Quesst Mission Overview for LaRC Alumni Association

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Illustration Credit: Lockheed Martin

Presentation Topics

- Historical Perspective
- Barriers to Commercial Supersonic Flight
- Mission Overview
- Flight Systems & Capabilities
- Integrated Ground Testing
- Flight Test
- Acoustic Validation
- Community Testing

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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 Assemble 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

Overcoming the Barrier to Overland Supersonic Flight

Quesst Mission Goal

Collect internationally accepted data to support ICAO-CAEP effort to develop an En Route Noise Standard

- **An En route Noise Standard is required**
  - Replace current prohibitions
  - Create relevant data to define limits
    - Community data from large, diverse population
  - Accepted internationally

Illustration Credit: Lockheed Martin

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Sonic Thump – How quiet will NASA's X-59 be?

NASA's X-59 aircraft will produce a barely audible sonic thump to people on the ground when cruising at supersonic speeds. In technical terms, the X-59s sonic thump will be around 75 Perceived Level decibels (PLdB) or less. PLdB is one of numerous scales, in decibels, used to understand human response to sounds and particularly for short duration sounds.

Car door shutting
20 ft away

Nail gun

Concorde
sonic boom

Distant thunder

Balloon pop

Soft door knock

Fireworks

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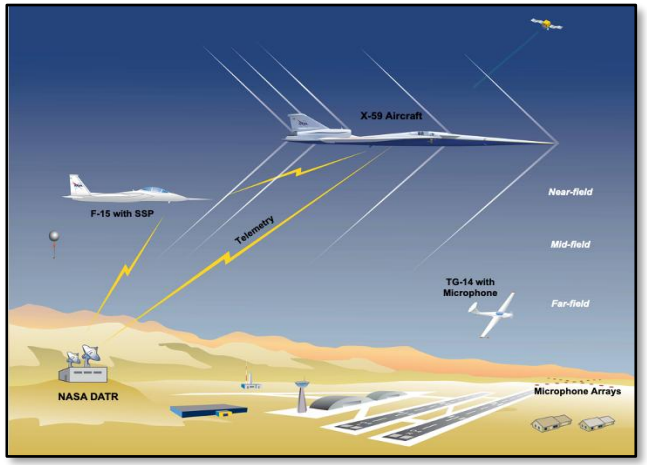
Quesst Timeline

First Flight Oct 2025

Phase 1 – X-59 Aircraft Development
Aircraft design, fabrication, and ground test
Checkout and envelope expansion

Systematic Approach Leading to Community Testing



Fall 2026

Phase 2 – Acoustic Validation
Detailed ground and flight measurements
Validation of sonic boom signature and prediction tools

Credit: Lockheed Martin

2027 >

Phase 3 – Community Response
Community response overflights, ground measurements, and surveys over representative communities across the U.S.

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Overview of X-59 Aircraft Features

X-plane approach that meets key requirements in a cost-effective design

Long nose to shape forward shock

External and forward visions systems for forward visibility

T-38 aft canopy and ejection seat to minimize qualification cost and schedule

T-tail to minimize aft shock

F-16 landing gear and other systems from high performance aircraft to minimize qualification cost and schedule

Wing shielding to minimize impact of inlet spillage on sonic boom

Conventional tail arrangement to simplify stability and control considerations

Single GE-F414 engine with standard nozzle to minimize cost and schedule

Design Parameters

- **Length: 99 ft**
- **Span: 29.5 ft**
- **Speed: Mach 1.4 (925 mph)**
- **Altitude: 55,000 ft**

Illustration Credit: Lockheed Martin

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Integrated Ground Testing

Engine and other integrated ground tests have been performed to validate the propulsion and related power systems (engine flows/temperatures, environmental controls, electromagnetic, battery systems, …)

Photo Credit: Lockheed Martin

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Emergency Restart and Taxi Testing

Ground testing of the engine restart systems and taxi testing was performed to further validate proper operation of the aircraft systems prior to flight. Taxi testing at increasing ground speeds was used to validate a wide variety of systems and operations such as the landing gear, flight controls, brake energy, air data, avionics, radio communications and data telemetry.

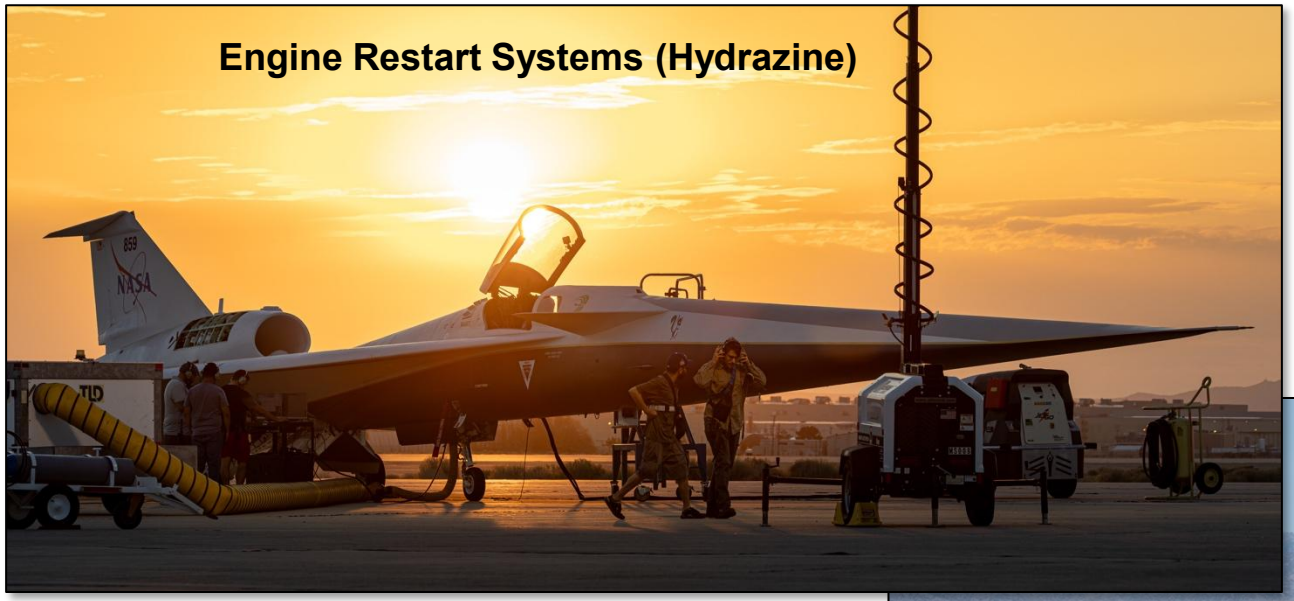

Photo Credit: Lockheed Martin

X-59 First Flight – Takeoff, Oct 2025

X-59 First Flight with F-18 Safety Chase

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X-59 First Flight Highlight Video (1:43)

CLICK LINK TO PLAY ▶ **https://youtu.be/EdeKVMANcSs**

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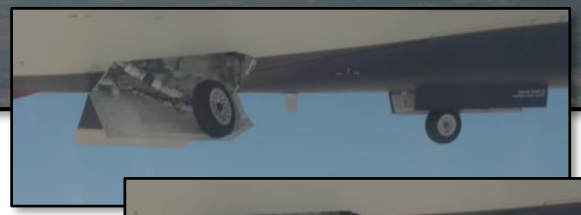
Aircraft Checkout Flights & Early Envelope Expansion

During the first block of flights, the X-59 team completed a major step forward conducting a variety of aircraft system checkouts and initial flight envelope expansion flights up to transonic speeds and 44,000 feet.

X-59 Aircraft During Early Integrated Test Blocks



Landing Gear

Flight Operations

Cockpit and Display Systems

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X-59 Flies Higher and Faster Video (3:21)

CLICK LINK TO PLAY ▶ https://youtu.be/gR4Xuslczoo

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Phase 2 Acoustic Measurements

- New state-of-the art acoustic Ground Recording System (GRS) developed by Crystal Instruments, Inc.
- Completed a series of risk reduction tests for Acoustic Validation flight and ground Ops readiness

Image credits: NASA

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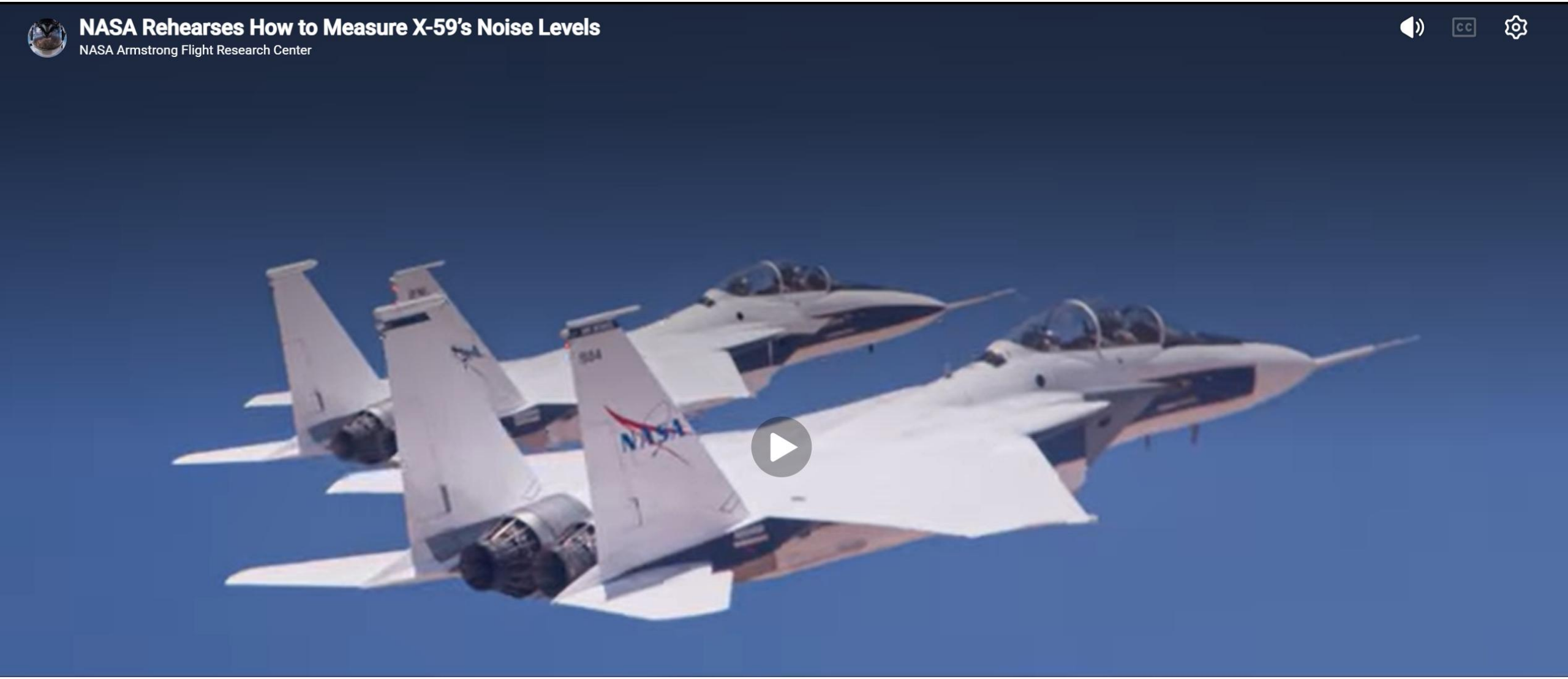
Acoustic Validation Dry Run Video (1:29)

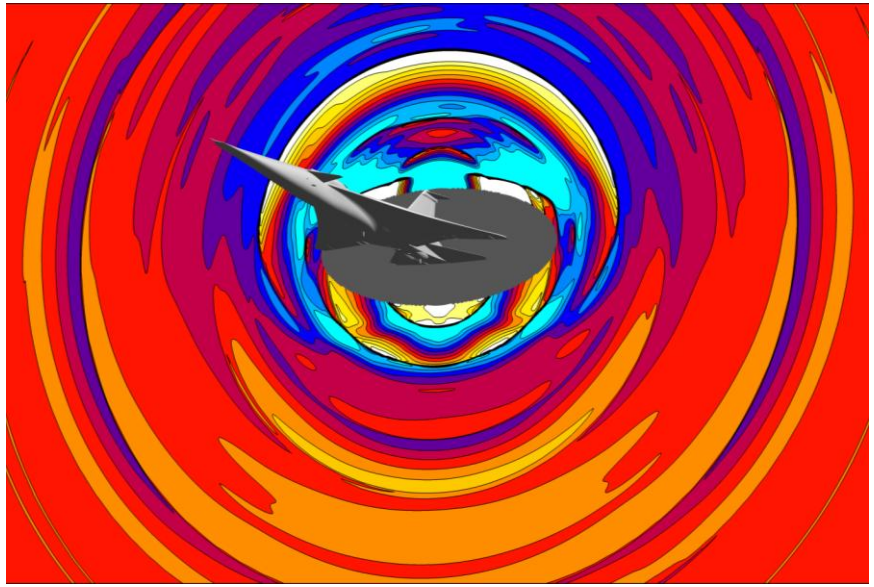


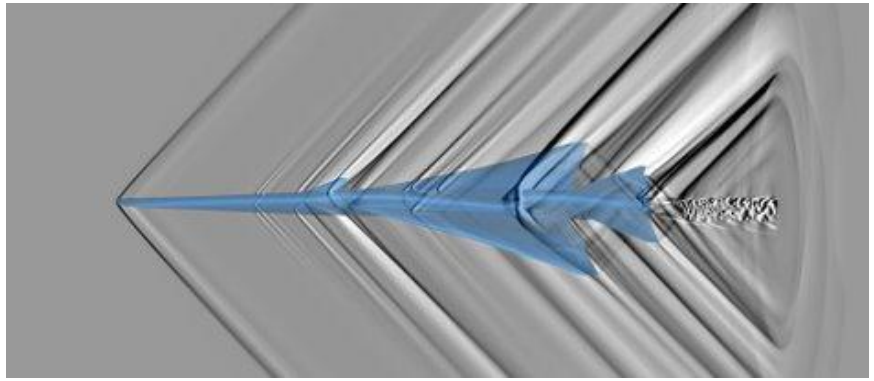
CLICK LINK TO PLAY

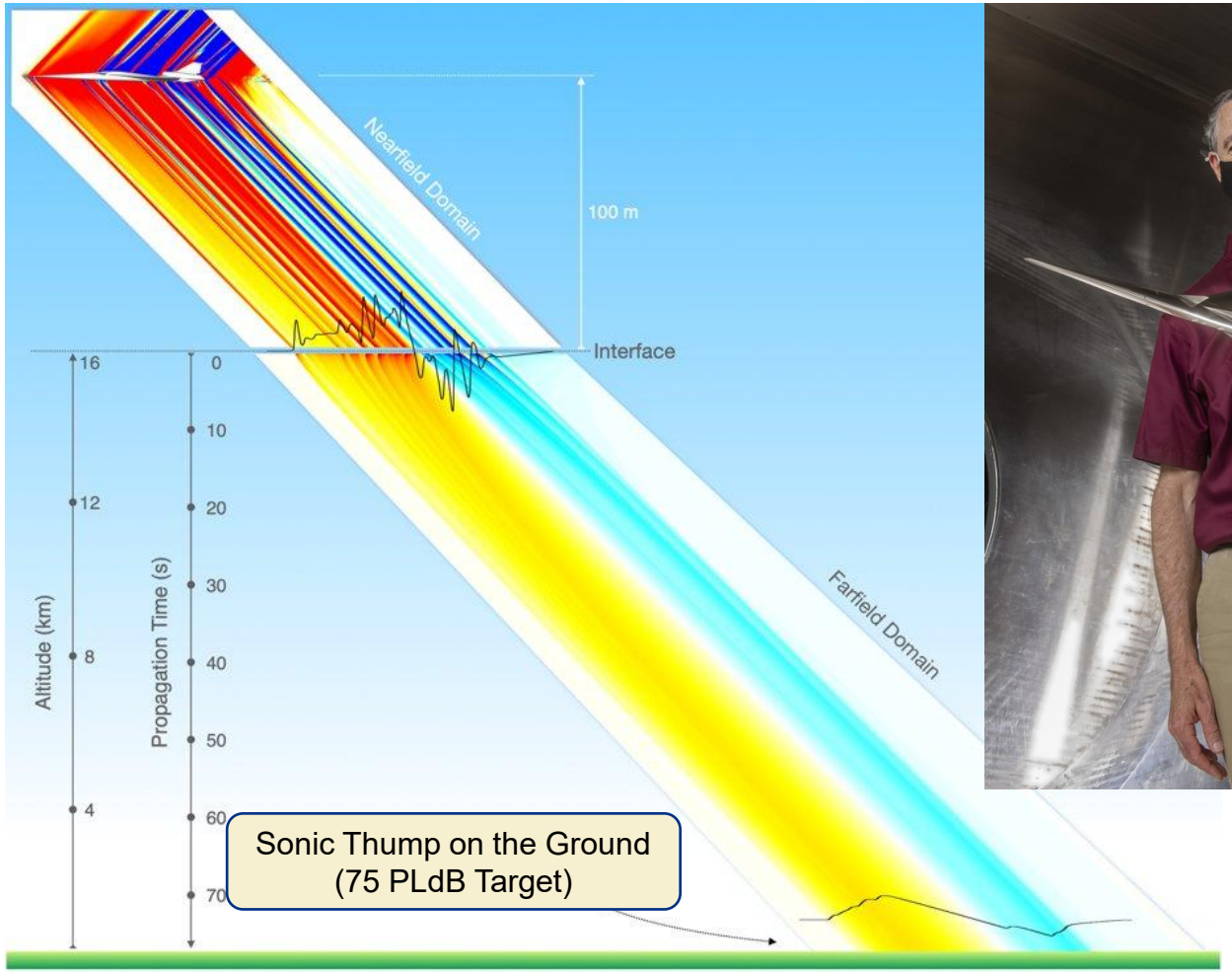
https://youtu.be/vSGRMNdmV0o

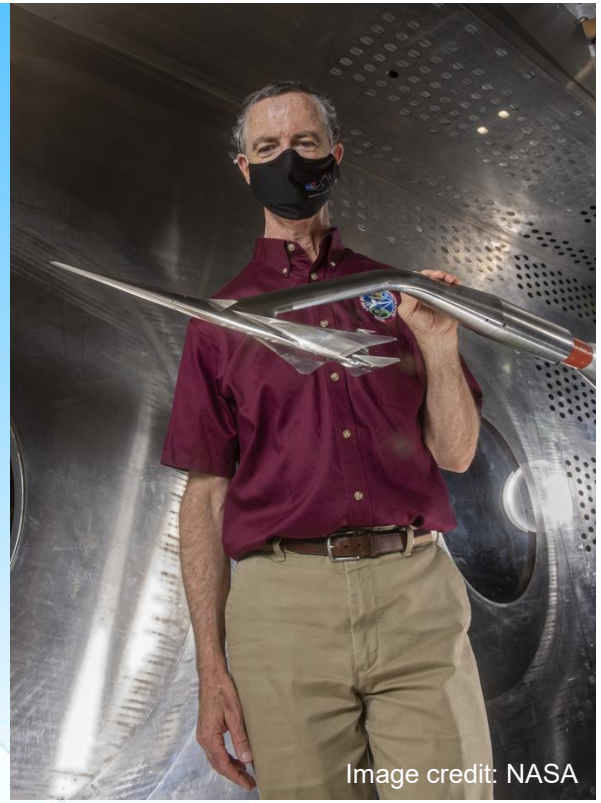
Phase 2 Acoustic Predictions

- Significant improvements in computational tool accuracy have been validated through wind tunnel experiments
- Refinements to acoustic propagation tools and atmospheric turbulence models
- Tools are ready for use in support of acoustic validation and community testing









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Community Test Planning and Execution

Plan and execute sonic boom tests with the X-59 aircraft over large non-experienced communities within the U.S. to provide a robust dose-response database of community annoyance

Airfield and Community Selection

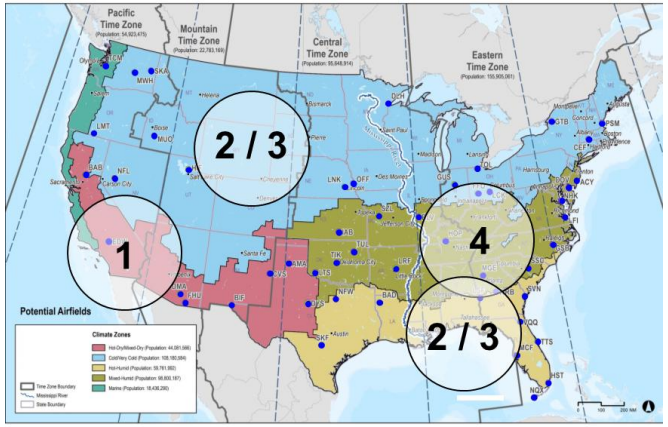
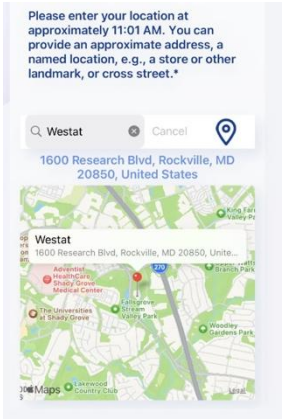
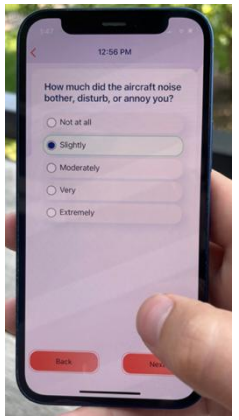


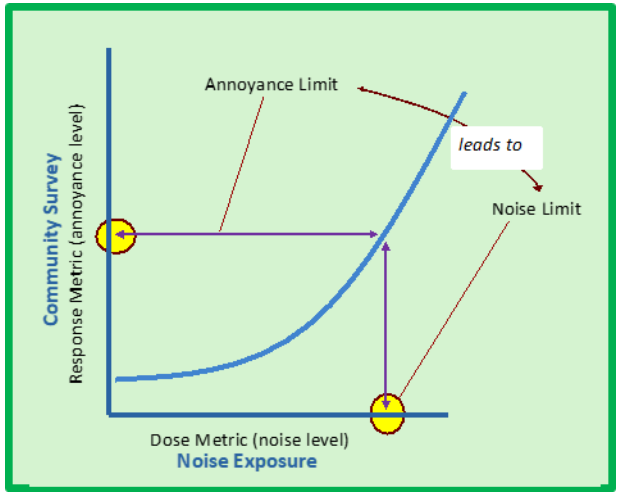
Image Credits: HMMH

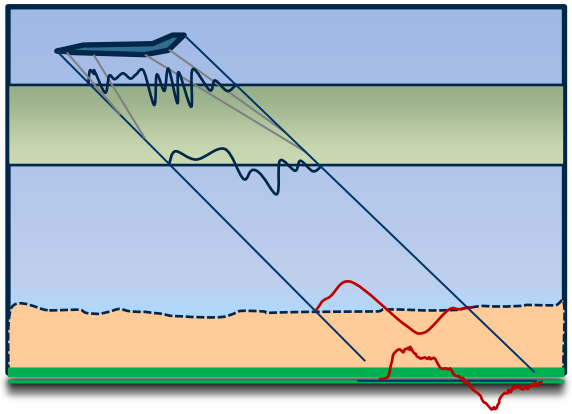
Survey Design and Analysis



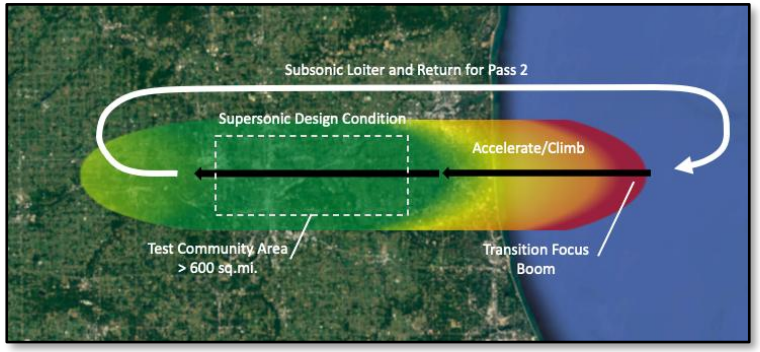


Dose-Response Relationship

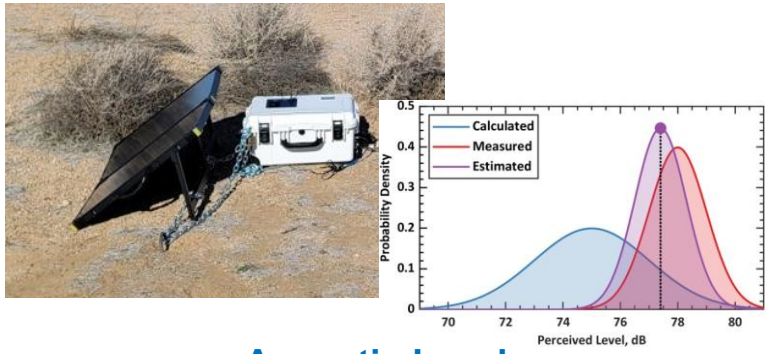




Exposure Estimation



Flight and Test Planning



Acoustic Levels

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Quesstions?

Photo Credit: Lockheed Martin

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