

AERONAUTICS

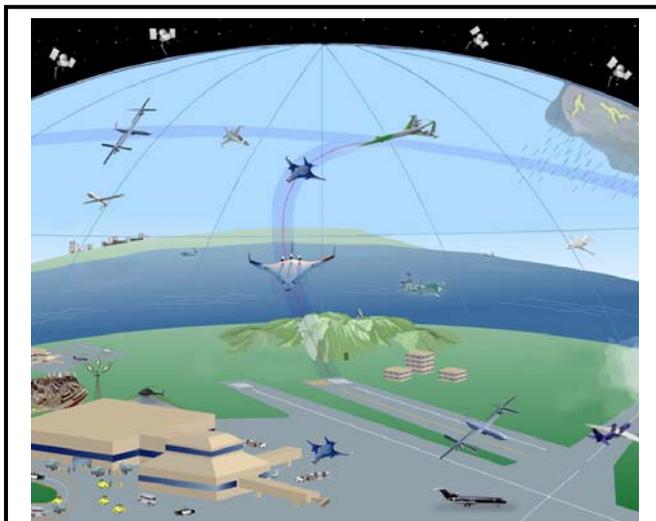
Budget Authority (in \$ millions)	Actual	Estimate		Notional			
	FY 2011	FY 2012		FY 2013	FY 2014	FY 2015	FY 2016
FY 2013 President's Budget Request	533.5	569.4	551.5	551.5	551.5	551.5	551.5
Aviation Safety	67.3	80.1	81.1	81.0	81.4	81.9	82.5
Airspace Systems	87.2	92.7	93.3	92.6	91.9	91.2	90.5
Fundamental Aeronautics	206.3	186.3	168.7	171.3	173.3	175.3	177.1
Aeronautics Test	76.4	79.4	78.1	78.0	78.0	78.1	78.2
Integrated Systems Research	75.9	104.2	104.0	102.3	101.2	100.1	98.8
Aero Strategy and Management	20.4	26.7	26.4	26.2	25.7	25.0	24.4

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FY 2013 BUDGET

Budget Authority (in \$ millions)	Actual	Estimate	FY 2013	Notional			
	FY 2011	FY 2012		FY 2014	FY 2015	FY 2016	FY 2017
FY 2013 President's Budget Request	533.5	569.4	551.5	551.5	551.5	551.5	551.5
Aviation Safety	67.3	80.1	81.1	81.0	81.4	81.9	82.5
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Integrated Systems Research	75.9	104.2	104.0	102.3	101.2	100.1	98.8
Aeronautics Strategy and Management	20.4	26.7	26.4	26.2	25.7	25.0	24.4
Change From FY 2012 Estimate	--	--	-17.9				
Percent Change From FY 2012 Estimate	--	--	-3.1%				



NASA is creating safer, greener, and more efficient air travel through research to enable fuel-efficient flight planning while reducing aircraft fuel consumption, emissions, and noise.

As an industry, aviation contributes \$1.3 trillion dollars to the Nation's economy and is responsible for 10 million jobs in aviation related fields. Airlines in the United States transport over one million people daily, but during peak travel times the air traffic and airport systems in the United States are stretched to capacity. Environmental concerns, such as aircraft noise and emissions, limit increased operations and the expansion of airports and runways. NASA's Aeronautics Research Mission Directorate (ARMD) works to solve these critical challenges that affect our nation's air transportation system and growth of the economy, while improving safety of the system that is already the safest mode of transportation.

ARMD houses four research programs, including the Aviation Safety program, Airspace Systems program, Fundamental

Aeronautics program, and Integrated Systems Research program. These programs conduct cutting-edge research at the fundamental levels and integrated systems levels to address these national challenges. That research supports current and emerging applications, as well as revolutionary concepts and technologies that could one day change the face of air transportation. Also, ARMD's Aeronautics Test program enables research through its critical support to NASA's infrastructure needs. The Aeronautics Strategy and Management program identifies new innovative aviation concepts through ARMD seedling funds. These seedling funds provide the opportunity to explore early stage innovative ideas by conducting research, analysis, and proof-of-concept demonstrations in areas of strategic importance to the solution of aeronautics challenges.

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Aeronautics programs also support the development of the Next Generation Air Transportation System (NextGen). NextGen is the name given to a new National Airspace System that proposes to transform America's air traffic control system from an aging ground-based system to a satellite-based system. NextGen technology will provide advanced levels of automated support to air navigation service providers and aircraft operators enabling shortened routes for time and fuel savings, reduced traffic delays, increased capacity, and permitting controllers to monitor and manage aircraft with greater safety margins. This transformation has the aim of reducing gridlock, both in the sky and at airports.

ARMD expands the boundaries of aeronautical knowledge for the benefit of the Nation through partnerships with academia, industry, and other government agencies, helping to foster a collaborative research environment in which ideas and knowledge are exchanged across multiple communities. These collaborations help ensure the future competitiveness of the Nation's aviation industry.

EXPLANATION OF MAJOR CHANGES FOR FY 2013

In FY 2013, the Fundamental Aeronautics (FA) program will be restructured to facilitate research on targeted advanced vehicle and technology capabilities. Research into crosscutting capabilities that benefit a variety of air vehicles will be consolidated, and hypersonic systems research will be merged with supersonic research into a single project that will focus on fundamental research for high-speed flight. Ongoing fundamental research on entry, decent, and landing technologies will be transferred to the Space Technology account.

ACHIEVEMENTS IN FY 2011

The NASA Aeronautics programs made significant progress towards their research goals in FY 2011 including:

- NASA developed a highly capable data mining algorithm that searches data from thousands of flights to discover unusual events that could be precursors to safety issues;
- NASA also made significant achievements using the En Route Descent Advisor tool. Providing air traffic controllers with speed and path changes to allow efficient arrival profiles to reduce flight time, fuel consumption, noise, and emissions, it results in more environmentally friendly en route and terminal operations;
- Through wind tunnel tests, NASA verified advanced supersonic aircraft models that produce significantly less sonic boom. These aircraft concepts were designed using NASA-developed computer-based tools for predicting aircraft shape and performance. These tools allowed supersonic aircraft shapes to be accurately and quickly assessed for sonic boom and other key attributes of successful supersonic aircraft flight such as aircraft efficiency and control; and
- NASA completed several conceptual design studies which identified advanced vehicle concepts and associated technology suites capable of simultaneously reducing community noise, emissions and fuel burn. The studies defined preferred system concepts for advanced vehicles that can operate safely within the NextGen.

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KEY ACHIEVEMENTS PLANNED FOR FY 2013

The NASA Aeronautics programs will continue their planned research activities with the goal of further advancing the field of aviation. The following highlights include a few of the key activities:

- NASA will complete the high ice water content flight campaign. Data from the campaign will provide a detailed understanding of atmospheric conditions that are conducive to high ice water engine icing. NASA aims to use this research to significantly reduce the impact of engine ice crystal icing and support new engine icing certification requirements proposed by the FAA.
- NASA will develop and test the dynamic weather routes capability in order to provide a tool to identify aircraft routes that will save time, fuel and distance under severe weather conditions.
- NASA will explore the viability of widely variable speed transmissions for rotorcraft using a new variable-speed transmission test facility at GRC. This capability enables high-speed, efficient rotorcraft operations, and initial testing indicates 25 percent savings are possible.

BUDGET EXPLANATION

The FY 2013 request is \$551.5 million. This represents a \$17.9 million decrease from the FY 2012 estimated level (\$569.4 million). This change includes labor and programmatic adjustments.

Programs

AVIATION SAFETY PROGRAM (AVSP)

AvSP provides knowledge, concepts, and methods to the aviation community to manage increasing complexity in the design and operation of vehicles and the air transportation system. This includes advanced approaches to enable improved and cost effective verification and validation of flight critical systems. AvSP provides knowledge, concepts, and methods to avoid, detect, mitigate, and recover from hazardous flight conditions and to maintain vehicle airworthiness and health. The program will investigate sources of risk and provide technology needed to help ensure safe flight in and around atmospheric hazards.

AIRSPACE SYSTEMS PROGRAM (ASP)

ASP develops and explores fundamental concepts, algorithms, and technologies to increase throughput of the National Airspace System (NAS) and achieve high resource efficiency. The program transitions key technologies from the laboratory to the field by integrating surface, terminal, transitional airspace, and en route capabilities to enable operational enhancements envisioned by NextGen.

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FUNDAMENTAL AERONAUTICS (FA)

The FA program conducts fundamental research to improve aircraft performance and minimize environmental impacts, explores advanced capabilities and configurations for low boom supersonic aircraft, and radically improves the civil effectiveness of rotary wing vehicles by increasing speed, range, and payload while decreasing noise and emissions.

AERONAUTICS TEST PROGRAM (ATP)

ATP ensures the strategic availability, accessibility, and capability of a critical suite of aeronautics ground test facilities and flight operations assets to meet Agency and national aeronautics testing needs.

INTEGRATED SYSTEMS RESEARCH PROGRAM (ISRP)

ISRP conducts research on promising concepts and technologies at an integrated system level. The program explores, assesses, and demonstrates the benefits of these potential technologies in a relevant environment.

AERONAUTICS STRATEGY AND MANAGEMENT

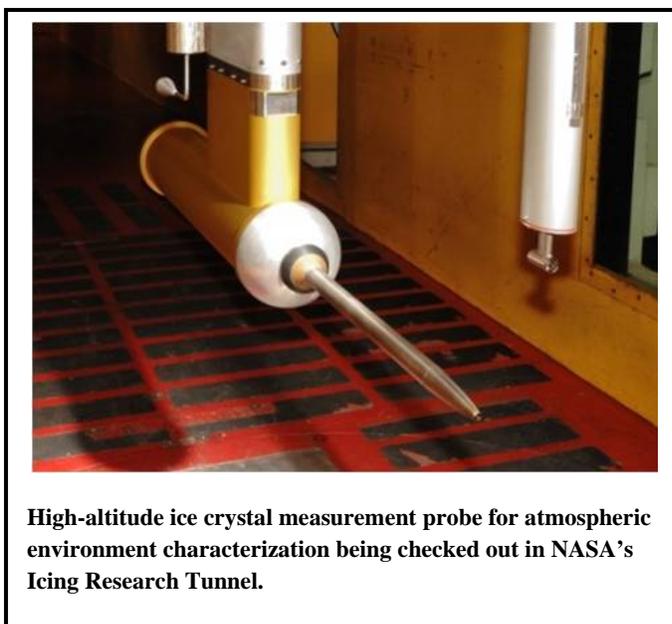
The Aeronautics Strategy and Management program explores novel concepts and new processes in aeronautics, funds institutional expenses for the Mission Directorate, funds the NASA portion of the Joint Planning and Development Office (JPDO) costs, and provides education and outreach opportunities for a wide variety of interested participants of all ages.

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AVIATION SAFETY PROGRAM (AvSP)

FY 2013 BUDGET

Budget Authority (in \$ millions)	Actual	Estimate	FY 2013	Notional			
	FY 2011	FY 2012		FY 2014	FY 2015	FY 2016	FY 2017
FY 2013 President's Budget Request	67.3	80.1	81.1	81.0	81.4	81.9	82.5
Change From FY 2012 Estimate	--	--	1.0				
Percent Change From FY 2012 Estimate	--	--	1.2%				



High-altitude ice crystal measurement probe for atmospheric environment characterization being checked out in NASA's Icing Research Tunnel.

The current U.S. air transportation system is widely recognized to be among the safest in the world. Over the past 10 years, the commercial accident rate has continued to drop, a credit to industry and government working together to solve problems and proactively identify new risks. However, the demand for air traffic is expected to continue to increase substantially in the next 10 to 20 years, and while NextGen will meet this demand by enabling efficient passage through the increasingly crowded skies, it will come with increased reliance on automation and operating complexity. Therefore, the vigilance of the aviation community must continue for the United States to meet the public expectations for safety in this complex, dynamic domain. To meet the challenge, AvSP develops cutting-edge technologies to

improve the intrinsic safety of current and future aircraft that will operate in NextGen. AvSP's contributions range from providing fundamental research and technologies on known or emerging safety concerns, to working with partners in addressing new safety challenges for NextGen. The program has three primary objectives:

- Continue to improve aviation system-wide safety;
- Advance the state-of-the-art of aircraft systems and flight crew operations; and
- Address the inherent presence of atmospheric risks to aviation.

AvSP has developed research plans with milestones and metrics in technology areas corresponding to these objectives. All areas emphasize innovative methods and use a systems analysis approach for identifying key issues and maintaining a research portfolio that addresses national aviation safety needs.

For more information, see http://www.aeronautics.nasa.gov/programs_avsafe.htm.

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AVIATION SAFETY PROGRAM (AVSP)

EXPLANATION OF MAJOR CHANGES FOR FY 2013

None.

ACHIEVEMENTS IN FY 2011

In FY 2011, NASA developed a highly capable data mining algorithm that searches data from thousands of flights to discover unusual events that could be precursors to safety issues. The algorithm successfully detected three operationally significant anomalies, data points that are significantly different from the majority of the data, across 177,000 flights. When anomalies are detected, airlines investigate the events and take corrective action if needed.

In FY 2011, NASA successfully demonstrated self-healing concepts to mitigate damage in metals and composites that are widely used in commercial aircraft construction. If left untreated, damage propagation can result in failure of aircraft structural components. Self-healing materials may eventually reduce the negative effects of minor structural damage that can be hard to detect by human observers.

In FY 2011, NASA completed several design reviews and prepared sophisticated instruments for a two-year flight campaign that will characterize the natural ice crystal environment associated with high ice water content clouds. These clouds are common in large, high-moisture thunderstorms found in the tropics. Flight through them has been determined to occasionally cause engine power interruptions and damage.

KEY ACHIEVEMENTS PLANNED FOR FY 2013

In FY 2013, NASA and its partners will complete the high ice water content flight campaign. Data from the campaign will provide a detailed understanding of atmospheric conditions that are conducive to high ice water engine icing. Atmospheric measurements will support NASA's tests on actual aircraft engines in the Propulsion Systems Lab, as well as development of computational tools designed to uncover why and where icing accretes inside engines. Through these activities, NASA aims to significantly reduce the impact of engine ice crystal icing and support new engine icing certification requirements proposed by the FAA.

In FY 2013, NASA will work with partners to develop and demonstrate an advanced aircraft health management capability known as a Vehicle-Level Reasoning System (VLRS). This system will actively monitor the operating status of key aircraft systems and subsystems and investigate root causes of adverse events. When a possible fault is detected in an onboard system, VLRS will probe that system and use data mining and machine learning capabilities to compare its internal readings with large operational databases of similar systems. It will then develop hypotheses about the cause of a problem and consider the likelihood of those causes. With this knowledge, VLRS will be able to estimate the remaining useful life of the affected system. This understanding can be presented to the flight crew to aid decision making.

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AVIATION SAFETY PROGRAM (AVSP)

BUDGET EXPLANATION

The FY 2013 request is \$81.1 million. This represents a \$1.0 million increase from the FY 2012 estimate (\$80.1 million). This increase reflects an adjustment in labor pricing, not program content. The budget includes:

- \$29.7 million for System-Wide Safety and Assurance Technologies;
- \$36.4 million for Vehicle Systems Safety Technologies; and
- \$14.9 million for Atmospheric Environment Safety Technologies.

Projects

SYSTEM-WIDE SAFETY AND ASSURANCE TECHNOLOGIES

The goal of system-wide safety and assurance technologies research is to provide knowledge, concepts, and methods to proactively manage increasing complexity in the design and operation of vehicles in the air transportation system. To meet this goal, the following challenges are being addressed:

- Safely incorporate technological advances in avionics, software, automation, and concepts of operation by developing verification and validation tools for manufacturers and certifiers to use to assure flight critical systems are safe in a rigorous and cost- and time-effective manner;
- Understand and predict system-wide safety concerns of the airspace system and vehicles by developing technologies that can use vehicle and system data to accurately identify precursors to potential incidents or accidents;
- Improve operator effectiveness within aviation systems by incorporating design elements that enhance human contributions to aviation safety; and
- Predict the life of complex systems by developing technologies that can reason under uncertainty about root causes, predict faults and remaining useful life across multiple systems, and aid decision making across multiple systems.

VEHICLE SYSTEMS SAFETY TECHNOLOGIES

The goal of vehicle systems safety technologies research is to identify risks and provide knowledge needed to avoid, detect, mitigate, and recover from hazardous flight conditions, and to maintain vehicle airworthiness and health. To meet this goal, the following challenges are being addressed:

- Demonstrate new capabilities that enable pilots to better understand and respond safely to complex situations;
- Develop and demonstrate new integrated health management and failure prevention technologies to ensure the integrity of vehicle systems between major inspection intervals and maintain vehicle state awareness during flight; and

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AVIATION SAFETY PROGRAM (AVSP)

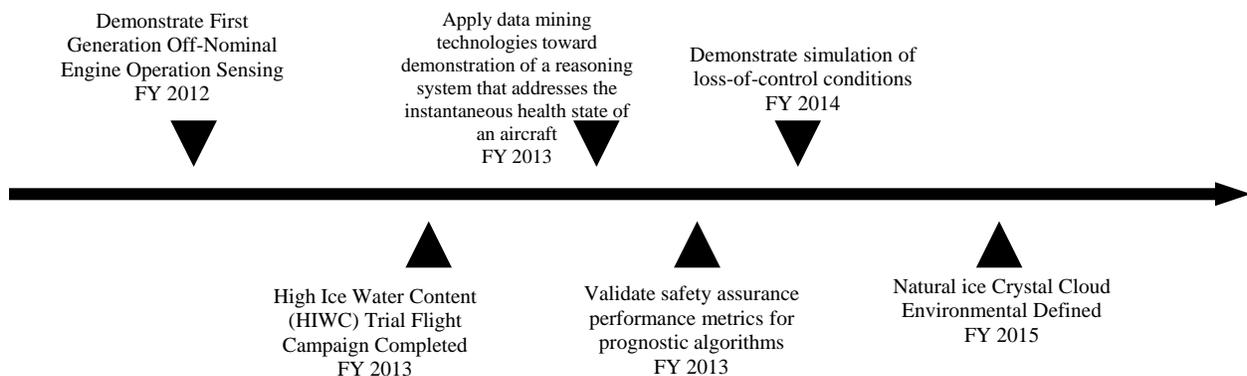
- Develop and evaluate integrated guidance, control, and system technologies that enable safe and effective crew/system aircraft control under hazardous conditions.

ATMOSPHERIC ENVIRONMENT SAFETY TECHNOLOGIES

The goal of atmospheric environment safety technologies research is to investigate sources of risk and provide technology needed to help ensure safe flight in and around atmospheric hazards. To meet this goal, the following challenges are being addressed:

- Address the atmospheric hazard of in-flight icing, of both engine and airframe, in cooperation with the icing community to characterize the various icing environments, develop remote sensors to detect conditions, understand and model the effects of ice accretion, and support the development of methods to mitigate the conditions; and
- Sense and mitigate other risks associated with other atmospheric hazards that pose serious threats to aviation.

Program Schedule



Program Management & Commitments

The ARMD Associate Administrator has oversight responsibility for the program. The program director oversees program portfolio formulation, implementation, evaluation, and integration of results with other ARMD and NASA programs.

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AVIATION SAFETY PROGRAM (AvSP)

Project/Element	Provider
System Wide Safety and Assurance Technologies	Provider: ARC, DFRC, GRC, LARC Project Management: HQ NASA Center: ARC, DFRC, GRC, LARC Cost Share: Boeing, Commercial Aviation Safety Team (CAST), DoD, easyJet, FAA, Honeywell, JPDO, ONERA, Southwest Airlines
Vehicle Systems Safety Technologies	Provider: ARC, DFRC, GRC, LARC Project Management: HQ NASA Center: ARC, DFRC, GRC, LARC Cost Share: A&P Technology, Alcoa Technical Center, American Airlines, ANSYS, Boeing, CAST, Cessna Aircraft Co., DOD, DLR, FAA, General Electric Aircraft Engines, Goodrich, Honeywell, JPDO, Makel Engineering, Moog, National Aerospace Laboratory of the Netherlands, ONERA, Pratt and Whitney, United Technologies Corp., University of South Carolina, Wichita State University
Atmospheric Environmental Safety Technologies	Provider: DFRC, GRC, LARC Project Management: HQ NASA Center: DFRC, GRC, LARC Cost Share: Boeing, CAST, DOD, Environment Canada, FAA, Honeywell, INTA (Instituto Nacional de Técnica Aeroespacial), JPDO, National Research Council Canada (NRCC), ONERA

Acquisition Strategy

AvSP spans research and technology from foundational research to integrated system capabilities. This broad spectrum necessitates the use of a wide array of acquisition tools relevant to the appropriate work awarded externally through full and open competition. Teaming among large companies, small businesses, and universities is highly encouraged for all procurement actions.

MAJOR CONTRACTS/AWARDS

NASA's aeronautics programs award multiple smaller contracts which are generally less than \$5 million. They are widely distributed across academia and industry.

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AVIATION SAFETY PROGRAM (AVSP)

INDEPENDENT REVIEWS

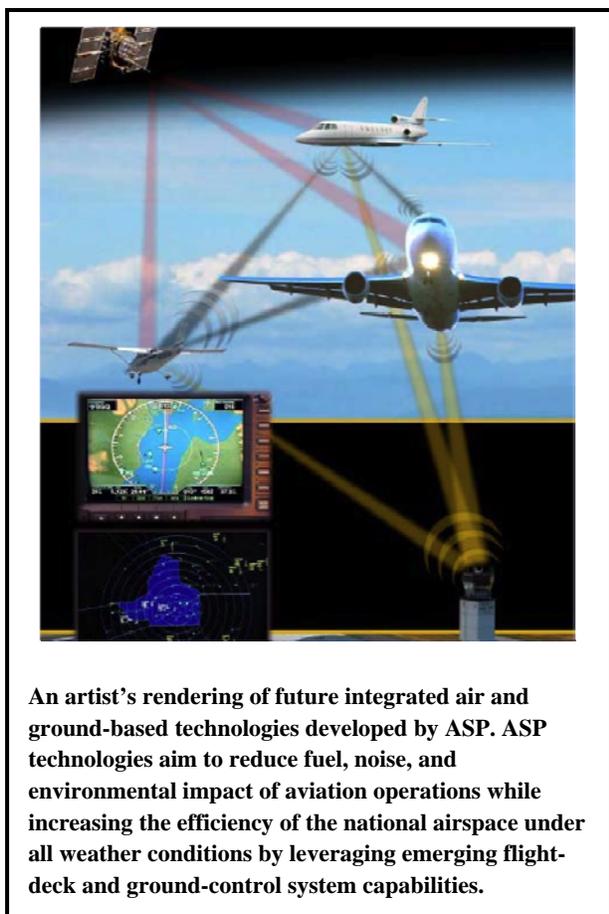
Review Type	Performer	Last Review	Purpose/Outcome	Next Review
Performance	Expert Review	Nov-11	The 12-month review is a formal independent peer review. Experts from other government agencies report on their assessment of technical and programmatic risk and program strengths and weaknesses.	12-Nov

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AIRSPACE SYSTEMS PROGRAM (ASP)

FY 2013 BUDGET

Budget Authority (in \$ millions)	Actual	Estimate	FY 2013	Notional			
	FY 2011	FY 2012		FY 2014	FY 2015	FY 2016	FY 2017
FY 2013 President’s Budget Request	87.2	92.7	93.3	92.6	91.9	91.2	90.5
Change From FY 2012 Estimate	--	--	0.6				
Percent Change From FY 2012 Estimate	--	--	0.6%				



An artist’s rendering of future integrated air and ground-based technologies developed by ASP. ASP technologies aim to reduce fuel, noise, and environmental impact of aviation operations while increasing the efficiency of the national airspace under all weather conditions by leveraging emerging flight-deck and ground-control system capabilities.

Increasing the capacity and efficiency of the air transportation system in a manner that continues to improve aviation safety and the impact on the environment is critically important to the Nation's economic well being. More than half of the Nation's busiest airports are already at capacity or are expected to reach capacity limits in the next 10 to 20 years. The associated environmental economic impacts are predicted to cost the Nation tens of billions of dollars annually. The risk of accidents caused by aircraft coming too close to one another, during airborne or ground operations, could increase as the volume of air traffic continues to climb towards exceeding the capacity of the airspace and airports.

ASP directly addresses the air traffic management research needs of the NextGen. While ASP’s research is uniquely focused on the development of concepts and tools that could be implemented in the far-term, it does have relevance in the near-term as well. NASA collaborates with other Government agencies, industry, and academic partners to bring the best talent and ideas to address the technical challenges and improve technology transfer to the users of its research products.

These new NextGen technologies will allow significant increases in capacity, efficiency, and flexibility of the National Airspace System (NAS). These advanced concepts and technologies will determine future roles and responsibilities for air traffic management functions performed by humans and automation in the aircraft and on the ground. The concepts will reduce delays caused by adverse weather by utilizing aircraft preferences that take into account weather information and forecast uncertainties across the spectrum of time horizons. The research will reduce noise, emissions, fuel consumption, and delays through automation, which will provide the most optimum aircraft flight paths and non-stop taxiing. In addition, system safety will be enhanced on the ground through automated aircraft-based runway and taxiway collision avoidance and in the air

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AIRSPACE SYSTEMS PROGRAM (ASP)

through automated signaling and recommendations for avoidance of conditions in which aircraft come too close to one another and compromise safety. This research will enable the seamless operation and utilization of the full potential capabilities of new aircraft types such as advanced rotorcraft, unmanned aerial systems (UAS), high-speed aircraft, and hybrid wing body.

For more information, please see http://www.aeronautics.nasa.gov/programs_asp.htm.

EXPLANATION OF MAJOR CHANGES FOR FY 2013

None.

ACHIEVEMENTS IN FY 2011

NASA developed a promising technology called Terminal-Tactical Separation Assured Flight Environment (T-TSAFE). T-TSAFE uses a trajectory algorithm based on available flight intent information that includes flight plans, area navigation departure routes, speed restrictions, and altitude clearances. Terminal airspace surrounds airports to a radius of about 40 miles. Air traffic controllers managing this airspace guide aircraft as they approach or depart and must maintain separation standards. Separation standards can change depending upon factors such as aircraft weight class, type of approach, visual versus instrument flight rules, and whether the aircraft is transitioning to or from en route airspace. T-TSAFE is able to predict the future positions of aircraft and check them for possible conflicts with significantly fewer false alerts. NASA continues to address additional T-TSAFE challenges to include traffic density, turning angle, and flight plan data availability.

NASA also made significant achievements using the En Route Descent Advisor tool. This tool that provides air traffic controllers with speed and path changes that will allow efficient arrival profiles. En Route Descent Advisor's innovation is its transformation of operations from existing procedures to ones that reduce flight time, fuel consumption, noise, and emissions, thus resulting in more environmentally friendly en route and terminal operations. This research supports NASA's goal to increase efficiency and throughput of aircraft operations during the arrival phase of flight and is scheduled for completion in FY 2012. The tool has been transitioned to the FAA.

KEY ACHIEVEMENTS PLANNED FOR FY 2013

In 2013, NASA will address research in separation assurance, safe and efficient surface operations at airports, traffic management, and airspace configurations en-route and in the terminal airspace environment.

In the area of weather-integrated air traffic management research, NASA will develop and test the dynamic weather routes capability. The objective of the dynamic weather routes technology is to provide a tool to identify aircraft and routes that will save time, fuel and distance under severe weather conditions. This research will extend voice-based automation to incorporate data link communication between the aircraft and the ground-based controller for equipped aircraft and automation at the sector controller

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AIRSPACE SYSTEMS PROGRAM (ASP)

stations. With data communication capability, more precise routes can be created and exchanged between air and ground, thereby increasing efficiency. The goal is to streamline the coordination between airlines and controllers required to implement dynamic weather routes and thereby achieve greater savings for airspace users and reduced workload for air traffic controllers. Additional goals are to determine how best to identify, evaluate, and implement dynamic weather routes for multiple flights simultaneously.

Airport surface operations work in 2013 will include conducting human-in-the-loop simulations for scheduling the movement of aircraft from gates, taxiways, and runways and assuring conformance to those scheduled movements. Initial surface movement concepts and algorithms have gone through a series of simulations of increasing complexity. In 2013 NASA will consider additional capabilities such as a longer surface movement planning horizon (up to one hour), and technologies that target reduced surface congestion and increased operational efficiencies.

Also in 2013, NASA will perform a series of integrated human-in-the-loop simulations, and will complete a number of development activities in support of the first Air Traffic Management Technology Demonstration (ATD) to be completed in 2015. The demonstration will incorporate Automatic Dependent Surveillance-Broadcast flight deck technology and investigate the full benefit of this technology in the NextGen operational environment. Automatic Dependent Surveillance-Broadcast is a flight deck based surveillance technology for tracking aircraft position. Ultimately, this technology will operationally demonstrate an integrated set of NASA technologies for planning and executing efficient arrival operations in the terminal environment of a high-density airport utilizing NextGen capabilities. The NASA technologies to be demonstrated are: advanced arrival scheduling (for planning), flight-deck interval management (for airborne spacing), and controller-managed spacing (for ground-based spacing). The human-in-the-loop simulations in 2013 will develop and validate the requirements and procedures to ensure the safe and efficient operation of the integrated air- and ground-based technologies for the demonstration. In addition, NASA algorithms and technologies will be integrated into prototype controller and pilot tools, including a version of the FAA's Traffic Management Advisor, and flight-deck avionics systems. NASA is developing significant FAA and industry partnerships for this effort.

BUDGET EXPLANATION

The FY 2013 request is \$93.3 million. This represents a \$0.5 million increase from the FY 2012 estimate (\$92.7 million). This increase reflects an adjustment in labor pricing, not program content. The budget request includes:

- \$55.6 million for NextGen - Concepts and Technology Development; and
- \$37.6 million for NextGen - Systems Analysis, Integration, and Evaluation.

AIRSPACE SYSTEMS PROGRAM (ASP)

Projects

NEXTGEN CONCEPTS AND TECHNOLOGY DEVELOPMENT

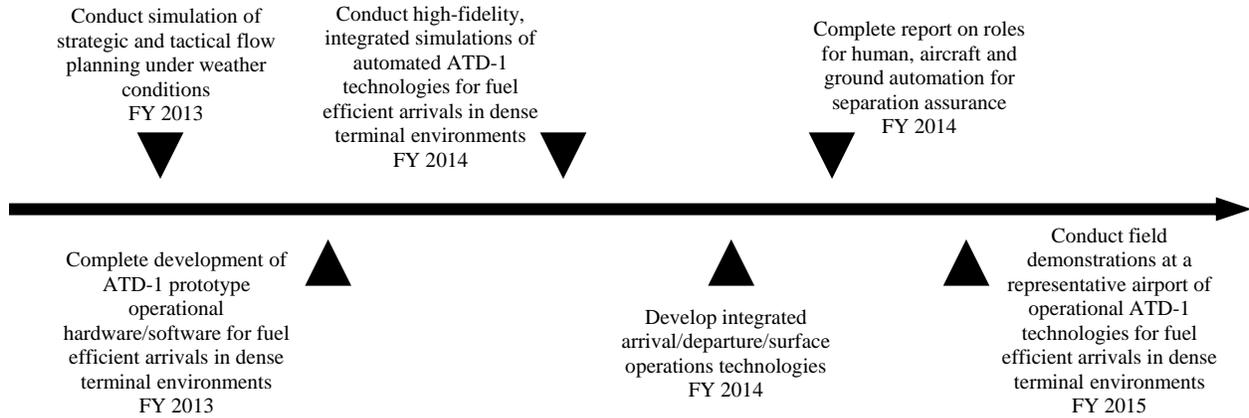
One goal of ASP is to identify the optimal allocation of automation technologies for use in the NextGen. These technologies can improve the efficiency of all stages of air travel, from gate to gate. Researchers are developing advances in the science and applications of flight trajectories while taking into account weather and forecast uncertainties across the entire flight path. The program also conducts research into efficient ways to dynamically modify flight paths in real-time to allow for the constantly changing environment within NAS. Throughout the development of these new technologies, the human interface must be addressed, with the goal of making the operations as effective and safe as possible. To be successful, the program must develop technologies that achieve the maximum possible productivity out of the entire airspace system, including the use of gates, taxiways, runways, terminal and en route airspace, and other airport services.

NEXTGEN SYSTEMS ANALYSIS, INTEGRATION, AND EVALUATION

Another key to the success of ASP is to ensure the relevance of its research. It does this through systems analysis. This analysis allows researchers to formulate models of the systems and use them to understand the impact and assess the benefits to NAS on areas of research being done within the program. Systems analysis also assists in the identification of other potential areas of NAS improvement and needed research. One of the challenges to achieving NextGen is the difficulty of introducing new concepts into a complex NAS. ASP research verifies the relevance of its research and implications when included in a complex system by investigating not only the benefits achievable by single concepts, but takes this research one step further to study the implications and improvements achievable when multiple new concepts are integrated into the NAS. These investigations mature in concept and fidelity from fast time modeling and simulation through human-in-the-loop simulations and, for the most promising areas of research, to demonstrations using field trials. These most promising areas are those that enable increases in capacity and efficiency while maintaining safety and environmental conditions. Relevance and near-term benefits are achieved throughout the maturing process as interim results, tools and concepts are provided to the program's stakeholders for near term cost savings in industry and NAS improvements implemented by other Government agencies.

AIRSPACE SYSTEMS PROGRAM (ASP)

Program Schedule



Program Management & Commitments

The ARMD Associate Administrator has oversight responsibility for the program. The program director oversees program portfolio formulation, implementation, evaluation, and integration of results with other ARMD or NASA programs.

Project Element	Provider
NextGen Concepts and Technology Development	Provider: ARC, LARC Project Management: HQ NASA Center: ARC, LARC Cost Share: FAA, JPDO, Boeing, General Electric, American Airlines, United Airlines, Rockwell Collins
NextGen Systems Analysis, Integration, and Evaluation	Provider: ARC, LARC Project Management: HQ NASA Center: ARC, LARC Cost Share: FAA, JPDO, Air Force Research Lab, Honeywell, General Electric

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AIRSPACE SYSTEMS PROGRAM (ASP)

Acquisition Strategy

ASP spans research and technology from foundational research to integrated system capabilities. This broad spectrum necessitates the use of a wide array of acquisition tools relevant to the appropriate work awarded externally through full and open competition. Teaming among large companies, small businesses, and universities is highly encouraged for all procurement actions.

MAJOR CONTRACTS/AWARDS

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INDEPENDENT REVIEWS

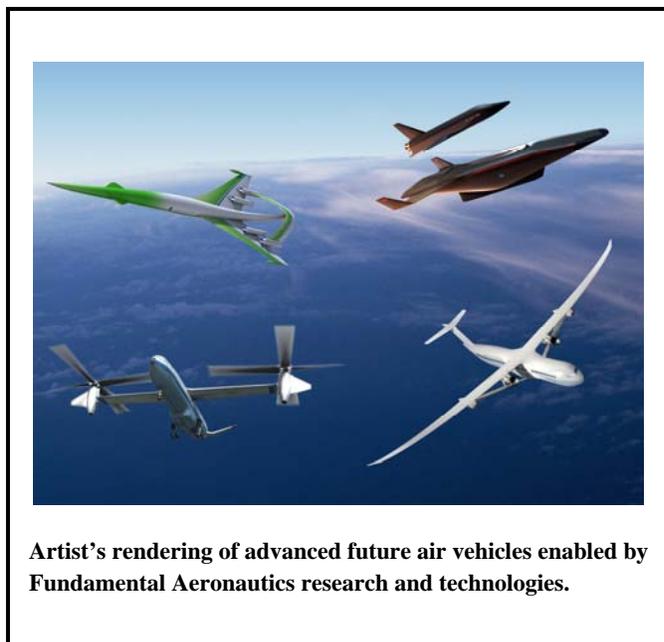
Review Type	Performer	Last Review	Purpose/Outcome	Next Review
Performance	Expert Review	Nov-11	The 12-month review is a formal independent peer review. Experts from other Government agencies report on their assessment of technical and programmatic risk and/or program weaknesses. In the FY 2011 review, the independent review panel rated ASP as "Excellent/Very Good" overall.	Nov-12

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FUNDAMENTAL AERONAUTICS (FA)

FY 2013 BUDGET

Budget Authority (in \$ millions)	Actual	Estimate	FY 2013	Notional			
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FY 2013 President's Budget Request	206.3	186.3	168.7	171.3	173.3	175.3	177.1
Change From FY 2012 Estimate	--	--	-17.6				
Percent Change From FY 2012 Estimate	--	--	-9.4%				



To meet aviation's future needs, the FA program develops the knowledge, technologies, tools, and concepts for new aircraft that will fly faster, cleaner, and quieter, and use fuel far more efficiently as the Nation transitions to a more modernized air transportation system. NASA's research impacts a wide spectrum of flight speeds from subsonic flight to very high speed flight. This program conducts research and development that has the ability to change the aviation system for the benefit of the public, including:

- Dramatically reduced aircraft noise and emissions;
- Dramatically improved fuel efficiency of a wide variety of future air vehicles; and
- Increased mobility and air travel flexibility even as NAS grows more crowded.

The FA Program conducts research on vehicle technologies that will enable new generations of advanced rotorcraft, advanced transport aircraft, and very high speed vehicles that can travel significantly faster than the speed of sound. In addition to providing to these benefits, research in the FA Program is coordinated with DoD on projects that are mutually beneficial to NASA and National security. Ultimately, FA Program research enables a future in which a variety of advanced air vehicles improve the flexibility, efficiency, and environmental impacts of the air transportation system.

For more information, see <http://www.aeronautics.nasa.gov/fap>.

AERONAUTICS

FUNDAMENTAL AERONAUTICS (FA)

EXPLANATION OF MAJOR CHANGES FOR FY 2013

In FY 2013, NASA will restructure the content of the FA program to facilitate research on targeted advanced vehicle and technology capabilities that would enable eventual introduction of completely new vehicle types and capabilities as described above. This restructuring process will also include the support of research efforts for important, cross-cutting capabilities that benefit a wide variety of air vehicles. NASA is combining hypersonic and supersonic research into a single project to focus on fundamental research for high-speed flight. Responsibility for fundamental research on entry, decent, and landing technologies will be transferred to Space Technology to increase synergy with the Agency's exploration and science missions.

ACHIEVEMENTS IN FY 2011

In FY 2011, NASA confirmed the accuracy of its second-generation aircraft system analysis tool. This tool enables design of aircraft that break the mold from current configurations and ways of thinking. This tool allows designers to conceive advanced, unconventional aircraft configurations and evaluate performance with a higher degree of confidence than ever before. Accuracy was confirmed by developing analytical aircraft performance predictions for both conventional and unconventional configurations (ones that are not a tube-and-wing shape) and then confirming the accuracy of these predictions against publically available data and/or other independent data sources. These advanced concepts and technologies will allow NASA aircraft to realize significant improvements in performance.

NASA also demonstrated advances in computational modeling for understanding and designing crashworthy rotorcraft and for predicting rotor hover performance for tiltrotors. Additionally, NASA acquired noise data for helicopters in complex flight patterns, discovered new ways to reduce transmission gear weight, and made significant investment in the capability to test large, advanced high-speed rotor concepts. Air travel needs a combination of advances like these to enable the safer, quieter and more efficient rotorcraft vehicles that can carry a larger percentage of passengers and cargo in the future.

Using wind tunnel tests NASA verified advanced supersonic aircraft models that produce significantly less sonic boom. These aircraft concepts were designed using NASA-developed computer-based tools for predicting aircraft shape and performance. These tools allow designers to accurately and quickly assess supersonic aircraft shapes and other key attributes of successful supersonic aircraft flight such as aircraft efficiency and control.

NASA also completed significant testing of the changing shape of a hypersonic engine inlet model as airspeed increased to Mach 4. The test results and the associated data analysis, as well as propulsion prediction and design tool developments, establish key knowledge for future application of turbine-based combined cycle engines for hypersonic vehicles. This culminates several years of wind tunnel combined cycle engine inlet model design and build, small-scale inlet testing, inlet performance tool development, and experimental data analysis.

AERONAUTICS

FUNDAMENTAL AERONAUTICS (FA)

KEY ACHIEVEMENTS PLANNED FOR FY 2013

In FY 2013, the FA program will continue to push the boundaries for advanced air vehicle design and performance. These advanced high-efficiency, environmentally-friendly vehicles will be enabled by concepts, technologies, tools, and knowledge.

In the fixed wing research area, NASA will conduct a flight test in which gas and soot emissions from the use of hydro-treated renewable jet fuel will be measured. This data, taken with the aircraft in flight, will help establish this fuel as a potentially carbon dioxide neutral aviation fuel. NASA will also build a coupled engine inlet and fan that is capable of high performance and operability while being part of an embedded engine system (engines buried within the aircraft fuselage) that is not found in today's commercial aircraft, which could lead to new designs with significant improvements in performance.

In the rotary wing research area, NASA will explore the viability of widely variable speed transmissions using a new variable-speed transmission test facility at GRC. This widely-variable speed transmission capability enables high-speed, efficient rotorcraft operations. NASA will also test active flow control to reduce the drag of the rotorcraft fuselage drag so that advanced rotorcraft will use significantly less fuel. Prior testing indicated savings of up to 25 percent, and testing in 2013 will continue to explore the benefits of this technology.

In the high-speed research area, NASA will take its supersonic aircraft models to the next level by adding to the low boom aircraft simulation capability, an enhanced modeling and prediction of the effects of engine inlet and exhaust flows. This capability is needed to realize practical overland supersonic flight. Research will also be conducted to further explore concepts for hypersonic airbreathing flight.

Aeronautical sciences research includes the initiation of an effort aimed at developing new tools for predicting the important details of the airflow around aircraft shapes. Such tools are critical for accurately predicting the performance of new air vehicles, including those that may bear little or no resemblance to current vehicles and design experience. In addition, research will advance the capabilities and use of ceramic matrix composites to push the envelope on the material's ability to withstand high temperatures, while being strong and light-weight, which allows for the design of propulsion systems that are more efficient and effective.

BUDGET EXPLANATION

The FY 2013 request is \$168.7 million. This represents a \$17.6 million decrease from the FY 2012 estimate (\$186.3 million). This change includes labor and programmatic adjustments.

The budget request includes:

- \$77.9 million for Fixed Wing;
- \$24.1 million for Rotary Wing;
- \$34.4 million for High-Speed; and
- \$32.3 million for Aeronautical Sciences.

AERONAUTICS

FUNDAMENTAL AERONAUTICS (FA)

NASA will combine hypersonic and supersonic research into a single project to focus on fundamental research for high-speed flight. Research for entry, descent, and landing (EDL), required for NASA's future exploration and planetary science missions, will be transferred to NASA's Space Technology program to increase synergy with Agency's exploration and science missions. These reductions and realignment will enable NASA to focus on higher-priority research to improve the safety and minimize the environmental impacts of current and future aircraft and air traffic management systems.

Projects

FIXED WING

Fixed wing research includes exploring and developing tools, technologies, and concepts for vastly improved energy efficiency and environmental compatibility necessary for the sustained growth of commercial aviation vital to the U.S. economy and quality of life. The objective is to develop concepts and technologies for dramatic improvements in the noise, emissions, and performance of transport aircraft. The resulting scientific knowledge, in the form of experiments, data, calculations, and analyses, is critical for conceiving and designing future generations of transport aircraft. Fixed wing research enables future generations of transport aircraft, with an eye towards "N+3," targeting vehicles three generations beyond current state-of-the-art aircraft by 2030. It is the fundamental research in the near term that will prime the technology pipeline enabling continued U.S. leadership, competitiveness, and jobs in the long term. Additionally, much of the scientific knowledge, technologies and concepts necessary to enable these longer-term vehicles may have benefit to aviation much sooner.

ROTARY WING

Rotary wing research includes exploring and developing tools, technologies and knowledge to enable radical improvements in rotary wing vehicles that can greatly enhance the air transportation system. The research efforts advance technologies that increase rotorcraft speed, range and payload, and decrease noise, vibration and emissions. This research will enable improved computer-based prediction methods and technologies for designing future high-speed, efficient rotorcraft of various sizes and configurations that will be viable as commercial vehicles operating in NAS.

HIGH-SPEED

High-speed vehicle research includes developing advanced computer-based prediction methods for supersonic aircraft shape and performance and developing technologies that will aim to eliminate today's technical barriers preventing practical, commercial supersonic flight. These barriers include sonic boom, supersonic aircraft fuel efficiency, prediction of vehicle control, operation and performance, and the ability to design future vehicles in an integrated, multidisciplinary manner. The high-speed research also

AERONAUTICS

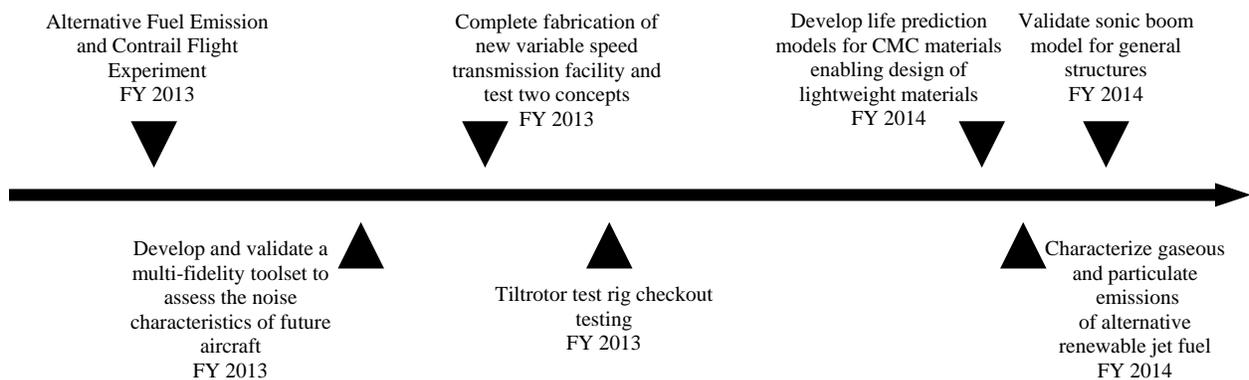
FUNDAMENTAL AERONAUTICS (FA)

includes expansion of foundational knowledge necessary for pushing the capabilities for controlled, air-breathing hypersonic flight.

AERONAUTICAL SCIENCES

In FY 2013, Aeronautical Sciences will start to develop computer-based tools and models as well as scientific knowledge that will lead to significant advances in our ability to understand and predict flight performance for a wide variety of air vehicles. Examples of this research include the development of new computational tools that are used to predict the flow around vehicles. Another area of research that is pervasive across a number of vehicle types is improving the understanding and development of new types of strong and lightweight materials that are important for aviation.

Program Schedule



AERONAUTICS

FUNDAMENTAL AERONAUTICS (FA)

Program Management & Commitments

The ARMD Associate Administrator has oversight responsibility for the program. The program director oversees program portfolio formulation, implementation, evaluation, and integration of results with other ARMD and NASA programs.

Project/Element	Provider
Fixed Wing Project	Provider: ARC, DFRC, GRC, LaRC Project Management: HQ NASA Center: ARC, DFRC, GRC, LaRC Cost Share: U.S. Air Force, Boeing, Pratt & Whitney, Northrop Grumman, General Electric Aviation, United Technologies Corporation, Rolls Royce/Liberty Works, FAA, ONERA, DLR, Lockheed Martin, Cessna, and U.S. Navy.
Rotary Wing Project	Provider: ARC, GRC, LaRC Project Management: HQ NASA Center: ARC, GRC, LaRC Cost Share: Boeing, United Technologies Corporation, U.S. Army, Center for Rotorcraft Innovation (CRI), Bell Helicopter, Sikorsky, Rolls Royce/Liberty Works, FAA, ONERA, JAXA, DLR, and U.S. Navy.
High Speed Project	Provider: ARC, DFRC, GRC, LaRC Project Management: HQ NASA Center: ARC, DFRC, GRC, LaRC Cost Share: Boeing, Pratt & Whitney, General Electric Aviation, Rolls Royce/Liberty Works, Gulfstream Aerospace, United Technologies Corporation, U.S. Air Force, FAA, JAXA, Lockheed Martin, Aerion Corporation, and U.S. Navy.
Aeronautical Sciences Project	Provider: ARC, DFRC, GRC, LaRC Project Management: HQ NASA Center: ARC, DFRC, GRC, LaRC Cost Share: TBD

AERONAUTICS

FUNDAMENTAL AERONAUTICS (FA)

Acquisition Strategy

The FA program spans research and technology from fundamental research to integrated system-level capabilities. This broad spectrum necessitates the use of a wide array of acquisition tools relevant to the appropriate work awarded externally through full and open competition. Teaming among large companies, small businesses, and universities is highly encouraged for all procurement actions.

MAJOR CONTRACTS/AWARDS

NASA's aeronautics programs award multiple smaller contracts which are generally less than \$5 million. They are widely distributed across academia and industry.

Independent Reviews

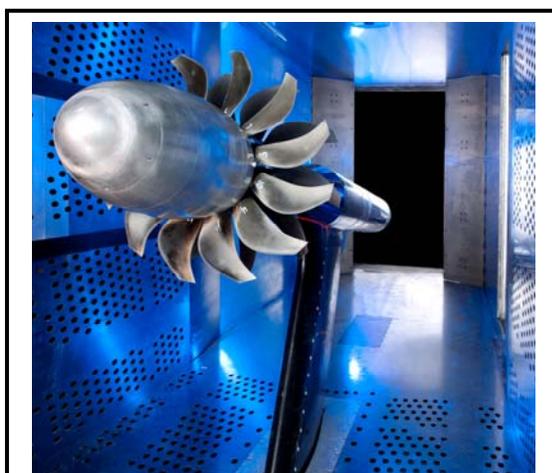
Review Type	Performer	Last Review	Purpose/Outcome	Next Review
Performance	Expert Review	Nov-11	The 12-month review is a formal independent peer review of the program. Experts from other government agencies will report on their assessment of technical and programmatic risk and/or program weaknesses. NASA receives recommendations in a timely fashion and develops a response no later than six months after the review.	Nov-12

AERONAUTICS

AERONAUTICS TEST PROGRAM (ATP)

FY 2013 BUDGET

Budget Authority (in \$ millions)	Actual	Estimate		Notional			
	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015	FY 2016	FY 2017
FY 2013 President's Budget Request	76.4	79.4	78.1	78.0	78.0	78.1	78.2
Change From FY 2012 Estimate	--	--	-1.3				
Percent Change From FY 2012 Estimate	--	--	-1.6%				



This high speed open rotor test in the GRC 8x6 wind tunnel, is a collaboration between the FAA's CLEEN program, General Electric, and NASA's ISRP.

U.S. leadership in aerospace depends on ready access to technologically advanced, efficient, and affordable aeronautics test capabilities. These capabilities include major wind tunnels, propulsion test facilities, and flight test assets. The Federal Government owns the majority of these critical test capabilities in the United States, primarily through NASA and DoD. However, changes in the aerospace landscape, primarily the decrease in demand for testing over the last two decades, required an overarching strategy for the management of these National assets. In response, NASA established ATP as a two-pronged strategic initiative to: retain and invest in NASA aeronautics test capabilities considered strategically important to the Agency and the Nation, and establish a strong, high-level partnership to expand cooperation between NASA and DoD, facilitating the establishment of an integrated national strategy for the management of their respective facilities. The national view or coordinated approach is becoming more important, specifically in addressing the challenges

NASA and the Nation are facing, in terms of managing and evolving this large critical set of capabilities in a changing and increasingly demanding environment.

ATP facilities that comprise this set of critical capabilities are geographically dispersed across the United States. They are located at the ARC, DFRC, GRC, and LaRC. These ATP facilities cover the flight envelope from subsonic through hypersonic and include unique capabilities ranging from simulating icing environments to modeling extreme dynamic situations. ATP offers Government agencies, the U.S. aerospace industry, and academic institutions unmatched research and experimental opportunities that reflect four generations of accumulated aerospace skill and experience. These capabilities encompass every aspect of aerospace ground and flight testing and all associated engineering.

ATP includes management and operation of low speed, transonic, high-speed wind tunnels and propulsion test facilities, along with an integrated set of flight test capabilities to support aircraft operations and maintenance required for flight research and other NASA missions. Included in the ATP flight test portfolio are the Western Aeronautical Test Range, support and test bed aircraft, flight simulation, and flight loads laboratories.

AERONAUTICS

AERONAUTICS TEST PROGRAM (ATP)

Three primary efforts support the long-term viability of ATP capabilities to ensure their efficiency and effectiveness for safe, reliable, and productive operations:

- Operations support, which provides a portion of the fixed costs for test capabilities to ensure facility and staff availability and user price stability;
- Maintenance and upgrades, which sustain the operation and correct known deficiencies in safety, reliability, and productivity to enable the capabilities to meet near-term and future testing requirements; and
- Test technology research and development to investigate, design and implement new technologies that increase test capability, improve productivity and efficiency, and improve data quality.

For more information, see <http://www.aeronautics.nasa.gov/atp>.

EXPLANATION OF MAJOR CHANGES FOR FY 2013

None.

ACHIEVEMENTS IN FY 2011

In FY 2011, NASA successfully executed more than 9,000 hours of ground testing and approximately 1,000 hours of flight testing for NASA and the Nation, achieving high overall customer satisfaction ratings and good facility availability and performance. NASA performed critical testing in the ARC Unitary Plan Wind Tunnel to validate design processes and predictions for a new low-boom, low-drag design for the ARMD FA program, Supersonics project. Flight testing was performed for the Supersonics project at DFRC to execute its Caustic Analysis and Measurement program to validate computer prediction tools to be used in design of future quiet supersonic aircraft. Several critical tests were performed for DoD in ATP facilities in FY 2011, including testing at the GRC Icing Research Tunnel for the Office of Naval Research, and at the LaRC 14x22 Subsonic Tunnel for the U.S. Army.

In FY 2011, NASA continued to address critical shortfalls identified in the 2011 National Aeronautics Research, Development, Test, and Evaluation Infrastructure Plan through efforts directed to engine icing research at the Propulsion Simulation Laboratory at GRC and acoustic measurement at the 14 by 22 foot tunnel at LaRC. Investments in test technology included advanced facility electronic systems required to meet modern research testing requirements and targeted investments in wind tunnel force measurement systems. In FY 2011, NASA undertook a project to modify an existing G-III subsonic research aircraft testbed at DFRC, which will result in new experimental flight test capability to assess emerging flight technologies. One of the first intended uses of the aircraft is to enable NASA to explore and mature alternative unconventional aircraft designs with the potential to simultaneously meet research goals for community noise, fuel burn, and nitrogen oxides emissions.

AERONAUTICS

AERONAUTICS TEST PROGRAM (ATP)

KEY ACHIEVEMENTS PLANNED FOR FY 2013

NASA will address opportunities and challenges with respect to operating and sustaining the program's aging facilities, long-range forecasting of aeronautics test demand, and determining the best approach to investing in new capabilities across the portfolio. A major FY 2013 focus is reevaluating the project management structure upon which ATP was established in 2006. This includes an expanded national view, reaching across agency boundaries (primarily DoD and NASA). In this assessment ATP will evaluate novel and cost effective operations scenarios for capabilities within its portfolio; assess further opportunities to divest and consolidate testing across the national portfolio; evaluate a revised approach to pricing of the test capabilities; and identify needed upgrades and technology development to address emerging NASA and national aeronautics test requirements.

NASA will also continue to implement its strategic plan, focusing efforts in the following four areas:

- Providing management guidance and recommendations to the NASA ARMD Associate Administrator and Center Directors with respect to use of NASA aeronautics ground and flight test capabilities;
- Representing the strategic interest of NASA and the Nation with respect to stewardship of NASA ground and flight test capabilities;
- Providing direction to NASA test capability managers; and
- Ensuring that the right facility, aircraft, and workforce capabilities are available at the right time to meet the needs of NASA and the Nation.

BUDGET EXPLANATION

The FY 2013 request is \$78.1 million. This represents a \$1.3 million decrease from the FY 2012 estimate (\$79.4 million). This decrease reflects an adjustment in labor pricing, not program content. The budget request includes:

- \$51.7 million for Aero Ground Test Facilities; and
- \$26.4 million for Flight Operations and Test Infrastructure.

AERONAUTICS

AERONAUTICS TEST PROGRAM (ATP)

Projects

FLIGHT OPERATIONS AND TEST INFRASTRUCTURE

The flight operations and test infrastructure consists of an integrated set of elements, including the Western Aeronautical Test Range, that support aircraft maintenance and operations; and the test bed aircraft that provide the resources required for research flight and mission support projects. ATP provides up to 100 percent of the facility fixed costs for these flight facilities to ensure facility and staff availability.

The activity also includes the simulation and flight loads laboratories, a suite of ground-based laboratories that support research flight and mission operations. ATP provides up to 50 percent of the fixed costs for laboratories, ensuring facility and staff availability. The remainder is covered by usage fees.

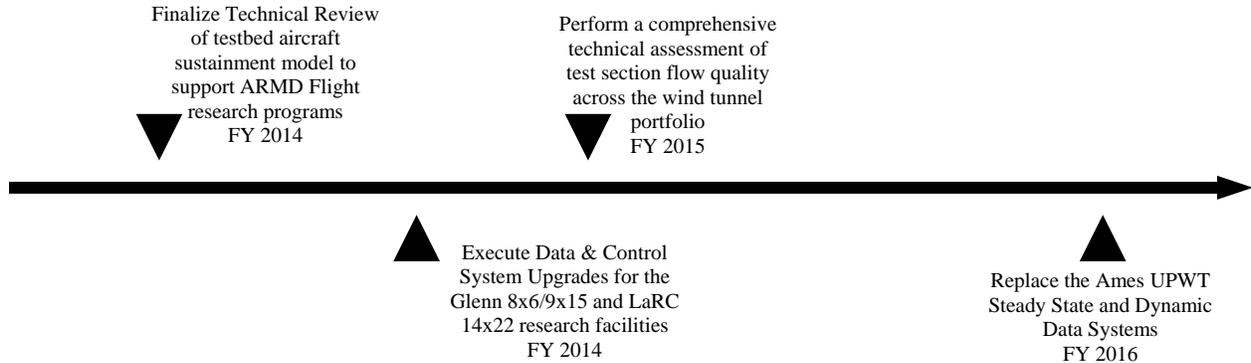
AERO GROUND TEST FACILITIES

The aeronautics ground test facilities are different classes of facilities including low speed, transonic, supersonic, and hypersonic wind tunnels. Three primary efforts support the long-term viability of the facilities and continually improve on the efficiency and effectiveness of safe, reliable, and productive operations.

- Facility operations support, which provides a portion of the fixed costs for ground test facilities to ensure facility and staff availability and user price stability;
- Facility maintenance and upgrades, which provides for maintenance and the upgrades that correct known deficiencies in facility safety, reliability, and productivity and enables the facilities to meet near-term and future testing requirements. These activities result in improved facility productivity and reduced operational cost; and
- Facility test technology, which develops and implements new technologies that increase test capability, improve productivity and efficiency, and improve data quality.

AERONAUTICS TEST PROGRAM (ATP)

Program Schedule



Program Management & Commitments

The ARMD Associate Administrator has oversight responsibility for the program. The program director oversees program portfolio formulation, implementation, evaluation, and integration of results with other ARMD or NASA programs.

Project Element	Provider
Flight Operations and Test Infrastructure	Provider: DFRC, LaRC Project Management: HQ NASA Center: DFRC, LaRC Cost Share: DoD
Aero Ground Test Facilities	Provider: ARC, GRC, LaRC Project Management: HQ NASA Center: ARC, GRC, LaRC Cost Share: DoD

AERONAUTICS

AERONAUTICS TEST PROGRAM (ATP)

Acquisition Strategy

Acquisitions supporting ATP activity are performed at each of the test sites consistent with the Federal Acquisition Regulation (FAR) and the NASA FAR Supplement. Each Center is responsible for coordinating major acquisitions supporting ATP activities through the ATP Office as required by the ATP Director.

MAJOR CONTRACTS/AWARDS

NASA's aeronautics programs award multiple smaller contracts which are generally less than \$5 million. They are widely distributed across academia and industry.

INDEPENDENT REVIEWS

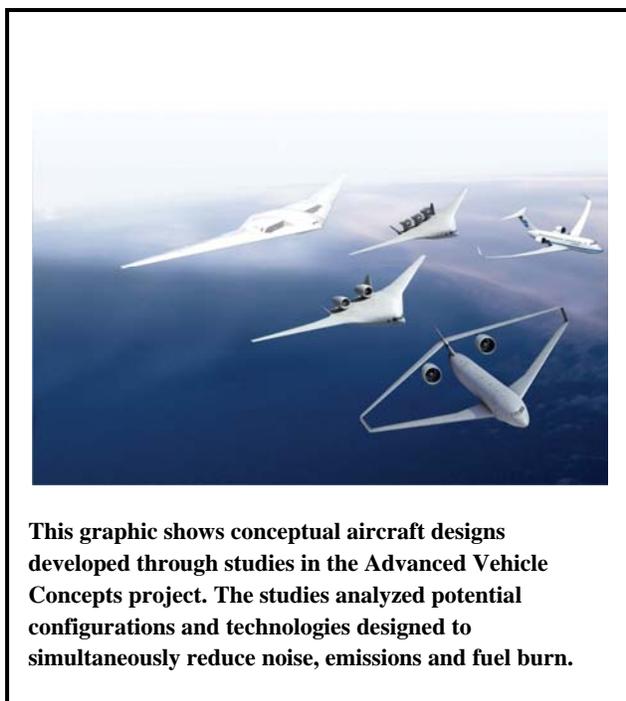
Review Type	Performer	Last Review	Purpose/Outcome	Next Review
Relevance	Expert Panel	Apr-10	Periodic reviews are carried out by the NAC and the U.S. users of ATP facilities. The last major community outreach meeting was held in April 2010 with NASA, DoD, and U.S. aerospace industry users at the Arnold Engineering Development Center. The next meeting is planned for September 2012.	Sep-12
Annual Program Review	Independent Review Panel	Nov-11	The primary purpose of the Annual Program Review is to provide an independent assessment by subject matter experts of the program's relevance, technical quality, and performance.	Nov-12

AERONAUTICS

INTEGRATED SYSTEMS RESEARCH PROGRAM (ISRP)

FY 2013 BUDGET

Budget Authority (in \$ millions)	Actual	Estimate	FY 2013	Notional			
	FY 2011	FY 2012		FY 2014	FY 2015	FY 2016	FY 2017
FY 2013 President's Budget Request	75.9	104.2	104.0	102.3	101.2	100.1	98.8
Change From FY 2012 Estimate	--	--	-0.2				
Percent Change From FY 2012 Estimate	--	--	-0.2%				



This graphic shows conceptual aircraft designs developed through studies in the Advanced Vehicle Concepts project. The studies analyzed potential configurations and technologies designed to simultaneously reduce noise, emissions and fuel burn.

ISRP conducts integrated system-level research on promising concepts and technologies to explore, assess, and demonstrate their benefits in an operationally relevant environment. ISRP focuses specifically on maturing and integrating technologies into major vehicle and operations systems and subsystems for accelerated transition to practical application. The research in this program is coordinated with ongoing, long-term fundamental research within the other three research programs, as well as efforts of other government agencies. This helps to ensure the most promising research is transitioned between the programs and to avoid duplicative efforts. ISRP's focus on system-level research differentiates it from other NASA aeronautics fundamental research programs, as its goals are to demonstrate integrated concepts and technologies to a level sufficient to reduce risk of implementation for stakeholders in the aviation community.

For more information, see http://www.aeronautics.nasa.gov/programs_isrp.htm.

EXPLANATION OF MAJOR CHANGES FOR FY 2013

None.

ACHIEVEMENTS IN FY 2011

In FY 2011, NASA completed several conceptual design studies that identified advanced vehicle concepts and associated technology suites capable of simultaneously reducing community noise, emissions, and

INTEGRATED SYSTEMS RESEARCH PROGRAM (ISRP)

fuel burn. The studies defined preferred system concepts for advanced vehicles that can operate safely within NextGen.

NASA also demonstrated:

- Fuel injector designs concepts which achieved a significant reduction in nitrogen oxide emissions;
- Lower noise, high propulsive efficiency counter-rotating open rotor systems to enable significant fuel burn reduction;
- Low-weight, damage-tolerant stitched composite structural concept on a curved panel (representing a conventional-type aircraft fuselage structure) capable of being fabricated and supporting the required combined pressure and tension loading condition; and
- Low-weight, damage-tolerant joints in stitched composite structures with fewer fasteners capable of being fabricated and supporting the required pressure loading.

In FY 2011, NASA also worked with JPDO and associated government agencies tasked by OMB to deliver a research, development, and demonstration roadmap for UAS access to NAS. NASA also provided rationale for international support for a radio frequency spectrum allocation to be addressed at the 2012 World Radiocommunication Conference.

KEY ACHIEVEMENTS PLANNED FOR FY 2013

FY 2013 will be the initial year of Phase 2 for the Environmentally Responsible Aviation project. Phase 1 will culminate in FY 2012 with a detailed assessment of candidate technologies that were assessed from FY 2010 through FY 2012. Those technologies will be assessed relative to their potential benefit to meet project goals, as well as associated costs and risks. In addition to systems level assessments of the most promising technologies, certain technologies with potentially high benefits will continue to be matured during FY 2013. For example, in 2013, NASA will complete community noise assessments for advanced tube and wing, and hybrid wing body aircraft configurations and engines. NASA will seek to demonstrate synergistic acoustic integration between advanced engines and airframe concepts that will enable the goal of 42 decibel cumulative noise reduction below Stage 4 in the 2020 timeframe. In addition, NASA will complete a large scale advanced composite structure test and assessment.

NASA will also continue to make progress on UAS integration through initial evaluations and risk reduction activities of the project's operationally relevant environment. The relevant environment provides the infrastructure to enable the human-in-the-loop simulations and flight tests required to demonstrate integrated Separation Assurance, Human Systems Integration, and Communication efforts. In addition, NASA will conduct simulations that assess the performance of aircraft separation assurance methods as well as develop communication models for all classes of UAS. These validated communication models are required to provide confidence in simulation results. Finally, NASA will work to provide recommendations for risk-related data collection to support development of UAS regulations.

AERONAUTICS

INTEGRATED SYSTEMS RESEARCH PROGRAM (ISRP)

BUDGET EXPLANATION

The FY 2013 request is \$104.0 million. This represents a \$0.2 million decrease from the FY 2012 estimate (\$104.2 million). This decrease reflects an adjustment in labor pricing, not program content. The budget request includes:

- \$73.5 million for Environmentally Responsible Aviation; and
- \$30.5 million for UAS Integration in the NAS.

Projects

ENVIRONMENTALLY RESPONSIBLE AVIATION

NASA is addressing vehicle related environmental concerns through system-level research and experiments of promising vehicle concepts and technologies that simultaneously reduce fuel burn, noise, and emissions. Research and development efforts are focused on understanding how advanced environmental technologies can best work in an integrated vehicle/aviation operations system. Through system-level analysis, promising advanced vehicle and propulsion concepts and technologies can be down-selected based on their potential benefit towards the stated national goals. Among the technologies to be explored are the following:

- Advanced aircraft architectures that enable simultaneous reduction of noise, fuel burn, and environmentally harmful emissions;
- Advanced propulsion systems for low noise and reduced fuel burn;
- Lightweight, low drag wing and fuselage concepts for reduced fuel burn and noise;
- Fuel flexible, low nitrogen oxide combustor designs; and
- Optimized propulsion/airframe integration concepts for reduced fuel burn and noise.

UAS INTEGRATION IN THE NAS

NASA also focuses on technologies to enable routine civil operations for UAS of all sizes and capabilities in NAS. Current Federal Aviation Regulations are built upon the condition of a pilot being in the aircraft; therefore few of those regulations specifically address UAS. To date, the primary user of UAS has been the military. Because of this, the technologies and procedures to enable seamless operation and integration of UAS in NAS need to be developed, validated, and employed by FAA through rule-making and policy development.

Specifically, NASA is addressing technology development in several areas to reduce the technical barriers related to the safety and operational challenges. The technical barriers include:

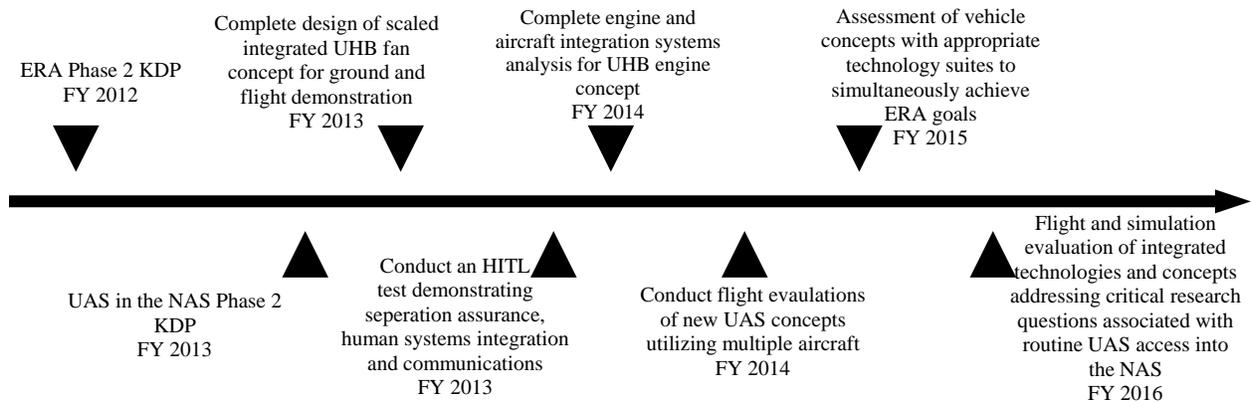
- Robust separation assurance algorithms;
- Command and control, and air traffic control communication systems;

INTEGRATED SYSTEMS RESEARCH PROGRAM (ISRP)

- Consistent standards to assess UAS ground control stations; and
- Airworthiness requirements for the full range of UAS size and performance.

NASA will validate data and technology through a series of high-fidelity human-in-the-loop simulations (i.e., where a human is part of the simulation and influences the outcome) and flight tests conducted in a relevant environment. Integrated test and evaluation will be conducted focusing on four technical challenges: separation assurance, communications, human systems integration, and certification. The project deliverables will help key decision makers in government and industry make informed decisions, leading towards routine UAS access.

Program Schedule



AERONAUTICS

INTEGRATED SYSTEMS RESEARCH PROGRAM (ISRP)

Program Management & Commitments

The ARMD Associate Administrator has oversight responsibility for the program. The program director oversees program portfolio formulation, implementation, evaluation, and integration of results with other ARMD or NASA programs.

Project Element	Provider
Environmentally Responsible Aviation	Provider: ARC, DFRC, GRC, LaRC Project Management: HQ NASA Center: ARC, DFRC, GRC, LaRC Cost Share: Boeing, General Electric, Pratt & Whitney, Air Force Research Laboratory, FAA, Gulfstream, Goodrich, Rolls Royce Liberty Works
UAS Integration in the NAS	Provider: ARC, DFRC, GRC, LaRC Project Management: HQ NASA Center: ARC, DFRC, GRC, LaRC Cost Share: Rockwell Collins, FAA

Acquisition Strategy

ISRP develops and further matures promising technologies to the integrated system level. This necessitates the use of a wide array of acquisition tools relevant to the appropriate work awarded externally through full and open competition. Teaming among large companies, small businesses, and universities is highly encouraged for all procurement actions.

MAJOR CONTRACTS/AWARDS

NASA's aeronautics programs award multiple smaller contracts which are generally less than \$5 million. They are widely distributed across academia and industry.

AERONAUTICS

INTEGRATED SYSTEMS RESEARCH PROGRAM (ISRP)

INDEPENDENT REVIEWS

Review Type	Performer	Last Review	Purpose/Outcome	Next Review
Performance	Review Panel	Nov-11	The 12-month review is a formal independent peer review. Experts from other government agencies report on their assessment of technical and programmatic risk and/or program weaknesses.	Nov-12

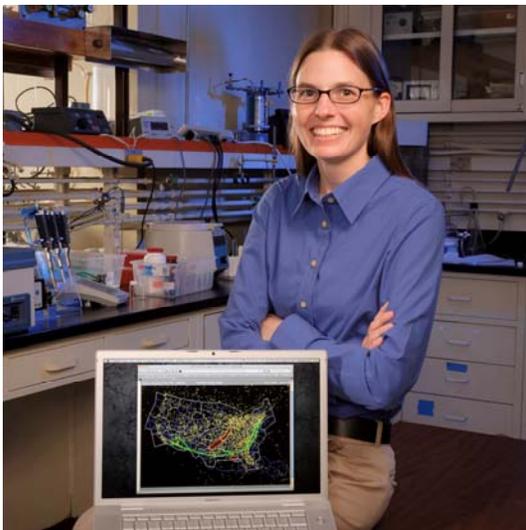
AERONAUTICS

AERONAUTICS STRATEGY AND MANAGEMENT

FY 2013 BUDGET

Budget Authority (in \$ millions)	Actual	Estimate	FY 2013	Notional			
	FY 2011	FY 2012		FY 2014	FY 2015	FY 2016	FY 2017
FY 2013 President's Budget Request	20.4	26.7	26.4	26.2	25.7	25.0	24.4
Change From FY 2012 Est. (\$M)	--	--	-0.3				
Percent Change From FY 2012Est.	--	--	-1.1%				

Note: In FY 2011, ASM activities were conducted in other programs.



While a NASA Aeronautics Scholarship recipient and summer intern at LaRC, Heather Arneson worked to develop algorithms to better control the flow of aircraft through airspace. She now continues that research as a full-time NASA employee.

The Aeronautics Strategy and Management program provides research and programmatic support that benefits each of the other five programs. The program efficiently manages directorate functions including: Innovative Concepts for Aviation, Education and Outreach, and Cross Program Operations.

EXPLANATION OF MAJOR CHANGES FOR FY 2013

None.

ACHIEVEMENTS IN FY 2011

In FY 2011, NASA established an Aeronautics Seedling Fund to provide NASA civil servants an opportunity to conduct research into early stage innovative ideas that meet aeronautics challenges. The seedling fund announcement

received over 300 notices of intent from across the Agency. NASA selected the best 20 proposals and began research efforts.

KEY ACHIEVEMENTS PLANNED FOR FY 2013

In FY 2013, Innovative Concepts for Aviation research plans will be fully implemented to include the Seedling Fund along with external prizes and challenges that are set to begin in FY 2012. In addition to new research ideas, successful research will be incorporated into existing programs, continued in demonstrations, or expanded into new fields of study.

AERONAUTICS

AERONAUTICS STRATEGY AND MANAGEMENT

BUDGET EXPLANATION

The FY 2013 request is \$26.4 million. This represents a \$0.3 million decrease from the FY 2012 estimate (\$26.7 million). This decrease reflects an adjustment in labor pricing, not program content. The budget request includes:

- \$10.0 million for Innovative Concepts for Aviation;
- \$5.4 million for Education and Outreach; and
- \$11.0 million for Cross Program Operations.

Projects

INNOVATIVE CONCEPTS FOR AVIATION

Innovative Concepts for Aviation explores novel concepts and processes with the potential to create new capabilities in aeronautics research. The program's goal is to mature the new concepts and incorporate them into the existing research programs or launch new avenues of aeronautics research. To meet this goal, NASA will target both internal and external aeronautics communities through solicitations, challenges, and prizes.

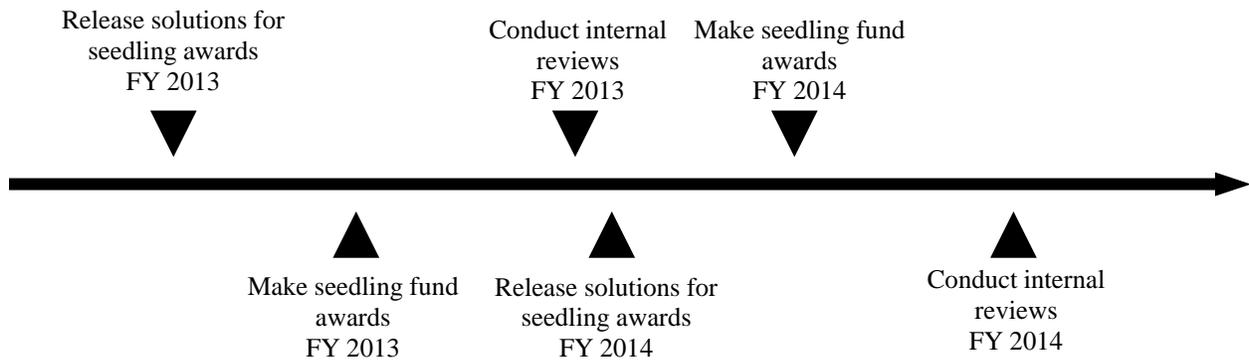
EDUCATION AND OUTREACH

Education and Outreach objectives include developing the future NASA Aeronautics workforce, contributing to Aeronautics research goals and objectives, and supporting Agency education and communication goals. Aeronautics education activities provide scholarships, internships, design competitions, exhibits and hands-on activities for formal and informal educators that engage students and teachers at all levels of learning. Outreach through exhibits, presentations, social media events and online interactives inform large numbers of the general public and other audiences of how they benefit from Aeronautics' work to improve the Nation's air transportation system.

AERONAUTICS STRATEGY AND MANAGEMENT

Program Schedule

Because this is a support program, NASA has not planned any significant technical milestones.



Program Management & Commitments

The ARMD Associate Administrator has oversight responsibility for the program.

Acquisition Strategy

The research conducted through Innovative Concepts for Aviation activities will use a wide array of acquisition tools relevant to the research objectives including external solicitations through full and open competitions.

MAJOR CONTRACTS/AWARDS

NASA's aeronautics programs award multiple smaller contracts which are generally less than \$5 million. They are widely distributed across academia and industry.

INDEPENDENT REVIEWS

Because this is a support program, NASA has not scheduled any independent reviews at this time. However, an annual internal review for Innovative Concepts for Aviation has been established.