Jason-CS

Richard Francis
CryoSat / Jason-CS Project Manager
ESA-ESTEC

Context

- Jason-CS is second component of the "hybrid" solution, after Jason-3
- Spacecraft to be derived from CryoSat
- Payload to be based on heritage of European missions, *or*, with US-provided instruments with heritage from Jason-3
- Launch in 2017

Status

- Phase B1 study underway, extended to end 2012
- Approval for implementation of ESA programme planned for end-2012
- Approval for partner agencies expected during 2013 and 2014

Payload Composition (1)

- Poseidon-4 Radar Altimeter
  - Heritage from CryoSat and Sentinel-3 (including SAR mode)
  - Technology improvements (digital hardware)
- Microwave Radiometer (2 options)
  - Improved AMR from Jason-2/3: “Climate Quality”
  - European radiometer derived from Sentinel-3 (3-frequency under investigation)
- Laser Reflector (2 options)
  - LRA from Jason-2/3
  - Russian LRR, heritage from CryoSat

Payload Composition (2)

- GNSS Receiver (2 options)
  - JPL TriG
  - Sentinel-3b GNSS Receiver, extended to 12 channels
  - Radio-Occultation option under investigation
- DORIS Receiver
  - DGXXS model (improved DGXX, following CryoSat-2 experience), heritage Jason-3
- Possible passenger: micro-accelerometer
  - To support neutral air density measurement for space weather applications

Poseidon-4 Modes

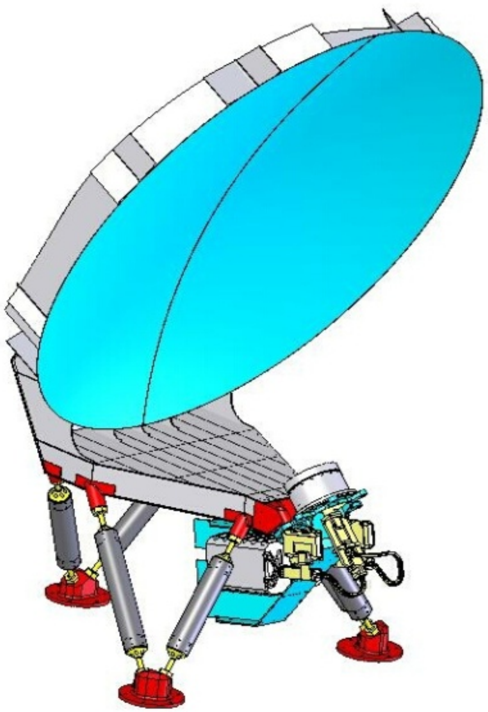
- LRM – classical pulse-width limited mode
- SAR mode – closed-burst operation, similar to CryoSat-2 and Sentinel-3
  - Height noise reduction by a factor 2 compared to LRM
- Interleaved mode under investigation – open burst operation providing LRM and SAR operation *simultaneously*
- On-board data processing required for global interleaved mode

Poseidon-4 Technology

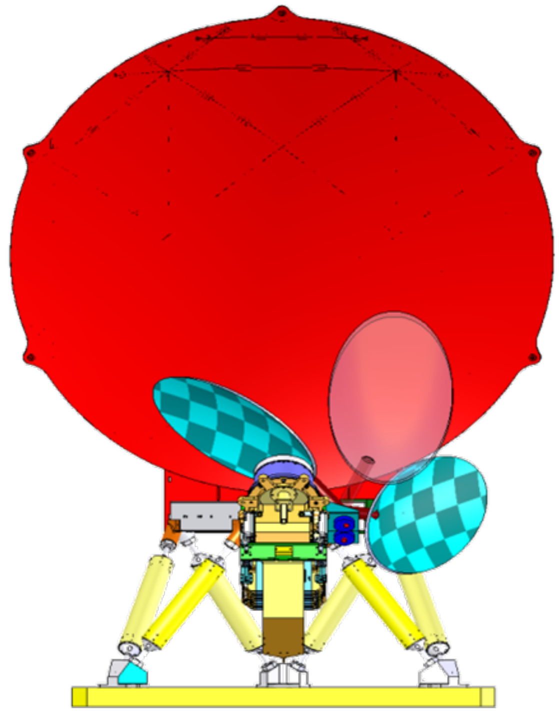
- Direct chirp up and down conversion
- Matched filtering instead of de-ramp
- Consequences:
  - Greater waveform fidelity
  - Reduced need for in-flight calibration
  - Greater reproducibility of manufacture (between redundancies and between missions)

Radiometer (AMR-C)

- Jason-CS Studies underway at NASA-JPL
- Enhanced version of Jason-3 Advanced Microwave Radiometer
- Objective of providing Climate Quality calibration stability using:
  - High stability in-flight calibration targets
  - Improved thermal stability
  - Improved ground processing system



Jason-2/3 AMR



Notional concept of AMR with in-flight calibrator

Radiometer (European)

- Derived from Sentinel-3 (heritage ERS-1, ERS-2, Envisat)
- Thermal design optimised to minimise variation over lifetime
- Addition of 3rd frequency (18 GHz) under investigation

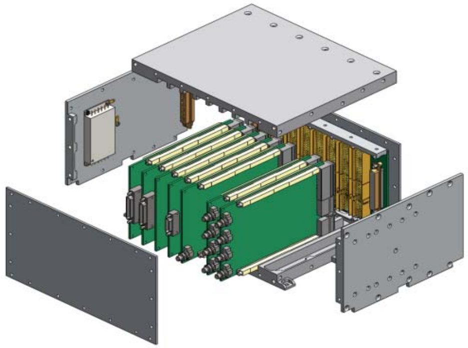
TriG Receiver (1)

- TriG - A GNSS Precise Orbit and Radio Occultation Space Receiver
- Orbit Determination:
  - 1 – 10 cm (3D) post processed POD
  - 1 – 3 m real-time on board navigation
- Signals In View:
  - GPS L1(C/A), L2(C), L5, Galileo E1, E5a, GLONASS (CDMA)

First Galileo Launch

TriG Receiver (2)

- Redesigned Radio Occultations (RO) Processing:
  - to extract highly dynamic, low amplitude signals as they cut though the atmosphere
- Increased Reliability



- Highly Configurable
- Software and Firmware Upgradable In flight
- Initial development funded by NASA

European GNSS Receiver

- GPS and Galileo constellations
- Signal types optimised for ca. 2020
- 12 channels (at least)
- Radio Occultation capability under investigation

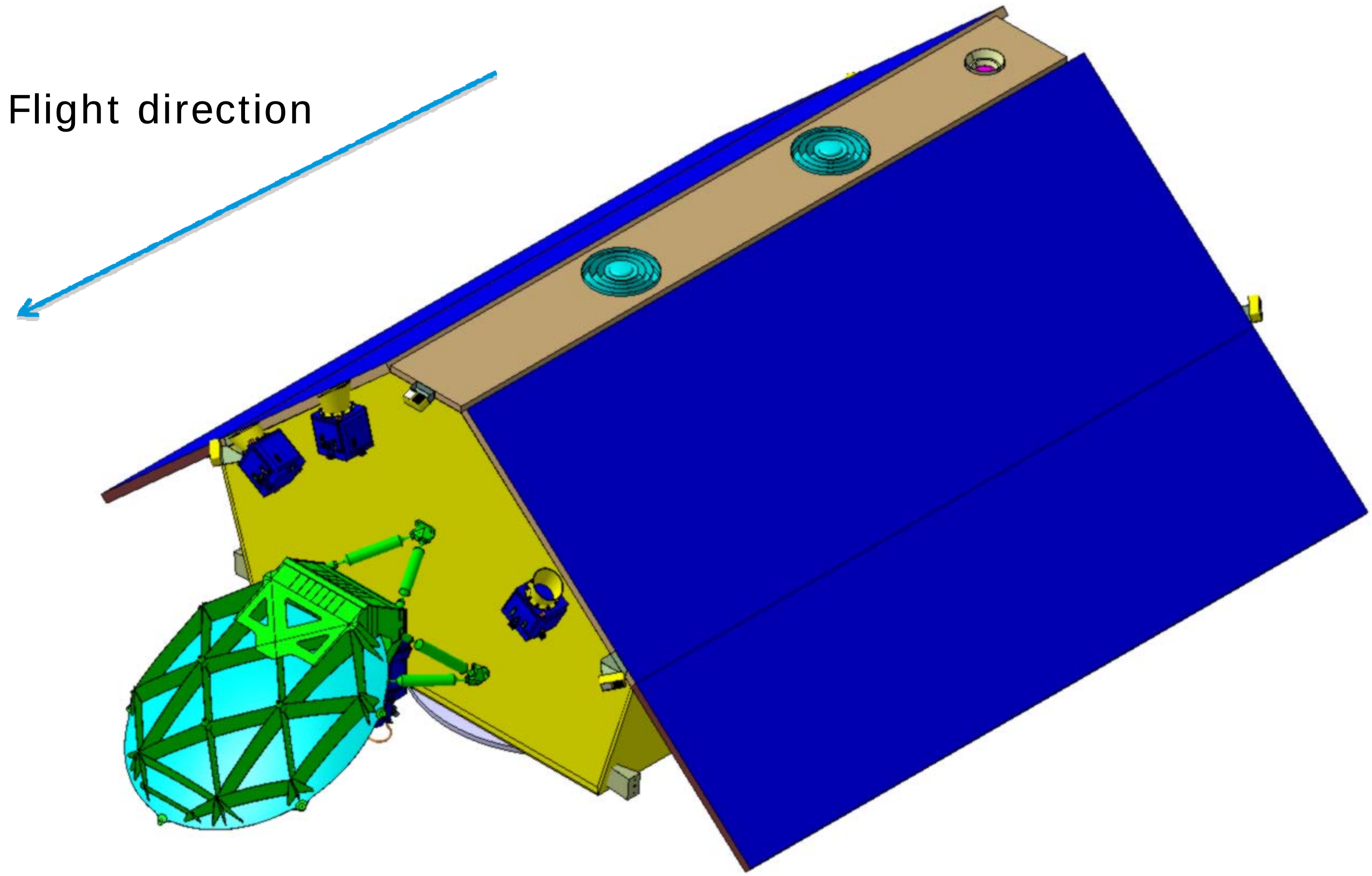
Satellite Design Constraints

- Orbit:
  - classical Topex/Poseidon orbit
- Lifetime
  - Increased from 3 years to 5 years (+2 years consumables)
- Operations concept
  - Near-real time mission
  - High data availabilty
- Compatibility with US & Vega launch vehicles

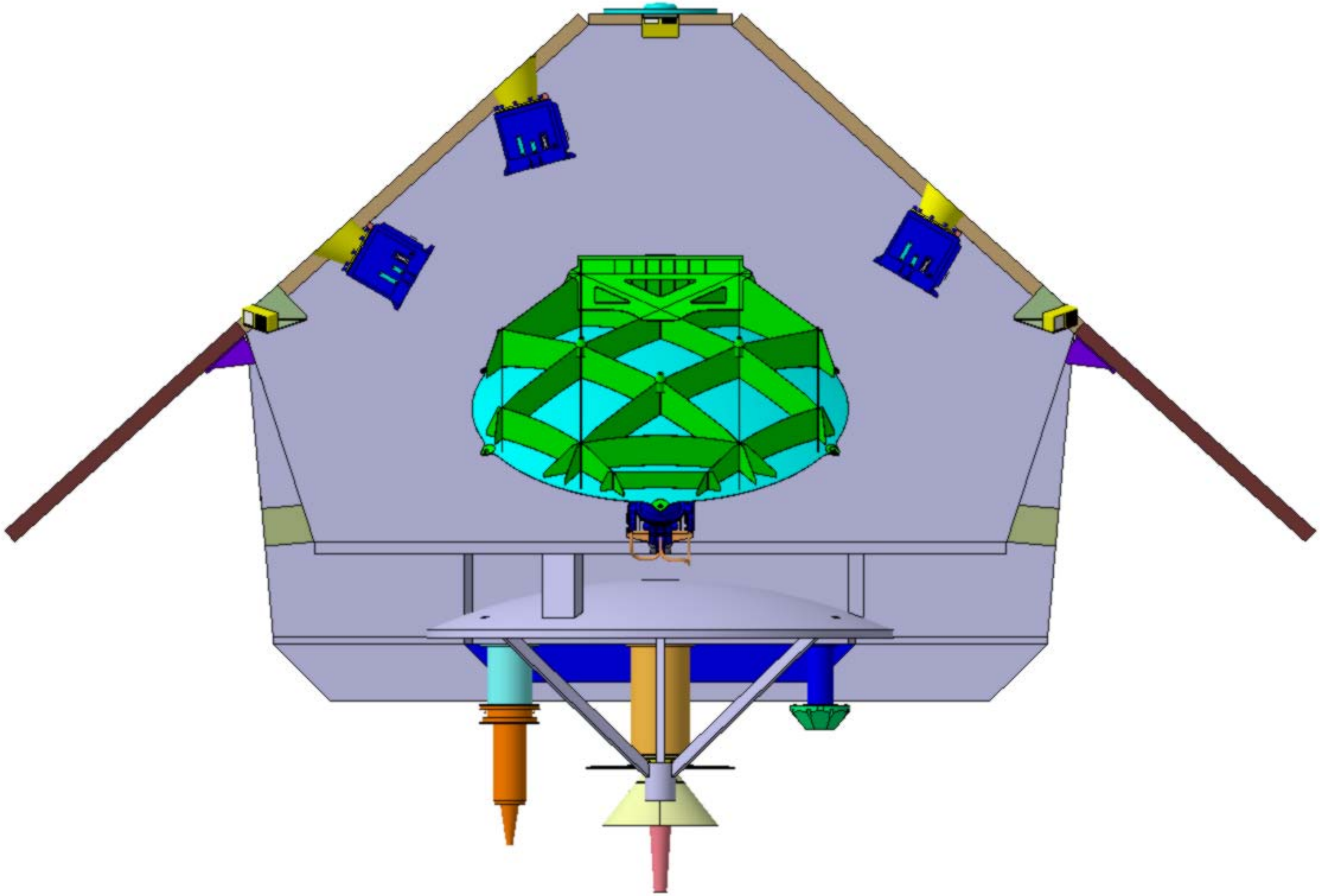
Orbit

- Attitude Control
  - Some changes in sensors and actuators needed
- Radiation
  - Higher radiation environment impacts star tracker selection
  - Some local shielding needed
- Space debris code of conduct
  - De-orbiting within 25 years required

Spacecraft Design

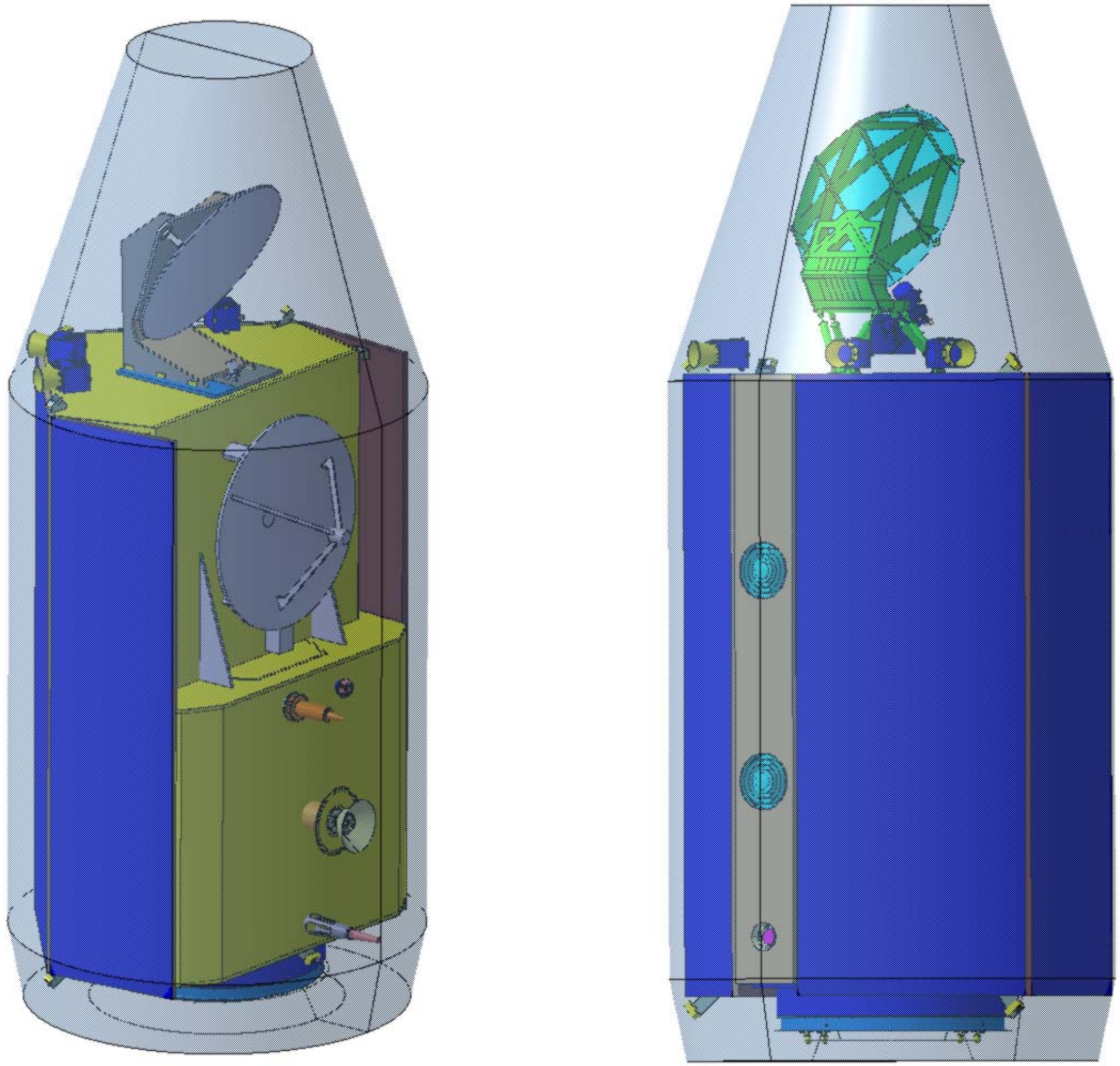


Constant Cross-section



Area/Mass = 0.003 m^2/kg (or 385 kg/m^2)

Vega Compatibility

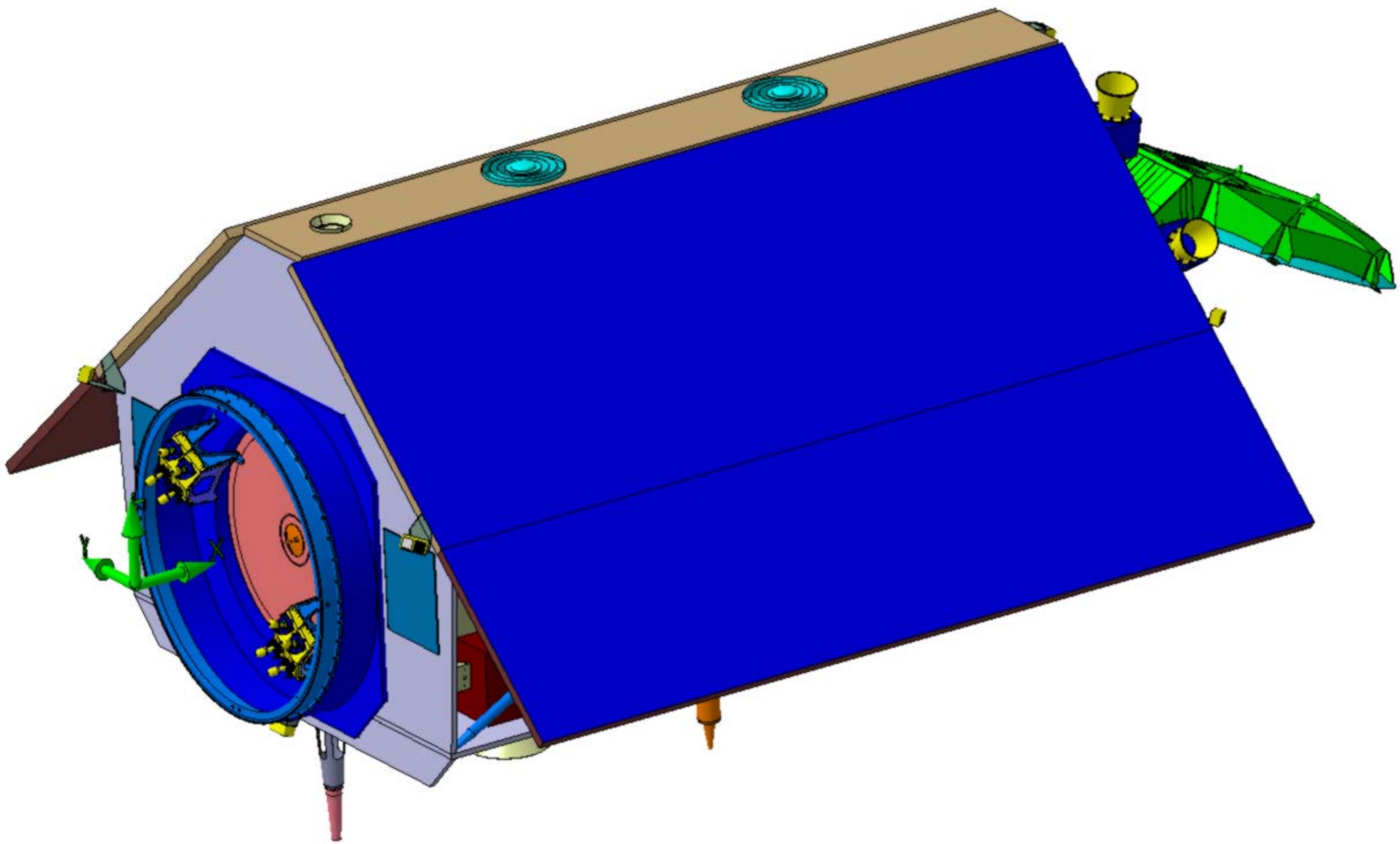


European Space Agency

Orbit

- Attitude Control
  - Some changes in sensors and actuators needed
- Radiation
  - Higher radiation environment impacts star tracker selection
  - Some local shielding needed
- Space debris code of conduct
  - De-orbiting within 25 years required

Propulsion



Launcher

- Provision by US
- Medium-class vehicle, such as:
  - Taurus II
  - Falcon-9
- Compatibility with Vega maintained

Ground Segment

- Operations (command and control, science data processing) at EUMETSAT
- Science data processing also at NOAA
- Data downlink to European and US stations
  - Full data set dumped to each station, providing autonomy and redundancy
  - Near real time service provided by European and US stations in complementary mode