Research to provide precise knowledge of vehicles and weather conditions, optimized interactions between humans and automated systems, advanced vehicle technologies, and more, will enable a safe, secure, efficient, and environmentally-friendly air transportation system.

Aeronautics Technology

MAJOR EVENTS IN FY 2005

- Demonstrate 70% reduction in nitrous oxides emissions in full-scale tests of combustor configurations suitable for a large subsonic vehicle.
- Demonstrate integrated technologies and polices that would allow routine UAV flight operations in the National Airspace System above an altitude of 40,000 feet.
- Complete Human in the Loop concept and technology evaluation of shared aircraft separation.
- Conduct experimental flight evaluation of key Small Airplane Transportation System enabling technologies.
- Accomplish objective of developing technologies that will enable a 50% reduction in the fatal accident rate from the 1991-1996 level.

Theme: Aeronautics Technology

OVERVIEW

From the Wright Flyer in 1903 to the jet transports of today, our Nation progressed from a single flight to over 25,000 each day. From enhancing our military capability to moving millions of people and goods worth billions of dollars to markets around the world, aviation has become an indispensable part of our lives. As a result of the research and technology developed by NASA and its National Advisory Committee for Aeronautics, NASA has achieved this level of performance. The critical role of aviation has brought with it challenges, from airline delays, to community noise and environmental emissions, to new security threats. Technology will continue to be a necessary and significant force in addressing these challenges. In partnership with other Government agencies, industry, and academia, NASA's role continues to be understanding the issues and challenges and developing the long-term technology base for the public good that industry or government partners cannot address on their own.

Technologies can do more than resolve existing issues; they have the potential to open a whole new era in aviation and provide new opportunities in air transportation safety and efficiency, national defense, economic growth, and quality of life. NASA will continue to work closely and partner with the Department of Defense (DoD), the Department of Transportation (DoT), the Federal Aviation Administration (FAA), the Department of Homeland Security, the Transportation Security Administration, academia, and industry to ensure that the research pursued by NASA finds it way into useful and timely products and processes. This partnership also enables the application of NASA technical expertise and test facilities to support air vehicle development and system upgrades, address in-service operation problems, support accident investigations and reconstructions, and develop high-payoff technologies for military air vehicles.

Missions	Goals supported by this Theme	Objectives supporting these Goals
To Understand and Protect Our Home Planet	2. Enable a safer, more secure, efficient, and environmentally friendly air transportation system.	2.1 Decrease the aircraft fatal accident rate, reduce the vulnerability of the air transportation system to hostile threats, and mitigate the consequences of accidents and hostile acts.
		2.2 Protect local and global environmental quality by reducing aircraft noise and emissions.
		2.3 Enable more people and goods to travel faster and farther, with fewer delays.
	3. Create a more secure world and improve the quality of life by investing in technologies and collaborating with other agencies, industry, and academia.	3.1 Enhance the Nation's security through partnerships with DoD, the Department of Homeland Security and other U.S. or international government agencies.
To Inspire the Next Generation of Explorers	7. Engage the public in shaping and sharing the experience of exploration and discovery.	7.1 Improve public understanding and appreciation of science and technology, including NASA aerospace technology, research, and exploration missions.
Exploration Capabilities	10. Enable revolutionary capabilities through new technology.	10.5 Create novel aeronautics concepts and technology to support science missions and terrestrial and space applications.

RELEVANCE

Over the last century, aviation has evolved to become an integral part of our economy, a cornerstone of national defense, and an essential component of our way of every-day life. Aviation generates more than $1 trillion of economic activity in the United States every year. Military aviation forms the backbone of our national security strategy, as was demonstrated again in the Iraq conflict. Just as the Nation (and the world) has become more dependent on moving people and goods faster and more efficiently via air, important obstacles have emerged. The air traffic and airport systems in both the Nation and overseas are reaching full capacity. In 1998, airline delays in the U.S. cost industry and passengers $4.5 billion, the equivalent of a seven percent tax on every dollar collected by all the domestic airlines combined. Concerns over environmental issues such as aircraft noise and emissions are preventing the construction of additional airports and runways. NASA's investment in the Aeronautics Technology Theme plays a key role in developing the technologies that are necessary to solve these problems and create a safer, more secure, environmentally friendly, and efficient national aviation system.

Advances in technology have paced aviation's evolution throughout its first century. Human investment and ingenuity, once the only bounds to growth in aviation, have produced a highly complex, integrated, and regulated aviation system. To advance aviation, the U.S. will need to capitalize on the convergence of a broad front of multidisciplinary advances in technology. Pursuing technology fields that are in their infancy today, developing the knowledge necessary to design radically new aerospace systems, and enabling efficient, high-confidence design and development of revolutionary vehicles are challenges that face the Nation. These challenges are intensified by the demand for safety, security, and increased capacity in highly complex aerospace systems while reducing the environmental impact of aviation operations.

Theme: Aeronautics Technology

Education and Public Benefits

The technologies that are being developed by the Aeronautics Technology Enterprise will enable a future where individuals have on-demand, as well as scheduled air mobility that will allow the public in both rural and urban areas to travel where they want, when they want, faster, safer, and without delays to both rural and urban areas. This is a future where the noise associated with aviation operations will be confined to within the airport perimeter, where aircraft emissions will be below objectionable limits, where avoidable aircraft accidents will be a thing of the past, and where the security of commercial aircraft operations is not a concern. NASA's national leadership role in aeronautics research offers unique opportunities to inspire student interest and promote academic success at all levels of education. NASA's aeronautics research programs conduct a wide range of education and outreach activities to capture the imagination of students, provide unique teaching tools for educators, supplement school curricula, and support the national standards for math, science, and technology education.

IMPLEMENTATION

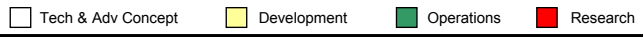
This Theme comprises three programs that are developing, demonstrating, and transferring the highest priority research and technology toward these opportunities. The Aviation Safety and Security program addresses technologies and strategies to improve aviation safety by reducing both aircraft accident and fatality rates and reducing the vulnerability of the aviation system to terrorist and criminal threats. The Airspace Systems program targets ground- and aircraft-based capabilities to increase the capacity and mobility of the Nation's air transportation system. In collaboration with the FAA, research in air traffic management technologies will develop new automation tools and concepts of operations and entirely new paradigms for air transportation management. The Vehicle Systems program is focused on the development of breakthrough air vehicle technologies, including advanced propulsion technologies, lightweight high-strength adaptable structures, adaptive controls, advanced vehicle designs, and new collaborative design and development tools. Technologies are targeted for all aircraft types, including subsonic, supersonic, and general aviation aircraft, extremely short-takeoff and landing aircraft, and unmanned aerial vehicles.

The Office of Aeronautics (OA) Enterprise Program Management Council has governing responsibility. The NASA Official is Dr. J. Victor Lebacqz, Associate Administrator, OA. The Aeronautics Technology Theme Director is Terrence J. Hertz, Director, Aeronautics Technology, OA.

Theme: Aeronautics Technology

IMPLEMENTATION SCHEDULE

Theme Element	Schedule by Fiscal Year 95 96 97 98 99 00 01 02 03 04 05 06 07 08 09	Purpose
2.2.2 - VS - Reduce Aviation NOx emission by 70% (re: 1996 ICAO standard)		Develop, demonstrate, and transfer technologies that improve local air quality and our global environment by enabling a significant reduction in emissions from aviation operations.
3.1.5 - VS - Develop technology both to and from the DoD		Development of technologies, in partnership with the DoD, to enhance National defense
2.1.1. Aviation Safety and Security - 50% reduction in fatal accident rate		Develop, demonstrate, and transfer technologies that will enable the reduction of the aviation fatal accident rate by 50% from the 1991-96 average to make a safe air transportation system even safer.
2.1.2 - AvSSP - Hostile Act Intervention		Develop, demonstrate, and transfer technologies that increase resiliency of the air transportation system against threats and hostile acts.
2.1.3a. - AvSSP - System Vulnerability Discovery and Management		Develop, demonstrate, and transfer technologies that identify and inform users of potential air transportation system vulnerabilities.
2.1.3b - AvSSP - Aircraft Self-Protection and Preservation		Develop, demonstrate, and transfer technologies that protect and prevent damage to aircraft due to abnormal operations and system failures.
2.1.3c - AvSSP - Human Error Avoidance (in formulation)		Develop, demonstrate, and transfer technologies that prevent unsafe flight situations due to breakdown between human and machine interface.
2.1.3d - AvSSP - Environmental Hazard Awareness & Mitigation (in formulation)		Develop, demonstrate, and transfer technologies that detect and/or eliminate natural hazards that could compromise safe Air Transportation System operations.
2.2.3 - VS - Reduce Aviation CO2 emissions by 25% (from 2000 SOA)		Develop, demonstrate, and transfer technologies that improve local air quality and our global environment by enabling a significant reduction in emissions from aviation operations.
3.1.3 AvSSP - Establish a joint technology roadmap with the DHS and the FAA		Reduce the vulnerabilty of the Air Transportation System to criminal and terrorist actions
2.2.1a - VS Reducing aviation noise by 20dB (re: 1997 SOA)		Develop, demonstrate, and transfer technologies to enable the reduction of perceived aircraft noise to improve the quality of life for airport neighbors.
2.2.2a - VS - Reduce Aviation NOx emission by 90% (re. 1996 ICAO standard)		Develop, demonstrate, and transfer technologies that improve local air quality and our global environment by enabling a significant reduction in emissions from aviation operations.
2.2.3a - VS - Reduce Aviation CO2 emissions by 45%		Develop, demonstrate, and transfer technologies that improve local air quality and our global environment by enabling a significant reduction in emissions from aviation operations.
10.5.1 - VS - Enable new HALE ROA missions		Develop technologies that enable HALE ROA to remain aloft for weeks and be used as "sub-orbital" satellites for science missions
10.5.2 - VS - Routine HALE ROA operations in the national airspace system, above 18,000 feet		Develop, demonstrate & transfer technologies that enable routine NAS access for ROAs in pursuit of homeland security, disaster management and economic growth.
Demonstrate hypersonic flight with air breathing propulsion.(X-43A)		Develop and demonstrate the world's first flight of a scramjet-powered vehicle (X-43 A) to Mach 7.
2.3.3a. - AS - Conduct trade-off analyses for future national airspace system concepts		Model and simulate the national airspace system, and explore the next generation of advanced operational concepts.
2.3.2 -AS - Enable increased utilization of local and regional airports		Provide technical basis for decisions regarding the use of small untowered airports to enhance mobility
2.3.3g -AS - Human Measures and Performance		Develop design standards, guidelines, recommended practices, recommended applications, methods, and technologies for applying human performance and human/system measures. Focus on human interaction, performance and reliability in the design of complex airspace systems.
2.3.3c -AS - Efficient Aircraft Spacing		Develop, demonstrate, and transfer technologies to aid individual aircraft in maintaining safe separation and efficient traffic flow within the NAS
2.3.3d -AS - Efficient Flight Path Management		Develop, demonstrate, and transfer tactical integrated and airborne traffic management decision support tools to evolve the National Airspace System toward the envisioned Future NAS
2.3.3b - VS Enable a 30% increase in aircrft efficiency (re: 2000 SOA)		Improve mobility by expanding the availability of air travel to a greater fraction of the population.
2.3.3e -AS - Strategic Airspace Usage		Develop strategic planning tools for Air Traffic Control System Command and Control (ATCSCC) and Air Operations Carriers (AOCs), and integrate assessment capability functions into the FAA TFM architecture.
2.3.3f - AS - Space-Based Technologies: communications, navigations and surveillance technologies / architectures		Develop demonstrate, and transfer communications, navigation, and surveillance technologies, architectures, and systems to improve efficient operations of the NAS.
2.2.1 -VS - Reducing aviation noise by 10dB (re: 1997 SOA)		Develop, demonstrate, and transfer technologies to enable the reduction of perceived aircraft noise to improve the quality of life for airport neighbors.



The programs within the Aeronautics Technology theme are compliant with NPG 7120.5B.

Theme: Aeronautics Technology

STATUS

Aviation Safety Program:

- Performed ground-based validation testing on fire/explosion protection systems, and evaluation of assembled systems in partially simulated in-flight environment;
- Conducted simulation and flight-test evaluation of low-cost forward-fit and retrofit synthetic vision systems technologies for general aircraft;
- Reviewed a preliminary operational concept for security technologies and developed a vulnerability assessment of the aircraft and system.

Airspace Systems Program:

- Demonstrated initial functionality, and evaluated human factors for an active decision support tool for complex airspace, the, Multi-Center Traffic Management Advisor, which will enable the more efficient management of arrival flows using highly accurate time-based metering across multiple air route traffic control centers;
- Demonstrated initial functionality of a non-real time system wide modeling system for the national air space, providing multi-objective (capacity, safety, cost) trade space analysis of air traffic management. The architecture is designed to be flexible and extensible to capture and analyze system-wide effects, including network effects for propagation of delays, as well as represent the operating environment (e.g. weather, turbulence, wake vortices) and new airspace structures and traffic management and control rules.

Vehicle Systems Program:

- Completed engine testing of coated polymer matrix composites (PMC) inlet guide vanes to demonstrate coating performance and resistance to erosion. This technology demonstrated the potential to more than double the life of the PMC fan inlet guide vanes, the use of the PMC in components such as guide vanes, contribute to reduction of the overall propulsion system weight thereby improving the thrust-to-weight ratio of the engine and reducing the carbon dioxide production;
- Investigated the use of non-circular inlets mounted over the top of wings to enable a breakthrough capability in next generation subsonic aircraft. The goal was to minimize the effects of flow distortion at the engine face using active flow control. In these inlets a large boundary layer is ingested into the inlet, which distorts the flow before it reaches the engine and reduces inlet efficiency, the baseline inlet produced a total flow distortion of 29 percent. With active flow control enabled, this distortion is reduced to 13 percent.

PERFORMANCE MEASURES

Outcomes/Annual Performance Goals (APGs)	
Outcome 2.1.1	*By 2005, research, develop, and transfer technologies that will enable the reduction of the aviation fatal accident rate by 50% from the FY 1991-1996 average.*
5AT1	Evaluate and flight validate selected next generation cockpit weather information, communications, airborne weather reporting, turbulence prediction and warning technologies, Synthetic Vision System and Runway Incursion Prevention System display concepts. The flight demonstration will illustrate the increased safety of integrating selected concepts in support of fleet implementation decisions. (AvSSP)
5AT2	Demonstrate through applications and simulations safety-improvement systems that will illustrate the increased safety of integrating selected concepts in support of fleet implementation decisions. (AvSSP)
Outcome 2.1.2	*By 2009, research, develop & transfer technologies that will reduce the vulnerability exposure of the aircraft, and reduce the vulnerabilities of other components in the air transportation system.*
5AT3	Create and establish a prototype data collection system for confidential, non-punitive reporting on aviation security by functional personnel in the aviation system.
5AT16	Develop a preliminary joint research plan with the Transportation Security Administration (TSA). (AvSSP)
Outcome 2.2.1	*By 2007, develop, demonstrate and transfer technologies that enable a reduction by half, in community noise due to aircraft, based on the 1997 state of the art.*
5AT4	Using laboratory data and systems analysis, complete selection of the technologies that show the highest potential for reducing commercial air transportation noise by at least 50%. (Vehicle Systems)
Outcome 2.2.2	*By 2007, develop, demonstrate and transfer technologies for reducing NO_x emission by 70% from the 1996 ICAO standard, to reduce smog and lower atmospheric ozone.*
5AT5	Demonstrate 70% reduction NO_x emissions in full-annular rig tests of candidate combustor configurations for large subsonic vehicle applications (Vehicle Systems).
Outcome 2.2.3	*By 2007, develop, demonstrate and transfer technologies for reducing the green-house gas, CO_2, emissions by 25% based on the state of the art for airframe and engine component technologies in 2000.*
5AT6	Based on laboratory data and systems analysis, select unconventional engine or power systems for technology development that show highest potential for reducing CO_2 emissions and/or enabling advanced air vehicles for new scientific missions. (Vehicle Systems)

Theme: Aeronautics Technology

Outcomes/Annual Performance Goals (APGs)	
5AT7	Complete laboratory aerodynamic assessment of low-drag slotted wing concept. (Vehicle Systems)
5AT19	Complete supersonic inlet design requirements study that will identify technology gaps and priorities required for design of future efficient long range supersonic propulsion systems. (Vehicle Systems)
5AT27	Demonstrate through sector testing a full scale CMC turbine vane that will reduce cooling flow requirements and thus fuel burn in future turbine engine system designs. (Vehicle Systems)
Outcome 2.3.2	*By 2005, develop, demonstrate and transfer key enabling capabilities for a small aircraft transportation system.*
5AT10	Complete experimental validation of airborne systems with concept vehicle development
Outcome 2.3.3	*By 2009, develop, demonstrate, and transfer technologies that enable a further 5% increase in throughput in the terminal area and a further 10% increase in en route throughput based on 1997 NAS capacity.*
5AT8	Complete development of WakeVAS concept of operations and downselect WakeVAS architecture.
5AT9	Complete human-in-the-loop concept and technology evaluation of shared aircraft separation. (Airspace Systems)
5AT11	Complete analysis of capacity-increasing operational concepts and technology roadmaps with VAST models, simulations, and Common Scenario Set. (Airspace Systems)
5AT12	Develop display guidelines that exploit new understanding of perceptual systems and cognitive and physiological determinants of human performance. (Airspace Systems)
5AT13	Establish the fluid dynamics mechanism for alleviating wake through experimental and computational fluid mechanics studies. (Airspace Systems)
5AT14	Complete System-Wide Evaluation and Planning Tool initial simulation and field demonstration. (Airspace Systems)
5AT15	Complete communications, navigation, and surveillance requirements analysis. (Airspace Systems)
5AT22	Using laboratory data and systems analysis, complete selection of the technologies that show the highest potential for reducing takeoff/landing field length while maintaining cruise Mach, low speed controllability and low noise. (Vehicle Systems)
Outcome 3.1.5	*Transfer technology both to and from the Department of Defense.*
5AT17	Complete NASA / Industry / DoD studies of heavy-lift Vertical Take Off and Landing (VTOL) configurations to provide strategic input for future decisions on commercial / military Runway Independent Vehicles. (Vehicle Systems)
Outcome 7.1.4	*Engage the public in NASA missions, discoveries and technology through public programs, community outreach, mass media, and the Internet.*
5AT18	Partner with museums and other cultural organizations and institutions to engage non-traditional audiences in NASA missions.
Outcome 10.5.1	*Develop technologies that will enable solar powered vehicles to serve as "sub-orbital satellites" for science missions.*
5AT20	Complete flight demonstration of a second generation damage adaptive flight control system. (Vehicle Systems)
5AT21	Define requirements for a robust, fault-tolerant avionics architecture that supports fully autonomous vehicle concepts. (Vehicle Systems)
5AT24	Complete laboratory aerodynamic assessment of low-drag slotted wing concept. (Vehicle Systems)
5AT25	Based on laboratory data and systems analysis, select unconventional engine or power systems for technology development that show highest potential for reducing CO2 emissions and/or enabling advanced air vehicles for new scientific missions. (Vehicle Systems)
5AT26	Complete initial flight series for validation of improved HALE ROA aero-structural modeling tools used to reduce risk and increase mission success. (Vehicle Systems)
Outcome 10.5.2	*By 2008, develop and demonstrate technologies required for routine Unmanned Aerial Vehicle operations in the National Airspace System above 18,000 feet for High-Altitude, Long-Endurance UAVs.*
5AT23	Demonstrate integrated technologies and policies for UAV flight operations above 40,000 feet. (Vehicle Systems)
Uniform Measures	
5AT28	This Theme will complete 90% of the major milestones planned for FY 2005.

Theme: Aeronautics Technology

INDEPENDENT REVIEWS

Review Types	Performer	Last Review Date	Next Review Date	Purpose
Quality	NRC / ASEB	2/03	2/06	Assess the scientific and technical quality.
Relevance	ATAC	9/03	2/04	Assess the relevance of the Aerospace research.
Performance	EPMC and Agency PMC	11/03	1/04	Quarterly Status Reviews by Enterprise and Agency Program Management Councils.

BUDGET

Budget Authority ($ millions)	FY2003	FY 2004	Change	FY 2005	Comments
Aeronautics Technology	**599.1**	**1,034.3**	**-115.1**	**919.2**	
Development	26.8				
Hyper-X (X-43-A)	26.8				
Technology and Advanced Concepts	572.3	1,034.3	-115.1	919.2	
Aviation Security and Safety Program (AvSSP)	93.6	180.0	+8.0	188.0	Full Cost Adjustment
Airspace Systems Programs	145.4	233.9	-79.5	154.4	No Congressional Interest Items
Vehicle Systems Program	333.3	620.4	-43.6	576.8	No Congressional Interest Items

Indicates changes since the previous year's President's Budget Submit.
Indicates budget numbers in full cost.

Theme: Aeronautics Technology
Technology and Advanced Concepts: Aviation Security and Safety Program (AvSSP)

PURPOSE

Objectives	Performance Measures
2.1, 7.1	5AT1-3,16,18

AvSSP directly addresses the safety and security research and technology needs of the Nation's airspace system to either prevent the unintentional and intentional actions that would cause damage, harm, and loss of life or mitigate the consequences when these types of situation occur. AvSSP conducts prevention, intervention, and mitigation research, and develops technologies and strategies aimed at one or more causal, contributory, or circumstantial factors associated with aviation accidents and systems vulnerability to criminal and terrorist attacks while dramatically improving the efficiency of such protections. High priority is given to strategies that address factors determined to be the largest contributors to accident, vulnerability, and fatality rates, as well as those that address multiple classes of factors. The AvSSP also develops and integrates information technologies needed to build a safer aviation system, which will support the needs of both pilots and air traffic controllers, as well as providing information to assess situations and trends that might indicate unsafe conditions before they lead to accidents or security incidents. The AvSSP research and technology planning activities are conducted in close coordination with the FAA and DHS.

OVERVIEW

The goal and objectives of the AvSSP are established in the NASA Strategic Plan. In the NASA 2000 Strategic Plan, which was the governing document at the initiation of program implementation, the Aeronautics Enterprise formulated a safety objective to "Make a safe air transportation system even safer." The plan further established the following safety performance metrics: Reduce the aircraft fatal accident rate 80% within 10 years and 90% within 25 years.

Based on this safety performance metric, the AvSSP goal for the FY 2000 through FY 2005 time period is the following: develop and demonstrate technologies that contribute to a reduction in the aviation fatal accident rate by a factor of 5 by the year 2007. With the intent of addressing aviation security research and technology needs, the scope of the program was expanded in the NASA 2003 Strategic Plan to include activities targeted at the aviation security applications beginning in FY 2004. Therefore, a new NASA objective was created to cover both safety and security research: "Decrease the aircraft fatal accident rate and the vulnerability of the air transportation system to threats and mitigate the consequences of accidents and hostile acts."

Specific safety performance goals and metrics for activities beginning in FY 2006 are under formulation. Security performance goals and metrics are being developed in partnership with the Department of Homeland Security.

To address the existing and projected objectives in aviation safety and security, the AvSSP has established strategic foci within which all safety and security research activities will be conducted. These foci and the Themes for research in each are as follows: 1) Hostile Act Intervention and Protection -Increase resiliency of the ATS against threats and hostile acts; 2) System Vulnerability Discovery and Management -Identify and inform users of potential ATS vulnerabilities; 3) Aircraft Self-Protection and Preservation -Protect and prevent damage to aircraft due to abnormal operations and system failures; 4) Human Error Avoidance -Prevent unsafe flight situations due to breakdown between human and machine interface; and, 5) Environmental Hazards Awareness and Mitigation -Detect and/or mitigate natural hazards that could compromise safe ATS operations.

PROGRAM MANAGEMENT

AvSSP is a multiple-project program within the Aeronautics Technology Theme. The Aeronautics Enterprise Program Management Council has AvSSP governing responsibility. The NASA Enterprise official is Dr. J. Victor Lebacqz, Associate Administrator, Office of Aeronautics. The Aeronautics Technology Theme Director is Terrence J. Hertz, Director, Aeronautics Technology, OA. The Program Manager is George Finelli, OA, hosted at the Langley Research Center. The program is compliant with NPG 7120.5b.

Theme: Aeronautics Technology
Technology and Advanced Concepts: Aviation Security and Safety Program (AvSSP)

TECHNICAL COMMITMENT

The baseline for this technical commitment is the FY2005 budget request.

Technical Specifications		FY 2005 President's Budget							Change from Baseline
		FY03	FY04	FY05	FY06	FY07	FY08	FY09	
Develop and demonstrate technologies that prevent unsafe flight situations due to breakdown between human and machine interface. (In formulation/Safety Follow-on)	TRL				3	3	4	5	--
	$M				35.80	35.50	42.80	39.00	--
Develop safety relevant technologies to detect and/or eliminate natural hazards that could compromise safe ATS operations. (In formulation/Safety Follow-on)	TRL				2	3	4	4	--
	$M				17.60	18.50	20.40	19.90	--
Develop and advance technologies that will identify and inform users of potential ATS vulnerabilities. (In formulation/Security SVD)	TRL		3	4	4	5	5	6	--
	$M		4.00	12.10	35.30	36.70	35.90	35.30	--
Develop and advance airborne technologies to protect and prevent damage to aircraft due to abnormal operations and system failures. (in formulation/Safety Follow-on)	TRL				3	3	4	4	--
	$M				40.40	40.90	40.40	49.10	--
Develop enabling technologies providing accurate, timely, and intuitive info during the en-route phases of flight to the flight deck to enable the detection and avoidance of atmospheric hazard.	TRL	4	5	6					--
	$M	13.10	26.70	22.80					--
Develop enabling technologies presenting accurate & timely (as verified by flight and ground experimentation) atmospheric turbulence hazard products to pilots, dispatchers, and ATC.	TRL	4	5	6					--
	$M	5.30	10.90	9.30					--
Develop a GA situational awareness enhancement system, utilizing database with display symbology and precise GPS navigational info. to create synthetic views of the current external environment.	TRL	4	5	6					--
	$M	2.70	5.20	5.80					--
Develop a commercial/business aircraft situational awareness enhancement system utilizing database, sensor and hazard detection technologies merged with display symbology and precise GPS navigation.	TRL	5	5	6					--
	$M	13.20	25.80	28.00					--
Demonstrate improved training modules, maintenance procedures, projected to reduce targeted human errors.	TRL	4	5	6					--
	$M	10.00	10.30	7.40					--
Demonstrate in flight Health and Usage Monitoring technologies for commercial transport aircraft.	TRL	4	5	6					--
	$M	23.40	27.00	32.80					--
Develop advanced structures, materials, and system designs, projected to improve crash survivability and fire hazard mitigation.	TRL	5	5	6					--
	$M	4.10	5.70	2.60					--
Develop design and analysis tools, ice protection systems technologies, and education and training tools for design, certification, and operation of aircraft.	TRL	3	3	4					--
	$M	8.70	17.80	18.10					--
Demonstrate integrated aviation system monitoring tools and infrastructure design to provide advanced indication of conditions that could lead to accidents.	TRL	3	5	6					--
	$M	13.10	21.70	17.80					--
Develop and advance technologies that increase resiliency of the ATS against threats and hostile acts. (In formulation/Security ASVM)	TRL		3	4	4	5	5	6	--
	$M		16.60	31.60	46.00	46.40	34.20	35.90	--

Schedule	FY 2005 President's Budget	Baseline	Change from Baseline
Complete Integrated Program Assessment	September 2004	September 2004	--
Complete Preliminary Aviation Security Concept of Operation	December 2004	December 2004	--
Test prototype Security Incident Report System at selected airports	December 2004	December 2004	--
Complete future Safety Operational Concept Scenarios	June 2005	June 2005	--
Validate Aviation Safety technology enabling 50% reduction in fatal accident rate	June 2005	June 2005	--

ACQUISITION STRATEGY AND PERFORMING ORGANIZATIONS

Leverage NASA's research and development investments through the use of cooperative agreements and cost-shared contracts whenever possible, maximize the impact of the deliverables and use NASA R&D as a catalyst for a national investment in key safety enhancing technologies. AvSSP will use standard competitive procurements when purchasing items where required specifications are known. NASA Research Announcements (NRAs) will be used to encourage new and creative approaches to technology challenges, when it is difficult to define detailed specifications. Multiple awards of grants, contracts, cost-shared contracts, and cooperative agreements may result from one solicitation. AvSSP will use the competitive NRA process to: stimulate cost-sharing from industry; leverage public and private R&D Programs and resources; and accelerate technology commercialization through broad technical teams capable of solving both the technical hurdles and the implementation and certification issues.

Current Acquisition	Actual*	Selection Method	Actual*	Performer	Actual*
Cooperative Agreement	20%	Full & Open Competition	95%	Industry	53%
Cost Reimbursable	50%	Sole Source	5%	Government	2%
Fixed Price	25%		100%	NASA Intramural	30%
Grants	5%			University	5%
Other	0%	Science Peer Review	%	Non Profit	10%
*As of FY 2003 direct procurement	100%	*As of FY 2003 direct procurement		*As of FY 2003 direct procurement	100%

Future Acquisition	Selection	Goals
Annual NASA Research Announcement	FY 05/06	100% Open Competition seeking cost and technology
Grants	FY 05/06	100% Open Competition seeking universities research studies
Interagency Agreements	FY 05/06	Increase use of other government agencies expertise

AGREEMENTS

Internal: The program is not dependent on other NASA activities outside of the control of the AA, Office of Aeronautics Technology.

External: 1) Umbrella agreement between the FAA and NASA concerning a Partnership to Achieve Goals in Aviation and Future Space Transportation, October 1998; 2) Memorandum of Understanding #FNA/05 between the FAA and NASA on Program Support, August 1990; 3) Memorandum of Agreement #FNA/05-97-01 between the FAA and NASA for support of FAA R&D Field Offices at NASA Centers, March 1997; 4) Memorandum of Understanding #FNA/08 between the FAA and NASA concerning Aviation Safety Research, July 1999; 5) Memorandum of Agreement #FNA/08-99-01 between the FAA and NASA concerning the Aviation Safety Reporting System, June 1999; 6)Memorandum of Agreement #FNA/08-00-01 between the FAA and NASA concerning Weather Accident Prevention R&D Activities, June, 2000; 7) Memorandum of Agreement #FNA/08-01-01 between the FAA and NASA concerning Accident and Incident Mitigation Research, June 2001; 8) Memorandum of Agreements #FNA/08-02-01 between the FAA and NASA concerning the Development and Evaluation of Enhanced Situational Awareness Technologies, June 2002; 9) Cooperative Agreements with Rannoch, Research Triangle Institute, Ohio University, Rockwell Collins, Jeppesen., and Honeywell International; 10) MoA with Department of Energy (Los Alamos Laboratories); and 11) MoA under development with Department of Homeland Security.

Theme: Aeronautics Technology
Technology and Advanced Concepts: Aviation Security and Safety Program (AvSSP)

RISK MITIGATION

Risk Date: 8/1/2003

Top Risks	G	Overall	G	Cost	G	Schedule	G	Technical	Probability	Impact	Mitigation Plan
G	Loss of critical workforce								moderate	moderate	in place
G	Agency reprioritization of R&D funds								moderate	moderate	in place
G	Loss of critical facilities								high	high	in place
G	Failure to gain acceptance of program output by users								moderate	moderate	in place

INDEPENDENT REVIEWS

Review Types	Performer	Last Review Date	Next Review Date	Purpose
Performance	IPAO	11/01	1/04	Assess the program performance against the approved program plan.
Quality	NRC/ASEB	2/03	2/06	Assess scientific and technical quality of the program against the current SOA.
Relevance	ATAC	6/03	2/04	Assess the relevance of the program to the potential end-users.

BUDGET

Budget Authority ($ millions)	FY 2003	FY 2004	FY 2005	Comments
FY2005 PRESBUD	93.6	180.0	188.0	
Vehicle Safety Technologies (VST)	50.0	75.7	77.8	
System Safety Technologies (SST)	23.8	30.8	21.4	Transfer to Vulnerability Mitigation
Weather Safety Technologies (WST)	19.9	45.0	44.3	
Aircraft & Systems Vulnerability Mitigation		24.9	35.5	Transfer from SST [above]
System Vulnerability Detection		1.6	5.7	
Technical Integration		2.0	3.3	
Changes since 2004 PRESBUD	-1.4	+11.5		
Vehicle Safety Technologies (VST)	+0.2	+1.2		Congressional Interest Item
System Safety Technologies (SST)	-0.5	-0.3		Transfer to Vulnerability Mitigation
Weather Safety Technologies (WST)	-1.0	+2.7		Congressional Interest Item
Aircraft & Systems Vulnerability Mitigation		+24.9		Transfer from AST [below]
System Vulnerability Detection		+1.6		Congressional Interest Item
Technical Integration		+2.0		Congressional Interest Item
Aviation Securities Technologies (AST)		-20.6		Transfer to Vulnerability Mitigation
FY2004 PRESBUD	95.0	168.5		
Vehicle Safety Technologies (VST)	49.8	74.5		
System Safety Technologies (SST)	24.3	31.1		
Weather Safety Technologies (WST)	20.9	42.3		
Aviation Securities Technologies (AST)		20.6		

Indicates changes since the previous year's President's Budget Submit.
Indicates budget numbers in full cost.

Theme: Aeronautics Technology
Technology and Advanced Concepts: Airspace Systems Programs

PURPOSE

Objectives	Performance Measures
2.1, 2.3, 7.1	5AT8-9,11-16,18

The AS program enables the development of revolutionary improvements to, and modernization of, the National Airspace System, as well as the introduction of new systems for vehicles whose operation can take advantage of the improved, modern ATM system. The customers for this technology are the FAA, state, and local airport authorities, and their systems suppliers, existing and new commercial and personal aviation operators, and the aircraft developers and their system suppliers. The primary goal of the AS program is to enable new aircraft system capabilities and air traffic technology to increase the capacity and mobility of the Nation's air transportation system. The objectives are to maximize operational throughput, predictability, efficiency, flexibility, and access into the airspace system while maintaining safety and environmental protection. The resultant benefit to the user will be reduced flight delays and reduction to doorstep-to-destination trip duration. This plan provides the details for the development and transition of ATM R&D from NASA to the FAA as technologies mature.

OVERVIEW

The AS Program is one of three programs within the Aeronautics Technology Theme. The AS program has identified strategic foci to guide the program toward the vision outlined in the NASA Aeronautics Blueprint. The three AS program strategic foci are: 1) Efficient Traffic Flow -Operations of individual aircraft within the NAS for efficiency of operations; 2) System-Wide Operations Technologies -Efficient operation of the NAS as an overall nation-wide system with global interaction; and 3) Airspace Human Factors -Human interaction, performance and reliability in the design of complex airspace systems. The AS Program is composed of the following projects: Advanced Air Transportation Technologies (AATT); Virtual Airspace Modeling and Simulation (VAMS); Small Aircraft Transportation System (SATS); Human Measures and Performance (HMP); Efficient Aircraft Spacing (EAS); Efficient Flight Path Management (EFPM); Strategic Airspace Usage (SAU); and Space-Based Technology (SBT). These eight projects map into the strategic foci as follows: Efficient Traffic Flow (AATT, EAS, EFPM); System-Wide Operations Technologies (VAMS, SATS, SAU, SBT); and Airspace Human Factors (HMP).

The AATT project develops decision-making technologies and procedures to provide all airspace users with more flexibility and efficiency, as well as enable new modes of operation supporting the FAA commitment to "Free Flight." The VAMS project, initiated in FY02, develops and assesses advanced system-level air transportation concepts to meet demand through 2025, and evaluates those concepts and other enhancements to the NAS. The SATS project develops technology to enable small aircraft to operate at non-towered, non-radar small airports. The HMP project, formerly the Airspace Operations Systems project, develops fundamental knowledge, models, and tools for the efficient and safe operation of aviation systems by their human operators. In FY02, the Airspace Systems Program Office began project advocacy/formulation for an FY04 NASA Exploratory Technologies for the National Airspace System initiative. Planning efforts for this FY04 program augmentation has resulted in four new projects (EAS, EFMP, SAU, and SBT) and a new program-level cross-cutting effort, Technology Integration. The EAS project will develop technologies to aid individual aircraft in maintaining safe separation and efficient traffic flow within the NAS. The EFMP project will develop tactical traffic management tools to aid the controllers in maintaining efficient traffic flow. The SAU project will develop strategic traffic management tools and system-wide operations technologies to improve operation of the NAS as an overall nation-wide system. The SBT project will develop communications, navigation, and surveillance technologies, architectures, and systems to improve efficient operations of the NAS. Technology Integration, a program-level effort, will integrate technologies across project, domain, and infrastructure boundaries, and will conduct system studies and systems analyses.

PROGRAM MANAGEMENT

AS is a multiple-project program. The Aeronautics Enterprise Program Management Council has AS governing responsibility. The NASA Enterprise official is Dr. J. Victor Lebacqz, Associate Administrator, Office of Aeronautics (OA). The Aeronautics Technology Theme Director is Terrence J. Hertz, Director, Aeronautics Technology, OA. Program Manager is Robert Jacobsen, OA, hosted at Ames Research Center. The program is compliant with NPG 7120.5b.

TECHNICAL COMMITMENT

The FY 2005 budget request establishes the new baseline for the program.

Technical Specifications		FY 2005 President's Budget							Change from Baseline
		FY03	FY04	FY05	FY06	FY07	FY08	FY09	
Develop strategic planning tools for Air Traffic Service Providers and Airline Operations Centers, which reduce delays in the NAS while increasing system throughput	TRL		3	3	4	4	5	5	--
	$M		0.50	10.48	17.90	21.90	28.39	28.37	--
Integrate technologies across project, domain, and infrastructure boundaries, and conduct system studies and systems analyses	TRL		1	2	2	3	3	3	--
	$M		17.09	14.73	14.78	15.77	16.74	17.72	--
Develop advanced CNS technologies and architectures	TRL		1	2	2	3	3	4	--
	$M		6.35	18.59	25.60	32.42	38.90	38.89	--
Complete the development and technology transfer of ATM decision support tools (McTMA, D2, SMS) to FAA Free Flight 2 Program and complete validation and assessment of NASA-developed AATT products.	TRL	5	6						--
	$M	82.49	98.81						--
Develop and demonstrate vehicle technologies to enable increased utilization of local and regional airports	TRL	3	4	5	5				--
	$M	26.84	28.73	16.52	4.10				--
Develop future NAS operational concepts	TRL	1	2	2	3	3			--
	$M	9.30	12.30	12	12.70	12.30			--
Develop modeling and simulation capability/ environment to assess new operational concepts at the domain and system level	TRL	2	3	3	4	5			--
	$M	16.30	18.40	17.90	19	18.50			--
Develop human performance measurements and design standards	TRL	1	1	2	2	3	3	4	--
	$M	10.45	19.22	18.02	19.59	19.52	19.49	19.47	--
Develop wake vortex operation procedures and standards to increase safety and capacity in the terminal area	TRL		1	2	2	3	3	4	--
	$M		9.18	23.06	27.24	23.17	25.76	25.85	--
Develop and explore distributed air/ground traffic management concepts	TRL		1	2	2	3	3	4	--
	$M		4.99	12.48	9.83	15.11	16.23	18.27	--
Develop long-term decision support tools and strategic planning tools to evolve the NAS toward the envisioned future NAS	TRL		3	3	4	4	5	5	--
	$M		1.48	14.01	21.04	25.04	31.24	31.23	--

Schedule	FY 2005 President's Budget	Baseline	Change from Baseline
Vehicle Technologies - Initial SATSLab Flight Experiments Conducted (SATS)	Aug. 2004	Aug. 2004	--
Vehicle Technologies - System Integration Validated	June 2005	June 2005	--
Vehicle Technologies - SATS Technology Demonstration and Project Closeout	Sept. 2005	Sept. 2005	--
VA - Build 3 VAST toolboxes with cognitive human performance attributes and CNS	Aug. 2004	Aug. 2004	--
VA - Complete preliminary evaluation of selected operational concepts (R-T only)	Sept. 2005	Sept. 2005	--
Develop and evaluate Oceanic/Wide-Area Communications and Surveillance System	Sept. 2008	Sept. 2008	--
CNS - Space-based surveillance system concept validation	Sept. 2008	Sept. 2008	--
Wake Vortex - Complete ICAO-level Wake VAS performance assessment	Sept. 2009	Sept. 2009	--
Wake Vortex - Complete wake alleviation feasibility assessment	Sept. 2009	Sept. 2009	--
LT DST - Develop System-Wide Evaluation and Planning Tool (SWEPT)	Sept. 2005	Sept. 2005	--
LT DST - Develop and demonstrate Collaborative Traffic Management capabilities	Sept. 2008	Sept. 2008	--
LT DST - Complete development and demonstration of Advanced Routing Tool	Sept. 2008	Sept. 2008	--
LT DST - Development and demonstrate Advanced SMS decision support tool	Sept. 2008	Sept. 2008	--
LT DST - Integrate and demonstrate SWEPT into FAA TFM architecture	Sept. 2008	Sept. 2008	--

Schedule	FY 2005 President's Budget	Baseline	Change from Baseline
Human Perform - Develop situation displays for collaborative decision-making	Sept. 2008	Sept. 2008	--
Human Perform - Complete ATC, AOC, and flight-deck collaboration training module	Sept. 2008	Sept. 2008	--
Decision support tools to increase en-route and terminal throughput by 10%	Sept. 2004	Sept. 2004	--

ACQUISITION STRATEGY AND PERFORMING ORGANIZATIONS

The AS program's acquisition strategy is to leverage NASA's R&D investments through the use of Space Act Agreements, joint government-industry partnerships, and cost-shared contracts whenever possible.

AS will use standard competitive procurements when purchasing items where required specifications are known. AS will use the competitive NRA process to: 1) stimulate cost-sharing from industry; 2) leverage public and private R&D Programs and resources; and 3) accelerate technology commercialization through broad technical teams capable of solving both the technical hurdles and the implementation and certification issues. In addition to government procured contract support, other resources may include: 1) FAA Technical Center; 2) DOT's Volpe Center; 3) Lincoln Laboratory; 4) MITRE CAASD; and 5) other FFRDCs. AS has selected a partner, National Consortium for Aviation Mobility for a joint venture to develop and demo air mobility technologies for small aircraft and airports.

Current Acquisition	Actual*	Selection Method	Actual*	Performer	Actual*
Cooperative Agreement	2%	Full & Open Competition	94%	Industry	71%
Cost Reimbursable	55%	Sole Source	6%	Government	4%
Fixed Price	16%		100%	NASA Intramural	2%
Grants	11%			University	14%
Other	16%	Science Peer Review	%	Non Profit	9%
*As of FY 2003 direct procurement	100%	*As of FY 2003 direct procurement		*As of FY 2003 direct procurement	100%

Future Acquisition	Selection	Goals
Real-time simulation (VAMS)	Fall '04	
Non-real-time simulation (VAMS)	Oct '05	

AGREEMENTS

External: 1) MoU between FAA and NASA on "Airspace System User Operational Flexibility and Productivity," September 1995; 2) MoA between the FAA and NASA concerning Research on Airport Surface Operations in Reduced Visibility Weather Conditions, 1997; 3) MoA between FAA and NASA on the support of FAA R&D Field Offices Located at NASA Centers, March 1997; 4) MoA between the FAA Technical Center and NASA Ames Research Center on Air Traffic Management Research and Technology, June 20, 1998' 5) Agreement between FAA and NASA concerning a Partnership to Achieve Goals in Aviation and Future Space Transportation, October 9, 1998. 6. MoU between the DoT Volpe Center and ARC concerning Research, Design, Development and Demonstration of Aviation Concepts and Technologies, June 2001; 7) MoA #FNA/08-00-02 between FAA/William J. Hughes Tech. Center and NASA establishing a collaborative working relationship, November 27, 2000; 8) MoA #FNA/08-00-02 (IAI-536) Annex 001 between FAA/William J. Hughes Tech. Center (WJHTC) and NASA concerning National Airspace Systems Research and Testing Development SATS Program Activities, April 19, 2001; 9) MOU in development between LaRC and the DOT Volpe Center, establishing the shared and NASA-funded tasks for analysis of market, consumer, and community response issues related to SATS services, May 10, 2002; 10) JSRDA between LaRC and the National Consortium for Aviation Mobility on the SATS project, May 2002.

RISK MITIGATION

Risk Date: 8/6/2003

Top Risks	G Overall	G Cost	G Schedule	G Technical	Probability	Impact	Mitigation Plan
G	Some technical elements do not meet expected performance				moderate	moderate	in place
G	Customer requirements change				moderate	moderate	in place
G	Agency reprioritization of funding				moderate	moderate	in place
G	Partners do not meet resource commitments				high	high	in place
G	Inaccessibility to FAA field test sites				high	high	in place
G	Unavailability of critical R&D facilities				moderate	moderate	in place

Theme: Aeronautics Technology
Technology and Advanced Concepts: Airspace Systems Programs

INDEPENDENT REVIEWS

Review Types	Performer	Last Review Date	Next Review Date	Purpose
Performance	IPAO	11/03	11/04	Assess the programmatic performance of the ASP against the approved program plan
Quality	NRC/ASEB	2/03	2/06	Assess scientific and technical quality of the program against the current SOA
Relevance	ATAC	12/02	9/04	Assess the relevance of the R&T program to the potential end-user

BUDGET

Budget Authority ($ millions)	FY 2003	FY 2004	FY 2005	Comments
FY2005 PRESBUD	145.4	233.9	154.4	
Advanced Air Transportation Technology	82.5	104.9		Planned End of Project
Small Aircraft Transportation System	26.8	31.5	16.6	Reformulation of Projects
Virtual Airspace Modeling & Simulation	25.6	33.1	29.9	Reformulation of Projects
Efficient Aircraft Spacing		20.5	35.4	Reformulation of Projects
Efficient Flight Path Management		14.8	14.0	Reformulation of Projects
Strategic Airspace Usage		1.5	7.1	Reformulation of Projects
Space-Based Technologies		0.5	18.6	Reformulation of Projects
Human Measures and Performance	10.4	7.2	18.1	Reformulation of Projects
Technical Integration		19.9	14.7	Reformulation of Projects
Changes since 2004 PRESBUD	+20.3	+16.7		
Advanced Air Transportation Technology	+10.9	-0.7		Planned End of Project
Small Aircraft Transportation System	+6.8	+0.8		Extend Schedule of Experiment
Virtual Airspace Modeling & Simulation	+2.3	-0.2		Full Cost Adjustment
Aviation Operations Systems	-10.2	-20.6		Reformulation of Projects
Next Generations Air Transportation System		-27.0		Reformulation of Projects
Efficient Aircraft Spacing		+20.5		Reformulation of Projects
Efficient Flight Path Management		+14.8		Reformulation of Projects
Strategic Airspace Usage		+1.5		Full Cost Adjustment
Space-Based Technologies		+0.5		Full Cost Adjustment
Human Measures and Performance	+10.4	+7.2		Reformulation of Projects
Technical Integration		+19.9		Reformulation of Projects
FY2004 PRESBUD	125.1	217.2		
Advanced Air Transportation Technology	71.5	105.6		
Small Aircraft Transportation System	20.0	30.7		
Virtual Airspace Modeling & Simulation	23.3	33.3		
Aviation Operations Systems	10.2	20.6		
Next Generations Air Transportation System		27.0		

Indicates changes since the previous year's President's Budget Submit
Indicates budget numbers in full cost.

Theme: Aeronautics Technology
Technology and Advanced Concepts: Vehicle Systems Program

PURPOSE

Objectives	Performance Measures
10.5, 2.2, 2.3, 3.1, 7.1	5AT4-7,17-27

The VS program is focused on the development the key enabling technologies to enable capabilities for future air vehicles. These technologies, when implemented, will reduce NO_x emissions to reduce pollution near airports and in the lower atmosphere, reduce emissions of carbon dioxide and reduce aircraft noise. These technologies will simultaneously enable air traffic growth and reduce overall environmental impact. Vehicle Systems technologies are also being developed in collaboration with the Department of Defense to ensure National security through various air vehicle concepts. Research on technologies to enable new vehicle concepts, such as High Altitude Long Endurance (HALE) Remotely Operated Aircraft (ROA) support the NASA science missions and increase quality of life for U.S. citizens.

OVERVIEW

The Vehicle Systems Program is developing enabling technologies to expand the availability of air travel that will satisfy the public's demand for increased air travel without affecting safety or degrading the environment. Research and technology will provide a broad spectrum of capabilities for vehicles in five classes: a) Subsonic Transports, b) Small Supersonic Aircraft, c) Unpiloted Air Vehicles, d) Runway Independent Air Vehicles and e) Personal Air Vehicles. The program develops technologies that are directly related to one or more of the vehicle classes. The program is focused on six technology focus areas in which key development will occur to advance the state-of-the-art of air vehicles.

1) Environmentally Friendly, Clean Burning Engines: develop innovative technologies to enable intelligent turbine engines that significantly reduce harmful emissions while maintaining high performance and increasing reliability. 2) New Aircraft Energy Sources and Management: discover new energy sources and intelligent management techniques directed towards zero emissions and enable new vehicle concepts for public mobility and new science missions. 3) Quiet Aircraft for Community Friendly Service: Develop and integrate noise reduction technology to enable unrestricted air transportation service to all communities. 4) Aerodynamic Performance for Fuel Efficiency: Improve aerodynamic efficiency, structures and materials technologies, and design tools and methodologies to reduce fuel burn and minimize environmental impact and enable new vehicle concepts and capabilities for public mobility and new science missions. 5) Aircraft Weight Reduction and Community Access: Develop ultralight smart materials and structures, aerodynamic concepts, and lightweight subsystems to increase vehicle efficiency, leading to high altitude long endurance vehicles, planetary aircraft, advanced vertical and short takeoff and landing vehicles and beyond. 6) Smart Aircraft and Autonomous Control: Enable aircraft to fly with reduced or no human intervention, to optimize flight over multiple regimes, and to provide maintenance on demand towards the goal of a feeling, seeing, sensing, sentient air vehicle.

PROGRAM MANAGEMENT

VS is a multi-project program within the Aeronautics Technology Theme. The Aeronautics Enterprise Program Management Council has VS governing responsibility. The NASA Enterprise official is Dr. J. Victor Lebacqz, Associate Administrator, Office of Aeronautics (OA). The Aeronautics Technology Theme Director is Terrence J. Hertz, Director, Aeronautics Technology, OA. The Program Manager is Dr. Richard Wlezien, OA hosted at NASA Headquarters. The program is compliant with NPG 7120.5b.

TECHNICAL COMMITMENT

The FY 2005 budget request provides a new baseline. In FY 2004 the program revamped and realigned the research and technology development to public good goals.

Technical Specifications		FY 2005 President's Budget							Change from Baseline
		FY03	FY04	FY05	FY06	FY07	FY08	FY09	
Conduct studies and system analysis to guide technology investments, evaluate progress toward goals, and provide capabilities assessments. (SVA)	TRL			3	3	3	3	3	--
	$M			22.90	22.70	22.80	23.10	24.90	--
Validate in a relevant environment selected aircraft component technologies and advanced flight operations for reducing noise by 10dB (re: CY 1997 SOA) to reduce community noise impact. (QAT)	TRL	3	3	4	5	6			--
	$M	19.20	64.80	72.30	75.70	26.00			--

Technical Specifications (continued)		**FY 2005 President's Budget**							**Change from Baseline**
		FY03	**FY04**	**FY05**	**FY06**	**FY07**	**FY08**	**FY09**	
Develop technologies and analytical tools for evaluation of aircraft configurations that will reduce community noise impact by 20dB, and validate these in a laboratory environment. (4X)	TRL					2	2	3	--
	$M					44.30	69.40	70.80	--
Demonstrate combustor configurations for reducing NOx emission by 70% (re: to 1996) to reduce pollution and lower atmospheric ozone formation. (UEET)	TRL	3	3	4	5	6			--
	$M	34.50	45.90	44.20	45.70	44.20			--
Develop and demonstrate combustor configurations for reducing NOx emissions by 90%. (re: to 1996 ICAO standards) (UEET-IPS follow-on)	TRL						3	3	--
	$M						44.50	44.10	--
Provide proof of concept validation of key technologies for future intelligent gas turbine engines, non-conventional propulsion systems, and hybrid electric propulsion systems. (P&P)	TRL	1	2						--
	$M	84.60	147.62						--
Develop and demonstrate technologies for reducing emissions of CO2 by 25% relative to year 2000 state of the art. (TCAT, UEET, UEET-IPS follow on, EASI)	TRL	3	3	4	4	5	5	6	--
	$M	78.10	79.20	121.90	122.40	118.50	118.40	119.00	--
Demonstrate an additional 10% emissions improvement in conventional propulsion systems while laying the foundation for proof of non-conventional systems that double the efficiency of today. (LEAP)	TRL			3	3	4	5	6	--
	$M			121.30	128.50	115.40	116.00	118.50	--
Provide proof of concept validation of self healing structures, ultra light structures, robust controls, and advanced sensor and actuator systems. (TCAT, BVT)	TRL	1	2						
	$M	58.70	155.90						--
Demonstrate lightweight high-lift technologies through subcomponent tests to reduce take-off and landing distances by 20% while maintaining high vehicle cruise performance and low noise levels. (ITAS)	TRL			3	3	4	5	6	--
	$M			71.60	70.10	70.00	69.30	71.10	--
Demonstrate autonomous vehicle technologies through flight tests and simulations that increase vehicle reliability by a factor of 2. (AuRA)	TRL			2	3	4	5	6	--
	$M			20.30	19.80	19.40	19.20	19.50	--
Develop and demonstrate technologies to enable advanced vehicle concepts. (AVC without X-43)	TRL	5	5						--
	$M	7.80	20.00						--
Develop innovative concepts and technologies for advanced instrumentation, flight test techniques, and flight testbeds to improve FR productivity by 15% while maintaining safety standards. (FR)	TRL	2	3						--
	$M	58.10	86.40						--
Develop and demonstrate technologies required for routine, safe and reliable Unmanned Aerial Vehicle operations in the NAS at and above the 18,000 ft. level. (F&SD)	TRL		3	4	5	6	7		--
	$M		8.70	18.70	19.80	24.60	29.70		--
Develop and demonstrate technologies and design methodologies to enable 7-14 day HALE ROA operations with 200 kg payload at altitude >60,000 foot. (F&SD)	TRL		3	4	4	5	5	6	--
	$M		10.00	17.00	16.00	17.00	15.00	26.90	--
Validate through flight and systems integration, technology developed while improving flight test techniques, assuring flight success and increasing productivity. (F&SD)	TRL			4	5	5	6	6	--
	$M			77.30	77.30	74.10	70.70	88.00	--

Schedule	FY 2005 President's Budget	Baseline	Change from Baseline
Proof of concept validation of technology to contribute a 45% CO2 reduction.	May 2006	May 2006	--
Decide the feasibility of a constant volume combustor for CO2 reduction.	June 2006	June 2006	--
Ident. the technologies that will reduce community noise impact by a factor of 4	Sept. 2006	Sept. 2006	--
Deliver an advanced adaptive, optimal neural net for air vehicle robustness.	Sept 2006	Sept 2006	--
Demonstrate on a full-size engine noise and emissions reduction.	April 2007	April 2007	--
Validate technologies that will reduce noise by 10dB (re: 1997 SOA).	June 2007	June 2007	--
Demonstrate combustor technologies that reduce NOx by 70% (re: to 1997 SOA).	June 2007	June 2007	--
Select technologies that reduce CO2 emissions by 25% (re: 1997 SOA).	August 2007	August 2007	--
Flight demo of integrated systems for UAV flight operations at or above 18,000 feet.	October 2007	October 2007	--
Validate fuel efficiency benefits of a transport wing using slotted technology.	Dec. 2008	Dec. 2008	--
Demo fully autonomous UAV ops during an emergency.	Sept 2008	Sept 2008	--
Demo a light-wt high lift system through subcomponent tests.	Sept. 2009	Sept. 2009	--
Flight Demonstrate HALE ROA above 60,000 ft of 7-14 days with 200kg payload.	August 2009	August 2009	--

ACQUISITION STRATEGY AND PERFORMING ORGANIZATIONS

Maximize R&D efforts in vehicle technologies through competitive sourcing, cooperative agreements, and cost-sharing with research partners, in addition to in-house projects. The Vehicle Systems Program is managed at NASA Headquarters, with Level II and III projects and sub-projects led at ARC, GRC, LaRC, and DFRC. The Vehicle Systems Program is composed of projects that encompass both low and mid TRL technology development. For the low-TRL development, infusion of new ideas is encouraged through NRA's and grants. The mid-TRL technology development is brought closer to technical maturation through partnerships with the end users in industry and other government agencies. Capabilities and expertise for some projects within the Vehicle Systems program are obtained through competitive sourcing, resulting in performance based contracts for certain activities.

Current Acquisition	Actual*	Selection Method	Actual*	Performer	Actual*
Cooperative Agreement	9%	Full & Open Competition	90%	Industry	76%
Cost Reimbursable	42%	Sole Source	10%	Government	5%
Fixed Price	5%		100%	NASA Intramural	2%
Grants	14%			University	15%
Other	30%	Science Peer Review	14%	Non Profit	2%
*As of FY 2003 direct procurement	100%	*As of FY 2003 direct procurement		*As of FY 2003 direct procurement	100%

Future Acquisition	Selection	Goals
JSRA for HALE UAVs in the NAS	FY 04	100% Full & Open Competition
NRAs to university & industry EASI, ITAS, AuRA, LEAP	FY 05-07	100% Full & Open Competition, 50% university/50% industry

AGREEMENTS

Internal: The program is not dependent on other NASA activities outside of the control of the Associate Administrator, Office of Aerospace Technology. External: 1. Umbrella agreement between the FAA and NASA concerning a Partnership to Achieve Goals in Aviation and Future Space Transportation; October 1998. 2. MoU #FNA/09 between the FAA and NASA concerning Aviation Environmental Compatibility; October 1990. 3. MoA #FNA/09-01-01 between the FAA and NASA concerning the Impact of Aviation Air Emissions on Climate and Global Atmospheric Composition; April 2001. 4. MoA #FNA/09-02-01 between the FAA and NASA concerning Aircraft Noise Reduction Technology; June 2002. 5. NASA will enter into additional external agreements to facilitate accomplishment of their objectives and the transfer of technology. A variety of mechanisms will be employed, including Memoranda of Understanding, Memoranda of Agreement, Interagency Agreements and Cooperative Agreements. Where applicable, the respective program plans will provide

specifics of these agreements explaining involvement of external organizations, other agencies or international partners, and a brief overview of the external support necessary to meet program objectives. Some of the entities the program office has agreements with are: DoE, DoT, FAA, AFRL, Navy, AEDC, Sandia National Lab, DARPA, GE, PW, Honeywell, Allison/R&R, Boeing, The Cleveland Clinic, University of Nevada and others.

RISK MITIGATION

Top Risks	G	Overall	G	Cost	G	Schedule	G	Technical	Probability	Impact	Mitigation Plan
G	Loss of flight vehicle during test or demonstration								moderate	moderate	in place
G	Insufficient technology transfer to customers								moderate	moderate	in place
G	Availability of appropriate skill mix for technology and managerial work								moderate	moderate	in place
G	Availability of critical facilities								moderate	moderate	in place

INDEPENDENT REVIEWS

Review Types	Performer	Last Review Date	Next Review Date	Purpose
Performance	IPAO	4/03	6/04	Assess the performance of the VSP against the approved program plan.
Quality	ASEB/NRC	2/03	2/06	Assess the scientific and technical quality of the R&T program against the SOA.
Relevance	ATAC	5/03	2/04	Assess the relevance of the program to other government and industry users.

Theme: Aeronautics Technology
Technology and Advanced Concepts: Vehicle Systems Program

BUDGET

Budget Authority ($ millions)	FY 2003	FY 2004	FY 2005	Comments
FY2005 PRESBUD	333.3	620.4	576.8	
Quiet Aircraft Technology (QAT)	19.2	64.8	72.1	Reformulation from Prior Projects
21st Century Aircraft Technology (TCAT)	27.8	66.6		Reformulated to New Projects
Flight Research (FR)	58.1	86.4		Reformulated to New Projects
Advanced Vehicle Concepts (AVC)	17.6	31.9		Reformulated to New Projects
Breakthrough Vehicle Technologies (BVT)	58.9	122.6		Reformulated to New Projects
Ultra-Efficient Engine Technology (UEET)	67.0	91.9	88.2	New Project
Propulsion & Power (P&P)	84.6	147.5		Reformulated to New Projects
Low Emissions Alternative Power			120.9	New Project
Efficient Aerodynamic Shapes & Integration			68.0	New Project
Integrated Tailored Aerostructure (ITAS)			71.4	New Project
Autonomous Robust Avionics (AURA 10X)			20.4	New Project
Flight and System Demonstration		8.7	112.9	New Project
Strategic Vehicle Architecture			22.9	New Project
Changes since 2004 PRESBUD	+59.0	+46.8		
Quiet Aircraft Technology (QAT)	-0.8	+4.6		Congressional Interest Item
21st Century Aircraft Technology (TCAT)	-1.2	+24.5		Congressional Interest Item
Flight Research (FR)	+19.2	+1.0		Congressional Interest Item
Advanced Vehicle Concepts (AVC)	+9.8	-9.1		Portion of General Reduction
Breakthrough Vehicle Technologies (BVT)	-3.0	+7.3		Congressional Interest Item
Ultra-Efficient Engine Technology (UEET)	+17.0	+1.9		Congressional Interest Item
Propulsion & Power (P&P)	+17.9	+7.9		Congressional Interest Item
Flight and System Demonstration		+8.7		Congressional Interest Item
FY2004 PRESBUD	274.3	573.6		
Quiet Aircraft Technology (QAT)	20.0	60.2		
21st Century Aircraft Technology (TCAT)	29.0	42.1		
Flight Research (FR)	38.9	85.4		
Advanced Vehicle Concepts (AVC)	7.8	41.0		
Breakthrough Vehicle Technologies (BVT)	61.9	115.3		
Ultra-Efficient Engine Technology (UEET)	50.0	90.0		
Propulsion & Power (P&P)	66.7	139.6		

Indicates changes since the previous year's President's Budget Submit.
Indicates budget numbers in full cost.