The Copernicus Sentinel-3 Mission: Getting Ready for Operations

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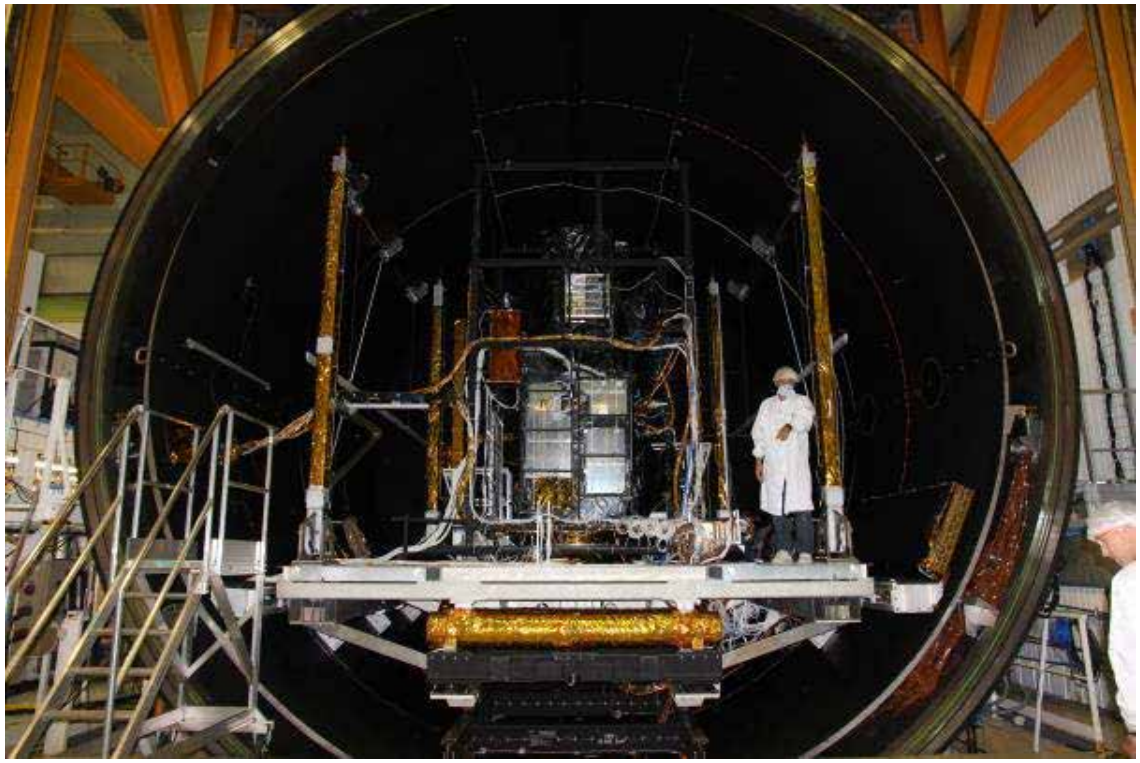
Sentinel-3 ESA development & operations teams

Sentinel-3A Status

S-3A Satellite on stand within the Acoustic Chamber at Thales Alenia Space in Cannes (Courtesy TAS-F)



Preparing the removal of the S-3A Satellite from the Thermal Vacuum Chamber at Thales Alenia Space in Cannes after testing (Courtesy of TAS-F)

Sentinel-3A Status

Platform readiness

- Sentinel-3A AIT progressing: Full satellite (including OLCI) integrated since early July 2014
- Mechanical and Thermal Test Campaigns successfully completed respectively by end 2014 and Q2 2015
- Alert on one component in SLSTR and MWR instruments which required preventive repair; completed for both SLSTR and MWR.

Payload readiness

- **SRAL** PFM instrument integrated on Satellite and tests complete.
- **MWR** PFM integrated on Sentinel-3A satellite.
- **SLSTR** FM2 integration into satellite completed after swap with un-calibrated PFM model.
- **OLCI** PFM re-integrated on Satellite after replacement of all OLCI-A cameras with those produced for OLCI-B (preventive measure following detection of a defective camera in Oct 2014 and risk of general issue not to be excluded)

Sentinel-3B Assembly, Integration and Test on-going

Launch Campaign

- **S-3A to be launched from Plesetsk cosmodrome: launch confirmed for 10 December 2015**
- Environmental and interfaces compatibility with Rockot successfully demonstrated during satellite environmental test campaign
- Export licenses for S-3A launch from Russia granted by relevant authorities
- Satellite transportation to Plesetsk has been booked, shipment ~end of October
- Detailed planning of the Launch campaign is finalised, last details depending on final launch date definition

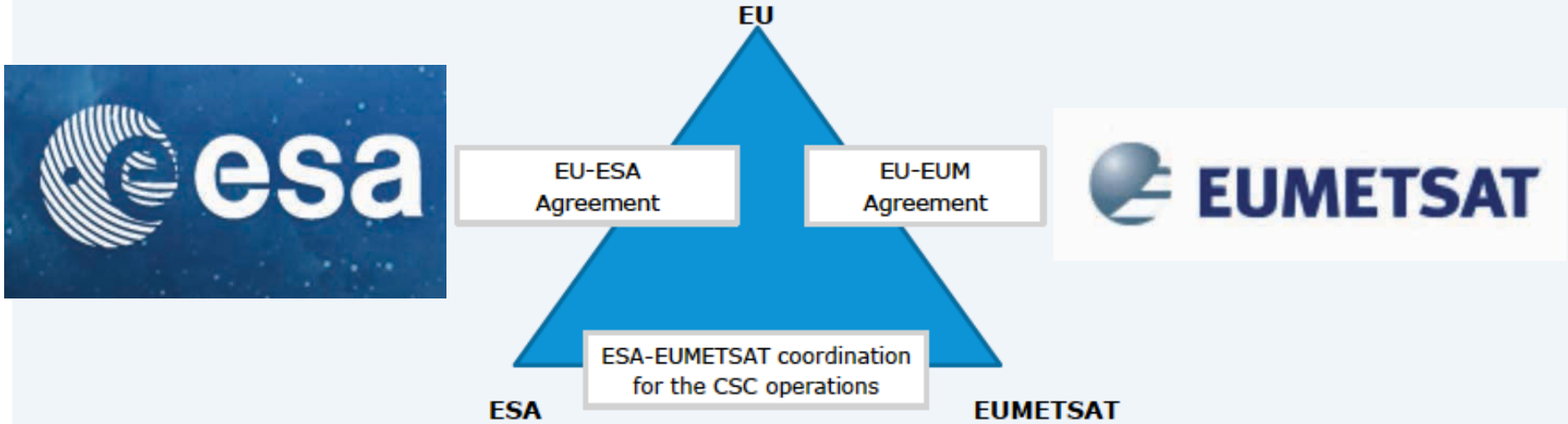
Copernicus: Programmatic aspects

Past months fundamental in defining the management and implementation of Copernicus Space Component and the Sentinels operations

1. **Providing the overall context: EU Copernicus Regulation approved (applicable from 25 April 2014)**
   - Establishes principle of a full, open and free data policy
   - Defines responsibilities for ESA and EUMETSAT
   - Defines the financial envelope for entire Copernicus context, i.e. services, in-situ and space components
2. **Assigning roles to ESA and EUMETSAT:**
   - EU-ESA agreement on implementation of Copernicus programme including transfer of ownership of the Sentinels (applicable from 1 Nov 2014)
   - EU-EUMETSAT agreement on the implementation of the Copernicus Programme including the transfer of ownership of certain assets (applicable from 7 Nov 2014)

NB: ESA and EUMETSAT share Sentinel-3 operations.

ESA and EUMETSAT share operational tasks



Operations, maintenance and evolution of

- the Flight Operations Segment for LEOP and Commissioning phases
- CSC shared multi-mission services (e.g. X-Band acquisition, POD)
- the **Sentinel-3 Land Payload Data Ground Segment**

and Post-Launch space segment support activities

Operations, maintenance and evolution of

- the Flight Operations Segment for routine phase, including mission planning, and
- EUMETSAT multi-mission (e.g. network) and specific facilities (e.g. processing, archiving, distribution) in support of the **Sentinel-3 Marine Payload Data Ground Segment**

Sentinel-3 ground segment: Status

Archive and Offline Processing Centre

Mission Performance Centre (MPC)

ALL FACILITIES SUPPORTING S-3 GROUND SEGMENT ACTIVITIES ARE ESTABLISHED

Stations: Data Acquisition and Near Real Time Product Generation: Data downlink, data processing (NRT and offline)

For Sentinel-3: Svalbard

Processing and Archiving Centres (PAC): perform the Sentinels' systematic non-time-critical data processing, the on-the-fly data processing for specific cases and the reprocessing in case of processing algorithms or calibration parameters upgrades.

For Sentinel-3: Archiving and offline processing centres

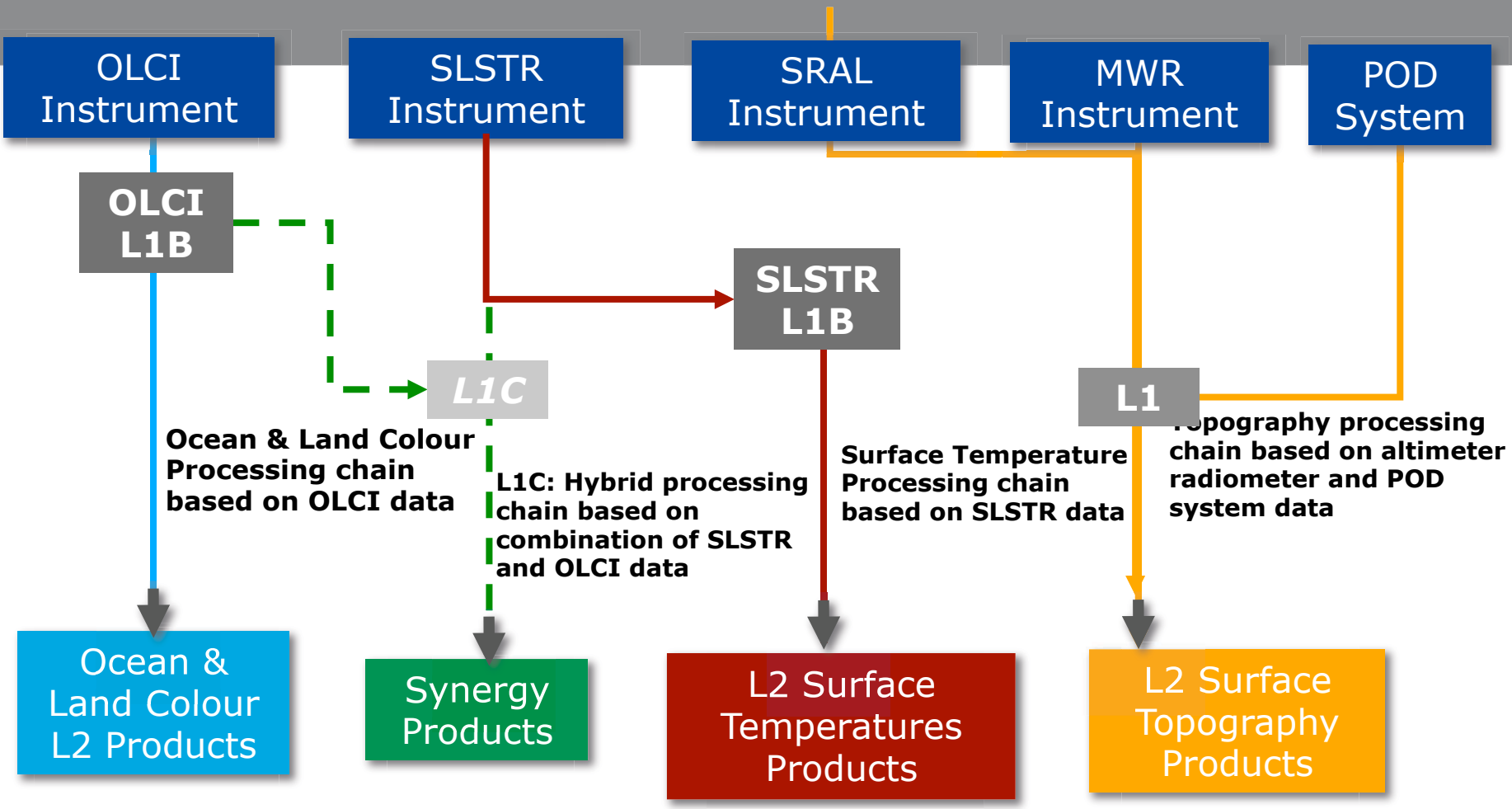
- DLR for OLCI processing and archiving
- CLS for SRAL processing and archiving
- ACRI for SLSTR and S-3 synergy products processing and archiving

EUMETSAT's marine centre acts as PAC for marine products

Missions Performance Centre (MPC): Operational Quality Control, Expert Support Laboratories (ESL), Calibration and Validation

For Sentinel-3: consortium led by ACRI

Sentinel-3: processing chains



Product delivery timeliness:

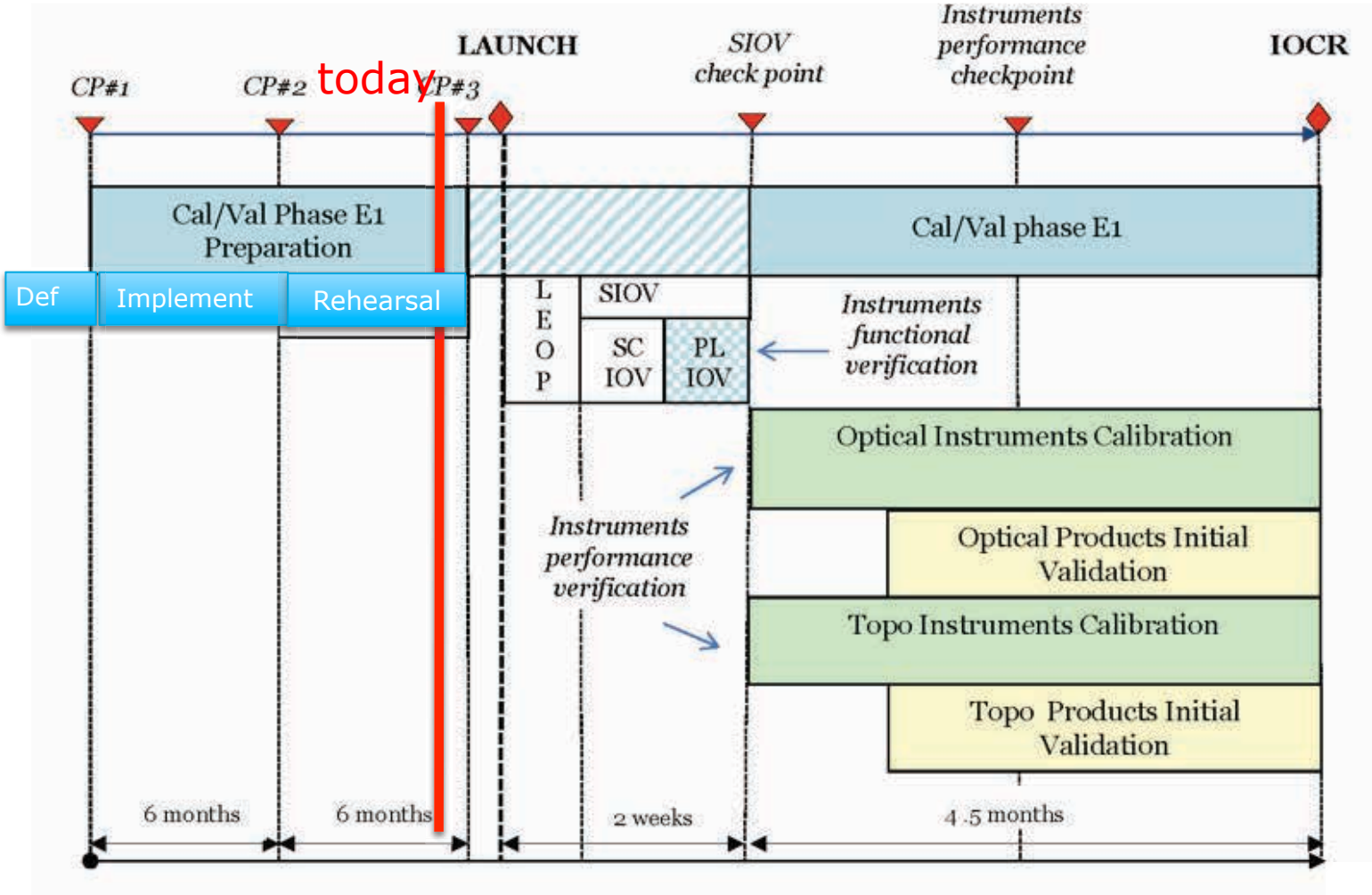
- Near-Real Time (< 3 hr) availability of L2 products (and L1b)
- STC/NTC delivery of higher quality topography products

Extending the S-3 core data product list

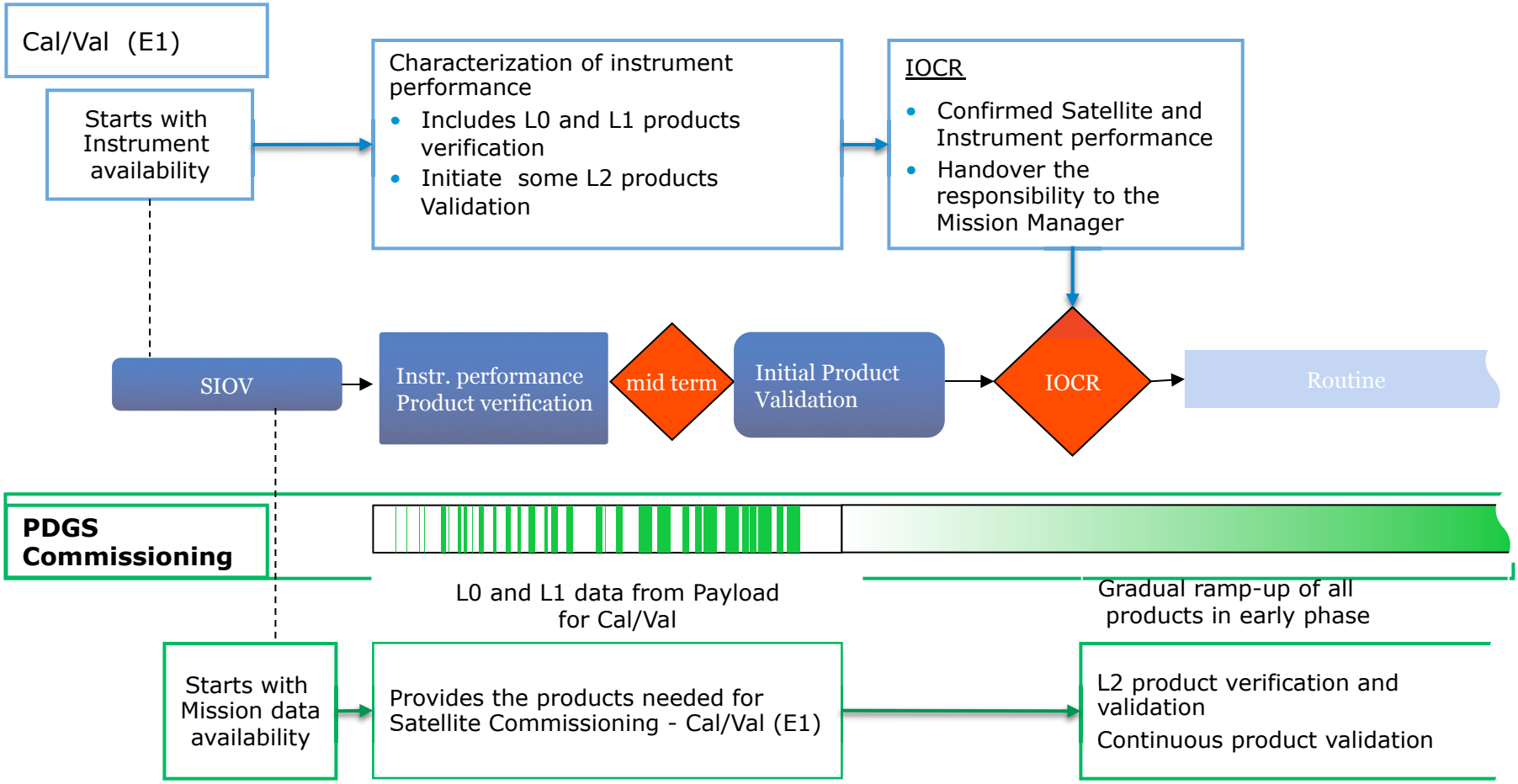
EC requested to following changes to the baseline:

Request	100% SAR	AOD/FRP	SYNERGY/LATENCY
Focus on	Operate SRAL in 100% SAR mode over land and ocean likewise (original baseline split LRM/SAR mode over land and ocean)	Provide both products operationally with certain resolution (pixel level), latency (NRT), format (BUFR, netcdf) etc	Improve latency for S-3 Synergy products (both full resolution products (SY_2_SYN) and reduced resolution (SY_2 VGP, SY_2_VG1, SY_2_V10) with a commitment of availability within 24 hours.
Status	**Approved**	ESA and EUMETSAT agreed on updated technical implementation, with EC at present.	**Approved**
Schedule	S-3A ramp-up, with the objective is to be ready to support the S-3A routine operations phase.	S-3A ramp-up, with the objective is to be ready to support the S-3A routine operations phase.	S-3A ramp-up, with the objective is to be ready to support the S-3A routine operations phase.
Implemen-tation	**S-3 will be the first mission to provide 100% SAR altimetry coverage!** Implementation foresees also release of additional L1 data products	TBD	Orbital data products in 24h using forecasted aux files; Composite products in 72 hours latency guaranteed, 48 hours on best efforts basis

E1 Commissioning Phase



Phase E1 data provision

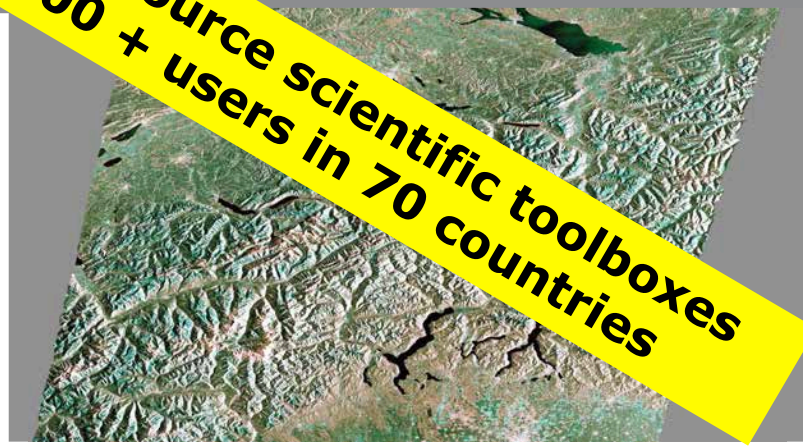


seom
scientific exploitation of operational missions

Scientific Toolboxes
S-1/2/3 TBX & STEP

esa

Open source scientific toolboxes
3000 + users in 70 countries



Sentinel-1A First Mosaics Post-Processing with S1TBX

Sentinel 1/2/3 Toolboxes

- Multi-mission Scientific Toolboxes
- Developed as open source software
- Common architecture
- Portable to a Cloud infrastructure

Download https://sentinels.copernicus.eu

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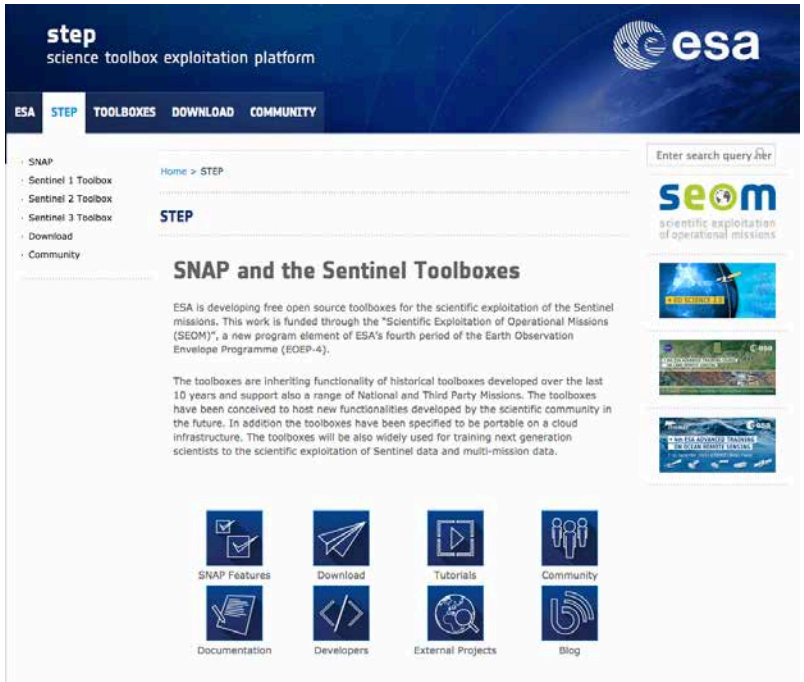
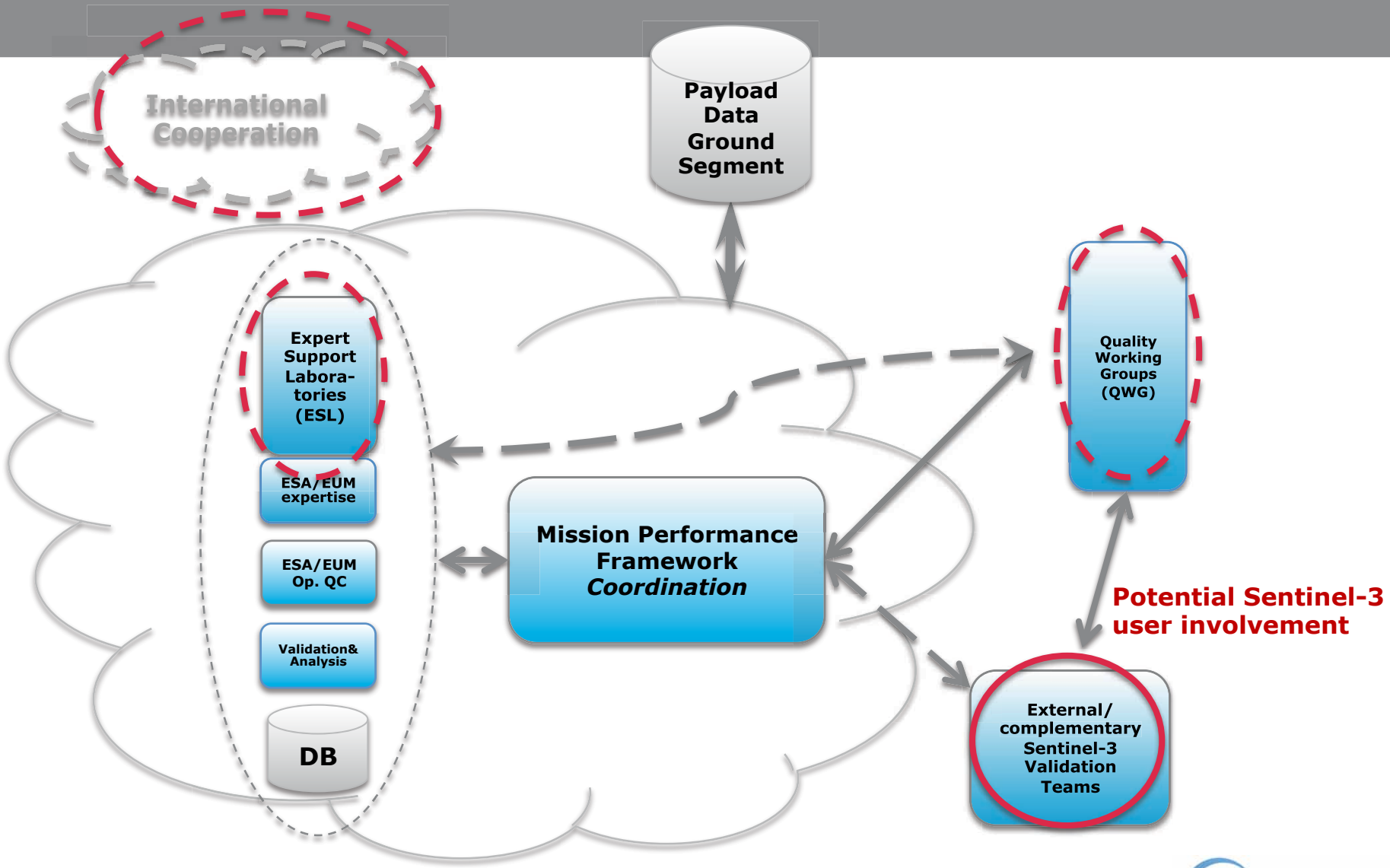
STEP (Science Toolbox Exploitation Platform)

- EO science collaborative platform
- Technical forum and community animation
- Gathering user feedback and usage
- Communicating on results
- Cloud demonstrator (e.g. Land Training 2015)

Under preparation at http://step.esa.int/



Interaction with users: Data quality



ESA Data Access Overview

- The Copernicus Space Component Ground Segment data access is ensuring that **all Sentinels core products** are accessible **<u>to all users</u> online**
  - List of Sentinel baseline core products published in Sentinel Online portal
  - Sentinel-1 data available since October 2014
  - Sentinel-2 data planned for release in October 2015

- Access to Sentinel **products** is made available via dedicated data hubs
  - User can self-register to the data hubs
  - All core products of the **last 12 months** of data is accessible via "rolling archives"
  - Data download via terrestrial network (output rates **up to 10 Gbps**)

- In addition, access to full **Sentinels <u>long-term archive</u>** will be made progressively available **<u>to all users online</u>** (when removing products from data hubs rolling archives)
  - no gap in online products availability

ESA: Sentinel-3 Data Access

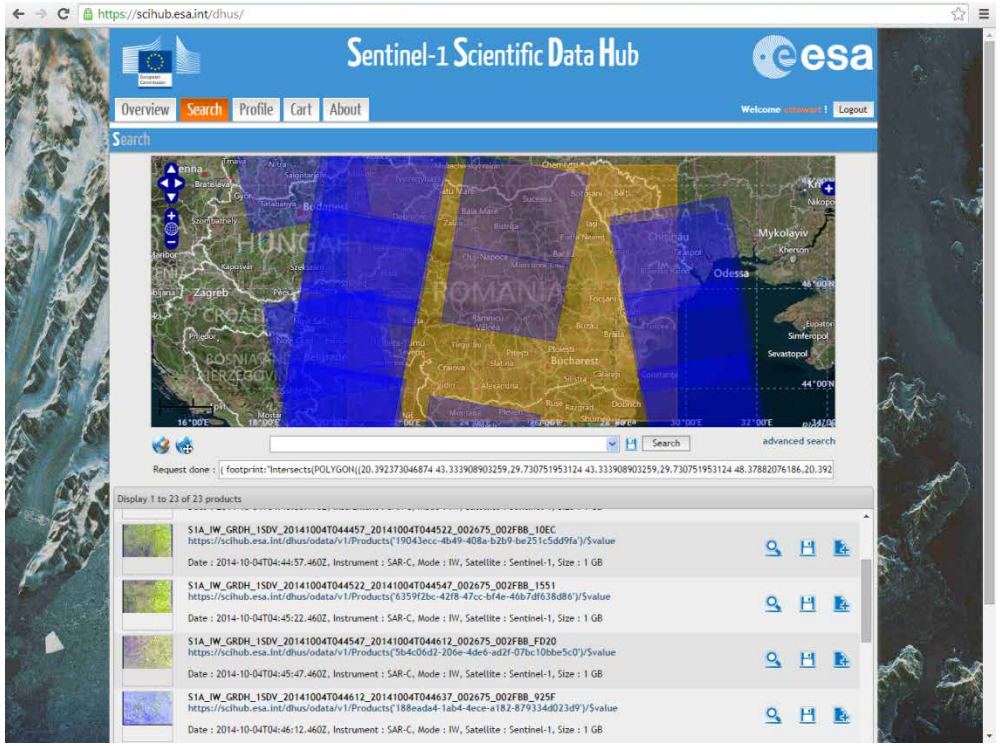
sentinels.copernicus.eu

For ESA:

- Data access system in operations since October 2014
- Open and free Sentinel-3 data access will follow same principle as for other Sentinels (e.g. S-1, S-2, S-5 Precursor), with different access routes depending on user typology

- **Sentinel Open Access Data Hub (simple online self registration)**
- Dedicated access for Copernicus Core services
- Dedicated access to Member States Collaborative Ground segment
- Dedicated access to International Agreements

Open & Free 'Science and Other' Data Access – In Operations



- Open and Free access
- Terms and Conditions for Sentinel data use and distribution published
- Self Registration and Sample Products open since Sentinel-1A launch
- Routine Data flow for S-1 opened on 3rd October 2014, S-2 data release planned for October 2015
- Rolling Archive:
  - In routine phase, at least the last 2 months of all Sentinels core products will be always available
  - Today ~12 months of data available, no data deleted
- Restriction of 2 concurrent downloads to ensure bandwidth availability for all users
- Automatic download through scripts

MAIN MESSAGES

- Readiness of Sentinel-3A platform and instrument integration and testing on track for a launch in November 2015
- Sentinel-3B readiness advanced, on track for a launch approx. 18 months after the A model
- EU-ESA and EU-EUMETSAT agreements signed and in place now, providing full coverage for S-3 mission operational costs and programmatic frame for joint operations between ESA and EUMETSAT
- All ground segment facilities supporting the Sentinel-3 operations are in place
- EC issued some change requests to mission baseline (SRAL 100% SAR operations; additional products: AOD, FRP; SYN within 24 h), which are presently under investigation and implementation
- Preparation for commissioning phase being finalised.
- ESA Data dissemination infrastructure in place and operational since October 2014. The ESA approach adopted for Sentinel-3 will follow same route as for other Sentinels (S-1, S-2, S5P)