SPACE EXPLORATION SYMPOSIUM (A3)
Mars Exploration – Part 1 (3A)

Author: Mr. Mark Barnet
MDA, Canada, Mark.Barnet@mdacorporation.com

Mr. Justin Allport
MDA, Canada, justin.allport@mdacorporation.com
Dr. Nadeem Ghafoor
MDA, Canada, nadeem.ghafoor@canadensys.com
Mr. Dave Parry
MDA, Canada, dave.parry@mdacorporation.com
Dr. Cameron Ower
MDA, Canada, cameron.ower@mdacorporation.com
Dr. Cameron Dickinson
MDA, Canada, cameron.dickinson@mdacorporation.com

A MARS SAMPLE RETURN TECHNOLOGY DEPLOYMENT

Abstract

Future space exploration goals undoubtedly include robotic planetary exploration. Rovers are ever more becoming the main tool of planetary geologists for exploring distant worlds. Mars Sample Return is a Canadian priority in planetary exploration, and in one step along this path, the Canadian Mars Sample Return Technology Deployment was conducted.

The mission was carried out as part of the Canadian Space Agency's Exploration Surface Mobility (ESM) project, the goals of which are: to learn how to conduct an analogue sample return mission; to incorporate scientific goals and objectives into a technology demonstration; and to develop detailed mission plans and procedures that show a clear path to flight. The analogue aspects of the mission were threefold. First the locations, as chosen by the science team, were in the Flagstaff, AZ area, and included Meteor Crater, SP Crater, and Cinder Lake. The first two sites had clear Mars analogues, and the third was deemed an excellent proving ground for the rover. Second was the hardware used for the mission. It comprised the Canadian Breadboard Rover (CBR), which is a planetary representative chassis employing a state-of-the-art guidance and navigation system, and an engineering model of a MER rovers' robotic arm outfitted with a mini-corer. Third, mission operations were planned written, and executed in conjunction with the science team to be representative of actual operations and decision making processes needed for sample collection. Operations were conducted from mission control at CSA's headquarters in Montreal, and followed the ESM Mars Sample Return methodology from mission planning, site selection, surface operations, and science objectives.

While the location and hardware used were important factors in this deployment, the implementation of representative operations greatly enhanced the lessons learned. The mission was not just "playing in the sandbox", it involved a team of flight controllers and scientists remotely commanding the rover through predefined and science driven tasks. The team built up experience through a number of short objectives over several days before commencing a three day Design Reference Mission (DRM). The DRM covered site localization, sample site selection, long and short distance autonomous traverses, robotic arm operations, 3D sample site scanning, and core sample acquisitions. At the conclusion of the mission, a field tested, refined set of operational procedures was developed, ready to be applied to future analogue and (eventually) real planetary missions.