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

Subject: FSTD Evaluation and Qualification for Upset Prevention and Recovery Training (UPRT) Tasks.

Purpose: In accordance with 14 CFR Part 60 effective May 31, 2016, this Guidance Bulletin describes the process and criteria for modification, testing, and application for additional FSTD qualification to support UPRT flight training tasks for a selected FSTD.

Background: On November 12, 2013, the FAA published the Crewmember and Aircraft Dispatcher Training final rule¹, adding the training tasks required by Public Law 111-216². These tasks included extended envelope training, recovery from bounced landings, enhanced runway safety training, and enhanced training on crosswind takeoffs and landings with gusts. The final rule also required that these maneuvers be completed in an FSTD. Through participation in several industry working groups³ and in consideration of the formal recommendations received from the SPAW ARC, the FAA determined that many existing FSTDs available for use by air carriers may not sufficiently represent the simulated aircraft for the required training tasks. On March 30, 2016, revisions to 14 CFR Part 60 were published. The revisions in this final rule are required to ensure that FSTDs are properly modeled and evaluated in order to fully implement the flight training required in the Crewmember and Aircraft Dispatcher Training final rule. After March 12, 2019, any FSTD used for UPRT maneuvers must be evaluated and issued 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).

² Section 208 of Public Law 111-216, Implementation of NTSB Flight Crewmember Training Recommendations, mandated stall training and upset recovery training for part 121 air carrier flight crew members (Aug. 1, 2010).

³ Working groups included the International Committee on Aviation Training in Extended Envelopes (ICATEE), the Industry Stall and Stick Pusher Working Group, the Stick Pusher and Adverse Weather Event Training Aviation Rulemaking Committee (SPAW ARC), and the Loss of Control Avoidance and Recovery Training (LOCART) Working Group.

Revision	Description of Change	Effective Date
0	Original Draft.	12/19/2011
1	Enhanced for clarity	12/20/2011
2	Updated for Publication of 14 CFR Part 60 Change 2	04/11/2016
3	Added clarification in Previously Qualified FSTDs section on page 4; Expanded notification and qualification section to provide more clarity.	02/22/2018

General Information

On March 30, 2016, the FAA published changes to the 14 CFR Part 60 Qualification Performance Standards (QPS) that define general requirements for the qualification of upset prevention and recovery training (UPRT) on Level C and Level D FSTDs. These changes are applicable to all new Level C or Level D FSTDs that are initially qualified after the effective date of the final rule⁴.

Additionally, the rule includes an FSTD Directive which imposes retroactive requirements for previously qualified FSTDs that were initially qualified before the effective date of this final rule. The retroactive requirements are published in FSTD Directive 2. This Directive along with other FSTD directives for airplane FSTDs, appear in Appendix A, Attachment 6 of 14 CFR Part 60.

Qualification of upset prevention and recovery training (UPRT) in accordance with FSTD Directive 2 is not necessarily required for previously qualified devices. However, after March 12, 2019, any FSTD which is used to conduct upset prevention and recovery training (UPRT) tasks in an FAA approved flight training program, must be evaluated and issued qualification to conduct these tasks.

UPRT Defined

Upset prevention and recovery training encompasses training maneuvers that are intended to exceed the parameters of an aircraft upset. As defined in the Airplane Upset Recovery Training Aid (AURTA), an aircraft is upset when unintentionally exceeding the parameters normally encountered in line operations or training:

- Pitch attitudes greater than 25 degrees nose up,
- Pitch attitudes greater than 10 degrees nose down,
- Bank angles greater than 45 degrees
- Within the above parameters, but flying at airspeeds inappropriate for the conditions

Note that previously qualified FSTDs which are used to conduct unusual attitude recovery training tasks⁵ that do not exceed the parameters of an aircraft upset are not required to be qualified for UPRT. For the purposes of FSTD UPRT qualification, airspeeds “inappropriate for the conditions” are defined as airspeeds below the activation of the stall warning system for the purpose of demonstrating full stall characteristics of the airplane. Brief airspeed excursions into stall warning (such as for approach-to-stall training) or excursions to demonstrate Mach buffet do not require UPRT qualification as long as the aircraft attitudes remain within the prescribed aircraft attitude conditions.

⁴ The final rule became effective on May 31, 2016. Industry has informally coined the revision as Part 60, Change 2.

⁵ 14 CFR Part 60, Appendix A, Table A1B, Entry No. 3.f., (Recovery From Unusual Attitudes) covers training tasks “within the normal flight envelope that are supported by applicable simulation validation data.”

Compliance Dates and Qualification Process

Initial FSTD Qualifications: All Level C and Level D FSTDs that are initially qualified after the effective date of the final rule must meet all UPRT requirements as defined in the Part 60 QPS at the time of initial qualification.

Previously Qualified FSTDs: For those FSTDs initially qualified before the effective date of the final rule, Sponsors may elect to not qualify FSTDs for UPRT training tasks. After March 12, 2019, however, any FSTD being used to conduct UPRT training tasks must meet the new general simulator requirements for UPRT as published in FSTD Directive 2. Where continued qualification for training, testing, or checking credit is requested, each FSTD sponsor is required to perform FSTD modifications under § 60.23 as needed, conduct additional subjective testing and apply for additional FSTD qualification under § 60.16.

Where sponsors intend to update a significant number of FSTDs for UPRT or other Directive 2 training tasks, they are encouraged to engage the NSP and share their update schedule in advance of official modification notification. Doing so will facilitate the scheduling process

The qualification process is as follows:

1. Utilizing NSP Form T011-FD2,⁶ submit notification of intent to qualify the FSTD UPRT maneuvers and describe any modifications to the FSTD. Per §60.23, the NSP and TPAA must be notified. Where scheduling of large FSTD fleets create special considerations for notification, sponsors should contact the NSP.
2. The notification should be accompanied by the required Statement of Compliance. The TPAA may or may not wish to receive the validation materials. Sponsors should consult their TPAA to this end. If the supporting documents are not available at the time of notification, submission must be made at a time that is mutually agreeable to both the sponsor and the NSP.
3. Once FSTD modifications and a sponsor evaluation are completed, submit the confirmation statement that the modified FSTD has been subjectively evaluated by a qualified pilot as described in § 60.16(a)(1)(iii) using NSP Form T012.

The NSPM will review each submission, determine if requirements have been met, and respond to the FSTD Sponsor as described in § 60.23(c). This response, along with any noted restrictions, may serve as an interim qualification until a permanent change is made to the Statement of Qualification (SOQ) following the next scheduled NSP conducted FSTD evaluation. Alternatively, the NSP may elect to conduct an update evaluation before the modified FSTD may be used in training.

During onsite evaluations, the NSP team may actively exercise the device or observe the execution of the maneuver by the SME. The team will also evaluate the IOS presentation for suitability and

⁶ This form is intended for the notification of intent to use an FSTD for full stall and stick pusher maneuvers, upset prevention and recovery maneuvers, maneuvers conducted in icing conditions, takeoff and landing maneuvers in gusting crosswinds, and bounced landing recovery maneuvers in accordance with FSTD Directive 2.

appropriate function. The SME (and instructor if present) should be familiar with these functions and effective use of the utilities. The evaluation team may ask for a demonstration of the training profile and an explanation of how the IOS utility is used by the instructor to evaluate the maneuver.

The IOS utility is indispensable in the training of upset recovery maneuvers and scenarios. In practice, recovery from an upset recovery maneuver may only last seconds making IOS page navigation impractical. The presentation should have the capability to display multiple parameters simultaneously and must possess clear indications of parameter exceedance. It is essential that the size and presentation of the display (or portable tablet) will readily facilitate interpretation of all parameters. See “Technical Requirements” of this NSP Guidance Bulletin for more details regarding the IOS utility. Attachment B provides a pictorial of a typical instructor/evaluator feedback mechanism used in training.

FSTD Validation Envelope

The FSTD validation envelope is explained in Attachment 7, section B of Part 60 Appendix A. It may be thought of as the entire realm in which the FSTD may be flown as a function of angle of attack and sideslip. The envelope is divided into three regions of relative fidelity. . These regions are defined by the type of validation and analysis used to develop the aerodynamic model. With this information, relative confidence levels can be defined to compare the simulator’s response to the expected aircraft response. From Attachment 7, the regions and expected confidence levels of the FSTD validation envelope are defined as follows:

- 1. Flight test validated region:** This is the region of the flight envelope which has been validated with flight test data, typically by comparing the performance of the FSTD against the flight test data through tests incorporated in the QTG and other flight test data utilized to further extend the model beyond the minimum requirements. Within this region, there is **high confidence** that the simulator responds similarly to the aircraft. Note that this region is not strictly limited to what has been tested in the QTG; as long as the aerodynamics mathematical model has been conformed to the flight test results, that portion of the mathematical model can be considered to be within the flight test validated region.
- 2. Wind tunnel and/or analytical region:** This is the region of the flight envelope for which the FSTD has not been compared to flight test data, but for which there has been wind tunnel testing or the use of other reliable predictive methods (typically by the aircraft manufacturer) to define the aerodynamic model. Any extensions to the aerodynamic model that have been evaluated in accordance with the definition of an exemplar stall model (as described in the Upset Scenarios section) must be clearly indicated. Within this region, there is **moderate confidence** that the simulator will respond similarly to the aircraft.
- 3. Extrapolated:** This is the region extrapolated beyond the flight test validated and wind tunnel/analytical regions. The extrapolation may be a linear extrapolation, a holding of the last value before the extrapolation began, or some other set of values. Whether this

extrapolated data is provided by the aircraft or simulator manufacturer, it is a “best guess” only. Within this region, there is **low confidence** that the simulator will respond similarly to the aircraft. Brief excursions into this region may still retain a moderate confidence level in FSTD fidelity; however, the instructor should be aware that the FSTD’s response may deviate from the actual aircraft.

The three regions of the FSTD validation envelope are graphically depicted in Figure 1 of Attachment 7 to Appendix A in the final rule. They are also reproduced in Attachment A of this NSP Guidance Bulletin. Angle of attack (AOA) is plotted on the vertical axis while sideslip is plotted along the horizontal. Notice that the relative values of FSTD AOA and sideslip are tracked throughout a UPRT maneuver in a flaps-up configuration. The presentation is an example of a typical instructor/evaluator feedback mechanism on the IOS.

Technical Requirements

All fixed-wing Level C and D FSTDs initially qualified after the effective date of May 31, 2016 must meet the requirements for UPRT as published in 14 CFR Part 60 Change 2. The technical requirements for these FSTDs are found in Appendix A,

Attachment 1, General Simulator Requirements: Table A1A (2.n.) Upset Prevention and Recovery Training, and

Attachment 3, Functions and Subjective Testing: Table A3A (5.b.3.) Upset Prevention and Recovery Maneuvers, and

Attachment 7, Additional Simulator Qualification Requirements for Stall, Upset Prevention and Recovery, and Engine and Airframe Icing Training Tasks: Section B.

Sponsors must review the complete technical requirements for UPRT as published in applicable sections of the rule. A brief summary of these requirements follows:

Statement of Compliance (SOC): An SOC is required that defines the source data used to construct the FSTD validation envelope. The SOC must also verify that each upset prevention and recovery feature programmed at the instructor station and the associated training maneuver has been evaluated by a suitably qualified pilot using methods described in this section. The statement must confirm that the recovery maneuver can be performed such that the FSTD does not exceed the FSTD validation envelope, or when exceeded, that it is within the realm of confidence in the simulation accuracy.

Upset Scenarios: All upset recovery maneuvers available for training must be evaluated for determining that the combination of angle of attack and sideslip do not exceed the range of flight test validated data or wind tunnel/analytical data while performing the recovery maneuver. A minimum of three maneuvers are required for qualification:

- A nose-high, wings level aircraft upset
- A nose-low aircraft upset
- A high bank angle aircraft upset

When evaluating UPRT maneuvers for qualification, the FSTD should remain within the high (flight test validated) and medium (wind tunnel/analytical) confidence regions of the FSTD validation envelope while executing the recovery maneuver. Brief excursions into the low confidence (extrapolated) region may be acceptable; however, the instructor should be aware that the FSTD's response may deviate from the actual aircraft. UPRT maneuvers that exceed the stall warning angle of attack for the purpose of demonstrating/training full stall recovery maneuvers must be evaluated for full stall qualification as described in FSTD Directive 2. All maneuvers may be manually flown for UPRT qualification purposes.

Dynamic upset scenarios, e.g. environmental disturbances, wake vortex, are not required for UPRT qualification; However, the use of realistic dynamic upsets at various phases of flight are encouraged to elicit the startle effect. Where dynamic upset scenarios or aircraft

system malfunctions are used to stimulate the FSTD into an aircraft upset condition, specific guidance must be available to the instructor on the IOS that describes how the upset scenario is driven along with any malfunction or degradation in FSTD functionality that is required to stimulate the upset.

Instructor Operating System (IOS): The IOS must have a feedback mechanism in place to notify the instructor/evaluator when the simulator's validated aerodynamic envelope and aircraft operating limits have been exceeded during an upset recovery training task. The instructor/evaluator must also consider the magnitude of the trainee's flight control inputs in analysis of the recovery. Feedback to the instructor must include:

- FSTD validation envelope: The FSTD must employ a method to display the expected fidelity with respect to the FSTD validation envelope for a minimum of flaps up and down conditions. The validation envelope must be derived by the aerodynamic data provider or derived using information and data sources provided by the original aerodynamic data provider. See Part 60 Table A1A (section 2.n) and attachment 7 for complete details and requirements.
- Flight control inputs: The FSTD must employ a method for the instructor/evaluator to assess the trainee's flight control inputs during the upset recovery maneuver. A time history or other equivalent format must be available to the instructor. This time history should be capable of capturing recorded parameters for instructor review in the FSTD during and immediately after the execution of the recovery maneuver. See Part 60 Table A1A (section 2.n) and attachment 7 for complete details and requirements.
- Aircraft Operational Limits: The FSTD must employ a method to provide the instructor/evaluator with real-time information concerning aircraft operational limits. The minimum required parameters for qualification are airspeed and airspeed limits (stall speeds and V_{mo}/M_{mo}); load factor and operational load factor limits; and angle of attack (AOA) and the stall identification AOA. Note that the stall identification AOA may not necessarily be the AOA at C_{l-max} since the stall may be defined by other limits for the particular aircraft, such as stick pusher activation or deterrent stall buffet. A time history or other equivalent format must be available to the instructor. This time history should be capable of capturing recorded parameters for instructor review in the FSTD during and immediately after the execution of the recovery maneuver. See Part 60 Table A1A (section 2.n) and attachment 7 for complete details and requirements.

A pictorial example of an IOS feedback presentation is provided in Attachment 7 of the rule and reproduced in Attachment B of this NSP Guidance Bulletin. The critical role of the IOS utility while conducting UPRT cannot be overstated. The IOS display (or portable tablet as applicable) must lend itself as a meaningful tool to instructors and students alike.

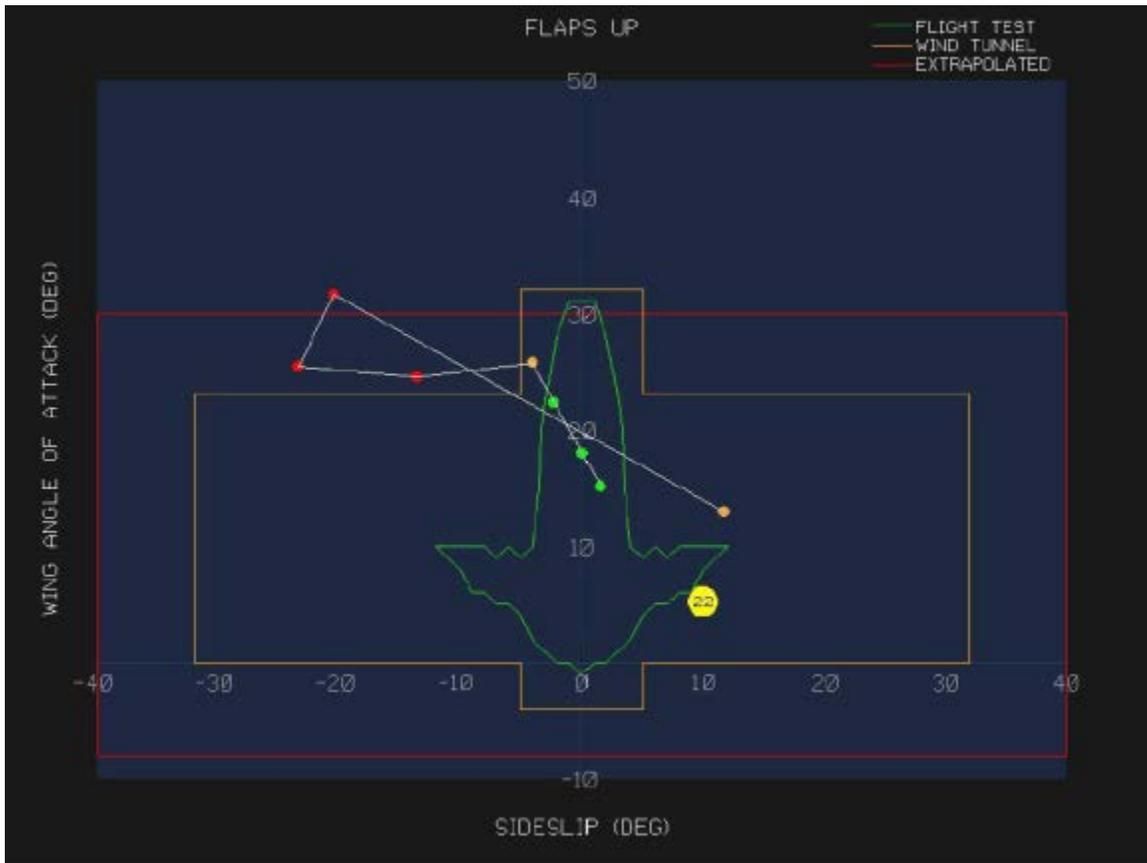
Additional Reading

1. FAA Information for Operators Bulletin (InFO 10010) – Enhanced Upset Recovery Training. This information bulletin recommends the incorporation of the material in the AURTA into flight crew training. The AURTA contains guidance for upset recovery training programs for air carrier flight crews, as well as the evaluation guidance for FSTDs used in such training.
2. AC 120-111 – FAA Advisory Circular for Upset Prevention and Recovery Training.
3. AC 120-109A – FAA Advisory Circular for Stall Prevention and Recovery Training.
4. Airplane Upset Recovery Training Aid (AURTA).

For questions regarding this Guidance Bulletin or 14 CFR Part 60 Change 2, please call the FAA National Simulator Program at 404.474.5620

Attachment A

Example FSTD Alpha/Beta Envelope Plot showing feedback from UPRT maneuver



Attachment B

Example IOS Instructor Feedback Display

