SECTOR:
LAND SYSTEMS

OFFERINGS:
BUILD TO SPECIFICATIONS

TECHNOLOGY:
FLUID DYNAMICS AND STRUCTURES

DESIGN OPTIMIZATION OF MUZZLE BRAKE FOR 155 MM ARTILLERY GUN

Our customer is a defence research laboratory engaged in the design and development of 155mm artillery gun. To reduce force on the recoil system, it is desired that suitable muzzle brake (MB) be designed. However, the presence of MB also puts limitations in terms of the loads on the barrel, wear on the muzzle brake, its efficiency, erosion characteristics and internal ballistics. Higher MB acoustics leads to early detection by enemy and should be kept in check. Lab also wanted a comparison between different types of muzzle brakes like double baffle, papper pot attachment and integrated papper pot.

ZN embarked on the problem by first simulating the internal ballistics of solid propellant burning. A numerical approach developed in literature for simulating internal ballistics of solid propellants was adopted for computation. 1DOF mass and energy balance model was used to calculate motion of the ordnance that gave its velocity at ABP. Once the ABP was achieved 3D CFD was used to simulate the release of hot gases from the baffles thereby giving the muzzle efficiency as output. Transient pressure data from CFD was used to perform fatigue analysis on MB. Erosion and wear analysis was performed to estimate the replacement life cycle of MB.

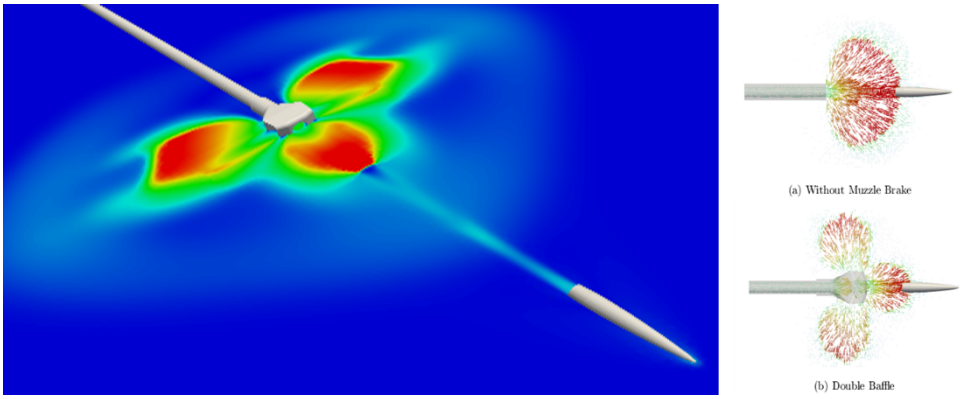

Figure 57: High velocity gases coming out from double baffle MB and comparison to without MB case

Project culminated in delivering an optimized design of MB to the customer. In addition, customized software was developed that created geometry and mesh of different MBs, performed all the simulations and provided results and automatic report. Delivered optimized design was 9percentage more efficient than the original design.

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