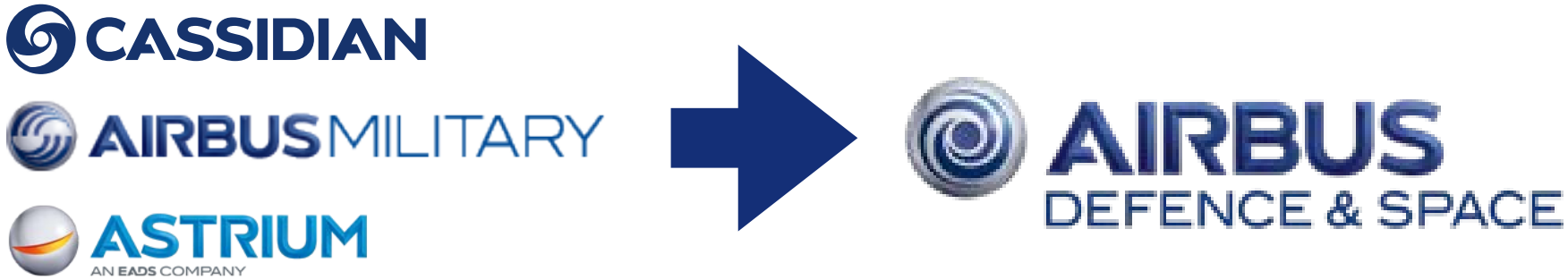
The Sentinels:
Access to data and “Big Data” processing.

Jacquie Conway, Head of Institutional Relations (GEO UK)
26/06/2014

AIRBUS
DEFENCE & SPACE

Airbus Defence and Space: A unique international leader

Being strong together – 3 turn into 1



One Parent Company
Three Brands
Multiple Business Segments

One Company
One Brand
Four Business Segments

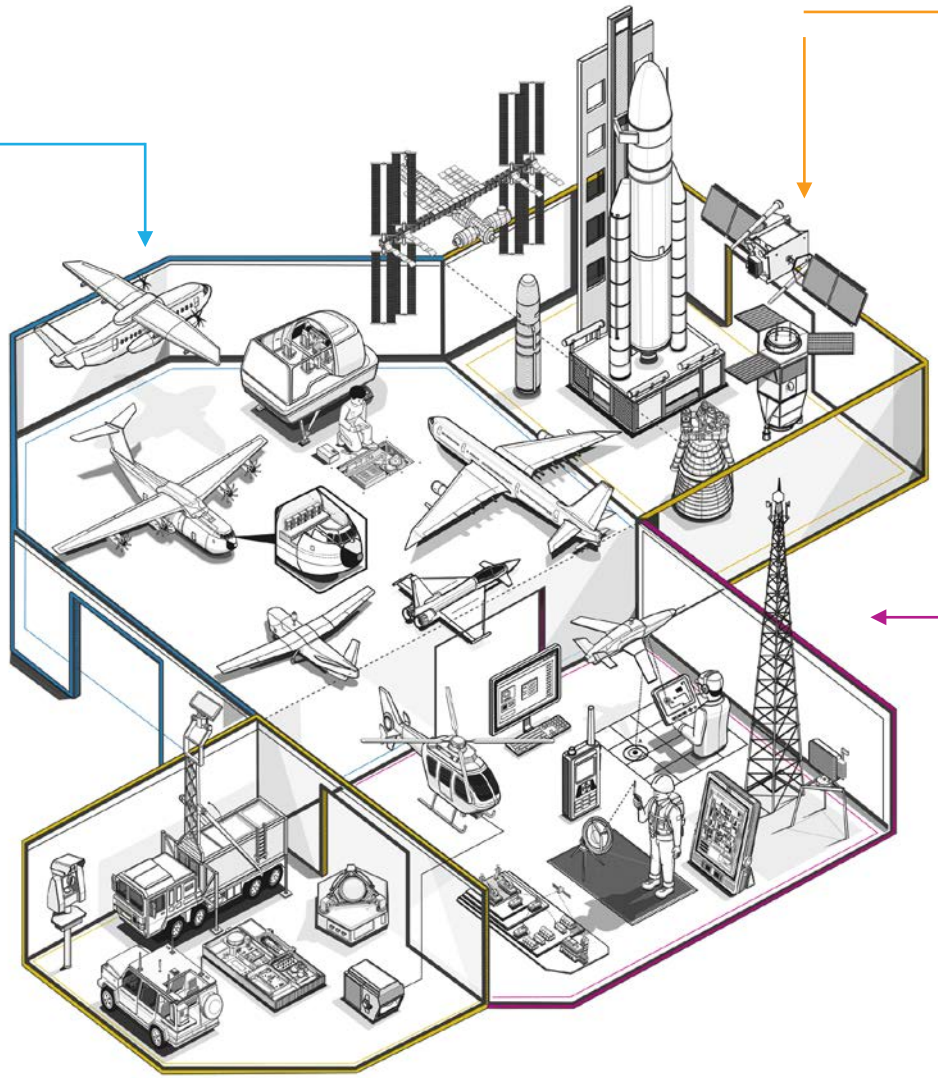
Airbus Defence and Space: 4 Business Lines

Military Aircraft

- A400M, A330 MRTT, CN235, C212, Orlik
- Eurofighter, Tornado
- Barracuda, Atlante, Harfang, Euro Hawk, Future European Male, Tracker, Tanan, Survey Copter

Electronics

- Radars and Identification Friend or Foe (IFF) Systems, Electronic Warfare, Mission Avionics, Space Platform Electronics, Space Payload Electronics



Space Systems

- Ariane 5, M51Automated Transfer Vehicle, Eurostar E3000, Pléiades, Gaia, Skynet, oberservation satellites (Spot, TanDEM-X, TerraSAR-X), MetOp, Swarm,, International Space Station ISS, interplanetary probes (Herschel, Mars Express, Solar Orbiter), Lunar Lander, COPERNICUS and Galileo

Communication, Intelligence & Security (CIS)

- Surveillance and Security Solutions, Secure Communications Solutions, Cyber Security, Coastal Surveillance Systems, NATO SATCOM Post-2000, Wireless Intranet Solutions in Theatre, **Geo-intelligence data, data management and solutions,** Tetra Systems

AIRBUS DEFENCE & SPACE

Introduction to Copernicus Europe's flagship EO programme.

Copernicus — The European Earth Observation Programme

Overview

- A source of information for policymakers, scientists, business and the public at large
- A European response to global needs to manage the environment, to understand and to mitigate the effects of climate change and to ensure civil security
- A user-driven programme of services for environment and security
- An integrated Earth Observation system (combining space-based and *in-situ* data with Earth System Models and services)

Space Infrastructure

- **SENTINELS** – EO missions developed specifically for Copernicus
- Contributing missions – EO missions built for purposes other than Copernicus but offering part of their capacity to Copernicus (EU/ESA MSs, EUMETSAT, Commercial, International)
- Managed for Europe by the European Space Agency (ESA)

Copernicus Services

Services Monitoring Earth Systems

Land

Marine

Atmosphere

Horizontal Services

Emergency

Security

Climate Change

Output: Value-Added Services

Space Component: Dedicated Missions - The Sentinels

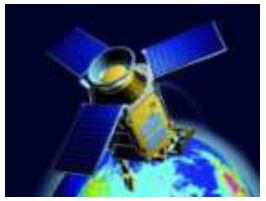
S1 A/B: Radar Mission

First Launch S1A
3rd April 2014

S2 A/B: High Resolution Optical Mission

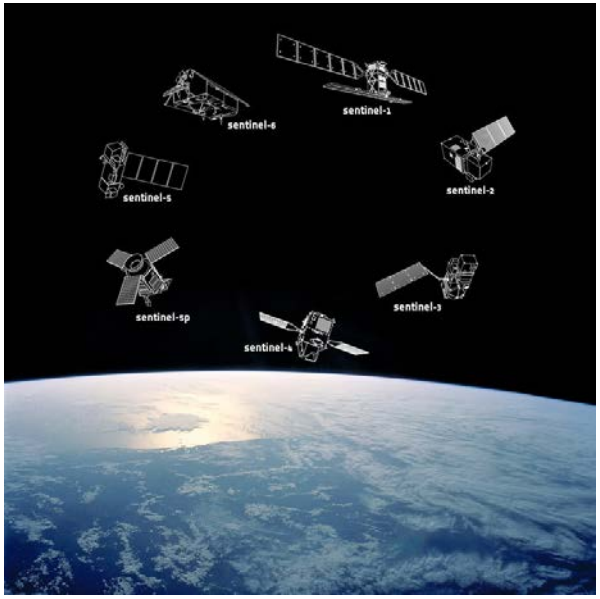
S3 A/B: Medium Resolution Imaging and Altimetry Mission

S4 A/B: Geostationary Atmospheric Chemistry Mission

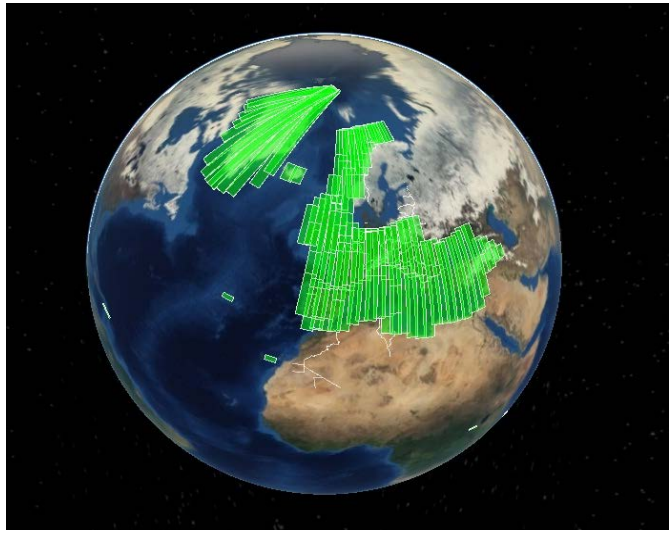


S5P: Low Earth Orbit Atmos. Chemistry Precursor Mission
S5 A/B/C: Low Earth Orbit Atmospheric Chemistry Mission

S6 A/B: Altimetry Mission (former Jason CS)



Operations Strategy



Main objectives of the Sentinels operations strategy:

- Reliable provision of data to Copernicus users
- Ensure systematic and routine operational activities:
  - with a high level of automation
  - with pre-defined operations to the maximum extent possible

Sentinels operations approach:

- Sentinels are operated via a **pre-defined background** observation and downlink plan:
  - Scenario is updated on a regular basis (e.g. 6-months) taking into account user requirements evolution
  - Generally no on-demand planning is allowed
- All Sentinels acquired data is **systematically downlinked and processed** to generate a predefined list of **core products** within specific timeliness

Operations Phase Definition

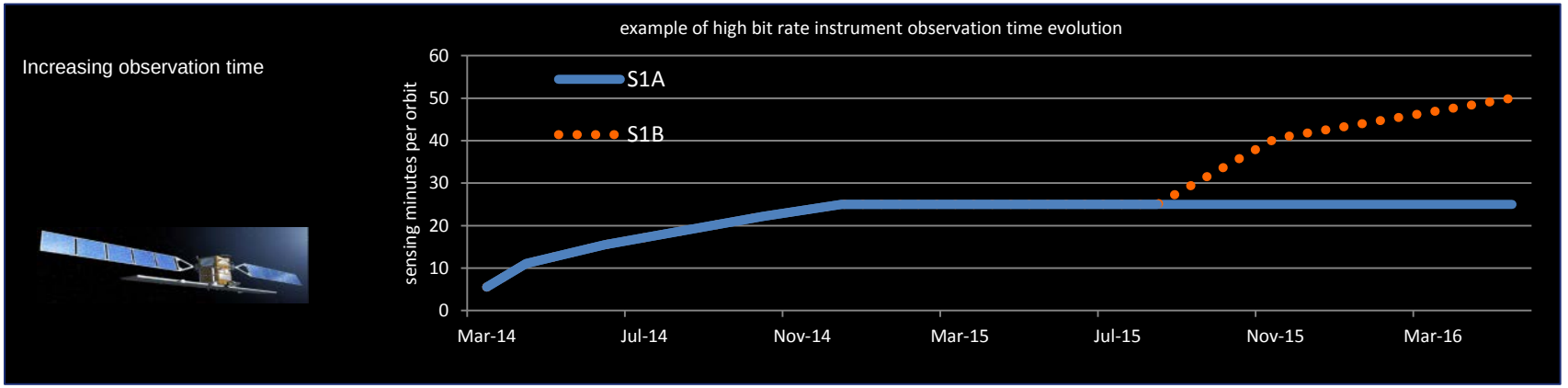
The ‘CSC Operations Concept’ refers to the period from mid 2014 onwards

An initial **ramp-up phase** is envisaged marking the transition towards the Full Operational Capability

This phase is characterised by a progressive integration of each Sentinel spacecraft in the overall system

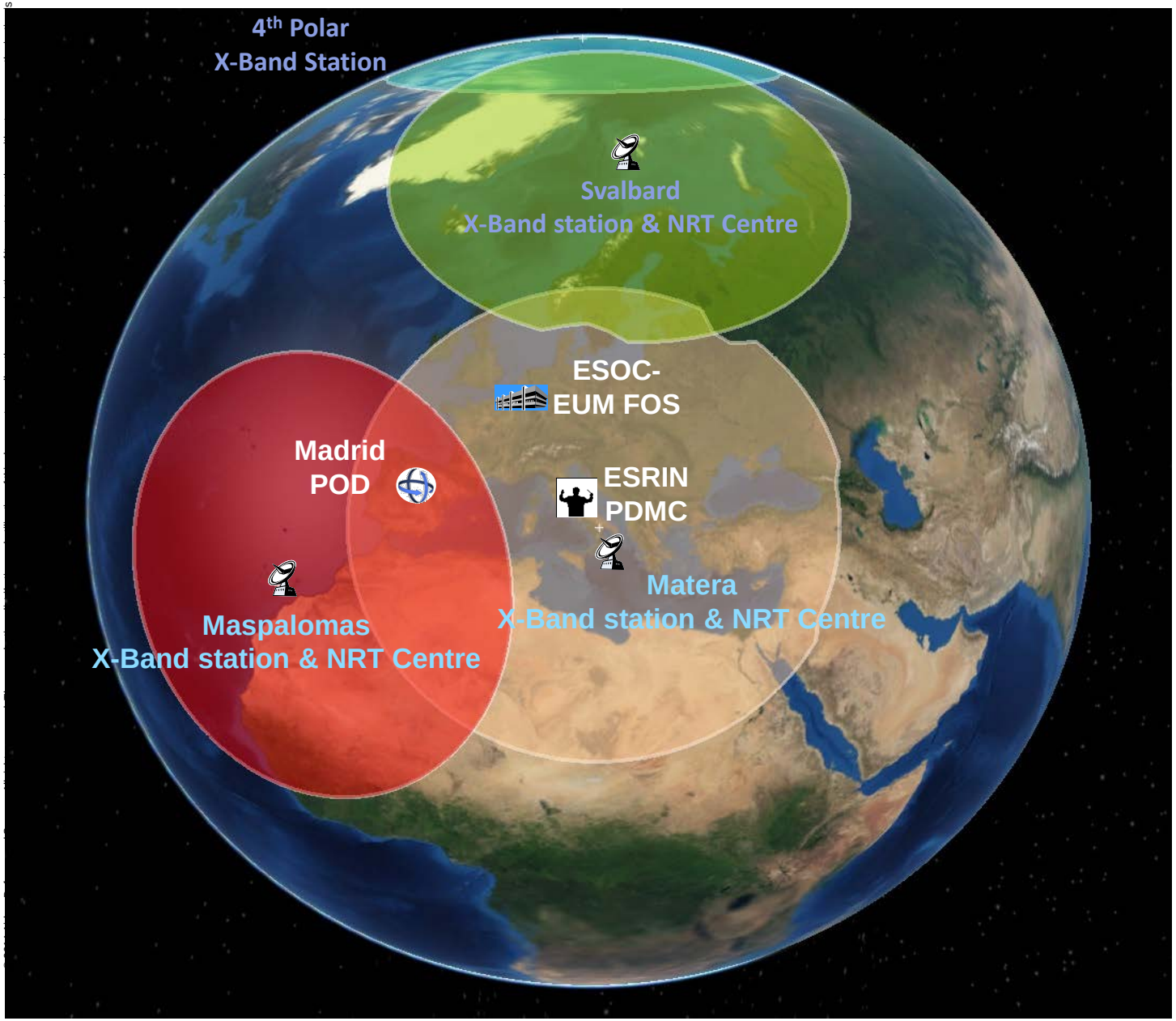
A gradual evolution is foreseen in the performance

- ✓of the availability of the overall system
- ✓of the data throughput and timeliness
- ✓of the services to users



AIRBUS DEFENCE & SPACE

Core Ground Segment Layout



Fight Operations Segment (FOS)

X-Band Stations & Near Real Time Processing Centre (CGS)

Payload Data Management Centre (PDMC)

Precise Orbit Determination Service (POD)

Core Ground Segment Layout

Archive and Offline Processing Centre

Mission Performance Centre (MC)

Sentinels Core Products

Sentinel-1	Sentinel-2	Sentinel-3
PDGS Core production for users dissemination & retrieval		
SAR L0	-	-
SAR L1 SLC	MSI L1B	OLCI L1
SAR L1 GRD	MSI L1C	SLSTR L1
SAR L2 OCN (waves, wind, radial velocity)	(*)	OLCI Water Colour L2
		OLCI Land L2
		SLSTR Water L2
		SLSTR Land L2
		SRAL L2
		Synergy/Vegetation L2

Launch dates:

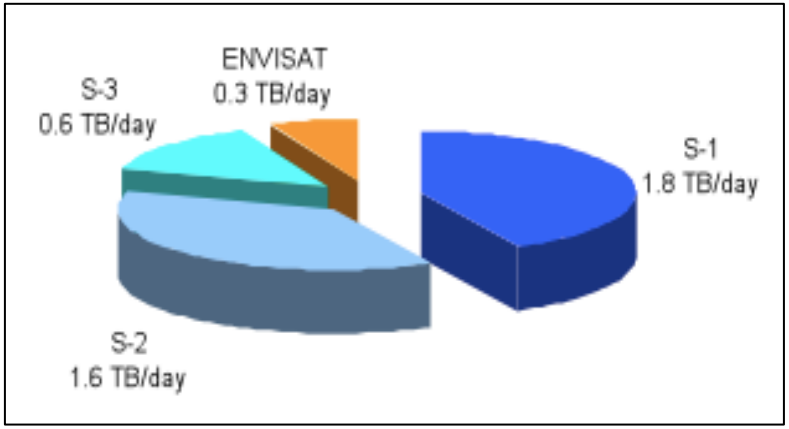
S1A 3rd April 2014

(in commissioning phase)

S2 A ~April 2015

S3 A > April 2015

B models ~ 18 months from launch of A models



	Corresponding average production rate (24h/24h)	Corresponding User products
Sentinel 1A*	150 Mb/s	L0 & all L1
Sentinel 2A*	200 Mb/s	All the different L1
Sentinel 3A	200 Mb/s	L1 & L2

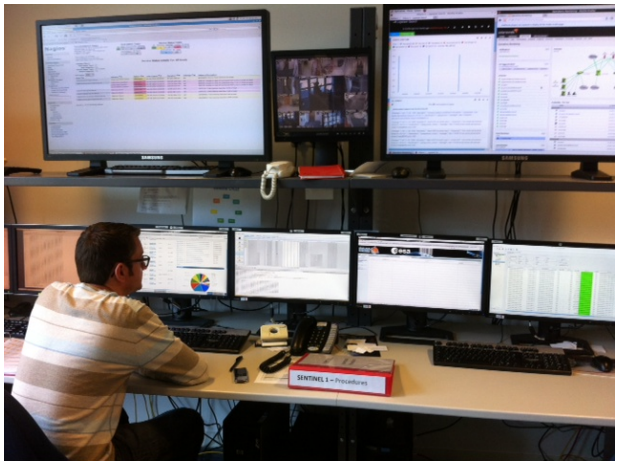
(*) based on average 15min downlink/Orbit

AIRBUS DEFENCE & SPACE

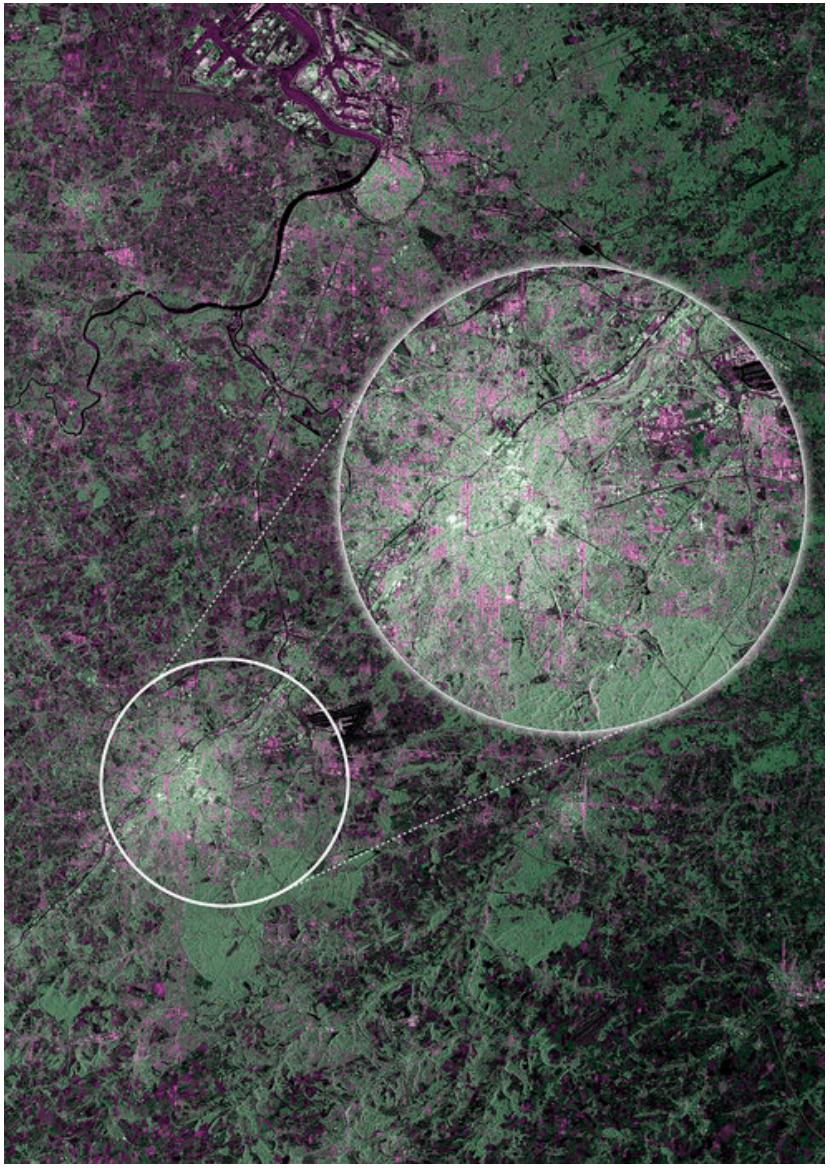
The Copernicus Sentinel Processing and Archiving facility in the UK.

Airbus GEO's facility in **Farnborough** is operating the **Processing and Archiving Centre** for ESA for **Sentinel 1 and Sentinel 2** disseminating data directly to the Copernicus Services

- The PAC for Sentinel 1 is currently in the **commissioning phase**, with ~35TB of data stored in the long term archive since satellite launch.
- ~1TB of data will be processed, stored and disseminated to Copernicus users per day when Sentinel 1 is in full operations.
- The Team are currently performing monitoring, reporting, production and reprocessing activities

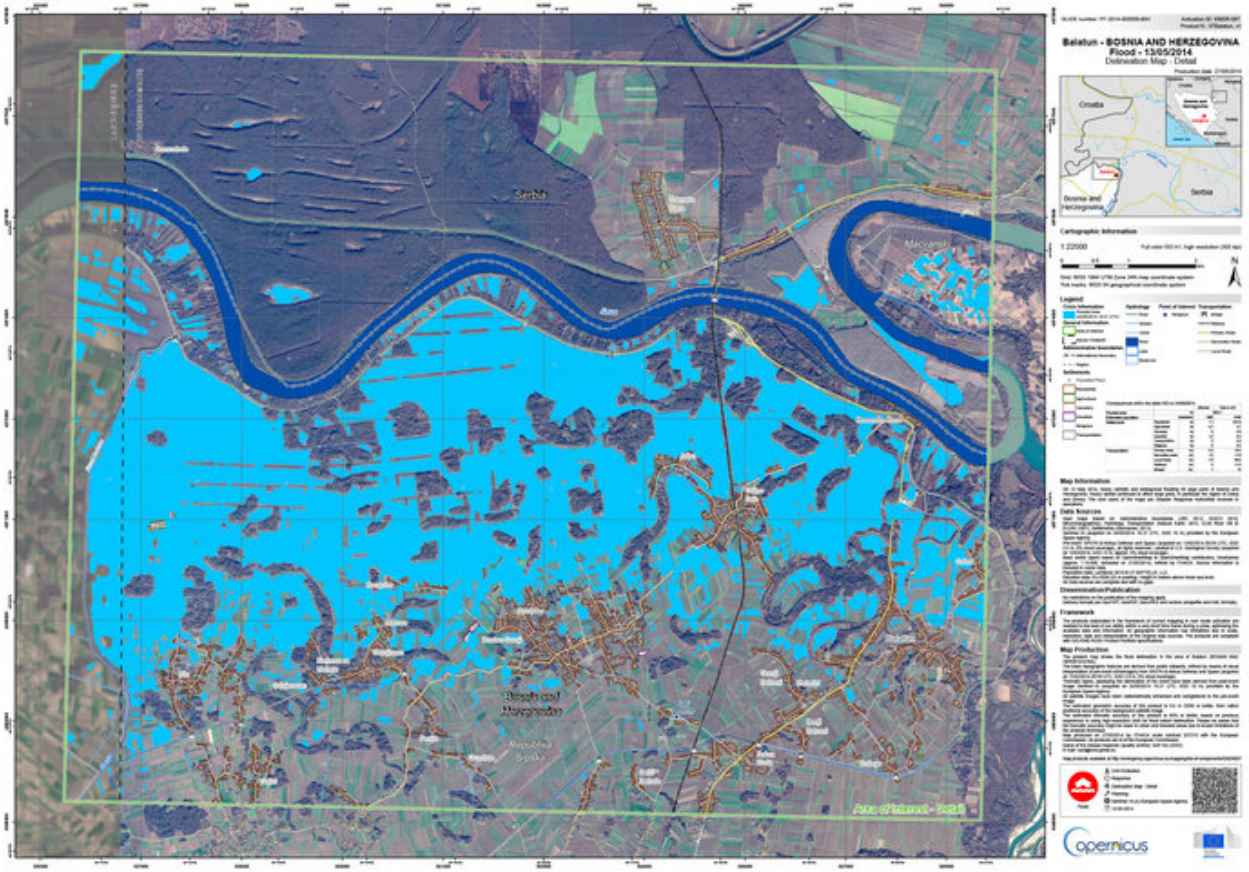


Sentinel 1 : Examples



First Sentinel 1 image – Brussels

Map of floods in Bosnia and Herzegovina

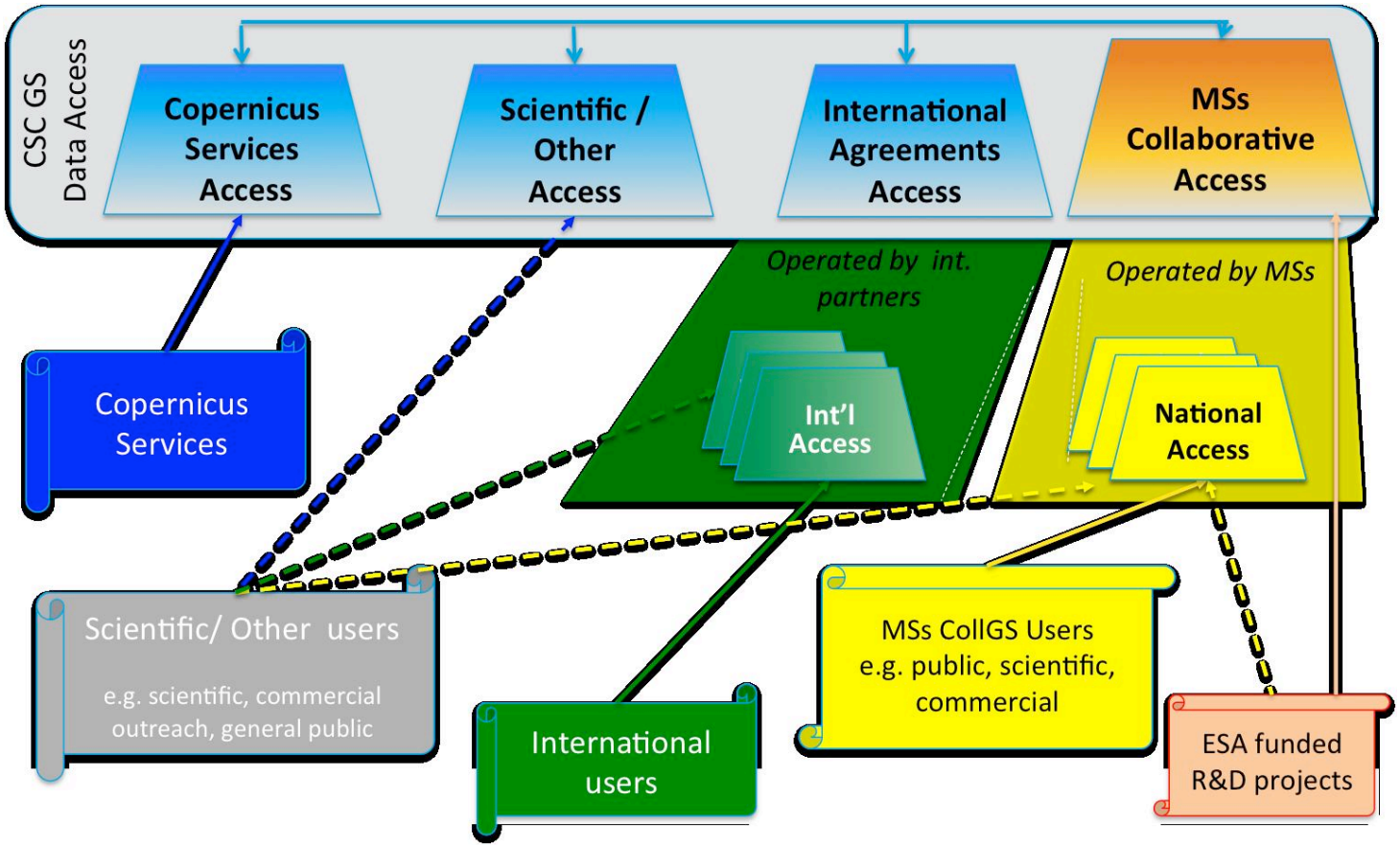


AIRBUS DEFENCE & SPACE

ESA Sentinel Access Mechanism

The ESA Sentinel Data Access Infrastructure has been adapted to the needs of the different user typologies, production, archiving and retrieval systems and facilities being operated by ESA, Eumetsat, ESA Member States (MS) or International Partners for the different user typologies.

No registration is required for **discovery** and **view** services while **it is a prerequisite to download Sentinel data.**



During the first months after launch (operations ramp-up phase) access to Sentinel-1 data will be progressively granted to the different use typologies in line with the increasing operational capacity.

AIRBUS DEFENCE & SPACE

The UK Sentinel Collaborative Ground Segment concept

Commercial users

Scientific users

JANET

Harwell

CATAPULT Satellite Applications

CEMS

Science & Technology Facilities Council
Rutherford Appleton Laboratory

Fast fibre link

AIRBUS DEFENCE & SPACE
Farnborough

AIRBUS
Processing Cloud

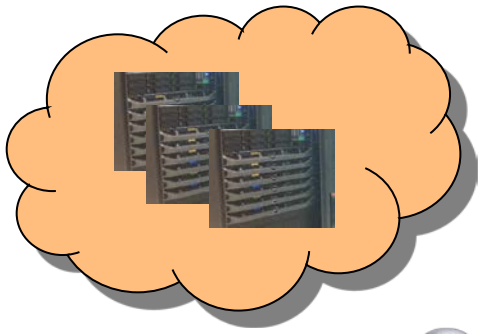
Big Data Processing: The AIRBUS Processing Cloud

MERIS Processing

- ✓ 1 day to implement IPF and test
- ✓ 3.5 days to process 2 years MER_RR

AATSR, ATSR-2, ATSR-1 Reprocessing

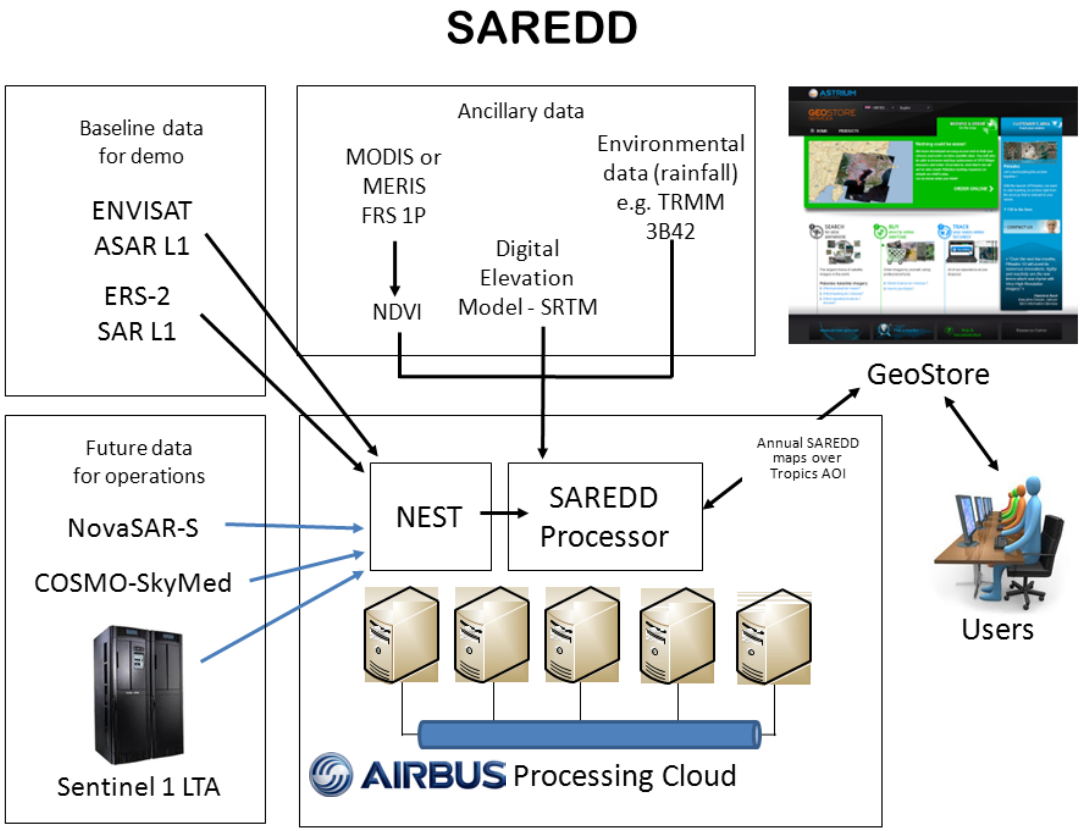
- L2P/L3U processing for **entire** missions
- Estimated processing time for AATSR mission using ESA provided infrastructure > 700 days
- Processing time using the AIRBUS Processing Cloud:
  - ✓ ATSR-1 5 days,
  - ✓ ATSR-2 10 days,
  - ✓ AATSR 2 weeks.



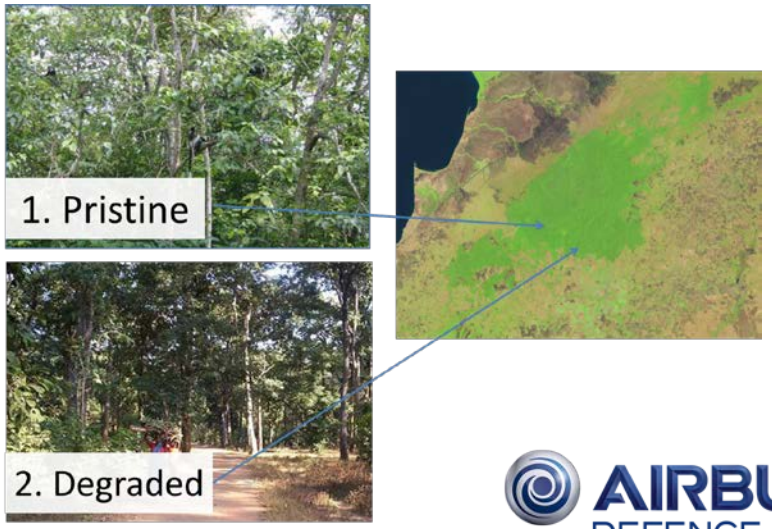
AIRBUS Processing Cloud

SAREDD - An Operational Service Providing Reliable Forest Degradation Information Using Satellite Radar Data

SAREDD is a system that uses satellite radar data to provide information about tropical forest degradation. It will incorporate an innovative methodology that generates output by processing stacks of imagery in a semi-automated procedure. Developed by **Airbus GEO and University of Edinburgh**.



- ✓ Critical role of the tropical forest in relation to global climate change
- ✓ UN REDD – Reducing emissions from Deforestation and Forest Degradation
- ✓ Forest degradation has received less attention than Deforestation but may account for over 50% emissions in much of Africa and Central America



AIRBUS DEFENCE & SPACE

Any Questions?

Presented by : Thomas Lankester

AIRBUS
DEFENCE & SPACE

Back-Up / Material

Detail of Data Access

Use Typology	Free data access to:	Access Points	Service commitment
Copernicus Services	• NRT/24h and consolidated Sentinels products • Different missions archives, including long term • On-demand production • Access via user available bandwidth to the Copernicus Space Component dissemination backbone • EUMETCAST access for Sentinel-3 marine products • Dedicated data sets generation (CORE DATASETS e.g. land coverage) • Possibility of requesting on-demand production (ADDITIONAL DATASETS) • Full time access to emergency services (24h/7/365, incl. rush mode) (for authorized users) • Service Desk support through dedicated user account management • CCMs data, according to CSCDA Terms and Conditions	- ESA & EUMETSAT catalogues & dedicated servers - EUMETCAST services for Sentinel-3 Marine	Committed performances
ESA/EU MS National Use	• A dedicated rolling archive of the NRT/24h and consolidated Sentinels products • Access via user available bandwidth to a dedicated dissemination bandwidth with committed reliability and performances • Dedicated support for limited on-request data set generation or on-demand processing	Rolling archive Data Hub server supporting dedicated product discovery and ftp & http downloads	Targeted performances to support ESA/EU Member States
Scientific Use and other use (e.g. commercial, outreach, public)	• A dedicated rolling archive of a consolidated production baseline (products availability may be deferred) • Access via user available bandwidth to a dedicated dissemination bandwidth ensuring gateway to the scientific GEANT backbone • Access configured to avoid resources saturation resulting from massive downloads by a limited user community (e.g. maximum number of parallel downloads, maximum volume per retrieval,…)	Rolling archive server supporting dedicated product discovery and http downloads, EUMETCAST services for Sentinel-3 Marine	Shared and open resources for scientific and other use accesses
International agreements	• A dedicated rolling archive of the NRT/24h and consolidated Sentinels products • Access via user available bandwidth to a dedicated dissemination bandwidth with committed reliability and performances • Dedicated support for limited on-request data set generation or on-demand processing	Rolling archive server supporting dedicated product discovery and ftp & http downloads, EUMETCAST services for Sentinel-3 Marine	Targeted performances to support EU International Agreements