

Title: Modelling Sonic Boom Propagation through Planetary Boundary Layer Turbulence near the Lateral Extent of the Carpet

Authors: Alexander Carr\*, Joel Lonzaga<sup>‡</sup>, S.A.E Miller\*

Up until this point: 30 words

Nonlinear acoustic propagation of sonic booms in the atmospheric boundary layer is considered in the context of a one-way solution to a third order wave equation. A split-step approach is utilized to compute different physical effects efficiently. Unlike previous approaches, the diffraction effects are computed exactly in the forward direction with no restriction on the angle of propagation. This results in more accurate modelling of sonic boom near the carpet edge. Heterogenous flow effects are incorporated with a wide-angle parabolic approximation. Nonlinear propagation is computed with a Burgers-Hayes method. Turbulence in the medium is constructed by the method of random Fourier modes. The turbulence spectra are constructed using an altitude dependent 3-dimensional von Karman spectrum. The turbulence field is considered frozen, as the eddy turnover time in the atmospheric boundary layer is generally much larger than the propagation time of the acoustic wave. Comparisons with benchmark predictions from the PCBoom software are conducted. The benchmark cases provide insight into the accuracy of the current prediction code for non-turbulent atmospheres. Future work is discussed regarding the prediction of shaped booms, boundary conditions, and predictions near the lateral extent of the boom carpet where previous approaches fail to capture the diffraction effects.

Abstract length: 200 words

Affiliations: \*University of Florida Department of Mechanical and Aerospace Engineering,

<sup>‡</sup>NASA Langley Research Center, Structural Acoustics Branch