



Federal Aviation
Administration

Guidelines for Experimental Permits for Reusable Suborbital Rockets - May, 2005

Federal Aviation Administration
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A. Introduction

On December 23, 2004, President George W. Bush signed into law the Commercial Space Launch Amendments Act of 2004 (CSLAA). The CSLAA promotes the development of the emerging commercial space flight industry and makes the Department of Transportation and the Federal Aviation Administration (FAA), through delegations, responsible for regulating private human space flight under 49 U.S.C. Subtitle IX, ch. 701. Among other things, the CSLAA establishes an experimental permit regime for developmental reusable suborbital rockets.

Before the CSLAA, a license was the only mechanism available to the FAA to authorize launch or reentry. Under the CSLAA, an experimental permit may be used. It differs from a license in the following ways:

- The FAA must make a determination whether or not to issue an experimental permit within 120 days of receiving an application. For a license, the FAA must make a similar determination within 180 days of receiving an application.
- No person may operate a reusable suborbital rocket under a permit for carrying any property or human being for compensation or hire. No such restriction applies for a license.
- A permit is not transferable. A license is transferable.
- Damages arising out of a permitted launch or reentry are not eligible for “indemnification,” the provisional payment of claims under 49 U.S.C. 70113. To the extent provided in an appropriation law or other legislative authority, damages caused by licensed activities are eligible for the provisional payment of claims.
- A permit must authorize an unlimited number of launches and reentries for a particular reusable suborbital rocket design. Although licenses can be structured to authorize an unlimited number of launches, no statutory mandate to do so exists.

In the near term, the CSLAA requires that the FAA (1) issue guidelines or advisory circulars to guide the implementation of the CSLAA as soon as practical after the date of its enactment on December 23, 2004; (2) issue proposed regulations governing experimental permits for launch or reentry of reusable suborbital rockets not later than December 23, 2005; and (3) issue final regulations not later than June 23, 2006.

B. Purpose

These guidelines fulfill the FAA’s requirement to provide direction on the implementation of the CSLAA with respect to experimental permits before issuing regulations. These guidelines are not binding. Until regulations called for in the CSLAA are issued, the FAA will issue permits on a case-by-case basis.

C. Scope

These guidelines address what the FAA may expect to review and evaluate in an application for an experimental permit. These guidelines also identify the safety measures that the FAA would expect a permittee to comply with while conducting permitted activities.

D. Applicability

These guidelines apply to a person proposing to launch or reenter a reusable suborbital rocket solely for the following reasons:

- a) Conducting research and development to test new design concepts, new equipment, or new operating techniques;
- b) Showing compliance with requirements as part of the process for obtaining a license; or
- c) Crew training prior to obtaining a license for a launch or reentry using the design of the rocket for which the permit would be issued.

E. Definitions

Anomaly	An apparent problem or failure that affects a system, subsystem, process, support equipment, or facilities, and that occurs during verification or operation.
Envelope expansion	That portion or portions of a permitted flight whose planned operations will subject the reusable suborbital rocket to the combined effects of altitude, velocity, acceleration, and burn duration that exceed a level or duration successfully verified during a prior flight.
Exclusion area	An area, defined by the FAA, within an operating area, that a reusable suborbital rocket's instantaneous impact point may not cross.
Experimental permit	An authorization by the FAA to a person to launch or reenter a reusable suborbital rocket.
Failure	Any anomalous condition that causes or potentially causes a reusable suborbital rocket, its components, or its debris to impact the Earth or leave the operating area during flight.
Instantaneous impact point	An impact point, following thrust termination of a launch vehicle, calculated in the absence of atmospheric drag effects.

Key flight-safety event	A permitted flight activity that has an increased likelihood of causing a failure compared with other portions of flight.
Operating area	A three-dimensional region where permitted flights may take place.
Reentry impact point	The location of a reusable suborbital rocket's instantaneous impact point during the period of unpowered exoatmospheric suborbital flight.
Validation	An evaluation to determine that safety measures derived from a system safety process are correct and complete.
Verification	An evaluation (by test, demonstration, analysis, or inspection) to determine that safety measures derived from a system safety process are effective and have been properly implemented.

F. General Information About an Experimental Permit

1) Scope of an experimental permit.

The scope of an experimental permit includes the flight of a reusable suborbital rocket, and pre- and post-flight ground operations as defined in paragraphs (a) and (b) of this subsection.

- a) Under 14 CFR § 401.5, permitted preflight ground operations begin with the arrival of a launch vehicle or payload at a U.S. launch site. The FAA will consider limiting, through its waiver authority, the scope of an experimental permit to those operations at a U.S. launch site that are closely proximate in time to flight, entail critical steps preparatory to initiating flight, are unique to space launch, and so inherently hazardous as to warrant FAA regulatory oversight.
- b) Permitted post-flight ground operations include those operations necessary to return the reusable suborbital rocket to a safe condition after landing.

2) Issuance of an experimental permit.

- a) The FAA issues a permit to an applicant if the FAA has found that the applicant is capable of conducting its proposed launch or reentry without jeopardizing public health and safety, the safety of property, or any national security or foreign policy interest of the United States.
- b) The FAA issues an experimental permit authorizing an unlimited number of launches or reentries for a particular suborbital rocket design.
- c) One permit may be issued to an applicant to operate multiple vehicles of a particular reusable suborbital rocket design.

d) The FAA will identify in the experimental permit the type of changes that the permittee may make to the reusable suborbital rocket design without invalidating the permit.

3) Duration of an experimental permit.

The duration of an experimental permit will be 1 year from the date the permit is issued. A permittee may apply to renew its permit.

4) Additional experimental permit terms and conditions.

The FAA may modify an experimental permit at any time by modifying or adding permit terms and conditions to ensure compliance with 49 U.S.C. Subtitle IX, ch. 701.

5) Rights not conferred by an experimental permit.

An experimental permit does not relieve a permittee of its obligation to comply with any requirement of law that applies to its activities.

G. Documentation to Obtain an Experimental Permit

This section identifies the types of documents the FAA expects to evaluate in an experimental permit application.

1) General.

To obtain an experimental permit -

a) An applicant should follow the application procedures in 14 CFR part 413.

b) An applicant should submit a program description, a flight test plan, and operational safety documentation as described in this section.

c) An applicant should provide the FAA with sufficient information to analyze the environmental impacts associated with proposed reusable suborbital rocket launches or reentries. The information provided by an applicant should be sufficient to enable the FAA to comply with the requirements of the National Environment Policy Act, 42 U.S.C. 4321 *et seq.* (NEPA), and the Council on Environmental Quality Regulations for Implementing the Procedural Provisions of NEPA, 40 CFR parts 1500–1508.

d) An applicant proposing to conduct a reusable suborbital rocket launch with flight crew or a space flight participant on board should show compliance with the following guidelines, as applicable:

- i) Draft Guidelines for Commercial Suborbital Reusable Launch Vehicle Operations with Flight Crew, February 11, 2005.
- ii) Draft Guidelines for Commercial Suborbital Reusable Launch Vehicle Operations with Space Flight Participants, February 11, 2005.
- e) An applicant should make the reusable suborbital rocket available to the FAA for inspection before the issuance of a permit for the FAA to determine whether the reusable suborbital rocket is built consistent with representations in the permit application.

2) Program description.

An applicant should—

- a) Describe the purpose for which a reusable suborbital rocket is to be used;
- b) Provide dimensioned three-view drawings or photographs of the reusable suborbital rocket;
- c) Provide gross liftoff weight and thrust profile of the reusable suborbital rocket;
- d) Describe all reusable suborbital rocket systems, including structural, flight control, thermal, pneumatic, hydraulic, propulsion, electrical, environmental control, and avionics and guidance systems used in the reusable suborbital rocket, and all propellants;
- e) Describe each payload or payload class planned to be flown; and
- f) Identify foreign ownership of the applicant as follows:
 - i) For a sole proprietorship or partnership, identify all foreign ownership,
 - ii) For a corporation, identify any foreign ownership interests of 10% or more, and
 - iii) For a joint venture, association, or other entity, identify any participating foreign entities.

3) Flight test plan.

An applicant should—

- a) Describe any flight test program, including estimated number of flights, key flight-safety events, and maximum altitude.
- b) Identify and describe the geographic boundaries of one or more proposed operating areas where it plans to perform its flights. The FAA will determine whether to approve each operating area using section H, subsection 4 as guidance.

4) Operational safety documentation.

An applicant should show the FAA in writing how it will meet the safety measures outlined in the following subsections of section H of these guidelines:

- a) Preflight and post-flight operations - subsection (2).
- b) Hazard analysis - paragraph (a) of subsection (3).
 - An applicant should provide all the results of each step of the hazard analysis process.
- c) Operating area containment – subsection (4).
 - An applicant should identify and describe the methods and systems used to contain its reusable suborbital rocket's instantaneous impact point within the operating area and outside any exclusion area, such as proof of physical limitations on the ability of the reusable suborbital rocket to leave the operating area, or abort procedures and safety measures derived from a system safety process.
 - An applicant should also provide evidence of one or more methods of verification for any systems used.
- d) Key flight-safety event limitations – subsection (5).
 - An applicant should identify and describe the methods and systems used to conduct key flight-safety events over unpopulated or sparsely populated areas.
 - An applicant should also provide evidence of one or more methods of verification for any systems used.
- e) Landing and impact locations – subsection (6).
- f) Agreements – subsection (7).
- g) Tracking – subsection (9).
- h) Flight rules – paragraphs (a) and (b) of subsection (11).
- i) Mishap response requirements – paragraph (b) of subsection (13).

H. Safety Measures for Permitted Activities

This section identifies the safety measures that the FAA would expect a permittee to comply with while conducting permitted activities.

1) Personnel rest rules.

A permittee should ensure that vehicle safety operations personnel adhere to the following work and rest standards:

- a) A maximum 12-hour work shift with at least 8 hours of rest after 12 hours of work during permitted activities,
- b) A maximum of 60 hours worked in the 7 days preceding a permitted activity,
- c) A maximum of 14 consecutive work days, and
- d) A minimum 48-hour rest period after 5 consecutive days of 12-hour shifts.

2) Preflight and post-flight operations.

Consistent with the scope of an experimental permit in subsection 1 of section F, a permittee should protect the public from adverse effects of hazardous operations and systems associated with preparing a reusable suborbital rocket for flight at a launch site in the United States and returning the reusable suborbital rocket and any support equipment to a safe condition after flight.

- a) A permittee should establish a safety clear zone that will contain the adverse effects of each operation involving a hazard.
- b) A permittee should verify that the public is outside of a safety clear zone before and during a hazardous operation.

3) Hazard analysis.

- a) An applicant should perform a hazard analysis that identifies and characterizes each of the hazards and assesses the risk to public health and safety and safety of property resulting from each permitted flight. A hazard analysis should –
 - i) Identify and describe hazards, including but not limited to those that result from component, subsystem, or system failures or faults; software errors; environmental conditions; human errors; design inadequacies; and procedural deficiencies.
 - ii) Determine the risk acceptability for each hazard, using the following criteria:

- (1) The occurrence of any hazardous condition that may cause death or serious injury to the public should be extremely unlikely.
 - (2) The likelihood of an occurrence of any hazardous condition that may cause major property damage to the public, major safety-critical system damage or reduced capability, decreased safety margins, or increased workload should be remote.
- iii) Identify and describe the risk elimination and mitigation measures necessary to meet the criteria of paragraph (a)(ii) of this subsection.
 - iv) Provide validation and verification evidence for risk elimination and mitigation measures. Methods of verification include test data, demonstration data, inspection results, and analyses.
- b) During permitted activities, a permittee should comply with the risk elimination and mitigation measures derived from its hazard analysis.
 - c) Throughout the term of the permit, a permittee should ensure the continued accuracy and validity of its hazard analysis.
- 4) Operating area containment.
- a) During each permitted flight, a permittee should contain its reusable suborbital rocket instantaneous impact point within an operating area determined in accordance with paragraph (b) of this subsection and outside any exclusion area defined by the FAA in accordance with paragraph (c) of this subsection.
 - b) An operating area should satisfy the following requirements:
 - i) No densely populated area should be present within an operating area.
 - ii) An operating area should be large enough to contain each planned trajectory, accounting for expected dispersions.
 - iii) An operating area should contain enough unpopulated or sparsely populated area to perform key flight-safety events consistent with subsection 5 of this section.
 - iv) The operating area should not contain significant automobile traffic, railway traffic, waterborne vessel traffic, or large concentrations of members of the public not otherwise reflected in census data.
 - v) An operating area should not have any densely populated areas adjacent to it.
 - c) The FAA may prohibit instantaneous impact point overflight of certain areas within an operating area, by designating one or more areas as exclusion areas, if necessary to

protect public health and safety, safety of property, or foreign policy or national security interests of the United States. An exclusion area may be flight-phase specific.

5) Key flight-safety event limitations.

- a) A permittee should conduct any key flight-safety event so that the reusable suborbital rocket's instantaneous impact point, accounting for expected dispersions, is over a sparsely populated or unpopulated area. At a minimum, key flight-safety events include the following:
 - i) Ignition of any primary rocket engine.
 - ii) Any staging event.
 - iii) Any envelope expansion portion of flight.
- b) A permittee should conduct each reusable suborbital rocket flight so that the reentry impact point does not loiter over a populated area.

6) Landing and impact locations.

A permittee should use a location for nominal landing, any contingency abort landing, or any reusable suborbital rocket component impact or landing that:

- a) Can be reached by the reusable suborbital rocket or component;
- b) Is of sufficient size to contain an impact, including debris dispersion upon impact; and
- c) At the time of landing or impact, does not contain any members of the public.

7) Agreements.

A permittee should enter into and comply with the agreements in this subsection.

- a) Launch site use agreement. An applicant should enter into an agreement with a Federal launch range, a licensed launch site, or any other required parties that provides for:
 - i) Access to and use of property and services required to support a permitted flight, and
 - ii) Public safety related operations and support.
- b) Agreements with the U.S. Coast Guard (USCG) and FAA Air Traffic Control. Unless otherwise addressed in agreements between a licensed launch site operator and the USCG and the FAA, respectively, an applicant using a launch site other than a Federal launch range should complete the following:

- i) For overflight of water, an agreement between the applicant and the local USCG district to establish procedures for issuing a Notice to Mariners before a permitted flight and other measures as the USCG considers necessary, and
- ii) An agreement between the applicant and responsible FAA Air Traffic Control office having jurisdiction over the airspace through which a launch is to take place, for measures necessary to implement the use of an operating area or areas.

8) Collision avoidance analysis.

- a) For a permitted flight with a planned maximum altitude greater than 150 kilometers, a permittee should obtain a collision avoidance analysis from United States Strategic Command, or from a Federal launch range for which the FAA has conducted a launch site safety assessment that shows that the Federal launch range conducts collision avoidance analyses equivalent to United States Strategic Command.
- b) The collision avoidance analysis should establish periods of time during which a permittee may not initiate flight, in order to ensure that a permitted vehicle and any jettisoned components do not pass closer than 200 kilometers to a habitable orbital object throughout the flight. A distance less than 200 kilometers may be used if the distance provides an equivalent level of safety, while accounting for all uncertainties in the analysis.

9) Tracking.

A permittee should operate a reusable suborbital rocket in a manner that provides —

- a) Air Traffic Control with the ability to know the real time position and velocity of the reusable suborbital rocket while operating in the National Airspace System; and
- b) Position and velocity data for post-flight use.

10) Communications.

- a) A permittee should be in communication with Air Traffic Control during all phases of flight.
- b) A permittee should record communications affecting the safety of the flight.

11) Flight rules.

- a) Before initiating rocket-powered flight, a permittee should confirm that all systems and operations necessary to ensure that parameters derived from subsections 3 through 10 are within acceptable limits.

- b) During all phases of flight, a permittee should –
 - i) Follow flight rules that ensure compliance with subsections 3, 4, 5, 6, 7, 9, and 10.
 - ii) Abort the flight if the reusable suborbital rocket is in a state such that the continued operation of the reusable suborbital rocket would endanger the public.
- c) During all phases of flight, a permittee should not operate a reusable suborbital rocket in a careless or reckless manner so as to endanger members of the public.
- d) For phases of flight where the reusable suborbital rocket is operated in the National Airspace System in a manner similar to an airplane, the FAA may incorporate in the permit portions of 14 CFR part 91 necessary to protect public health and safety and safety of property.

12) Anomaly reporting.

- a) A permittee should record anomalies and implement corrective actions for those anomalies.
- b) A permittee should report any anomaly of any system necessary for compliance with subsections 3, 4, and 5 to the FAA before the next flight.

13) Mishap reporting, responding, and investigating.

A permittee should report, respond to, and investigate mishaps, as defined in 14 CFR § 401.5, that occur during the conduct of permitted activities, in accordance with this subsection.

- a) Reporting. A permittee should –
 - i) Immediately notify the FAA Washington Operations Center in case of a launch accident, launch incident, or a mishap that involves a fatality or serious injury, as defined in 49 CFR 830.2;
 - ii) Notify within 24 hours the Associate Administrator for Commercial Space Transportation in the event of a mishap that does not involve a fatality or serious injury, as defined in 49 CFR 830.2; and
 - iii) Submit within 5 days of the event a written preliminary report to the FAA Associate Administrator for Commercial Space Transportation in the event of a launch accident or launch incident occurring during a permitted flight. The report should identify the event as either a launch accident or launch incident and should include the following information:
 - (1) Date and time of occurrence,

- (2) Description of the event and sequence of events leading to the launch accident or launch incident, to the extent known,
 - (3) Intended and actual location of launch or reentry, including landing or impact on Earth,
 - (4) Identification of any payload,
 - (5) Number and general description of any fatalities and injuries,
 - (6) Property damage, if any, and an estimate of its value,
 - (7) Identification of hazardous materials, as defined in 14 CFR § 401.5, involved in the event, whether on the reusable suborbital rocket or on the ground,
 - (8) Action taken by any person to contain the consequences of the event, and
 - (9) Weather conditions at the time of the event.
- b) Response. A permittee should —
- i) Immediately respond to —
 - (1) Ensure the consequences of a mishap are contained and minimized; and
 - (2) Ensure data and physical evidence are preserved.
 - ii) Report to and cooperate with FAA and National Transportation Safety Board investigations and designate one or more points of contact for the FAA or NTSB; and
 - iii) Identify and adopt preventive measures for avoiding recurrence of the event.
- c) Investigation. A permittee should —
- i) Investigate the root cause of an event described in paragraph (a) of this subsection;
 - ii) Report investigation results to the FAA;
 - iii) Delineate responsibilities, including reporting responsibilities, for personnel assigned to conduct investigations and for any unrelated entities retained by the permittee to conduct or participate in investigations.