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CRYOFENIX (CRYOGENIC SOUNDING ROCKET EXPERIMENT) RESULTS

Abstract

Prediction of the behaviors of cryogenic liquid propellant in microgravity is a key element for decreasing development risk and optimizing design of a new generation of cryogenic upper stage (Ariane 6) or cryogenic orbiter with long ballistic phase. For this purpose, CNES and Air Liquide Advanced technologies have developed through a partnership innovative models to be used with a commercial CFD tool. Those models mainly focused on thermal aspect, were validated through analysis of laboratory's experiments, but also with microgravity experiments using magnetic levitation devices or parabolic flights.

The next step to increase our tool IRL concerns the global behavior and the use of cryogenic fluid with larger test scale and longer microgravity duration. This is the target of Cryofenix project which will use MASER type sounding rocket, provided by the Swedish Space Corporation. This service offers 6 minutes of microgravity for a 400 kg payload. Inside this payload, well instrumented cryogenic tests cells will be installed. During microgravity phase, behavior and characteristics of the liquid hydrogen will be observed and recorded. Hence comparison between data and simulation will give us a clear status of our tool. And then, additional models improvements and refinement can be engaged.

Cryofenix will be the first European sounding rocket experiment with liquid hydrogen inside. Globally, this project will allow CNES and Air Liquide to get a better understanding of fluid behaviour in microgravity and will give confidence in our numerical tool used for Ariane 6. Thus, our propellant management capacity for long ballistic phases will be improved.

The paper will present the Cryofenix project and the results.