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HELIOS - HUMAN EXPLORATION LAUNCH AND IN-ORBIT SUPPORT INFRASTRUCTURE: A CONCEPT STUDY

Abstract

Earlier work outlines the political requirements for an infrastructure that would provide Europe with an autonomous capability to support inhabited LEO orbit facilities. The HELIOS (Human Exploration Launch and In-Orbit Support) study explored a technical solution that meets these requirements. Past human capability is achieved either through modification of uncrewed launch systems or a general purpose launch system combining human and non-human requirements. HELIOS is a fully reusable specialist infrastructure that is focused solely on the station support function and all the system requirements were derived from this role. Any additional capabilities are a matter of serendipity.

The potential interest in the approach derives from the following logic. The fundamental driver with reusable launch systems is to make them as small as practical. The smaller size reduces the acquisition costs, and, once in operation, the higher launch rate decreases the cost per launch. For a general purpose system that can capture the current launch market, the payload mass should be around 15 tonnes. However, to support the anticipated post ISS LEO infrastructure the smallest practical payload is a third of this value – around three to four tonnes. So, a small specialist system for space station support may prove a more attractive option.

The technical solution was centred on a triamese launch system: three identical vehicles, two acting as boosters while the third goes into orbit. The orbiter carries a specialist Mission Module to match each flight objective. There are two basic types, attached and deployed. The attached modules are carried by the orbiter throughout the flight carrying either crew or logistics. The deployed modules are left at the station to act as either free flying systems or attached utilities support.

Twelve flights annually could fully support up to ten orbital crew with a quarter of the flights actually carrying people. As a fully reusable system it offers economic, flexible on-demand access to orbital facilities. The current reusable launcher developments are oversized to deliver small crews and a regular flow of logistics that is ideal to operate post-ISS stations. By contrast a smaller system, that has been optimised for these support operations, offers a cheaper and more effective service. Although the study context was achieving European autonomy, its conclusions on the optimum infrastructure to maintain LEO space stations have a wider applicability.