

EXPEDITION TWO SUMMARY

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BACKGROUND

Expedition Two is the second in a series of fifteen pre-planned expeditions to Mars analog locations worldwide. The long-term goal of the expeditions is to develop the strategies and technologies that will result in a successful “Humans to Mars” mission. The goals of Expedition Two will be to carry out a wide range of research projects in an approximately 200 km radius of Arkaroola in the northern Flinders Ranges in the Australian Outback. There will be four main themes to the research: collecting baseline environmental data on the field area, carrying out Mars-mission related engineering analogue research, human factors studies, and public outreach with respect to human exploration of Mars. Expedition Two will culminate in the selection of the site for the construction of MARS-OZ, the fourth of four Mars Analog Research Stations (the other three are in the U.S.A., Canada and will be erected in Iceland). The Expedition also hopes to carry out field trials of the Starchaser Marsupial analogue pressurized rover, currently under construction in Perth, and the MarsSkin 3 analogue mechanical counter pressure suit, currently being made in Sydney.

In addition to the science and engineering goals, the expedition will provide an excellent platform for public education and outreach. Previous expeditions by MSA (Jarntimarra-1 in 2001) and the first joint Mars Society Expedition (Expedition 1 to Utah in 2003) led to extensive print, broadcast, and web-based coverage in Australia, Canada, the US, France and internationally through the BBC. The publicity and outreach will heighten the profile of the Mars Society, sponsoring agencies, and both Mars analogue and Flinders Ranges research.

WHY ARKAROOA?

The Mars Society Australia selected the Arkaroola region as its prime Mars analogue area as an outcome of its Jarntimarra-1 Expedition in 2001. 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.

Arkaroola region is of considerable scientific interest, both generally and because of its potential as a Mars analogue site. Areas of scientific interest include geology, geomorphology and regolith studies, palaeontology, hydrology, microbiology, geophysics, and remote sensing.

Geology

The Arkaroola area is a region of considerable interest with respect to geology. The haematite-rich fossil hydrothermal system of Mount Gee provides a possible analogue to putative haematite-depositing hydrothermal systems on Mars. The Neoproterozoic sediments of the Adelaide Geosyncline of the region record a number of events of interest to planetary-scale geology, including the Marinoan and Sturtian glacial deposits that form the basis of the “Snowball Earth” hypothesis and the Acraman impact ejecta horizon.

Geomorphology and regolith

The landscapes of the Northern Flinders Ranges and the Cainozoic history of the Lake Frome Plain record a complex history of landscape evolution under differing climate regimes. The various surfaces, duricrusts and sediments provide an analogue for the type of complexity that would need to be interpreted on Mars. Some of these deposits, such as the mobile sand dunes at Gurra Gurra Waterhole have already been used as Mars analogues.

Palaeontology

The Neoproterozoic sediments in the region contain many stromatolitic horizons and cherts that may contain microfossils. The younger Neoproterozoic successions host the world famous Ediacara fauna, the controversial assemblage that is believed to represent the first assemblage of large animals on earth Jenkins. Slightly younger sediments to the south of Arkaroola contain records of the Cambrian explosion, the radiation of skeletal organisms that transformed the interaction between organisms and sediments.

Hydrology

There are a number of hydrological issues that could be studied. These include the hydrology of the Paralana Hot Spring, the hydrology and hydrochemistry of uranium bearing waters of the Lake Frome Plain, hydrochemistry of the major salt lakes such as Lake Frome, and the mound springs along the eastern margin of Lake Frome.

Biology

Numerous opportunities exist for the study of dry land ecology, endolithic and cryptoendolithic organisms. Of particular interest is the presence of radiation resistant extremophiles in the waters of Paralana hot spring. Numerous other occurrences of radioactive minerals occur in the Mount Painter complex, these also may provide niches for radiation resistant extremophiles, but are completely unstudied. The extremophile populations of the various salt lakes in the study area are largely unknown. The nature of the biota in ephemeral water bodies could also shed light on the dynamics of such systems and how they, and their putative Martian equivalents, might be studied.

Geophysics

Many of the faults in the Arkaroola area are seismically active. One potential research topic would be to establish a local seismometer net to pinpoint the zones of greatest activity. Another project would be the monitoring of radon emissions along faults and fracture systems. Lastly, the different aquifers, including those associated with the radiogenic and mound springs, as well as perched and shallow ground waters, would serve as excellent targets to test a range of geophysical techniques.

Remote sensing

Potential projects include evaluation and comparison of various remote sensing systems for mineral mapping including Aster, HYMAP, and LANDSAT. Ground truthing of remotely sensed data is also important, using instruments such as PIMA and especially actual XRD analyses of surface mineralogy).

Scale of Investigations

Unlike other such sites elsewhere, such as Devon Island or Hanksville Utah, the selected area consists of an entire region, rather than one spatially constrained sites or cluster of sites. Although the Arkaroola analogue region was nominally constrained to a radius of 100 km from the site, there are few constraints on vehicles traveling further afield to other areas of interest, such as Sturts Stony Desert. Therefore, compared to other Mars analogue sites, the Arkaroola region provides a unique venue for large scale studies, whether of geological or biological systems, or of long range surface reconnaissance and mobility.

Outreach and education

The Arkaroola resort is Australia's first and largest private nature preserve. The Sprigg family has a long history of scientific research and interest in ecotourism. They are supportive of the establishment of a mars analogue facility and the many visitors to the region provide an excellent opportunity for outreach.

PARTICIPANTS

Participants include researchers from Australia, Canada, and the United States, from universities, government agencies and organizations including The Mars Society (US), Mars Society Australia, the Mars Society Canada. The following list is incomplete, but includes all people who have expressed an interest in participating in the expedition.

Australian participants include Dr. Jonathan Clarke, Prof. Vic Gostin, Dr. Mark Bishop, Vic Waclawik (geology), Adrian Brown (GIS, remote sensing), Dr. Robert Anitori, Prof Malcolm Walter (astrobiology), Dr. Steve Dawson (psychology), Dr. Graham Mann, Mark Smith, James Waldie (engineering), David Willson (engineering-habitat design), Guy Murphy (MSA president), Jennifer Laing (MSA PR and media director), Anna Clarke (nursing), David and Maureen Cooper (logistic support), Jennifer Clarke, and Rosalind Clarke (students).

From Canada the team includes Rocky Persaud, Melissa Battler (geology), Stan Piechocinski, and Matt Bamsey (engineering). The U.S.A. participants include Shannon Rupert, Dr. Penny Boston, Dr. Nancy Wood, Dr. Edward Martinez (biology), Dr. David Bushman (aeronautical engineering), and Aurora Rupert (student).

STRUCTURE

Deciding on the above budget options results in a modification to the expedition structure and numbers of participants. There are now two fortnight long phases. A crew exchange can be effected in the middle by using 2WD vehicles to ferry people to and from Arkaroola. The following table illustrates the distribution of personnel over the period.

Person	Phase 1	Phase 2
1	XXXXX	XXXXX
2	XXXXX	
3	XXXXX	
4	XXXXX	
5	XXXXX	
6	XXXXX	
7	XXXXX	
8	XXXXX	
9	XXXXX	
10	XXXXX	
11	XXXXX	
12	XXXXX	
13		XXXXX
14		XXXXX
15		XXXXX
16		XXXXX
17		XXXXX
18		XXXXX
19		XXXXX
20		XXXXX

21		XXXXX
22		XXXXX
23		XXXXX

The crew would overlap for two days in the middle, allowing for briefings and other joint sessions.

Several add on missions can be appended to the core. Examples include the Marsupial field trials and geophysical programs. These add-ons would work with the core mission, traveling separately or together as required, but are neither essential to the core mission nor will effect the core mission's work program. They would be expected to pay their own way.

BUDGET

The following table contains the projected budget for Expedition two.

Budget items			Total
Vehicle hire	3 X 4WD for 30 days	8910	8910
Insurance	Included in vehicle hire		
Excess	1000 X 3	3000	3000
Fuel	4200 km	3098	3098
Equipment (unconfirmed)	1 st aid kit + field kit X 3	605	605
Accommodation	Shearer's quarters	0	0
Food		2400	2400
Sub total		24683	18013
Communications			650
Maps etc			500
Camping gear hire			0
Hire car 4 days (for middle weekend)	2WD X 2	456	456
Insurance	152	152	152
Excess	X 2	440	440
Fuel X2	480	480	480
TOTAL			20691

A 10% contingency component brings the cost up to \$22761. A further 10% MSA management levy raises it to \$25037. To date \$11,000 has been raised through grants from MSC, Australian Geographic, and the psychology department at the Australian National University.

Core expeditioners will be expected to meet the following costs themselves

- Transport to and from Adelaide.
- Two main meals in Arkaroola village for each weekend they spend there.
- Laundry costs.
- Personal phone costs (from Arkaroola).

Expeditioners taking part through add on components will fund their own participation.

All expeditioners will have the opportunity to minimize cost and maximize exposure to South Australia by staying with MSA members in Adelaide.

ISU COLLOBERATION

Discussion with Michael Davis and Juan de Dalmau of ISU has indicated a number of potentially fruitful avenues for collaboration with them during the 2004 ISU SSP in Adelaide in July-August. First, there are a number of researchers who will be attending the SSP as faculty who might be interested in participating. These include Cheryl Bishop of University of Texas (who is in regular correspondence with Steve Dawson), Alberto Dehar and possibly Chris McKay of Ames), and several others. Second, there will be opportunities through several of the project themes, such as exploration architecture, life and physical science, for people to work on X2 as part of the course. Third, there is the possibility of some of the faculty being available to speak at AMEC 2004 and MSA members to perhaps contribute to their program both in and outside X2. The curriculum will be finalized in early February and the relationship clarified by that date.