

JASON-3 Mission Status

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- **Mission Background and Mission overview**
- **Jason-3 System elements**
- **Driven documents :**
 - > **Mission Req Document MRD -> Performances,**
 - > **Operational Service Spec OSS --> Products**
 - > **System Budget performances**
- **Jason-3 Changes comparing to OSTM/Jason-2**
- **Jason-3 Project Development Status**
- **Risks and concerns**

- 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-2 launched on June 20, 2008 was the result of the cooperation of CNES, NASA, EUM and NOAA.
- Decision in March 2009 (first official letters) to re-conduct first a 3 then a 4 partner program Jason-3
- The Jason-3 Programme is lead 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
- Discussions about the MOU started in March/April 2009 and the final agreement was reached in February 2010 including responsibility sharing, legal statements, partner contribution (launcher, instruments, satellite, ground system, ...)
- Jason-3 MOU was signed in July 2010



Science Measurements

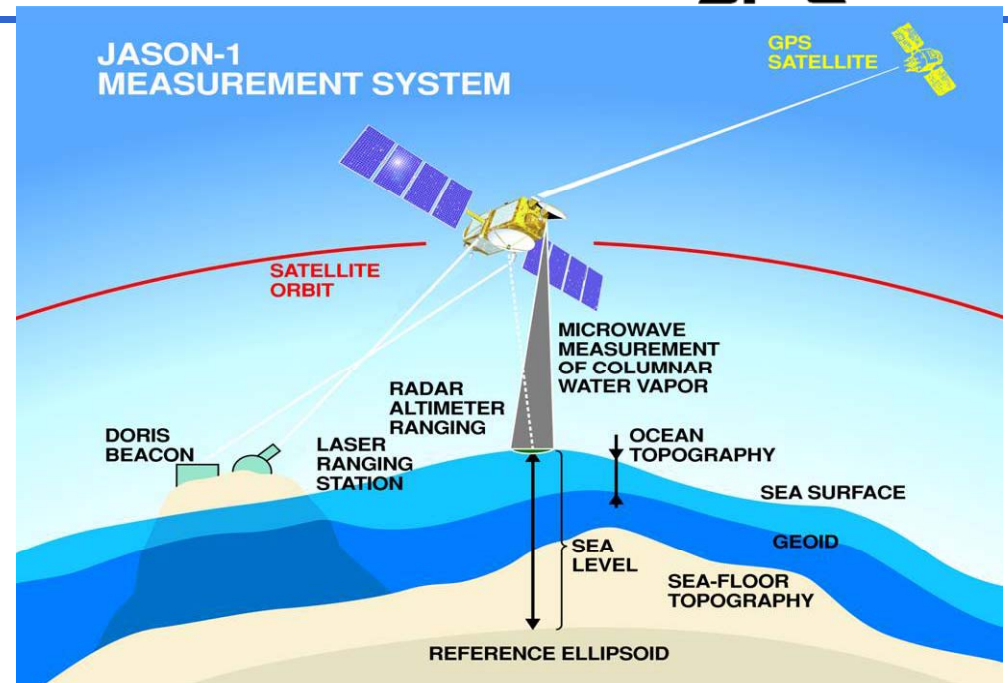
Global sea surface height to an accuracy of ≤ 4 cm every 10 days, for determining ocean circulation, climate change and sea level rise

Mission Objectives

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

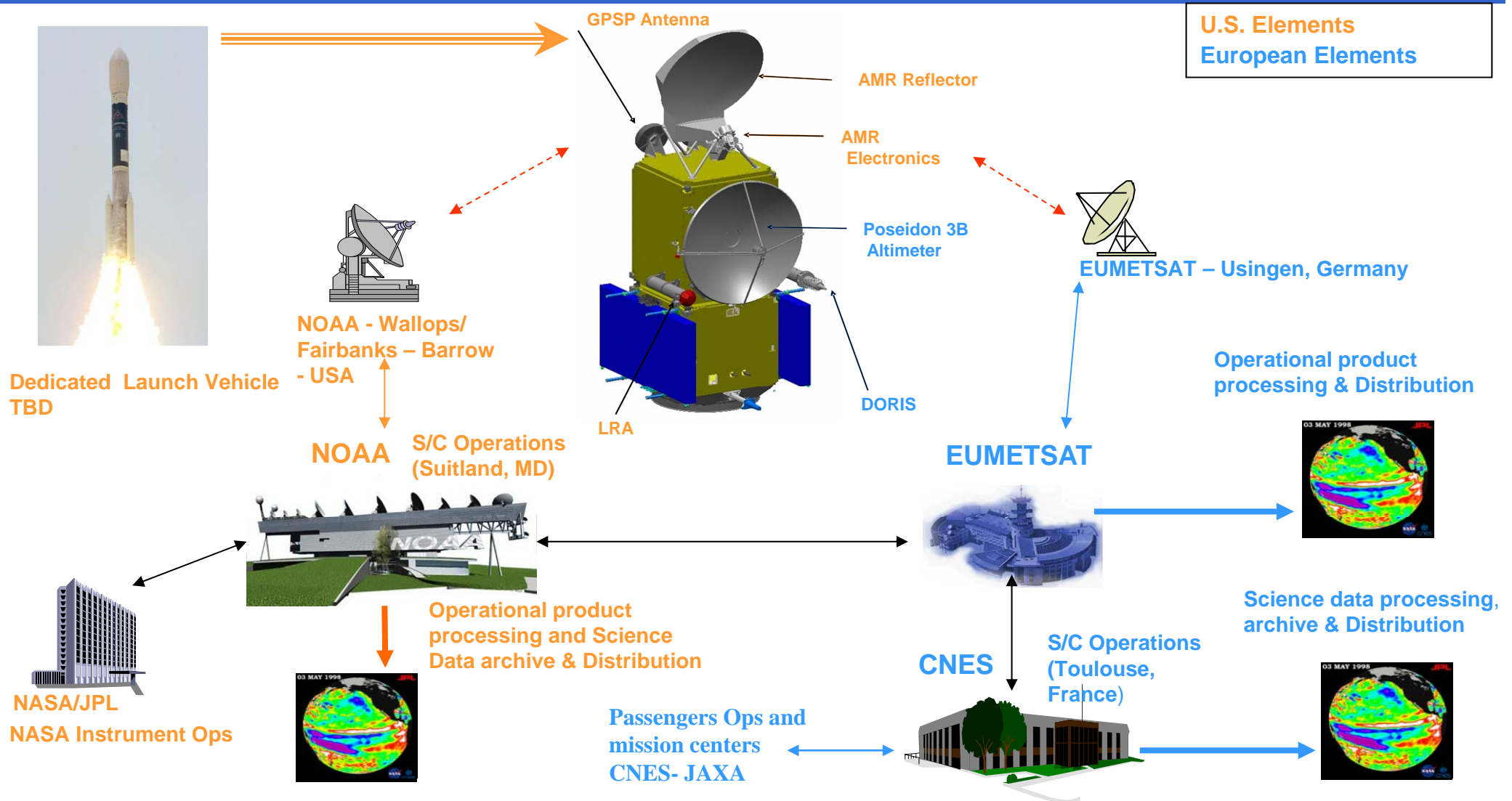
Instruments

- 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: April 2014
- Launch Vehicle: TBC
- Proteus Spacecraft Bus provided by CNES
- Mission life of 3 years (goal of 5 years)
- 1336 km Orbit, 66° Inclination



- **Assumptions :**
 - Use of the 6th PROTEUS Platform
 - Core mission instruments similar to Jason-2
 - > 2 experiments embarked (the same as for Jason-2) : CARMEN3 and LPT for radiation effects with the same constraints as for Jason-2
 - Launcher compatible with the satellite (equivalent to Jason-2) : not yet selected
 - Same ground architecture and operations sharing
- **European activities started from March 2010 :**
 - Satellite contract : March 2010 - Review SRR : June 2010
 - POS3B contract : March 2010
 - DORIS DGXXS contract : July 2010
- **US (NASA-JPL) activities started from June 2010 :**
 - AMR: Requirements and Inheritance Reviews (Dec 2010)
 - > Long lead parts and flight sub-contracts: Jan/Feb 2011
 - GPSP: Requirements and Inheritance Reviews (Dec 2010)
 - > Study, Long lead parts, flight contracts: Nov/ Dec / Feb 2011
- **Ground activities started from June 2010**

- **Mission Requirement Document MRD : Reference TP4-J0-SP-52-CNES v 1.0**
 - **Heritage from OSTM/Jason-2 :**
 - > **Design constraints - Constellation context**
 - > **Signed by all PIs, program managers, project managers**
 - **Mission objectives**
 - > **Institutional users : CEOS**
 - > **Science users : OSTST**
 - **Drift requirements : Specific Seattle OSTST recommendation**
 - **J3-TARG-PROD-147 As a goal, 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.**
 - **J3-TARG-SYST-335 In order to satisfy the stability goal of reaching an uncertainty of less than 1mm/year in mean sea level change, allocations shall be given and enforced to the different components of the JASON-3 system that contribute to this measurement.**
 - **J3-GUID-SYST-336 Tentative allocation for mean sea level change error budget is as follow:**
 - » **External geophysical correction: 0.1 mm/yr**
 - » **Orbit drift: 0.1 mm/yr**
 - » **Microwave radiometer wet troposphere correction: 0.7 mm/yr**
 - » **Sigma0 drift impact on sea state bias (through wind speed): 0.1 mm/yr**

Changes compared to Jason-2
are in blue

	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) <i>(Ja2 : 10 cm)</i>	2.5 cm	1.5 cm	1 cm
Total RSS sea surface height	6.8 cm <i>(Ja2 : 11 cm)</i>	3.9 cm	3.4 cm	2.5 cm
Significant wave height	10% or 0.5 m <i>(b)</i>	10% or 0.4 m <i>(b)</i>	10% or 0.4 m <i>(b)</i>	5% or 0.25 m <i>(b)</i>
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 <i>(c)</i>

(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

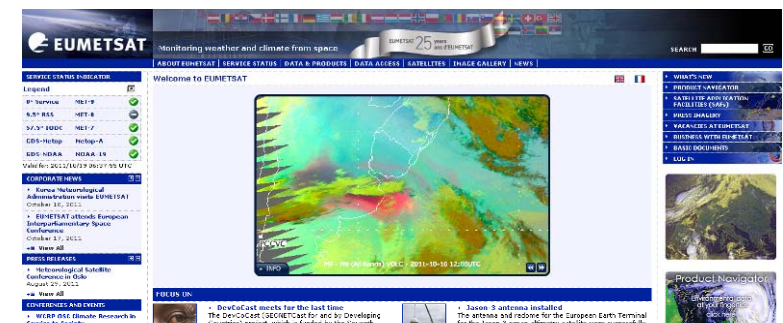
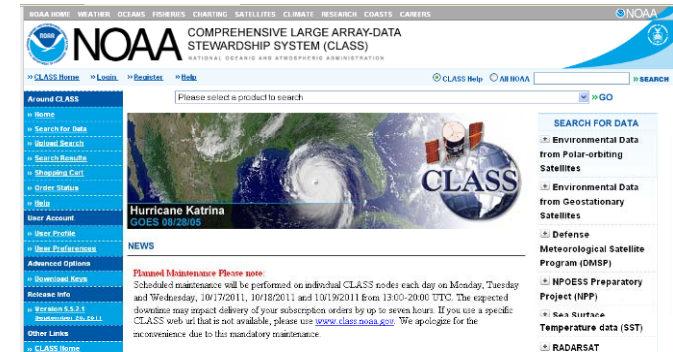
- **Operational Service Specifications : Reference TP4-J0-STB-32-CNES v 1.0**
 - **Data Products requirements : Level2 ocean type products (geo-located and along-track geophysical products)**
 - **Near-Real Time (NRT) products :**
 - > **Operational Geophysical Data Record (OGDR) : produced in near real time (3-5 hours)**
 - **Fast Quality Control & Check : Elementary and automatic controls, product delivered in any case**
 - **Priority given data latency with respect to validation and auxiliary data availability + forecast meteo files used.**
 - **Off-Line (OFL) products :**
 - > **Interim Geophysical Data Record (IGDR) : produced in 1.5 days**
 - **Quality Control & Check : Product not delivered in case of problems detected; Products validated by SALP/Calval activities (Calval chain + verification step); Possible reprocessing in case of quality problems.**
 - **Improvement of : orbit quality (MOE), pole location data, restituted DORIS USO frequency, altimeter/radiometer calibrations, analyzed meteorological fields, dynamic atmospheric corrections applied.**
 - > **Geophysical Data Record (GDR) : produced in 60 days**
 - **Quality Control & Check : Products fully validated by experts (CNES and JPL); Possible reprocessing.**
 - **Improvement of: orbit quality (POE), more accurate pole location data, more accurate dynamic atmospheric corrections**

No change compared to Jason-2 !
Follow Jason-2 products improvement

Product	OGDR	IGDR	GDR
Processed by	NOAA and EUMETSAT	CNES	CNES
Disseminated by <i>Systematic – Electronic</i>	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 !
Follow Jason-2 products improvement

- 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/Jason2 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).



- **Jason-3 Products Conclusion :**
 - 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.).
 - Many ideas for the future (that should be discussed in the frame of “Measurement System Engineers - MSE” meetings), many studies already or soon completed.



- **TP4-J0-NT-131-CNES : « JASON-3 system performances budget » first issue**
- **Performances Key point will take place about 1 year before Launch**
- **Performances (as for Jason-2) will be monitored and assessed**
 - **System**
 - > Reliability, Availability, Data Products latency
 - **Satellite performances :**
 - > JASON-3 satellite budget available at satellite CDR in 2012
 - > Knowledge of satellite parameters for POD
 - > POS3B Nadir pointing, POS3B/AMR co-alignment
 - **Instruments performances :**
 - > POS3B noise, electronics stability
 - > AMR accuracy, path delay drift
 - > Time tagging performances (PPS, Doris, Altimeter)
 - > DORIS USO frequency stability
 - **Orbit determination performances :**
 - > On-board real-time orbit determination (DIODE) :
 - > MOE, POE (DORIS, GPSP, LRA)
 - **Processing Algorithms**

- **System Requirements changes ==>**
 - Modifications in mission requirements error budgets
 - Integration of OSTST recommendation for global Mean Sea Level (MSL) measurement
 - OSTST recommendation (Lisbon 2010) ==>
 - > The OSTST recommends that the Jason-3 project continue to consider the possibility of improving the AMR stability through on board calibration to the extent feasible within budget and scheduling constraints
- See S. Brown / V. Couderc presentation (today 14h00 : “Points for Splinter Sessions”)**
- **US launcher not yet selected. Anticipation of potential launchers ==>**
 - change of DORIS antenna location
 - change of satellite OBSW
 - change in PIM structure panels
 - AOCS analysis

- **T2L2 passenger not flying on JASON-3**
- **”JA2/JA3 formation flight” in assessment phase ==>**
 - > **Impact on the ground system of 2 new ground stations : Barrow (NOAA) and Usingen2 (EUM)**
 - > **Capability to operate simultaneously the 2 satellites (NOAA)**
- **Instruments changes**
 - **POS3B altimeter**
 - > **JASON-2 : The altimeter modes “autonomous tracking” (nominal) and “DIODE/Digital Elevation Model” (probationary) were complementary but exclusive.**
 - **DEM mode gives more measurements than tracking mode on the zones correctly described in the DEM, but only on these zones**
 - > **JASON-3 : implementation of a mixed mode allowing on-board automatic transitions between DIODE/DEM mode and acquisition/tracking mode, with respect to the satellite position.**

→ See J.D. Desjonqueres : responsible for POS3B altimeter

- **Instruments changes**

- **DORIS DGXXS**

- > New generation taking into account lessons learned from Jason-2
- > Improvement in modeling Solar Panels position

→ See C. Jayles : poster session “NRT products”

- **AMR radiometer:**

- > Performed thorough lesson learned review from Jason-2 experience
- > Mostly recurring design with small design updates to:
 - Account for parts obsolescence
 - Improve the instrument thermal control and stability
 - Small design updates to retire residual implementation risks on Jason-2

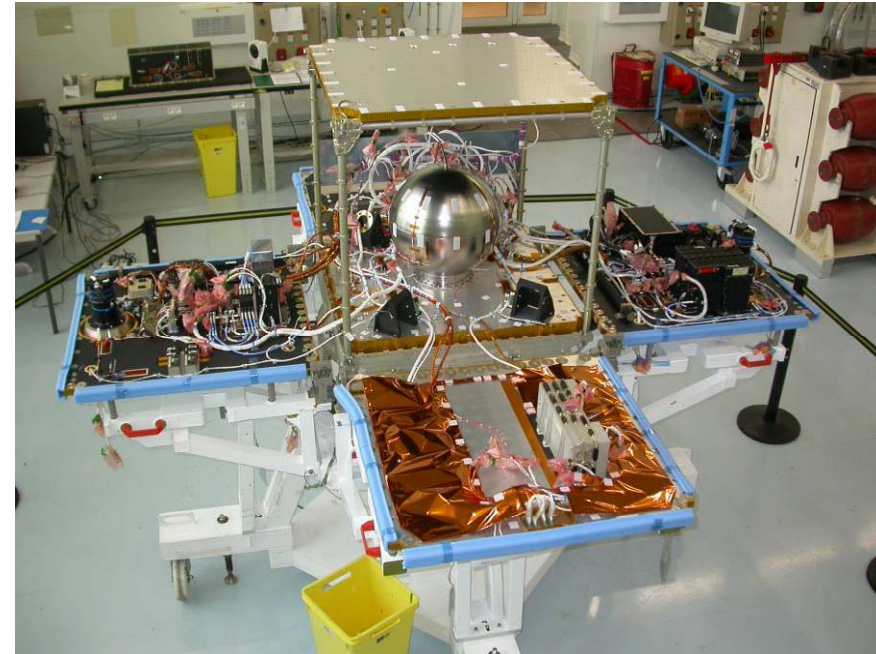
- **GPSP**

- > Different receiver but with same basic (blackjack) design as on Jason-1 and 2
 - No changes to data processing or products
 - Expect same or better performance as on Jason-2
- > Not mission critical but applying further updates for rad hard parts and shielding

- **4 partner main event in May 2011:**
 - **FY2011 budget restriction led to a delay in US instruments delivery and LV procurement ==> target launch date postponed in April 2014 (JSG decision : May 30, 2011)**
- **System :**
 - **System documentation signed and under configuration.**
 - **4 partner mission review SDR held successfully on Feb 1, 2011**
 - **Studies for AMR calibration in progress**
 - **Satellite Data Base and Platform Simulators for instruments in progress**
 - **Satellite Simulator PRESTO for System tests is in development**
 - **All the planned reviews have been held successfully**

- **Satellite :**

- Integration of the Jason-3 platform has been completed end 2010.
- Since Dec 10 the platform is stored.
- It will be tested every 6 months (first test successful in June 2011 – next test beg Dec 2011)



- Definition of the Payload Module is in progress based on the instruments interface inputs. Manufacturing (panels and harness) is planned to start in Nov 2011.
- On Board Software (OBSW) activities are in progress (TX off for safety purpose). OBSW validation has started.
- The satellite review CDR is postponed and depends on the date of Launcher Selection

- **Payload instruments :**
 - **POS3B , DORIS :**
 - > Progress is nominal. Instruments on schedule.
 - > POS3B reviews completed : CDR in Oct 2010
 - > DORIS DGXXS reviews completed : CDR in July 2011
 - > Manufacturing in progress

 - **AMR, GPSP, LRA :**
 - > Progress is nominal. Instruments on schedule.
 - > Instruments AMR and GPSP PDR's completed: August 2011
 - > Transition to phase B (NASA KDP-B Review): July 2011
 - > Instrument Prototypes/Engineering Model built showing good performance to prepare for CDR by end of 2011.

 - **Passengers : CARMEN3 , LPT**
 - > Progress is nominal. Instruments on schedule.

- **Launch Vehicle :**

- **Selection has been delayed to assess and fully incorporate outcomes of the Taurus XL launch failure with the GLORY mission.**
- **Results are expected by end of 2011 to provide further guidance on proceeding with a LV procurement for Jason-3**
- **Project has developed a bridging technical study to provide interim S/C to LV interface inputs to support continued satellite development.**
- **Project is also studying all potential alternate LV's and configurations such as Delta II, Min IV, Atlas V, dual-launch,....**
- **NASA and NOAA are coordinating closely to provide a path forward for securing a Launch Vehicle for Jason-3 ASAP while minimizing impacts to the satellite development and launch readiness schedule.**

- **Ground**
 - **CNES : OK**
 - > All the planned reviews have been held successfully. CNES Jason-3 elements are under development. Integration of the Control Center is completed. Mission Center SSALTO development is nominal. Usingen2 equipments have been delivered.
 - **EUM : OK**
 - > Usingen2 infrastructure is delivered. Acceptance of the station in Nov 2011. Jason-3 Ground Key points have been successfully held. EUMETSAT Ground System design and test plan has been completed in July, team is in place, no critical point identified.
 - **NOAA : OK**
 - > Completed Ground System PDR and CDR. NOAA ground is on schedule. Completed Fairbanks and Barrow site survey for the implementation of telemetry system. Installation mid Nov 2011. Ordering process of the Hardware for the Operational NOAA Ground system components has begun.
 - **JPL : OK**
 - > Instrument operations system and Radiometer ARCS system development is underway with no issues
- **System tests :**
 - 4 partner network is expected to be ready beginning 2012.
 - System tests are defined. Documentation is available.
 - Start of discussion on the Jason-2 / Jason-3 merge strategy and plans.

- **FY2012 budget restriction ==> risk**
 - NOAA is watching the FY2012 budget outcome and working on risk mitigation. The full Jason-3 funding is included in the president's budget submission to congress
 - For EUM, further delays will place a new risk on the total European Jason-3 programme financial envelope
 - For CNES, further delays impact the consumption of manpower margin due to additional work to keep the satellite contract on line and mainly schedule elongation
- **Launch Vehicle compatibility and selection timeline**
 - Further delays in LV selection will impact on-going S/C development.
 - 4 partners are continuing to implement a risk reduction approach to define as best possible the key inputs and interfaces from the LV to continue the satellite development on schedule and minimize any impacts to the partners.

- **Jason-3 development is nominal at satellite, instruments and ground levels**
- **2012 will be a very important “key” year for Jason-3 project in term of Launcher decision and associated Project schedule**
- **Thanks to all the project teams (NOAA, EUMETSAT, CNES, NASA/JPL)**

Backup Slides

• 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.

• 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.

• 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 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



- **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



- **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



- **EUMETSAT activities:**

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



- 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

Mission phases

