IAF SPACE TRANSPORTATION SOLUTIONS AND INNOVATIONS SYMPOSIUM (D2)
Launch Services, Missions, Operations, and Facilities (2)

Author: Mr. David Perillo
Politecnico di Milano, Italy

Mr. Matteo Tacconi
European Space Agency (ESA), retired, The Netherlands
Ms. Giulia Priotti
University of Trento, Italy
Ms. Elaheh Maleki
France
Mr. Riccardo Morelli
SEDS Italy, Italy
Mr. Ruben Arena
SEDS Italy, Italy
Ms. Andreea Lita
Politehnica University of Bucharest, Romania
Mr. Cesar Bernal
Spain
Mr. Giangiulio Bagnai
United Kingdom

LAUNCHERSCANNER: AN INNOVATIVE APPROACH TO MATCHMAKING PAYLOADS AND LAUNCH SYSTEMS

Abstract

This paper presents a novel method for matching small space payloads with launchers and deployers, enhancing the sustainability of space exploration by optimizing launch capacity utilization and minimizing the effort to identify suitable launch opportunities. The approach enables payload allocation by systematically comparing launchers interface requirements with payload design requirements. It uses mathematical optimization with heuristic algorithms, for their efficiency in handling dynamic constraints, to optimize payload allocation. This method assesses compatibility and automates decision-making, reducing efforts and speeding up response times. This method reduces computation time, identifying last-minute partners and assisting launch providers in finding replacements for cancelled payloads. An analysis of widely used Launchers' and Deployers' User Manuals reveals a lack of homogeneity and standardization in interface specifications, regarding payload integration and environmental requirements. This lack of standardization forces developers to adapt their designs to specific launchers, increasing costs and complexity in design changes or hardware adaptation. When payloads fail to meet criteria, they are often removed from the manifest, creating gaps that launch providers fill with dummy payloads to balance the launch vehicle. This practice is economically inefficient for both launchers and payload developers and imposes high costs for these last ones in case of changes often non affordable by the payload's developers. Additionally, launchers may also need to cancel missions or alter interface requirements, disrupting integration process and requiring payload developers to secure last-minute alternatives. Unlike traditional launch coordination, which provides broad envelope requirements, our approach enables prompt payload allocation. Space Agencies usually set enveloped structural, volume, mass, and thermal constraints but they cannot

do the same for mechanical, electrical, or software interfaces, requiring developers to verify compatibility manually. In contrast, our method systematically compares payload needs with launcher and deployer constraints, streamlining selection and assessing reallocations for last-minute changes or cancellations. This improves efficiency, reduces delays, and enhances sustainability by maximizing launch opportunities and minimizing waste. This approach matches payloads with launch slots, reducing reliance on dummy payloads, lowering costs, and improving scheduling flexibility. By reducing delays and optimizing launch capacity, it fosters a more sustainable space industry. By minimizing resource waste and unnecessary manufacturing, this approach reduces environmental impact and promotes responsible launch infrastructure use. Additionally, it strengthens the resilience of the space transportation network by mitigating last-minute cancellations, ensuring mission continuity and enhancing launch predictability. By broadening access to launch opportunities, this approach fosters an inclusive and sustainable ecosystem for all payload developers.