DORIS SYSTEM NEWS

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DORIS MISSIONS

Today 5 satellites contribute to IDS

- SARAL (CNES/ISRO): 800km, 98.5° — February 2013 → 2018 (DGXX+LR)
- HY2-A (CNSA, NSOAS): 960km, 99° — August 2011 → (DGXX+LRA+GPS)
- CRYOSAT-2 (ESA): 717 km, 92° — April 2010 → end 2017 (DGXX + LRA)
- JASON2 (NASA/CNES): 1336 km, 66° — June 2008 → 2017 (DGXX+LRA+GPS)
- SPOT5 (CNES): 830 km, 98° — May 2002 → October 2015 (DGM)

  ➔ on a lower orbit (-2.5 km) since April 2015 for the take-5 mission , end of Doris data : end October 2015

FUTURE MISSIONS

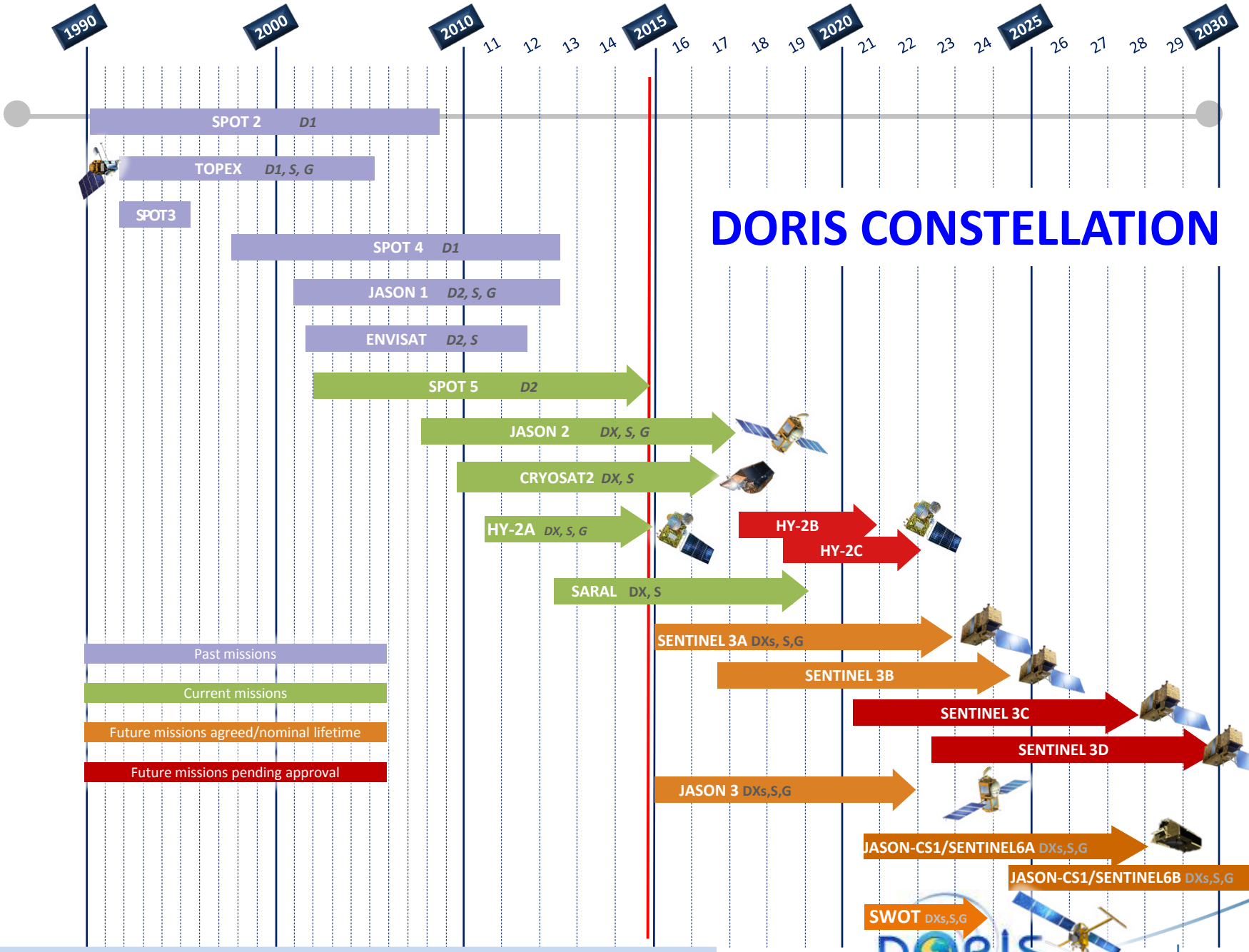
- 11 DORIS instruments have contributed to IDS since 1990

- In a near Future:
  - 2 are ready for launch:
    - Sentinel3A (Dec. 2015),
    - Jason3 (Dec. 2015)
  - 1 is in Assembling Intregration Test (AIT): Sentinel 3B (June 2017)
  - 3 are ordered for post 2020:
    - JasonCS1/ Sentinel6A,
    - JasonCS2/Sentinel6B,
    - SWOT
  - and few are in preparation …

NEXT MISSIONS

- Missions Sentinel3C&D
  - Continuity of the Sentinel3 mission
  - Recurrent satellites with Sentinel3A&B
  - Mission decided, negociation on going
- Mission GRASP (4 geodetic techniques: GNSS, SLR, DORIS, VLBI)
  - NASA/CNES cooperation (phase 0 only)
- Chinese Missions : HY2-B and C
  - Contact to order 2 DORIS instruments (need for 2017!)

DORIS CONSTELLATION



On board instruments:

D1, D2, DX, DXs: DORIS/versions, **S**:SLR, **G**:GNSS

FOURTH GENERATION BEACON B4G

- Designed to be operational up to 2030
  - New electronic (with up to-date components)
  - Better masks clearance expected thanks to longer distance between beacon and antenna (up to 50 m)
  - Already integrated in existing system

- Schedule :
  - Manufacturers offers received. Negotiations on going.
  - Final choice by the end of 2015
  - Kick off of development is planned for early 2016
  - First production units by the end of 2017

RADIO FREQUENCY CHARACTERIZATION OF ALCATEL DORIS GROUND ANTENNA

- **Objective** :
  - Define the phase center and the dispersion of ALCATEL Antennas,
  - determine the impact on the phase law.

- **Five Alcatel ground antenna have been characterized at CNES compact antenna test range (CATR).**
  - **Ongoing results analysis, report in progress**
  - Data still have to be studied to determine the impact on the phase laws.

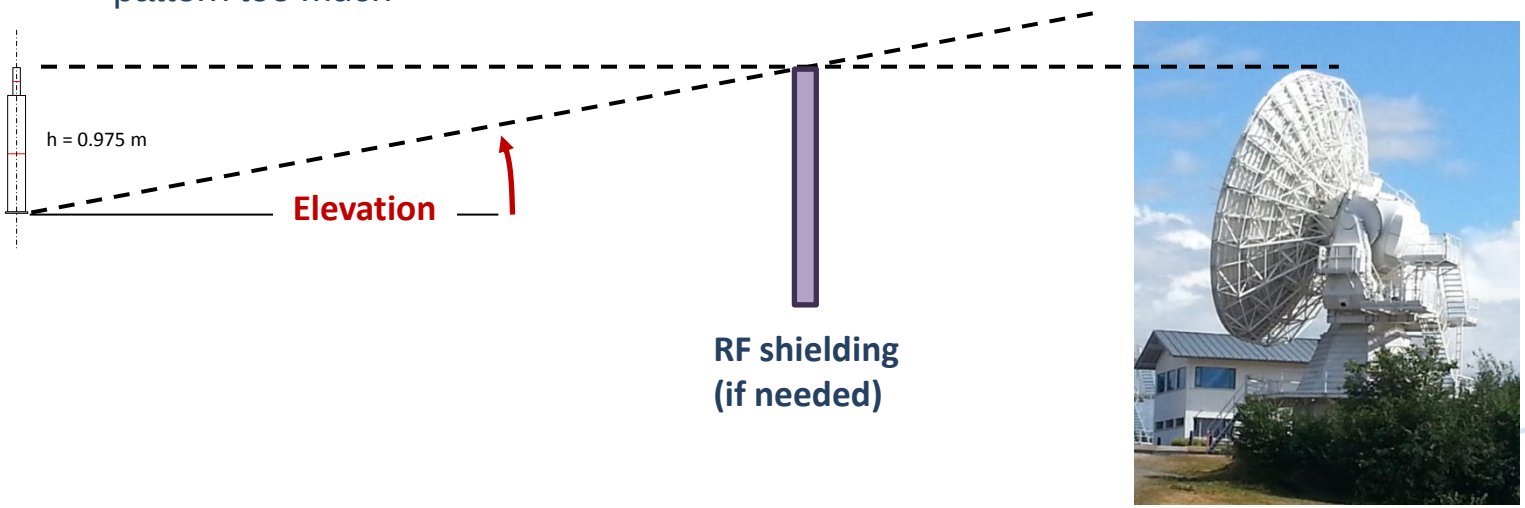
Alcatel Antenna

DORIS / VLBI COMPATIBILITY

CNES is working on the subject to improve the installation recommendations of the DORIS beacon on a VLBI site.

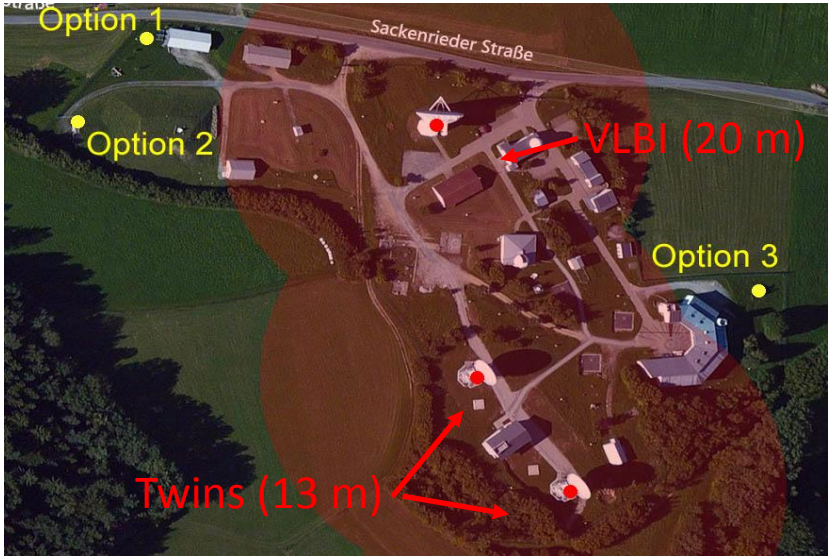
A best fitting installation of the DORIS beacon with regards to the site topography :

- as far as possible from the VLBI antennas
- as high as possible from the VLBI
  - The radiated emission is lower for low elevation
  - There should be less obstacles reflecting or diffracting the DORIS signals
  - The use of an RF shielding (metallic plate and absorber) would not obstruct the DORIS emission pattern too much



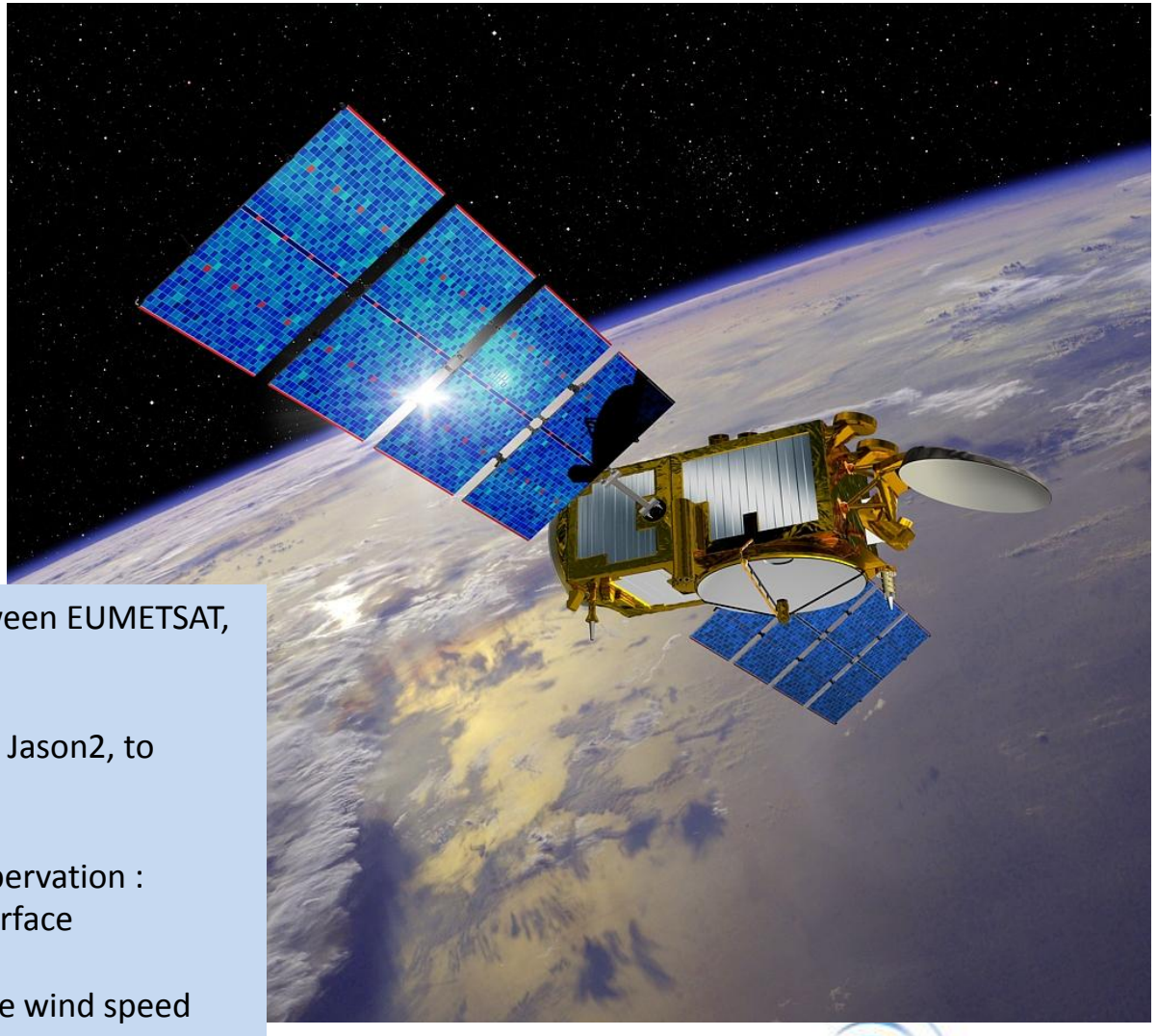
DORIS / VLBI COMPATIBILITY - ON GOING TESTS IN WETTZELL

- 3 VLBI antennas in Wettzell , small area ➔ not easy to find a good location for DORIS that meets requirements of the 2 techniques.
- Characterization of several positions (3 options) of the DORIS beacon.
- Test of natural barriers and /or radio frequency blockers to attenuate DORIS signal.
- Test to be continued in close collaboration CNES & Wettzell teams: study absorber material and check on a long period (several weeks) to assess good performance of both system.



BACK UP SLIDES

JASON3



International Cooperation between EUMETSAT, NOAA, NASA/JPL and CNES

Mission strongly recurrent with Jason2, to ensure continuity of service

Altimetry mission for oceans obervation :

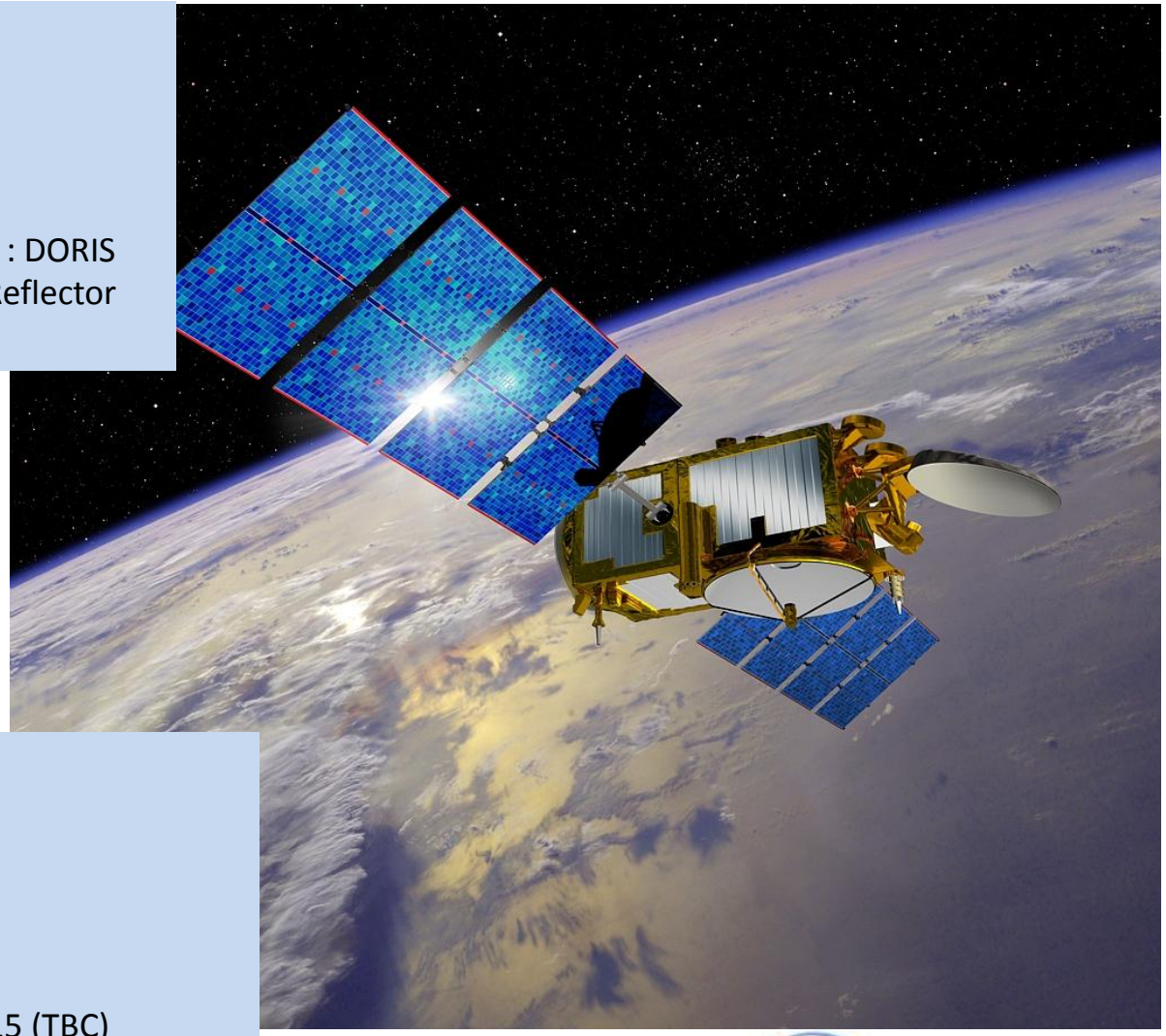
- Measurement of the sea surface topography
- Measurement of the surface wind speed
- Mean wave height

JASON3

Mini satellite PROTEUS

Payload :

- Radar Altimeter Poseidon 3B
- Microwave Radiometer AMR
- 3 systems of precise orbitography : DORIS (DGXX-S generation), GPS, Laser Reflector LRA

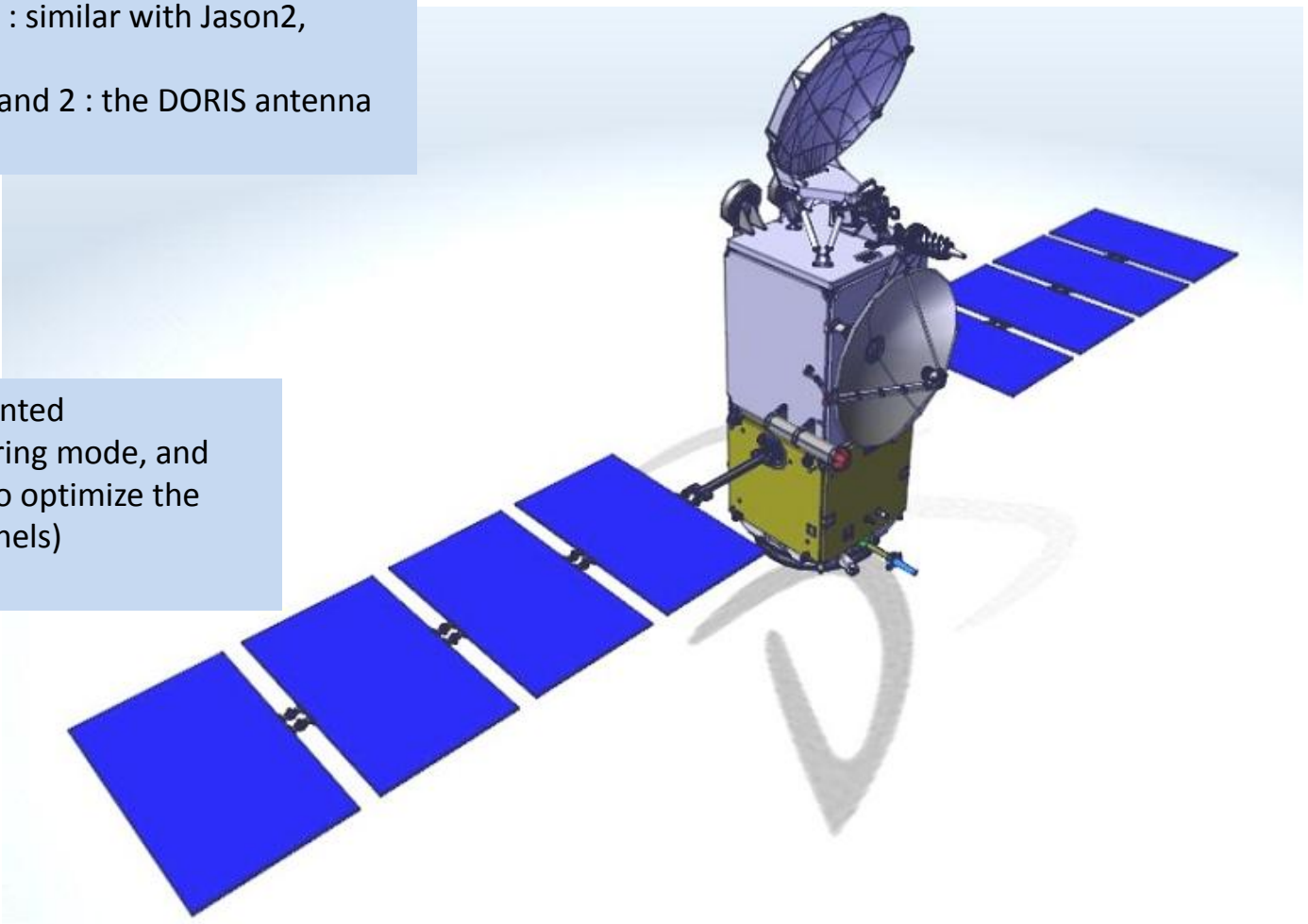


Orbit circular
Non sun-synchronous
Inclination : 66°
Altitude : 1336km
Life time : 5 years

Launch planned : December 2015 (TBC)

JASON3

Satellite model (DIODE) : similar with Jason2, model with 6 faces
Difference with Jason1 and 2 : the DORIS antenna reference point



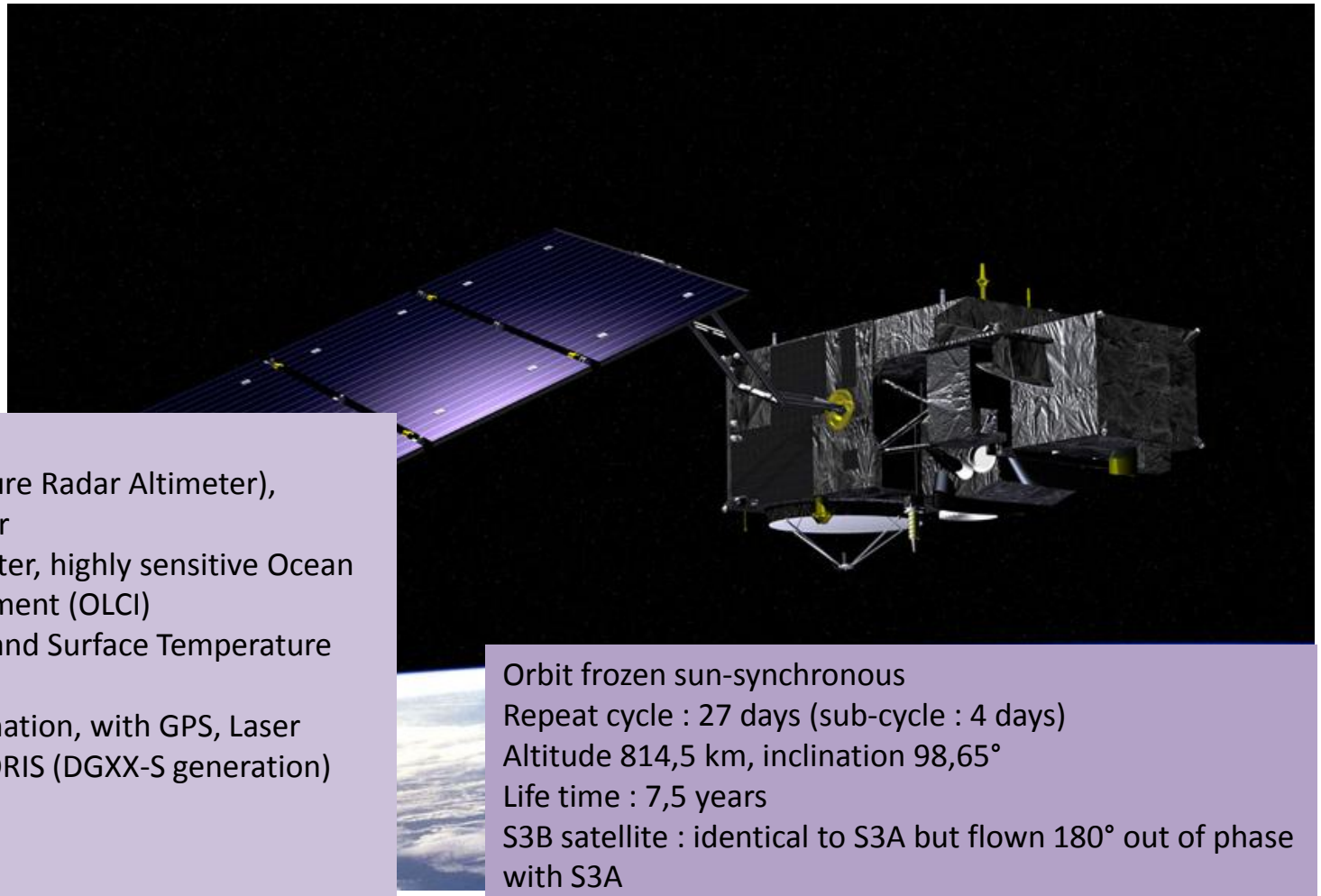
Satellite nadir Earth pointed
Attitude law : Yaw-steering mode, and sometimes yaw fixed (to optimize the illumination of solar panels)

SENTINEL3A & 3B

Earth observation satellite mission designed for the GMES (Global Monitoring for Environment and Security) program of ESA

The aim of the mission : to ensure the continuity of ENVISAT and SPOT/Vegetation

SENTINEL3A & 3B



Payload :

- SRAL (Synthetic Aperture Radar Altimeter), Microwave Radiometer
- An imaging spectrometer, highly sensitive Ocean and Land Colour Intrument (OLCI)
- A dual-view Sea and Land Surface Temperature Radiometer (SLSTR)
- Precise Orbit Determination, with GPS, Laser Retro-reflector and DORIS (DGXX-S generation)

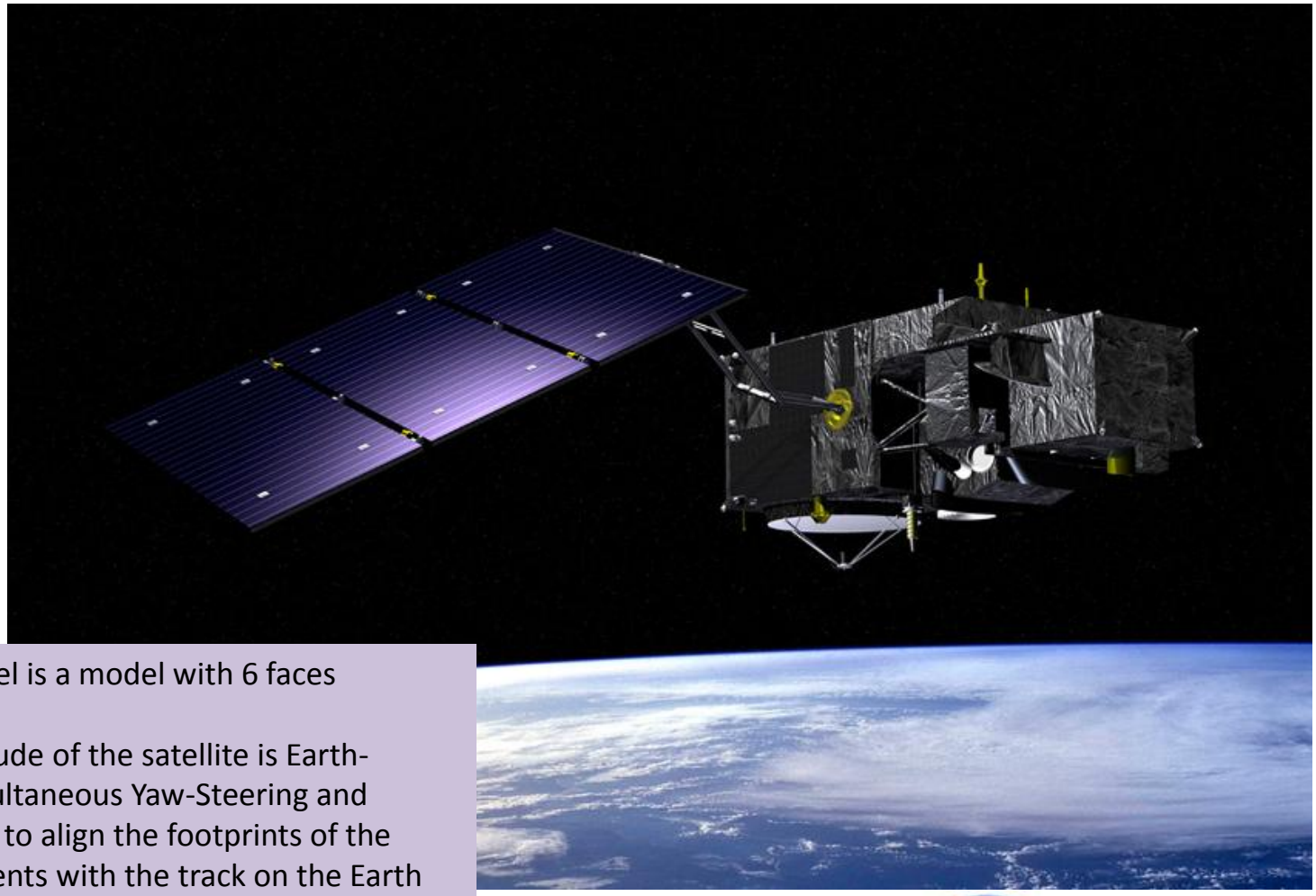
DORIS on Sentinel3 :

- POD
- 10MHz signal, from USO, used by the master clock of the SRAL instrument

Orbit frozen sun-synchronous
Repeat cycle : 27 days (sub-cycle : 4 days)
Altitude 814,5 km, inclination 98,65°
Life time : 7,5 years
S3B satellite : identical to S3A but flown 180° out of phase with S3A

S3A Launch planned : December 10th 2015
S3B launch planned : about 18 months later, June 2017

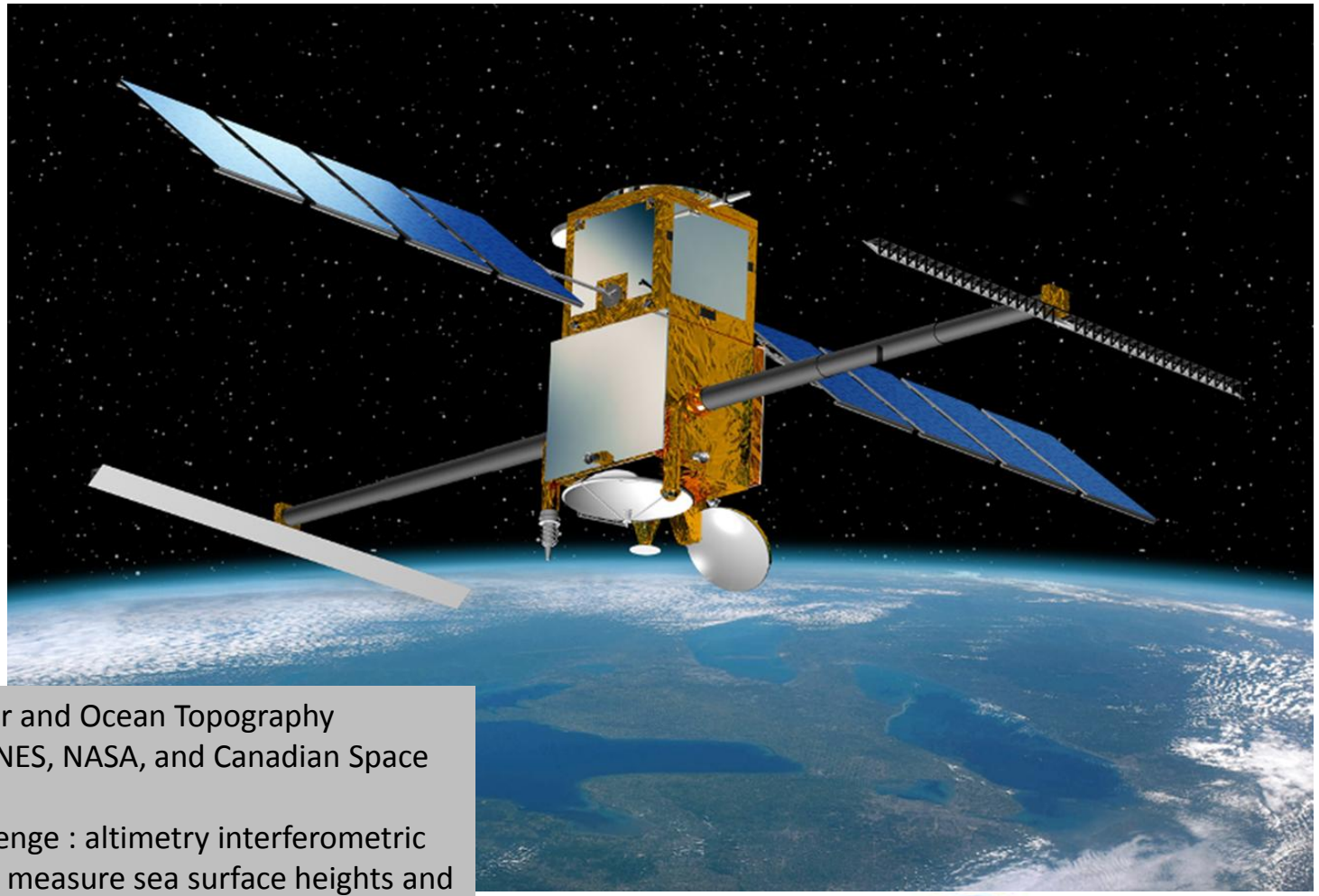
SENTINEL3A & 3B



The satellite model is a model with 6 faces

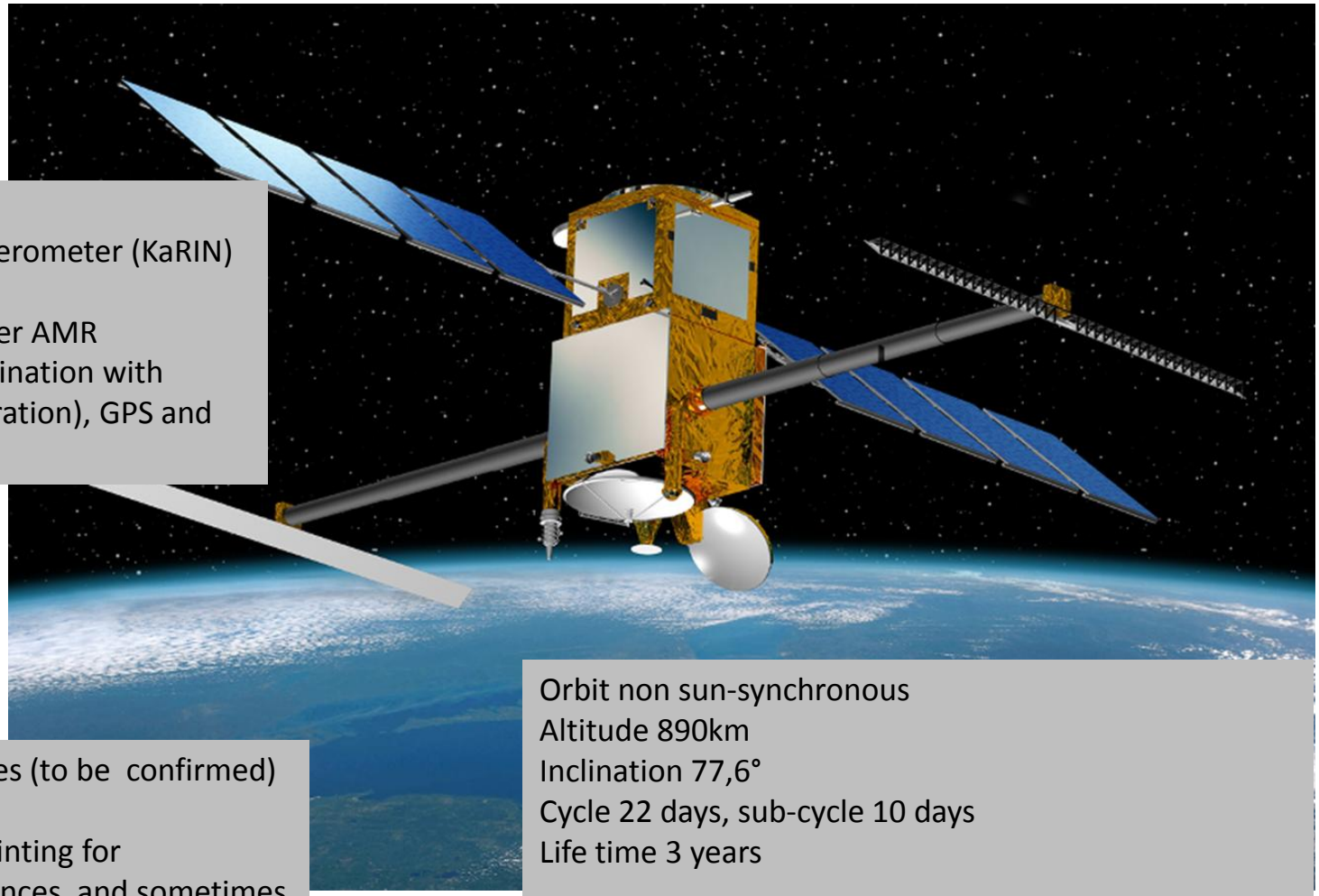
The nominal attitude of the satellite is Earth-pointed with simultaneous Yaw-Steering and geodetic pointing to align the footprints of the different instruments with the track on the Earth surface.

SWOT



SWOT Surface Water and Ocean Topography
Cooperation with CNES, NASA, and Canadian Space Agency
New technical challenge : altimetry interferometric with large swath, to measure sea surface heights and terrestrial water heights

SWOT



Payload
- Ka-band Radar Interferometer (KaRIN)
- Nadir Altimeter
- Microwave radiometer AMR
- Precise Orbit Determination with DORIS (DGXX-S generation), GPS and LRA

Satellite model : 6 faces (to be confirmed)

Attitude : geodetic pointing for instruments performances, and sometimes yaw flip to optimize the illumination of solar panels.

Orbit non sun-synchronous
Altitude 890km
Inclination 77,6°
Cycle 22 days, sub-cycle 10 days
Life time 3 years

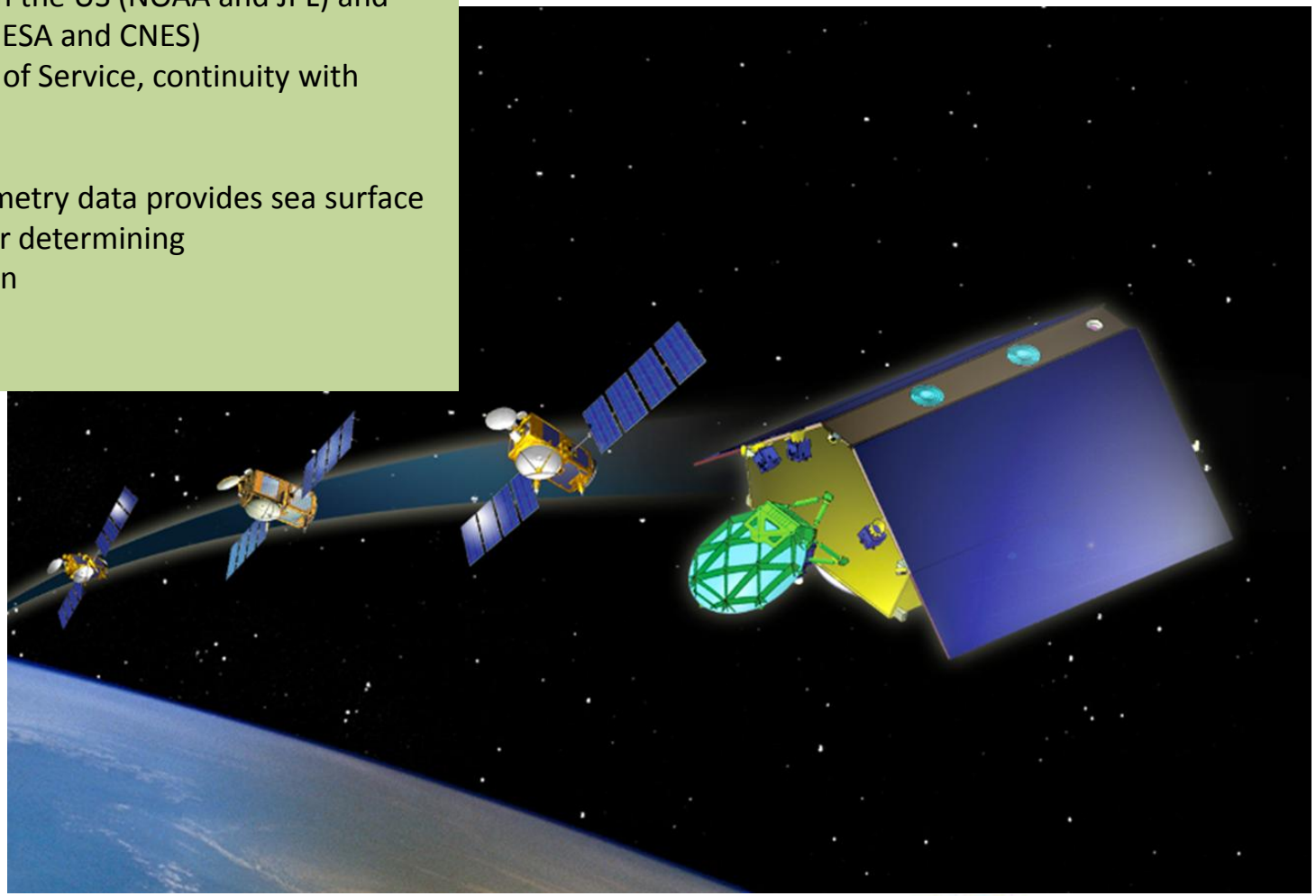
Launch planned in October 2020

JASON-CS (SENTINEL6)

Partnership between the US (NOAA and JPL) and Europe (EUMETSAT, ESA and CNES)
« CS » as Continuity of Service, continuity with JASON missions

Like JASON, the altimetry data provides sea surface and wave heights for determining

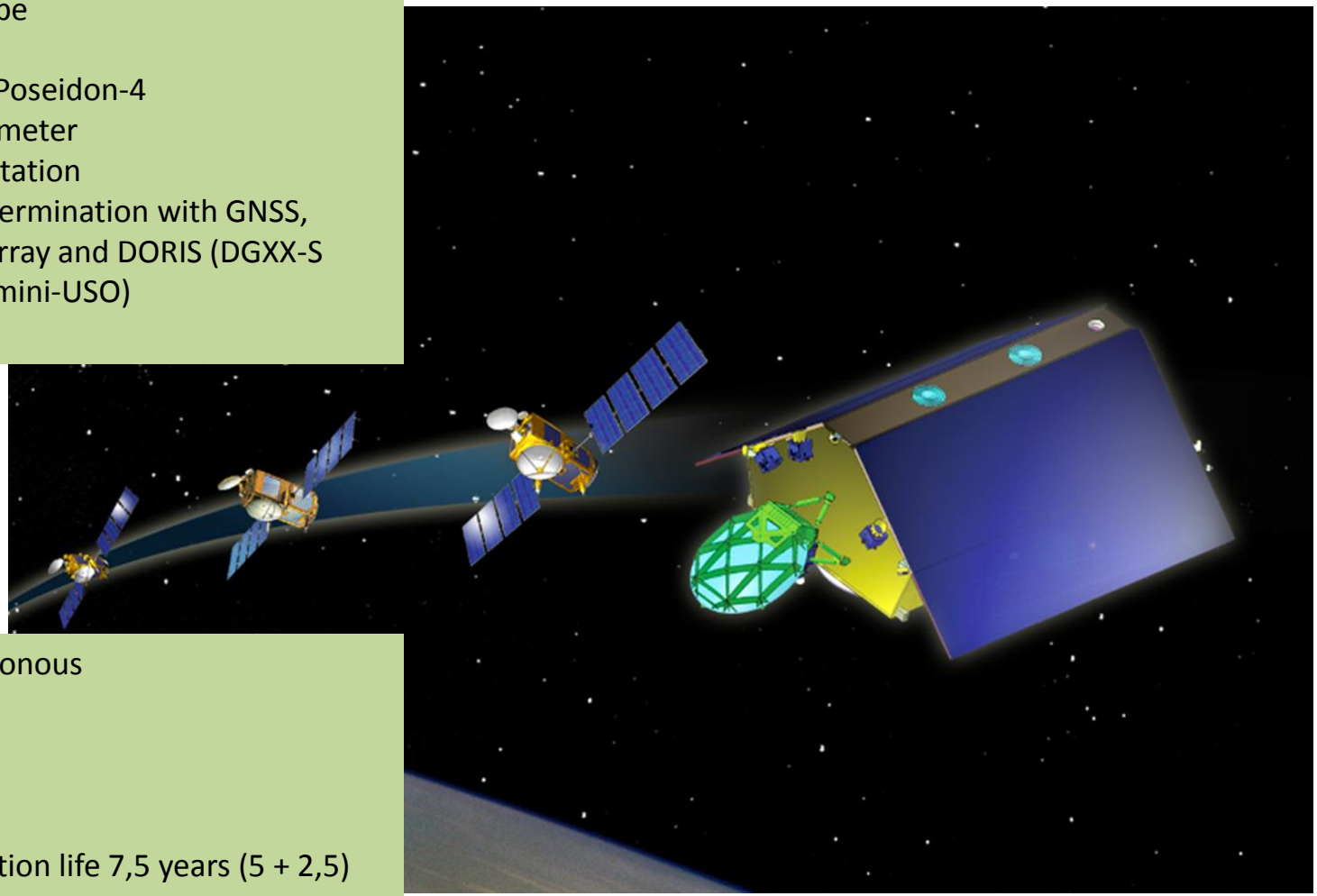
- Ocean circulation
- Climate change
- Sea-level rise



JASON-CS (SENTINEL6)

Platform : CryoSat type
Payload :

- Radar altimeter, Poseidon-4
- Microwave radiometer
- GNSS radio-occultation
- Precise Orbit Determination with GNSS, Laser Reflector Array and DORIS (DGXX-S generation with mini-USO)



Orbit non sun-synchronous
Altitude 1336km
Inclination 66°
Repetitivity 10 days

2 satellites with duration life 7,5 years (5 + 2,5)

Launches planned : 2020 and 2026

JASON-CS (SENTINEL6)

Planned satellite model : 10 faces, 8 for satellite and 2 for radiometer

Attitude : normal pointing including yaw steering