NASAfacts

Fundamental Aeronautics Program

The Fundamental Aeronautics Program (FA), part of NASA's Aeronautics Research Mission Directorate, works to enable a future where a variety of advanced aircraft exist that improve the flexibility, efficiency and environmental impact of air travel.

As the nation transitions to an upgraded air-transportation system, Fundamental Aeronautics helps develop the tools, technologies and scientific knowledge to aid in the design of new types of vehicles that will fly faster, cleaner, quieter, and use less fuel.

FA research areas include:

- Revolutionary fixed-wing aircraft and rotorcraft configurations;
- Lighter and stronger materials and structures;
- Improved propulsion systems;
- Advanced computational tools and models; and
- Advanced concepts for increasing lift and reducing drag.

Among the potential benefits of FA research are:

- Reductions in aircraft noise and emissions;
- More efficient operational performance; and
- Increased mobility through an increasingly busy national airspace.

Fundamental Aeronautics also studies ways to improve technology approaches to 21st century supersonic commercial airplanes and hypersonic vehicles.

Images (Clockwise, left to right) **Designing for Efficiency:** This wind tunnel model is of the "D8"—a proposed future aircraft design with a very wide fuselage to provide extra lift, a low-sweep wing to reduce drag and weight, and embedded engines that sit aft of the wings. **Speeding Toward Space:** This artist's rendering is of a NASA concept for a vehicle that uses an airbreathing engine to travel at hypersonic speed to reach the edge of space. **Reimagining Supersonic:** This computer image shows researchers the calculation grid and the calculated airflow over a conceptual supersonic aircraft and engine design. **Improving Rotorcraft:** NASA uses this Large Rotor Test Apparatus to test new technologies that could improve rotor blade noise levels and maneuverability.

FA RESEARCH PROJECTS

Fixed Wing

Fixed-wing aircraft that fly just under the speed of sound comprise the majority of vehicles that move people and goods through the national airspace 24 hours a day, seven days a week. Today's air travel provides an unmatched combination of speed and range, but tomorrow's will require subsonic aircraft that operate far more efficiently while meeting rigorous environmental requirements.

Project research includes exploring and developing the computer software, next-generation technologies and advanced aeronautical concepts necessary for the sustained growth of commercial aviation in the United States. NASA scientists and engineers are studying ways to decrease aircraft noise and emissions, and enhance performance. The resulting scientific knowledge, in the form of experiments, data, calculations, and analyses, is critical for conceiving and designing future air vehicles.

Rotary Wing

Advanced rotary-wing vehicles, or rotorcraft, could alleviate anticipated air-transportation capacity issues by making use of non-primary runways, taxiways and aprons. Project research includes exploring and developing the tools, technologies and knowledge to enable significant rotorcraft improvements, such as increasing rotorcraft speed, range and payload, and decreasing noise, vibration and emissions.

Researchers are also developing improved computer-based prediction methods and technologies to enable design of future high-speed, efficient, commercially viable rotorcraft in a variety of sizes and configurations that can be readily integrated into the U.S. air transportation system.

High Speed

Supersonic air travel has been possible for decades, but has not been commercially viable because of serious environmental and performance challenges, including overland sonic boom annoyance, high fuel consumption, and nitrogen oxide emission at high altitudes. Additional issues include accurate prediction of vehicle control, operation and performance, and future-vehicle design that is multidisciplinary in approach and structurally integrated.

High-speed aircraft research includes developing advanced computer-based prediction methods for supersonic aircraft shape and performance, and advancing technologies that will help eliminate today's technical barriers to practical, commercial supersonic flight. Studies are also underway to expand the foundational knowledge necessary for expanded capabilities for controlled, air-breathing hypersonic flight.

Aeronautical Sciences

Aeronautical Sciences researchers are developing computer algorithms and software models to better understand and predict flight performance for a wide variety of aircraft. Specific examples include computer-aided prediction of air flow around vehicles, and study of new types of strong and lightweight materials and their benefit to commercial aviation.

We're Working on...

"Greener" aircraft: cleaner, quieter and more fuel-efficient

Faster cruise speeds for rotary-wing aircraft like helicopters

Shrinking the sonic-boom "footprint" to make commercial supersonic flights over land practical

Very high-speed flight for potential lower-cost access to space

For more information about the Fundamental Aeronautics Program and NASA aeronautics research, visit **www.aeronautics.nasa.gov/fap/**.

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