

Two-Phase Flows Investigations in Liquid Propulsion Systems: “TRL Booster” Research at the von Karman Institute

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Since 2012, at the von Karman Institute (VKI), the Space Propulsion research group is actively working on scientific investigations aiming to serve as “Technology Readiness Level booster” for liquid propulsion applications. The expertise of the team can, indeed, provide fundamental insights to specific fluid-related phenomenon in order to increase and develop the degree of maturity of the technologies related to spacecraft sub-systems. Typically, a combined experimental and numerical approach is undertaken to tackle the extremely complex fluid dynamics aspects characterizing the propellant tanks, feedlines and major related components such as space valves. The peculiar strength of the team is to meaningfully reproduce at laboratory scale and accurately characterize fundamental phenomena involved in such cryogenic systems, ranging from flow boiling and cavitation to liquid sloshing. Standard sensors, in-house-built innovative instruments, as well as new detection methods, are developed to match the requirements of the specific investigations.

This talk proposes an overview of the VKI Space Propulsion team activities, including ambitious future perspectives, aiming to strengthen European capabilities in developing propulsion systems which satisfy a wider range of space mission requirements. The past and ongoing achievements focused on fundamental physic phenomena encountered in launchers and satellites propulsions systems will be illustrated. Hints will be given on the envisaged road to face fluid management in the coming future challenges of space re-fueling and deep space exploration missions.