SECTOR:
ROCKETS AND MISSILES

OFFERINGS:
ENGINEERING SIMULATION SERVICES

TECHNOLOGY:
FLUID DYNAMICS

ESTIMATION OF UNSTEADY PRESSURE FIELD FOR SPACE VEHICLE

Our customer is a subsidiary of multi-national Aerospace and Defence Corporation that provides civil and military space systems and services. They are prime contractor for an expendable launch vehicle that is used to deliver payloads into geostationary orbits. They were interested in estimating unsteady pressure field exerted on the external surface of launch vehicle during its ascent for direct use in vibro-acoustic analysis. A numerical simulation tool to predict unsteady field in the frequency range of 5 Hz to 1000 Hz was thus desired.

Zeus Numerix employed coupled CFD-CAA methodology for calculating noise sources generated by flow entrainment of rocket exhaust jets. Unsteady compressible flow field using URANS (Unsteady Reynolds Averaged Navier Stokes) was simulated on proprietary CFD tools. Noise sources were classified along the jet boundary as monopoles, dipoles and quadruples. Lastly, an FW-H (Ffowcs-Williams Hawkings) acoustic solver was developed to calculate noise at target points.

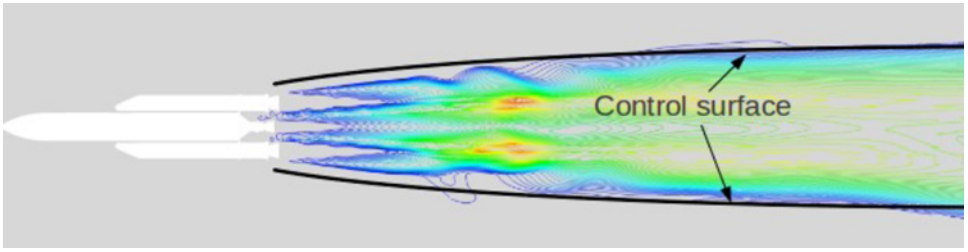

Figure 20: Control surface enclosing the zone of turbulence in rocket jet

The customer was delivered with the detailed numerical analysis report containing data for sound pressure level (dB) at different frequencies, noise propagation around the jet and acoustic load on fairings. It was concluded that mesh sizes greater than 15 million cells were a must for reasonable prediction. Higher mesh refinements and LES turbulence model will be needed to simulate for frequencies greater than 200 Hz.

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