

**Summary of the EnMAP Round Table Discussion at the 6th EARSeL
Imaging Spectroscopy (IS) Special Interest Group (SIG) Workshop,
Tel Aviv, Israel, March 16-18, 2009**

Panellists:

H. Kaufmann, GFZ, Germany
G. Rossner, DLR, Germany
K. Staenz, Univ. Lethbridge, Canada
A. Held, CSIRO, Australia
R. Green, JPL, USA

Chairman:

M. Berger, ESA-ESRIN, Italy

Following the EnMAP Session at which the EnMAP mission characteristics were presented in detail, a dedicated round table was organised to discuss the mission characteristics and exploitation strategies with the wider community. Experts in the field of Imaging Spectrometer (IS) systems served as panellists, taking the questions from the audiences. The panellists were: H. Kaufmann, GFZ, Germany, Principal Investigator of the EnMAP mission; G. Rossner, DLR, Germany, responsible for the EnMAP data utilisation; K. Staenz, ATIC/University of Lethbridge, Canada, involved in various IS space concept development activities and co-chairman of the International Spaceborne Imaging Spectroscopy Working Group (ISIS WG); A. Held, CSIRO, Australia, initiator and co-chairman ISIS WG, and R. Green, JPL, USA, manager of the AVIRIS programme and Principal Investigator of the proposed HypIRI mission. The following topics were proposed for discussion:

- Mission requirements
- Product retrievals and requirements
- Data policy and dissemination
- Cal/Val plans
- Science exploitation and preparatory activities
- GMES and IS systems
- International cooperation

In addition to these topics the audience requested to also discuss:

- Commercialisation aspects of IS systems

For the latter some participants had the opinion that the commercialisation of IS systems was not given sufficient attention which may be the key to get spaceborne IS systems approved. This opinion was not shared by the broad audience. It was noted that various attempts to commercialise remote sensing systems failed and that it would be too early to go directly into market development activities. Operational services need to be elaborated step by step supported by an open data policy which may lead eventually into operational requirements. A similar approach was applied for the GMES services. After more than 30 years of remote sensing experience, services based on remote sensing systems are acknowledged as public goods which will further foster downstream service developments and spin-offs and thus support value added companies. It therefore was stressed that the benefit of IS systems need

to be demonstrated in an operational context, e.g. as service evolution for GMES. There was a general agreement that a range of core and downstream services could truly benefit from IS systems.

The discussion of the EnMAP **mission requirements** was focused on the background mission plans. It was noted that it is planned to define details of the background mission with the community using dedicated workshops. Ideas could be related to certain scientific topics such as desertification and specialised measurement campaigns such as BRDF campaigns, or in support of the preparation of future IS systems such as HypIRI. It was also noted that likely there will be only little room for a background mission, as it is expected that data requests will fill the available data acquisition (strips of 1000km per orbit and a maximum of 5000 km per day).

Within the **products requirements** discussion it was stressed that a strong link to the end-user community is required to have a mutual understanding of their detailed requirements. This is in particular important as some products with the same names may have different meanings for different communities. They often serve as proxies for processes with different physical descriptions used in different model environments. It was noted that details of the product portfolio will be elaborated through a series of workshops. Products up to a level of atmospherically and geometrically corrected reflectance products will be provided through the ground segment and higher level products shall be supported by a dedicated toolbox which will be provided to the community free of charge. In this context the drawback of toolboxes which may limit the use of synergies of various sensor systems within an integrated data processing scheme was mentioned. Concerning higher level products there was the opinion that the toolboxes could be designed open enough to allow product integration. The development of integrated processing using lower level data (system-corrected-radiance fields) is considered important for the future. In this context recently launched activities aiming at the direct assimilation of radiance measured by different sensor systems with different characteristics (spatial, spectral, radiometric, angular and temporal sampling), is considered important. Also the standardisation of certain products was mentioned in this context. Standardisation activities are underway which shall be observed in the framework of the elaboration of the EnMAP product portfolio. It was further stressed that product uncertainties need to be provided as additional information layers to the users. This is being foreseen by means of quality flags for the lower level products that are provided by the ground segment, where uncertainties can be derived from system performance characteristics but will be more difficult for higher level products. Further discussion need to be devoted for this aspect in the context of the Cal/Val plans.

Data policy and dissemination was introduced within the EnMAP session. The open data policy which foresees free access for scientific use was in particular welcomed by the community.

In the discussion of the **calibration and validation** needs, it was mentioned that the EnMAP team is involved in the CEOS WGCV discussions and it is envisaged to coordinate their plans with the proposed CEOS sites. Currently a validation plan is under development which shall include dedicated teams are being set-up, which will be responsible for different sites around the globe. A range of airborne campaign shall support the activities. Within this context the cooperation with the Italian PRISMA team was also recommended. According to the current schedule both sensors will fly simultaneously allowing coordinated calibration and validation activities and a further assessment of the temporal information component,

with the increased temporal revisit of both sensor systems. In addition, the use of the moon as a calibration source was also discussed. Spectral characterisation based on the Moon Mineralogy Mapper (M³) onboard the Chandrayaan-1 mission is now available (first results were presented during the workshop). Both, the PRISMA and the EnMAP team noted that moon calibration is currently included as an option, whereas the EnMAP team outlined that the baseline is to conduct sun calibration while moon calibration is still under discussion as an additional option.

Concerning the **science exploitation and its preparatory activities** it was noted that the full science exploitation and definition of activities will be elaborated during national and international workshops. The first national workshop is being planned for October this 2009, while an international workshop is considered in 2010. Within this context it was addressed to consolidate and coordinate the different activities. It was stressed in the further discussions that the science is two-fold. There are activities related to improving and developing applications and science related to supporting challenges as outlined by various science disciplines of the Earth system modelling community. For the latter, IS systems could contribute to model parameterisation as, for example, the parameterisation of plant function types used in ecosystem models. There was a consensus that plans need to be detailed within the EnMAP exploitation preparation phase.

The **GMES and IS systems** context was already mentioned during the commercialisation discussion. Although there are currently no requirements for IS systems requested by GMES services, there is a large potential for future service evolution by enhancing existing services by the provision of increased product accuracies and additional new products. Also data harmonisation, for example automated atmospheric correction, would benefit from future IS systems. It was stressed that dedicated demonstration projects shall be pursued for various services. As an example, inland water quality was mentioned where it is believed that IS systems could provide an essential contribution.

Under the topic **International cooperation**, the objectives of the International Spaceborne Imaging Spectroscopy Working Group (ISIS) was introduced which aims at a coordinated approach to pursue future spaceborne missions and to seek international partnerships to the benefit of the global user community. For example, coordination activities include: the interoperability among missions, 'best practice' mission implementation, mass data management challenges and development of a forward work plan for improved coordination activities amongst member agencies. In this context, the EnMAP team outlined that international workshops are being planned for coordination with the wider international science community.

In summary, the round-table discussion was considered useful in addressing a range of issues, which will need special attention for the preparation of the EnMAP mission and its coordination with other international activities.