2. Poseidon-4 Radar Altimeter – Primary Payload

Designed to improve on the performance of heritage altimeters by incorporating State of the Art technology. (Right) Overall mission requirements, with a focus on the science SAR mode. Improved theoretical performances in red. The table is under review noting SSB requires further analysis.

2.1 State of The Art:
Right: Pulse limited altimeters allow retrieval of geophysical parameters (elevation, wind speed and SWH) over single shot scales between about 1km to 5km.
Middle: Filtering the along track rates of change of phase allows improvement of along track resolution (300m).
Left: Focusing the echoes improves the overall SNR and thus improves performance.

2.2: Altimeter Performance
In-Orbit CS-2 data allows assessment for future missions: (Left) Range noise as a function of SWH between LR and SAR Processing. (Right) SWH noise.

2.3 Improvements with SAR
Breakthroughs have been made with SAR altimetry from CryoSat-2:
• Evidence (Fig. 2.3-a) that the SAR data does not show a mesoscale/ sub-mesoscale phenomena now associated with footprint size.
• Fig. 2.3-b shows the current theoretical performances in range noise for LRM compared with SAR based on “State of the Art” technology and processing.

3. AMR-C: Low Frequency Advanced Microwave Radiometer (Climate Quality)
The AMR-C (Fig. 3.1-a) is being developed by NASA-JPL and combines the existing design of the AMR (Jason-2 and Jason-3) with the potential addition of an on-board calibrator to improve retrievals of Brightness Temperature at 18.7, 23.8 and 34 GHz by a factor of 2. In addition, as is the baseline with Jason-3, a periodic 10-30 day cold sky calibration (Fig. 3.1-a) is being planned that involves a pitch manoeuvre of 80° that will be carried out over land in order to minimise loss of Poseidon-4 data over its primary target regions. This two point calibration system in addition to other potential sources of external calibration will improve overall accuracy.

Improved Performance: The expected improvement of the AMR-C with its predecessors in terms or reducing the bath delay (RD) drift is provided in Fig. 3.1-c.

Heritage: The design and inversion algorithms that deliver tri-channel brightness temperature to obtain total column water vapour correction for the radar altimeter are well understood at the lower frequencies. The AMR-C will provide basis for correcting the altimeter for the Wet Tropospheric delay.

5. Precise Orbit Determination and Attitude: DORIS/GNSS/LRA + Star Trackers

The Precise Orbit Determination (POD) package consists of three elements of heritage:

DORIS: will be embarked to provide the main component of data for on-board navigation, also used in the NRT processing. It also supplies the ultra stable oscillator that drives the Poseidon-4 precise retrievals and positional information allowing improved altimeter surface tracking improving coastal and inland water retrievals. The DORIS is procured with significant support from CNES.

GNSS: The heritage Sentinel-3b instrument enhanced to 12 channels is being embarked for use with GPS constellations.

LRA: The Laser Retro-reflector Array is planned to be procured by NASA-JPL and is used with global laser stations as an independent measure of delay used in the POD processing.

Star Trackers: Used within the on-board Attitude and Orbit Control System (AOCS) the 3 star trackers attitude information (or “pointing”) key to the Poseidon-4 SAR retrievals that are sensitive to platform "mis-pointing."

6. Radio Occultation with TriG

Recognising the interest in retrieving, from the occultation of GNSS satellites, temperature and pressure profiles the partner Agencies have conducted an initial assessment to determine if number of retrievals from a high elevation satellite in a drifting non sun-synchronous orbit are of use. The profile data as used for assimilation into Numerical Weather Prediction models.

The RD The Radio Occultation package is being developed by NASA-JPL based on TriG.

The main requirements are:
• to achieve the retrieval of about 1000 occultations per day.
• Provide NRT L1b and L2 products within 3 hours (90%).
• Measurement for ray path tangents up to 80km.
• Measurement with ray path tangents extending to 500km altitude.