

NASA Quesst Mission Overview

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Briefing to Fort Lauderdale Airport Noise Advisory Committee

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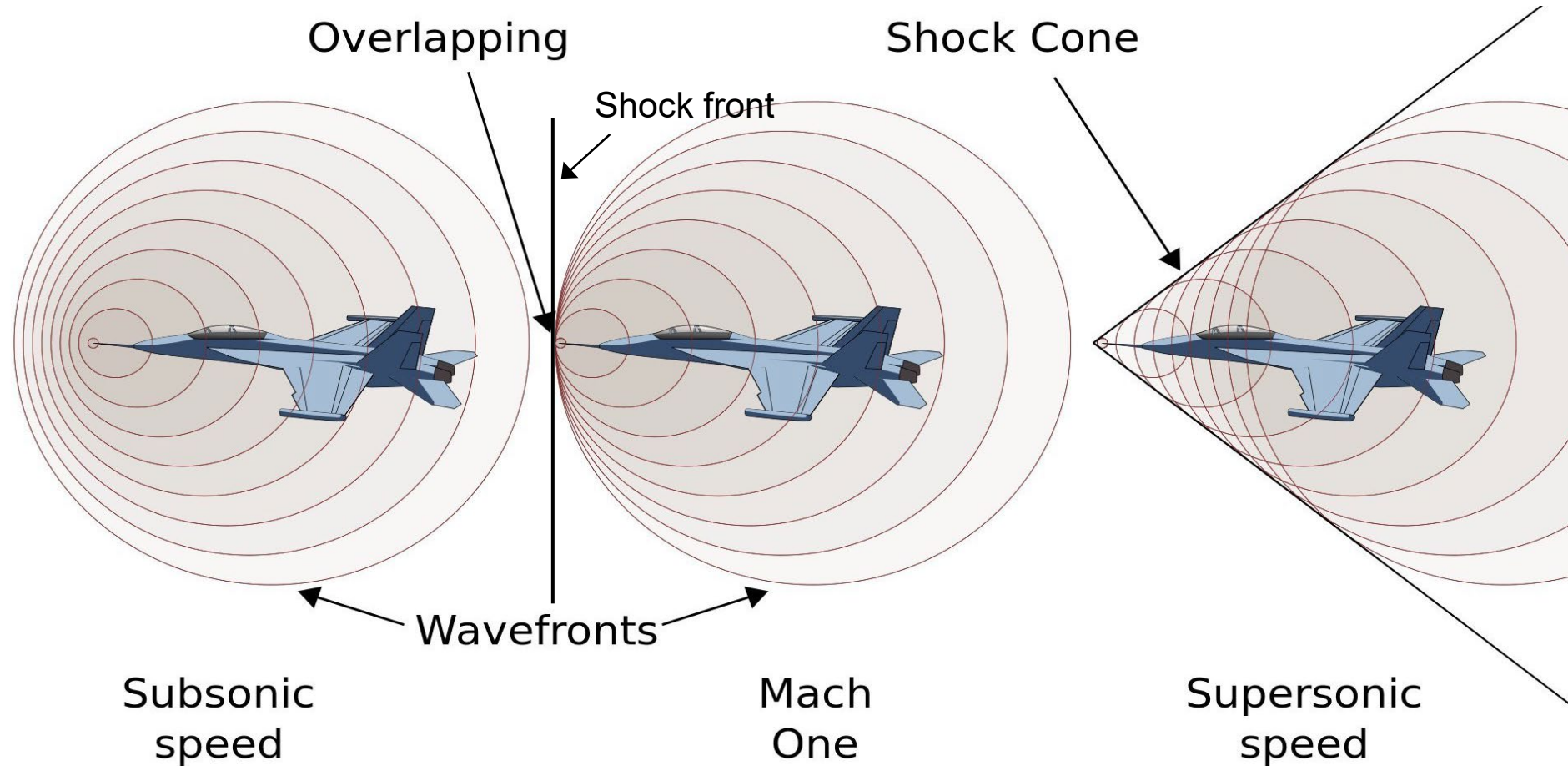
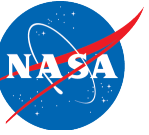
Barriers to Commercial Supersonic Flight

Sonic Boom Noise and Overland Flight Prohibitions

BELL X-1 Concorde

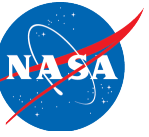
- First supersonic flight: 1947
- Introduction of supersonic commercial transports in 1970s brought the problem of sonic boom noise to public attention & showed sonic boom noise to be unacceptable
- Supersonic overflight restrictions followed
 - US: FAA Regulation (FAR) prohibits supersonic flight over 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

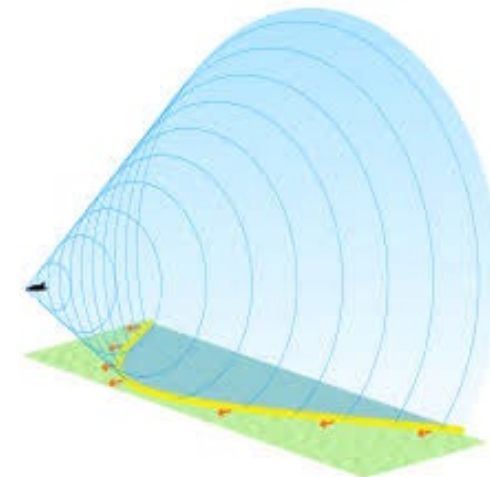
“Typical” Aircraft/Airport Noise

- Primarily engine and aerodynamic noise
- Predominantly at low altitude; diminishes as altitude increases
- Localized under flight path
- Long-duration sound
- Generally in proximity to airport; large variations in potential effects to local communities



Supersonic 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
- Sound level is similar across large area



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

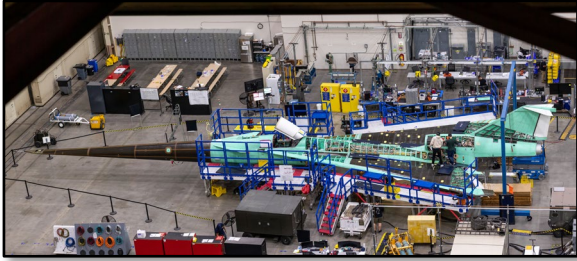
- Length: 99' 7"
- Span: 29' 6"
- Speed: Mach 1.4 (925 mph)
- Altitude: 55,000 ft

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?

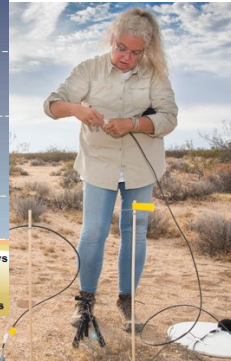
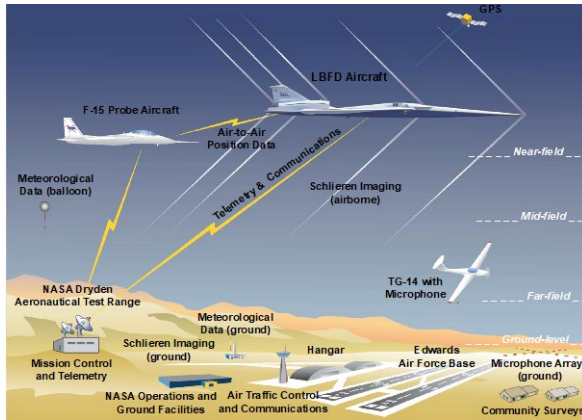


Phase 1 – Aircraft Development

In progress (2018-2024)

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

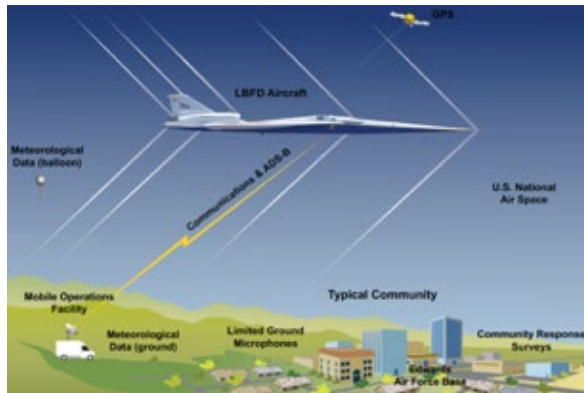
**Systematic
Approach
Leading to
Community
Testing**



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

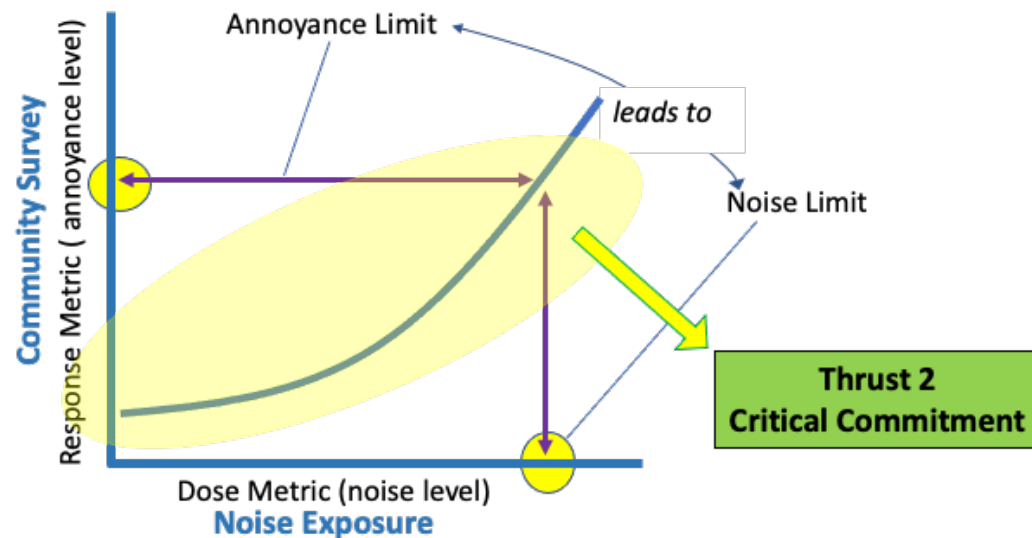
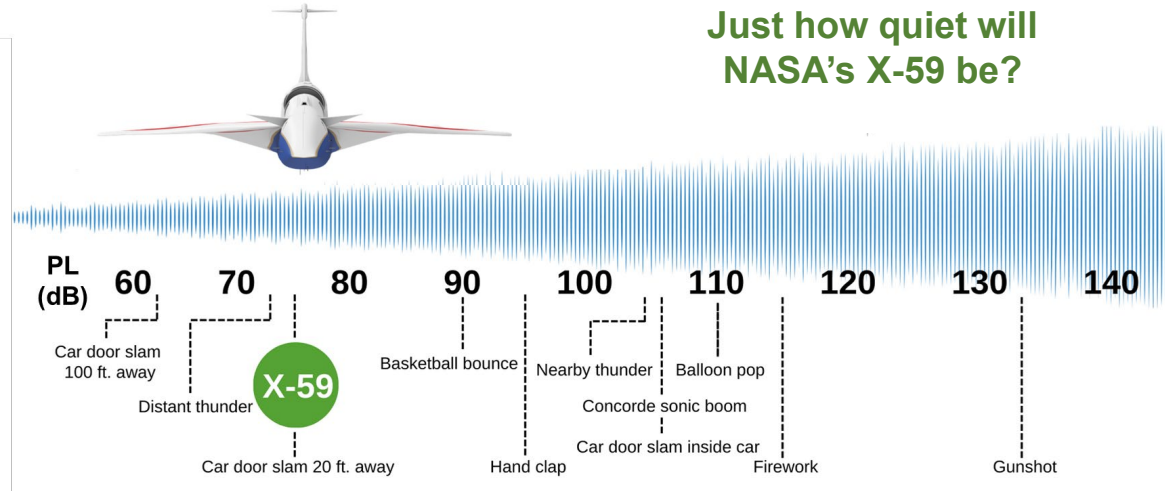
Preparation in progress, execution begins 2026

- 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



Just how quiet will
NASA's X-59 be?



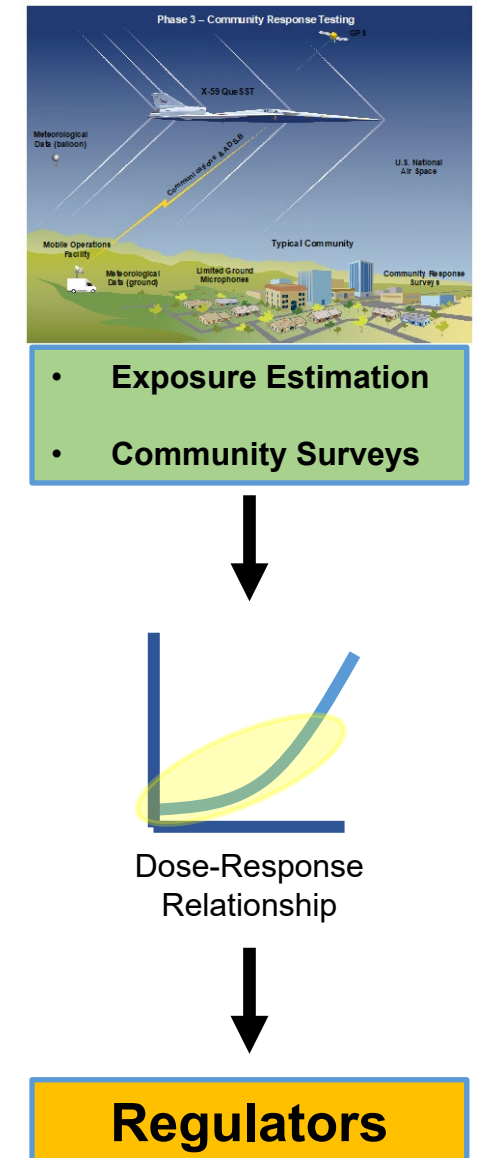
Some aspects of community tests

- 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

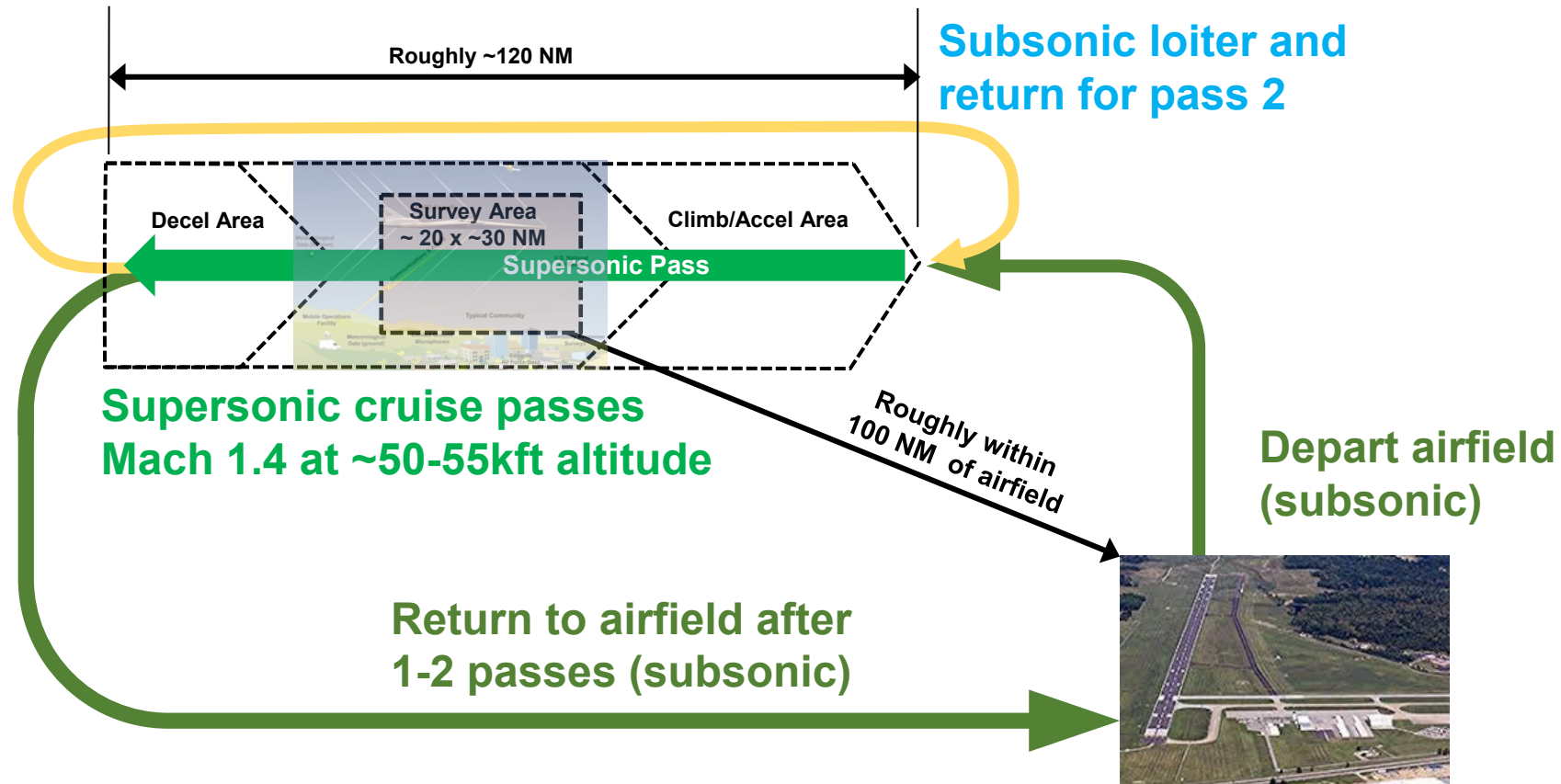
Quesst Phase 3 – Key Elements of Community Testing



- **Airfield and community site selection**
 - Aircraft operational acceptability
 - Demographic representativeness
 - Public engagement
- **Survey Design and Analysis**
 - Participant recruitment
 - Data analysis/statistical methods
 - Tests of survey implementation, automated data processing methods
- **Exposure Design and Estimation**
 - Acoustic monitor placement strategies
 - Recording and extraction of signature
 - Characterization of carpet over test area (combining prediction and measurements)
- **Developing Dose-Response Relationship and Delivery to ICAO**
 - Matching sound levels to participant response and location
 - Aggregating of multiple community test results
 - Ensuring validity/acceptance of technical approach



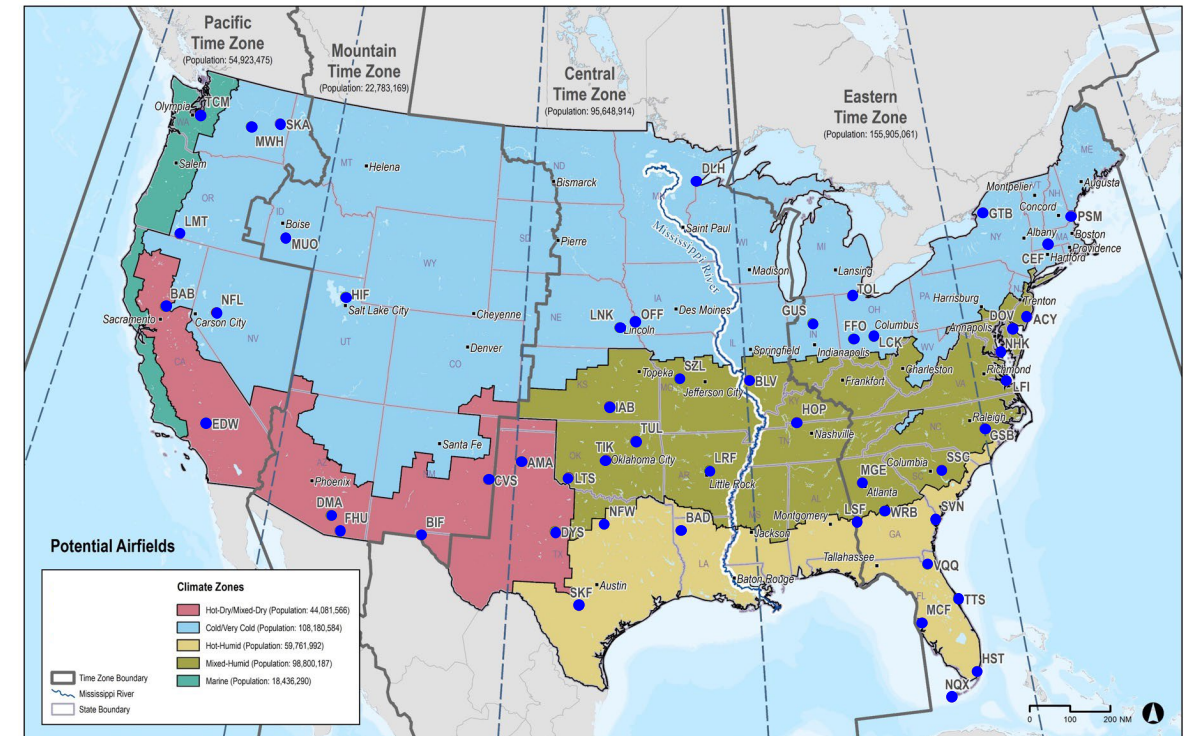
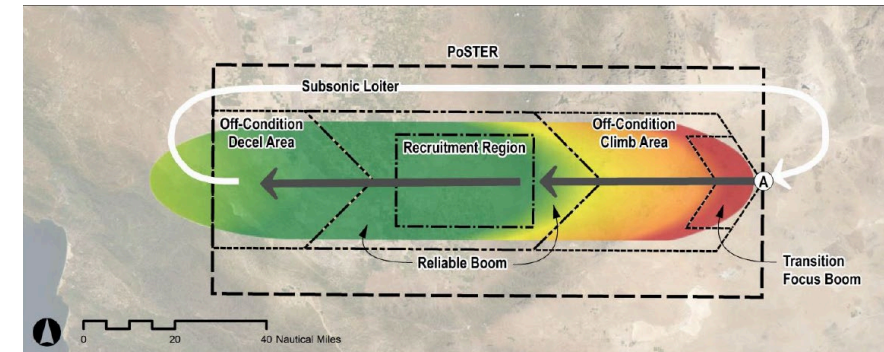
Typical Community Response Flight



Airfield and Community Test Site Selection



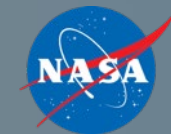
- **4-6 Tests planned for 2026-2028**
 - Test #1 from NASA Armstrong (Southern California)
 - Subsequent test locations TBD
- **Technical and aircraft-related constraints**
 - Runway, airfield infrastructure
 - Emergency/alternate landing sites
 - Available population centers
- **Ensuring representativeness**
 - 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 - 2025	2026 - 2028	2027+
<i>Planning Stage</i>	<i>Execution Stage</i>	
• Develop overall Community Testing plans ○ Survey design ○ Exposure estimation ○ Operations ○ Public outreach and communication • Risk reduction activities ○ Survey test ○ Acoustic monitor and infrastructure checkout ○ Automated data processing validation • Obtain feedback on survey methods and exposure estimation approaches ○ ICAO CAEP Working Group 1 participation ○ Virtual and in-person international workshops ○ Independent review panel	• Community Test 1 near NASA Armstrong • Additional community tests ○ Various regions ○ Participant demographics • Survey and exposure data analysis • Develop dose-response relationship • Aggregate analyses and extend to nationally-representative database	<i>Data delivery to regulators</i>



Thank You!



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Any Questions?