sentinel-1

→ RADAR VISION FOR COPERNICUS

esa

Sentinel-1 Mission Status - Overview of Future Copernicus SAR missions (S1 NG & ROSE-L)

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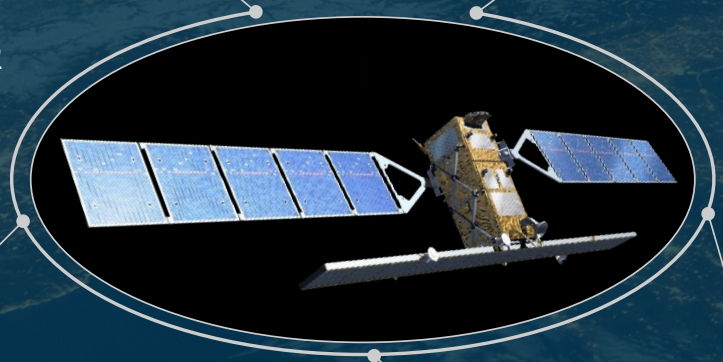
Sentinel-1 Mission in Brief

MISSION PROFILE

- Constellation of two identical SAR C-band (5.405 GHz) satellites: (A & B → C units)
- Near-Polar, sun-synchronous (dawn-dusk) orbit at 693 km altitude
- 7 years lifetime (consumables for 12 years)
- 12-day repeat cycle (each satellite), 6 days for the constellation

OPERATIONS

- Systematic SAR data acquisition using a predefined observation scenario
- Instrument duty cycle of max. 25 min/orbit in High Bit Rate modes (30 min outside eclipse) and 75 min/orbit in Low Bit Rate mode (Wave)



PROGRAMMATICS

- Sentinel-1C launch Q2 2023
- Sentinel-1D currently in storage to be launched as needed

PAYLOAD

- C-Band SAR
  - Centre frequency: 5.405 GHz
  - Polarizations: HH, VV, HH/HV, VV/VH
  - Incidence angle: 20º - 45º
  - Radiometric accuracy: 1 dB (3σ)
  - Radiometric stability: 0.55 dB (3σ), 0.45 (3σ) for S-1 C/D
  - NESZ: -22 dB
  - DTAR: -22 dB
- **AIS Instrument marine surveillance (for S-1 C and D)**

IMAGING MODES

- Strip Map Mode: 80 km swath and 5x5 m (range x azimuth) resolution
- Interferometric Wide-Swath Mode: 250 km swath, 5x20 m resolution
- Extra-Wide-Swath Mode: 400 km swath and 20x40 m resolution
- Wave Mode: 5x5 m resolution, leap-frog sampled images of 20x20 km

Sentinel-1 Mission Status Highlights

- **Sentinel-1A**, launched in April 2014, **has reached its design lifetime of 7 years of operations**:

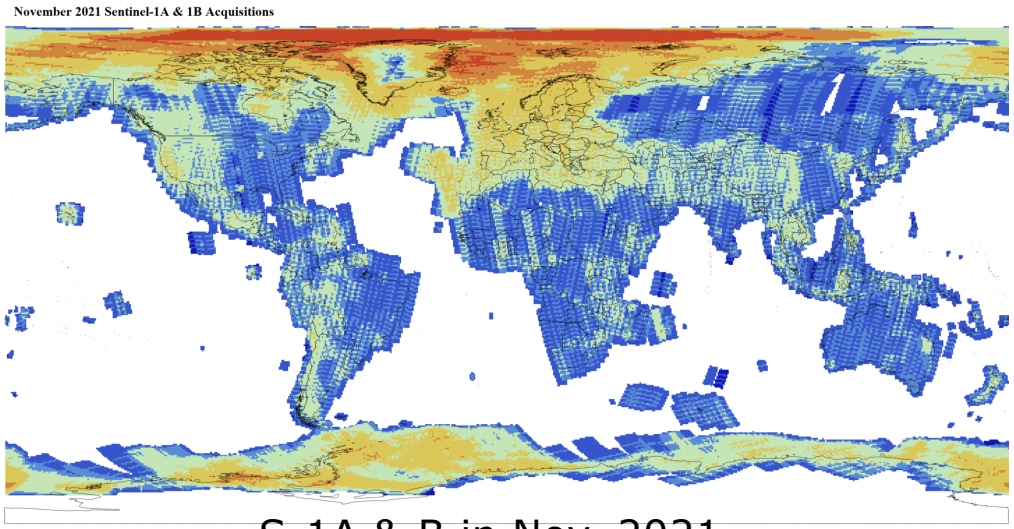
  https://www.esa.int/Applications/Observing_the_Earth/Copernicus/Sentinel-1/First_Copernicus_satellite_exceeds_design_working_life

- **Sentinel-1A is fully operational** and remains key for many Copernicus Services and users worldwide in the operational, scientific, commercial domains

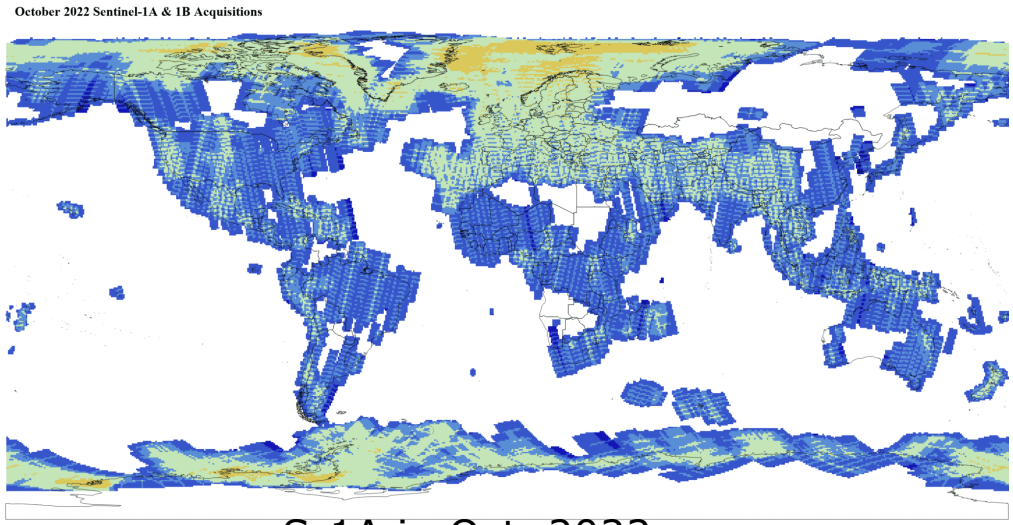
- **Sentinel-1B major anomaly** occurred on 23 Dec 2021, premature **end of mission was declared end July 2022 after 5.5y lifetime**
  - **S-1B is kept under control pending for de-orbiting in Q3-2024**
  - **All S-1B data are maintained in the long term archive and made accessible to users**
  - **Space is a risky business!!!**

Sentinel-1A observation plan

- Following the end of mission of Sentinel-1B, an adjustment of the Sentinel-1A observation plan was performed:
  - To some extent only, as **Sentinel-1A is operated close to its full mission capacity** (i.e. difficulty to accommodate additional observations)
  - Giving priority to Copernicus Services and Participating States to the Copernicus programme.



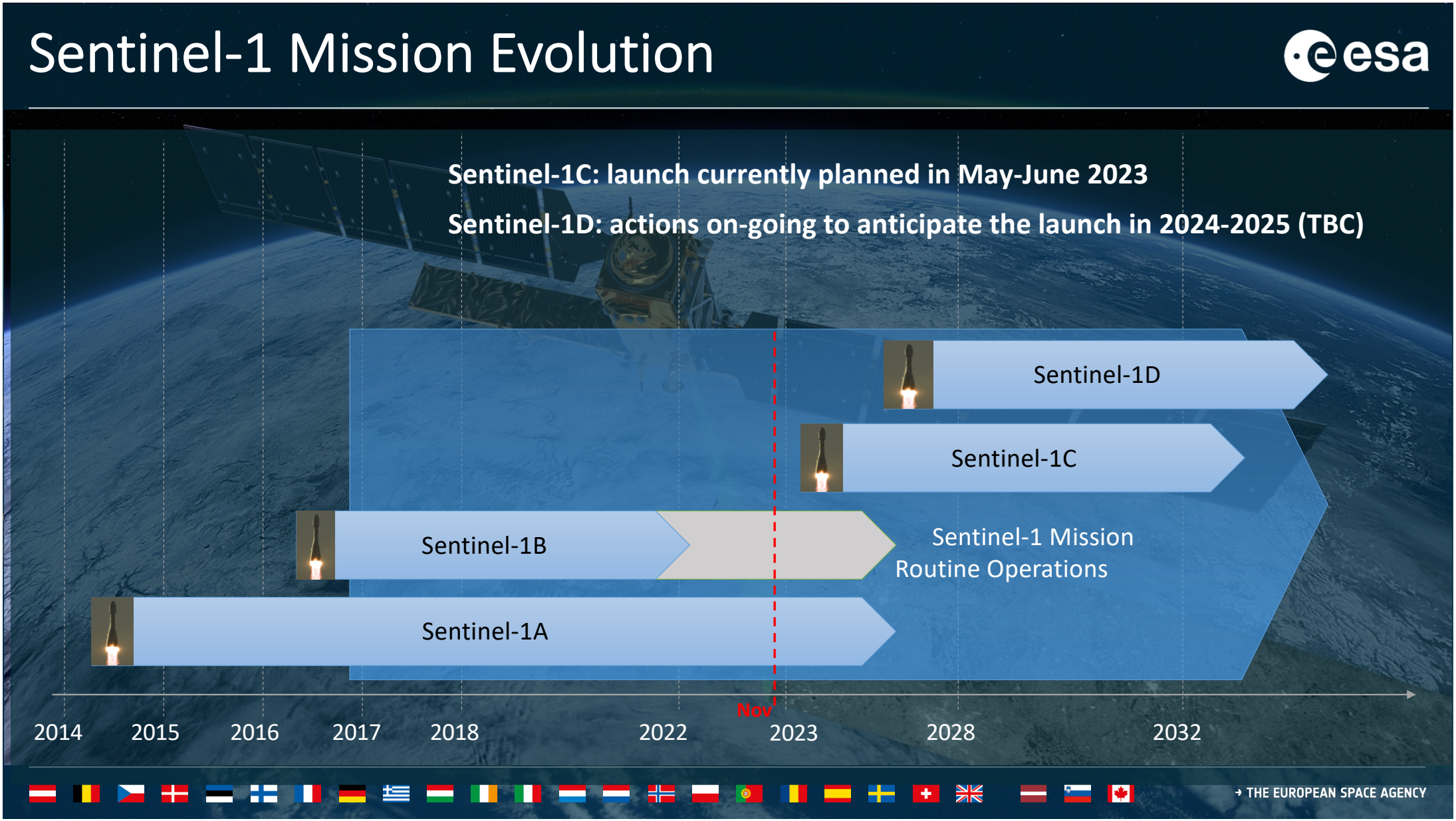
S-1A & B in Nov. 2021



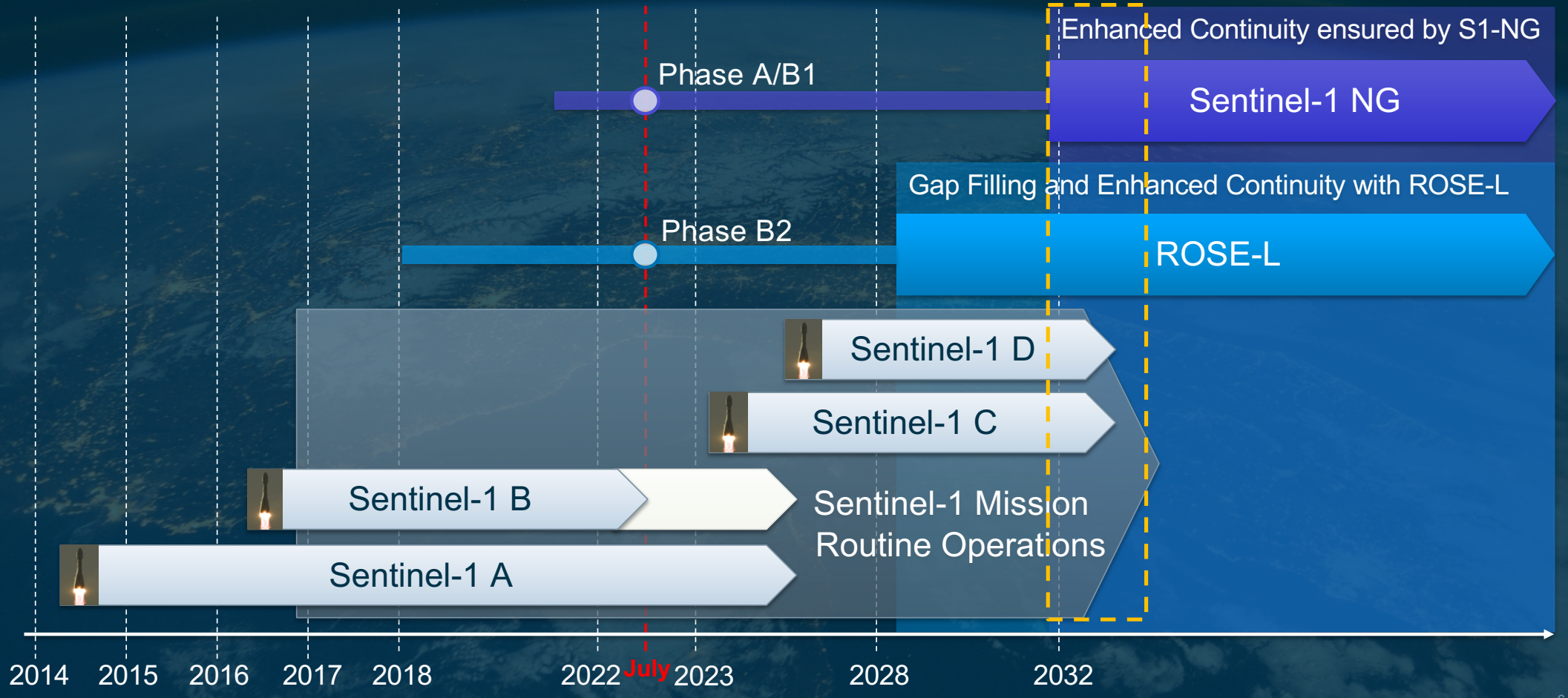
S-1A in Oct. 2022

Observation plan details available at:
https://sentinels.copernicus.eu/web/sentinel/missions/sentinel-1/observation-scenario/

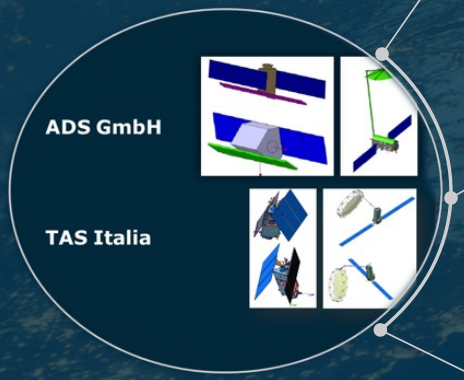
Sentinel-1 Mission Evolution



Copernicus Timeline – Current and Future SAR Missions



Sentinel-1 Next Generation (NG) Highlights



OBJECTIVES

- *Ensure continuity* and expansion of services and applications relying on Sentinel-1
- *Enhance* existing services and applications
- *Enable* new application developments building on improved performance and observation gaps (e.g. resolution, revisit and others)

PROGRAMMATICS

- Phase A/B1 in two years 2021-2023
- Development Phase (Phase B2/C/D) expected to start in 2023
- Expected launch > 2032

PERFORMANCE REQUIREMENTS

- Performance shall be equal or better than Sentinel-1 FG
- Revisit: 3 days Global, 0.5 days Arctic and sea ice
- Resolution ≤ 25 m^2
- NESZ ≤ -26 dB

Swath > 400 km
Duty cycle > 40%

Concluding remarks

- Sentinel-1A mission operations on-going

- Efforts are being made to: 1- launch Sentinel-1C as soon as possible (target May-June 2023), to come back to the 2-satellite constellation scenario ; 2 - to advance the launch of Sentinel-1D to 2024-2025, to increase the robustness of the system

- Mission continuity and expansion of services & applications is ensured on the long term with the Sentinel-1 Next Generation, first launch planned in 2032+

- Enjoy using Sentinel-1 Data!