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- Collaborative project -

**D8.3 Final User Consultation Workshop
(Demonstrator)**

WP8 – Outreach

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| Dissemination Level | | |
| PU | Public | x |
| PP | Restricted to other programme participants (including the Commission Services) | |
| RE | Restricted to a group specified by the consortium (including the Commission Services) | |
| CO | Confidential, only for members of the consortium (including the Commission Services) | |

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Executive Summary

This document provides a short description on the final user consultation workshop of the iMars project organised in conjunction with the Europlanet RPIF 3D workshop held in June 2016 at the premises of UCL/MSSL. The workshop included a number of presentations and demonstrations as well as hands-on sessions related to iMars data products and software tools.

A total of 22 international students participated in this workshop testifying the significant impact of the workshop.

The workshop provided insights to the developments and results of the iMars project. Feedback by the participants by means of a questionnaire and via e-mail communication after the workshop to the coordinator (see Section 4.6) indicated that topics presented are of great interest to the science community and that the workshop itself was of high quality.

Furthermore, a short overview about the contributions to the DPS/EPSC Meeting 2016 is provided. Here iMars provided 10 contributions, 5 thereof were oral presentations and 5 poster presentations. The talks were attended well and raised questions showed great interest in the presented material. The poster presentations were, according to the contributors, placed inconveniently such that the less attraction could be gained in comparison to the oral presentations.

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Key word list

Martian surface mapping; remote sensing; digital terrain models; stereo-matching; image processing algorithms; image feature detection; georeferencing; image co-registration

Definitions and acronyms

| Acronyms | Definitions |
|----------|---|
| 3D | Three dimensional |
| AAS | American Astronomical Society |
| CTX | Context Camera |
| DEM | Digital Elevation Model |
| DPS | Division of Planetary Sciences |
| DTM | Digital Terrain Model |
| EPSC | European Planetary Science Congress |
| GIS | Geographic Information System |
| HiRISE | High Resolution Imaging Science Experiment |
| HRSC | High Resolution Stereo Camera |
| ISIS | Integrated Software for Imagers and Spectrometers |
| MOC | Mars Orbiter Camera |
| MSL | Mars Science Laboratory |
| NASA | National Aeronautic and Space Administration |
| PDS | Planetary Data System |
| PSA | Planetary Science Archive |
| RPIF | Regional Planetary Image Facility |
| USGS | United States Geological Survey |
| VO | Viking Orbiter |
| WP | Work Package |

1 Introduction

The overall objectives of the work package 8 “Outreach” of the iMars project are as follows:

- coordinate dissemination activities among all project partners and ensure visibility of project aims and results to the science community and general public,
- develop strategies for further exploitation of the project results and identify opportunities for follow-up projects
- implement efficient communication with scientific community and general public for enhancing and promoting the use and benefit of iMars tools and data, and
- employ the NASA Regional Planetary Imaging Facilities (RPIFs) to promote the products and tools developed by iMars.

Task 8.3, the final user consultation workshop, was initially foreseen to be held in conjunction with a major international meeting or conference with the specific objective to present the progress of the project, and to collect user feedback to update plans for dissemination of the project.

At the time of preparation of the work programme for iMars it was assumed that the European Planetary Science Congress (EPSC) would be held at a location in Europe. However Pasadena, California, USA was selected as the venue for EPSC 2016, joining for the first time the annual meeting of the Division of Planetary Science (DPS) of the American Astronomical Society (AAS). The focus of this conference was on science results in a narrower sense compared to the usually more wide-ranging EPSC topics that also include mixed scientific/technical sessions as well as pure technical sessions. Furthermore, DPS does not call for session proposals as is usually the case for the EPSC such that no dedicated session could be organised within the scope of the DPS/EPSC.

Due to these circumstances, the iMars consortium decided to split the dissemination activities related to task 8.3 into a science dissemination part and a workshop part. The former was realised through coordinated contributions to DPS/EPSC 2016, a major event in planetary science, while the workshop part was joined with the Europlanet RPIF 3D workshop which offered an excellent opportunity to attract a strong group of professionals working in thematically related areas.

The workshop took place at UCL/MSSL in July 2016 and was supported by the Europlanet 2020 Research Infrastructure (RI) project under its Networking Activities (NA1 – Innovation Through Science Networking). Europlanet 2020 RI is project to integrate and support planetary science activities across Europe which is funded under the European Commission's Horizon 2020 program (grant agreement No.654208). The Co-ordinator of iMars, Prof. Jan-Peter Muller (UCL-MSSL) led a large team to organise the workshop, find students, appoint trainers, set-up a website for registration, organise all travel and food logistics for all student attendees and host all the events.

This summary mainly reports on the user consultation workshop rather than on the presentations at the DPS/EPSC meeting since the latter are conventional scientific conference presentations and well documented by the conference programme and proceedings.

2 Presentations on iMars Progress

A total number of 10 abstracts were submitted to the DPS/EPSC 2016 (see Table 2-1) of which 5 were accepted as oral presentations at the meeting and the remainder as poster presentations. Furthermore, the consortium asked meeting and science organizers to possibly bundle the presentations in one

session to highlight their common links to the overall approach of iMars. Unfortunately, this could not be granted by the program committee as contributions are accepted and arranged according to individual sessions at DPS conferences.

Nevertheless, the iMars contributions covered the entire palette of topics dealt with within the project. Spreading the presentations over different sessions, on the other hand, provides also an advantage, as a wider audience can be reached.

The Co-ordinator attended some of the oral presentations. The talk given by Jessica Wardlaw (Sprinks et al., 2016a) was well attended with some 30 people, the talks from Lida Fanara, Jung-Rack Kim and Yu Tao had almost a 100 attendees with lots of follow-up questions raised. The poster session was very poorly attended with only 2-3 visitors/poster. Physically it was away from the main part of the poster room and away from the refreshments.

Table 2-1: iMars contributions to the DPS/EPSC Meeting 2016

| Title | Contributor | Reference | Accepted | Timeslot |
|--|-------------|---------------------------------|---|------------------------|
| Better the Martian you know? Trust in the crowd vs. trust in the machine when using a Martian Citizen Science platform | UNOTT | (Sprinks et al., 2016a) | Oral: "Citizen and Student Engagement in Space Science: The Latest Educational Research and Future Studies" | 8:40-8:50a.m.; 20.Oct |
| Mars in Motion: An online Citizen Science platform looking for changes on the surface of Mars | UNOTT | (Sprinks et al., 2016b) | Poster | Thursday, 426.01 |
| SWIR Spectral Mapping of the Martian South Polar Residual Cap Using CRISM. | UCL | (Campbell et al., 2016) | Poster | Thursday, 426.05 |
| The investigation of active Martian dune fields using very high resolution photogrammetric measurements | UoS | (Kim et al., 2016) | Oral: "Active Surface Process on Mars: Volatiles, Wind and Impacts" | 3-3:10p.m.; 21.Oct. |
| Analysis of Dark Slope Streaks on Mars based on Multitemporal Imagery and Digital Elevation Model derived from HRSC Data. | FUB | (Schreiner et al., 2016) | Poster | Thursday, 426.08 |
| Super-resolution restoration applied to the characterisation of dynamic surface changes on the Martian surface | UCL | (Tao and Muller, 2016) | Oral: "Active Surface Process on Mars: Volatiles, Wind and Impacts" | 2:30-2:40p.m.; 21.Oct. |
| Automatic detection of surface changes on Mars - a status report | UCL | (Sidiropoulos and Muller, 2016) | Poster | Thursday, 426.03 |
| Properties of the Medusae Fossae Formation as seen by the MARSIS radar | EPFL | (Ivanov and Cantini, 2016) | Oral: "Martian Geology and Habitability " | 8:40-8:50a.m.; 21.Oct |
| EU-FP7-iMARS: analysis of Mars multi-resolution images using auto-coregistration, data mining and crowd source techniques: A Status Report | UCL | (Muller et al., 2016) | Poster | Thursday, 426.02 |
| Frequency of block displacements at the north pole of Mars based on HiRISE images | DLR | (Fanara et al., 2016) | Talk: Active Surface Process on Mars: Volatiles, Wind and Impacts Session | 3:10-3:20p.m.;21.Oct. |

3 The RPIF 3D Workshop

The workshop was organized by MSSL/UCL in co-operation with the RPIF UK facility (Director: Prof. Jan-Peter Muller & Data Manager: Dr Pete Grindrod) and Europlanet (Prof. Steve Miller & Dr. Norbert Krupp). Its main objective was to introduce early-career scientists to the range of software tools available to generate 3D data products from planetary exploration data, mainly using data of Mars. In addition to known software libraries and workflows like the NASA-USGS ISIS and Socetset® solution, newly developed software like the modified UCL-NASA Ames Stereo Pipeline, which was developed within the iMars project, was demonstrated. Other topics of this 3 full day workshop included data handling and data fusion, tools for the digitisation of geological and geomorphological features and an introduction to GIS systems.

In total 22 international students and young professionals participated in the workshop including 1 participant from Turkey, 4 from Russia, 1 from Spain, 3 from Poland, 1 from Hungary, 1 from Slovenia, 1 from Italy, and 10 from the UK.

In the scope of WP8 Task 3 – the Final User Consultation Workshop – the iMars consortium was a major contributor to this workshop, demonstrating data products, software tools, and providing hands-on session for the participants (cf. Table 3-1).

All aspects of the iMars project were covered in the presentations, which included:

- Introduction of new datasets from the HRSC experiment
- Co-registration of different NASA data sets to HRSC
- Processing of stereo data into DTMs and data mining
- GIS presentations and tools
- Introduction of Citizen Science platforms for scientific research.

Next to the demonstration of the iMars products, a questionnaire was developed to be answered by the workshop participants that should provide information on the following questions:

- What is the background of the participant?
- What is their field of research?
- What kind of data and derived products are participants currently working with?
- Which derived products or software tools would aid their work?
- What is requested most by scientists – processed data or tools to process data?

Answers provide guidance to further steps of the project and its dissemination as well as potential spin off projects.

Table 3-1: Agenda of the RPIF 3D Workshop

Tuesday, 7 June 2016

| | | |
|-------|-------|--|
| 09:45 | 10:00 | Coffee, tea, biscuits, registration |
| 10:00 | 11:00 | Introduction to RPIF-3D & 3D Imaging |
| 11:00 | 13:00 | Introduction to USGS ISIS+SOCET |
| 13:00 | 14:00 | Lunch |
| 14:00 | 15:00 | Introduction to ArcGIS |
| 15:00 | 15:30 | Hyperspectral imaging Processing - CRISM |
| 15:30 | 15:45 | Coffee, tea, biscuits, registration |
| 15:45 | 16:00 | Hyperspectral imaging Processing - CRISM |
| 16:00 | 18:00 | Practical exercises using CRISM |

Wednesday, 8 June 2016

| | | |
|-------|-------|---|
| 09:45 | 10:00 | Coffee, tea, biscuits, registration |
| 10:00 | 11:00 | Introduction to HRSC 3D products & iMars feedback |
| 11:00 | 12:30 | Introduction to ACRO |
| 12:30 | 13:00 | Introduction to stereo photogrammetry & NASA-ASP |
| 13:00 | 14:00 | Lunch |
| 14:00 | 15:00 | Introduction to CASP-GO |
| 15:00 | 16:00 | Introduction to PRoGIS 2.0, QGIS & radar echoes inside QGIS |
| 15:30 | 15:45 | Coffee, tea, biscuits, registration |
| 16:00 | 17:00 | Introduction to iMars webGIS |
| 17:00 | 18:00 | Practical exercises using webGIS |

Thursday, 9 June 2016

| | | |
|-------|-------|---|
| 09:45 | 10:00 | Coffee, tea, biscuits, registration |
| 10:00 | 11:00 | Introduction to data mining |
| 11:00 | 12:00 | Introduction to 3D visualisation inc Geowall & Fledermaus |
| 12:00 | 13:00 | Introduction to PRo3D® |
| 13:00 | 14:00 | Lunch |
| 14:00 | 15:00 | Practical exercises using PRo3D |
| 15:00 | 16:00 | Introduction to Citizen science |
| 16:00 | 17:30 | Training samples for data mining |
| 17:30 | 18:00 | Feedback on iMars products & services |

4 User Consultation

4.1 General Survey

22 participants of the workshop filled in the questionnaire that was handed out at the beginning of this meeting. Expertise and fields of research of the participants was wide spread with a concentration on planetology, geology and GIS (Figure 4-1). All, except two of the participants do work with planetary image data of various sources. However, the majority did have contact with Mars exploration data of some kind. Here it was indicated that the highest resolution orbital

imaging data (CTX and HiRISE) are the most used data, followed (as far as Mars data are concerned) by HRSC images from the European Mars Express mission and rover images of NASA’s MSL. The category “Others” includes Martian spectral data as well as orbital data of missions to other planetary bodies like Messenger data or Cassini data.

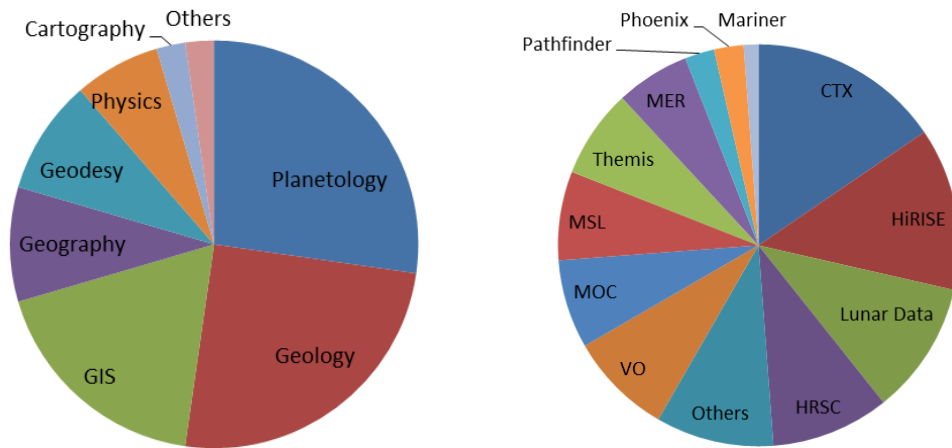


Figure 4-1: Distribution of participants’ interests and study fields (left). Right – data participants worked before the workshop

Based on the questionnaire answers, for most participants of the workshop the focus of their studies appears to be the interpretation of data and data products rather than producing derived products like DTMs themselves. Though 16 out of the 22 participants need to process retrieved data to achieve their tasks.

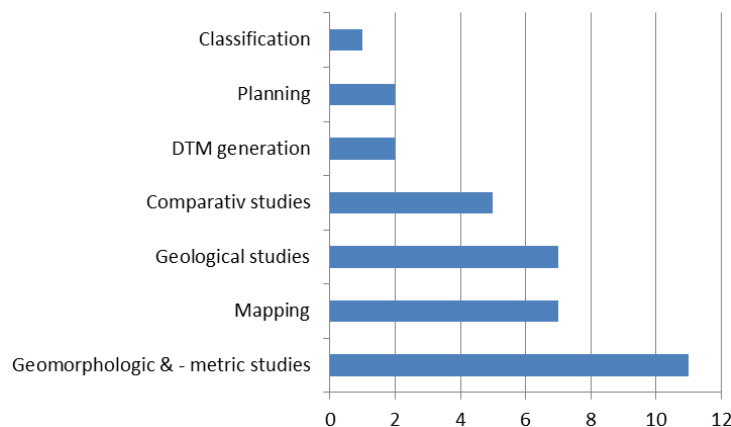


Figure 4-2: Fields of application indicated by the workshop participants.

Data processing in this case includes co-registration, preparatory work to load the data into software, i.e. ArcGIS, radiometric calibration, and also mosaicking to extend the covered area to the area of interest. All this is done for the purposes of final DTM generation, mapping, mosaicing and detailed interpretation of the data. Visual inspection of input data to the processing appears to be a common method to judge the suitability of data for the purpose. Though, some participants do use the meta-information to select their input data.

4.2 Introduced Processing Software

90% of the participants would like to see additional derived products and tools available through public archives. Mostly DTMs/DEMs and subsequent mosaics are of great interest. But also map

projected and “ready to use” other data like spectral information were mentioned as missing derived data products.

As a consequence, 86% answered that they would like to get their hands on software introduced during the workshop and would like to learn how to process data with that software. As reasons for that, participants stated that tools currently applied for co-registration often do not provide the expected results and are very time consuming and needed data sets are not readily available.

4.3 WebGIS Survey

During the workshop a Beta version of the iMars WebGIS was presented and participants were asked to judge from their experience with other GIS systems if this development provides added value to the science community and which aspects they do not see implemented in other systems.

82% of the participants thought the iMars WebGIS provides additional features in comparison to other systems. Here the majority stated that the selection of epochs appears to be very useful for their purposes. 9% thought the WebGIS presented is not new and could hold more data sets to be compatible with other systems like the Mars Orbital Data Explorer. The remaining 9% were undecided and stated that the iMars WebGIS appears to be a valid tool but added value in comparison to other system is limited.

4.4 Citizen Science Aspects

The questionnaire showed that citizen science is not very well known. 73% of the participants had not heard of citizen science before that workshop. The few who did were either involved in a project using a scientific community platform or participated in other projects in their spare time.

After the introduction to the iMars Citizen Science project [“Mars in Motion”](#) 91% of the participants thought this is a valuable tool for science. Though, 32% think a large number of samples are necessary to make the study reliable and 23% do think a good explanation of the science case and task for the participant is essential to trust the results.

Only a few participants thought of setting up a citizen science project for their research. Main concerns were that preparation and validation of the collected data could be as time consuming as performing the tasks themselves, as their research tasks do not involve so much data.

The effort to conveniently setup such a project is documented in deliverable D7.3 (Houghton et al., 2016). Though at a first glance the deliverable might underline the concerns of the workshop participants regarding the high efforts with respect to setup and evaluation, it also describes the benefits of crowd sourced data.

4.5 Summary

Participants did have a good background on planetary data, data handling, processing and analysis. Taken this into account, the answers are judged as qualified and trustworthy.

There appears to be a need for more “ready to use” data derived products that should be provided through public channels to the science community. Established archives were considered to be well organised and suitable for retrieval of data by the workshop participants and could be used as channel to provide the iMars results to the community. Though, selection of data via a geolocation selection tool like a WebGIS appears also to be a common method to retrieve at least information on available data sets.

The Citizen Science platform was not very well known. The workshop introduced participants to this kind of research tool and brought more attention to the iMars [“Mars in Motion”](#) project.

4.6 Testimonies by the participants

The joint workshop between RPIF 3D, Europlanet and iMars is considered successful also by the participants. This was testified by several e-mails that reached the organisers after the workshop. Here, a few excerpts are provided exemplarily:

Participant 1

The workshop was very insightful and I was grateful for the opportunity to connect with students and trainers with such a diverse range of expertise.

I found the sessions on HRSC data products (...) and automatic co-registration and orthorectification (...) particularly useful. I learned a lot from their very clear explanations of the processes by which raw data is processed before it is released on public databases, and the errors that arise from these processes.

Participant 2

I can tell you that the experience was of great reward to myself. For my PhD research I am involved in preparing data analysis techniques for spectral imaging with the ExoMars PanCam instrument. As such I would otherwise have had limited opportunity to explore the 3D Stereoscopic capabilities of the instrument.

Now that I have received the comprehensive training of the workshop, new avenues have opened for my research, as I am able to manipulate 3D data to complement spectral analysis of surface reflectance.

The workshop also provided excellent networking opportunities.

Participant 3

The workshop helped me to gain an understanding of the main software packages for planetary image processing. The programme was very comprehensive and in a short time gave an overview of the basic possibilities and instruments, as well as advantages and disadvantages of the techniques.

The outline of the workshop lectures is like a guide through planetary data: we were told so many details which are nearly impossible to guess but are very important while dealing with the data.

And the Internet, of course, has everything, but it is so difficult to find the best programme there. Also exchange of experience is an invaluable thing. Now we have very useful links to tutorials and instructions which are available online, so we can try to implement the whole processing chain by ourselves.

I was mostly involved in Lunar studies before but now I know where and how I can get Martian data as well. It broadens the field of my studies a lot (and I plan to include this into my PhD work). Moreover,

presented online web-GIS services give the opportunity to look through the available data easily and even solve some tasks without downloading and preprocessing of raw images.

Participants 4-6

We obtained a huge amount of knowledge about planetary data processing and new planetary software. We were also able, thanks to this meeting, to start collaboration with (other participating scientists). The workshop gave us a new perspective on both possibilities and challenges in the planetary science world. Thank you very much.

5 Summary

5.1 Workshop results and conclusions

The Final User Consultation Workshop held in 6-8 June 2016 at UCL is considered very successful. Much information could be collected indicating which data products are most needed but also indicating that iMars is already working in the right direction by not only developing tools to derive further data products but also providing results through a number of channels, like the webGIS or PSA/PDS in the case of the HRSC mosaics (Gwinner et al., 2016).

To further support the participants, presentations of the workshop were collected on the iMars website and are now publically available from:

<http://www.i-mars.eu/outreach/workshops/rpif-3d-workshop-jun2016/presentations>

Photographic impressions were also collected and are available on the Europlanet Flickr website (<https://flic.kr/s/aHskL6ZTWt>) as well as on the iMars website (<http://www.i-mars.eu/outreach/workshops/rpif-3d-workshop-jun2016/workshop-photos>).

5.2 Dissemination Activities

The DPS/EPSC was a well-attended international conference (1400 is largest ever DPS but only 200 EPSC registrations cf. 800 normally) providing a very good stage to promote the iMars project. With 10 contributions to the DPS/EPSC 2016, including 5 poster and 5 oral presentations, iMars could present its results and current status at this major scientific meeting in the field of planetary science. The presentations were given in a number of different sessions which is seen as an advantage since a wider audience was addressed in comparison to a dedicated session.

5.3 User Interactive Workshops

The Final User Consultation Workshop concludes the series of three user interactive workshops within the iMars project. The first, User Requirements Workshop, was held during the European Geoscience Union (EGU) meeting in 2014, introduced iMars' goals and development plans to the science community and collected feedback as well as further inputs on needs of the science community (see D8.1 for more details (Gwinner and Gasselt, 2014)). Around the projects mid-term the User Consultation Workshop was a more informative workshop during the EPSC 2015 in Nantes. Similar to the Final User Consultation Workshop reported in this document, the User Consultation Workshop in 2015 was comprised of mainly oral presentations during a regular session of the congress and an interactive dedicated session (see D8.2 for more details (Willner et al., 2015)).

This Final User Consultation Workshop provided valuable feedback on the results of the iMars project on one hand, indicating that iMars has gone the right way in developing tools for co-registration and change detection as well as providing “ready to use” data products to the science community. The questionnaire also provided clues on what kind of facilities are currently needed by end users within the planetary science community which could be an initial seed for future research projects.

6 References

Campbell, J., Sidiropoulos, P., Muller, J.-P., 2016. SWIR spectral mapping of the Martian South Polar Residual Cap using CRISM, AAS/Division for Planetary Sciences Meeting Abstracts.

Fanara, L., Gwinner, K., Hauber, E., Oberst, J., 2016. Frequency of block displacements at the north pole of Mars based on HiRISE images, AAS/Division for Planetary Sciences Meeting Abstracts.

Gwinner, K., Gasselt, S.v., 2014. D8.1 - User Requirements Workshop, WP 8 - Outreach. EU FP7 Project "iMars", p. 79.

Gwinner, K., Jaumann, R., Hauber, E., Hoffmann, H., Heipke, C., Oberst, J., Neukum, G., Ansan, V., Bostelmann, J., Dumke, A., Elgner, S., Erkeling, G., Fueten, F., Hiesinger, H., Hoekzema, N.M., Kersten, E., Loizeau, D., Matz, K.D., McGuire, P.C., Mertens, V., Michael, G., Pasewaldt, A., Pinet, P., Preusker, F., Reiss, D., Roatsch, T., Schmidt, R., Scholten, F., Spiegel, M., Stesky, R., Tirsch, D., van Gasselt, S., Walter, S., Wählisch, M., Willner, K., 2016. The High Resolution Stereo Camera (HRSC) of Mars Express and its approach to science analysis and mapping for Mars and its satellites. *Planetary and Space Science* 126, 93-138.

Houghton, R., Sprinks, J., Wardlaw, J., 2016. D7.3 - Report on data validation tests by citizen scientific users, WP 7 - Crowd-sourced features for change discovery and validation of data mining. EU FP7 Project "iMars".

Ivanov, A.B., Cantini, F., 2016. Properties of the Medusae Fossae Formation and its relation to the volcanic history of Mars, AAS/Division for Planetary Sciences Meeting Abstracts.

Kim, J., Kim, Y., Park, M., 2016. The investigation of active Martian dune fields using very high resolution photogrammetric measurements, AAS/Division for Planetary Sciences Meeting Abstracts.

Muller, J.-P., Sidiropoulos, P., Tao, Y., Gwinner, K., Willner, K., Fanara, L., Waehlich, M., Walter, S., Schreiner, B., Steikert, R., Ivanov, A.B., Cantini, F., Wardlaw, J., Sprinks, J.C., Giordano, M., Kim, J., Houghton, R., Bamford, S., 2016. EU-FP7-iMARS: analysis of Mars multi-resolution images using auto-coregistration, data mining and crowd source techniques: A Status Report, AAS/Division for Planetary Sciences Meeting Abstracts.

Schreiner, B.P., Walter, S., Muller, J.-P., Sidiropoulos, P., 2016. Analysis of Dark Slope Streaks on Mars based on Multitemporal Imagery and Digital Elevation Model derived from HRSC Data, AAS/Division for Planetary Sciences Meeting Abstracts.

Sidiropoulos, P., Muller, J.-P., 2016. Automatic detection of surface changes on Mars - a status report, AAS/Division for Planetary Sciences Meeting Abstracts.

Sprinks, J.C., Wardlaw, J., Houghton, R., Bamford, S., Marsh, S., 2016a. Better the Martian you know? Trust in the crowd vs. trust in the machine when using a Martian Citizen Science platform, AAS/Division for Planetary Sciences Meeting Abstracts.

Sprinks, J.C., Wardlaw, J., Houghton, R., Bamford, S., Marsh, S., 2016b. Mars in Motion: An online Citizen Science platform looking for changes on the surface of Mars, AAS/Division for Planetary Sciences Meeting Abstracts.

Tao, Y., Muller, J.-P., 2016. Super-resolution restoration applied to the characterisation of dynamic surface changes on the Martian surface, AAS/Division for Planetary Sciences Meeting Abstracts.

Willner, K., Gwinner, K., Fanara, L., Wählisch, M., 2015. D8.2 - User Consultation Workshop, WP 8 - Outreach. EU FP7 Project "iMars", p. 21.