# METRICS FOR HUMAN RESPONSE TO SONIC BOOMS

**Brenda M. Sullivan**

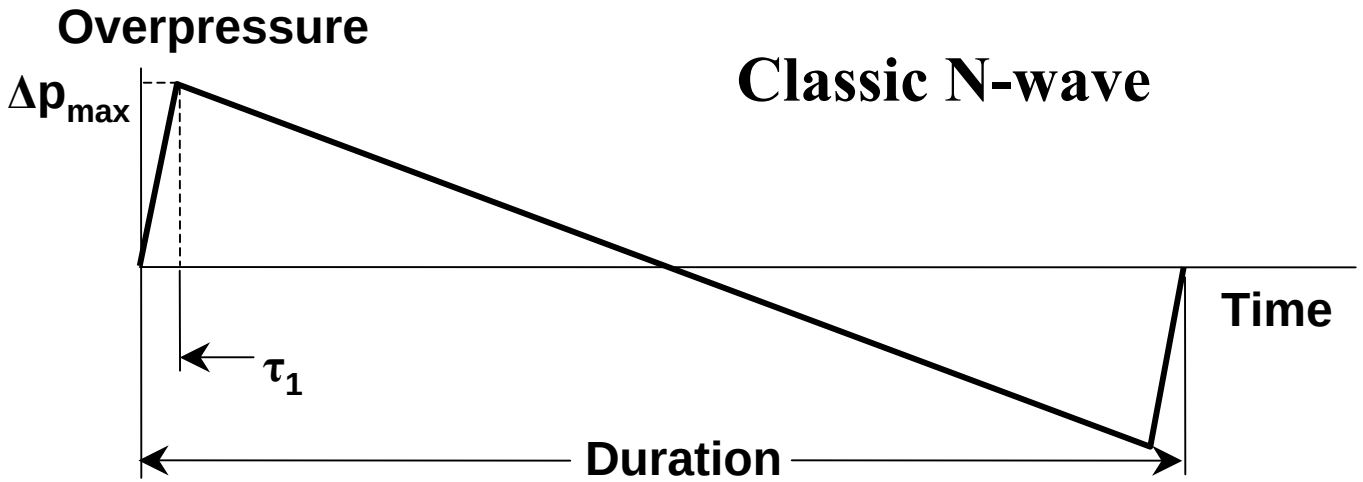
**NASA Langley Research Center**

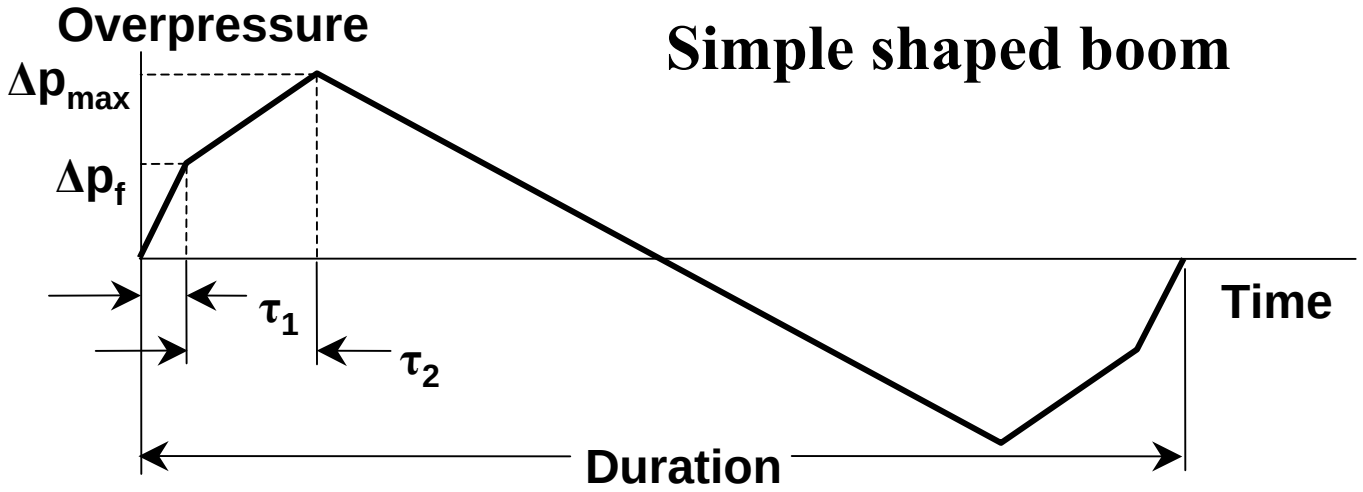
**FAA Civil Supersonic Aircraft Technical Workshop**

**Arlington, VA**

**November 13, 2003**

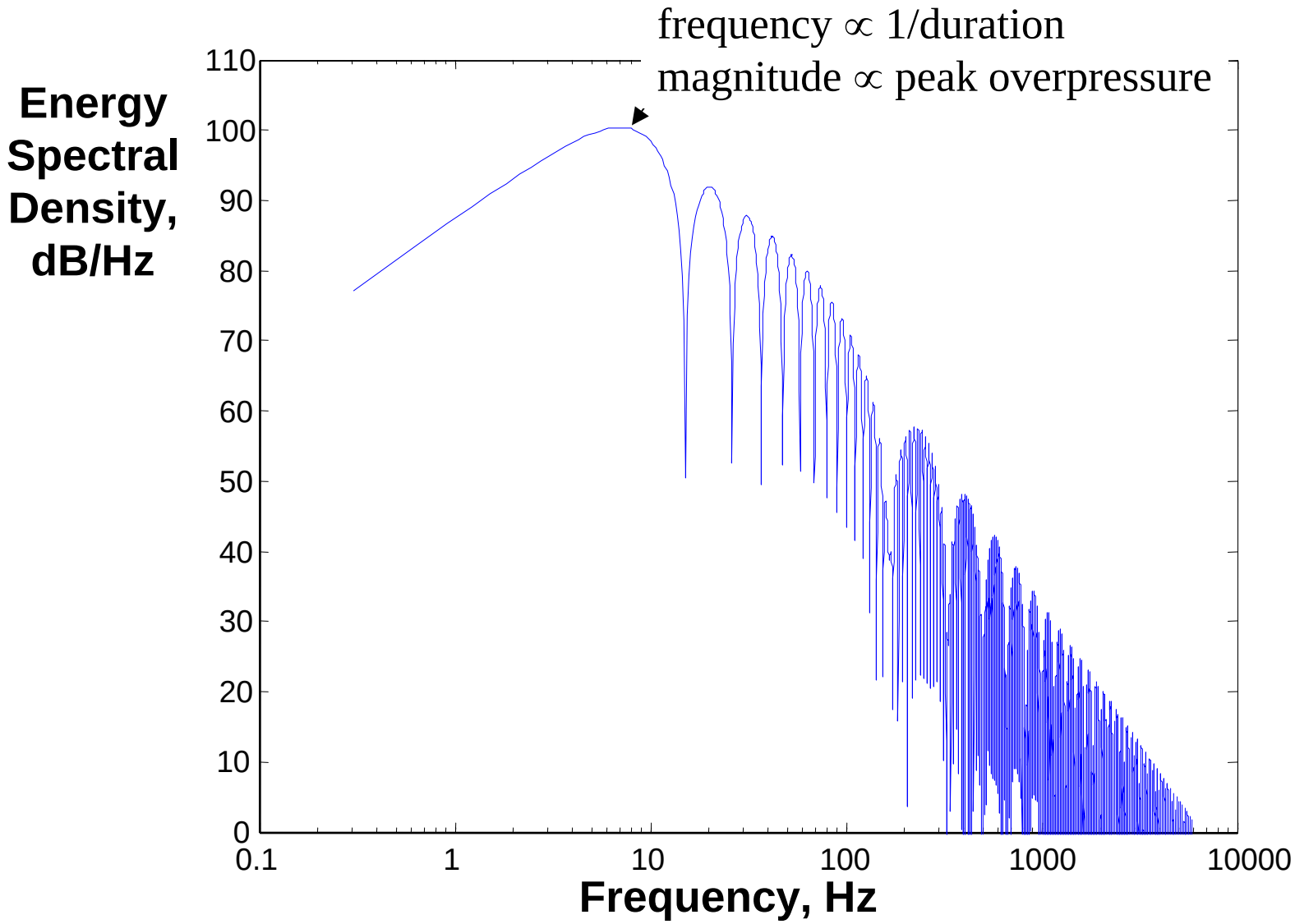
# Elements of an Idealized Sonic Boom



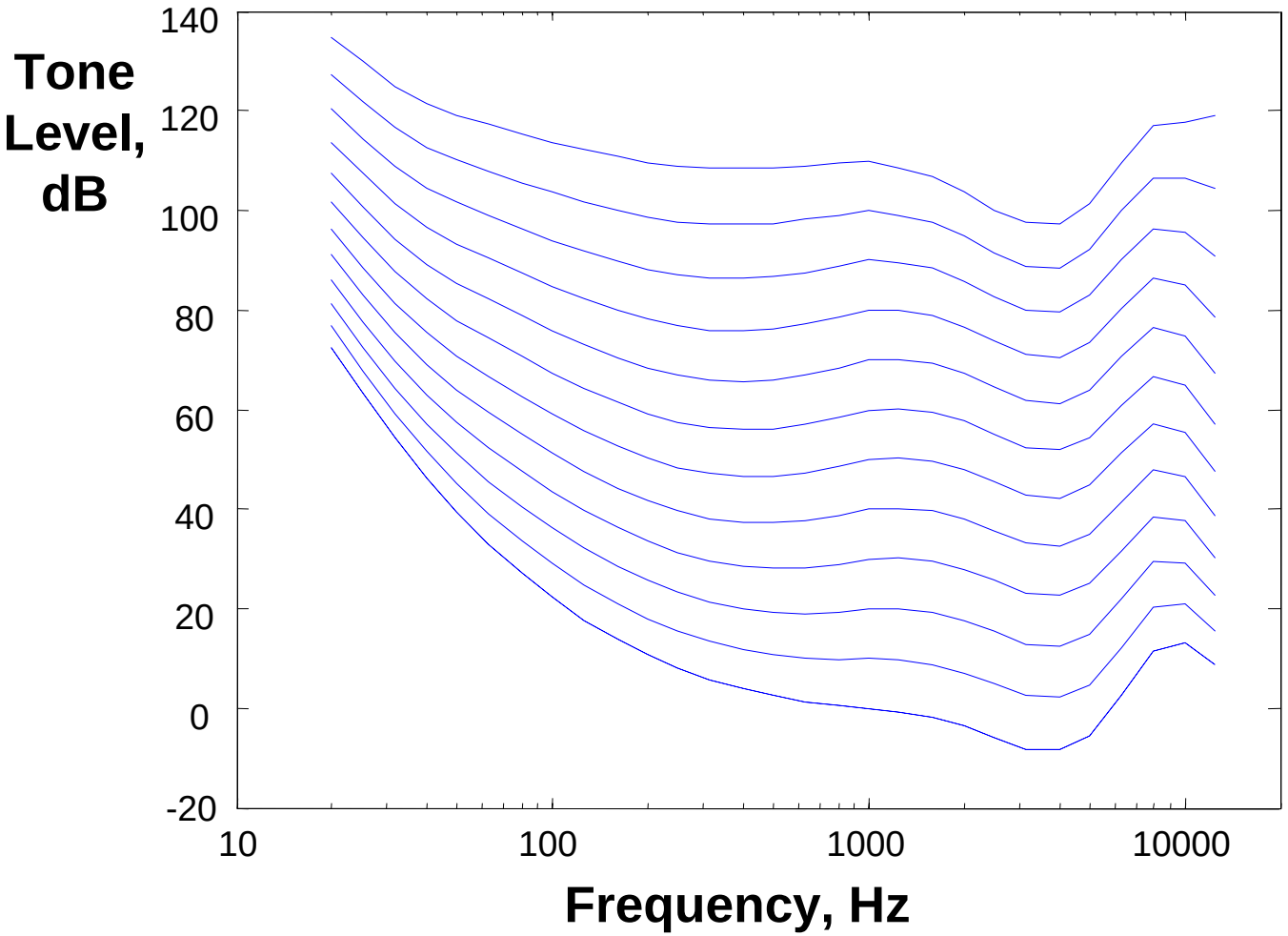



# Spectrum of an Idealized N-Wave

## (6 ms rise time, 100 ms duration, 1 psf peak)

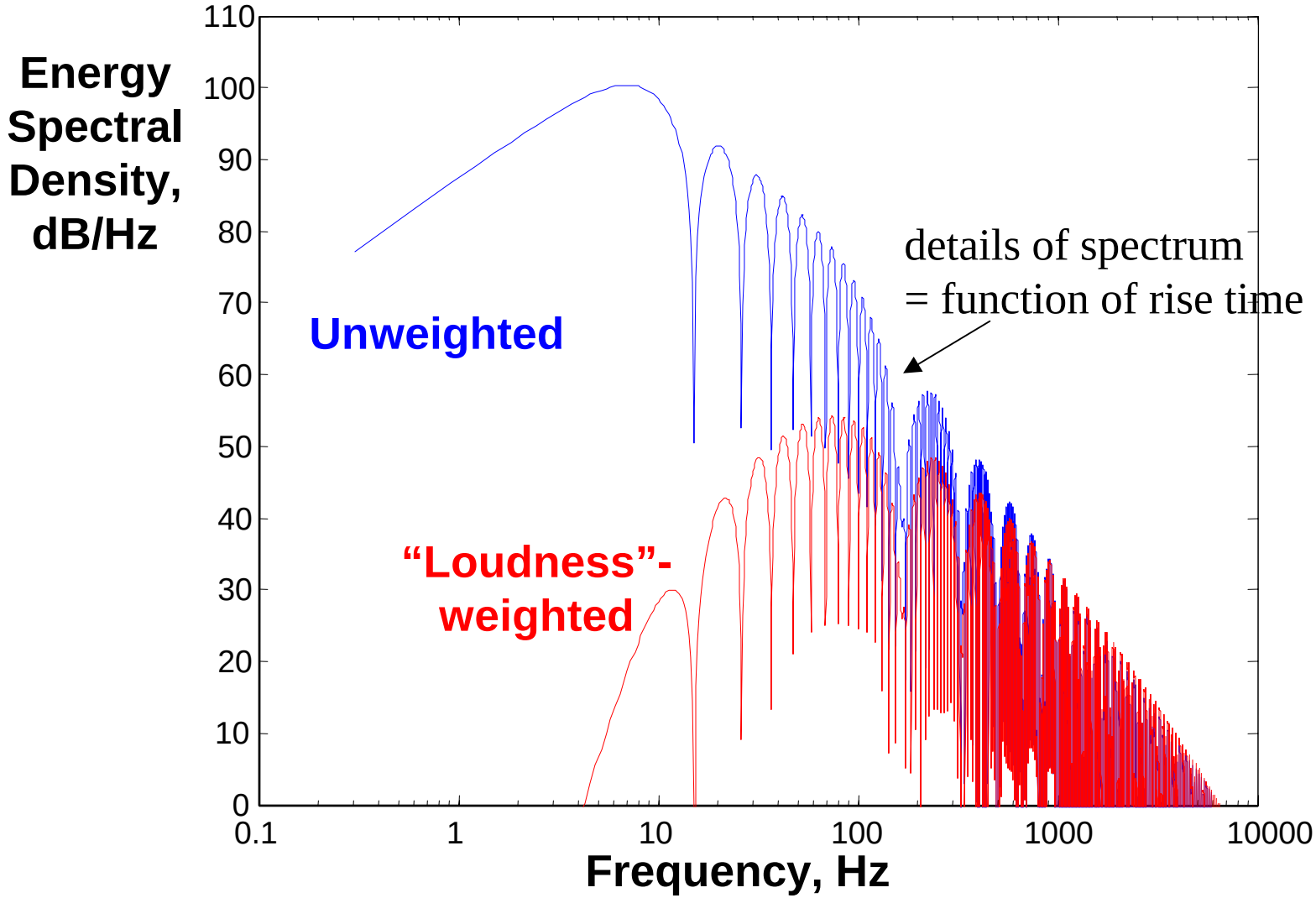


# Equal Loudness Contours

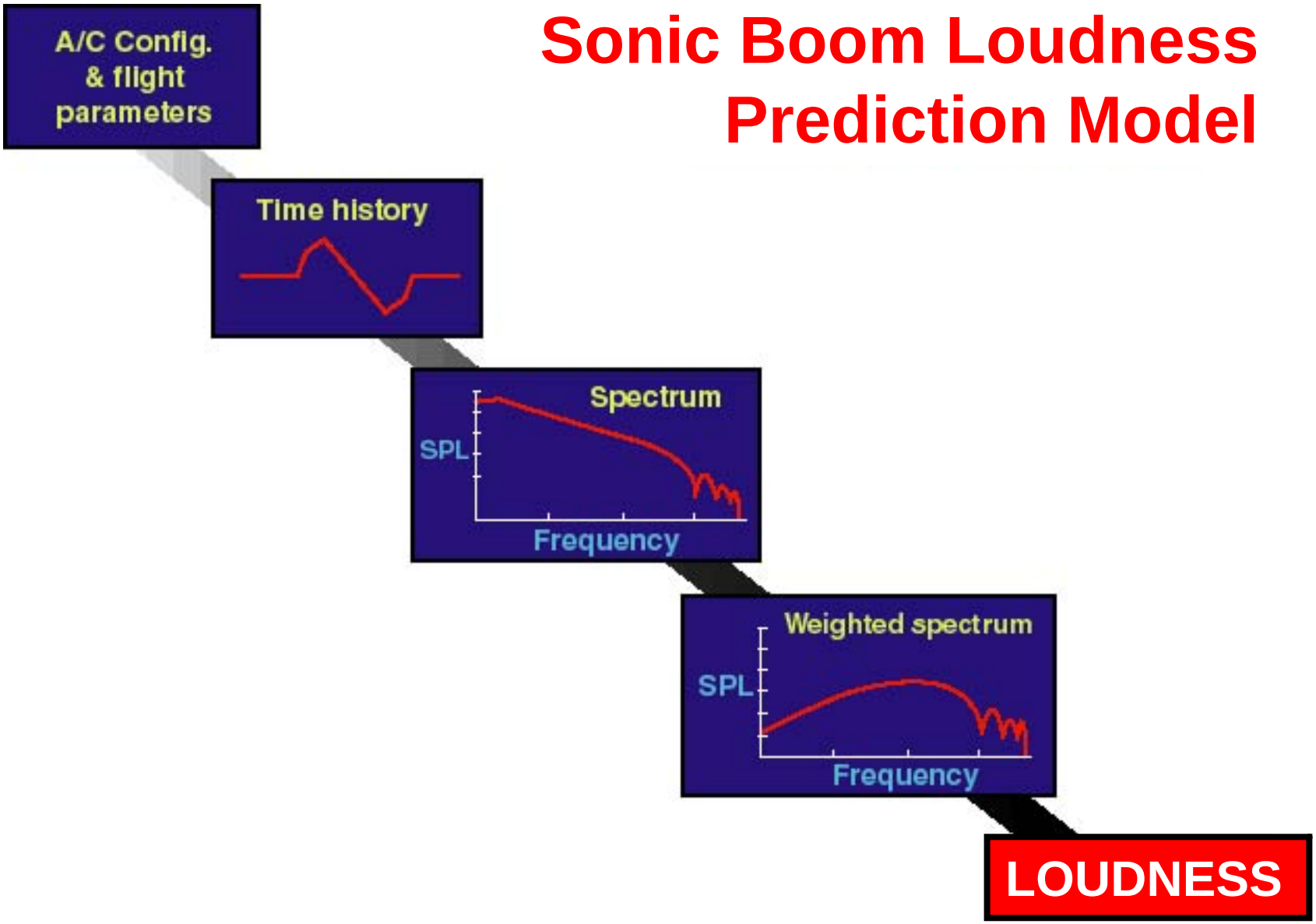


# Spectrum of an Idealized N-Wave

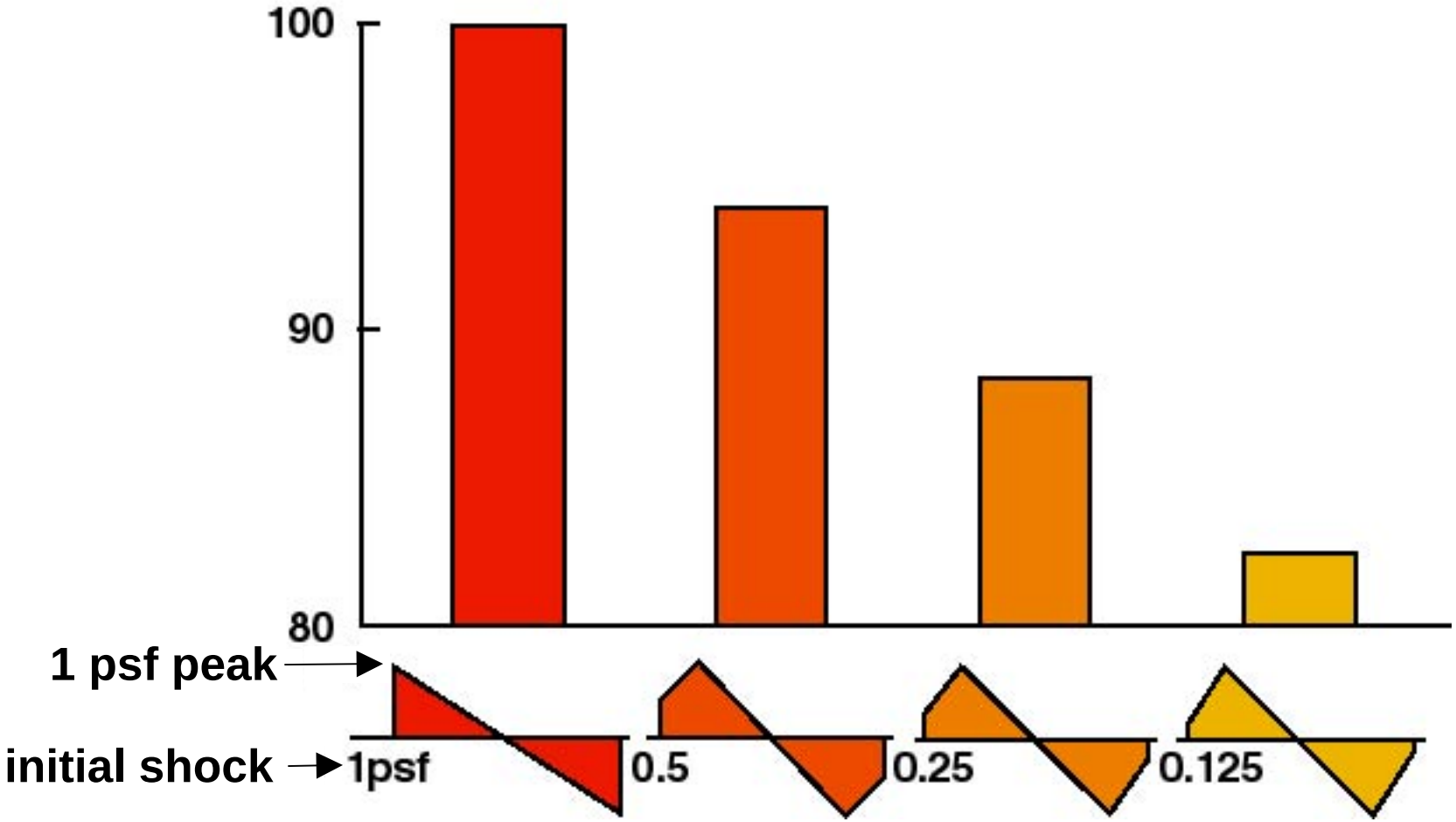
## (6 ms rise time, 100 ms duration, 1 psf peak)



# Sonic Boom Loudness Prediction Model



# Calculated Loudness of Shaped Booms

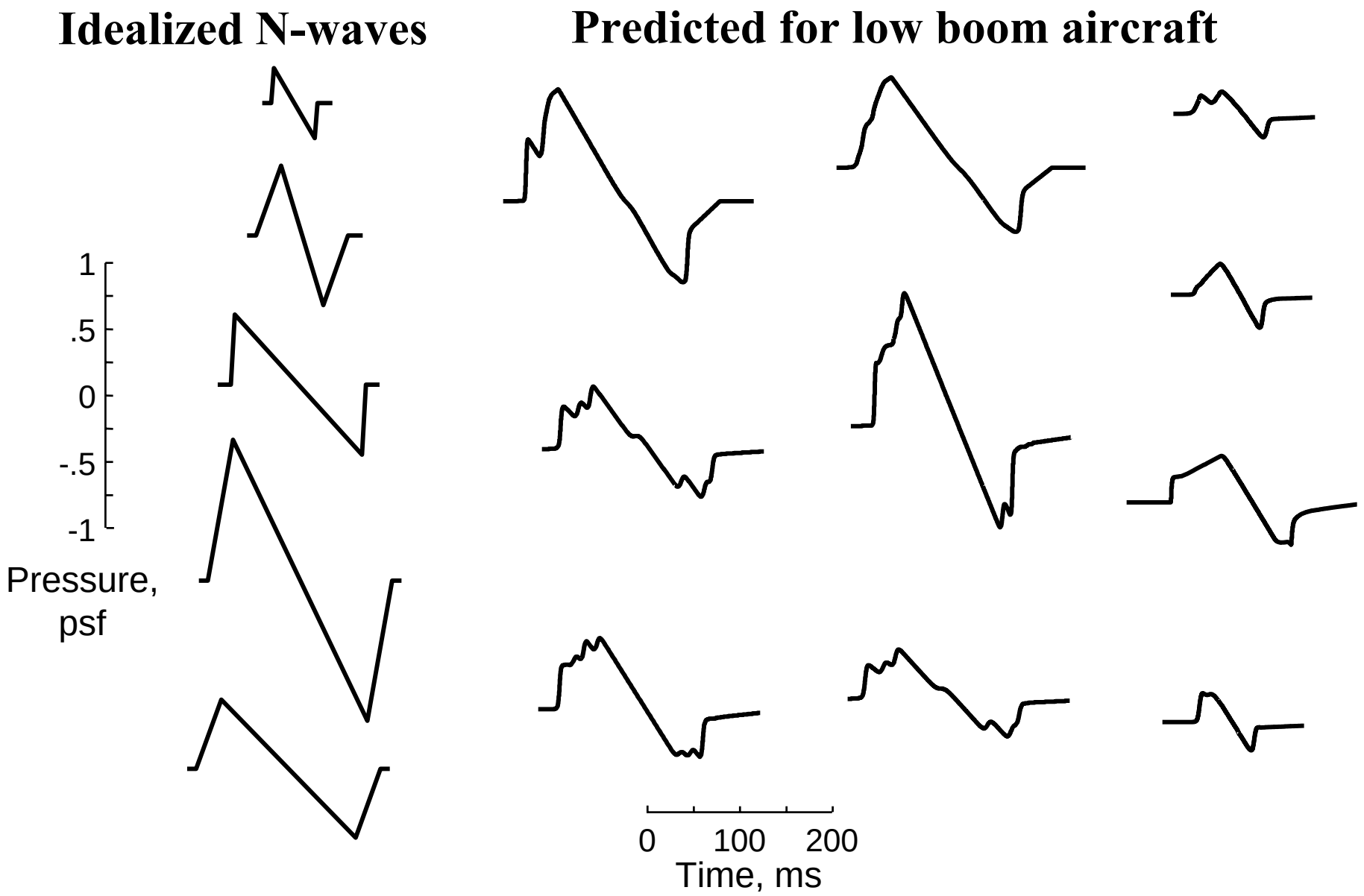



all these booms have 1 ms initial rise time

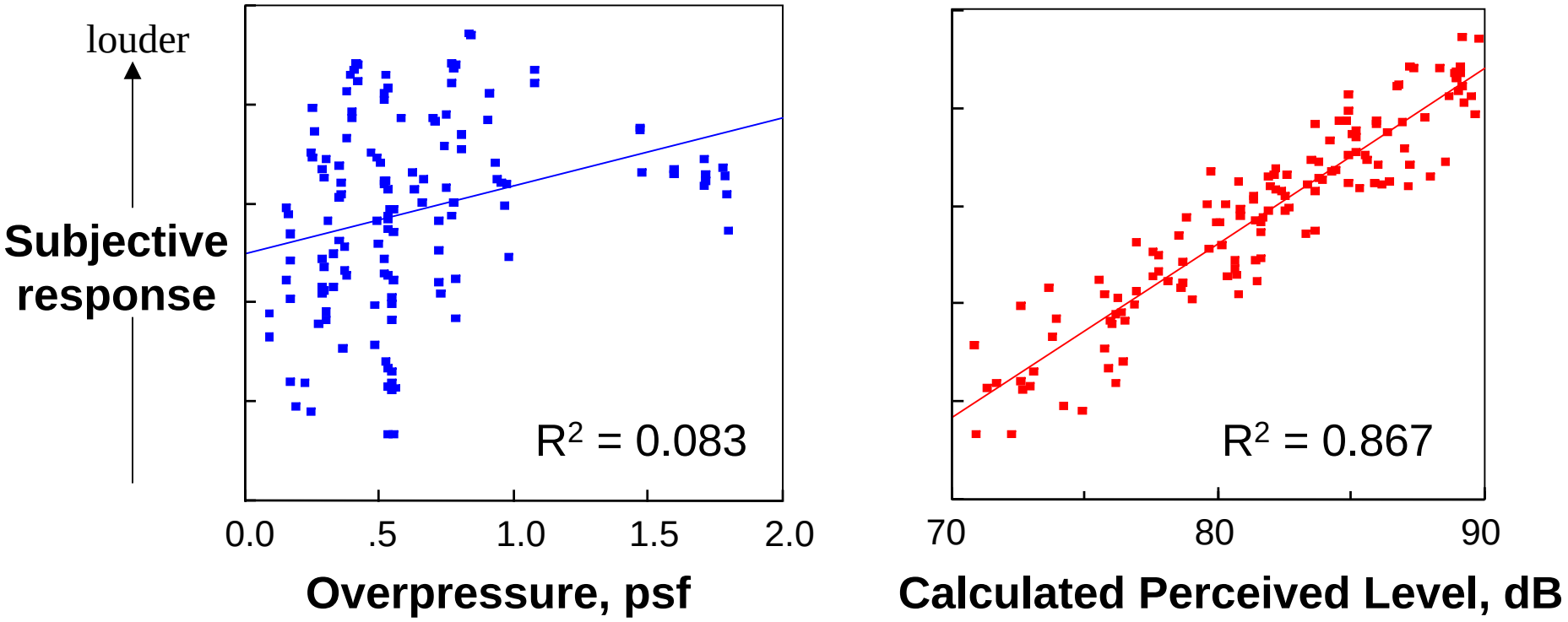
# Measuring Subjective Response to Sonic Booms

**NASA Langley Sonic Boom Simulator**

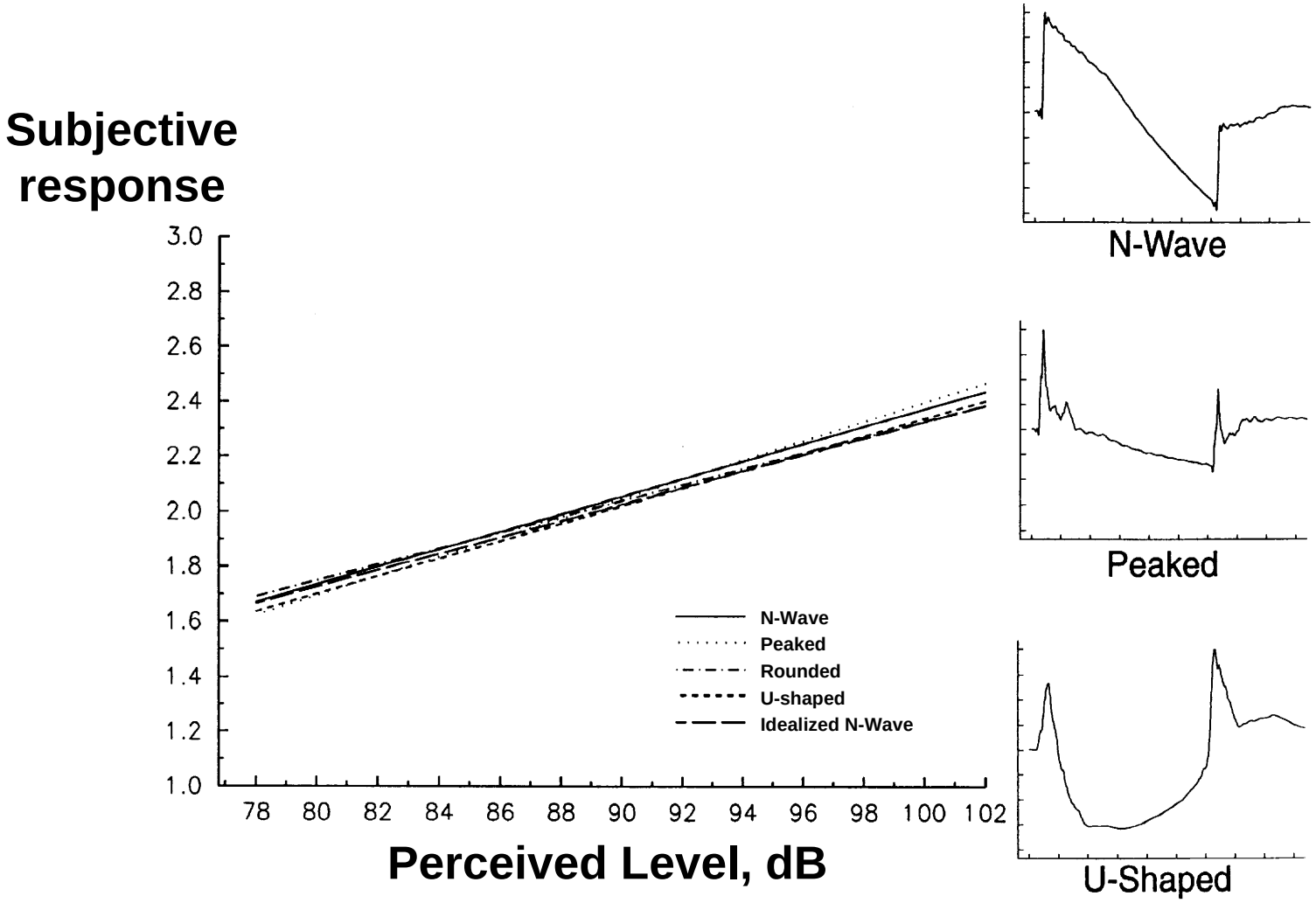
# Variety of shapes used in testing



# Prediction of Loudness Response to Sonic Booms



# Subjective Response to Real and Simulated Sonic Booms



# SONIC BOOM SIMULATOR STUDIES SUMMARY

- **Loudness model validated for:**
  - **wide range of ideal N-waves and shaped booms**
  - **“real” booms distorted by atmosphere**
  - **“indoor” N-waves and shaped booms**

- **Major finding:**
  - **substantial benefits of boom shaping (indoors and outdoors)**

- **Loudness model provides guidance to low-boom design efforts**

- **300 msec idealized sonic booms**
- **2 msec initial rise times**
- **30 msec secondary rise time**