

43rd STUDENT CONFERENCE (E2)
Student Team Competition (3-V.4)

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ENGINEERING DESIGN OF A LOW GRAVITY EXPERIMENT ONBOARD REXUS 16: CHEMICAL
WAVE IN SORET EFFECT (CWIS)

Abstract

The purpose of the CWIS experiment is to visualize the chemical wave due to thermodiffusion in a liquid binary mixture. The chemical wave is represented by a strong concentration gradient given by thermodiffusion at the beginning of the process. The milligravity condition will allow to clearly see the effect in the mixture composed by water and ethylene glycol. This effect cannot be visualized on ground since it is masked by buoyancy. The concentration of each component of the mixture will be measured using a Mach Zehnder interferometer.

The very beginning of the phenomenon has never been observed experimentally, but S. Van Vaerenbergh and J. C. Legros in 1990 gave an analytical demonstration of the enhancing of the process at the boundaries during its initial phase.

The experiment will be performed during the REXUS 16 campaign in Kiruna (Sweden) in March 2014.

The REXUS/BEXUS programme is realised under a bilateral Agency Agreement between the German Aerospace Center (DLR) and the Swedish National Space Board (SNSB). The Swedish share of the payload has been made available to students from other European countries through a collaboration with the European Space Agency (ESA).

EuroLaunch, a cooperation between the Esrange Space Center of SSC and the Mobile Rocket Base (MORABA) of DLR, is responsible for the campaign management and operations of the launch vehicles. Experts from DLR, SSC and ESA provide technical support to the student teams throughout the project.

This article illustrates in details the engineering design of the experiment. Some design requirements are shown and the relative mechanical and electronical solutions are presented. From the mechanical

point of view, a deep FEM analysis showed the behaviour of the payload and allowed to insulate it from vibrations. The electronics, telemetry and power distribution system has been designed using COTS products. The verification of the design has been performed through some qualification tests, like vacuum test, thermal test and electrical insulation test. The results of the tests already performed are presented at the end of the article.