Space Safety Program

CASI
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Canada

Background

- The ESA Space Situational Awareness (SSA) Programme was initiated in 2008. New periods created in 2012 and 2016.
- Canada was not offered to participate in 2008 and, although offered to, declined subsequent participations in 2012 and 2016.
- There is a recognized need for an evolution of the ESA SSA Programme toward Space Safety with a view to protect our planet, humanity and assets in space and on Earth from threat originating in space.

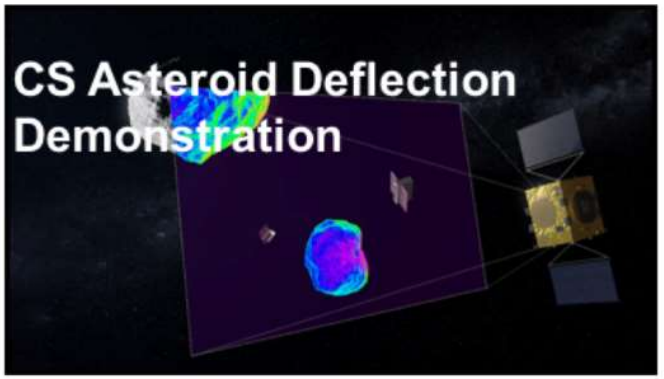
Space Safety Program - Highlights

- Projected overall financial envelope: 600 ME at 2019 e.c. for the period of 2020-2023.
- General objective: protection of our planet, humanity and assets in space and on Earth from threats originating in Space and to contribute to Europe providing safety from such threats, as a service to its society.
- It is an "envelope program" containing 3 program segments
  - Space Weather
  - Planetary Defence
  - Space Debris and Clean Space
- Focus is on the development of critical capabilities and the production of vital data

Space Safety

5 Activity areas, 4 Cornerstone (CS) missions, 1 Programme

Core Activities

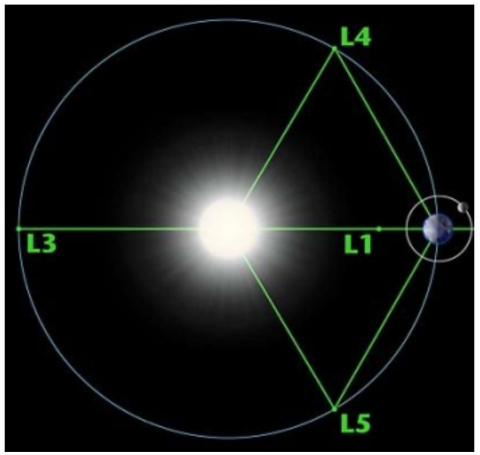


Space Weather Objectives

- Operational space weather services tailored to *European* user needs providing timely, accurate and actionable information.
- Tested and exercised early warning system enabling prompt responses based on actionable information.
- Operational space weather monitoring system with longer term maintenance and enhancement plan.
- A resilient society (incl. infrastructure).
- **(CS) An operational space weather mission at Lagrange point L5**

(CS) An operational space weather mission at Lagrange point L5

- Primary objective is to enhance operational space weather services
- Location away from Earth provides opportunities for increased forecast lead times of potentially hazardous phenomena
- Phase A Study is completed and Phase B1 will be completed in Q3 2019
- Bridging Phase leading to a shorter Phase B2 will be carried out
- Launch foreseen in 2025
- Cost for Phase B2/C/D/E1 of 500M€ and 230M€ requested for Space19+



Planetary Defence Objectives

- An early warning system with prompt mitigation measures based on actionable information.
- An international planetary defence system based on technological solutions for removal/mitigation of threat
  - The capabilities to provide early warnings for asteroids larger than 40 m in size about three weeks in advance
  - Able to deflect asteroids smaller than 1 km, if known more than two years in advance
  - Part of a global international effort
- **(CS) Asteroid Deflection Demonstration**

(CS) Asteroid Deflection Demonstration (Hera)

- Asteroid Impact and Deflection Assessment (AIDA) consists of two missions
  - NASA Double Asteroid Redirection Test (DART);
  - ESA's Hera rendez-vous spacecraft.
- Main objective of Hera is to characterise the outcome of the kinetic impactor test on the Didymos binary asteroid
- Currently in Phase B1 and Phase B2-1 expected to begin in Q3 2019
- Launch targetted in 2024 with backup in 2026 and 2027
- Cost for Phase B2-2/C/D/E1 of 290M€ and 180M€ requested for Space19+

Space Debris and Clean Space Objectives

- Develop the capacity
  - to monitor and safely manage its space-related traffic
  - to remove and avoid debris
  - to understand and assess related risks
  - to apply end-of-life measures for sustainable use of space in an economically-viable way
- Develop a sustainable European space traffic management including monitoring, risk assessments, and debris avoidance;
- Develop capabilities and regulations for end-of-life activities
- **(CS) A debris removal mission to address debris and at the same time support in-orbit servicing market**
- **(CS) A Satellite Collision Avoidance Automation System**

(CS) In-Orbit Servicing/Debris Removal

- This initiative addresses three objectives
  - to perform the removal of ESA satellite(s) as a precursor of in-orbit servicing;
  - to demonstrate technologies, functions and operational know-how to perform other in-orbit services;
  - to achieve the above by means of service contract(s) to provide an opportunity to space industry to enter into this new space market.
- Following a Request for Information in September 2018, ESA published a Service Offer Request to 6 industrial consortium
- Up to two offers will be proposed to Member States and Canada at Space19+ to address these objectives

(CS) Collision Avoidance Automated System

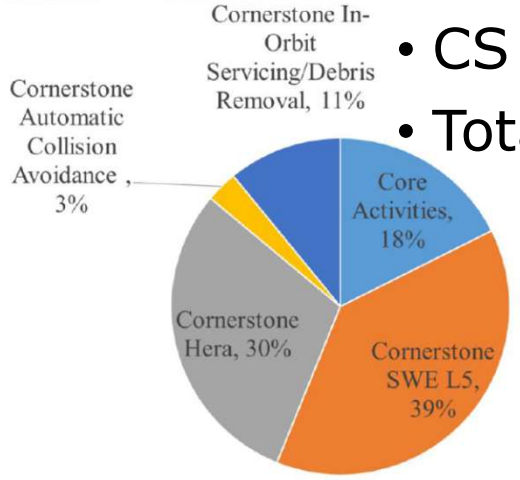
- Also dubbed CREAM for Collision Risk Estimation and Automated Mitigation
- Main goal is to conduct safe and efficient collision avoidance manoeuvres without human intervention
- Will employ and mature machine learning approaches to replicate expert decisions
- This CS is not a dedicated mission. It entails
  - the development of the technology for automated collision avoidance
  - demonstrate it with a suitable flying demonstration platform

Overall SSP objectives

- Threat detection and analysis
  - Space Weather
  - Planetary Defence
  - Space Debris and Clean Space
- Impact prevention, mitigation and protection
  - Space Weather
  - Planetary Defence
  - Space Debris and Clean Space
- Responding, Crisis management and Recovery
  - Planetary Defence
- Remediation
  - Space Debris and Clean Space

Tentative Program Budget

- Core Activities 105 ME
- CS Space Weather 230 ME
- CS HERA 179 ME
- CS In-orbit Servicing/Debris removal 65 ME
- CS Debris Risk Est. & Auto, Mitigation 20 ME
- Total 599 ME



Benefit for Canada

- Industrial benefit
- Contribution to overall worldwide effort for long term sustainability
- Protecting space assets, astronauts
- Opening new markets for industry

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