

SPACE TRANSPORTATION SOLUTIONS AND INNOVATIONS SYMPOSIUM (D2)
Future Space Transportation Systems Verification and In-Flight Experimentation (6)

Author: Mr. Thierry Pichon
Herakles Safran, France, thierry.pichon@safran.fr

Mr. François Buffenoir
Herakles Safran, France, francois.buffenoir@herakles.com

CMC WINDWARD TPS AND NOSE OF THE IXV VEHICLE :
QUALIFICATION, INTEGRATION, AND FLIGHT

Abstract

The launch of the Intermediate eXperimental Vehicle has represented a major achievement, with the first European in-flight demonstration of some of the most advanced technologies in the field of re-entry. In particular, this vehicle relied on a large array of C-SiC based thermal protection systems, in development for many years, but only completely validated through the actual IXV flight.

Herakles, Safran, has been entrusted since 2008 with the development and qualification of two of the most critical TPS subsystems of the vehicle: the nose and the panels covering the major part of the windward area, two of the most heated areas during re-entry. After a successful CDR outcome in 2011, these subsystems have successfully been qualified through the manufacturing and testing of specific hardware, which allowed the production of the flight model hardware.

The technology developed for these applications combines a high-temperature resistant C-SiC outer shell, mechanically fastened to the structure of the vehicle, and internal lightweight insulation layers. These systems have to comply with a set of very strict requirements related to the harsh environment of atmospheric re-entry, combined aerodynamic shape control and mass objectives. Consequently, a large number of test campaigns have been performed throughout the detailed design phase, addressing the different components of the subsystems, with particular focus on C-SiC parts and on integrated subsystem performance.

Manufacturing of the components of the Qualification Model, as well as the Flight model, has been a challenge. This paper will recall the main steps of the hardware production. It will also summarize the results of the qualification tests, that comprise both dynamic tests and thermal and mechanical tests on a series of full-scale parts representing the nose of the vehicle and the most critical areas of the windward TPS. Then, an overview of the integration activities that have been performed during the assembly of the components onto the vehicle will be provided.

Finally, initial preliminary considerations will be provided concerning the post flight condition of the TPS, based on the available data to date.