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Federal Aviation Administration

NSP GB

National Simulator Program
FSTD Qualification Guidance Bulletin

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National Simulator Program Guidance Bulletin

An NSP GB contains information for FSTD sponsors that should help them meet certain administrative, regulatory, or operational requirements with relatively low urgency or impact on safety.

Subject: Evaluation of FSTD Ground Handling Models for Bounced Landing Recovery Training.

Purpose: To provide guidance to sponsors of Level C and D FSTDs on the evaluation of ground handling models to support bounced landing recovery training.

Background: On November 12, 2013, the FAA published the Qualification, Service, and Use of Crewmembers and Aircraft Dispatchers final rule[1], which required several new training tasks. These tasks include extended envelope training, enhanced runway safety training, enhanced training on crosswind takeoffs and landings with gusts, and recovery from bounced landings. These maneuvers are required to be completed in an FSTD. Revisions to 14 CFR Part 60 were published on March 30, 2016 to define FSTD requirements and evaluation methods leading to implementation of the flight training requirements contained in the Crewmember and Aircraft Dispatcher Training final rule.

By March 12, 2019, revisions to part 121 training programs are required in order to comply with the Crewmember and Aircraft Dispatcher Training final rule. After March 12, 2019, any FSTD used for bounced landing recovery training maneuvers must be evaluated and issued additional qualification to conduct these tasks in an FAA approved flight training program.

[1] Crewmember and Aircraft Dispatcher Training final rule, RIN 2120-AJ00. See 78 FR 67800 (Nov. 12, 2013).

Revision	Description of Change	Effective Date
0	Original Draft.	10/05/2017

Bounced Landing Discussion

A typical bounce is when the aircraft makes initial contact with the terrain and rebounds causing the aircraft to gain lift and hence significant altitude before re-contacting with the terrain. Often this causes a ballooning effect that leads to a consecutive touchdown(s) which may result in insufficient remaining runway distance to effect a safe deceleration and stop. When the bounce is of smaller height and without the ballooning effect it may be in the form of a 'skip'.

A bounce may also occur when the nose wheel contacts the terrain first, leading to an upward moment about the lateral axis and subsequent main gear contact forces the aircraft in a "porpoising" motion along the runway. Large category transport aircraft are more susceptible to bounces or skips while smaller aircraft may exhibit porpoising tendencies.

The lead-in to an aircraft bounce is typically a result of higher than recommended descent rate to touchdown caused by pilot technique, a sudden downdraft around touchdown, landing gear oleo damping, or inadvertent functioning of lift or drag devices around touchdown.

The increase in angle of attack from a nose high attitude immediately after first contact increases aircraft lift and drag. If not controlled immediately, this could lead to periodic excursions that which could be catastrophic.

Replicating aircraft behavior during landing and touchdown is a product of many factors. These include: aerodynamic modeling (ground effect), motion cueing special effects, weight and balance, environmental stimulus, and the ground reaction modeling.

FSTD Requirements

In the 2016 revision to part 60, changes were made to FSTD ground reaction modeling requirements defined in Appendix A, Table A1A (General Requirements), section 2. d.2.

Changes include ground reaction modeling, which produces the appropriate effects of a bounced or skipped landing, to include the effects and indications of ground contact due to landing in an abnormal aircraft attitude or rate of descent.

Other information in this section concerning ground reaction modeling during landing, including factors such as aircraft gross weight, airspeed, and rate of descent on touchdown, did not change from the 2008 revision to part 60.

Table A1A – Minimum Simulator Requirements						
QPS REQUIREMENTS						INFORMATION
Entry Number	General Simulator Requirements	Simulator Levels				Notes
		A	B	C	D	
2.d.2.	Ground reaction. Ground reaction modeling must produce the appropriate effects during bounced or skipped landings, including the effects and indications of ground contact due to landing in an abnormal aircraft attitude (e.g. tailstrike or nosewheel contact). An SOC is required.		X	X	X	Ground reaction includes modeling that accounts for strut deflections, tire friction, and side forces. This is the reaction of the airplane upon contact with the runway during landing, and may differ with changes in factors such as gross weight, airspeed, or rate of descent on touchdown.

FSTD Evaluation

Part 60 does not require specific objective testing of a bounced landing recovery maneuver for FSTD qualification. Subjective evaluation of the ground reaction modeling however is required and must be conducted by a subject matter expert pilot with experience in the aircraft.

NOTE: While Part 60 does not contain specific objective tests for bounced landings, there are other required objective tests which evaluate the FSTD performance and handling qualities in similar conditions (e.g. normal landing, ground effect, minimum unstick takeoff, etc.).

The following are some techniques which may be used to induce a bounce in order to evaluate the ground reaction modeling and ensure the FSTD reacts appropriately:

- Landing with an excessive sink rate requiring a rapid flare maneuver.
- Late flare initiation by not putting the airplane at the normal landing pitch attitude prior to touchdown.
- Incorrect flare technique resulting in a higher than normal pitch attitude at touchdown (which may result in a tail-strike).
- Excessive airspeed, allowing the airspeed to bleed off during an excessive time held in the flared attitude.
- Touching down with power-on, sometimes preventing the extension of ground spoilers.
- Excessive nose-up attitude during the recovery maneuver to check for tail-strike or other effects.
- Incorrect touchdown technique with nose gear touching down prior to the main gears resulting in “porpoising” excursions.

NOTE: Bounced landing recovery training task approval, in an operator’s part 121 training program, will be conducted by the Training Program Approval Authority (POI). The NSP will only evaluate the adequacy of the FSTD’s ground reaction model.

FSTD Bounced Landing Scenarios

The FAA does not prescribe or require instructors to use an Instructor Operating Station (IOS) function to compel a bounce and abnormal modifications to the aerodynamic or ground reaction models in order to induce a landing bounce must be avoided. Actual aircraft behavior should be retained in the FSTD's aerodynamic and ground reaction modeling.

If an artificial stimulus is employed to induce a bounced landing, special care must be taken to ensure that the stimulus is realistic. If special scenarios are used to demonstrate FSTD capability during qualification, the sponsor must provide a detailed description of the scenario features and its implementation to the evaluating inspector.

NOTE: As described in the Part 121 Pilot Training and Checking Advisory Circular (AC 120-114)[2], a bounced landing recovery maneuver may be accomplished simply by the instructor verbally calling a bounce during the landing and having crews execute the recovery procedure.

[2] See Pilot Training and Checking (14 CFR Part 121 Subparts N and O, Including Appendices E and F), Advisory Circular 120-114, September 29, 2016.