X-59 Aircraft Overview and Status

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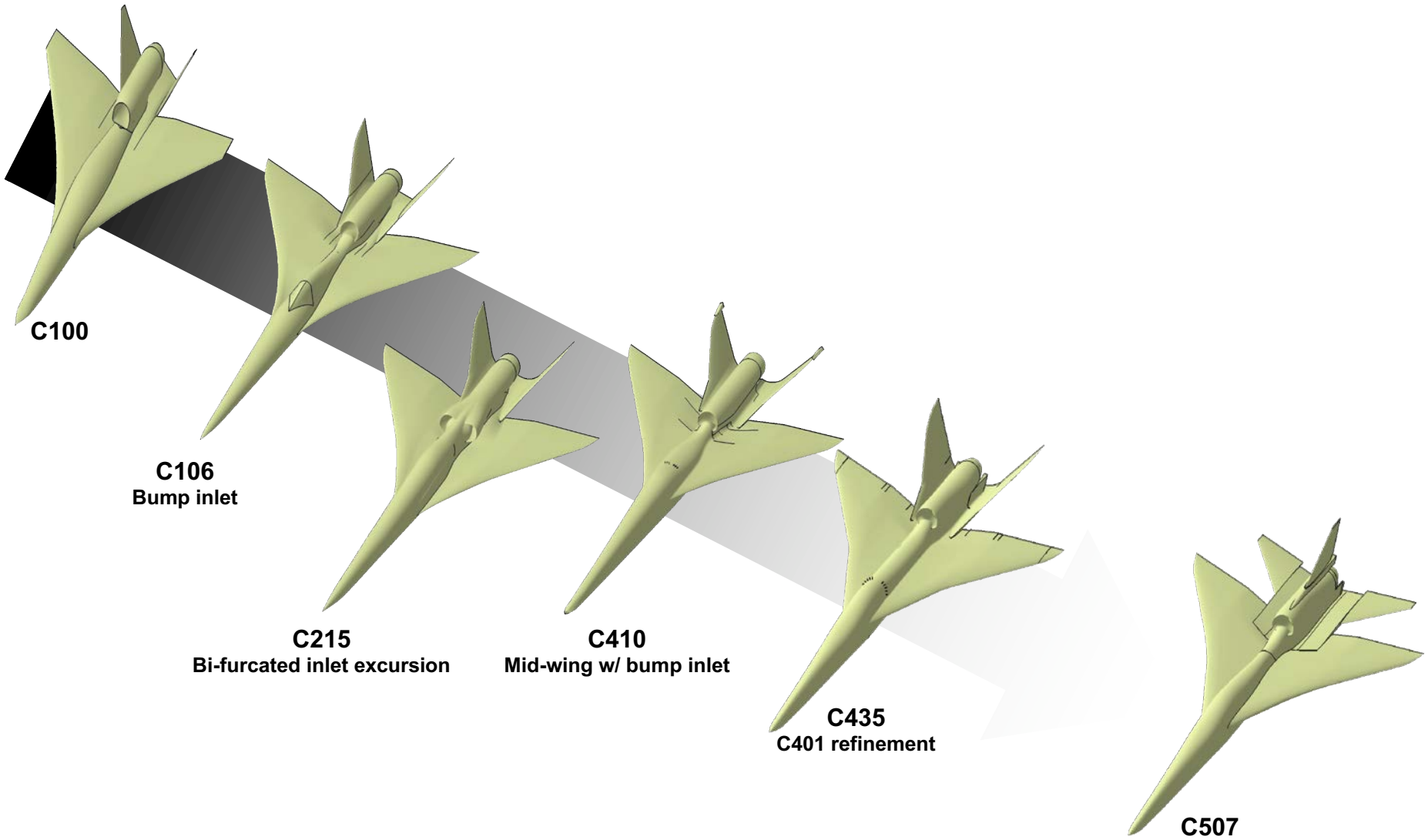
2023 AIAA SciTech Forum

Presentation Topics

- X-59 Concept Evolution
- X-59 Aircraft
  - Features and Design
  - Fabrication
  - Systems Integration
  - Ground Testing
- Supporting Technologies and Flight Systems
- X-59 Team

X-59 Concept Evolution



X-59 Preliminary Design Review - July 2018

Image Credit: Lockheed Martin

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

Fixed canard for nose-up trim at low-boom design point

T-tail to minimize aft shock

Large, unitized skins reduce parts count and manufacturing cost

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

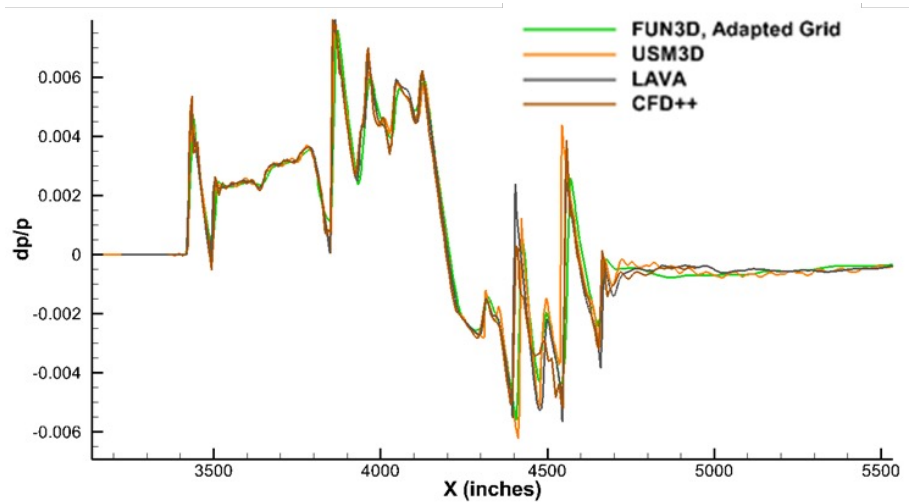
Single GE-F414 engine with standard nozzle to minimize cost and schedule

Design Parameters

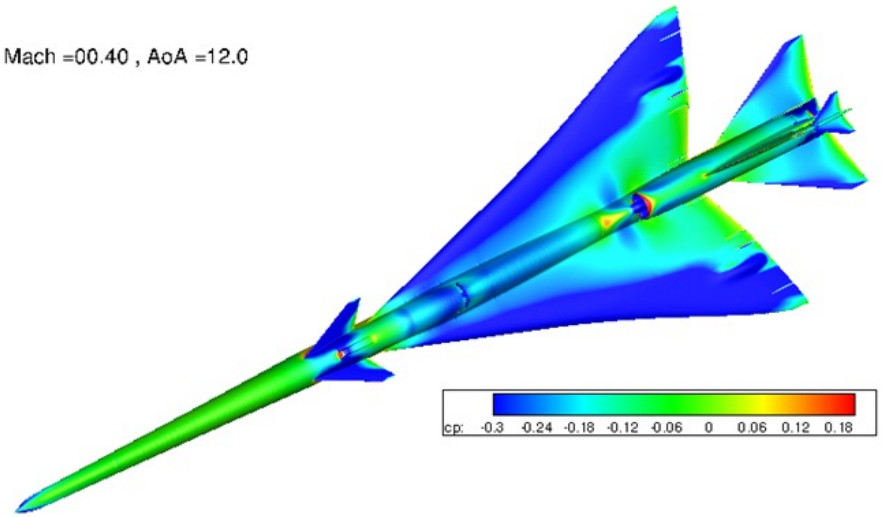
- **Length: 99 ft**
- **Span: 29.5 ft**
- **Speed: Mach 1.4 (925 mph)**
- **Altitude: 55,000 ft**

Image Credit: Lockheed Martin

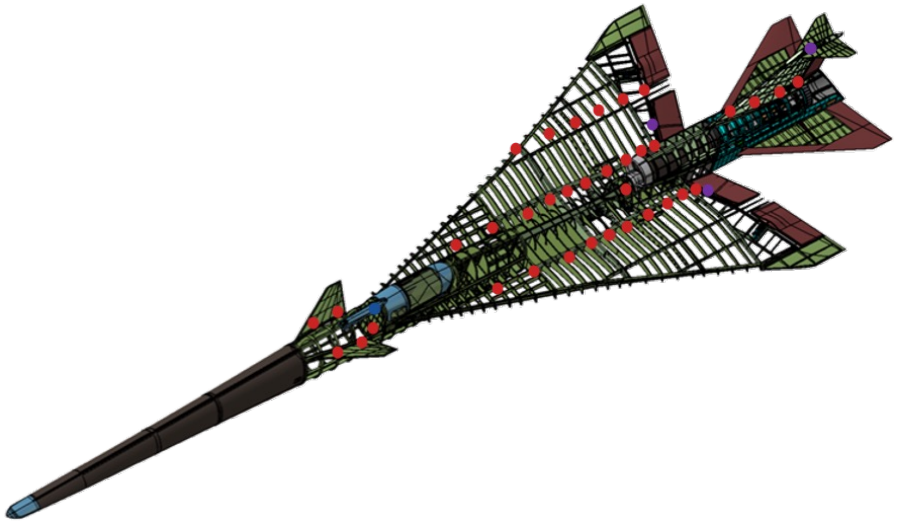
X-59 Aircraft Assessments



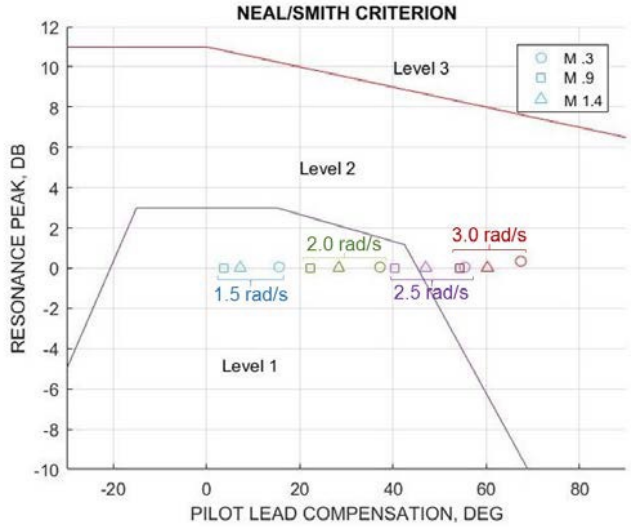
Sonic Boom



Aerodynamic Performance



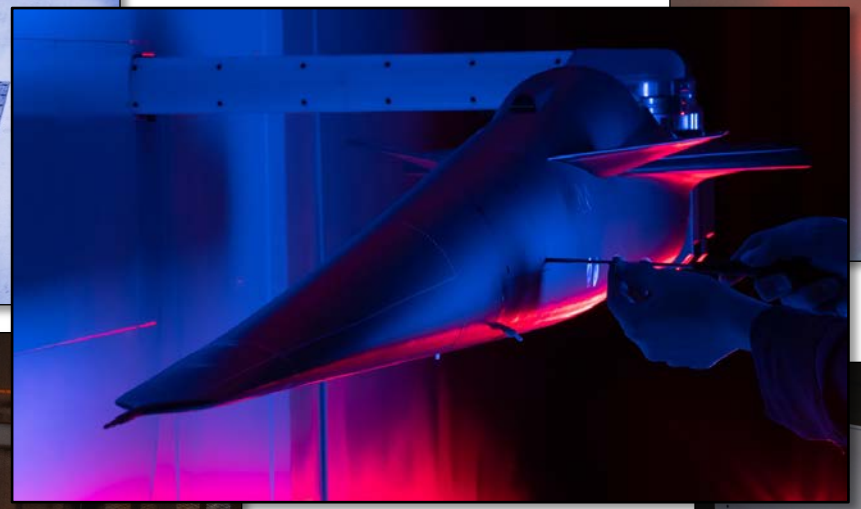
Structural Modeling

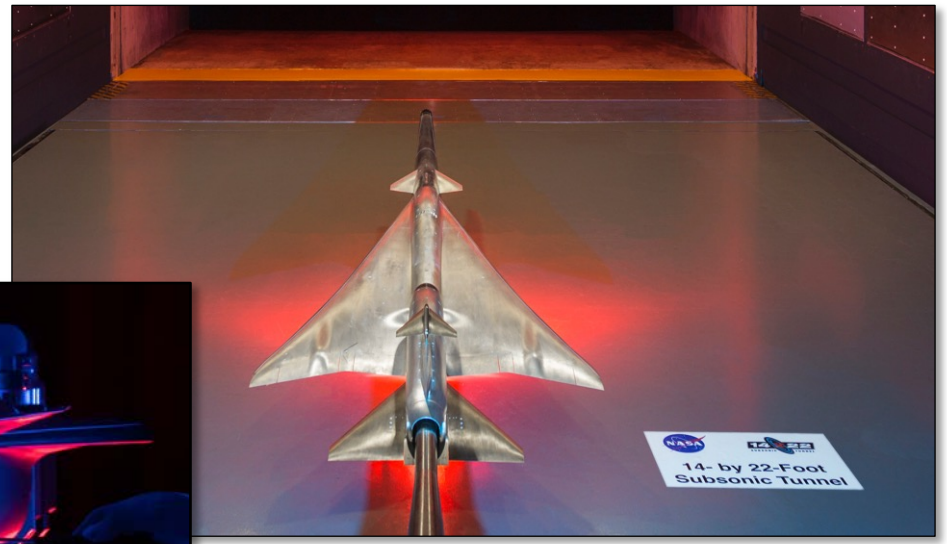


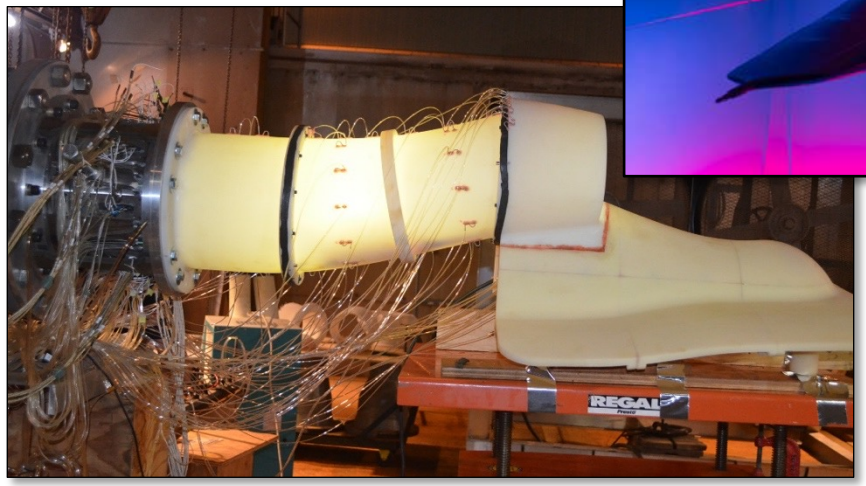
Handling Qualities

Wind Tunnel Validations

Low-and high-speed aerodynamic and Propulsion Airframe Interaction (PAI) wind-tunnel tests validate predictions and ensure readiness of the design







Credit: Lockheed Martin

X-59 Aircraft 3-View

Configuration C612	
MDGW	25,000 lbs
Fuel (Max)	8,700 lbs
Payload	600 lbs
Design Mach	1.4
Loudness	<75 PLdB
Engine	1xF414-GE-100
Landing Gear	F-16 Blk25 NLG F-16 Blk25 MLG

Control Surfaces	
Aileron	12.9 sq ft/+35/-25 deg
Flap	12.4 sq ft/+30/-3 deg
Stabilator	39.9 sq ft/+20/-15 deg
Rudder	8.5 sq ft/+25/-25 deg
T-tail	6.8 sq ft/+10/-0 deg

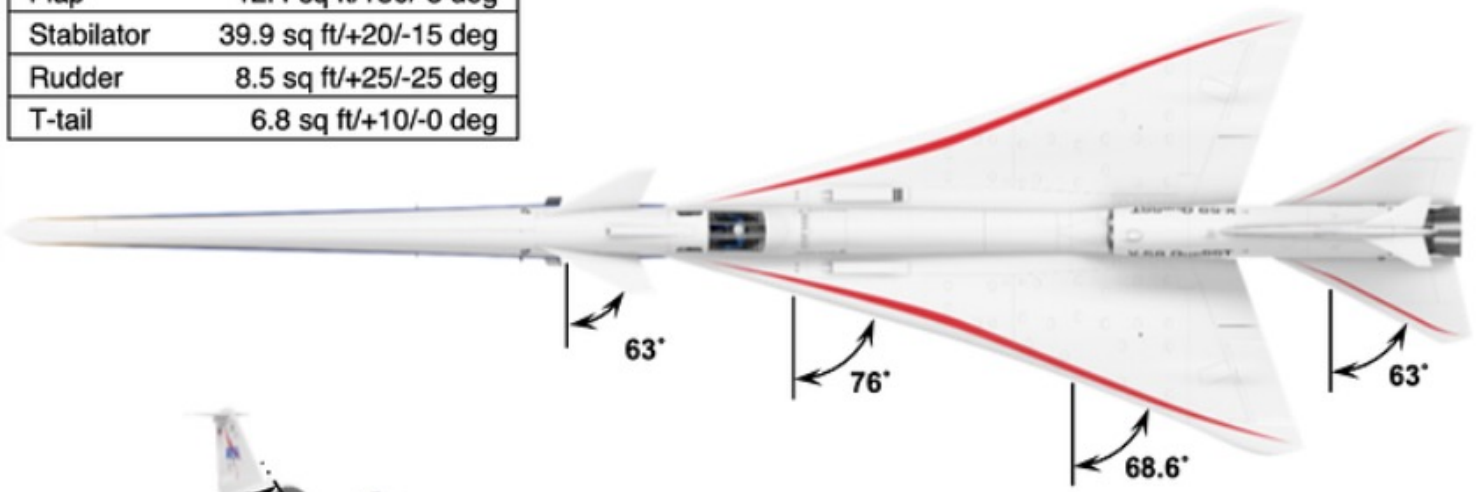
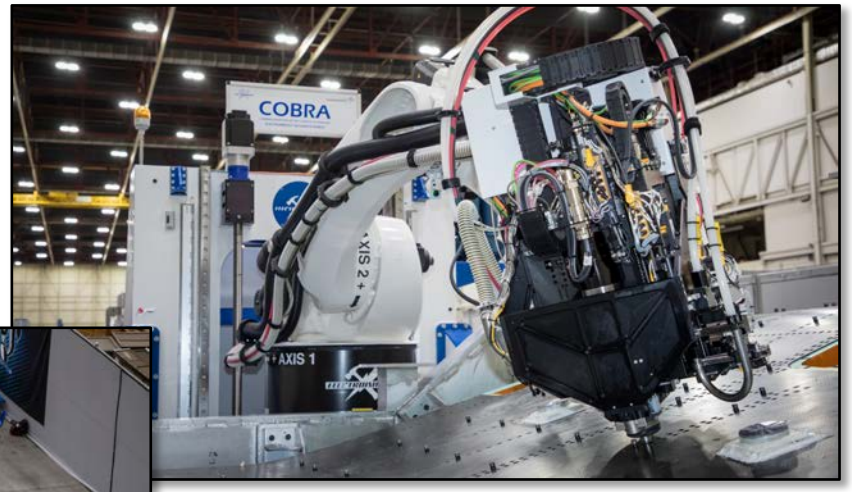
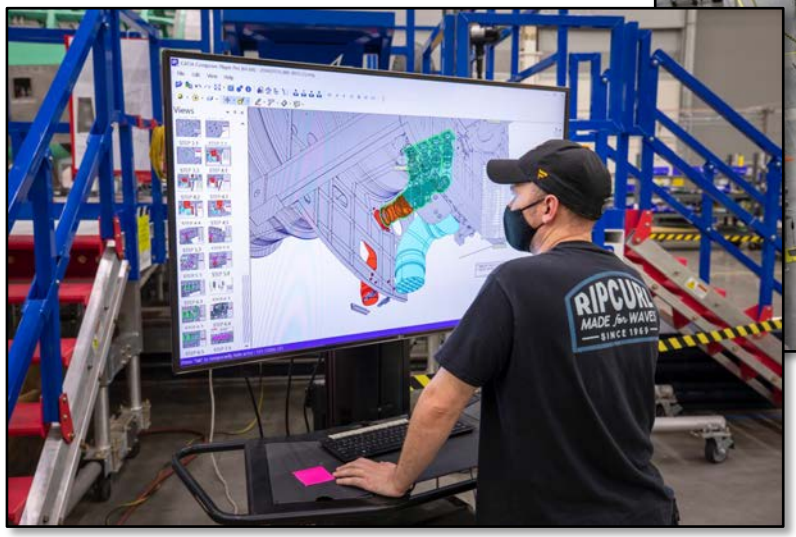


Image Credit: Lockheed Martin

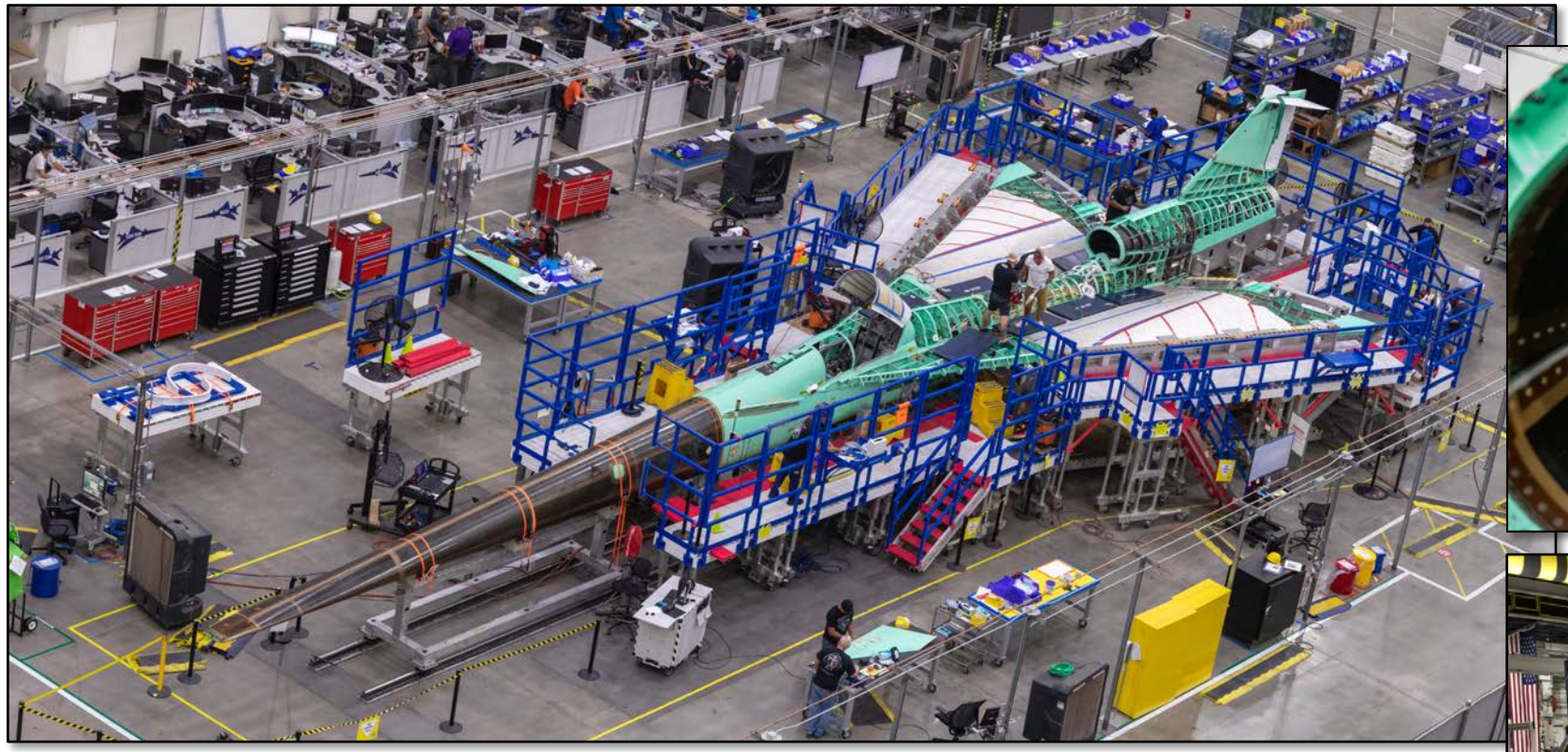
X-59 – Early Aircraft Fabrication and Integration



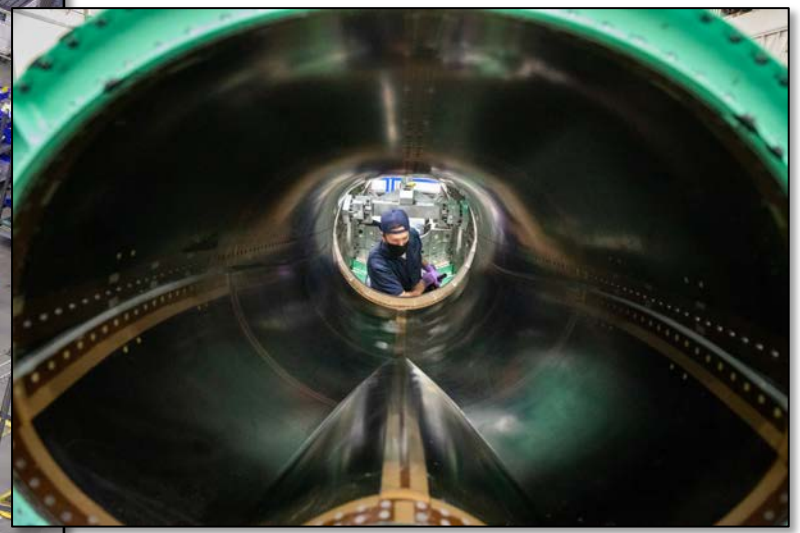


Credit: Lockheed Martin

X-59 Aircraft Fabrication and Integration



Credit: Lockheed Martin



Credit: General Electric

X-59 Aircraft Ground Testing in Ft. Worth

The Long Journey

Preparing the Aircraft for Structural Testing

Credit: Lockheed Martin

X-59 Aircraft Ground Testing in Ft. Worth

Structural Testing

Fuel Systems Testing

Credit: Lockheed Martin

Return to Palmdale
Continue Wiring and System Installations

eXternal Vision System (XVS)

Landing Gear

Stabilator

Credit: Lockheed Martin

Final Wiring and System Integration

Backbone Wiring

Electrical Power System

Credit: Lockheed Martin

Integrated System Checkouts Begin

Crew Station

Credit: Lockheed Martin

Engine Bay – Upper Empennage

Cockpit Simulations

Aircraft and cockpit simulations validate aircraft designs, systems, and performance – also used for pilot training and flight planning

Credit: Lockheed Martin

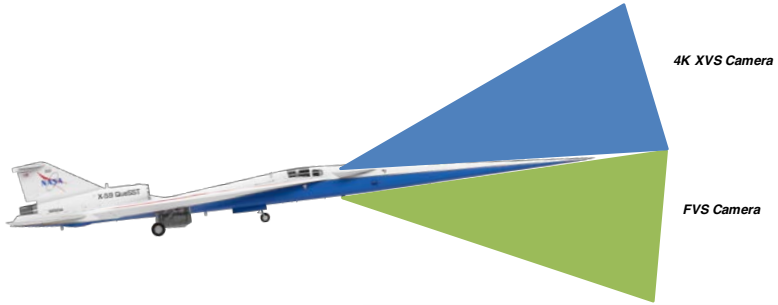
X-59 eXternal Vision System (XVS)

- XVS is designed to provide forward vision for X-59
  - Enhances mission performance for the community test phase

- System components
  - NASA developed 4K camera system
  - LM Forward Vision System Camera (EVS3600)
  - XVS Processor
  - UHD Display with integrated symbology

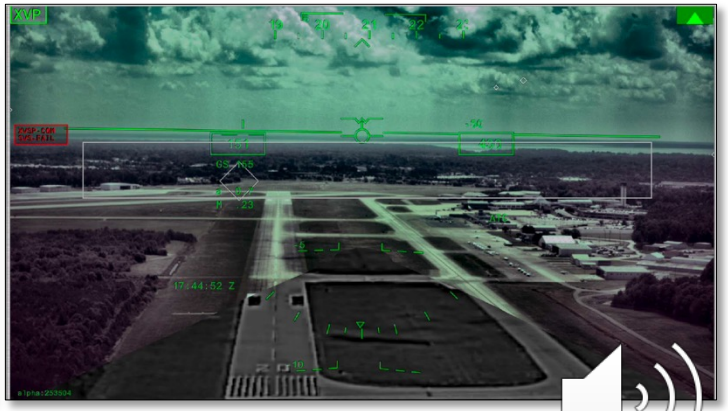
- System performance verified in flight test
  - X-59 hardware installed on NASA UC-12 aircraft
  - Several guest pilots compared normal vision and XVS on see-to-avoid and see-to-follow tasks

- Final component qualification, installation, and ground checkout in the X-59 aircraft completed



Concept Views of X-59 Cockpit

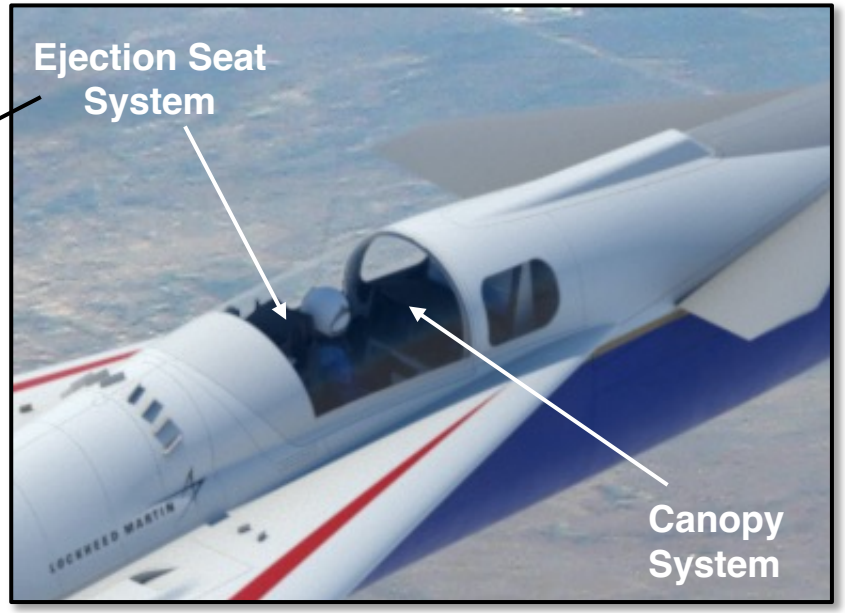
Flight Test Setup



XVS Image During Flight Test

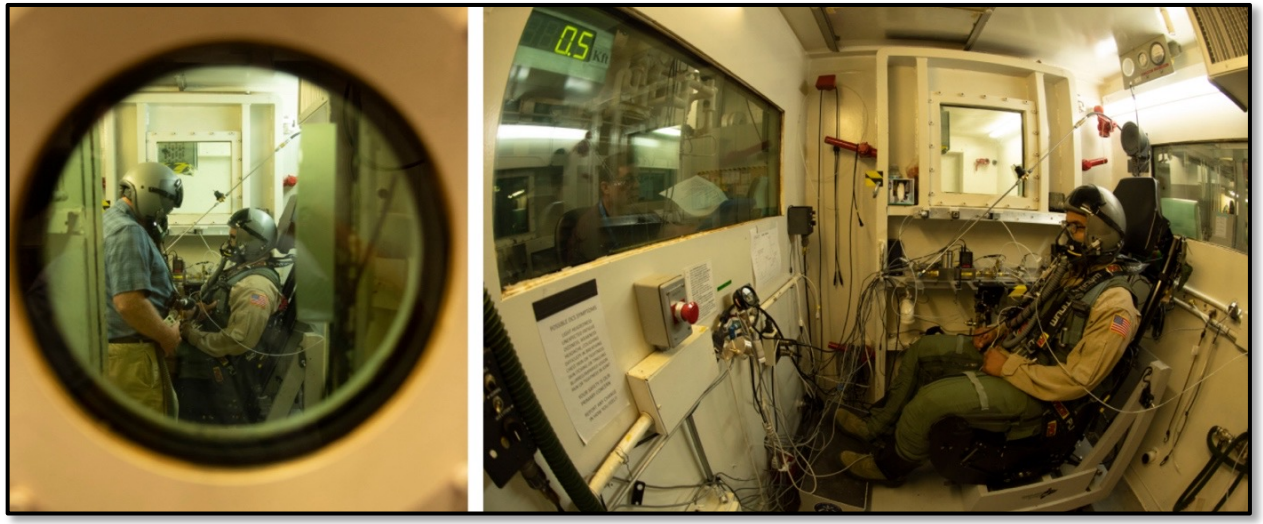
X-59 Life Support and Crew Escape Systems


Credit: Martin Baker



NASA has worked with hardware vendors to ensure pilot safety by providing the hardware, checkout, and certification of the X-59 aircraft life support and crew escape systems

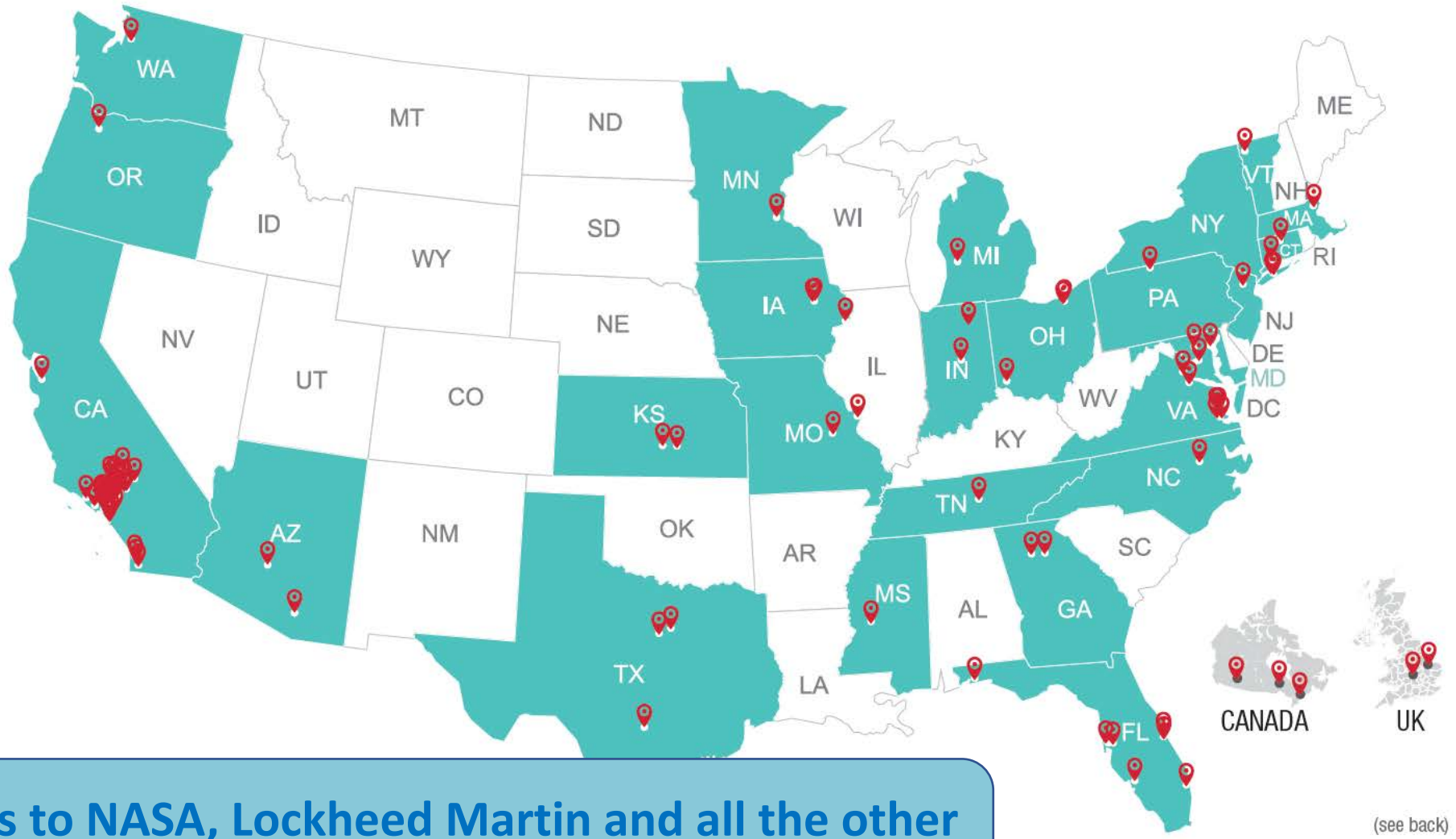
The Crew Escape System (CES) provides the pilot with an integrated ejection seat and canopy systems to ensure pilot safety during normal and emergency flight and ground scenarios.


Credit: KBR

Hypobaric Chamber Testing

The Life Support System (LSS) provides the pilot with breathing oxygen at the right pressure, flowrate, and concentration to maintain the pilot's well-being in any scenario, from normal flight missions to in-flight emergencies. Key components of this system were tested in a hypobaric chamber to simulate reduced pressure conditions that the pilots could experience at the higher altitudes.

Companies Contributing to the X-59



Special thanks to NASA, Lockheed Martin and all the other contributors to this presentation and X-59 aircraft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Any Questions?