SIMPLIFYING MISSION OPERATIONS AT CNES THROUGH A COLLABORATIVE SOLUTION: THE PULP APPROACH

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What do these missions have in common?

- **SWOT**: NASA/CNES LEO satellite altimeter
- **MMX Rover**: CNES/DLR rover for JAXA’s MMX mission
- **KINEIS**: 25 satellites constellation Argos system and IoT applications

They are all using PULP!
Outline

1. A short history of PULP
2. PULP coverage and contents
3. PULP’s multi-mission collaborative process
4. Usage statistics after 3 years
5. What’s next?
6. Achievements
A short history of PULP

- ISIS PL provides core components for all kinds of missions
- PULP (PULP is the Unified Layer Package): common operability layer to all missions (2020)
- MIG (‘Mission Générique’ / Generic Mission): dummy mission to test PULP developments and provide an example of implementation
PULP coverage

Two main purposes:

- Allow mission teams to focus on their specificities rather than how to build and operate a mission control center
- Define common practices and environment to facilitate working on multiple missions

What is in PULP? A non-exhaustive list:

**Code**

- Common configuration for ISIS PL components
- Python libraries for control procedures
- Ansible playbooks and roles
- Infrastructure sizing and security baseline
- Databases

**…but not only!**

- Activities: elementary bricks of concepts of operations used sequentially along the mission’s lifecycle
- Naming conventions
- Wiki documentation for practices and quality process
- Decision-making process
Multi-target aspects

A target is a set of components and activities used for different ISIS PL applications such as AIT (Assembly, Integration and Tests) or CCC (Command and Control Center).

Some elements of PULP are common across targets, and some are target-specific (e.g.: no scheduling in AIT).

![Diagram showing common and specific aspects of CCC and AIT within the PULP framework.](image)
**PULP development process for mission contributions**

- **Mission A contribution**
  - Bug fix
  - Change proposal

- **Control board**
  - Authorizes the development
  - May ask for amendments

- **Development**
  - Amend code if needed
  - Add example to the validation mission, MIG

- **Mission B integration**
  - Analyze mission impacts
  - Merge PULP branches
  - Additional mission tests

- **PULP Release**
  - All non-regression tests are performed
  - Tags on all repos
  - Release note describing all mission impacts

- **Validation**
  - Relevant non-regression tests with MIG
  - Code review and merge to develop branches
PULP development process over 1 year

Interactions between two missions, PULP and ISIS PL

- Released every 6 months
- Released every 2 months
- Last release before launch
- Post-launch, 1 to 2 PULP updates/year
- Mission contributions
- Pre-launch freeze
**PULP development process over 1 year**

New mission instantiation from MIG

- Released every 2 months
- Released every 6 months
- Most releases are used
- Instantiation based on MIG
- Pre-launch freeze
CNES’ PULP APPROACH FOR MISSION OPERATIONS – GSAW 2023

Statistics after 3 years

>1600 contributions in total
~50 active contributors
~200 end users
(CNES + contractors)
6 missions, and more to come!

JIRA tickets by category

- Flight 20%
- COMMON 23%
- Ground/Infra 22%
- Ground/Functional 35%

Opened tickets
Closed tickets
Total opened trend

Opened tickets
Closed tickets
What’s next?

• Expand MIG test coverage (e.g. contingency scenarios)
• Improve quality of code for maintainability
• Ease new mission creation
• Reduce the number of Git repos (> 30 for PULP + MIG) and simplify Git usage
• Frequent Delivery of PULP
  ➢ 2 launches to come this year: NISS CubeSat and KINEIS constellation (1st batch)
Achievements

Cost reduction
- Mission development time reduced from 1~2 years to 1~2 months
- Operators can work seamlessly on multiple missions

Operability
- 4 satellites currently operated
- 1 rover in AIT test phase

Community
- Common, strong commitment from operators around PULP
- Initiatives and innovations from all missions