

EU FP7 SEN3APP

Copernicus-Sentinels presentation

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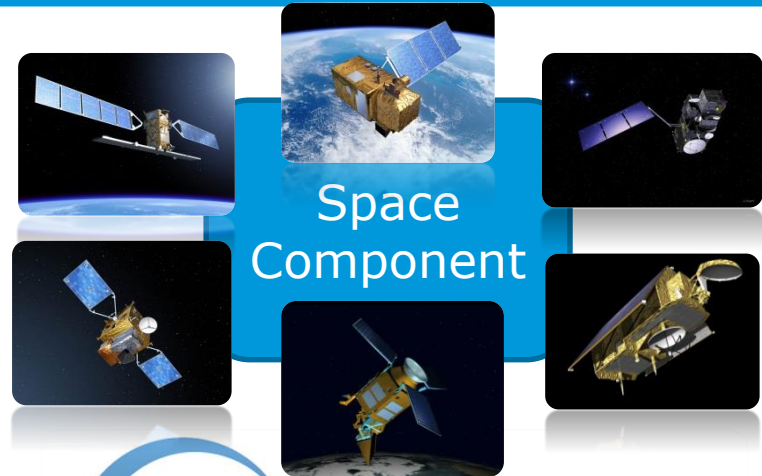


What is Copernicus?



European response to global needs:

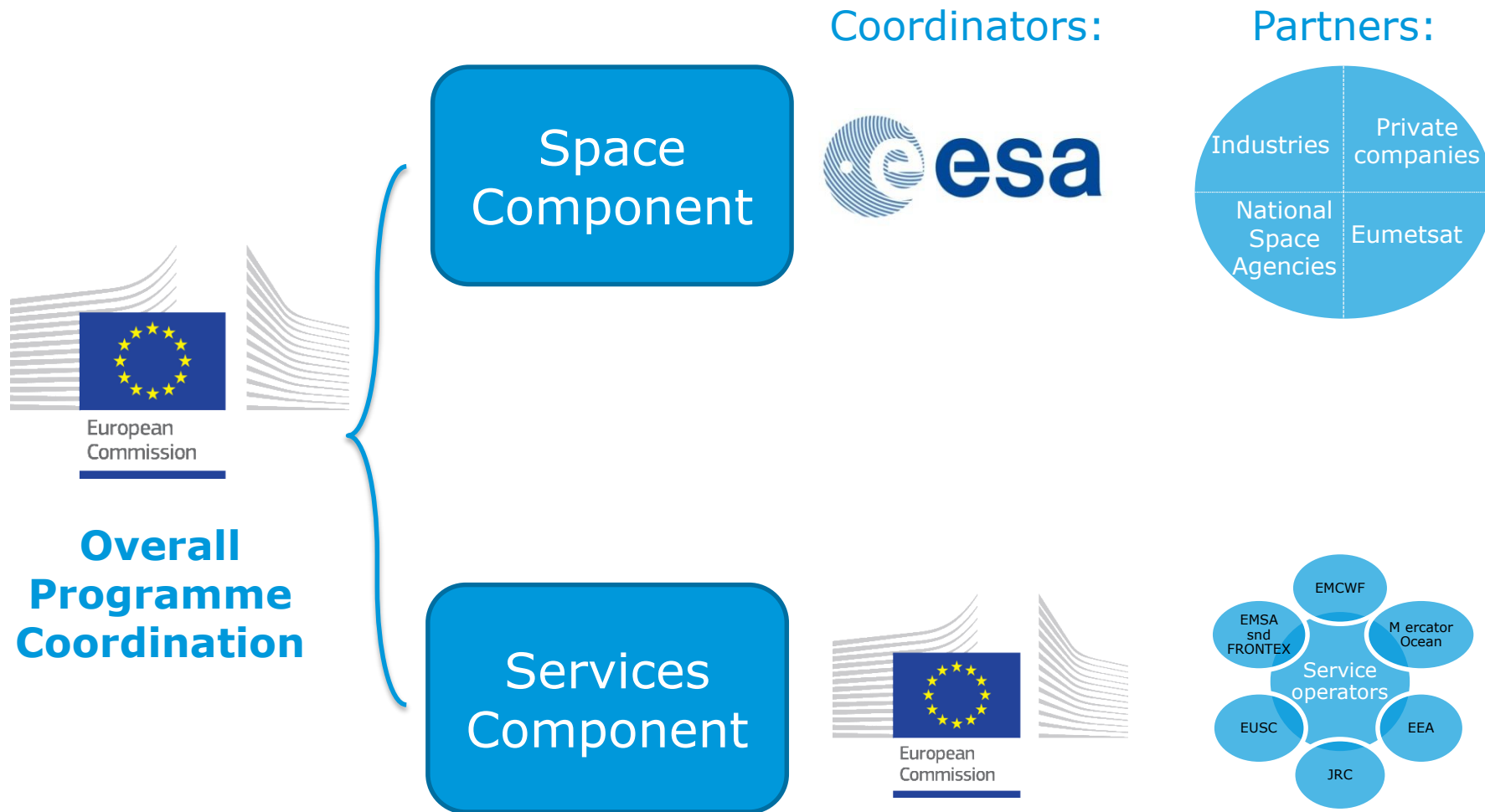
- to manage the environment,
- to mitigate the effects of climate change and
- to ensure civil security



Copernicus



Components & Competences



In-situ data are supporting the Space and Services Components

Sentinel Data Policy = **FREE and OPEN access**

- Joint COM/ESA **Sentinel Data Policy Principles** have been prepared in 2009 - adopted by ESA MSs in Sep 2009
- **EU Delegated Act** on Copernicus Data and Information Policy has been published on 12 July 2013 (C(2013)4311, final)
- ESA will table a **Sentinel Data Policy** for approval by PB-EO in Sep 2013. Main principles of Sentinel data policy:
 - **Open** access to Sentinel data by anybody and for any use
 - **Free** of charge data licenses
 - Restrictions possible due to technical limitations or security constraints

Copernicus Space Component

Role of ESA



- **Coordinator of overall Copernicus Space Component**
 - Definition of overall architecture and plan for future evolutions
 - Coordinating access to Copernicus missions from national, EUMETSAT and third party satellite owners
- **Development and procurement Agency for dedicated space infrastructure**
 - Development of first spacecraft and Ground Segment
 - Procurement of recurrent elements
- **Operator of Sentinel-1, Sentinel-2, Sentinel-3 (land) and Sentinel-5 precursor**
 - EUMETSAT is operator of Sentinel-3 (marine), Sentinel-4, Sentinel-5 and Sentinel-6

Copernicus Space Component: the dedicated Sentinels ...



S1A/B: Radar Mission

3 Apr 2014/22 Apr 2016



S2A/B: High Resolution Optical Mission

23 June 2015/2017



S3A/B: Medium Resolution Imaging and Altimetry Mission

16 Feb 2016/2017



S4A/B: Geostationary Atmospheric Chemistry Mission

2021/2027



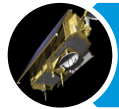
S5P: Low Earth Orbit Atmospheric Chemistry Mission

2016



S5A/B/C: Low Earth Orbit Atmospheric Chemistry Mission

2021/2027



S6A/B: Altimetry Mission

2020/2025

... with a long-term operational perspective

2011

2014

2020

2030

Access to Contributing Missions

S-1 A/B/C/D



S-1 2nd Generation



S-2 A/B/C/D



S-2 2nd Generation



S-3 A/B/C/D



S-3 2nd Generation



S-4 A/B (on MTG)



S-5 Precursor



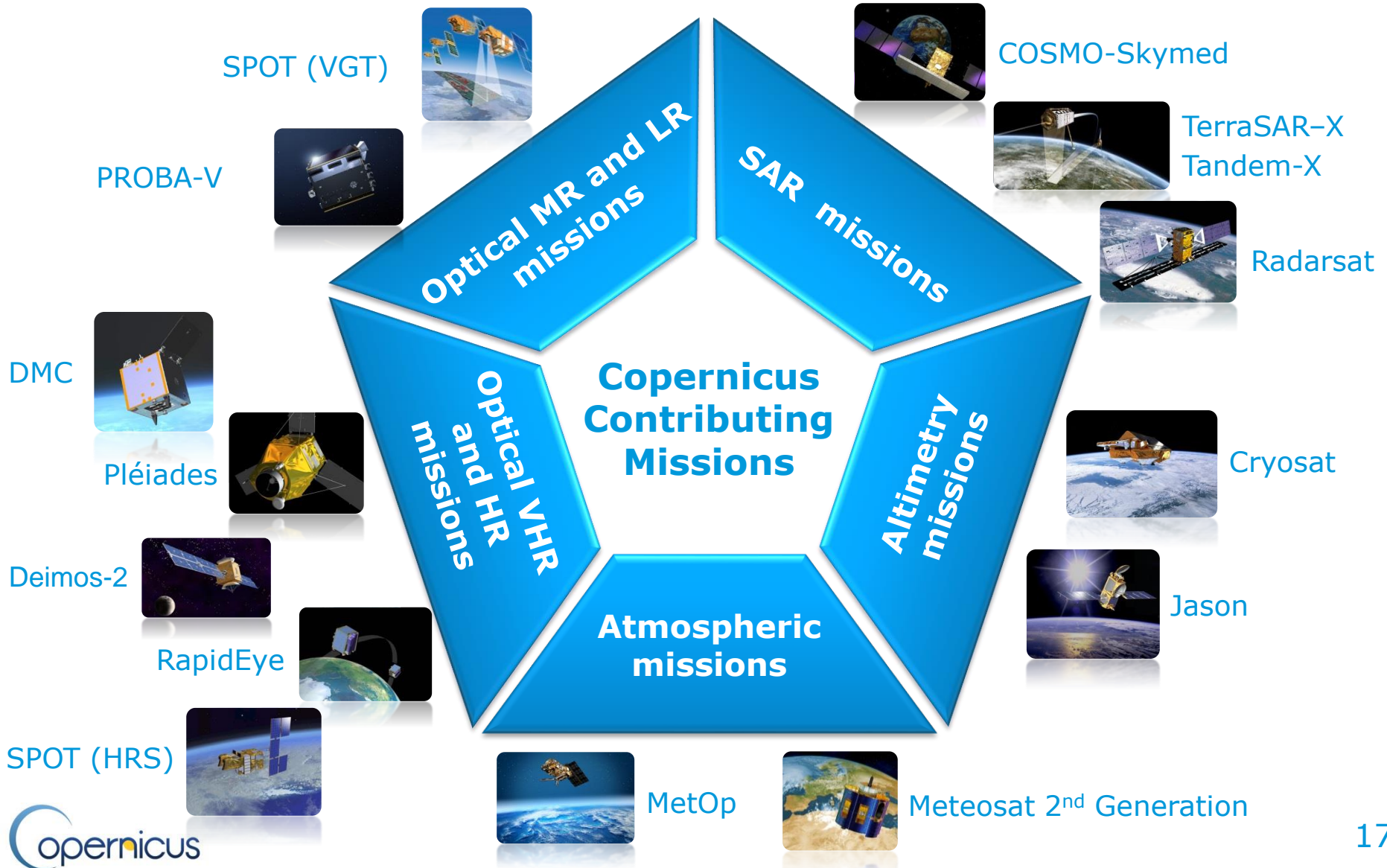
S-5 A/B/C (on MetOp-SG)



S-6 A/B



Copernicus Contributing Missions



Launch Sentinel-1A



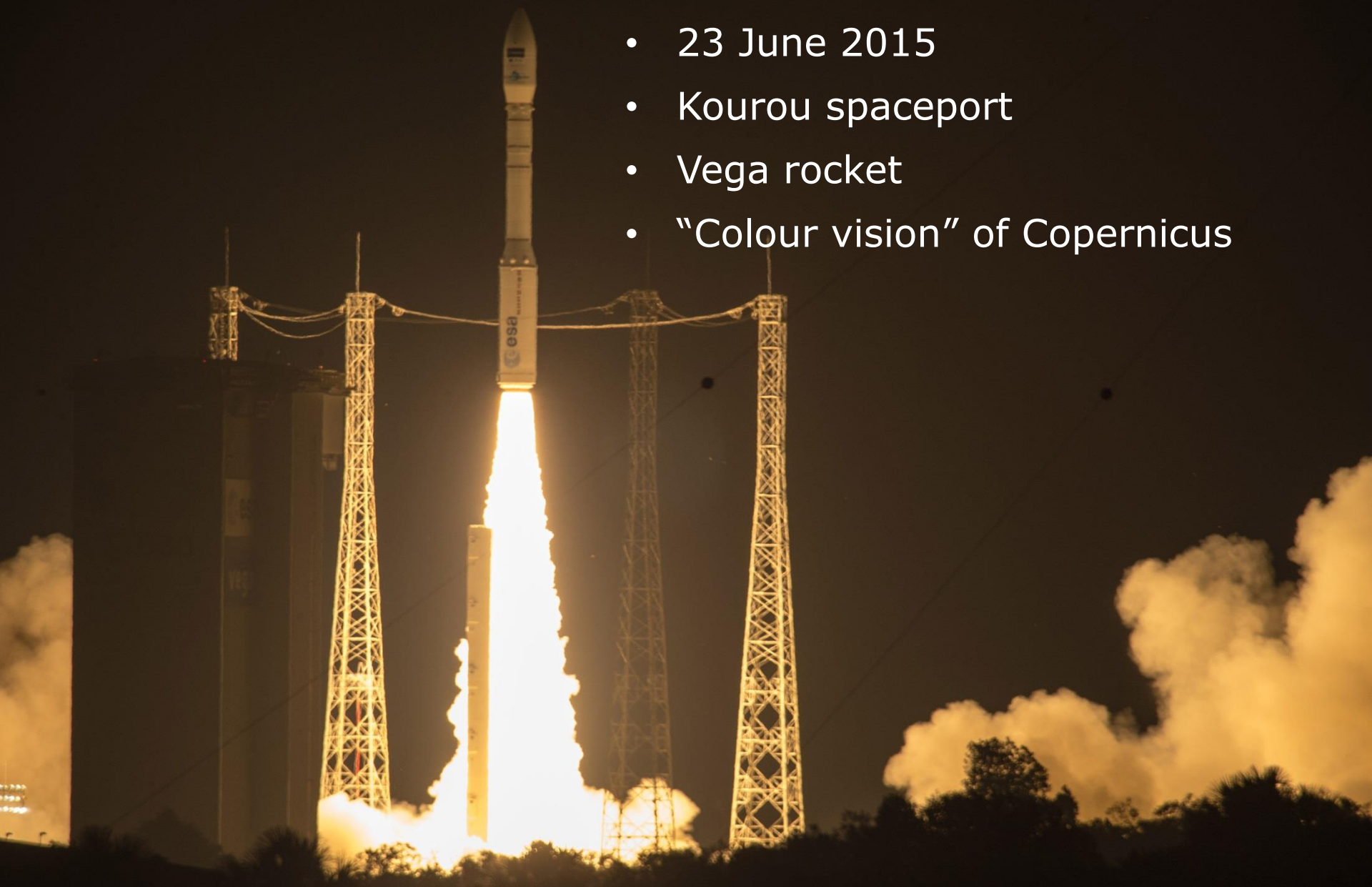
- 3 April 2014
- Kourou spaceport
- Soyuz-2 rocket
- New era of Earth observation



Launch Sentinel-2 A



- 23 June 2015
- Kourou spaceport
- Vega rocket
- “Colour vision” of Copernicus



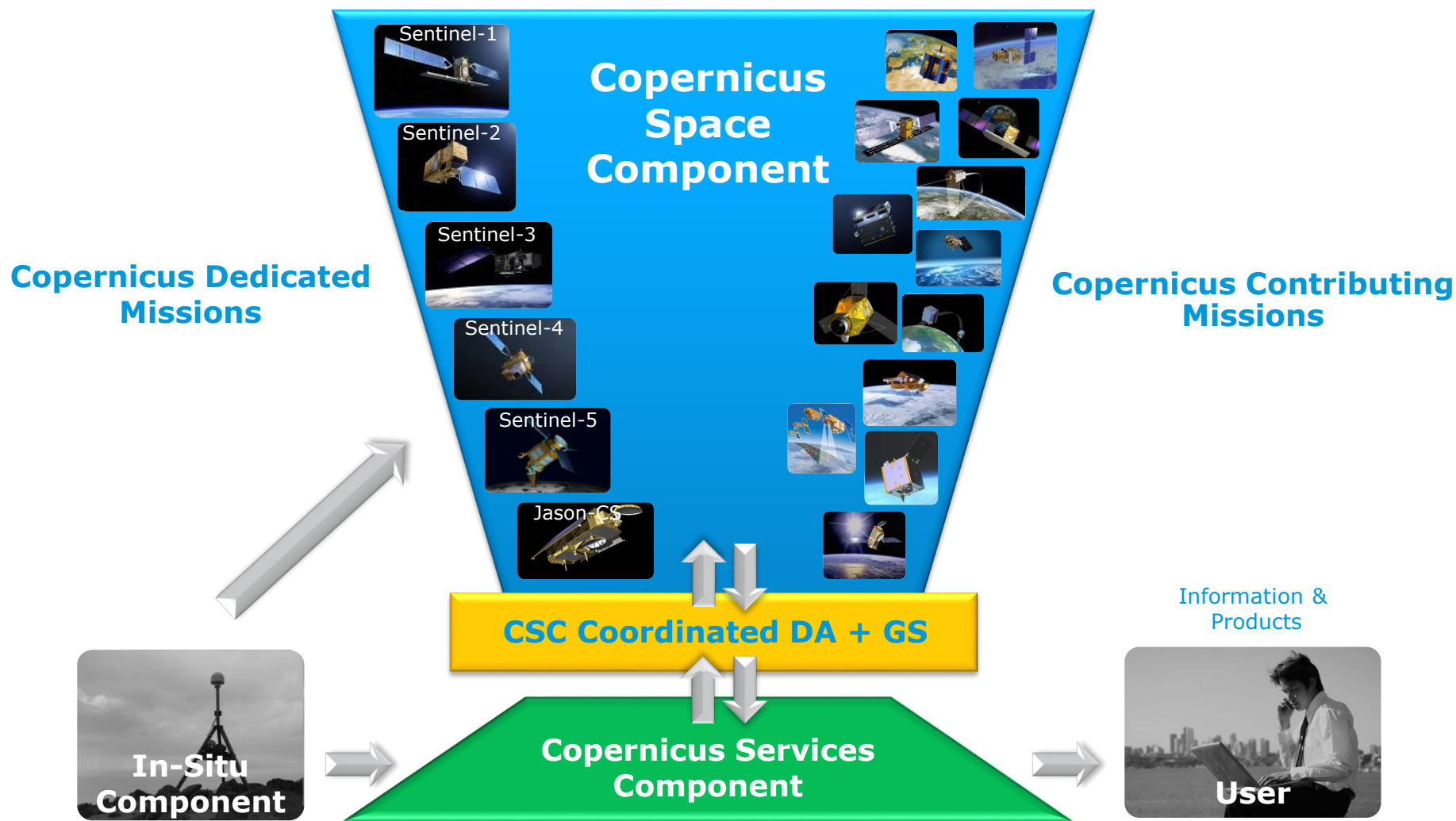
Launch Sentinel-3 A



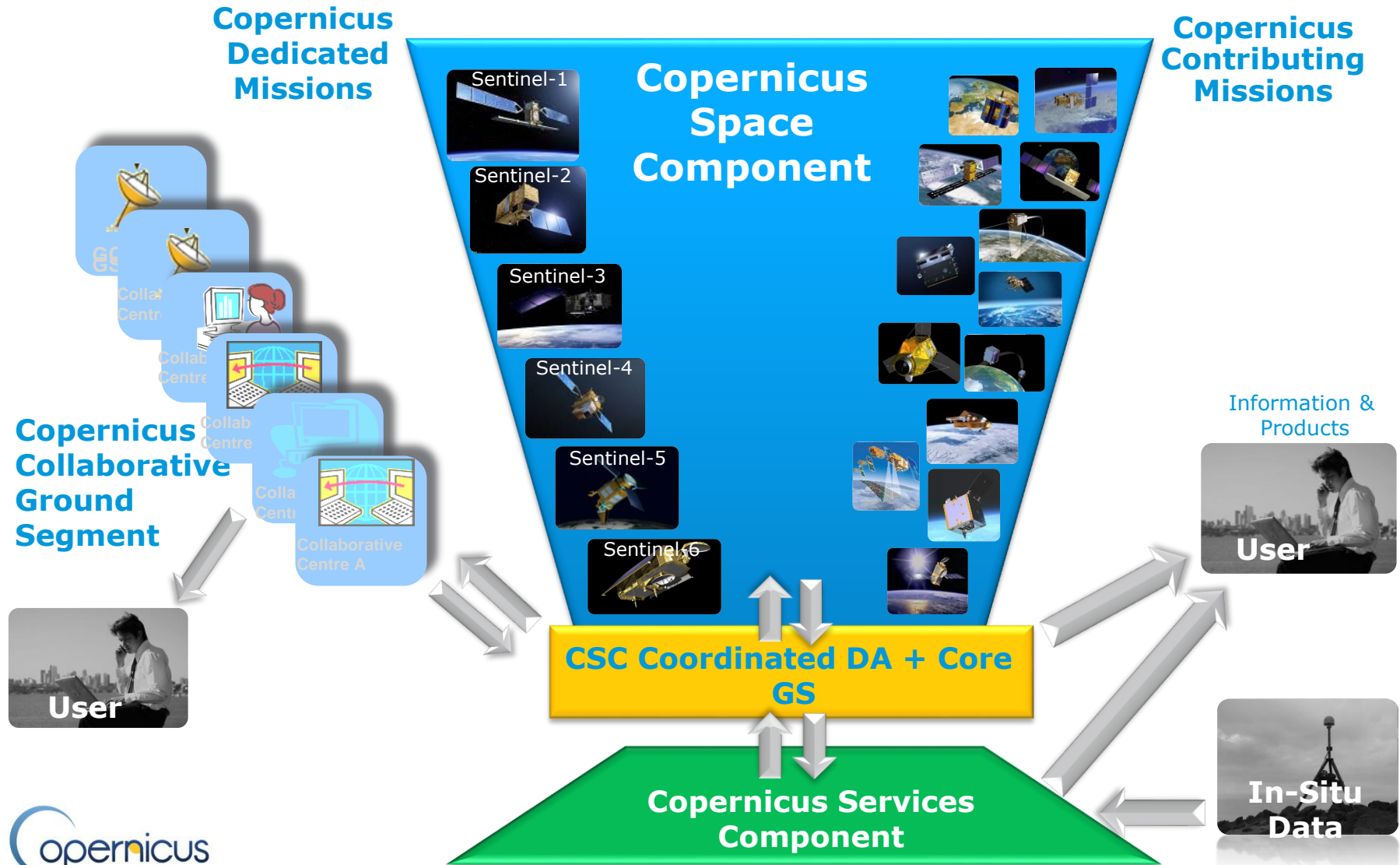
- 16 February 2015
- Plesetsk Cosmodrome
- Eurockot rocket
- “Bigger vision” of Copernicus



Copernicus Ground Segment (w/o CoIGS)



Copernicus Space Component: the Ground Segment ...





**Copernicus Space Component
Data Access Portal**

sentinel.esa.int

**Copernicus
Services
Access**

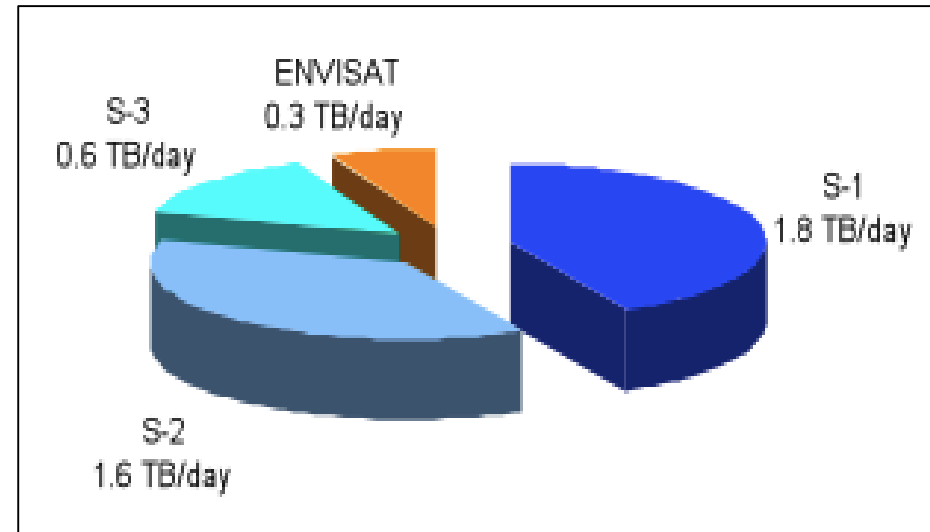
**Scientific / Other
Access Hub**

**Collaborative
Access Hub**

**International
Agreements
Access Hub**

Sentinel-1, Sentinel-2, Sentinel-3 acquire data

- continuously,
- over much wider swaths,
- at improved resolutions,
- in more spectral bands than any of their 'predecessors'



Sentinels-1/-2/-3 (A+B) generate, together, more than **13 times the volume of data** generated by the 10 instruments on board Envisat, the largest EO satellite ever

- free and open access
spacedata.copernicus.eu

Users and Products Statistics: (status 8 July 2015)

- 8586 registered users
- More than 1.3 million products downloaded by users, representing about 1.6 Petabyte of data
- More than 180,000 products available for download

Mission profile:

- 
- ↑ **C-Band SAR** at 5.4 GHz, multi-polarisation
 - ↑ Sun synchronous orbit at **693 km** mean altitude
 - ↑ **250 km** swath width (Interferometric Wide-swath mode)
 - ↑ **6 days** repeat cycle at Equator with 2 satellites
 - ↑ **7 years** design life time, consumables for 12 years
 - ↑ **4** nominal mutually exclusive operation modes

Mission objectives:

- Ice and marine, land monitoring
- Mapping for humanitarian aid and crisis management

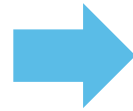
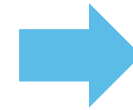
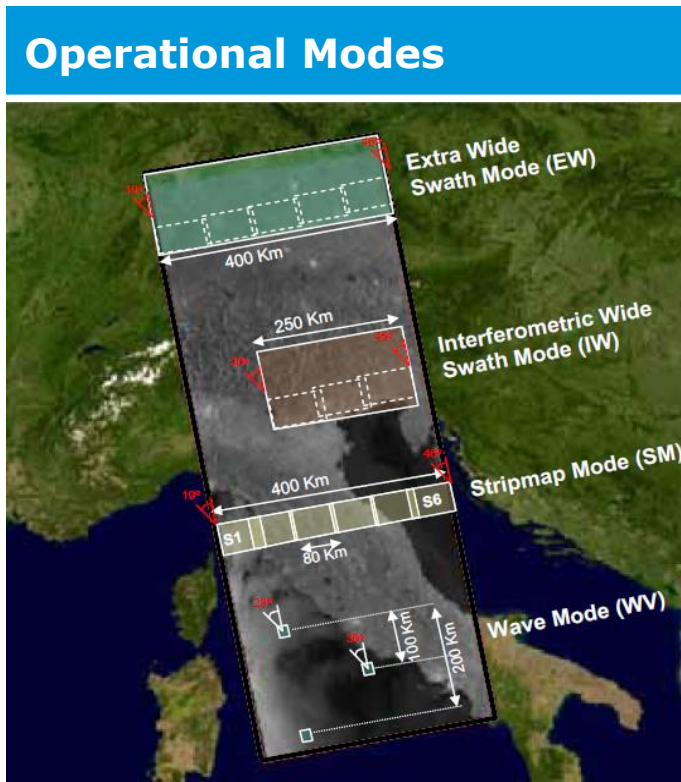
Sentinel-1

- **5 m** ground range resolution
- **250 km** swath width (Interferometric wide swath mode)
- **6 days** repeat cycle (with 2 satellites)
- **2 x 260 Mb/s** downlink data rate
- **7 years** design lifetime (consumables for 12 years)

Envisat

- **20 m** ground range resolution
- **100 km** swath width (Imaging mode)
- **35 days** repeat cycle
- Up to **100 Mb/s** space to ground data rate
- **5 years** design lifetime

Sentinel-1: Twice the sensitivity and thrice the accuracy in radar imaging quality



| Resolution | Swath Width | Polarisation |
|------------------------|---|----------------|
| 20 x 40 m ² | > 400 km | HH+HV or VV+VH |
| 5 x 20 m ² | > 250 km | HH+HV or VV+VH |
| 5 x 5 m ² | > 80 km | HH+HV or VV+VH |
| 5 x 5 m ² | 20 x 20 km ² at 100 km spacing | HH or VV |

- **Daily coverage of high priority areas, e.g. Europe, Canada, shipping routes**

Mission profile

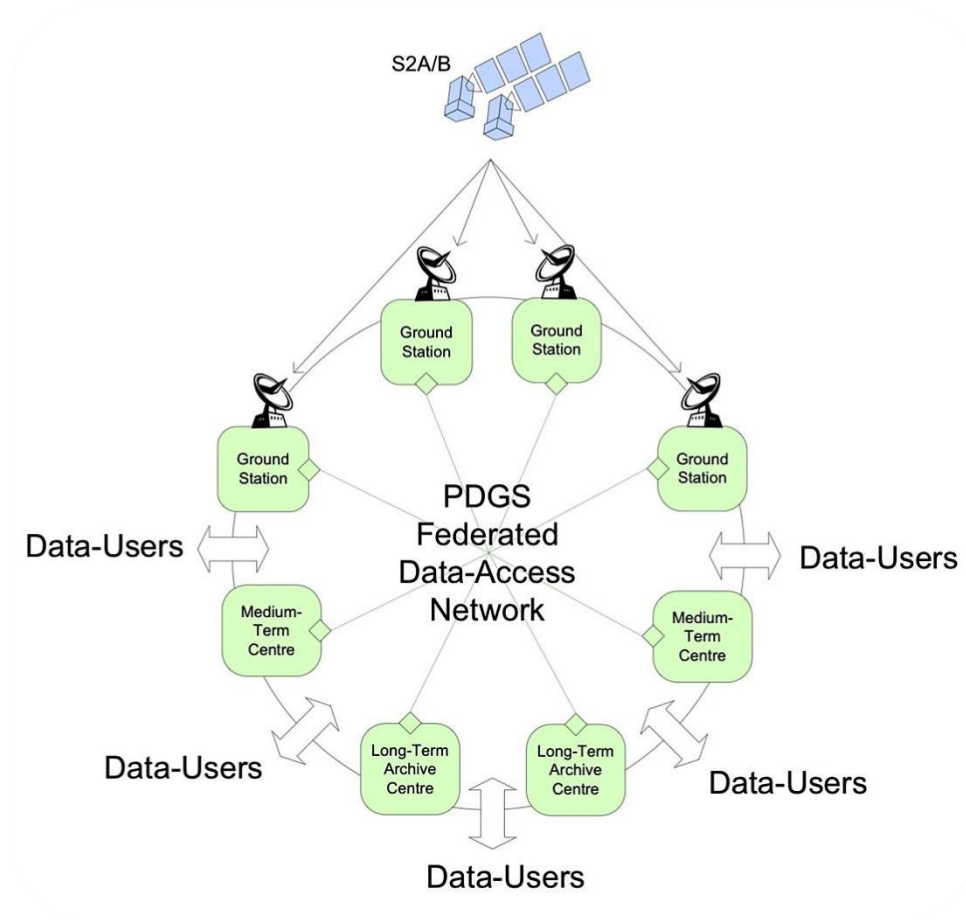
- Multispectral instrument with **13** spectral bands (VIS, NIR & SWIR)
- Sun synchronous orbit at **786 km** mean altitude
- **290 km** swath width
- **5 days** repeat cycle at Equator (cloud free) with 2 satellites
- **7 years** design life time, consumables for 12 years
- **10, 20** and **60 m** spatial resolution

Mission objectives:

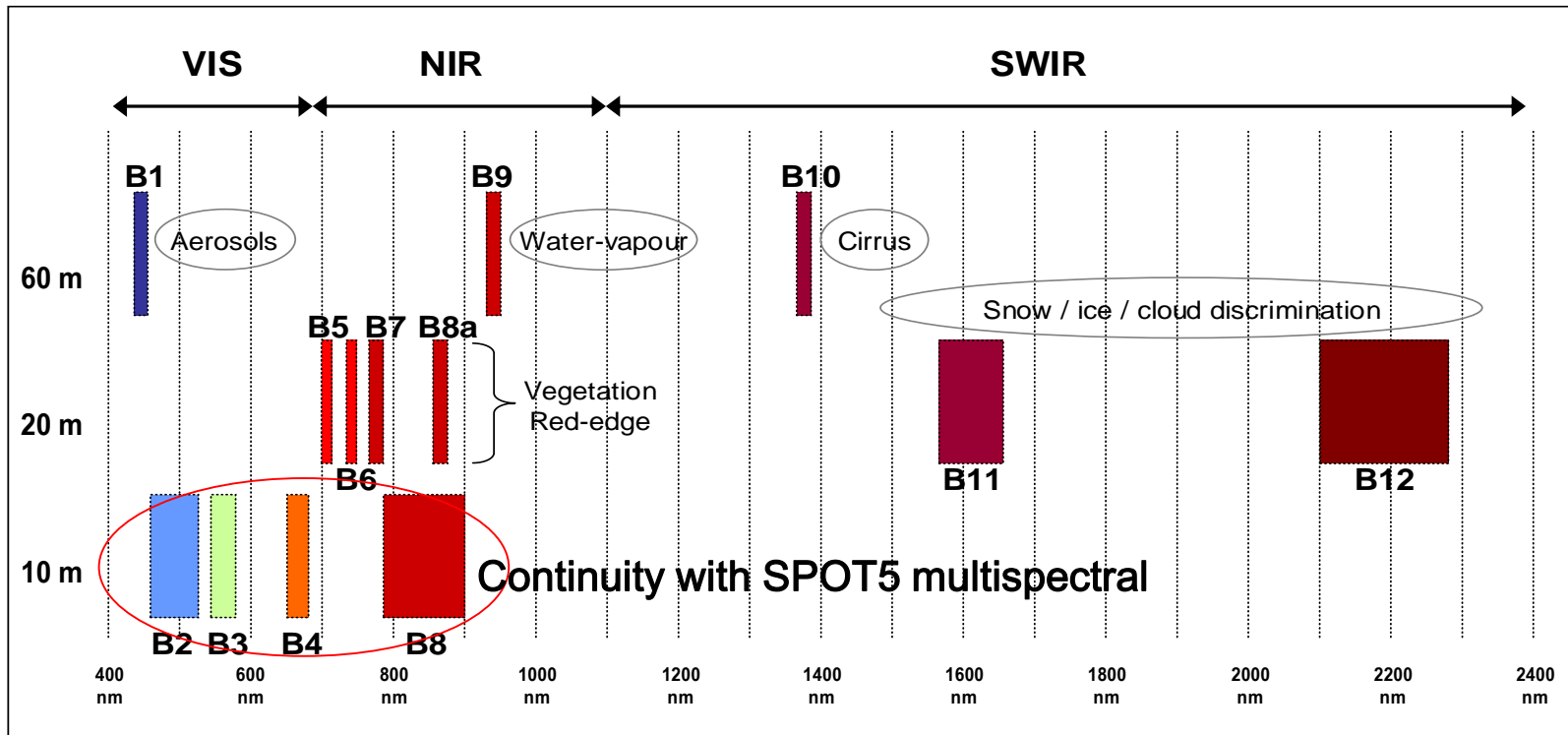
- Generic land cover maps
- Risk mapping and disaster relief

Ground Segment

- Data delivered to 4 core GS within **1-3 hours** after acquisition
- X band data downlink with instrument data rate of **490 Mb/s** (after onboard wavelet compression)
- **Laser Communication** through geo terminal (can be operated simultaneously with the X band subsystem)
- **900 GB** per day: cloud-free images will be further processed



Sentinel-2: 13 Spectral Bands



Spectral bands versus spatial resolution

LANDSAT 7



SPOT-5



Mission profile

- ↑ **3** main instrument sets: OLCI, SLSTR and RA
- ↑ Sun synchronous orbit at **814.5 km** mean altitude over geoid
- ↑ **1270 km** swath width for OLCI and **750 km** for SLSTR
- ↑ **< 1 day** repeat cycle for OLCI/SLSTR with 2 satellites, **27 days** for the topography package
- ↑ **7 years** design life time, consumables for 12 years

Mission objectives:

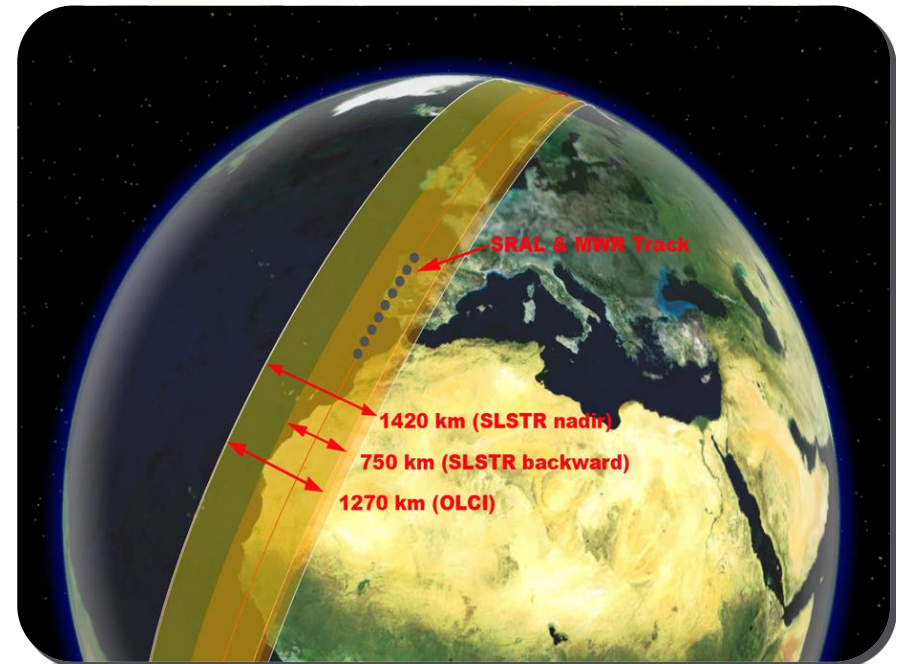
- Sea/land colour data
- Sea/land Surface temperature
- Sea surface and land ice topography

Optical Mission Payload

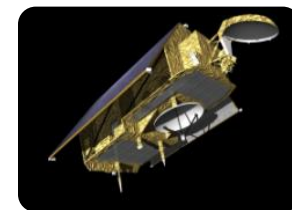
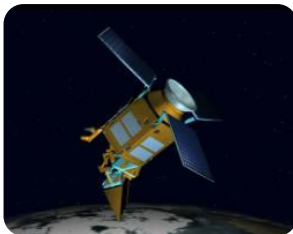
- Ocean and Land Colour Instrument (OLCI)
- Sea and Land Surface Temperature Radiometer (SLSTR)

Topography Mission Payload

- Ku-/C-band Synthetic Aperture Radar Altimeter (SRAL)
- MicroWave Radiometer (Bi-frequency)
- Precise Orbit Determination (POD) including:
 - GNSS Receiver
 - DORIS
 - Laser Retro-Reflector

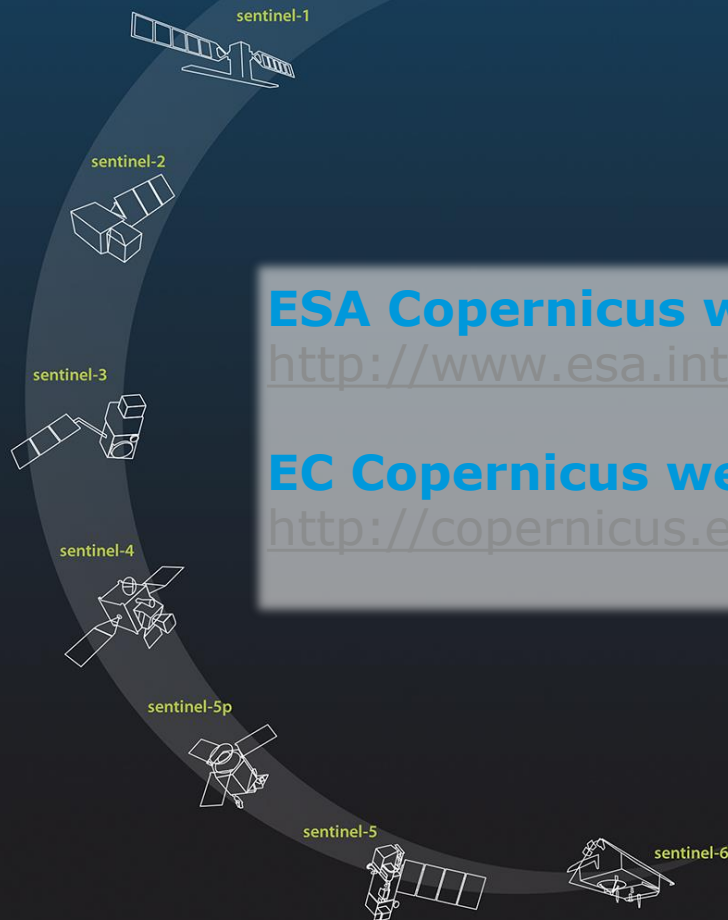


Advantages of Sentinel Satellites





Interested In More?

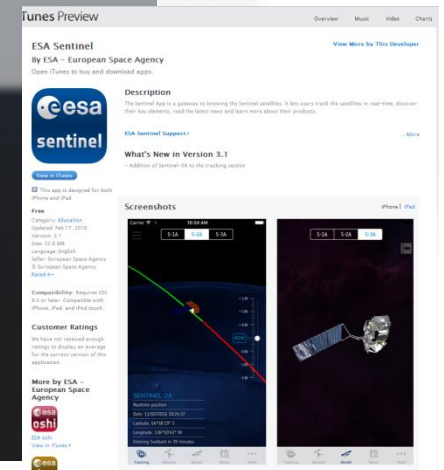


ESA Copernicus website

<http://www.esa.int/copernicus>

EC Copernicus website

<http://copernicus.eu>



- **Data provisioning**
- **Run sample algorithm with sample data on virtual machines**
- **Scale-up your processing**

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