



Forging Future Flight: Aeronautics Research at the NASA Langley Research Center (Environmentally Responsible Aviation Research)

The NASA Langley Research Center (LaRC)

Located in Hampton, VA, LaRC was established as the nation's first civilian-led aeronautics research laboratory in 1917. NASA Langley serves as a world leader in "cutting edge" aeronautics research. Approximately \$180 million was invested in aeronautics research at LaRC



(2011). In 2010 NASA Langley contributed \$946.8 million to the Virginia economy while supporting 8,624 jobs in the state of Virginia. In the Hampton Roads area in 2010, Langley contributed \$886.7 million to the local economy while supporting 7,962 jobs.

Aeronautics Research Directorate (ARD)

The ARD at NASA LaRC manages projects that support four programs: (1) Integrated System Research Program, (2) Fundamental Aeronautics Program, (3) Aviation Safety Program, and (4) Airspace Systems Program. Research activities are performed under the specific projects described later. The NASA LaRC ARD facilitates external partnerships to complement the agency's aeronautics mission.



NASAfacts

Environmentally Responsible Aviation (ERA) Project (Integrated Systems Research Program)

LaRC, as the host research center, and with partner centers Ames Research Center (ARC), Dryden Flight Research Center (DFRC), and Glenn Research Center (GRC) are conducting integrated systems research in the following areas: (1) Airframe Technology Sub-Project (Innovative flow control concepts for drag reduction and advanced composites for weight reduction), (2) Propulsion Technology Sub-Project (Advanced Ultra High Bypass engine designs for specific fuel consumption and noise reduction and advanced combustor designs for landing and take-off oxides of nitrogen reduction), and (3) Vehicle Systems Integration Sub-Project (Airframe and engine integration concepts for community noise reduction).

Primary Goal: Develop and demonstrate technologies to reduce the noise and emission impact of commercial aviation transportation on society, including technologies that reduce emissions by reducing fuel consumption. The research is conducted as an integration of technologies into systems to demonstrate viable solutions to technology readiness level (TRL) 5/6 by 2015 to enable technology transition opportunities into the fleet between now and 2025.

Technical Challenges:

- Develop vehicle concepts that simultaneously reduce community noise, fuel burn, and landing and take-off and cruise oxides of nitrogen
- Develop and incorporate innovative flow control concepts for drag reduction
- Develop advanced composites for weight reduction
- Develop advanced Ultra High Bypass engine designs for specific fuel consumption and noise reduction
- Develop advanced combustor designs for landing takeoff oxides of nitrogen reduction
- Develop airframe and engine integration concepts for community noise reduction

Recent Research Accomplishments:

- Completed stitched composite structures testing including: (1) Pultruded rod, stitched, efficient, unitized structure (PRSEUS) compression panel testing, (2) PRSEUS curved panel testing at the FAA Full-Scale Aircraft Structural Test Evaluation and Research (FASTER) facility, and (3) PRSEUS cabin noise testing.
- Completed Hybrid Wing Body (HWB) aerodynamic model tests in the 14- by 22-Foot Subsonic Tunnel.

National Aeronautics and Space Administration

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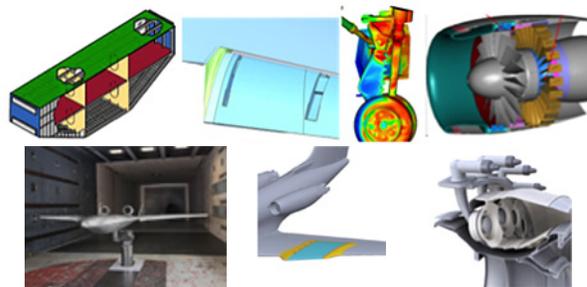
- Completed Gulfstream G550 aerodynamic semi-span model tests in the 14- by 22-Foot Subsonic Tunnel.

LaRC Facilities and Capabilities Used in Research:

14- by 22-Foot Subsonic Tunnel
National Transonic Facility (NTF)
Combined Loads Test (COLTS) Facility
Jet Noise Laboratory
Low Speed Aero-Acoustic Wind Tunnel (LSAWT)
Spin Tunnel
Acoustic Liner Technology Facility
Structural Acoustics Loads & Transmission Facility
Aero-Acoustics Research Lab
Anechoic Quiet-Flow Facility
Human-Response to Noise Laboratory
Acoustics & Dynamics Lab
Interior Effects Room (Structural Acoustics Branch)
James H. Starnes Structures and Materials Lab
Material Research, Composite Processing, Composites and Polymer Labs



Preferred system concepts from ERA for Advanced Vehicle Concepts (AVC) NASA Research Announcement (NRA) N+2 timeframe



ERA Technologies (a-g)

- Lightweight Integrated Structures for weight reduction
- Flap edge treatments for noise reduction
- Lightweight landing gear for noise reduction
- Propulsion technologies
- Propulsion-Airframe Integration (PAI) and Propulsion Airframe Aero-Acoustics (PAA)
- Hybrid laminar flow control via discrete roughness elements
- Advanced Combustors for NO_x reduction

For more information about NASA LaRC aeronautics research, visit <http://aero.larc.nasa.gov/>

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