

SPACE EXPLORATION SYMPOSIUM (A3)
Mars Exploration – Part 2 (3B)

Author: Dr. Kris Zacny
Honeybee Robotics, United States, zacny@honeybeerobotics.com

DRILLING AND CACHING ARCHITECTURE FOR THE MARS2020 MISSION

Abstract

The goal of the Mars2020 mission is to acquire up to 28 rock/regolith samples and 3 blanks (or 34 rock/regolith samples and 3 blanks), and cache these for the future sample return mission. Honeybee Robotics investigated three architectures; however only two showed promise. In the One Bit One Core (OBOC) architecture, individual drill bits with core samples are cached. This is the least complex architecture and results in the total mass (cache+bits+rocks) of less than 2 kg and Orbital Sample diameter of 19 cm for the 31 cores case and slightly more (2.4 kg cache and 20 cm OS) for the 37 cores. In the One Breakoff System One Core (OBSOC) architecture, the breakoff tube and the sleeve with cores are removed from the drill bit and cached. The architecture also uses one time use bit assemblies (plus spares). This architecture results in the lowest cache mass and OS diameter but the trade is complexity and sampling system mass. The OBSOC cache mass is 1.5 kg and 1.86 kg for the 31/37 cases respectively, while the OS diameter is 17 cm and 17.5 cm for the 31/37 cases respectively. All architectures use SLOT bit that allows inspection of rock samples along their lengths prior to caching. The paper also introduces several key technologies developed by Honeybee Robotics over the past 15 years.