

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

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FLAP CONTROL SYSTEM (FPCS) FOR IXV RE-ENTRY DEMONSTRATOR.

Abstract

The aerospace company SABCA, located at Brussels, Belgium, is in charge of the development and manufacturing of the Flap Control System (FpCS) of the IXV vehicle, under Thales Alenia Space Italy (TAS-I)'s responsibility. Basically, the FpCS subsystem will be active during the IXV re-entry phase itself (between 120 km and 30 km altitude); it will hold the flaps in a fixed position during the launch phase, the orbital flight (up to 415 km altitude) and the last part of the descent.

The IXV FpCS subsystem is derived from the VEGA ZEFIRO Z23/Z9 Thrust Vector Control (TVC) System, that was successfully used on the first VEGA launcher on February 13th, 2012. It consists of 2 electro-mechanical actuators (EMA's), controlled by 1 EMA controller unit (EMACU), supplied by a set of two Li-Ion batteries; the actuators interface with the flap rods through levers. The main design changes between the VEGA TVC and IXV FpCS designs are the following: - The IXV FpCS actuators feature specific pin-to-pin length and strokes, and include the specific locking mechanism, that was not implemented into the VEGA TVC design. - The IXV EMACU uses specific software control parameters, as well as a specific IGBT, compatible with the IXV mission, and the re-entry phase in particular.

Basically, the locking mechanism is a passive static teeth brake, that will hold the flaps position when unpowered; during the FpCS detailed design phase (C), some engineering tests were performed in 2011 with a breadboard locking mechanism, in particular: - Functional and performance tests - Vibrations tests - Endurance test in vacuum - Temperature tests. The lessons learnt from the engineering test campaign supported the proto-flight model (PFM) design.

Most of the FpCS components are COTS (component off-the-shelf) classified and, as such, will be submitted to a delta qualification campaign (phase D), in order to demonstrate the compliance with the IXV mission requirements, in particular: - (Actuator + lever) vibrations tests - Actuator shock tests - (Actuator + lever + EMACU) thermal performances tests - FpCS thermal vacuum cycling test - FpCS duty cycle test. The FpCS qualification campaign is scheduled from October 2012 till February 2013, the IXV flight being scheduled at the end of 2013.