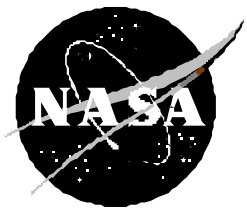
IG-03-002

AUDIT REPORT

EXPENDABLE LAUNCH VEHICLE PERFORMANCE MEASURES

October 16, 2002



National Aeronautics and
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Acronyms

ELV	Expendable Launch Vehicle
FY	Fiscal Year
GAO	General Accounting Office
GPRA	Government Performance and Results Act of 1993
HEDS	Human Exploration and Development of Space
NPD	NASA Policy Directive
OMB	Office of Management and Budget
QuikTOMS	Quik Total Ozone Mapping Spectrometer

October 16, 2002

W

TO: M/Associate Administrator for Space Flight

FROM: W/Assistant Inspector General for Audits

SUBJECT: Final Report on Audit of Expendable Launch Vehicle Performance Measures
Assignment Number A-02-002-00
Report Number IG-03-002

Enclosed please find the subject final report. Please refer to the Executive Summary for the overall audit results. Our evaluation of your response has been incorporated into the body of the report. We consider management's proposed, corrective actions responsive for the recommendation. The recommendation will remain open for reporting purposes until corrective actions are complete. Please notify us when actions have been completed on the recommendation. The final report distribution is in Appendix G.

We appreciate the courtesies extended to the audit staff. If you have questions concerning the report or would like to schedule an exit conference, please contact Mr. Daniel Samoviski, Program Director, Earth/Space Science Audits, at (301) 286-6890; Ms. Nora Thompson, Program Manager, at (757) 864-3268; or Mr. Jim Richards, Auditor-in-Charge, at (321) 867-4841.

[original signed by]
Alan J. Lamoreaux

Enclosure

cc:
HQ/B/Acting Deputy Chief Financial Officer
HQ/B/Comptroller
HQ/BF/Director, Financial Management Division
HQ/G/General Counsel
HQ/M-5/Assistant Associate Administrator for Launch Services
HQ/JM/Director, Management Assessment Division
KSC/AA/Director, John F. Kennedy Space Center
KSC/VA/Manager, ELV and Payload Carriers Program, Kennedy Space Center

Contents

NASA Office of Inspector General

IG-03-002 **October 16, 2002**
A-02-002-00

Expendable Launch Vehicle Performance Measures

Executive Summary

Background. NASA's fiscal year (FY) 2003 budget for Expendable Launch Vehicle (ELV) services[1] is $338 million,[2] including $36 million for technical management and acquisition services. The term expendable applies to launch vehicles that are used once and not recovered for reuse.[3] In February 2002, the NASA Administrator[4] stated "NASA's ELV Program continues to afford the Agency a high level of launch success, with an impressive flight record of 98 percent." Within the Human Exploration and Development of Space (HEDS) Enterprise,[5] the Office of Space Flight has overall responsibility for the ELV Program. Customers of the ELV Program include NASA Enterprises, such as the HEDS, Earth Science and Space Science Enterprises, and other Federal agencies such as the National Oceanic and Atmospheric Administration. Launch sites include Cape Canaveral Air Force Station, Florida; Vandenberg Air Force Base, California; Wallops Flight Facility, Virginia; Kwajalein Island, Republic of the Marshall Islands; and Kodiak, Alaska.

The NASA FY 2003 Annual Performance Plan (Performance Plan)[6] includes two performance goals related to the ELV Program and one performance indicator for each

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[1]Since 1987, NASA has relied on commercially procured ELV's to meet its requirements for scientific, Earth sensing, and planetary missions that do not require the Space Shuttle's unique capabilities. Before 1987, NASA relied primarily on the Space Shuttle for such missions and rarely used ELV's.

[2]The $338 million FY 2003 budget request for the ELV Program consists of (a) $36 million for ELV mission support (technical management and acquisition services); (b) $148 million for launches by the Space Science Enterprise (see footnote 5); (c) $53 million for launches by the Earth Science Enterprise; (d) $7 million for launch services needed by the Tracking and Data Relay Satellite System; and (e) $94 million for launch services that NASA provides to other Federal agencies (for example, for weather satellites launched by the National Oceanic and Atmospheric Administration). The Federal agencies reimburse NASA for the $94 million in launch services the Agency provides them. The auditee provided the FY 2003 ELV budget information.

[3]The Space Shuttle is NASA's only reusable launch vehicle currently in operation.

[4]The NASA Administrator's comment was part of his prepared statement to the House Committee on Science, on February 27, 2002. The 98-percent success rate was based on 55 successful missions of 56 missions launched since 1987.

[5]NASA established five Enterprises to function in primary business areas for implementing NASA's mission and serving customers. Each Enterprise has a unique set of strategic goals, objectives, and implementing strategies that address the requirements of the Agency's primary customers. The five NASA Enterprises are: Space Science, Earth Science, HEDS, Aerospace Technology, and Biological and Physical Research.

[6]NASA included performance goals for the ELV Program beginning with the NASA FY 2002 Annual Performance Plan.

goal (see Appendix B). The Performance Plan and ELV goals and indicators must meet requirements of the Government Performance and Results Act of 1993 (GPRA)[7] and Office of Management and Budget (OMB) Circular A-11, "Preparing and Submitting Budget Estimates." Goals and indicators must be defined either in an objective and quantifiable manner or as precise, descriptive statements that allow an accurate, independent determination to be made of actual performance. In addition to the goals and indicators in the Performance Plan, Kennedy Space Center (Kennedy) has developed several metrics to evaluate performance of operations and organizations that provide launch services for the ELV Program.

NASA Policy Directive (NPD) 8610.7, "Launch Services Risk Mitigation Policy for NASA-Owned or NASA-Sponsored Payloads," dated February 4, 1999, contains the risk mitigation policy for launches of NASA-owned or -sponsored payloads. NASA payloads must use reasonable commercial sources of launch services while ensuring vehicles are not exposed to excessive risk. To control mission risk, management must categorize payloads against specific criteria in NPD 8610.7 and select launch vehicles based on the payload risk category (see Appendix C). Additionally, management must follow other procedures in NPD 8610.7, relating primarily to procurement, that ensure the implementation of risk mitigation policy (see Appendix D).

Objectives. Our overall audit objective was to evaluate the ELV Program's performance measurement system and compliance with NASA risk mitigation policy for launch vehicles. Specifically, we determined whether NASA did the following:

- Established a performance measurement system[8] for the ELV Program that complied with Federal requirements and other appropriate criteria.

- Managed ELV launch services in compliance with Agency risk mitigation policy. Specifically, we determined whether NASA categorized payload and instrument risk and selected launch vehicles based on the risk category. We also determined whether NASA complied with other relevant provisions of NASA's risk mitigation policy, including applicable Federal and NASA clauses in contracts for launch services.

Details on the audit objectives, scope, and methodology are in Appendix A.

Results of Audit. Generally, NASA established an adequate performance measurement system that complied with Federal requirements. Additionally, the four Kennedy metrics that we reviewed met applicable GPRA and OMB requirements. Further, planned procedures to verify and validate performance data for the ELV Program (see

[7]Public Law 103-62, as amended, contains the GPRA legislation.
[8]For purposes of this audit, the performance management system includes (1) NASA's system for measuring ELV Program performance as stated in the NASA Annual Performance Plan and (2) the ELV Program Office system for measuring performance.

Appendix E) appeared to meet requirements.[9] Finally, the ELV Program Office met NPD 8610.7 risk mitigation requirements that we reviewed for the nine launches completed in or scheduled for 2001 through 2003.

However, NASA needs to clarify one of two ELV performance goals and indicators in the Agency's FY 2003 Performance Plan to better meet GPRA and OMB requirements. Specifically, the Office of Space Flight had not fully defined two key terms or provided the basis for the prescribed 95-percent launch success rate used in one of two performance goals and indicators in the FY 2003 Performance Plan. Fully defining the terms and explaining the basis for the 95-percent rate will provide improved performance information. With improved performance information, external stakeholders, such as the Congress and the public, will be better able to determine the relative effectiveness of the ELV Program and have confidence that the program's results justify the $36 million spent for technical management and acquisition services for the $338 million ELV Program.

Recommendation. NASA should explain the ELV Program performance indicator in the FY 2003 NASA Performance Plan or Performance Report to clarify the meaning of the two key terms and the basis for the prescribed 95-percent launch success rate.

Management's Response. NASA concurred with the recommendation and will take corrective action starting with the FY 2002 NASA Performance Report, which NASA expects to release in late-January 2003. The complete text of management's response is in Appendix F.

[9]NASA's FY 2002 Performance Plan explains NASA's planned verification and validation procedures for FY 2002 performance data. However, we could not test the adequacy of procedures because they will not be performed until after the end of FY 2002.

Introduction

ELV Program Management. The NASA Office of Space Flight has responsibility for the ELV Program. Within the Office of Space Flight, the Associate Administrator has tasked the Assistant Associate Administrator for Launch Services to develop specific objectives, strategies, and requirements for the ELV Program and to serve as an internal and external advocate for the program. In addition, the ELV Flight Planning Board is the Agency-level forum for approval of new missions, vehicle configuration changes, and launch manifest changes. The Board includes representatives from four NASA Enterprises--HEDS, Earth Science, Space Science, and Aerospace Technology. Kennedy serves as the lead Center for ELV launch services through the ELV Program Office. The ELV Program Office is responsible for technical management and acquisition of launch services for all NASA-managed launches.

Performance Measurement. Performance measurement involves a process of planning a goal, establishing an objective measure of actual performance, recording performance, evaluating actual performance against the planned goal, and reporting results. GPRA, the OMB, the General Accounting Office (GAO), and NASA use slightly different terms for performance measures. GPRA and OMB define a performance measure as a performance goal or performance indicator. GPRA states that a performance goal means a target level of performance expressed as a tangible, measurable objective, against which actual achievement can be compared. A performance indicator means a particular value or characteristic used to measure output or outcome. The GAO considers performance measures as synonymous with performance indicators. For performance measurement, the NASA FY 2003 Performance Plan uses annual performance goals and indicators.

Performance Goals and Indicators. The FY 2003 Performance Plan includes two ELV Program performance goals and indicators (see Appendix B). NASA will use the goals and indicators to report on performance of the ELV Program in the FY 2003 Performance Report. Additionally, Kennedy has developed several performance metrics applicable to the ELV Program, including metrics for mission success and customer satisfaction.

NASA Risk Mitigation Policy. NPD 8610.7 states that launch services acquired for deployment of NASA-owned, NASA-sponsored payloads must take advantage of all reasonable sources of U.S. commercial launch services and at the same time, ensure that taxpayer-funded spacecraft are not exposed to excessive risk. The policy states that the NASA launch services acquisition strategy shall seek to balance mission risk with the demonstrated flight history and maturity of the launch vehicle. The policy provides criteria for categorizing payloads, launch vehicle requirements for each category, and controls to mitigate risk. Appendix C provides a description of categories and control requirements, and Appendix D lists the other risk mitigation requirements we reviewed.

Finding and Recommendation

Performance Indicators in NASA Performance Plan

NASA needs to clarify one of the two ELV Program performance goals and indicators in the NASA FY 2003 Performance Plan or Performance Report to better meet GPRA and OMB requirements. Specifically, the Office of Space Flight has not fully defined two key terms or the basis for the 95-percent success rate. The condition occurred because the Office of Space Flight viewed the NASA Performance Plan as a high-level, succinct document that did not require definition of every key term or the basis of the success rate. Without improved performance information, external stakeholders, such as the Congress and the public, may not be readily able to determine the relative effectiveness of the ELV Program and may not have confidence that the program's results justify the $36 million that will be spent in FY 2003 for technical management and acquisition services for the $338 million ELV Program.

Federal Requirements for Performance Measurement

Both the GPRA and OMB Circular A-11 require management to define performance goals and indicators in an objective manner to ensure that users of performance information can accurately and independently determine actual performance.[10] The GAO stated that performance goals must specifically define the results the agency expects to achieve for program activities in the agency's budget.[11] Management must establish a performance goal against an agency baseline, historical trend data, or benchmark from another organization performing similar activities.

The GPRA and OMB Circular A-11 state that the objective of performance measurement is to improve three areas. First, performance measurement will improve congressional decision making because it provides decision makers objective information on how Federal programs are actually performing. Second, performance measurement will improve public confidence in the capability of the Federal government because reporting actual performance holds Federal agencies accountable for results. Third, performance measurement will improve service quality, because Federal managers must plan for results and will have the information they need to achieve results.

The President's Management Agenda (Agenda) states that by FY 2003, Federal agencies must formally integrate performance review with budget decisions as part of the

[10]The requirements are in GPRA, Section 4, and OMB Circular A-11, "Preparing and Submitting Budget Estimates," July 17, 2001, Sec. 220.9, "General Guidelines on Developing Performance Goals and Indicators."

[11]GAO guidance on defining performance goals and objectives is in the following: GAO/GGD-10.1-20, "The Results Act: An Evaluator's Guide to Assessing Agency Annual Performance Plans," April 1998, and GAO/GGD/AIMD 10.1-18, "Agencies' Annual Performance Plans Under the Results Act: An Assessment Guide to Facilitate Congressional Decision-making," February 1998.

management initiative called Budget and Performance Integration.[12] Budget and Performance Integration connects goals with resources. The intent of Budget and Performance Integration is to use objective measures that will identify Government programs that are not succeeding or programs that should be reinvented, redirected, or retired. It should allow the Congress, the public, and agency management to calculate cost-effectiveness, compare different approaches to similar goals, and compare the program to other programs with similar goals.

The FY 2003 Performance Plan

For one of the performance goals and indicators for the ELV Program, the NASA FY 2003 Performance Plan did not fully explain the terms "success" and "running average" and did not provide the basis for the 95-percent success rate as shown below:

> **Strategic Goal 1:** Explore the Space Frontier
>
> **Performance Goal and Indicator 3H03:** Provide reliable launch services for approved missions.
>
> - NASA success rate at or above a running average of 95 percent for missions noted on the Flight Planning Board manifest and launched pursuant to commercial launch service contracts.

The Performance Plan lacked specific detail on the terms success and running average and on the bases for the 95-percent rate as discussed below:

- The Performance Plan did not specifically define success or state the criteria the Office of Space Flight would use to determine launch success. Launch service contracts include the criteria management will use to determine whether a launch is a success or failure, but the Performance Plan did not reflect the contract criteria.

- The Performance Plan did not state the timeframe for calculating the running average success rate. The Office of Space Flight explained that the running average applied to the period 1987[13] to the present rather than to the fiscal year. Also, the Performance Plan did not fully explain that the running average would not include launches of NASA secondary payloads.[14] For example, the launch of the Quik Total Ozone Mapping Spectrometer (QuikTOMS) spacecraft failed on

[12]The President's Management Agenda includes the requirement under the section titled, "Budget and Performance Integration." The President's Management Agenda states, "Agency performance measures tend to be ill defined and not properly integrated into agency budget submissions and the management and operations of agencies. . . ."

[13]The ELV Program used a 1987 start date because that was the year NASA changed from procuring ELV vehicles to procuring ELV services.

[14]NASA secondary payloads on commercial launches receive much less NASA oversight and insight than NASA payloads launched pursuant to NASA launch service contracts.

September 21, 2001. The ELV Program running average will exclude the launch, because the QuikTOMS spacecraft was a secondary payload on a commercially sponsored launch.

- The Performance Plan did not explain the basis for the prescribed 95-percent success rate. The Office of Space Flight explained that the 95-percent rate was based on the goal to achieve a demonstrated reliability rate at or better than the standard ELV design reliability.[15] The Performance Plan did not indicate why the 95-percent rate was an acceptable indicator of successful performance or how the rate compared to other similar organizations.

High Level Document

The performance goal and indicator did not include fully defined key terms because the Office of Space Flight viewed the NASA Performance Plan as a high-level, succinct document that did not require the definition of every key term or number. NASA personnel sufficiently understood the terms success and running average and the basis of the 95-percent success rate. The Office of Space Flight believed that other stakeholders, such as congressional oversight committees and the public, were familiar with NASA missions and would understand the meaning of these terms without additional explanations.

Better Performance Reporting for Stakeholders

Improved performance information will allow external stakeholders, such as the Congress and the public, to better determine the relative effectiveness of the ELV Program and to better evaluate whether the program's results justify the $36 million spent annually for technical management and acquisition services for the program:

- The Congress and the public will know how NASA management will evaluate and report a launch that is not completely successful (for example, a mission launched into exact orbit after using extra propellant). Including this information in the Performance Plan helps the Congress and the public to better evaluate reports of successful performance.

- The Congress and the public will more clearly understand the calculation of the running average success rate. For example, external stakeholders can then understand why the ELV Program might have a high success rate during the same year a launch failed. Without properly explaining how the running average

[15]NPD 8610.7, "Launch Services Risk Mitigation Policy for NASA-Owned or NASA-Sponsored Payloads," requires 95-percent reliability for launch vehicles used to launch NASA payloads. Launch vehicles with established launch history must demonstrate the reliability, while launch vehicles with limited history must show a 95-percent predicted design reliability. See Appendix C for further information on NPD 8610.7 reliability requirements.

success rate is calculated, at least three different calculations (and resulting rates) are possible as shown below for fiscal year 2001:[16]

Running Average Success Rate	
Description	**Rate (percent)**
Years 1987 through FY 2001 (Excluding secondary payloads)	98.2[1]
FY 2001 (Excluding secondary payloads)	100.0[2]
FY 2001 (Including secondary payloads)	87.5[3]

[1]The 98.2-percent rate resulted from the ratio of 54 successful launches out of a total of 55 launches. The success rate for 1987 to December 2001 was 98.2-percent, or 55 successful launches out of a total of 56 launches, because there was one additional successful launch during the additional 3-month period, October through December 1987.
[2]The 100-percent rate resulted from the ratio of seven successful launches out of a total of seven launches. The calculation excluded the failed launch of the QuikTOMS, a secondary payload on a non-NASA launch, because it was a secondary payload.
[3]The 87.5-percent rate resulted from the ratio of seven successful launches out of a total of eight launches. The one launch failure was QuikTOMS, a secondary payload on a non-NASA launch.

- The Congress and the public will obtain insight into how the 95-percent success rate compares to NASA's historical launch performance or to launch performance by comparable launch operations at Government and private organizations. Insight into the rate will enable the Congress and the public to determine whether meeting the 95-percent success rate is an acceptable level of performance.

Conclusion

GPRA and the President's Management Agenda intend that performance information for the ELV Program give the Congress and the public insight for decisions and confidence in the results achieved for the $36 million FY 2003 budget for technical management and acquisition services. GPRA and OMB require agencies to state performance goals and indicators in an objective form to accomplish this intended purpose. In Strategic Goal 1 and Performance Measure 3H03, the Office of Space Flight did not clearly define the terms success and running average and did not provide the basis of the 95-percent success rate. With additional explanations, external users of performance information, such as the Congress and the public, can better understand reports of actual performance and can better evaluate actual performance against the $36 million spent for the $338 million program.

[16]NASA will not report actual performance under the FY 2002 performance goals and indicators until after September 30, 2002.

Recommendation, Management's Response, and Evaluation of Management's Response

The Associate Administrator for Space Flight should direct the Assistant Associate Administrator for Launch Services to explain the ELV Program performance goal and indicator in the FY 2003 NASA Performance Plan or Performance Report to clarify the

- **meaning of the key terms success and running average and**

- **the basis for the prescribed 95-percent rate established for mission success.**

Management's Response. Concur. NASA will explain the ELV Program performance indicator in the FY 2003 NASA Performance Plan or Performance Report to clarify the two key terms and the basis for the prescribed 95-percent rate established for mission success. In addition, NASA's FY 2002 Performance Report will include a description of how the noted performance indicator was achieved, including clarification of noted terms. It is expected that the FY 2002 NASA Performance Report will be released in late-January 2003 (see Appendix F).

Evaluation of Management's Response. Management's planned corrective action is responsive to the recommendation. The recommendation is resolved but will remain undispositioned and open for reporting purposes until the corrective action is completed.

Appendix A. Objectives, Scope, and Methodology

Objectives

Our overall objective was to evaluate the Expendable Launch Vehicle (ELV) Program's performance measurement system and compliance with NASA risk mitigation policy for launch vehicles. Specifically, we determined whether NASA did the following:

- Established a performance measurement system for the ELV Program that complied with Federal requirements and other appropriate criteria.

- Managed ELV launch services in compliance with Agency risk mitigation policy. Specifically, we determined whether NASA categorized payload and instrument risk and selected launch vehicles based on the risk category. Also, we determined whether NASA complied with other relevant provisions of NASA's risk mitigation policy, including applicable Federal and NASA clauses in contracts for launch services.

Scope and Methodology

For the first objective, we interviewed the NASA Assistant Associate Administrator for Launch Services and other key ELV Program officials at Kennedy Space Center. We reviewed laws, policy, procedures, and guidelines applicable to performance measures.[17] We also reviewed the ELV Program Management Plan, the ELV Program Commitment Agreement, ELV Launch Services Project Plan, and other key documents for information on performance measures. We evaluated (1) the two ELV Program performance measures (that is, annual performance goals and indicators) appearing in the Agency's fiscal year 2002 and 2003 Annual Performance Plans and (2) the four performance metrics Kennedy Space Center (Kennedy) uses to measure ELV Program performance. The two performance measures are in Appendix B, and the four Kennedy metrics we evaluated were Mission Success, On-Time NASA launches, On-Time Processing, and External Customer Satisfaction. We also reviewed benchmarks NASA used for evaluating the ELV Program's performance; procedures NASA management will use to gather, validate, and report performance data for FY 2002 and subsequent years; and support for Kennedy performance metrics.

For the second objective, we interviewed the NASA Assistant Associate Administrator for Launch Services, the Kennedy ELV Program Deputy Program Manager, and other key ELV Program and procurement officials at Kennedy. We reviewed NASA Policy Directive (NPD) 8610.7, "Launch Services Risk Mitigation Policy for NASA-Owned or

[17]Specifically, we reviewed the Government Performance and Results Act (GPRA), Office of Management and Budget Circular A-11 ("Preparing and Submitting Budget Estimates") sections relating to performance plans and reports, and two General Accounting Office guides for preparing and evaluating Federal agencies' annual performance plans.

NASA-Sponsored Payloads"; the ELV Program Management Plan; the ELV Program Commitment Agreement; the ELV Launch Services Project Plan; and other key management documents. The scope included a universe of 27 ELV payloads scheduled for launch from 2001 to 2003. From the universe of 27 launches, we selected 9[18] for further review. For the nine selected launches, we asked the Assistant Associate Administrator for Launch Services to provide information on the cost, complexity, and risk category of each payload and the risk category of the launch vehicle selected for each. We used that information to evaluate NASA compliance with NPD 8610.7 launch vehicle selection requirements. We did not evaluate whether the subject launch vehicles met the technical certification requirements for their respective risk categories. See Appendix C for further information on the NPD 8610.7 risk categories and suitable launch vehicles. We also reviewed other risk mitigation controls contained in NPD 8610.7: (1) NASA contract insight provisions, (2) NASA Spacecraft Announcements of Opportunities,
(3) the launch service task order (solicitations) process, and (4) records of vehicle history and reliability statistics. See Appendix D for further information on these NPD 8610.7 requirements.

We did not test computer-processed data, because we did not rely on the data to achieve our objectives.

Management Controls Reviewed

As part of our evaluation of performance measurement, we reviewed (1) management controls over the development of performance goals and indicators included in the FY 2003 Performance Plan to ensure their compliance with the Government Performance and Results Act and Office of Management and Budget requirements; (2) procedures management will use to validate, verify, and report performance data for the FY 2002 Performance Plan; and (3) metrics being developed to evaluate the performance of operations and organizations that provide launch services. Controls were adequate except for the matters discussed in the finding section of the report.

As part of our evaluation of risk mitigation, we reviewed compliance with risk mitigation controls on launches covered by NPD 8610.7 and on two launches not covered by NPD 8610.7 that experienced problems. For the seven launches we reviewed, procedures and practices met control requirements outlined in NPD 8610.7.

[18]The nine launches we reviewed consisted of (1) seven launches procured under the Small ELV Services and NASA Launch Services contracts, to which NPD 8610.7 applies, and (2) two other launches that experienced problems. The two problem launches included the Quik Total Ozone Mapping Spectrometer mission's launch, which failed, and the Kodiak Star mission's launch, which was delayed several times but was eventually successful.

Audit Field Work

We conducted field work from November 2001 through May 2002 at NASA Headquarters and Kennedy. We performed the audit in accordance with generally accepted Government auditing standards.

Appendix B. ELV Program Performance Goals and Indicators Excerpted From the NASA FY 2003 Performance Plan

Human Exploration and Development of Space (HEDS) Enterprise Access to Space (Expendable Launch Vehicles and Payloads)	
NASA Strategic Goals and Objectives	**Annual Performance Goals and Indicators**
Goal 1 - Explore the Space Frontier Objective: Enable human exploration through collaborative robotic missions. Public Benefit: A better understanding (at the earliest possible dates) of the space and planetary environments to which human explorers will one day travel will make possible a more focused, more effective and lower cost investment to develop the technologies needed for future human and robotic exploration and development of space. This knowledge and understanding will also make possible reduced risks to the health and safety of future astronauts. Overall, pursuing collaborative robotic missions will result in future human and robotic exploration missions with lower costs and greater benefits that would be otherwise achievable. HEDS supports this strategic objective by working collaboratively with other enterprises on advanced planning activities and providing launch services supporting NASA sponsored missions including robotic spacecraft missions.	3H03: Provide reliable launch services for approved missions. • NASA success rate at or above a running average of 95 percent for missions noted on the Flight Planning Board manifest and launched pursuant to commercial launch service contracts.
Goal 3 - Enable the Commercial Development of Space Objective: Improve the accessibility of space to meet the needs of commercial research and development. Public Benefit: New commercially developed launch services will be able to compete for NASA launches when they meet NASA's risk mitigation policy.	3H17: Establish mechanisms to enable NASA access to the use of U.S. commercially developed launch systems. • Assure that NASA launch service contracts include annual on-ramps for newly developed commercial launch services as they meet NASA's risk mitigation policy.

Appendix C. Payload/Instrument Risk Categories in NPD 8610.7

To balance mission risk with launch vehicle demonstrated history and maturity, NASA Policy Directive 8610.7, "Launch Services Risk Mitigation Policy for NASA-Owned or NASA-Sponsored Payloads," divides payloads and instruments into the following three risk categories and describes suitable launch vehicles for each category.

Risk Category 1

- **Payloads/Instruments** - Applies to payloads and instruments that are non-mission critical, require simple interface and mission design, and/or are low cost (for example, university research experiments or instrumentation).

- **Suitable Launch Vehicle** - Applies to a launch vehicle such as (1) a new launch vehicle with no previous flight history or (2) the first flight of a new configuration of a flight-proven launch vehicle incorporating a major system upgrade. Launch vehicle must achieve 95-percent predicted design reliability.

Risk Category 2

- **Payloads/Instruments** - Applies to missions that are collectively mission critical to the implementation of NASA's Strategic Plan, require moderate complexity of mission design and integration, and/or are of moderate cost.

- **Suitable Launch Vehicle** - Mission may launch on (1) NASA-acquired launch services from qualified suppliers with at least one fully successful launch of a common vehicle or (2) Kennedy Space Center (Kennedy) verification that the demonstrated common vehicle configuration met predicted vehicle and performance parameters. Launch vehicle must achieve 95-percent predicted design reliability.

Risk Category 3

- **Payloads/Instruments** - Applies to missions that are individually mission critical to implementation of NASA's Strategic Plan, require complex mission interface or design, and/or are of high cost.

- **Suitable Launch Vehicle** - Missions may launch on (1) NASA-acquired launch services from qualified suppliers with a demonstrated flight record consisting of a series of consecutive successful launches of a common vehicle configuration (that is, 95-percent reliability at 50-percent confidence level); (2) Kennedy verification that the common vehicle configuration has been verified to meet predicted vehicle

and performance parameters; or (3) an on-orbit services contract utilizing services from a qualified supplier that will be considered on a case-by-case basis for analysis between the mission Enterprise Associate Administrator and the Office of Space Flight. To prove the 95-percent reliability at a 50-percent confidence level, the launch vehicle must achieve a series of 14 or more consecutive successful flights of common vehicle configuration.

Appendix D. Risk Mitigation Requirements in NPD 8610.7

Our review included the following NASA Policy Directive 8610.7, "Launch Services Risk Mitigation Policy for NASA-Owned or NASA-Sponsored Payloads," risk mitigation requirements:

> Section 1.c.(5)
>
> Any NASA contracts which include the launch services as an integrated mission service (e.g., on-orbit or turnkey service) for a NASA-funded mission shall include a provision for NASA insight into launch contractor systems engineering, processes and process control to ensure quality and reliability of launch services, and consistency with this policy.
>
> Section 5.b.
>
> The Enterprise Associate Administrators are responsible for assuring that all spacecraft Announcement of Opportunities and Request for Proposals are coordinated with the Office of Space Flight for consistency with this policy prior to publication.
>
> Section 5.c.
>
> The Kennedy Space Center Director is responsible for ensuring that all launch services solicitations for NASA-owned or NASA-sponsored payloads are consistent with this policy and coordinated with the Office of Space Flight (OSF).
>
> Section 7.a.
>
> OSF will maintain a record of vehicle flight history and reliability statistics for all U.S. and foreign launch vehicle suppliers.

Appendix E. Verification and Validation of Performance Data

The FY 2003 Performance Plan describes the following verification and validation procedures:

Verification and Validation

Internal Assessment

Interim evaluation and monitoring of performance targets will be conducted -- as required -- as an element of regular meetings of the Office of Space Flight and HEDS [Human Exploration and Development of Space] Management Boards.

Final data collection, reporting and verification for inclusion in NASA's Annual Performance Report will rely on several different processes depending on the particular Annual Performance Goal. Wherever possible, a specific tangible product has been identified in the indicator for individual performance goals to strengthen the validation process.

For many HEDS performance goals, (e.g. Space Shuttle in-flight anomalies, International Space Station assembly milestones) verification of performance is straightforward and progress is monitored through regular management channels and reports.

External Assessment

To assist in evaluating those performance goals that are more difficult to associate with specific tangible products, HEDS will employ an annual external assessment process. Past external assessors have included the: NASA Advisory Council, Space Flight Advisory Committee, General Accounting Office, NASA's Office of Inspector General, and National Research Council.

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Appendix F. Management's Response

National Aeronautics and
Space Administration
Headquarters
Washington, DC 20546-0001

September 16, 2002

Reply to Attn of: M-5

TO: W/Assistant Inspector General for Audits

FROM: M/Associate Administrator for Space Flight

SUBJECT: Draft Report on Audit of Expendable Launch Vehicle (ELV) Performance Measures (# A-02-002-00)

NASA has reviewed the subject draft report provided for our review and comment on August 19, 2002.

NASA concurs with the recommendation to explain the ELV Program performance indicator in the FY 2003 NASA Performance Plan or Performance Report to clarify the meaning of the two key terms (success and running average) and the basis for the prescribed 95 percent rate established for mission success.

NASA's FY 2002 Performance Report will include a description of how the noted performance indicator was achieved, including clarification of the noted terms. It is expected that the FY 2002 NASA Performance Report will be released in late-January 2003.

There were no other recommendations from the subject audit. If you have any questions, please contact Ms. Karen Poniatowski at 358-2331. Thank you for the opportunity to review this draft report before publication.

for William F. Readdy

cc:
HQ/B/Chief Financial Officer
HQ/B/Comptroller
HQ/BF/Director, Financial Management Division
HQ/G/General Counsel
HQ/M-2/Assistant Associate Administrator for Policy and Planning
HQ/M-5/Assistant Associate Administrator for Launch Services
HQ/JM/Director, Management Assessment Division
KSC/AA/Director
KSC/VA/Manager, ELV and Payload Carriers Program

Appendix G. Report Distribution

Note: This list shows the distribution of the final report only. The list does not apply to the draft report.

National Aeronautics and Space Administration (NASA) Headquarters

HQ/A/Administrator
HQ/AI/Associate Deputy Administrator
HQ/AA/Chief of Staff
HQ/B/Acting Deputy Chief Financial Officer
HQ/B/Comptroller
HQ/BF/Director, Financial Management Division
HQ/G/General Counsel
HQ/H/Assistant Administrator for Procurement
HQ/HK/Director, Contract Management Division
HQ/HS/Director, Program Operations Division
HQ/J/Assistant Administrator for Management Systems
HQ/JM/Director, Management Assessment Division
HQ/L/Assistant Administrator for Legislative Affairs
HQ/M/Associate Administrator for Space Flight
HQ/S/Associate Administrator for Space Science
HQ/Y/Associate Administrator for Earth Science

NASA Centers

KSC/AA/Director, John F. Kennedy Space Center
KSC/CC/Chief Counsel, John F. Kennedy Space Center

Non-NASA Federal Organizations and Individuals

Assistant to the President for Science and Technology Policy
Deputy Associate Director, Energy and Science Division, Office of Management and Budget
Branch Chief, Science and Space Programs Branch, Energy and Science Division, Office of Management and Budget
Managing Director, Acquisition and Sourcing Management Team, General Accounting Office
Senior Professional Staff Member, Senate Subcommittee on Science, Technology, and Space

Chairman and Ranking Minority Member – Congressional Committees and Subcommittees

Senate Committee on Appropriations
Senate Subcommittee on VA, HUD, and Independent Agencies
Senate Committee on Commerce, Science, and Transportation
Senate Subcommittee on Science, Technology, and Space
Senate Committee on Governmental Affairs
House Committee on Appropriations
House Subcommittee on VA, HUD, and Independent Agencies
House Committee on Government Reform
House Subcommittee on Government Efficiency, Financial Management, and Intergovernmental Relations
House Subcommittee on Technology and Procurement Policy
House Committee on Science
House Subcommittee on Space and Aeronautics

Congressional Member

Honorable Pete Sessions, U.S. House of Representatives

NASA Assistant Inspector General for Audits
Reader Survey

The NASA Office of Inspector General has a continuing interest in improving the usefulness of our reports. We wish to make our reports responsive to our customers' interests, consistent with our statutory responsibility. Could you help us by completing our reader survey? For your convenience, the questionnaire can be completed electronically through our homepage at http://www.hq.nasa.gov/office/oig/hq/audits.html or can be mailed to the Assistant Inspector General for Audits; NASA Headquarters, Code W, Washington, DC 20546-0001.

Report Title: Expendable Launch Vehicle Performance Measures

Report Number: _____ **Report Date:** _____

Circle the appropriate rating for the following statements.

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	N/A
1. The report was clear, readable, and logically organized.	5	4	3	2	1	N/A
2. The report was concise and to the point.	5	4	3	2	1	N/A
3. We effectively communicated the audit objectives, scope, and methodology.	5	4	3	2	1	N/A
4. The report contained sufficient information to support the finding(s) in a balanced and objective manner.	5	4	3	2	1	N/A

Overall, how would you rate the report?

- ☐ Excellent
- ☐ Very Good
- ☐ Good
- ☐ Fair
- ☐ Poor

If you have any additional comments or wish to elaborate on any of the above responses, please write them here. Use additional paper if necessary. _____

How did you use the report? _____

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How could we improve our report? _____

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How would you identify yourself? (Select one)

- ☐ Congressional Staff
- ☐ NASA Employee
- ☐ Private Citizen
- ☐ Government: _____ Federal: _____ State: _____ Local: _____
- ☐ Media
- ☐ Public Interest
- ☐ Other: _____

May we contact you about your comments?

Yes: _____ **No: _____**
Name: _____
Telephone:_____
_____

Thank you for your cooperation in completing this survey.
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Major Contributors to the Report

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