NASA Spaceward bound Mojave 2010 Report

Dr Kenneth Silburn

Opportunities for teachers to participate in authentic scientific discovery are few and far between. Mars Society Australia with strong links with the NASA Spaceward Bound Project advertised and selected three science educators from Australia to work with world-renowned planetary scientists in the Mojave Desert in late March 2010.

The Spaceward Bound project provides vital opportunities for teachers to participate in the exploration of scientifically interesting activities, in remote and extreme environments on Earth, as analogs for human exploration of the Moon and Mars.

Jane Hall-Dadson from Tasmania, Danielle Shean from Victoria and Ken Silburn from NSW were selected to participate in the project from an extensive list of national applicants. It is envisaged that these teachers will return to their classrooms and be able to share their experiences with their students and fellow teachers, both at their schools and also within the wider science education community.

The teachers were also given the opportunity for a rare behind the scenes tour of the NASA AMES Research Centre in Moffett Field, California with Dr. Chris McKay, Planetary Scientist from the Space Science Division and Principal Investigator of the Spaceward Bound Project.

The project also offers a unique experience for teachers to mix and communicate with scientists and engineers who are internationally recognised as leaders in their fields. The invitation for science teachers from Australia to participate also added to this international exchange.

Spaceward Bound Mojave was situated at the Desert Studies Center Zzyzx, California, which is the location for the annual Californian Spaceward Bound, providing an opportunity for ongoing research from the crew of regular scientists and other attendees.

Ken Silburn, Head Science Teacher from Casula High School said that being able to participate in the project was an eye-opening experience. “Often we just take for granted what is around us. I was surprised at the places that we found could support life. Even under rocks where the cyanobacteria were able to have enough light dispersing through the rock to allow photosynthesis to occur.”

Investigations during the week-long expedition included:

- Use of a submersible microscope
- High altitude balloon launch
- Desert transect (270 km long)

- Volcanic cave exploration
- Evidence of hypolithic bacteria
- Geological investigation of the landscape
- Investigation of stromatolite beds
- Remote control rovers for collecting data
- DNA extraction and analysis

Jane Hall-Dadson, science teacher from Exeter High School said " Insights from Penny Boston, Director of Cave and Karst Studies at New Mexico Tech and Henry Sun from the Desert Research Institute inspired me to develop microbiological activities that students could undertake in class."
The ability of microbes to metabolise minerals and deposit minerals around themselves could be important in the detection of life on Mars – how cool will it be if kids can say "we did that in class" when they apply to work in future Mars projects?

Submersible digital in-line holographic microscope (SDIHM)
Michelle Wen from San Francisco State University demonstrated the SDIHM. Few instruments exist that can image microscopic marine organisms in their natural environment so that their locomotion mechanisms, feeding habits, and interactions with surfaces can be investigated *in situ*. This may be the perfect instrument for detecting life under an ice cap. The SDIHM can image organisms and their motion with micron resolution.

High altitude balloon launch
The launch of three high altitude balloons were responsible for a lot of early morning excitement. The hydrogen filled balloon launch was part of the Columbus Space Program DREAMS-8 project which included payloads from 5th graders from a Science Club in San Francisco. The data logging equipment was able to take a reading every second during the flight. The students also included a digital camera that was able to take photos during the flight. Recording exceptional photos from space (approximate altitude 26 km) showing the curvature of the earth. The incredible photos are available from http://mojavescience.columbus2space.org/

Desert Transect

If microbes exist on Mars (or other planets) one factor they must cope with is an extremely dry environment – no liquid water. Hence the reason for conducting experiments in the desert environment.

The transect along a precipitation gradient measured a total length of 270 km recording the soil and vegetation profile. Soil was also collected for analysis of the microbes present and DNA for molecular studies.

The dry landscape vegetation composing of creosote bushes, sage and Joshua trees is different from that found in Australia.

Geological investigation of the landscape and Investigation of stromatolite beds

The wealth of knowledge available for teachers to tap into was incredible. This included explanations from leading astrobiologists such as Chris McKay and Stephen Wells, President of the Nevada Desert Research Institute.

Danielle Shean, Lead Educator and Research Scientist from the Victorian Space Science Education Centre, Victoria said "Spaceward Bound was a fantastic experience for me. I've been able to put some of the scientific sampling techniques I learnt about into our space programs. One of the really interesting areas we studied, for me, was the stromatolite beds – one minute these hapless bacteria are living their little lives, then the next they are gone! Then they just start all over again. What is so interesting, is trying to figure out what killed them off and what caused them to come back and recolonise. "There are so many wonderful mysteries to solve both on Earth and in Outer Space, and it was so exciting to be able to participate in trying to solve a few!"

Volcanic lava tube exploration

As well as an extremely dry environment the Mojave also has a volcanic landscape that could be similar to that found on Mars. The expedition visited the Pisgah Crater and lava field. The lava stopped flowing the about 25 000 years ago, however it is still a dominant feature of the landscape. As the lava flows it creates long tube structures that are left after the lava stops flowing. Wearing helmets and flashlights we explored one lava tube. Collecting specimens of microorganisms that were found in the dark zone of the cave.

Rover

The rocky terrain also gave the scientists a chance to test the robotic rovers. The operation of these rovers were similar to that of a toy remote car with the exception of the expensive cameras and data recoding equipment. The Mars rovers, Spirit and Opportunity demonstrate the importance of using robotics for data collection.

Dr Silburn said the teachers were ecstatic and privileged to be involved in the program. It is obvious that the success of the program will continue to have a lasting effect on our students and our teaching. We have made so many friends and professional associations during the trip that we undoubtedly will foster in years to come.

These teachers will also be presenting a report at the forthcoming Australian Mars Exploration Conference being held at the Victorian Space Science Education Centre from the 9th to 11th of July.

For specific details and mission reports please check the NASA Spaceward Bound page; http://quest.nasa.gov/projects/spacewardbound/