








Space Surveillance & Tracking Portugal

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Agenda



-  Portugal's Implementation of Space as an Operational Field:
 -  Portugal's Space Defence Strategy
 - Portugal's SST Project
 - Portugal's EU-SST Role
 - Conclusion

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Conclusion

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Portugal's Implementation of
Space as an Operational Field

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Portugal's Space Defence Strategy

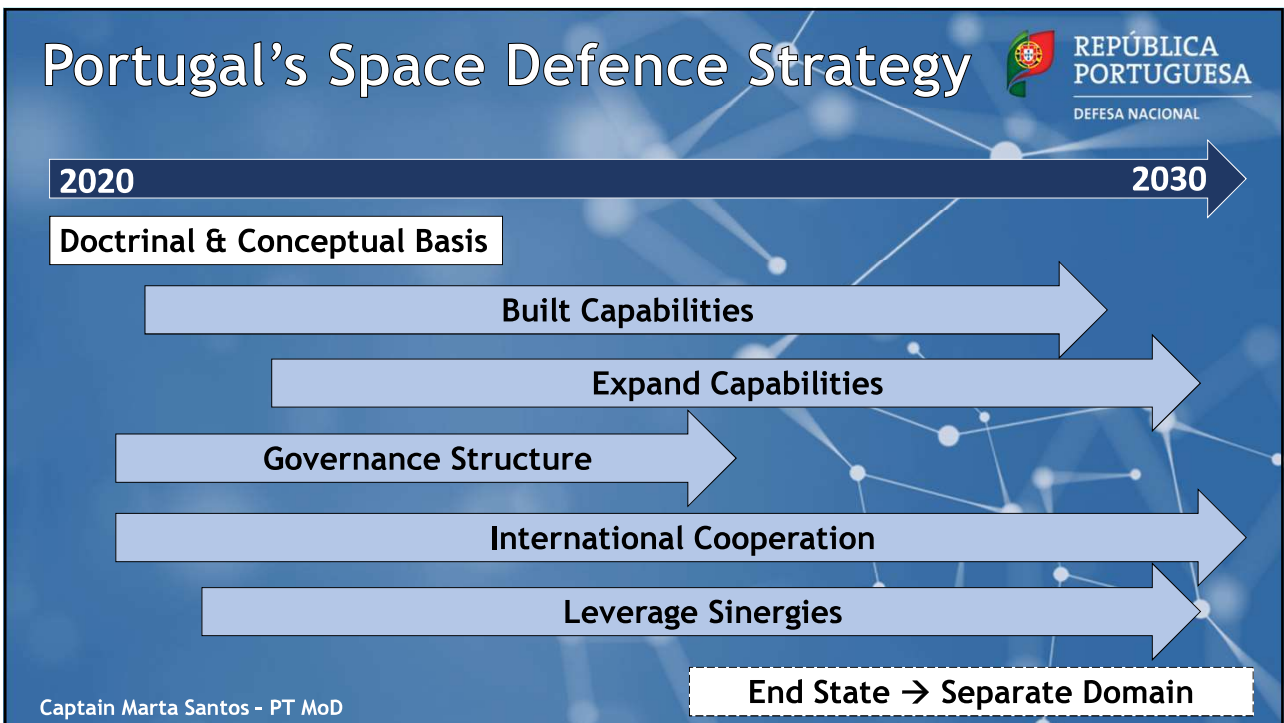
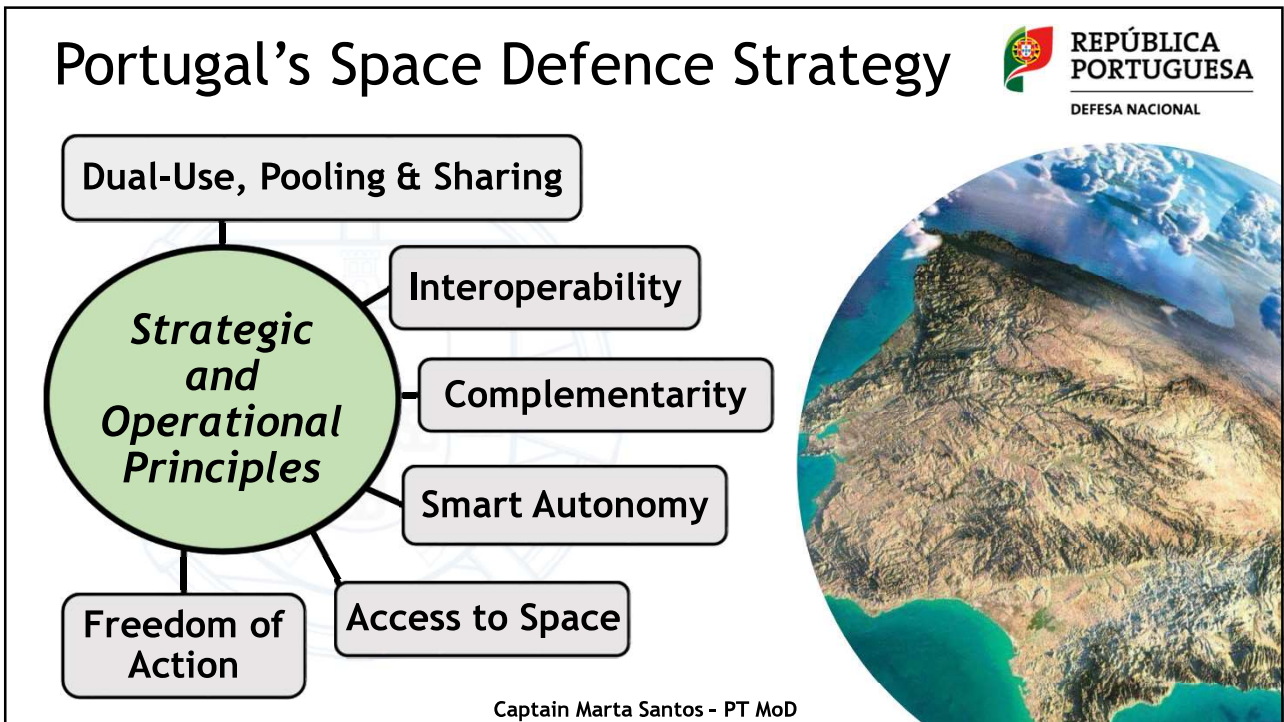


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Vision:

“Resorting to Space and associated technologies to enhance the autonomy of the Armed Forces in order to expand Portugal's freedom of action, in the defense of sovereignty and national interests.””

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Portugal's Space Defence Strategy



2020

2030

Built Capabilities

Space Monitoring (SSA & SST)



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Portugal's Space Defence Strategy



2020

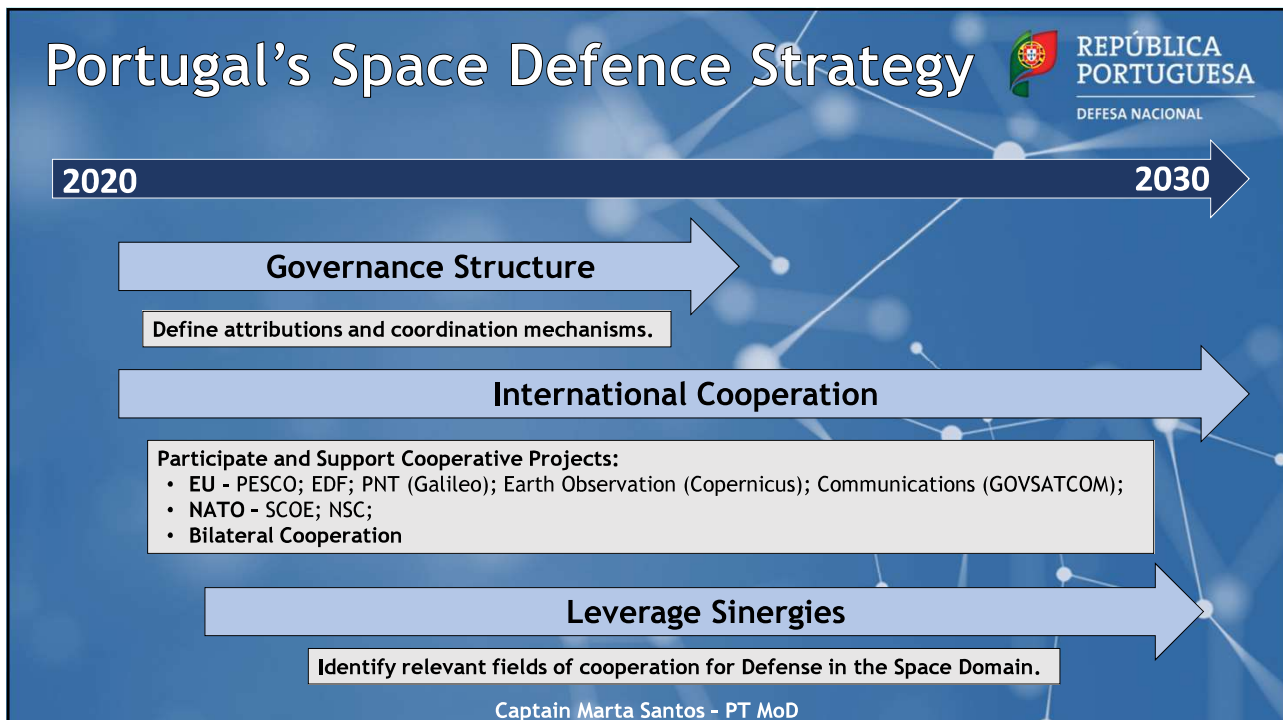
2030

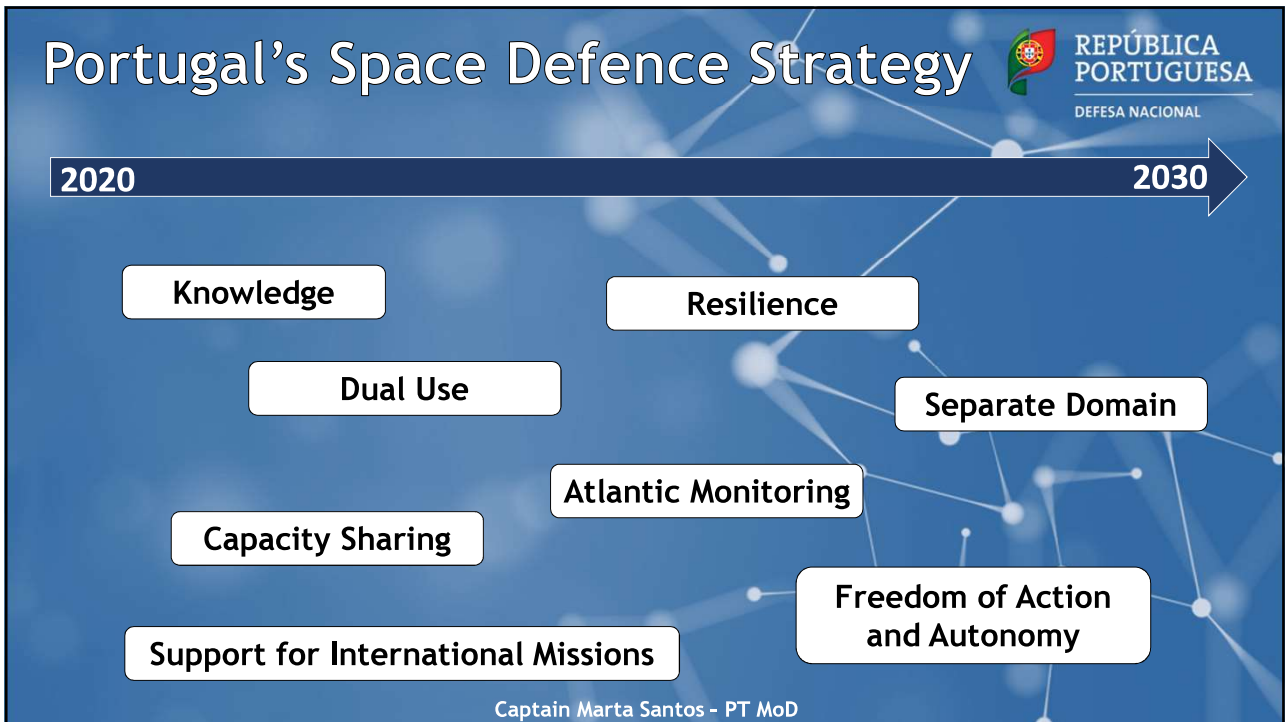
Built Capabilities

SATCOM & Ground Segment



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Portugal's Space Surveillance & Tracking



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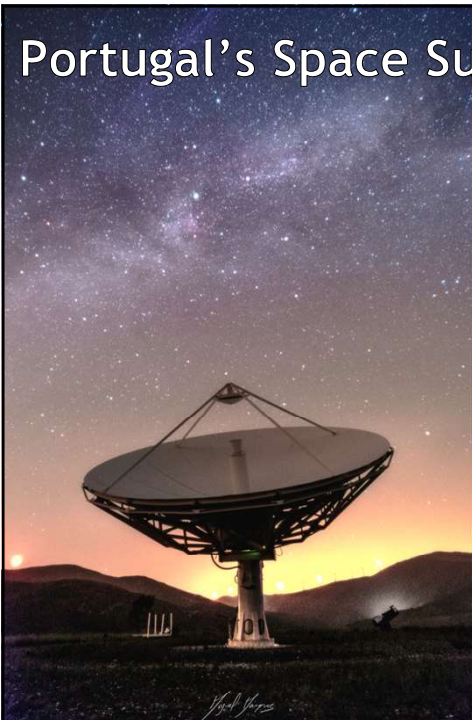
- ✓ Contribute to greater National and International Security in Space, as the most privileged environment for ensuring comprehensive surveillance of human activities on land and at sea.

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Portugal's Space Surveillance & Tracking



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- ✓ Maximizing the Geostrategic Advantage of Portugal's 2 regions, Azores and Madeira, while promoting the creation of jobs and knowledge in a highly technology field, such as Space.

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Portugal's Space Surveillance & Tracking



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- ✓ The SST-PT project has a very strong dual Civil-Military component and has already allowed the establishment of a dozen jobs which in turn create a differentiated scientific and technical knowledge.

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Portugal's Geostrategic Advantage



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Portugal's Geostrategic Advantage

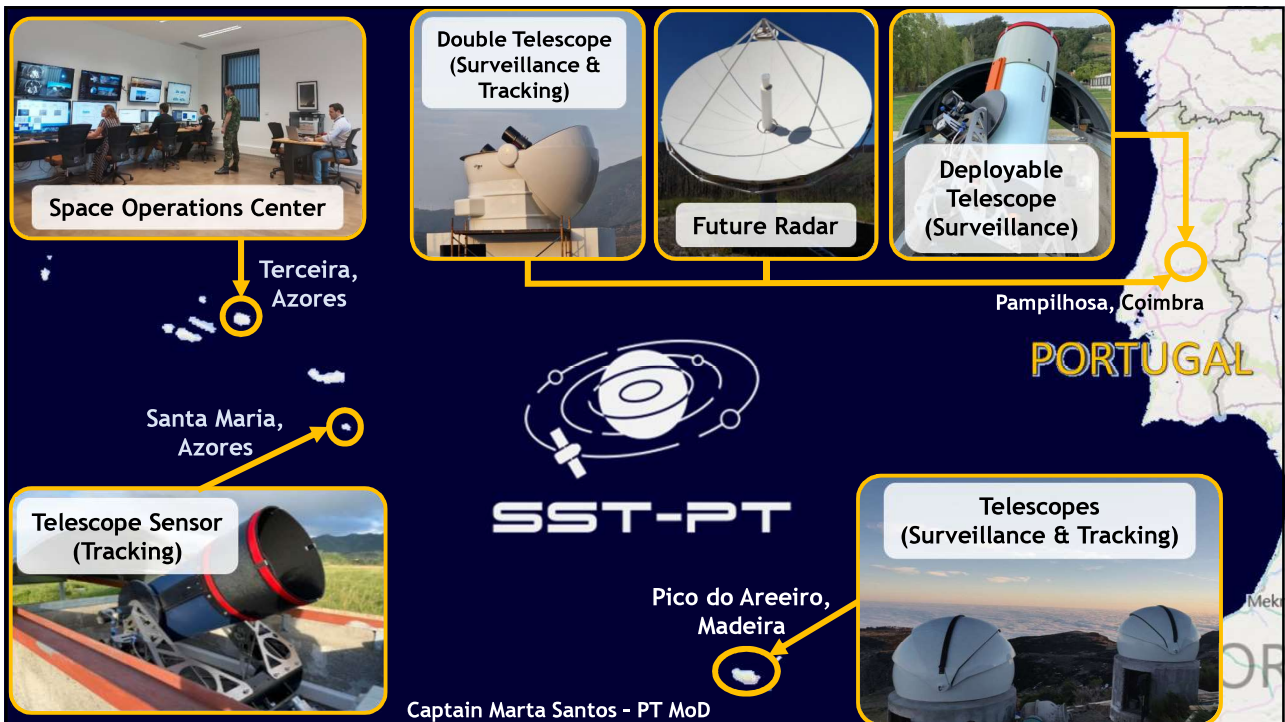


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Portugal's Geostrategic Advantage



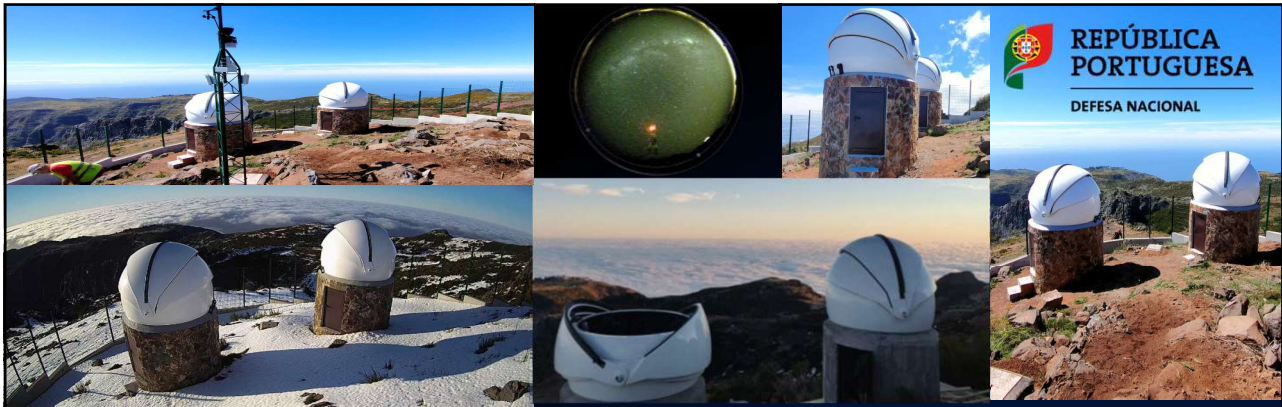
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OPTICAL SITE:
SANTA MARIA,
AZORES

- **1 Optical Sensor: Tracking**
 - Manually controlled from the Island.
 - Local processing servers and local operator terminal.

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OPTICAL SITE:
PICO DO AREIRO,
MADEIRA

- 2 Optical Sensors: Surveillance & Tracking
 - Remotely controlled from the SOC.
 - Local processing servers.

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OPTICAL & RADAR
SITES:
PAMPILHOSA DA
SERRA, COIMBRA

- 2 Optical Sensors: Surveillance & Dual LEO Telescope
- 1 Monostatic Radar: Tracking
 - Remotely controlled from the SOC.
 - Local processing servers.

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3 Types of Optical Sensors:

Parameters	Tracking Telescope	Survey Telescope	LEO Survey & Tracking Double Telescope
Range	GEO/MEO	GEO/MEO	LEO
Status	Operational	Operational	In Development
Mounting	Equatorial	Equatorial	Equatorial



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Monostatic tracking radar :

operating at 5,56GHz

Parameters	Before Upgrade	Planned Upgrade
Pulse Modulation	Amplitude Modulation	Arbitrary Waveform Modulation
Bandwidth	80MHz	200Mhz



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SPACE OPERATIONS CENTER SST: TERCEIRA, AZORES

- 2 SOC Operators Terminals
- 2 SOO Operators Terminals

- Video wall screens:
 - Display remote views of the sensors, weather information and the NOC dashboard.
- Daily workflow:
 - SOC operators during daytime - processing observations taken during the night, analyze data and produce plans based on the results of the analysis.
 - SOO operators during night time - performing requested observations.

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● PLANNING:

Tool for planning surveillance and tracking observations:

- Plans are generated automatically every day for each sensor and approved or recomputed by the NOC operator.
- They take into account the:
 - Positioning of the sensors;
 - Orbits of the objects;
 - Milky way;
 - Earth's shadow;
 - Moon;
 - Daylight;
 - Weather;

Name	Value
Plan ID	21
Sensor	PT_AzoresTel2
Observation Night	2021-02-17
Mode	tracking
Status	

Gantt chart for tracking plan No. 21 (Observation night: 2021-02-17)

Time (hh:mm:ss)

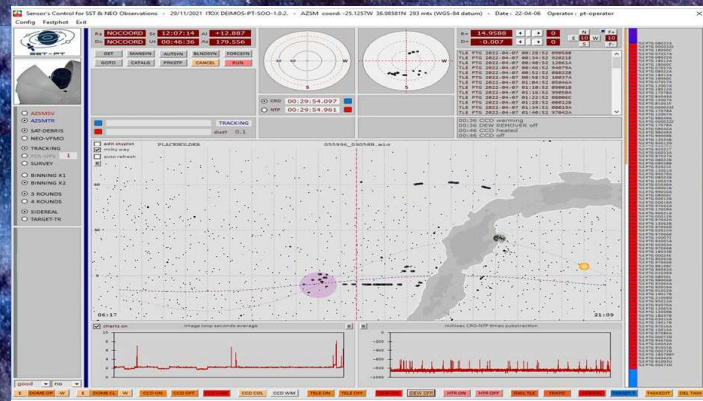
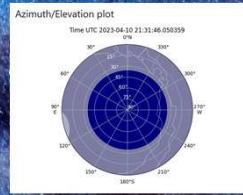
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● **PLANNING:**

Tool for planning surveillance and tracking observations:

- Plans are generated automatically every day and approved or recomputed by the NOC operator.
- For Tracking Plans, objects of interest are considered (involved in Conjunction or Re-Entry).

Tracking - Azores



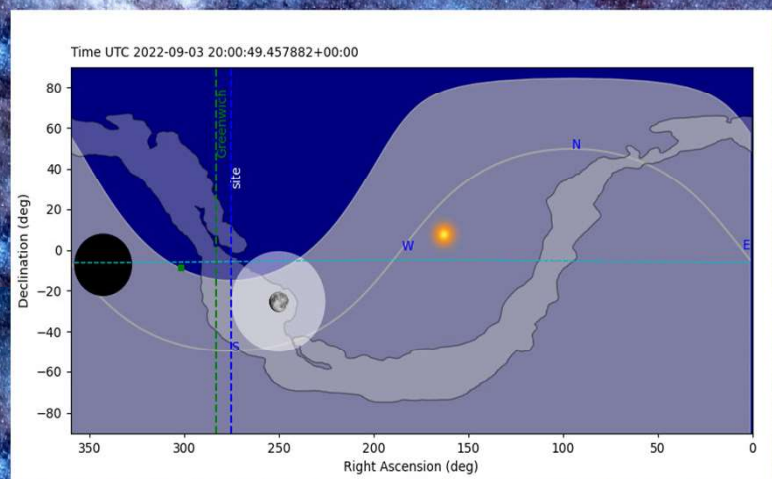
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● **PLANNING:**

Tool for planning surveillance and tracking observations:

- Plans are generated automatically every day and approved or recomputed by the NOC operator.
- For Tracking Plans, objects of interest are considered (involved in Conjunction or Re-Entry).
- For Survey Plans, optimized strategies are built every night, avoiding the Earth's Shadow, the Moon Light and the Milky Way.

Surveillance - Madeira

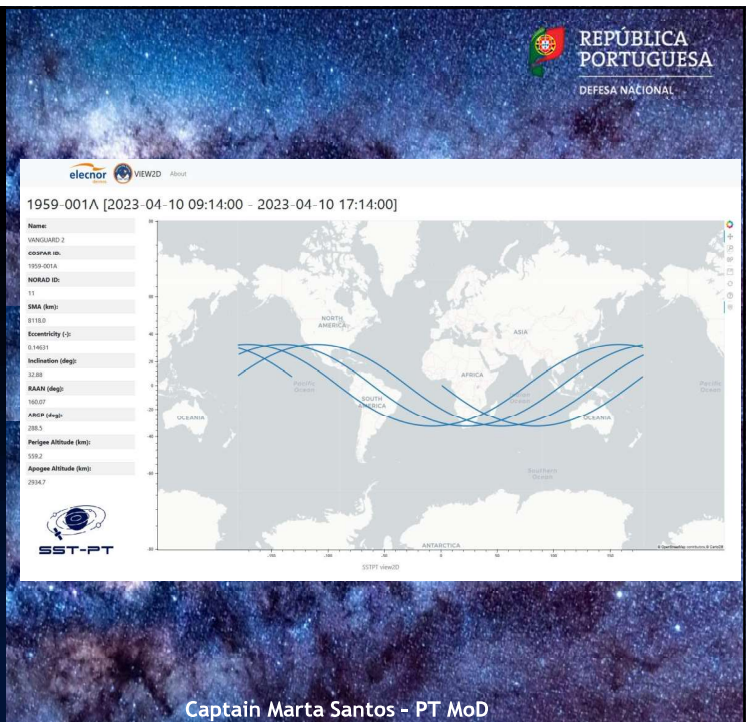


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● 2D VISUALIZATION:

Displays groundtracks of objects with automatic retrieved from the database.

- Plot arbitrary pubic TLE or OEM file(web interface).
- Integrated in re-entry subsystem.
- Available for display in the NOC dashboard.



DATABASE:

- Integrates all SST-related NOC systems.
- Main components:
 - Tracks - Observations obtained by the sensors of the SSTPT network.
 - Internal catalogue - Orbits obtained by the cataloguing system.
 - External catalogue - External catalogue from open source.
 - Sensors - Information of the sensors that belong to the SSTPT network.
 - Conjunctions - Information of conjunctions detected by the system.
 - Re-entries - Information of re-entries detected by the system.
 - Fragmentations - Information of fragmentations detected by the system.
 - Sensor plans - Observations plans generated by the system.
 - Sensor statistics - Statistical information on the performance of the sensors.



SERVICES:

3 Main Services SST-PT

- Conjunctions
- Re-Entry
- Fragmentations

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SERVICES:

3 Main Services SST-PT

- Conjunctions
- Re-Entry
- Fragmentations

Conjunctions

- Provides risk assessment of collision between spacecraft or between spacecraft and space debris, and generates collision avoidance alerts
- Analyses all the available information in order to detect close approaches with different levels of risk


ID	Target	Owner	Number of satellites	Date of last update	Alert	Type of closest approach	Min. distance	Collision Probability	View
10718	PT-2A-008 (27169-2000-0000)	EMERSON (0000-0000-0000)	3	2023-03-12 09:17	TC_Conjunction	2023-03-14 13:00:00 (20000)	10.000	0.0	View
10719	ARABIA 3 (AR 07162-2000-0000) CORDED-08-1000	EMERSON (0000-0000-0000)	1	2023-03-07 09:16	TC_Conjunction	2023-03-07 13:00:00 (10000)	10.000	0.0	View
10720	PT-2A-008 (27169-2000-0000)	EMERSON (0000-0000-0000)	1	2023-03-02 09:16	TC_Conjunction	2023-03-02 13:10:00 (10000)	17.000	0.0	View
10708	ARABIA 3 (AR 07162-2000-0000) CORDED-08-1000	EMERSON (0000-0000-0000)	1	2023-03-07 09:16	TC_Conjunction	2023-03-07 13:00:00 (10000)	10.000	0.0	View
10709	ARABIA 3 (AR 07162-2000-0000) CORDED-08-1000	EMERSON (0000-0000-0000)	1	2023-03-07 09:16	TC_Conjunction	2023-03-07 13:00:00 (10000)	10.000	0.0	View
10704	EMERSON (0000-0000-0000) CORDED-08-1000	EMERSON (0000-0000-0000)	1	2023-03-07 09:16	TC_Conjunction	2023-03-07 13:00:00 (10000)	10.000	0.0	View
10705	EMERSON (0000-0000-0000) CORDED-08-1000	EMERSON (0000-0000-0000)	1	2023-03-07 09:16	TC_Conjunction	2023-03-07 13:00:00 (10000)	10.000	0.0	View
10706	EMERSON (0000-0000-0000) CORDED-08-1000	EMERSON (0000-0000-0000)	1	2023-03-07 09:16	TC_Conjunction	2023-03-07 13:00:00 (10000)	10.000	0.0	View
10707	EMERSON (0000-0000-0000) CORDED-08-1000	EMERSON (0000-0000-0000)	1	2023-03-07 09:16	TC_Conjunction	2023-03-07 13:00:00 (10000)	10.000	0.0	View
10700	ARABIA 3 (AR 07162-2000-0000) CORDED-08-1000	EMERSON (0000-0000-0000)	1	2023-03-07 09:16	TC_Conjunction	2023-03-07 13:00:00 (10000)	10.000	0.0	View
10701	PT-2A-008 (27169-2000-0000)	EMERSON (0000-0000-0000)	1	2023-03-07 09:16	TC_Conjunction	2023-03-07 13:00:00 (10000)	10.000	0.0	View

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SERVICES:

3 Main Services SST-PT

- Conjunctions
- **Re-Entry**
- Fragmentations



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Re-Entry

• Provides risk assessment of uncontrolled re-entry of man-made space objects into the Earth's atmosphere and generates related information.

• Analyses all the available information regarding the uncontrolled re-entries.

Ex:


<p>Satellite name: CZ-5B R/B</p> <ul style="list-style-type: none"> • SSTPT ID: 27817 • NORAD ID / SATNO: 53240 • COSPAR ID: 2022-085B 	<ul style="list-style-type: none"> • Perigee: 160.0 km • Apogee: 220.0 km • Inclination: 41.5 • Period: 88.3 minutes
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SERVICES:

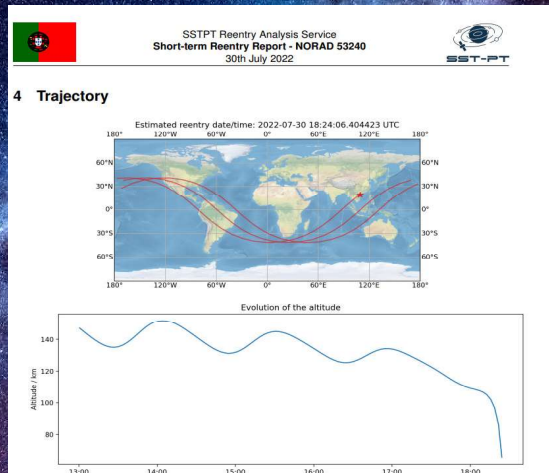
3 Main Services SST-PT

- Conjunctions
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Re-Entry



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● SERVICES:

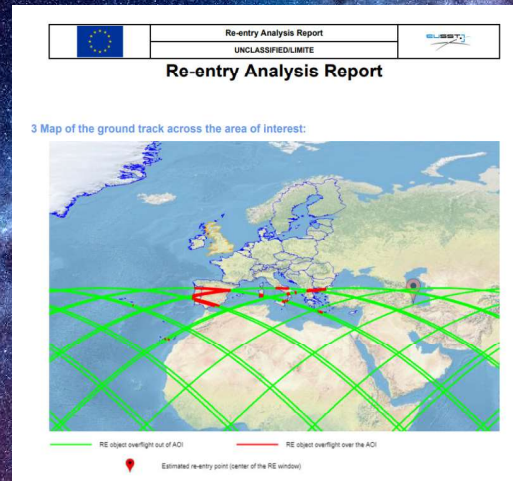
3 Main Services SST-PT

Conjunctions

Re-Entry

Fragmentations

Re-Entry



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● SERVICES:

3 Main Services SST-PT

Conjunctions

Re-Entry

Fragmentations

Fragmentations

- Provides detection and characterization of in-orbit fragmentations, break-ups or collisions.
- Analyses all the available information (at short, medium and long term) regarding the object(s) involved in the event.

**WORK IN
PROGRESS**

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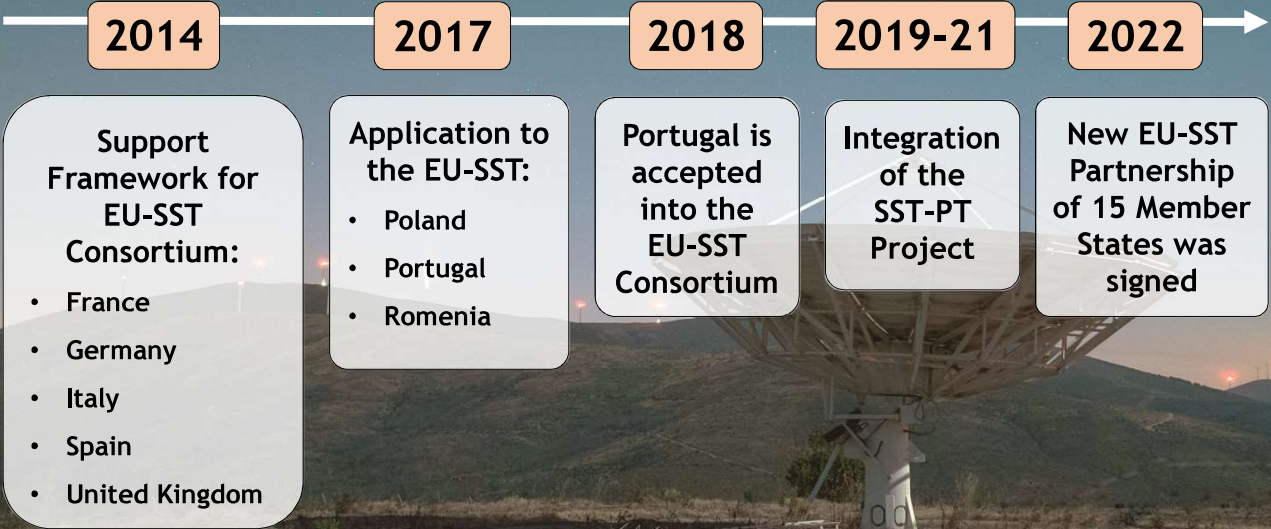
How does Portugal fit in the EU-SST?



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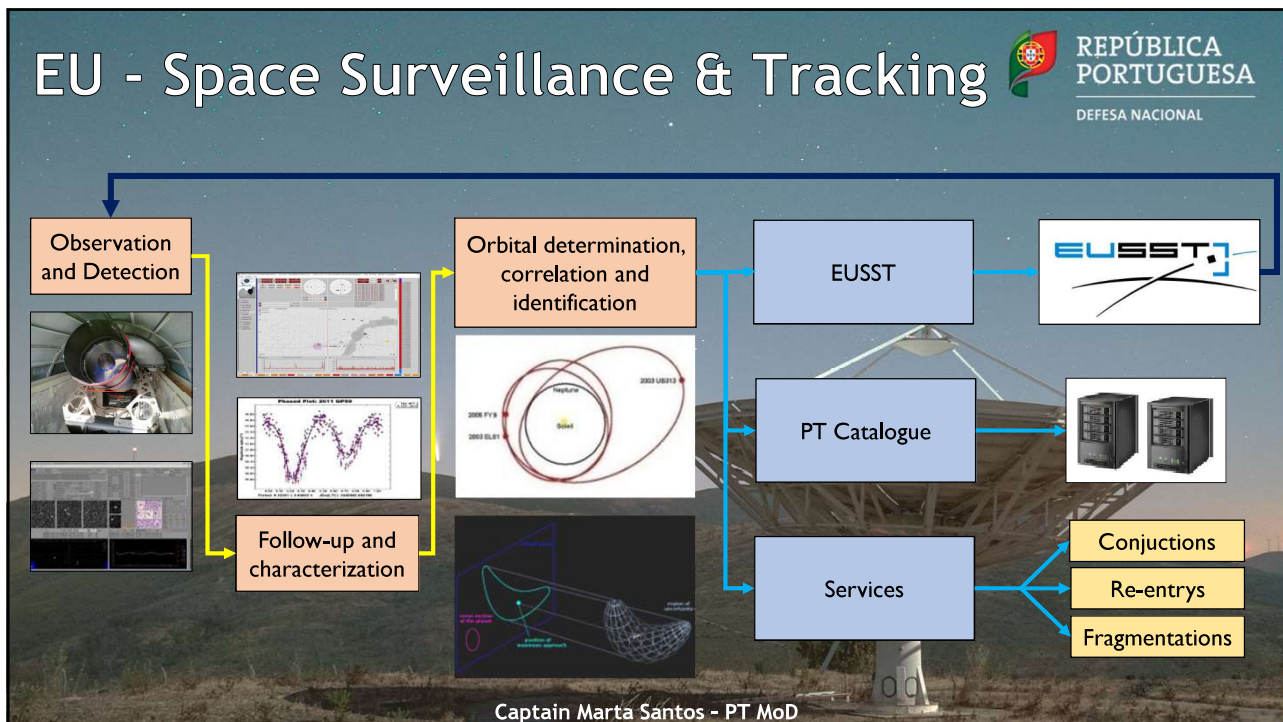


EU - Space Surveillance & Tracking



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2014	2017	2018	2019-21	2022
<p>Support Framework for EU-SST Consortium:</p> <ul style="list-style-type: none"> • France • Germany • Italy • Spain • United Kingdom 	<p>Application to the EU-SST:</p> <ul style="list-style-type: none"> • Poland • Portugal • Romania 	<p>Portugal is accepted into the EU-SST Consortium</p>	<p>Integration of the SST-PT Project</p>	<p>New EU-SST Partnership of 15 Member States was signed</p>



Future

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- Continue to upgrade the SST-PT Network.
- Keep adding sensors to the SST-PT Network.
- Possibly moving the Deployable Sensors outside Portugal (locations TBD).
- Integrating the outputs of the SST-PT into to the planning of operations of the Armed Forces.

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Conclusion



- ✓ Portugal has approved a **Space Defence Strategy (2020-2030)** that intends on building a **Space Capability for Portugal**, taking advantage of its unique Geostrategic relevance and with focus on Monitoring and Protecting our jurisdiction, with focus on the Atlantic.
- ✓ The SST-PT network is currently the most developed project of Portugal's implementation of its Space Defence Strategy.

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Conclusion



- ✓ The SST-PT initial capability has been established and Portugal provides data for the EU-SST almost everyday.
- ✓ Portugal intends to continue to grow its Space Capability and upgrading its SST-PT Network.
- ✓ To make it happen we intend on growing our valuable Civil-Military synergies, as well as exploring Partnerships with our allies and international groups.

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