

Federal Aviation Administration AFS-205 404.832.4700	National Simulator Program Flight Simulation Training Device Qualification Guidance	Guidance Bulletin Number: 03-03	Revision 2
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FSTD Guidance Bulletin 03-03

Enhanced Flight Vision System (EFVS) FSTD Qualification

Purpose:

This Guidance Bulletin describes evaluation methodology used by the National Simulator Program in the Qualification of simulated Enhanced Flight Vision Systems installed on level C and D FSTDs. Minimum requirements and evaluation criteria are provided.

Scope:

This Guidance Bulletin provides an acceptable means, but not the only means of compliance with Title 14 Code of Federal Regulations (CFR) Part 60 pertaining to the Evaluation and Qualification of Flight Simulation Training Devices (FSTD) for use in FAA Approved Flight Training Programs. If an applicant chooses to use the approach described within this Guidance Bulletin, that applicant must adhere to all methods, procedures, and standards herein. Should an applicant desire to use another means, a proposal must be submitted to the National Simulator Program Manager (NSPM) for review and approval prior to implementation. This Guidance Bulletin does not change regulatory requirements or create additional ones, and does not authorize changes in, or deviations from, regulatory requirements.

Approval: Harlan Gray. Sparrow III
National Simulator Program Manager

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REVISION HISTORY		
Rev	Description of Change	Effective Date
0	Original	04/05/2003
1	Revision	02/07/2006
2	Revised to address updated technology and reference FAR 91.175 requirements. Clarify testing methodology. Defer to AC 90-106 for equipment specifications and add AC 20-167 for additional reference and definitions. Repair broken hyperlink and update format.	07/05/2012

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1. APPLICABILITY. This procedure for the qualification of a simulated Enhanced Flight Vision System (EFVS) applies to all FSTDs used to satisfy the training requirements pertaining to the certificate holder's approved EFVS flight training program and the Flight Standardization Board Report for the aircraft. Flight Standardization Board Reports may be found within the FAA [Flight Management Standards Information Management System](#) (FSIMS). The evaluation of a simulated EFVS will additionally include those subjective evaluation elements contained in NSP Guidance Bulletin 03-02, HUD FSTD Qualification.

2. STATEMENT OF COMPLIANCE. For those simulators where EFVS hardware is not provided as original equipment with the airplane, and is subsequently added to the airplane and simulator, a statement of compliance is required. The statement of compliance must state that the simulation of the added simulator hardware/software, including associated cockpit displays and annunciation, functions the same or equivalent to the system(s) installed in the airplane. The SOC should detail the type of EFVS used in the aircraft being simulated and the method of EFVS simulation used in the FSTD. Capability/limitations of the simulation compared to the actual aircraft system should be noted. A block diagram describing the input and output signal flow and comparing it to the airplane configuration shall support this statement.

3. EFVS STANDARDS. This section describes the minimum simulator requirements for qualifying an EFVS system in a simulator.

- a. The simulator used for EFVS must be an FAA qualified Level C, with a daylight visual display, or a level D simulator.
- b. The EFVS simulator hardware/software, including associated cockpit displays and annunciation, must function the same or equivalent to the EFVS system installed in the airplane.
- c. The instructor operator station (IOS) must include an EFVS display of the representative EFVS and HUD scene, as seen through the pilot's Head-Up Display (HUD) combiner glass or the cockpit flight displays.
- d. A minimum of one airport must be modeled for EFVS. That model must have an ILS and a non-precision approach (With VNAV if required by the AFM for that type) available. In addition to EFVS modeling, the airport model must meet the requirements for Class I, II, or III visual models as described in 14 CFR Part 60, for a level D simulator.

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It should be noted that a simulated EFVS must include the following, per FAR 91.175(m):

- A display element, which is a head-up display (HUD) or an equivalent display (e.g. cannot be a head-down display), that presents the features and characteristics required by the regulations such that they are clearly visible to the pilot flying in his or her normal position and line of vision looking forward along the flight path.
- A real-time image of the forward external scene topography, as described above.
- The specific aircraft flight information called for in FAR 91.175(m)

4. OBJECTIVE TESTS. The ground and flight tests required for qualification are listed in this section. Computer generated simulator test results should be provided for the transport delay tests. The time history results should be produced on a multichannel recorder, line printer, or other appropriate recording device acceptable to the NSPM. Time histories are not required unless otherwise indicated. The following tests are required:

	Test	Tolerance	Flight Condition	Comments
1.	HUD Attitude vs. Simulator Attitude Indicator (Pitch and Roll of Horizon)	Demonstration Model		
2.	EFVS Registration Test ¹	Demonstration Model.	Takeoff Point and 200' AGL	This test validates the visual alignment of the EFVS.

¹ **Note:** Because of the camera position vs. the pilot eye position, this must be checked at both 200' on final similar to a visual ground segment and on the ground at the takeoff point. As you get closer to the ground (e.g. takeoff position) you will be able to observe the registration issues caused by the parallax.

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3.	EFVS RVR and visibility Calibration	Demonstration Model. The scene indicates 1200 ft and 1 mile EFVS RVR and correct light intensity.	IR scene representative of both 1200 ft., and 1 mile. Visual scene may be removed.	This test validates the RVR and visibility of the EFVS.
4.	Visual, EFVS, Motion, and Cockpit Instrument Response. Transport Delay	150 msec or less after control movement, + or - 30 msec from visual system, and not before motion response	Pitch, Roll, Yaw	Time histories are required in each axis. (Total of 3 tests)
5.	EFVS Thermal Crossover (for IR sensor based EFVS)	Demonstration Model.	Day & Night.	Dynamic test with respect to time. Should be a continuous test, although time may be sped up for demonstration purpose. Scene content should show a realistic depiction of crossover effect.

5. SUBJECTIVE TESTING.

- a. **DISCUSSION:** An FAA Simulator Evaluation Specialist will evaluate accurate replication of EFVS systems functions. The evaluation will include procedures using the operator's approved manuals and checklists. Handling qualities, performance, and simulator systems operation, while using the EFVS system, will be subjectively assessed by an FAA Simulator Evaluation Specialist familiar with the respective aircraft.
- b. **TEST REQUIREMENTS:** The ground and flight tests and other checks required for qualification of the EFVS system are listed below. This includes maneuvers and procedures to assure that the EFVS system functions and performs appropriately for use in pilot training and checking

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in the maneuvers and procedures delineated in the sponsors approved training program. The evaluation should be conducted using daylight, dusk, and night conditions. Daylight is the most difficult to simulate.

- (1) Preflight Inspection of the EFVS system. Perform a check of all EFVS warnings and annunciations.
- (2) Check to insure that the IOS has preset selections that match the training program i.e. realistic values for visibility. (See AC 90-106 under "Aircraft or Flight Simulator Training")
- (3) Taxi.
 - (a) Observe parallax caused by camera position.
 - (b) Observe ground hazards especially other aircraft.
 - (c) Signs may appear as a block (unreadable) due to no temperature variation between the letters and the background.
- (4) Takeoff:
 - (a) Normal takeoff in night VMC conditions. Observe the terrain and surrounding visual scene.
 - (b) Instrument takeoff using visual RVR settings of 600. The EFVS RVR should be better than the visual RVR (This will depend on the accuracy of the simulation and how the obstruction to visibility is modeled, e.g. haze or smoke, fog, etc. The SOC should detail the capability/limitations of the model compared to the actual aircraft system.)
- (5) In-flight Operations:
 - (a) Adjust the scene to VMC and see if the image horizon is conformal with the visual horizon and the combiner horizon.
 - (b) Using a VMC night or dusk scene, select a thunderstorm at a distance of at least 20 miles and see if the imager detects the clouds.
- (6) Approaches:
 - (a) Normal approach in night VMC conditions.
 - (b) ILS approach.
 - i) Select the preset that allows the PF to see the EFVS image at approximately 500' AGL. This should preset the EFVS

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- visibility and visual RVR appropriately (e.g. RVR may be 2400' and EVFS visibility may be approximately 1.4 miles).
- ii) Fly or reposition the aircraft to 500' AGL on the ILS. Freeze position. The PF should be able to see the image of the runway approach lights. PNF should not be able to see any lights (Some very slight bleed through of strobes is acceptable, but no steady lights).
 - iii) Continue the approach and freeze position at 200' AGL. The PF should be able to see approximately 1 mile down the runway, and the PNF should be able to visually acquire the approach lights and REILs.
 - iv) Continue the approach and landing. Observe the blooming effect of the airport lights.
- (c) Non-precision approach.
 - (d) Missed approach.
- (7) Visual Segment and Landing:
- (a) Normal:
 - (i) From nonprecision approach.
 - (ii) From precision approach.
- (8) Abnormal Procedures:
- (a) EFVS malfunctions on the ground
 - (b) EFVS malfunctions in the air.

Note: Emphasis should be placed on the simulator's capability to demonstrate that the EFVS system is able to display the visual scene necessary for the pilot to identify the required visual references required by CFR 91.175 (i) (3) to descend below the published decision altitude (DA) when conducting instrument approaches with vertical guidance, when those required visual references are identified. The EFVS should continue to provide glide path and alignment information between DH and touchdown. During landing roll out, visual alignment information should be available to the pilot.

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Also note the more stringent visual reference requirements while using EFVS:

In order to descend below DA or MDA, the following visual references (specified in § 91.175(l) (3)) for the runway of intended landing must be distinctly visible and identifiable to the pilot using the enhanced flight vision system:

- (a) The approach light system (if installed), or
 (b) The following visual references in *both* (b)1. and (b)2. below:

1. The runway threshold, identified by at least *one* of the following:
 - The beginning of the runway landing surface,
 - The threshold lights, or
 - The runway end identifier lights.
2. The TDZ, identified by at least *one* of the following:
 - The runway TDZ landing surface,
 - The TDZ lights,
 - The TDZ markings, or
 - The runway lights.

6. QUALIFICATION TEST GUIDE (QTG).

- a. For new FSTDs, the operator must develop the statement of compliance (see section 2), accomplish the performance determination, objective tests, and include the information in the QTG submission. Sponsors seeking an additional qualification under 60.16 must submit notification of proposed modification in accordance with 60.23 and [NSP Guidance Bulletin 11-02](#). The above information should be attached to the [T011 notification form](#).
- b. The simulator will be scheduled for an evaluation in accordance with 60.15 or 60.16.

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- c. During the onsite evaluation, the evaluator will ask the operator to run the performance tests and record the results. The results of these onsite tests will be compared to those results previously approved and placed in the QTG.
- d. Qualification Test Guide's for new or updated simulators shall contain or reference the information described in paragraphs 2 through 4 of this document as may be appropriate for the simulator.

7. Additional References:

[\(AC\)20-167: Airworthiness Approval of Enhanced Vision System, Synthetic Vision System, Combined Vision System, and Enhanced Flight Vision System Equipment](#)