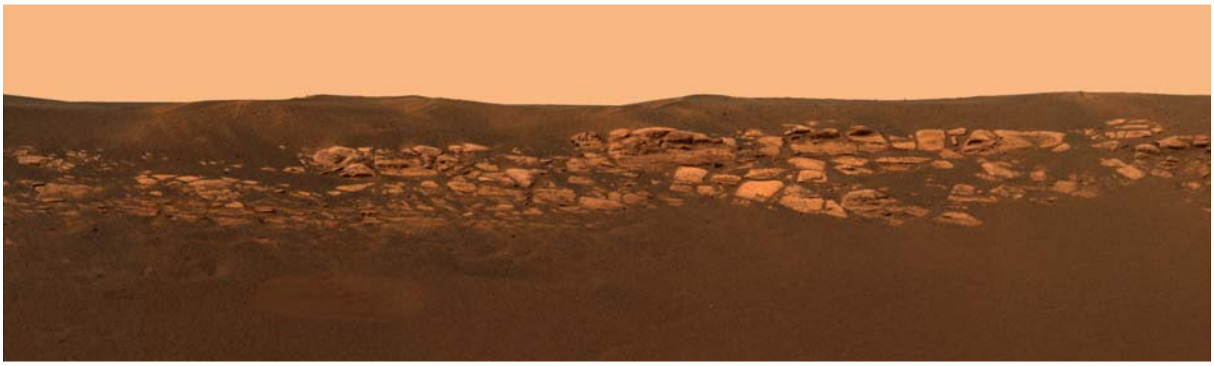
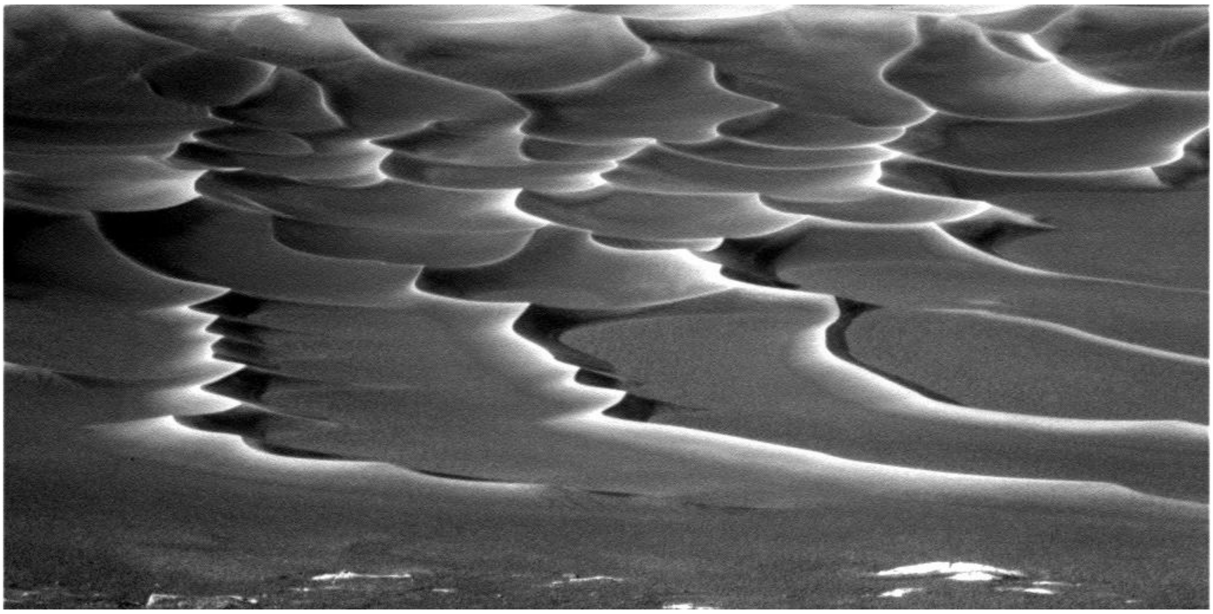
Proceedings of the 8th Australian Mars Exploration Conference

AMEC 2008

Editor: Colin Pain





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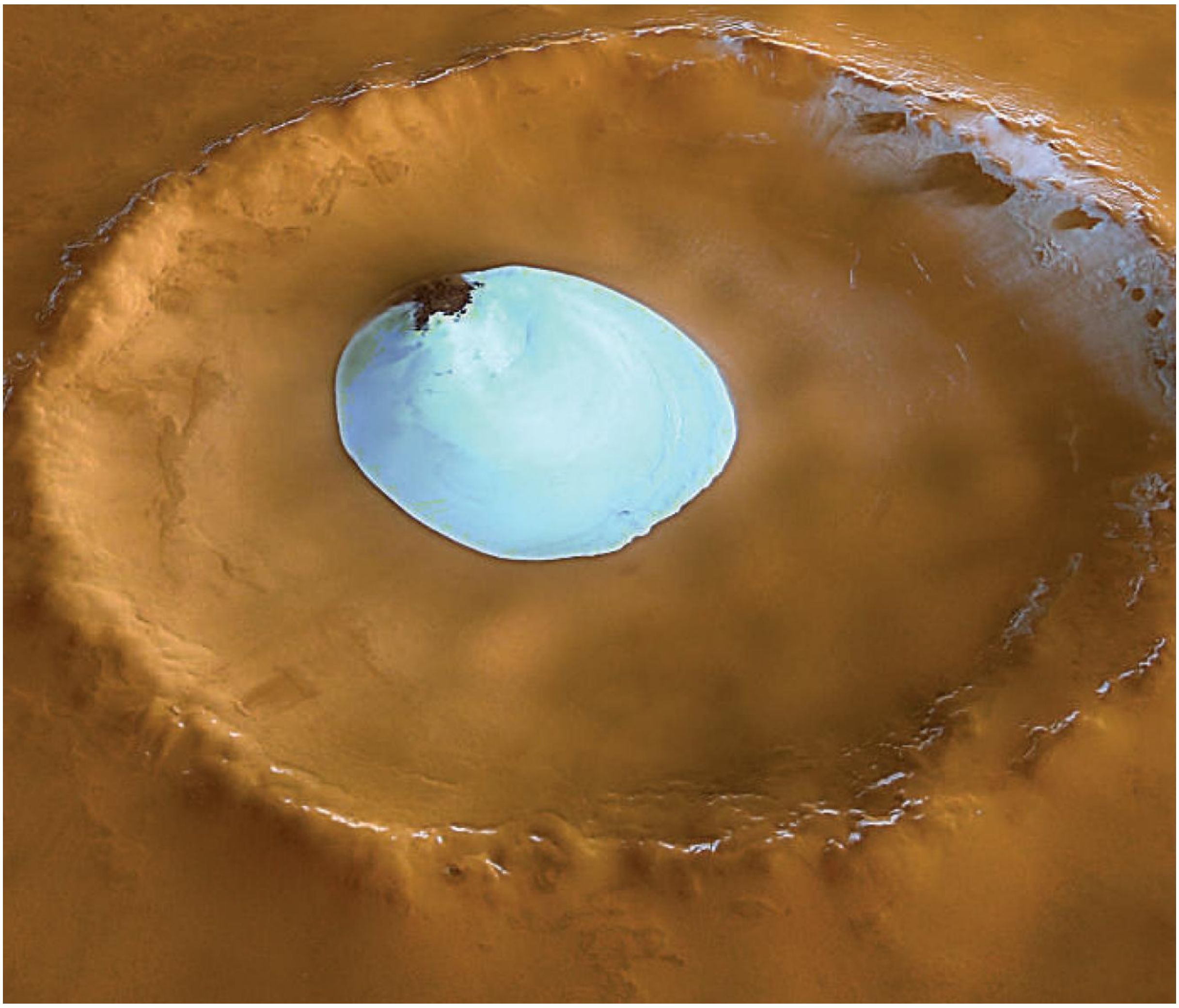

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Colin Pain

Mars Society Australia, PO Box 327, Clifton Hill, VIC 3068, Australia
(59 David Street, O'Connor ACT 2602, Australia)

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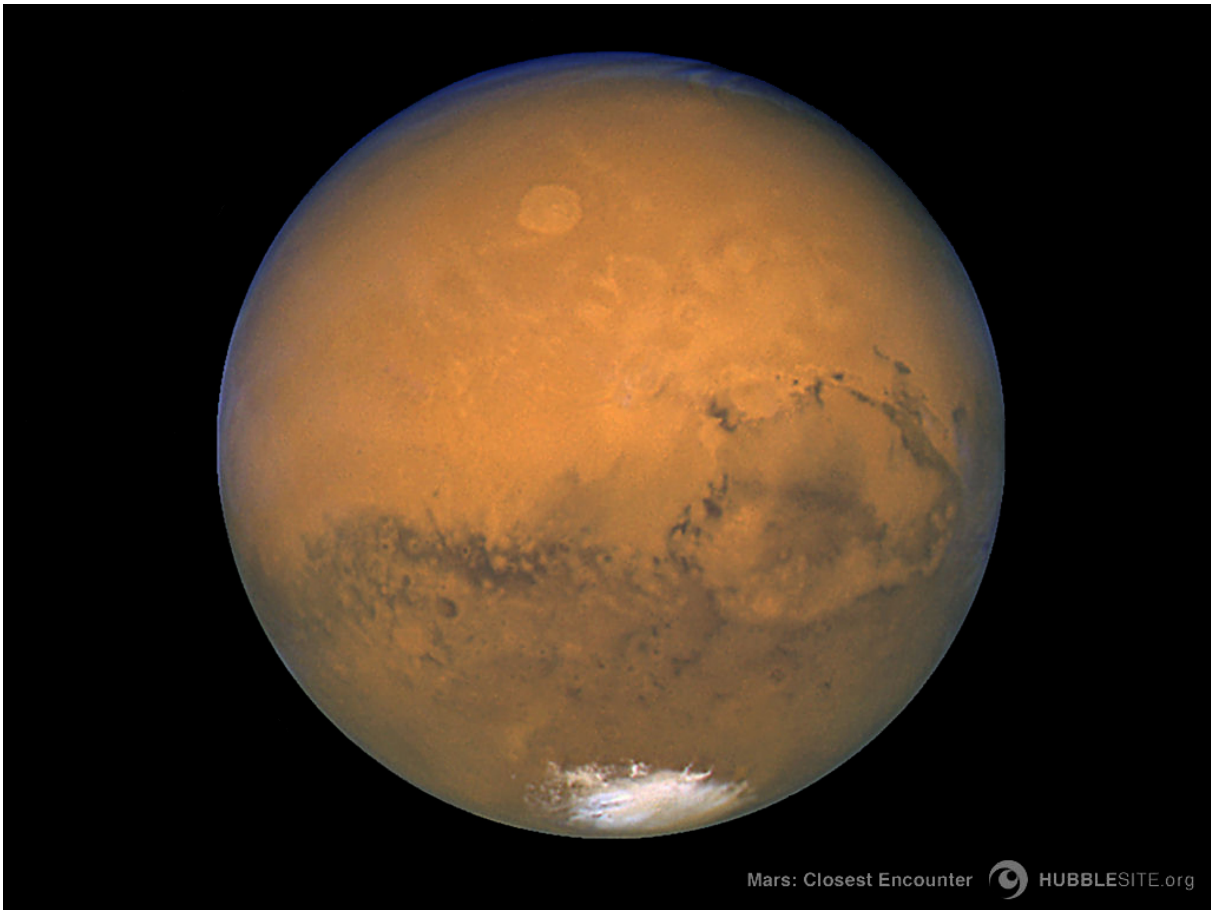
Mars: Closest Encounter
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Phoenix

Jonathan D A Clarke[1]

[1] Mars Society Australia, PO Box 327, Clifton Hill, VIC 3068, Australia jon.clarke@bigpond.com

The Phoenix mission gets its name from the fact it is made from components of two abortive missions to Mars, the 11998 Mars Polar Lander and the 2001 Mars Surveyor mission. Most of the questions Phoenix is designed to answer were framed during the Viking missions 30 years ago, although several earlier missions have attempted to answer them, all have failed. Phoenix is the first spacecraft to successfully land at the martian poles. A NASA funded mission, Phoenix has contributions from Canada, Germany, Finland, Denmark, and the United Kingdom. Phoenix successfully touched down at Scaandia Colles on Mars, 68.22°N 234.25°E, on May 25th, 2008. The design mission is 90 sols, although the lander may last 60 or 70 sols more. Phoenix uses a robotic arm to sample to the landing site, studying the physical and chemical properties of the martian surface, as well as imaging the area and collecting atmospheric data. Phoenix has already shown a landing site characterised by polygonal patterns indicative of polygons. The exhaust blast of the landing rockets exposed massive ice beneath the lander and excavations by the robot arm have shown ice cemented materials subliming on exposure to the atmosphere. Detailed results were not available at the time of writing, but the Phoenix mission is expected to greatly improve our understanding on the nature of the martian surface and atmosphere at high latitudes, the physical and chemical properties of globally distributed fines, and how water ice is occurs in the regolith. The results are expected to be especially significant for human missions by better quantifying potential hazards and resources

Keywords: Mars, rovers, exploration, human missions

Crewed Vehicles for Mars Exploration – A Potential Users Guide

Jonathan D A Clarke,[1] Graham Mann[2], and David Willson[3]

[1]Mars Society Australia, PO Box 327, Clifton Hill, VIC 3068, Australia jon.clarke@bigpond.com

[2]School of Information Technology,Murdoch University, South Street, Murdoch WA 6150

[3]Mars Society Australia, PO Box 327, Clifton Hill, VIC 3068, Australia

Rovers are essential for the exploration of Mars beyond the radius of pedestrian sorties by astronauts. A range of rover designs have been proposed, both pressurised and un-pressurised. This paper reviews the type of rovers required to support the Mars Oz reference mission from the perspective of safety, technology base, and mission requirements. It identifies a number of issues for future study, many of which can be addressed, at least in part, with the Starchaser Marsupial rover.

Keywords: Mars, rovers, exploration

Spaceward Bound: Training the Next Generation of Explorers

Liza Coe

Australian Mars Education Conference (AMEC), Adelaide, Australia

Spaceward bound is an educational program developed at NASA Ames Research Center in California. The mission of Spaceward Bound is to train the next generation of space explorers by having students and teachers participate in the exploration of scientifically interesting but remote and extreme environments on Earth as analogs for human exploration of Mars. Spaceward Bound supports the second major NASA education goal to attract and retain students in STEM disciplines through a progression of educational opportunities for students and teachers. Undergraduate and graduate STEM students; pre-service and in-service STEM K-12 teachers; and STEM education faculty contribute to the science mission and goals by becoming members of science expedition teams. While learning STEM content, concepts and skills they become immersed in the conduct of scientific research and experience first-hand the intrigue, excitement, collegiality, and challenges of terrestrial analog field research. A growing body of evidence indicates that these experiences are unique and exceptional in their ability to inspire and motivate participants into dual roles of scientist and teacher. This paper will present in-depth information about the program, previous and current expeditions, and outcomes from expeditions to the Atacama Desert, Mojave Desert, Pavilion Lake, North Dakota and Lassen Volcanic National Park and descriptions of future expeditions to the Arctic and Australia.

Exploring Knowledge beyond the Rutted Path: Aligning Computer Based Technologies with New Curricula for Teaching and Learning High School Science and Mathematics

Michael L. Darby

Department of Electrical and Computer Engineering
Division of Science and Engineering, Curtin University of Technology
Perth, Western Australia 6566, Australia
M.Darby@curtin.edu.au

This paper provides a critical review of the reasons for the lack of acceptance and integration of computer based technologies into mainstream high school education ,specifically mathematics and science, given that research recognises the importance to teaching and learning of the those technologies. This paper then proposes a framework for a new exploration based curricula and supporting case study.

Keywords: Anchored instruction, exploration based learning, virtual learning environments, modelling and simulation, computer based technologies, Bloom's taxonomy and technology.

Creating the Next Generation of Space Explorers Now

Mark Gargano

Science Coordinator, Society & Environment, Technology & Enterprise and Year 10 Coordinator, St Joseph's School, P.O. Box 500, Northam, Western Australia, 6401, Australia.
gargano.mark@cathednet.wa.edu.au

Do your students dream big, have their heads in the clouds, are often caught out looking into space?

This is not a bad thing, turn their imagination into reality through exciting new space science initiatives. Examining the new MSA and NASA Spaceward Bound connection, this paper will highlight activities that will utilise expeditions to develop skills and prepare for off-world exploration.

This paper will discuss classroom and local initiatives, arising from the recent completion of Spaceward Bound-Mojave, which connect classroom, research and development. The mission of Spaceward Bound is to train the next generation of engineers and scientists by having teachers and students participate in the exploration of scientifically interesting but remote and extreme environments on Earth as a simulation for human exploration of the Moon and Mars. A range of practical activities and student excursion and expedition scenarios will be presented, all to stimulate the next generation of explorers.

Keywords: Spaceward Bound, Outcome Based Education, STEM, excursions, student expeditions, student fieldwork, space science education, practical projects and investigations, scientific journaling, Bloom's taxonomy and exploration based learning.

Mark is the Science Coordinator at St Joseph's School, Northam, in Western Australia. He has been in Science Education for over 15 years and has been in various Middle Management positions for most of that time. He is an active member of the Science Teacher Association of WA (STAWA) and the Australian Science Teachers Association (ASTA) and has been providing sessions, curriculum and course materials and professional development opportunities in space science related areas to other educators for many years. He is also a member of several educational planning committees and is an Education member of the American Institute of Aeronautics and Astronautics (AIAA), Mark recently participated in the April Spaceward Bound Mojave 2008 Expedition and this will provide the thrust of his presentation.

Project MAST - Mars Analogue Simulation Trainer

Hugh S. Gregory[1]

[1] SpaceBase ™ © - The Astronomy and Space Sciences Educational Information Service, PO Box 81220, Burnaby, BC, CANADA V5H 4K2
Hgregory3a@aol.com

One of the key ingredients for planning any expedition be it on Earth or off Earth into outer space and out ward to another planetary body is pre-mission reconnaissance and familiarisation training capabilities. All of The Mars Society's analogue research stations (FMARS, MDRS and the soon to be deployed EuroMARS and OzMARS) are missing this capability. Yes, incoming crews can look back over several years worth of web shots and reports for MDRS and FMARS, but that only gives the new crew a peep through a key hole at selected tiny areas of the HABs and the surrounding terrain who's exploration they are about to undertake.

Project MAST is a Virtual Reality simulator was conceived and developed by Hugh S. Gregory, Spaceflight Historian, as a solution to this problem. From 2005 to 2007 Project MAST gathered data at MDRS (both inside and out) and over a series of five missions to the MDRS area, also recorded its surrounding network of ATV trails and exploration routes.

The interior of the FMARS HAB was added to Project MAST over the winter of 2005-2006 with data gathered for Project MAST by the FMARS 10 crew. A demo available of Project MAST - The FMARS Version, in which one can in a limited manner "walk around" inside the FMARS HAB. It is now available on request to the author.

Project MAST visited the EuroMARS deployment area in Iceland in June of 2006 but was only able to document the approaches to the intended HAB deployment site as a late season snow storm dropped over 2 meters of fresh snow across the area only 2 weeks before the recon visit. The initial version of Project MAST for EuroMARS was released as a shareware demo during EMC-6 in Paris in October of 2006. It to is available on request to the author.

It is intended that the EuroMARS version of Project MAST be implemented for it when that HAB is ready to go into service.

Project MAST will be visiting the Arkaroola site in June 2008 to perform an initial recon and documentation of the surrounds of the OzMARS deployment site. It is intended that the OzMARS version of Project MAST be implemented for it when that HAB is ready to go into service.

Currently the Project MAST VR software will enable first time members of incoming crews to train for their rotation for FMARS and MDRS analogue HAB's in the comfort of their own home on their personal computer. It will also allowing returning veterans to refresh their memories of what is where and help them plan their next analogue HAB mission. Annual updates will enable the latest version of the MAST VR simulator to reflect which foot and vehicular (ATV or mule) travel routes are currently open or closed to travel and what new exploration areas have been authorised for investigation. Finally it will graphically represent any changes have been made in a HAB since their last crew rotation.

The initial test of the MAST VR software using data gathered on MDRS Crew 35 in Feb-March of 2005 was a complete success. Two privately sponsored data gathering missions to MDRS were approved and mounted in June and October of 2005 Project MAST was invited to join The Artemis One Expedition Moon Base simulation by Moon Society President Peter Kokh (MDRS Crew 45) to complete it's initial data acquision for the MDRS version of Project MAST. In April of 2007 a third privately sponsored data gathering mission to MDRS was approved and mounted to update the project with the significant interior and external engineering changes to the MDRS HAB area since March of 2006. The access to Lith Canyon West was documented during the University Rover Competition in June of 2007.

The Project MAST VR simulator is being sponsored, funded and produced in house by SpaceBase(tm)(c) - A Not For Profit Astronomy & Space Sciences Educational Information Service based in Vancouver, Canada with “in-kind” support from Sagewood Software of Burnaby, BC.

Hugh S. Gregory is Spaceflight Historian, Chief Documents Editor, Chief Cartographer and WP Database Curator for MDRS and FMARS Research stations. Engineering Judge for the University Rover Competition, Comdr. MDRS Crew 35 (and Crew Scientist - Project MOSS), Crew Scientist-Surveyor MDRS Crew 45 (Moon Society Artemis One Expedition) also Crew Scientist-Surveyor for off season crews at MDRS, FLAME-1, MAST 1 (2005) and MAST 2 (2007).

Keywords: catography, simulator, training, Arkaroola

Colouring Mars: Revisiting Historical Spacecraft Imagery

Steven Hobbs B.Sc.

7/1 Tennant Court, Golden Grove SA 5125

The electronic age has brought about a revolution in spacecraft imaging. For the first time, digital manipulation tools that were the domain of major institutions are now readily available to individuals. The author has applied 21st century imaging techniques to historic Mars imaging data from early US and Soviet missions. This has led to the ability to reprocess imagery originally released as monochrome into colour.

Keywords: Mars, Mariner, Phobos 2, Colour

Modeling the Martian Subsurface in Search of Water

Eriita Jones[1] and Charles Lineweaver[1]

[1] Research School of Astronomy & Astrophysics, Australian National University, Mt Stromlo Observatory, Cotter Rd., Weston ACT 2611, AUSTRALIA.
Email: eriita@mso.anu.edu.au

Our current knowledge of life on Earth indicates that life requires liquid water. A first step therefore in identifying the environments on Mars which are most favourable to current life is to locate where there is liquid water. On Mars stable liquid water must be confined beneath the surface. It is important to locate the shallowest potential liquid water environments as they may be the most easily accessible by future missions. We are developing a model to estimate the range of subsurface depths on Mars at which the temperature and pressure conditions allow water to be a liquid. The depths to liquid water on Mars can be constrained by developing and improving models of the geothermal gradients and heat flow in the Martian subsurface. This method relies on the measured physical parameters of Martian materials (such as thermal inertia) which have low spatial resolution and are indicative of the thermal characteristics of the top surface layers. An important complication in these models is the shallow temperature gradient (within several meters of the surface) which is strongly influenced by diurnal and seasonal surface temperature variations. We use a simplified solution to the one-dimensional, time-dependent heat conduction equation to determine how periodic surface temperature variations affect temperatures below the Martian surface. Using estimates of the range of Martian surface temperatures and the plausible range of thermal diffusivities of Martian materials we can constrain the maximum variation in temperature that could occur at a given depth below the surface. This will allow us to determine if liquid water can ever occur transiently at shallow depths. Such a result has important implications both for the explanation of shallow putative water flow features on the Martian surface (such as gullies) and for the exploration of environments hospitable to microbial life, which may be of significance for a future shallow drilling mission. In this talk our model will be discussed and preliminary results presented.

Keywords: Mars, liquid water, biosphere, astrobiology

Trust me, I'm a Science Communicator!

Rob Morrison

Professorial Fellow, School of Education, Flinders University, GPO Box 2100, Adelaide SA 5001.
rob.morrison@flinders.edu.au

In this presentation, Dr Rob Morrison explores the relationship between science and the media, how to get science into the news, and why scientists should bother doing so.

The presentation analyses a typical science news report, explores the news angles that are good (and bad) for scientists, examines the relative benefits of TV, Radio and Print and demonstrates how to prepare a Media Release that works.

Increasingly people are choosing to get their news through the internet, and the presentation examines the particular challenges and hazards facing those putting out science news through the web.

Science Communication is a developing field, and the presentation deals briefly with some of the professional guidelines that have emerged to help scientists deal with the media, and the role of the Australian Science Media Centre, which is transforming the ways in which the Australian media handle science stories.

Rob is a freelance Science Communicator and broadcaster, and holds the position of Professorial Fellow at Flinders University.

Rob has written 34 books on science and natural history, and is co-author of 13 more, as well as dozens of articles. A science and environment broadcaster for forty years on television and radio, he co-hosted the long-running national television program *Curiosity Show*, which screened in 14 countries. He was for ten years the environment and science correspondent for Channel Ten TV News and produced the science segments on *NEXUS*, the television program of the Australia Network, Australia's Asia Pacific Service, which screens in 41 countries.

He has won many national and international awards, including the Michael Daley Award for Science Journalism, the Skeptics Eureka Prize for Critical Thinking, The Australian Government Eureka Prize for the Promotion of Science and the inaugural SA South Australian Government award for Excellence in Science Communication. In 2004, he was awarded the Order of Australia for Science Communication and Conservation.

Rob is currently Patron of National Science Week SA, Interim Chairman for *SciWorld*, South Australia's interactive science and environment centre, Vice-President of the Australian Science Communicators, a member of the Board of the Australian Science Media Centre, and Chair or a member of many Boards and Councils of environment and conservation organisations. He is the South Australian Senior Australian of the Year for 2008.

Quantitative Evaluation of Human-Robot Options for Maintenance Tasks during Analogue Surface Operations

Graham A. Mann

School of Information Technology, Murdoch University South Street, Murdoch WA 6150
g.mann@murdoch.edu.au

Due to the scarcity of human labour plus the harsh conditions at any human Mars base of the foreseeable future, robots are likely to be employed in to assist with at least some assembly, deployment, transportation, inspection, servicing or repair tasks. By the first human landing, robotic technology is expected to have made possible the use of robot teams already on the surface to prepare the landing site, ensure the functioning of ISRU equipment and survey the local area for the arriving astronauts. Robots are also likely to assist them during their stay and after their departure. Today's researchers are increasingly interested in the question of how to systematically choose the best combination of robots and/or humans for particular tasks, and how to actually demonstrate and measure teams performing these tasks in realistic simulations. This paper critically examines a quantitative method developed by Roderiguez and Weisbin of JPL for computing performance/resource scores for a range of human-machine systems on a variety of tasks. It then proposes a practical experiment, to be conducted at a future Mars Society surface operations simulation, that will apply the method to quantitatively compare human maintenance task scores with those of a hexapodal service robot that the author is currently building.

Keywords: Mars analogue studies, field robotics, evaluation, sliding

Messages for the Future:
The concept for a first human landing marker on Mars

Trevor Rodwell

Masters Candidate, Faculty of Design and Creative Practice, University of Canberra,
earthlight@iweb.net.au

A human landing on Mars is the ultimate goal of many working within the broad field of space exploration. However, the enormous costs associated with such a mission causes problems for government-funded space agencies as governments look for indications of public support before sanctioning such expenditure. Reports suggest that some form of involvement of the public in the mission would be necessary.

This paper presents research being undertaken to develop a framework for an artwork-inspired First Human Landing Marker on Mars incorporating a time capsule of digital recordings from the people of Earth. The basis of this research is to offer a means of involving the global population in a science and technology venture, thereby creating an environment for support through a shared mission.

Keywords: Land art, time capsules, public participation, monuments, Mars mission.

A Geological Study of Two of the Potential Landing Site for Mars Science Laboratory

Jenna Sharp

School of Geoscience, Monash University, Victoria
Jenna.sha@sci.monash.edu.au

As my honours degree at Monash University I am comparing the geology and landing potential of two areas on Mars that have been selected as potential landing sites for the Mars Science Laboratory rover (MSL). The aims of the MSL are to determine the planet's biological potential, both past and present, by looking for things such as organics and biosignatures; study the geology and geochemistry; determine past processes that influence habitability; and study the varying processes affecting the area at present, including many types of radiation and the water cycle. The rover will mostly do this by studying the rocks, soil and the local geological setting via remote sensing and direct contact as well as through the use several other instruments.

MSL will be launched between September and October of 2009, aiming to arrive at the red planet in October 2010. It is approximately twice the size of Spirit and Opportunity and has a much different landing system (sky crane). The MSL payload weighs 75kg, with an allocated total rover mass of 775kg, compared to the MERs payload weight of 9kg and total rover mass of 170kg. The range of MSL is much more significant than previous rovers as well, both in how far it can drive (>20km), plus in the latitudes and altitudes it can reach: 45°N to 45°S, and <+1km MOLA height.

The two sites I am focusing on are Mawrth Vallis (24°N, 340°E) and Nili Fossae (21°N, 74°E). Mawrth Vallis is currently the most likely location for the rover's landing; Nili Fossae, one of five other possible sites, I chose as my comparison site. Mawrth Vallis is mid to early Noachian in age and was chosen as a candidate site due to the presence of phyllosilicates, which is a subclass of silicates that forms in sheets. One common phyllosilicates is clay, which has been identified at both sites. Evidence suggests that the clays at Mawrth Vallis formed early in the areas history, and that they formed as a result of sedimentary processes, most likely aqueous (excluding deep marine). This means that they have a higher chance of containing evidence of life, as life would have required water and have evolved early in the planets history. Plus, given the nature of clays, they generally have a higher chance of preserving evidence of life, if there was any life to leave evidence of course.

Nili Fossae is a potential MSL landing site as it has fan deposits, which also contain phyllosilicates. Clay is present in the form of smectite. These clays and the formation of Nili Valleys are also Noachian in age. This sites also presents a high chance of preservation of evidence of life, because of the presence of the old clays and because textural features could be preserved in the sedimentary deposits. The clays may be either lacustrine or hydrothermal in origin, but which is the case has not yet been determined. There is also not a lot of dust present at the site, and a number of clear outcrops have been observed, which means, over all, getting to the rocks is that much easier. The rocks observed so far are strongly layered from unaltered Noachian crust to altered material (phyllosilicates). In addition, there is a transition from Noachian to Hesperian material within the landing ellipse, which will be beneficial in studying the geological history of the area.

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Keywords: MSL rover, Mawrth Vallis, Nili Fossae, Geology

Revival Possibilities of Dead Planet Mars

Mani Kant Shrivastava

(President Awardee Teacher – 1997), Ex Lecturer – Geography, Baiga Para, Gaura Chowk, Durg (C.G), INDIA. kantmani12@yahoo.co.in

Earth's internally produced energy (hot mantle) constantly sends submerging seawater back (through Mid Oceanic Ridges/MOR) to the surface by vaporization and thus hot mantle also keeps effluence of huge amount of CO_2 (Dissolved Inorganic Carbon/DIC) and other dissolved gases alive, from submerging seawater to the Earth's atmosphere. In this way, Earth's active internally produced energy (hot mantle) prevents the entire surface water from getting submerged into its subsurface along with the huge amount of DIC and other dissolved gases and is responsible for constant existence of surface water, atmosphere and greenhouse effect on Earth.

Diminished internally produced energy of early Mars would have resulted in a cold mantle. While getting cold the volume of Martian liquid mantle would have reduced because of constriction due to solidification. Then the solid Martian crust might have had adjusted itself over the cooling mantle creating many crakes in the crust and gaps at many places between Martian cold mantle and crustal base while shifting of crust on the mantle. These gaps and crakes would have acted as sufficient reservoir for submerging Martian surface water. Therefore, diminishment of internally produced energy of earlier Mars would have resulted in gradual submersion of the entire Martian surface water into its subsurface and some interior (which could not return back to the surface due to cold Martian mantle) along with a large amount of DIC, breaking the efflux of CO_2 from submerging seawater to the early Martian atmosphere, however its influx remain continued. It would have caused disappearance of Martian surface water and poorer green house effect further cooling the Martian atmosphere.

Similarly other dissolved gases might also have submerged along with Martian surface water resulting in thin atmosphere and very low surface temperature on Mars. Melting of Martian polar and subsurface ice by increased green house effect, bombardment of asteroids, etc. would make liquid water available on Martian surface but this melted water will again get submerged gradually, with the dissolved gases into Martian subsurface and will not return back due to diminished internal energy production (cold mantle) of Mars. Hence terraforming Mars will be possible only when its diminished internal energy production is got regenerated or reactivated to make its mantle hot again. Only then, the submerged water (subsurface ice), trapped CO_2 and other gases will return back and exist constantly on the Martian surface and in its atmosphere.

Without this all the efforts to terraform or revive Mars would ultimately result in failure. But such technology which can regenerate or reactivate the diminished Martian internal energy production has not been developed so far and its possibility in near future also seems to be negligible. So, to terraform or revive Mars, we should first think that in future, can we ever reactivate or regenerate the diminished Martian internal energy production? As this is an impossible task with in the present frame of knowledge. In future Earth will have to encounter similar conditions like present day Mars, when Earth's internally produced energy will also get diminished.

Keywords: Internally produced energy, internal water cycle, Loss of water, Depletion of CO_2 & atmosphere, Terraforming.

Technological Heritage on Mars: Towards a Future of Terrestrial Artifacts on the Martian Surface

Dirk H.R. Spennemann[1] and Guy Murphy[2]

[1] Institute for Land, Water and Society, Charles Sturt University, P.O. Box 789, Albury, NSW, 2640, Australia. Email: dspennemann@csu.edu.au

[2] Mars Society Australia, P.O. Box 327, Clifton Hill, VIC ,3068, Australia. Email: gmmurphy@ozemail.com.au

For the past 45 years the red planet has been the focus of human space exploration. Commencing with the crash landing of Mars 2 some 35 years ago, humanity has left a range of traces on the Martian surface. This paper provides an overview of the successful landing missions and the material culture these missions deposited on the surface of Mars. Environmental conditions on Mars are also considered, as these differ from those of the Earth, and have important implications for the future integrity and management of these sites. This essay is the first step in a systematic appraisal of the cultural heritage values these sites possess for humanity at large and how such sites should be managed for the benefit of humankind.

Keywords: History of space exploration, extreme environments, space heritage, Mars, interplanetary probes

Note: This paper was first presented at the 6th European Mars Society Convention (EMC6) in Paris, 2006, and then published in the *Journal of the British Interplanetary Society***,** Volume 60, pp 42-53, 2007.

Growing up: Bonding the Mars Societies Worldwide together in a Renewed Internationally-shaped Mars Society

Artemis Westenberg

Director International Relations, The Mars Society Inc. Boulder, President Mars Society, Netherlands.
artemis@marssociety.org

Over the last ten years, the Mars Society has enjoyed phenomenal success in many areas: the Mars Analogue Research Station programme has reached a global audience, the Society is now recognised as a world leader in organising and running major Mars-related conferences around the world (USA, Europe, Australia), and we have created a truly international presence.

It is in the latter regard that the Mars Society has reason to celebrate its greatest success in spreading the vision of human missions to Mars. From humble beginnings in Boulder Colorado, the Society has grown into an international network of organisations, many of which are independently incorporated as legal entities within their particular country of origin.

All organisations naturally evolve throughout their lifespan – adapting to new challenges and opportunities, positioning themselves to make sure their message is clearly heard on the international stage, and so on. In this regard, the Mars Society is no different to any other global institution. With ten years of steady growth under our collective belt, the time is now right to review issues of international cooperation and support: to develop a framework that not only builds on the past, but positions us to face the challenges of the next 10 years.

The Mars Society worldwide should be about:

- Facilitating equal and open communication between all national Mars Societies.
- Providing a single unified portal for information about the activities of Mars Societies world-wide.
- Providing a moderated forum in which international policies, projects and campaigns can be determined.
- Providing a conflict resolution mechanism should any disputes arise in joint projects between international societies.
- Being a source of innovation and dynamism for the society.
- Being inclusive in seeking views and accommodating differences of opinion in determining possible future directions of the organisation.
- Encouraging fiscal responsibility and transparency in the operation of national Mars Societies and projects.
- Providing active encouragement and support to those seeking to establish new national Mars Societies

In short it should grow up and be a truly international corporation.

The Mars Society has a number of active projects right now. These are the two Mars Analogue Research Stations, Flashline Mars Arctic Rresearch Station and Mars Desert Research Station. But also the University Rover Challenge held for the last two years at the MDRS attracts more competing teams each year contributing to outreach goals and university involvement around the world in robotic research as a tool to assist Marsonauts while on Mars.

In 2007, two years before the Roskosmos and ESA collaborate on the Mars500 project, TMS has sustained a 4 month Mars-simulation in the arctic at FMARS with crew of 7, which added tremendous knowledge and understanding what it means to sustain a group of people on Mars.

Over the last year restructuring of the Mars Society Inc. in the USA was taken in hand to meet the demands of the new decade and the rewriting of the By-Laws to express this new structure. The newly created position of Director International Relations, the appointment of an Executive Director at the head office in Boulder and the newly appointed members of the Board of Directors are examples of the new structure of The Mars Society.

This Hab is not Self-Cleaning. All that is needed to run Mars-simulations and how to make them count

Artemis Westenberg

President Mars Society Netherlands, Amiranten 12, 2904 VB Capelle aan den IJssel, Director International Relations, The Mars Society Inc. Boulder. artemis@marssociety.nl

More than 70 crews working at Mars Society's research stations have worked and lived testing life on analogue Mars, and doing so accumulated a substantial amount of science and operation information. These crews depend on the smooth operation of the Habitats to optimize time spend at the Mars Simulation Research Stations. To ensure the smooth operation the Mission Support team of the Mars Society monitors every crew on an almost 24 hour basis.

The management structure for the Habitats consists of the following groups:

- Mission Support led by a Mission Support Director
- The CapComs (=captains of communications) 'speaking' via internet to the crews each night also led by the Mission Support Director who is herself one of the CapComs.
- The Engineering Team led by a the Chief Engineer.
- The Science Team led by a coordinator.
- Local support person who can drive out to the Hab if need be and physically lend support.

With some exceptions all these groups find their members mostly among the former crewmembers of previous crews.

These people are distributed around the world, which incidentally makes 24 hour watch over the welfare of crews and buildings easier.

The goal of all these groups is uniform and clear: Keep the crews healthy, happy and productive and maintain the habitats to the best of their ability, while adhering to Simulation Regulations as strict as possible.

Background

Mars Society operates two Mars simulation research stations since 2001/2002: one in Devon Island (FMARS) and one in Utah (MDRS). The goal of these stations is to simulate human mission -work and life on the Surface of Mars. FMARS receives one crew each year while at MDRS crews change every second week except for the summer season. In the last 7 years 71 crews worked at MDRS. Their results are published in various forums: in peer-reviewed papers, conference abstracts, books, private websites or other publications [1] [2] [3] [5]. The actual work of all crews is documented as specialized daily reports together with images and are available at the MDRS website [4] (Fig. 1, Fig. 2.). Updated operation manuals and carto-graphic resources [1] are also available on the website.

Plans for Australia and Europe

The Mars Society UK, The Mars Society France, The Mars Society Netherlands, with input from The Mars Society Spain have planned a EuroMARS (= European Mars Analogue Research Station) to be placed in Iceland.

They have found funds to build the structure in the USA and display it there. They have scouted Iceland in 2002 for an appropriate mars-analogue site and found one with the help of the Iceland minister of Science on the fresh lavaflows of the Krafla Vulcano. As finding enough funds to outfit the

Hab and ship and operate it on Iceland has so far not been succesful enough the EuroMARS at present is still in its developmental stage.

Fig. 1. Mars Societies MDRS Daily Reports page

The Mars Society Australia has had her own Mars-Analogue station planned. I will not go into the details of that as the Australian Mars Society is far more knowledgeable on that subject than I am.

Management

Management of the Habs is far more than just keeping machines and people alive and operating well within established parameters. The operation manuals of the Hab (96 pages! and growing) is at present the only guide for the mission support personal and the crews to manage the technical side of life at the Habs. But the knowledge accumulated at the Habs needs to be managed as well.

Right now all knowledge is stored the webpages of the Daily Field Reports and in the aforementioned operations manuals. It is very hard to keep these manuals up to date as systems at the Hab are constantly adapted, upgraded or simply tinkered with, whatever makes them perform their task for the present crew. Therefore for quite some time there was a need felt to make the knowledge of the Hab-systems (generator, autoclave, bread maker, water recycling system, etc) easier accessible. This lead in 2006 to the creation of a Wiki 'Hablife' [6].

This year the wiki will be enlarged in a collaborative effort between The Mars Society Hungary and the Mars Society Netherlands, of course with added input of volunteers from around the world. The Hablife wiki will be available to everyone on the web, to function as a practical guide for present crews and future crews and an outreach tool for the general public.

Crews can insert new information, upload files and modify previous data if needed (correction, update etc). However the articles would not be open to the public for writing/modifying (or, only after registration), but would be open for reading all articles and writing to discussion pages (or for other Mars-simulation related information, like [1-5]).

This Wiki would ensure more continuity in the day to day handling of the systems at the Hab and would support both mission support members and crews at the research stations.

These articles could serve as a historical database how various crews saw the subject, collecting all information in an organized way. It would also prevent crews for trying to solve problems or get data that previous crews already did; giving them the chance to make one step ahead for a subsequent problem, using data from previous crews.

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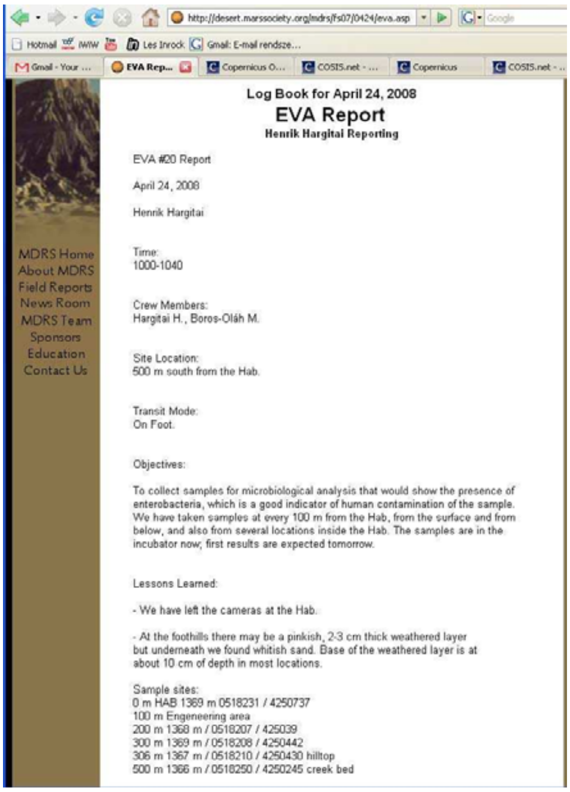

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Log Book for April 24, 2008

EVA Report

Henrik Hargitai Reporting

EVA #20 Report

April 24, 2008

Henrik Hargitai

Time:
1000-1040

Crew Members:
Hargitai H., Boros-Oláh M.

Site Location:
500 m south from the Hab.

Transit Mode:
On Foot.

Objectives:

To collect samples for microbiological analysis that would show the presence of enterobacteria, which is a good indicator of human contamination of the sample. We have taken samples at every 100 m from the Hab, from the surface and from below, and also from several locations inside the Hab. The samples are in the incubator now; first results are expected tomorrow.

Lessons Learned:

- We have left the cameras at the Hab.

- At the foothills there may be a pinkish, 2-3 cm thick weathered layer but underneath we found whitish sand. Base of the weathered layer is at about 10 cm of depth in most locations.

Sample sites:
0 m HAB 1369 m 0518231 / 4250737
100 m Engeneering area
200 m 1368 m / 0518207 / 425039
300 m 1369 m / 0518208 / 4250442
306 m 1367 m / 0518210 / 4250430 hilltop
500 m 1366 m / 0518250 / 4250245 creek bed

Fig 2: An EVA Report: this is how "collective knowledge" is now stored at the MDRS website

DESERT PAVEMENT

Deflation-made pebble fields (Desert pavement) / pavements of stone / gibber plains (AUS) / desert armour

Stony desert pavements stabilize the surface by furnishing protection to underlying desert soils. The pebble's source is varied: it may be the direct disintegration of conglomerates or can be deposited by flowing water. They are made of roughly similar size pebbles, the smallers removed by wind. Roundness pebbles originate from its paleoenvironment: they are round in the the original conglomerate, so their shape is not a result of subsequent weathering.

Formation of desert pavement

Pebble cover N of Shannons Range

On higher levels pavements of stone are clearly made of the disintegrated rocks (conglomerates), while on the lower levels fluvial activity may move or accumulate pebbles. During flooding pebbles can be complete removed from the levels below water level while in the higher ground (terraces) they are left unchanged, making islands of desert pavement.

This resembles desert pavement of Regs/Serirs (pebble deserts)

Conglomerates NW of Easter's Hill has a different erosional product: small crumby pieces, may be because the cementing material is stronger or fluvial processes have removed smaller grains

Pebble field N of Lady Dunes, on a flat, plateau surface. Here rounded pebbles are clearly a remnant of weathered,, disintegrated capstone conglomerates that could be found in a higher layer. (below)

Fig. 3. Sample page from a publication on MDRS area geography [5].

MARS-Oz: A Proposal for a Simulated Mars Station at Arkaroola in South Australia providing an Inspirational Setting for Science Education and a Focal Point for Australian Planetary Science: A Presentation

D.Willson[1] and J.D.A Clarke[2]

[1] Tenova-SEMF, 2nd floor 45 Murray Street Hobart Tasmania 7000/ Mars Society Australia, PO Box 327, Clifton Hill, VIC 3068 Australia. david.willson@au.tenovagroup.com

[2] Mars Society Australia, PO Box 327, Clifton Hill, VIC 3068, Australia jon.clarke@bigpond.com

The Mars Society Australia's MARS Oz project, 'Mars Analogue Research Station – Oz' has been developed during the last 6 years to provide a facility for practical education and research for planetary science in Australia. The education aim of the project is to:

> "Provide students and professionals an inspirational environment to explore the art of living on another planet encouraging students to develop and improve their science skills"

The project achieves this aim in two ways. Firstly, the station is located in an area that provides diverse geological and astrobiological Mars analogues. Secondly, the station design is a simulation of a horizontally landed bent biconic craft that could be used for a crewed Mars expedition. The combination of the location and realistic engineering design will give students and professionals an exciting and integrated approach to the issues of exploring another planet.

MARS-Oz could be used to undertake one to two week workshops for late primary school students, high school students, teachers, tertiary students and the general public. Practical and realistic 'Mars mission' scenarios can be created to explore questions such as: What do we need to travel and live on another world? Does life exist on other worlds? How do we find it or recognise it? What do we do when we find it? How can we live and work for long periods isolated from Earth and what kind of new society can we create on a new world?

MARS-Oz aims are similar to 'NASA's Spaceward Bound' educational aims. As such MARS-Oz will become a focal point of the Mars Society Australia's 'Spaceward Bound Australia' program being built in partnership with NASA Ames. The initial goal of Spaceward Bound will be to train teachers in the field of planetary science for teaching in the class though partaking field expeditions with professionals.

Finally, the presentation reviews the reasons for choosing the bent biconic vehicle and briefly covers the various technical arguments developed to adopt this vehicle as part of a Mission Architecture for an actual crewed Mars mission.

Keywords: MARS-Oz, Mars Base, Biconic vehicle, Arkaroola, Spaceward Bound

Robotic Mission

Colin Pain

The probe coasted into the planetary system from above the plane of the ecliptic, and began to survey the planets that orbited the rather ordinary star that sat in the centre of the system. It was looking for a particular kind of planet, one that showed the potential to produce intelligent life. The probe's makers were already an old race when this star began to form. They know that planetary systems were common in the galaxy, and that, although not so common, planets suitable for life were also abundant. But they still knew little about the long term processes that led to intelligence, so they had sent forth an armada of probes to search for planets that were suitable for life, but did not yet have intelligent beings. They knew that this could take a very long time, but they were patient, and long-lived enough to be able to see the results of their efforts. The probes were each designed to choose a suitable planet, and then gather data on its development. Only when unmistakable signs of intelligence were observed were the probes to send their observations back to their home system. In this way the scientists would not be inundated with data.

The probe noted that the system had the usual gas giants, although one was unusual in having a spectacular ring system. The system also had a number of rocky planets that orbited star-ward of the gas giants. This was promising, because many planetary systems in the galaxy seemed to be dominated by gas giants that orbited ridiculously close to their stars. After carefully comparing the characteristics of the rocky planets with the information and rules provided by its makers, the probe selected one of the rocky planets.

The planet it chose had an atmosphere thick enough and with a surface pressure high enough to protect life forms from harmful stellar radiation, and abundant surface water in oceans, lakes and channels and in the subsurface. The planet was also tilted relative to the ecliptic, which meant that it would have seasonal changes in temperature, wind, and water movement. It had two ice caps that would fluctuate with seasonal changes. It also had a number of impact craters, but this was common in young planetary systems. The planet met all the conditions for a pre-life planet, so the probe began to watch, record and wait. Only when it detected the presence of intelligent beings would it break its silence and make contact with its makers.

During the next four billion years major changes occurred on the planet and all these changes were faithfully recorded by the probe. There were shifts in the distribution of land and sea, the polar ice caps waxed and waned, there was volcanic activity, large areas were eroded, and the resulting sediments deposited in lakes and seas, and along river valleys. Some places that were formerly wet dried out and became covered with wind blown sand. Lakes and seas dried up, and other areas were inundated. Glaciers formed, and carved valleys and moved rocks. Occasionally truly catastrophic events such as major floods occurred.

Then suddenly, about 4 billion years after it began its vigil, the probe noted the presence of the signs of intelligence, primitive artefacts orbiting around the planet and, in the blink of an eye compared with its long wait, vehicles orbiting the planet, and some landing and taking off, first with a few and than many intelligent life forms. It awoke from its passive observations, and began sending 4 billion years worth of data back to its makers.

* * * * * * * * * *

There was an air of excitement and anticipation in the control centre as the Astrobiologist entered the room. The previous evening a preliminary message had arrived on the sub-space communicator from Probe 672B indicating that it had detected intelligent life, and that it was about to begin sending the data for which the Astrobiologist had been waiting for nearly 4 billion years.

His First Assistant was already in front of the control screen on which a summary of the data would be displayed; the rest would be stored for leisurely study in the coming millennia. At a nod from the Astrobiologist he set the display in motion. The first images showed tiny and primitive vehicles orbiting the planet. These were soon joined by larger vehicles that contained the unmistakable signature of intelligent life. It seemed that these beings had at last escaped from the planet on which they had developed at the end of 4 billion years of evolution. It was time to look at the planet, and to see, first in summary, and then in great detail the steps that had led to their evolution. The Astrobiologist instructed the First Assistant to begin with the earliest images, and to step through the development of the planet at a pace that would allow them to see the broad outlines of its evolution.

The first images were encouraging. There was a dense atmosphere, and abundant surface water, with lakes and oceans. Precipitation meant the formation of drainage systems and in places the building of fans and deltas, the latter advancing out into lakes. There was also volcanism. All in all it was a most satisfactory setting for the development of life. But then, about 3.5 billion years ago things began to change and to become much less encouraging. The rivers dried up and the planet began to loose its atmosphere. Surface water retreated underground. There was still some volcanic activity, and occasionally there were catastrophic floods as underground water was suddenly released on to the surface. But by 2 billion years ago the planet was essentially dry, and the main activity was the formation of sand dunes and the widespread movement of dust as storms built up and then dissipated in the thin atmosphere. Occasional volcanic activity interrupted a very passive period up to the present. During this long period the planet clearly became unsuitable for life, even if it had been there during the earliest period.

Then, suddenly, the vehicles with intelligent life appeared. The Astrobiologist was by now quite agitated. This was intelligent life, but it cannot have arisen on the planet they were looking at. Where did it come from? The Astrobiologist watched with growing puzzlement as the last of the images of the dry and dusty planet were delivered from the probe.

Then suddenly he sat up. “Go back to that last image”, he instructed. The First Assistant did as he was told.

The Astrobiologist leaned forward. “Enhance that part of the image just above the hills on the left”, he said, pointing.

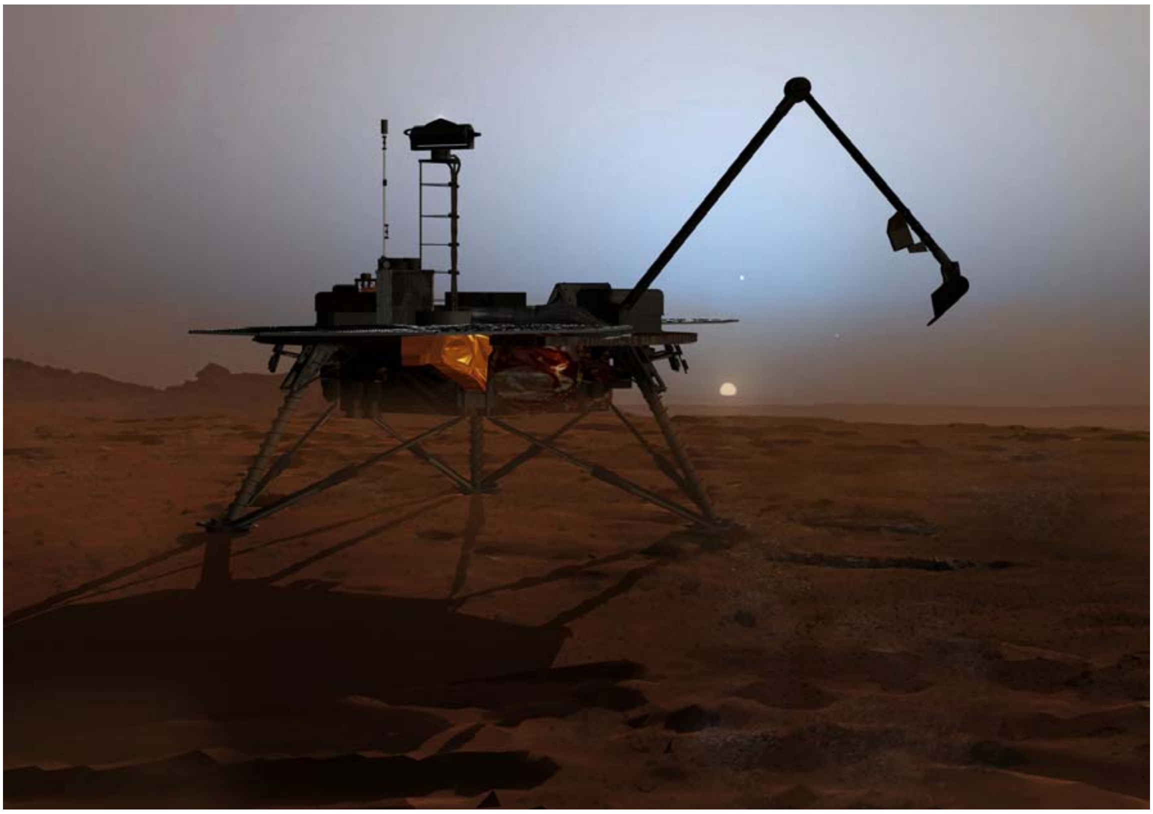
The First Assistant did so. A small white dot grew bigger as the high resolution enhancing capabilities of the screen did their job. As it grew the dot became blue, and then partly covered with swirling white areas. The image continued to grow until they were looking at a blue and white sphere against the black of space. Other sensors told them that the blue colour was mainly a result of water, and that the white swirling areas were made of water vapour clouds in an oxygen-rich atmosphere. There was also the clear signal of civilisations made by intelligent beings – intelligent enough to have built and sent vehicles to a neighbouring planet.

The Astrobiologist was devastated. The data the probe had collected would tell him nothing about the evolution of life and the development of intelligence, although there might be enough of passing interest to keep the geologists happy. He was almost at a loss for words. But not quite.

“That, that, that . . . . ROBOT!”, he yelled. “It chose the wrong planet!”

Colin Pain
59 David St, O’Connor ACT 2601
colin-pain@grapevine.com.au

Image: NASA



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