



ICAO | UNITING AVIATION



# **NASA's Environmentally Responsible Aviation Focus**

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## NASA Aeronautics - Six Strategic Thrusts

### **Safe, Efficient Growth in Global Operations**

- Enable full NextGen and develop technologies to substantially reduce aircraft safety risks

### **Innovation in Commercial Supersonic Aircraft**

- Achieve a low-boom standard

### **Ultra-Efficient Commercial Vehicles**

- Pioneer technologies for big leaps in efficiency and environmental performance

### **Transition to Low-Carbon Propulsion**

- Characterize drop-in alternative fuels and pioneer low-carbon propulsion technology

### **Real-Time System-Wide Safety Assurance**

- Develop an integrated prototype of a real-time safety monitoring and assurance system

### **Assured Autonomy for Aviation Transformation**

- Develop high impact aviation autonomy applications

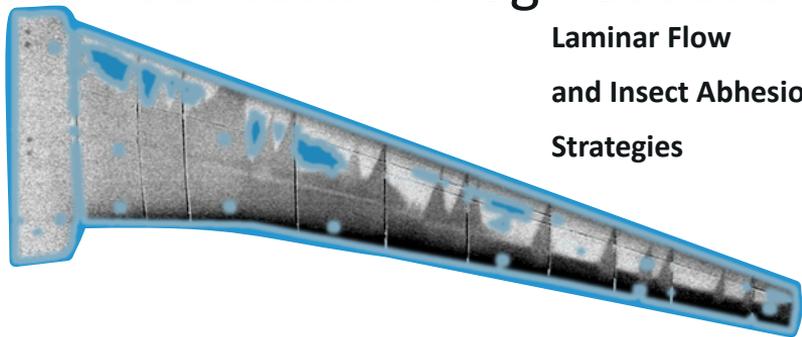


## NASA's Environmentally Responsible Aviation Focus

- Vision
  - expand the viable and well-informed trade space for commercial transport design decisions
  - enable simultaneous realization of national noise, emissions, and performance goals by 2025
- Mission
  - Execute integrated technology demonstrations
  - Partner w/Industry and transfer knowledge
- Scope
  - Mature technology for application in the 2020+ time frame
    - Advance the state-of-the-art, reduce risk of application
  - Perform System/subsystem research in relevant environments

# Technology for Green Commercial Aviation

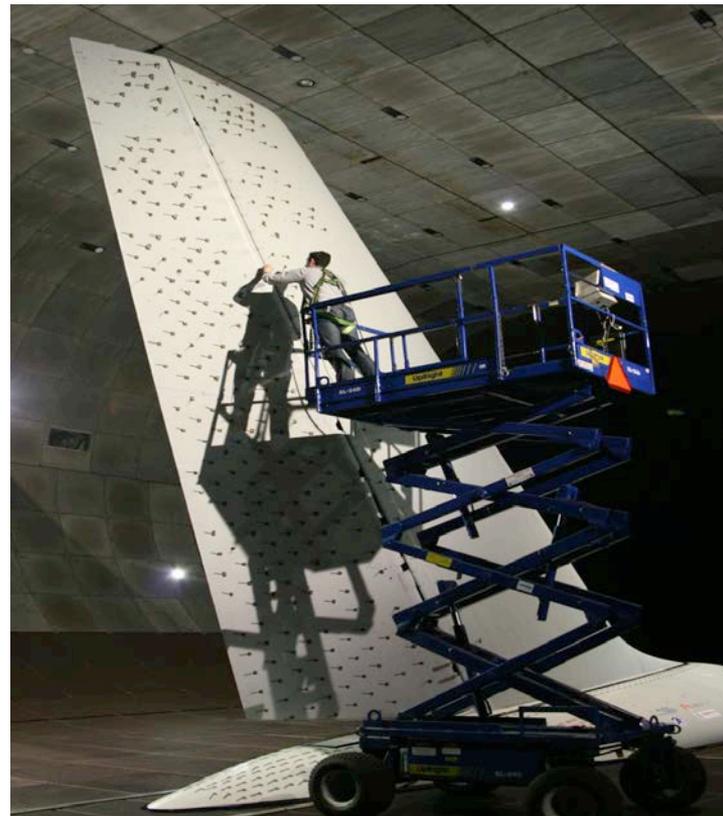
## Reduce Fuel Burn – Drag Reduction by 8 Percent



Laminar Flow  
and Insect Adhesion  
Strategies



B757 eco-Demonstrator Flying Test-bed A/C



Active Flow Control on B757 Tail

# Technology for Green Commercial Aviation

Reduce Fuel Burn – Weight Reduction by 10+ Percent



Pultruded Rod Stitched Efficient Unitized Structure (PRSEUS)

# Technology for Green Commercial Aviation

## Reduce Fuel Burn – Reduce SFC by 15+ Percent

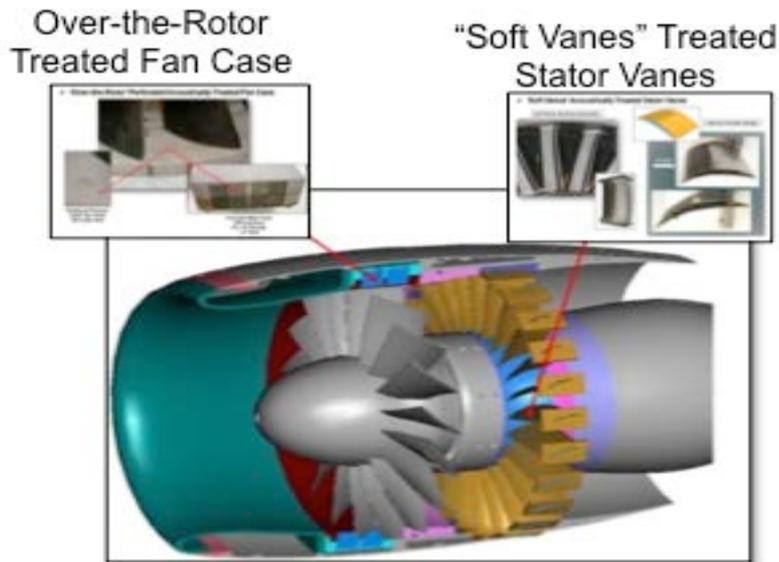
Pratt & Whitney and NASA Demonstrate Benefits of Geared TurboFan™ System in Environmentally Responsible Aviation Project

PARIS AIR SHOW, Wednesday, June 19, 2013

Pratt & Whitney, a United Technologies Corp. (NYSE:UTX) company, recently reached a milestone in the National Aeronautics and Space Administration's (NASA) Environmentally Responsible Aviation (ERA) Project by demonstrating unprecedented performance and efficiency of a Geared TurboFan™ ultra-high bypass system, successfully completing 275 hours of fan rig testing in the NASA Low Speed Wind Tunnel. *This ultra-high bypass technology will be used to create the next generation of Pratt & Whitney's PurePower® Geared Turbofan engines.*

*SFC = Specific Fuel Consumption*

*FEGV = Fan Exit Guide Vane*



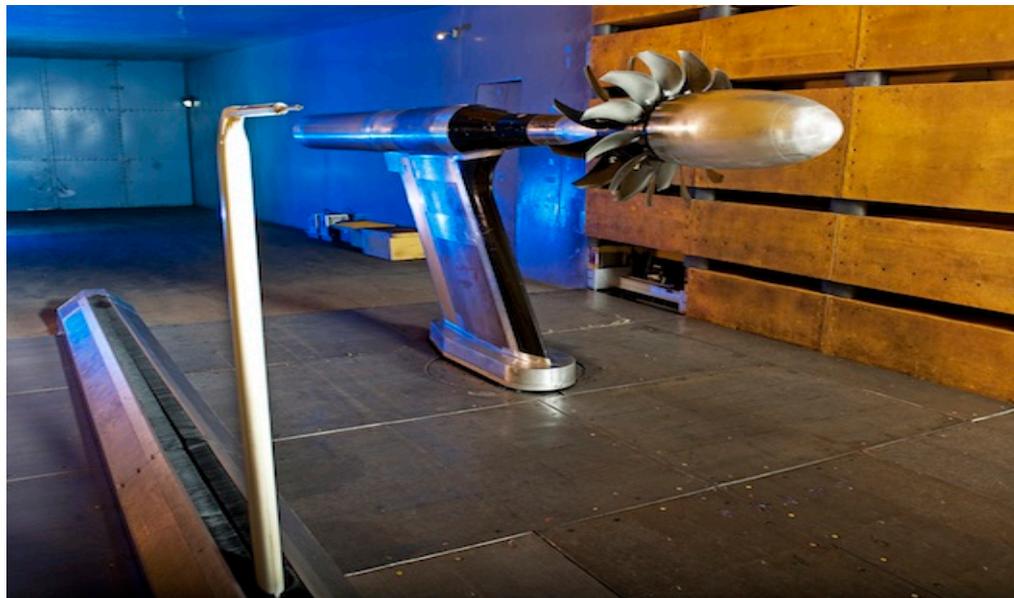
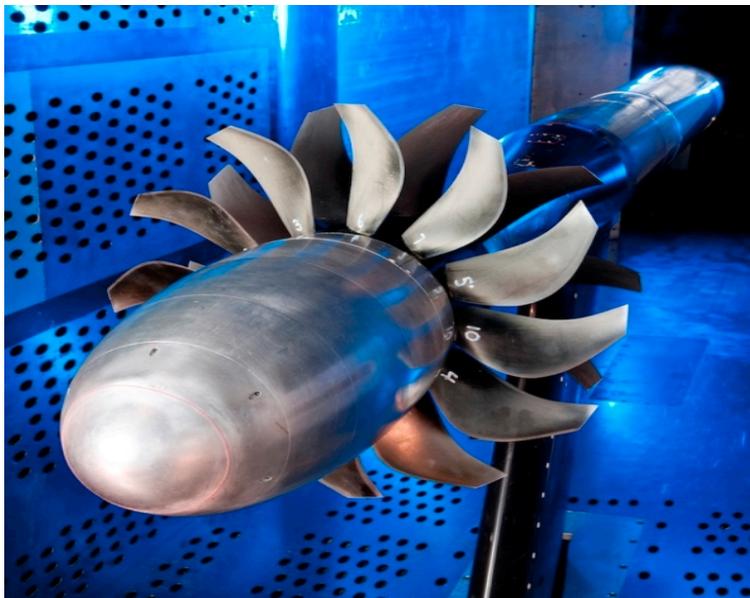
**Ultra High Bypass Propulsor Testing  
Modern Fan**

**Acoustic Treatments**

**Low Loss FEGV & Short Nacelle**

# Technology for Green Commercial Aviation

Reduce Fuel Burn – Reduce SFC by 15+ Percent

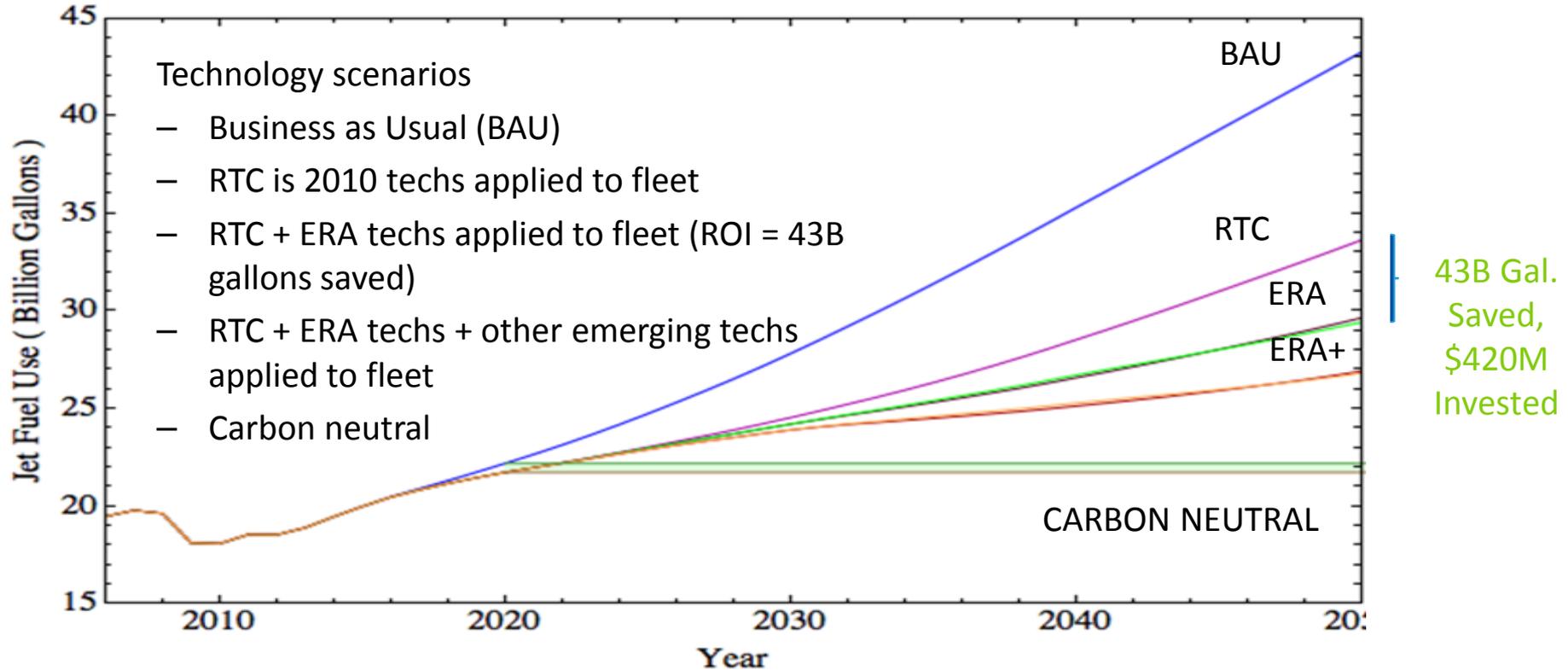


*Open Rotor Propulsion Rig installed in GRC's 8x6 and 9x15 Wind Tunnels (GE)*

This technology applied to advanced 2025 EIS single aisle A/C showed 36 percent block fuel reduction & 15 EPNdB cum. noise margin below Stage 4 (compared to 1998)

SFC = Specific Fuel Consumption

# What may be the impact?



# Advanced Transports for Green Commercial Aviation – 2025+ EIS - 2 examples

