Orissa Journal of Physics
ISSN 0974-8202

Vol. 22, No.1
February 2015
pp. 9-16

Modelling Artillery Projectile Sound Energy

M K DAS and M C ADHIKARY

Lecturer in Physics, BJB College, Bhubeneswar,
Reader in Applied Physics and Ballistics, FM University, Vyasavihar, Balasore,
email - mkdas@iopb.res.in; email - mcadhikary@gmail.com and

Received : 2.10.2014 ; Accepted : 7.1.2015

Abstract : Artillery projectile is a class of projectiles around which much of aeroballistics physical theory was originally developed, and it continues to form a significant part of the aeroballistician's and aerophysist's interest. Generally, a supersonic projectile generates an acoustical shock wave along their trajectory. This projectile sound is only audible in the Mach region area. The geometry of this area depends on the projectile speed relative to the speed of sound and on the decrease of the projectile speed along the trajectory. At some distance from the projectile, the shape of the waveform is the typical N-wave shape. In 1950 and 1952, Witham published two papers on the prediction of the sound pressure of projectile sound including the non-linear effects. The pressure prediction depends on the diameter, length and shape of the projectile and on the local Mach number. Due to non-linearity, the spectral energy content is not constant but depends on distance. For large area, multiple source noise contour maps, this model leads to long calculation times and due to some limitations in the model generates prediction errors in those cases where the projectile speed becomes subsonic along its trajectory. In view of above, this paper discusses an energy model for projectile sound to understand these phenomena. This energy model assumes that the source of the projectile sound is the local loss of kinetic energy. A fraction of that energy loss radiates as sound energy into the direction determined by the local Mach number. For distances far enough to apply linear acoustics, this model predicts the free field sound exposure level and a constant time duration of the N-wave. The paper also compares the result to the non-linear pressure model.

Keywords: projectile, subsonic, supersonic, Mach and etc

[Full Paper]