Mitigation, protection and remediation of space debris for sustainable orbital environment

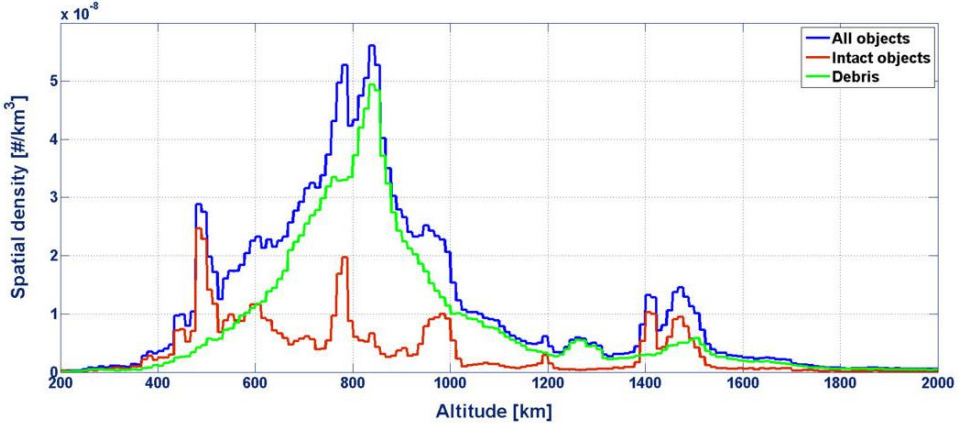
Lion Luca- 37^{th} Cycle

Meeting - 21/01/2022

Outline

- Orbital environment sustainability
- Doctoral work objectives
- Research activities
- Work organization

Orbital environment sustainability



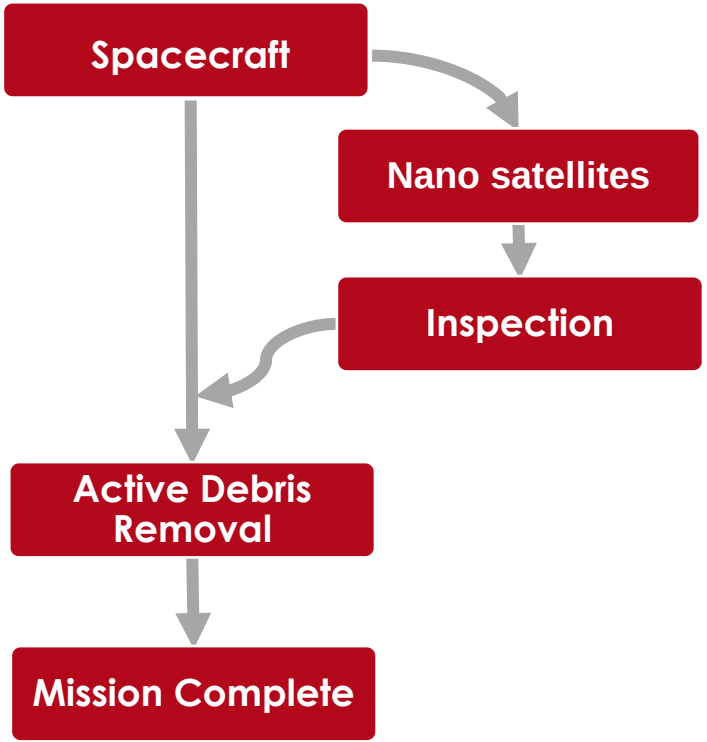
- Mitigation
- Protection
- Remediation

Orbital environment sustainability

Remediation → Active Debris Removal → Target Knowledge → Inspection

ClearSpace-1 mission

Doctoral work objectives



Possible advantages:

- **High versatility**
- **Failure resistant**
- **Cheap technology**

Challenges:

- **Technologies integration**
- **Data handling and processing**
- **Close Proximity Operations (CPOs)**

Doctoral work objectives

Definition of a strategy to automize the creation of a 3D model of the target

Starting from the data acquired by the nanosatellite, an automated process to obtain a 3D representation of the target will be studied and implemented.

Preliminary design of nano-satellites for the observation of a target

A dedicated nano-satellite (CubeSat) will be designed and developed to meet the requirements and constrains defined by the mission. The docking mechanism and navigation system will be also

Selection of a GNC system finalized to the inspection of a target

The behavior of the nanosatellite during the observation phase will be studied, focusing on Close Proximity Operations

Validation of numerical simulations through experimental activities

Research Activities

Mission Analysis

- Literature review
- Mission definition and simulation

Definition of a strategy to automize the creation of a 3D model of the target

- Selection of the image capture procedure
- Selection of image data acquisition and transfer strategy
- Selection of image data processing strategy
- 3D representation of the target and post processing
- Test campaign

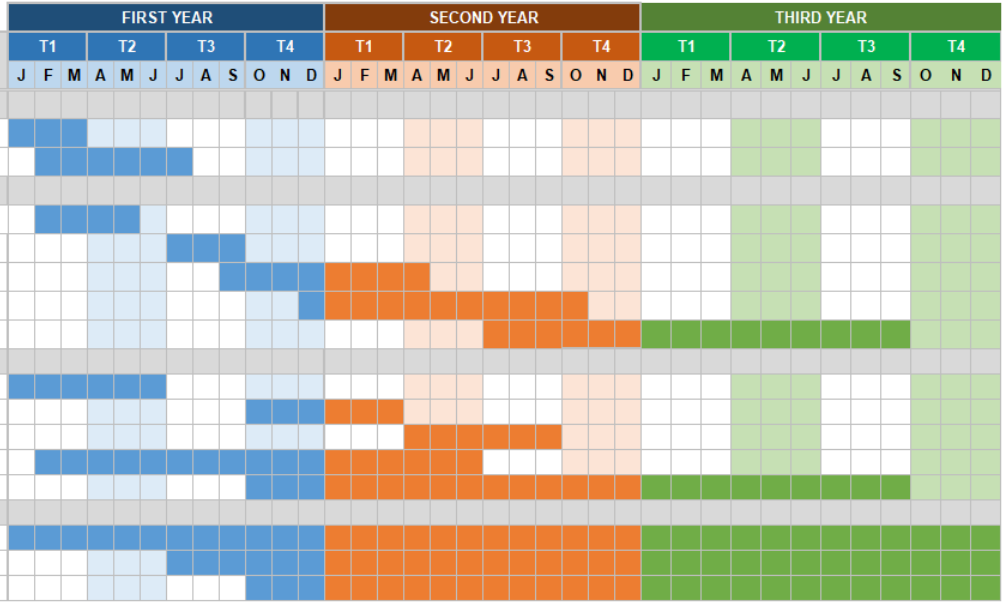
Nano-Satellites Preliminary Design

- Selection of a docking mechanism and navigation system
- Selection of GNC and Close Proximity Operations strategies
- Nano-Satellites Preliminary Design
- Facility development for testing purpose
- Test campaign

Work Organization

PHD STUDENT	Luca Lion	DATE	17/10/2022
PHD THESIS	Mitigation, protection and remediation of space debris for a sustainable orbital environment	ADMISSION TO	First year

WBS NUMBER	TASK TITLE	% OF TASK COMPLETE
1	Mission Analysis	
1,1	Literature review	0%
1.1	Mission definition and simulation	0%
2	Definition of a strategy to automize the creation of a 3D model of the target (FOCUS)	
2.1	Selection of the image capture procedure	0%
2.2	Selection of image data acquisition and transfer strategy	0%
2.3	Selection of image data processing strategy	0%
2.4	3D representation of the target and post processing	0%
2.5	Test campaign	0%
3	Nano-Satellites Preliminary Design	
3.1	Selection of a docking mechanism and navigation system	0%
3.2	Selection of GNC and Close Proximity Operations strategies	0%
3.3	Nano-Satellites Preliminary Design (nottingham)	0%
3.4	Facility development for testing purpose	0%
3.5	Test campaign	0%
4	Writing PhD thesis and reports	
4.1	Writing reports	0%
4.2	Articles redaction	0%
4.3	Writing PhD thesis	0%



Thanks for the attention