ASA S3-SC1 WG4

A Computational Engine for Bringing Environmental Consequence Analysis into Aviation Decision-Making

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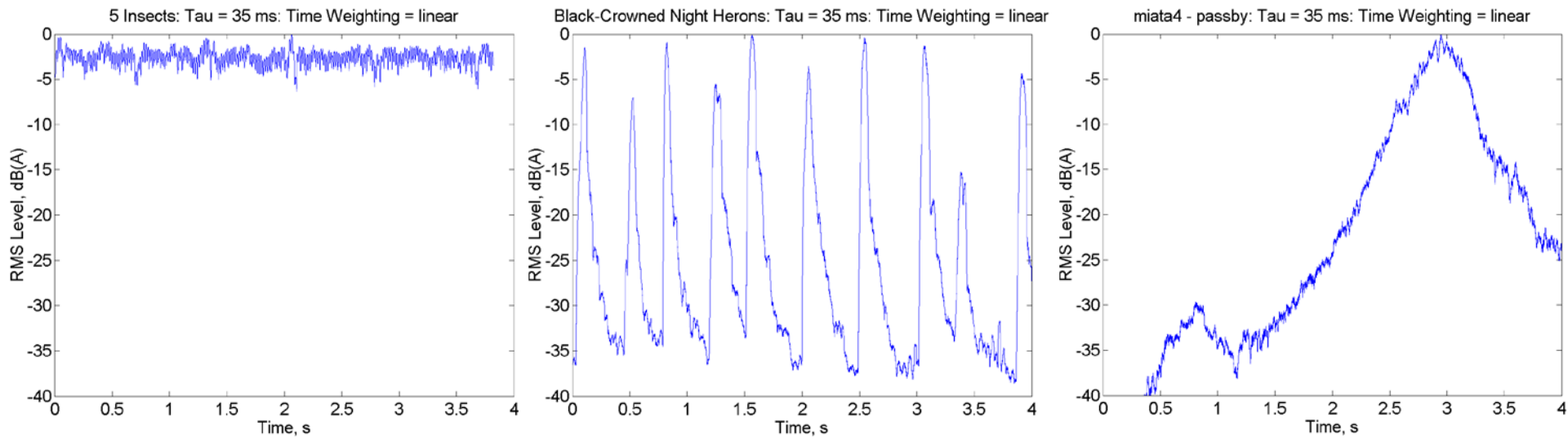
Ambient Masking of Non-natural Sounds

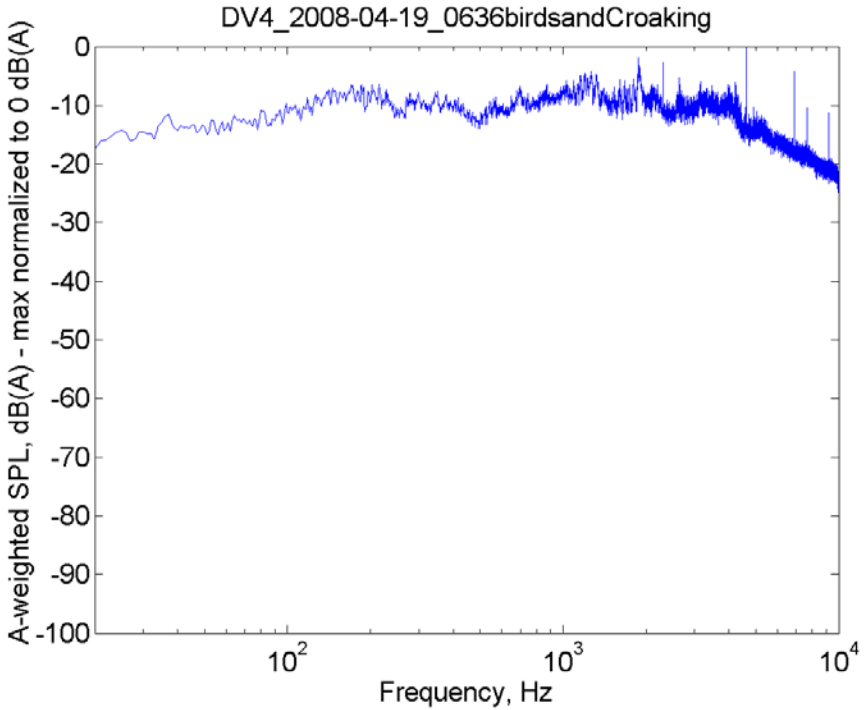
	Temporal Distribution	Frequency Content	Spectral Balance	Sound Pressure Level
Stronger Masking Potential	Continuous	Broadband	Low Frequencies	High
Weaker Masking Potential	Intermittent	Tonal	High Frequencies	Low

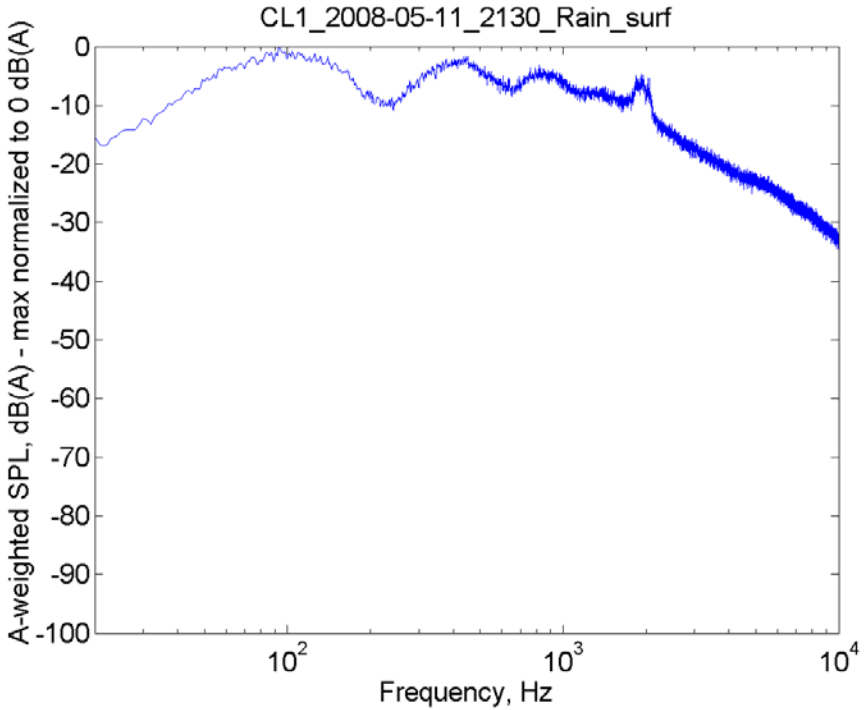
A-weighted Sound Pressure Level vs. Time



- Pre/Post-masking is not very effective
- A masking sound that is continuous over the signal event is a better masker
- A masker that is continuous over a long period is more likely to coincide with a signal event
- Do ½ second and hourly LAeqs effectively account for these effects?

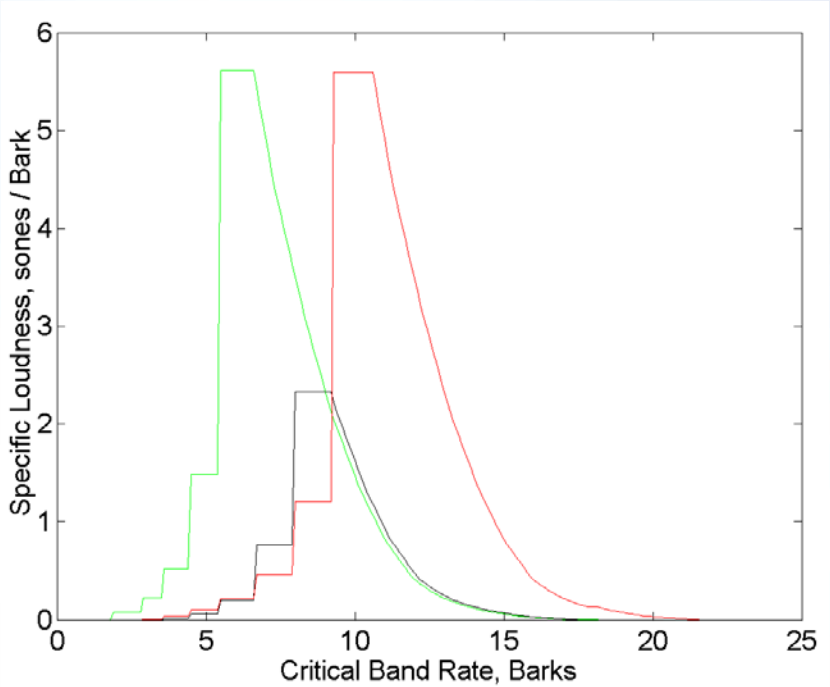
Frequency Content



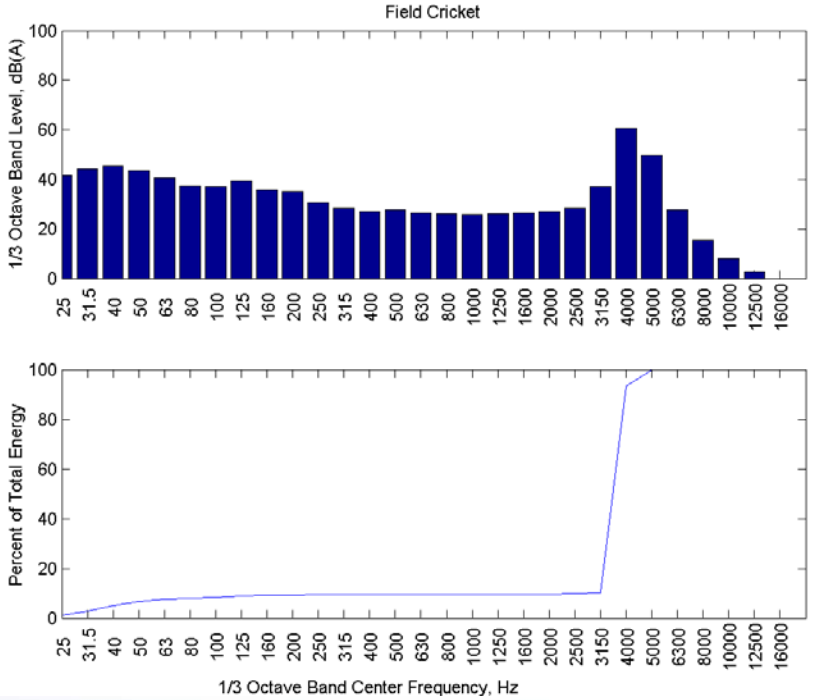


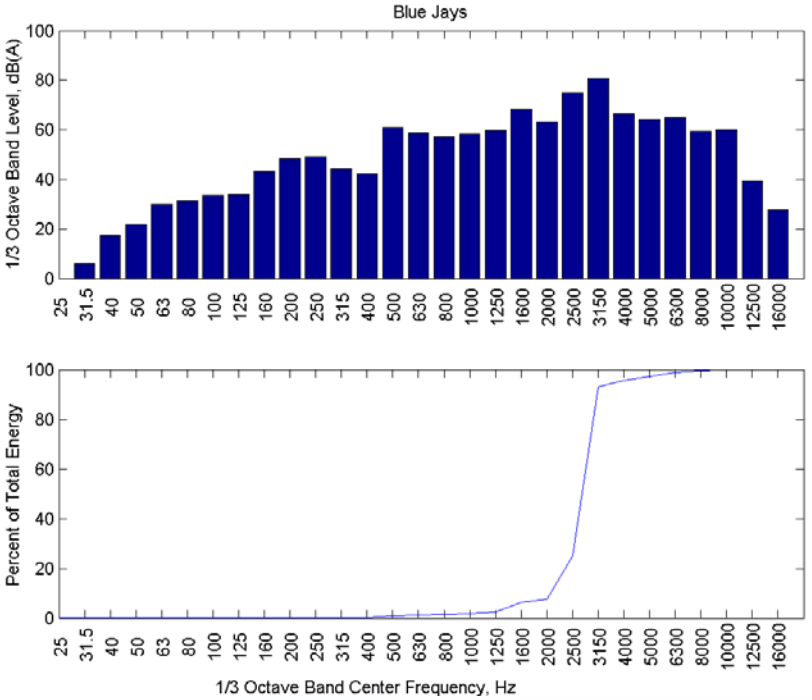
- Masking most effective when the masker spectrum overlaps the signal spectrum; more likely to occur if the masker is broadband in nature
- Land vehicles tend to be dominated by broadband spectra
- Aircraft can have both broadband spectra and tonal components
- Animal sounds often dominated by tonal components
- Wind and water sounds often have broad frequency content

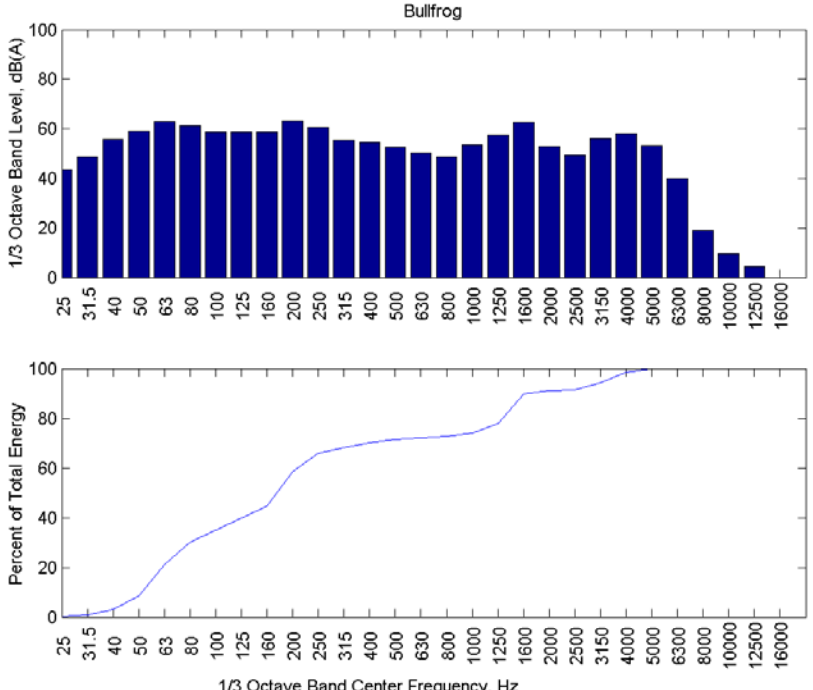
Spectral Balance

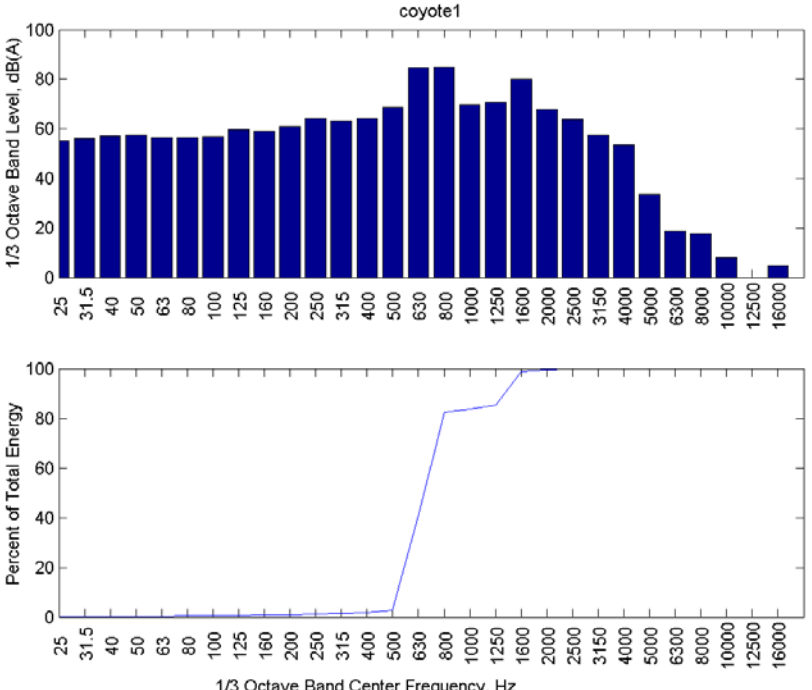


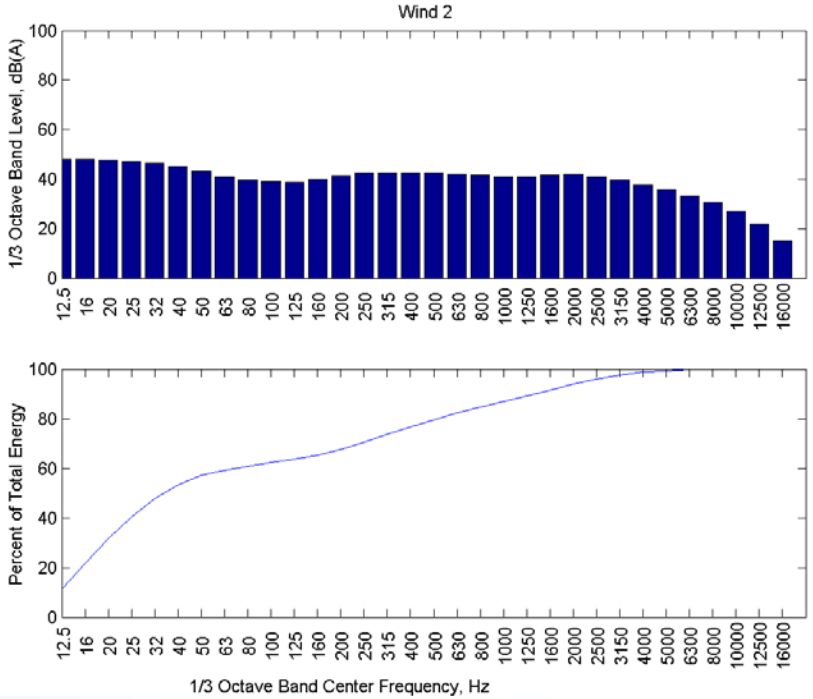
- Off-frequency masking is most effective if masker is at a lower frequency than signal
- Animal sounds often dominated by high frequencies
- Wind and water sounds often have somewhat evenly distributed frequency content
- Aircraft/land vehicles tend to be dominated by low to mid frequencies

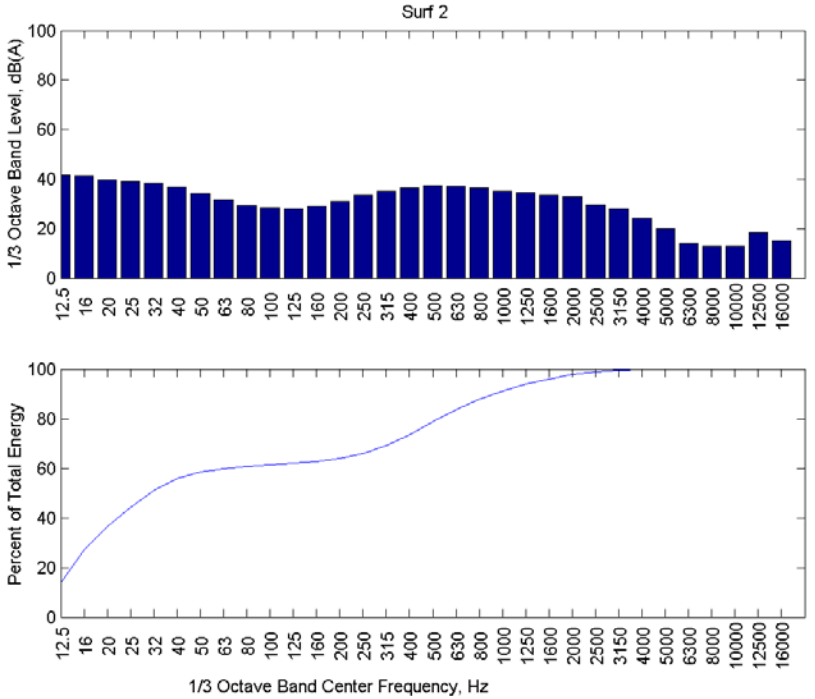

Field Cricket
1/3 Octave Band Level, dB(A)
Percent of Total Energy
1/3 Octave Band Center Frequency, Hz

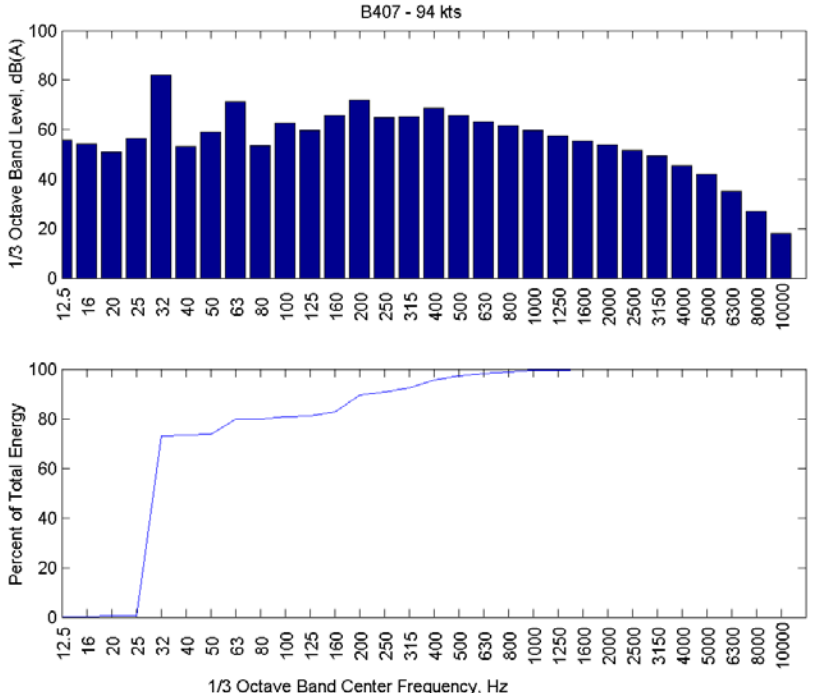

Blue Jays
1/3 Octave Band Level, dB(A)
Percent of Total Energy
1/3 Octave Band Center Frequency, Hz

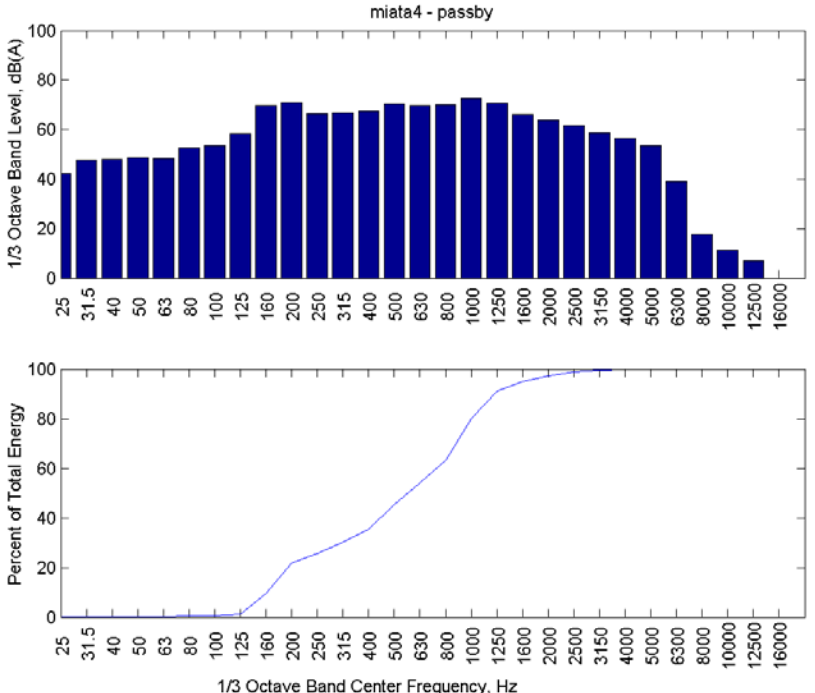

Bullfrog
1/3 Octave Band Level, dB(A)
Percent of Total Energy
1/3 Octave Band Center Frequency, Hz


coyote1
1/3 Octave Band Level, dB(A)
Percent of Total Energy
1/3 Octave Band Center Frequency, Hz

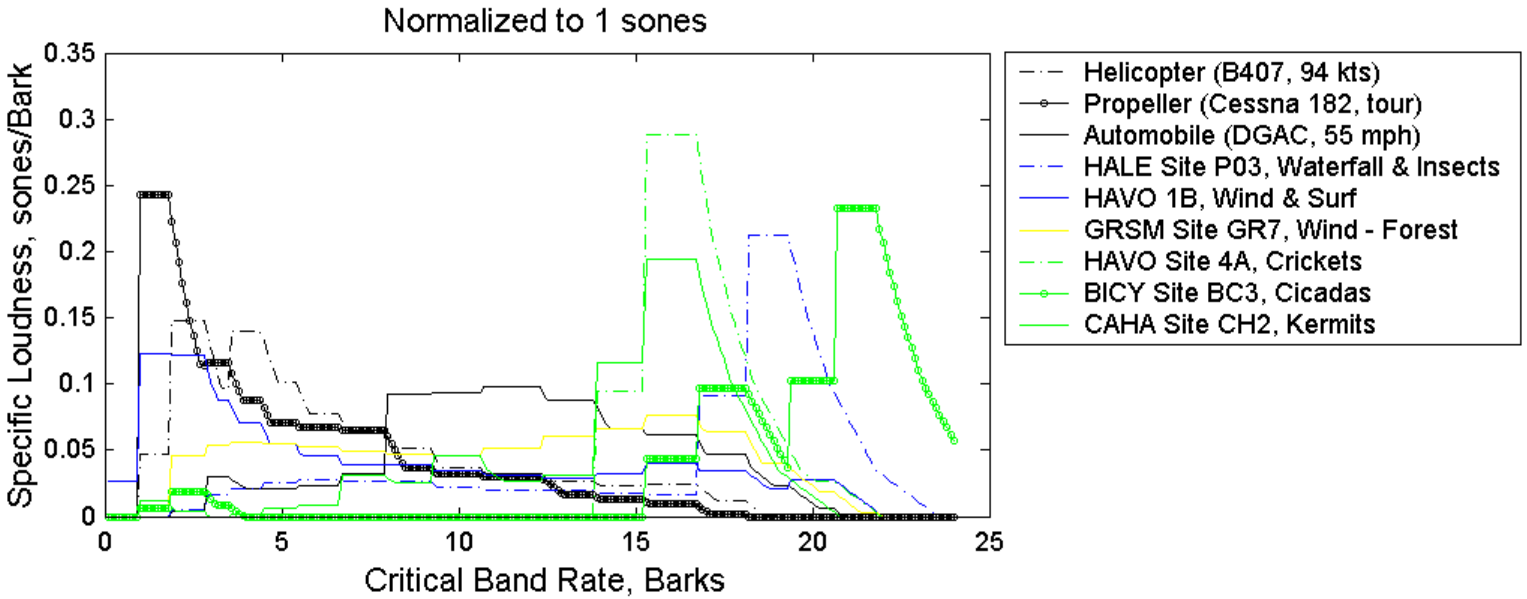

Wind 2
1/3 Octave Band Level, dB(A)
Percent of Total Energy
1/3 Octave Band Center Frequency, Hz

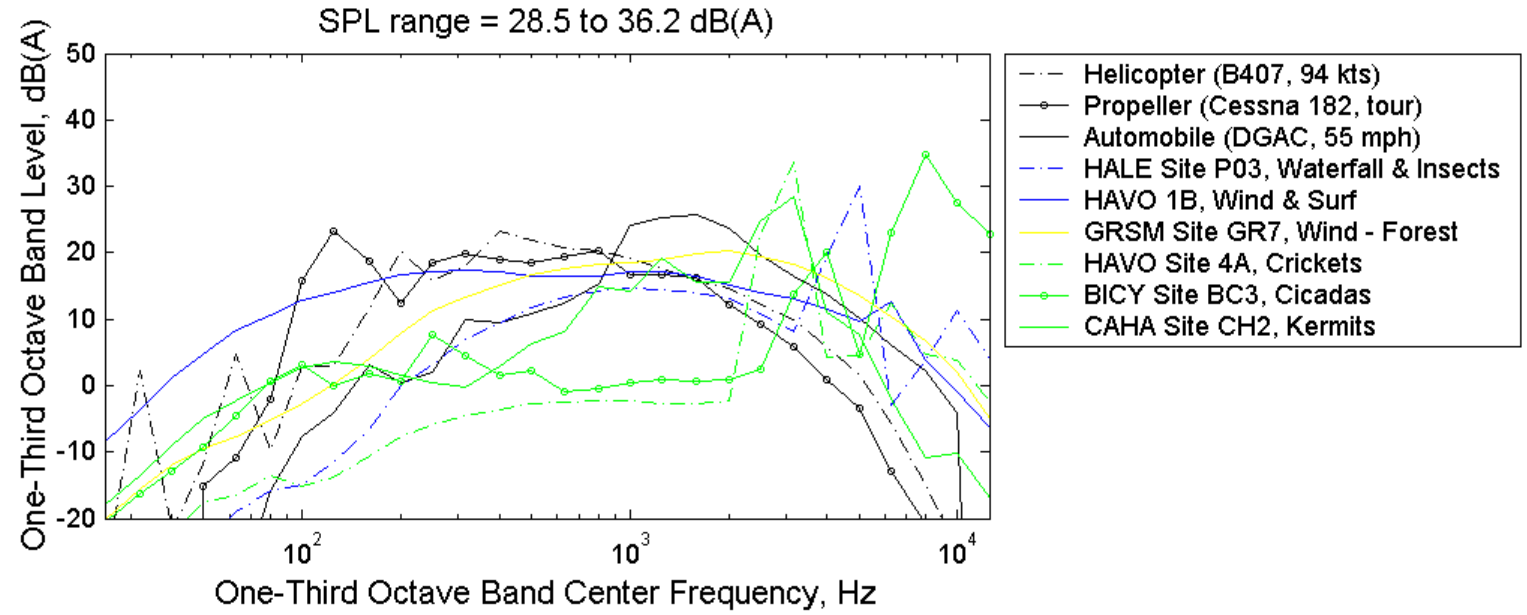

Surf 2
1/3 Octave Band Level, dB(A)
Percent of Total Energy
1/3 Octave Band Center Frequency, Hz


B407 - 94 kts
1/3 Octave Band Level, dB(A)
Percent of Total Energy
1/3 Octave Band Center Frequency, Hz

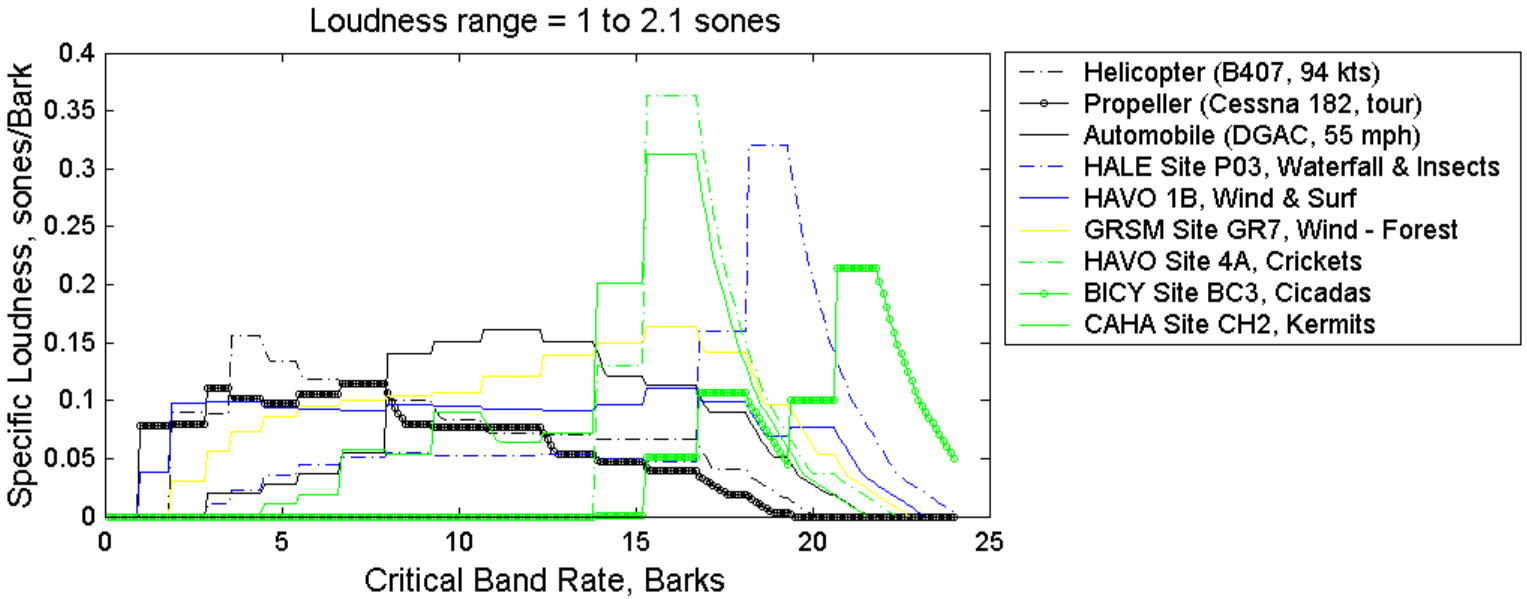

miata4 - passby
1/3 Octave Band Level, dB(A)
Percent of Total Energy
1/3 Octave Band Center Frequency, Hz

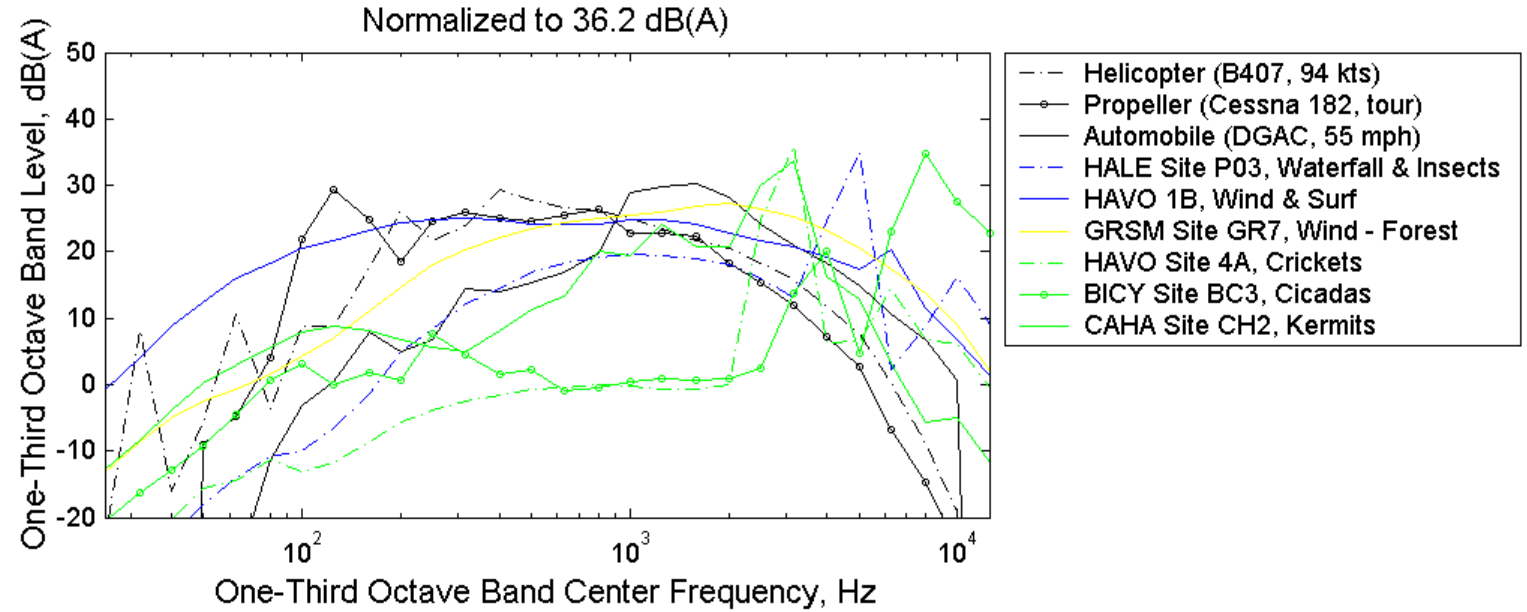
Comparison of Loudness Spectra



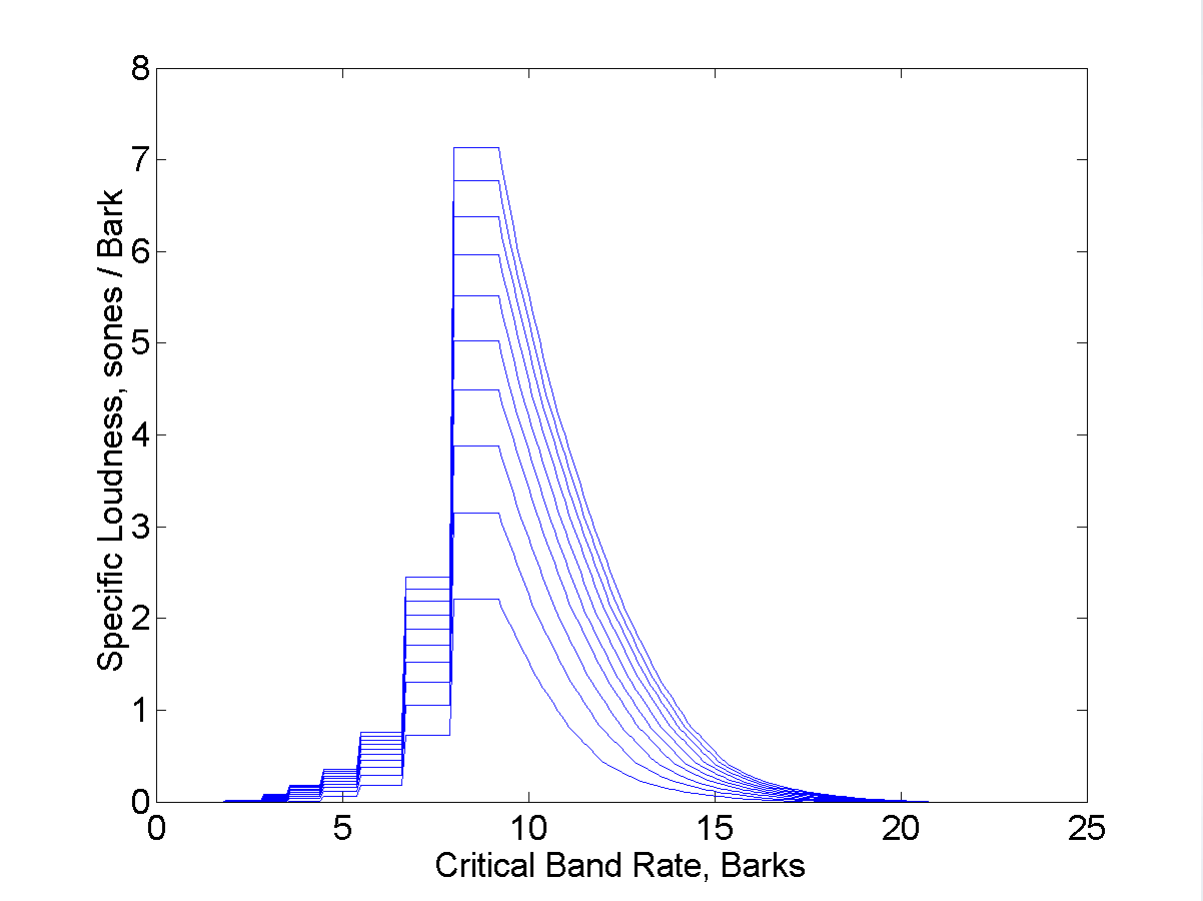


Comparison of Loudness Spectra





Sound Pressure Level



- As level of masker increases, it masks more signal
  - Signal-to-noise ratios decrease
  - Upward and downward spread of masking increases