

all of the safety official's concerns are addressed prior to launch.

§417.105 Launch personnel qualifications and certification.

(a) *General.* A launch operator must employ a personnel certification program that documents the qualifications, including education, experience, and training, for each member of the launch crew.

(b) *Personnel certification program.* A launch operator's personnel certification program must:

(1) Conduct an annual personnel qualifications review and issue individual certifications to perform safety related tasks.

(2) Revoke individual certifications for negligence or failure to satisfy certification requirements.

§417.107 Flight safety.

(a) *Flight safety system.* For each launch vehicle, vehicle component, and payload, a launch operator must use a flight safety system that satisfies subpart D of this part as follows, unless §417.125 applies.

(1) *In the vicinity of the launch site.* For each launch vehicle, vehicle component, and payload, a launch operator must use a flight safety system in the vicinity of the launch site if the following exist:

(i) Any hazard from a launch vehicle, vehicle component, or payload can reach any protected area at any time during flight; or

(ii) A failure of the launch vehicle would have a high consequence to the public.

(2) *In the downrange area.* For each launch vehicle, vehicle component, and payload, a launch operator must provide a flight safety system downrange if the absence of a flight safety system would significantly increase the accumulated risk from debris impacts.

(b) *Public risk criteria.* A launch operator may initiate the flight of a launch vehicle only if flight safety analysis performed under paragraph (f) of this section demonstrates that any risk to the public satisfies the following public risk criteria:

(1) A launch operator may initiate the flight of a launch vehicle only if the risk associated with the total

flight to all members of the public, excluding persons in waterborne vessels and aircraft, does not exceed an expected average number of 0.00003 casualties ($E_c \leq 30 \times 10^{-6}$) from impacting inert and impacting explosive debris, ($E_c \leq 30 \times 10^{-6}$) for toxic release, and ($E_c \leq 30 \times 10^{-6}$) for far field blast overpressure. The FAA will determine whether to approve public risk due to any other hazard associated with the proposed flight of a launch vehicle on a case-by-case basis. The E_c criterion for each hazard applies to each launch from lift-off through orbital insertion, including each planned impact, for an orbital launch, and through final impact for a suborbital launch.

(2) A launch operator may initiate flight only if the risk to any individual member of the public does not exceed a casualty expectation (E_c of 0.000001 per launch ($E_c \leq 1 \times 10^{-6}$) for each hazard.

(3) A launch operator must implement water borne vessel hazard areas that provide an equivalent level of safety to that provided by water borne vessel hazard areas implemented for launch from a Federal launch range.

(4) A launch operator must establish aircraft hazard areas that provide an equivalent level of safety to that provided by aircraft hazard areas implemented for launch from a Federal launch range.

(c) *Debris thresholds.* A launch operator's flight safety analysis, performed as required by paragraph (f) of this section, must account for any inert debris impact with a mean expected kinetic energy at impact greater than or equal to 11 ft-lbs and, except for the far field blast overpressure effects analysis of §417.229, a peak incident overpressure greater than or equal to 1.0 psi due to any explosive debris impact.

(1) When using the 11 ft-lbs threshold to determine potential casualties due to blunt trauma from inert debris impacts, the analysis must:

(i) Incorporate a probabilistic model that accounts for the probability of casualty due to any debris expected to impact with kinetic energy of 11 ft-lbs or greater and satisfy paragraph (d) of this section; or

(ii) Count each expected impact with kinetic energy of 11 ft-lbs or greater to a person as a casualty.

(2) When applying the 1.0 psi threshold to determine potential casualties due to blast overpressure effects, the analysis must:

(i) Incorporate a probabilistic model that accounts for the probability of casualty due to any blast overpressures of 1.0 psi or greater and satisfy paragraph (d) of this section; or

(ii) Count each person within the 1.0 psi overpressure radius of the source explosion as a casualty. When using this approach, the analysis must compute the peak incident overpressure using the Kingery-Bulmash relationship and may not take into account sheltering, reflections, or atmospheric effects. For persons located in buildings, the analysis must compute the peak incident overpressure for the shortest distance between the building and the blast source. The analysis must count each person located anywhere in a building subjected to peak incident overpressure equal to or greater than 1.0 psi as a casualty.

(d) *Casualty modeling.* A probabilistic casualty model must be based on accurate data and scientific principles and must be statistically valid. A launch operator must obtain FAA approval of any probabilistic casualty model that is used in the flight safety analysis. If the launch takes place from a Federal launch range, the analysis may employ any probabilistic casualty model that the FAA accepts as part of the FAA's launch site safety assessment of the Federal launch range's safety process.

(e) *Collision avoidance.* (1) A launch operator must ensure that a launch vehicle, any jettisoned components, and its payload do not pass closer than 200 kilometers to a manned or mannable orbital object—

(i) Throughout a sub-orbital launch; or

(ii) For an orbital launch:

(A) During ascent to initial orbital insertion and through at least one complete orbit; and

(B) During each subsequent orbital maneuver or burn from initial park orbit, or direct ascent to a higher or interplanetary orbit or until clear of all manned or mannable objects, whichever occurs first.

(2) A launch operator must obtain a collision avoidance analysis for each

launch from United States Strategic Command or from a Federal range having an approved launch site safety assessment. United States Strategic Command calls this analysis a conjunction on launch assessment. Sections 417.231 and A417.31 of appendix A of this part contain the requirements for obtaining a collision avoidance analysis. A launch operator must use the results of the collision avoidance analysis to develop flight commit criteria for collision avoidance as required by §417.113(b).

(f) *Flight safety analysis.* A launch operator must perform and document a flight safety analysis as required by subpart C of this part. A launch operator must not initiate flight unless the flight safety analysis demonstrates that any risk to the public satisfies the public risk criteria of paragraph (b) of this section. For a licensed launch that involves a Federal launch range, the FAA will treat an analysis performed and documented by the Federal range, and which has an FAA approved launch site safety assessment, as that of the launch operator as provided in §417.203(d) of subpart C of this part. A launch operator must use the flight safety analysis products to develop flight safety rules that govern a launch. Section 417.113 contains the requirements for flight safety rules.

§417.109 Ground safety.

(a) Ground safety requirements apply to launch processing and post-launch operations at a launch site in the United States.

(b) A launch operator must protect the public from adverse effects of hazardous operations and systems associated with preparing a launch vehicle for flight at a launch site.

(c) §§417.111(c), 417.113(b), and 417.115(c), and subpart E of this part provide launch operator ground safety requirements.

§417.111 Launch plans.

(a) *General.* A launch operator must implement written launch plans that define how launch processing and flight of a launch vehicle will be conducted without adversely affecting public safety and how to respond to a launch mishap. A launch operator's launch plans