



DEPARTMENT OF DEFENSE
UNITED STATES AIR FORCE

MIL-HDBK-516C CHANGE NOTICE No. 516CN-3

<p style="text-align: center;">AIRWORTHINESS BOARD DETERMINATION MIL-HDBK-516C CHANGE NOTICE</p>	<p>1. DATE (YYYYMMDD) 20160510</p>
<p>2. ALFCMC/EZ POINT OF CONTACT Greg Schoeppner, EZFS</p>	<p>3. PHONE (DSN) 986-9921</p>
<p>4. BOARD SECRETARIAT Holli Bone, AFLCMC/EZSC</p>	<p>5. PHONE (DSN) 656-9557</p>
<p>6. SUMMARY OF AIRWORTHINESS BOARD DETERMINATION / MIL-HDBK-516C CHANGE (See attached Airworthiness Board charts for more information.)</p> <p>MIL-HDBK-516C Sections 5.1.8 for Trainer Sink Speeds</p> <p>Change impacts:</p> <ul style="list-style-type: none">• Modified Standard: See attached charts.	
<p>7. TAA SIGNATURE</p> <p>X <u>K J Bone, for 19 May 16</u> Jorge F. Gonzalez Technical Airworthiness Authority</p>	<p>8. ORGANIZATION</p> <p>AFLCMC/EN-EZ</p>



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USAF Airworthiness Change Notice Board



Trainer Sink Speeds

09 July 2015



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Change Notice (CN) Overview



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- **Title**: Trainer Sink Speeds
- **Date Proposed**: 26MAY2015
- **POC**: Schoeppner, EZFS, & 656-9921
- **Revision To**: CN Proposal Revises MIL-HDBK-516C

Paragraph(s) Impacted	Impact to C/S/MOC			
	Title	New	Modified	No Change
5.1.8	Criterion Standard		X	X
	Method of Compliance			X



Rationale for Change



- **Rationale:** The T-X program office requested clarification on sink speed requirements for primary, basic and advanced trainer aircraft. Primary trainer (PT), basic trainer (BT) and advanced trainer (AT) terminology reflect legacy designators (see the attached white paper). The basic and primary category of trainers terminology used in MIL-HDBK-516C reflects legacy designators that needs to be deleted from 516C to eliminate confusion. Sink speed requirements are the same for all trainers.
- * See attached white paper for trainer sink speed background



Proposed Criterion



- **Proposed Criterion:** Verify that the aircraft is designed for ground loading conditions that reflect fleet operations. Verify that the airframe has sufficient structural integrity to take-off, catapult, land, arrest, and operate on the ground, ship, or other remote operating facilities.



Proposed Standard



- **Proposed Standard:**

- a) For Fixed-Wing Aircraft:

- 1) The airframe is designed such that the maximum landing touchdown vertical sink speeds of the air vehicle center of mass used in the design of the airframe and landing gear are:
 - a. 13 feet per second (fps) for landing design gross weights of ~~primary and basic~~ trainers; 10 fps for all other classes.
 - b. 10 fps for maximum landing design weights of ~~primary and basic~~ trainers; 6 fps for all other classes
- 2) The airframe is designed such that crosswinds at take-off and landing are those components of surface winds perpendicular to the runway centerline with the landing gear loads being 80% of the vertical reaction for the inboard acting load and 60% of the vertical reaction of the outboard acting load. This is based on the vertical reaction being 50% of the maximum vertical reaction from two point and level symmetrical landings.



Proposed Standard



- **Proposed Standard (con't):**

- 3) The airframe is designed such that the landing touchdown roll, yaw, pitch attitude, and sink speed combinations are based on a joint probability within an ellipsoid with axes of roll, yaw, and pitch.
- 4) The airframe is designed such that taxi discrete bumps and dips are as defined in JSSG-2006 for wave length, amplitude and shape for the maximum ground weight. It is also designed such that the angle between the path of the aircraft and the lateral axis of the contour are at angles up to 45 degrees.
- 5) The airframe is designed such that the maximum combination of wind loading and air vehicle load factor conditions that are utilized when assessing jacking of the air vehicle.
- 6) The airframe is designed such that the ground loading conditions considered are those required and expected to be encountered in critical combinations of configurations, gross weights, centers of gravity, landing gear/tire servicing, external environments, thrust or power, and speeds and are used in the design of the airframe.
- 7) The airframe is designed such that ground operations include symmetric and ~~unsymmetric~~ **unsymmetrical** fuel and payload loadings and adverse trim conditions.
- 8) The airframe is designed for ground operations consisting of taxing, turning, pivoting, braking, landing (including arrestment) and takeoff.
- 9) The airframe is designed for ground handling conditions consisting of towing, jacking, and hoisting.
- 10) The airframe is designed for dynamic response and shimmy during ground operations as well as for rough runway conditions.
- 11) The airframe is designed for ground winds as a result of weather and jet blast.



Proposed Standard



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- **Proposed Standard (con't):**

- b) For Rotary-wing Aircraft:

- 1) The normal landing capability is defined for the structural design gross weight and associated center of gravity envelope. The aircraft is in the pitch and roll attitude for trimmed descent for landing. The rotor lift is equal to $\frac{2}{3}$ the weight of the aircraft, and tail rotor forces and moments are as required for trimmed flight. The wind speed is 45 knots from any azimuth. The landing conditions are as follows:
 - a. A level landing on a level surface at 12 fps sink speed with a forward velocity of 0-60 knots.
 - b. A landing of 8 fps sink speed with a zero forward velocity on a 12 degree slope in any azimuth relative to the aircraft.
 - c. For the maximum alternate gross weight, the landing capability in terms of sink speed, forward velocity and slope angle is defined based on the demonstrated capability. The rotor lift equals the weight of the aircraft.
- 2) The air vehicle structure is designed such that crosswinds at take-off and landing are those components of surface winds perpendicular to the runway centerline with the landing gear loads being 80% of the vertical reaction for the inboard acting load and 60% of the vertical reaction of the outboard acting load. This is based on the vertical reaction being 50% of the maximum vertical reaction from two point and level symmetrical landings.
- 3) The air vehicle structure is designed such that the landing touchdown roll, yaw, pitch attitude, and sink speed combinations are based on a joint probability within an ellipsoid with axes of roll, yaw, and pitch.
- 4) The air vehicle structure is designed such that taxi discrete bumps and dips are as defined in JSSG-2006 for wave length, amplitude and shape for the maximum ground weight. It is also designed such that the angle between the path of the aircraft and the lateral axis of the contour are at angles up to 45 degrees.
- 5) The air vehicle structure is designed such that the maximum combination of wind loading and air vehicle load factor conditions that are utilized when assessing jacking of the air vehicle.
- 6) The air vehicle structure is designed such that the ground loading conditions considered are those required and expected to be encountered in critical combinations of configurations, gross weights, centers of gravity, landing gear/tire servicing, external environments, thrust or power, and speeds and are used in the design of the airframe.

Markup Key: Current Text [~~Proposed Deletion~~] [Proposed Addition]



Proposed Standard



- **Proposed Standard (con't):**

- 7) The air vehicle structure is designed such that ground operations include symmetric and ~~unsymmetric~~ **unsymmetrical** fuel and payload loadings and adverse trim conditions.
- 8) The air vehicle structure is designed for ground operations consisting of taxing, turning, pivoting, braking, ski loads, landing (including arrestment) and takeoff.
- 9) The air vehicle structure is designed for ground handling conditions consisting of towing, jacking, and hoisting.
- 10) The air vehicle structure is designed for dynamic response and shimmy during ground operations as well as for rough runway conditions.
- 11) The air vehicle structure is designed for ground winds as a result of weather and jet blast.
- 12) The air vehicle structure is designed for main gear obstruction loads. The main landing gear contacts the ground simultaneously, with the auxiliary landing gear just clear of the ground. The forward velocity is zero, rotor lift equals the aircraft weight, the sink speed is 12 fps, and the landing surface slope is zero. A load equal to one-half of the maximum vertical reaction at each point of contact, but not greater than the weight of the aircraft, is applied in a foreword, aft, inboard, and outboard direction, each in combination with a vertical load, considering each point of contact independently. The transverse loads on the other gear are zero.
- 13) The air vehicle structure is designed for auxiliary gear obstruction loads. The auxiliary landing gear contacts the ground simultaneously, with the main gear just clear of the ground. The forward velocity is from zero to 5 mph, rotor lift equals the aircraft weight, the sink speed is 12 fps and the landing slope is zero. A load equal to one half of the maximum vertical reaction at the auxiliary gear points of contact, but not greater than the weight of the aircraft, is applied in a forward, aft, inboard, and outboard direction, each in combination with the vertical load. The transverse loads on the other gear are zero. Swiveled wheels are centered and locked. If positive locking provisions are not provided, it is assumed that the wheels remain centered and that the loads are reacted by the centering mechanism.



Proposed Method of Compliance



- **Proposed Method of Compliance:**

Verification methods include analyses, tests, and inspection of documentation. The ground loading conditions used in the design of the airframe as defined in the standards are verified by a series of analyses and tests.

- a. Correlated ground loads analyses including dynamic response analyses are provided in which details of magnitudes and distribution of all critical design loads are established. Dynamic stability/taxi analyses are provided to assess shimmy and development of design loads. Ground vibration tests and landing gear shimmy lab tests are utilized to define the dynamic characteristics of the gear. Loads calibration tests are utilized to develop ground load equations. Ground loads test demonstrations, shimmy ground tests, and rough runway tests are utilized to correlate analytical model and substantiate the design loads.
- b. For rotorcraft, loads analysis is performed for design load conditions specified in ADS-29 (cancelled). Structural demonstration flight testing (which includes hard landings) is performed in accordance with ADS-24 (cancelled) to demonstrate the safe operation of the aircraft to the maximum attainable operating limits consistent with the structural design and to verify that loads used in the structural analysis and static tests are not exceeded at the structural design limits of the airspeed and load factor envelope, or if analytical loads are exceeded during structural demonstration testing to establish the allowable flight envelope and the critical conditions for strength, rigidity, and operation.



Specific Comments



- **Organization:** Identify the commenter's name and organization
- **Comment:** Present exact comment(s) submitted by POC
- **Date Comment Received:**
- **Response:**



Recommendation



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Role	Organization	Coordination	Approve	Disapprove	Comment
TA	AFLCMC/EZFS	Greg Schoeppner	X		
TD	AFLCMC/EZA	Mike Knisely	X		
TD	AFLCMC/EZF	Larry Rogers	X		
TD	AFLCMC/EZS	Terrell Allen	X		

- Recommendation:**

Approve

Disapprove

- Potential safety/design impact to currently fielded fleet:**

Significant

Insignificant

Checking 'Significant' above will help TAA determine need to inform program offices of urgent safety/design issue