



MISSILE AERODYNAMICS – A GARTEUR SUCCESS STORY

Meteor is the new generation Beyond Visual Range Air-to-Air Missile system that will revolutionize air-to-air combat in the 21st Century. The weapon brings together six nations (DE, ES, FR, IT, SE, UK) with common requirements.



For such a missile development to be successful, it is largely depending on numerical simulation for external aerodynamics at supersonic conditions and high angle of attack, supersonic air intake and ramjet design and aircraft integration (Typhoon, Gripen and Rafale).

There is a long commitment since the 1990-ies of GARTEUR AD-GoR on the application of CFD to missile aerodynamics as it can be seen through the list of the following action groups:

AD/AG-15 Validation of Euler Codes for Supersonic Flows

AD/AG-24 Navier-Stokes Calculations of the Supersonic Flow About Slender Configurations

AD/AG-34 Aerodynamics of Supersonic Air Intakes

AD/AG-42 Numerical simulations of turbulent subsonic and transonic flows about missile configurations

All these actions groups allowed to develop and improve the numerical tools for the specificities of missile aerodynamics: high angle of attacks, vortical flows, high supersonic regimes (Mach > 3) and increased confidence in the European portfolio of CFD codes for these applications. Recent use of advanced CFD applications gave also a deep insight on flow physics.

Presently (2012-2013), three on-going GARTEUR groups are of great interest for future applications:

AD/AG-46 Highly Integrated Subsonic Air Intakes

In which advanced CFD is used for calculating the air intakes which will equip the future cruise missiles.

AD/AG-48 Lateral Jet Interactions at Supersonic Speeds

Dedicated to a crucial aerodynamic aspect of a potential future European Ballistic Missile Defence terminal vehicle

and



AD/AG-51 Laminar-Turbulent Transition Prediction in Hypersonic flows

Deals with the important difficulty of transition prediction and triggering on future hypersonic air-breathing vehicles.

It is worth noting that the last two action groups go further than CFD and include a deep understanding of flow physics via experimental, theoretical and simulations approaches.

In summary it can be stated that the joint European knowledge in Missile Aerodynamics, and especially in numerical simulation, has largely been built up over the past decades through national efforts coordinated via GARTEUR Action Groups. There is no other organisation in Europe where such a collective effort is done for the specific topics of Missile Aerodynamics.

