National Aeronautics and Space Administration

NASA**facts**

Integrated Systems Research Program

The Integrated Systems Research Program (ISRP), part of NASA's Aeronautics Research Mission Directorate, focuses on the national airspace challenges of mobility, capacity, safety, security, energy and the environment.

The program's primary aim is to help with the nation's transition to the Next Generation Air Transportation System, or NextGen, by developing technologies that can be integrated into future air vehicles and operational systems and subsystems.

ISRP concentrates on proven technologies, and performs testing and validation in an operationally relevant environment. This approach helps to transition advances more quickly to the aviation community and provides direction for future fundamental research. To enhance its relevance, the program's systems level research is guided by the usefulness to and the interest of key aviation stakeholders.

The program synchronizes its work with the long-term, foundational research conducted by other NASA aeronautics programs, and closely coordinates with the research efforts of other federal government agencies.

ISRP organizes its research into two projects. The Environmentally Responsible Aviation Project chooses the most promising vehicle concepts and technologies that can simultaneously reduce aircraft fuel use, noise and emissions. The Unmanned Aircraft Systems Integration in the National Airspace System Project works to reduce the technical barriers to allow the safe and routine operation of unmanned air vehicles in the nation's skies.

Images (Clockwise, left to right) **X-48C Prototype:** A scale model of a blended wing body aircraft design is tested in a NASA wind tunnel. **Unmanned Aerial Systems:** NASA's Ikhana, an unmanned aerial vehicle, represents the type of civil aircraft that needs to be safely integrated into the national airspace. **Advanced Designs:** This possible future aircraft design uses a boxed-wing concept that can reduce drag and improve fuel efficiency. **Advanced Structures/Materials:** Large curved panels made of damage-tolerant composite (nonmetallic) materials are being tested for future use in new aircraft shapes.

RESEARCH AREAS

Environmentally Responsible Aviation Project

Decades of NASA investments in aeronautical research have improved aircraft fuel efficiencies, lowered noise levels and reduced harmful emissions. Although substantial progress has been made, much more needs to be done. That's why NASA created the Environmentally Responsible Aviation Project: to explore and document the feasibility, benefits and technical risk of emerging vehicle concepts and enabling technologies to substantially lessen the environmental impact of aviation.

Environmentally Responsible Aviation, or ERA, invests in:

- Testing unconventional aircraft configurations that improve fuel efficiency through higher lift-to-drag ratios, more efficient propulsion and lighter weight;
- Developing technologies that reduce airport noise and harmful emissions; and
- Assessing the environmental benefit of technologies such as laminar flow, advanced damage-tolerant composite structures and fuel-flexible combustors.

Environmentally Responsible Aviation consists of three subprojects: Airframe Technology, Propulsion Technology and Vehicle Systems Integration. Together, the trio help industry enlarge the viable trade space—that is, the degree to which performance objectives can be traded against each other to achieve the best overall value—to help in designing and building the most environmentally efficient commercial aviation vehicles.

The ERA Project will disseminate all of its research results to the widest practical extent. NASA has also put mechanisms in place to engage academia and industry, including working groups and technical interchange meetings; Space Act Agreements for cooperative partnerships; and the NASA Research Announcement process that provides for full and open competition for the best and most promising research ideas.

Unmanned Aircraft Systems in the National Airspace System

Monitoring fires, analyzing climate change, making weather observations, even tracking endangered species: these are but a few of the tasks assigned to Unmanned Aircraft Systems, or UAS, as they take to the skies and make use of the National Airspace System, or NAS. These, and other missions of vital importance to national security and defense, emergency management, and basic science, are all adding to the increased pressure to allow routine access of UAS in the NAS.

Despite these needs and vital contributions, currently UAS routine access is limited by many barriers such as a lack of automated separation assurance integrated with collision avoidance systems, robust communication technologies, robust human systems integration, and few standardized safety and certification guidelines.

Federal aviation regulations have been built upon a fundamental assumption: that humans will be present in and will pilot all aircraft. With the introduction and success of UAS, this assumption has been recast. The goal of the UAS Integration in the NAS Project is to use integrated, system-level tests in a relevant environment to reduce the technical barriers associated with the safety and operational challenges of UAS NAS access.

We're Working on...

"Green" airplane designs that will fly cleanly, quietly and very fuel efficiently

Reducing drag to improve fuel efficiency by 50% or more

Dramatically more lightweight, damage-tolerant structures that can be easily adopted by aircraft manufacturers

New technologies that will enable autonomous aircraft to operate safely and routinely in the nation's airspace system

For more information about the Integrated Systems Research Program and NASA aeronautics research, visit **www.aeronautics.nasa.gov/programs_isrp.htm.**

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