



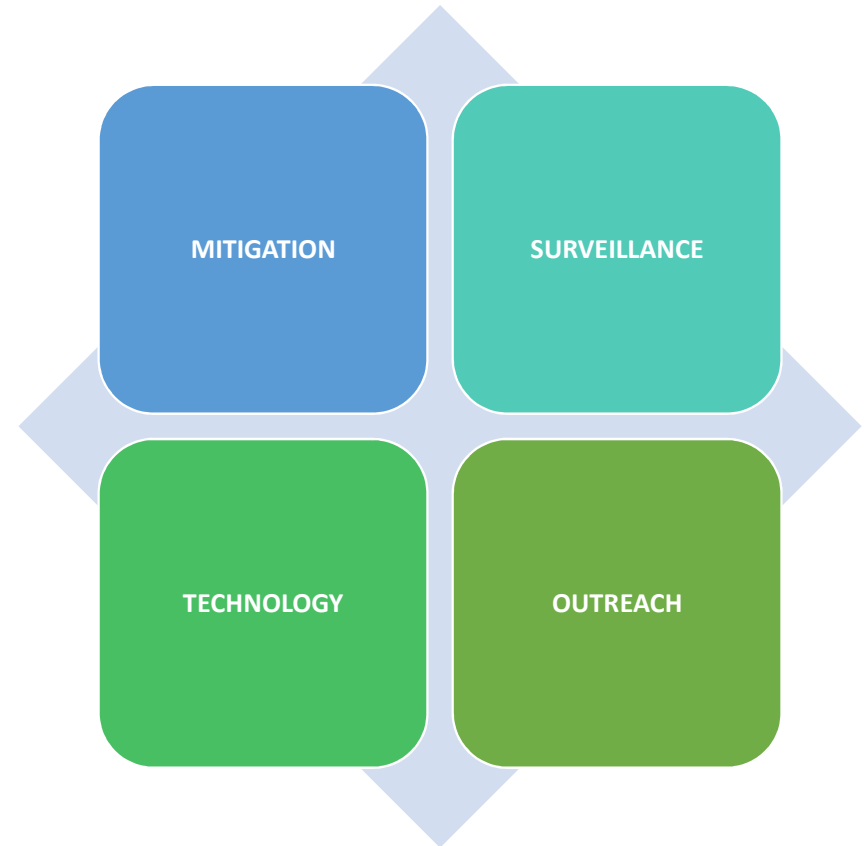
# FRANCE SPACE DEBRIS ACTIVITY UPDATES

61st STSC Session - COPUOS 2024

Laurent FRANCILLOUT  
CNES – Centre National d'Études Spatiales



# Space Debris : a CNES top priority



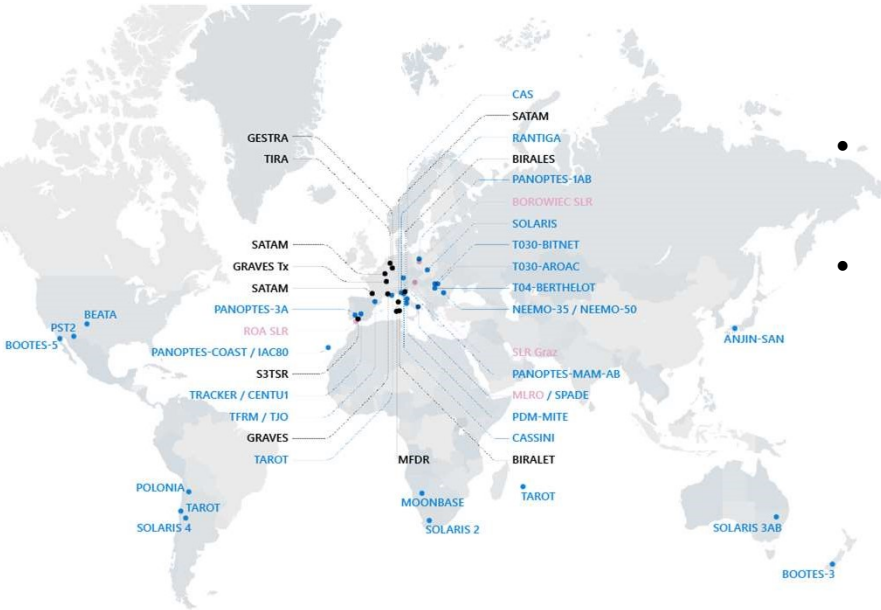
# SURVEILLANCE : France involved in EUSST



**EU SST**  
Space Surveillance and Tracking

**434**  
Satellites

**67**  
ORGS



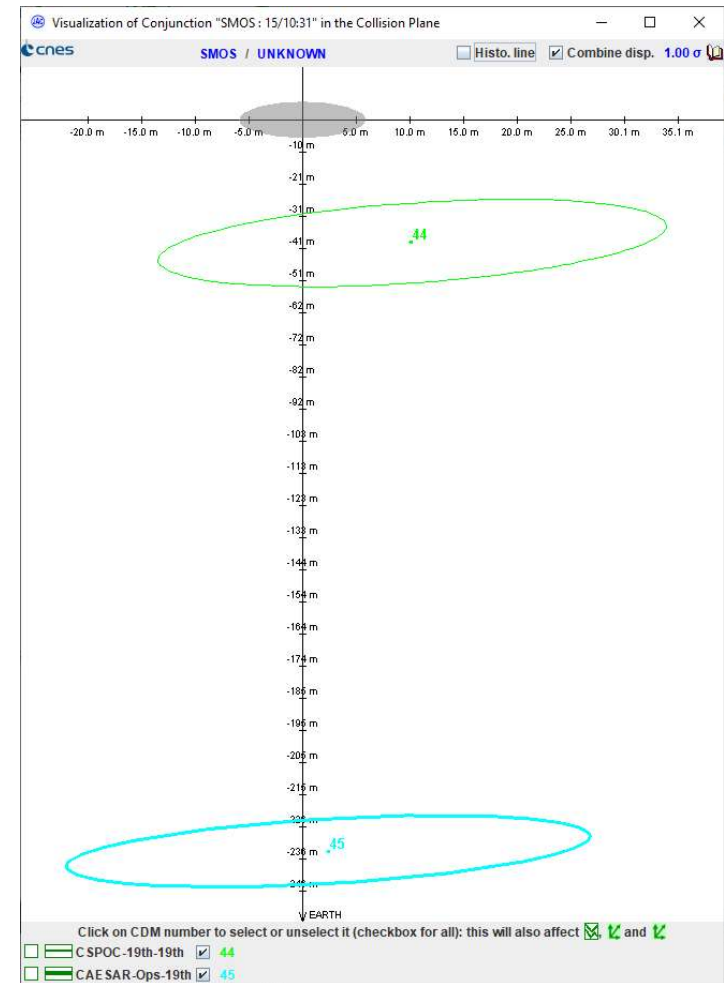
- **CAESAR** is the CNES operational collision avoidance service
  - 2 on-calls teams to monitor the fleet on a 24/7 basis
- EU SST rely on CNES and Spanish Space Agency to provide a free of charge collision avoidance service to all European Union satellite operators ()
  - Statistics in 2023 :
    - As of 01/01/2024 : 434 satellites, 67 organisations registered
    - 3,5 millions CDM managed (~9700 per day) by CNES
    - 24 avoidance manoeuvres on the fleet monitored by CNES
  - Service open to non EU users beginning of 2023
    - Service provided for a few operators coming from Americas, Africa, Asia
- EU SST rely on CNES :
  - To coordinate and support the European Industry to develop innovative commercial solutions (sensors and value chains)
  - To manage commercial data providers to catalogue objects orbiting the Earth and provide services



## SURVEILLANCE : Example of conjunction management

- **Risk of collision between SMOS (2009-059A), operated by CNES and an UNKWOWN fragment**
  - Time of Closest Approach (TCA): 2023/02/15 at 10:31:19
  - First detection of the risk : 5 days before TCA,
  - Very Small fragment only tracked by the US sensors, CDMs provided by the US DoD → **very large uncertainties**
  - 1 day before TCA :
    - PoC still above maneuver threshold
    - SMOS attitude in the collision plane was known  
→ Radius of SMOS decreased from 5m to 4.2m, but PoC still just above the threshold

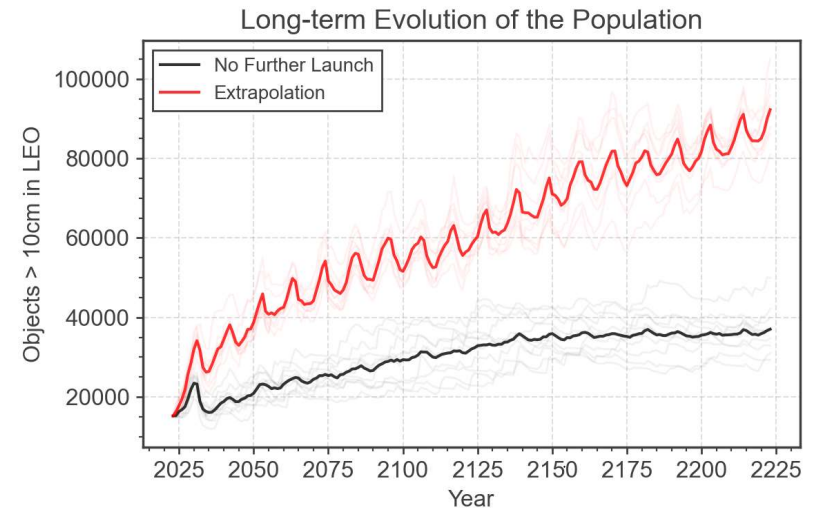
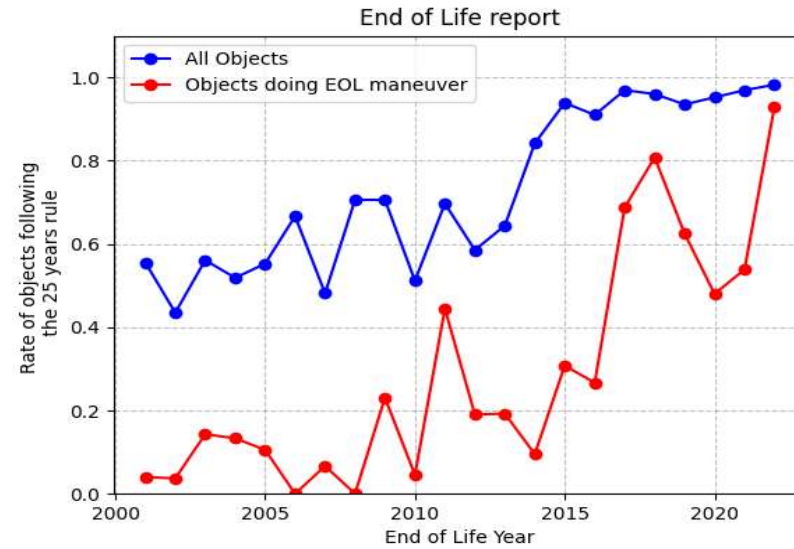
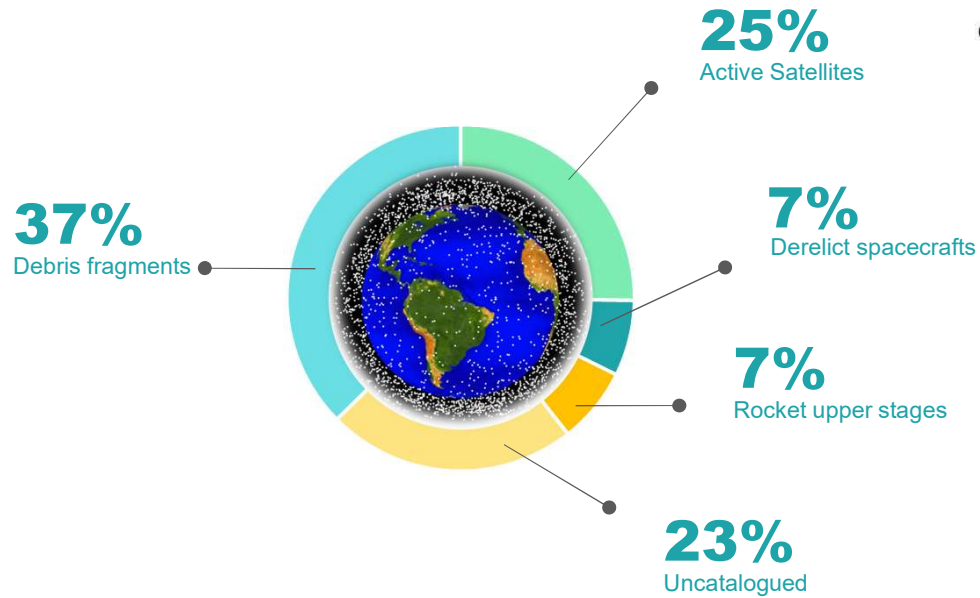
→ **CNES operators decided to schedule an avoidance maneuver 0,5 orbits before TCA.**



## SURVEILLANCE : Space environment

IADC Report on the Status of the Space Debris Environment :

- **About 34000** space objects > **10 cm**
- **About 900 000** space objects between **1 and 10 cm**



## MITIGATION : France is active in standards and guideline setting fora

- France actively supports international groups in charge of establishing best practices, guidelines and standards :
  - ECSS : CNES has setup and conducts a STM mirror group and participate to debris mirror group
  - ISO : active participation to TC20/SC14 WG3 (system & operations) & WG7 (debris mitigation)
  - UN COPUOS : participation to LTS working groups
  - IADC : CNES is an active member of IADC, contributes to the Environment report on Debris and performs studies



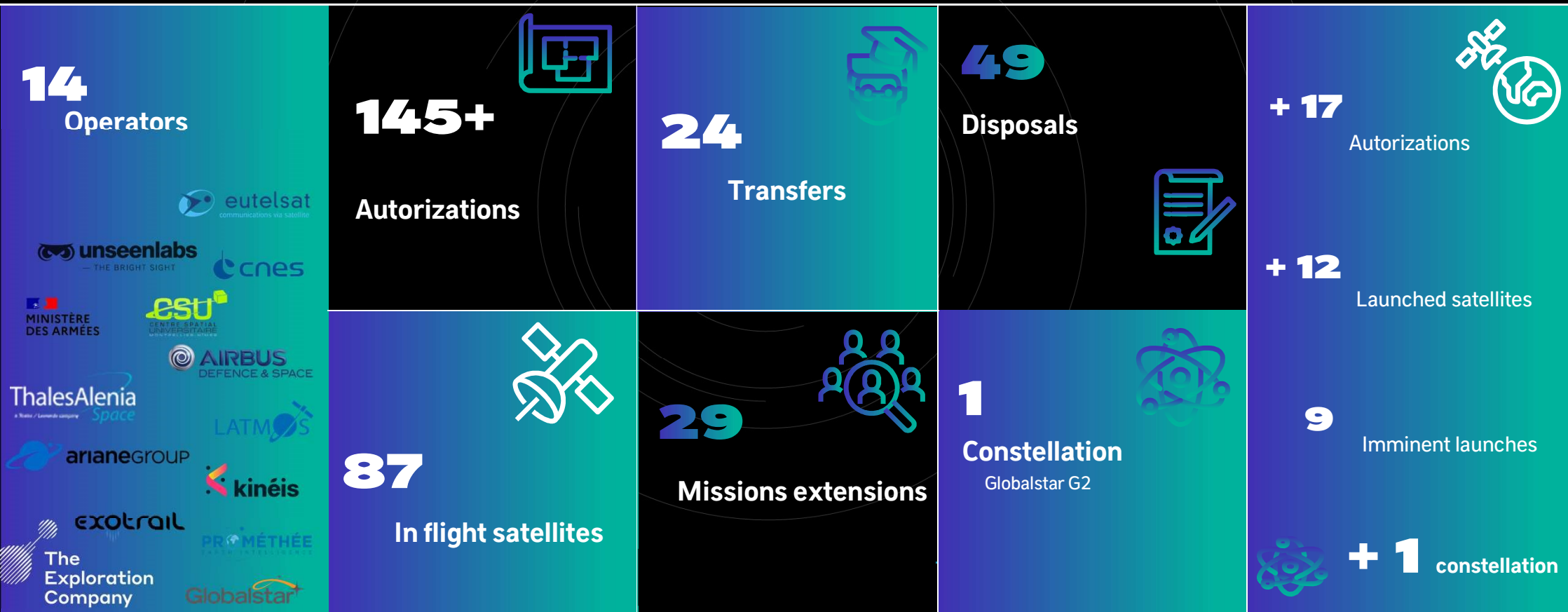
*France has translated international guidelines and standards in its regulation : French Space law*

# MITIGATION

French Space Law has demonstrated its efficiency for more than 10 years

2010

2023



## MITIGATION : Technical Regulation evolution perimeter

### Consultation and participation of the French space ecosystem between 2020 and 2023

#### Feedback on the application of the current TR

- Removal of ambiguities, clarification of expectations, formalization of processes already in place, ...

#### Consideration of the New Space perimeter

- In-Orbit Servicing, Constellations, Nanosatellites, ...

#### Better consideration of the risk of collision

- Adapt the requirements to international rules, taking into account the current space environment in orbit, ...

#### Identification and tracking of space objects

- Encourage the use of a system facilitating identification and tracking

#### Restriction of orbital lifetime

- Condition re-entry duration to the duration of the operational mission, ...

#### Higher requirements on probability of successful disposal

- Comply with international guidelines (probability of 0.9 – IADC / ISO)

~300

comments  
(incl. ~50 non-French)

30

entities  
(incl. 6 non-French)



2024

Latest version of the TR available (in French, English or German) on EC website:  
<https://technical-regulation-information-system.ec.europa.eu/en/notification/25145>



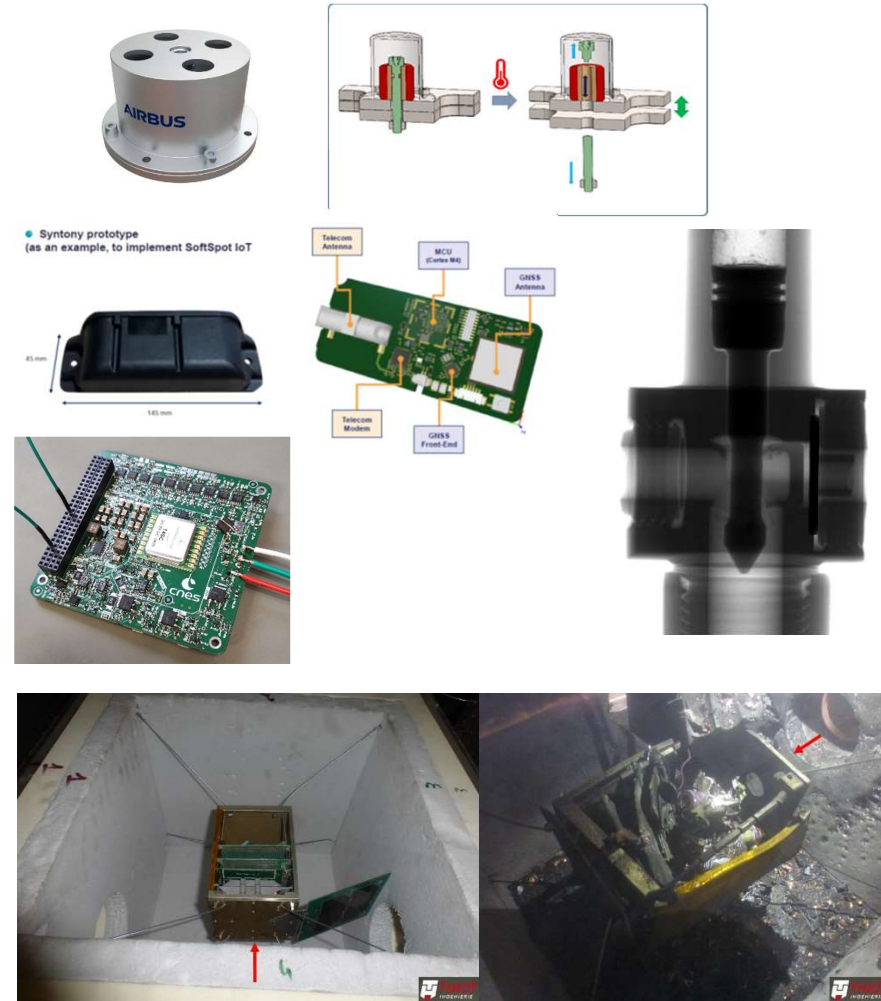
## TECHNOLOGY : Tech4SpaceCare

*Tech4SpaceCare* Initiative aiming to develop technological elements for orbital systems to ensure the sustainable use of space and the safety of space operations

- **T4SC-1 : Increase SSA measurement accuracy**
- **T4SC-2 : Improving satellite passivation at end of life**
- **T4SC-3 : Protection against High velocity impacts**
- **T4SC-4 : Prepare spacecraft to ADR/IOS**
- **T4SC-5 : Decrease orbit duration after EoL**
- **T4SC-6 : Minimize risk during reentries**
- **T4SC-7 : Developing onboard anti-collision**
- **T4SC-8 : Improve missions extension and failures detection**
- **T4SC-9 : Darkening of satellites in low Earth orbit**



The first in-orbit experiments began in 2023. A dedicated mission is under preparation to demonstrate the effectiveness of these technologies.



Coming

**7th International Workshop on Debris Modeling & Remediation, France, from 10th -12th June, 2024.**