

IAF SPACE SYSTEMS SYMPOSIUM (D1)  
Interactive Presentations - IAF SPACE SYSTEMS SYMPOSIUM (IPB)

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SIROM STANDARD INTERFACE APPLICABILITY FOR HARD DOCKING SCENARIOS.  
AIR-BEARING TEST CAMPAIGN AS INITIAL STEP TOWARD THE VALIDATION OF CONTACT  
DYNAMICS.

## Abstract

In the frame of current European space projects, functional interfaces (I/F) emerge as a cornerstone to facilitate standardization of future's connection and transfer operations among space vehicles. However, the functional needs of these interfaces are expected to evolve along with future space mission's requirements. The current European space eco-system is pushing towards new opportunities on the on-orbit assembly and on orbit servicing domains, topics where modularity, interoperability and upgradability play a fundamental role.

PoC-01 -in space transportation Proof of Concept- emerges as example of these initiatives, focussing on the identification and maturation of key space transport capabilities towards the establishment of a space logistic ecosystem. In the specific instance of PoC-01, the envisaged operational scenarios involve cargo transfer and refuelling operations, wherein not only mechanical capture interfaces but also interfaces (I/Fs) to perform power/data and fuel transfer will be required.

Far beyond the challenges related to transfer operations, a critical impediment emerges in the form of the current European interfaces' limited capacity to withstand reaction forces during both docking operations and subsequent high thrust manoeuvres.

In this context, SENER has participated with its Standard Interface (SI) -named SIROM- in several initiatives proposing conceptual solutions to augment SIROM mechanical capabilities.

Furthermore, SIROM's development team has been collaborating with SENER's GNC -Guidance Navigation and Control- team to perform an initial assessment through computational modelling of SIROM suitability for rendezvous/docking operations. Its promising initial outcomes has resulted in a grown interest to further explore and validate the applicability in docking scenarios. However, the need to correlate the initial simulations with physical tests are considered essential proof to reassure simulations validity.

Due to the limitations to test veridically 6DoF on ground, air bearing tests in the Orbital Robotics Lab facilities of ESA -European Space Agency- have been prepared as fundamental intermediate step towards the docking applicability of SIROM. These tests, including REACSA and MANTIS floating platforms for simulating the dynamics of rigid body contact, presents an opportunity to gather valuable insights into the performance of SIROM in docking scenarios.

The presented study dives deep into the definition of an air-bearing test and correlation with contacts dynamics model developed in ADAMS, to, subsequently, calibrate a 6DOF representative model of space dynamics. Additionally, a reflection on the suitability of SIROM for hard docking, presenting conceptual modifications to facilitate this operation are included.