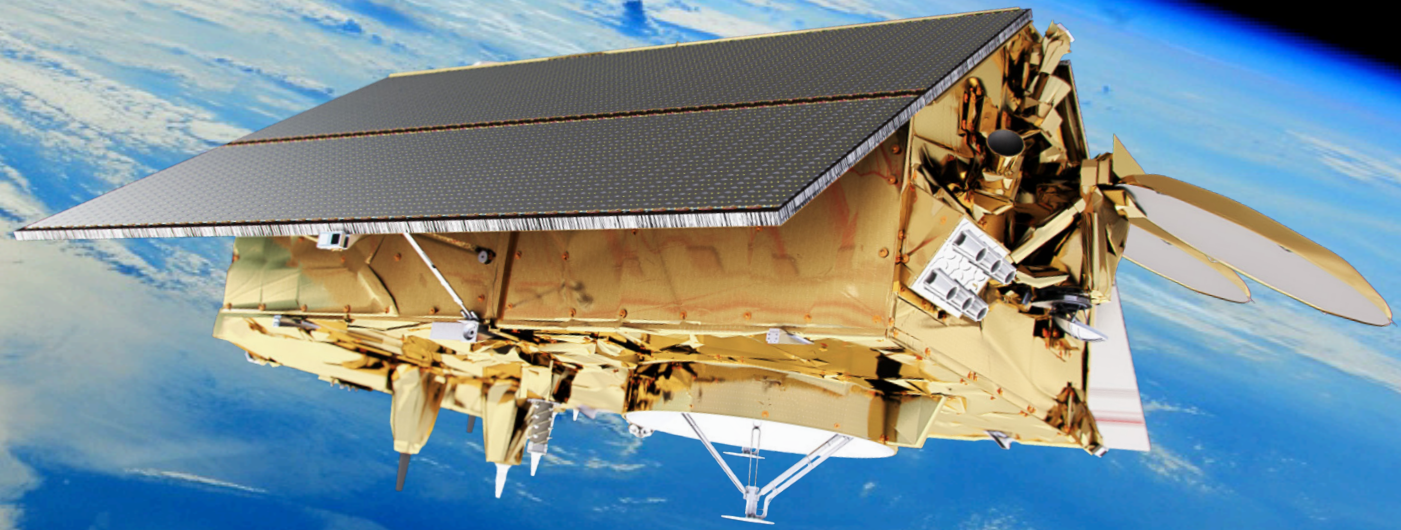


Sentinel-6/Jason-CS
News & developments

Pierrik Vuilleumier & Parag Vaze

ESA/ESTEC (NASA-JPL)

Programme status

- **Funding for two satellites**
  - ESA GSC-3 + EC MFF programmes already in place.
  - Entry into force of the EUMETSAT programme.
  - FY16 NASA budget approval (AMR-C, RO, LRA, Launcher).

- **Inter-agencies agreements**
  - Three parties/four partners MOU
    - Yet to be finalised text to be approved by ESA/NASA/NOAA/EUM.
    - MAG open points.

  - ESA/EUMETSAT Implementing arrangement
    - Fixed contribution to the Satellite A model.
    - About one third of the Satellite B model.

  - ESA/CNES cooperation agreement
    - Support agreement for Sentinel-6 (System, topography, POD).

Project status

- **Full space segment consortium under contract**
  - For the two Satellites A & B procured at the same time
- **Common GNSS POD receiver with Sentinels 123 CD**
  - Also tracking Galileo
- **Collaboration with Sentinel-3 CD for procuring DORIS**
  - Same key person at ESTEC for both projects
- **Anticipated manufacturing**
  - Structure metallic parts.
  - Honeycomb panels

  .
- **Upcoming Satellite CDR**
  - Review kick-off March 29th at ESTEC
  - Review collocation May 16th-18th

Project status (continued)

- **Level 1b and Level 2 GPP under contract**
  - Including associated mission performance simulator
  - Preliminary delivery to EUMETSAT for level 1b

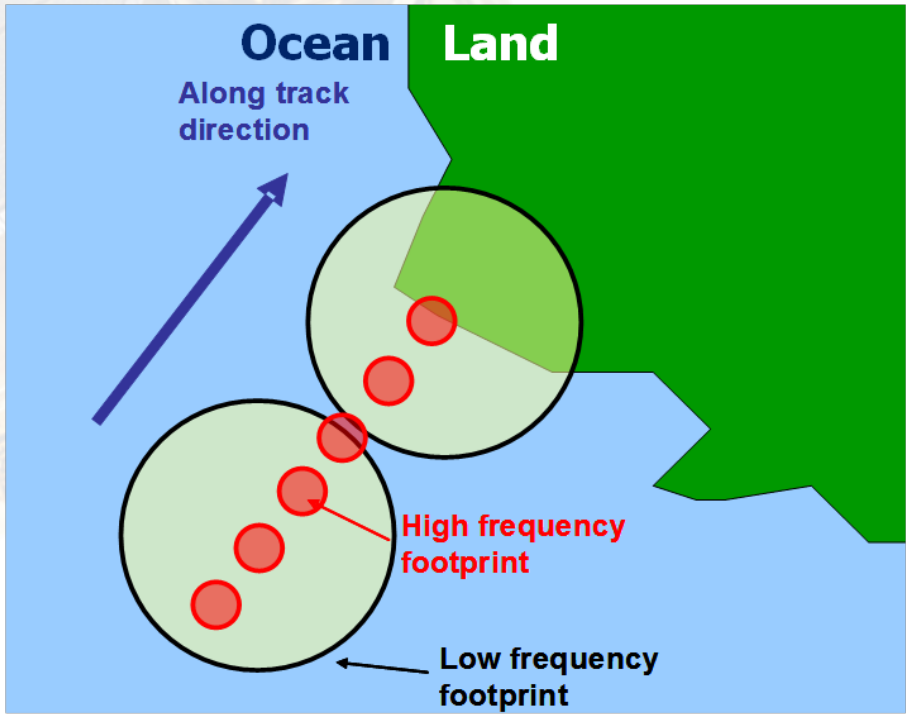
- **Launch date**
  - Agreed among the parties
  - November 2020 with two months of contingency
  - Satellite B model in 2025

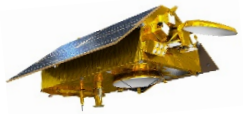
Mission improvements

- **Radiation monitor**
  - Engineering data for housekeeping
- **OLTC memory increase**
  - Lesson learned from Sentinel-3 commissioning
- **Improved USO crystal screening**
  - Jason-3 POD results demonstrate the advantage of low dose rate screening.
  - CNES and ESA are contributing to achieve that for Sentinel-6.
- **Altimeter and POD driven by same USO**
  - Traditional architecture with DORIS USO driving the altimeter.
  - Alignment with S3 to also drive the GNSS receiver with DORIS USO.
  - Easier error budgeting.
  - Capability to monitor the new USO against GPS system.

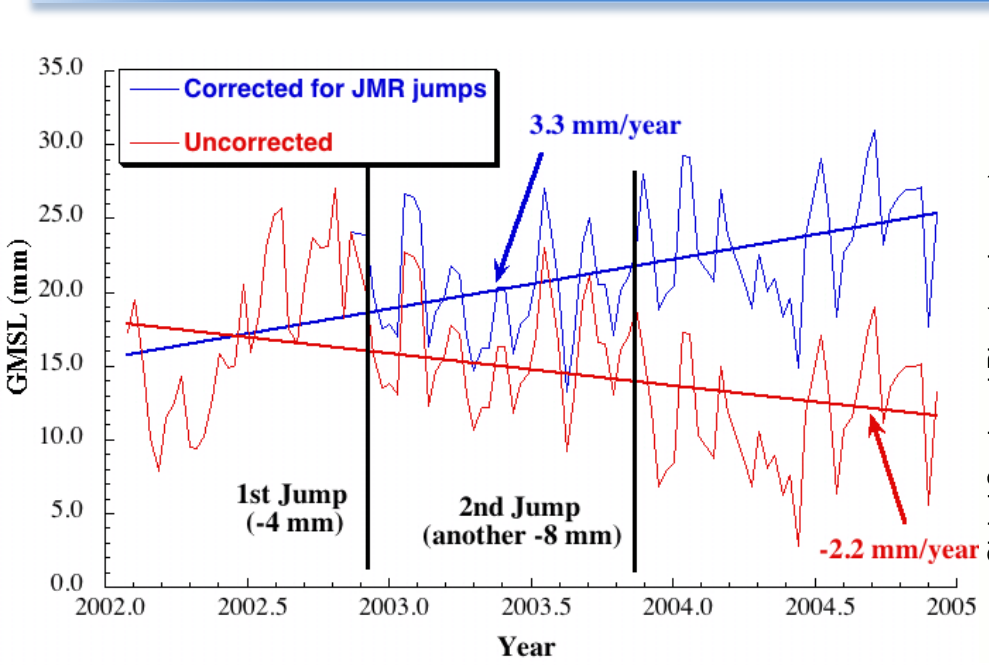
High frequency radiometer add-on

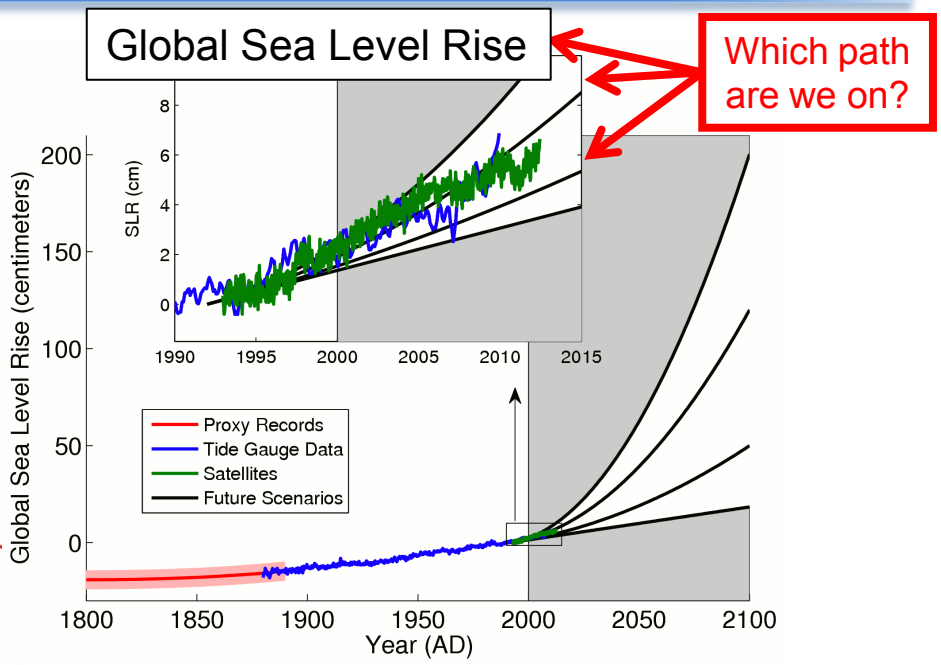
- **Three additional channels: 90GHz, 130GHz and 166GHz**
  - Experimental, non redundant
- **Same reflector**
  - Dedicated feed
  - Offset footprint
- **Independent electronics**
  - Dedicated interfaces
- **Not part of the mission products**
  - At least at first
- **Opportunity for new science**





AMR-C Enhanced Measurement Stability

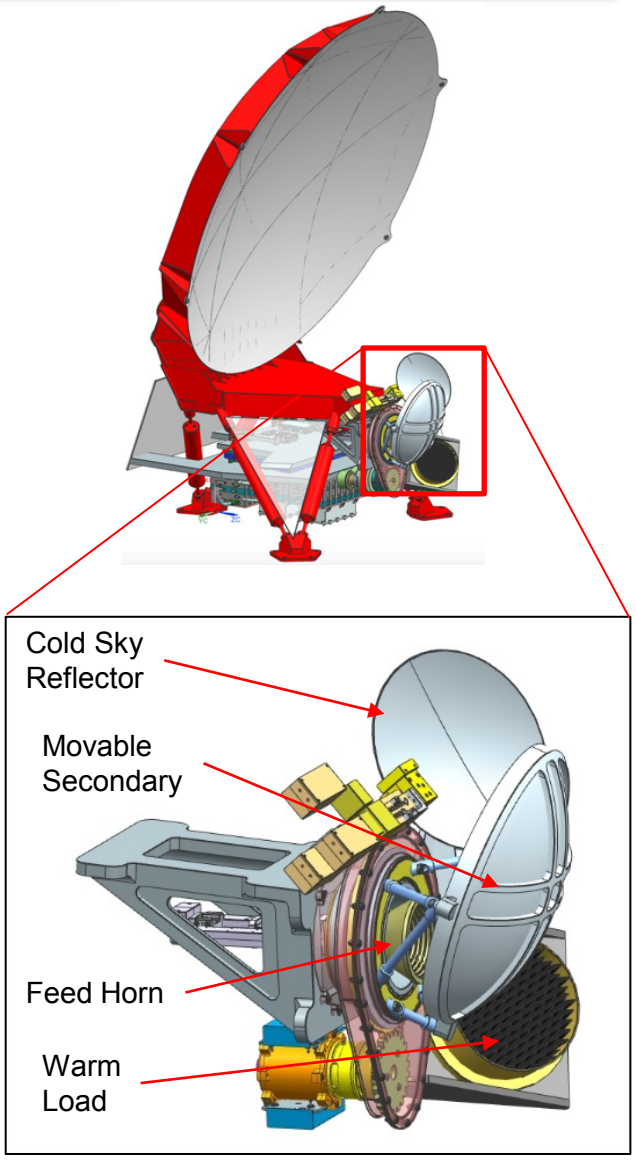




- Radiometer drifts & jumps directly affect globally averaged sea level observations, leading to uncertainty many times greater than the trend being measured
- Based upon OSTST recommendations, a specific requirement has been established to maintain the stability of the global mean sea level measurements (in the ALT-NTC Level 2 products) to levels established to within 1 mm (standard error) averaged over any one year period.

AMR-C: Supplemental Calibration System (SCS) (1/2)

- Project studies concluded that an in-flight Supplemental Calibration Subsystem (SCS) for the AMR would be the only way to confidently meet this requirement
- SCS applies a proven technique using of a periodic, 2-point radiometric calibration by redirecting the main beam to cold & warm calibration targets using a scanning scan mirror
- Build approach is to design a high reliability, low risk system minimizing potential single-point failure elements
- After a deep engineering effort: All credible designs involved mechanism with residual potential single fault elements: gears and bearing
  - Gear and bearing design is straightforward and has excellent reliability record for many high value flight applications
  - Project is applying maximum risk mitigations (e.g., robust design margins, strict adherence to critical manufacturing processes, life-testing, telemetering of key functional parameters, graceful degradation, etc…)
- With all these efforts, a very small likelihood (but non-zero) risk for in flight failure exists



AMR-C: Supplemental Calibration System (SCS) (2/2)

- The project has developed (at significant cost), a robust, low risk design maximizing the use of high reliability and heritage elements.
- The SCS provides a significant enhancement in the measurement performance and responds to a long standing recommendation from the OSTST
- The project believes the science benefits outweigh the low likelihood, residual risk for a potential inflight failure of the AMR-C
- NASA/JPL engineering authorities have reviewed the current design and will apply the proper oversight and scrutiny of the on-going engineering development and test process prior to flight
- OSTST endorsement of the science utility of this enhancement outweighing the residual risk is a key aspect for continuing the development and flight of this important capability

AMR-C: Supplemental Calibration System (SCS)

Backup

Development of Drift Requirement: A History

- 2009: OSTST recommends project to study feasibility of stability requirement:
  - Pages 3 & 4 of 2009 Meeting report: http://www.aviso.altimetry.fr/fileadmin/documents/OSTST/2009/OSTST_meeting_report_final.pdf
- 2010: OSTST recommends that future missions adopt a system climate stability requirement:
  - Pages 6 & 7 of 2010 Report: http://www.aviso.altimetry.fr/fileadmin/documents/OSTST/2010/oral/final%20report/10_lisbon_OSTST_meeting_report.pdf
- 2011: Complete implementation of calibrator on Jason-3 was outside the project resources, so OSTST recommended cold sky look on Jason-3 which improves ability to detect and correct drift on-orbit
  - Pages 3 & 4 of 2011 report
- 2011: Calibration targets are under consideration for Jason-CS, OSTST maintains desire for stability requirement
  - R. Francis plenary talk
  - Page 8: http://www.aviso.altimetry.fr/fileadmin/documents/OSTST/2011/OSTST_2011_SanDiego_final_report.pdf
- 2013: Long-term stability requirement adopted for Jason-CS:
  - Page 7: http://www.aviso.altimetry.fr/fileadmin/documents/OSTST/2013/oral/OSTST_2013_Meeting_Report.pdf
  - Radiometer will include calibrator to meet stability requirement
- 2014: OSTST expresses appreciation for inclusion of long-term stability implementation on Jason-CS:
  - page 4: http://www.aviso.altimetry.fr/fileadmin/documents/OSTST/2014/OSTST_2014_Meeting_Report.pdf