th MetSoc Meeting* (2013) Abstract #5069. [4] Allton J.H. *et al*. *Adv. Space Resources* (1998) 373-382. [5] Calaway M.J., Allen C.C., Allton J.H. *76th MetSoc Meeting* (2013) Abstract # 5073. [6] Calaway M.J. *et al*. *LPSC XLIV*, (2013) Abstract #1242. [7] Calaway M.J. *et al LPSC XLIV*, (2013) Abstract #1241. [8] Fries M. *et al 46th LPSC* (2015) Abstract #2805. [9] Calaway M., Fries M., *46th LPSC* (2015) Abstract #1517.