National Aeronautics and
Space Administration

NASA GLENN RESEARCH CENTER

AERONAUTICS RESEARCH

NASA's Glenn Research Center has a long history of supporting and advancing aviation research in the United States, and it is currently working to usher in a commercial air travel revolution. Glenn is researching technologies that are critical in supporting the development of new aircraft concepts and systems for the future of aeronautics.

Our researchers are evolving next-generation aircraft propulsion systems that will significantly reduce the cost, energy consumption, noise and emissions, while opening up new markets and opportunities for U.S. industry. We are also committed to investigating the use of alternative energy sources and improving the safety and expediency of commercial and general aviation.

OUR EXPERTISE

- Advanced propulsion and airframe integration
- Alternative fuels and more-electric aircraft propulsion
- Turbomachinery
- Engine and airframe icing research
- Propulsion acoustics and noise reduction
- Advanced materials and components
- Subsonic, supersonic and hypersonic research and testing

WHAT WE'RE WORKING ON

Icing Research

At NASA Glenn, "We Freeze to Please," as most aircraft icing protection technologies in use today were largely developed here at NASA Glenn.

NASA Glenn, then known as Lewis, began researching aircraft icing in 1944 following the completion of its Icing Research Tunnel (IRT), the longest-running and second-largest icing research facility in the world.

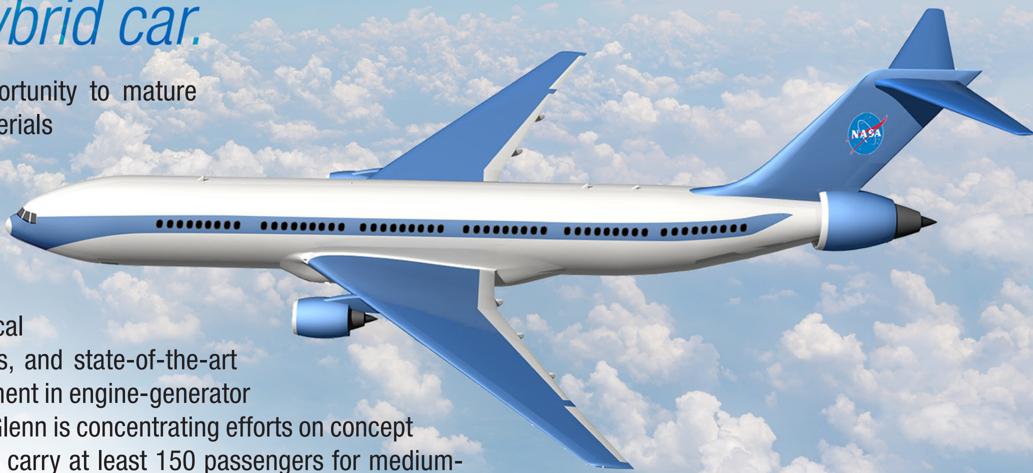
Since then, NASA Glenn has been an international research leader on airframe and engine icing, contributing to an increase in aircraft safety. The center's researchers have provided research and information on the effects of icing conditions—via ground-based testing, software tools and flight evaluations—that has informed regulatory agencies, like the Federal Aviation Administration (FAA).

Today, Glenn's icing research team uses the IRT, the Propulsion System Laboratory, and small-scale laboratories to create icing conditions for models, wing sections and engines on the ground, as well as utilizing flying laboratories to study icing conditions in real time. Glenn is also engaged with industry and academia on exploring new, developmental technologies, like icephobic materials, and in evaluating other potential aircraft icing issues.

Electric Aircraft Propulsion

What does electric aircraft propulsion mean?

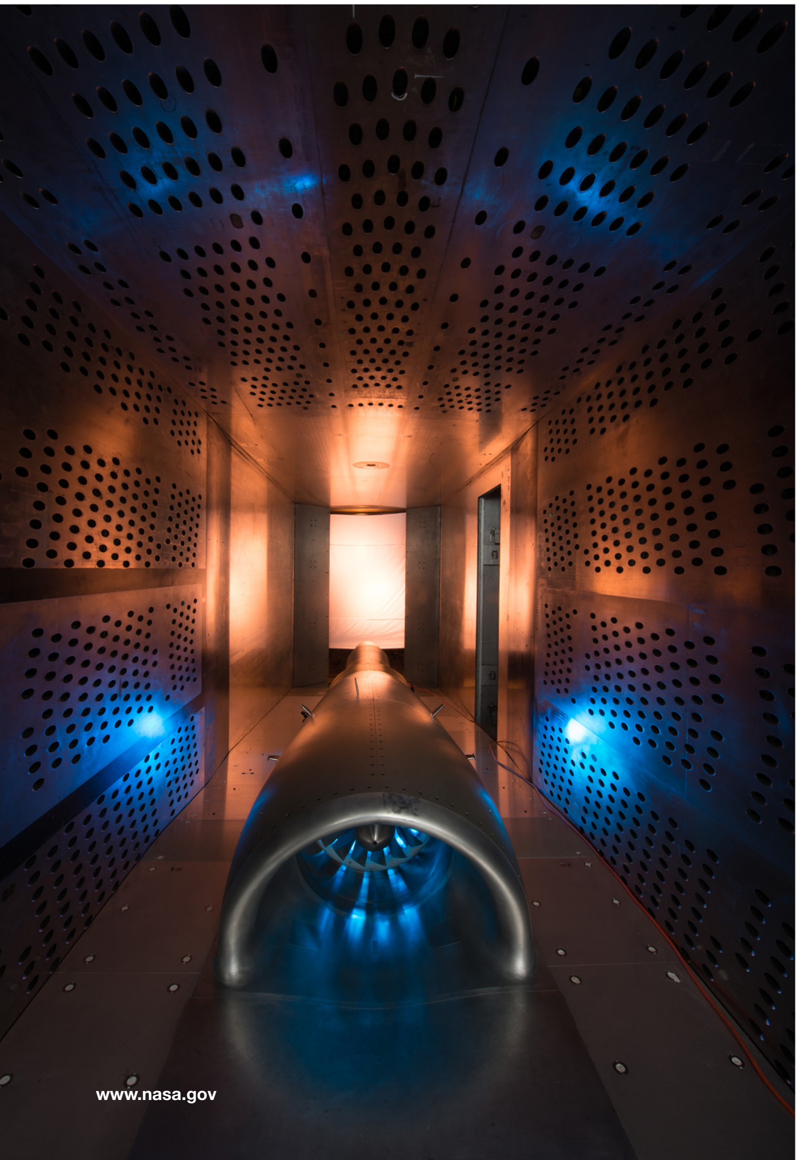
Think of a flying hybrid car.



This research represents an exciting opportunity to mature revolutionary engine technologies and materials that will dramatically improve the fuel efficiency, emissions, and noise levels in commercial transport aircraft.

NASA Glenn's work in this area includes aircraft concepts, propulsion and electrical power systems, components and materials, and state-of-the-art test facilities, along with exploratory investment in engine-generator interactions and boundary-layer ingestion. Glenn is concentrating efforts on concept passenger aircraft that are large enough to carry at least 150 passengers for medium-to-long distances.

Researchers are currently working to understand how electrification of the propulsion system affects things like overall energy during the course of a flight, how batteries might be used to boost power during takeoff and how to reduce drag through the strategic placement of electrically-driven engines.



Advanced Airframe and Propulsion Integration

As an aircraft flies through the sky, it has four major forces acting on it—thrust, drag, weight and lift. Thrust makes an airplane go, drag slows it down and lift offsets the weight to keep it flying One of the main causes of drag on an airplane as it flies is a layer of slower moving air that builds up along the fuselage and wings, which is called the boundary layer.

On today's aircraft, engineers have attempted to decrease boundary layer effects by placing the engines on the wings or tail to move them away from the boundary layer. However, NASA engineers believe they can improve aircraft performance by embedding the engines into the airframe and having engines consume the boundary layer air. By ingesting the boundary layer, drag is significantly decreased, which leads to an improvement in overall aircraft efficiency.

This may sound like a simple change, but it's actually quite challenging. Boundary layer air is extremely turbulent, and that turbulence affects engine performance. To counteract the distorted airflow, these engines will need to be more durable than a typical engine used today.

Engineers at NASA Glenn are currently researching these **Boundary Layer Ingestion** (**BLI**) distortion-tolerant engines, and it's believed this new technology has the potential to reduce the aircraft fuel-burn by as much as 7 percent compared to today's aircraft. In 2016, NASA Glenn successful tested a new BLI distortion tolerant engine in its 8×6 supersonic wind tunnel. The results of this first-of-its-kind test were positive and NASA is continuing its BLI technology research.