National Aeronautics and Space Administration

NASA Aeronautics Research

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Alignment with National Goals

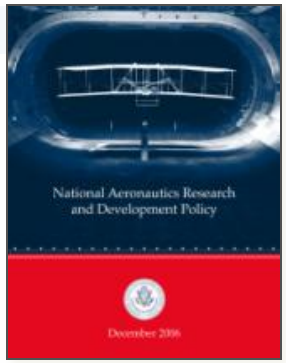
How do we know we are working on the right goals?

National Aeronautics Research and Development Policy

"NASA and in consultation with other Federal agencies shall develop a national aeronautics policy to guide the aeronautics programs of the Administration through 2020" – Science, State, Justice, Commerce, and Related Agencies Appropriation Act, 2006 (Public Law 109 – 108 - November 22, 2005)

•Executive Order signed by President Bush, December 2006

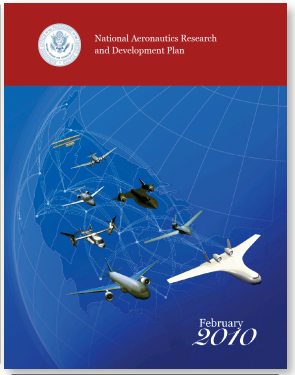
- Outlines principles to follow in order for the U.S. to "maintain its technological leadership across the aeronautics enterprise"



National Plan for Aeronautics Research and Development and Related Infrastructure

Original plan signed by White House December 2007; Biennial update signed Feb 2010

- Goals and objectives for mobility, national security and homeland defense, aviation safety, energy and the environment (except workforce which is being worked under a separate activity)
- Summary of system-level challenges identified with specific quantitative targets



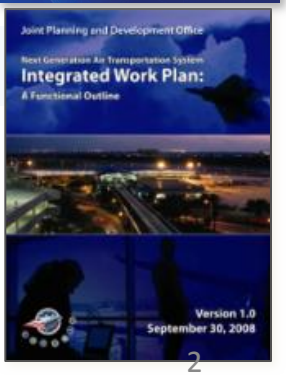
Vision 100 Century of Aviation Reauthorization Act and the Integrated Work Plan (IWP)

Vision100: Public Law 108-176, December 2003

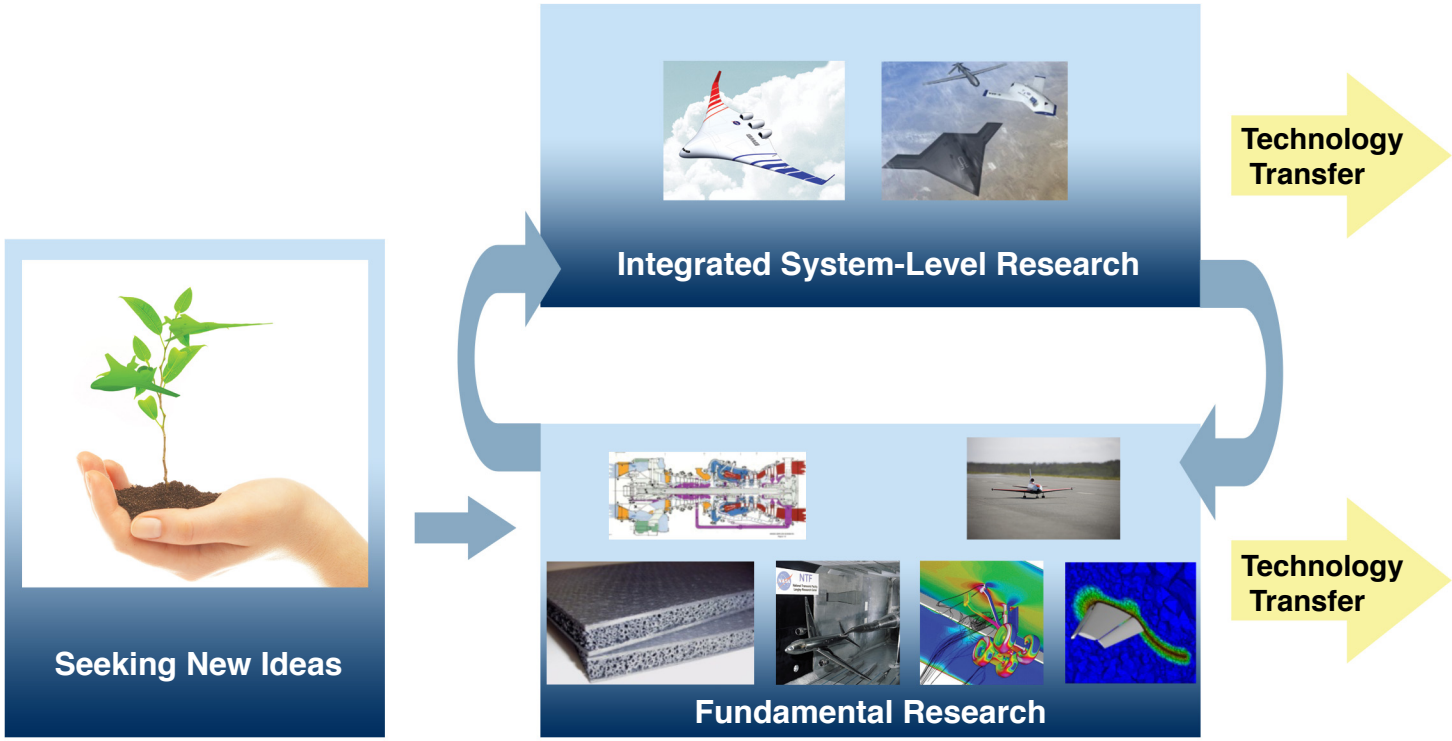
- Established the Joint Planning and Development Office (JPDO) to engage multiple agencies to plan, develop and implement the Next Generation Air Transportation System (NextGen)

IWP: Version 1.0 Released September 2008

- Functional outline of activities needed to achieve the NextGen Vision



NASA Aeronautics Investment Strategy



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

NASA Aeronautics Programs

Fundamental Aeronautics Program

Conduct cutting-edge research that will produce innovative concepts, tools, and technologies to enable revolutionary changes for vehicles that fly in all speed regimes.

Integrated Systems Research Program

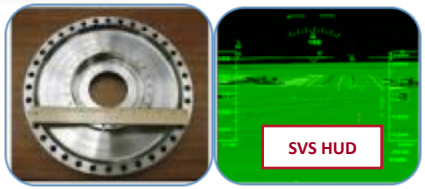
Conduct research at an integrated system-level on promising concepts and technologies and explore/assess/demonstrate the benefits in a relevant environment.

Airspace Systems Program

Directly address the fundamental ATM research needs for NextGen by developing revolutionary concepts, capabilities, and technologies that will enable significant increases in the capacity, efficiency and flexibility of the NAS.

Aviation Safety Program

Conduct cutting-edge research to produce innovative concepts, tools, and technologies to improve the intrinsic safety attributes of current and future aircraft and air traffic management systems.



Aeronautics Test Program

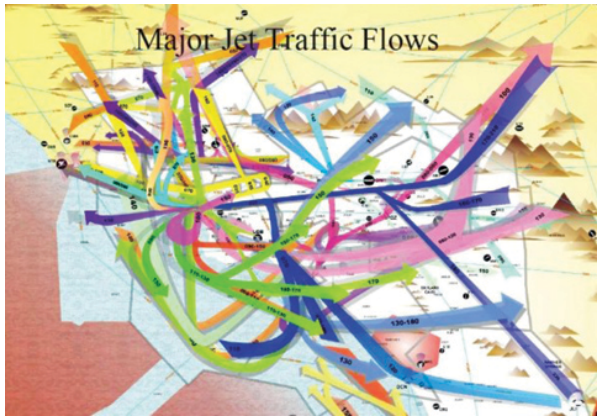
Preserve and promote the testing capabilities of one of the United States' largest, most versatile and comprehensive set of flight and ground-based research facilities.

NextGen Operations

Problem

Current ground delay policy at SFO can lead to excessive unrecoverable delays due to fog

$ 0.5M FAA Collaborative Agreement Contribution



San Francisco Bay area air traffic flows

Approach

Conducted a simulation recommending Ground Delay Program (GDP) parameters for SFO airport. Merges National Weather Service real-time data with Air Traffic Control departure scheduling.

Results

Significant near-term reduction in ground delays at San Francisco Airport.

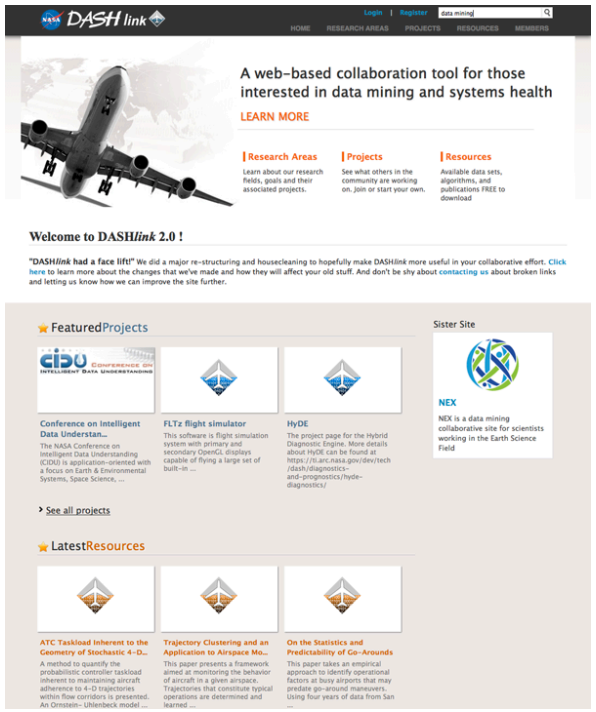
Next Steps

- Brief FAA Air Traffic Control System Command Center (Dec. 2010)
- Delivery of implementation plan (Jan. 2010)

Partners: FAA, Mosaic ATM, and MIT Lincoln Laboratory

Data Mining for Aviation Safety

- NASA has open-sourced key data mining software for analyzing flight data recorder output through DASHlink, a collaborative website with over 300 members
- Southwest Airlines acquired sequenceMiner and Orca, two advanced anomaly detection techniques, through DASHlink
- Early application of these techniques to data from 7200 flights uncovered flight events specified in SWA's Flight Operations Manual that were not caught by SWA's existing analysis methods
- Events flagged by these software tools will be added to SWA's daily operations review to improve operational performance
- Southwest plans to incorporate these software tools into daily use – 1600 flights/305 planes.
- Five year non-reimbursable Space Act Agreement is being drafted



SOUTHWEST
FLIGHT OPS SAFETY
Flight Data Analysis Program

Environmentally Friendly Vehicles

Since July 2007, NASA has conducted more than 80 flights of the Hybrid Wing Body X-48B aircraft, in partnership with the U.S. Air Force, Boeing, and Cranfield Aerospace Ltd.

Benefits to the Public

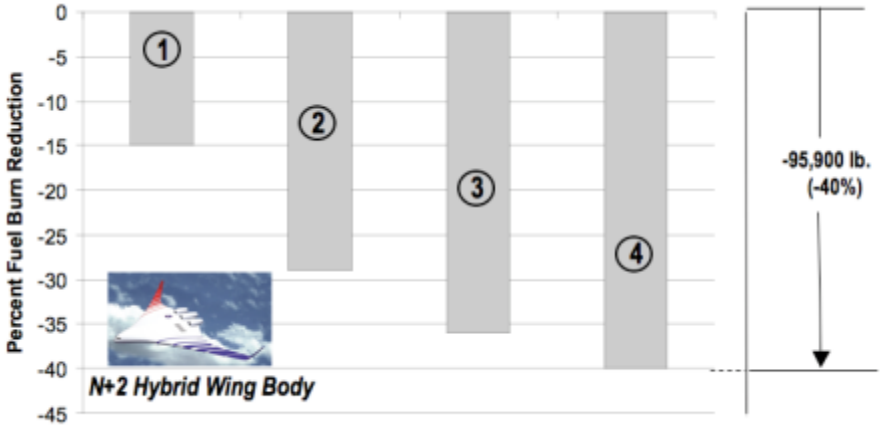
Fuel burn savings:
Over 40% reduction from current aircraft

Emissions reduction:
Local air quality: 50% less NOx
Global climate: 40% less CO_2

Noise reduction
1/6th the objectionable ground noise footprint of current aircraft

Vehicle Estimated Fuel Savings*

Achieving Significantly Reduced Fuel Burn Will Require Integration of Multiple Technologies



1 = Hybrid wing configuration
2 = + advanced engine and airframe technologies
3 = + embedded engines with BLI inlets
4 = + laminar flow

* NASA systems analysis results. Reductions relative to B777 with GE90 engines.

Advanced Vehicles System Study

Description: Completed four 18-month "Advanced Concept Studies for Commercial Subsonic Transport Aircraft Entering Service in the 2030-35 Period". Study is intended to stimulate far-term thinking towards future aircraft needs and identify key technology needs to meet the challenges.

Results:

- Lower cruise speeds at higher altitude (~40-45k ft)
- Heading toward BPR 20 (or propeller) with small, high efficiency core
- Higher wing aspect ratio and laminar flow to varying degrees
- Uniquely enabling concepts/technologies emerged (strut/truss, double bubble, hybrid-electric (battery) propulsion for example)
- Broadly applicable technology advances needed (for example lightweight materials, high-temp materials, gust load alleviation)

Boeing, GE, Georgia Tech

Impact: Results used as key information to guide future investment in the SFW project. Phase 2 investigations to follow.

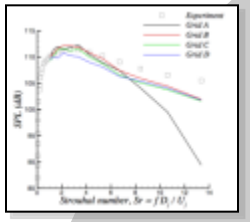
MIT, Aurora, P&W, Aerodyne

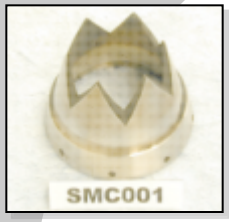
Chevrons - The Road From Idea to Deployment

Initial service entry, 2002

Systems Assessment: 2001-2005

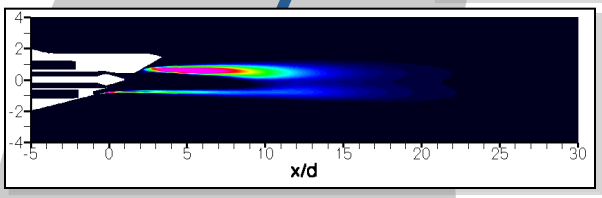
- *Ground-test evaluation in engine test stands*
- *Flight evaluation in relevant environments*

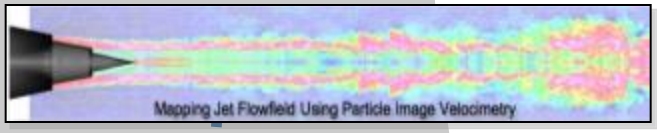


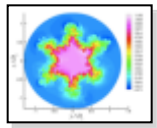


Fundamental Research: 1996-2000

- *Computational and experimental research to develop a fundamental understanding of the fluid mechanics governing the effectiveness of the concept*
- *Development of practical implementations (chevrons)*







Seedling Idea: 1994-1996

Basic studies on jet mixing suggest that tabs can enhance jet mixing, with the potential to reduce noise

Boeing 747-8 with Chevron Nozzles

Source: The Boeing Company

ARMD Internal Concepts for Innovation in Aeronautics
(ARMD Seedling Activity)

What is the ARMD Seedling Fund?

- The Seedling Fund is an element of a new ARMD investment strategy to explore early-stage innovative ideas for aeronautics
- While all of the R&D conducted in Aeronautics programs is innovative, the Seedling Fund fills a gap by investing in high-risk, high-payoff concepts at the bottom of the TRL (Technology Readiness Level) scale
- The Seedling Fund is intended to support primarily in-house work conducted by NASA Civil Servants (CS) on efforts that span one to two years.
- Funds are awarded through selection of short proposals solicited annually
- 20 proposals selected and $3M awarded in FY11 phase I; FY12 proposal call will be coming out soon

What the Seedling Fund is NOT:

- The Seedling Fund is NOT intended to:
  - Supplement funded R&T projects
  - Serve as a gap-filler when program funds are insufficient
  - Provide last-resort coverage for AFNW or WYE
  - Serve as a core competency preservation fund
  - Restore funding to activities canceled by other funding sources