



Benchmark Data for Evaluation of NASA Impedance Eduction Methods

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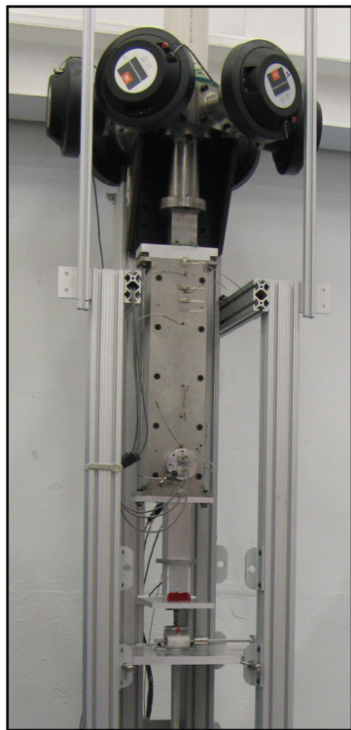
2 – 6 August 2021

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- 1. Evaluate 3 distinct liners with NASA normal incidence (NIT) and grazing flow impedance (GFIT) tubes***
- 2. Explore effects of source type, source level, and Mach number on educed (inferred) impedance***
- 3. Validate prediction models***

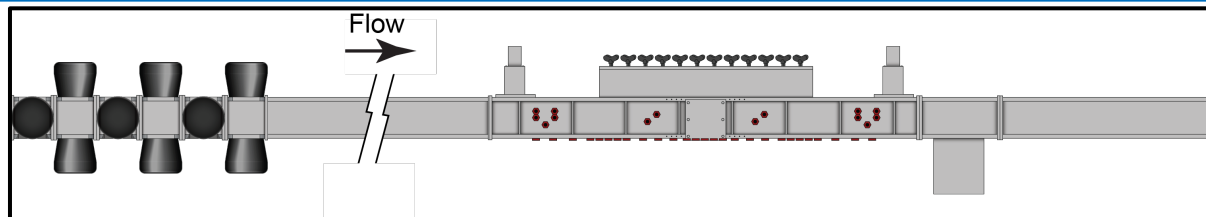




Normal Incidence Tube (NIT)

- Freq: 0.4 to 3.0 kHz
- Source SPL: 100, 120, 140 dB
- Two-Microphone Method

*Stepped Sine and
Swept Sine Sources*

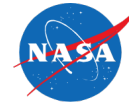


Grazing Flow Impedance Tube (GFIT)

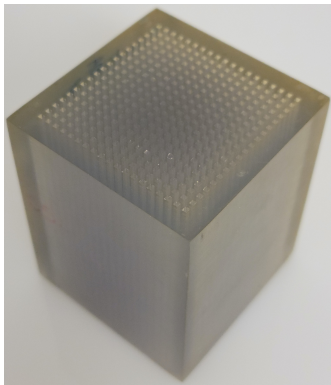
- Freq: 0.4 to 3.0 kHz
- Source SPL: 120, 140 dB
- Mach #: 0.0, 0.3
- Prony Method



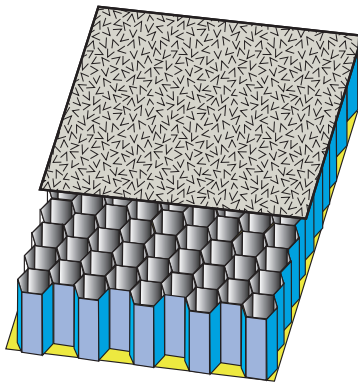
Test liners and prediction models



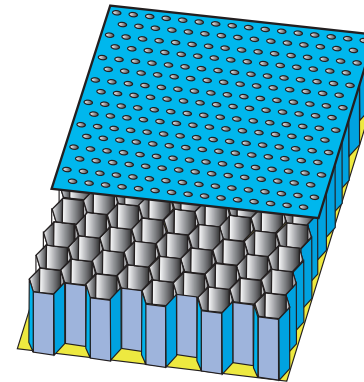
1. CSQ3



2. E15R27, C1R27



3. GE01



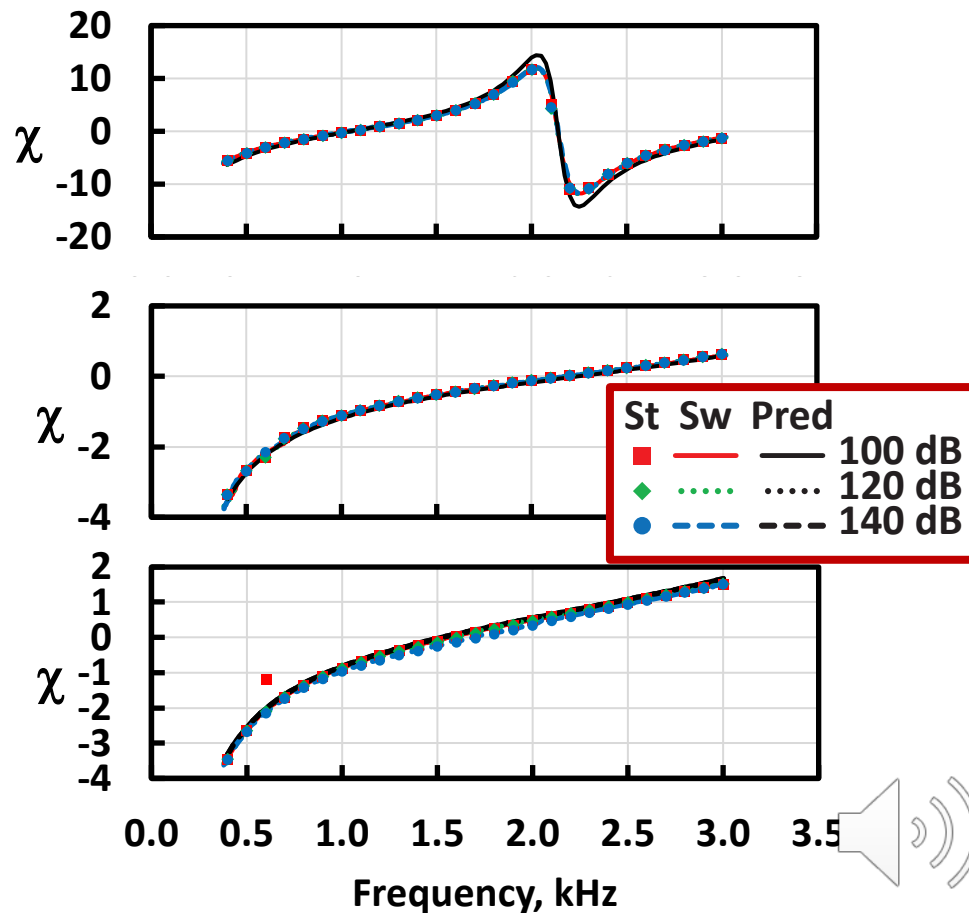
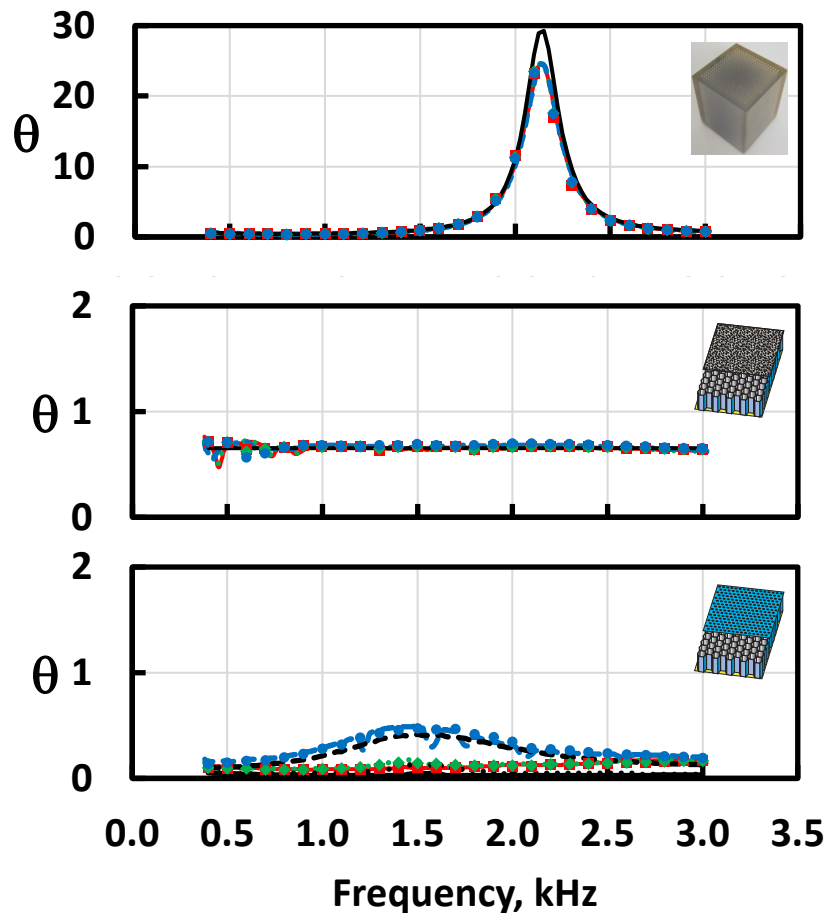
1. Transmission Line Model (ZKTL)[†]
2. Simplified model: $\zeta_{wm} = \frac{R_f}{\rho c} - i \cot(kD)$
3. Two-Parameter Model[‡]

[†] Parrott, T. L. and Jones, M. G., "Parallel-Element Liner Impedances for Improved Absorption of Broadband Sound in Ducts," *Noise Control Engineering Journal*, Vol. 43, No. 6, Nov. 1995.

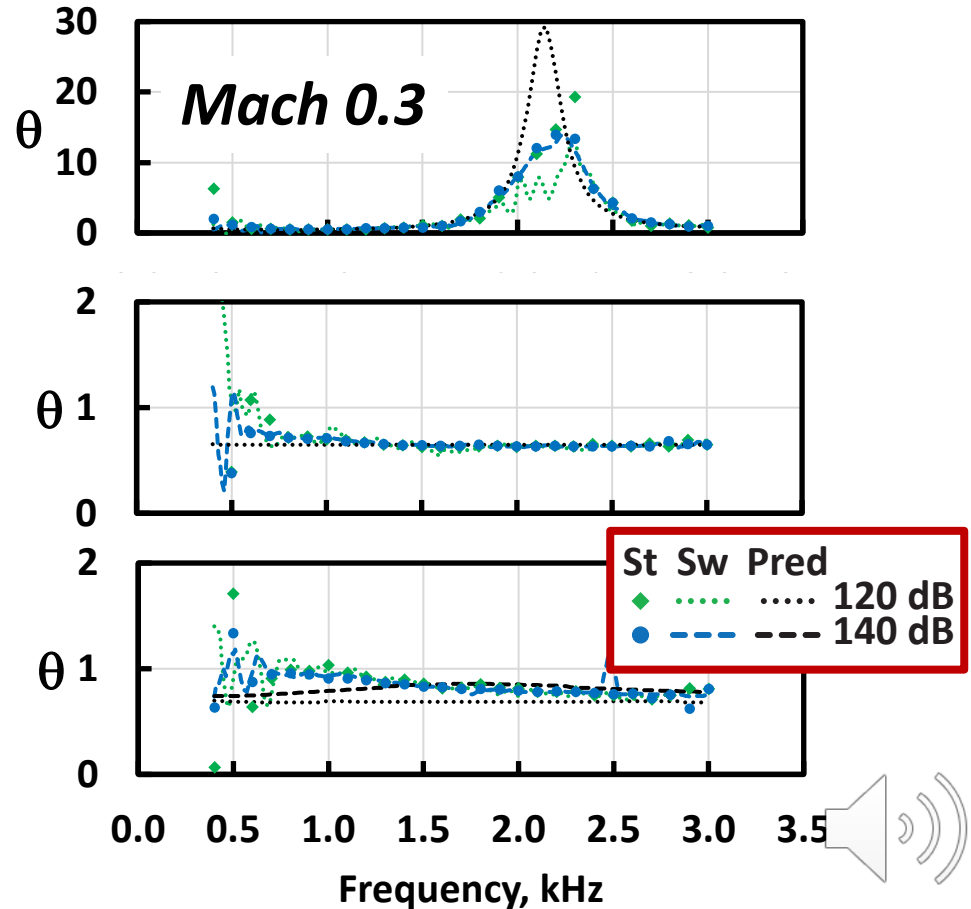
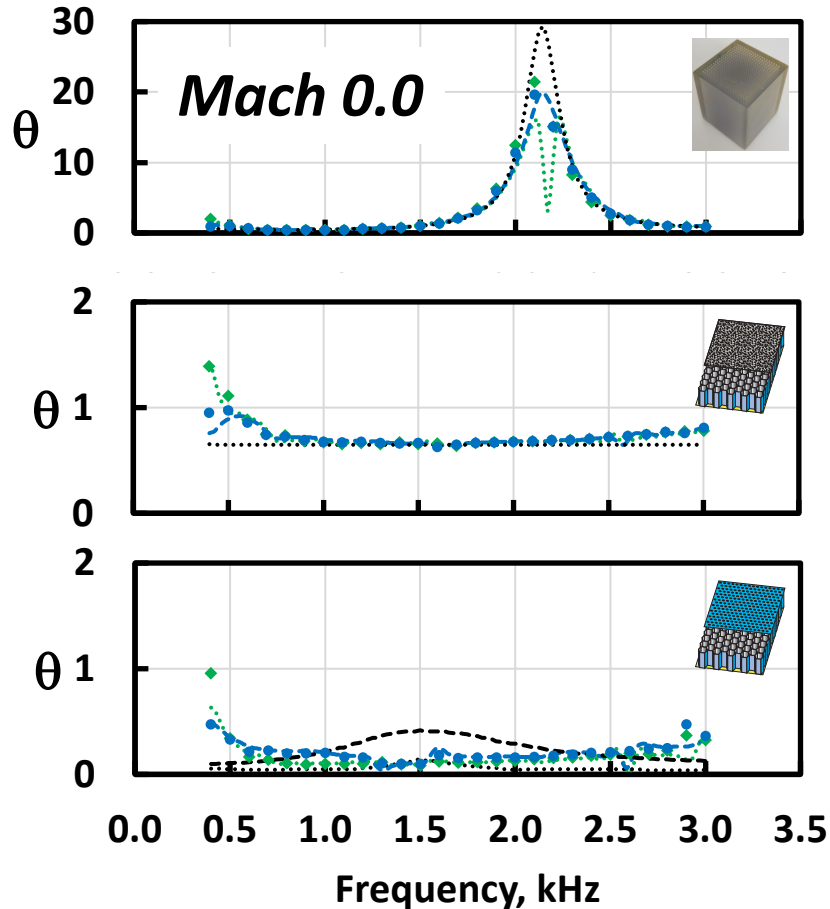
[‡] Parrott, T. L. and Jones, M. G., "Assessment of NASA's Aircraft Noise Prediction Capability, Chapter 6: Uncertainty in Acoustic Liner Impedance Measurement and Prediction," NASA TP 2012-215653, July 2012.



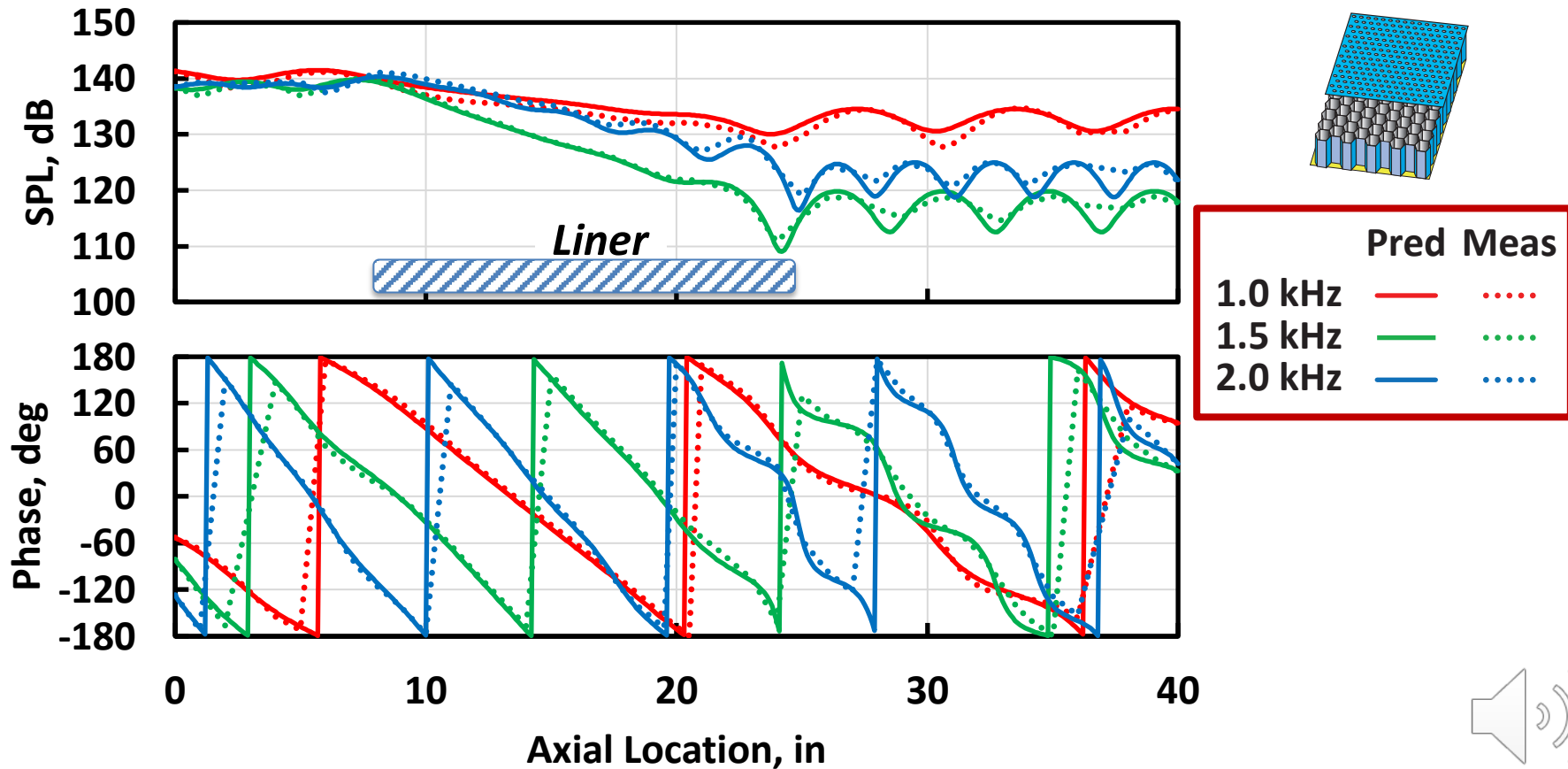
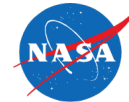
Predicted & Educated Impedances – NIT



Predicted & Educated Resistances – GFIT



Acoustic Pressure Profiles – GE01, Mach 0.3, 140 dB Source



- 1. Good agreement is achieved for impedances educed with stepped and swept sine data.***
- 2. Proposed prediction models are very good for linear liners (CSQ3, E15R27/C1R27) and adequate for the perforate liner (GE01).
Extensive perforate modeling review has been initiated.***
- 3. Good comparison is achieved between predicted and measured acoustic pressure profiles.***



Acknowledgements



- Alonso “Max” Reid and Martha Brown for NIT and GFIT testing
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