AMASE Rover Platform for Testing Instrumentation for Potential Astrobiology and Mars Sample Return Missions. P. Younse[1], M. DiCicco[1], A. R. Morgan[1], P. Conrad[2], A. Steele[3], H.E.F. Amundsen[4], P. Backes[1], and the AMASE 2010 Team, [1]Jet Propulsion Laboratory, Pasadena, California, 91109, [2]NASA Goddard Space Flight Center, Code 699, Greenbelt, MD 20771, [3]Geophysical Laboratory, Carnegie Institution of Washington, 5251 Broad Branch Rd., Washington, DC 20015, [4]Earth and Planetary Exploration, Jac Aals Gate, Oslo Norway.

Introduction: A FIDO-class Mars technology rover, a mid-sized rover with mobility and capability similar to the MER rovers, was used to develop a platform to integrate, operate, and field test science instruments and sample acquisition and caching systems in Mars analog environments for potential future astrobiology and Mars Sample Return missions

The Arctic Mars Analogue Svalbard Expeditions (AMASE), funded through the NASA ASTEP Program aims to aid development of technology to identify, acquire, and contain astrobiologically interesting samples for future potential Mars Sample Return missions. Several sample collection and caching system have been integrated, tested, and assessed over the last few years. In 2009, a scooping system tested was tested in Svalbard, Norway (Younse et al., 2010). The 2010 sample acquisition and caching system tested the SHEC subsystem and control software developed through the JPL RTD task IMSAH (PI: Paul Backes).

Rover Platform: The Pluto FIDO-class rover, based at the Jet Propulsion Lab, was utilized to implement a coring drill, caching system, and MI (see Figure 1). The rover is fully operational and capable of autonomy. It contains a rocker-bogey suspension system, six independently drivable and steerable wheels, a mast with navigation and panoramic cameras, and a 5-DOF arm for instrument deployment and sample collection.

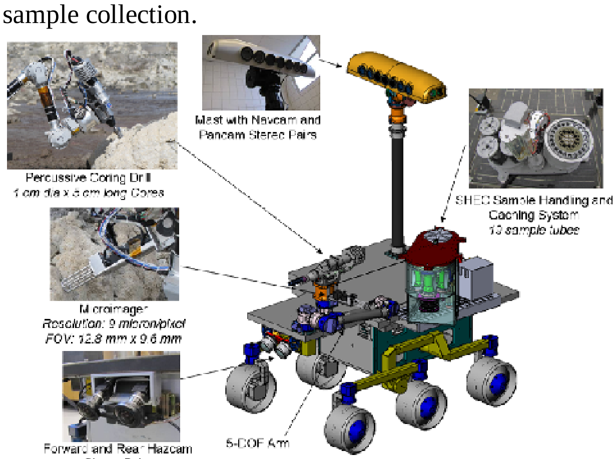

Figure 1. Pluto rover integrated for AMASE 2010 Field Testing.

Sample Acquisition and Handling System: The sample handling, encapsulation, and containerization subsystem (SHEC) contains four drill bits, 19 sample tubes, 1 spare sample tube, and 20 sample plugs (Figure 2) and is described in further detail in Younse et al. (2010) and Backes et al. (2010). A handling arm inside the SHEC performs the tube transfer, sealing, and tube loading operations. The SHEC subsystem and control software was developed through the JPL RTD task IMSAH (PI: Paul Backes).

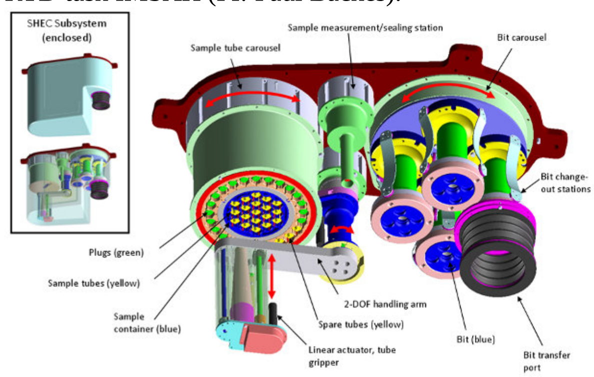

Figure 2. The Sample Handling, Encapsulation, Containerization subsystem (SHEC).

A commercial hammer drill was modified and mounted onto the end of the rover arm, as shown in Figure 3. The drill allows for an attachable SHEC coring bit with a sample tube inside, capable of coring 1 cm diameter x 5 cm long cores.

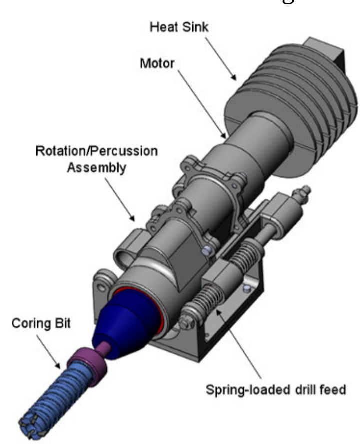

Figure 3. Percussive drill design.

Rover Sample Acquisition and Caching Operation: The sample acquisition and caching system starts with a handling arm in the SHEC loading an empty sample tube from the sample canister into a drill bit on the bit carousel, which is then attached to the coring drill. Core samples are aquired by the drill through an automated coring algorithm, collecting the cores directly into the sample tube in the bit. Once a sample has been collected, the coring bit is placed back into the SHEC, where the handling arm can remove the filled sample tube, seal it with a plug, and then place it back into sample canister. The sequence is summarized through Figures 4-8.

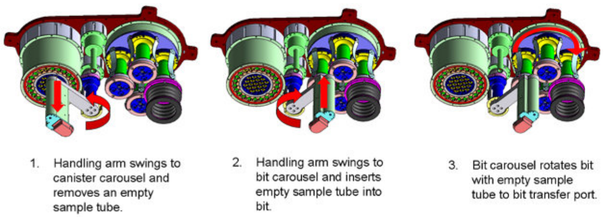

Figure 4. Automated tube insertion in SHEC.

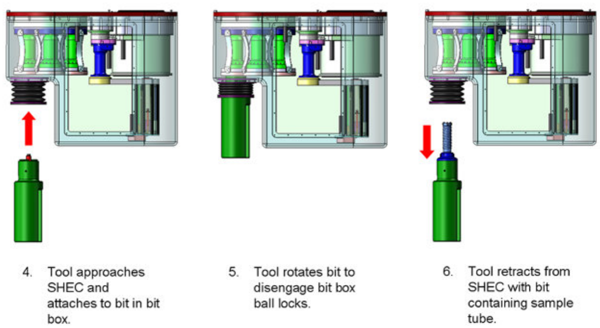

Figure 5. Manual bit transfer from SHEC to tool.

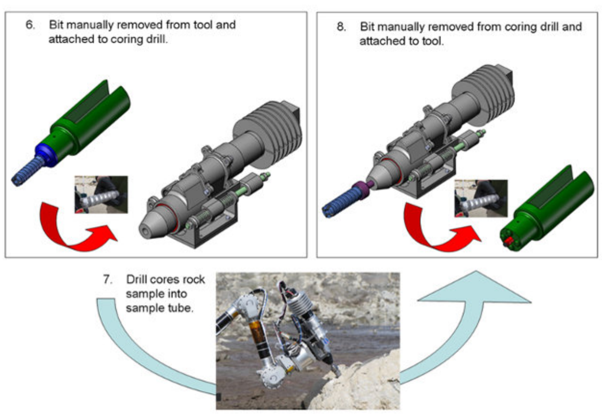

Figure 6. Manual bit changeout and coring.

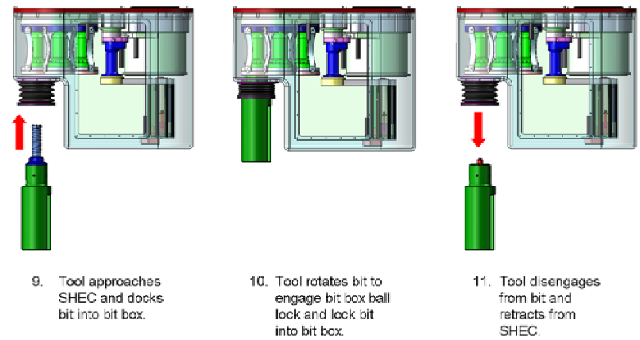

Figure 7. Manual bit transfer from tool to SHEC.

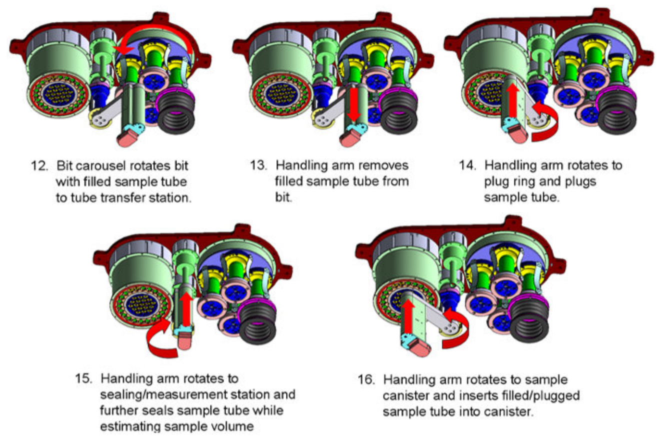

Figure 8. Automated tube sealing in SHEC.

References: [1] Backes P. et al. (2010) *IEEE Aeropsace Conference*, Paper #1675. [2] Younse P. et al. (2010) *Abscicon*, 1538, 5621. [3] Younse P. et al. (2010) *IPPW-7*, Paper #502.