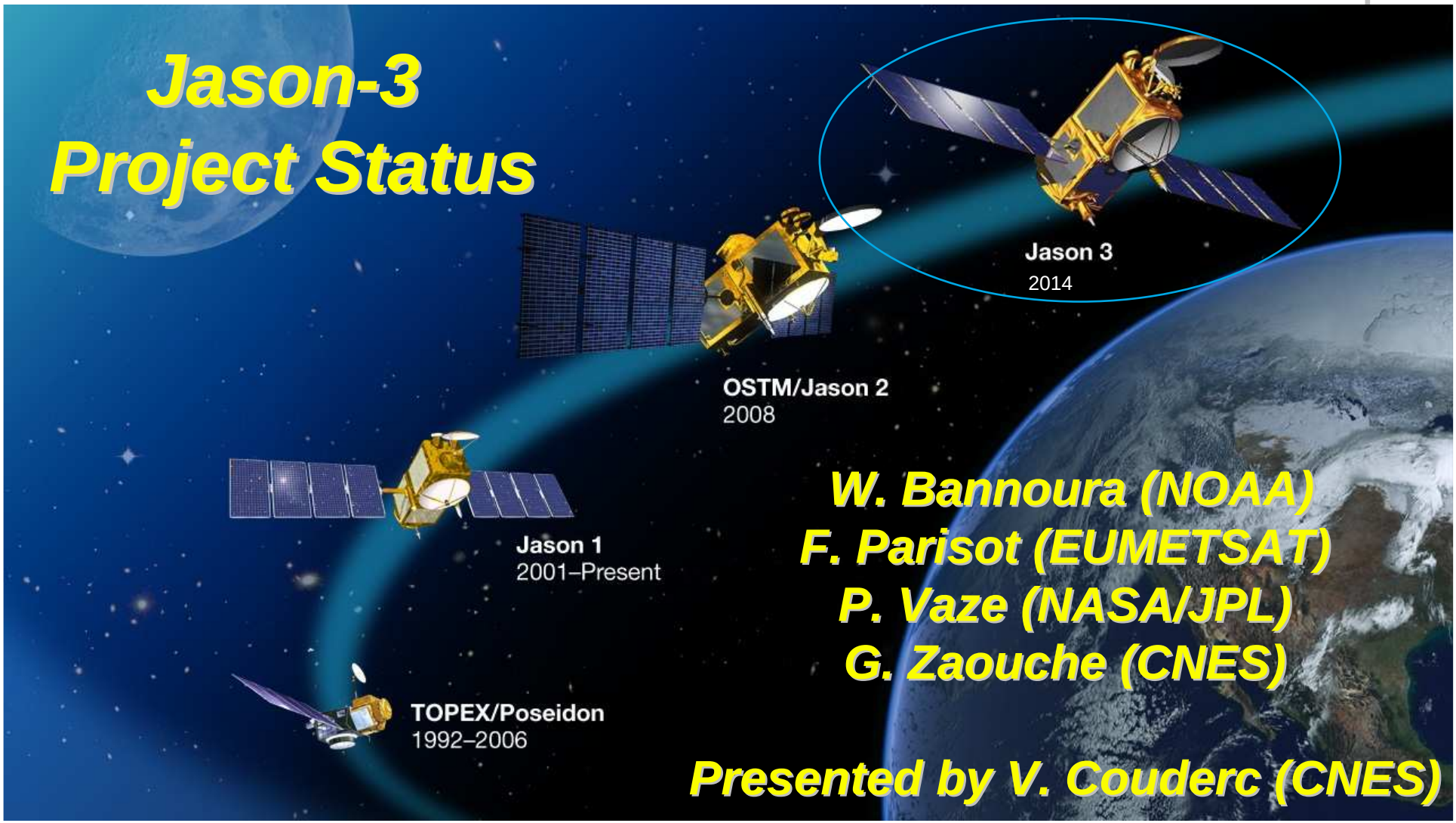
Jason-3 Project Status



W. Bannoura (NOAA)
F. Parisot (EUMETSAT)
P. Vaze (NASA/JPL)
G. Zaouche (CNES)

Presented by V. Couderc (CNES)

Summary

- Mission Background and Mission Overview
- Jason-3 Project Development Status
- Jason-3 Project Summary and Next Steps

Mission Background

- The objective of the Jason-3 Mission is to provide continuity to the unique accuracy and coverage of the TOPEX/Poseidon, Jason-1 and OSTM/Jason-2 missions in support of operational applications related to extreme weather events and operational oceanography and climate applications and forecasting

- Jason-1 launched on Dec 7, 2001 was the result of the cooperation of CNES and NASA.

- Jason-2 launched on June 20, 2008
  was the result of the cooperation of CNES, NASA, EUM and NOAA.

- The Jason-3 Programme is led by the operational agencies EUMETSAT and NOAA, with CNES making a significant in-kind contribution and acting at technical level as the system coordinator. NASA in conjunction with EUMETSAT, NOAA and CNES will support science team activities

Mission Summary

Science Measurements

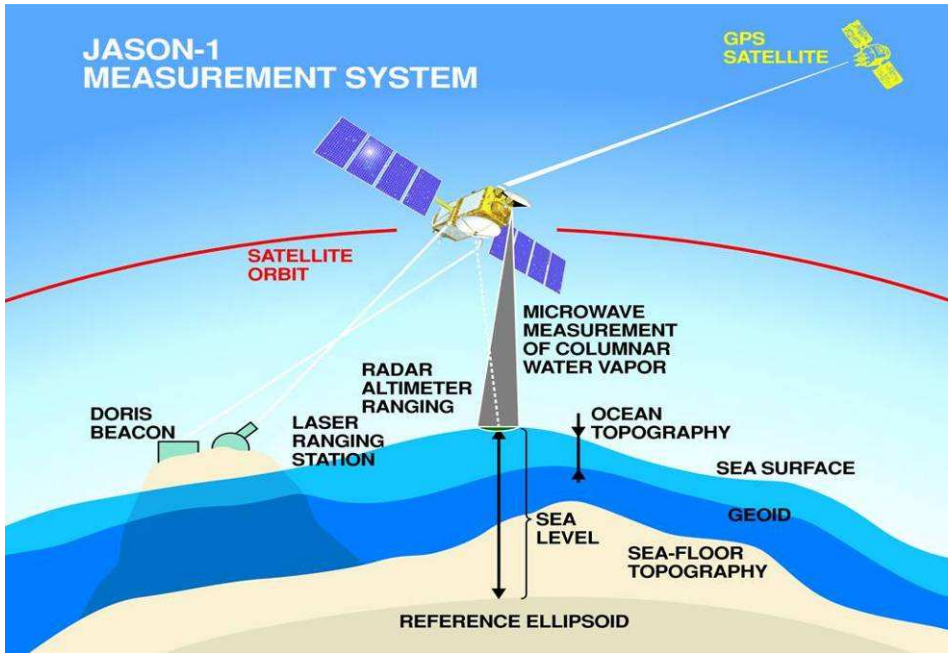
Global sea surface height to an accuracy of ≤ 4 cm every 10 days, for determining ocean circulation, climate change and sea level rise

Mission Objectives

- **Provide continuity of high precision ocean topography measurements beyond TOPEX/Poseidon , JASON-1 and JASON-2**
- **Provide a bridge to an operational mission to enable the continuation of multi-decadal ocean topography measurements**

Instruments

- **Core Mission:**
  - **Poseidon-3B Altimeter**
  - **DORIS (Precise Orbit Determination System)**
  - **Advanced Microwave Radiometer (AMR)**
  - **GPS Payload (GPSP)**
  - **Laser Retro-reflector Array (LRA)**
- **Passengers:**
  - **JRE (Carmen3 + LPT)**



Mission Overview

- **Launch Date: Dec 2014**
- **Launch Vehicle: Falcon 9 (SpaceX)**
- **Proteus Spacecraft Bus provided by CNES**
- **Mission life of 3 years (goal of 5 years)**
- **1336 km Orbit, 66º Inclination**

Summary of science and Ops requirements

- Jason-3 shall meet the better than 4 cm rms accuracy, at 1 Hz, on the fully validated sea surface height measurements and shall provide intermediate products with the required delay and accuracy (See “Performances Requirements” in the backup slides)

- Expectation of collecting a maximum of valid data near the coasts, over inland waters and sea-ice, in order to support emerging research in coastal dynamics, hydrology, sea-ice interactions…

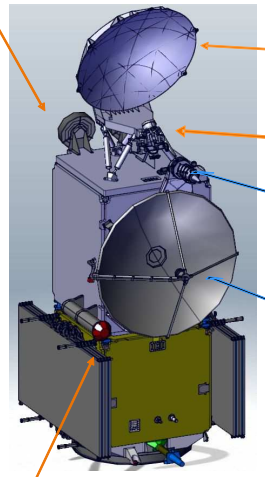
- Baseline : Same products as Jason-2 (See “Products Requirements” in backup slides) : currently the standard is GDR-D
  No major evolutions foreseen for Jason-3 core mission products.
  Jason-3 is part of multi-mission altimetric facilities and will follow data evolution (in terms of standard, auxiliary files, etc.) and improvements coordinated in the frame of “Measurement System Engineers - MSE” meetings.

Jason-3 System elements

U.S. Elements
European Elements

Dedicated Launch Vehicle : Falcon9

GPSP Antenna



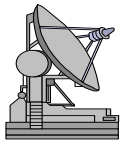
AMR Reflector

AMR Electronics

DORIS

Poseidon 3B Altimeter

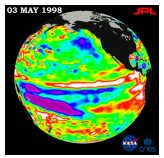
LRA



NOAA - Wallops/ Fairbanks – Barrow - USA

NOAA S/C Operations (Suitland, MD)

Operational product processing and Science Data archive & Distribution



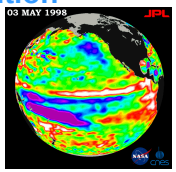
NASA/JPL

NASA Instrument Ops

EUMETSAT – Usingen, Germany

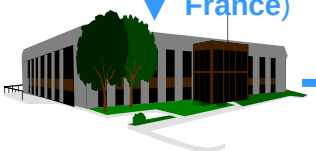
EUMETSAT

Operational product processing & Distribution



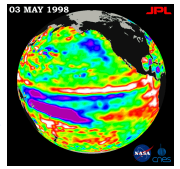
CNES

S/C Operations (Toulouse, France)



Passengers Ops and mission centers CNES- JAXA

Science data processing, archive & Distribution



Changes and new features wrt OSTM/Jason-2 (1)

System : AMR on-board calibration

- Lisbon OSTST recommendation, San Diego OSTST decision
- Satellite pitch maneuvers (80° off nadir)

Satellite

- Slight modification of satellite OBSW (Tx OFF for safety improvement)
- Change in PIM structure panels for compliance with each potential launch vehicle by waiting for the selection

POS3B (Altimeter)

- Implementation of a single mode with on-board automatic transitions between DIODE/DEM tracking and autonomous tracking, with respect to the satellite position.
- POS3B DEM upload is now possible without mission interruption

DORIS

- New generation DGXX-S taking into account lessons learned from Jason-2
- Change of DORIS antenna location for compliance with each potential launch vehicle while waiting for the selection
- Improvement in modeling the Solar Panels position

Changes and new features wrt OSTM/Jason-2 (2)

AMR (Radiometer)

- Mostly recurring design with improvement of the instrument thermal control and stability (lesson learned from Jason-2 experience)

GPSP

- Different receiver but with same basic design as on JASON-1/2
- Not mission critical but applying further updates for radiations hardened parts and shielding

Launcher : The launch vehicle has changed : Falcon 9 (SpaceX)

Ground : Capability to operate simultaneously JASON-2 and JASON-3 :

- Required the addition of ground stations for the phase of formation flight : Barrow (NOAA) and Usingen2 (EUM, new)
- JASON-2 and JASON-3 operations “merging” considered after the launch

Jason-3 Project
Development Status - 1 (system)

4 partner main event in 2012:

- Jason-3 Launcher selection

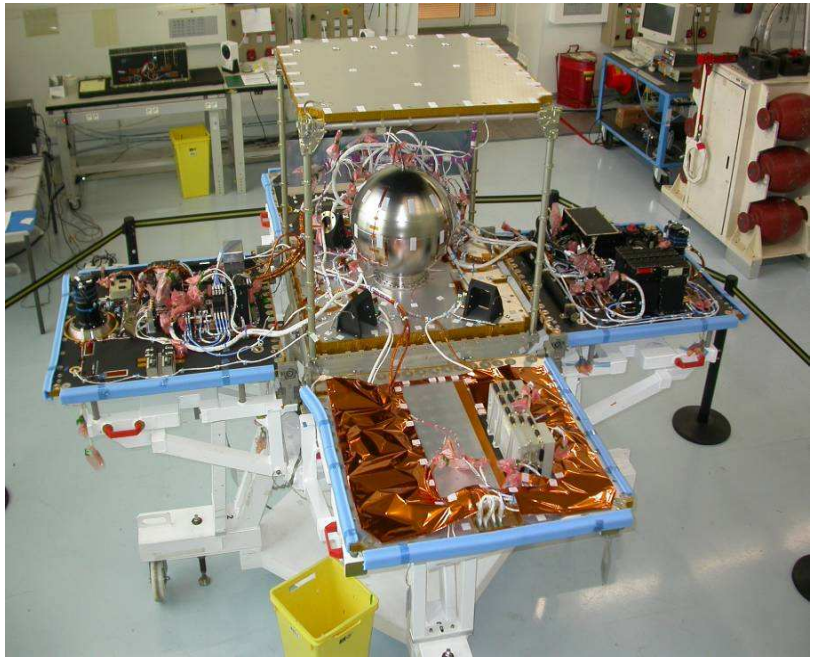
System

- System documentation signed and under configuration.
- Preparation of the next 4 partner mission review SIR (planned in Feb 2013)
- Satellite Data Base in progress
- Satellite Simulator PRESTO for System tests has been accepted
- All the planned reviews have been held successfully

Jason-3 Project
Development Status - 2 (satellite)

Satellite

- Integration of the Jason-3 platform has been completed on Dec.10th 2010. Since then the platform is stored.
- It has been regularly successfully tested.
- Next step : PF de-storage to start the Payload AIT in 2013



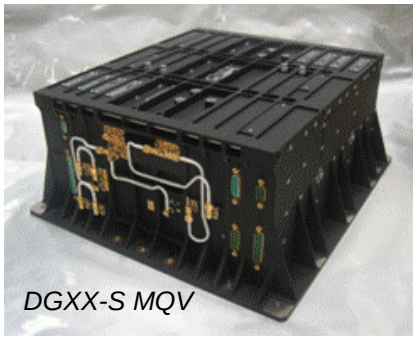
- Payload Module has been manufactured (panels and harness). Acceptance in Oct 2012.
- On Board Software (OBSW) activities (TX off for safety purpose) are completed and validated.
- The satellite review CDR is planned beginning December 2012

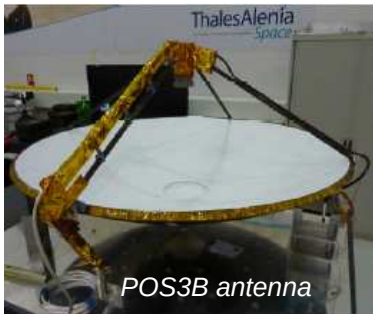
Nominal progress of the satellite activities

Jason-3 Project
Development Status - 3 (payload)

Payload instruments

- POS3B , DORIS :
  - Progress is nominal
  - POS3B and DORIS antennae are available
  - Instruments are manufactured and in validation phase
  - On schedule : delivery expected in Feb 2013
- AMR, GPSP, LRA :
  - Progress is nominal
  - Instruments AMR and GPSP are manufactured and in validation phase
  - On schedule : delivery expected in Feb 2013
- Passengers : CARMEN3 , LPT
  - LPT instrument is validated and available
  - CARMEN3 Instrument is on schedule.

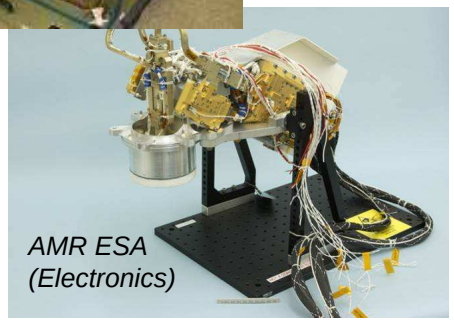

DGXX-S MQV



POS3B antenna

AMR RSA (Reflector)

GPS Electronics Unit


AMR ESA (Electronics)

LRA

Jason-3 Project
Development Status - 4 (launcher)

Launch Vehicle :

- In 2012, by waiting for the selection, 4 partners had implemented a risk reduction approach to define as well as possible the key inputs and interfaces from the LV to continue the satellite development on schedule and minimize any impacts to the partners.

- Selection has been made mid July 2012 : Falcon 9 from SpaceX
- Intensive work to consolidate the interfaces definition and coordinate the launcher development plan with regard to the satellite integration milestones
- Jason-3 Launch is planned in December 2014

Safety :

- Activities progress nominally. Expected waivers have been submitted.
- Selection of a new launcher to be taken into account

Jason-3 Project
Development Status - 5 (Ground)

Ground System

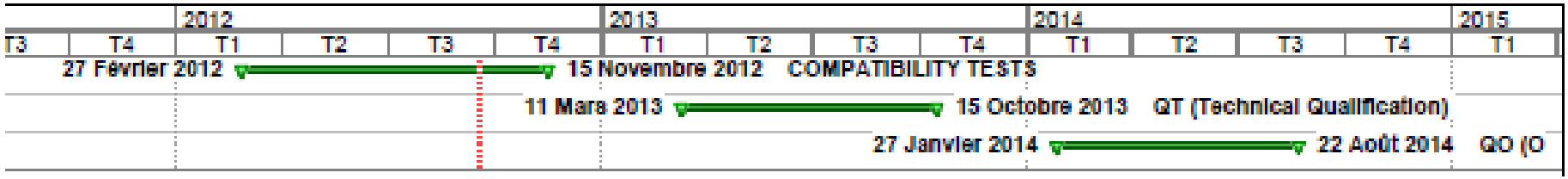
- CNES : OK
  - » CNES Jason-3 Control Center is implemented and validated
  - » Mission Center SSALTO development is nominal, TM-NRT delivery planned end 2012
- EUM : OK
  - » Ground System design and implementation has been completed
  - » Usingen2 new earth terminal has been validated, now under testing
- NOAA : OK
  - » NJGS design and implementation has been done, acceptance testing will last till end 2012.
- JPL : OK
  - » Instrument Data system (IDS) and Radiometer Calibration system (ARCS) under development

Preparation of operations

- Elaboration of Jason-2 / Jason-3 operations merge strategy and plans.

4 Partner tests

- System tests are defined, documentation is available
- Global testing schedule



- Compatibility tests are currently run :
  - » First step between CNES and EUM : successfully completed
  - » Second step with all partners (starting with network test) : on-going (mid-Sept. till end Nov. 2012)

Jason-3 Project Summary and Next Steps

Jason-3 development is nominal at satellite, instruments and ground levels

- Launcher :
  - An important point has been made with the launcher selection
  - Next step is to deeply assess the compatibility between the new launcher and satellite.
    The results of analysis are planned beg. 2013
- Payload AIT (Integration and Tests) and then Satellite AIT will be the key events of 2013
- Technical Qualification of the Ground System will be demonstrated in 2013

Thanks to all the project teams (NOAA, EUMETSAT, CNES, NASA/JPL)

Backup Slides

MOU Mission Partnership Responsibilities

NOAA responsibilities:

- Lead with EUMETSAT the Jason-3 Programme.
- Provide support to the overall system engineering.
- Provide the U.S. payload consisting of the AMR radiometer, a LRA retroreflector and a GPSP positioning receiver package.
- Provide launch services compatible with the Jason-3 satellite and the mission requirements.
- Provide and operate a command and control center for the satellite, command and data acquisition stations.
- Provide and operate near real-time data processing for data collected by NOAA ground stations.
- Provide dissemination of all near real-time data products (NOAA and EUMETSAT) and offline data products.
- Provide a long-term archive of all near real-time and offline data products including telemetry, orbital and auxiliary data sets.
- Support the relevant Research Announcement process, and assess the relevance of investigation results for future operational services.

EUMETSAT responsibilities:

- Lead with NOAA the Jason-3 Programme.
- Provide support to the overall system engineering.
- Fund the European payload consisting of the Poseidon3B altimeter and the DORIS orbitography receiver package, the payload module and its integration.
- Provide and operate near real-time data processing for data collected by European ground stations.
- Provide dissemination of all near real-time data products (NOAA and EUMETSAT).
- Fund a command and control center for the satellite, a European Earth Terminal and the offline data processing, archiving and dissemination for the Programme.
- Support the relevant Research Announcement process, and assess the relevance of investigation results for future operational services.

CNES responsibilities:

- Provide as in-kind contribution : system engineering and associated human resources, standard flightworthy PROTEUS platform, CNES human resources as part of the operations.
- Conduct and coordinate with the partners the preparation and release of relevant Research Announcements.
- Conduct, in coordination with EUMETSAT, the selection of European Investigators.

NASA responsibilities:

- Conduct and coordinate with the partners the preparation and release of relevant Research Announcements.
- Conduct, in coordination with NOAA the selection of U.S. Investigators.

Mission Partnership Activities

NASA activities:

- Project Management
- Launch vehicle
- Payload
  - Advanced Microwave Radiometer (AMR)
  - GPS Receiver (GPSP)
  - Laser Retro-reflector Array (LRA)
- JPL Payload integration and test
- Mission Operation support for JPL instruments

NOAA activities:

- Project Management
- Ground System & Operations
  - Satellite Operations Control Center (SOCC)
  - CDA Stations (2)
  - NRT product processing
  - All product distribution
  - All archiving
  - Ground network
  - Satellite operations after handover
- User interface

CNES activities:

- Project Management
- Satellite, Proteus bus
- Payload
  - Nadir Altimeter POS3B
  - DORIS
  - CARMEN3 - LPT
- Ground System & Operations
  - Satellite Control Command Center (CCC)
  - OFL product processing and distribution
  - All archiving
  - Ground network
  - Satellite Operations before handover
  - Navigation, Guidance, Expertise for all mission
- System integration & test
- Mission Operation support for CNES instruments
- System Coordination for all mission phases
- User interface

EUMETSAT activities:

- Project Management
- Ground System & Operations
  - Earth Terminal (1)
  - NRT product processing, archiving and distribution
  - Ground network
- User interface

« Level-1» driving requirements

- Provide minimum 3 years of precise measurement of ocean surface topography
- Launch in to the same orbit as Jason-2
- Fly within +/- 1 km of the same 9.9-day repeating ground tracks as Jason-2.
- Maintain at least the same measurement accuracy as Jason-2 for the Sea Surface Height (3.4 cm RSS, goal 2.5 cm)
- As a goal, maintain the stability of the global mean sea level measurement (drift < 1 mm/year)
- Maintain the accuracy of significant waveheight
- Minimize any relative bias from Jason-2 to less than 5mm.
- Conduct a verification phase of the mission of up to 10 months (with a “formation flight” with JASON-2 if it is still functioning)
- Collect and process more than 95% of all possible data
- Process all over-ocean data into Geophysical Data Records and make data available to the user community.
- After the verification phase, deliver the operational products according to their data latency
- Maintain for Jason-3 products at least the same content, accuracy and timeliness as Jason-2 products

Performance requirements

Changes compared to Jason-2 are in red

	OGDR 3 hours	IGDR 1.5 days	GDR 60 days	GOALS
Altimeter Range RMS	**4.5 cm**	**3 cm**	**3 cm**	**2.25 cm**
RMS Orbit (radial)	5 cm *(a)* *(Ja2 : 10 cm)*	**2.5 cm**	**1.5 cm**	**1 cm**
Total RSS sea surface height	6.8 cm *(Ja2 : 11 cm)*	3.9 cm	3.4 cm	2.5 cm
Significant wave height	**10% or 0.5 m *(b)***	**10% or 0.4 m *(b)***	**10% or 0.4 m *(b)***	**5% or 0.25 m *(b)***
Wind speed	**1.6 m/s**	**1.5 m/s**	**1.5 m/s**	**1.5 m/s**
Sigma naught	**0.7 dB**	**0.7 dB**	**0.7 dB**	**0.5 dB**
System drift				**1 mm/year *(c)***

(a) Real time DORIS onboard ephemeris *(b)* Whichever is greater

(c) Jason 3 shall measure globally averaged sea level relative to levels established during the cal/val phase with zero bias +/- 1 mm (standard error) averaged over any one year period

Jason-3 Level2 Product files

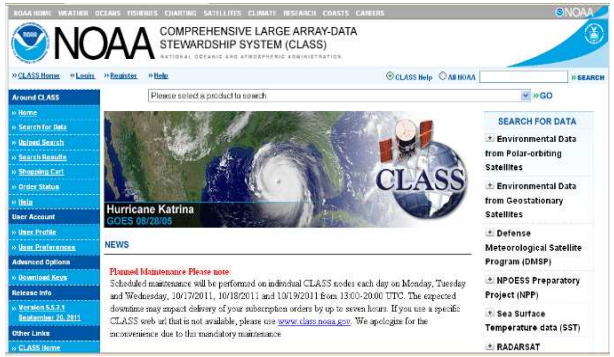
Product	OGDR	IGDR	GDR
Processed by	**NOAA and EUMETSAT**	**CNES**	**CNES**
Disseminated by *Systematic – Electronic*	**NOAA and EUMETSAT**	**NOAA and CNES**	**NOAA and CNES**
Latency	**3-5 hours**	**1.5 days**	**~ 60 days**
1-Hz	**OGDR-SSHA**	**IGDR-SSHA**	**GDR-SSHA**
1-Hz 20-Hz	**OGDR** **OGDR-BUFR**	**IGDR**	**GDR**
Waveforms	**-**	**S-IGDR**	**S-GDR**
Structure	**segment**	**pass**	**pass**
Packaging	**segment**	**day**	**cycle**

No change compared to Jason-2 ! Current standard : GDR-D
JASON-3 will have benefit from any Jason-2 products improvement

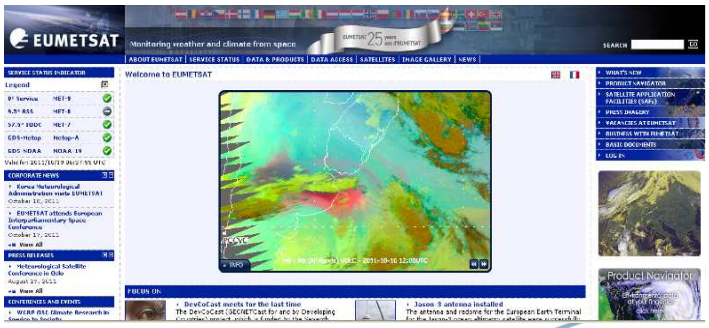
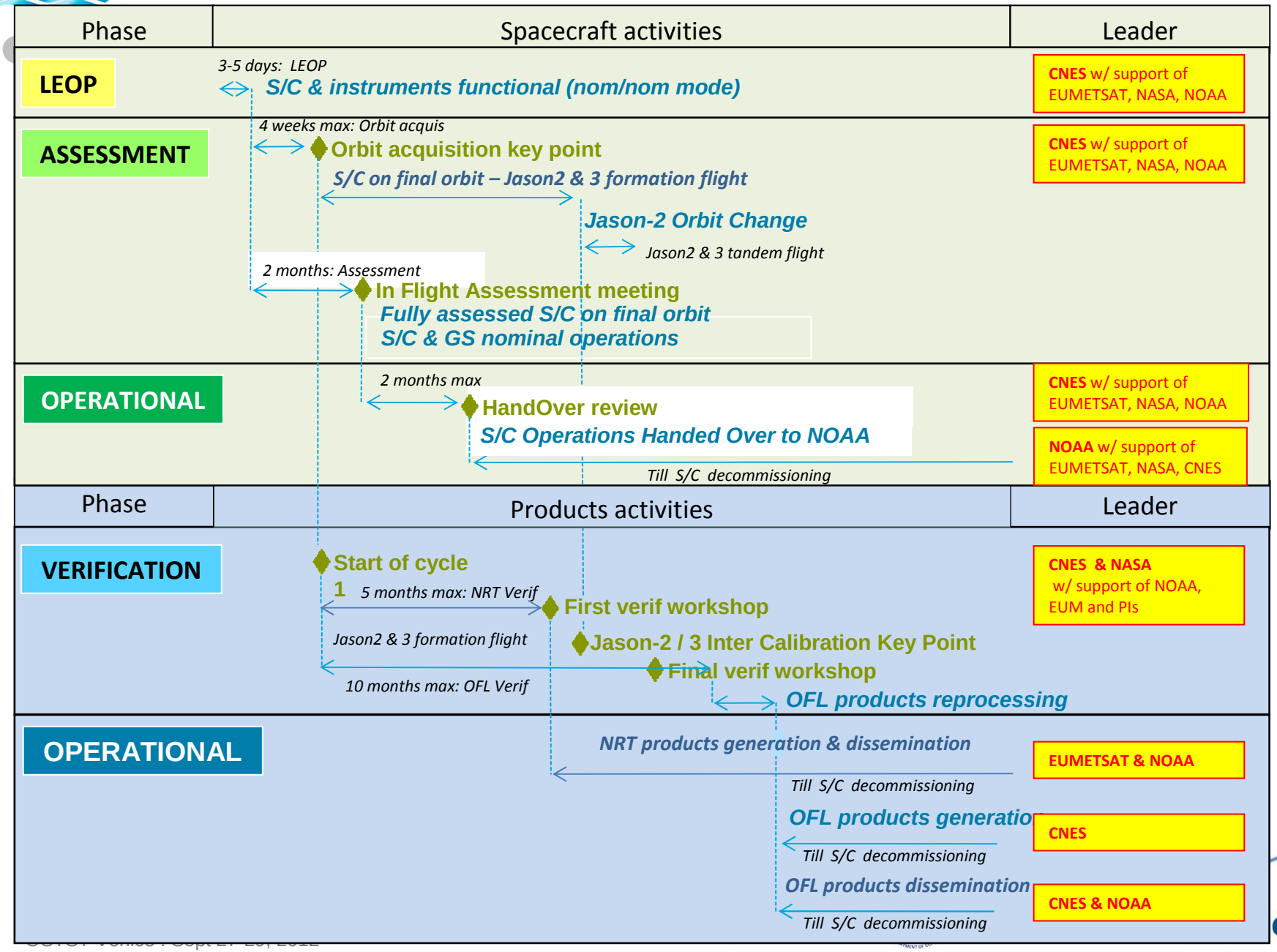
Products Web sites for Jason-3

- On CNES side, archiving and dissemination of offline Jason-3 products via :
- AVISO CNES Data Center
  http://aviso-data-center.cnes.fr/ssalto
- AVISO offline data user satisfaction survey performed each year

- On NOAA side , archiving and dissemination of offline Jason-3 products via :
- NODC: www.nodc.noaa.gov/SatelliteData for NRT OGDR, as well as IGDR and GDR
- CLASS: www.class.noaa.gov for OGDR, IGDR, GDR and all auxiliary data
- GTS: Global Telecommunication System (alternative option for reception of BUFR products)



- On EUMETSAT side, archiving and dissemination of J3 near-real-time products via:
- The Earth Observation Portal available on www.eumetsat.int (retrieval of archived products).
- EUMETCast: Satellite Broadcasting System (reception of disseminated products).
- GTS: Global Telecommunication System (alternative option for reception of BUFR products).



Mission phases