# Project 41
# Identification of noise acceptance onset for noise certification standards of supersonic airplanes

## Motivation and Objectives

**Part A: Certification Metric Evaluation**
- Applicability of single event metrics for certification
- Removal of turbulence effects from measurements
- Location of microphones for certification measurements
- Role of non-linearity in obtaining confidence in supersonic signatures along with reference day corrections

**Part B: Community Impact and Acoustic Acceptability**
- Finalize low cost noise monitors and assessment of social media monitoring (SMM) tools to observe communities
- Environmental Masking: A literature review relating the role masking plays on noise impact in differing background noise for urban, suburban or rural environments.
- Social survey: develop a low boom rural vs. urban survey

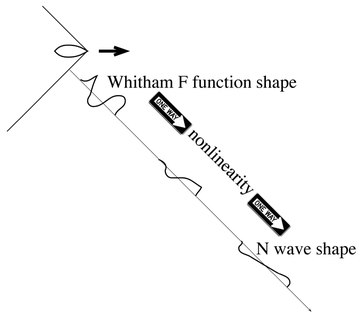
## Approach

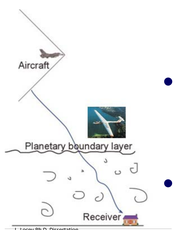
**Part A: Certification Metric Evaluation**
- Expanding on the results from Project 7
- Obtaining confidence in supersonic signatures
  - Explore reference day approaches
  - Include effects of nonlinearity and atmospheric profile
- Deturbing
  - Assess ground signature rise times when deturbing
  - Investigate signature estimation techniques
- Locating microphones
  - Consider placement options

**Part B: Community Impact and Acoustic Acceptability**
- Finalize low cost noise monitors and SMM tools
- Conduct literature review of environmental masking
- Develop social survey for environmental masking
  - Survey team: ARL and PSU Survey Research Center
  - Conducted with NASA WSPRRR community test in 2018
  - 50 respondents: 25 from rural and 25 from urban areas
  - Review of the survey instrument by both NASA and FAA
  - Submit for regulatory approvals from IRB and OMB

## Summary

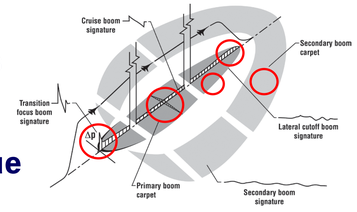
**Part A:**
- De-propagation does not work for supersonic aircraft due to nonlinear boom propagation




- Measurements made in differing atmospheric conditions cannot be directly compared
- Need to define a reference day for normalizing ground measurements

- Microphone locations for sonic boom certification need to record features unique to supersonic flight

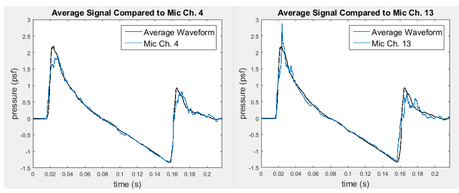



Maglieri, et al. *Sonic Boom: Six Decades of Research*. NASA

**Part B: Community Impact and Acceptability**
- The low cost monitors and SMM tools will be used to monitor low boom field test areas.
- The environmental masking literature search will seek information that addresses the auditory perception of the noise, the dose response, and the psycho-social expectation with respect to the background noise environment.
- The small scale social survey will advance understanding of differences in noise impact between rural and urban communities.

## Results and Discussion

**Part A:**
- Must account for nonlinear propagation
- Averaging signatures over a linear array is limited due to changes in nonlinear lengthening along different ray paths




**Part B:** The results of this study will facilitate interpreting noise field test results across areas with varying community density and environmental noise, and advance understanding of the role that masking has on low boom noise for varying background noise environments.

## Conclusions and Next Steps

These topics are designed to support CAEP/WG1/SSTG and NASA activities on sonic boom research. Part A is providing support for the ongoing development of certification standards regarding single event metrics, measurement techniques, data processing, and atmospheric effects. Part B of this research is proposed in support of future community response testing using an experimental low-boom flight demonstrator X-plane as part of the NASA Quiet SuperSonic Technology (QueSST) Program.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