# Design and testing of a vision based navigation system for a spacecraft formation flying simulator


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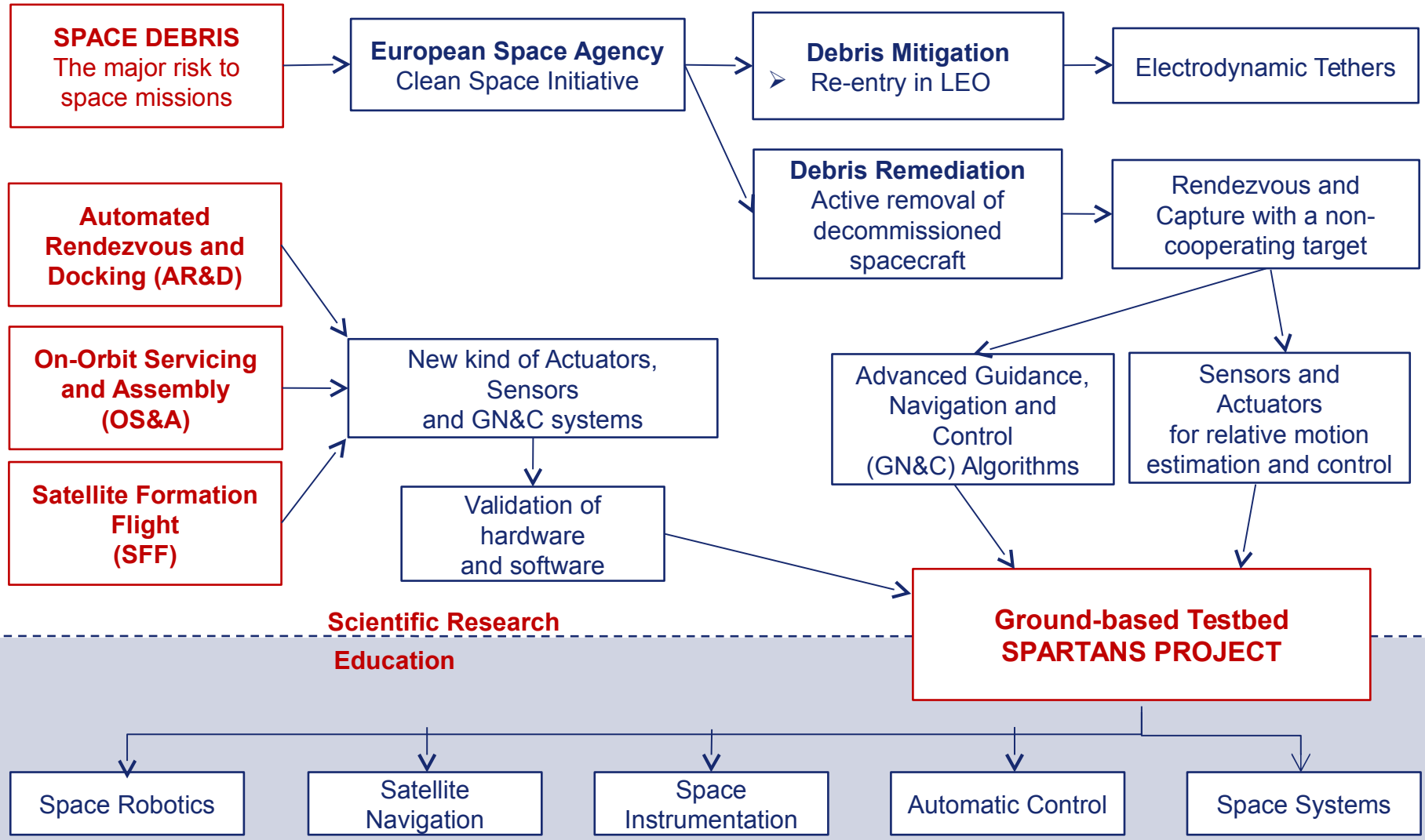
DIPARTIMENTO DI INGEGNERIA INDUSTRIALE

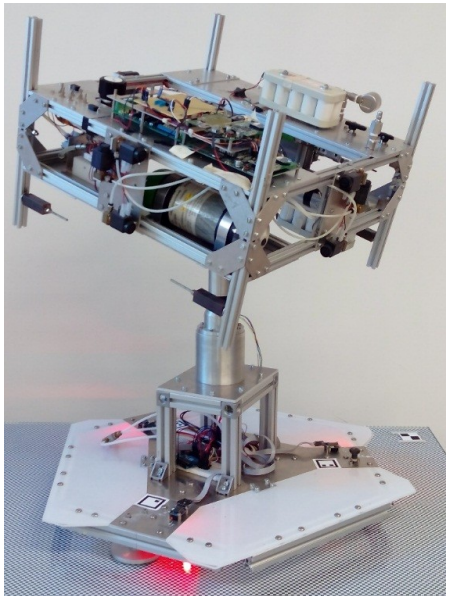
# Outline

- Background and motivation
- The SPARTANS project
- Second year activities: overview
  - Localization system prototype
  - Software development
- Fly Your Thesis! 2017 - PACMAN project
- Conclusions

# SPARTANS Project Motivation



# SPARTANS Project Overview



**SPARTANS**: cooperating **SPA**cec**R**aft **T**estbed for **A**utonomous proximity operatio**N**s experiment**S**

Representative dynamic environment for the development and verification on ground of:

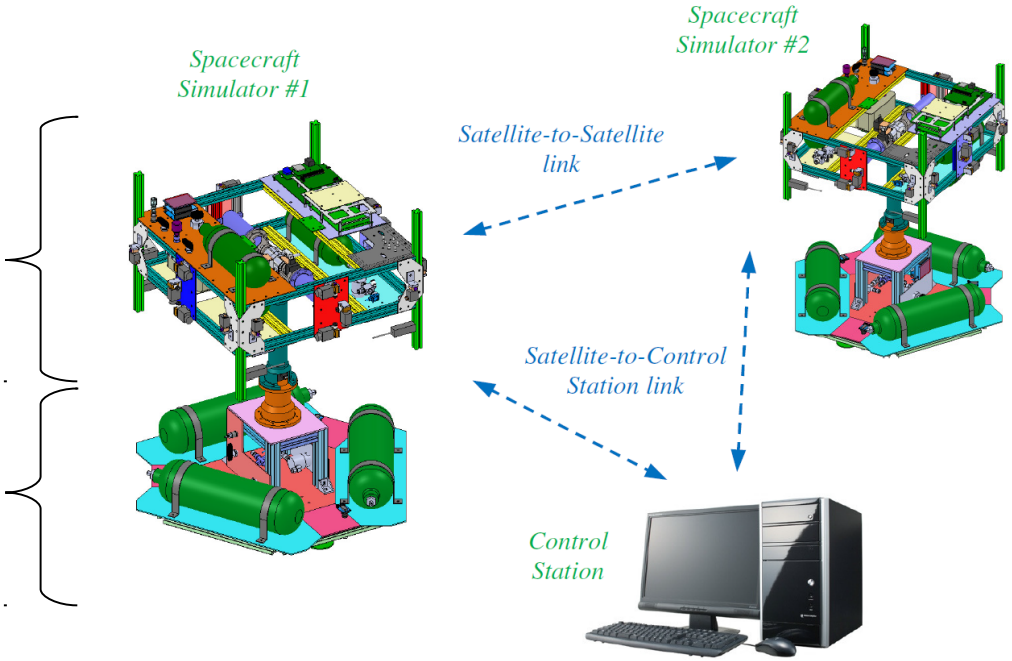
- Sensors and algorithms for relative navigation;
- Coupled position and attitude control algorithms.

## ATTITUDE MODULE (AM)

three rotational degrees of freedom provided by mechanical gimbals

## TRANSLATIONAL MODULE (TM)

two position degrees of freedom traslating on a glass-covered table using a low friction air cushion system



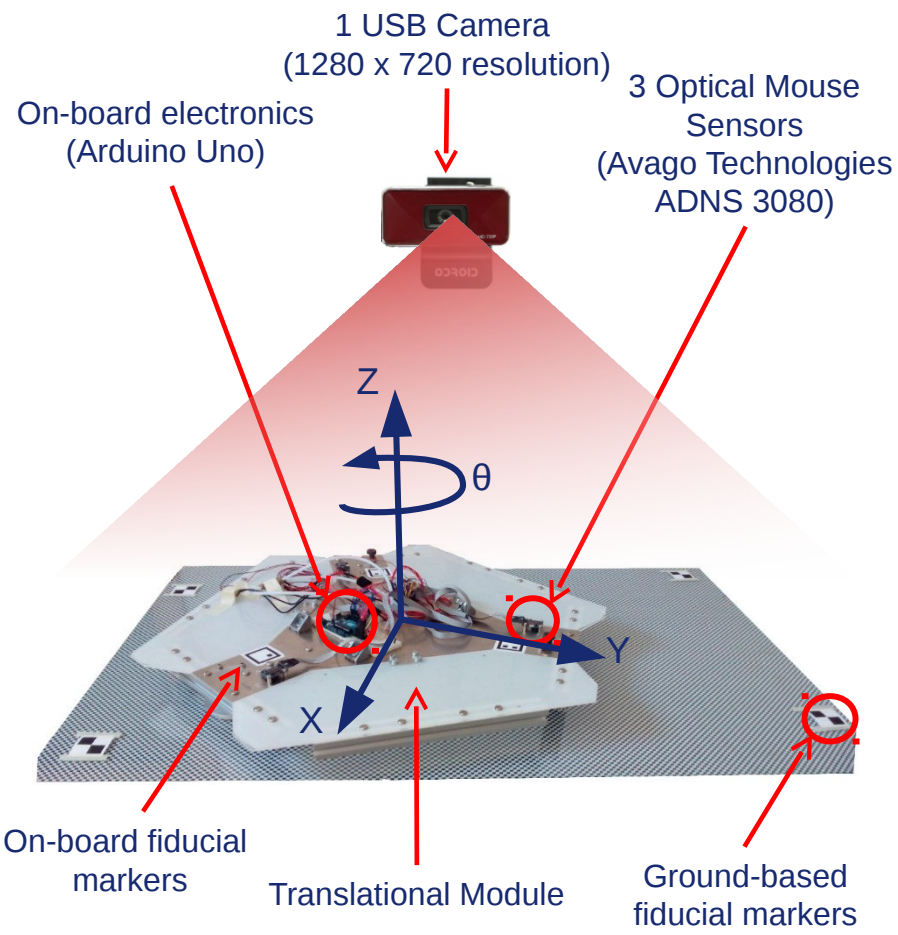
# Localization System Prototype
## Overview

**Main objectives**

- **development of a first prototype of the localization system for the SPARTANS testbed.**
- **determine the position and orientation of the TM with respect to a global inertial reference frame.**

- Contactless measurement system
- High-frequency acquisition
  - Good accuracy in the short term period
- Low-frequency acquisition system
  - Reset the uncertainty level of the high frequency segment

**Measurement Testbed**
Experimental Setup



# Publications

**2015**

• Valmorbida A., Tronco S, **Mazzucato M**, Debei S, Lorenzini E C (2015). Optical Flow Sensor based Localization System for a Cooperating Spacecraft Testbed. In: Metrology for Aerospace (MetroAeroSpace), 2015 IEEE. p. 568-573, Benevento.
• Valmorbida A, **Mazzucato M**, Tronco S, Debei S, Lorenzini E C (2015). SPARTANS - A cooperating spacecraft testbed for autonomous proximity operations experiments. In: Instrumentation and Measurement Technology Conference (I2MTC), 2015 IEEE International . p. 739 -744, Pisa, 11-14 May 2015.
• Pertile M, **Mazzucato M**, Bottaro L, Chiodini S, Debei S, Lorenzini E C (2015). Uncertainty evaluation of a vision system for pose measurement of a spacecraft with fiducial markers . In: Metrology for Aerospace (MetroAeroSpace), 2015 IEEE . p. 283-288, Benevento.

**2016**

• **Mazzucato M**, Tronco S, Valmorbida A, Scibona F, Lorenzini E C (2016). Development of a ground-based cooperating spacecraft testbed for research and education. 1 st symposium on space educational activities, Padova.
• **Mazzucato M**, Valmorbida A, Tronco S, Costantini M, Debei S, Lorenzini E (2016). Development of a camera-aided optical mouse sensors based localization system for a free floating planar robot. In: Metrology for Aerospace (MetroAeroSpace), 2016 IEEE.