EU SST
Space Surveillance and Tracking

Ensuring space safety and sustainability

Keynote speech on European Union Space Surveillance and Tracking

Dr. Pascal Faucher, Chairman, EU SST Partnership, Defense and Security, CNES

01/11/2023, SDSC23

#EUSpace

PROGRAMME OF THE EUROPEAN UNION

What is EU SST?

EU SST
Space Surveillance and Tracking

- **Fully-fledged sub-component** of the EU Space Programme 2021-2027
- **Inherently dual governance** structure in place in which civilian, military and security actors collaborate, which enables to operate effectively taking into account the **security** dimension of the SSA domain

EU SST Partnership

15 EU Member States:

Austria, Czech Republic, Denmark, Finland, France, Germany, Greece, Italy, Latvia, the Netherlands, Poland, Portugal, Romania, Spain, Sweden

FFG Promoting Innovation. · Czech Republic Ministry of Transport · FMI · cnes Centre National d'Études Spatiales · DLR German Space Agency at DLR · National Observatory of Athens · ASI Agenzia Spaziale Italiana · Ministry of Education and Science Republic of Latvia · Ministerie van Economische Zaken en Klimaat · PLSA Polish Space Agency · SST-PT · rosa Romanian Space Agency · CDTI Innovación · Rymdstyrelsen Swedish National Space Agency

EUSPA as Front Desk

EUSPA European Union Agency for the Space Programme

Overseen by **European Commission**

European Commission

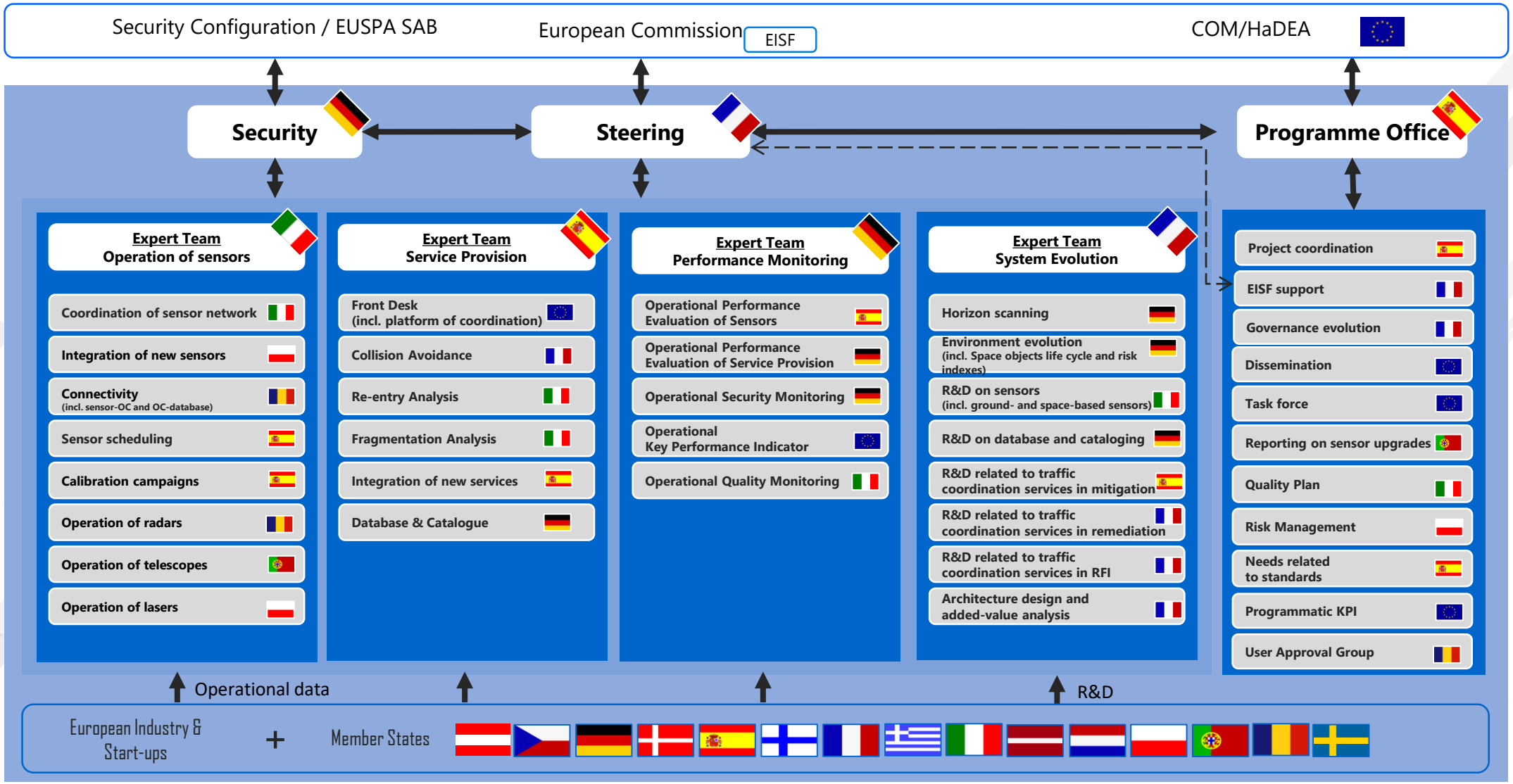
Strategy ▪ Five priorities

EU SST
Space Surveillance and Tracking

1. We are fully **operational** 24/7 and deliver public services to users (collision avoidance, re-entry and fragmentation analysis) to ensure a minimum level of space safety and sustainability
2. Perform research and development of SST capabilities to improve the level of performance and **strategic autonomy**
3. Foster innovation and **competitiveness** of the European industry and start-ups, we support the consolidation of a commercial ecosystem around SSA, strengthening strategic autonomy in Europe
4. Exploit **synergies between civil and defense**, avoid unnecessary duplications, and join forces in order to improve the level of European strategic autonomy
5. Engage with **international partners** and contribute to the global burden sharing of the SSA domain through a regional SSA approach

Governance ▪ Organization of the Partnership

EU SST
Space Surveillance and Tracking



Governance ▪ Progressive expansion of the Partnership

EU SST
Space Surveillance and Tracking

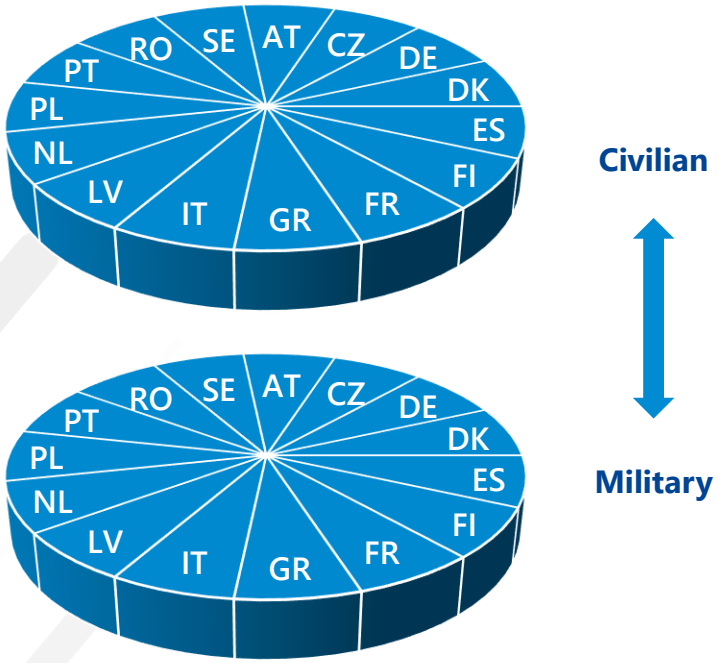
2015/6/16: founders
(Brexit: UK left EU SST in 2020)

2018/12/27: 1st enlargement

2022/11/11: 2nd enlargement

1.	France	Dr Philippe Baptiste, Chief Executive Officer, CNES
2.	Germany	Dr Walther Pelzer, Head of the German Space Agency, DLR
3.	Italy	Ing. Giorgio Saccoccia, President, ASI
4.	Spain	Mr. Francisco Javier Ponce Martínez, Director General, CDTI
5.	Poland	Prof. Dr hab. Grzegorz Wrochna, President, POLSA
6.	Portugal	Mr. Vasco Manuel Dias Costa Hilário, Director General, DGRDN, Ministry of National Defense
7.	Romania	Dr. Fiz. Marius-Ioan Piso, President and CEO, ROSA
8.	Austria	Dr. Henrietta Egerth-Stadlhuber and Dr. Klaus Pseiner, Managing Directors, Austrian Research Promotion Agency (FFG)
9.	Czech Republic	Mr. Martin Kupka, Minister of Transport, Ministry of Transport (MDCR)
10.	Denmark	Colonel Henrik Hegner Nielsen, Chief of Staff, Air Command Denmark, Royal Danish Air Force
11.	Finland	Dr. Jussi Kaurola, Director General, Finnish Meteorological Institute (FMI)
12.	Greece	Prof. Emmanouil Plionis, Director and President of the BoD of NOA, National Observatory of Athens (NOA)
13.	Latvia	Ms Līga Lejiņa, Ministry of Education and Science of the Republic of Latvia (IZM)
14.	Netherlands	Mr. Micky Adriaansens, Minister, Ministry of Economic Affairs and Climate Policy
15.	Sweden	Mrs. Anna Rathsman, Director-General, Swedish National Space Agency (SNSA)

Governance ▪ Inherently dual governance structure



Civilian

Military

The **dual governance model** allows for **addressing and preserving sovereign security interests** of the participating Member States within a civilian framework, which is key to the success of any future multilateral SSA or STM initiative.

How do we take into account duality?

- EU SST ensures that sovereign security concerns are addressed through the participation of **ministry of defense** representatives and **national security authorities** in all strategic decisions in both the Steering Committee and the Security Committee
- EU SST integrates and leverages **military and civil operational SST capabilities** from the participating Member States, including sensors, operations centers and personnel
- EU SST also deals with the security interests of the **respective partners and allies** of the participating Member States regarding the use and exchange of SST data and information by the Partnership through an internal Data Policy and security classification guidelines

Security ▪ Cybersecurity measures

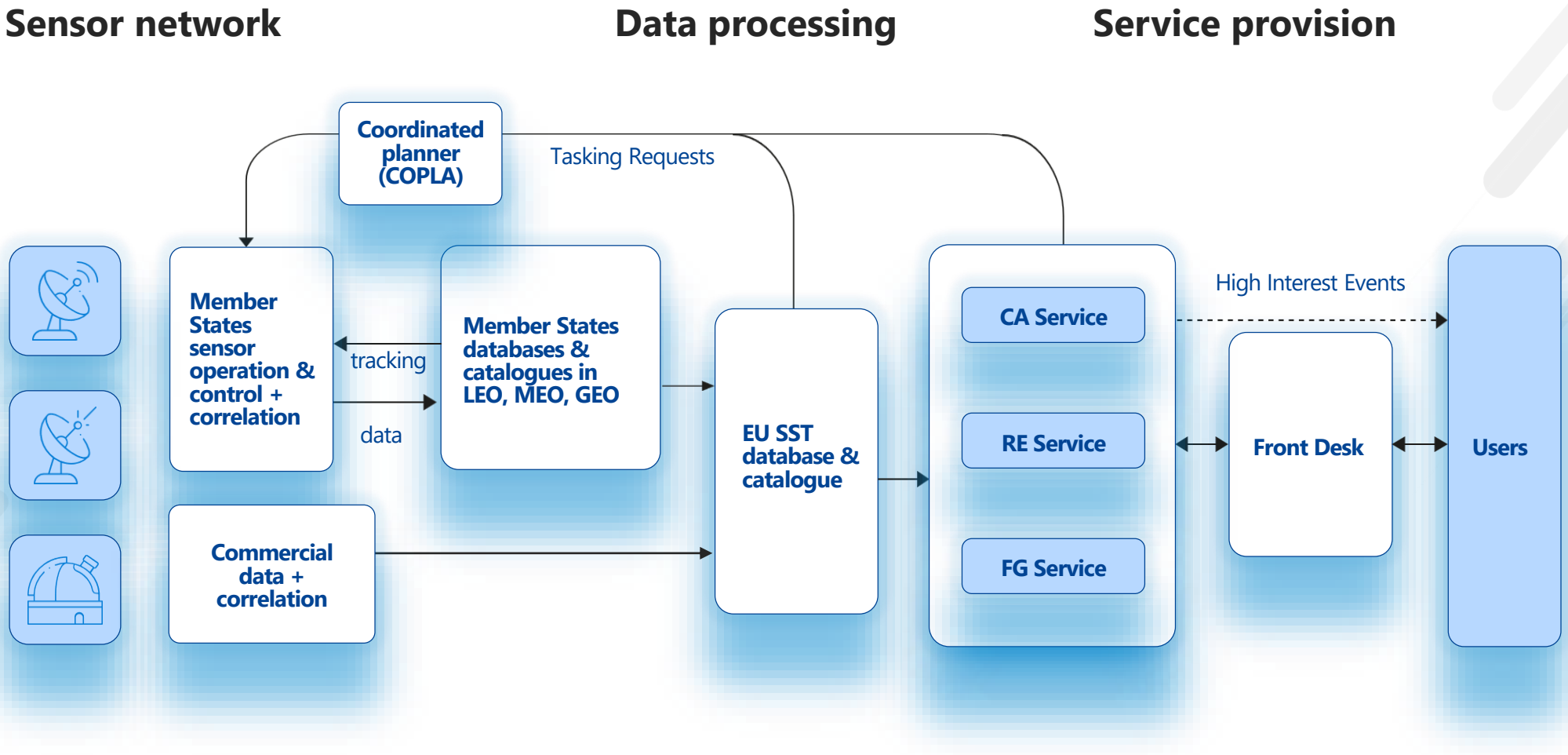
EU SST
Space Surveillance and Tracking

- The cyber security of the EU Space Programme is critical as it **mitigates threats to network and information systems** used to provide essential services in key sectors contributing to the Union's security and to the effective functioning of its economy and society. The recent debates in the Space regulation and EU Space Law are perfect examples of this.

- Strong measures have been put in place to create a **cyber-secured architecture** to ensure the confidentiality, integrity and availability of EU SST data and services:
  - A rigorous choice of hardware and software solutions, strictly justified in terms of needs;
  - Protection measures for the EU SST system network, databases and other critical physical infrastructures;
  - The check of the innocuousness of data shared via EU SST ;
  - User management of EU SST services to control exchanges and access to EUSST public data

- With these measures, overseen by the **Security Committee**, EU SST is fully committed to follow European Union directives on cybersecurity similarly to the other European flagship components of the EU Space Programme

Operations ▪ Overview



Sensors ▪ 12 military, 19 civil, 9 commercial sensors

EU SST
Space Surveillance and Tracking

MADEIRATEL-1/MADEIRATEL2

3 SATAM tracking radars

S3TSR survey radar

GRAVES survey radar

MFDR-MR/LR

PdM-MiTe

- 3 Lasers
- **9 Radars**
  (2 surveillance, 7 tracking)
- **28 Telescopes**
  (18 surveillance, 10 tracking)

Dual approach which enables the use of sensors of different origins: **military, civil and commercial**

EU SST network is regularly evolving, see https://www.eusst.eu/about-us/

Crucial contribution of military sensors which account for 97% of measurements shared in EU SST

Service provision ▪ three public services

EU SST
Space Surveillance and Tracking

Collision Avoidance (CA)

Risk assessment of collision and generation of collision avoidance alerts

Fragmentation Analysis (FG)

Detection and characterisation of in-orbit fragmentations

Re-entry Analysis (RE)

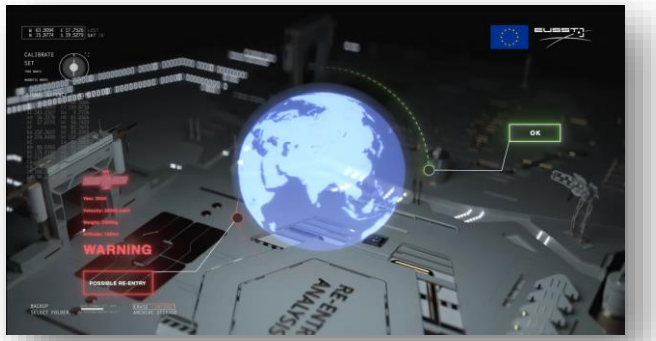
Prediction of space objects re-entry into the Earth's atmosphere

Key features

- Provided by ES (S3TOC) and FR (FR-SSA)
- Hot redundancy scheme with harmonised service level and single service provider per registered user
- Enhanced **Analysis & Risk Mitigation** support (e.g. covariance estimations, HBR estimations, PoC sensitivity analysis, CAM support)

- Provided by IT (C-SSA)
- Short-term notification to **confirm quickly an FG event**
- Medium-term FG analysis based on the orbital parameters of the **catalogued fragments** e.g. Gabbard Diagram
- Long-term FG analysis (**with simulations with breakup model**)

- Provided by IT (C-SSA)
- Long-term (within 30 days) **re-entry predictions**
- Short-term (a few days) overflight predictions with **ground tracks over customisable areas of interest**



Service provision ▪ Users

EU SST
Space Surveillance and Tracking

202
ORGS
23 EU MS

Collision Avoidance
64
ORGS

Fragmentation Analysis
155
ORGS

Re-entry Analysis
161
ORGS

419
Satellites

Service provision ▪ Users

EU SST
Space Surveillance and Tracking

419
satellites

29 new SC since 05/07:
Armsat1 Urdaneta, Gei-Sat precursor, Astrocast 01/02/101/102/103/104/105 201/202/203/204/205/301/302/303/304 Arthur-1, Gregoire, Optsat-3000, Droid.001, Iceye-X23/X25/X26/X30, PLATiNO-1, Ion SCV-011, Protomethee

11 removed SC:
Aeolus, EUTE 28B, NSS-6, FossaSat2E1/2/3/4/5/6/7/11

LEO

176

Optsat-3000
SAR-LUPE 1, 2, 3, 4, 5
BIROS
Tandem-X, Terrasar-X
PAZ
Brik-II
CHEOPS
METOP B, C
SENTINEL 1A, 1B, 2A, 2B, 3A, 3B, 5P, 6A
DEIMOS 1, 2
FossaSat 2E8, 12, 13, 14, 15, 16, 17
ION-SCV 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11
NEPT-1
Reaktor HW, Sunstorm, W-CUBE
Spartan, Platform 1, 2
Urdaneta, Gei-sat pre.
Suomi-100
TRISAT
UPMSat-2
NEMO-HD

CSO-1, 2
CERES 1, 2, 3
VENµS, SARAL
CALIPSO
JASON 3
PLEIADES 1A, 1B
SMOS
ANGELS, EYESAT
SWOT
NESS
BRITE PL-1,PL-2
Odin, GMS-T, MATS
GomX-4A. 4B
XR-1, ICEYE-X1, 2, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 23, 24, 25, 23, 27, 30
HiVE01
Spacevan-001
Star Vibe
Arthur-1, Gregoire
PLATiNO-1
Protomethee

DELFI C3, N3XT, PQ
HUMSAT-2D, LUME-1
Robusta 1B
AISSat 1, 2
NorSat 1, 2, 3, TD
ELO3, 4
YAM-2, 3, 5
Globalstar M065, M066, M069, M070, M071, M072, M073, M074, M075, M076, M077, M078, M079, M080, M081, M082, M083, M084, M085, M086, M088, M089, M090, M091, M092, M093, M094, M095, M096, M097, M087
Astrocast 1, 2, 101, 102, 103, 104, 105, 201, 202, 203, 204, 205, 301, 302, 303, 304
Droid.001

MEO

58

GSAT / Galileo 0101, 0102, 0103, 0104, 0201, 0202, 0203, 0204, 0205, 0206, 0208, 0209, 0210, 0211, 0207, 0212, 0213, 0214, 0215, 0216, 0217, 0218, 0219, 0220, 0221, 0222, 0223, 0224
O3B PFM, O3B FM 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, mPower 1, 2, 3, 4, 5, 6
ALPHA
CELESTA, MT-Cube-2
TRISAT-R

GEO

185

COMSATBW-1, 2
XTAR-EUR, SPAINSAT
METEOSAT-9, 10, 11, 12
ASTRA 1KR, 1L, 1M, 1N, 2A, 2C, 2E, 2F, 2G, 3B, 5B
AMC 3, 6, 11, 15, 18, 21
SES 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11,12, 14, 15, 16/Govsat-1, 17, 18, 19, 20, 21, 22
NSS 7, 9, 10, 11, 12
SIRIUS 4, QUETZSAT 1, CIEL 2
EDRS-C
GRAVITY SPACE 1
AMAZONAS 2, 3, 5, HISPASAT 30W-5, 30W-6, 36W-1, 74W-1, AMZ-NX
HYLAS 1, 2, 4

ATHENA-FIDUS
SYRACUSE 3A, 3B, 4A, 4B
HELLAS-SAT 2, 3, 4
EUTE 10A, 16A, 172A, 21B, 36B, 3B, 65W, 7WA, 70B, 7A, 7B, 8WB, 9A, 9B, HB 13B, 13C, 13D, KASAT 9A, 12WB, 172B, 7C, 5 WEST B, Konnect, Quantum, KVHTS, HB13F, HB13G, E10B
INMARSAT 3F1, 3F2, 3F3, 3F5, 4F1, 4F2, 4F3, AF1, 5F1, 5F2, 5F3, 5F4, GX5, 6F1, 6F2
VIASAT 1, 2, Wildblue 1
Thor 5, 6, 7

G25, 11, 12, 13, 14, 15, 16, 17, 18, 19, 23, 28, 30, 31, 32, 33, 34, 35, 36, 37, 3C
H2, 3e
IS10, 1002, 11, 14, 15, 16, 17, 18, 19, 1R, 20, 21, 22, 23, 25, 28, 30, 31, 32e, 33e, 34, 35e, 36, 37e, 38, 39, 40e, 5, 9, 901, 902, 904, 905, 906
MEASAT 3A, 3B, 3D
BADR-8
SATRIA (NST)

Commercial 313

Civil 83

Military 23

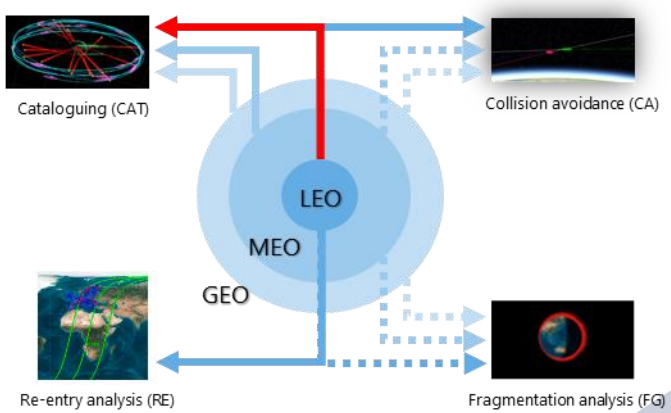
PROGRAMME OF THE EUROPEAN UNION

Updated as of 15/10/2023

Sensitive unclassified

Strategic autonomy ▪ Foreseen performance evolution

EU SST
Space Surveillance and Tracking



Higher autonomy in cataloguing

2028 Timeframe

LEO Cataloguing performance
- **50% of the objects above 7 cm**
- **65% above 10 cm** (catalogue 12 000 objects)

MEO Cataloguing performance
- Not yet evaluated, expectations are all objects above 35 cm

GEO Cataloguing performance
- **All objects above 35 cm**

2023 Timeframe

LEO Cataloguing performance
- **25% of the objects above 10 cm** (around 4600 objects)

MEO Cataloguing performance
- **Around 50% of the objects above 35 cm**

GEO Cataloguing performance
- **All objects above 35 cm**

< 10cm	> 10cm	> 50cm	> 1m
None	**~25%**	~85%	~100%

Simulations in 2024 to be revised after inclusion of commercial SST sensors

Strategic autonomy ▪ Upgrade of MS sensors

- **Total national investment of ~250 M€**, among which 28 M€ of EU funding

  → High level of Member States (MS) co-funding between 55% and 90%+

- Radar capabilities

FR GRAVES & GRAVES NG

PT TRACKING RADAR

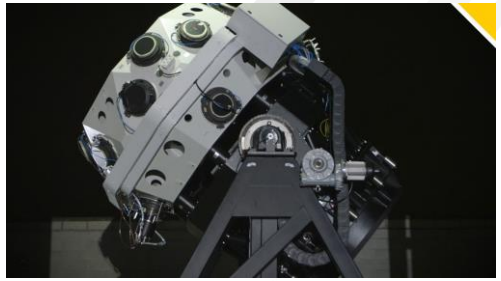
ES S3TSR

- Optical sensor capabilities

FR TAROT SURVEY OPTICAL SENSOR

PT SURVEY OPTICAL SENSOR

CZ SHOT SURVEY OPTICAL SENSOR



IT FLYEYE OPTICAL SENSOR NETWORK

Competitiveness ▪ EU Industry and Start-ups Forum

EU SST
Space Surveillance and Tracking

- Jointly with European Commission, EU SST has established the **European Union Industry and Start-ups Forum on Space Traffic Management** (EISF) in April 2022 to foster a dialogue with European industry and start-ups.
- Already **4 editions** of the EISF in one year, with a 5th one planned for November 15th, 2023, with **150 to 200 participants** from more than **40 European companies**
- EISF helps promoting opportunities for the industry and start-ups with the participation of representatives from the European Defence Fund, Cassini Fund, IOD/IOV, etc.
- The work has led to concrete recommendations for the total budget of **70 M€** in open European calls - 18 M€ on commercial data provision, 30 M€ for the development of commercial sensors, and 22 M€ on R&D activities

2nd EISF, November 24 2022

4th EISF, May 23-24 2023

Competitiveness ▪ Commercial SSA capabilities

- **EU funding 48 M€**

- **Provision of commercial SSA data for EU SST operations**
  - **Budget: 18M€ (100% of EU funding)**

- **Development of SSA commercial sensors (total investment of upgrade: 67 M€)**
  - **Budget: 30M€ (45% of EU co-funding)**
    - Investment on optical sensors: 4M€
    - Investment on radars, SBSS, passive ranging, others : 26M€
    - Criteria of co-funding: at least 55% from industry

- EU SST acts as a **public anchor customer** for SST commercial data in order to support the competitiveness of European industry and start-ups while increasing the performance and strategic autonomy in the SST domain

- EU SST acts as a **public investor** for innovative commercial sensors owned by the industry and start-ups, under specific criteria of co-funding, in order to acquire future data coming from those newly built commercial sensors at best conditions for the first years (virtuous circle)

R&D plan on SST

CONTRACTS INFORMATION

- Mostly open tender competition, with few exceptions
- Estimated Calls Opening Date : Between last semester of 2023 and first semester of 2024

TARGETS

- Improving EU SST capabilities
- Fostering EU industry innovation
- Increase EU industry competitiveness within the global SST ecosystem
- Improving EU autonomy in SSA

HOW TO

Developing cross transversal technologies
Enhancing cooperation between EU SST and EU industry
Maintaining a certain level of capabilities within EU SST to ensure safety and security of operations

- **R&D activities: 22 M€**

Activities
R&D on propagation
Architecture design (FR)
Architecture design (ES)
R&D on CA (FR)
R&D on CA (ES)
R&D on lasers
R&D on maneuver detection
R&D on RE and FG
Monitoring rate
R&D on attitude estimation
R&D on radio-frequency
Horizon scanning
Population hazardous object
Population evolution
Architecture twin concept (FR)
Architecture twin concept (ES)
SBSS
R&D on DB & CAT
Secure network
R&D commercial use
DLT added value

International engagement

- EU SST engages with international partners and contributes to the **global burden sharing of the SSA domain** through a regional SSA approach

- Regular exchanges at expert level with the **Office of Space Commerce** (US DoC)
  - Successful joint EU-US SSA data sharing experiment, aimed at evaluating and quantifying the benefits and challenges of data sharing
  - Future experiments to be conducted

- Towards a global federated coordination between **regional operational SSA systems**

BREAKING DEFENSE

The results of joint study by the Office of Space Commerce (OSC) and the 15-nation European Union Space Surveillance Tracking (EU SST) Consortium will be presented for the first time on Friday here in Hawaii at the annual Advanced Maui Optical and Space Surveillance Technologies (AMOS) Conference.

Source: Breaking Defense

Systems like European Union Space Surveillance and Tracking (EU SST) are emerging to provide services similar to what the U.S. government has been offering. He described EU SST as "the first of what will be a proliferation of international SSA systems."

Source: SpaceNews

Summary

- EU SST considered as the **operational capability** for the EU STM approach (cf. **Joint Communication on STM, Council Conclusions on STM**)
- Europe is very far from autonomy in SST capabilities for security and defense. Therefore, priority is to develop a **strategic autonomy** in space surveillance and tracking of space objects in all orbit regimes.
- Priority is also to rely more and more on our **vibrant and energized commercial industry and start-ups ecosystem** in Europe, contributing to strategic autonomy
- EU SST has an inherently **dual governance structure**, competent on security topics such as sharing of SST data
- Lack of funding considering the tremendous challenges ahead of us. We need to exploit synergies between **civil and defense**, avoid unnecessary duplications, and join forces in order to improve the level of European strategic autonomy

EU SST
Space Surveillance and Tracking

Ensuring space safety
and sustainability

Thank you!

@EU_SST

EU-SST

EUSST

#EUSpace

PROGRAMME OF THE
EUROPEAN UNION