Arctic Mars Analogue Svalbard Expedition (AMASE) 2009. A. Steele[1], H.E.F. Amundsen[2], P.G. Conrad[3], and L. Benning[4], on Behalf of the AMASE 09 team. [1]Geophysical Laboratory, Carnegie Institution of Washington, 5251 Broad Branch Road, Washington DC., [2]Earth and Planetary Exploration, Oslo Norway., [3]Jet Propulsion Laboratory, Pasadena, California, [4]University of Leeds, Department of Earth Science, Leeds UK.

Introduction: The Arctic Mars Analogue Svalbard Expeditions (AMASE) 2009 was the latest of a series of expeditions that are NASA ASTEP and ESA funded and have as their primary goals 1) testing portable instruments for their robustness as field instruments for life detection, 2) assessing Mars analogue environments for biosignatures, 3) refining protocols for contamination reduction, 4) defining a minimal sample suite for Astrobiology science on Mars and 5) sample acquisition, collection and caching on rover platforms: first Cliffbot, then Athena. The goals and technologies used during this ASTEP campaign are very similar to that proposed by the current MEPAG MAX-C mission concept and set the stage for future sample return missions. As such the field-tested technologies, procedures and protocols can be used to address specific science objectives proposed for the 2018 Mars mission opportunity.

In 2009 thirty-five scientists and engineers involved in Mars exploration including MER, MSL and ExoMars mission team members, conducted instrument testing and simulated Mars surface operations training exercises. Twelve instruments have been deployed in the field, testing their individual capabilities and utility within an instrument suite, as well as the performance during simulated Mars surface operations. The contact and remote sensing instruments include; remote Raman, contact Raman, LIBS, ground penetrating radar (WISDOM), FTIR, PanCam and life marker chip (LMC) and induced native fluorescence detectors. Portable instruments deployed also included Thermal evolved gas analysis (from the MSL, SAM team), Raman spectrometer, XRD (CheMin), FTIR spectrometer, and spectrophotometer for pigments and nutrients. Digital and rover mounted microscopy for imaging was used along with PanCam, Hazcam and NavCam imagery. Contact instruments were evaluated against analytical suite measurements: MSL instrument Sample Analysis at Mars simulated by commercially available GCMS and CheMin XRD/XRF by its field derivative, the Ex Situ, Inc. Terra.

In the past four expeditions, we have made 12 Rover deployments both with ATHENA and "Cliffbot" on challenging terrain in Svalbard in addition to measurements made by the instruments listed above. Our work also extends to testing Mars sample return technology in several ways; the development and testing of a ATHENA mounted platform system specific for collection of samples via a robotic arm and scoop (Figure 1), developed protocols and science justification for contact instrument suite for sample targeting and initial analysis and successfully developed protocols for sterilization in the field to ensure sample integrity (backed up by biotechnology assessments of sample cross contamination (2). The scientific team has developed a close working relationship with the JPL-based rover engineers resulting in initial development of Rover arm sample targeting systems and protocols.

Samples returned from the 2009 field expedition are being treated as Martian returned samples in that they will be used to assess laboratory instrument suites for a sample receiving facility. A comprehensive suite of instruments are currently being used and include; GCMS, GCIRMS, LCMSMS, ToFSIMS, NanoSIMS, two step laser ablation mass spectrometry (UL^2MS), Raman, FTIR, culturing and microbial characterization techniques, light and electron microscopy.

As NASA and ESA enter a new era of collaboration, AMASE has provided and will continue to provide, a test bed for both in situ and Mars Sample Return mission architectures.

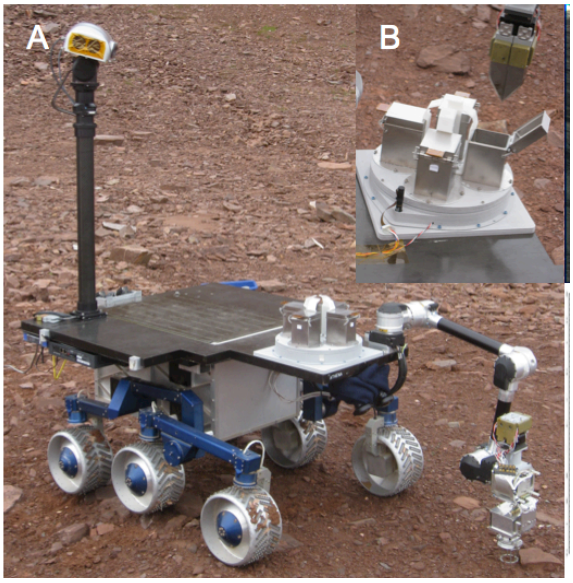

Figure 1. A) ATHENA rover with sample scoop and caching carousel deployed on AMASE 09. B) close up of robotic arm placing a scoop containing sample into the scoop housing within the caching box.

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