SAMPLE ACQUISITION AND CACHING ARCHITECTURES FOR THE MARS2020 MISSION. K. Zacny[1], P. Chu[2], G. Paulsen[1], K. Davis[3], [1]Honeybee Robotics, 398 W. Washington Ave, Suite 200, Pasadena, CA 91103, zacny@honeybeerobotics.com, [2]Honeybee Robotics, Houston, TX, [3]Honeybee Robotics, New York, NY.

Introduction: The goal of the Mars2020 mission is to acquire up to 34 rock/regolith samples and 3 blanks, and cache these for the future return mission. Since the 1990s, Honeybee Robotics has been continuously engaged in developing technologies applicable to the Mars sample return mission. These technologies include 9 coring drills, 3 grinding tools, and sampling bits: the SLOT caching bit, the Powder and Regolith Acquisition Bit (PRABit), Rock Abrasion and Brushing Bit (RABBit), and PreView Bit (Figure 1). Honeybee also developed 3 caching architectures; however only two are promising for the M2020 mission [1-3].

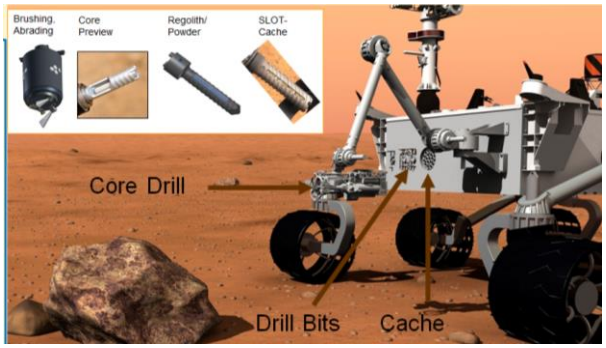

Figure 1. Mars2020 architecture with 4 bit types.

Caching Architectures:

***One Bit One Core (OBOC*):** In the OBOC architecture, a core is acquired using a low mass SLOT bit with integral break-off system. Following visual verification, the entire bit with core sample is placed directly into the cache (Figure 2). To collect/store 37 samples, the mission must bring 37 bits (plus spares). The advantage is lower operational complexity (risk).

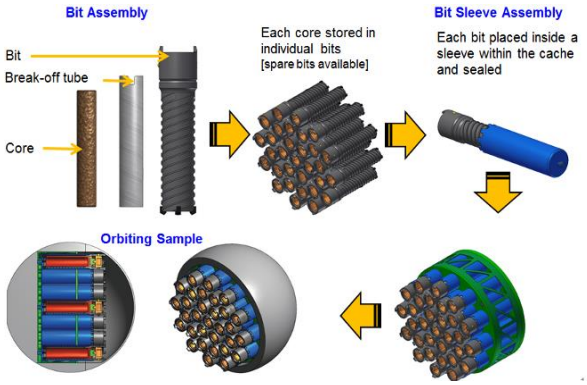

Figure 2. One Bit One Core (OBOC).

One Breakoff System One Core (OBSOC: In the OBSOC architecture, a core is acquired using a low mass SLOT bit with integral break-off system just like in the OBOC architecture. Following visual verification of sample the bit's cutting teeth, flute sleeve and shank (i.e. an auger bit) are discarded and the core sample, positively captured within the break-off tube, is stored in a cache (Figure 3). Hence only the breakoff tube and sleeve are retuned with the core. To collect/store 37 samples, the mission must bring 37 bit assemblies (removable break-off systems are preinstalled in bits). The main advantage is that only the minimum elements necessary to maintain positive control of core sample are retuned. This yields lowest returned mass and volume.

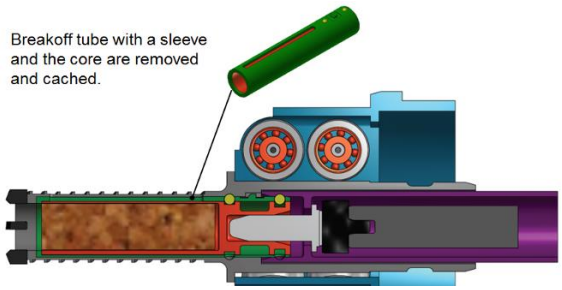

Figure 3. One Breakoff System One Core (OBSOC).

Trade Studies for 31 and 37 Cores: Figure 4 compare OBOC and OBSOC architectures. The cache with bits/tubes and rock samples weighs under 2.5 kg for OBOC architecture and <2 kg for OBSOC architecture.

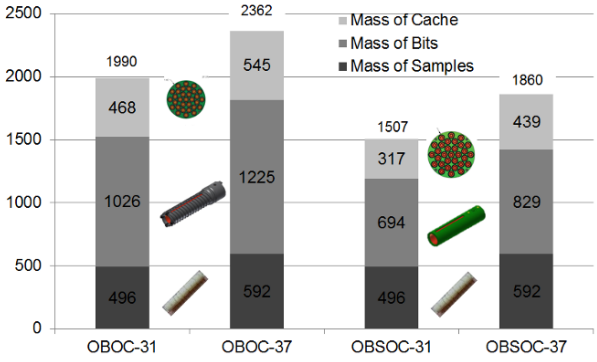

Figure 4. Mass of the two architectures.

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References: [1] Zacny et al. (2014), Mars2020 Sample Acquisition and Caching Technologies and Architectures, IEEE Aero Conf. [3] YouTube: http://www.youtube.com/watch?v=VhfL3htrtZ8, and https://www.youtube.com/watch?v=cf47bvULtEQ, https://www.youtube.com/watch?v=NphWPvi9cy4,