Jason-2 Project Status

OSTM/Jason 2
2008

Jason 1
2001–Present

TOPEX/Poseidon
1992–2006

Jason 3

Thierry Guinle
CNES Jason-2
Project Manager
Major events since last OSTST (October, 2011)

- **Project Milestones**
  - Fourth Jason-2 REVEX: May 9-11, 2012 ➔ successful

- **Satellite major events**
  - None

- **Payload major events**
  - DORIS OBS upgrade (Sept. 19th 2012) ➔ successful
    - To provide an even more radial performance for real time products
  - Passengers instruments:
    - LPT off since early September – investigation by JAXA in progress

- **Ground major events**
  - Upgrade to GDR-D standard ➔ successful
  - Jason-2 reprocessing in progress ➔ successful

Current OSTM/Jason-2 mission Status is OK
• The Jason-2 satellite bus is OK; no incident
  – Thermal aspects: OK
    • Active thermal control works successfully and is sized with significant margins to meet further worst case conditions
  – Electrical aspects: OK
    • Satellite power and consumption are within the power, consumption and energetic budgets
  – Command / control, RF: OK
    • On-Board Software, Mass Memory, Jason2 Telemetry & Telecommand system: nominal behavior
  – AOCS (attitude and orbit control system): OK
    • All AOCS units work nominally, AOCS control laws work as expected

• Satellite activities:
  – Unused equipment destocking (gyro, STR) OK
  – STR monitoring OK
  – SADM expertise OK
  – Gyro calibration OK
  – Cross maneuver: None (on request)

Jason-2 satellite is fully operational after more than 4 years in orbit
Jason-2 guidance

• Station keeping maneuvers
  Equatorial Nodal Crossing requirement:
  ± 1 km from reference nodes
  
  • Jason-2 ground tracks are maintained within ±1km from the reference grid
  • Jason-2 station keeping maneuvers are made with only one thrust above land on any orbit

• more activities due to Jason-1 orbit change
  • If nadir separation is less than 100 km, Jason-1 emission stopped
  • If nadir separation is less than 1 km, Jason-2 in CAL mode

• Remaining propellant: > 23 kg
Payload Status since last OSTST (October, 2011)

• **Core Payload**
  – **POSEIDON3**
    • New MNT (Kantanos area) for calibration over transponder
  – **DORIS**
    • New OBS v11 uploaded September ‘12
  – **AMR**
  – **GPSPA**
    • 6 resets on the period. Procedure in place with OPS team with no impact on operation

• **Passengers**
  – **T2L2**
  – **CARMEN2**
    • 2 occurrences of the Experiment board blocking. Requires OFF/ON
  – **LPT**
    • OFF from Sept 5/09 due to APS-A anomaly (latchup-TBC)
      JAXA expects no damage on hardware and resume observations soon

**core payload FULLY OPERATIONAL after more than 4 years in orbit**
**passengers perform satisfactorily**
• As proposed and accepted in San Diego, a new release of DIODE software (v11) is now on-board. Main evolutions are:
  – PAPEETE as a Master Beacon
  – Hill along-track acceleration
  – OAP formula change

• This issue has been activated on September 19th

• Expected performance for real-time orbit accuracy (OGDR) is **2.7 cm (radial rms)**

  => **18 % improvement**

To be confirmed with flight data in few days by comparison with POE orbit
DORIS OBS upgrade

DORIS restart at 10:20:00 UTC

Nominal performance recovered in 3 hours

500m 1h30 later
• Without ARCS processing, PDs would exhibit 7 mm/yr drift
• Drift on GDR-T product < 1mm/yr
• Drift on GDR-D product << 1mm/yr

<table>
<thead>
<tr>
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<th>Trend [ mm/yr]</th>
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<tbody>
<tr>
<td>PD ECMWF</td>
<td>-0.1 ± 0.02</td>
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<tr>
<td>PD AMSR-E</td>
<td>+0.6± 0.04</td>
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<tr>
<td>PD SSMI F15</td>
<td>+0.3± 0.1</td>
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<tr>
<td>PD TMI</td>
<td>+0.6± 0.05</td>
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</table>
AMR Performance Summary

• Residual drift in GDR-D wet PD estimated to be <1mm/year

• ARCS processing mitigates large TB drift on operational GDRs

• GDR-D will also include new processing to produce valid PDs in the coastal zone in addition to radiometer rain and sea ice flags
  – Currently available on AMR enhanced product (via PO.DAAC)

• AMR continues to provide excellent performance meeting and exceeding all requirements
Ground & Operations Status and performances

- **Earth terminals:**
  - Usingen (USG): OK
  - Wallops and Fairbanks (CDAS): OK

- **Control Centers:**
  - J2CCC CNES Control center: OK
    - all the elements are OK
  - SOCC NOAA Control center: OK
    - successful DORIS on-board software upload
    - successful transfer of GPSP1 SW to ESPC

- **Instrument Commanding and Monitoring Centers:**
  - SSALTO for CNES instruments: OK
  - JPL Mission facility for NASA/JPL instruments: OK
  - Passengers Mission centers: OK
OGDR products
Status and performances

NRT products (OGDR)
produced by EUMETSAT Mission Center and NOAA/ESPC Mission Center

- Major changes in the period
  - Update was applied to AMR characterization file: 5-January 2012
  - New N400 and N640 Gaussian grids and new ECMWF forecast and analysis model version: cyc1e 37r2 and upgrade of ECMWF model level output from GRIB1 to GRIB2: May 2012
  - GDR-D science upgrade implemented at EUMETSAT and NOAA: 31-July 2012.

- EUMPC : ~100% OGDR successful for PLTM1 acquired at USG
- NOAA ESPC : ~100% OGDR successful for PLTM1 acquired at CDAs

- 100 % OGDR products archived, all disseminated via EUMETCast and via NOAA dissemination services

OGDR products
Status and performances

- **Operational Geophysical Data Record (OGDR) data latency:**
  - Requirements are:
    - 75% of OGDR data within 3 hours from sensing
    - 95% of OGDR data within 5 hours from sensing

Performance (measured at EUMETCast end user level)
- 91% in less than 3 hours
- 98% in less than 5 hours

EUMETSAT’s Inputs

Performance (measured at NOAA ESPC production level)
- 94% in less than 3 hours
- 98% in less than 5 hours

NOAA’s Inputs


- 3-Hour Requirement: 76%
  - Oct-2011 through Sep-2012: 94.64%

- 5-Hour Requirement: 95%
  - Oct-2011 through Sep-2012: 98.72%
Off-line products
Status and performances

• Off line products produced by SSALTO CNES Mission Center

• Jason-2 IGDR processing is OK (CNES : 100% IGDR successful)
• Latency : more than 97% of products available in less than 1.5 day
• 100% IGDR products archived
• all disseminated via CNES AVISO and NOAA dissemination services

• Jason-2 GDR processing is OK (CNES : 100% GDR successful)
  – Systematic cross checked validation by CNES and JPL
  – 148 cycles of 152 have been generated and validated.
  – For each cycle, a full validation report is produced by CNES
    ➔ see ftp://avisoftp.cnes.fr/AVISO/pub/jason2/gdr
• 100% GDR products archived
• all disseminated via CNES AVISO and NOAA dissemination services
• GDR_D reprocessing : available on AVISO ftp server

Yearly CALVAL report available
### Off-line products

#### Status and performances

- **Reprocessing status:**
  - Started in April 2012 (should be completed by November)
  - Cross validation CNES + NASA/JPL

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<tr>
<th>Operating Steps</th>
<th>Cycles</th>
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<tr>
<td>1. Level 1 reprocessing completed</td>
<td>1  2  3  4  5  6  7  8  9  10</td>
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<tr>
<td>2. Level 2 reprocessing completed</td>
<td>11  12  13  14  15  16  17  18  19  20</td>
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<td>3. CNES validation</td>
<td>21  22  23  24  25  26  27  28  29  30</td>
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<td>4. JPL Validation</td>
<td>31  32  33  34  35  36  37  38  39  40</td>
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<tr>
<td>5. Level 2 products available on SEF Server</td>
<td>41  42  43  44  45  46  47  48  49  50</td>
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<tr>
<td>6. Level 2 products available on CLASS</td>
<td>51  52  53  54  55  56  57  58  59  60</td>
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<td>* Problem: investigation in progress</td>
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Last update: 25/09/2012
System Requirements and Performances

- Jason-2 data products are now available with GDR-D standard
- Major evolutions:
  - Correction of biases (Pseudo Datation + range)
  - Orbit GDR-D + last issue of MSS (2011), MDT (2009), tides (GOT 4.8)
  - New algo for wet trop correction
  - MLE3 retracking into products
  - Etc…

Current figures:

- RMS Orbit (radial component) **DIODE** (vs POE): OGDR: 3 to 4 cm
- RMS Orbit (radial component) **POE**: GDR: 1 cm
- RMS Orbit (radial component) **MOE** (vs POE): IGDR: 2 cm
- Altimeter noise (from RMS from 20Hz Ku range): 1.8 cm
- Wet troposphere (J2-J1) RMS results: 0.1 to 0.8 cm
- Total RSS sea surface height (J2-J1) RMS results: IGDR: 3.9 cm
- Significant wave height (J2-J1) RMS results: IGDR: 0.12 to 0.24 m
- Wind speed (J2-J1) RMS results: IGDR: 0.2 to 0.8 m/s

Requirements:

- 10 cm
- 2 cm
- 2.5 cm
- 1.8 cm
- 1.2 cm
- 3.9 cm
- 0.4 m
- 1.5 m/s
System Requirements and Performances

- Altimeter Antenna Pointing:
  - Requirement: < 0.2°
  - Pointing performance stable since launch

  **Typical pointing value below 0.07°**

*STR1 locked in standby on 2009/02/23*

**OFF Nadir**

% of the points per day with mispointing > 0.2°
System Requirements and Performances

• **Data availability**:  
  – Requirement: The GDR shall contain 95% of all possible over-ocean data (acquisition and archive) during any 12 month period, with no systematic gaps.

• from October 2011 until August 2012

  ⇒ **satellite unavailability**  
  – bus: 0%  altimeter: 0.01%  Doris: 0%  AMR: 0%  
  • POS3: routine calibration + Gavdos  
  • POS3: exceptional calibrations

  ⇒ **ground unavailability**  
  ~0%  < 1% req  
  loss of data at station level

⇒ **Global Jason-2 system availability:** 99.9%

⇒ **GDR data availability vs theory**

  All surfaces: 96.3%

  Over Ocean: 99.8%
Conclusion

• Jason-2 satellite has an excellent behavior

• All satellite and system performances requirements are fulfilled with large margins

• Operational Routine Phase is nominal

• Successful REView of EXploitation (REVEX) : May 9-11, 2012

• All products in GDR-D standard

➔ thanks to all the teams (CNES, NOAA, EUMETSAT, NASA/JPL) a system running fine, with an excellent availability level

➔ the process for a mission extension is started
Thanks for your attention and also... many thanks to the contributors!!

- CNES
  - C. Marechal
  - A. Krauss
  - A. Latourte
  - JL. Mestre
  - E. Bronner
  - F. Bailly-Poirrot
  - N. Picot
  - Jean-Damien Desjonquères
  - Christian Jayles
  - Cédric Tourain
  - P. Guillemot
  - E. Lorfèvre
  - O. Okudaira

- NOAA
  - D. Donahue

- EUMETSAT
  - S. Dieterle

- JPL
  - G. Shirtliffe

- CNES
  - C. Maréchal
  - A. Krauss
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  - P. Guillemot
  - E. Lorfèvre
  - O. Okudaira
Poseidon-3 Altimeter

- POS-3 current configuration:
  - Turn-On of chain #1 on 22 June 2008 (Chain #2 is redundant)
  - POS3-1 availability is **100%**. No anomaly.
    - no measurement data when extra operations are made (daily calibrations, specific calibrations, EEPROM modification and check)
  - Tracking mode: Autonomous Tracking Mode only (Median Tracker since beginning of cycle 35: June 14, 2009 4h30)

- POS-3 configuration change: None since last OSTST

- POS-3 performances: Identical, still very good

- POS3-1 operations:
  - Regular transponder calibration (#109 & #18) stopped due to GAVDOS transponder unavailability
  - New possible transponder site tested in July (suitable also for Sentinel3)
• DORIS configuration and availability
  – No configuration change since last OSTST
    • Nominal chain: DORIS #1 (since June 2008)
      – OBSW DGXX V11.0 (on EEPROM-A since Sept. 2012, EEPROM-B will be aligned soon)
    • Redundant Chain: DORIS #2 (OBSW DGXX V4.0)
  – DORIS availability is 100%

• DORIS performances
  – DOPPLER MEASUREMENT
    • mean value for noise is 4.2-5.0 mm (POE residuals, over a 10 seconds period)
  – DORIS Time-tagging of PPS performances (used for altimeter data)
    • accuracy is 1-2 microseconds as compared to on-board GPS (bus)
  – Navigator (DIODE) performances
    • daily radial RMS: 3 to 5 cm
    • daily 3D-RMS: 10 to 20 cm

• DORIS operations and DORIS beacon network
  – On board software upload (12-14 Sept.) and restart on Sept. 19th – No measurements during 4 hours
  – Very good availability (~90%)
  – 4 Master beacons since 2009
Summary:

- The LRA continues to provide returns adequate for tracking.
- SLR Tracking of Jason-2 has been nominal.
- LRA Returns are the same power as Jason-1.
- The top five stations for Jason-2 tracking are:
  - Yarragadee (Australia)
  - Zimmerwald (Switzerland)
  - Mt. Stromlo (Australia)
  - Changchun (China)
  - Graz (Austria)
T2L2 : Time Transfer by Laser Link

- **Availability**: 100%
  - No new anomaly since June 2011.

- **Performance**: Nominal
  - No aging of the instrument
  - No degradation of the performances
  - Optical fiber: Loss of transmission due to radiations ~9% per year, no impact

- **Operations**: Nominal

- **Science**: Level 4 products available since January 2012
  - New assessment of T2L2 time transfer accuracy: <200 ps
  - New comparison between T2L2 and DORIS: within 10^{-12}, first independent validation of the DORIS USO frequency restitution.

*Instrument is still fully operational after more than 4 years of continuous operations, exploitation agreed until end of 2014.*
CARMEN-2: to study the influence of space radiation on advanced components (a spectrometer and an Experiment Module "MEX")

- **CARMEN-2 current configuration**
  - no change since last OSTST

- **Availability**:
  - spectrometer 98%
  - MEX 98%: 2 anomalies (communication loss between MEX and CARMEN-2 processors → instrument restart)

- **Performances**:
  - **Spectrometer**: correctly calibrated, satisfies technical specifications (particles, energies) → Several solar events have been well observed.
  - **MEX**: according to the experiments, good correlation between expected behavior and measurements. **Correlation with CARMEN-1 instrument in progress.**

- **Operations**
  - nominal

**Instrument is performing well**

**Last year Activity**: L-Diagram (Nb of magnetic field line versus time) for 86MeV protons & >1.6MeV electrons

- **Improvement**: Method of energy range extension

- **Data Processing (ex)**: Mapping of errors observed on a memory under in-flight test
**LPT** : Light Particle Telescope (to measure radiation environment around the Jason-2 S/C : Electrons, protons, 4He particles)

Instrument is performing well since launch and is working properly

- **LPT current configuration**
  - No change
    (trigger mode of ELS-B (electron sensor) changed in 2008)

- **Availability**: ~100%
  - 1 OFF/ON required on Nov ’09

- **Performances**:
  - Observed radiation enhancement due to solar flare and magnetic storm.
  - Level 1 and 2 data in CDF format are available by user’s request.
  - Level 2 data will be served in JAXA’s website “SEES”.

- **Operations**:
  - On September 5th, 2012, LPT is halting observation because of APS-A anomaly. It was probably due to a single event latchup. So JAXA is expecting LPT has no damage on its hardware and will be able to resume observation after a power-on operation.