AIRCRAFT EQUIPMENT ACCELERATION LOADS

By Tom Irvine Email: tomirvine@aol.com

January 4, 2012

The following sections are excerpts from the FAA Federal Air Regulations (FARs) intended for commercial aircraft. Military aircraft experience higher loads, such as an aircraft making an arrested landing on an aircraft carrier.

Sec. 23.561

Part 23 AIRWORTHINESS STANDARDS: NORMAL, UTILITY, ACROBATIC, AND		
COMMUTER CATEGORY AIRPLANES		
Subpart CStructure	Emergency Landing Conditions	

Sec. 23.561

General.

(a) The airplane, although it may be damaged in emergency landing conditions, must be designed as prescribed in this section to protect each occupant under those conditions.

(b) The structure must be designed to give each occupant every reasonable chance of escaping serious injury when--

(1) Proper use is made of seats, safety belts, and shoulder harnesses provided for in the design;

(2) The occupant experiences the static inertia loads corresponding to the following ultimate load factors--

(i) Upward, 3.0g for normal, utility, and commuter category airplanes, or 4.5g for acrobatic category airplanes;

(ii) Forward, 9.0g;

(iii) Sideward, 1.5g; and

(iv) Downward, 6.0g when certification to the emergency exit provisions of Sec. 23.807(d)(4) is requested; and

(3) The items of mass within the cabin, that could injure an occupant, experience the static inertia loads corresponding to the following ultimate load factors--

(i) Upward, 3.0g;

(ii) Forward, 18.0g; and

(iii) Sideward, 4.5g.

(c) Each airplane with retractable landing gear must be designed to protect each occupant in a landing--

(1) With the wheels retracted;

(2) With moderate descent velocity; and

(3) Assuming, in the absence of a more rational analysis--

(i) A downward ultimate inertia force of 3g; and

(ii) A coefficient of friction of 0.5 at the ground.

(d) If it is not established that a turnover is unlikely during an emergency landing, the structure must be designed to protect the occupants in a complete turnover as follows:

(1) The likelihood of a turnover may be shown by an analysis assuming the following conditions--

(i) The most adverse combination of weight and center of gravity position;

(ii) Longitudinal load factor of 9.0g;

(iii) Vertical load factor of 1.0g; and

(iv) For airplanes with tricycle landing gear, the nose wheel strut failed with the nose contacting the ground.

(2) For determining the loads to be applied to the inverted airplane after a turnover, an upward ultimate inertia load factor of 3.0g and a coefficient of friction with the ground of 0.5 must be used.

(e) Except as provided in Sec. 23.787(c), the supporting structure must be designed to restrain, under loads up to those specified in paragraph (b)(3) of this section, each item of mass that could injure an occupant if it came loose in a minor crash landing.

Sec. 25.473

Part 25 AIRWORTHINESS STANDARDS: TRANSPORT CATEGORY AIRPLANES	
Subpart CStructure	Ground Loads

Sec. 25.473

Ground load conditions and assumptions.

(a) For the landing conditions specified in Secs. 25.479 through Sec. 25.485, the following apply--

(1) The selected limit vertical inertia load factors at the center of gravity of the airplane may not be less than the values that would be obtained--

(i) In the attitude and subject to the drag loads associated with the particular landing condition;

(ii) With a limit descent velocity of 10 f.p.s. at the design landing weight (the maximum weight for landing conditions at the maximum descent velocity); and

(iii) With a limit descent velocity of 6 f.p.s. at the design takeoff weight (the maximum weight for taxiing conditions and landing conditions at a reduced descent velocity).

(2) A wing lift, not exceeding the airplane weight, may be assumed to exist throughout the landing impact and to act through the center of gravity of the airplane.

(b) The prescribed descent velocities may be modified if it is shown that the airplane has design features that make it impossible to develop these velocities.

(c) The minimum limit inertia load factors corresponding to the required limit descent velocities must be determined in accordance with Sec. 25.723(a).