

STATUS OF JASON-3 AND FOLLOW-ON

The Jason-3 mission is a joint effort among four organizations: NOAA (National Oceanic and Atmospheric Administration), EUMETSAT (European Organisation for the Exploitation of Meteorological Satellites), CNES (Centre National d'Etudes Spatiales), and NASA (National Aeronautic and Space Administration), to measure sea surface height by using a radar altimeter mounted on a low-earth orbiting satellite. The collection of precise measurements of sea surface height is essential for ocean climatology and ocean weather applications. Ocean climatology includes global sea-level rise, a key indicator of climate change, decadal variability in the ocean, seasonal/inter-annual variability, and coastal variability and its impact on ecosystems. Ocean weather involves operational oceanography, surface wave forecasting and evaluation, and hurricane intensity forecasting.

The Jason-3 mission will ensure the continuity of the 20 plus year data record started with TOPEX/Poseidon in 1992 and continued with Jason-1 and 2. The launch of Jason-3 is planned in 2013 with an 6-month overlap with Jason-2. The overlap period will be used to conduct initial cross-calibration and validation activities, complete on-orbit check-out operations, and maintain consistent observations of sea surface height between the successive altimeter missions.

In order to ensure continuity of these key measurements over the next 15 years, , discussions have been initiated between potential Partners in Europe and in the US on a new programme named Jason CS (Continuity of Service). The programme will be based on at least two satellites, the first one being launched in 2017 covering the time span before a new technology can eventually become operational.

This paper presents the status of the Jason-3 Programme development and plans for the follow-on missions.

Status of Jason-3 and follow-on

1 INTRODUCTION

The Jason-3 mission is a joint collaboration among four organizations: National Oceanic and Atmospheric Administration (NOAA), National Aeronautics & Space Administration/Jet Propulsion Laboratory (NASA/JPL), Centre National d'Etudes Spatiales (CNES) and European Organisation for the Exploitation of Meteorological Satellites (EUMETSAT). This mission was established through a Memorandum of Understanding (MOU) among the 4 partners and a series of bi-lateral Agreements in Europe and in the US.

The Jason-3 satellite launch is planned for in 2013, with a lifetime of five years. The development activities for the Jason-3 mission are already underway.

In order to ensure continuity of these key measurements over the next 15 years, discussions have been initiated between potential Partners in Europe and in the US on a new programme named Jason CS (Continuity of Service). The programme will be based on at least two satellites, with the first one planned to be launched in 2017, covering the time span before a new technology can eventually become operational.

2 BACKGROUND

The sea surface height measurements are used for Ocean Climatology and Ocean Weather applications, as described below.

2.1 Ocean Climatology

Global sea-level rise - A fundamental indicator of climate change. Altimeter time series of several decades will be needed to distinguish signals related to manmade warming from those related to natural variability, as well as to clarify whether the rate of sea-level is accelerating.

Decadal variability in the ocean - Has an impact on fishery regime changes, and it correlates with droughts on land and changes in hurricane activity.

Seasonal/inter-annual variability - On seasonal to inter-annual timescales, ocean-atmosphere interactions in the tropical Pacific, Atlantic Ocean, the El Nino / Southern Oscillation phenomena, currently provide much of the signal for seasonal forecasts.

Coastal variability & its impact on ecosystems - Provide observations for modelling the ocean basin and the broader coastal area. Coastal forecasting is needed in responding to environmental problems such as oil spills and harmful algae blooms, as well as forecasting tides and currents important to commercial shipping.

2.2 Ocean Weather

Operational Oceanography - Input to operational integrative services based on global and regional ocean models that provide real-time and prognostic information on the state of the global ocean. This capability helps users understand and monitor the world's marine environment and facilitate a safe, non-polluting and sustainable human exploitation of the ocean environment.

Surface wave forecasting & evaluation - Accurate surface wave forecasts are a major requirement for offshore operators (e.g., oil rig operations, fishing fleets, sailing). Over the last decade, altimeter-derived significant wave height data have been critical for improvements in wave prediction systems.

Hurricane intensity forecasting - The knowledge of the upper ocean heat content (OHC) is a critical factor in forecasting the intensity of hurricanes as they approach the coast.

3 JASON-3 DEVELOPMENT STATUS

3.1 Programmatic status

From a programmatic standpoint, the Programme is articulated around a Jason-3 MOU between the 4-partners and a set of bi-lateral Agreements. Development activities for the Jason-3 mission are already underway by the four international partners, with NOAA and EUMETSAT taking the lead for the program as the Operational Agencies. CNES acts as the system coordinator at the technical level, and all Partners support science team activities.

Major responsibilities of the organizations are described below:

3.2 NOAA and NASA Responsibilities:

NOAA and NASA jointly provide the Advanced Microwave Radiometer (AMR) and its antenna, a laser retroreflector array (LRA), and a Global Positioning System Payload (GPSP) receiver package. NOAA also provide the launch vehicle and launch services. NOAA will be responsible for the operation of the satellite and the generation of near-real-time products from the data collected at the CDASs. NOAA will archive and disseminate all near-real-time and off-line data products.

3.3 EUMETSAT and CNES Responsibilities:

EUMETSAT and CNES jointly provide the PROTEUS platform, the Poseidon dual-frequency radar altimeter and antenna, and the Doppler Orbitography and Radio positioning Integrated by Satellite (DORIS) receiver package, the payload module and its integration, the command and control center for the satellite, and a European Earth Terminal (EET). EUMETSAT is responsible for generation of near-real-time products from the data collected at the Earth Terminal. EUMETSAT will archive and disseminate all near-real-time and off-line data products. CNES will provide the LEOP and initial routine operation phase before handing over the operations to NOAA.

3.4 Technical constraints

In the current planning assumptions, there will be a minimum of six-month overlap between Jason-2 and Jason-3 in 2013. The Jason-3 orbit will be similar to as the Jason-2 orbit but will have a flight separation of 1 to 10 minutes during the inter calibration phase. The orbit has a 66 degrees inclination, with an average altitude of 1336Km. Its orbital period is 112 minutes which provides for a repeat cycle of 9.9156 days.

3.5 Jason-3 Flight Segment

The Jason-3 spacecraft will be the last one to use the PROTEUS platform that has already been used for Jason-1 and 2 but also other scientific missions.

The Jason-3 system is heavily based on Jason-2 with a maximum of recurrence between both missions. The Jason-3 spacecraft core instruments are presented in Table 1.

Type	Instrument	Description
Core Mission	Poseidon-3B Radar Altimeter	This is the mission's main instrument. It measures sea-level height, wave heights, and wind speed.
	Advance Microwave Radiometer (AMR)	The AMR measures <i>water vapor</i> content in the atmosphere. It is used to determine how water vapor content impacts <i>radar</i> signal propagation.
Location System	Doris Tracking Receiver	This receiver locates the on orbit satellite in real time, information essential for providing <i>altimetry</i> data in near real time or offline.
	Laser Reflector Array (LRA)	The LRA is a totally passive reflector designed to reflect laser pulses back to their point of origin on Earth, allowing the OSTM spacecraft to be tracked with centimeter accuracy by 40 satellite laser ranging stations.
	GPS Payload receiver (GPSP)	This tracking system uses the GPS constellation of satellites to determine the exact position of a transmitter. It also provides backup precise orbit determination.

Table 1. Jason-3 Core Instrumentation

The launcher will constitute the main change with regard to Jason-1 and 2. In fact, the Delta II launcher that has been used for both Jason-1 and 2 is no longer available and analysis is underway to identify suitable alternative launchers and assess the impact of the change.

In parallel, all flight elements have started their development phase.

3.6 Jason-3 Ground System, Data Processing, and Distribution

The Jason-3 Ground System is made up of NOAA, CNES, and EUMETSAT ground segments. During the routine operation phase, the NOAA Satellite Operations Control Center (SOCC) is the primary mission operations Centre. NOAA operates and controls the Jason-2 satellite with support from CNES and NASA/JPL for mission planning and satellite monitoring. NOAA schedules and conducts satellite operations through the NOAA Command & Data Acquisition Stations (CDASs) at Wallops and Fairbanks and remotely through the Usinger Earth Terminal (ET) for satellite telemetry collection and commanding.

NOAA and EUMETSAT receive and store the satellite telemetry and instrument data at their respective ground stations (CDASs, ET), process the near-real-time (NRT) science data and products, and make them available to partners and users. EUMETSAT and NOAA produce and exchange Operational Geophysical Data Records (OGDRs). The OGDRs will be made available within 3 to 5 hours of observation.

CNES produces and distributes off-line products: the altimetry science products called Geophysical Data Records (GDRs) as well as an interim product (IGDR) with lower orbit accuracy. The GDR is a fully validated product that uses a precise orbit and the best environmental/geophysical corrections. This product is available per repeat cycle with a latency of 60 days. The GDRs are disseminated to users as they become available, as well as ingested in two main archives (at CNES and NOAA).

4 JASON-3 FOLLOW-ON PLANS

4.1 Jason-CS concept

Recognising the need to have a long term planning for the Precise Altimetry missions, all Partners have agreed to plan the Post Jason-3 mission called Jason-CS.

The continuation of the excellent cooperation between Europe and the US i.e. NOAA and NASA on high accuracy altimetry mission is also considered as essential and is part of the the foundation of the future Programme. In this sense, all studies are coordinated with the US and the science team (OSTST) is the consulted entity.

The Jason-CS (Continuity of Service) will also be based on heritage from previous missions and will use the platform of the successfully launched ESA Cryosat 2 missions. In Europe, the programme would be articulated around cooperation agreements between ESA, EUMETSAT, CNES and the EC. The objective is to have a concept for this cooperation that will identify the role and responsibility of each agency by the end of the year 2010. The programme will be based on at least two satellites, the first one would need to be launched in 2017 to ensure an adequate overlap with Jason-3 and the second satellite around 2022 to cover the gap before a new technology such as wide swath interferometry may become an operational mission.

4.2 Jason-CS status

A phase B study will be started in the coming months to analyze and assess all the modifications needed from Cryosat to Jason-CS. Among these modifications, the most obvious one is the accommodation of a different payload, with in addition to the altimeter and Doris, already on Cryosat, the need for a microwave radiometer and a high precision GPS receiver.

One important change will also be the modification of the Cryosat orbit to a To Be Defined orbit. The choice of orbit for Jason-CS has not yet been done and is being studied, again with the involvement of all Partners relying on the OSTST science team expertise. This topic will be addressed at the next OSTST meeting planned in October in Lisbon

5 CONCLUSIONS



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CGMS is invited to take note of the status of the Jason-3 and follow on missions.