Missile External Aerodynamics Using STAR-CCM+

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Computational Fluid Dynamics has been integrated as a key component of missile aerodynamic performance analyses at Lockheed Martin Missiles & Fire Control for many years. Applications are varied, including preliminary aerodynamic databases, identifying component loading, investigating complex flow fields, and assessing safe separation. A discussion of the procedures and tools used is presented, with specific emphasis on STAR-CCM+. Aerodynamic performance predictions from STAR-CCM+ and an in-house code are compared to wind tunnel test data at several Mach numbers for the Joint Common Missile, a tactical air-to-surface missile developed in the early 2000s. The solution procedure from CAD file import through automated batch solver runs and data reduction is discussed. Effects of mesh topology and turbulence models are investigated. Solver performance improvements due to solution acceleration techniques available in STAR-CCM+, such as Grid Sequencing Initialization and Expert Driver convergence control, are also assessed.

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[1] http://www.cd-adapco.com/sites/default/files/Presentation/4-lockheed_0.pdf