NASA Quesst Mission Overview

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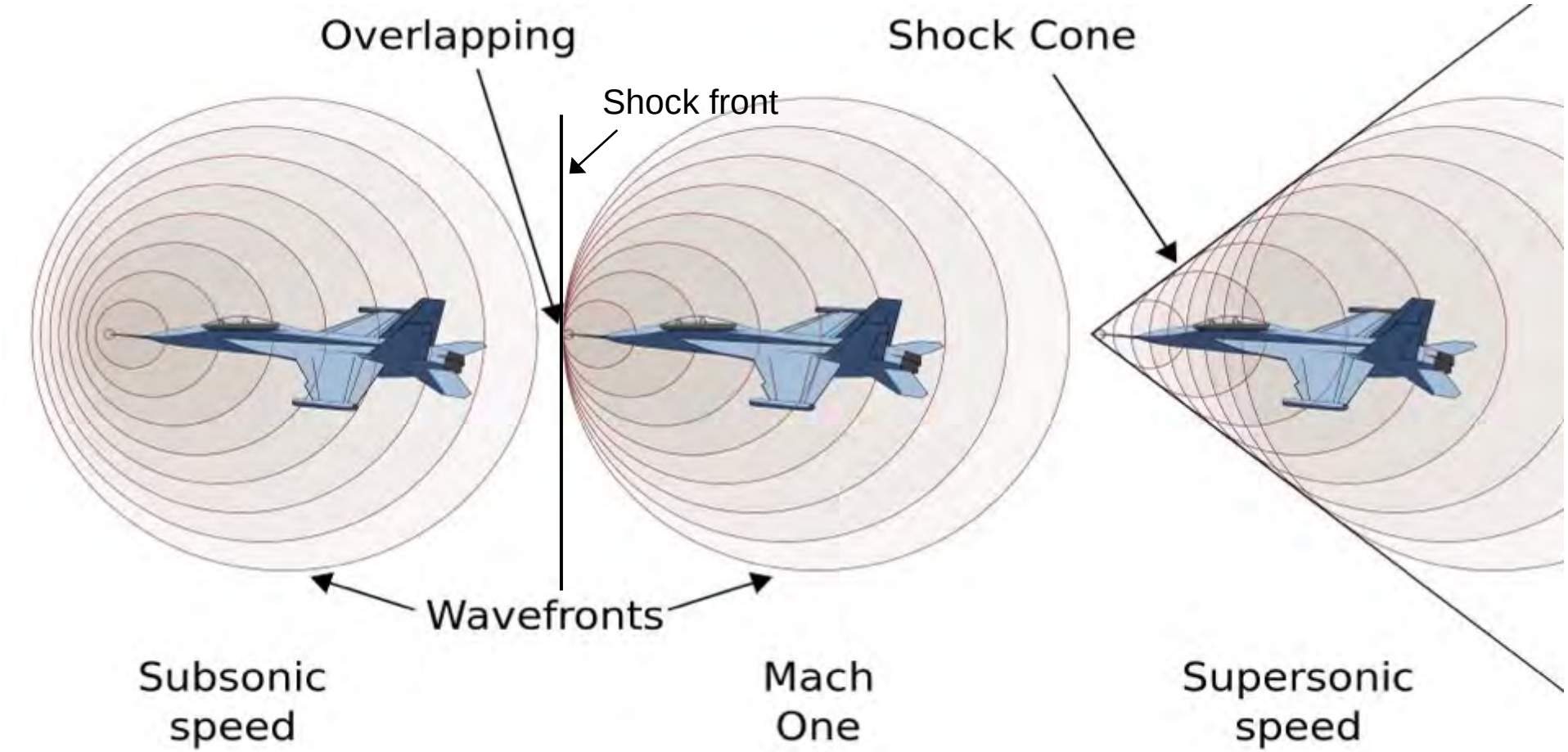
QUESST

Barriers to Commercial Supersonic Flight

Sonic Boom Noise and Overland Flight Prohibitions

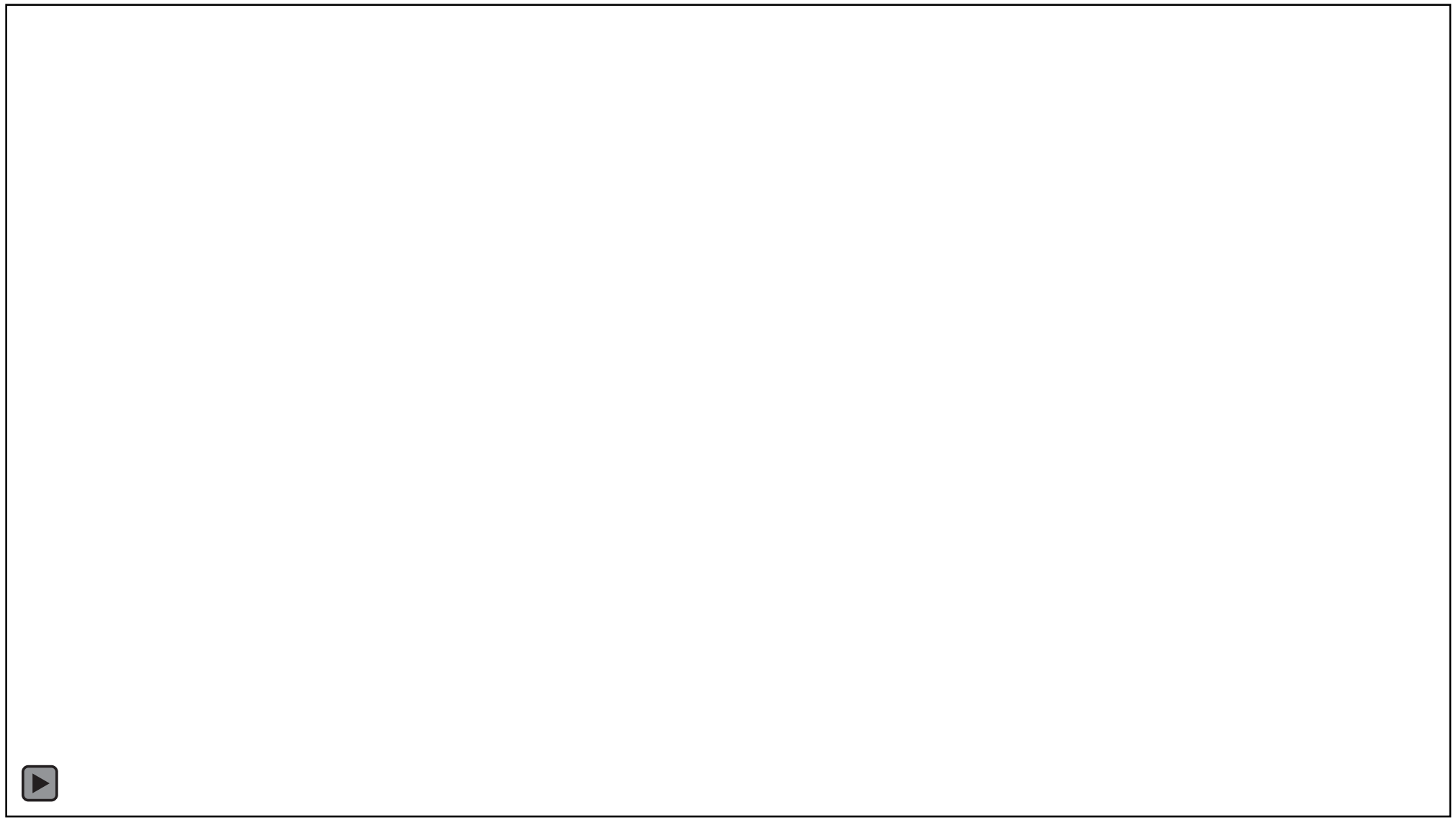
- First supersonic flight: 1947
- Introduction of supersonic commercial transports in 1970s brought the problem of sonic boom noise to public attention & showed sonic boom noise to be unacceptable
- Supersonic overflight restrictions followed
  - US: FAA Regulation (FAR) prohibits supersonic flight over US
  - Worldwide: ICAO Assembly Resolution – “No unacceptable situation for the public due to sonic boom”
- Restriction dramatically limited market potential for supersonic commercial flight
- The creation of a market for supersonic commercial aircraft requires eliminating sonic boom as a barrier to overland flight
- **NASA’s Quesst mission aims to provide U.S. and international regulators with statistically valid data required to approve new rules that could allow commercial supersonic flight over land**

What Makes a Sonic Boom?



- **Conical shock wave produces sonic boom at ground which moves with the airplane**
- **Boom is created over entire length of supersonic flight path, just as a boat wake is continuous**

Sonic Boom Moves With The Aircraft



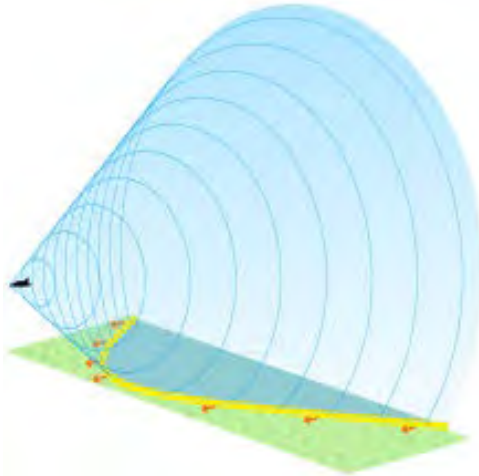
Nominal Aircraft Noise vs Sonic Boom

“Typical” Airplane Noise

- Primarily from engine and aerodynamics
- Predominantly low altitude; diminishes w/height
- Localized under flight path
- Long-duration sound
- Generally in proximity to airport; large variations in potential effects to nearby communities

Supersonic Flight-Generated Sound

- Sound due to shockwave, not engine
- Normally high-altitude/cruise conditions
- Only generated when supersonic
- Experienced along entire supersonic flight path
- Short-duration, impulsive sound
- Similar sound level experienced over large areas



The X-59 Aircraft

Key requirements drive X-59 design

- The acoustic signal of the X-plane must effectively replicate that of future larger supersonic commercial aircraft.
- The X-plane must conduct community overflight tests using normal commercial aircraft flight maneuvers.

Design Parameters

- Length: 99’ 7”
- Span: 29’ 6”
- Speed: Mach 1.4 (925 mph)
- Altitude: 55,000 ft

Design Features

- New, unique airframe design with acoustic signature shaping
- Many components from existing aircraft to reduce cost
- Payload capacity: single pilot/flight test instrumentation

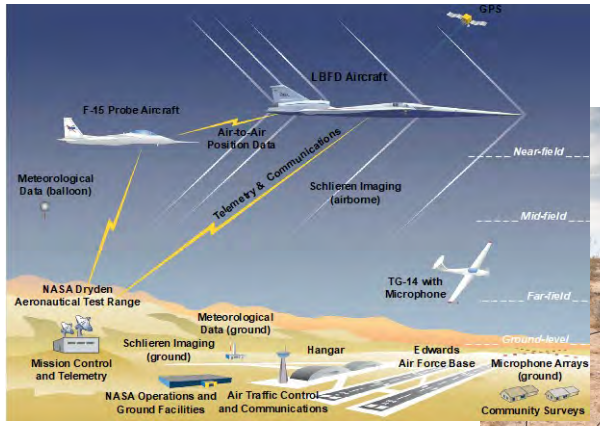
What is the NASA Quesst Mission?

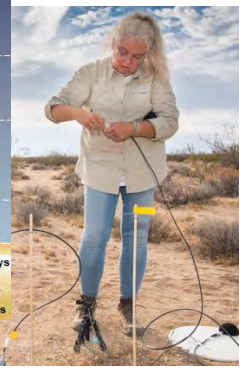
Phase 1 – Aircraft Development

In progress (2018-2024)

- Detailed design
- Fabrication, integration, ground test
- Subsonic and supersonic envelope expansion

Systematic Approach Leading to Community Testing





Phase 2 – Acoustic Validation

Preparation in progress, execution begins 2024

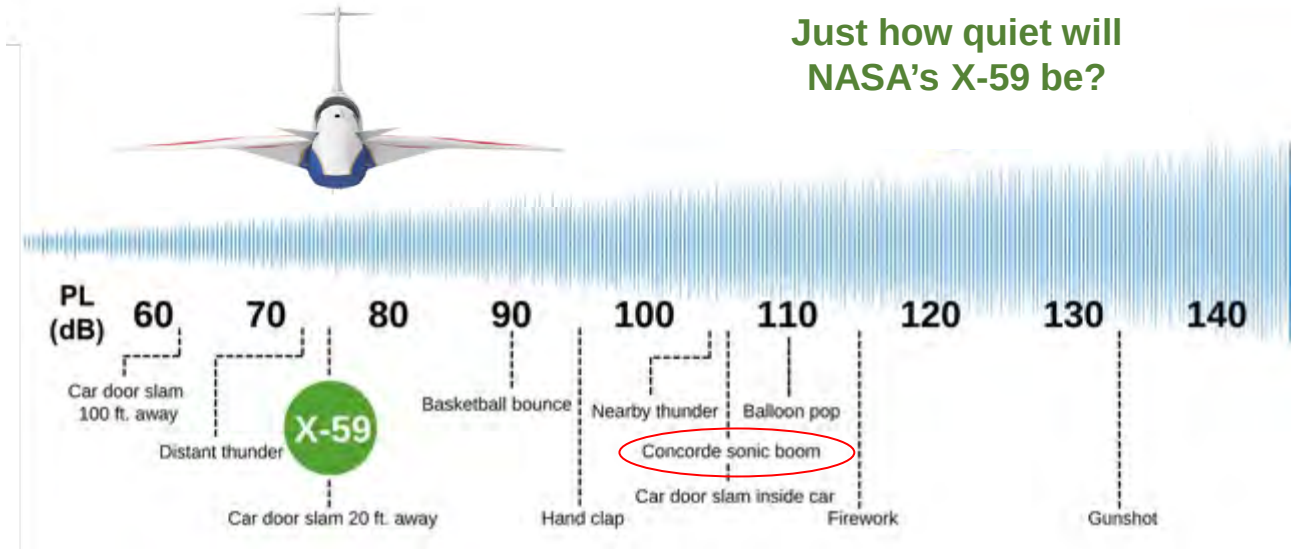
- Detailed in-flight and ground measurements
- Validation of X-59 acoustic signature and prediction tools
- Development of acoustic prediction tools for Phase 3

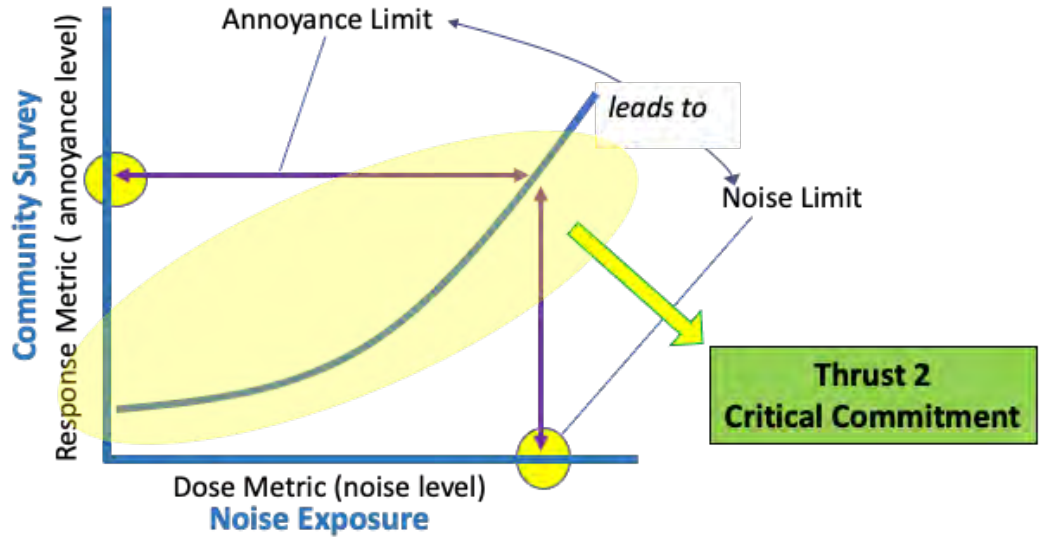
Phase 3 – Community Response Testing

Preparation in progress, execution begins 2026

- Community site selection
- Community response surveys
- Noise exposure design and estimation (measurement and predictions)
- Dose-response relationship development and data delivery

Quesst Phase 3 - Community Response Testing

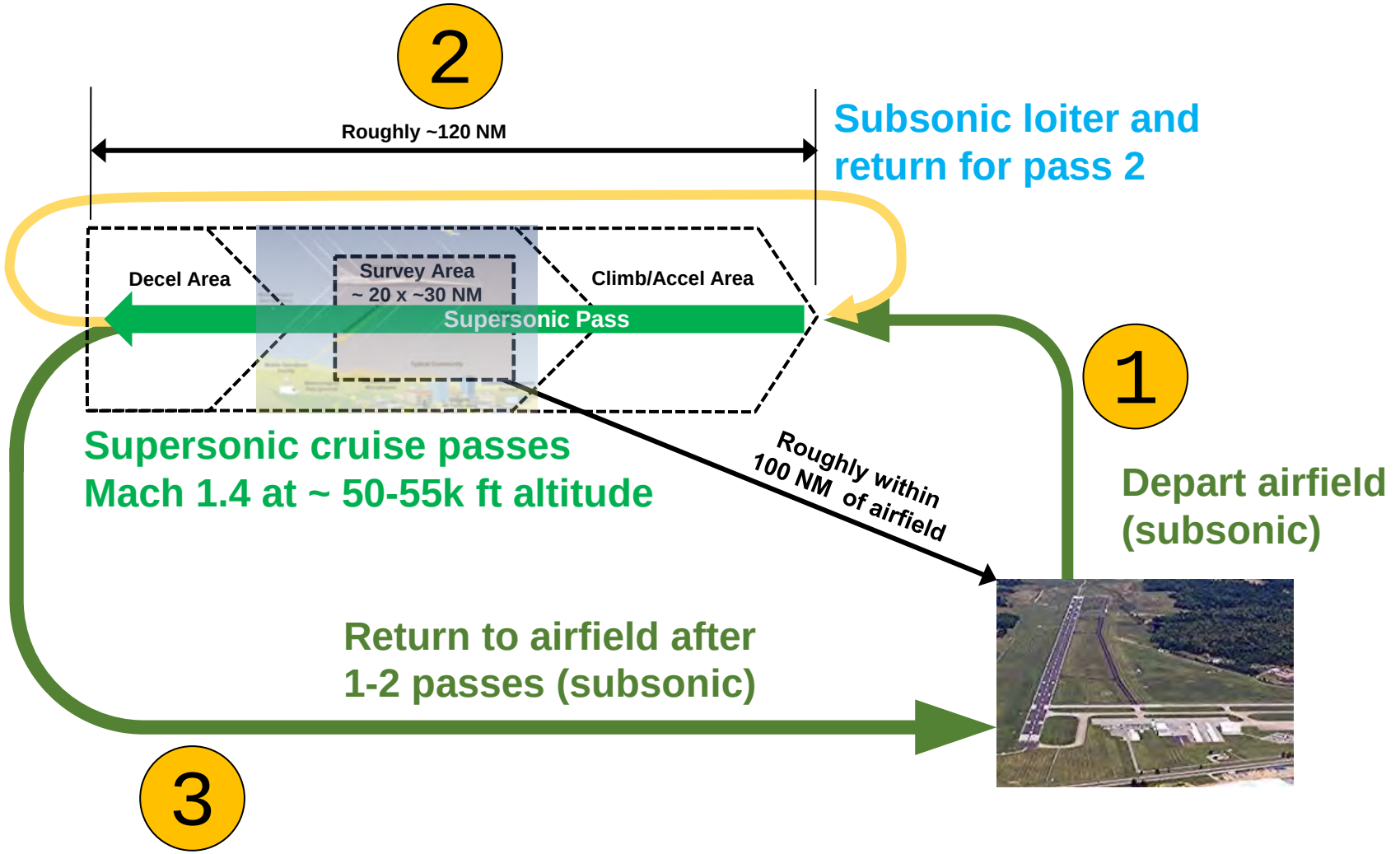




Some aspects of community tests

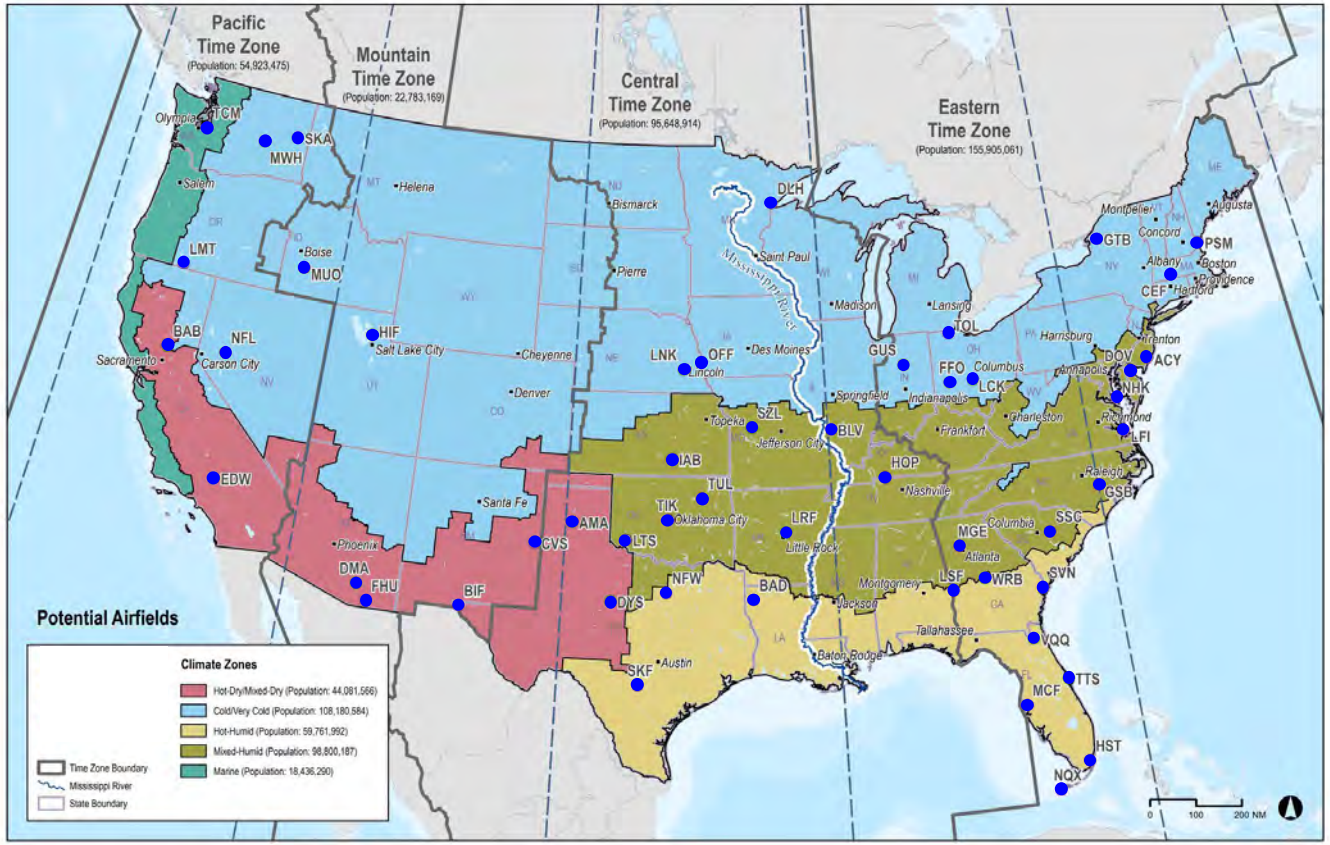
- 4-6 tests in different communities across the US
- Location selection will consider:
  - Variation in climate zones
  - Population demographics
  - Urbanization level
- Each test approximately 1 month long
- Daytime/waking hours
- Range of sound levels
- Acquire community response representative of the general population

Typical Community Response Flight



Airfield and Community Test Site Selection

- **4-6 Tests planned for 2026-2028**
  - Test #1 from NASA Armstrong (Edwards AFB/So Cal)
  - Subsequent test locations in review
- **Technical and aircraft-related constraints**
  - Runway, airfield infrastructure
  - Emergency/alternate landing sites
  - Available population centers
- **Ensuring representativeness**
  - Sampling approaches and statistical validity
  - Geographic and climate zone variation
  - Survey participant demographic diversity
  - Variation in urbanization level



Quesst Mission Phase 3 Overall Timeline

2019 - 2026	2026 - 2028	2027+
Planning Stage	***Execution Stage***	
• Develop overall Community Testing plans o Survey design o Exposure estimation o Operations o Public outreach and communication • Risk reduction activities o Survey test o Acoustic monitor and infrastructure checkout o Automated data processing validation • Obtain feedback on survey methods and exposure estimation approaches o ICAO CAEP Working Group 1 participation o Virtual and in-person international workshops o Independent review panel	• Community Test 1 near NASA Armstrong • Additional community tests o Various regions o Participant demographics • Survey and exposure data analysis • Develop dose-response relationship • Aggregate analyses and extend to nationally-representative database	***Data delivery to regulators***

Thank You!

Any Quesstions?