ABOUT SLOWD

SLOshing Wing Dynamics (SLOWD) aims to investigate the effect of sloshing on the dynamics of flexible, wing-like structures carrying a liquid (fuel), through the development of experimental, numerical and analytical methods, and to use sloshing to reduce the loads occurring from gusts and turbulence.

Its main goal is to provide a holistic approach (both experimental and numerical) in order to quantify the energy dissipation effects associated with the liquid movement inside the fuel tanks, as the wing undergoes dynamic excitations. An increase of the order of 50% in the damping characteristics of the structure is expected.

The primary focus of the project is the application of modelling capabilities to the wing design of large civil passenger aircraft (subject to EASA CS-25 type certification), which are designed to withstand the loads occurring from atmospheric gusts and turbulence and landing impacts.

SLOWD is the first project to propose full scale wing tests which include slosh dynamics. The work proposed in SLOWD is therefore aiming to advance the state-of-the-art capabilities in the field of sloshing/structure/control interaction to increase significantly on the international competitiveness of the European aerospace industry. Also, it aims at making recommendations to EASA so as to make aerospace design practices safer and more competitive.

SLOWD TEAM

Coordinator

AIRBUS

arianeGroup

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UKRI Science and Technology Facilities Council

Consiglio Nazionale delle Ricerche

https://slowd-project.eu

SLOWD

Sloshing Wing Dynamics

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SLOWD OBJECTIVES

» Setup of an Experimental Campaign to investigate the response to dynamic loading of the wings of a modern passenger airliner (200 passengers or more) carrying fuel.

» Further Develop Numerical Methods for the concurrent modelling of the experimental setup and generation of a high-fidelity digital-twin.

» Evaluate Reduced-Order and Analytical Models, as reduction in the complexity of the numerical models for subsequent inclusion into an industrial design framework.

» Integration of the Models into a Multidisciplinary Design Framework using an industrialised version of the developed software to understand the influence of design parameters and define an optimal architecture of the wing fuel tanks, which maximises the dissipation effects due to fuel sloshing.

EXPECTED IMPACT

Advanced multidisciplinary capabilities for whole Aircraft

» **SLOWD** methods integration to have enormous potential for already certified aircraft.
» Expensive & unnecessary structural reinforcements / weight increase will be avoided.
» 3% saving on total wing weight with direct impact on fuel consumption.
» Exploiting conservatism in existing designs will limit the option in active and passive control strategies.

Significantly reduced aircraft design cycle and higher complexity decision trade-offs

» Optimal design in a shorter time frame.
» Innovative design solutions, novel wing tank layouts.
» Target weight savings of 6% (2x of that achievable for an existing design).

Development of synergies on visualisation methods & big-data analytics

» Integrate full order and reduced order / analytical models.
» Understanding the simulation results and comparing the accuracies of the different types of models.
» Identifying key simulation parameters and developing visualisation techniques.

Increase the European innovation potential in Aeronautics and Air Transport (AAT)

» Exchange of personnel between large aerospace groups, SMEs and Academia.
» Involvement of partners active also in space and other transport sectors.
» Methods and tools on a common computing environment.