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Modelling Flow Phenomena in Time Dependant Store Release from Transonic Aircraft

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Abstract content
   (Max 300 words)
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In the Mach number range between 0.8 and 1.2, aerodynamic loads on aircraft and launch vehicles are very sensitive to the presence of shocks. While numerical models in the subsonic and supersonic ranges rely on a range of assumptions and can run relatively fast, transonic models are very sensitive to geometry and are computationally demanding.

Computational Fluid Dynamics (CFD) is a useful tool in addition to wind tunnel test and flight test. Testing is required in order to predict carriage loads, and release safety.

Validation of relevant public domain cases in CFD is a rigorous requirement. The case of a double-ogive finned store dropped from a pylon beneath a delta wing has been studied experimentally (R. Heim, Arnold Engineering Development Centre Report, 1991) and using CFD (L.E. Lijewski, N.E. Suhs, J. Aircraft, 31, 886-891, 1994).

At free-stream Mach number M = 0.95, the flow structures directly under the wing include shocks at the fore and aft limits of the pylon. A shock-wake interaction occurs downstream of the pylon. The interaction between the aft pylon shock and the spanwise shock usually found on delta wings is explored. The shock system of the parent body interacts with that of the moving store and with its associated expansion fans. In the simulations, the sting supports of the wing and the store are neglected. The flow field developing between the wing and the store for the first 500 ms of release under gravity is of considerable significance in the overall trajectory of the store.

Inviscid tests of the parent body alone indicate that modelling of the flow over the parent body displays time dependence in which the shock parallel to the delta wing trailing edge oscillates fore and aft, displacing the shock system around the pylon.

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