Jason-CS
or,
Sentinel-6 / Jason-CS

Richard Francis
ESA-ESTEC

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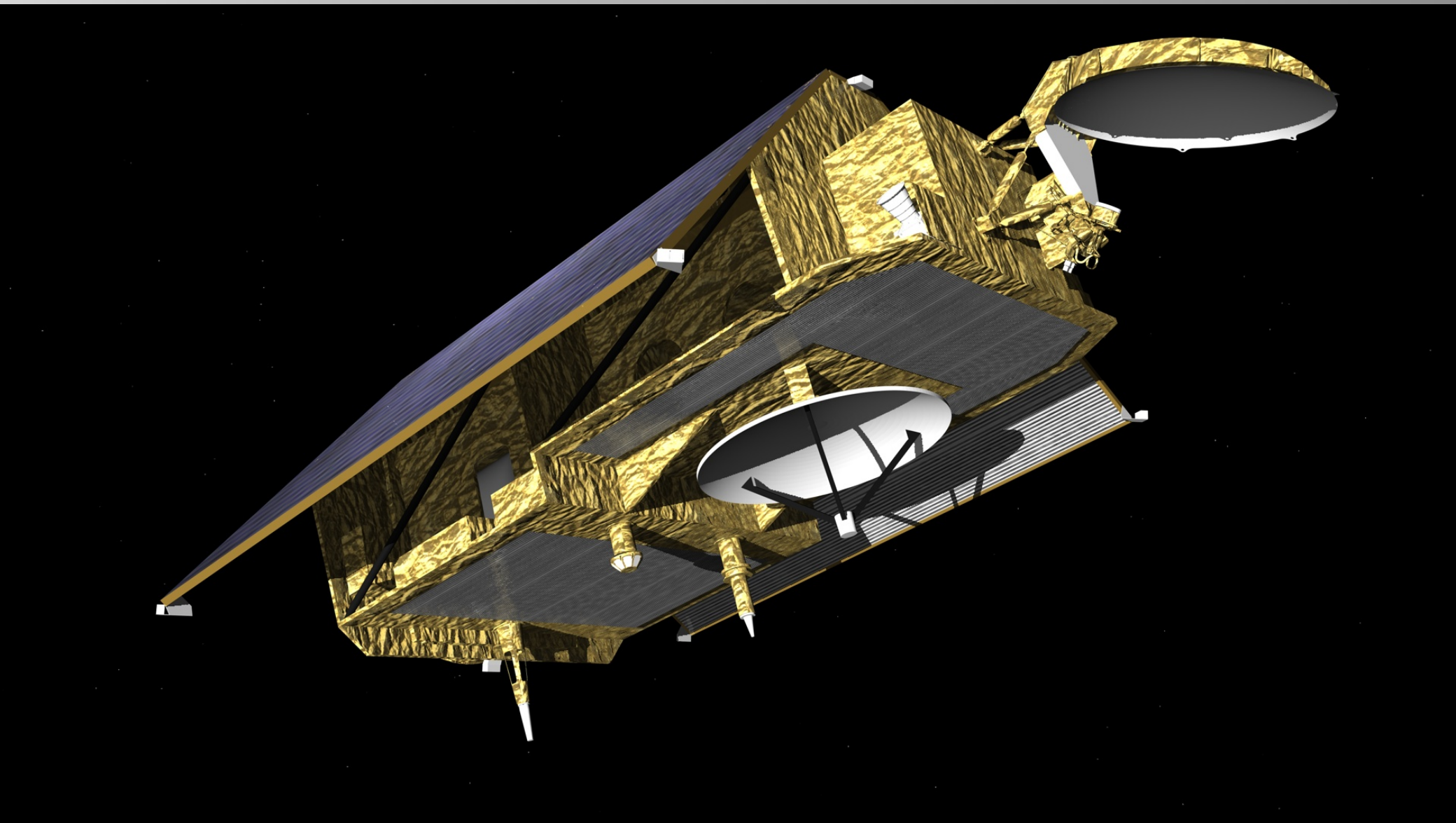
JASON CS
CONTINUITY OF SERVICE

Jason-CS (2012)



One year ago ...

- Poseidon-4 altimeter
  - SAR+LRM or Interleaved mode?
- Microwave radiometer
  - various options
- GNSS Receiver
  - various options
- DORIS Receiver
- Laser Retroreflector

Jason-CS in October 2013

- Since the last OSTST there has been progress in many areas:
  - funding secured for Phase B2, which has been kicked off
  - decisions on many critical payload issues
  - bread-boarding of critical technology
  - evolution of the space-debris mitigation scenario
  - solutions to obsolescence of parts and equipment
  - agreement on the approach to radiation hardness
  - establishment and expansion of the industrial team
  - major progress on high-level documentation

2012 OSTST Outcome (1)

- Poseidon-4 operating mode (SARM *vs* LRM)
  - OSTST strongly recommends Jason-CS altimeter shall deliver LRM and SARM over all oceans, seamlessly and simultaneously (interleaved mode).
  - LRM (at least) and SARM (if feasible) shall be delivered with latency similar to previous missions.
  - Land and inland water applications shall be enabled to the fullest extent possible under the constraint that sea level measurement must be the primary mission.

Payload: Poseidon-4 (1)

- Poseidon-4 introduces *digital architecture*, a major departure from previous altimeters:
  - full-bandwidth digital chirp, direct up-conversion to transmit frequency;
  - direct down-conversion and digitisation of incoming signal;
  - full pulse-compression in the digital domain – no more full de-ramp;
  - high technology demand (eg >20000 point FFT's in <100 us)
- Result: high stability; better calibration

Payload: Poseidon-4 (2)

- Interleaved mode (open burst) is now the baseline (simultaneous SARM and LRM).
- Includes partial on-board processing (range migration correction) to enable reduction in range window by 2 – reversible on ground.
- permanent SAR-raw, SAR-RMC and LRM provided on different channels, allowing on-board selection for recording.

System: Poseidon-4 data

- All data generated on board recorded in separate file-stores.
- Downlink once per orbit to EUMETSAT and NOAA stations.
- Downlink capacity (150 Mbps) is the bottleneck to data throughput.
- This limits SARM data recording to ocean areas (including coastal) only.
- LRM data everywhere, plus multi-orbit buffer to ensure data availability.

2012 OSTST Outcome (2)

- Radiometer
  - Main improvement is instrument enhancements for long-term stability, eliminate dependence on ancillary data and reduce latency of final product.
  - Jason-CS will benefit significantly from a 3-frequency radiometer.
  - Most significant benefit from the embarkation of a second radiometer would be for it to operate at high frequencies to resolve km-scale water vapour, for coastal altimetry and inland hydrology.

Recommendation 1

- Main improvement is instrument enhancements for long-term stability, eliminate dependence on ancillary data and reduce latency of final product.
  - This recommendation is linked to the new calibrator system included in the AMR-C.
  - This enables views to a hot target and cold space with the main measurement system (no switches).
- Implemented in baseline Jason-CS

Recommendation 2

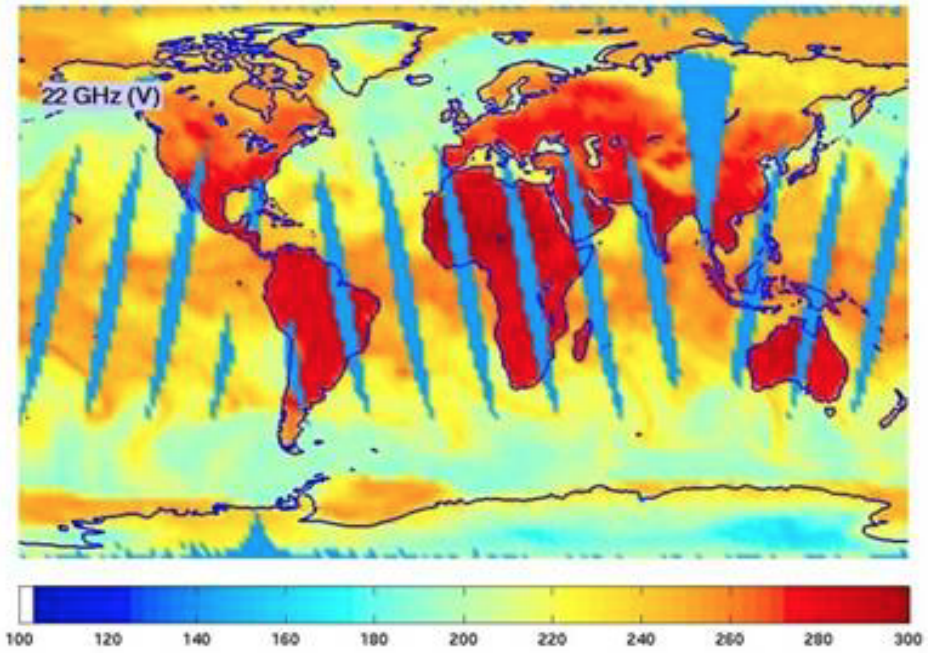
- Jason-CS will benefit significantly from a 3-frequency radiometer.
  - Since the 2012 OSTST the European 2-frequency radiometer has been removed from the baseline payload.
  - Only the 3-frequency AMR-C radiometer has been retained.
- Implemented in baseline Jason-CS

Recommendation 3

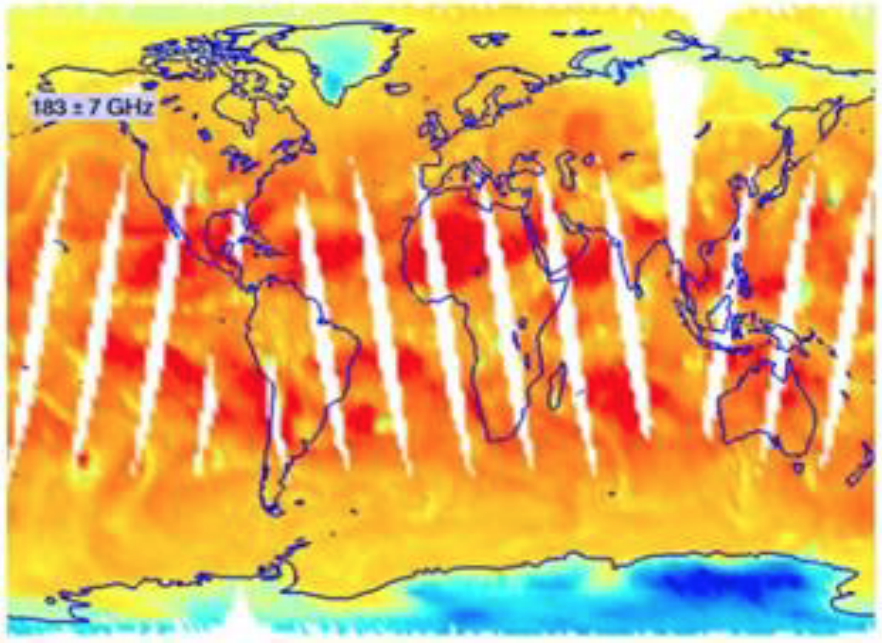
- Most significant benefit from the embarkation of a second radiometer would be for it to operate at high frequencies to resolve km-scale water vapour, for coastal altimetry and inland hydrology.
  - A new radiometer, called High-Resolution Microwave Radiometer (HRMR) is included, as an option, in the payload.
  - 2 parallel Phase A sub-contracts kicked off with one to be selected for Phase B, as part of the overall Jason-CS contract.
  - No details yet, until down-selection in Feb 2014 …

Water Vapour Signal

22 GHz



183 GHz



data from F16 SSMIS

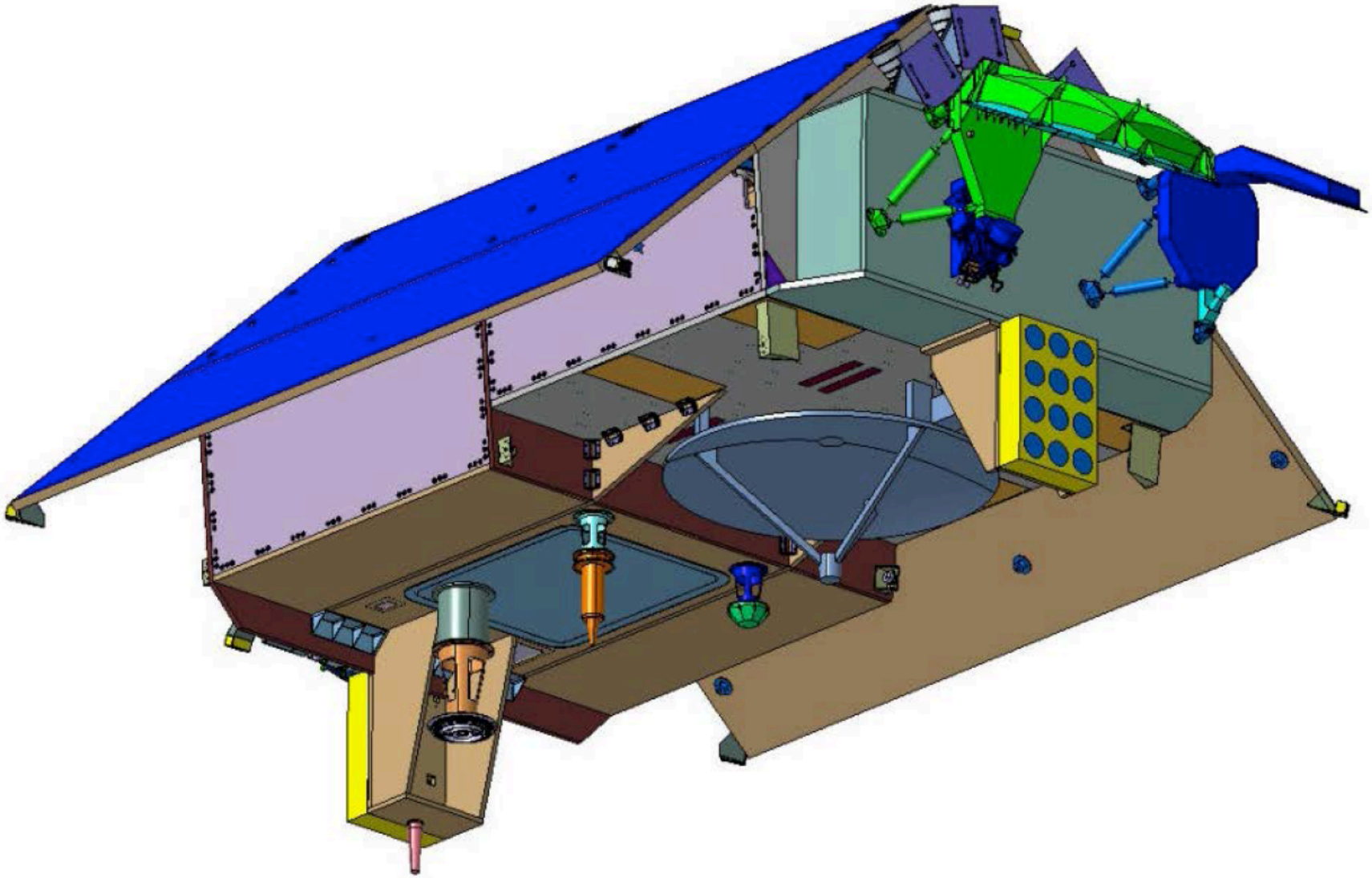
EUMETSAT Requirements

- Jason-CS shall embark a GNSS receiver able to measure radio-occultation (RO) of GNSS satellites.
  - Originally from EUMETSAT member states, this requirement has been endorsed by NOAA.

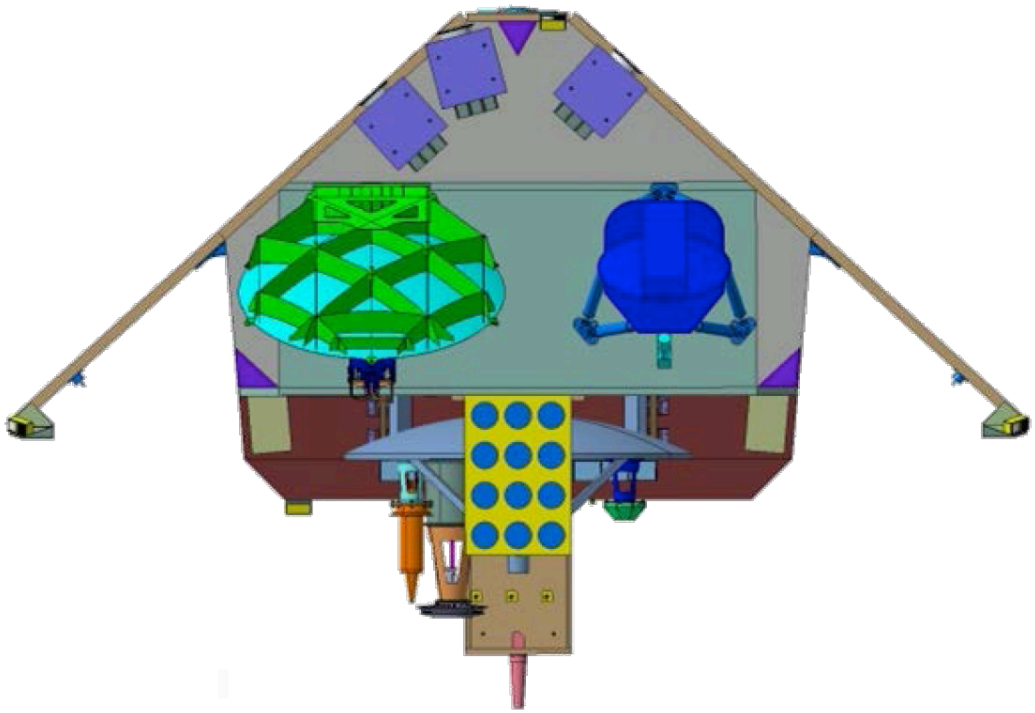
GNSS on Jason-CS

- GNSS Receiver with Sentinel-3B heritage, extended to 12 channels. Nominally dedicated to POD.
  - also DORIS and Laser Retroreflector array for POD.
- TriG Receiver from JPL, dedicated to Radio-Occultation, with fore and aft antennas.
  - two different RO antenna configurations under investigation.

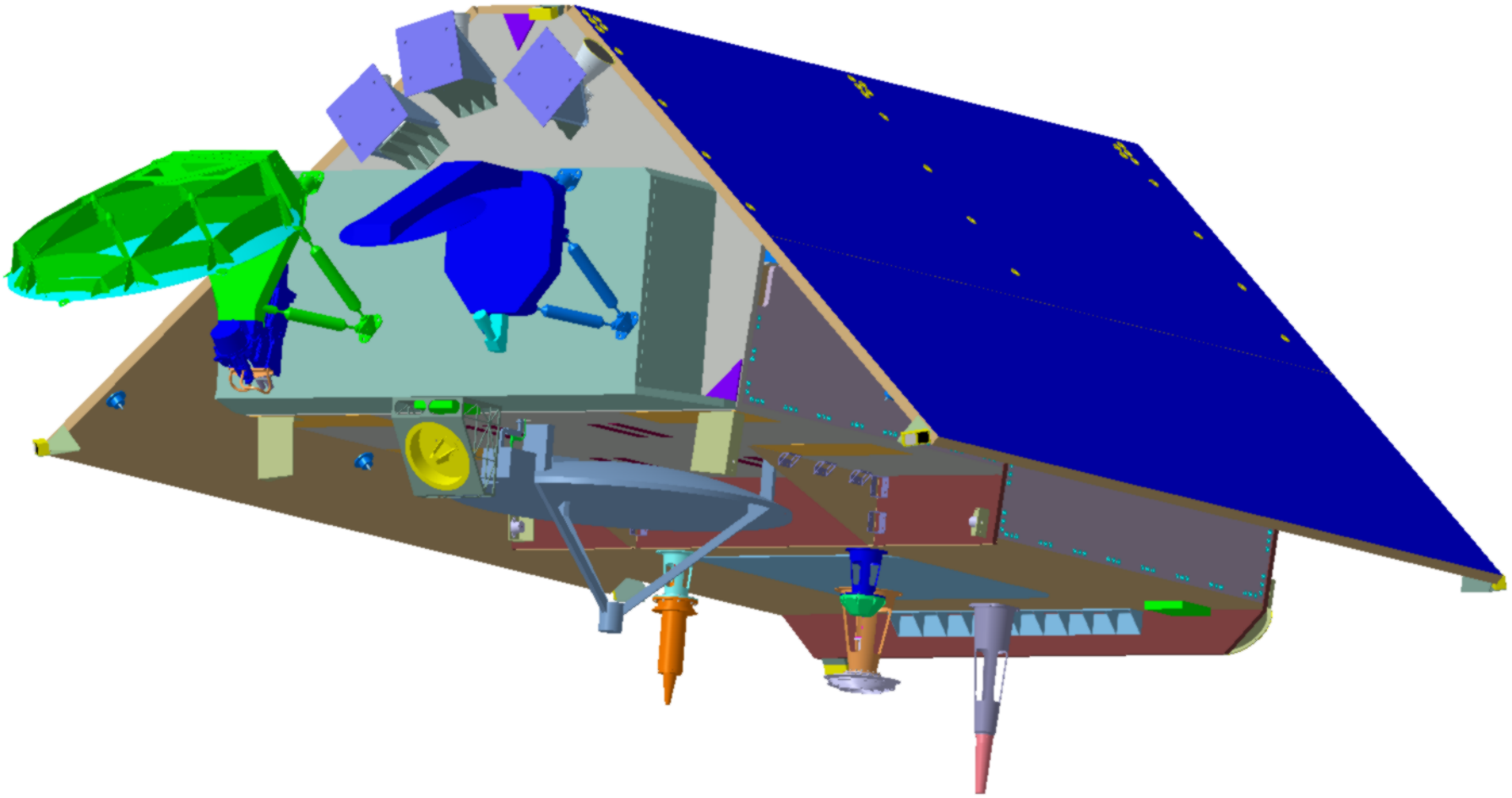
Configuration (1)



Configuration (2)



Configuration (3)



Funding and Approval

- ESA:
  - Phase B2 at C-MIN'12, with full approval in 2014
- EUMETSAT:
  - Preliminary Programme approved Jun 2012
  - Full Programme entry into force expected mid-2015
- EU:
  - Included in "Long-Term Scenario", funded under Multiannual Financial Framework 2014-2020
- NOAA:
  - To be included in FY'15 President's Request, Feb 2014

Outlook

- No major technical problem.
- Securing substantial funding from 4 agencies is difficult:
  - 2 are rather secure, but 2 have yet to obtain approval
  - strong user support could be very helpful!
- Funding is driving the schedule:
  - Development phase likely to be delayed to mid-2015
  - Launch no earlier than 2020.