Jason-3 Project Status

Jason 3
2015

OSTM/Jason 2
2008 -- Present

Jason 1
2001 -- 2013

TOPEX/Poseidon
1992 -- 2006

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- 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
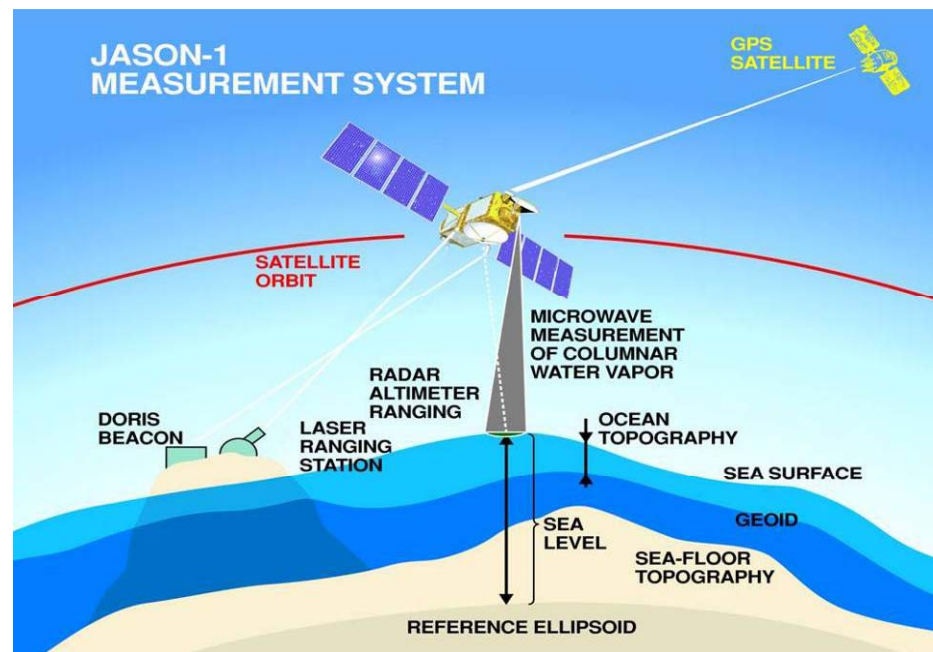
Mission Summary

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)
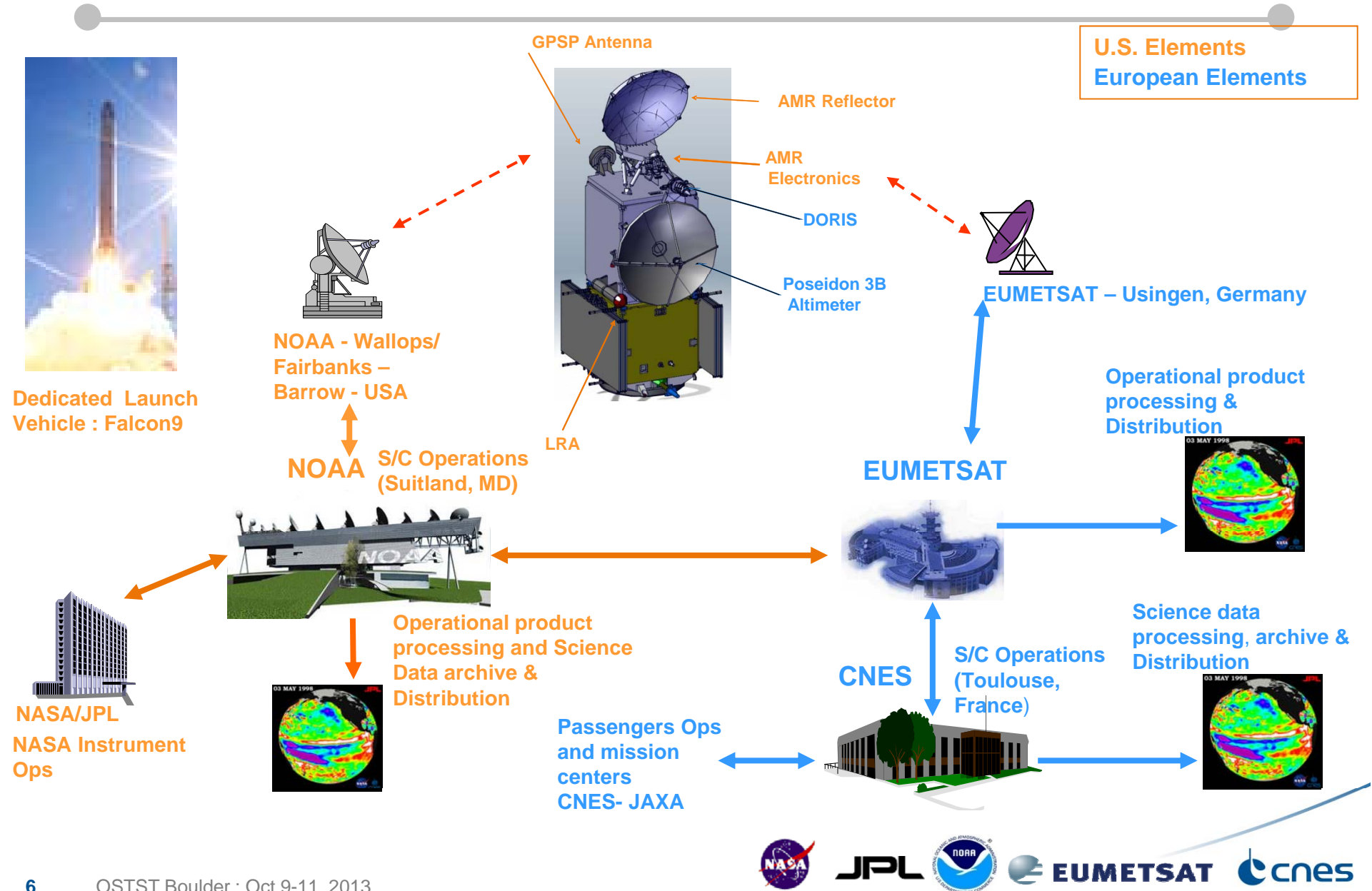- Passengers:
    - JRE (Carmen3 + LPT)

Mission Overview

- Launch Date: March 2015
- 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

GPSP Antenna

AMR Reflector

AMR Electronics

DORIS

Poseidon 3B Altimeter

LRA

U.S. Elements
European Elements

Dedicated Launch Vehicle : Falcon9

NOAA - Wallops/ Fairbanks – Barrow - USA

NOAA **S/C Operations (Suitland, MD)**

EUMETSAT – Usingen, Germany

Operational product processing & Distribution

EUMETSAT

NASA/JPL

NASA Instrument Ops

Operational product processing and Science Data archive & Distribution

CNES

S/C Operations (Toulouse, France)

Passengers Ops and mission centers CNES- JAXA

Science data processing, archive & Distribution

NASA JPL NOAA EUMETSAT cnes

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

System : AMR in-flight cold-space calibration
- Lisbon OSTST recommendation, San Diego OSTST decision
- Satellite pitch maneuvers (80° off nadir).

This change is completed and will be tested in 2014.

Satellite
- Slight modification of satellite OBSW (Tx OFF for safety improvement, PIM structure panels).

Completed

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.

Completed

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

Completed

DORIS antenna

AMR (Radiometer)

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

Completed

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

Completed

Launcher

● Launch vehicle : Falcon 9 (SpaceX)
● New Payload Processing Facility (PPF) at Vandenberg : SpaceX PPF

Ground :

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

● Addition of stations for the "formation flight" phase : Barrow (NOAA) and Usingen2 (EUM)
● JASON-2 and JASON-3 operations "merging" considered after the launch

Completed

Product Processing :

● Development of a "digital retracking" to be used for Jason-3 GDR allowing to take into account the actual instrument features before launch and in-orbit and to better estimate the low sea states.

4 partner main events in 2013:

- 4 partner mission review SIR (System Interface Review) has been successfully held beg Feb 2013.
  - ✦ No recommendations. A few action items : all completed

- Launch date in March 2015, delayed by 3 months
 - ✦ Contractual option ("grace days") exercised by the vehicle vendor end 2012.

System

- System documentation signed and under configuration.

- Satellite Data Base generated and regularly provided to partners when updated

- Satellite Simulator PRESTO used for System tests

- All the planned reviews have been held successfully

Payload instruments

- **POS3B , DORIS :**
  - Manufactured and successfully validated
  - Available in Feb 2013 and delivered for Payload AIT mid 2013

- **AMR, GPSP, LRA :**
  - Manufactured and successfully validated
  - Available in Feb 2013 and delivered for Payload AIT mid 2013

- **Passengers : CARMEN3 , LPT**
  - Manufactured and successfully validated
  - LPT instrument delivered for Payload AIT mid 2013
  - CARMEN3 Instrument delivered in August 2013

DGXX-S MQV

POS3B antenna

AMR RSA (Reflector)

GPS Electronics Unit

AMR ESA (Electronics)

LRA
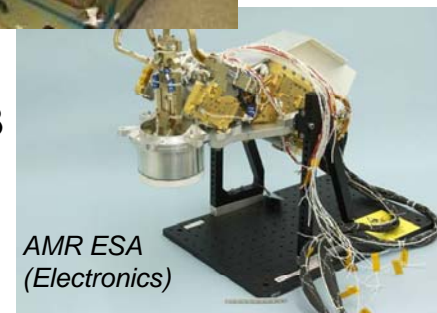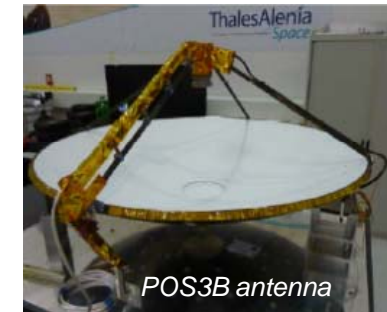
Satellite

- The satellite review CDR has been successfully held beg December 2012

- Platform (PF) de-storage (March 2013) performed successfully

- Payload Instruments integration on the Payload Instrument Module (PIM) completed in September 2013

- Satellite AIT activities start with the "initial reference performance" tests. "Thermal Vacuum" test is planned in Nov/Dec 2013. Completion of Satellite AIT sequence expected by May 2014

Nominal progress of the satellite activities

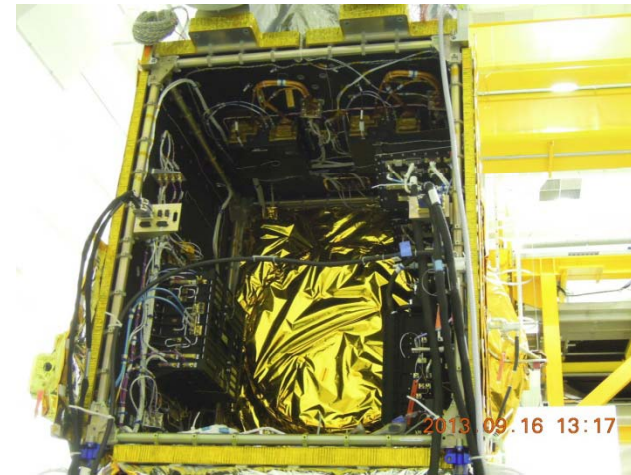## PIM mating and AMR integration

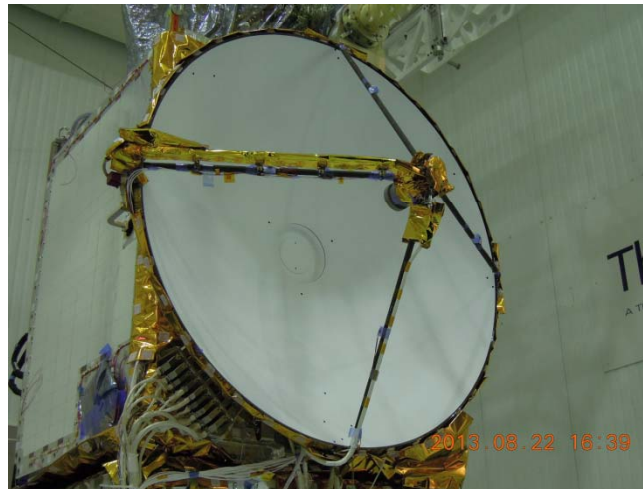Credit TAS

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Credit TAS

Altimeter POS3B integration

Credit TAS

Credit TAS

Credit TAS

Payload AIT: All the instruments are integrated in the PIM
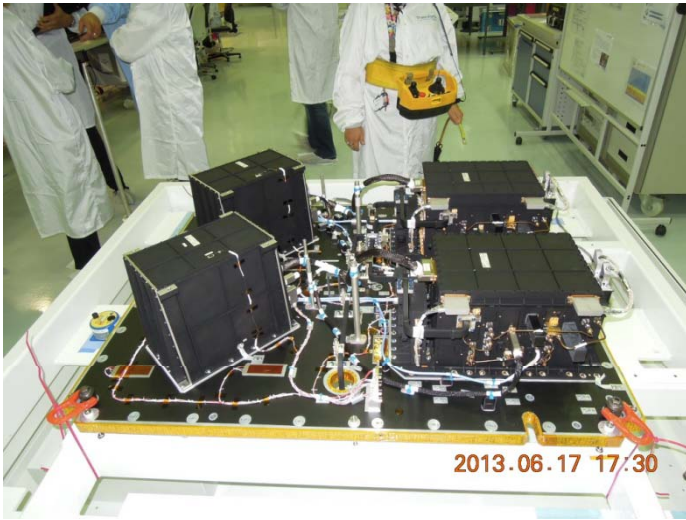
Credit TAS

Credit TAS

Jason-3 Project
Development Status - 5 (launcher)

Launch Vehicle :

- From the launcher selection (mid July 2012) an intensive work to consolidate the interfaces definition and coordinate the launcher development plan with regard to the satellite integration milestones has been made

- Significant step : Successful Falcon9 launch on Sept 29, 2013 (v1.1, fairing , VAFB, representative of configuration being considered for Jason-3)

- Environment assessment will be based on launcher flight data, launcher compatibility to be demonstrated early 2014

- Jason-3 Launch is planned in March 2015

Safety :

- Expected waivers have been signed

Credit SpaceX

Ground Systems

- CNES, EUM, NOAA, JPL : OK
  - All the 4 partner ground systems are implemented and validated
    - » CNES Control Center and Mission Center SSALTO
    - » EUMETSAT Processing Center and Usingen2 Earth terminal
    - » NOAA Control Center, Stations and Processing Center
    - » JPL Instrument Data system (IDS) and Radiometer Calibration system (ARCS)

Preparation of operations

- Elaboration of Jason-2 / Jason-3 operations merge strategy and plans
- All the 4 partner ground systems are able to simultaneously control Jason-3 and Jason-2 satellites and process Ja3 and Ja2 data

4 Partner tests

- 4 partner "Compatibility Tests" are successfully completed

- Technical Qualification tests currently run :
  - First LEOP test (including the 4 partners) has been successfully run beg Sept 2013
  - Preparation of the "Long Term Routine" test planned end 2013
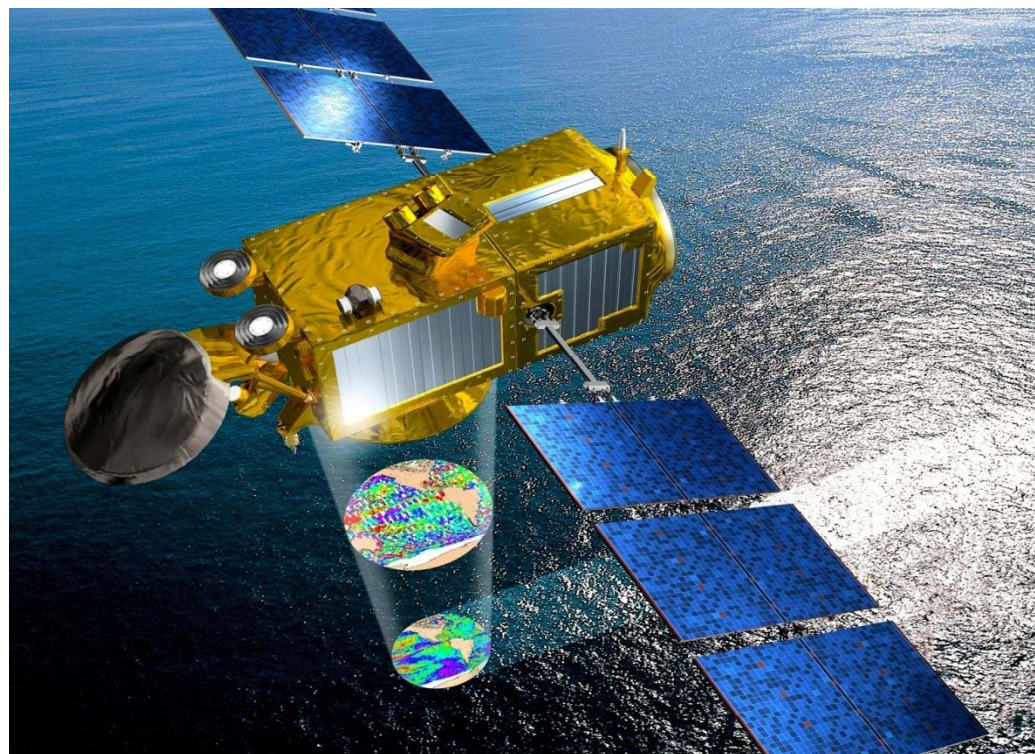
Nominal progress of the tests activities

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

- Launcher compatibility with the satellite will be deeply assessed/confirmed in 2014

- Satellite AIT completion will be the key event of 2014

- Operational Qualification (QO) of the Ground System will be demonstrated in 2014

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

Backup Slides

OSTST Boulder : Oct 9-11, 2013

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

	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
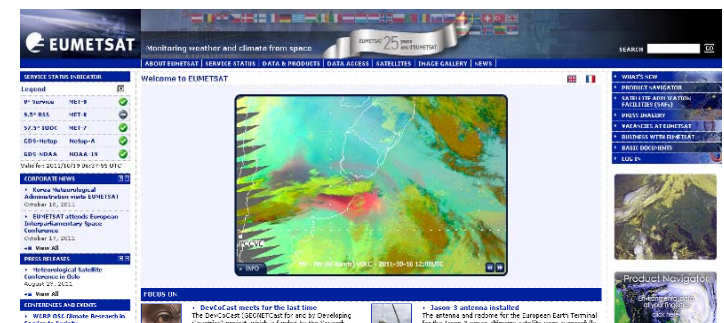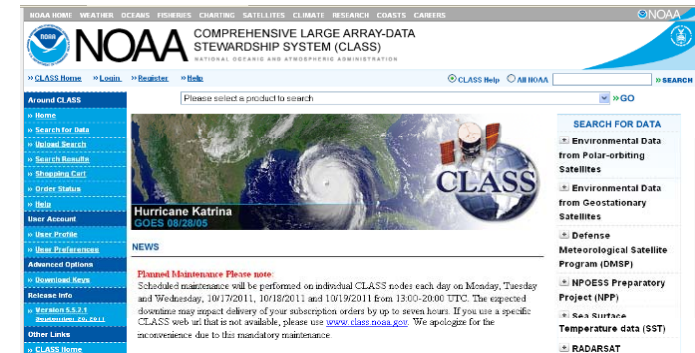
Jason-3 Level2 Product files

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