National Aeronautics and Space Administration

NASA
Fundamental Aeronautics Program

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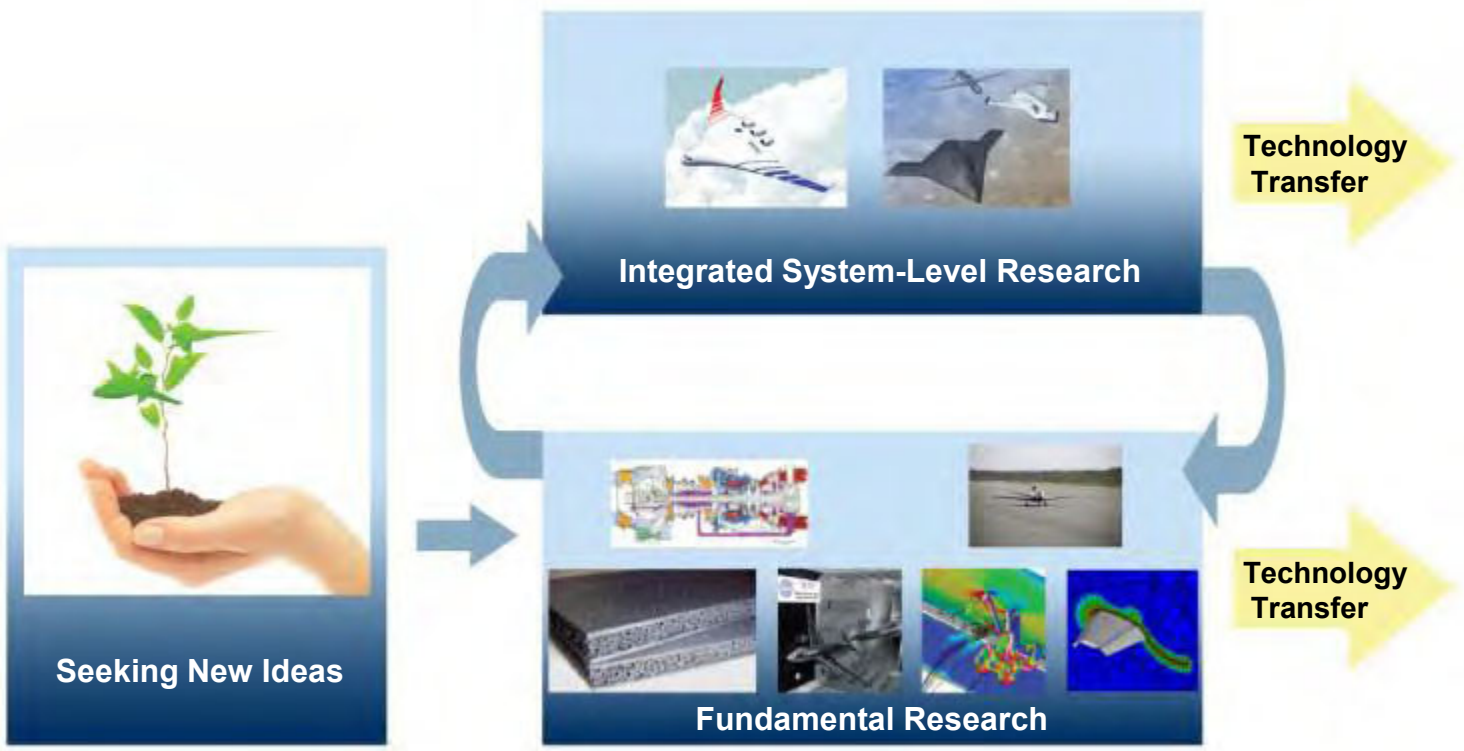
Fundamental Aeronautics 2011 Annual Meeting
March 15, 2011

Meeting Overview

Fundamental Aeronautics 2011 Annual Meeting

- 3-day meeting to communicate details of work pursued by the Fundamental Aeronautics Program. Interaction is important.
- 4 parallel technical sessions with more than 120 presentations focused on the technical content of each Fundamental Aeronautics Project:
  - Subsonic Rotary Wing
  - Subsonic Fixed Wing
  - Supersonics
  - Hypersonics
- Plenary talk Wednesday Luncheon:
  - "A Historian Looks to the Past... to Peer Into the Future."
    Dr. Tom D. Crouch, Senior Curator, Aeronautics
    National Air and Space Museum, Smithsonian Institution
- Feedback sessions, one-on-one meetings
  - Projects
  - Program Office

NASA Aeronautics Investment Strategy



Enabling "Game Changing" concepts and technologies from advancing fundamental research ultimately to understand the feasibility of advanced systems

Aeronautics Programs




Fundamental Aeronautics Program

Integrated Systems Research Program



Airspace Systems Program


Aviation Safety Program



Aeronautics Test Program


Fundamental Aeronautics Program Overview

Overarching goal:

To achieve technological capabilities necessary to overcome national challenges in air transportation including reduced noise, emissions, and fuel consumption, increased mobility through a faster means of transportation, and the ability to ascend/descend at very high speeds through atmospheres.

Subsonic Fixed Wing (SFW)

Enable revolutionary energy efficiency improvements of subsonic/transonic transport aircraft that dramatically reduce harmful emissions and noise for sustained growth of the air transportation system.

Subsonic Rotary Wing (SRW)

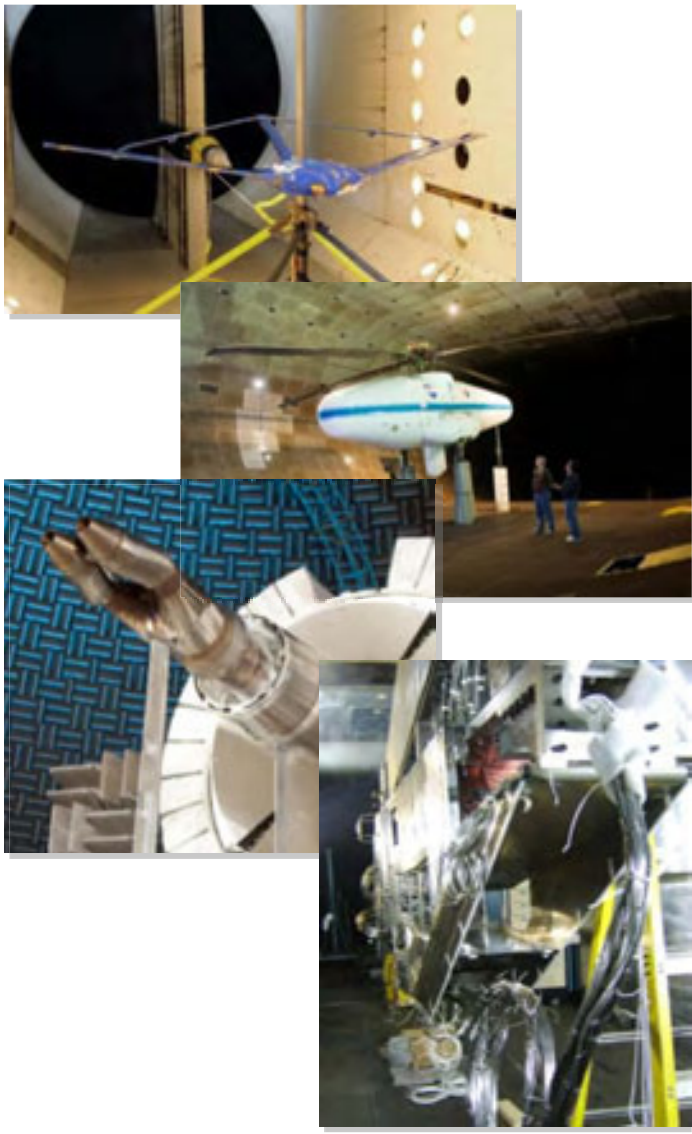
Radically improve the transportation system using rotary wing vehicles by increasing speed, range, and payload while decreasing noise, **vibration**, and emissions.

Supersonics (SUP)

Eliminate environmental and performance barriers that prevent practical supersonic vehicles (cruise efficiency, noise and emissions, performance, boom acceptability).

Hypersonics (HYP)

Enable airbreathing access to space and high mass entry, descent, and landing into planetary atmospheres.



Vastly Different Flight Regimes

Subsonic Fixed Wing


1903 — 1930s — 1950s — 2000s

- Many millions of flight hours
- Most utilized form of air transportation

Subsonic Rotary Wing


1907 — 1940s — 1950s — 1990s

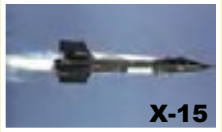
- Significant military & light civil helicopter use
- Limited tilt-rotor experience

Supersonics

1947 — 1970s

- Only 20 Concordes built – no longer in service
- Overland supersonic flight prohibited

Hypersonics



1961 — 2000s

- Few experimental flights
- Air-breathing hypersonic flight experience measured in ~~seconds~~ minutes

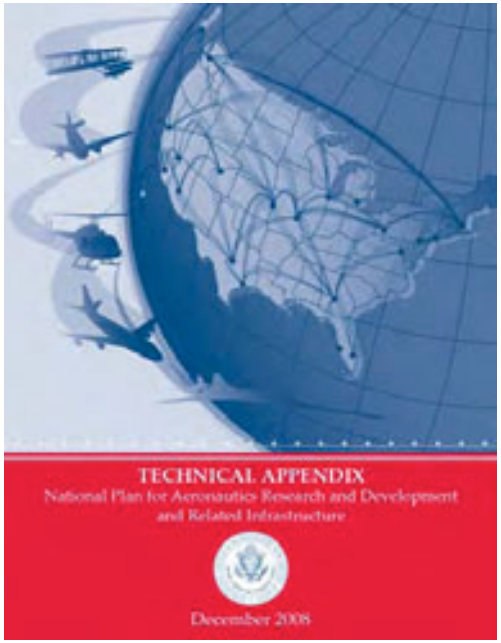
National Aeronautics Policy & Plan; NASA Strategic Plan

- National Aeronautics R&D Policy (Dec 2006) and Plan (Dec 2007, Feb 2010),
  - "Mobility through the air is vital…"
  - "Aviation is vital to national security and homeland defense"
  - "Assuring energy availability and efficiency is central…" and "The environment must be protected…"
- NASA Strategic Plan
  - Strategic Goal 4: "Advance aeronautics research for societal benefit"
- NextGen: The Next Generation Air Transportation System
  - Joint Planning Development Office (JPDO), Vision 100 (2003)
  - Revolutionary transformation of the airspace, the vehicles that fly in it, and their operations, safety, and environmental impact

Key Principles: Energy and Environment

Assuring energy availability and efficiency is central to the growth of the Aeronautics Enterprise and the environment must be protected while sustaining growth in air transportation.

- Goal 1: Enable New Aviation Fuels Derived from Diverse and Domestic Resources to Improve Fuel Supply Security and Price Stability
- Goal 2: Advance Development of Technologies and Operations to Enable Significant increases in the Energy Efficiency of the Aviation System
- Goal 3: Advance Development of Technologies and Operational Procedures to Decrease Significant Environmental Impacts of the Aviation System



Key Principles: Mobility and Security

Mobility Through the Air is Vital to Economic Stability, Growth and Security as a Nation

•Goal 5: Develop Expanded Manned and Unmanned Aircraft System Capabilities to Take Advantage of Increased Air Transportation System Performance.

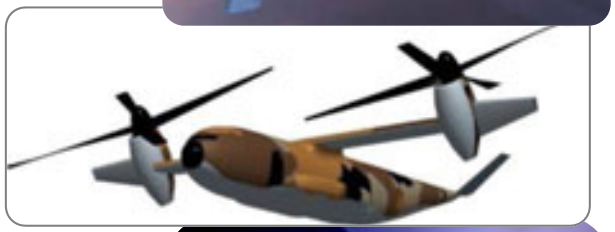
Aviation is Vital to National Security and Homeland Defense

•Goal 1: Demonstrate Increased Cruise Lift-to-Drag and Innovative Airframe Structural Concepts for Highly Efficient High-Altitude Flight and for Mobility Aircraft

•Goal 2: Develop Improved Lift, Range, and Mission Capability for Rotorcraft

•Goal 3: Demonstrate Reduced Gas Turbine Specific Fuel Consumption

•Goal 5: Demonstrate Sustained, Controlled Hypersonic Flight



Supporting Fundamental Research for the Agency

Enable new capabilities to support other NASA missions

- Efficient and safe transition of large payloads through an atmosphere requires new technologies.
- Airbreathing propulsion systems offer potential for significant improvements in access to space, but understanding of key physical characteristics and development of new systems are still in early phases.
- ARMD conducts vital foundational research that is the “seed corn” for advances in other areas of the Agency.

Flow-down from National Plan

Mobility is Vital

- Goal 5: Expanded Capabilities → SFW, SUP, SRW

Energy & Environment

- Goal 1: Alt. Fuels → SFW
- Goal 2: Increased Energy Efficiency → SFW
- Goal 3: Reduced Environmental Impact → SFW, SUP, SRW

National Defense

- Goal 1: Increase Cruise Lift to Drag → SFW, SUP
- Goal 2: Improved Rotorcraft → SRW
- Goal 3: Reduced Engine SFC → SFW, SUP
- Goal 5: Sustained Hypersonic Flight → HYP

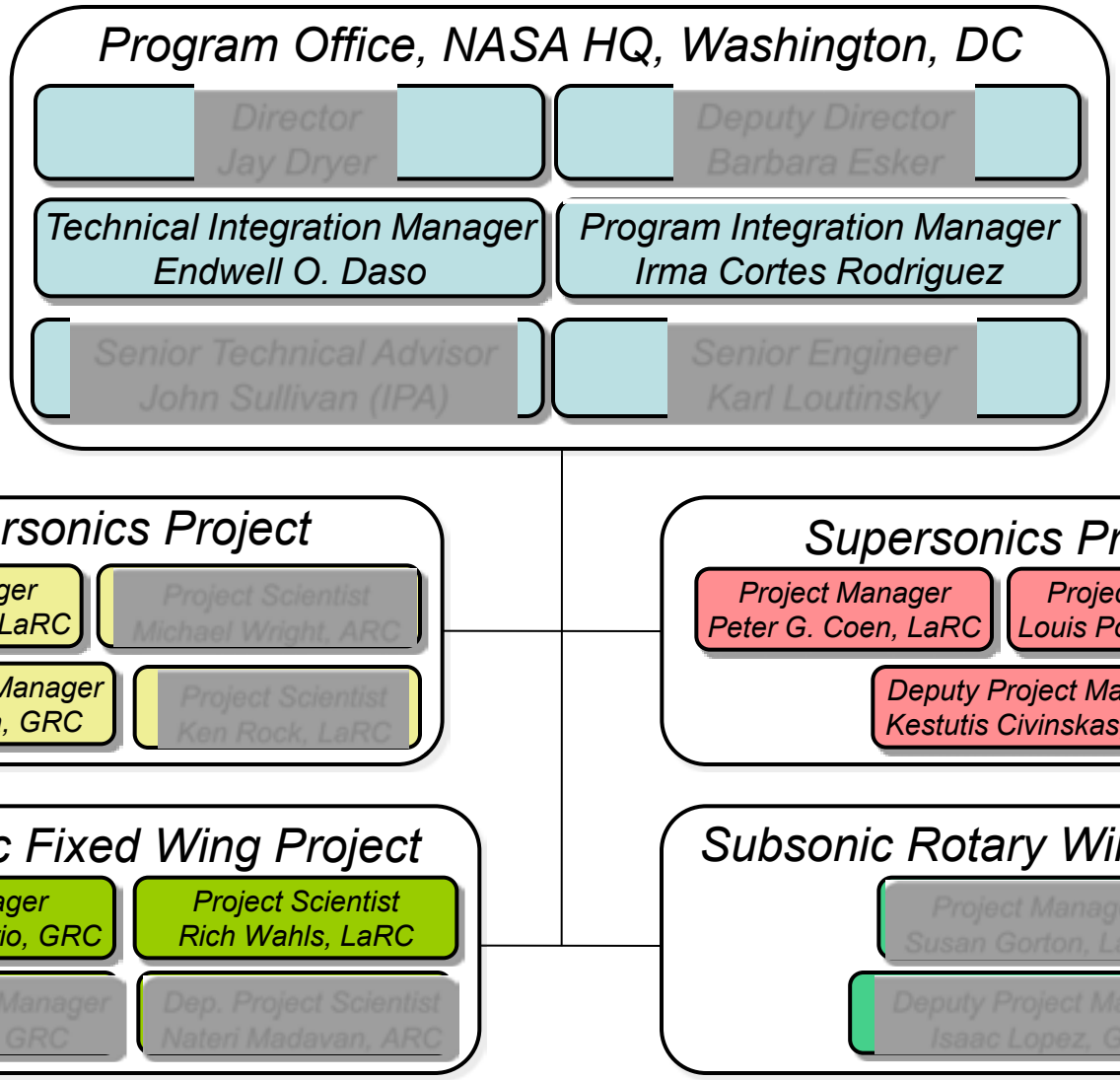
FA Program Focus Areas

Support for National Objectives

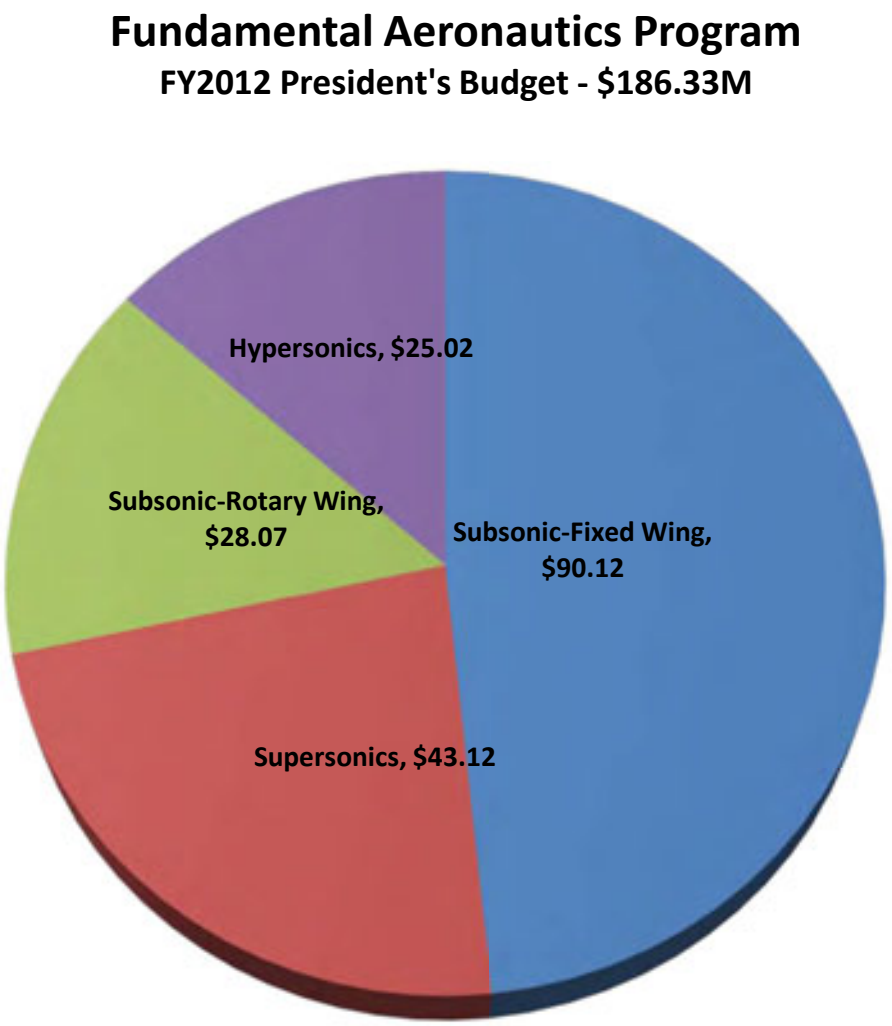
→ Strong Focus

→ Supporting Role

Fundamental Aeronautics Program Team



FY2012 President's Budget



Note: The budget represents the FY 2012 full cost budget submitted on the FY12 President's Budget

Collaboration with External Partners

Other Government Agencies

U.S. Industry

NORTHROP GRUMMAN
LOCKHEED MARTIN
Gulfstream
Raytheon
BOEING
Sikorsky
A United Technologies Company
Bell Helicopter

Academia

International Organizations

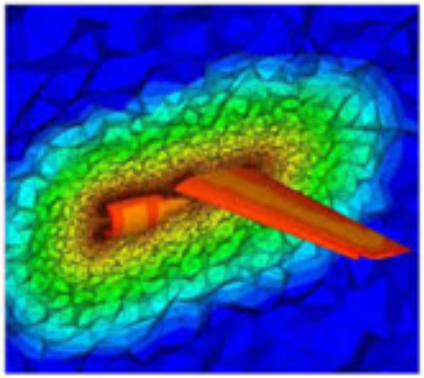
Aeronautics

NASA Research Announcement Partnerships

The Research Opportunities in Aeronautics (ROA) NRA continues to be an extremely successful component of the ARMD research portfolio.

- Open to academic institutions and industrial and non-profit organizations.
- Full and open competition which encourages participation from a broad range of organizations.
- Thorough annual review process for on-going technical quality and relevance to the project, program, and Mission Directorate goals.
- Efforts complement NASA in-house expertise and provides a collaborative mechanism between NASA and non-NASA researchers.
- Research solicitation topics are generated by project leadership based on input from sub-project leaders, and technical line organizations and are based on identified technology gaps.

N+3 Future Systems Study



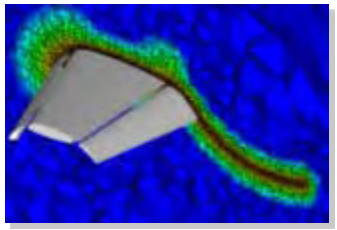
Computational Fluid Dynamics

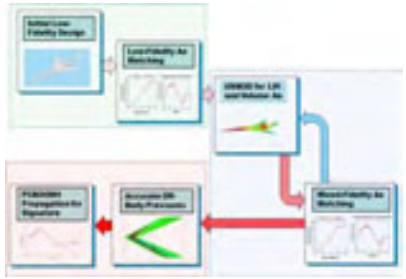
SYSTEM FOCUSED ⟷ **FOUNDATIONAL**

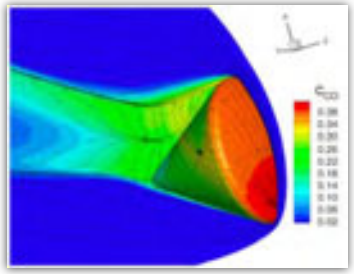
Key Technical Challenges

Early in FY09, ARMD directed the projects to focus their efforts around key Technical Challenges that represent game-changing capabilities for the vehicle flight regimes. This Focusing was also endorsed by several Independent Review Panels.

- Project planning is focused on what is required to meet the Technical Challenges.
- The Technical Challenges are utilized in prioritizing the portfolios.
- Technical challenges still vary in scope from Project to Project depending on a number of factors.
- Projects' Technical Challenges will be presented in their respective briefings.







Key Questions to Address

- What are you trying to do? Articulate your objectives.
- How is it done today, and what are the limits of current practice?
- What's new in your approach and why do you think it will be successful?
- Who cares? If you're successful, what difference will it make?
- What are the risks and the payoffs?
- How much will it cost? How long will it take?
- What are the midterm and final "exams" to check for success?

The answers to these questions help effectively communicate what we are doing, why it is important and how we ensure that it is progressing appropriately.

The FA Program is Making an Impact

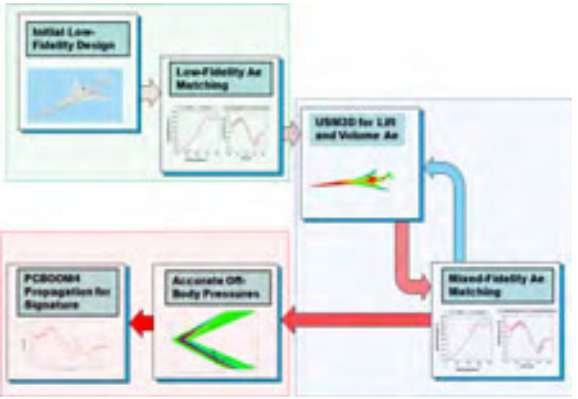
Producing world-class data

Creating the next generation of tools to process information

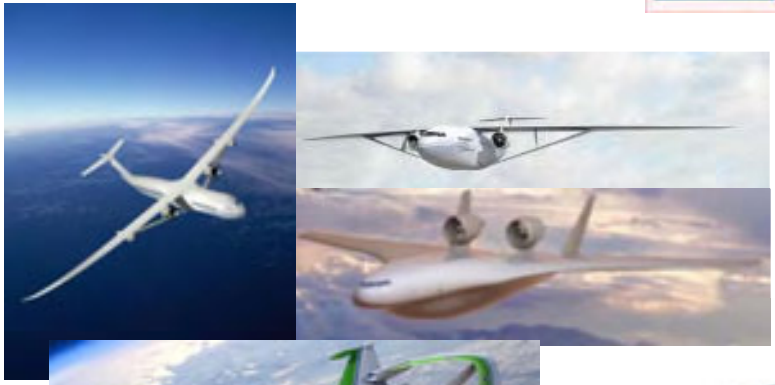
Generating knowledge to advance the field of aeronautics

Inventing technologies that make a difference

UH-60 Airloads

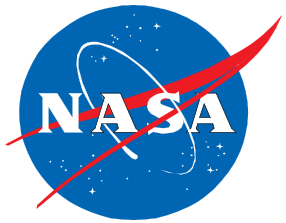


Advanced Design Tools



N+3 Studies

Inflatable Re-Entry Systems


NASA