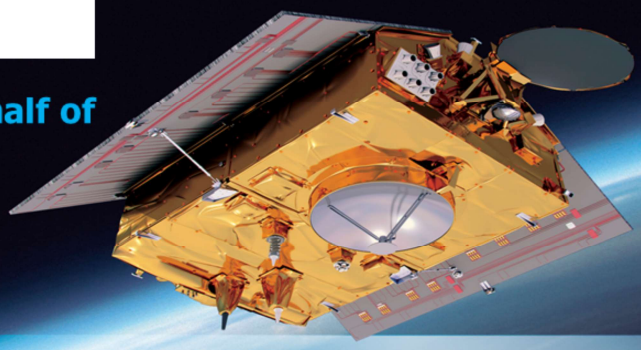
sentinel-6

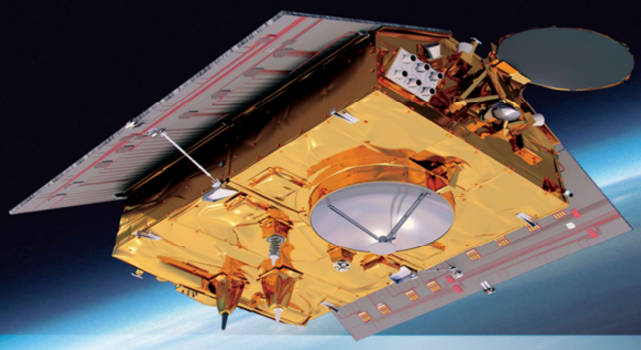
Sentinel-6 Michael Freilich calibration and validation

Cristina Martin-Puig (EUM) on behalf of the S6 MPWG team

OSTST 2020



Calibration and Validation Implementation Plan



Copernicus EUMETSAT NASA NOAA esa

What is the Cal and Val Implementation Plan?

- The S6 CVIP describes how the agencies CNES, ESA, EUMETSAT, NASA/JPL and NOAA responds to the Cal/Val Concept Plan, in order to implement and perform the calibration and validation tasks during **commissioning (phase E1)** through the **routine in-orbit (phase E2)** for the two satellites, **Sentinel-6A and -6B** until the end of the mission.
- This document identifies the agencies contribution/coordination per activity with possible delegation, cross-support and contributions.
- This document addresses verification and validation of all performance requirements, linking them to the various activities
- These activities are presented in the next slides

This document has been written by all members of the MPWG > see next slide

This is not a public document, but the high level description of activities is provided in the next slides.

Who compose the S6 MPWG

The S6 MPWG or S6 Mission Performance Working Group is composed by 2 experts per Agency. The current members are:

- ESA: Robert Cullen, Luisella Giulicchi
- NASA/JPL: Shailen Desai, Jean-Damien Desjonqueres
- CNES: Nicolas Picot, Gilles Tavernier
- NOAA: Alejandro Egido, Eric Leuliette
- EUMETSAT: Remko Scharroo, Cristina Martin-Puig

POD CVIP activities

Description	CNES	ESA	EUM	NASA / JPL	NOAA	Coord E1	Coord E2
POD quality assessment	x			x		CNES	CNES
POD validation with laser tracking	x			X		CNES	CNES

All Agencies with a cross have committed to work on the activity described.

For S6 CNES will lead all Cal/Val POD activities with the support of NASA/JPL.

AMR-C instrument CVIP activities

Description	CNES	ESA	EUM	NASA / JPL	NOAA	Coord E1	Coord E2
AMR-C internal radiometric calibration verification				x		NASA/JPL	NASA/JPL
AMR-C vicarious calibration				x	x	NASA/JPL	NASA/JPL
AMR-C correction validation	x		x	x	x	NASA/JPL	NASA/JPL

All Agencies with a cross have committed to work on the activity described.

For the AMR-C all cal/val activities are under the lead of NASA/JPL for both phases.

Note that S6 is the first altimeter from the Jason series to provide AMR products. These activities will be very interesting in terms of validating the ALT products, as well as the AMR products.

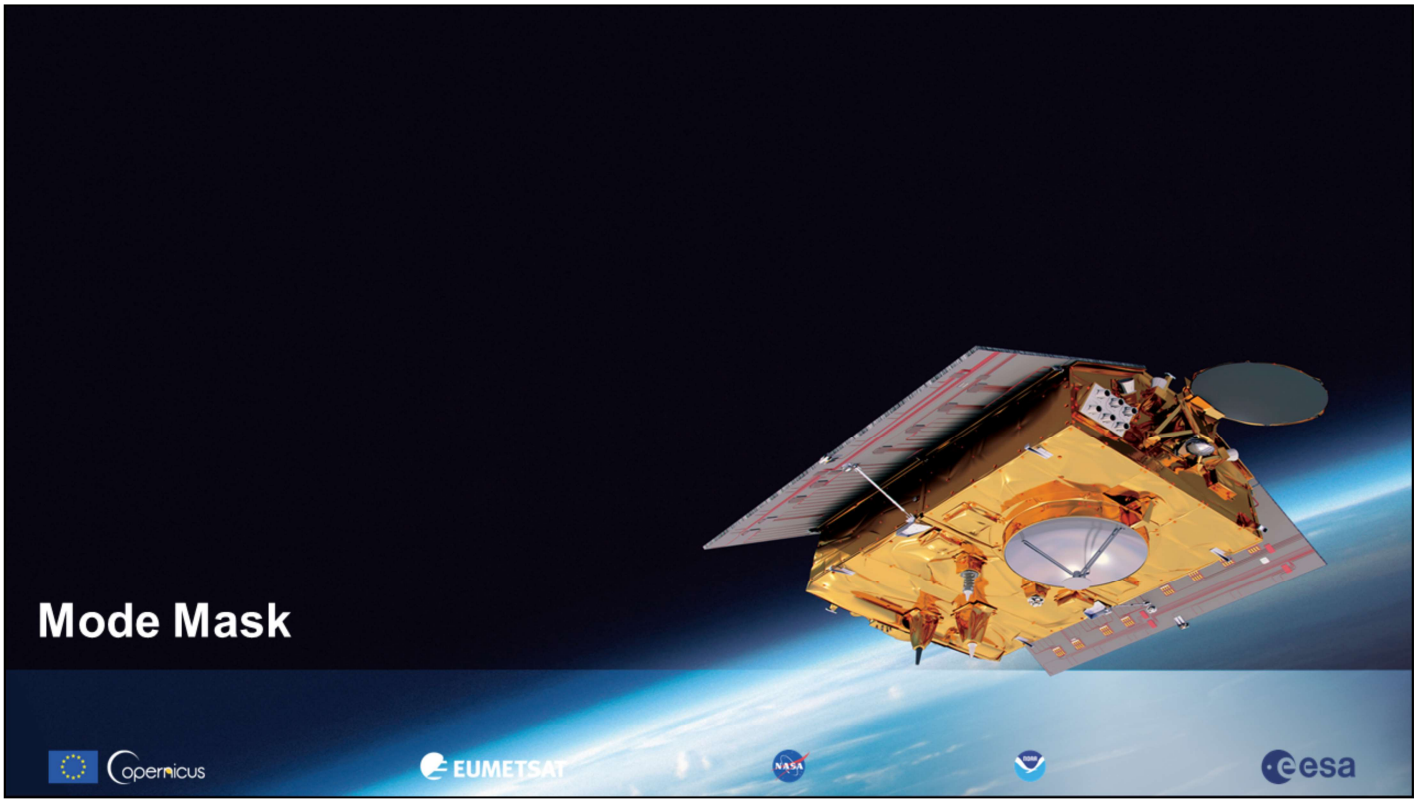
POS4 instrument CVIP activities

Description	CNES	ESA	EUM	NASA / JPL	NOAA	Coord E1	Coord E2
POS4 CAL1 sequence validation	X	X	X			ESA	CNES
POS4 CAL2 sequence validation	X	X	X		x	ESA	CNES
POS4 time tagging validation	X	X	X	X	x	ESA	CNES
POS4 pointing angle assessment	X	X	X	X	x	ESA	CNES
POS4 range calibration with transponder	X	X				ESA	CNES
POS4 RMC mode validation	x	x			x	ESA	CNES
POS4 DIODE/DEM mode validation	X		X			CNES	CNES
POS4 median tracker validation	x	X				ESA	CNES

POS4 instrument monitoring activities are under the coordination of

Product Assessment CVIP activities

Description	CNES	ESA	EUM	NASA / JPL	NOAA	Coord E1	Coord E2
Quality assessment over ocean (STC + NTC)	x	x	x	x	x	EUM	EUM
Quality assessment over in land water (All timeliness)	x					CNES	CNES
NRT service performance	x		x	x	x	EUM	EUM



Special mode mask for commissioning

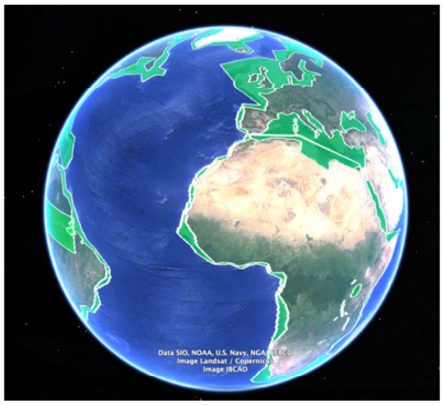
POS4 Acquisition Modes

Acquisition Mode	Open Loop	Closed Loop	Data available
LRM	x	x	Only LR data
LX	x	x	LR + HR RAW data
LX2		x	LR + HR RAW + HR RMC data
LRMC	x	x	LR + HR RMC data
TRANSPONDER			LR + HR RAW + HR RMC data (fixed Gain and H0)
CALIBRATION MODES NOT PRESENTED IN THIS SECTION			

Transponder is neither open nor closed loop. When the acquisition mode is transponder by telecommand we can specify a fixed gain and fixed H0

The Baseline Acquisition Mode

Acquisition Mode	Data Available	Surface
LRM	LR	Land
LX	LR + HR-RAW	Coastal zone and transponders
LRMC	LR + HR-RMC	Open ocean
Exception during drift period (SatIOV)		
LX2	LR + HR-RAW + HR-RMC	Coastal zone
TRANSPONDER	LR + HR-RAW + HR-RMC	Transponders, only during drift (SatIOV)



This is the baseline acquisition mask used so far for sizing

RMC everywhere

- Several technical studies have recently demonstrated that HR-RMC is equivalent to HR-RAW over open ocean, and coastal area.
- HR-RMC is suitable for FFSAR processing.
- HR-RAW data could be of interest over sloppy terrains, but this is out of the scope of S6 mission requirement as a very limited part of Greenland and Antarctica are observed at those latitudes.
- The more HR-RAW acquired, the less HR-RMC.

- Demonstrating the equivalence between HR-RAW and HR-RMC is key to allow for HR-RMC everywhere!

A dedicated POS4 instrument activity will also allow to the verification of RMC

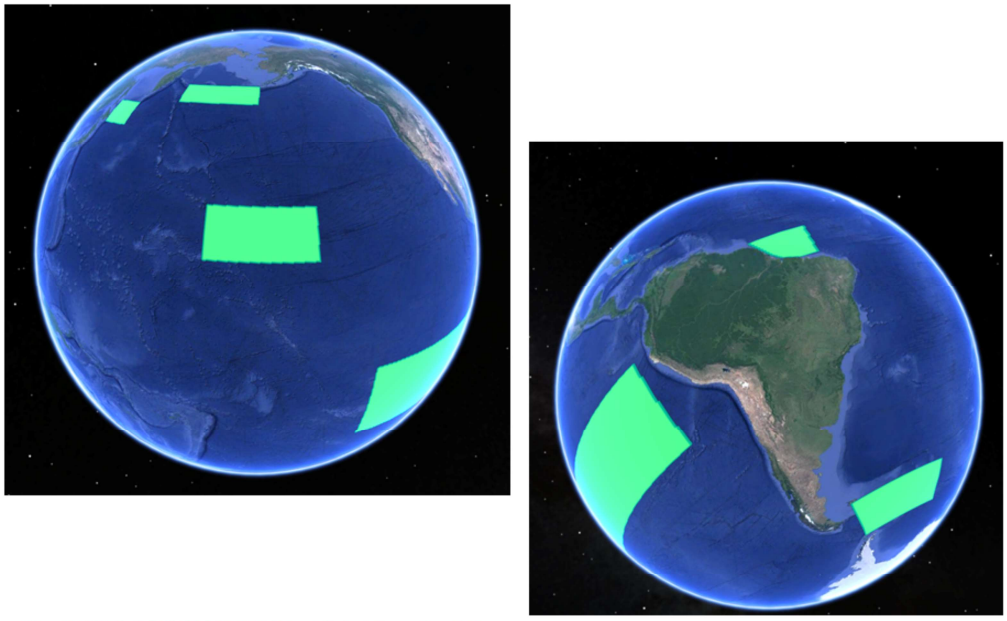
The case for LX2

- **LX2 is useful for**
  - Analysing that HR-RMC performance is equivalent to HR-RAW
  - Verifying that HR-RMC can be reconstructed on-ground from HR-RAW
- **However**
  - Once the latter is satisfied **any number of HR-RAW (LX) data** can be converted to HR-RMC on ground
  - LX2 can **only be run** in **Closed Loop**
  - Switching between Closed Loop and Open Loop creates ~5 second gaps. This is also not good for consistency.
  - Hence, LX2 shall be used **only on limited amount of data** and preferably during drift phase where Open Loop is not possible.

What is needed for RMC everywhere?

During commissioning it will thus be necessary to build up maximum experience of using and understanding the differences between HR-RAW and HR-RMC data and derived products over all surfaces prior to switching to a routine operations mode mask.

BOX1 (Geoid slopes and dynamic regions)



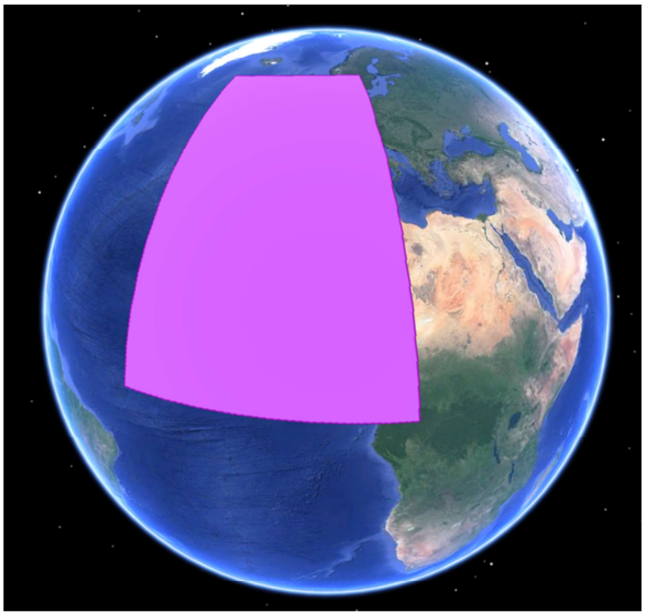
BOX 1 = A wide and continuous box (i.e., as for the CryoSat Pacific box) in the open ocean where we can address the potential issues linked to internal tide, swell, geoid slope, ... But no coastal in this Box.

- Aleutian trench
- Hawaiian islands
- Kuril trench
- Pacific
- Sandwich trench
- Internal tides

Slide 15

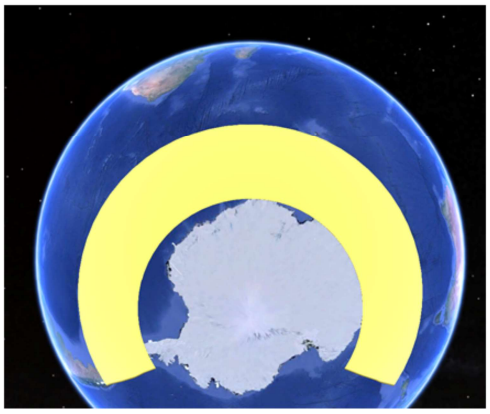
RS4 Added explanation in title
Remko Scharroo, 04/09/2020

BOX2 (North-East Atlantic)



BOX 2 = A box covering the North Atlantic Ocean + Med Sea (from the equator to 66 °), to cover nearly all the dynamics (except tropical waves and atolls), complex coastal areas, Hudson Bay, … thus also including high variability of the tide (and therefore of the centring of the echoes). This box includes only ocean surfaces

BOX3 N (Arctic) and S (Antarctic)



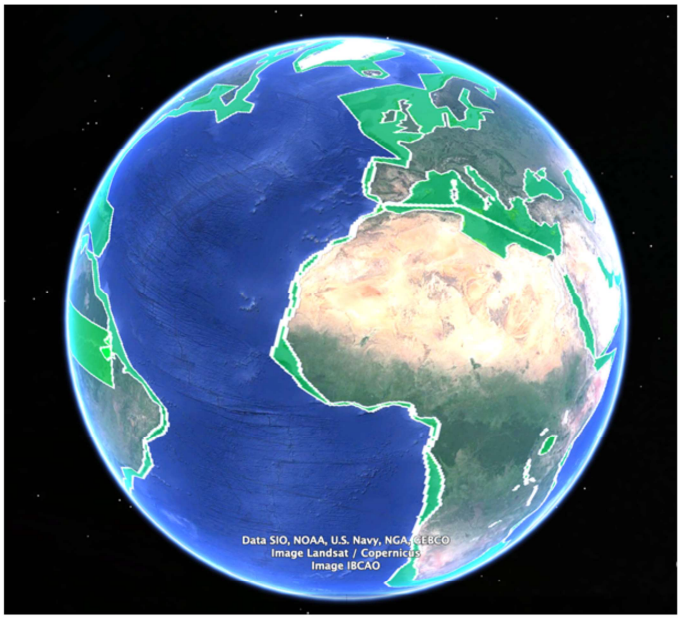
BOX 3N = a box covering the Arctic Ocean (sea ice – depending on the season, the marginal ice zone between a 55S and 66S latitude band), choosing the cycle to observe different types of sea ice.

BOX 3S = a box covering the Antarctic Ocean (sea ice – depending on the season, the marginal ice zone between a 55S and 66S latitude band), choosing the cycle to observe different types of sea ice.

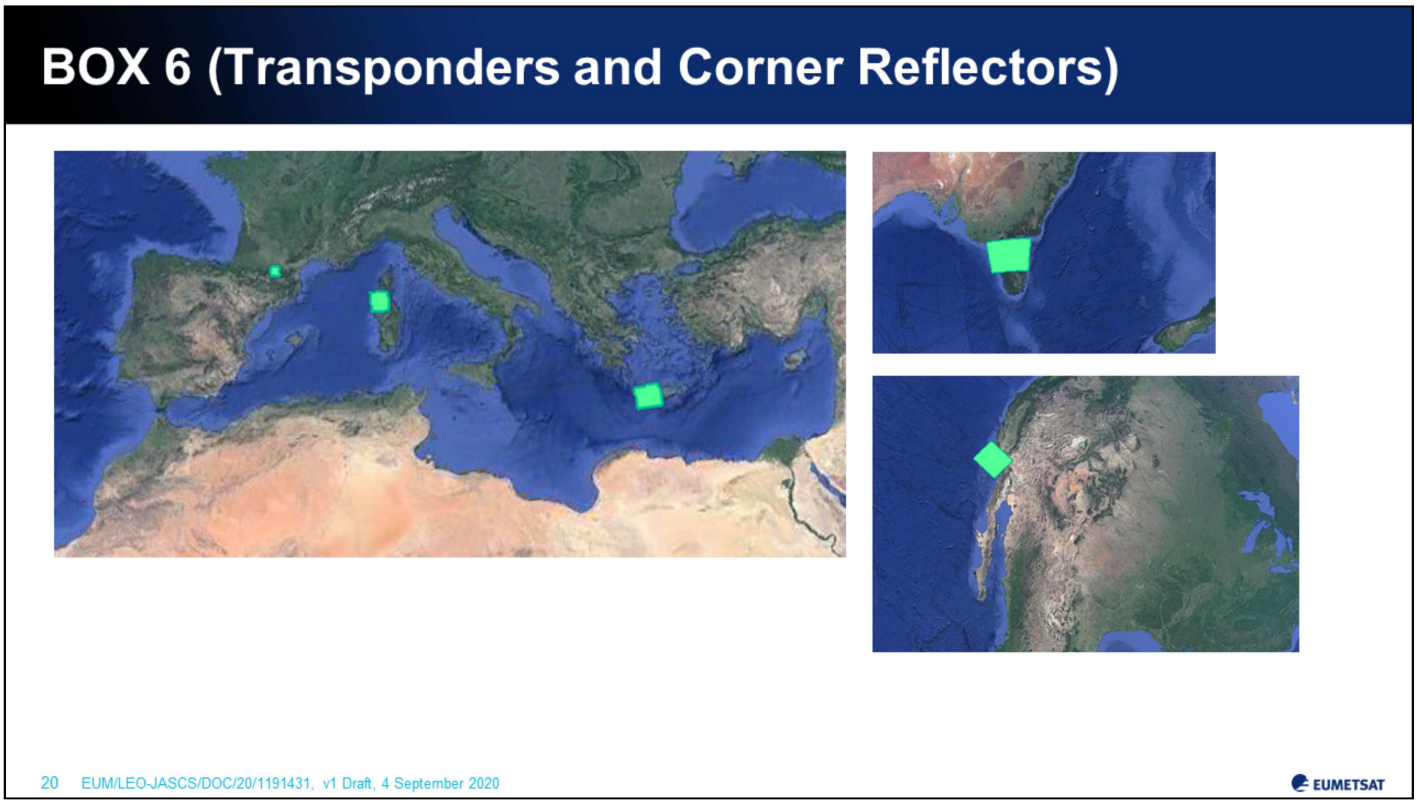
BOX 4 (Europe – Hydrology)

BOX 4 = A box covering the West of Europe for the inland water analysis, choosing the cycle to observe different types of continental inland water conditions (summer / winter, impact of the snow, ...) This box is proposed to allow an accurate validation with existing insitu networks. We could do the same exercise over North America but on CNES/CLS side we have much more experience over Europe.

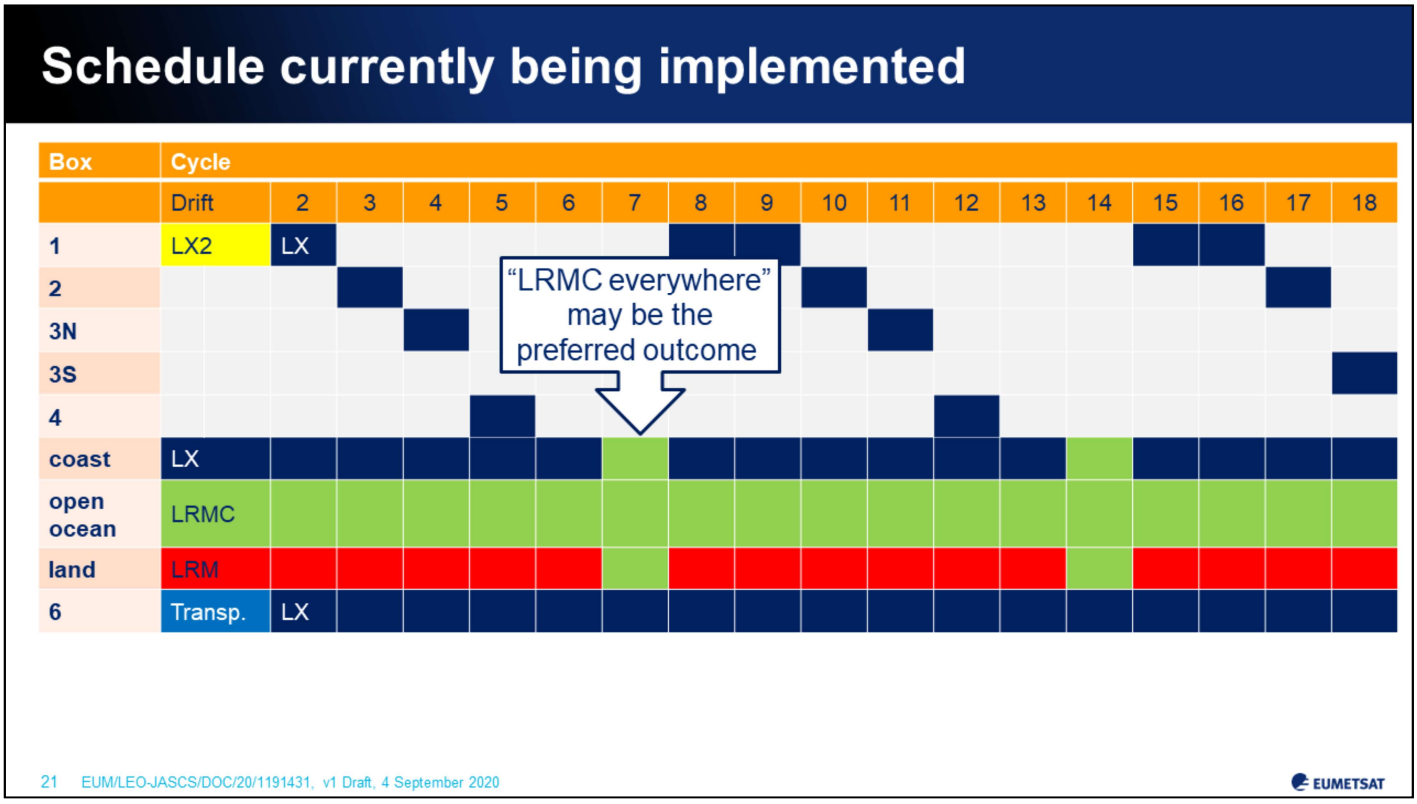
BOX 5 (Coastal Zones)



BOX 5 = The nominal coastal mask (including larger lakes). The version of this box from 2014 was used for sizing the system. In March 2020 the Madagascar coast was added.



BOX 6 = Covering all transponders sites. This Box is acquired over all cycles.



Commissioning schedule for POS4 acquisition