

IAF SPACE POWER SYMPOSIUM (C3)  
Space Power System for Ambitious Missions (4)

Author: Mr. Diego A. Urbina  
Space Applications Services, Belgium, diego.urbina@spaceapplications.com

Mr. Maurice Prendergast  
Space Applications Services, Belgium, maurice.prendergast@spaceapplications.com

Mr. Hemanth Madakashira  
Space Applications Services, Belgium, hemanth.madakashira@spaceapplications.com

Mr. Tigo Van Roy  
Space Applications Services, Belgium, tigo.van.roy@spaceapplications.com

Mr. Andres Martin Barrio  
Space Applications Services, Belgium, andres.martin.barrio@spaceapplications.com

Mr. Mathieu Deremetz  
Space Applications Services, Belgium, mathieu.deremetz@spaceapplications.com

Dr. Advenit Makaya  
European Space Agency (ESA), The Netherlands, advenit.makaya@esa.int

Mr. Levin Gerdes  
European Space Agency (ESA), The Netherlands, levin.gerdes@esa.int

SKYBEAM: IN-ORBIT ASSEMBLY FOR SPACE-BASED SOLAR POWER WITH EUROPEAN  
ROBOTIC TECHNOLOGIES

**Abstract**

Advanced green energy generation concepts like space-based solar power (SBSP) have extensively been studied in the past and interest in these concepts has increased recently. To prepare for future decision making on SBSP, ESA has initiated a preparatory initiative called SOLARIS. In November 2022, funding for this initiative was approved at the ESA Council at Ministerial Level.

Previous studies have shown that implementing space-based solar power (SBSP) is challenging due to the demand for tremendously large infrastructures that require numerous launches with large masses. In-Orbit Assembly using robotic systems in weightlessness is expected to be required, and various enabling technologies being developed could be used, including those under the PER ASPERA programme, a collaboration between ESA, National Agencies, the EU, and Industry, as well as ESA technology developments. These technologies include HOTDOCK modular interconnect, the MOSAR walking manipulator, and the ESA MIRROR Multi-Arm Robot (MAR).

To advance the concept of In-Orbit Fabrication and Assembly for SBSP, the Skybeam project, an effort funded by the ESA Open Space Innovation Platform (OSIP) and precursor to SOLARIS, conducted a literature survey of 27 SBSP concepts and identified a suitable reference architecture for the project. The survey included a comprehensive comparison of the architecture overview, conceptual functional breakdowns, existing assembly approach, concept parameters, system budgets, and level of available information for each concept. Based on this survey, the team selected SPS-ALPHA as the most appropriate baseline architecture for the project.

The team has proposed modifications to the SPS-ALPHA concept and the technologies of interest to converge on an assembly concept compatible with both. To gain insight into the assembly concept of operations and establish construction duration parametrically, the team has carried out a simulation

of the assembly process. This simulation framework is used in order to gain insight into the concept of operations of the assembly process, and can be used to simulate the assembly of space systems as large as SPS-ALPHA in the future.