

Security in Outer Space: Rising Stakes

Forging ahead: from SSA to Space Safety

12th ESPI Autumn Conference, Vienna, 27-28 Septembre

Nicolas Bobrinsky ESA, H/ SSA Programme

ESA UNCLASSIFIED - For Official Use

Space Situational Awareness - Goals



- Society heavily dependent on critical space and ground assets
- Critical assets need to be protected against adverse effects from space
- SSA Programme Declaration calls for: Independent European access to SSA data and services
- Three main areas:



Space Weather

Near Earth Objects

Space Debris Cleanspace

4

ESA UNCLASSIFIED - For Official Use

ESA | 27-28/09/2018 | Slide 2

Participants in ESA's SSA Programme



ESA UNCLASSIFIED - For Official Use

Finland France

Italy

NorwayPoland

Sweden

- 3

Germany

Luxembourg
Netherlands

Portugal Romania Spain

Switzerland

ESA | 27-28/09/2018 | Slide 3

From SSA to Space Safety



ESA | 27-28/09/2018 | Slide 4

*

ESA UNCLASSIFIED - For Official Use

<u>esa</u>

Space Weather L5 mission

Asteroid Deflection

Cornerstones of Space Safety

Debris Remediation

Automated Collision Avoidance

Space Safety (2020 – 2027)



CORNERSTONE TOPICS

- **1. SWE L5 mission** (L1: NOAA)
- 2. Asteroid deflection demo. for Planetary Defence
- **3. Debris removal** as an anchor institutional mission
- 4. Spacecraft Collision Avoidance

CORE ACTIVITIES

- Space Weather: instruments, smallsats, applications, modelling, networking, hosted payloads;
- Space Debris and Clean Space: technologies, radars, telescopes, laser systems, applications, servicing, ADR;

*

3. NEOs and Planetary Defence: telescopes, GNC, networking, smallsats,

cataloguing, risk evaluatiuon;

ESA UNCLASSIFIED - For Official Use

ESA | 27-28/09/2018 | Slide 6

SSA / Space Safety: timeframe





- Space Weather
- Pre-operational as from 2020
- After 2020: SWE L5, SWE instruments, ...



- Planetary Defence & Near Earth Objects
- Pre-operational as from 2020
- After 2020: 2nd Fly-Eye, asteroid deflection, ...



- Space Debris & Cleanspace
- R&D in SST sensors, applications, ...
- Active Debris Removal

ESA UNCLASSIFIED - For Official Use

ESA | 27-28/09/2018 | Slide 7

Space Debris threats for the Critical Space Infrastructure



- Growing space debris population
- Increasing number of small satellites
- Announcement of large constellations

ESA UNCLASSIFIED - For Official Use

ESA | 27-28/09/2018 | Slide 8

*

Enhanced SST capabilities



Laser station



High Performance surveillance radar (future, estimated at 600 M€, 3 years) .

ESA UNCLASSIFIED - For Official Use



Surveillance of Space Debris for Collision Avoidance





ESA UNCLASSIFIED - For Official Use

ESA | 27-28/09/2018 | Slide 10

Laser ranging to non-cooperative targets

- Satellite Laser Ranging for noncooperative targets
- Support to European technology development
- Momentum transfer





Matera, Italy



ESA | 27-28/09/2018 | Slide 11



Debris mitigation and removal

- Debris impact mitigation and protection
 - Applications
 - Collision Avoidance Automation
 - Technology development

Debris Remediation

Debris removal mission





*

ESA UNCLASSIFIED - For Official Use

ESA | 27-28/09/2018 | Slide 12

Protection of Critical space and ground assets: SSA/SWE







+

ESA UNCLASSIFIED - For Official Use

ESA | 27-28/09/2018 | Slide 13

Importance of Space Weather





ESA UNCLASSIFIED - For Official Use

ESA | 27-28/09/2018 | Slide 14

*

Enhanced SWE observation system





ESA UNCLASSIFIED - For Official Use

ESA | 27-28/09/2018 | Slide 15

+

Enhanced SWE observation system: L5 + L1 Cesa

Development of SWE L5:

- Solar corona monitoring
- Heliospheric imaging
- Solar disc magnetic field
- EUV imaging
- In-situ measurements:
 - \circ solar wind
 - o magnetic field
 - charged particles
 - o hot plasma
- Mission phases in SSA-P3
 - **A/B1**
 - Readiness for B2/C/D



*

ESA UNCLASSIFIED - For Official Use

ESA | 27-28/09/2018 | Slide 16

Protection of Critical space and ground assets: SSA/NEO

- Less than 1% of NEOs (15 40m) discovered
- Average one impact every 10 years (Chelyabinsk type)









ESA | 27-28/09/2018 | Slide 17



Protection of Critical space and ground assets: SSA/NEO – Tchelyabinsk event





ESA | 27-28/09/2018 | Slide 18

*

ESA UNCLASSIFIED - For Official Use

Planetary Defence Beyond 2019 Cesa

NEO Detection and Threat Analysis

- NEO observations
- NEO sensors development
- Networking of assets

NEO impact mitigation and protection

- Deflection techniques
- Asteroid deflection mission



ESA UNCLASSIFIED - For Official Use

ESA | 27-28/09/2018 | Slide 19

Hera: a mission of "firsts"

 First precise measurement of deflection efficiency and Planetary Defence capability (****)

- First binary asteroid and smallest asteroid ever visited
- First detailed measurement of small body cratering physics
- First deep-space CubeSat for very close asteroid inspection



_ = 11 🖕 == + 11 = 🚝 = 11 11 = = = 🖂 🖬 11 = = 🕄 12 🕷 🖕

•

Summary SSA / Space Safety

- L5 mission in coordination with NOAA
- Technologies for Space Debris monitoring and mitigation
- Asteroid deflection demo in progress
- Good progress in the development of a SSA system in Europe with many actors: Member States, ESA, EU. Distribution of roles needs to be finalised: development vs exploitation!
- Performance gap in surveillance radars
- Need to agree on a suitable governance scheme for the exploitation of a future high performance European surveillance radar
- Development of a high performance radar can be achieved within 3 years !
- SWE and NEO systems will reach pre-operational status by 2020. Which Operator ?

ESA UNCLASSIFIED - For Official Use





European SSA System (artist view)

ESA | 27-28/09/2018 | Slide 21



THANK YOU

www.esa.int