

# TRAJECTORY ANALYSIS OF A SOLID FUEL RAMJET PROPELLING AN ARTILLERY SHELL

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## Abstract

This paper intends to estimate the possible range of a 155 mm artillery shell propelled using a ramjet in a fuel-rich propellant configuration. It also intends to obtain an optimum design of ramjet to maximize the range. A six degree of freedom trajectory simulation was developed to obtain the trajectories of the shell with a ramjet, which dynamically evaluates the off-design performance of the ramjet during the flight. A fuel-rich propellant was taken from literature for evaluating the performance of the ramjet. Various trajectories of shell were obtained at different initial thrusts and A/F ratios and with a constant combustion efficiency of 0.95. Results showed that with a 39-calibre gun, the range enhancement of around 105% compared to the current range of 24 km was obtained with a 155 mm artillery shell without any base bleed unit. This was achieved for the ramjet providing thrust equal to 1.2 times the drag at sea level with an initial A/F ratio of 11.

**Keywords:** Artillery Shell, Ramjet, Fuel-rich Propellant, Range Enhancement, Trajectory Simulation