

SpaceOps Workshop 2017

The SpaceOps workshop 2017 will be hosted by the Space Research Institute of the Russian Academy of Sciences (IKI RAN <http://www.iki.rssi.ru/eng/index.htm>) and will take place in Moscow, Russia. The workshop will span over 3 days, from the **26th to the 28th of June 2017**, whereby each day is dedicated to a specific topic. The three topics that will be addressed are:

1. **Advanced Data Analysis Technologies**
2. **Mission Operations 2030 and Beyond**
3. **Space Endeavors via Moon and Mars**

Further description of these topics is given below.

The SpaceOps Committee invites its members to nominate participants to the workshop, noting that the aim is to have constructive discussions on the topics, and thus active participation by the (expert) attendees is desired. In order to allow for effective discussions, the workshop targets approximately 60 participants in total.

Participants are asked to initially provide a short abstract of their presentation. Once participation is confirmed, a presentation on the selected topic(s) is required. Please note:

- Participants can choose to present on one or more of the above topics
- No paper will be required; only the presentation.

The following schedule is foreseen:

- **10th of March: Deadline for abstracts and list of participants**
- 31st of March: Abstracts reviewed and outcome communicated to participants.
- 28th of April: Participants confirm plans to attend
- 2nd of June: Deadline for (draft) presentations
- 26th to 28th of June: Workshop

Further information about the location of the workshop and logistics, including VISA requirements, is provided in the accompanying presentation.

Description of the topics

1. Advanced Data Analysis Technologies

The increase of the amount of Telemetry and ancillary data (e.g. those delivered from Ground assets and/or produced by ground processing) per mission, the need for high autonomic operations, the change of operations paradigms are only a few of the challenges requiring modern techniques for analysing and handling of spacecraft data.

Intelligent data agents with e.g. novelty detection systems and machine learning algorithms allow to automatically recognize new items, self-assess and improve the spacecraft monitoring. They support operators in detecting anomalies earlier, give time to engineers to assess the situation and take action before the traditional out-of-limit is triggered.

Participants to the SpaceOps Workshop are invited to present and discuss their own monitoring approach, the new requirements identified or envisaged for recent and upcoming missions and an update on the current research and development in this area. Aspects such as mitigation of false alarms, contextualized detection, analysis of telemetry data streams, on-board adoption of data analytics methods (e.g. on-board smart reporting), are welcome to be addressed.

2. Mission Operations 2030 and Beyond

With the advancing technologies and the changing requirements for missions, we would like to address a number of concepts for mission operations, and whether these are likely to be applied in the medium/long term, e.g. 2030 and beyond. The underlying question is: Will we still operate/manage space missions in the same way as today (responsibilities, tools)?

We would like to explore potential changes to the setup of an operations centre as we know it today.

Examples are:

- Splitting Mission operations from payload operations - Direct access to payloads by PI's, possibly also for commanding.

- Decentralising operations - different companies offering different specialties (for example flight dynamics or communications). No longer a need for centres that offer the end-to-end service?
- Turnkey solutions - will spacecraft always be delivered with the ground segment and operations concept? Will users needs be limited to training and a room to host their operations?

Furthermore, will there still be a need for institutional operations centres, or will operations be done by private organisations? What about human exploration missions? What are the security measures that would need to be considered?

If we examine the technologies used in monitoring & control, will mission control in the future still be based on the same underlying TT&C concept used today (that originates from the 1960s if not earlier)? How could the space sector benefit from remote operations in other domains such as off-shore. And what about advances in the underlying technologies, such as computers and networks? What will be the new technologies that will dominate operations, e.g. Virtual/Augmented reality.

Taking the above into account, will the layout of a control centre become different? E.g. going away from the control of the end asset (spacecraft) to the control of the control systems controlling the asset? Will we have control rooms or will we control from smaller rooms such as offices? How will this affect the operations of constellations or collaborations on different missions; will this rekindle the role of operations centres?

Participants to the workshop are invited to reflect on the above considerations and share their views and ideas on the development of operations concepts for future missions.

3. Space Endeavors via Moon and Mars

Space Exploration is a wide field but the trend is to have a specific target. For various organisations the target for the next 20 years seems to be the human exploration of Mars, and some are considering the Moon be a practical intermediate step to verify the technologies needed for the mission to Mars. During this session, we would like to address the operational aspects of such endeavours, e.g.:

- The identification of the differences between operations on or around the Moon and Mars; is a Lunar mission a stepping stone towards Mars, or are there significant differences that would impact the choice of operations tools and technologies to be used? Which operations technologies can be verified using the Moon as an intermediate step (habitat, etc.)?
- Technical challenges on the way to the Moon and Mars, such as the challenges of deep space communications including data relays.
- What are the legal aspects, international laws, to be considered for operations on/around the Moon and Mars? Typical issues are: liability in joint operations, space object disposal, international licensing. Are there any legal obstacles or uncertainties for certain mission scenarios? (Note: We want to avoid a discussion of exploiting space resources and international space law, and limit the discussion to legal aspects affecting operations).

We invite participants to present and discuss their views and considerations, as well as any measures or developments they are undertaking in preparing for the operational aspects of human exploration of the Moon and/or Mars.