A COMPREHENSIVE RVD SIMULATION ENVIRONMENT FOR GNC ALGORITHMS DESIGN AND IMPLEMENTATION

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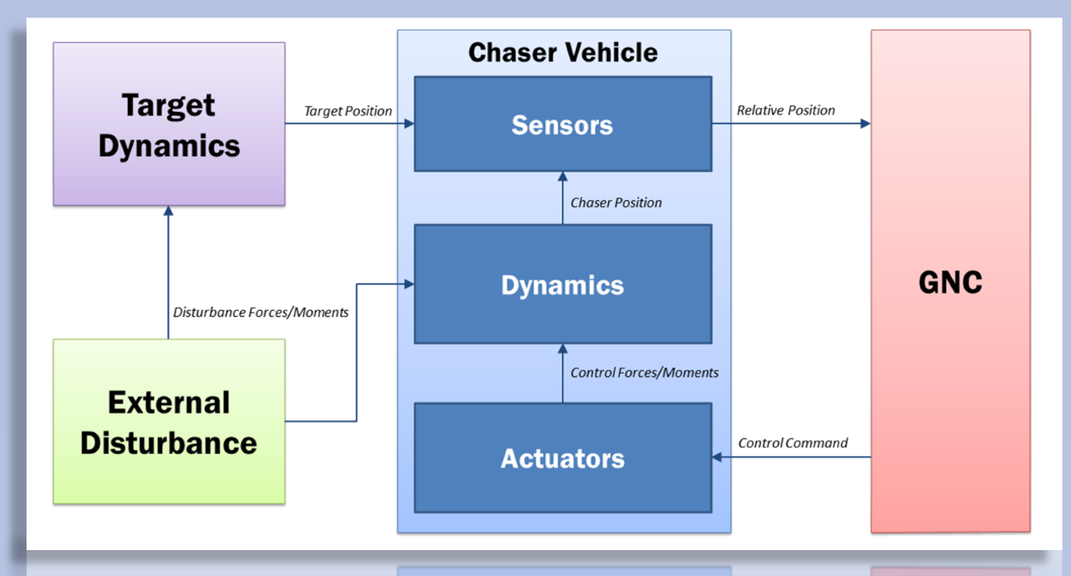
INTRODUCTION

The aim of this reaserch actvity is to develop a comprehensive simulator and guidance algorithms for rendezvous (RVD) maneuvers, starting from far range rendezvous to the final approach. The simulator is designed to reproduce space flight operations along Low Earth Orbits (LEO) for Chaser-Target systems.



THE SIMULATOR

The simulator is developed in Matlab/Simulink environment and it includes accurate and realistic models of sensors and actuators (thrusters and reaction wheels), which allow a complete simulation of autonomous spacecraft behavior orbiting in LEO. A simplified model of external disturbances is included as well.

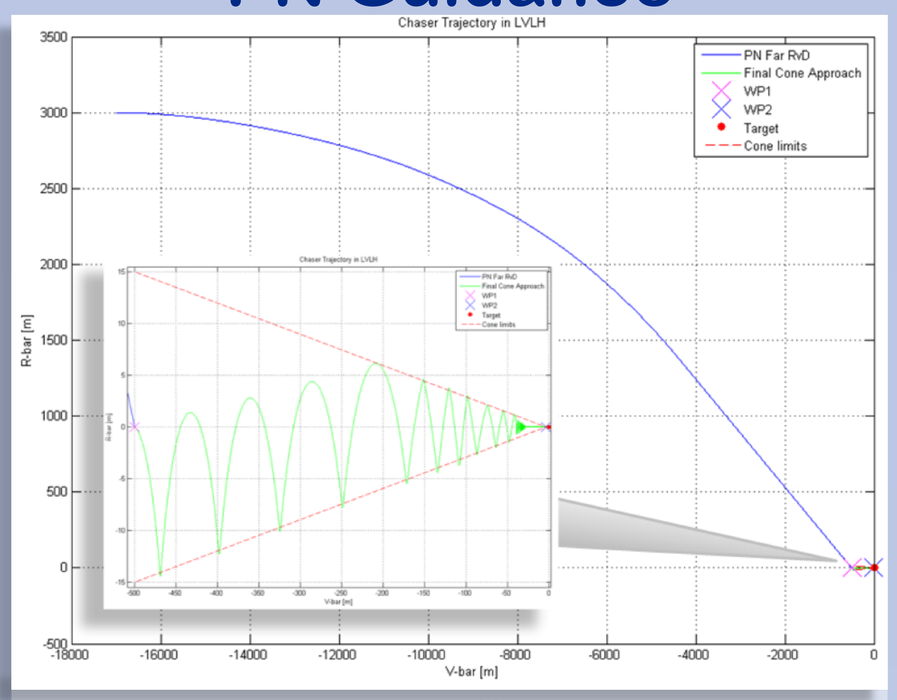
GUIDANCE ALGORITHMS

Two different guidance algorthims have been tested according to the Rendez-vous mission scenario: the classical Proportional Navigation (PN) and the Zero Effort Miss – Zero Effort Velocity (ZEM-ZEV) guidance.

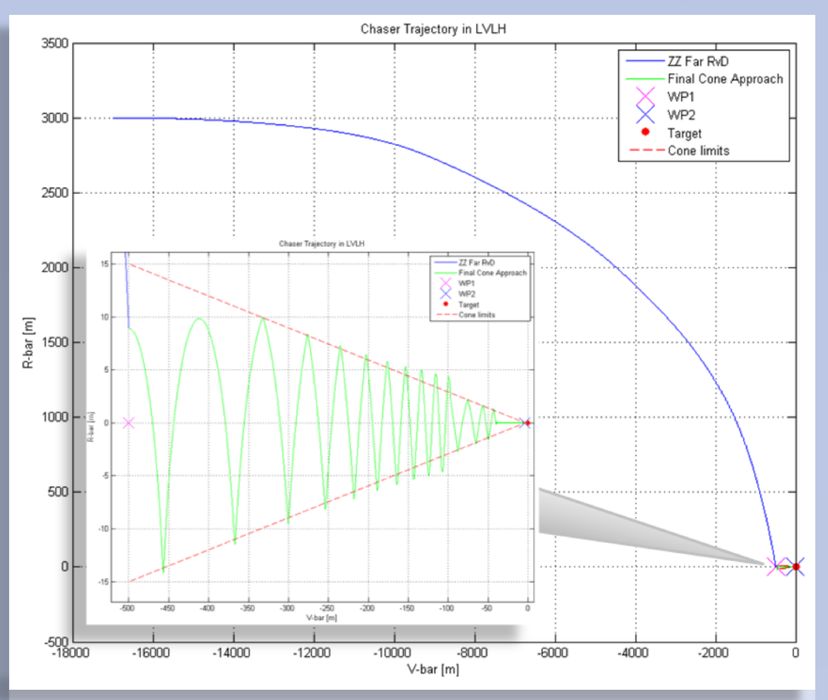
SIMULATION RESULTS

Extensive simulations have been performed in order to simulate a complete RVD maneuver. The maneuver has been split in two phases: the first phase (far-range RVD) is driven by the two guidance algorithms described above; the final phase (final approach) follows a cone approach and ends at a distance of 4 m from the Target spacecraft.

PN Guidance



ZEM-ZEV Guidance



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