

§417.217

direction above the launch point, at which activation of the launch vehicle's flight termination system or breakup of the launch vehicle would not cause hazardous debris or critical overpressure to affect any populated or other protected area.

§417.217 Overflight gate analysis.

For a launch that involves flight over a populated or other protected area, the flight safety analysis must include an overflight gate analysis. The analysis must establish the portion of a flight safety limit, a gate, through which a normally performing launch vehicle's tracking icon will be allowed to proceed. A tracking icon must enable the flight safety crew to determine whether the launch vehicle's flight is in compliance with the flight safety rules established under §417.113. When establishing that portion of a flight safety limit, the analysis must demonstrate that the launch vehicle flight satisfies the flight safety requirements of §417.107.

§417.218 Hold-and-resume gate analysis.

(a) For a launch that involves overflight or near overflight of a populated or otherwise protected area prior to the planned safe flight state calculated as required by §417.219, the flight safety analysis must construct a hold-and-resume gate for each populated or otherwise protected area. After a vehicle's tracking icon crosses a hold-and-resume gate, flight termination must occur as required by sections 417.113(d)(6).

(b) The hold-and-resume gate analysis must account for:

(1) *Overflight of a wholly contained populated or otherwise protected area.* A hold-and-resume gate must be a closed, continuous contour that encompasses any populated or otherwise protected area located wholly within the impact limit lines. The hold-and-resume gate must encompass a populated or otherwise protected area such that flight termination or breakup of the launch vehicle while the tracking icon is outside the gate would not cause hazardous debris or overpressure to endanger the populated or otherwise protected area.

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(2) *Overflight of an uncontained populated or otherwise protected area.* A hold-and-resume gate must be a closed, continuous contour that encompasses any area in which flight termination is allowed to occur. The hold-and-resume gate must encompass all hazard areas such that flight termination or breakup of the launch vehicle while the vehicle's tracking icon is inside the gate would not cause hazardous debris or critical overpressure to endanger any populated or otherwise protected area.

§417.219 Data loss flight time and planned safe flight state analyses.

(a) *General.* For each launch, a flight safety analysis must establish data loss flight times, as identified by paragraph (b) of this section, and a planned safe flight state to establish each flight termination rule that applies when launch vehicle tracking data is not available for use by the flight safety crew. Section 417.113(d) contains requirements for flight termination rules.

(b) *Data loss flight times.* A flight safety analysis must establish the shortest elapsed thrusting time during which a launch vehicle can move from normal flight to a condition where the launch vehicle's hazardous debris impact dispersion extends to any protected area as a data loss flight time. The analysis must establish a data loss flight time for all times along the nominal trajectory from liftoff through that point during nominal flight when the minimum elapsed thrusting time is no greater than the time it would take for a normal vehicle to reach the overflight gate, or the planned safe flight state established under paragraph (c) of this section, whichever occurs earlier.

(c) *Planned safe flight state.* For a launch vehicle that performs normally during all portions of flight, the planned safe flight state is the point during the nominal flight of a launch vehicle where:

(1) No launch vehicle component, debris, or hazard can impact or affect a populated or otherwise protected area for the remainder of the launch;

(2) The launch vehicle achieves orbital insertion; or

(3) The launch vehicle's state vector reaches a state where the absence of a

flight safety system would not significantly increase the accumulated risk from debris impacts and maintains positive flight safety system control to the maximum extent feasible.

§417.221 Time delay analysis.

(a) *General.* A flight safety analysis must include a time delay analysis that establishes the mean elapsed time between the violation of a flight termination rule and the time when the flight safety system is capable of terminating flight for use in establishing flight safety limits as required by §417.213.

(b) *Analysis constraints.* A time delay analyses must determine a time delay distribution that accounts for the following:

(1) The variance of all time delays for each potential failure scenario, including but not limited to, the range of malfunction turn characteristics and the time of flight when the malfunction occurs;

(2) A flight safety official's decision and reaction time, including variation in human response time; and

(3) Flight termination hardware and software delays including all delays inherent in:

- (i) Tracking systems;
- (ii) Data processing systems, including all filter delays;
- (iii) Display systems;
- (iv) Command control systems; and
- (v) Flight termination systems.

§417.223 Flight hazard area analysis.

(a) *General.* A flight safety analysis must include a flight hazard area analysis that identifies any regions of land, sea, or air that must be surveyed, publicized, controlled, or evacuated in order to control the risk to the public from debris impact hazards. The risk management requirements of §417.205(a) apply. The analysis must account for, at a minimum:

(1) All trajectory times from liftoff to the planned safe flight state of §417.219(c), including each planned impact, for an orbital launch, and through final impact for a suborbital launch;

(2) Regions of land potentially exposed to debris resulting from normal

flight events and events resulting from any potential malfunction;

(3) Regions of sea and air potentially exposed to debris from normal flight events, including planned impacts;

(4) In the vicinity of the launch site, any waterborne vessels, populated off-shore structures, or aircraft exposed to debris from events resulting from any potential abnormal flight events, including launch vehicle malfunction;

(5) Any operational controls implemented to control risk to the public from debris hazards;

(6) Debris identified by the debris analysis of §417.211; and

(7) All launch vehicle trajectory dispersion effects in the surface impact domain.

(b) *Public notices.* A flight hazard areas analysis must establish the ship hazard areas for notices to mariners that encompass the three-sigma impact dispersion area for each planned debris impact. A flight hazard areas analysis must establish the aircraft hazard areas for notices to airmen that encompass the 3-sigma impact dispersion volume for each planned debris impact. Section 417.121(e) contains procedural requirements for issuing notices to mariners and airmen.

§417.224 Probability of failure analysis.

(a) *General.* All flight safety analyses for a launch, regardless of hazard or phase of flight, must account for launch vehicle failure probability in a consistent manner. A launch vehicle failure probability estimate must use accurate data, scientific principles, and a method that is statistically or probabilistically valid. For a launch vehicle with fewer than two flights, the failure probability estimate must account for the outcome of all previous launches of vehicles developed and launched in similar circumstances. For a launch vehicle with two or more flights, launch vehicle failure probability estimates must account for the outcomes of all previous flights of the vehicle in a statistically valid manner.

(b) *Failure.* For flight safety analysis purposes, a failure occurs when a launch vehicle does not complete any phase of normal flight or when any