Abstract Submitted
for the DFD20 Meeting of
The American Physical Society

The Dynamics of Azimuthal Fourier Modes in Rectangular Jets[1] SURYA CHAKRABARTI, DATTA GAITONDE, The Ohio State University, SASIDHARAN NAIR UNNIKRISHNAN, Florida State University — Rectangular propulsion jets exhibit airframe-integration and thrust-vectoring advantages over the more commonly studied circular jets but have not been analyzed as extensively. This work seeks to leverage techniques developed for axisymmetric jets to analyze three rectangular jets with aspect ratios (AR) 1, 4 and 8. Large-Eddy Simulation databases are employed for each, together with a benchmark circular jet to provide a reference. Key variations from axisymmetric jets include: a decrease in potential core length with an increase in the AR, axis switching (in AR=4), and a peak azimuthal asymmetry of 2dB in the noise field (in AR=8). To utilize the azimuthal Fourier analysis usually adopted for axisymmetric jets, the acoustic dynamics of the rectangular jets are projected on a cylindrical coordinate system. All rectangular jets show good convergence of the dynamics on to the leading azimuthal modes indicating the possibility of simplifying their modelling by considering only a few modes similar to circular jets. Additionally, two mechanisms unique to the high AR rectangular jets, namely, preferential flapping in the minor axis direction and a coupling of the axisymmetric and second azimuthal modes are identified as causes of the asymmetry in nearfield RMS acoustic intensity.

[1]Office of Naval Research (Grant: N00014-17-1-2584)

Surya Chakrabarti
The Ohio State University

Date submitted: 03 Aug 2020 Electronic form version 1.4