

the effect of photo-dissociation on the composition of the grain mantle; A. Souza discussed the processing of formic acid containing ice by heavy and energetic cosmic ray analogues; L. Majumdar talked about the spectral signature and chemical evolution of some complex molecules which could be treated as the precursor of some bio-molecules in the ISM.

This was a brief, yet very successful meeting and the organisers would like to thank COSPAR for the opportunity to arrange this session.

Capacity Building in Solar and Sun-Earth Connection Studies (PCB.1)

[Report by M. Machado, C. Gabriel]

International cooperative programmes have proven to be excellent capacity building tools in solar and solar-terrestrial physics research. Starting with the SMY (Solar Maximum Year) in the 80s, followed by ISTP and most recently IHY, ILSW and ISWI ("International Space Weather Initiative"), they all have contributed or continue to do so, to disseminate the use of spacecraft data in conjunction with that obtained by ground based instruments. Many examples also exist of bilateral or multilateral agreements involving developed and developing countries that have served the same purpose. This half-day session, held in the morning of 19 July 2012, reviewed past, present and possible future programmes and cooperation opportunities, with emphasis on underscoring strengths and weaknesses with regard to scientific outcome and the linking with the building of new capacities.

Eight solicited and contributed papers were presented, dealing with the aforementioned programmes as well as the capacity building use of space physics modelling tools. The session started with a review of the COSPAR programme of Capacity-Building Workshops, which have as a main objective the encouragement of the scientific use of space data by scientists in developing countries. This is possible in view of the large number of extensive archives of data from past and

current space missions and the ready access to these and the associated analysis software which is afforded by the internet, the typical workshop aims to provide a highly practical training in the use of one or more of these, based on current missions.

A lively exchange of ideas followed the presentations on the rising awareness of space weather science and its link to capacity building initiatives, as well as global cooperation programmes and the use of ground based instrumentation in various regions of the globe. It was stressed that the use of standard ground based equipment provides an affordable way to participate in a meaningful way in these cooperative programmes, with substantial capacity building and societal benefits. It is also interesting to note that, even though they were not mentioned in the outline of the meeting, neither in any of the submitted abstracts, a discussion arose with regard to the use of cubesats as an affordable means for university groups and less developed countries to train and make contributions in space science and technology. A cubesat is a type of mini satellite for space research that usually has a volume of exactly one litre (10 cm cube), a mass of no more than 1.3 kg, and typically uses commercial off the shelf electronics components.

Since attendance was not very large (around 20 participants in total), something typical in the case of programmatic-type meetings at COSPAR assemblies, this facilitated the communication of experience and new ideas between the attendees, possibly leading to new initiatives.

Planetary Protection Mission Implementation and Status (PPP.2)

[Report by A. Spry]

The PPP2 session is targeted at planetary protection implementation, the status of on-going and planned missions, and the techniques and procedures applied to spacecraft, instruments and other hardware in order to meet planetary protection

requirements.

A summary of the status of NASA missions (in flight and in development) was provided by C. Conley, followed by a similar status summary for ESA missions presented by C. Erd, in place of G. Kminek who was unable to attend. In each case, missions already launched are maintaining compliance with COSPAR Planetary Protection policy, and credible paths to compliance were described for missions under development.

A more detailed description of the planetary protection status of NASA's recently launched Mars Science Laboratory (MSL) mission was given by JPL's N. Benardini, updating the PP implementation progress from that reported at Bremen in 2010. The MSL Project was in compliance, and approval granted for launch on 26 November 2011, as a COSPAR Category IVa mission. Final assessment indicates that the 1-ton spacecraft left Earth bound for the red planet accounting for only 5.64×10^4 spores on landed hardware and 1.81×10^5 spores on impacting hardware.

Subsequent presentations described mission design concepts and planetary protection implementations for proposed or planned missions. H. Yano described the JAXA Hayabusa-2 project and its plan to return samples from 1999 JU3, a C-type NEO, proposed as a Category II outbound/Category V (unrestricted Earth return) mission. The mission looks forward to returning asteroid samples in late 2020.

An update to the ExoMars programme was provided by ESA's D. Rebuffat, standing in for G. Kminek. The 2016 element of the ExoMars programme is planning to use the orbital lifetime approach to meeting its Category III planetary protection requirements at Mars, but is also maintaining a bioburden management activity to ensure it can switch to the alternative bioburden control approach, if required. The "Entry, Descent and Landing" technology demonstrator flying as part of the 2016 mission plans to meet Category IVa requirements, whereas the later 2018 mission with the ExoMars rover payload plans to meet Category IVb requirements.

C. Erd then gave an overview of the proposed planetary protection implementation for the ESA JUICE (Jupiter Icy Moons Explorer) mission concept to the Jovian system. The presentation described the approach to meeting Category III requirements, highlighting the restriction of unintentional impact with Europa to the 1×10^{-4} probability level in the mission design.

The next three presentations focused on concepts and technologies for Mars Sample Return (MSR) missions. M. Viso's presentation on CNES's sample capsule sealing methodology study compared three seal welding technologies: electron beam, friction stir and laser. Based on extensive testing with representative model hardware and materials, the laser technology came out as the preferred option.

D. Rebuffat then presented the planetary protection approach for MSR in the context of the ESA Mars Robotic Exploration Preparation (MREP) programme. In particular, the reliability of the return vehicle and the biological flight containment system was discussed, including study of the effect of micrometeoroids on TPS.

R. Gershman, JPL, then described NASA's most recent approach to back-contamination for an MSR campaign architecture, focusing on containment assurance aspects of the architecture. Fault tree analysis work, designed to assure a very low probability of inadvertent release of Martian material into the Earth's biosphere, with an unprecedented degree of confidence in hardware performance, was presented.

The final presentation of the session was a survey of current and emerging technologies for biological contamination control, presented by A. Frick of the Space Policy Institute, which highlighted the need to design the spacecraft to planetary protection requirements, and not try to design planetary protection around the spacecraft.