# The Copernicus Missions Sentinel-4 and Sentinel-5

Ben Veihelmann, Giorgio Bagnasco, Didier Martin, Olivier Le Rille, Stefano Mattia, Ruyman Azzollini, Matthias Erdmann, Abelardo Perez-Albiñana, ESA/ESTEC

Acknowledgements: Sentinel-4 and Sentinel-5 teams at ESA and EUMETSAT, industrial consortia led by Airbus, Level-2 consortia led by DLR led by S&T, Sentinel-5P community

AC-VC#20, College Park, MD, USA, October 2024

# Copernicus Missions for Atmospheric Composition

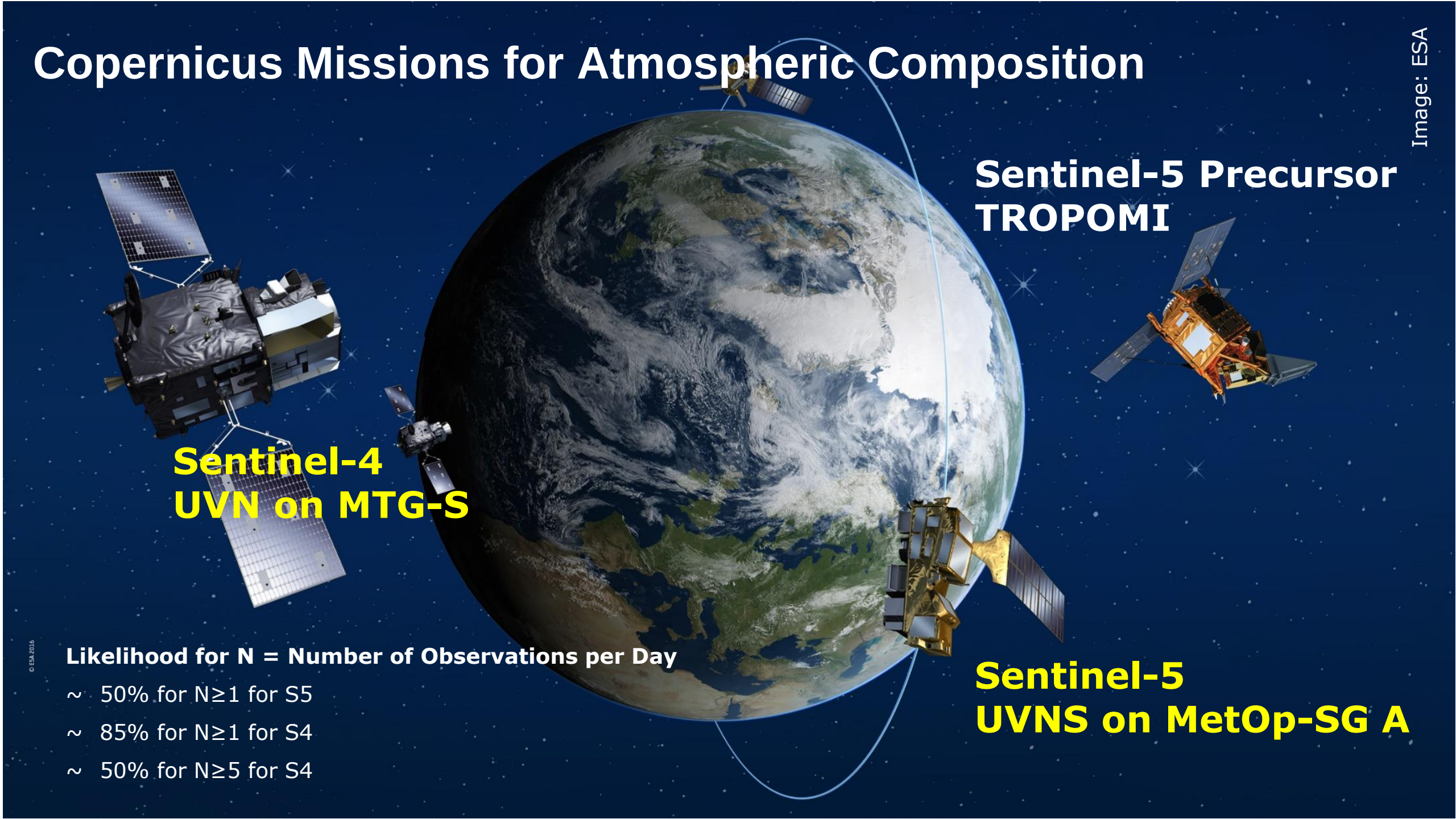


Image: ESA

**Sentinel-5 Precursor TROPOMI**

**Sentinel-4 UVN on MTG-S**

**Sentinel-5 UVNS on MetOp-SG A**

**Likelihood for N = Number of Observations per Day**

- ~ 50% for N≥1 for S5
- ~ 85% for N≥1 for S4
- ~ 50% for N≥5 for S4

# Copernicus Sentinel-4

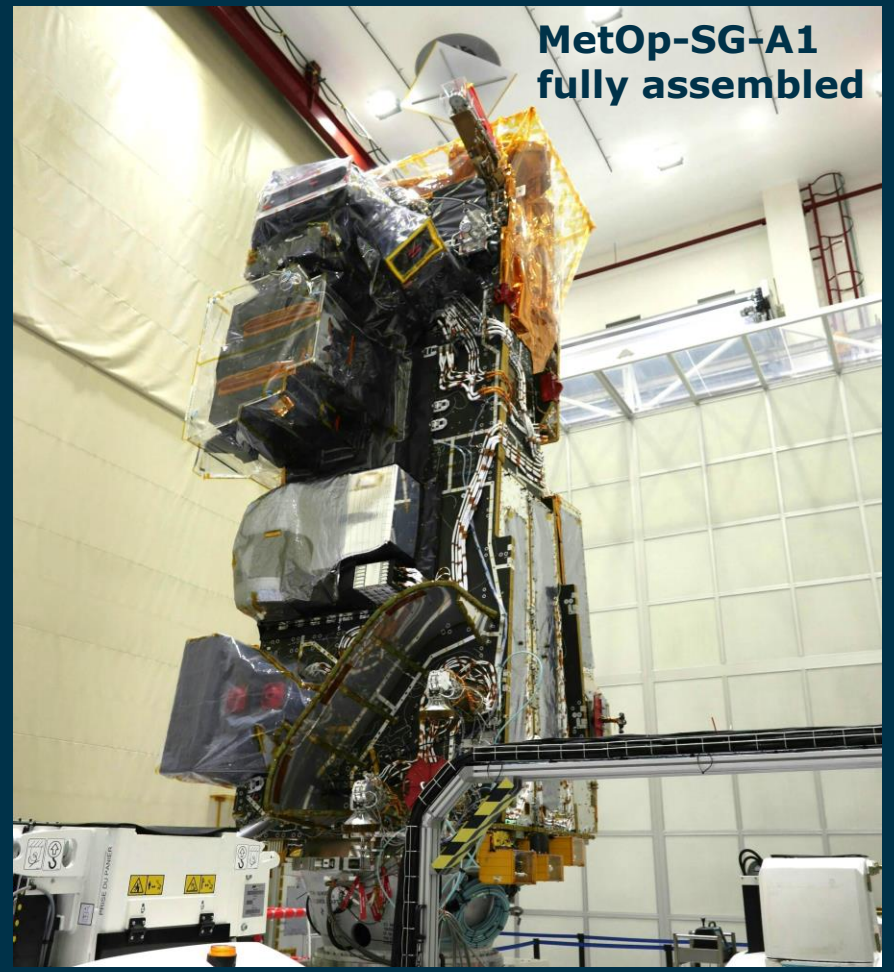
## UV-Vis-NIR (UVN) Imaging Spectrometer
## For observing air quality over Europe with hourly revisit time

- Built under the responsibility of ESA
  - Instruments and L1b Prototype Processor (L1bPP) by a consortium led by Airbus
  - L1 Reference Processor (L1RP) by Huld
  - Level-2 Operational Processor (L2OP) by a consortium led by DLR
- Operated by EUMETSAT
- Geostationary → hourly coverage of Europe
- Two S4/UVN in sequence → mission lifetime of 15 years
- Embarked on Meteosat Third Generation Sounder S1 and S2
- Synergy with FCI and LI on MTG-I, IRS on MTG-S
- On-ground characterization & calibration completed
- Qualification Acceptance Review completed
- Proto Flight Model mounted on MTG-S1, FM2 integration ongoing
- L1bPP V2, L1RP V1, L2OP V2
- **Launch expected mid 2025**

# Copernicus Sentinel-5

## UV-Vis-NIR-SWIR (UVNS) Imaging Spectrometer
## For observing the atmospheric composition with daily global coverage

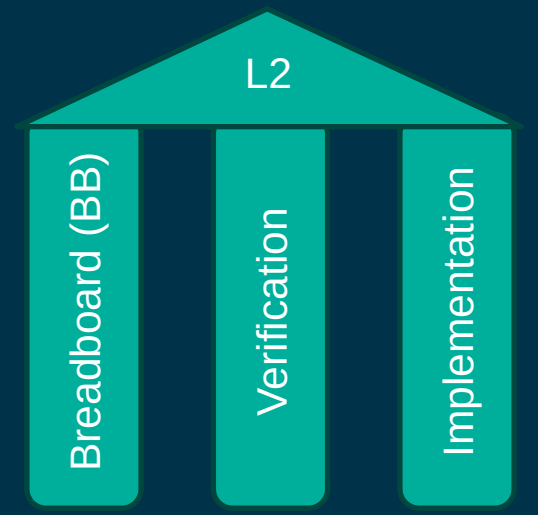
- Built under the responsibility of ESA
  - Instruments and L1bPP by a consortium led by Airbus
  - L1bPP extensions by Huld
  - Level-2 Prototype Processor (L2PP) by a consortium led by S&T
- Operated by EUMETSAT
- Low Earth Orbit ~9h30 local solar time
- Three S5/UVNS in sequence → mission lifetime 21 years
- Embarked on MetOp Second Generation A1, A2 and A3 satellites
- Synergy with MetImage, IASI-NG, and 3MI on MetOp-SG-A
- On-ground characterization & calibration completed
- Qualification Acceptance Review ongoing
- PFM mounted on MetOp-SG A1, FM2, FM3 integration ongoing
- L1bPP V2, L2PP V2
- **Launch expected in second half of 2025**



# Atmospheric Sentinels Level-2 Products

| | S4 | S5 | S5P |
|---|---|---|---|
| $O_3$ | TOC & TRC | TOC & PRO | TOC, TRC, PRO |
| $NO_2$ | TOC & TRC | TOC & TRC | TOC & TRC |
| $SO_2$ | TOC | TOC & layer height | TOC & Layer height |
| HCHO | TOC | TOC | TOC |
| CHOCHO | TOC | TOC | |
| Aerosol | AOD, Layer height UV index | AOD, Layer height, UV index | Layer height, UV index |
| $CH_4$ | | TOC | TOC |
| CO | | TOC | TOC |
| Cloud | AUX | AUX | AUX |
| Surface | AUX | climatology | climatology |
| UV | | Near surface downwelling | Near surface downwelling |

TOC = total column
TRC = tropospheric column
PRO = profile

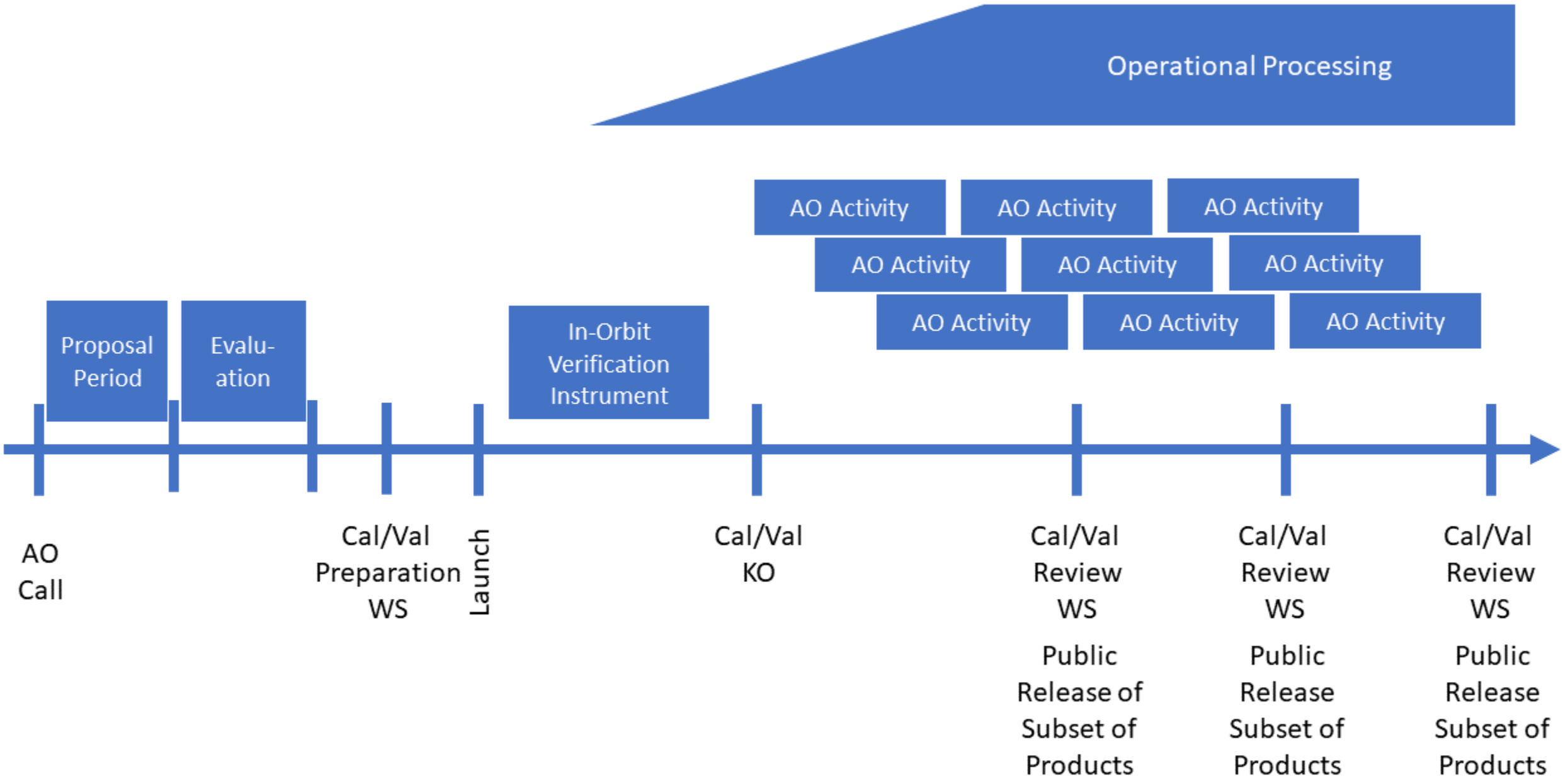



S4 L2OP consortium lead by DLR

S5 L2PP consortium lead by S&T

# AO Call Calibration & Validation (Cal/Val)

- Joint ESA & EUMETSAT AO Call for Sentinel-4 and Sentinel-5
- Trigger & coordinate Cal/Val activities
- Establish in-flight data quality, verify that performance targets are met
- Released on 12 July 2024
- Submissions of proposals by 11 October 2024
- Proposal evaluation just started


Operational Processing
AO Activity
AO Activity
AO Activity
AO Activity
AO Activity
AO Activity
AO Activity
AO Activity
AO Activity
Proposal Period
Evalu-ation
In-Orbit Verification Instrument
AO Call
Cal/Val Preparation WS
Launch
Cal/Val KO
Cal/Val Review WS
Public Release of Subset of Products
Cal/Val Review WS
Public Release Subset of Products
Cal/Val Review WS
Public Release Subset of Products

# Thank you for your attention