

## Science & Exploration Ground segments : new challenges seen from CNES

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1. Context
2. Analysis
3. Plan

# OUR CONTEXT

**New organization at CNES with 3 technical directories (DIA / DSO / **DNO**)**

**New Department **DNO/SC** , it has in charge Science & Exploration G/S Development & Operations**

- Our main mission: Support the French Space Science community

## **With**

- Less national missions (instrument contributions vs global system design)
- New actors (new space, commercial , students, ... )
- New kind of missions (nanosat, constellations ...)
- Less budget





# OUR TEAM





# OUR CONTRIBUTIONS

*Planet & Small  
Bodies Operations*

- ❖ MSL (2012) , INSIGHT (2018),  
MARS2020 (2020)
- ❖ MASCOT (2018)
- ❖ TEAM INDUS Cooperation  
(GOOGLE X PRIZE )



*Science Instrument  
Expertise*

- ❖ MICROSCOPE (2016)
- ❖ TARANIS (2019)



**Contributions  
done through  
our support to  
French  
Laboratories**

*Science  
Data Processing*

- ❖ CDP / MEDOC / SSA
- ❖ GAIA (2015)
- ❖ EUCLID (2021)
- ❖ LISA (2032)
- ❖ SVOM (2021)



*Human Space  
Flights  
Experiments*

- ❖ PHARAO/ACES (2019)
- ❖ USOC (PROXIMA 2016)
- ❖ DECLIC
- ❖ CARDIOMED / CARDIOSPACE



# FACILITIES & TOOLS

❖ Operations Mission Facilities



❖ **Laboratories** for preparation and validation of microgravity experiences



❖ Access to specific **infrastructures** such as ZERO-G plane, ISS, ...



❖ **Specific tools & Common services** to manage development & exploitation

❖ Scientific processing **expertise** with HPC & HTC infrastructure



## FEDERATE FACILITIES FOR SCIENCE COMMUNITY



# OUR ANALYSIS

- Collaboration is a key factor for participating to Space projects
- CNES has a strong experience in developing and managing "complex G/S systems" and has a "system engineering" culture
- Focus on Teams: skills, empowerment, capitalization ...and improve the share of good practices & knowledge
- Reactivity, Agility & Flexibility to address future "Space Of Things" missions

# OUR PLAN

- Collaborative S/E platform
- Share good practices
- Do Simple tools
- Improve skills
- Open innovation
- Improve visibility
- Improve long term issues (patrimonial)

**ENHANCE OUR SUPPORT TO SCIENTIFIC COMMUNITY  
TO ENABLE THEM TO FOCUS ON SCIENCE**

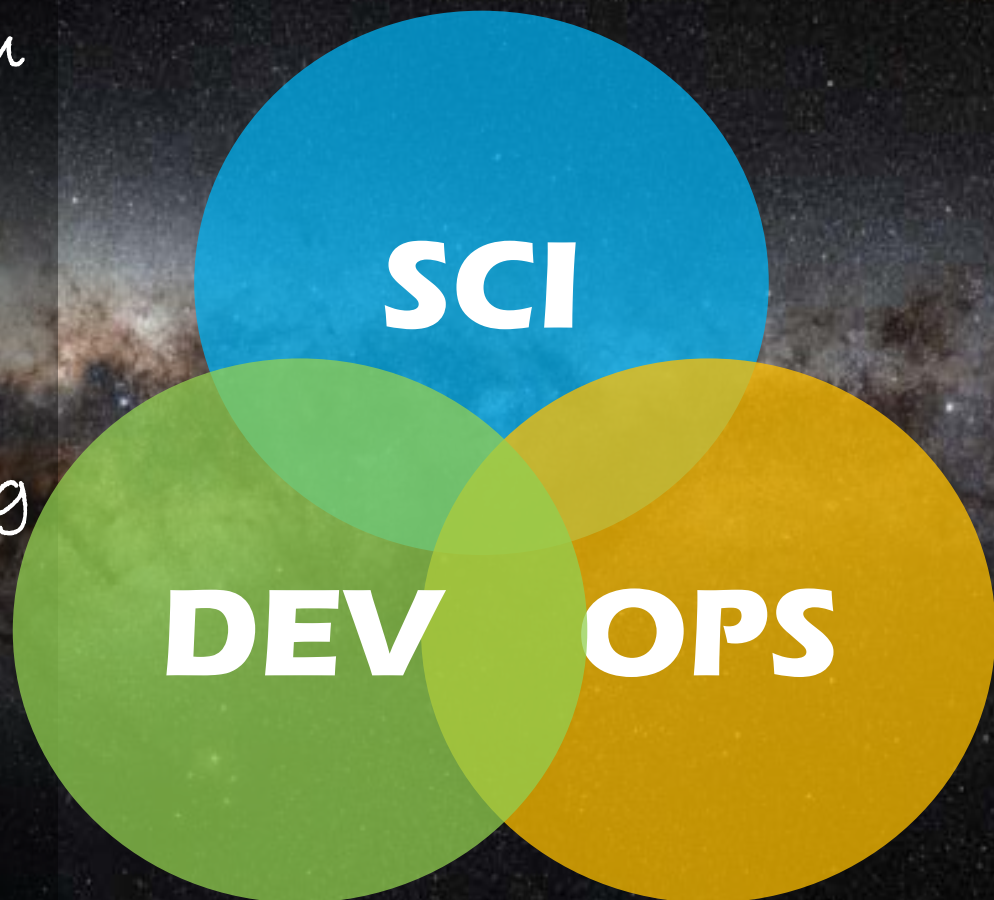


# COLLABORATIVE S/E PLATFORM

Need to have an open System Engineering collaboration platform for Sci / Dev / Ops teams

Need to have flexibility using Virtualization, Container & Automation technologies

Open innovation for future G/S development or integration of legacy applications





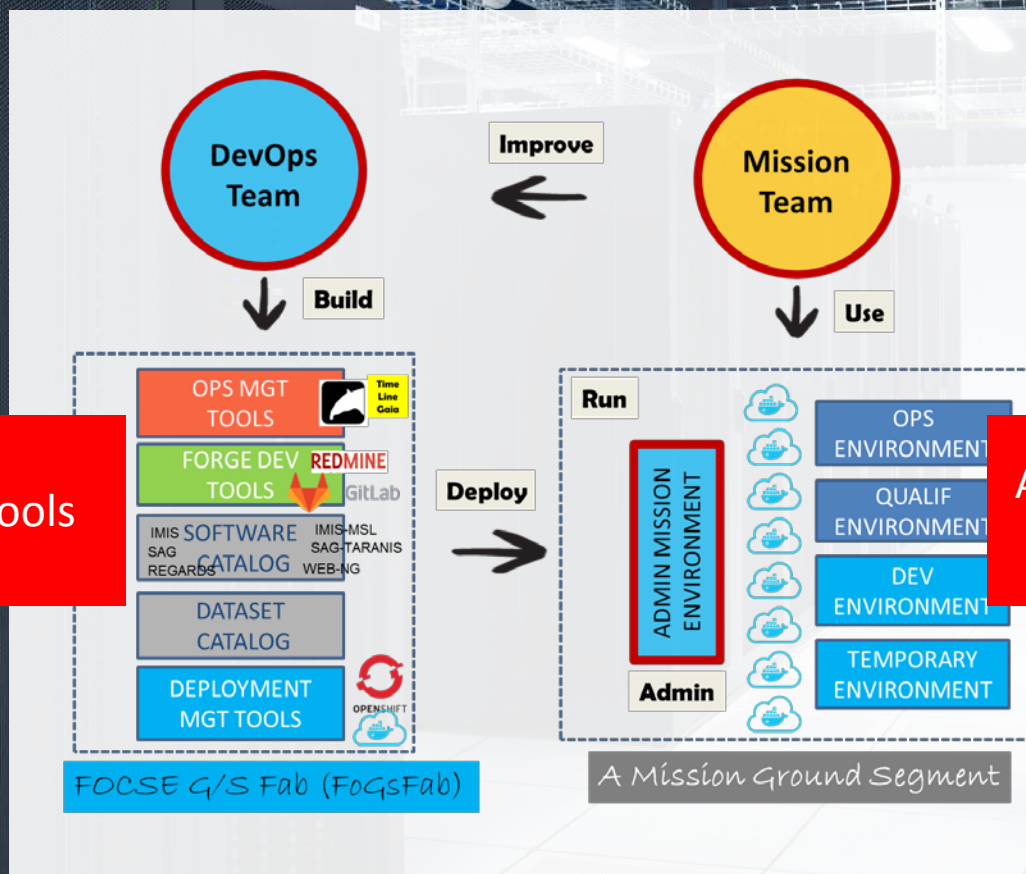
# S/E FUNCTIONS

Dev & Project  
Management Tools

System & Software  
Qualification Tools

Environment &  
Software  
Deployment Tools

Operations  
Management Tools

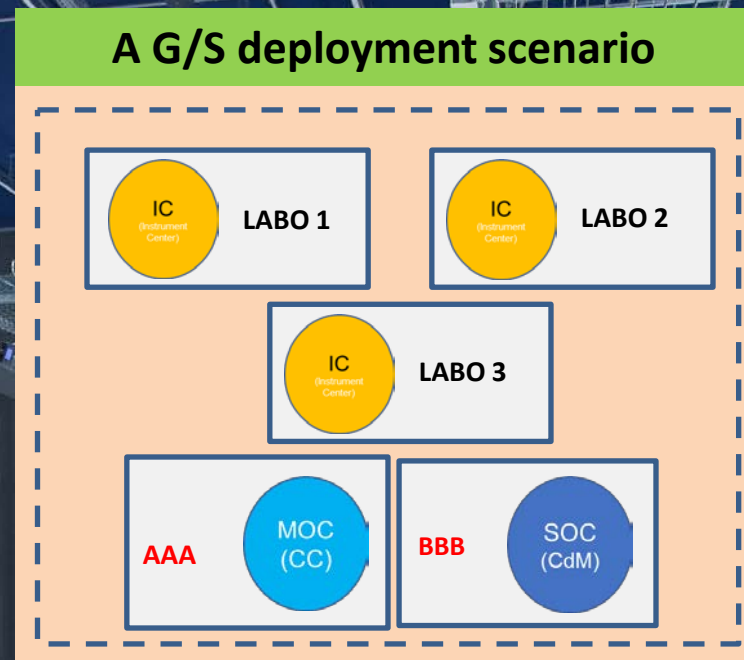
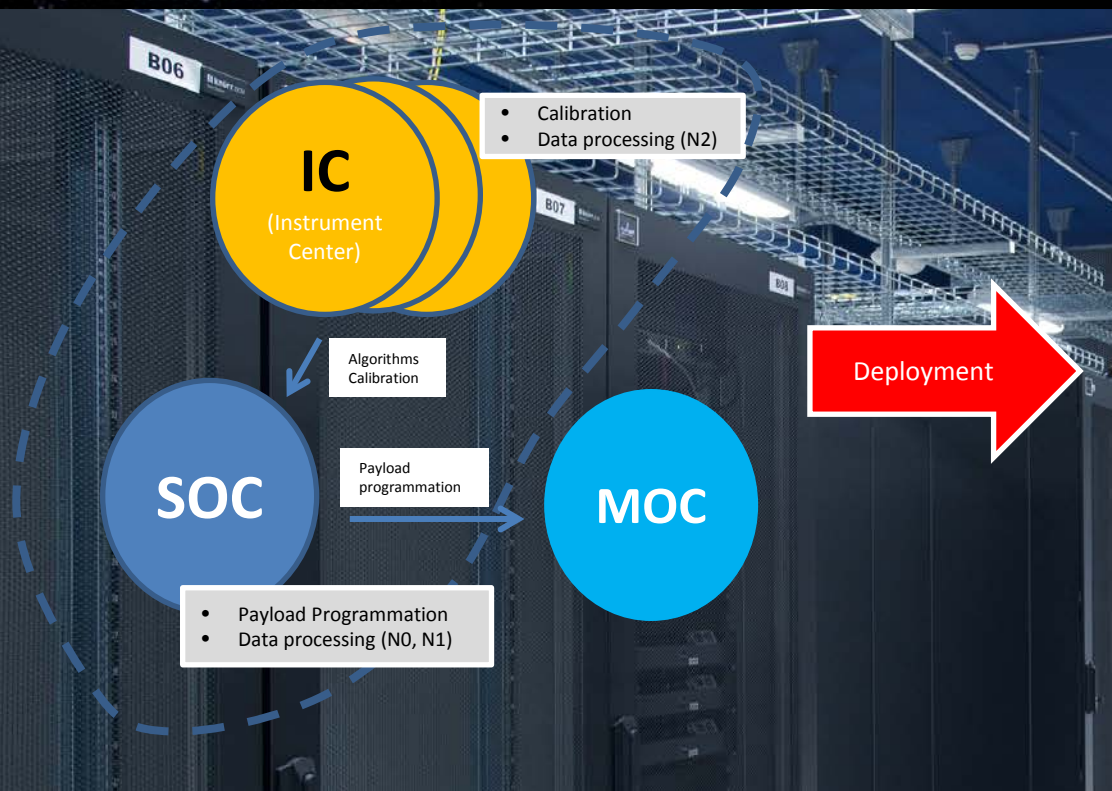


« As a service » Tools

Automated deployment  
of environments

Give autonomy to do the daily work

# AGILE DEPLOYMENT




- **Whatever the deployment of G/S components will be : cloud or on premise, centralized or distributed**
- **The important question is on the responsibilities & activities to be done by each party involved**
- **The essential issue is to provide autonomy & reactivity to the actors**



# DO SIMPLE TOOLS

- We have developed some generic tools
- Sometimes hard to use, customize and deploy !
- New product development in progress
  - REGARDS (Data Catalog)
  - SPIRIT ( Mission Data Processing Core)
- Let complex things to the projects



- Catalog ▾
- Search
- Enumerations
- Import
- Processing ▾
  - Processes
  - Chains
  - Dashboard**
  - Triggers
- Supervision ▾
- Statistics

PROCESSING > DASHBOARD

↺

RELANCER

ARRÊTER

Choose ▾

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3	ProcessExecutionModel	20b49891-80b7-4d9f-9f8d-c3...	Traitement Exec 3	2017-05-21T20:15:46.924155Z	2017-05-21T20:15:46.924155Z	
4	ChainExecutionModel	a4d17430-f1ed-4733-86c3-e7...	Chaine Exec 1	2017-05-21T20:15:46.924155Z	2017-05-21T20:15:46.924155Z	
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1-5/9 results

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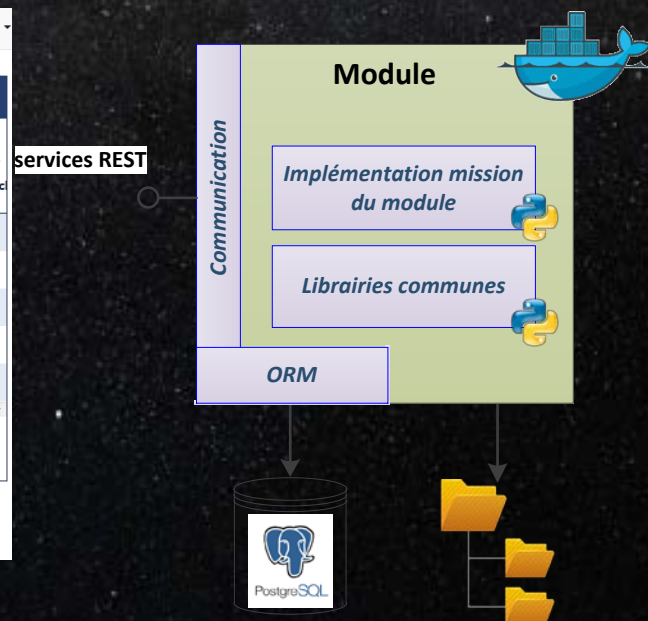
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5 results per page

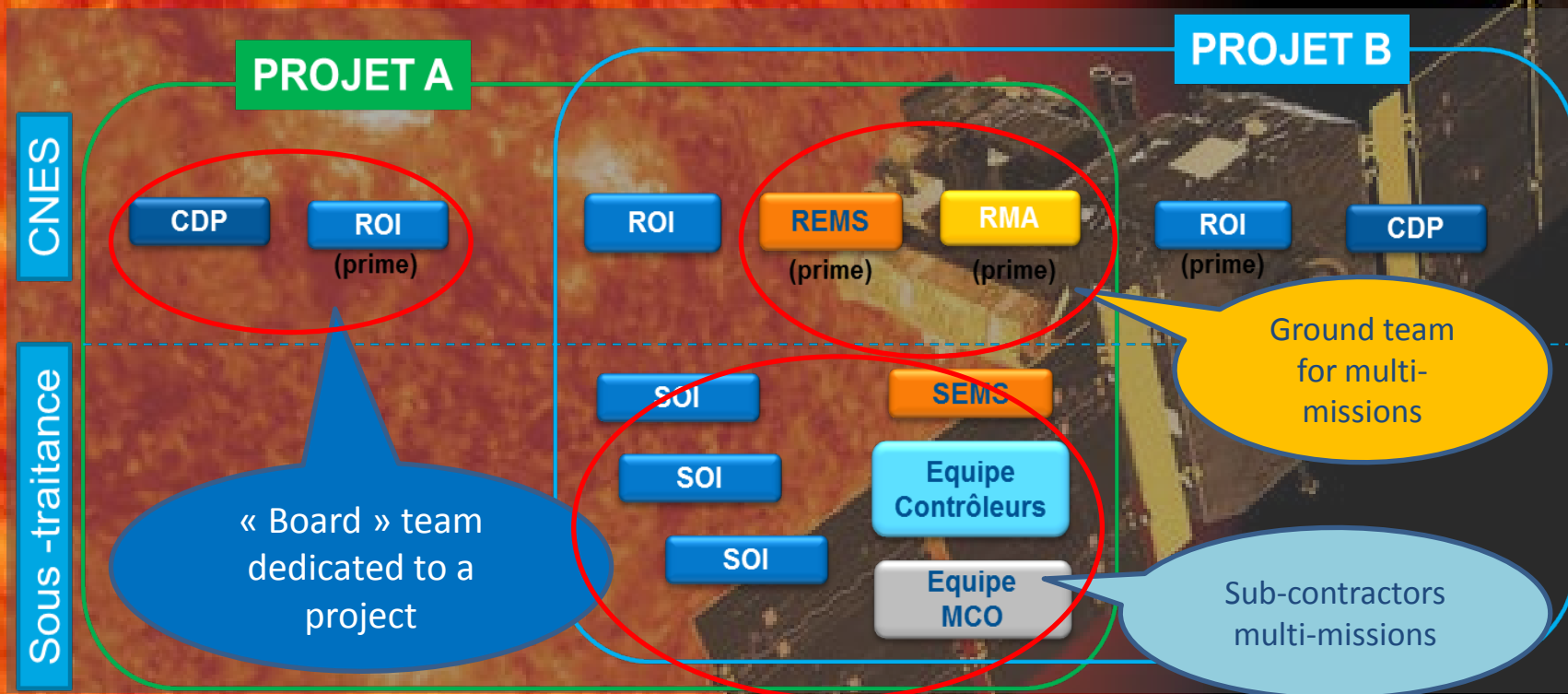
**SPIRIT : First Alpha Release on 11/2017**



# IMPROVE SKILLS

- ❖ **RSYS**: G/S System Responsible , in charge of **development and validation**.
- ❖ **RMA**: Responsible of Application **Maintenance** during exploitation for a set of projects

- ❖ **CDPE**: Operations Project Manager, **responsible** of Mission Operations
- ❖ **ROI** : Responsible of **Operations Instruments**,
- ❖ **REMS**: Responsible of Data processing and of coordination of **Ground means**





- Data Archive & Valorization
  - CNES Data archive
  - ESA Data Archive
  - Copernicus DIAS Platform in progress for Earth Observation
  - ...
- Scientific & Operations Software  
« Archive »

Looking at EU initiative on Open Science Infrastructure ?

Improve Data Accessibility

Federation vs Integration

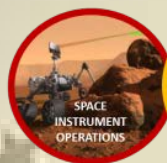
Resiliency of Data Archive ?

# IMPROVE VISIBILITY

- Each mission center used to have a dedicated name (e.g. SONC for Rosetta, FIMOC for MSL, SISMOC for Insight ...)
- We propose a unique name that federates all dedicated centers, independent from the CNES Organization

# FOCSE

French Operations Center for Science & Exploration





# CONCLUSION

- We are initializing this "roadmap" (for some parts) and need to quickly address some issues
- We need more interactions (out of projects) with our Scientific & our Partners communities
- It is mandatory to get prepared for budget optimisation !