



National Aeronautics and Space Administration
John F. Kennedy Space Center, Florida

K-ELV-10.2
Revision B
February 2, 2001

Expendable Launch Vehicles Program

PROGRAM/PROJECT MANAGEMENT INSTRUCTION

RESPONSIBLE OFFICE: EXPENDABLE LAUNCH VEHICLE PROGRAM OFFICE

SUBJECT: EXPENDABLE LAUNCH VEHICLE CERTIFICATION

- REFERENCE:**
- (a) Section 201, Public Law 105-303, Commercial Space Act of 1998
 - (b) NPD 8610.7 "Launch Services Risk Mitigation Policy for NASA-Owned or NASA-Sponsored Payloads"
 - (c) NPD 8610.23 "Technical Oversight of Expendable Launch Vehicles (ELV) Launch Services"
 - (d) NASA STD-8709.2 "NASA Safety and Mission Assurance Roles and Responsibilities for Expendable Launch Vehicle Services"
 - (e) MSFC-RQMT-3019 "Expendable Launch Vehicle (ELV) Qualification Requirements"
 - (f) ISO 9001-1994, International Organization for Standardization

1.0 PURPOSE AND APPLICABILITY

Any launch vehicle configuration utilized by Launch Service Providers (LSP) to launch National Aeronautics and Space Administration (NASA) payloads must be certified in accordance with NASA Policy Directive (NPD) 8610.7, "Launch Services Risk Mitigation Policy for NASA-Owned or NASA-Sponsored Payloads."

This Instruction sets forth the criteria to be used by the KSC ELV Program Office (ELVPO) to certify any launch vehicle configuration under contract to the ELVPO.

2.0 IMPLEMENTATION

2.1 For acquisition of NASA launch services, the ELVPO has established the following requirements:

- (a) The LSP shall be a domestic LSP pursuant to Section 201 of Public Law 105-303, "Commercial Space Act of 1998."

- (b) The LSP must obtain an ISO 9001 third party certification, from a registrar accredited by either the International Registrar of Certified Auditors (IRCA) or the Registrar Accreditation Board (RAB), for any corporation, corporate divisions, subsidiaries, joint ventures, partner(s) and/or any other business entity actually performing launch vehicle manufacturing, management, payload/launch vehicle integration, testing, and launch.
 - (c) For contract award of any launch services solicited under a NASA request for launch service proposal, the proposed launch vehicle configuration shall be certified to the required payload risk category, as defined by the NASA Enterprises or the LSP shall provide a viable plan to achieve this certification prior to launch. (Note: The payload risk categories are defined in NPD 8610.7 "Launch Services Risk Mitigation Policy for NASA-Owned or NASA-Sponsored Payloads.")
 - (d) The ELVPO has established the Launch Vehicle Certification Process as outlined in Section 4. The LSP shall submit the required documentation for NASA evaluation and determination of certification category. NASA shall not bear any cost associated with the development of any LSP documentation required for the certification of a launch vehicle configuration.
 - (e) Prior to issuance of mission Authority to Proceed (ATP), the proposed common launch vehicle configuration shall achieve one successful launch. (Note: ATP shall be construed as L-27 months before launch or at option exercise, whichever is closer to launch.)
 - (f) Prior to launch of the NASA payload, the proposed launch vehicle configuration shall be certified to the required payload risk category.
 - (g) NASA reserves the right to require that selected Category 3 payloads be launched on launch vehicle configurations that have fourteen consecutive, successful launches of the launch vehicle configuration.
 - (h) If no certified launch vehicle configuration exists to meet specific mission requirements solicited under a NASA request for contract proposal, the ELVPO may elect to award or issue ATP of a mission, contingent on the launch vehicle configuration achieving tailored certification requirements.
- 2.2 A launch vehicle certified to a higher category is inherently certified to launch lower category payloads (i.e., launch vehicles certified to launch Category 3 payloads are also certified to launch Category 1 and 2 payloads).
- 2.3 Upgrades or modifications to a certified common vehicle configuration do not require re-certification. For upgraded or modified vehicle configurations, NASA requires technical insight into the design, manufacturing, testing, integration, and launch of the affected systems and launch vehicle.
- 2.4 Significant changes to a certified common vehicle configuration would be considered a new launch vehicle and therefore requires a new certification.

- 2.5 In the event of a launch failure of a certified common vehicle configuration, the NASA ELVPO will either participate in or perform a failure investigation/return-to-flight board. NASA must concur with the outbrief of the LSP failure investigation/return-to-flight board for the LSP to retain their certification.

3.0 DEFINITIONS

Certified Common Vehicle Configuration: A common vehicle configuration which has met the requirements defined in this document for a specific payload risk category.

Common Vehicle Configuration: A distinct combination of core propulsive stages and hardware used to deliver payloads to earth orbit or escape trajectories.

Core Propulsive Stages: All propulsive stages except strap-on motors, final stages (exclusively used for orbit circularization or escape), and trim stages.

Common Vehicle Configuration Upgrades or Modifications: Items that do not substantially affect operating time, total impulse, and/or the thrust profile of one or more propulsive stages are considered upgrades or modifications to the certified common vehicle configuration. Examples of upgrades and modifications include changes in software, payload fairing, payload electrical/mechanical interfaces, incorporation of mission-unique requirements, and the addition or deletion of a final stage (exclusively used for orbit circularization or escape), strap-on motors, and/or trim stage. Upgrades or modifications are not to be interpreted as common vehicle configuration changes.

Common Vehicle Configuration Changes: Items that substantially affect the airframe integrity, operating time, total impulse and/or thrust profile of one or more core propulsive stages are considered changes to the certified common vehicle configuration. Examples of vehicle configuration changes include the replacement of engine types, core propulsive stages, and/or major airframe structures.

Payload: A spacecraft and any integral propulsive system.

Successful Flight: A launch which met primary mission requirements.

4.0 CERTIFICATION PROCESS

4.1 Category 1 Certification Requirements:

To achieve a Category 1 certification, the requirements of the Marshall Space Flight Center (MSFC) document MSFC-RQMT-3019, "Expendable Launch Vehicle (ELV) Qualification Requirements," must be met.

4.2 Category 2 Certification Requirements:

To achieve a Category 2 certification, the LSP must have a minimum of one successful flight of the common vehicle configuration and participate with NASA in a review of vehicle characteristics and LSP processes as follows:

LAUNCH VEHICLE DESIGN ASSESSMENT

- (a) Launch Vehicle Design: The ELVPO will conduct a review of the launch vehicle predicted design reliability with respect to 95 percent at an 80 percent confidence level.
- (b) Vehicle Flight Hardware/Software Qualification: The ELVPO will conduct a comprehensive review of the LSP's qualification and acceptance test program. The LSP must submit documented and comprehensive vehicle qualification and acceptance test results from its environmental, propulsive, avionics, and payload electrical/mechanical interface testing programs.
- (c) Flight Margin Verification: The ELVPO will verify the demonstrated vehicle configuration flight met the predicted vehicle and performance parameters within three sigma criteria. Actual vehicle and performance parameters which exceed three sigma predictions will be investigated by NASA as anomalies regardless of mission success determination as defined in this document.
- (d) Demonstrated System Safety: The LSP shall submit documentation to the ELVPO verifying compliance to EWR 127.1 (or equivalent for launch sites other than Eastern and Western ranges) with regard to its launch vehicle systems.

MANAGEMENT AND PROCESS AUDITS

- (a) Flight Hardware/Software Operational/Integrated Test Process. The ELVPO will conduct an assessment of all flight vehicle hardware environmental, assembly-level, and integrated assembly test process.
- (b) Manufacturing Processes. The ELVPO will conduct audits/2nd party audits with focus on the LSP's manufacturing processes.
- (c) Quality Systems. The ELVPO will conduct an audit of the LSP's management processes, quality systems, and problem reporting and corrective action systems. NASA will utilize industry-accepted practices to perform the audits in accordance with NASA STD-8709.2, "NASA Safety and Mission Assurance Roles and Responsibilities for ELV Services" and ANSI/ASQC Q10011-1-1994, "Guidelines for Auditing Quality Systems-Auditing."
- (d) Launch Service Complex Review. Prior to the first NASA launch, the ELVPO will perform an audit of the launch service complex, its operation, and associated ground support equipment.

- (e) Vehicle Insight. NASA shall maintain insight into all common vehicle configuration upgrades and modifications as outlined in NPD 8610.23 and NASA STD-8709.2

4.3 Category 3 Certification Requirements

To achieve a Category 3 certification, the LSP must achieve a minimum of 14 consecutive, successful flights of a common vehicle configuration and shall participate with NASA in post flight data reviews:

- (a) Flight Margin Verification. The ELVPO will verify all fourteen flights of the common vehicle configuration met predicted vehicle and performance parameters within three sigma criteria. Actual vehicle and performance parameters which exceed three sigma predictions will be investigated by NASA as anomalies regardless of mission success determination as defined in this document.
- (b) Vehicle Insight. NASA shall maintain insight into all common vehicle configuration upgrades and modifications as outlined in NPD 8610.23 and NASA STD-8709.2

4.4 Alternate Category 3 Certification Requirements

An alternate option for Category 3 certification has been provided for new launch vehicles derived from previously certified Category 3 LV's. To achieve a Category 3 Certification, the LSP must perform six successful consecutive flights of the new common vehicle configuration and participate with NASA in a review of vehicle characteristics and LSP processes to satisfy the intent of 14 flights. The ELVPO will perform an assessment of:

Category 2 Certification. The new LV must successfully obtain a Category 2 certification as described in Section 4.2 of this document.

VEHICLE DESIGN ASSESSMENT

- (a) LV Heritage Assessment. NASA shall conduct a detailed assessment of the LV's heritage to a previously certified Category 3 LV.
- (b) Launch Vehicle Analysis. The ELVPO will conduct a review of qualification data, pre-flight analyses and corresponding reports in the following areas: flight design, flight software, control dynamics, guidance, structural dynamics, environments, thermal, stress and structures, and EMC/RF.
- (c) Flight Margin Verification. The ELVPO will verify all six flights of the common vehicle configuration met predicted vehicle and performance parameters within three sigma criteria. Actual vehicle and performance parameters which exceed three sigma predictions will be investigated by NASA as anomalies regardless of mission success determination as defined in this document.

- (d) LSP Past Performance. The ELVPO will assess the LSP's most recent and relevant launch service activity. The ELVPO will conduct an assessment of the launch vehicle's performance to verify that the launch parameters were within the identified three sigma criteria on previous flight(s). The ELVPO may require additional flight experience of a vehicle configuration prior to launch of a NASA payload.

MANAGEMENT AND PROCESS AUDITS

- (a) Test Philosophy. The ELVPO will review documented test practices as they apply to manufacturing, sub-assembly, assembly, sub-system, and system level testing. NASA will specifically analyze how the LSP has adapted proven test practices documented for Category 3 certified vehicles to the launch vehicle proposed for certification.
- (b) Risk Mitigation. The ELVPO will review documented risk management policies with respect to the identification, tracking, analysis, and mitigation techniques used to manage potential impacts to delivery of the launch service.
- (c) Documentation Systems. The ELVPO will review the LSP's existing documentation system discipline with regard to requirement definition, requirement tracking, procedure development and release, test execution, problem reporting and corrective action, procedure deviations, recurrence control, and quality control.
- (d) Program Management. The ELVPO will assess and the LSP shall provide documentation detailing:
 - 1. Major program management functions required to provide the launch service and to satisfy typical mission requirements.
 - 2. Documentation with respect to formal program, design, and readiness review processes.
- (e) Configuration Management. The ELVPO will assess the LSP's configuration management system. Launch vehicle design and production for all launch vehicle hardware/software components, assemblies, and systems will be evaluated.
- (f) Design and Engineering Processes. The ELVPO will conduct audits/2nd party audits with focus on the LSP's design and engineering processes.
- (g) Vehicle Insight. NASA shall maintain insight into all common vehicle configuration upgrades and modifications as outlined in NPD 8610.23 and NASA STD-8709.2.

5.0 LAUNCH VEHICLE CERTIFICATION REQUEST

5.1 Request for Certification:

The LSP should request certification by sending a written request to the ELVPO. The request should identify the type of certification and be accompanied by the following:

- (a) A letter, signed by a corporate official, certifying that the company is a domestic LSP pursuant to Section 201 of Public Law 105-303, "Commercial Space Act of 1998."
 - (b) A copy of the quality management system ISO 9001 third party certification received from an accredited registrar from either the International Registrar of Certified Auditors (IRCA) or the Registrar Accreditation Board (RAB).
 - (c) A description of the launch vehicle configuration, including any heritage to a previously certified launch vehicle configuration.
 - (d) A list of mission names, launch dates, launch vehicle configurations, and associated customers for all planned and/or performed launches of the vehicle configuration requesting certification.
 - (e) A contractor certification plan and integrated schedule of activities which address and meet the requirements of section 4.0 above, as appropriate.
 - (f) A point-of-contact for coordination of NASA's certification process.
- 5.2 Throughout the certification process, open dialog is encouraged between the LSP and NASA to ensure timely delivery of appropriate documentation and to avoid unnecessary efforts.
- 5.3 Upon completion of the certification process, the ELVPO will issue a letter to the LSP informing them of the launch vehicle configuration's certification category.

APPROVAL

//Original Signed By//

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