PRELIMINARY RESULTS OF A MULTI-GOAL MARS ANALOGUE EXPEDITION (EXPEDITION TWO) TO THE ARKAROOLA REGION, AUSTRALIA

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Expedition Two was the second in a series of expeditions to Mars analogue locations worldwide under the auspices of the Mars Expedition Research Council (MERC). The goals of Expedition Two were threefold: research, operations, outreach and education. The expedition will be contained with approximate 100 km radius of Arkaroola in the northern Flinders Ranges in the Australian Outback. There were six main themes to the expedition within the goals: ***Field Science*** *– Collecting baseline geological and biological data on the field area and its Mars analogue significance.* ***Field Engineering*** *- Trials of the MarsSkin 3 analogue Mechanical Counter Pressure suit.* ***Exploration Operations*** *– evaluation of exploration methodologies, data collection and data loggers, and a site database, and selection of the site for MARS-OZ* ***Human Factors*** *– psychological profiling of an international, multi-disciplinary team of expeditioners, cognitive function, leadership philosophies, and crew social interaction.* ***Outreach****– The expedition had extensive television, radio, newspaper and internet coverage.* ***Education*** *– The expedition interacted with students from the International Space University's Summer School Program and undergraduates from the planetary science course at the University of Technology, Sydney*

INTRODUCTION

The Mars Society Australia (MSA) selected the Arkaroola region as its prime Mars analogue area as an outcome of its Jarntimarra-1 (JNT-1) Expedition in 2001 (Mann *et al.*, in 2004, Clarke and Mann, in 2004). The survey team used a careful selection process that recorded information on the site name, date visited, coordinates, ownership, access, risks, maps, geology, climate, flora/fauna, history, analogue value and references. Comparative judgments with respect to MSA's specific needs were made on a separate assessment sheet with a list of 9 scientific, 8 engineering, 7 logistic, and 8 visual criteria. The Arkaroola region was selected from a short list of six regions (Figure 1).

The area was revisited in August 2004 over a period of 26 days by a team of 26 researchers and support personnel from Australia, Canada, the United States, and France (Clarke and Persaud 2004). The expedition was under the auspices of the Mars Expedition Research Council (MERC), as part of the MERC's planned series of 15 progressive research expeditions. Actual achievements of the expedition against the goals outlined by Clarke and Persaud (2004) will be summarised.

GEOGRAPHICAL RESEARCH AREAS

Five areas were designated by Clarke and Persaud (2004) for Expedition Two (Figure 2). They consisted of:

1) The Mount Painter province and Adelaide Fold Belt in the Arkaroola area. This features radiogenic hot springs, weathered uranium (and other metals) prospects, the Cambrian-Precambrian boundary, Proterozoic glacials, and stromatolite horizons (Coats 1972, Coates and Blissett 1971)

2) The eastern fans. These drain from the northern Flinders ranges and have deposited a range of both modern and relict fans and their associated drainage systems. These discharge into the large playa of Lake Frome. Associated with these deposits are localised minor dunes. Neotectonics along the eastern and northern flanks of the Flinders ranges have resulted in tilting of the fans and thrusting of Adelaide Fold Belt and basement rocks over the Quaternary sediments (Twidale and Bourne 1996).

3) The Strzelecki Desert. This is a major sand sea of longitudinal dunes. At Gurra Gurra waterhole on Strzelecki Creek there were previously both aeolian erosional features (yardangs) and crescentic dunes that have been used as a Mars analogue (Bishop 1999). Also in the area are ephemeral rivers, evidence of high lake level shorelines, salt pans, gibber plains, and several mound springs (Twidale and Wopfner 1990, Peake-Jones 1952)

4) The Mount Babbage Inlier. This is the northern-most end of the Flinders Ranges and features four or five clusters of mound springs, fans, excellent exposures of glacial-marine Cretaceous, duricrusts, and an exhumed Mesozoic landscape (Coats and Blissett 1971).

5) Northern fans and surfaces. This area consists of deposits formed by drainages flowing north and west from the Flinders Ranges. Features of interest include modern and relict fans and surfaces, duricrusts, gibber plains, sand dunes, and floodouts.

In practice the planned areas of investigation proved too ambitious. Apart from some reconnaissance in areas 3, 4 and 5. Most of the work focussed on areas 1 and 2. This is not to indicate that the other areas are not important, rather than it did not prove practical to study them in any detail in the time frame available. They remain areas of investigation for future expeditions.

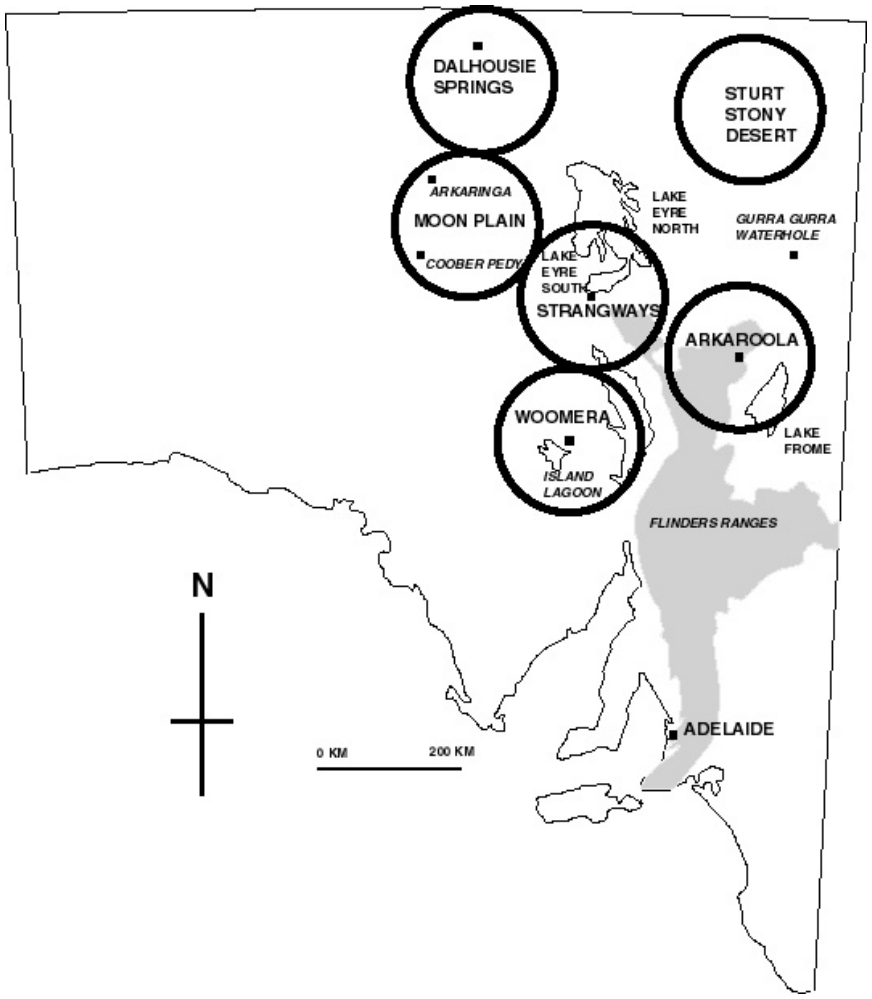

Figure 1. Arkaroola and the six other Mars analogue regions investigated during JNT-1 (after Mann *et al.* 2004).

EXPEDITION THEMES

Clarke and Persaud (2004) outlined the following six themes for Expedition Two activities:

- **Field Science:** Preliminary research into sites geological, biological, and hydrological analogue potential of the Arkaroola region. This will provide a foundation for future research programs.
- **Field Engineering** Evaluate the performance of the latest development of the MarsSkin (version 3) analogue Mars Counter Pressure suit.
- **Operations:** Perform operational research of significance to field science data logging (using digital photo, voice and text records each stamped with precise time and GPS locations) for assisting the field scientist with mapping and data documentation protocols, develop exploration methodologies, and select the site for MARS-OZ.
- **Human Factors:** Investigate crew interactions and leaderships in a normal field expedition. This will provide a basis for comparison with future research of crew interactions under varying levels of simulation.
- **Outreach:** Interviews with web, print, and broadcast media organisations, updates on society web sites.
- **Education:** Interaction with the International Space University and the planetary science course at the University of Technology, Sydney

These goals provide a means of assessing the success of the expedition after its completion (see section below).

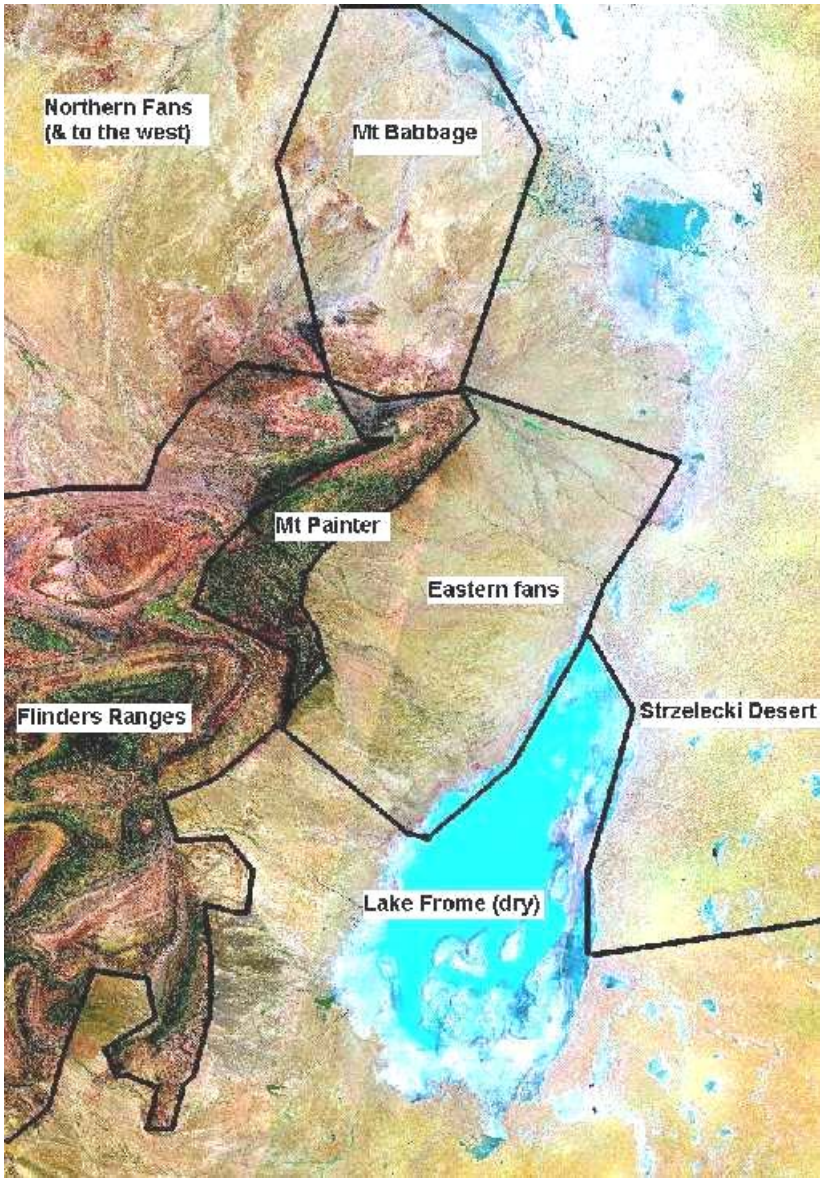

Figure 2. Approximate boundaries of the Expedition Two study regions in the northern Flinders Ranges and adjacent areas.

EXPEDITION PROGRAM

Expedition Two was designed to operate in four phases, each of approximately one week's duration. Expeditioners came and went at the start of each phase, but the crew structure will be was during each. The goals and regions studied in each phase are outlined below.

Phase 1

This phase was intended consist of five main activities: orientation and familiarization, initial trials of the MarsSkin 3 suits, selection of the prime site for MARS-OZ, flights of the Aerosonde UAV, and interaction with students from the International Space University (ISU) and the

University of Technology, Sydney (UTS). During this phase expeditioners were intended to work as a group and be accommodated in the Arkaroola Shearer's quarters, which will serve as the main base throughout the expedition. The areas visited during this phase were intended be primarily area 1 and parts of area 2. The weekend would consist of a 1-2 day period of reduced activity during which time crew changes would occur.

Phase 2

In this and subsequent phases the group was intended to divide into two subgroups: a base team that would work out of the shearer's quarters on a daily basis and an away team that would camp in vehicles at remote sites for a period of up to 6 days. The weekend would consist of a 1-2 day rest and relaxation period during which time crew changes will occur. During phase 2 the away team will visit sites in the Strzelecki Desert (area 3). The base team will investigate areas 1 and 2.

Phase 3

During the third phase of the expedition the away team was intended to work in the region of Mt Babbage (area 4). The base team in the mean time would focus on areas 1 and 2. The weekend would consist of a 1-2 day rest and relaxation period during which time crew changes will occur.

Phase 4

The away team in the final phase of the expedition was intended to work in the most distant region, the northern fans (area 5) in the vicinity of Apollinaris Well. Depending on contingencies, vehicle availability and crew numbers, it was possible that the base team might join the away team on this part of the expedition.

The above phase goals also provide a way of assessing the success of the expedition in meeting the planned targets (see below).

RESEARCH PROJECTS

Research during expedition one occurs in 12 projects in four main areas: field science (biology and geology), exploration methodologies, human factors, and engineering.

Biology

Project 1: A proposal for a Mars Analog Microbial Observatory and the need for baseline biodiversity studies at MDRS, FMARS, Euro-MARS, and MARS-OZ. The researchers are: Shannon Rupert-Robles (Department of Physical Sciences, MiraCosta College, San Diego) and Edward Martinez (California State University, Sacramento, Department of Environmental Studies). The work focused on areas 1, 2, and 4. Objectives of the study are to conduct baseline surveys that include transect monitoring of terrestrial plant communities, macroinvertebrate identification counts, and water quality measurements. By accomplishing these objectives we

will be one step closer to the establishment of a worldwide Mars Analogue Microbial Observatory network.

In the event the researchers focussed on waterholes and springs in the northern Flinders Ranges. They included Black Spring, Old Paralana Spring, Paralana Hot Spring, and Nepouie Spring (all true springs discharging with significant hydraulic head). Paralana Hot Spring and Nepouie Spring were hot and warm respectively. Paralana Hot Spring, Old Paralana Spring, and Black Spring all had elevated radioactivity. Other sites visited included Arkaroola Spring, Echo Camp water hole, Bararranna Gorge, Bolla Ballana water hole, Nooldoonooldana water hole, and Munyallina Spring. These sites all consisted of outcroppings of the shallow creek aquifer or deep bedrock pools in water courses. The data will provide important baseline information on the ecosystems of the area preparatory to the establishment of a microbial observatory. This will be an important step for the carrying out of astrobiological research in the area.

Project 2: Characterization of Extremophile Population Surrounding Arkaroola using 16S RNA based Molecular Probes. The researcher is Fathi Karouia (University of Houston, Department of Biology and Biochemistry). The prime areas will be 1 and 2. The research proposal is a field test of a comprehensive bacterial detection system based on 16S ribosomal RNA (rRNA) targeted probes to identify organisms at both the genus and species level. This system has been adapted to a variety of assays that exploit advanced solution hybridization technologies such as molecular beacons and microarrays.

The researcher collected soil samples from the proposed MARS-OZ simulated Mars base site, the Mount Painter Number 6 workings (a historic uranium mine), Paralana Hot Spring, and elsewhere in areas 1 and 2. This study provides an ideal complement to project 2, and tests the validity of "lab on a chip" technology in a field setting.

Geology

Project 3: Geological, hydrological, and meteorological characterization of springs in the Arkaroola region. The researcher is Jennifer Heldmann (NASA Ames Research Centre). This project is part of a post-doctoral fellowship. The prime areas were intended to be 2, 3 and 4. Questions addressed in this project are: 1. What is the history of the fluvial and aeolian landscape? 2. What is the history of water in the area? These questions are vital to NASA analysis of Mars landing sites, and the applying them to key sites in the Arkaroola region will enable the researcher to better engage the application of these questions to Mars.

Jennifer Heldmann was able to install instruments at Nepouie and Paralana Hot Springs (areas 1 and 2). These instruments along with 11 month's worth of data will be retrieved in July 2005. In addition a reconnaissance of the Twelve Springs Complex at Mt. Babbage (area 4) and the Blanche Cup, Bubbler and Strangways Springs at Lake Eyre South was also carried out.

Project 4: Remote methods for detection of hydrothermal activity in the Mt. Painter District, northern Flinders Ranges, South Australia. The researchers are: Adrian Brown (Australian Centre for Astrobiology Macquarie University), Matilda Thomas (Geoscience Australia / Australian Centre for Astrobiology Macquarie University), and Michael West (Dept.

Mechatronics Engineering, University of Sydney). This project will be centred on area 1 but will also cover part of areas 2 and 4. It proposes to bring a variety of remote mapping techniques to bear on resolving the problem of mapping hydrothermal alteration in the Mt. Painter district near Arkaroola using airborne instruments (HYMAP) and satellite data (ASTER).

Both Adrian Brown and Matilda Thomas were able to carry out extensive ground truthing of their chosen area. In addition Matilda Thomas was able to use a PIMA infrared spectrometer to record the spectra of hand specimens in an improvised field laboratory.

Project 5: The evolution and dynamics of desert dunes in the Lake Eyre Basin, South Australia. The researchers are: Kathryn Fitzsimmons and Vjeko Matic (Dept. Earth and Marine Sciences, Australian National University). This work is part of Kat Fitzsimmon's research towards a PhD and therefore will be carried out in area 3. The project planned to examine the dunes and yardangs at Gurra Gurra water hole (Bishop 1999) and carry out a reconnaissance of those east of Lake Frome.

The reconnaissance was carried out as planned during phase 2. The team discovered that the features studied by Bishop (1999) had been destroyed by natural processes and were now revegetated. Kat Fitzsimmons and the team were however able to collect a range of samples for OSL dating from the dunes of the Strzelecki Desert.

Project 6: Neotectonics of the alluvial fans of the Lake Frome Plains. The researcher is Vic Waclawik (Dept. Earth and Environmental science, University of Adelaide). This work is towards Vic Waclawik's PhD. This project will focus on area 2. During field work the researcher examined the signature of neotectonic events on the geomorphology, sedimentology, and induration of the fans draining east from the northern Flinders Ranges.

In the course of phase 2 of the expedition the researcher, with considerable assistance from Vic Gostin of Adelaide University and some from Mar Bishop and Jonathan Clarke examined a range of sites along the eastern Flinders Ranges and documented a range of neotectonbic features including over-steeped fan surfaces, raised and dissected mantled pediments, fans, and duricrusts.

Project 7: Structural measurements from satellite imagery, with ground-truthing in the field, in order to create a structural model of the Flinders Ranges in area surrounding the Expedition Two research sites. The researcher is Rocky Persaud (University of Toronto Department of Geology). The prime region is therefore area 1. Comparison of remotely sensed data with ground observations will better develop interpretation methodologies application to basin studies on Mars.

Only a preliminary investigation was carried out because of the time constraints of other research projects.

Human Factors

Project 8: Social Psychological and Leadership and Group Intervention Issues Relevant to a Human Mission to Mars. The researchers are: Steve Dawson & Phil Krins (School of Psychology, Australian National University), Nishi Rawat (Department of Emergency Medicine, Johns Hopkins University Hospital, Baltimore), and Sheryl Bishop (University of Texas Medical Branch, Galveston). The project was not area specific but draws on experience during Expedition One in Utah. It investigated the impact of group and sub-group identity and goal alignment on motivation, effort to achieve group goals, and effective communication both within a particular group and between subgroups. In addition to this there will be a number of measures which attempted attempt to assess which self categorizations are utilized by individuals in the course of a day. Other issues to be investigated will include group polarization and ostracism.

A considerable volume of data, in the form of questionnaires, computer-based measures of cognitive function, and observations by the expedition psychologist, was generated during the course of the expedition.

Exploration Operations

Project 9: Scouting exploration methodologies study (SEMS) to optimize field science with remote collaborations. The researchers are: Stacy Sklar (Dept of Geology, University of Arizona), Shannon Rupert-Robles (MiraCosta College, Department of Physical Sciences, San Diego), Aurora Rupert (student, San Diego), Rocky Persaud (University of Toronto Department of Geology), Steve Jordan (Mars Society) and Jonathan Clarke (Geoscience Australia / Australian Centre for Astrobiology, Macquarie University). This project is not area specific. The project will evaluate the effectiveness of non specialists in the collection of field geological and biological observations and specimens.

Owing to time constraints only a limited number of comparative studies were done. Preliminary trials were satisfactory, however.

Project 10: Arkaroola Mars analogue database. The research coordinator is Jonathan Clarke (Geoscience Australia/Australian Centre for Astrobiology, Macquarie University). This project builds on experience with the construction of the Jarntimarra database during the JNT-1 expediton. The database will contain information on all sites visited, including a description of its geology, geomorphology, biology, and hydrology, its GPS coordinates, a photograph, and a summary of work performed, and any publications on the site or area. The purpose of the database is to aid future researchers in the selection of research topics and study sites.

Twenty sites were categorised in this study. These include all the main visited sites and the planned location for MARS-OZ. The sites will be entered into a searchable web database when this has been constructed.

Project 11: Field science, field mapping and scouting time/motion operational studies using EVA data-logging functional prototypes. The researchers are: John Roesch (Mars Society Canada), Rocky Persaud (University of Toronto, Dept. of Geology), and Steve Jordan (Mars Society). This project is not area specific. Note Projects 10, 11 and 12 will often be conducted together.

There was considerable effort invested into this project. Some of the trials were also conducted using the MarsSkin 3 simulated space suit. Although setting out and downloading of data proved more time consuming than envisaged, more than 75% of the tests planned were achieved. Sites included a range of geological settings, including creek beds, gorges, hilly terrain and the MARS-OZ site.

Engineering

Project 12: MarsSkin 3: its validity as an analogue MCP suit. The researchers are: James Waldie and Natalie Cutler (BAe Systems). This project is not area specific, as the MarsSkins will be used in all areas. This version of the MarsSkin includes lessons from development of version 2 during Expedition One to Utah. It will featured new inner and outer compression suit, a new bubble helmet, and a new back pack for the associated ventilation and electronic systems.

The trials included extensive glove flexibility tests, carried out with the assistance of students from the ISU SSP, who served as experimental subjects, and from the UTS planetary science course, who devised some of the experiments, supervised their execution, and provided experimental subjects. MarsSkin 3 proved a considerable improvement on earlier versions. Future versions will be more robust.

Project 13: MARS-OZ site selection. This project was coordinated by David Willson and assisted by Jonathan Clarke. Its purpose was to select a site for the MARS-OZ simulated Mars base that met a diverse range of criteria, including security, accessibility, diverse local features of scientific interest and visual verisimilitude. A site on the Arkaroola property was strongly preferred.

Three sites were evaluated and ranked. All were along the eastern edge of the Arkaroola property, either on the eastern fans or in the foothills of the Flinders Ranges adjacent to them. The best site was located on a bedrock geology that comprised Neoproterozoic Wooltana basalts that had undergone multiple phases of hydrothermal alteration resulting in quartz-haematite breccia veins. The bedrock geology was overlain by local veneers of boulders from nearshore marine Cretaceous sediments and dissected Quaternary conglomerates. Local deep weathering profiles were exposed beneath the Cretaceous sediments. The landscape consisted of low hills at the site, dissected pediments and fans further east, and the ranges to the west, cut by major gorges, such as that of Arkaroola Creek. Vegetation was sparse, consisting of scattered emu bushes and minor forbs and grasses. The site is 30 minutes drive from Arkaroola and can be accessed by an easily upgradeable track from a main road five km to the east. The tracks can be closed off from public access by the installation of a gate some 1.8 km from the preferred site

OUTREACH

In addition to the above science and engineering projects, a number of outreach and education programs formed a part of Expedition Two. The original programs consisted of joint events with the International Space University (ISU), University of Technology Sydney (UTS), and the Australian Science Teacher's Association (ASTA).

International Space University

In phase 1 Expedition Two was joined by a group of 50 faculty and students from the ISU. The ISU are holding their annual Summer School Program (SSP) for 2004 in Adelaide. The SPP visited the Arkaroola region for three days, they were taken on a field trip for the one full day they were on site. On the first of the two evenings they were present Jonathan Clarke, David Willson and James Waldie made presentations about the expedition program, the MARS-OZ facility, and the MarsSkin program. This was followed by James Waldie coordinating a series of glove flexibility tests using the SSP students as part of his MarsSkin research project. On the second night Jonathan Clarke chaired a discussion that included representatives from the expedition, the SSP, and the UTS on the topic of how analogue research at places such as Arkaroola could faciliate the exploration of the moon and Mars.

University of Technology Sydney

A group of twelve planetary science students for the UTS also interacted with the expedition during phase 1. Their interest was primarily in the geological and biological significance of the area and how research in these disciplines can better facilitate understanding of Mars and possible abodes for life elsewhere in the solar system. Expedition members will guide the UTS students to sites of specific interest without interfering with other research activities. The UTS students devised a number of tests for the glove study, assisted with the coordination of the experiments with the ISU students, and were themselves subjects of the research.

Australian Science Teachers Association

It was originally intended that Phase 3 and 4 of Expedition Two would see development of an online diary and Q&A forum aimed specifically at school students, with potential for live, moderated web chats and one-way video-conferencing. This would also be used on future expeditions. The facility would have allow students to follow the work of researchers "on Mars" for the duration of the Expedition (or part thereof). The project would have interacted with the Australian Science Teachers' Association (ASTA) for National Science Week (NSW) that coincides with phase 3. This year's NSW topic is, appropriately, "Investigating Space". Jeffery Candiloro and Michael West were to have been managers of this project with the assistance at Arkaroola of two students from Canberra, Ros and Jennifer Clarke. In the event Jeff Candiloro was unable to participate in the expedition and so the program was cancelled a week before it was scheduled to begin.

Other media

There was considerable media interest in the expedition. In addition to numerous radio interviews, the expedition featured in three reports on Channel 7 news, two reports on Channel 10 news, twice on ABC television's Stateline program, and once on Channel 9's "A Current Affair". There was also one interview for a Japanese radio station. All expedition reports, journal entries and images were uploaded onto the expedition web site at MSA's Publicity director, Jennifer Laing, coordinated these opportunities in Australia. MSC's Communications

Director, Reyna Jenkyns, coordinated operations in Canada. Rocky Persaud supervised the web site.

APPLICATION OF OUTCOMES TO FUTURE EXPEDITIONS

General

Each expedition in MERC's progressive Mars analogue expedition series leads into subsequent projects. Geological and biological investigations provide the situational context for all human factors research (work psychology, cognitive studies, social-psychology and ergonomic design), operational investigations (exploration strategies, field work processes, efficiency optimization), and engineering studies (science instruments, exploration technology, life sustaining and work enhancing technologies, habitat design). Some investigations need necessarily be accomplished before others. Progressively linked, all these investigations proceed towards refining the choices available for Martian expedition planning.

Results from the operational studies of Expedition Two will directly influence the research program of future expeditions. For Expedition Three and beyond, Expedition Two will provide advancement over Expedition One on the near-term goals of understanding expedition operations, and for the long-term goals of learning how to design an appropriate mission simulation of at least 500 days. With numerous science goals each reduced to sequences of tasks and functions, optimizing each will improve overall mission scenarios, definition of technical and human factors, and expedition planning. Indexing science goals to the tools and tasks used to accomplish them, their products and data-inputs, their human requirements, and their technical requirements will allow Martian expeditions to be planned for maximizing science return and optimizing the use of crew time over a limited-duration surface mission.

Specific lessons

Particular operational lessons from Expedition Two include:

Safety

Future expeditions should have an accident and incident book to record events. Return times for daily excursions should be more clearly defined. Field vehicles should have fire extinguishers (not need on this trip) and there should be a larger central first aid kit. The vehicle roll over is a reminder that gravel roads, even though familiar to the driver must be treated with respect and that extra care must be taken by drivers inexperienced with loose surfaces.

Budget

In future funding security should be obtained as soon as possible. This would reduce a considerable source of uncertainty. This means that budgetary planning will need to commence at least 12 months in advance of the expedition. This is especially the case when the expedition involves major items such as insurance, hire of equipment and vehicles.

Crew size

The larger the crew the greater the coordination required for daily activities. Given the nature of expedition and where and how it was carried out 15 people may have been the practical limit. Furthermore, there are significant differences in how the larger (15-17) and smaller (7-8) crew interacted. This may be an important consideration for planning future social-psychological research.

Having designated cooks for the larger crew was a definite asset. Otherwise too much time is spent in food preparation by researchers. Cleaning up should be a rostered activity by the other expeditioners. For smaller crews cooking as well as cleaning up should be rostered also. This worked well on the expedition.

A full time coordinator/expedition "nag" was also needed with a larger crew to ensure that everything happened on time. With experienced crews where everyone is equally experienced with the operating environment it would be highly desirable to rotate this position on a weekly basis. The smaller crews definitely can act on a more relaxed, approach, provided that a regular schedule has been established and the expeditioners sufficiently self-motivated. Any person undertaking this role should not expect to carry out independent research, unless the position is rotated. Conversely in a smaller crew, time for personal research is possible.

Scheduling

The importance of a daily schedule that is strictly adhered to cannot be over emphasized, especially with a larger group. This lesson of Expedition One was applied to Expedition Two, with I believe good results.

Another lesson learned from Expedition One is the importance of allowing time for psychological research – such as filling out questionnaires or working on programs such as Cogstate. If time is not set aside some expeditions will tend not to take part. During Expedition two the hour before and the hour after the evening meal was set aside for such purposes. Similar practices should be followed in future expeditions.

Future expeditions should be careful not to be over ambitious in their scheduling of the research program. Not only does this set up the expedition for apparent failure through inability to meet unrealistic goals, it can also lead to over work and frustration. Because not all programs may be completed, it is also important that no one program is mission critical, i.e. the expedition stands or falls on that one project.

Conversely, there should be some reserve to add or extend research programs should the opportunity arise – such as inability to visit some sites, or completion of programs ahead of schedule.

A specific day off should always be scheduled. Essential functions on that day should be rotated to ensure that everyone gets time off.

Communications

Good phone communications and effective (not necessarily unrestricted) internet access is very important. Attitudes to communications with the outside world varied. Some people were definitely deprived of their thrice daily internet fix, others found the isolation beneficial.

Field communications are also important. Ideally, each vehicle should have both UHF for local communications between vehicles and with the local repeater base. A satellite phone should be with each vehicle group away from base to provide emergency backup. In the future it is possible that mobile phone coverage may be extended to the northern Flinders Ranges within a few years.

Equipment

A homogeneous fleet of properly equipped (long range fuel tanks, integral water tanks, bull bars, two spare tires) vehicles of appropriate capability (twin cab utilities) is highly desirable. In addition to recovery gear, the vehicles should have a good tool kit. Manual transmissions are essential for work off the main roads. This raises issues for some overseas participants in expeditions from North America who may be unfamiliar with manual transmissions. Such people should seek training prior to the expedition, where possible. Trailers are less useful than utilities.

A stock of camping gear should be acquired by MSA for future expeditions. The lightweight generator and first aid kits acquired for this expedition are a start. Mark Bishop of the University of SA has agreed to be custodian of the field equipment store. Every effort should be made to minimize the amount of equipment needed by the away teams, both personal and expedition.

Use of the portable generator on away teams should be avoided if possible. More use needs to be made of 12V inverters that run off vehicle electrical systems. However, in these cases, a way of restarting the vehicle in the event of accidental drainage of the battery must be available.

Insurance

Comprehensive insurance would be a major cost for any future expedition. In the interim, a combination of personal travel insurance, short term public liability (if requested) and the use of fully insured hire or institutional vehicles may be adequate.

Media

An on site press officer is highly desirable, at least during the opening weeks of the expedition.

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