



CENTRE NATIONAL D'ÉTUDES SPATIALES

ISIS

# ISIS An Initiative for Space Innovative Standards

Author: Paola VAN TROOSTENBERGHE with ISIS team (CNES)

Avionics Data Control Software Systems November 2010 – ESTEC

## Presentation's summary

- **Status**
- **ISIS content**
- **ESA SAVOIR / CNES ISIS links**
- **Conclusion**

# STATUS

## ■ Institutional missions

### ◆ PROTEUS and MYRIADE line of products

- Product line approach efficiency demonstrated (institutional and industrial missions )
- On going obsolescence

### ◆ Standard and regulation evolutions

### ◆ Exploitation costs growing : CNES currently operating 25 in orbit satellites belonging to different product families (SPOT, Proteus, Myriade)

## ■ Industrial missions

### ◆ Existing multi mission industrial platform product lines

### ◆ LEO missions market growth

### ◆ But a small market which leads to important non recurring and maintenance effort

## Common opportunity

**Both institutional and industrial needs lead to :**

- ◆ Rationalizing operational concept and system architecture, making the most of lessons learned from previous product families experience
- ◆ Making a "reasonable" step forward in innovation and performance, to fit future missions requirements and to limit operation costs
- ◆ Deriving a long term development strategy
- ◆ Taking into account new standards and regulations (French Space Operations and Debris Mitigation Law)
- ◆ Mastering procurement conditions: costs, schedules, risks

**=> Opportunity to a common approach between institutional and export missions to share development and maintenance costs**

## ISIS ? Initiative for Space Innovative Standards

- **Born from a convergence between CNES and Industrial partners**
  - ◆ Same conclusions about the context
  - ◆ Needs of more standardisation in the product lines
  - ◆ Needs of a better sharing of non recurring development and maintenance costs
  
- **To define a standard based on state of the art technology and a good vision on both institutional and export needs**
  - ◆ Allows a smooth transition from existing product lines
  - ◆ Is more appropriate than developing a new generic product line from scratch in economical terms
  
- => A partnership between CNES and primes (EADS and TAS) to commonly define and promote such rationalisation**

## Main drivers from lessons learnt

- **New Standards and technical state available**
  - ◆ Board to ground interface (Packet Utilization Standard, CCSDS)
  - ◆ ECSS batch C
  - ◆ French law on space operations and debris mitigation
  - ◆ Autonomy driving more operation automation and system validation simplification
  
- **Rationalisation of Space Services and Operations (interoperability)**
- **Reuse of products involved in space services: Platform, Command & Control Ground Segment, Simulators, System Data Base**
  
- **Improve rationalisation of processes involved throughout the Missions life, from early mission sizing to operations and maintenance**

## ISIS : area of concern

- A technical standard allowing rationalisation of :
  - ◆ Space Services in terms of operations & payload services
  - ◆ Products involved in space services: Platform, Command & Control Ground Segment, Simulators, System Data Base
  
- A rationalisation of processes involved throughout the Space Missions life
  - ◆ Early mission sizing
  - ◆ Mission Specifications writing
  - ◆ Development and Validation (System and Satellite)
  - ◆ Operations and Maintenance
  
- A dedicated organisation with CNES and Primes in charge of
  - ◆ Defining the standard
  - ◆ Deploying the standard
  - ◆ Maintaining the standard

## Technical standardization axes

- **Mission control : Interfaces between mission control center and satellite control center**



- **Operations**

- ◆ Reuse of ground control segment components
- ◆ Board / ground interface
- ◆ Operability, TM & TC: modes, monitoring...

- **Payload units**

- ◆ Requires heavy interface management
- ◆ Standardization of the platform resources and interfaces used by the payload

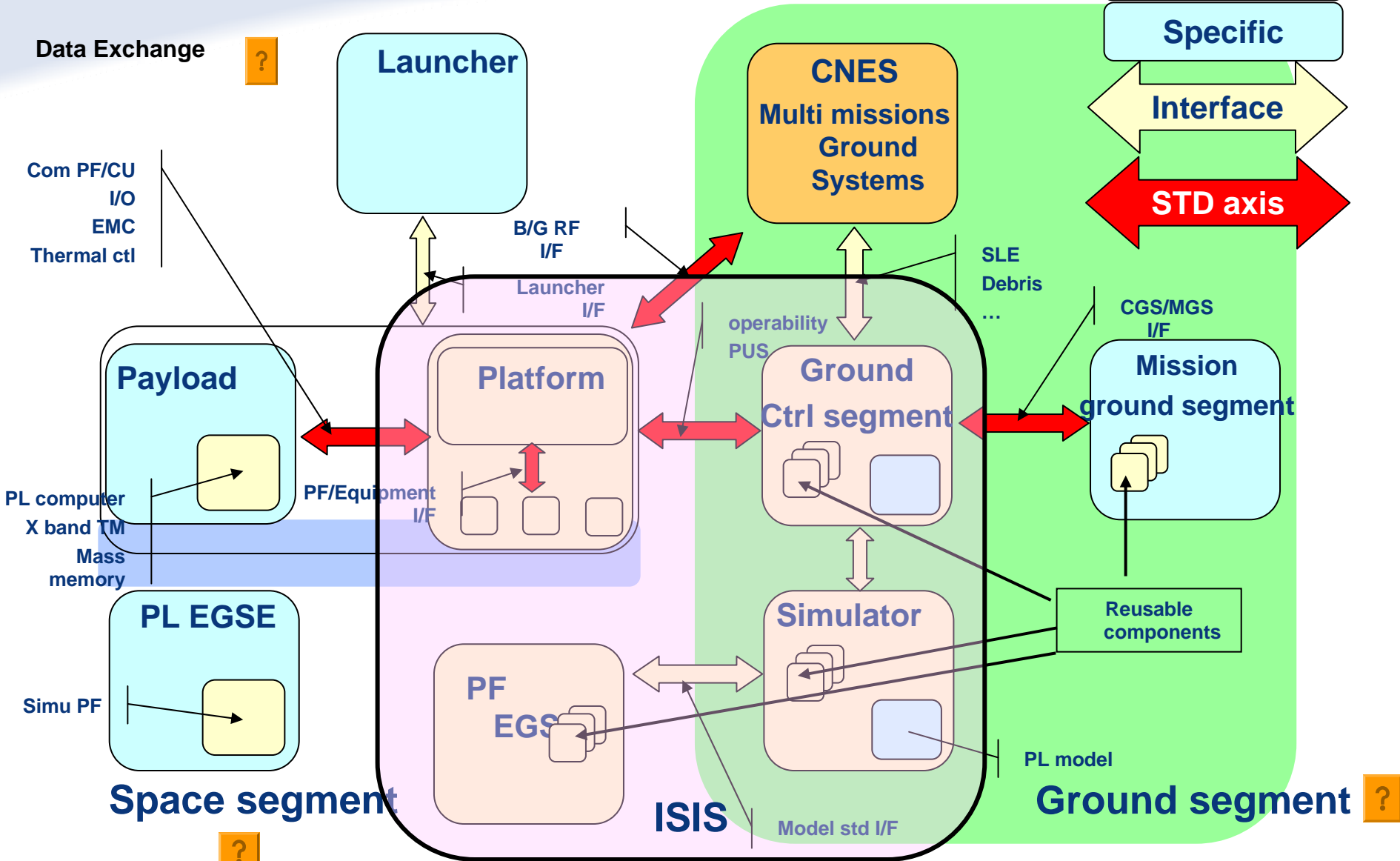
- **Platform equipment (OBC, TTC, sensors, power units, I/O...) :**  
General interface and environment specifications



Mission ?

# ISIS framework

Data Exchange ?



## REUSABILITY

- Product and interfaces identification is not the only driver for reuse
- Flexibility is also a key issue for reuse of a product line (platform, command & control ground segment components)
- ISIS standards provide driving technical requirements in terms of:
  - ◆ Modularity (battery, power distribution, I/O...)
  - ◆ Options (ciphering / authentication, payload data management...)
  - ◆ Segmentation of performances (pointing, propellant, agility...)

## Main processes standardisation axes

- **Generic documents rationalizing processes:**
  - ◆ Initial missions sizing: based on standardised data and method from primes product lines
  - ◆ PA specs, based on ECSS tailoring
  - ◆ Operation concept
  - ◆ Development (SOW, standard deliveries & development plan...)
  - ◆ Requirement management & traceability
  
- **Improvement of exchanges between entities involved in the mission**

# ISIS Documentation

ISIS standard specification

Rationalise the products

Rationalise the processes

Product Trees

Missionisation Guide

Requirements/conf. Mgt

SOW template

SYSTEM

Design Spec

Generic System Spec

Data model

System and  
OnBoard/Ground  
IF Specs

System AIV Plan

Nomenclature

Syst Data Mgt

PA Syst Referential

SATELLITE

segments/design Spec

Generic Sat Spec

GDIR

PF/CU  
IF Specs

Satellite AIV Plan

CC design

STB CC

PA Satellite Referential

GROUND

Design Spec

Generic CCC Spec

Specs IF sol/sol

PA Ground Referential

OPS  
SIMU

Standard Spec for Sim<sup>o</sup> Models

IF Specs  
TOMS/CCC

Generic TOMS specification

## The opportunistic deployment process

### ■ Status:

- ◆ Existing product lines
- ◆ Limited number of short term missions
- ◆ Permanent evolution: obsolescence, ITAR, regulations, standards, geo-return...

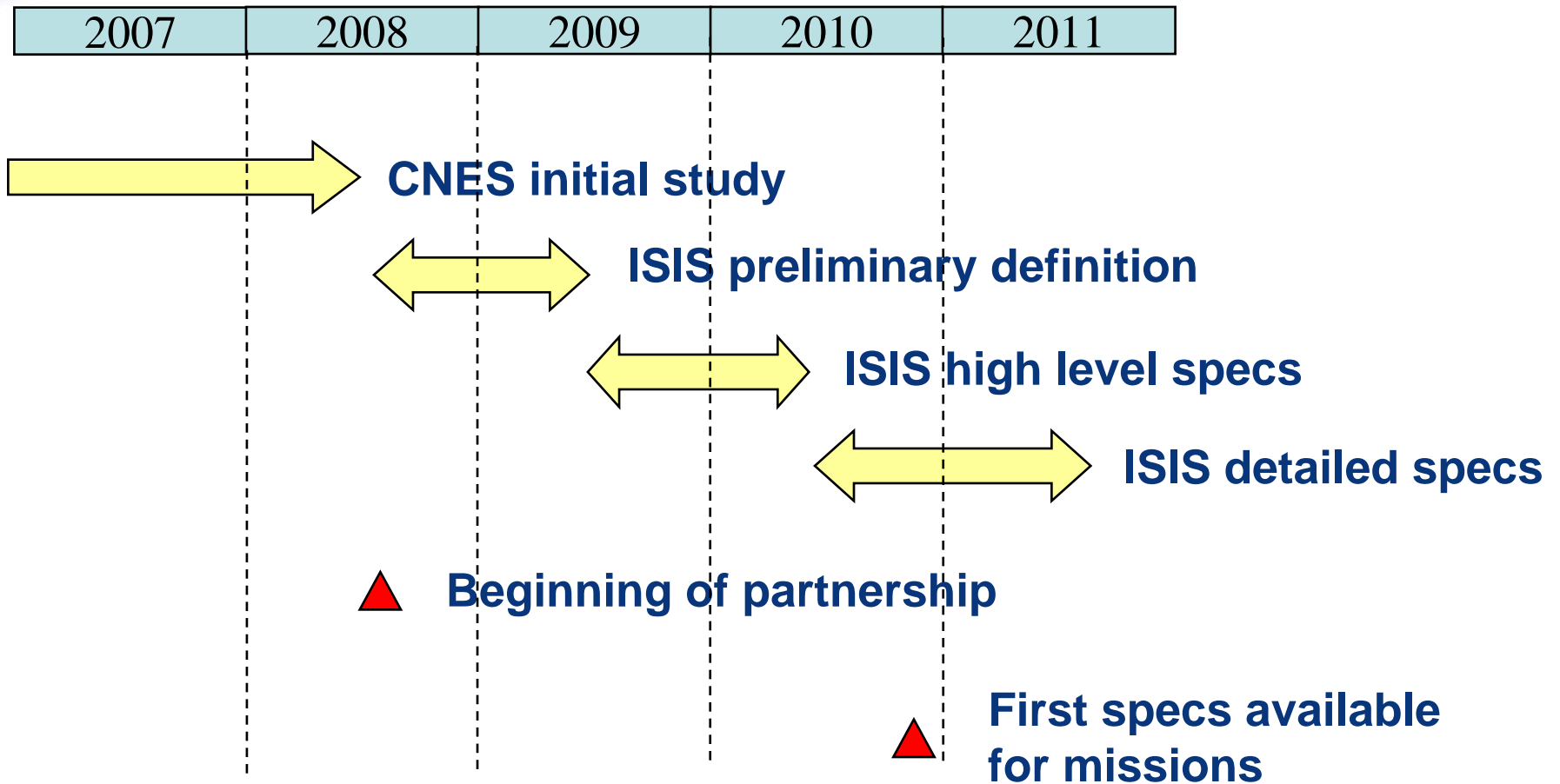
### ■ Deployment process:

- ◆ Developing new product lines only for standardization does not make sense
- ◆ A mid term convergence process seems preferable:
  - ISIS standards will be progressively applied in the frame of missions
  - Every time new developments are required due to the "natural" evolution process, ISIS specifications will be promoted
- ◆ Needs to well define which target to converge to => reason why the ISIS standard must be clearly visible

## Relationship with other standards

- **ISIS is not a new European standard**  
but is complementary to others :
  - ◆ More a « rationalized » way of expressing CNES missions requirements
  - ◆ As close as possible to ECSS, CCSDS...
  - ◆ Complementary to SAVOIR (system interfaces, operability)
  - ◆ Oriented towards short term applications
  
- As far as they can help, ISIS standards will be proposed as input for other standardization

## ISIS main schedule



## Preliminary lessons learned after 2 years work

- Rationalization is difficult on topics subject to competition and has to be limited to basic services
- Primes product lines are not so different as far as basic services are concerned
- Standardization should be focussed on topics involving separate entities:
  - ◆ Primes
  - ◆ PF equipment suppliers
  - ◆ Payload suppliers
  - ◆ Operational teams
- On the opposite, standardization should not address matters local to one entity, and limit design constraints as much as possible
- Standardization requires a leading authority, able to make a choice between equivalent solutions. In ISIS case: the CNES.



## ESA SAVOIR and CNES ISIS on going relationship

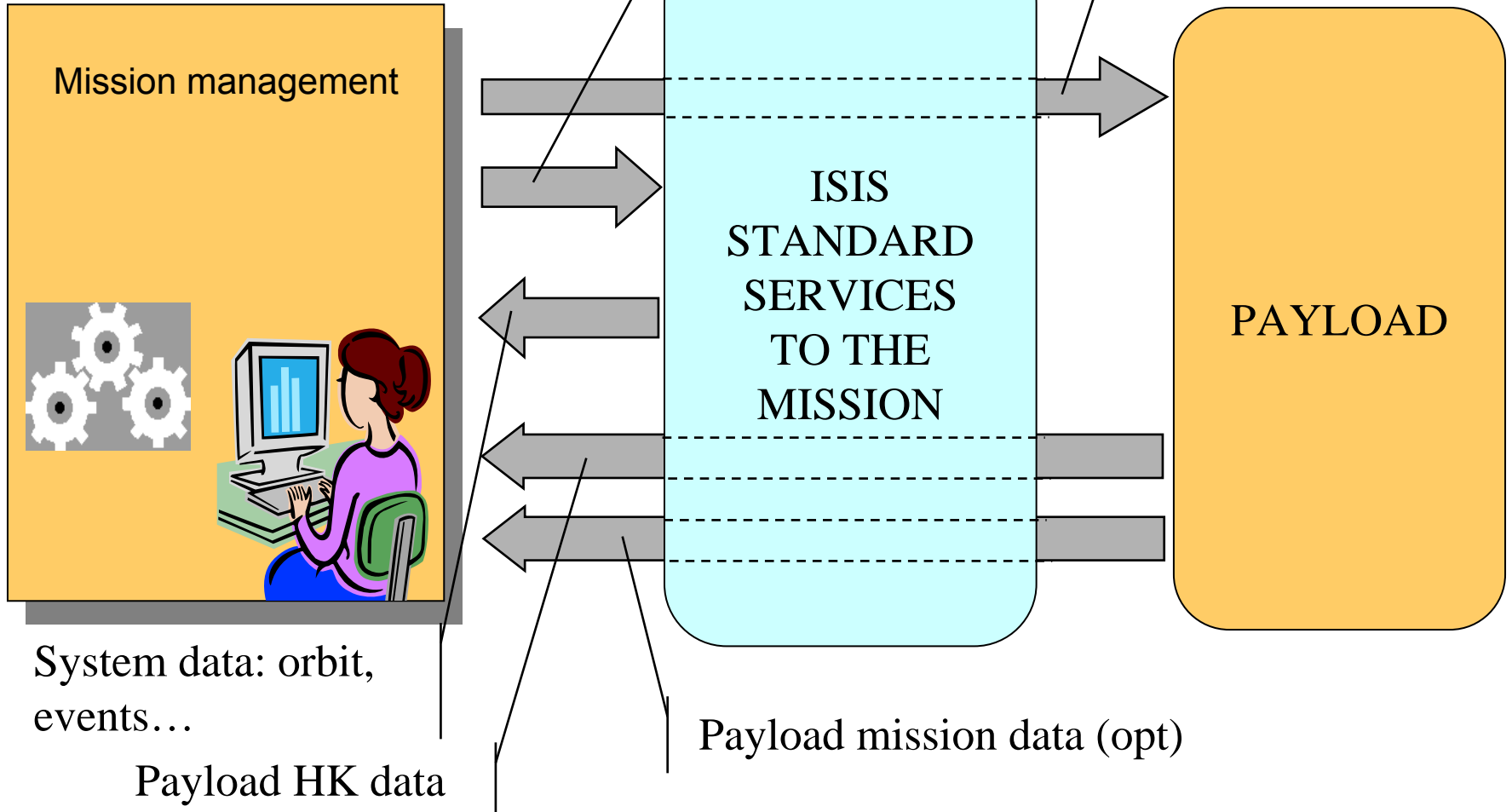
- Existing exchanges on SAVOIR process and CNES ISIS initiative
- Documentation exchanges
- On going analysis to confirm what could benefit to each others from the 2 different approaches

## Conclusion

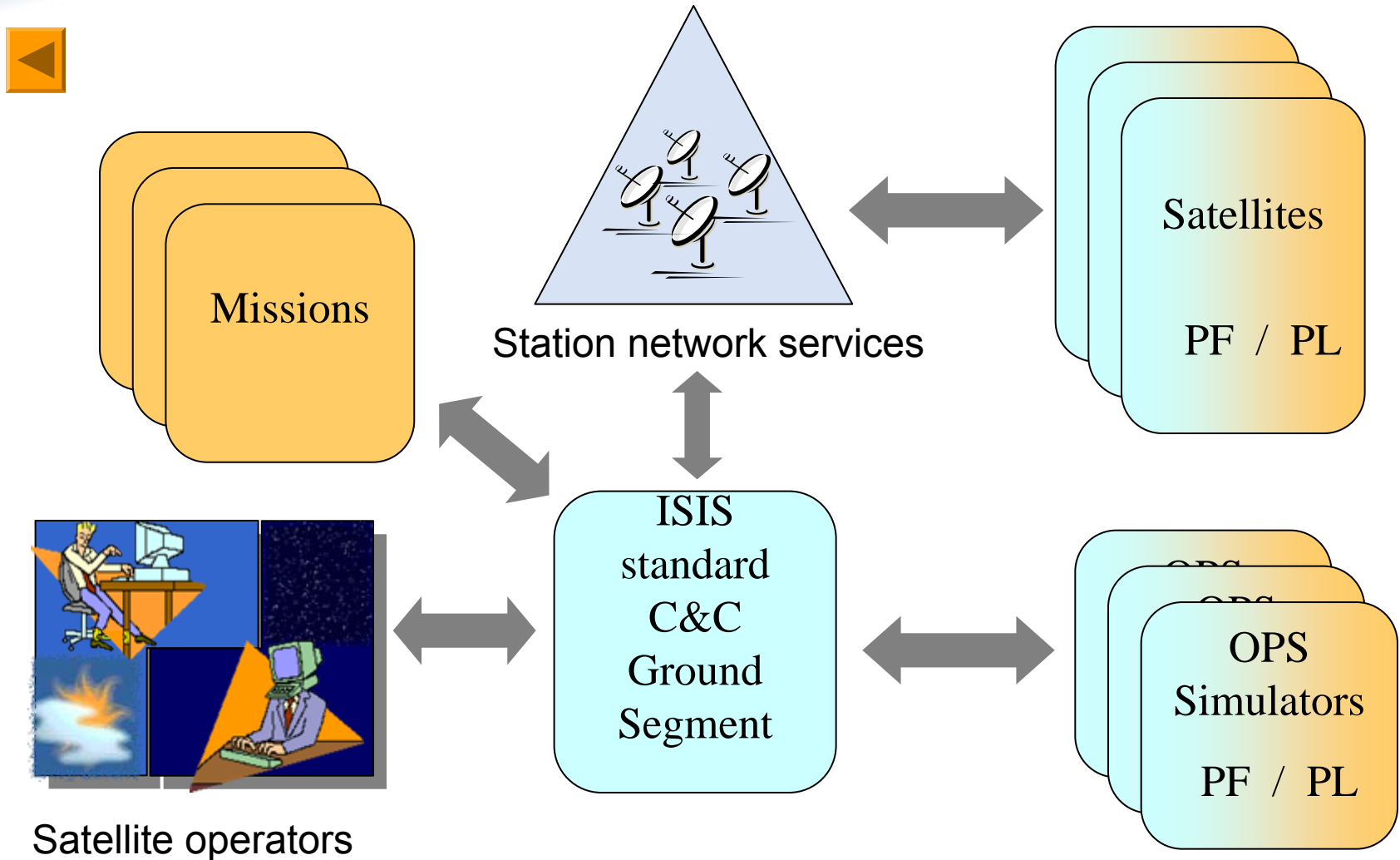
- **ISIS is a great opportunity:**
  - ♦ A complete, suitable and coherent set of specifications dedicated to a wide range of LEO missions, close to finalization
  - ♦ Compatible with up to date technology, standards and regulations
  - ♦ Will contribute to significant system costs and risks reduction
  - ♦ To standardise as much as possible a way of developing, validating and operating space systems
  
- **Beyond the formal documentation, the standardization process is on the way, and is already progressively introduced in missions:**
  - ♦ PUS tailoring
  - ♦ PA specifications
  - ♦ Board / ground interface specifications
  - ♦ in the future GDIR, PF/payload interfaces

**Thanks for your attention**

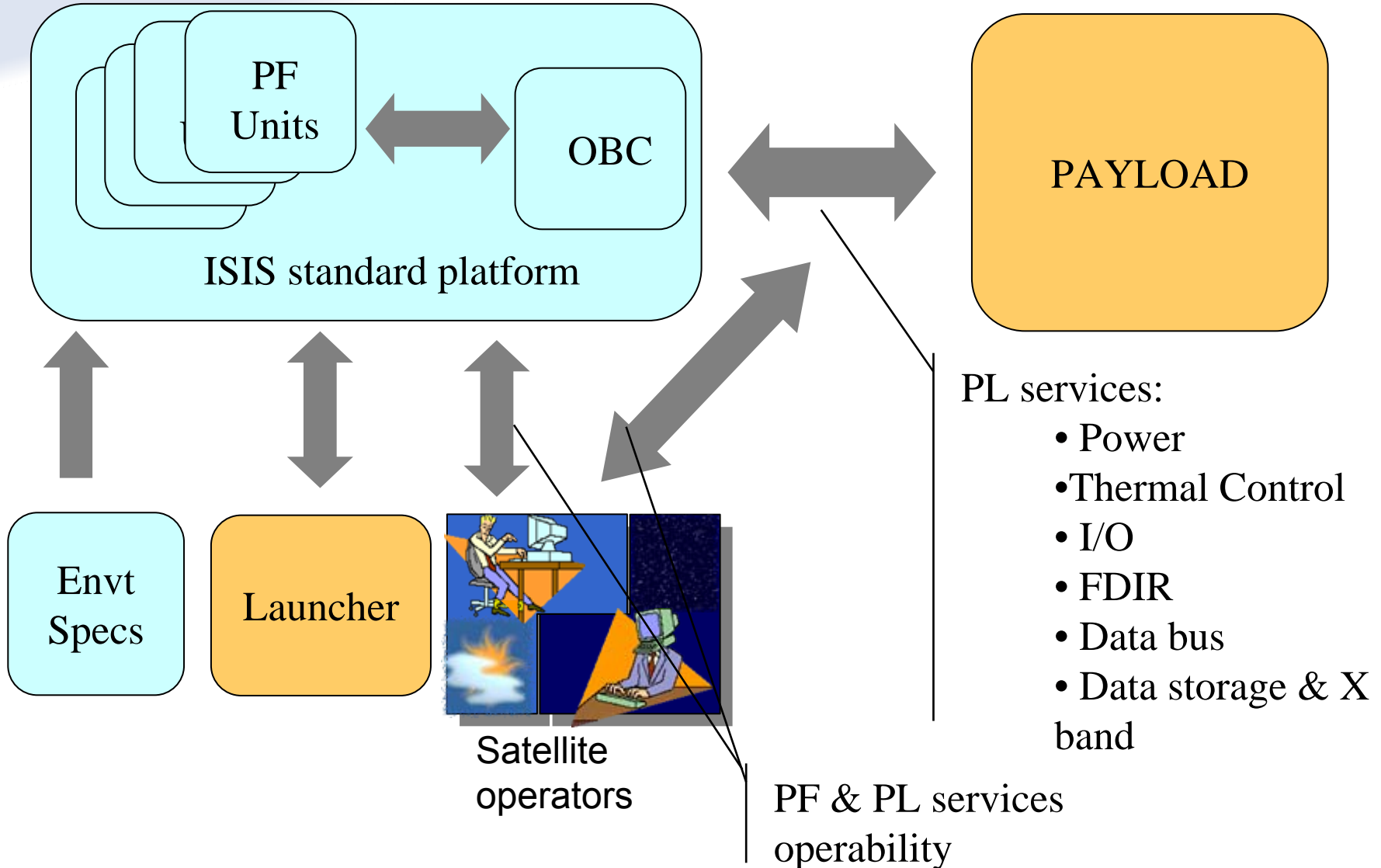
# The mission point of view



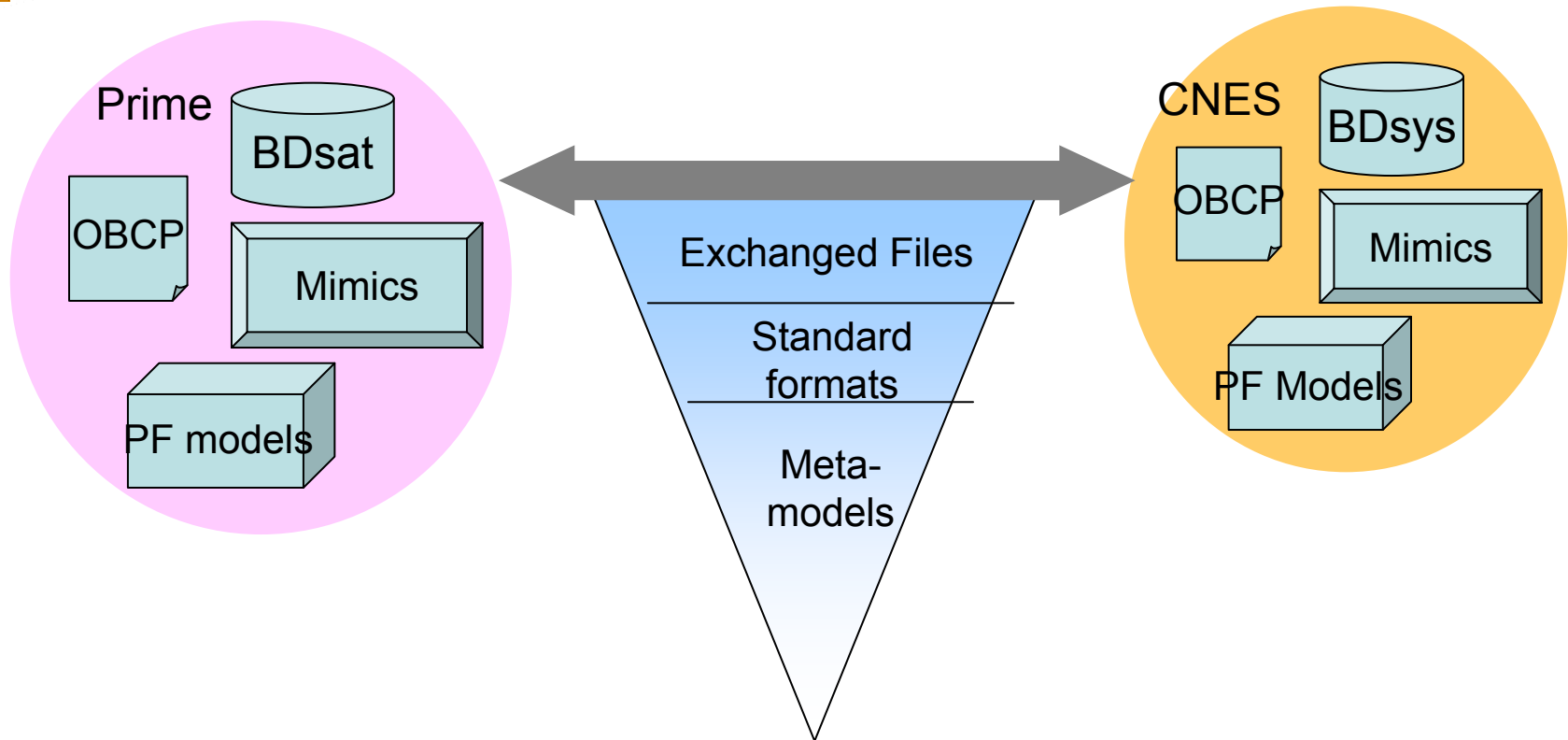
## Interoperability : The ground segment point of view



## ISIS: the spacecraft point of view



## DATA EXCHANGES



=> Better system data exchanges to improve development, validation and maintenance processes