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Flight Simulation Training Device Qualification Information Bulletin

An TSG Information Bulletin (IB) contains information for FSTD sponsors that should help them meet certain administrative, regulatory, or operational requirements with relatively low urgency or impact on safety. See FAA Order 8000.374 for additional information on information bulletins.

Subject: Flight Simulation Training Device Qualification with Extended Reality Systems

Purpose: This Information Bulletin provides information and recommended practices which applies to immersive extended reality (XR) simulation technologies using head mounted display (HMD) systems on Flight Simulation Training Devices (FSTDs) evaluated and qualified in accordance with Title 14, Code of Federal Regulations (14 CFR) Part 60. This bulletin is not intended for aviation training devices (ATDs) or non-qualified devices used for classroom training and general flight deck familiarization purposes.

Background: At the time of the writing, it is recognized that there are many different types and applications of XR technologies for immersive simulation--technologies are constantly advancing with new developments. Unlike conventional simulation, there is very little established precedent and published research on the efficacy requirements of applying these technologies for pilot training, particularly for in-flight maneuvers training that currently requires the use of an FSTD or the aircraft. As a result, this bulletin does not specify a minimum standard for XR technologies but provides general guidelines on potential limitations as applied to pilot training and checking and recommends testing methods that operators and manufacturers can use to demonstrate that the XR-equipped FSTD performs at least equivalently to a conventional FSTD in the training environment.

Revision	Description of Change	Effective Date
0	Original	6/5/2026

1 General

1.1 Objective

The objective of this bulletin is to assist FSTD sponsors in evaluating an XR FSTD to ensure that the addition of extended reality technologies do not negatively impact the training capabilities of the device. The evaluation includes conducting a gap analysis when applying the technical standards in Part 60 Qualification Performance Standards (QPS) to FSTDs equipped with XR technologies as well as outlining Part 60 deviations requirements, where necessary, to enable the use of these technologies.

Tables and attachments within the bulletin provide information, checklists and templates to support the issuance of deviations to these standards as authorized under § 60.15(c)(5) where necessary. The information in this bulletin is provided as one means to do so and does not restrict the FSTD sponsor from proposing other means.

NOTE: Attachment 1, "Sponsor Checklist for XR FSTD Qualification" provides a checklist for sponsors requesting initial qualification of an XR equipped FSTD.

1.2 Applicability

This bulletin focuses on applying current helicopter Flight Training Device (FTD) standards in Part 60 Appendix D for devices equipped with XR systems. Current FAA intent is to only qualify XR FTDs; Level 4 through Level 7 for single pilot training. Qualifying XR FSTDs at full flight simulator levels is not addressed at this time. Additionally, the FAA anticipates that future updates will be made to this bulletin to address airplane FTDs, powered-lift FTDs, and/or multicrew FTDs as more information is learned.

1.3 Regulatory Authority

The initial and continuing qualification standards for FSTDs are defined in 14 CFR Part 60. This bulletin provides supporting material to enable the qualification of XR equipped FSTDs as defined in the following sections of Part 60:

- § 60.1 - Applicability
- § 60.4 - Qualification Performance Standards
- § 60.15 - Initial Qualification Requirements
- § 60.15(c)(5) - Part 60 deviation authority
- Appendix D – Qualification Performance Standards for Helicopter FTDs

1.4 Definitions

This bulletin is intended to address head-mounted extended reality display technologies that may be used in lieu of conventional simulation systems to replace the out-the-window visual environment, flight deck environment, or instructor interface and/or instructor operating station (IOS) of a flight simulation training device. For the purposes of this bulletin, the term, Extended

Reality (XR) is used as an umbrella term that encompasses various immersive technologies using a head-mounted device (HMD), combining and blending real and virtual environments using immersive technologies. XR includes virtual reality (VR) as well as augmented reality (AR) and mixed reality (MR) (both partially virtual, partially video-passthrough/look-through), representing the spectrum of immersive technologies that blend physical and digital experiences, each of them serving different purposes and offering unique experiences. The term XR also covers future spatial computing technologies that may arise. Engagement, sensory aspects, and immersion are the most relevant factors that make up XR and help defining the related sub technologies.

In the aviation related context of flight crew training, VR, MR and AR are the most prevalent XR technologies using HMDs today. Through collaboration with some industry working groups examining these technologies, the following definitions have been agreed upon as applied to XR devices used for pilot training[1]:

- **Virtual Reality (VR)** – Virtual reality (VR) is a computer-generated fully-virtual visual representation of a three-dimensional environment that immerses the user in an artificial world. This immersive experience is achieved through the use of head-mounted devices (HMDs) and other interactive devices, allowing users to interact with the virtual environment as if they were physically present.

  As an aviation related example for flight crew training, the out-the-window visual as well as the entire flight deck are represented fully virtually. Flight crew interaction can happen through hand and pose tracking as well as head and eye tracking, in some cases with hand-controllers, and potentially even co-locating physical haptic objects with the virtual representation. In simple terms: in VR, there is no real-world perception (look-through, video, etc.) but only virtual imagery.

- **Augmented Reality (AR)** – Augmented reality (AR) is a technology that superimposes a computer-generated image on a user's view of the real world, thus providing a composite view and enhancing the user's perception of their environment. This interactive experience combines real and virtual elements in real-time, using see-through head-mounted devices (HMDs) or other devices, allowing users to interact with both the real and virtual components seamlessly. It requires 3D registration of the real-world object's for referencing the placement of virtual overlay.

  As an aviation related example for flight crew training, overlayed relevant information and highlighting graphics can guide a pilot when performing an outside check on a real aircraft. In simple terms: for AR (in many cases), think of virtual imagery objects being placed and visually perceived within and as if part of the real-world environment.

[1] *ARINC Document 451, Guidance on the Application of Extended Reality (XR) And Supporting Technologies to Flight Training and Simulation, a comprehensive and detailed guide on the application of Extended Reality (XR) technologies – including Augmented Reality (AR), Mixed Reality (MR), and Virtual Reality (VR) – in aviation training. This document is an industry standards document which provides detailed technical information that may help sponsors in the application of this information bulletin. This document may be obtained through SAE Industry Activities at https://aviation-ia.sae-itc.com/.*

- **Mixed Reality (MR)** – Mixed reality (MR) is a technology that merges real-world and computer-generated environments, allowing physical and virtual objects to co-exist and interact with in real-time. This immersive experience uses head-mounted devices (HMDs) to present both real environment (including camera pass-through) and computer-generated virtual graphical content seamlessly blended to the observer.

  As an aviation related example for flight crew training, the out-the-window visual in MR would be represented virtually, potentially including some part of the flight deck that will not need haptic interaction to increase immersion, while all areas with instruments, panels and flight controls will be represented through a video-stream, blended into the overall visual perception of the environment, and enabling to actually see the physical interaction with physical flight deck components. In simple terms: for MR (in many cases), think of certain areas in your field of regard being either a real-world or virtual image area.

1.5 Conflicts with the Part 60 Technical Standards

This section defines various Part 60 evaluation requirements where potential conflicts or disparities are anticipated. Attempting to apply the current FSTD standards to a device equipped with an XR system for some FSTD qualification levels may not be practical due to one of the following reasons:

1. An FSTD with an XR system cannot meet existing standards.
2. Existing standards do not adequately test the unique and possibly limiting features of an XR system.
3. Existing objective tests, while potentially applicable to XR systems, cannot be conducted using traditional testing methods.

In general, it is expected that most of the Part 60 requirements for performance and handling characteristics as well as visual scene content requirements will still apply to FSTDs equipped with an XR system. Because an XR system may essentially replace much of the physical flight deck environment with a virtual representation, alternate evaluation methods must be considered for qualification purposes and to ensure an adequate training environment.

For Level 4 and Level 5 FTDs, the general flight deck configuration standards (as defined in Appendix D, Table D1A) do not contain requirements for a "replica" of the flight deck to be provided, but simply requires that the flight deck be "simulated sufficiently for the authorized training/checking events to be accomplished". Due to this performance-based requirement, it is not anticipated that a formal deviation to Part 60 will be required for qualification on a Level 4 or Level 5 FTD where all other applicable Part 60 requirements have been met. For all other FSTD levels (Level 6 FTD and above) where a "replica" of the flight deck is required, a Part 60 deviation request must be submitted by the sponsor with supporting justification that the XR equipped FSTD will perform at least equivalently to a conventionally equipped FSTD in qualified training tasks.[2]

While the information provided in this bulletin is focused on the qualification of helicopter FTDs and references existing regulatory requirements in Appendix D of Part 60, much of the provided

[2] The Part 60 deviation authority is defined in § 60.15(c)(5).

information may be applied to the qualification of airplane FTDs under Appendix B of Part 60 as well as powered-lift FSTDs qualified under the Special Federal Aviation Regulation (SFAR) for powered-lift aircraft operations in § 194.105.

Table 1 and Table 2 below summarize relevant general requirements and objective testing requirements from Appendix D of Part 60 that may be impacted by the installation of an XR system and details various considerations when applying these standards to devices equipped with XR systems. Sponsors should refer to table 1 and 2 when conducting a gap analysis to reference how their system meets or exceeds the existing standard that can be presented with a deviation request.

Table 1:
Part 60 FSTD Considerations as Applied to XR Systems

Section (Table D1A)	Requirement	Overview	XR Considerations **(Level 4 and Level 5 FTDs)**	XR Considerations **(Level 6 FTD and higher)**
1.a	General Flight Deck Configuration	This section describes the flight deck configuration requirements including instruments, panels, systems, circuit breakers, and controls. In general, Level 6 FTDs and higher require an enclosed flight deck that is a replica of the aircraft with controls and switches that are identical to the aircraft. For Level 4 and Level 5 FTDs, an open flight deck area may be used with flight deck equipment that is simulated sufficiently for the authorized training/checking events to be accomplished.	For Level 4 and Level 5 FTDs, the standard for the general flight deck configuration does not specifically require a flight deck "replica" but requires that the FTD have "…equipment (i.e., instruments, panels, systems, circuit breakers, and controls) simulated sufficiently for the authorized training/checking events to be accomplished. The installed equipment, must be located in a spatially correct configuration, and may be in a flight deck or an open flight deck area." Due to this performance-based requirement for flight deck configuration, the physical replication of some flight deck switches and controls may not be necessary in order to accomplish the authorized training and checking. Where an XR system is employed that does not include haptic feedback for flight deck equipment, controls, and switches, the sponsor should fully evaluate the FTD against all qualified tasks to ensure adequate training effectiveness.	(Level 6 and Level 7 FTDs): While the Part 60 requirement does not define the term, "replica", the requirement for the direction of movement of controls and switches to be identical to the helicopter implies that the flight deck must be a physical replica, which will require a deviation from the standards for FSTD qualification. Due to the unique nature of the XR environment, several issues and limiting factors should be considered: XR system resolution should be high enough to enable the reading of all applicable flight deck instrumentation and checklists without excessive compensation (head and body movement) by the pilot. The XR system's fixed field-of-view should provide adequate coverage to enable viewing of all required flight

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Section (Table D1A)	Requirement	Overview	XR Considerations **(Level 4 and Level 5 FTDs)**	XR Considerations **(Level 6 FTD and higher)**
				deck instrumentation/controls and out-the-window visual cues (including peripheral cues) without excessive compensation by the pilot. The XR system should provide an accurate representation of the flight deck to include correct dimensions, colors, and haptic feedback of flight deck switches and controls. The digital image of flight deck elements should closely align with the location of physical (haptic) elements. Table 3 of this bulletin contains recommended standards for this alignment, however, the FSTD sponsor must fully evaluate their FSTD to determine the XR system's suitability for all qualified training tasks. Due to potential errors being introduced into HMD head tracking, proper alignment should be verified in both static conditions and while

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				any optionally installed motion cueing is active. While the structure of the flight deck may be simulated through the HMD image, the addition of physical structural elements of the flight deck should be considered where necessary to accomplish qualified training tasks.
2.c.	Latency/Transport Delay	This section requires a maximum response time of 150 ms or less for flight deck instruments and motion/visual cueing where employed. Compliance may be demonstrated through latency or transport delay testing.	The current standards for a Level 4 FTD do not include a transport delay/latency requirement. While Level 4 FTDs are not typically used for in-flight training tasks, inadequate latency has been shown to increase simulation sickness in flight deck familiarization tasks conducted in a static setting. Until specific tolerances are developed, the applicant should fully evaluate their system for adverse effects due to excessive latency and present these findings to the FAA along with the FSTD qualification request.	The current latency standard requires measurement of the instrument response from an abrupt input at the pilot's control. In addition to control inputs, the rendering of an XR image in the HMD is dependent upon the pilot's current head position, so transport delay measurements should also include the end-to-end delay from the head position sensor to the rendering of the image in the HMD. The current transport delay standards were not developed with XR systems in mind. In an immersive environment,

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Section (Table D1A)	Requirement	Overview	XR Considerations **(Level 4 and Level 5 FTDs)**	XR Considerations **(Level 6 FTD and higher)**
				excessive latency may be more perceptible to the user and may also contribute to simulation sickness. Past studies have suggested that a maximum latency in the 20 to 75 ms range might be necessary for XR systems to avoid sickness. Recommended latency standards are provided in Table 3 of this information bulletin. Until specific tolerances are developed, the sponsor should fully evaluate their system for adverse effects due to excessive latency and include these findings in the Part 60 deviation request.
3.e. 3.f.	Flight Controls	This section requires control forces and control travel that correspond to the helicopter or set of helicopters. Additional objective validation testing is required for some FSTD levels (Table D2A).	In general, Level 5 FTDs and higher require the primary and secondary flight controls to be physical controls. This requirement implies that a mixed reality solution will be required to include the haptics of the physical primary and secondary flight controls.	To meet the control travel requirement, the flight controls must be depicted in the HMD's image of the flight deck and closely aligned to the physical primary and secondary flight controls. Both physical and XR controls must replicate the full control travel and forces react in the same manner as the helicopter.

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Part 60 FSTD Considerations as Applied to XR Systems

Section (Table D1A)	Requirement	Overview	XR Considerations **(Level 4 and Level 5 FTDs)**	XR Considerations **(Level 6 FTD and higher)**
				System latency must be sufficient to capture rapid control movements for both the pilot as well as the instructor who may be viewing the flight controls through a separate HMD or visual display.
4.a. 4.b.	Instructor or Evaluation Facilities	This section requires suitable seating arrangements for an instructor/check airman and FAA inspector that provide an adequate view of the crewmember panel(s). This section also requires instructor controls that permit activation of normal, abnormal, and emergency conditions, as appropriate.	No differences	In an XR simulation environment, the instructor or evaluator must be provided with sufficient equipment, such as a monitor depicting the virtual environment, to fully assess the performance of the pilot undergoing training or evaluation. The instructor/evaluator should have the ability to independently monitor all relevant flight deck equipment and controls as well as view the out-the-window visual scene regardless of where the trainee pilot is currently looking in his or her HMD as well as the HMD viewpoint/perspective.
5.a.	Motion System	This section states that where an optional motion cueing system is installed, it must not be distracting	No differences	While motion cueing is not a minimum requirement for any FTD level, supplemental motion cueing might be found to be

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Part 60 FSTD Considerations as Applied to XR Systems

Section (Table D1A)	Requirement	Overview	XR Considerations **(Level 4 and Level 5 FTDs)**	XR Considerations **(Level 6 FTD and higher)**
		and must also meet latency/transport delay requirements.		necessary to mitigate simulation sickness on the users. For FTD levels with optional motion cueing, there is no minimum envelope requirements (such as displacement, velocity, and acceleration), however, the cueing algorithms should be carefully tuned to avoid false cueing.
6.a.1	Visual System - Latency	The visual system must respond to abrupt input at the pilot's position. Note that visual systems that depict out-the-window scene content are optional for Level 4 through Level 6 FTDs.	See section 2.c above	See section 2.c above
6.a.3 6.c.	Visual System – Field of View	This section defines the minimum visual system field of view as 18 deg x 24 deg for Level 4 through Level 6 (where installed). For Level 7 FTD, the requirement is for a continuous FOV of at least 146 deg x 36 deg.	Out the window visual scene content is not required for Level 4 and Level 5 FTDs. However, where an XR system is used that renders an image of the flight deck instrumentation, the FOV provided by the XR system must be fully evaluated by the applicant and determined to be sufficient to conduct the qualified tasks.	The current visual FOV standards defined in Part 60 were intended to apply to out-the-window visual images in a conventional simulator/FTD. These requirements did not consider the use of XR to render flight deck instrument displays and are likely insufficient to provide an adequate view of all necessary instrumentation

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Part 60 FSTD Considerations as Applied to XR Systems

Section (Table D1A)	Requirement	Overview	XR Considerations **(Level 4 and Level 5 FTDs)**	XR Considerations **(Level 6 FTD and higher)**
				without excessive head movement by the pilot. For Level 7 FTDs, the fixed FOV requirements cannot be met with some commonly available XR HMDs. However, the FOV requirements can typically be met when applied to the total field of regard (FOR) that an XR system can produce. Because the total FOV is displayed in a non-continuous manner, a deviation to the Part 60 FOV requirement will be necessary.
6.a.6	Visual System – Display minimum distance	This section states that the minimum distance from the surface of a direct view display may not be less than the distance to any front instrument panel.	No differences	Visual images of the flight deck and OTW visual scene content displayed by an XR system's HMD will not meet this requirement. However, this requirement did not anticipate the use of modern XR system and was intended for external visual displays in a conventional FTD.
6.a.7 4.e (Table D2A)	Visual System – Resolution	This section requires a minimum resolution of 5 arc-minutes for computed and displayed pixel size.	For Level 4 through Level 6 FTDs, the minimum visual resolution requirements were intended to be applied to OTW visual images. For XR systems that render flight	The minimum visual resolution requirements were intended to be applied to OTW visual images. For XR systems that render flight deck

Table 1:
Part 60 FSTD Considerations as Applied to XR Systems

Section (Table D1A)	Requirement	Overview	XR Considerations **(Level 4 and Level 5 FTDs)**	XR Considerations **(Level 6 FTD and higher)**
		For Level 7 FTDs, the minimum surface resolution requirement is defined in Table D2A as 2 arc-minutes.	deck instrumentation and controls, the current 5 arc-min resolution requirement will likely not be sufficient to adequately display some controls and indications on the flight deck. While a minimum resolution requirement has not been defined for such XR systems, the resolution must be sufficient to conduct all qualified tasks and provide a sufficient "replica" of the flight deck as described in section 1.a.	instrumentation and controls, the current 2 arc-min resolution requirement will likely not be sufficient to adequately display some controls and indications on the flight deck. HMD systems should strive for 1 arc-min resolution. The resolution must be sufficient to conduct all qualified tasks and provide a sufficient "replica" of the flight deck as described in section 1.a.. The HMD pixel density/resolution requirements for flight deck images will likely be a function of the specific aircraft instrumentation and may be much higher than what is necessary for OTW visual images.
7.a.	Sound System	This section requires the simulation of significant flight deck sounds resulting from pilot actions that correspond to those heard in the helicopter. (Level 6 and Level 7 only)	Level 4 and Level 5 FTDs do not require flight deck sounds.	Both the Level 6 and Level 7 FTD require a "replica" of the flight deck as described in section 1.a. In a conventional FTD, this is typically a physical replica of an enclosed flight deck. In an XR system, the flight deck enclosure may be presented virtually in an open flight deck area that will have different

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Part 60 FSTD Considerations as Applied to XR Systems

Section (Table D1A)	Requirement	Overview	XR Considerations **(Level 4 and Level 5 FTDs)**	XR Considerations **(Level 6 FTD and higher)**
				acoustics which may impact flight deck sounds. Additionally, flight deck sounds in an XR environment might be provided through a headset which may impact immersion and realism. While Level 6 and Level 7 FTDs do not have objective sound testing requirements, the applicant should fully evaluate the FTD to ensure that simulated flight deck sounds are adequate to conduct the qualified training tasks.

Table 2:
Part 60 FSTD Objective Testing Considerations as Applied to XR Systems

Section (Table D2A)	Requirement	Overview	XR Considerations **(Level 4 and Level 5 FTDs)**	XR Considerations **(Level 6 FTD and higher)**
4.a.	Latency/Transport Delay	See Table 1, section 2.c	See Table 1, section 2.c	See Table 1, section 2.c
4.b.	Continuous visual field-of-view	See Table 1, section 6.c.	See Table 1, section 6.c.	See Table 1, section 6.c.
4.c.	Surface contrast ratio	This objective test requires the contrast ratio between surfaces to be measured and meet the minimum standard of 5:1.	N/A	Standard measurement procedures using a one-degree spot photometer are not possible for an XR HMD. Alternate testing methods may be proposed by the applicant.
4.d.	Highlight brightness	This objective test requires the highlight brightness to be measured and meet the minimum standard of 3 foot-lamberts.	N/A	Standard measurement procedures using a one-degree spot photometer are not possible for an XR HMD. Alternate testing methods may be proposed by the applicant.
4.e	Surface Resolution	This objective test requires a minimum visual resolution of 2 arc minutes for out-the-window visual images.	N/A	See Table 1, section 6.a.7
4.g.2	Lightpoint contrast ratio	This objective test requires the lightpoint contrast ratio to be measured and meet the minimum standard of 25:1	N/A	N/A for Level 6 FTD. For Level 7 FTDs, standard measurement procedures using a one-degree spot photometer are not possible for an XR HMD. Alternate testing methods may be proposed by the applicant.

1.6 Recommended Standards for XR Equipped FSTDs:

As mentioned in previous sections of this information bulletin, the current Part 60 standards were not intended to apply to XR systems and do not address the unique characteristics of these systems. While the FAA does not currently provide published minimum objective standards for qualified FSTDs using XR technology, the following guidelines in Table 3 are provided for applicants as acceptable tolerances and are based upon published research and other documentation in the public domain.[3] Note that where a Part 60 deviation is required for FSTD qualification, these recommendations/guidelines may be used to support a deviation request, however, the applicant will be expected to provide supporting data to demonstrate training effectiveness in the XR equipped FSTD.

In addition to the recommended standards listed in Table 3, the applicant should also propose objective testing of the XR equipment to be conducted on a recurring basis to evaluate potential system degradation which may have a negative impact on pilot training. This testing may be proposed to support FAA conducted continuing qualification evaluations, sponsor conducted testing at periodic intervals, or for evaluating the system during required preflight inspections. This testing may include, but is not limited to, HMD brightness and color, flight deck alignment, or other characteristics of the system in which the manufacturer anticipates that equipment degradation can be reasonably expected to occur over time.

[3] European Aviation Safety Agency (EASA) issued special conditions for one manufacturer's VR equipped FSTD were considered in compiling these recommended standards. This document may be found at: EASA FSTD Special Conditions for VR HMDs

Table 3:
Recommended Standards for XR Equipped FSTDs

Standard	Recommended Tolerance	Description
Flight Deck Alignment Error	≤ 10 mm	In an extended reality system, physical switches, panels, and controls are represented digitally through the head mounted display image. The physical location of these flight deck controls must closely match the image presented within the HMD and must be evaluated for all required flight deck controls. Testing should also be conducted with (optional) motion cueing active as this could affect flight deck alignment due to HMD head tracking errors.
HMD Latency/Transport Delay	≤ 20 ms	The current transport delay minimum requirements were developed for conventional simulation and are not sufficient for application on an XR system. In order to provide smooth display movement and to avoid simulator sickness, latency should be kept below a 20 ms threshold. Latency measurement should be conducted from the head tracking input to the rendering of the image in the HMD.
Frame Rate	≥ 90 fps	Adequate frame rate is necessary to avoid simulator sickness and noticeable jittering in the display image. Depending upon the types of training maneuvers conducted in the FTD, frame rates of up to 90 fps should be achievable.
Motion Cueing	N/A	While motion cueing is not required for any level of FTD, studies have shown that the addition of motion cues may reduce the rate and severity of simulator sickness. Where an optional motion cueing system is installed, the latency/transport delay of the motion response should be no greater than 150 ms as specified in the current standards.
Motion System Visual Compensation	Translational < 0.4 in Rotation < 1 degree. ** 0.4 in = 10.16 mm)	Measures the visual system's ability to mitigate movements of the visual scene caused by movement of the simulator motion system. Eliminating false visual cues is critical to avoid motion sickness and maintain realistic pilot perspective.
Visual Resolution	≥ 60 ppd ≤ 1 arcmin	Where rendered images of the flight deck instrumentation are displayed in the HMD, resolutions higher than those defined in the current standards (intended for OTW visual images) may be required to view and interact with flight deck instrumentation. Lower resolutions may be acceptable depending upon the specific aircraft instrumentation and implementation methods. For Level 7 FSTDs, the HMD should offer Eye-Tracking Foveated Rendering (ETFR)

Table 3:
Recommended Standards for XR Equipped FSTDs

Standard	Recommended Tolerance	Description
Fixed Field of View (FOV)	150 x 40 deg	For FSTD levels without a visual system requirement, as listed in Appendix D for Level 4 through Level 6 FTDs, the fixed FOV should be sufficient to accomplish the qualified training tasks without excessive pilot compensation. For Level 7 FTDs, the HMD's fixed FOV must meet the minimum standard of 146 x 36 degrees. Deviation to this requirement may be granted where the applicant can demonstrate that the qualified training tasks may be accomplished and provide positive transfer of training with a reduced fixed FOV (see section 2.5).
Instructor Operating Station	N/A	For helicopter FTDs, instructor operating station (IOS) requirements are defined in Tables D1A, D3A, D3D, D3E, and D3F of Appendix D. For XR specific implementations, the IOS should incorporate the following features to enable adequate student/instructor interaction in the virtual environment: • The IOS should have a means to allow for the instructor to point or otherwise direct attention to objects within the student's virtual flight deck environment. • The IOS should have a means for the instructor to independently see all relevant flight deck instrumentation, panels, and flight controls either through a dedicated HMD or conventional display system. • The IOS should have the ability to see the student's hand and head movement while conducting training tasks. • The IOS should have a means for the instructor to see the out-the-window visual image. • The IOS should have the capability for the instructor to hear all required flight deck sounds.
Hand Tracking Transport Delay	≤20 ms	Measures signal delay between pilot head movement and change in virtual scene viewing angle.
HMD Tracking Accuracy	Translational < 0.4 in Rotation < 1degree ** 0.4 in = 10.16 mm)	When HMD trackers are used, facilitates realistic pilot perspective and performance of cockpit. Measures accuracy of pilot viewing angle within the virtual cockpit.

Table 3:
Recommended Standards for XR Equipped FSTDs

Standard	Recommended Tolerance	Description
Grating Resolution	FOV 0-40° : 2 arcmin FOV 40-60° : 3 arcmin FOV 60-120° : 8 arcmin	Measures the ability of the visual system to produce and transmit high resolution virtual images across the entire FOV regardless of HMD lens incidence angles and despite an accumulation of potential lens effects. High resolution is critical to avoid eye strain while facilitating performance of cockpit operations and flight maneuvers.
IPD Setting and 3D Projection	+/- 10% Target Distance	Measures the ability of the visual system to account for pilot IPD and represent depth of virtual objects. Accurate 3D projection is critical for performance of near-ground flight maneuvers and facilitates cockpit operations.
Chromatic Aberration	FOV 0-60 deg: 6 arcmin FOV 60-120 deg: 12 arcmin	Measures the ability of the HMD lenses to accurately transmit position of all colors within the virtual image despite variation of light wavelengths across the color spectrum. Limited chromatic aberration effects such as rainbowing and resolution degradation are critical to avoid eye strain and enhance realism.
Uniformity	TBD	Measures the ability of the HMD lenses to uniformly transmit luminance and color across the entire virtual image despite natural tendency for luminance decrease as viewing angle increases. High uniformity is critical to ensure adequate color representation and brightness across the entire pilot FOV. It may also be a factor in avoiding motion sickness by eliminating the perception of false movement cues caused by changing brightness/color as the pilot eye tracks around the FOV.
Color degradation	Luminace Deviation ≤6 dB Luminance Ration Deviation ≤3 dB	Measures color luminance of the HMD display to create a performance baseline. Comparison of baseline result against recurrent testing will demonstrate how much display hardware luminance has degraded and indicate need for replacement. For displays utilizing hardware components known to gradually degrade over time, such as LEDs, this test will ensure that adequate color representation and brightness are maintained post certification.
Color Representation	SME subjective match	Evaluates accuracy of virtual cockpit color with respect to aircraft cockpit elements.
Simulator Sickness/Cybersickness	TBD	The applicant should assess their XR device for potentially inducing excessive rates and severities of simulation sickness on the users. The use of a standardized simulator sickness questionnaire, such as the SSQ[4] is recommended to survey representative sets

[4] Robert S. Kennedy , Norman E. Lane , Kevin S. Berbaum & Michael G. Lilienthal (1993) Simulator Sickness Questionnaire: An Enhanced Method for Quantifying Simulator Sickness, The International Journal of Aviation Psychology, 3:3, 203-220, DOI: 10.1207/s15327108ijap0303_3

Table 3:
Recommended Standards for XR Equipped FSTDs

Standard	Recommended Tolerance	Description
		of users for symptoms of simulator sickness. Currently, acceptable rates of simulator sickness for XR devices are undefined, however, some published literature suggests that average SSQ scores exceeding 20 may indicate a “problem” simulator. Sponsors should work to minimize sickness levels through available mitigation measures and monitor user sickness levels, particularly after modifications have been made to the FSTD or the training program.

1.7 Simulator Sickness/Cybersickness

Previous research studies have indicated that exposure to an extended reality simulation environment can induce simulation sickness at rates that are generally higher and more severe than in conventional simulation. While the rates of simulation sickness will likely vary significantly depending upon the specific implementation and the tasks being performed in the virtual environment, some studies have found rates of simulation sickness that may exceed 20% of participants with some symptoms being severe enough to prematurely end exposure. In general, while the fidelity of commercially available XR systems and components have improved significantly in recent years, some evidence suggests that increased fidelity, such as wider HMD fields-of-view, may increase the rate and severity of simulation sickness.

With the potential for simulation sickness in XR equipped FSTDs, devices should be fully assessed to determine if pilot training effectiveness is being adversely affected due to simulation sickness. Standardized evaluation tools, such as the Simulator Sickness Questionnaire (SSQ), should be utilized to determine if a device is inducing unacceptable levels of simulator sickness while conducting qualified training tasks. While specific maximum levels of simulator sickness are not currently defined, results from standardized testing can be used to compare against the benchmark of training outcomes and measured simulator sickness in a similarly equipped conventional FSTD. Where high levels of sickness are identified, mitigation efforts should be examined to minimize any adverse impact to training.

Where Part 60 deviations are requested for the use of XR equipment in qualified FSTDs, the justification provided to the FAA to support a deviation should include an analysis of simulator sickness on representative groups of pilots conducting qualified training tasks in the XR equipped FSTD. Where mitigation efforts are employed, these should be fully defined in the deviation request and will be included as a condition of continuing FSTD qualification.

1.8 FSTD Levels

As mentioned previously in this bulletin, the FAA is not currently publishing guidance material on the qualification of full flight simulators with XR systems until additional information is collected through ongoing FAA-sponsored research. The FAA will consider qualification of Level 4 and Level 5 FTDs under the current Part 60 standards where the applicant demonstrates that the flight deck is simulated sufficiently for the authorized training/checking events to be accomplished. For Level 6 and Level 7 FTDs, where specific requirements of the current Part 60 standards cannot be met with an XR system, the FAA will consider qualification of these devices under the Part 60 deviation authority with adequate justification provided by the applicant. Additional information that provides general descriptions of the various levels of helicopter FTDs can be found in Appendix D, paragraph 24 (Levels of FTD) in Part 60.

2 Qualification Basis

2.1 Applicable Standards

As discussed in previous sections of this information bulletin, FSTDs equipped with XR systems must meet the current standards as defined in the applicable Part 60 QPS. FSTD sponsors should refer to Table 1 and Table 2 of this bulletin as a guideline to evaluate their system to verify compliance with the standards. Where it is found that the FSTD is unable to meet specific requirements, a deviation from the applicable sections of the Part 60 standards will be required.

Based upon the absence of current XR technology standards within Part 60 at the time of publication of this bulletin, it is anticipated that Part 60 deviations and supporting justification will be required for the qualification of Level 6 and Level 7 FTDs due to the inability of current XR HMDs to meet the flight deck replica and the continuous visual system field-of-view requirements (where applicable).

For Level 4 and Level 5 FTDs considerable flexibility exists in the current standards to enable the qualification of XR systems and are not anticipated to require formal deviations from part 60. While a deviation may not be necessary for these FTD levels, the device must be fully evaluated by an SME pilot to ensure that the XR system simulates the flight deck sufficiently for the authorized training/checking events to be accomplished. This evaluation should focus on XR system limitations that may impact training and checking events, such as latency, FOV, resolution, sound systems, and IOS implementation.

2.2 Part 60 Deviation Authority

For the initial qualification of FSTDs, § 60.15(c)(5) contains the authority for the FAA to approve deviations to the Part 60 QPS. As mentioned in previous sections, an FSTD equipped with an XR system might be unable to meet certain Part 60 requirements or the Part 60 requirements do not directly apply to the unique characteristics of an XR system.

In order for the FAA to grant a deviation to the Part 60 standards, § 60.15(c)(5) requires the following from the FSTD sponsor:

> "The FSTD sponsor or FSTD manufacturer…must provide sufficient justification that the deviation meets or exceeds the testing requirements and tolerances as specified in the Part 60 QPS or will otherwise not adversely affect the fidelity and capability of the FSTDs evaluated and qualified under the deviation."

When adequate supporting data is provided that demonstrates equivalent capability, the FAA may issue a deviation for initial qualification of an XR equipped FSTD. When required, conditions and limitations may be issued to meet FSTD performance objectives following initial qualification.

2.3 Progressive Qualification Process

For the qualification of Level 6 and Level 7 FTDs using XR technologies, deviations may be issued to allow for the XR device to be progressively integrated within an existing training program to assess for training effectiveness. Under this process, the deviation may initially authorize the use of the XR FTD for a portion of the required training time with the remaining training time being conducted in a conventional FSTD or in the aircraft. With this initial authorization in place, the FSTD sponsor may gradually increase XR FTD flight training time in the training program to assess training effectiveness as demonstrated in pilot proficiency evaluations. Continued qualification of the XR FTD under the deviation will be contingent upon adequate supporting data being provided to the FAA TCPM and TSG which demonstrates that the use of the XR FTD is not adversely affecting training.

2.4 Sponsor Conducted FSTD Evaluation for Initial Qualification (§ 60.15)

To support the request for initial evaluation, the FSTD sponsor must fully assess the XR FTD to determine its adequacy for use in the flight training program. At a minimum, the FAA recommends the following assessments are conducted by the FSTD sponsor and the results submitted to the FAA along with the request for initial qualification.[5]

- Subjective Assessment: In this subjective evaluation, all qualified training tasks should be evaluated with particular emphasis placed on evaluating known limitations of the XR system and their impact on successfully completing the training tasks (e.g. limited fixed visual FOV, HMD resolution, and flight deck haptics). The XR FSTD should also be assessed to ensure that all applicable pilot training/certification maneuvers can be successfully completed in the device within the published criteria in the Practical Test Standards (PTS) or Airman Certification Standards (ACS).

- Simulator Sickness Assessment: The simulator sickness assessment is intended to determine if the XR FSTD is causing excessive levels of simulation sickness, to determine if limitations should be imposed to mitigate the onset of sickness in the FSTD, and for the sponsor to determine a baseline level of assessed sickness levels for future comparison. It is recommended that the FSTD sponsor utilize standard simulator sickness questionnaires across representative groups of student pilots to determine sickness levels after typical training sessions.

2.5 Training Effectiveness Assessment (For FSTDs requiring a Part 60 deviation)

As mentioned previously, supporting justification must be provided by the sponsor to demonstrate that the approval of a deviation will not adversely impact the capability of the FSTD in training. In order to demonstrate this, it is recommended that the training effectiveness of the XR FSTD be compared to that of a conventional FSTD (or aircraft) by assessing pilot performance in an aircraft or in an FSTD that is qualified for proficiency checks. While the

[5] These XR specific evaluations may be conducted concurrently with those required in § 60.15(b). For FSTDs requiring a deviation to Part 60 technical requirements, it is recommended that these evaluation results be submitted with the initial request for deviation.

FSTD sponsor may propose alternate methods to demonstrate training effectiveness of the XR FTSD, the following sections outline one potential approach for consideration:

Note: While it is recommended that the training effectiveness assessment is completed and submitted along with the initial request for deviation, the TSG may consider the approval of a deviation to allow the FSTD sponsor to gradually phase in the use of the XR FSTD into an existing training program while collecting training effectiveness data. Deviations will be coordinated with the POI or TCPM for concurrence before approval.

2.5.1 Student Groups (XR FSTD vs Conventional Training)

Under a deviation, it is recommended that the XR FTSD be gradually phased into the current training program while measuring the proficiency of pilots within student groups after the completion of training. The purpose of this is to evaluate for potential improvement or deterioration to training as a function of increased training time in the XR FTSD. Student groups should be composed with progressively increasing amounts of training conducted in the XR FSTD vs training conducted in a conventional FSTD or in the aircraft. It is anticipated that if training is negatively impacted by the introduction of increased XR FSTD time, a corresponding reduction in performance in the proficiency evaluations will be evident.

2.5.2 Proficiency/Skills Evaluation

After the completion of training, the pilots in all student groups should be evaluated for proficiency in an FSTD approved for proficiency checks (typically an FFS) or in the aircraft. These evaluations should be conducted on a task-by-task basis to examine for significant effects as a result of specific limitations in the XR system. While the FSTD sponsor may propose other methods to conduct these proficiency evaluations, it is recommended that, at a minimum, the following metrics be captured and evaluated for trends by student group:

- Pilot performance: Performance of the student is rated by the evaluating pilot on a rating scale by individual task.
- Pass/fail rate: Pass/fail ratio of students by individual task
- Number of attempts to pass: Number of attempts required to satisfactorily complete each task.

2.5.3 Data Collection and Reporting

The training effectiveness assessment may be submitted with the deviation request to justify unrestricted use of the XR FSTD after the device is issued a Statement of Qualification. Where limited training effectiveness data is available prior to FSTD qualification, the sponsor may request the issuance of a deviation to progressively integrate the XR FSTD into an existing training program. To support the issuance of a deviation, the sponsor should develop a plan to collect training effectiveness data and coordinate this plan with the TSG and the POI/TCPM. In general, deviations will be time-limited to allow for training effectiveness data to be collected by the sponsor to support the continued qualification and use of the XR FSTD in an approved training program.

3 Qualification Process

3.1 General Guidelines

Due to the unique nature of XR equipped FSTDs, the applicant should coordinate with the FAA well in advance of an initial FSTD evaluation date. For FSTDs that do not require a deviation to the Part 60 requirements (generally Level 4 and Level 5 FTDs)[6], the applicant should submit a statement of compliance and FSTD evaluation report to the FAA at least three months before an anticipated initial FSTD evaluation date. For FSTDs that may require a deviation to the Part 60 standards, the supporting justification and deviation request should be submitted to the FAA at 9-AFS-200-Correspondence@faa.gov at least six months before an anticipated initial FSTD evaluation date. The FSTD evaluation request may be submitted to the Training and Simulation Group (TSG) public email address at 9-ASO-AFS205-NSP-SIMULATOR-SCHEDULING@faa.gov. Once this information has been received and reviewed by the FAA and any applicable deviations have been issued, the FAA will follow the initial evaluation request process as defined in§ 60.15, Appendix D, and supplemented in information bulletin #99-01 (https://www.faa.gov/sites/faa.gov/files/about/initiatives/nsp/bulletins/99-01.pdf). Attachment 1 to this information bulletin provides a checklist for FSTD sponsors to follow.

3.2 All FTD Levels

The applicant should evaluate the FSTD against the standards in the applicable Part 60 QPS with emphasis on the information provided in Table 1 and Table 2 of this information bulletin. The Statement Of Compliance (SOC) should confirm that the FSTD meets all applicable requirements and has been evaluated by an appropriate SME pilot. The SOC should also include the following information to support the Part 60 general requirement that the flight deck is "simulated sufficiently for the authorized training/checking events to be accomplished.":

- A Subjective Assessment and Simulator Sickness Assessment Report (see section 2.4 of this bulletin)
- Confirmation that the XR system's FOV, resolution, and latency and any other system limitations are satisfactory to conduct each required training task (Attachment 2).
- A statement verifying all Part 60 requirements relevant to XR systems have been addressed (e.g. Table 1 of this bulletin)
- Technical specifications of the XR system to include HMD resolution, FOV, and transport delay.
- Any declared training limitations as determined by the applicant.
- The applicant should coordinate the use of the XR training device with their POI or TCPM prior to seeking concurrence as required by § 60.15 for initial evaluation.

3.3 Level 6 and Level 7 FTDs

Where it is determined that the XR equipped FTD cannot meet the current Part 60 standards, the applicant must apply for a deviation to the relevant Part 60 requirements in accordance with §

[6] For the purpose of level 4 and 5 FTD's the QPS criteria for visual systems outlined in 14 CFR Part 60 is satisfactory.

60.15(c)(5). In order to support the approval of a deviation, the applicant must show adequate justification that the XR equipped FTD can perform equivalently in approved training/checking events as compared to a conventional FTD of the same qualification level or other training conducted in a conventional manner. This justification should include a training effectiveness assessment report as described in section 2.5 or a training effectiveness assessment plan for sponsors intending to progressively integrate the XR device into an existing training program while concurrently collecting training effectiveness data.

3.4 FAA Review and Deviation Issuance

The FAA will review the deviation request and contact the applicant with any questions or requests for additional information. In order to expedite the review process, the FAA may request to meet with the applicant to discuss the supporting justification as well as to conduct preliminary evaluations of the FSTD ahead of a formal initial evaluation.

Once the FAA has determined that the applicant has adequately justified the request for a deviation, the FAA will approve or conditionally approve and issue a deviation letter to the applicant. The deviation letter will contain any conditions and limitations as determined necessary by the FAA. The conditions and limitations may be supplemented by restrictions issued with the Statement of Qualification (SOQ) at the conclusion of the initial FSTD evaluation.

Letters of deviation may be issued to sponsors for individual FSTDs or issued to cover a set of FSTDs that share similar designs and/or aircraft types.

3.5 Initial FSTD evaluation

After the deviation letter has been issued by the FAA, the initial FSTD evaluation may be scheduled in accordance with the process defined in 3.1 above. The information supplied as part of the deviation request will be used by the FAA evaluation team to guide the evaluation process.

Attachment 1

Checklist for XR FSTD Qualification
FTD Helicopter

Sponsor FSTD MR (Management Representative) activities to request an XR qualification

- ☐ Review the following Tables in this information bulletin to conduct a gap analysis with current FSTD standards and determine the potential need for Part 60 deviations to support FSTD qualification:
  - Table 1 "Part 60 FSTD Minimum Requirements as Applied to XR Systems"
  - Table 2 "Part 60 FSTD Objective Testing Requirements as Applied to XR Systems"
- ☐ For all FSTD levels (see section 2.4 of this information bulletin):
  - Conduct a subjective evaluation of the FSTD using the Table in Attachment 2 as a guideline. This evaluation should be conducted by an SME pilot and should specifically address any potential limitations of the XR system.
  - Conduct a simulator sickness assessment of the FSTD to determine baseline levels of sickness and if additional sickness mitigations are required.
  - Review Table 3 "Recommended Standards for XR Equipped FSTDs" and provide a list of relevant XR system specifications
  - Provide a list of any declared training limitations
- ☐ For FSTDs requiring a Part 60 deviation (see section 2.5 of this information bulletin):
  - A training effectiveness assessment report which provides supporting data that demonstrates that the XR equipped FSTD performs equivalently to conventional flight training methods/devices (FSTD or aircraft training).
  - For FSTD sponsors requesting a deviation to progressively integrate an XR FSTD into an existing training program, a training effectiveness assessment plan should be submitted with the deviation request.

- ☐ Complete Attachment 3 “Request for VR Deviation from 14 CFR 60 Qualification Performance Standards”

- ☐ Submit deviation request along with supporting information to 9-AFS-200-Correspondence@faa.gov

- ☐ Email completed XR FSTD initial qualification package to: 9-ASO-AFS205-NSP-SIMULATOR-SCHEDULING@faa.gov

Attachment 2

Helicopter - XR Subjective Evaluation Checklist – FTD Level 4 – 7

Legend

'X' – FSTD is qualified for the task
'X_1 – FSTD qualified only if accomplished in a running takeoff or running landing
'A' – FSTD may be qualified for the task where the system is simulated and evaluated
'T' – FTSD may be qualified only for introductory training (no proficiency checking)

[adapted from]
(FAA Order 8900.1, Volume 3, Chapter 19, Section 6. Table 3-68)

FLIGHT PHASE	TRAINING EVENT	FTD LEVEL				Comments
		4	5	6	7	
PREPARATION	Visual Inspection (Flight Deck Only)	A	A	X	X	
	Before Taxi Procedures	A	A	X	X	
	Performance Limitations	A	A	X	X	
	Stabilized Hover Check	-	-	-	T	
SURFACE OPERATION	Starting	A	A	X	X	
	Rotor Engagement	A	A	X	X	
	Rotor Engagement on Water SEA	A	A	A	A	
	Taxiing-Ground	-	-	-	T	
	Taxiing-Hover	-	-	-	T	
	Water Taxiing SEA	-	-	-	-	
	Lift-to-Hover In Ground Effect (IGE)/Out of Ground Effect (OGE)	-	-	-	T	
	Hover Turns IGE/OGE	-	-	-	T	
	Sideward/Rearward Hovering	-	-	-	T	
	Slope Operations	-	-	-	-	
	Liftoff	-	-	-	T	
	Landing	-	-	-	T	
TAKEOFF	Normal	-	-	-	T	
	Instrument	-	-	T	X_1	

FLIGHT PHASE	TRAINING EVENT	FTD LEVEL				Comments
		4	5	6	7	
	Obstacle Clearance	-	-	-	T	
	Running (High-Density Altitude)	-	-	-	T	
	Category “A”	-	-	-	T	
	Category “A” With Powerplant Failure Before Takeoff Decision Point (TDP)	-	-	-	T	
	Category “A” With Powerplant Failure After TDP CLIMB	-	-	-	T	
	Rejected Takeoff	-	-	-	T	
CLIMB	Normal	-	-	X	X	
	Obstacle Clearance	-	-	-	X	
	Vertical	-	-	X	X	
	One-Engine-Inoperative	-	-	X	X	
EN ROUTE	Medium-Banked Turns	-	T	T	T	
	Powerplant Shutdown and Restart	-	-	X	X	
	Low-Speed Characteristics	-	-	-	T	
	High-Speed Handling Characteristics	-	-	-	T	
	Navigational Techniques	A	A	X	X	
DESCENT/ APPROACHES	Normal	-	-	X	X	
	Maximum Rate	-	-	X	X	
	Autorotative Glide	-	-	X	X	
	VFR Procedures Normal (Level 5/6 requires visual system)	-	A	A	X	
	Obstacle Clearance	-	-	-	X	
	High-Density Altitude	-	-	X	X	
	Elevated Landing Site	-	-	-	X	

FLIGHT PHASE	TRAINING EVENT	FTD LEVEL				Comments
		4	5	6	7	
	With Degraded Control Augmentation	-	-	X	X	
	IFR Precision Approaches ILS/Normal	-	A	X	X	
	ILS/One-Engine-Inoperative	-	-	X	X	
	(OpSpec) PAR/Normal	-	A	X	X	
	(OpSpec) PAR/One-Engine-Inoperative	-	-	X	X	
	IFR Nonprecision Approaches NDB/Normal	-	A	X	X	
	VOR/Normal	-	A	X	X	
	(OpSpec) LOC Backcourse Procedures	-	A	X	X	
	(OpSpec) SDF/LDA Procedures	-	A	X	X	
	(OpSpec) ASR Procedures	-	A	X	X	
	(OpSpec) RNAV Procedures	-	A	X	X	
	(OpSpec) Circling Approach (Simulator must be qualified for training/checking on the circling maneuver)	-	-	A	X	
	Missed Approaches From Precision Approach	-	-	T	T	
	From Nonprecision Approach	-	-	T	T	
	NOTE: At least one MAP must be a complete approved procedure.					
	With Powerplant Failure	-	-	T	T	
LANDINGS	Normal-to-the-Surface	-	-	-	T	

FLIGHT PHASE	TRAINING EVENT	FTD LEVEL				Comments
		4	5	6	7	
	Normal-to-the-Water SEA	-	-	-	-	
	(OpSpec) Category “A”	-	-	-	T	
	(OpSpec) Category “A” With Powerplant Failure After Landing Decision Point (LDP)	-	-	-	T	
	Crosswind	-	-	-	T	
	Rejected	-	-	-	T	
	From Precision Instrument Approach	-	-	-	T	
	From a Precision Approach with at Least 50 percent Power Deficiency	-	-	-	T	
	With Degraded Control Augmentation	-	-	-	T	
AFTER LANDING	Taxiing-Ground	-	-	-	T	
	Taxiing-Hover	-	-	-	T	
AFTER LANDING (Cont’d)	Water Taxiing SEA	-	-	-	-	
	Parking & Securing	A	A	X	X	
	Stopping the Rotors	A	A	X	X	
	Emergency Evacuation	A	A	X	X	
UNPREPARED SITE OPERATIONS	Confined Areas	-	-	-	A	
	Pinnacles	-	-	-	A	
	Ridgelines	-	-	-	A	
	Water Sites SEA	-	-	-	-	
OTHER FLIGHT PROCEDURES DURING ANY AIRBORNE PHASE	Holding	-	-	X	X	
	Ice Accumulation on Airframe	-	-	-	-	
	Air Hazard Avoidance	-	-	-	A	
	Wind Shear/Microburst	-	-	-	-	
	Recovery From IIMC	-	-	-	X	

FLIGHT PHASE	TRAINING EVENT	FTD LEVEL				Comments
		4	5	6	7	
SYSTEMS PROCEDURES TRAINING DURING ANY PHASE -Normal -Abnormal -Alternate	Pneumatic/Pressurization	A	A	X	X	
	Air Conditioning	A	A	X	X	
	Fuel and Oil	A	A	X	X	
	Electric	A	A	X	X	
	Hydraulic	A	A	X	X	
	Flight Controls	A	A	X	X	
	Anti-Icing and Deicing Systems	A	A	X	X	
	Autopilot	A	A	X	X	
	Flight Management Guidance Systems	A	A	X	X	
	Automatic or Other Approach & Landing Aids	A	A	X	X	
SYSTEMS PROCEDURES TRAINING DURING ANY PHASE -Normal -Abnormal -Alternate (Cont'd)	Loss of Antitorque Effectiveness	-	-	T	T	
	Airborne Weather Radar	A	A	X	X	
	Flight Instrument System Malfunction	A	A	X	X	
	Communications Equipment	A	A	X	X	
	Navigation Systems	A	A	X	X	
SYSTEMS PROCEDURES TRAINING DURING ANY AIRBORNE PHASE -Emergency	Aircraft Fires	A	A	X	X	
	Smoke Control	A	A	X	X	
	Powerplant Malfunctions	A	X	X	X	
	Electrical, Hydraulic, Pneumatic Systems	A	A	X	X	
	Flight Control Systems Malfunction	A	A	X	X	
	Landing Gear Malfunction	A	A	X	X	
	Antitorque Failure	-	-	T	T	

FLIGHT PHASE	TRAINING EVENT	FTD LEVEL				Comments
		4	5	6	7	
	Settling-with-Power	-	-	-	T	
FSTDs That Are Night Vision Goggle (NVG) Qualified NVG ADDITIONAL CONSIDER-ATIONS	Night Vision System Operational Checks	-	-	A	A	
	NVG Failure	-	-	A	A	
	NVG Inadvertent Instrument Meteorological Conditions (IIMC)	-	-	A	A	
	Unusual Attitude Recovery	-	-	-	A	
	Transitions: Aided/Unaided	-	-	A	A	
FSTDs That Are Night Vision Goggle (NVG) Qualified NVG ADDITIONAL CONSIDER-ATIONS (Cont'd)	Ground Hazard Recognition	-	-	A	A	
	Brownout/Whiteout/Flat-Light Operations	-	-	A	A	
	External Light Techniques	-	-	A	A	
For NVG qualification, the Training and Simulation Group (TSG) must evaluate and qualify the FSTDs in accordance with Information Bulletin #10-01.	Scanning Techniques	-	-	A	A	

Attachment 3

Request for XR Deviation from 14 CFR 60 Qualification Performance Standards

Sample/Template

(Date)

Manager, FSTD Planning and Initial Qualification Section, AFS-280
P.O. Box 20636
Atlanta, GA 30320

RE: Request for Deviation from 14 CFR 60 Qualification Performance Standards for Extended Reality (XR) Technologies

(FSTD Sponsor Name) seeks a deviation from 14 CFR § 60.4 requiring proposed (Helicopter) XR FSTD (FTD (4/5/6/7)) to meet qualification standards referenced in 14 CFR § 60 Appendix D. As authorized by § 60.15(c)(5), (FSTD Sponsor Name) offers the attached justification to demonstrate that the proposed deviation "…will not adversely affect the fidelity and capability of the FSTD evaluated and qualified under the deviation".

Reasons for seeking deviation

Since the current FAA FSTD qualification standards in 14 CFR § 60.4 Appendix D do not cover XR technologies, this request for deviation intends to propose alternate means of compliance for specific Part 60 requirements in which an XR equipped FSTD cannot meet. These include the following requirements in Part 60, Appendix D:

- Table D1A (Minimum FTD Requirements)
  - Section 1.a.: Flight deck “replica” requirement
  - Section 2.c.: Continuous visual system field-of-view requirement (146 x 36)
- Table D2A (FTD Objective Tests)
  - 4.b.2: Continuous visual field-of-view
  - 4.c.: Surface contrast ratio (alternate testing method)
  - 4.d.: Highlight brightness (alternate testing method)
  - 4.g.: Lightpoint contrast ratio (alternate testing method)

Reasons Why Granting the Deviation Would Not Adversely Affect Safety

The proposed deviation to qualify the (Helicopter) XR FSTD does not adversely affect safety as it was specifically designed to demonstrate compliance with the requirements of Part 60 Appendix D and cover to the aspects relevant to new generation devices through alternative means of compliance. The FSTD was fully evaluated by our SME

pilots for all required training tasks and was found suitable for our training program. Additionally, a training effectiveness analysis was conducted to compare pilot performance in post-training proficiency evaluations and found no significant degradation in training effectiveness between pilots trained in the XR FSTD and those trained using conventional methods.

Please do not hesitate to contact me with any questions.

Sincerely,

(Signature)
Management Representative

Attachments:

- XR FSTD subjective evaluation checklist (Attachment 2)
- XR FSTD Part 60 Gap Analysis
- Simulator Sickness Assessment
- Training Effectiveness Assessment Report or Plan