

SAFETY, MISSION ASSURANCE AND ENGINEERING (SMA&E)

**FY 2003 ESTIMATES
BUDGET SUMMARY
SUMMARY OF RESOURCE REQUIREMENTS**

**OFFICE OF SAFETY & MISSION ASSURANCE
OFFICE OF THE CHIEF ENGINEER**

SAFETY, MISSION ASSURANCE AND ENGINEERING

	FY 2001*	FY 2002	FY 2003
	OP PLAN	INITIAL	PRES
	<u>REVISED</u>	<u>OP PLAN</u>	<u>BUDGET</u>
		(Millions of Dollars)	
Safety and Mission Assurance	25.1	28.5	28.5
Engineering	17.5	19.1	19.1
Advanced Concepts**	4.8	--	--
 Total.....	 <u>47.4</u>	 <u>47.6</u>	 <u>47.6</u>
 <u>Distribution of Program Amount by Installation</u>			
Johnson Space Center	7.2	7.2	8.7
Kennedy Space Center	0.4	0.7	0.7
Marshall Space Flight Center	3.2	3.1	3.6
Stennis Space Center	0.1	0.2	0.4
Ames Flight Research Center	1.2	0.6	1.0
Dryden Research Center	0.2	0.2	1.0
Langley Research Center	5.9	5.5	5.8
Glenn Research Center	2.5	2.5	2.1
Goddard Space Flight Center	15.6	12.2	12.6
Jet Propulsion Laboratory	7.3	7.7	7.3
Headquarters	3.9	7.7	4.4
 Total.....	 <u>47.4</u>	 <u>47.6</u>	 <u>47.6</u>
 Direct Full Time Equivalent (FTE) Personnel***	 97	 92	 91

*In FY 2001 and prior, these activities were included in the Mission Support appropriation.

**Beginning in FY 2002, funding for Advanced Concepts is included within the Aerospace Technology Enterprise.

***Includes personnel that support cross-Agency functional SMA&E activity and excludes personnel assigned to specific programs.

BASIS OF FY 2003 FUNDING REQUIREMENT

SAFETY AND MISSION ASSURANCE

	<u>FY 2001</u>	<u>FY 2002</u>	<u>FY 2003</u>
Safety and Mission Assurance	25.1	28.5	28.5

(Millions of Dollars)

DESCRIPTION/JUSTIFICATION

Safety, Mission Assurance and Engineering (SMA&E) is an investment to enable the safety and success of all NASA programs. The SMA&E budget supports the activities of the Office of Safety and Mission Assurance and the Office of the Chief Engineer. These Offices advise the Administrator, oversee NASA programs, develop Agency-wide policies and standards, and support technology requirements of NASA flight programs. Each area is discussed separately.

Safety and Mission Assurance (SMA) assures that sound and robust SMA strategies, processes, and tools are in place to enable safe and successful missions. It establishes strategies, policies, and standards, and assures that effective and efficient processes and tools are appropriately applied throughout the program life cycle. SMA analyzes, oversees, and independently assesses programs and flight and ground operations to assure that attention is placed on risk, missions are conducted safely, and there is a high probability of meeting Agency objectives. SMA funds research, development, pilot application, and evaluation of tools, techniques, and practices that advance NASA’s capabilities in areas such as facility and operational safety, risk management, human reliability, software assurance, and risk analysis. Funding also develops SMA training courses.

SMA GOALS

- Early integration and life-cycle implementation of safety, reliability, maintainability, and quality assurance (SRM&QA) into NASA’s programs and operations.
- Thorough and expeditious independent assessments (IA’s) of program/project safety, reliability, maintainability, and quality.
- Innovation and rapid transfer of SRM&QA technologies, processes, and techniques to help program/project managers improve the likelihood of mission success while reducing overall costs.
- Development and application of risk management methodologies to provide relevant, practical, and timely contributions to NASA’s management of risk.
- Deployment of an Agency-wide Safety and Mission Assurance (SMA) team that is highly motivated, trained, and properly equipped.
- Development of Assurance tools and methodologies for application on system development work performed by SMA, SMO, and Engineering organizations

SMA PROGRAM CONTENT

Safety and Mission Assurance funding contributes to advances in the following areas:

- Software Assurance
- Safety
- Risk Management
- Probabilistic Risk Assessment
- Mission Assurance Project Applications
- Failure Detection and Prevention
- Non-Destructive Evaluation
- HEDS Independent Assessment
- Assurance Assessments

ACCOMPLISHMENTS AND RESULTS IN THE PAST YEAR

The Office of Safety and Mission Assurance (OSMA) accomplishments over the past year included research, development, pilot application, and evaluation of SMA tools, techniques and practices in disciplines such as operational and facility safety, risk management, probabilistic risk assessment, software assurance, failure detection and prevention, and human reliability with the goal of enhancing NASA safety and mission success. OSMA also completed revisions to SMA policies & guidance, including safety and mission success and mishap reporting; and developed a policy and guidance for software independent verification and validation. OSMA provided support to and independent review of International Space Station (ISS), Space Shuttle (missions), and science programs (including expendable launch vehicle (ELV) payload launches) in FY 2001.

In FY 2001, NASA achieved a lost time injury rate of 0.31 occurrences of lost time injuries per 100 workers. This experience is well below the goal of 1.15 occurrences per 100 workers established by the President in "Federal Worker 2000". OSMA made significant progress to improve NASA's capability to conduct Probabilistic Risk Assessment (PRA) in support of its projects and developed PRA policy, methodology training, tools, and reference materials. The procurement and SMA communities joined forces to establish a Risk-Based Acquisition Management (R-BAM) process to consider risk early in the acquisition process.

Over the past year, OSMA made considerable progress in the development of the Process-Based Mission Assurance (PBMA) Knowledge Management System (KMS). PBMA-KMS is a web-based resource that enables NASA to share critical knowledge and best practices.

NASA continued the Agency Safety Initiative in FY 2001. The Centers advanced on the Agency's goal to have all Centers certified to Voluntary Protection Program standards by the end of FY 2002. Three of 10 Centers are now certified, and several other Centers are nearing their certification review.

PROGRAM PLANS FOR FY 2003

Independent review of the ISS will continue. SMA support and review will be provided to seven Shuttle and ten ELV and payload missions in FY 2002, and four Shuttle and nine ELV and payload missions in FY 2003. OSMA will continue to identify, develop, update, and evaluate SMA tools, techniques, and practices (including risk management, operational safety, probabilistic risk assessment, software assurance, failure detection and prevention, and human reliability) to enhance safety and mission success.

OSMA began to enhance the Agency's quality program for hardware and software in FY 2001 and is planning to establish and manage a quality program to integrate the experiences of each Center with that of the Defense Contract Management Agency. Better control of products produced by prime contractors and their vendors will enhance the level of success for NASA missions. In FY 2002 and beyond, OSMA expects further advances in software and human reliability and the development of a PRA database.

Full implementation of PBMA-KMS is expected in FY 2003 following roll out of PBMA-KMS to all Centers in FY 2002.

Safety and Mission Assurance will conduct policy and process evaluations as needed through FY 2002 and FY 2003. Any missions carrying nuclear materials will be reviewed for safety.

BASIS OF FY 2003 FUNDING REQUIREMENT

OFFICE OF THE CHIEF ENGINEER

	<u>FY 2001</u>	<u>FY 2002</u>	<u>FY 2003</u>
Engineering	17.5	19.1	19.1

(Millions of Dollars)

DESCRIPTION/JUSTIFICATION

The Office of the Chief Engineer (OCE) serves as the steward of the cross-cutting Agency process to Provide Aerospace Products and Capabilities, which governs a very substantial portion of the total NASA budget. In that capacity, the office is directly involved with overseeing the application of the process to specific agency programs and with improving the efficiency and effectiveness of the Program and Project Management approach and the requisite supporting Engineering capability.

ENGINEERING GOALS

The specific goals of the Engineering program are as follows:

- Maintain and improve NASA’s engineering capability through advances in processes, tools and skills
- Continuously improve NASA’s Program/Project management process to ensure requirements are met within cost/schedule

ENGINEERING PROGRAM CONTENT/APPROACH

Specific elements of engineering and program management improvement are as follows:

- Systems Engineering to improve the processes, tools and capabilities for consistent integration of complex systems
- Software Engineering using structured processes to increase assurance and effectiveness in meeting mission needs
- Technical Standards to provide and improve technical guidance for engineering
- Electronic Parts and Packaging to support program needs for evaluation and low risk insertion of electronic technology.
- Independent Program Assessment and Cost Analysis of NASA Programs and Projects to support Program Management verification of flight program technical readiness, implementation, and cost performance

ACCOMPLISHMENTS AND RESULTS

In FY 2001, NASA began developing guidance for an Agency-wide systems engineering process. Implementation and training should begin in FY 2002. Priorities for improved analysis tools and methods will be identified to establish an advanced engineering environment enabling greater efficiency and effectiveness in systems engineering practice.

A draft NASA Software Procedures and Guideline (NPG 2820) was developed and software process improvement plans were established for all NASA Centers. Software process improvement will be initiated in FY 2002 including skill training and metrics to monitor improvement.

A new capability now provides NASA engineers centralized, web-based access to full-text technical standards and update information, supporting adoption of over 2,000 voluntary consensus standards, implementing PL 104-113. A major focus for FY 2002 is linking “lessons learned” to technical standards, integrating current experience with the technical guidance used for programs.

The NASA Electronic Parts and Packaging (NEPP) Program performs evaluations of the reliability and radiation tolerance of newly available and emerging microelectronic and photonic technologies to facilitate infusion of required technologies into NASA flight systems. FY 2001 evaluations included advanced commercial processors, and a variety of specialized devices. Guidelines on technology reliability and a Web Portal now provide access to NEPP information, including new methods for qualification of parts and packages.

In FY 2002, NEPP will emphasize increased dependence on commercial off-the-shelf (COTS) parts, technology insertion and electronic board level qualification. Leveraging of NASA dollars continues through partnerships and collaboration. New technology evaluations will include reliability at extreme temperatures, very long mission parts requirements, and very low power electronics.

Independent Program Assessments, managed and conducted by the Independent Program Assessment Office (IPAO), which is located at LaRC while serving as an agent of the Headquarters OCE, provide evaluations of program concept readiness during program formulation and ability to meet requirements once programs are approved. Independent Assessments (IA’s) are detailed reviews of proposed concepts; Non Advocate Reviews (NAR’s) confirm thoroughness and realism during formulation; Independent Implementation Reviews (IIR’s) evaluate progress against plans. The first two reviews include Independent Life Cycle Cost Analysis (ILCCA). During FY 2001, seven IA’s and 2 NAR’s were completed. In addition, 25 IIR’s were completed, including one for the Space Station Program, providing an improved basis for revised program plans. An Independent Review Team process has been instituted to combine existing review teams for efficiency, and places increased reliance on non-NASA reviewers to improve independence. In FY 2001, NASA began increasing cost estimating capabilities through university cooperation, external recruiting, training, and improvements to cost estimating models.

In FY 2002, the Independent Program Assessment Office will conduct 20 IIR's, 3 IA's and 5 NAR's. In addition, the IPAO will complete eight Independent Life-Cycle Cost Analyses for certification and submittal to Congress, in accordance with the FY 2000 Authorizations Act. The IPAO will also provide leadership for the improvement in cost estimating capability across NASA in the areas of personnel development, tool development, and process improvement.

PROGRAM PLANS FOR FY 2003

In FY 2003, implementation of improved systems engineering tools and methods will support some piloting of an advanced engineering environment. Capability assessment of engineering system maturity and project performance will be used to measure the benefit of systems engineering process improvements.

FY 2003 software emphasis will include formal assessment of software capability, infusion of software technology into programs and improvements to the software acquisition process. Software metrics will be collected from all major flight programs.

Field Center best practices will be consolidated into Agency-wide standards and, where possible into Voluntary Consensus Standards. Linking of "lessons learned" to standards will be expanded and expert systems evaluated for selecting technical standards and relevant lessons learned to enhance design capabilities.

NEPP areas of emphasis will include testing for complex parts/packages, qualification at higher levels of integration, and methods for rapid qualification of increasingly more complex parts. Programs will be aligned with industry roadmaps to increase use of COTS.

Assessment plans for FY 2003 include approximately 3 IA's and 2-3 NAR's and approximately 20-25 IIR's. Approximately 10-15 Independent Life Cycle Cost Analyses (ILCCA) will be performed, including those required by NASA's FY 2000-2002 Authorization Bill (P.L. 106-391); and cost estimating improvement capabilities, that began in FY 2001, will continue.