Mission Data System Innovation For Earth Observation Mission

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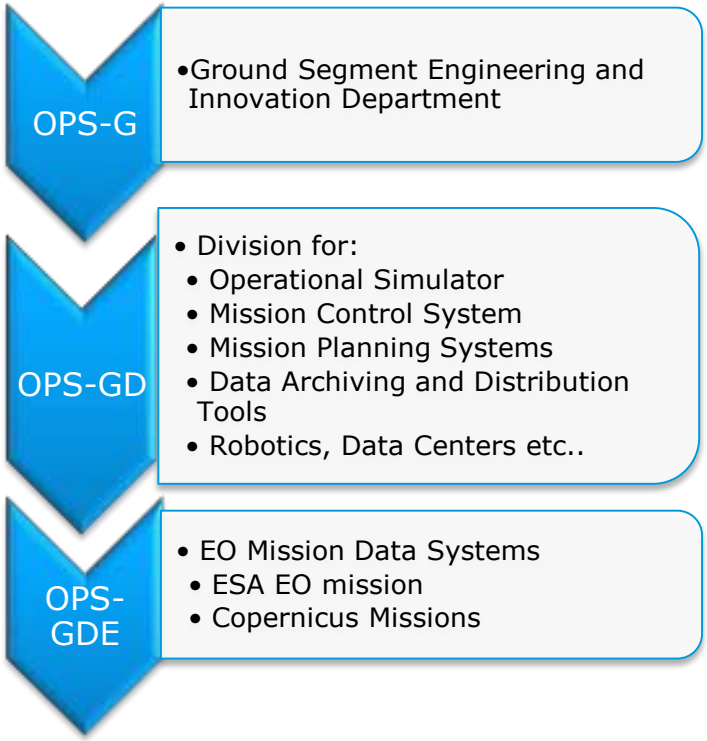
14/11/2016

Introduction

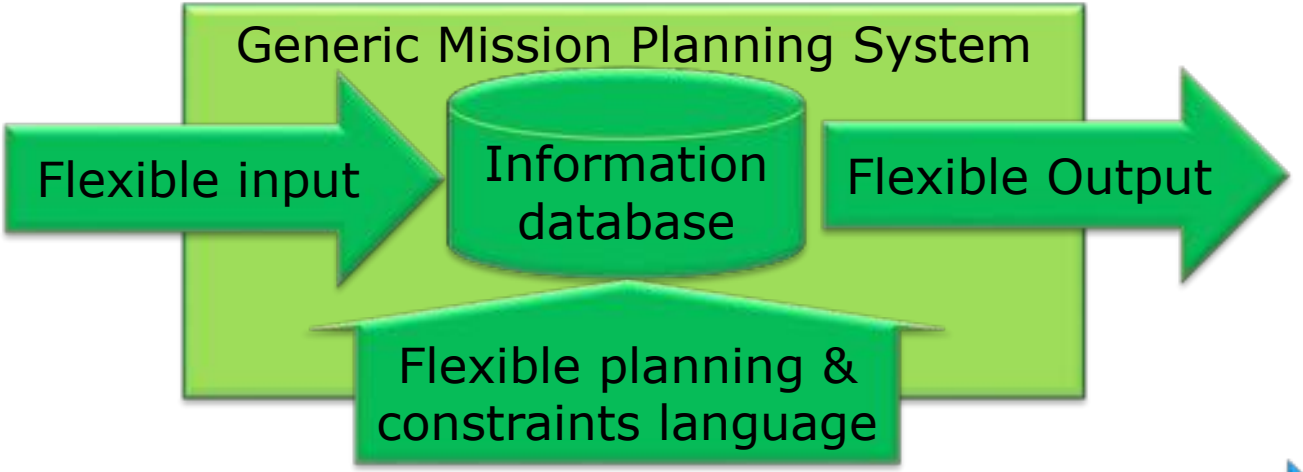
- Provide Operational Data Systems for EO missions.
- Build on common infrastructure:
  - MICONYS (for M&C)
  - SIMULUS (for S/C simulation)
- Innovation is key to enable future mission concepts
- This presentation gives overview of selected innovation activities:
  - Benefits
  - Status



Content

- Flexible Mission Planning System
- Archiving, Distribution and Long Term Preservation of Data
- File Based Operations (FBO)
- EGOS-CC
- DTN and Network Architecture
- OPS-SAT
- Other activities and Summary

Flexible Mission Planning System



For you:
- Allow advanced planning technologies (AI etc…)
- Allow more elaborate constraints checking
- Allow better utilization of on-board resources

Coming when? Now!

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Archiving, Distribution and Long Term Data Preservation for EO

- Collection of all missions into a single archiving solution.
- Expanding the Hadoop based Big Data infrastructure.
- On-going work to expand the set of data available from traditional Tm/Tc to also auxiliary data: Flight Dynamics, Ground station etc…
- Via ESA Long Term Data Preservation (LTDP) program:
  - Adding also heritage missions.
  - Make data more accessible and understandable.

For you:
- Increased availability of data for external users
- Ready for advanced big data analytics
- Access to historical data (via LTDP)

Coming when?

Continuous improvement process…

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File Based Operations

- Already baseline for several Science mission.
- Planned part of Next Generation Generic Platform for EO.
- Based on international CCSDS CFDP standard and ECSS PUS-C
- Include protocol level re-transmissions allowing move towards more unreliable links like Ka/Optical → Higher downlink volume.
- Simplify operational tasks.

For you:
- More flexible handling of payload data.
- Easier processing, downlink and distribution concepts.
- Allow more elaborated services (emergency requests, selective re-transmission etc…)

Coming when?

Baseline for next generation platform and future missions!

EGS-CC adaptation for EO missions

- EGOS-CC: Generic adaptation of ESOC Ops Infrastructure for EGS-CC
  - New Operational Preparation Environment (OPEN) available
- Started preparation for EGOS-CC adaptation for Copernicus:
  - COP-CC & OPEN-MC: Feasibility studies for usage of EGOS-CC for Copernicus
- EGS-CC based M&C baseline for all S/C launching as of Mid-2020s

EGS-CC

For you:
- Harmonization within Europe
- Open architecture → Opportunities for SMEs to perform EGS-CC/EGOS-CC compatible innovation.
- Native Automation support

Coming when?

Mid-2020s

Delay Tolerant Network & Network architecture

- Baseline solution for Future Exploration scenarios (LOP-G etc…)
  - An CCSDS standard allowing interoperability.
- Store and Forward solution beneficial for simple EO networks.
- Efficient usage of unreliable links:
  - Ka-Band or Low elevation pass periods in other bands.
- Allow smooth move from dedicated node-poor point-to-point architecture to node-rich network view
  - Efficient usage of Optical Coms both DTE and LEO-LEO ISL.

For you:
- Simplify 3rd party payload hosting on ESA S/C.
- Abstract away communication complexity from planning purpose.
- Allow new operational concepts.

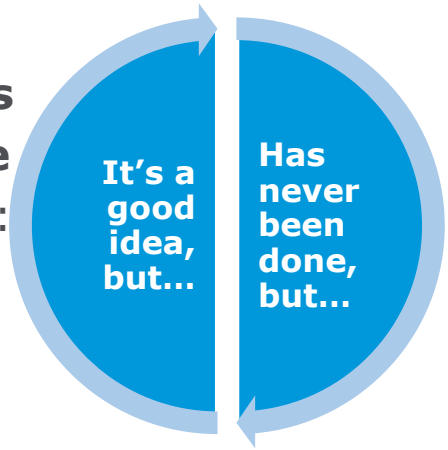
Coming when?

Protocols Ready; On-board impl. Missing; Looking for mission!

OPS-SAT

The mission's primary goal is to **break** the **"has never flown, therefore it will never fly"** cycle:

- Communication (CCSDS MO services, compression, security, IP, DTN ……)
- FDIR/AOCS concepts.
- Onboard SW design & Autonomy



For you:

- dual core ARM CPU + FPGA
- GNSS receiver, S-band, X-band downlink
- HD camera, software defined radio, optical receiver, reaction wheels and more…
- **Opportunity for YOU to fly YOUR experiment!**

Other Topics and Summary

Other topics we looking into:

- AR/VR (spin-in from ongoing Robotics Activities)
- Security
- Digitalization, MBSE etc…

Summary:

- Data Systems for EO missions are constantly evolving
- We are actively promoting a number of technologies:
  - FBO, DTN, Planning SW, Big Data infrastructure, CCSDS MO etc…
- Number of initiatives to prepare for more advanced technologies:
  - AI, Data Analytics etc…

Thank you

and

Let’s invent the future!

Recommended next:

“Artificial Intelligence for Space Operations“

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