DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

14 CFR Parts 1, 23, 25, 27, 29, 61, 91, 121, 125, and 135

[Docket No.: FAA–2013–0485; Amdt. Nos. 1–70, 23–63, 25–144, 27–48, 29–56, 61–139, 91–345, 121–376, 125–66, and 135–135]

RIN 2120–AJ94

Revisions to Operational Requirements for the Use of Enhanced Flight Vision Systems (EFVS) and to Pilot Compartment View Requirements for Vision Systems

AGENCY: Federal Aviation Administration (FAA), DOT.

ACTION: Final rule.

SUMMARY: Prior to this final rule, persons could only use an Enhanced Flight Vision System (EFVS) in lieu of natural vision to descend below the decision altitude, decision height, or minimum descent altitude (DA/DH or MDA) down to 100 feet above the touchdown zone elevation (TDZE) using certain straight-in landing instrument approach procedures (IAPs). This final rule permits operators to use an EFVS in lieu of natural vision to continue descending from 100 feet above the TDZE to the runway and to land on certain straight-in IAPs under instrument flight rules (IFR). This final rule also revises and relocates the regulations that permit operators to use an EFVS in lieu of natural vision to descend to 100 feet above the TDZE using certain straight-in IAPs. Additionally, this final rule addresses provisions that permit operators who conduct EFVS operations under parts 121, 125, or 135 to use EFVS-equipped aircraft to dispatch, release, or takeoff under IFR, and revises the regulations for those operators to initiate and continue an approach, when the destination airport weather is below authorized visibility minimums for the runway of intended landing. This final rule establishes pilot training and recent flight experience requirements for operators who use EFVS in lieu of natural vision to descend below the DA/DH or MDA. EFVS-equipped aircraft conducting operations to touchdown and rollout are required to meet additional airworthiness requirements. This final rule also revises pilot compartment view certification requirements for vision systems using a transparent display surface located in the pilot's outside field of view. The final rule takes advantage of advanced vision capabilities, thereby achieving the Next Generation Air Transportation System (NextGen) goals of increasing access, efficiency, and throughput at many airports when low visibility is the limiting factor. Additionally, it enables EFVS operations in reduced visibilities on a greater number of approach procedure types while maintaining an equivalent level of safety.

DATES: The final rule is effective March 13, 2017, except for the amendments to §§ 61.66 (amendatory instruction no. 15), 91.175 (amendatory instruction no. 18), 91.1039 (amendatory instruction no. 23), 121.651 (amendatory instruction no. 27), 125.325 (amendatory instruction no. 33), 125.381 (amendatory instruction no. 35), and 135.225 (amendatory instruction no. 38), which are effective March 13, 2018.

ADDRESSES: For information on where to obtain copies of rulemaking documents and other information related to this final rule, see ''How to Obtain Additional Information'' in the **SUPPLEMENTARY INFORMATION** section of this document.

FOR FURTHER INFORMATION CONTACT: For technical questions concerning this action, contact Terry King, Flight Technologies and Procedures Division, AFS–400, Flight Standards Service, Federal Aviation Administration, 800 Independence Avenue SW., Washington, DC 20591; telephone (202) 267–8790; email *Terry.King@faa.gov*.

SUPPLEMENTARY INFORMATION:

Authority for This Rulemaking

The FAA's authority to issue rules on aviation safety is found in Title 49 of the United States Code (49 U.S.C.). Subtitle I, Section 106 describes the authority of the FAA Administrator. Subtitle VII, Aviation Programs, describes in more detail the scope of the agency's authority.

This rulemaking is promulgated under the authority described in 49 U.S.C. 40103, which vests the Administrator with broad authority to prescribe regulations to ensure the safety of aircraft and the efficient use of airspace, and 49 U.S.C. 44701(a)(5), which requires the Administrator to promulgate regulations and minimum standards for other practices, methods, and procedures necessary for safety in air commerce and national security.

List of Abbreviations and Acronyms Frequently Used in This Document

AC—Advisory circular
ADS–B—Automatic Dependent Surveillance-Broadcast
AFM—Airplane flight manual
AFMS—Airplane flight manual supplement
AIM—Aeronautical Information Manual
ALPA—Airline Pilots Association
APV—Approach (procedure) with vertical guidance
ASR—Airport surveillance radar
ATC—Air Traffic Control
AWO—All weather operations
AWOH ARC—All Weather Operations Harmonization Aviation Rulemaking Committee
CAA—Civil aviation authority
CVS—Combined Vision System
DA—Decision altitude
DH—Decision height
EASA—European Aviation Safety Agency
EFVS—Enhanced Flight Vision System
EVS—Enhanced Vision System
FAA—Federal Aviation Administration
FAF—Final approach fix
FFS—Full flight simulator
FPARC—Flight path angle reference cue
FPV—Flight path vector
FSB—Flight Standardization Board
GAMA—General Aviation Manufacturers Association
GPS—Global positioning system
HAI—Helicopter Association International
HGS—Head Up Guidance System
HMD—Head mounted display
HUD—Head up display
IAP—Instrument approach procedure
ICAO—International Civil Aviation Organization
ICAO HESC—International Civil Aviation Organization HUD, EVS, SVS, and CVS Subgroup
IFR—Instrument flight rules
ILS—Instrument landing system
IMC—Instrument meteorological conditions
IR—Infrared
LED—Light emitting diode
LIDAR—Laser imaging detection and ranging
LOA—Letter of authorization
LODA—Letter of deviation authority
LPV—Localizer performance with vertical guidance
MASPS—Minimum aviation system performance standards
MDA—Minimum descent altitude
MSpec—Management specifications
NextGen—Next Generation Air Transportation System
NPRM—Notice of Proposed Rulemaking
NVG—Night vision goggle
OEM—Original equipment manufacturer
OpSpec—Operations specifications
PAR—Precision approach radar
PCG—Pilot/Controller Glossary
PIC—Pilot in Command
RNAV—Area navigation
RNP—Required navigation performance
RVR—Runway visual range
SNPRM—Supplemental Notice of Proposed Rulemaking
TERPS—Terminal instrument procedures
TDZE—Touchdown Zone Elevation
VFR—Visual flight rules
VNAV—Vertical navigation
WAAS—Wide area augmentation system

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I. Overview of Final Rule

This final rule modifies the requirements for EFVS operations. The FAA is revising the definition of an EFVS in § 1.1 to describe the components of an EFVS and to specify that an EFVS is an ''installed aircraft system'' rather than an ''installed airborne system'' because some EFVS operations may be conducted on the surface as well as airborne. The FAA is also adding a new term, ''EFVS operation,'' to § 1.1.

The FAA is creating new § 91.176, which contains the operating rules for EFVS operations to touchdown and rollout and for EFVS operations to 100 feet above the TDZE. The FAA is relocating to § 91.176(b) the regulations for EFVS operations to 100 feet above the TDZE, which were previously located in § 91.175(l) and (m), and is revising and restructuring these regulations. Prior to this final rule, persons could only use EFVS in lieu of natural vision to descend below DA/DH or MDA down to 100 feet above the TDZE using certain straight-in landing IAPs. Section 91.176(a) now expands the existing operational capability by permitting persons to use an EFVS in lieu of natural vision to continue descending below 100 feet above the TDZE to landing and rollout. Paragraphs (a) and (b) of § 91.176 are organized into three main areas—equipment requirements, operating requirements, and visibility and visual reference requirements. The equipment,

operating, and visibility requirements in paragraph (a) for conducting an EFVS operation to touchdown and rollout are different from the requirements in paragraph (b) for conducting an EFVS operation to 100 feet above the TDZE. In addition, persons are permitted to use two new visual references for descent below 100 feet above the TDZE for EFVS operations conducted under both § 91.176(a) and (b). The FAA is also amending the operating rules for Category II and Category III operations in § 91.189 to permit the use of EFVS in lieu of natural vision during the performance of those operations.

This final rule also establishes training and recent flight experience requirements for persons conducting EFVS operations.[1] The ground and flight training requirements in § 61.66(a), (b) and (c) apply to pilots conducting EFVS operations to 100 feet above the TDZE as well as to pilots conducting EFVS operations to touchdown and rollout. A pilot must comply with the training provisions of part 61 in addition to the training provisions of the part under which the operation is conducted, which may require additional ground and flight training appropriate to the particular assignment of the pilot flightcrew member. Recent flight experience and refresher training requirements for persons conducting EFVS operations are located in § 61.66(d) and (e). Additionally, § 61.66(f) contains the requirements applicable to military and former military pilots in the U.S. Armed Forces who wish to conduct EFVS operations under § 91.176.

The FAA is revising §§ 121.651, 125.325, 125.381, and 135.225 to permit operators of EFVS-equipped aircraft to initiate or continue an approach when the destination airport visibility is below authorized minimums. The FAA is also revising § 91.1039(e) to permit part 91 subpart K operators to conduct takeoff operations using EFVS when the visibility is less than 600 feet in accordance with the certificate holders' Management Specifications (MSpec) for EFVS operations, and to clarify that an EFVS operation is permitted when the landing weather minimums are less than those prescribed by the authority having jurisdiction over the airport.

Section 91.176(a)(2)(viii) through (xi) requires operators conducting EFVS operations to touchdown and rollout under part 91, 121, 125 (including part 125 Letter of Deviation Authority (LODA) holders), 129, or 135 to obtain FAA authorization to conduct those operations. Section 91.176(b)(2)(vii) through (ix) requires operators conducting EFVS operations to 100 feet above the TDZE under part 91 subpart K, 121, 125 (including part 125 LODA holders), or 135 to obtain FAA authorization to conduct those operations. Under § 91.176(b)(2), part 91 operators, other than those operating under part 91 subpart K, are not required to obtain FAA authorization to conduct EFVS operations to 100 feet above the TDZE.

The FAA now revises the pilot compartment view rules contained in §§ 23.773, 25.773, 27.773, and 29.773 to establish airworthiness standards for vision systems with a transparent display surface located in the pilot's outside field of view, such as a head up display, head mounted display, or other equivalent display. This final rule eliminates the current need to issue special conditions for vision system video on a head up display. The FAA notes that its Notice of Proposed Rulemaking (NPRM), ''Revision of Airworthiness Standards for Normal, Utility, Acrobatic, and Commuter Category Airplanes,'' 81 FR 13452 (Mar. 14, 2016), contains proposals that significantly restructure part 23. Because the part 23 NPRM is pending, references to part 23 in this final rule refer to existing part 23, and revisions to the pilot compartment view rules contained in §§ 23.773, 25.773, 27.773, and 29.773 include the general requirements that were previously contained in special conditions. Revising § 23.773 establishes a requirement that could later be used as a means of compliance if the proposed part 23 rule becomes final.

This final rule also makes related and conforming amendments to §§ 91.175, 91.905 and 135.225. The FAA is updating regulatory cross references and terms in § 91.175 to coincide with this final rule and with another FAA final rule, which was published after the NPRM.[2] The FAA is amending § 91.905 to include § 91.176 as a regulation subject to waiver. Additionally, the FAA is revising § 135.225 to correct a drafting error that arose from another final rule, ''Enhanced Flight Vision Systems,'' 69 FR 1620 (Jan. 9, 2004), and later identified in an FAA legal interpretation dated September 20, 2013.[3]

II. Background

A. Statement of the Problem

The FAA created regulations in 2004, § 91.175(l) and (m), which permitted persons to use an EFVS in lieu of natural vision to descend an aircraft below DA/DH or MDA down to 100 feet above the TDZE. These regulations, however, did not provide operators with the ability to fully utilize the benefits of EFVS technology. The FAA believes it can better leverage EFVS capabilities by issuing performance-based requirements for current and future enhanced flight vision systems, which should increase access, efficiency, and throughput at many airports when low visibility is a factor.

Under the 2004 EFVS regulations, the pilot of an aircraft operating under part 121, 125, or 135 could not begin an approach or continue an approach past the final approach fix (FAF), or, where a FAF was not used, begin the final approach segment of an instrument approach procedure, when the weather at the destination airport was reported to be below authorized minimums. These restrictions prevented persons conducting operations under parts 121, 125, or 135 from using EFVS for maximum operational benefit.

Under § 91.175(l), persons could use the enhanced flight visibility provided by an EFVS for operational benefit only in that portion of the visual segment of an approach that extended from DA/DH or MDA down to 100 feet above the TDZE. While that provided significant benefits, the requirement to transition to natural vision at 100 feet above the TDZE prevented operators from realizing the benefits of permitting EFVS operations to touchdown and rollout.

Furthermore, the 2004 EFVS regulations did not specify any training, recent flight experience, or proficiency requirements in part 61 for persons conducting EFVS operations. Since the 2004 final rule was enacted, the number of EFVS operations has significantly increased. The FAA believes this final rule will further increase the number of operators conducting EFVS operations to lower altitudes in low visibility conditions. Therefore, training, recent flight experience, and refresher training requirements in part 61 are needed to ensure an appropriate level of safety is maintained.

Additionally, the 2004 EFVS regulations did not permit persons to use EFVS for operational benefit during Category II and Category III operations. The FAA believes an EFVS can provide operational and safety benefits during Category II and Category III operations,

[1] As further discussed in section III.E of this preamble, the FAA has reorganized the training, recent flight experience, and proficiency requirements that were proposed in §§ 61.31 and 61.57 and consolidated them in new § 61.66.

[2] Qualification, Service, and Use of Crewmembers and Aircraft Dispatchers, 78 FR 67800 (Nov. 12, 2013).

[3] Legal Interpretation, Letter to Mr. Phillip Kelsey from Mark W. Bury, Acting Assistant Chief Counsel for Regulations (September 20, 2013).

especially as more advanced imaging sensor capabilities are developed, which function more effectively in lower visibility conditions.

Finally, prior to this final rule, there were no airworthiness standards that specifically addressed vision systems, such as EFVS. Accordingly, the FAA used special conditions to certificate aircraft with vision systems, which imposed significant delays on the certification process.

B. Related Actions

The FAA revised Advisory Circular (AC) 90–106, Enhanced Flight Vision Systems, and AC 20–167, Airworthiness Approval of Enhanced Vision System, Synthetic Vision System, Combined Vision System, and Enhanced Flight Vision System Equipment to incorporate the provisions of this final rule. AC 90–106A contains guidance for the operational approval of EFVS, and AC 20–167A specifies a means of compliance that may be used to obtain airworthiness approval for EFVS.

C. Summary of the NPRM

On June 11, 2013, the FAA published an NPRM titled ''Revisions to Operational Requirements for the Use of Enhanced Flight Vision Systems (EFVS) and to Pilot Compartment View Requirements for Vision Systems,'' 78 FR 34935. The comment period was initially scheduled to close on September 9, 2013. Dassault Aviation submitted a request to extend the NPRM comment period to October 15, 2013, stating that it needed additional time to evaluate and prepare comments for the NPRM, draft AC 90–106A, and draft AC 20–167A, all of which are directly related. On September 6, 2013, the FAA published a notice in the **Federal Register** extending the NPRM comment period to October 15, 2013, to coincide with the close of comment period for draft AC 90–106A and draft AC 20–167A. ''Revisions to Operational Requirements for the Use of Enhanced Flight Vision Systems (EFVS) and to Pilot Compartment View Requirements for Vision Systems; Extension of Comment Period,'' 78 FR 54790.

The regulatory evaluation associated with the NPRM was not posted to the docket prior to the close of the comment period. Therefore, to ensure that the public had the opportunity to provide comments specifically on the regulatory evaluation posted in the docket, the FAA published a notice in the **Federal Register** on August 20, 2015, reopening the comment period for 30 days to allow for comments on the regulatory evaluation only. ''Revisions to Operational Requirements for the Use of Enhanced Flight Vision Systems (EFVS) and to Pilot Compartment View Requirements for Vision Systems; Reopening of Comment Period,'' 80 FR 50587.

In the NPRM, the FAA proposed to—

- More fully define the components of an EFVS and provide a definition of the term ''EFVS operation'' in § 1.1.
- Establish airworthiness standards for vision systems with a transparent display surface located in the pilot's outside field of view in §§ 23.773, 25.773, 27.773, and 29.773.
- Require training and an endorsement for EFVS operations in § 61.31(l).
- Require recent flight experience or a proficiency check for a person conducting an EFVS operation or acting as pilot in command (PIC) during an EFVS operation in § 61.57(i).
- Re-designate § 91.175(l) and (m) as § 91.176(b). The FAA proposed to place all EFVS regulations contained in part 91, except those pertaining to Category II and Category III operations, in a single new section for organizational and regulatory clarity.
- Permit EFVS to be used in lieu of natural vision to continue descending below 100 feet above the touchdown zone provided certain equipment, operating, visibility, and visual reference requirements were met.
- Permit an EFVS to be used to identify the visual references required to continue an approach below the authorized DA/DH on Category II and Category III approaches conducted under § 91.189 that provide and require the use of a DA/DH.
- Add § 91.176 to the list of rules subject to waiver in § 91.905.
- Amend §§ 121.613 and 121.615 to permit an EFVS-equipped aircraft to be dispatched or released when the visibility was forecast or reported to be below authorized minimums for a destination airport.
- Permit a pilot conducting an EFVS operation in accordance with § 121.651 to continue an approach past the FAF, or begin the final approach segment of an instrument approach procedure, when the weather was reported to be below authorized visibility minimums. Proposed § 121.651 also would have permitted EFVS-equipped part 121 operators to conduct EFVS operations in accordance with § 91.176 and their operations specifications issued for EFVS operations.
- Permit flight release under §§ 125.361 and 125.363 for EFVS-equipped aircraft when weather reports or forecasts indicated that arrival weather conditions at the destination airport would be below authorized minimums.
- Permit the pilot of an EFVS-equipped aircraft to execute an instrument approach procedure when the weather is reported below authorized visibility minimums under §§ 125.325 and 125.381. Proposed § 125.381 also would have permitted EFVS-equipped part 125 operators to conduct EFVS operations in accordance with § 91.176 and their operations specifications.
- Permit flights in EFVS-equipped aircraft to be initiated under § 135.219 when weather reports or forecasts indicated that arrival weather conditions at the destination airport would be below authorized minimums.
- Permit the pilot of an EFVS-equipped aircraft to initiate an instrument approach procedure under § 135.225 when the reported visibility was below the authorized visibility minimums for the approach. Proposed § 135.225 also would have permitted EFVS-equipped part 135 operators to conduct EFVS operations in accordance with § 91.176 and their operations specifications issued for EFVS operations.
- Make additional related and conforming amendments.

In the NPRM, the FAA proposed performance-based requirements not limited to a specific sensor technology. The FAA intended to accommodate future developments in real-time sensor technologies and maximize the benefits of advanced flight deck systems. The final rule is consistent with the agency's Next Generation Air Transportation System (NextGen) goals of increasing access and throughput during low visibility operations.

The operating requirements of the proposal only addressed enhanced flight vision systems that utilize a real-time image of the external scene topography. The proposed operating requirements did not address synthetic vision, which uses a computer-generated image of the external scene topography from the perspective of the flight deck, derived from aircraft attitude, a high precision navigation solution, and a database of terrain, obstacles and relevant cultural features. The airworthiness standards proposed in §§ 23.773, 25.773, 27.773, and 29.773, however, addressed synthetic vision systems (SVS) with a transparent display surface located in the pilot's outside field of view because the airworthiness standards apply to more than enhanced flight vision systems; they apply to all transparent display surfaces located in the pilot's outside field of view.

Finally, the NPRM did not address the use of EFVS for takeoff because the FAA can authorize these operations through existing processes. Section 91.175(f) already provides a means for persons conducting operations under parts 121, 125, 129, or 135 to obtain authorization for lower than standard takeoff minimums, which could include the use of EFVS. Additionally, the regulations do not prescribe civil airport takeoff minimums for part 91 operators (other than part 91subpart K operators) as discussed in section III.C.2.h of this preamble.

D. General Overview of Comments

The FAA received comments from 34 commenters. The commenters consisted of 16 original equipment manufacturers (OEMs), five industry associations, several operators, an aircraft management service, an aerospace consulting company, a standards organization, and several individuals. All but one commenter generally supported the proposed changes. Three commenters supported the proposal with no changes, and the remaining 30 commenters generally supported the proposal with 171 comments containing questions, concerns, and suggested changes.

A number of commenters stated that they support the FAA's intent to better leverage EFVS capabilities by providing a performance-based regulation for existing and evolving EFVS technology. One commenter stated that future improvements in EFVS sensor technologies may enable additional performance-based operations under the FAA's proposal, and others commented that they believe EFVS technology has tremendous potential for increasing safety and enhancing airspace utilization within the NAS while creating economic benefits to the public. Several industry associations said they strongly support the FAA creating and supporting a flexible regulatory structure that encourages innovation and improves operational efficiencies. Several OEMs specifically supported the FAA's proposal to eliminate the need to issue special conditions by revising the pilot compartment view certification requirements in the airworthiness standards of parts 23, 25, 27, and 29.

Specific changes recommended by the commenters as well as the concerns expressed by one individual who opposed the FAA's proposal are discussed in detail in ''Section III. Discussion of Final Rule and Public Comments.''

III. Discussion of Final Rule and Public Comments

A. Revise the Definition for EFVS and Add a Definition for EFVS Operation (§ 1.1)

Section 1.1 defines enhanced flight vision system (EFVS) to mean ''an installed aircraft system which uses an electronic means to provide a display of the forward external scene topography (the natural or manmade features of a place or region especially in a way to show their relative positions and elevation) through the use of imaging sensors, such as forward-looking infrared, millimeter wave radiometry, millimeter wave radar, or low-light level image intensification. An EFVS includes the display element, sensors, computers and power supplies, indications, and controls.'' This definition differs from what was proposed in the NPRM, because the FAA is not including the equipment requirements in the definition, which proposed ''The EFVS sensor imagery and required aircraft flight information and flight symbology are displayed on a head up display, or an equivalent display, so that they are clearly visible to the pilot flying in his or her normal position with the line of vision looking forward along the flight path.'' The proposed definition would have inappropriately embedded requirements.

The definition of EFVS also differs from what was proposed in the NPRM because the FAA is not using the word ''applicable'' to describe the natural or manmade features that an EFVS may display. Upon further reflection, the FAA has decided that the word ''applicable'' could generate confusion because an EFVS cannot differentiate between applicable and non-applicable items. An EFVS simply senses and displays items. The FAA is, however, adopting the proposed relocation to § 1.1 of the descriptive material from § 91.175(m)(3).

Garmin International suggested that the FAA revise the definition of EFVS by replacing ''EFVS sensor imagery'' with ''EFVS image'' or ''EFVS sensor imagery and aircraft flight symbology.'' In other words, Garmin was concerned that the term ''sensor imagery,'' as used in the definition, might be misinterpreted to mean only the image from the imaging sensor without encompassing the remaining EFVS elements. Garmin also believed its suggested revision would make the proposed definition in § 1.1 more consistent with proposed §§ 91.176(a)(1)(i)(B), 91.176(a)(1)(i)(E), and 91.176(a)(1)(ii).

The FAA is not adopting the proposed equipment requirements in the definition of EFVS, because § 91.176(a)(1)(i)(B) already contains these requirements.[4] This decision is not intended to be a substantive change as the FAA is relying on the equipment requirements in § 91.176(a)(1)(i)(B) to replace the requirements it had proposed in the definition of EFVS. Definitions only describe what something is, not what it must do. Accordingly, definitions should not contain substantive regulatory provisions, such as regulatory requirements. If the FAA were to adopt requirements in the definition of EFVS, the FAA would not be able to grant an exemption from those requirements in the future because the FAA's regulations describe an exemption as a request for relief from the requirements of a regulation.[5] Nor would the FAA be able to grant a waiver from those requirements, if they were in the definition, because § 91.903 permits the FAA to grant a waiver from any rule listed in § 91.905 and a definition is not a rule. Therefore, § 1.1 defines the EFVS to which § 91.176 applies and § 91.176 contains the regulatory requirements.

This change obviates addressing Garmin's concern because the definition no longer contains the terminology Garmin sought to revise. However, as a result of Garmin's comment, the FAA discovered that § 91.176(a) and (b), as proposed, did not contain specific references to ''aircraft flight information,'' as had been proposed in the definition of EFVS in § 1.1. Accordingly, the FAA is revising paragraphs (a) and (b) of § 91.176 to include ''aircraft flight information'' where appropriate.

Section 1.1 defines an ''EFVS operation'' as an operation in which visibility conditions require an EFVS to be used in lieu of natural vision to perform an approach or landing, determine enhanced flight visibility, identify required visual references, or conduct the rollout. This definition differs slightly from the NPRM, where the FAA proposed to define ''EFVS operation'' as an operation in which an EFVS is required to be used to perform such tasks. This change clarifies that not all operations in which a pilot uses an EFVS constitute an EFVS operation under the definition. Rather, an EFVS

[4] Section 91.176(a)(1)(i)(B) requires an EFVS to present EFVS sensor imagery, aircraft flight information, and flight symbology on a head up display, or an equivalent display, so that they are clearly visible to the pilot flying in his or her normal position with the line of vision looking forward along the flight path.

[5] 14 CFR 11.15

operation is an operation that a pilot would not be permitted to perform without the use of an EFVS. For example, a person may not descend below the DA/DH using natural vision if the flight visibility using natural vision is less than what is required by the instrument approach procedure being flown. That person may, however, use an EFVS in lieu of natural vision to descend below the DA/DH if the enhanced flight visibility is not less than what is required by the instrument approach procedure.

Boeing commented that the FAA stated in the preamble that while an EFVS can provide situation awareness in any phase of flight, such use would not constitute an EFVS operation unless an EFVS was required in lieu of natural vision to perform any visual task associated with approach, landing, and rollout. Boeing recommended that the FAA consider not just approach, landing, and rollout as part of an EFVS operation but approach, landing, and/or rollout to clarify that EFVS might be used for one segment of the terminal operation, but not other segments.

The FAA agrees but Boeing's concern is addressed in the definition of ''EFVS operation'' in § 1.1.

B. Consolidate EFVS Requirements in Part 91 in a New Section (§ 91.176)

The FAA created a new section, § 91.176, for the EFVS regulations to ensure organizational and regulatory clarity. As the FAA originally proposed in the NPRM, § 91.176(a) contains the requirements for EFVS operations to touchdown and rollout, and § 91.176(b) contains the requirements, which were previously located in § 91.175(l) and (m), for EFVS operations to 100 feet above the TDZE. Boeing recommended that the FAA move the regulations for EFVS operations to 100 feet above the TDZE from § 91.176(b) to § 91.176(a), and move the regulations for EFVS operations to touchdown and rollout from § 91.176(a) to § 91.176(b). Boeing believed this format would facilitate reading and understanding the changes, because the existing EFVS rules, which were previously located in § 91.175(l) and (m), would be placed first.

The FAA disagrees with Boeing and is retaining the format as originally proposed. The FAA placed the new rules for EFVS operations to touchdown and rollout in § 91.176(a) because it believes that operators will eventually conduct the majority of EFVS operations to touchdown and rollout. Placing these regulations in § 91.176(a) facilitates quick reference. The FAA placed the rules for EFVS operations to 100 feet above the TDZE, which were previously located in § 91.175(l) and (m), in § 91.176(b) because it expects operators will use these rules less frequently in the future. Furthermore, the regulations for EFVS operations to touchdown and rollout are more extensive than the regulations for EFVS operations to 100 feet above the TDZE. By placing the more extensive rules in § 91.176(a), the FAA is able to cross reference the equipment requirements of § 91.176(a)(1)(i)(A)–(a)(1)(i)(F) in § 91.176(b)(1)(ii), thereby eliminating significant redundancy.

C. Equipment, Operating, and Visibility and Visual Reference Requirements for EFVS Operations to Touchdown and Rollout (§ 91.176(a))

1. Equipment Requirements

a. Real-Time Imaging Sensors

Section 91.176(a)(1)(i)(A) requires, as originally proposed in the NPRM, that an EFVS have an electronic means to provide a display of the forward external scene topography, which consists of the applicable natural or manmade features of a place or region, especially in a way to show their relative positions and elevation, through the use of imaging sensors, such as forward-looking infrared, millimeter wave radiometry, millimeter wave radar, or low-light level image intensification. Airbus and Thales commented on the list of imaging sensors. Airbus suggested that the FAA use an ellipsis at the end of the list to emphasize that it is not exhaustive, and Thales proposed that the FAA add laser imaging detection and ranging (LIDAR) to the list.

The FAA finds that the use of the term ''such as'' after the reference to imaging sensors indicates the list of examples is non-exhaustive. However, based on the concerns raised by the commenters, the FAA has revised the definition to clarify that imaging sensors includes but is not limited to the list of examples in §§ 1.1 and 91.176(a)(1)(i)(A).

b. Head Up Presentation Requirement for EFVS Operations

As originally proposed, § 91.176(a)(1)(i)(B) requires that an EFVS present the sensor imagery, aircraft flight information, and flight symbology on a head up display, or an equivalent display, so that the imagery, information and symbology are clearly visible to the pilot flying in his or her normal position with the line of vision looking forward along the flight path.[6] This requirement applies to both EFVS operations to touchdown and rollout and EFVS operations to 100 feet above the TDZE.[7]

Several commenters expressed concerns about the requirement to present sensor imagery, aircraft flight information, and flight symbology on a head up display (HUD). Honeywell commented that the FAA is unnecessarily restricting the goals of increased access, efficiency, and throughput in low visibility conditions by this requirement. Honeywell agreed that there is value in requiring EFVS information to be displayed on a HUD for EFVS operations to touchdown and rollout but believes EFVS operations to 100 feet above the TDZE should allow for head down presentations.[8] FedEx Express, Gulfstream Aerospace Corporation (Gulfstream), Honeywell, and General Aviation Manufacturers Association (GAMA) commented that the FAA should not limit an equivalent display to a head up presentation. Instead, it should consider all vision systems containing the required sensor imagery and flight symbology that meet an acceptable level of performance and safety for the intended operation. One commenter suggested that an acceptable location for an EFVS display, or an equivalent display, was in the normal line-of-sight established at 15 degrees below the horizontal plane, +/− 15 degrees for the vertical field-of-view, or +40 degrees up and -20 degrees down as a maximum deviation.

Commenters were also concerned that the head up presentation requirement might have limiting effects on future technology. Honeywell contended that the FAA's HUD requirement for EFVS does not allow for new technologies and new ways of presenting information that could be developed in the future. It also believed that alternative means for displaying the sensor imagery and flight information have already been shown to satisfy the necessary performance criteria. Additionally, several commenters stated that the FAA is unnecessarily limiting future aircraft or

[6] Section 91.175(m) previously contained this requirement.

[7] Section 91.176(b)(1)(ii) requires the EFVS to meet the requirements of § 91.176(a)(1)(i) with the exception of the flare prompt, flare guidance, and height above ground level requirements.

[8] Honeywell asserted that § 91.176(a) and (b) describe two different operations that do not necessarily require the same equipment. Honeywell explained that operators may currently perform Category II ILS approaches down to 100 feet above the TDZE using head down primary displays. Honeywell's comments are out of scope as the FAA did not propose to change the existing head-up display, or equivalent display, requirements. Furthermore, the FAA notes that EFVS operations to 100 feet above the TDZE and Category II ILS approaches down to 100 feet above the TDZE are two distinct operations.

systems that may be capable of meeting performance-based criteria appropriate for EFVS operations, such as vision systems that use head down displays, high-speed aircraft that have reduced or limited front window designs, or unmanned aerial systems (UASs). GAMA recommended that the FAA create a performance-based framework rather than making EFVS dependent only on HUD technology. It believes this would not only permit different technology solutions but would allow manufacturers to design an EFVS that enables operations to different performance minima.

The FAA is not adopting these recommendations because they are outside the scope of this rulemaking. The FAA did not propose to change the existing head-up display, or equivalent display, requirements under § 91.175(m).[9] Rather, the FAA proposed to expand EFVS operations to touchdown and rollout using the existing operational construct in § 91.175(l) and (m). More specifically, the FAA proposed to apply all the equipment requirements of the EFVS regulations found in § 91.175(m), including the head-up presentation requirement, to EFVS operations conducted to touchdown and rollout. As a result, others have not had an opportunity to comment on the use of HDDs to conduct EFVS operations. While the FAA is not issuing an SNPRM at this time to propose the use of HDDs under § 91.176, the FAA notes that it may grant waivers to OEMs from the applicable sections of § 91.176 to enable OEMs to use HDDs during EFVS operations for the purpose of research and development. After the FAA has had sufficient time to gather information and analyze the safety of HDDs used to conduct EFVS operations in the national airspace system, the FAA may contemplate future rulemaking.

c. EFVS Terminology

A couple of commenters sought clarification and alignment of the EFVS terminology used in § 91.176.

Under § 91.176(a)(1)(i), a U.S.-registered aircraft must have an operable EFVS that meets the applicable airworthiness requirements.[10] The terminology in this requirement differs slightly from the NPRM, which would have required an operable EFVS that had an FAA type design approval certified for EFVS operations. Dassault Aviation requested that the FAA clarify the terms ''approved EFVS,'' ''certified EFVS,'' and ''EFVS-equipped operator.'' The FAA finds it unnecessary to clarify the terms ''approved EFVS'' and ''EFVS-equipped operator'' because it did not specifically use these terms in the proposed regulations. Nor is the FAA using these terms in this final rule. The FAA also finds it unnecessary to clarify the term ''certified EFVS'' because it has deleted the word ''certified'' from proposed § 91.176(a)(1)(i), (a)(3)(i), and (b)(3)(i). Instead, the FAA is using the phrase ''meets the applicable airworthiness requirements.'' [11]

d. EFVS Equipment Requirements for Foreign-Registered Aircraft

Under § 91.176(a)(1)(i) and (b)(1)(i), an aircraft must be equipped with an operable EFVS that meets the applicable airworthiness requirements. The requirements in paragraphs (a)(1)(i) and (b)(1)(i) differ from the NPRM based on a comment from Thales and the ICAO standards that were adopted after the NPRM was published. Additionally, the NPRM proposed § 91.176(b)(1)(i) as § 91.176(b)(1)(iii).[12]

Thales commented that an EFVS-equipped foreign-registered aircraft that does not have an FAA type design approval, but has been certified by its own Civil Aviation Authority (CAA) to operate with an EFVS, should not have to demonstrate compliance to the FAA regulations. Thales stated that this requirement is not always feasible as a foreign CAA may not be able to correctly interpret the FAA regulations. In addition, it stated that this requirement is not consistent with International Civil Aviation Organization (ICAO) standards without citing the specific standards at issue.[13] Thales asserted that a foreign operator operating in the United States should only have to demonstrate that it has been authorized to operate the EFVS in accordance with the rules of its own CAA and that the FAA should recognize them as being compliant with FAA rules without requesting a specific compliance demonstration.

The FAA agrees that it should not require an EFVS-equipped foreign-registered aircraft to have an EFVS that meets the FAA's certification requirements if that EFVS has been certified by the foreign-registered aircraft's own CAA in accordance with ICAO Annex 6. ICAO Annex 6 defines an enhanced vision system (EVS) as a ''system to display electronic real-time images of the external scene achieved through the use of image sensors.'' ICAO's definition of EVS encompasses the FAA's definition of EFVS. Accordingly, the ICAO Annex 6 standards on EVS apply to EFVS.

Annex 6, Part I, Standard 6.23.2 requires the State of the Operator, in approving the operational use of EVS, to ensure that the equipment meets the appropriate airworthiness certification requirements. Annex 6, Part II, Standard 2.4.15.2 requires the State of Registry, in approving the operational use of EVS, to ensure that the equipment meets the appropriate airworthiness certification requirements.[14] Based on the FAA's interpretation of these standards, if an EFVS-equipped foreign-registered aircraft has an EFVS that has been approved by the State of the Operator or the State of Registry to meet the CAA's airworthiness certification requirements, the FAA cannot subsequently require that foreign-registered aircraft's EFVS to meet U.S. certification requirements.[15]

Accordingly, paragraphs (a)(1)(i) and (b)(1)(i) now require an aircraft to be equipped with an operable EFVS that meets the applicable airworthiness requirements. By using the phrase ''meets the applicable airworthiness requirements,'' the requirement applies to both U.S.-registered aircraft and foreign-registered aircraft. The U.S.-registered aircraft must be equipped with an EFVS that has demonstrated

[9] The FAA notes that commenters raised these issues in 2004. The FAA disagreed that it should permit the presentation of EFVS information on head down displays, and noted that EFVS information must be presented on a head up display, or an equivalent display, so that the imagery, aircraft flight information, and flight symbology are clearly visible to the pilot flying in his or her normal position with the line of vision looking forward along the flight path. Please see the previous disposition of comments in ''Enhanced Flight Vision Systems,'' 69 FR 1620 (Jan. 9, 2004).

[10] *See* AC No. 20–167A, *Airworthiness Approval of Enhanced Vision System, Synthetic Vision System, Combined Vision System, and Enhanced Flight Vision System Equipment* (providing guidance for obtaining airworthiness approval for enhanced and synthetic vision systems in aircraft).

[11] The disposition of Thales' comment in the next section of the preamble explains why the FAA is using the phrase ''meets the applicable airworthiness requirements.''

[12] The FAA restructured the requirements in proposed § 91.176(b)(1)(i)–(iii) to be more consistent with § 91.176(a)(1)(i) for organizational clarity.

[13] The FAA believes that Thales is referring to ICAO Annex 6, Part I, 6.23.2 and ICAO Annex 6, Part II, 2.4.15.2, which are discussed in the following paragraph. The FAA notes that ICAO adopted these standards after the NPRM was published on June 11, 2013.

[14] ICAO adopted Annex 6, Part I, Standard 6.23.2 and Annex 6, Part II, Standard 2.4.15.2 after the FAA issued the NPRM on June 11, 2013,

[15] The FAA could have required this prior to the adoption of Annex 6, Part I, Standard 6.23.2 and Annex 6, Part II, Standard 2.4.15.2, which explains why § 91.175(l)(7) previously required a foreign-registered aircraft to have an EFVS that complies with all of the EFVS requirements of 14 CFR and why the FAA proposed to retain the requirement in the NPRM.

compliance with the applicable airworthiness requirements by issuance of a design approval through the type certification process (*i.e.,* type certificate, amended type certificate, or supplemental type certificate).[16] The foreign-registered aircraft must be equipped with an EFVS that has been approved by either the State of the Operator or the State of Registry to meet the appropriate airworthiness certification requirements in accordance with ICAO Annex 6.

While a foreign-registered aircraft with an EFVS certified to a foreign airworthiness standard may operate within the United States without obtaining an FAA type design approval and without meeting the FAA's certification requirements, that EFVS-equipped foreign-registered aircraft must meet all of the requirements in § 91.176, including the equipment requirements, in order to be used in EFVS operations in the United States. This requirement is consistent with ICAO standards. Article 11 of the Convention on International Civil Aviation requires aircraft subject to its provisions and operating within the territory of a contracting State to comply with the applicable laws and regulations enacted by that State. ICAO Annex 6, Part I, Chapter 3 states that an operator shall meet and maintain the requirements of the States in which the operations are conducted and that an operator shall ensure that all pilots are familiar with the laws, regulations and procedures pertinent to the performance of their duties prescribed for the areas to be traversed.[17] Similarly, ICAO Annex 6, Part II, Chapter 2.1 requires the PIC to comply with the laws, regulations, and procedures of those States in which operations are conducted and to be familiar with the laws, regulations, and procedures pertinent to the performance of his or her duties prescribed for the areas to be traversed.[18] ICAO Annex 2, Standard 2.1.1 states that the rules of the air apply to aircraft of a contracting State to the extent they do not conflict with the rules published by the State having jurisdiction over the territory flown. The FAA also notes that certain foreign authorities have imposed requirements on operators of U.S.-registered aircraft in their airspace that are in addition to those established by the FAA to permit the conduct of EFVS operations.

[16] Section 91.175(l)(7) previously required an EFVS to have an FAA type design approval.

[17] ICAO Annex 6, Part I, Standards 3.1.1 and 3.1.2.

[18] ICAO Annex 6, Part II, Standards 2.1.1.1 and 2.1.1.2.

e. Line of Vision and Conformal Display

Section 91.176(a)(1)(i)(B) states, as originally proposed, that an EFVS must present EFVS sensor imagery, aircraft flight information, and flight symbology on a head up display, or an equivalent display, so that the imagery, information and symbology are clearly visible to the pilot flying in his or her normal position with the pilot's line of vision looking forward along the flight path.

Boeing commented that a sensor will likely be hard-mounted to the airframe such that it is pointing straight along the longitudinal axis. It also noted that a HUD is aligned with the longitudinal axis of the aircraft, and when someone flies a ''crabbed'' approach the flight path does not coincide with the longitudinal axis. Therefore, Boeing recommended that the FAA revise the rule from ''looking forward along the flight path'' to ''looking forward along the aircraft longitudinal axis with adequate downward field of view to accommodate sight along the normal flight path vector.'' Boeing noted that it is currently allowed to ''ghost'' symbology on the HUD that appears outside the HUD field of view, and that this capability should be preserved.

The FAA is not adopting Boeing's recommendation because it could unnecessarily restrict new technology that becomes available in the future. The EFVS requirements are performance-based, with means of compliance contained and updated as necessary in advisory circular documents. While the FAA recognizes that the aircraft's flight path may not necessarily coincide with the aircraft's longitudinal axis, the phrase ''clearly visible to the pilot flying in his or her normal position with the line of vision looking forward along the flight path'' is intended to ensure that the EFVS provides a head up presentation and will accommodate Boeing's recommendation.

As proposed in the NPRM, § 91.176(a)(1)(i)(C) requires an EFVS to present the displayed EFVS sensor imagery, attitude symbology, flight path vector (FPV), and flight path angle reference cue (FPARC), and other cues, which are referenced to the EFVS sensor imagery and external scene topography, so that they are aligned with, and scaled to, the external view. The term ''referenced to'' is used to reflect the FAA's expectation that the vision system imagery and certain symbology use the same coordinate reference system as the pilot's perspective outside view of the world. This is because the pilot uses the vision system imagery and symbology in coordination with, and sometimes in very low visibility as a substitute for, the outside view of the world, including the terrain, features of the runway environment, and topology in general.

Rockwell Collins asked whether it could conduct EFVS operations under the rule if the ''Flight Path Symbol'' became limited, and therefore nonconformal, to the EFVS image due to severe crosswinds or blowing snow conditions.

The ability to perform an EFVS operation with a nonconformal FPV depends on a variety of factors, such as the particular EFVS and the type and severity of the limiting conditions. Because the EFVS is the primary means by which the pilot will maneuver the airplane to land, conditions that cause the FPV to become field-of-view limited, and therefore nonconformal, could make the display unacceptable for landing. An applicant should demonstrate EFVS operations on a variety of instrument approach procedures and in various wind conditions with pilot-in-the-loop simulation and a flight test, if possible, to establish the operational effects that limiting conditions might have on landing with an EFVS. The FAA may impose limitations in the Airplane Flight Manual (AFM) or Airplane Flight Manual Supplement (AFMS) for conditions where the required level of performance is not satisfactorily demonstrated.

f. Flight Path Angle Reference Cue (FPARC)

Pursuant to § 91.176(a)(1)(i)(D), the EFVS must display the FPARC with a pitch scale, and the FPARC must be selectable by the pilot to the desired descent angle for the approach and be suitable for monitoring the vertical flight path of the aircraft. The FAA made changes to this paragraph from what it originally proposed based on concerns raised by Boeing.

Boeing asserted that the proposed requirement implied that the pitch scale was selectable, not the FPARC. Boeing commented that the FAA should revise § 91.176(a)(1)(i)(D) to clarify that the FPARC must be selectable by the pilot to the desired descent angle for the approach being flown. Boeing also recommended that the provision indicate that the appropriate descent angle associated with the approach be selectable either by the pilot or automatically by the flight management computer.

The FAA agrees and is revising § 91.176(a)(1)(i)(D) accordingly. However, the FAA does not consider it necessary to specify whether the

descent angle selected is accomplished manually or automatically. The rule does not prohibit the automatic setting of the flight path angle; however, the pilot must have the ability to either manually select the flight path angle or to manually override the automatic setting.

g. Requirement To Display Height Above Ground Level

Section 91.176(a)(1)(i)(B) specifies an equipment requirement for EFVS operations to touchdown and rollout, which requires an EFVS to display height above ground level, such as that provided by a radio altimeter or other device capable of providing equivalent performance. Dassault Aviation asked whether the FAA could provide an example of such a device.

The FAA is not providing an example of an equivalent device, because it intends this rule to be a performance based requirement that is not limited to one device and that could accommodate future advances in technology. The FAA notes, however, that such a device must be capable of equivalently performing the function of a radio altimeter, which is to provide an accurate and reliable indication of aircraft height above the ground.

h. Requirement To Display Flare Prompt or Flare Guidance

For EFVS operations to touchdown and rollout in aircraft other than rotorcraft, § 91.176(a)(1)(i)(B) requires the EFVS to display flare prompt or flare guidance. This requirement reflects a slight change from what was proposed in the NPRM, where the FAA would have required the display of flare prompt or flare guidance for all aircraft, for achieving acceptable touchdown performance.

Helicopter Association International (HAI) commented that rotorcraft certificated under parts 27 and 29 should be excluded from the requirement to display flare prompt or flare guidance, because parts 27 and 29 do not require flare prompt or flare guidance based on lower operating speed and maneuverability. The FAA agrees for the reasons the commenter provided. Accordingly, § 91.176(a)(1)(i)(B) now excepts rotorcraft from the requirement.

Boeing and Airbus also raised concerns about the definition of acceptable touchdown performance. Boeing stated that the FAA should define acceptable touchdown performance in guidance material, because it was unsure whether the term meant landing in the touchdown zone, compliance with landing performance specified in AC 120–28D, equivalency to the AIII mode of a head up guidance system, or compliance with some other performance standard. Boeing also suggested that the FAA address quantitative standards in guidance material to ensure an applicant or designer can demonstrate compliance with the regulatory requirement. Airbus provided a similar comment, suggesting that the FAA provide pass/fail criteria for acceptable touchdown performance during an EFVS operation using flare prompt or flare guidance.

The FAA is not adopting a requirement ''as appropriate, for acceptable touchdown performance'' under § 91.176(a)(1)(i)(B) because the term ''acceptable touchdown performance'' is both vague, as identified by the commenters, and extraneous. ''Acceptable touchdown performance'' is not a regulatory term to date. Nor is it defined in the regulations. Furthermore, § 91.176(a)(1)(i)(F) already requires an EFVS to display characteristics, dynamics, and cues that are suitable for manual control of the aircraft to touchdown in the touchdown zone of the runway of intended landing. Because paragraph (a)(1)(i)(F) requires the flare cue, *i.e.* flare prompt or flare guidance, to be suitable for manual control of the aircraft to touchdown in the touchdown zone of the runway of intended landing, it is therefore unnecessary to require an EFVS to display flare prompt or flare guidance for achieving ''acceptable touchdown performance'' in paragraph (a)(1)(i)(B). Each applicant for a type design approval must demonstrate touchdown performance for their particular EFVS implementation using either flare prompt or flare guidance. AC 20–167, paragraph 6–2(f)(4) specifically discusses landing performance demonstrations for EFVS operations conducted to touchdown and rollout and provides a means of demonstrating compliance for applicants or designers.

Boeing further commented that the FAA should provide touchdown requirements that are strictly performance-based and asserted that the FAA should not require flare guidance or flare cue for a particular EFVS implementation if the pilot can achieve acceptable sink rate and position without them. The FAA disagrees. The FAA finds it necessary to provide the pilot with additional information to conduct a flare maneuver during conditions of low visibility typically encountered during EFVS operations to touchdown and rollout. The FAA based the requirement in § 91.176(a)(1)(i)(B) on RTCA DO–315A and incorporated it in the interest of safety to ensure continued safe approaches and landings in low visibility conditions.[19] The FAA notes that by requiring flare prompt or flare guidance for EFVS operations to touchdown and rollout, it provides manufacturers flexibility to use either means to achieve acceptable touchdown performance.

Airbus and Thales raised concerns about the requirement to display flare prompt or flare guidance when using autoland during EFVS operations. Airbus commented that EFVS operations using autoland should be possible, but the requirement to display flare prompt or flare guidance is not relevant when using it. Thales stated that the FAA should mandate flare prompt or flare guidance for manual operations using the EFVS to achieve acceptable touchdown performance, but it should not require an EFVS to display flare prompt or flare guidance during an approach using EFVS that is performed with a certified autoland function.

The FAA disagrees with the commenters. All autoland systems to date have been approved based on performance demonstrations at runways with Category III approach infrastructure. If conducting an autoland approach with any other kind of runway infrastructure (*i.e.,* less than Category III), the visual conditions must be sufficient for the pilot to monitor the operation and, if necessary, take immediate manual control. EFVS provides enhanced flight visibility to compensate for what the pilot cannot see unaided. In the case of an EFVS landing, the EFVS must be equipped with an approved flare prompt or flare guidance as part of the required visual information to be eligible for EFVS operational approval to land. For this reason, even if the crew is approved to use autoland during an EFVS operation, the EFVS must be equipped with and must display all of the required features.

i. Pilot Monitoring Display

When a minimum flightcrew of more than one pilot is required, § 91.176(a)(1)(ii) requires the aircraft to be equipped with a display that provides the pilot monitoring[20] with

[19] RTCA is a private, not-for-profit association. It was founded in 1935 as the Radio Technical Commission for Aeronautics to advance the art and science of aviation and aviation electronic systems for the benefit of the public. The organization functions as a Federal Advisory Committee and develops consensus-based recommendations on contemporary aviation issues. The organization's recommendations are often used as the basis for government and private sector decisions as well as the foundation for many FAA documents. For more information, see *http://www.rtca.org.*

[20] The term ''pilot monitoring'' refers to the individual who is sitting at the pilot controls and

EFVS sensor imagery Also, as proposed, the pilot monitoring display may provide symbology but any symbology displayed may not adversely obscure the sensor imagery of the runway environment. However, the FAA is not adopting the requirement for the pilot monitoring display to be located within the maximum primary field of view [21] of the pilot monitoring. This departure from what the FAA originally proposed arose as a result of the FAA's own continued review of the proposal. The FAA is also not adopting the requirement for the EFVS sensor imagery and aircraft flight symbology to be displayed to the pilot monitoring on a HUD or an equivalent display for certain future EFVS operations at the Administrator's discretion. This departure from what the FAA originally proposed arose out of comments.

Upon further reflection, the FAA is not adopting the requirement for the PM display to be located in the ''maximum primary field of view'' because the term ''maximum primary field of view'' is not used or defined in the regulations to-date and the proposed location requirement is unnecessary. When a PM display is installed on an aircraft, it must meet the arrangement and visibility requirements in §§ 23.1321, 25.1321, 27.1321, and 29.1321, which will achieve the same objective as the proposed requirement by requiring the PM display to be located so that any pilot seated at the controls can monitor the airplane's flight path and the instruments with minimum head and eye movement. The FAA will also require aircraft that pre-date §§ 23.1321, 25.1321, 27.1321, and 29.1321 to meet the arrangement and visibility requirements in those sections for the installation of PM displays. Because the airworthiness requirements of §§ 23.1321, 25.1321, 27.1321, and 29.1321 will already ensure the proper placement of a PM display, the FAA finds it unnecessary to adopt a location requirement in the operating rule.

Several commenters shared concerns about the provision in proposed § 91.176(a)(1)(ii) that would have allowed the Administrator to require a head up display, or equivalent display, for the pilot monitoring based upon the EFVS operation to be conducted. Boeing noted that designers and operators needed to know the conditions under which the FAA might require a head up display for the pilot monitoring. Similarly, Airbus asked the FAA for clarification, and Thales suggested that the FAA develop criteria to define when a pilot monitoring had to have a head up display. Additionally, Bombardier Aerospace was concerned that, while the FAA intended the language to provide for future technological advancements, the agency could immediately apply the requirement to current installations where it would be impractical to implement.

The FAA agrees with the commenters that the proposal was unclear. The FAA intended to address future EFVS operations and technological advancements; however, based on the confusion surrounding the provision, the FAA has decided not to adopt it. Instead, to facilitate the performance of future EFVS operations, the FAA is adding new § 91.176(a)(4) that states that the Administrator may prescribe additional equipment, operational, and visibility and visual reference requirements to account for specific equipment characteristics, operational procedures, or approach characteristics. These requirements will be specified in an operator's operations specifications, management specifications, or letter of authorization authorizing the use of EFVS. This provision will better facilitate the FAA's ability to respond to future technological developments without causing confusion around the pilot monitoring requirement.

Boeing also commented that the pilot monitoring display requirements should include a horizon line, flight path vector cue, and FPARC in addition to the EFVS sensor imagery. Boeing contended that without this aircraft flight symbology, the pilot monitoring would have no cues with which to judge performance and noted that RTCA DO–315A specifies the additional cues.

During EFVS operations to touchdown and rollout, when a minimum flightcrew of more than one pilot is required, the aircraft must be equipped with a display that provides the pilot monitoring with EFVS sensor imagery. The FAA finds it unnecessary to require additional features on the pilot monitoring display, such as an artificial horizon line, a flight path vector cue, and a FPARC, because the pilot monitoring display requirements are intended only to enable that pilot to see a real time sensor image of the required visual references. Section 91.176(a)(1)(ii) is a minimum requirement, however. Accordingly, it does not preclude OEMs and operators from including additional features, such as those described by the commenters. The FAA notes that any additional features that are displayed on the pilot monitoring display may not interfere with the EFVS image of the required visual references.

Boeing further stated that it was unclear whether the pilot monitoring display had to be a repeater of the display provided to the flying pilot, or an independent system. Sierra Nevada Corporation submitted a similar comment asking the FAA to clarify whether the EFVS sensor imagery required to be provided to the pilot monitoring had to be identical to that provided to the pilot flying on the HUD, or whether the pilot monitoring display could utilize imagery that was augmented by color, symbolic representation of features and obstacles, a synthetic database of features and obstacles, an alternate perspective view such as a top-down view, an alternate EFVS sensor source, or blending.

The FAA intends the regulatory requirement for the pilot monitoring display to be performance based. Accordingly, the provision does not specifically require a repeater display or an independent system. Nor does it preclude the display of imagery that is augmented by features such as those described by Sierra Nevada Corporation. Whether the pilot monitoring display should be a repeater display or an independent system will depend on the operation to be conducted. AC 20–167A contains means of compliance for the pilot monitoring display. The FAA also notes that, as display technology continues to improve, it will evaluate additional display capabilities and features that become available provided the display meets applicable airworthiness requirements.

Rockwell Collins also submitted comments on the pilot monitoring display. It asserted that the FAA should take into account other monitoring methods, such as those used by a pilot monitoring the safe conduct of a Head up Guidance System (HGS)-flown Category III approach, landing, and rollout. Such monitoring methods would not require a second HUD, nor would they require the pilot monitoring display to repeat the HUD symbology.

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monitoring the operation of the aircraft. Historically, the FAA has referred to this individual as the pilot not flying. In 2003, the FAA amended AC 120–71A, Standard Operating Procedures for Flight Deck Crewmembers, and replaced the term ''pilot not flying'' with ''pilot monitoring'' to convey that the pilot not flying should be actively engaged in the safe operation of the aircraft and, as such, should be trained and evaluated in performing active pilot monitoring skills. *See* Qualification, Service, and Use of Crewmembers and Aircraft Dispatchers, 78 FR 67800, 67812 (Nov. 12, 2013) (discussing pilot monitoring duties and training).

[21] Maximum primary field of view is based on the maximum vertical and horizontal visual fields from the design eye reference point. The values for the maximum vertical visual field (relative to normal line-of-sight forward of the airplane) are +40 degrees up and −20 degrees down. The values for the maximum horizontal visual field are +35 degrees left and +35 degrees right. AC 25–11B and AC 20–167A.

For example, a person could use expanded deviation scales based on global positioning system (GPS) to verify alignment with the runway, and ADS–B information to monitor other aircraft and vehicles on the runway. Rockwell Collins also proposed that the requirement identify the items that the pilot monitoring must monitor and assess, rather than indicating the actual equipment the pilot monitoring must use to perform the monitoring tasks, such as a display of EFVS imagery.

The FAA is not adopting Rockwell Collins' recommendations. When a minimum flightcrew of more than one pilot is required, the pilot monitoring must have a display that provides him or her with EFVS sensor imagery. This requirement is necessary because, when the pilot flying relies on EFVS from DA/DH to touchdown and rollout, it cannot be assumed that the pilot monitoring sees anything of the outside environment using natural vision. Providing the pilot monitoring with EFVS sensor imagery supports his or her view of the outside environment, enables confirmation of the required visual references and safe conduct of the approach and landing, and provides common situational awareness between the pilot flying and the pilot monitoring. The FAA notes, however, that the pilot monitoring display is not the only source of flight path information available to the pilot monitoring. The pilot monitoring may use GPS and ADS–B information, as Rockwell Collins suggested, in addition to the EFVS sensor imagery. The FAA further notes that the pilot monitoring should monitor sources of information that he or she would normally monitor during an approach and landing.

j. Applicability of EFVS Provisions to Rotorcraft Operations

The GAMA, HAI, and Eurocopter and American Eurocopter commented that the scope of the NPRM appeared to apply to both fixed-wing airplanes and rotorcraft; however, the technical requirements appear to apply only to fixed wing airplanes. GAMA and Eurocopter and American Eurocopter recommended that the FAA modify § 91.176(a)(1), as proposed in the NPRM, to ensure the equipment requirements accommodated the differences between airplanes and rotorcraft. They also recommended that the FAA consider permitting the use of EFVS in rotorcraft IFR operations, such as wide area augmentation system/localizer performance with vertical guidance (WAAS/LPV) approaches, published instrument approach procedures to heliports, offshore helicopter operations, and point in space instrument approaches.

The FAA notes that this rule does not preclude persons from conducting EFVS operations under IFR in rotorcraft. Section 91.176(a) limits EFVS operations to touchdown and rollout to approaches with a DA/DH and prohibits the pilot from using circling minimums. Currently, there are no instrument approach criteria or procedures that have been developed for straight-in landing operations below DA/DH under IFR to heliports or platforms. If such approach procedures were developed in the future for heliports or platforms, along with appropriate visual reference requirements for rotorcraft operations,[22] persons could conduct EFVS operations to a landing in rotorcraft on these approaches. However, EFVS operations may not be conducted on approaches to a point-in-space followed by a ''proceed VFR'' visual segment, or on approaches designed to a specific landing site using a ''proceed visually'' visual segment.

HAI also commented that the FAA should expand its references to landing and rollout to address the maneuverability of aircraft certificated under parts 27 and 29 and that it should specify ''approach to hover'' and ''hover taxiing.'' The FAA disagrees with the commenter. The FAA finds it unnecessary to expand the terminology in the EFVS regulations to specifically encompass the maneuverability of rotorcraft because it did not intend the terms landing and rollout to restrict persons from conducting EFVS operations in rotorcraft. The FAA also notes that this rule does not address taxi operations. Accordingly, this rule does not apply to hover taxiing.

k. Requirement To Obtain a Certificate of Waiver When Conducting Certain EFVS Operations

Section 91.176(d) states that the requirement to have an EFVS that meets the applicable airworthiness requirements specified in § 91.176(a)(1)(i), (a)(2)(iii), (b)(1)(i), and (b)(2)(iii) does not apply to operations conducted in an aircraft issued an experimental certificate under § 21.191 for the purpose of research and development or showing compliance with regulations provided the Administrator has determined that the operations can be conducted safely in accordance with operating limitations issued for that purpose. This paragraph was added as a result of comments.

The 2004 EFVS regulations, specifically § 91.175(l)(2), required a person to have a certified EFVS in order to use the EFVS in lieu of natural vision to descend below the authorized DA/DH or MDA. Proposed § 91.176 would have required the same. The FAA recognizes, however, that an EFVS used to obtain an FAA type design approval may not yet be certified. To date, a person obtaining an FAA type design approval with an EFVS that has not yet been certified has been required to obtain a certificate of waiver[23] in order to use the EFVS in lieu of natural vision to descend below the DA/DH or MDA during flights prior to type design approval.

FedEx Express, Gulfstream, Elbit Systems of America, Sierra Nevada Corporation, and GAMA commented that the FAA should eliminate the requirement to obtain a certificate of waiver from the EFVS rules in order to demonstrate compliance during EFVS certification flights. Several of these commenters further stated that the FAA should remove the term ''certified'' because the operating rules assume the equipment is certified. Additionally, many commenters felt that the FAA should not require waivers for certification flight tests that are conducted with aircraft in the experimental category.

The FAA acknowledges the commenters' concerns and is revising the EFVS regulations by adding § 91.176(d), which enables persons to conduct EFVS certification flights without obtaining a waiver, provided the Administrator has determined that the operations can be conducted safely in accordance with operating limitations issued for that purpose. The FAA will issue operating limitations when it approves an applicant's program letter describing the flight operations to be conducted and issues the experimental certificate for the purpose of research and development or showing compliance with regulations. The FAA is also adding the exception and a reference to § 91.176(d) to the introductions in § 91.176(a) and (b). The FAA finds that eliminating the waiver requirement, which resulted from the promulgation of § 91.175(l) and (m) in 2004, will streamline the process both for the FAA and for applicants seeking to certify an EFVS. This will be accomplished without a reduction in FAA oversight. The FAA notes, however, that an operator is not relieved from complying with the EFVS operating rules when it places an aircraft in the experimental category; it

[22] The visual reference requirements under § 91.176(a)(3) and (b)(3) were derived from the visual reference requirements under § 91.175(c)(3), which were established for runways.

[23] Section 91.175(l) was a rule subject to waiver under § 91.905.

is only relieved from the requirement to have an EFVS with an FAA type design approval for the purpose of research and development or showing compliance with the regulations. AC 90–106A and AC 20–167A contain guidance material pertaining to the § 91.176(d) exception.

2. Operating Requirements

a. Approaches Permitted for EFVS Operations

Under § 91.176(a), a person conducting an EFVS operation in an aircraft below the authorized DA/DH to touchdown and rollout must conduct the operation on an approach with minimums [24] that include a DA/DH. In the NPRM, the FAA had proposed to permit an EFVS operation below the authorized DA/DH to touchdown and rollout only using a straight-in precision instrument approach procedure or an approach procedure with approved vertical guidance. This change in the final rule arises out of comments asking the FAA to clarify what instrument approach procedures can be used for EFVS operations to touchdown and rollout. This change in language does not constitute a change in operational concept.

Boeing and the Airline Pilots Association (ALPA) objected to proposed § 91.176(a) because it was unclear which approach procedures they could use to conduct EFVS operations. For the reasons discussed in greater detail below, § 91.176(a) no longer states that EFVS operations to touchdown and rollout may be conducted using only straight-in precision instrument approach procedures or approach procedures with approved vertical guidance.

Boeing objected to limiting EFVS operations to ''straight-in'' approaches as defined in the Pilot/Controller Glossary (PCG). Relying on the PCG, Boeing asserted that a straight-in approach applies to an approach with no procedure turn, and a straight-in landing refers to a landing made on a runway aligned within 30 degrees of the final approach course following completion of an instrument approach. Boeing contended that flying a procedure turn should not affect whether someone could conduct EFVS operations. Boeing recommended that EFVS operations to touchdown and rollout be permitted using a ''straight-in landing'' from a precision approach or an approach with approved vertical guidance. Boeing recommended similar revisions to § 91.176(b).

The FAA agrees with Boeing that operators could have concluded from the proposal that a ''straight-in'' instrument approach procedure refers to an approach with no procedure turn. This is because the term ''straight-in approach'' is used differently in the Aeronautical Information Manual (AIM), the PCG, and the United States Standard for Terminal Instrument Procedures (TERPS).[25] The FAA did not intend to limit EFVS operations to touchdown and rollout to instrument approaches where the final approach was begun without first having executed a procedure turn. Therefore, § 91.176(a) now requires that a person must conduct an EFVS operation to touchdown and rollout on an approach with minimums that include a DA/DH. This revision ensures that a person may conduct EFVS operations to touchdown and rollout using precision approaches or approaches with approved vertical guidance regardless of whether the pilot first executes a procedure turn. Furthermore, paragraph (a)(2)(i) clarifies that EFVS operations to touchdown and rollout are not permitted on circling approaches. Adding paragraph (a)(2)(i) eliminates the confusion surrounding the terms straight-in approach and straight-in landing, while achieving the same objective—prohibiting EFVS operations using circling minimums. The FAA made similar revisions to § 91.176(b)(2)(i) as suggested by Boeing.

Boeing also recommended that the FAA permit EFVS operations on curved required navigation performance (RNP) approaches, which may have a straight-in landing segment. Boeing stated that the use of curved RNP approaches is increasing, that they are often used in mountainous terrain where go-arounds could be more of an issue, and that EFVS could improve safety and efficiency in such situations.

The FAA agrees that § 91.176(a) and (b) should not prohibit persons from conducting EFVS operations on curved RNP approaches that have a straight-in landing segment. RNP approaches are approved, vertically guided instrument approach procedures that are designed to align with a specific runway and terminate with a DA. While their line of minima is charted somewhat differently than other approaches with straight-in ''S'' line of minima, the curved RNP line of minima specifies a DA. Accordingly, § 91.176(a) and (b) permit RNP approaches. However, because EFVS performance may affect the specific approaches that an operator may conduct, the FAA may define applicable limitations in an operator's Operations Specifications (OpSpec), Management Specifications (MSpec), or Letter of Authorization (LOA) accordingly.

ALPA stated that the proposal would permit an EFVS operation to touchdown and rollout on a ''straight-in precision instrument approach procedure or an approach with approved vertical guidance,'' which would seem to encompass an approach procedure with vertical guidance (APV). However, APV describes a class of approach procedures defined in ICAO Annex 6 as an approach procedure ''which utilizes lateral and vertical guidance but does not meet the requirements established for precision approach and landing operations.'' Based on this definition, a person could conclude that an APV approach is a non-precision approach procedure. The proposal indicated that EFVS operations to touchdown and rollout would not be permitted on non-precision approaches. ALPA noted that this could cause confusion and recommended that the FAA clarify what it meant by ''approved vertical guidance.''

The FAA agrees with ALPA that the phrase ''straight-in precision approach procedure or an approach with approved vertical guidance'' is confusing because persons could conclude that APV approaches are non-precision approaches, which are not permitted under § 91.176(a). The FAA did not intend to prohibit persons from conducting EFVS operations to touchdown and rollout on APV approaches, which will have a charted DA/DH. Therefore, for this reason and in addition to the reasons Boeing raised, § 91.176(a) now permits EFVS operations to touchdown and rollout on approaches with minimums that include a DA/DH. Additionally, as mentioned previously, § 91.176(a)(2)(i)

[24] See Instrument Flying Handbook, FAA–H–8083–15B (2012) (stating that the term ''minimums'' refers to the landing section of an instrument approach chart, which sets forth the lowest altitude and visibility approved for the instrument approach procedure).

[25] The AIM provides the aviation community with basic flight information and Air Traffic Control (ATC) procedures. The PCG promotes a common understanding of terms used in the ATC system, including terms which are intended for pilot/controller communications. The TERPS consists of criteria for constructing terminal instrument procedures. In the AIM, ''straight-in approach'' describes a procedure with straight-in landing minimums, without regard to whether or not a procedure turn is required. In the PCG, ''straight-in approach'' means an instrument approach where the final approach is begun without first having executed a procedure turn, but not necessarily completed with a straight-in landing or made to straight-in landing minimums. The PCG defines a ''straight-in landing'' as ''a landing made on a runway aligned within 30 degrees of the final approach course following completion of an instrument approach.'' The use of ''straight-in approach'' in TERPS criteria generally refers to an approach that is aligned with a runway—not necessarily within 30 degrees—and for which straight-in landing minimums are authorized.

specifies that persons conducting EFVS operations may not use circling minimums. The FAA believes these revisions clarify that EFVS operations to touchdown and rollout may be conducted on APV approaches.

Sierra Nevada Corporation suggested editorial changes to proposed § 91.176(a) to clarify that persons must follow the requirements specified in paragraph (a). The commenter recommended similar revisions to § 91.176(b). The FAA agrees with the commenter and adopted the editorial changes in § 91.176(a), which more clearly articulate the regulatory requirements. The FAA did not, however, adopt the editorial changes in § 91.176(b) because they did not coincide with the revised language in that paragraph.

Dassault Aviation asked whether the FAA would take into account the new approach classifications described in the revised draft ICAO All Weather Operations (AWO) Manual in the EFVS regulations. Dassault Aviation stated that the draft AWO Manual describes 2D and 3D approaches rather than ''precision approaches'' and ''approaches with vertical guidance.'' The FAA is not including the ICAO terms or definitions in this final rule as they are outside the scope of the NPRM. The necessary references and descriptions in U.S. guidance material have not been updated at this time, but the FAA notes that the agency continues to work with ICAO on this subject.

Rockwell Collins commented that the FAA's statement in the proposal about not permitting EFVS operations to touchdown and rollout on non-precision approaches implies that non-precision approaches are no longer an approved EFVS operation. The FAA disagrees. Section 91.176 contains two distinct types of EFVS operations. Section 91.176(a) contains the new regulations, which enable EFVS operations to touchdown and rollout. Section 91.176(b) contains the regulations originally found in § 91.175(l) and (m), which enable EFVS operations to 100 feet above the TDZE. Section 91.176(a) permits EFVS operations to touchdown and rollout only on approaches that have a DA/DH. However, § 91.176(b) continues to permit EFVS operations down to 100 feet above the TDZE on non-precision approaches, just as § 91.175(l) has allowed these operations since 2004.

Finally, Gulfstream commented that § 91.176(a) should allow EFVS operations to touchdown and rollout on the same instrument approach procedures for which EFVS to 100 feet operations are permitted, which would include approaches without published vertical guidance. The FAA does not agree. The intent of § 91.176(a) is to provide for a stabilized descent and to ensure the aircraft is oriented toward the runway of intended landing while conducting an EFVS operation to touchdown and rollout. A stabilized descent reduces the need to maneuver at low altitudes, thereby minimizing risk. Therefore, the pilot must conduct the EFVS operation to touchdown and rollout on an approach to a DA or DH using vertical guidance that is part of the approach design.

The FAA notes, however, that operators who have been issued OpSpec/MSpec/LOA C073, ''Vertical Navigation (VNAV) Instrument Approach Procedures (IAP) Using Minimum Descent Altitude (MDA) as a Decision Altitude (DA)/Decision Height (DH),'' may conduct EFVS operations to touchdown and rollout on certain non-precision approaches that use an MDA as a DA/DH in accordance with the OpSpec/MSpec/LOA.

OpSpec/MSpec/LOA C073 authorizes operators to use an MDA as a DA/DH using vertical navigation (VNAV) on certain instrument approach procedures, which are listed in OpSpec/MSpec/LOA C052, ''Straight-In Non-Precision, APV, and Category I Precision Approach and Landing Minima—All Airports.'' It has always been the FAA's intent to allow EFVS operations on certain non-precision approaches in accordance with OpSpec/MSpec/LOA C073. However, as discussed above, we made changes to proposed § 91.176(a) as a result of comments. In making these changes, § 91.176(a) would have prohibited EFVS operations on certain non-precision approaches conducted in accordance with OpSpec/MSpec/LOA C073 because paragraph (a) would have restricted EFVS operations to touchdown and rollout to approach procedures with minimums that included a DA or DH. Accordingly, the FAA is adding language to § 91.176(a) that allows an operator who is otherwise authorized by the Administrator, such as through OpSpec, MSpec, or LOA C073, to use an MDA as a DA/DH with vertical navigation on an instrument approach procedure, to conduct an EFVS operation to touchdown and rollout in an aircraft below the authorized MDA in accordance with that authorization. When an operator is conducting an EFVS operation in accordance with OpSpec/MSpec//LOA C073, that operator must still meet the requirements of paragraphs (a)(1) through (a)(4) of § 91.176.

The FAA notes that it is revising the regulatory language to be performance based and allow for new technologies and approaches that ensure a stabilized visual segment. Accordingly, this final rule allows EFVS operations to touchdown and rollout on all approach procedures with an authorized DA or DH, and it omits direct reference to the types of approach procedures permitted and eliminates the term ''approved vertical guidance.'' The FAA recognizes that many factors may affect an operator's ability to conduct an EFVS operation. As stated in § 91.176(a)(4), the FAA may prescribe additional limitations through an OpSpec, MSpec, or LOA to ensure the safe conduct of EFVS operations.

b. Touchdown Zone

As proposed in the NPRM, for EFVS operations to touchdown and rollout, § 91.176(a)(2)(v) requires the aircraft to continuously be in a position from which a descent to a landing on the intended runway can be made at a normal rate of descent using normal maneuvers, and § 91.176(a)(2)(vi) requires the descent rate to allow touchdown to occur within the touchdown zone of the runway of intended landing.

Several commenters raised concerns about the term ''touchdown zone'' in § 91.176(a)(2)(vi). Boeing commented that the FAA needs to define the term ''touchdown zone'' for purposes of EFVS operations and pointed out that it is defined differently in different documents. For example, the AIM defines the touchdown zone as the first 3,000 feet of the runway beginning at the threshold, but RTCA DO–315A and its revision, RTCA DO–315B, define the touchdown zone as the first 3,000 feet or first one-third of the runway, whichever is shorter. Boeing asked the FAA for clarification because applicants and EFVS equipment designers need to know what the performance expectations are for the EFVS equipment. Dassault Aviation recommended that the FAA specify that the touchdown zone is the first 3,000 feet or the first one-third of the runway because the 3,000-foot metric may not be adequate for short runways. An individual commenter expressed similar concerns and added that ICAO defines touchdown zone as the portion of a runway, beyond the threshold, where it is intended that a landing aircraft first contact the runway. He also noted that other FAA documents contain guidance to land in the first one-third of a runway. Given the operational implications of EFVS operations, he recommended that the FAA revise the EFVS rule and the AIM to emphasize that landing in the first third of the

runway or the first 3,000 feet, whichever is less, should suffice for almost all landing operations by fixed wing aircraft.

The FAA agrees with the commenters that, for the purpose of EFVS operations, pilots should touch down in the first 3,000 feet or the first one-third of the runway, whichever is shorter. However, the FAA will not amend the definition of ''touchdown zone'' in the AIM, nor define ''touchdown zone'' in the EFVS rule because the term has a broader application than EFVS operations. The AIM contains the ICAO definition of touchdown zone but also defines it as the first 3,000 feet of the runway beginning at the threshold. This definition is used to determine TDZE in the development of straight-in landing minimums for instrument approaches. The subject of landing performance is complex and is affected by many variables such as available landing runway, surface conditions, aircraft performance, operating procedures, and many other factors. Furthermore, the use of the term touchdown zone in § 91.176(a)(2)(vi) is similar to its use in other sections of the regulations that address both EFVS and other operations, such as §§ 91.175(c)(1), 121.651(c)(1), 121.651(d)(1), and 91.175(l)(1), the latter of which is being moved to § 91.176(b)(2)(v) in this final rule.

Accordingly, although the FAA does not consider it appropriate to amend the definition of ''touchdown zone'' in this rule, the FAA notes that AC 20–167A specifies a relevant means of compliance to obtain airworthiness approval for EFVS. AC 20–167A, paragraph 6–2(f)(4) states that, during airworthiness performance demonstrations, persons should demonstrate longitudinal touchdown performance within the first one-third, or the first 3,000 feet of the runway, whichever is more restrictive, and touchdown performance should be equivalent to or better than that achieved in visual operations for the specific aircraft.

c. Definition of ''EFVS Operation'' and Underlying Operational Concepts

Section 1.1 defines ''EFVS operation'' as an operation in which visibility conditions require an EFVS to be used in lieu of natural vision to perform an approach or landing, determine enhanced flight visibility, identify required visual references, or conduct the rollout.

Dassault Aviation asked the FAA to clarify why the definition of an EFVS operation includes determining enhanced flight visibility, identifying required visual references, and conducting the rollout, whereas the EFVS I and EFVS II operations referred to in AC 90–106A only appear to address approaches below DA/DH and approaches to touchdown.

The definition of an EFVS operation is consistent with the operational descriptions in proposed AC 90–106A. While an EFVS can provide situational awareness in any phase of flight, such use does not constitute an EFVS operation unless visibility conditions require the use of an EFVS in lieu of natural vision to perform an approach or landing, determine enhanced flight visibility, identify required visual references, or conduct the rollout. When flight visibility using natural vision is less than what is required by the instrument approach procedure being flown, a person may perform an EFVS operation. It would be an EFVS operation in this scenario because the visibility conditions require the person to use the EFVS in lieu of natural vision to descend below DA/DH. More specifically, the person must use the EFVS to assess that the enhanced flight visibility is not less than what is required by the instrument approach procedure and to identify the required visual references. The EFVS I and EFVS II operations referred to in proposed AC 90–106A are consistent with the definition of an EFVS operation, because they address operations where the visibility conditions require the use of an EFVS for descent, namely, EFVS operations. The FAA notes, however, that AC 90–106A no longer contains the terms EFVS I and EFVS II. Instead, that AC uses terminology consistent with § 91.176.

d. Light Emitting Diodes (LEDs) and EFVS Operations

The Aerospace Medical Association commented that many airports are installing new position, taxi, and obstruction lights that use LED lights. It stated that night vision goggles (NVGs) and current EFVS systems are unable to sense LED lights. As a result, aircrew using EFVS to descend through the weather may not acquire visual aids or obstruction lights that use LEDs. Central Management Services (CMS) submitted a similar comment noting that EFVS is designed to sense incandescent lights, not LED lights, and that as airports install LED lighting to save money, the new lighting will eliminate the benefits of EFVS. The commenter also stated that the FAA should require airports to install Infrared (IR) emitters in all new LED airport lighting systems and retrofit existing LED installations. Additionally, the commenter stated that airports will not spend the money to install IR emitters on their own, and it is only a matter of time before LEDs appear in approach lighting and runway lighting systems.

The FAA acknowledges the commenters' concerns regarding LED lighting; however, the FAA disagrees that the installation of LED lights will eliminate the benefits of EFVS and it does not mandate the installation of specific lighting technologies. On January 4, 2007, Congress passed the Energy Independence and Security Act, which mandates phasing out certain incandescent lights for energy conservation purposes. As a result, LED lighting is becoming more prevalent in the NAS. While currently approved IR-based EFVS cannot sense LED lighting, LEDs do not completely eliminate the benefits of EFVS. The EFVS regulations provide for required visual references other than lighting, such as markings, the runway threshold, and the runway touchdown zone landing surface. Therefore, as long as a pilot can see the required visual references using an EFVS, he or she may conduct an EFVS operation. The FAA also notes that the presence of LEDs does not make an EFVS operation unsafe. If the required visual references are not distinctly visible and identifiable by the pilot, then the pilot must execute a missed approach just as he or she would if the approach were being conducted with natural vision instead of EFVS. The FAA has addressed operational considerations associated with LED lighting in AC 90–106A and Information for Operators (InFO) 11004, Enhanced Flight Vision System (EFVS), Enhanced Vision Systems (EVS), and Night Vision Goggles (NVG) Compatibility with Light-Emitting Diodes (LEDs) at Airports and on Obstacles. Also, EFVS sensors based on other technologies might be developed and approved in the future, and thus would be unaffected by the installation of LED airport and runway lighting.[26]

[26] The FAA and industry are currently working together to address EFVS and LED interoperability through the SAE G–20 Airport Lighting Committee. This committee was tasked by the FAA to evaluate and recommend potential solutions. To date, several prototype IR/LED light fixtures have been developed and are currently being tested at the FAA's William J. Hughes Technical Center. Additionally, in October 2014, the FAA conducted an LED Symposium comprised of FAA, other government agencies, SAE G–20, and industry participants. One of the action items from the LED Symposium was to develop a comprehensive operational test plan and conduct operational flights and evaluations using EFVS, the LED approach lighting system at the FAA's William J. Hughes Technical Center, and prototype infrared emitters.

Furthermore, the FAA does not mandate installation of specific lighting technologies. Airport operators decide what approved lighting technologies they will install at their airport location, and incandescent and LED airport lighting technologies both meet the requirements of § 139.311, ''Marking, signs, and lighting.'' Lighting technology manufacturers have significantly reduced the availability of traditional incandescent lighting technology for airport applications as a result of the Energy Independence and Security Act.

e. LOA Requirement for Part 91 Operators To Conduct EFVS Operations to Touchdown and Rollout

Section 91.176(a)(2)(viii) requires a person conducting EFVS operations under part 91 to conduct the operation in accordance with an LOA unless the operation is conducted under subpart K of part 91, or conducted in an aircraft that has been issued an experimental certificate under § 21.191 for the purpose of research and development or showing compliance with regulations.[27] This slightly differs from what was proposed in the NPRM, in that the FAA did not propose to provide an exception from the LOA requirement for EFVS operations conducted under part 91 in aircraft issued an experimental certificate under § 21.191 for the purpose of research and development or showing compliance with regulations.

Three commenters expressed concerns about requiring an LOA for part 91 operators to conduct EFVS operations to touchdown and rollout. An individual commented that requiring part 91 operators to obtain an LOA is an unnecessary regulatory requirement; however, he supported the FAA's proposal to require training and recent flight experience for EFVS operations. Central Management Services and an individual commented that pilots with a demonstrated history of EFVS training and currency should not be required to obtain an LOA and should be ''grandfathered'' under the new EFVS regulation. Central Management Services further stated that only pilots new to EFVS technology and equipment should be required to obtain an LOA. Central Management Services and an individual contended that there is precedence for ''grandfathering'' pilots with previous experience and pointed to those paragraphs in § 61.31 pertaining to pilots who had previous experience operating pressurized aircraft above 25,000 feet and pilots who had previous tailwheel experience. HAI, Central Management Services, and an individual expressed concern about the length of time it generally takes the FAA to issue an LOA.

Because of the performance-based structure of the EFVS regulations under § 91.176(a), the FAA finds it necessary to require part 91 operators, other than those conducting operations under part 91 subpart K or in an aircraft that has been issued an experimental certificate under § 21.191 for the purpose of research and development or showing compliance with regulations, to obtain an LOA to conduct EFVS operations to touchdown and rollout. The FAA has written § 91.176(a) in a way that is performance-based rather than explicitly specifying visibilities or other EFVS operating conditions and limitations in rule language. The FAA has structured the regulations so that it can manage the operating conditions and limitations for EFVS operations to touchdown and rollout through an operator's OpSpec, MSpec, or LOA. The FAA specifically structured the EFVS regulations this way to provide flexibility and to enable the FAA to structure an operator's authorization in a way that links equipage and system performance to specific operational capabilities. This structure also enables the FAA to respond more rapidly to new technology. Rather than restricting the use of all EFVS to a rigid and limiting set of visibility values and operating conditions and limitations, the FAA can permit a range of EFVS operations as vision system technologies and appropriate equipment certification guidance are developed. The FAA believes this structure best accommodates future growth while eliminating the need for additional rulemaking. Lastly, the FAA acknowledges the commenters' concerns about the length of time it generally takes to issue an LOA. The FAA notes that every effort is made to process applications in a timely manner.

The FAA notes that § 91.176(a)(2)(viii) now excepts EFVS operations conducted under part 91 in aircraft issued an experimental certificate under § 21.191 for the purpose of research and development or showing compliance with regulations from the requirement to obtain an LOA. These operations typically consist of a series of flights conducted to collect data or show compliance with regulations during EFVS certification activities using aircraft that have been placed in the experimental category. The flights are authorized when the FAA approves the program letter[28] describing the flight operations to be conducted and issues the experimental certificate with operating limitations. The FAA authorization is time-limited and carries an expiration date. Because these operations require FAA-approval, are time-limited, and carry operating limitations specific to the flights to be conducted, an LOA to conduct these operations is not required.

f. EFVS Operations Outside the U.S.[29]

Pursuant to § 91.176(a)(2)(x) and (b)(2)(viii), any person serving as a required flightcrew member for a foreign air carrier subject to part 129 must conduct both EFVS operations to touchdown and rollout and EFVS operations to 100 feet above the TDZE in accordance with OpSpecs authorizing the use of EFVS. The appropriate International Field Office (IFO) is responsible for authorizing part 129 foreign air carriers for EFVS operations. AC 90–106A contains additional information for EFVS operations conducted by foreign air carriers in the United States.

Part 91 operators (other than part 91, subpart K operators, who are required to obtain an MSpec under § 91.176(b)(2)(vii)) are not required to obtain an LOA in order to conduct EFVS operations to 100 feet above the TDZE under § 91.176(b). Verizon conducts EFVS operations to 100 feet above the TDZE under part 91 in the United States and pointed out that the rules for EFVS operations to 100 feet already in effect do not contain a provision for issuing an LOA to a part 91 operator. Verizon commented that, because it does not have an LOA, it has been unable to obtain approval from a foreign CAA to conduct EFVS operations to 100 feet

[27] The FAA also added language to § 91.176(a)(2)(viii) so persons who are otherwise authorized to conduct EFVS operations under other operating rules (*i.e.* subpart K of part 91 and parts 121, 125, 129, and 135) do not have to obtain an LOA to conduct part 91 operations such as ferry flights.

[28] For an aircraft to be eligible for an experimental certificate the aircraft must be registered and the applicant must satisfy one or more of the purposes stated in 14 CFR 21.191. Pursuant to § 21.193, applicants for experimental certificates must submit certain information with an application for airworthiness certification. This information is referred to as the ''program letter.'' The FAA uses the program letter to assist in establishing eligibility for an experimental certificate. The program letter must contain the required items listed in § 21.193 and be detailed enough to permit the FAA to prescribe the conditions and limitations necessary to ensure safe operation of the aircraft. ''Airworthiness Certification of Products and Articles,'' Order 8130.2H (Feb. 4, 2015).

[29] A person serving as a required flightcrew member of a foreign registered aircraft conducting operations under part 91 is not required to obtain an LOA in order to conduct EFVS operations to 100 feet above the TDZE because § 91.176(b)(2) does not require part 91 operators, other than those operating under part 91 subpart K, to obtain FAA authorization to conduct EFVS operations to 100 feet above the TDZE.

above the TDZE in the foreign country. As a result, it has been unable to use EFVS on its Gulfstream fleet for operational benefit outside of the United States. Verizon requested that the FAA revise § 91.176(b) to make provision for issuing an LOA to part 91 operators to facilitate approval by foreign CAAs.

The FAA is not revising § 91.176(b) as the commenter suggested. Part 91 operators have been authorized to conduct EFVS operations to 100 feet above the TDZE in the United States without an LOA for over 12 years. However, the FAA is aware that certain foreign CAAs require an authorization from the State of the operator in order to obtain approval to conduct EFVS operations in that country. The FAA is developing a process to facilitate foreign CAA approval for part 91 operators. AC 90–106A contains additional information about international EFVS operations.

g. EFVS Authorizations

Section 91.176(a) contains the regulations for EFVS operations to touchdown and rollout, and § 91.176(b) contains the regulations for EFVS operations to 100 feet above the TDZE. Under § 91.176(a)(2)(viii)–(xii), operators must obtain an LOA, MSpec, or OpSpec authorizing the use of EFVS in order to conduct EFVS operations to touchdown and rollout. Similarly, under § 91.176(b)(2)(vii)–(x), operators, except for part 91 operators (other than part 91, subpart K operators) must obtain an LOA, MSpec, or OpSpec authorizing the use of EFVS in order to conduct EFVS operations to 100 feet above the TDZE. Thales asked the FAA to clarify whether it will issue authorizations for EFVS operations to touchdown and rollout separately from authorizations for EFVS to 100 feet above the TDZE. Thales also asked whether authorizations for EFVS operations to touchdown and rollout will include EFVS operations to 100 feet above the TDZE. Lastly, Thales asked if operators who are currently authorized to conduct operations under § 91.175(l) and (m) will have to reapply for authorization to conduct EFVS operations under new § 91.176.

The FAA will issue separate authorizations for EFVS operations to touchdown and rollout and EFVS operations to 100 feet above the TDZE. Operators who are currently authorized to conduct EFVS operations to 100 feet above the TDZE, who wish to conduct additional operations now permitted under this rule, may do so only if those operations are authorized by their OpSpec, MSpec, or LOA for EFVS operations.

Operators currently conducting EFVS operations to 100 feet above the TDZE may continue to conduct those operations under their existing authorization until the FAA revises the operator's authorization to conform to the applicable provisions of the EFVS final rule. Lastly, AC 90–106A, Section 10, ''Operational Approval Process for EFVS Operations,'' provides guidance on the operational approval process and obtaining authorizations for EFVS operations.

h. EFVS for Takeoff Operations

FedEx Express, Gulfstream, Dassault Aviation, Elbit Systems of America, and Sierra Nevada Corporation commented that the FAA's notice did not address takeoff credit for EFVS. They noted that the FAA referenced existing processes through which takeoff credit for EFVS could be approved and requested that the FAA clarify those processes. In addition, Dassault Aviation requested that the FAA address when it plans to develop operational requirements and associated guidance material for takeoff using EFVS.

The FAA did not propose to enable the use of EFVS during takeoff operations because it may already authorize these operations through existing processes under § 91.175(f), which prescribes civil airport takeoff minimums for persons conducting operations under part 121, 125, 129, or 135. Under § 91.175(f), a person conducting operations under part 121, 125, 129, or 135 may obtain an authorization from the FAA, such as an OpSpec or LOA, authorizing lower than standard takeoff minimums, which may include the use of EFVS. The regulations, however, do not prescribe any takeoff minimums for part 91 operators (other than part 91, subpart K operators which under § 91.1039(e) have a minimum takeoff visibility of 600 feet). Therefore, part 91 operators (other than part 91, subpart K operators) may conduct takeoff operations using EFVS without obtaining an authorization from the FAA to conduct such operations.

It has come to the FAA's attention, however, that there is no existing process under the regulations for part 91, subpart K operators to obtain an authorization from the FAA to conduct takeoff operations using EFVS when the visibility is less than 600 feet. The FAA is therefore amending § 91.1039(e) to permit part 91, subpart K operators to conduct takeoff operations using EFVS when the visibility is less than 600 feet, provided these operations are conducted in accordance with the certificate holder's MSpec for EFVS operations.

The FAA is aware of the need for operational guidance regarding the use of EFVS during takeoff operations and is currently working to develop it.

i. Combined Vision Systems

A couple of commenters raised concerns about the use of synthetic vision. The HAI commented that § 91.176 and AC 90–106A should address the use of synthetic vision, when combined with an EVS that uses a real-time sensor image and appropriate flight information. Rockwell Collins commented that there are future technologies that could provide a real-time image of the external scene topography, which may be based on a database or communicated position information. It further commented that while these technologies may be considered combined vision system (CVS) applications,[30] the lines between enhanced vision, synthetic vision, and combined vision may become even less defined over time. Rockwell Collins suggested that only synthetic vision systems which exclusively use a computer-generated image of the external scene topography should not be addressed by the operational requirements in this rule. Furthermore, Eurocopter and American Eurocopter commented that the FAA should clarify whether a person could use CVS as an EFVS provided the CVS satisfied part 91's requirements.

The FAA disagrees that § 91.176 should address the use of synthetic vision. The amendments to part 91 address new operational benefits and requirements for EFVS only. However, a CVS consisting of an enhanced flight vision system and synthetic vision could be approved for EFVS operations if it met all of the requirements of the EFVS regulations.

j. Use of the Term ''EFVS'' in Rule Language

Garmin International commented that the proposed rule language unnecessarily references EFVS. It pointed out that in the future, part 91 might be updated to include additional technologies. Removing references to EFVS, and using only references to § 91.176, would eliminate the necessity for future revisions of the regulations.

The FAA disagrees with Garmin. The FAA is retaining the references to EFVS in the rule language because the rule is intended to address new operational

[30] A combined vision system involves a combination of SVS and EVS or EFVS. See AC No. 20–167A, *Airworthiness Approval of Enhanced Vision System, Synthetic Vision System, Combined Vision System, and Enhanced Flight Vision System Equipment.*

benefits and requirements for EFVS; it is not intended to address other systems that do not meet requirements applicable to EFVS.

k. Approach Plates and EFVS Operations

Under § 91.176(a), EFVS operations to touchdown and rollout may be conducted at any airport below the authorized DA/DH. Under § 91.176(b), EFVS operations to 100 feet above the TDZE may be conducted at any airport below the authorized DA/DH or MDA to 100 feet above the TDZE. Additionally, EFVS operations using circling minimums are not authorized pursuant to § 91.176(a)(2)(i) and (b)(2)(i).

The Aerospace Medical Association commented that an EFVS approach plate should be developed that specifies the procedure, equipment requirements, and visibility required to conduct EFVS operations. The FAA disagrees because persons may conduct EFVS operations on any instrument approach procedure that meets the criteria specified above. Therefore, an approach plate specifically for EFVS operations is not necessary.

The Aerospace Medical Association also asked whether the FAA will issue a special rating for pilots who conduct EFVS operations. The commenter stated that minimum qualification and experience should be required for pilots to perform EFVS operations. It pointed out that most airlines only permit captains to fly very low visibility takeoffs and instrument landing system (ILS) Category IIIB landings and that first officers must also have the same training.

The FAA will not issue a special rating to pilots for EFVS operations. Instead, the FAA is establishing ground and flight training requirements for EFVS operations in § 61.66(a), (b), and (c), and recent flight experience and refresher training requirements for EFVS operations in § 61.66(d) and (e). The FAA believes that the training, recent flight experience, and refresher training requirements of § 61.66 are sufficient to ensure safe operations and that a special rating for pilots who conduct EFVS operations is unnecessary. Furthermore, Flight Standardization Board (FSB) reports pertaining to specific EFVS and aircraft installations have not specified that pilot ratings for EFVS operations are necessary.[31]

[31] FSBs make findings of operational suitability and recommend master training, checking, and currency requirements applicable to aircraft and equipment.

l. References to EFVS-Specific Callouts

Airbus noted that the NPRM makes reference to ''EFVS-specific callouts'' but does not provide a precise definition of the term. Airbus requested that the FAA clarify where this term is defined in the proposed rule.

The FAA does not define the term ''EFVS-specific callouts.'' The FAA used this term twice in the NPRM to describe callouts, such as ''EFVS lights,'' which are unique to EFVS operations. Operators may develop other EFVS-specific callouts related to crew coordination activities during EFVS operations.

m. Miscellaneous Revisions to EFVS Operating Requirements

Sierra Nevada Corporation commented that proposed § 91.176(a)(3), which stated, ''No pilot operating under this section or §§ 121.651, 125.381, and 135.225 . . .'' should be changed to state, ''No pilot operating under this section or §§ 121.651, 125.381, or 135.225 . . .'' It also commented that the FAA should make a similar change to proposed § 91.176(b)(3) and that the FAA should delete the words ''and land'' from § 91.176(b)(3) because, under § 91.176(b), a pilot must land using natural vision and is not permitted to rely on EFVS to land.

The FAA agrees with the commenter, and has revised ''and'' to ''or'' in § 91.176(a)(3) and (b)(3) accordingly. However, the FAA disagrees with the commenter that it should remove ''and land'' from § 91.176(b)(3) because that section contains the visibility and visual reference requirements for using an EFVS to descend below DA/DH or MDA down to 100 feet above the TDZE and for using natural vision to descend below 100 feet above the TDZE to touchdown.

n. Opposing Comments on the FAA's Proposal

One commenter opposed the proposal. A private individual commented that the notice proposes a set of rules that are technically ambiguous, does not provide adequate safety for air carrier operations, favors one technology over other methods and technologies the commenter considers to be better and safer, and is unnecessary to achieve the intended benefits. The commenter believes that if these provisions are implemented they will not enhance safety or operability over competing and currently available technologies, and that the proposal could result in additional and unnecessary safety vulnerability.

The commenter stated that IR-based systems cannot penetrate certain fog conditions necessary for safe flight below a 100-foot height above touchdown (HAT) and that certain radar systems, while potentially able to marginally penetrate fog, have other severe resolution limitations. The commenter believes that picture based systems can provide little more than situational awareness and do not provide adequate closed loop flight control capability for missions requiring air carrier levels of accuracy, integrity, and availability. The commenter asserted that this is why UAVs still routinely crash when flying based on visual control, even with high quality visibility systems. The commenter further asserted that if path definition and flight guidance are available, the visual scene becomes unnecessary and is only an aid to situational awareness.

The FAA disagrees with the commenter and believes that this final rule provides an adequate level of safety for EFVS operations. EFVS operations to 100 feet above the TDZE have been conducted for over 12 years. The FAA is not aware of any accidents over this time period in which EFVS was a factor. This final rule extends these operations to include EFVS operations to touchdown and rollout and to permit operators using EFVS-equipped aircraft to dispatch, release, or takeoff under IFR, and to initiate and continue an approach, when the destination airport weather is below authorized visibility minimums for the runway of intended landing. This final rule also provides specific equipment, operational, and visibility and visual reference requirements for the conduct of EFVS operations to touchdown and rollout and EFVS operations to 100 feet above the TDZE. Additionally, this final rule includes detailed and specific ground and flight training requirements, and recent flight experience and proficiency requirements for pilots intending to conduct EFVS operations. It also provides updated requirements for pilot compartment view and equipment for EFVS. Authorizations to conduct EFVS operations will contain operating conditions and limitations appropriate to the EFVS operations to be conducted and may prescribe additional equipment, operational, and visibility and visual reference requirements to account for specific equipment characteristics, operational procedures, or approach characteristics. The authorizations to conduct the additional EFVS operations as well as the new training, recent flight experience, and proficiency requirements are

specifically intended to address the operating conditions and limitations necessary to ensure the safe conduct of all EFVS operations. The FAA's disposition of Boeing's comment in Section III.F further discusses this matter.

The commenter also contended that the notice was unfair and prejudiced and showed unjustified favoritism for one technology (EFVS, EVS, or SVS) over better and safer competing technologies, such as Autoland, Flight Guidance based HDDs, or Flight Guidance based HUDs, that are already adequately and fairly treated by current regulations and guidance. As an example, the commenter stated there is no safety case justification for crediting EFVS, without also crediting the far safer AUTOLAND LAND III and LAND II Modes, as well as HUD AIII modes, for flight release or dispatch credit, as well as for approach initiation or alternate minimums credit. The commenter believes that this rule will expose the FAA to significant legal challenges by OEMs and operators with far better and safer systems that are not being offered equivalent or better benefits.

It is not the intent of the FAA to provide an unfair advantage to one specific technology, but rather to address the conduct of EFVS operations in this rule. Other operations were not the subject of the proposal. The FAA notes, however, that the regulations have permitted operators to conduct Category III operations to dispatch, flight release, or takeoff under IFR and initiate and continue an approach in lower than standard visibility conditions for many years. The FAA is structuring similar dispatch, flight release, and approach initiation benefits for EFVS operations in lower than standard visibility conditions within the performance limitations of the EFVS equipment to be used.

3. Visibility and Visual Reference Requirements

a. Visual References Below 100 Feet Above the TDZE During EFVS Operations to Touchdown and Rollout

Under § 91.176(a)(3)(i), a pilot conducting an EFVS operation to touchdown and rollout may not operate an aircraft below the authorized DA/DH and land unless that pilot determines that the enhanced flight visibility provided by an EFVS is not less than the visibility prescribed in the instrument approach procedure being used. Additionally, § 91.176(a)(3)(iii) permits a pilot to continue descending below 100 feet above the TDZE and land using the enhanced flight visibility provided by an EFVS, provided one of the following visual references is distinctly visible and identifiable to the pilot: The runway threshold, the lights or markings of the threshold, the runway touchdown zone landing surface, or the lights or markings of the touchdown zone. The requirement remains unchanged from the NPRM.

Thales commented that § 91.176(a)(3)(iii) as proposed would have permitted a pilot to use only enhanced flight visibility provided by an EFVS to identify the required visual references at and below 100 feet above the TDZE. Thales stated that it is possible a pilot could see the required visual references with natural vision, but not with enhanced flight visibility. Thales recommended that § 91.176(a)(3)(iii) permit a pilot to use either enhanced flight visibility provided by an EFVS or natural vision to identify the required visual references to descend below 100 feet above the TDZE. It asserted that conducting a missed approach when a pilot sees the required visual references with natural vision, but not with enhanced flight visibility provided by an EFVS, would be unnecessary and counterproductive.

The FAA disagrees with Thales that § 91.176(a)(3)(iii) should also allow the use of natural vision to identify the required visual references to descend below 100 feet above the TDZE. If visibility conditions improve after a pilot begins an EFVS operation, whether it is conducted under § 91.176(a) or (b), that pilot may continue descending to a landing using natural vision provided he or she continues the flight in accordance with existing flight rules based on natural vision, with existing requirements under § 91.175(c) for operation below DA/DH or MDA, or with existing requirements under § 91.176(b) for descending below 100 feet above the TDZE. Accordingly, if an operator were conducting an EFVS operation to touchdown and rollout under § 91.176(a), and could acquire the visual references with natural vision at 100 feet above the TDZE, that operator would not have to conduct a missed approach as Thales suggested so long as the operator complies with the flight rules based on natural vision, § 91.175(c), or § 91.176(b).[32] In order to continue descending below 100 feet above the TDZE under § 91.176(b)(3)(iii), however, the pilot conducting the EFVS operation must meet the training requirements to conduct operations under § 91.176(b). The FAA anticipates that the majority of operators conducting EFVS operations will be authorized to conduct EFVS operations under both § 91.176(a) and (b).

During an EFVS operation to touchdown and rollout, the pilot must comply with both paragraphs (a)(3)(i) and (a)(3)(iii) at 100 feet above the TDZE of the runway of intended landing and below that altitude. Therefore, at 100 feet above the TDZE and below that altitude, the enhanced flight visibility provided by an EFVS may not be less than the visibility prescribed in the IAP being used. Additionally, the enhanced flight visibility using EFVS must be sufficient for one of the visual references in paragraph (a)(3)(iii) to be distinctly visible and identifiable to the pilot. The only exceptions to these requirements would be when visibility improves such that a pilot could continue descending to a landing under the conditions described in the previous paragraph.

b. Enhanced Flight Visibility Requirement During EFVS Operations to 100 Feet Above the TDZE

Under § 91.176(b)(3)(i), in order for a pilot to continue an approach below the authorized MDA or DA/DH and land, the pilot must determine that the enhanced flight visibility observed by use of an EFVS is not less than the visibility prescribed in the instrument approach procedure being used. This requirement differs from what the FAA proposed because it applies from descent below MDA or DA/DH until touchdown,[33] rather than to the portion of the approach from the authorized MDA or DA/DH to 100 feet above the TDZE, as proposed. This change resulted from our own continued review of the NPRM.

In the NPRM, the FAA explained that the requirements of § 91.176(b)(3)(iii) would be structured to conform to the original intent of § 91.175(l)(4). However, in clarifying the requirements of § 91.175(l)(2) and (l)(4), the FAA inadvertently proposed a requirement in § 91.176(b)(3)(i) that was contrary to the original intent of § 91.175(l)(2) and (l)(4). In the 2004 EFVS rule, the FAA intended § 91.175(l)(2) to provide an enhanced flight visibility requirement equivalent to § 91.175(c)(2), except that the pilot could use an EFVS to determine ''enhanced flight visibility''

[32] Regardless of whether an operator is conducting an EFVS operation under § 91.176(a) or (b), the pilot must determine that the enhanced flight visibility observed by use of the EFVS is not less than the visibility prescribed in the instrument approach procedure. 14 CFR 91.176(a)(3)(i) and (b)(3)(i).

[33] Section 91.175(l)(2) previously contained this requirement.

as compared to ''flight visibility'' with natural vision.[34] Additionally, the FAA intended § 91.175(l)(4) to require that, in addition to determining that the enhanced flight visibility is not less than that prescribed in the instrument approach procedure being used, at 100 feet above the TDZE and below, one of the required visual references would have to be distinctly visible and identifiable without relying on the EFVS for the pilot to continue to a landing.

As evidenced from a legal interpretation dated September 10, 2010, the pilot must maintain the flight visibility required in § 91.175(c)(2) from descent below MDA or DA/DH until touchdown.[35] Because the FAA intended the requirements of § 91.176(b)(3)(i) and (b)(3)(iii) to conform to the original intent of § 91.175(l)(2) and (l)(4), and the original intent of § 91.175(l)(2) was to provide a requirement equivalent to § 91.175(c)(2), § 91.176(b)(3)(i) now requires the pilot to maintain the enhanced flight visibility from descent below MDA or DA/DH until touchdown. Therefore, at 100 feet above the TDZE and below, a pilot must meet the requirements of § 91.176(b)(3)(i) and (iii) in order to continue to a landing.

c. Visual References for Rollout

As proposed in the NPRM, § 91.176(a)(3) specifies visibility and visual reference requirements for EFVS operations below the authorized DA/DH and for EFVS operations below 100 feet above the TDZE. A couple of commenters raised concerns regarding the lack of visibility and visual reference requirements for rollout during an EFVS operation. Thales proposed that the FAA either clarify the rollout requirements or add visibility and visual reference requirements to the regulations. Sierra Nevada Corporation contended that the required visual references specified in § 91.176(a)(3)(iii) are typically behind the aircraft by the time the aircraft slows to a safe taxi speed. It asserted that the FAA should specify an additional set of visual references for rollout, such as those in RTCA DO–341, Section 3.1.3.4, which includes visual references for rollout, such as the centerline lights or markings and the runway edge lights or markings, if installed and serviceable, or other visual references which accurately indicate the runway edges and the runway centerline.

The FAA finds it unnecessary to specify visual references for rollout by regulation because the operating rules require sufficient forward visibility in order to conduct EFVS operations to touchdown and rollout, and an applicant must demonstrate that the EFVS can safely perform the rollout task during the equipment certification process. Under § 91.176(a), a pilot must determine that the enhanced flight visibility observed by using an EFVS is not less than what is prescribed in the IAP before descending below DA/DH to touchdown. This requirement in addition to the visibility and visual reference requirements specified in § 91.176(a)(3) ensures that sufficient forward visibility exists for the pilot to safely conduct the approach, landing, and rollout. Furthermore, during the certification flight test, an applicant will have to demonstrate that he or she can use the EFVS to safely perform rollout tasks. Additionally, the FAA may include visibility and visual reference requirements for rollout in an operator's authorization to conduct EFVS operations, if necessary. The FAA notes that AC 20–167A provides a means of compliance for an EFVS to obtain airworthiness approval and contains guidance applicable to the evaluation of EFVS performance during rollout to a safe taxi speed.

d. Controlling Runway Visual Range (RVR) Values

Section 91.176 does not specify which runway visual range (RVR) values are controlling for operational purposes. Therefore, Dassault Aviation asked the FAA to clarify whether the touchdown zone, mid, or rollout RVR is controlling when more than one RVR value is provided for the runway of intended landing. The FAA will specify which RVR values are controlling for operational purposes in an operator's OpSpec, MSpec, or LOA for EFVS operations. The FAA is also providing guidance on this topic in AC 90–106A.

e. Emitter Technologies as Alternative Visual Aids

An individual commented that the NPRM addresses EFVS operations in a performance-based manner but provides no performance-based equivalent for light components. The commenter stated that emitters of various types that might be interoperable with EFVS sensor technologies could be implemented as an alternative or supplement to traditional lighting systems or visual aid components. The commenter further stated that emitters of this type could be useful in conditions of below Category II weather or used in locations where approach lighting systems are not possible, such as when an airport is surrounded by water. The commenter recommended that the FAA revise the visual reference language in § 91.176 to permit the use of emitter technologies in addition to the visual references currently specified.

While emitters that might be interoperable with EFVS sensor technologies could be implemented as an alternative or supplement to traditional lighting systems or visual aid components, specifying a performance based equivalent for light components is outside the scope of this rulemaking. The FAA notes, however, that §§ 91.176(a)(3) and (b)(3) do not prohibit the use of emitter technologies to facilitate the identification of the required visual references.

f. Use of EFVS To Satisfy the Visibility Requirements of §§ 91.155 and 91.157 During Rotorcraft Operations

HAI commented that the FAA should permit rotorcraft to use EFVS to provide the required visibility necessary to operate under §§ 91.155 and 91.157. The FAA is not adopting this suggestion because it is outside the scope of this rulemaking. The FAA did not propose to permit such operations and others have not had an opportunity to comment.

D. Revisions to Requirements for EFVS Operations to 100 Feet Above the TDZE (§ 91.176(b))

1. Methods for Conducting Approaches During EFVS Operations to 100 Feet Above the TDZE

Section 91.176(b) contains the regulations for EFVS operations to 100 feet above the TDZE. These requirements were previously located in § 91.175(l) and (m). A commenter noted that § 91.176(b) does not contain a regulatory requirement to use vertical guidance to fly a non-precision approach and that, upon meeting the visual reference requirements, a pilot could descend immediately and as rapidly as desired to 100 feet above the TDZE rather than descend along a vertically guided continuous descent profile. The commenter, therefore, recommended that § 91.176(b) restrict EFVS operations to 100 feet above the TDZE to approaches that have approved vertical guidance. The commenter also noted that § 91.176 does not require descent along an obstacle-free path and that EFVS was not designed to detect obstacles, but it is important for a pilot to ensure that a descent is accomplished

[34] Enhanced Flight Vision Systems, NPRM, 68 FR 6802, 6805 (Feb. 10, 2003).

[35] Legal Interpretation to Mr. Gary Thomey (Sept. 10, 2010); *see* Takeoff and Landing Minimums, 46 FR 2280, 2282 (Jan. 8 1981) (revising the requirement, then codified as § 91.116, to ''make it clear that the pilot must have this flight visibility from descent below MDA or DH until touchdown'').

along a path known to be obstacle-free, such as by using another approach to the same runway that has a DA, or by using a VASI, PAPI, or other information. The commenter therefore recommended that proposed § 91.176(b)(2)(iii) require the aircraft to be continuously in a position from which a descent to a landing on the intended runway can be made along an obstacle-free path at a normal rate of descent using normal maneuvers.

Central Management Services shared similar concerns. It noted that, while it doubted any Part 141 or Part 142 facility advocated the ''dive and drive'' method for conducting straight-in, non-precision approaches, the EFVS rule does not prohibit it, and therefore recommended that the FAA do so in § 91.176.

The FAA finds that these comments are outside the scope of this rulemaking. The FAA did not propose these restrictions to § 91.176(b); therefore, other persons did not have an opportunity to comment. Additionally, persons have been conducting EFVS operations to 100 feet above the TDZE safely for over 12 years under § 91.175(l) and (m), which did not contain such restrictions.[36] AC 90–106A provides guidance on how to safely conduct EFVS operations on approaches with an MDA using straight-in landing minimums.

E. Training, Recent Flight Experience, and Refresher Training Requirements for Persons Conducting EFVS Operations (§ 61.66)

The FAA has reorganized the pilot requirements proposed in §§ 61.31 and 61.57 and consolidated them in new § 61.66. Section 61.66 contains the EFVS ground and flight training requirements, which were proposed as § 61.31(l), and the EFVS recent flight experience requirements, which were proposed as § 61.57(h) and (i).[37] The FAA is consolidating the EFVS training requirements with the EFVS recent flight experience requirements into a single section for organizational clarity. The FAA believes that consolidating these requirements into a single new section in part 61, which is comprised solely of the EFVS pilot requirements, will help facilitate compliance with the regulations by making them more accessible and comprehensible to pilots. The FAA has also made modifications to these requirements as a result of comments and as a result of the FAA's own continued review of the proposal, which this section will discuss in detail below.

The following table outlines each requirement, its previously proposed section in the NPRM, its corresponding section in new § 61.66, and a summary of the significant changes from the proposal.

Requirement	NPRM	Final rule	Change from NPRM
Ground Training	Proposed § 61.31(l)(1)	§ 61.66(a)(1)	Clarifies that a person must receive the ground training from an authorized training provider under an FAA approved training program. Clarifies that the EFVS ground training must be appropriate to the category of aircraft for which the person is seeking the EFVS privilege.
Ground Training Subjects	Proposed § 61.31(l)(2)(i)–(vii).	§ 61.66(a)(2)(i)–(viii)	Adds the following ground training subject: EFVS sensor imagery and required aircraft flight information and flight symbology.
Flight Training	Proposed § 61.31(l)(3)	§ 61.66(b)(1)	Clarifies that a person must receive the flight training from an authorized training provider under an FAA approved training program. Clarifies that the EFVS flight training must be provided in the category of aircraft for the EFVS operation to be conducted.
Flight Training Tasks	Proposed § 61.31(l)(4)(i)–(viii).	§ 61.66(b)(2)(i)–(viii)	No significant changes from NPRM.
Supplementary EFVS Training.	Proposed § 61.31(l)(6)	§ 61.66(c)	Clarifies that supplementary EFVS training, previously proposed as differences training, consists of both ground and flight training. Clarifies that a person must receive supplemental EFVS training in the category of aircraft for the EFVS operation to be conducted. No longer permits a pilot to receive a proficiency check in lieu of supplementary EFVS training.
Recent Flight Experience: EFVS.	Proposed § 61.57(h)	§ 61.66(d)	Clarifies that the EFVS recent flight experience requirements must be obtained in the category of aircraft for which the person is seeking the EFVS privilege.
EFVS Refresher Training	Proposed § 61.57(i)	§ 61.66(e)(1)	Calls the mechanism by which a person reestablishes EFVS currency a ''refresher course'' rather than a ''proficiency check.'' Provides pilots with an additional 6 months to satisfy the EFVS recent flight experience requirements.
Individuals who may conduct EFVS Refresher Training.	Proposed § 61.57(i)(2)	§ 61.66(e)(2)	Requires EFVS refresher training to be conducted by an authorized training provider.
Military Pilots and Former Military Pilots in the U.S. Armed Forces.		§ 61.66(f)	Adds a new paragraph that specifically addresses military pilots and former military pilots in the U.S. Armed Forces.

[36] In the 2004 EFVS final rule, ''Enhanced Flight Vision Systems,'' 69 FR at 1625 (Jan. 9, 2004), the FAA explained that the obstacle risk for a non-precision approach using EFVS is significantly mitigated by only permitting EFVS operations on straight-in approaches. The FAA further noted that a pilot could maintain obstacle clearance by using the recommended procedures to fly a straight-in instrument approach procedure with an MDA, and by using the FPV cue and FPARC displayed by the EFVS to monitor and maintain the desired vertical path when operating below the MDA.

[37] As discussed in section III.E.2, § 61.66(e) clarifies the proficiency check requirements that were proposed in § 61.57(i).

Requirement	NPRM	Final rule	Change from NPRM
Use of Full Flight Simulators (FFS).	Proposed § 61.31(l)(5) ..... Proposed § 61.57(h)(2) Proposed § 61.57(i)	§ 61.66(g)	Creates a new paragraph, which contains the requirements for using a FFS to meet the flight training, recent flight experience, and refresher training requirements. Clarifies that each FFS must be qualified and maintained in accordance with part 60, or be a previously qualified device, as permitted in accordance with § 60.17. Clarifies that each FFS must be approved by the Administrator for the tasks and maneuvers.
Grandfather clause and compliance date for persons conducting EFVS operations to 100 feet above the TDZE.	Proposed § 61.31(l)(7)(ii) ...	§ 61.66(h)(4) § 91.176(b)(4)	Creates two provisions for clarity. Section 61.66(h)(4) contains the grandfather clause, and § 91.176(b)(4) contains the compliance date.

1. Training Requirements for Persons Conducting EFVS Operations (§ 61.66(a), (b) and (c))

Under § 61.66(a) and (b), no person may manipulate the controls of an aircraft or act as pilot in command of an aircraft during an EFVS operation as specified in § 91.176(a) or (b) unless that person has received and logged ground and flight training for the EFVS operation under a training program [38] approved by the Administrator and obtained a logbook or training record endorsement from an authorized training provider certifying that the person has satisfactorily completed the ground and flight training. Section 61.66(a) also requires a person serving as a required pilot flightcrew member (who does not manipulate the controls) during an EFVS operation to touchdown and rollout to comply with the ground training requirements in paragraph (a). EFVS training must include ground training on the subjects set forth in § 61.66(a)(2) and flight training on the tasks set forth in § 61.66(b)(2).

Consistent with the proposal, under the final rule, the Administrator may approve a training program that includes ground and flight training for one EFVS operation (*e.g.,* § 91.176(a) or (b)) or both EFVS operations (§ 91.176(a) and (b)). If a person receives training and an endorsement for only one EFVS operation in § 91.176, then seeks to conduct an additional EFVS operation for which that person has not received training, § 61.66(c) requires that person to receive ground and flight training and an endorsement appropriate to the additional EFVS operation to be conducted. AC 61–65 will contain sample endorsements for use by authorized training providers when endorsing logbooks or training records pursuant to § 61.66(a)(1), (b)(1) and (c)(2).

The training requirements in new § 61.66(a), (b), and (c) differ slightly from what was proposed in the NPRM as a result of comments and revisions, which are discussed in more detail below.

a. Separate Training for EFVS Operations to 100 Feet Above the TDZE and EFVS Operations to Touchdown and Rollout

Dassault Aviation commented that it favors separate training for EFVS operations to 100 feet above the TDZE and for EFVS operations to touchdown and rollout. It also commented that training for EFVS operations to touchdown and rollout should automatically include training for EFVS operations to 100 feet above the TDZE.

The FAA will not require separate training programs for the two types of EFVS operations, nor will it require training for EFVS operations to touchdown and rollout to automatically include training for EFVS operations to 100 feet above the TDZE. The FAA has adopted ground and flight training requirements with sufficient flexibility to achieve both the desired safety benefits and training efficiencies. While the rule does not require separate training for the two types of EFVS operations, the FAA notes that the training must address the operations the EFVS operator is authorized to conduct. Under certain circumstances, an operator authorized to conduct EFVS operations to touchdown and rollout might find it necessary to conduct EFVS operations to 100 feet above the TDZE. For example, if the pilot monitoring display is inoperative, the flightcrew may not conduct an EFVS operation to touchdown and rollout, but they may conduct an EFVS operation to 100 feet above the TDZE provided they meet all applicable regulatory requirements, including training to conduct EFVS operations to 100 feet above the TDZE. Accordingly, an operator may elect for its pilots to receive training for both types of EFVS operations.

b. EFVS and Aircraft-Specific Training

A couple of commenters raised concerns about aircraft-specific EFVS training. GAMA commented that proposed § 61.31 should specifically enable a pilot who is trained in EFVS operations on one airplane model to be EFVS-qualified on multiple airplane types. GAMA noted that FAA FSBs have authorized pilots trained on one airplane model for EFVS to be EFVS-qualified on another airplane, such as on the Falcon 900 and Falcon 2000. GAMA further noted that proposed § 61.31 did not recognize the FSB credit that currently exists.

Rockwell Collins commented that it assumed the training proposed by the FAA could be performed during ground/simulator training using a ''generic'' aircraft type, given that initial EFVS training includes an introduction to EFVS image characteristics, such as infrared-based sensor imagery, determining EFVS-equivalent visibility, image artifacts, and other items. It asked whether training could carry over to multiple aircraft types with similar EFVS installations and noted that this could allow training companies to provide generic training packages.

Section 61.66, proposed as § 61.31, does not reflect GAMA's request because § 61.66(a) and (b) do not require a pilot to receive training on each specific combination of EFVS and aircraft model for which the pilot is qualified to fly. Accordingly, as Rockwell Collins requested, training obtained pursuant to § 61.66 may carry

[38] Under part 121 and part 135, the term ''training program'' is a broad term that encompasses all curriculums in the air carrier's approved training program. Therefore, part 119 certificate holders operating under part 121 or part 135 would not have an EFVS training program; they would have an EFVS training curriculum as part of their approved training program. For purposes of part 119 certificate holders operating under part 121 or part 135, the term ''training program'' in § 61.66 means training curriculum.

over to multiple aircraft types with similar EFVS installations. The intent of § 61.66 is to establish minimum standards for a broad range of operators who may be operating various types of aircraft and EFVS equipment. The FAA has revised the language in § 61.66, however, to make clear that the training and endorsements for EFVS operations must be specific to category of aircraft. This requirement is consistent with the language proposed in § 61.57(i) requiring an EFVS proficiency check to be accomplished in the category of aircraft for the EFVS privilege sought.

In addition to the training requirements of part 61, an operator must comply with any training requirements specified in the part under which the operator conducts operations. Additionally, an operator's OpSpec, MSpec, or LOA for EFVS operations may contain specific training requirements. The FAA notes that this rule provides operators with the flexibility to develop training programs that address their specific operational requirements. Furthermore, for part 121, 135, and 91 subpart K operators, the FAA requires that a pilot obtain training in the EFVS-equipped aircraft in which the pilot expects to conduct operations, and that an operator's approved training program address training and proficiency for each specific combination of EFVS and aircraft model applicable to that operator and its EFVS operations. FSB reports also provide recommendations for training, checking, currency, recent flight experience, and special emphasis areas.

c. Adaptation Period Prior to Using an EFVS in Flight Operations

The Aerospace Medical Association commented that during B–787 training, one of their members experienced a habituation period when utilizing the HUD as a primary flight display and the instrument panel as secondary information. It believes the FAA should consider a similar habituation period for EFVS. The commenter stated that the habituation period should provide pilots with enough time to become accustomed to EFVS prior to flying solo or during actual instrument meteorological conditions (IMC). It asserted that use of simulators should also be considered for training.

The FAA believes that the time necessary to meet the EFVS training requirements will provide pilots with the necessary habituation period. Furthermore, § 61.66(g) already states that a pilot may use a level C or higher full flight simulator (FFS) equipped with a daylight visual display and an EFVS to meet the flight training requirements of § 61.66(b).

Boeing commented that § 61.31(l) already exists and contains the exceptions to the requirement for a type rating. Boeing recommended that the FAA move the existing regulations in § 61.31(l) to § 61.31(m) and use § 61.31(l) for the proposed additional training required for EFVS operations. Boeing further stated that this will prevent having two different sections with the same number. This revision is unnecessary because the FAA is adopting new § 61.66 instead of proposed § 61.31.

d. Revisions To Clarify Training Requirements in § 61.66(a), (b) and (c)

Section 61.66(a), (b), and (c) now require pilots to receive EFVS ground, flight, and supplementary training from an ''authorized training provider'' under an FAA approved training program.[39] The FAA is using the term ''authorized training provider,'' rather than ''authorized instructor'' as proposed in the NPRM, to underscore that all EFVS training must be accomplished in accordance with an FAA approved training program under 14 CFR parts 91, 91 subpart K, 121, 125, 135, 141, or 142. This revision is consistent with the NPRM, which explained that the FAA would require persons to receive EFVS training under an FAA approved training program to ensure that pilots are trained and tested to a specific standard and that the training program content supports the EFVS operation to be conducted. Because the proposed rule always intended for EFVS training to take place under an approved training program, the only authorized instructors would be those instructors working for training providers with approved training programs, such as instructors employed by part 141 pilot schools, part 142 training centers, and part 119 certificate holders.

While an FAA approved training program is not required under part 125, § 61.66 requires a part 125 operator to accomplish EFVS training in accordance with an FAA approved training program. A part 125 operator may accomplish § 61.66 EFVS training in accordance with an FAA approved training program offered at a part 141 pilot school or a part 142 training center.[40] Alternatively, a part 125 operator may submit an EFVS training program to the FAA for approval.

Under part 141, the FAA may approve an EFVS training course in accordance with § 141.11 and appendix K to part 141, paragraph 9, Special Operations Course, which contains the minimum curriculum requirements for both aeronautical knowledge and flight training pertaining to special operations courses. A special operations course for EFVS must also meet the applicable parts of FAA regulations that pertain to that special operations course. Accordingly, an EFVS training course must meet the requirements of § 61.66 in addition to the minimum curriculum requirements in appendix K to part 141.

Because training programs already exist for persons conducting EFVS operations to 100 feet above the TDZE, there is already a cadre of training instructors qualified to administer training on the subjects and tasks set forth in § 61.66(a)(2) and (b)(2) that are applicable to EFVS operations to 100 feet above the TDZE.

As a result of this final rule, new training programs for EFVS operations to touchdown and rollout will be developed. Section 61.66 requires persons to obtain EFVS training from an authorized training provider under an FAA approved training program. However, before persons can receive training on EFVS operations to touchdown and rollout from an authorized training provider, there must first be a cadre of training instructors qualified and authorized to administer the training. The FAA recognizes that there will be an initial period when training providers may provide training and evaluation without meeting certain qualification requirements in order to establish an initial cadre of instructors. AC 90–106A contains the FAA's policy for initiating and building a cadre of authorized training instructors qualified to administer training on EFVS operations to touchdown and rollout.

The FAA added language to § 61.66(a)(1) and (b)(1) to make clear that the ground and flight training for EFVS operations, and the respective endorsements, must be specific to the category of aircraft for which the person is seeking the EFVS privilege. It has always been the FAA's intent to require the EFVS training to be category specific. This requirement is consistent with the language proposed in § 61.57(i) requiring an EFVS proficiency check to be accomplished in the category of aircraft for the EFVS privilege sought.

[39] Unless otherwise excepted in § 61.66(h), the training requirements in § 61.66(a), (b), and (c) apply to any pilot conducting EFVS operations under 14 CFR 91.176, including pilots conducting operations under part 91, part 91 subpart K, part 121, part 125, or part 135.

[40] However, based on the special rules in § 125.296, a part 125 operator may not use a part 141 pilot school to meet training, testing, or checking requirements under part 125.

The FAA is reorganizing the supplementary EFVS training requirements in § 61.66(c) (proposed as differences training) to be more consistent with § 61.66(a) and (b).[41] Accordingly, § 61.66(c)(1) requires a person to receive and log the ground and flight training specified in § 61.66(a) and (b) under an FAA approved training program appropriate to the EFVS operation to be conducted, and § 61.66(c)(2) requires that person to obtain a logbook or training record endorsement from an authorized training provider certifying the person is proficient in the use of EFVS for the EFVS operations to be conducted. These revisions are consistent with proposed § 61.31(l)(6)(i), which would have required the person to obtain the flight training and endorsement specified in § 61.66(b) appropriate to the additional EFVS operations to be conducted.

The FAA is requiring the supplemental EFVS training in § 61.66(c) to consist of ground and flight training on the subjects and tasks specified in (a)(2) and (b)(2) appropriate to the additional EFVS operation to be conducted, as opposed to only flight training which was what the NPRM proposed in § 61.31(l)(6). This change to the regulatory text is consistent with the discussion in the NPRM,[42] where the FAA explained that a pilot trained to conduct EFVS operations to 100 feet above the TDZE would not be required to complete the full training program applicable to EFVS operations to touchdown and rollout if he or she later decided to conduct EFVS operations to touchdown and rollout. Instead, he or she would be required to complete only that portion of the full training program addressing the differences between the two operations. A full training program consists of both ground and flight training. The FAA therefore intended the supplemental EFVS training to consist of both ground and flight training. The FAA inadvertently omitted ground training, however, in its proposed regulatory text. The FAA is adding ground training to § 61.66(c) to clarify that supplemental EFVS training includes ground training on the subjects specified in § 61.66(a)(2) in addition to flight training on the tasks specified in § 61.66(b)(2) appropriate to the additional EFVS operation to be conducted.

The FAA is also requiring the supplemental EFVS training to be specific to the category of aircraft for which the person is seeking the EFVS privilege, which is consistent with the training requirements in § 61.66(a) and (b) and with the recent flight experience and refresher training requirements in § 61.66(d) and (e).

The FAA is not permitting a person to receive a proficiency check in lieu of the supplemental EFVS training, as originally proposed in § 61.31(l)(6)(ii). Nor is the FAA permitting a person to receive a proficiency check in lieu of the initial ground and flight training, as originally proposed in § 61.31(l)(7). The FAA is not adopting these proposed proficiency checks because they cannot be applied as a practical matter and they are inconsistent with the FAA's reasons for establishing EFVS training requirements. During a proficiency check, a pilot must satisfactorily perform certain flight tasks. Prior to being checked on the flight tasks, a pilot must first receive training on the flight tasks. It is therefore impractical to permit a proficiency check on the tasks listed in § 61.66(b)(2) in lieu of initial training on those tasks. Furthermore, as explained in the NPRM, the FAA, EFVS manufacturers, and operators of EFVS-equipped aircraft have all recognized the need for specialized training in the use of EFVS. The FAA proposed to establish EFVS training requirements to ensure that pilots meet minimum requirements to operate EFVS equipment, that they are trained and tested to a standard, and that an appropriate level of public safety is maintained. The FAA now recognizes that proposed § 61.31(l)(6) and (l)(7) would have permitted a pilot who is untrained and inexperienced with the use of EFVS to receive a proficiency check on the tasks set forth in § 61.66(b)(2) in lieu of receiving the initial training on those tasks. This was not the FAA's intent as such a requirement would contravene the FAA's reasons for establishing EFVS training requirements. The FAA notes, however, that pilots who have satisfactorily completed training on EFVS operations to 100 feet above the TDZE prior to this final rule will not be required to receive duplicative training under § 61.66(a) and (b). Instead, those pilots will be given credit for their previously obtained training pursuant to § 61.66(h)(4), which is discussed in more detail below.

The FAA is also revising § 61.66(a)(2) and (b)(2)(vii) as a result of a comment raised by GAMA. GAMA recommended that the FAA align the terminology in proposed § 61.31(l)(4)(vii) with the terminology ''EFVS image,'' ''EFVS sensor imagery,'' and ''flight information and flight symbology,'' used in § 91.176. Sections 91.176(a)(1)(i)(B) and (a)(1)(i)(E) now use the phrase ''aircraft flight information and flight symbology,'' rather than ''aircraft flight symbology.'' The FAA agrees with GAMA that the terminology should be consistent in part 61. The FAA is therefore revising § 61.66(b)(2)(vii), previously proposed as § 61.31(l)(4)(vii), to include a reference to required aircraft flight information and flight symbology, as used in § 91.176. For consistency, the FAA is also revising § 61.66(a)(2), previously proposed as § 61.31(l)(2), by adding new paragraph (ii) to include EFVS sensor imagery and required aircraft flight information and flight symbology as subjects of ground training for EFVS operations.

Additionally, the FAA is revising § 61.66(a)(2)(i) to read ''Airplane Flight Manual or Rotorcraft Flight Manual limitations'' instead of ''AFM limitations'' because EFVS operations apply to both airplanes and rotorcraft. The reference to ''Airplane Flight Manual or Rotorcraft Flight Manual limitations'' includes the limitations found in the Airplane Flight Manual Supplement or Rotorcraft Flight Manual Supplement as well as those found in the AFM or RFM.

The FAA is also revising certain terms and concepts in § 61.66 to be consistent with current regulations, including revisions resulting from several rulemaking actions that were published after the EFVS proposal was published.[43] The FAA is replacing the terminology ''other endorsement'' with ''training record endorsement'' in § 61.66(a)(1)(ii), (b)(1)(ii), and (c)(2) for consistency with terminology used in other sections of part 61.

[41] In the NPRM, the FAA described the additional EFVS training requirements in proposed § 61.31(l)(6) as differences training. Upon further reflection, the FAA has decided not to use the term ''differences training'' because it is a term of art used by air carriers, which may cause confusion in the context of additional EFVS training. Under part 121 subpart N and part 135 subpart H, differences training is required if a flightcrew member will serve on a variation of a particular aircraft type that has pertinent differences from the base aircraft type. To avoid confusion, the FAA is describing the additional EFVS training requirements as ''supplementary EFVS training.''

[42] ''Revisions to Operational Requirements for the Use of Enhanced Flight Vision Systems (EFVS) and to Pilot Compartment View Requirements for Vision Systems.'' 78 FR at 34943 (June 11, 2013).

[43] These rulemaking actions include the final rules ''Pilot Certification and Qualification Requirements for Air Carrier Operations,'' 78 FR 42374 (Jul. 15, 2013), ''Certified Flight Instructor Flight Reviews; Recent Pilot in Command Experience; Airmen Online Services,'' 78 FR 56828 (Sept. 16, 2013), and ''Qualification, Service, and Use of Crewmembers and Aircraft Dispatchers,'' 78 FR 67800 (Nov. 12, 2013).

2. Recent Flight Experience and EFVS Refresher Training for Persons Conducting EFVS Operations (§ 61.66(d) and (e))

Section 61.66(d) requires a person to perform and log six instrument approaches as the sole manipulator of the controls using an EFVS under any weather conditions in the category of aircraft for which the person is seeking the EFVS privilege. In order to manipulate the controls of an aircraft or act as pilot in command of an aircraft during an EFVS operation, these six instrument approaches must be accomplished within six calendar months preceding the month of the flight. These instrument approaches may be performed in either day or night conditions. One approach must terminate in a full stop landing. For a person authorized to conduct EFVS operations to touchdown and rollout, that person must conduct the full stop landing using the EFVS. These requirements were previously proposed in § 61.57(h). The FAA is adopting these requirements in new § 61.66(d) with two substantive changes. First, the FAA is clarifying that recent flight experience may be performed in either day or night conditions. Second, to be consistent with the requirement originally proposed for proficiency checks in § 61.57(i), the FAA is clarifying that recent flight experience must be performed in the same category of aircraft for which the pilot holds EFVS privileges under § 61.66(a) and (b).

Section 61.66(e) requires a person who has failed to meet the recent flight experience requirements of paragraph (d) for more than six calendar months to reestablish EFVS currency only by satisfactorily completing an approved EFVS refresher course in the category of aircraft for which the person is seeking the EFVS privilege. The EFVS refresher course must consist of the subjects and tasks specified in § 61.66(a)(2) and (b)(2) applicable to the EFVS operations to be conducted. Section 61.66(e) differs from the proposal in the NPRM in that it more closely resembles the instrument proficiency check requirements in § 61.57(d) and rather than calling the mechanism by which a person reestablishes EFVS currency a proficiency check, the FAA is calling it a refresher course.

In the NPRM, proposed § 61.57(i) would have required a person who did not meet the recent flight experience requirements in proposed § 61.57(h) to pass an EFVS proficiency check to act as PIC in an EFVS operation or to manipulate the controls of an aircraft during an EFVS operation. However, the discussion of proposed § 61.57(i) in the NPRM obscured the proposed requirement by stating that a person acting as PIC or a person manipulating the controls of an aircraft in an EFVS operation would either have been required to meet the proposed EFVS recent flight experience requirements or pass an EFVS proficiency check. Because of the statement in the NPRM, proposed § 61.57(i) could have been interpreted one of two ways. Proposed § 61.57(i) could have meant that a pilot who did not meet the recent flight experience requirements of proposed § 61.57(h) could have reestablished EFVS currency only by completing an EFVS proficiency check. Alternatively, proposed § 61.57(i) could have meant that a pilot who did not meet the recent flight experience requirements in § 61.57(h) could have reestablished EFVS currency by either: (1) Satisfying the EFVS recent flight experience requirements in proposed § 61.57(h); or (2) completing an EFVS proficiency check pursuant to § 61.57(i).

The FAA's intent was to require a person who did not meet the recent flight experience requirements to reestablish EFVS currency only by completing an EFVS proficiency check, similar to the instrument proficiency check requirements in § 61.57(d). Upon further reflection, the FAA has decided that the term proficiency check is inappropriate in the context of reestablishing EFVS currency. Unlike an instrument proficiency check, which is based on the instrument practical test standards, an EFVS proficiency check would not have been based on any standards. Rather, an EFVS proficiency check would have consisted of the training tasks specified in proposed § 61.31(l). Because proposed § 61.57(h) would have resulted in a person receiving additional training rather than a proficiency check based on performance standards, the FAA has decided to call it an EFVS refresher course. Additionally, because proposed § 61.57(h) would have required the additional training to consist of the tasks in proposed § 61.31(l), which proposed both ground and flight training, the FAA is requiring the EFVS refresher course to consist of the ground subjects and the flight tasks specified in paragraphs (a)(2) and (b)(2) as applicable to the EFVS operation to be conducted.

To avoid ambiguity, the FAA is restructuring § 61.66(e) to more closely resemble the language for instrument recent flight experience in § 61.57(d) with respect to the six calendar month timeframe. The FAA believes that using language from § 61.57(d), which pilots are already familiar with, will better inform pilots on how to remain current for EFVS operations under § 61.66. Accordingly, under new § 61.66(e), if a person has failed to meet the EFVS experience requirements of § 61.66(d) for more than six calendar months—meaning it has been more than six months since the person was last current to perform an EFVS operation, that person may reestablish EFVS currency only by satisfactorily completing an EFVS refresher course pursuant to § 61.66(e). The FAA notes that the six calendar month period described in § 61.66(d) begins when a pilot satisfactorily completes the ground and flight training and obtains the necessary endorsements under § 61.66(a) and (b).[44]

Section 61.66(e) contains a substantive change from what was proposed in that it provides a six-month grace period for pilots who have failed to maintain the EFVS recent flight experience requirements of § 61.66(d). The proposed regulatory text would have required a pilot to receive an EFVS proficiency check if he or she had not performed and logged the tasks specified in § 61.66(d) within the 6 calendar months preceding the month of the flight. Under new § 61.66(e), however, a pilot may fail to maintain EFVS currency for up to 6 calendar months without having to obtain refresher training. As with instrument recent flight experience, a pilot has an additional 6 calendar months to complete the recent EFVS flight experience tasks specified in § 61.66(d) without having to take an EFVS refresher course to reestablish his or her EFVS privileges.[45] In other words, a pilot has six months from the date that he or she was last current to conduct EFVS operations to perform the EFVS

[44] *See* Legal Interpretation, Letter to Mr. Joshua Wynne from Rebecca B. MacPherson, Assistant Chief Counsel for Regulations (Aug. 1, 2008) (explaining that the six calendar month period described in § 61.57(c) begins when a pilot successfully completes his or her practical test). ''By passing the practical test, the pilot has demonstrated his or her instrument proficiency.'' *Id.* Similarly, the six calendar month period described in § 61.66(d) begins when a pilot successfully completes the EFVS training and obtains the necessary endorsements.

[45] *See* ''Pilot, Flight Instructor, and Pilot School Certification; Technical Amendment,'' 76 FR 78141, 78142 (Dec. 16, 2011) (''[A] pilot who has failed to maintain instrument currency for more than six calendar months may not serve as pilot in command under IFR or in weather conditions less than the minimums prescribed for visual flight rules (VFR) until completing an instrument proficiency check. A pilot whose instrument currency has been lapsed for less than six months may continue to reestablish instrument currency by performing the tasks and maneuvers required in [§ 61.57(c)].'')

recent flight experience required by § 61.66(d), which may be accomplished in any weather conditions.[46] If a pilot fails to maintain EFVS currency for more than 6 calendar months, however, that pilot may not manipulate the controls or act as PIC of an aircraft during an EFVS operation until he or she completes an EFVS refresher course.

The FAA never intended the requirements of § 61.66(d) to replace the instrument experience requirements of § 61.57(c). In fact, the instrument experience requirements specified in § 61.57(c) lay the foundation for conducting safe EFVS operations by ensuring pilots are proficient in conducting instrument approach procedures. The FAA structured § 61.66(d) to enable pilots to satisfy both the instrument experience requirements and the EFVS operating experience requirements during the same flight or series of flights. For example, a person performing an EFVS operation on an instrument approach under IMC may be able to log that instrument approach under § 61.57(c) provided he or she is operating the aircraft solely by reference to the instruments. Under certain conditions, the pilot may have to remove the EFVS sensor image for a portion of the approach in order to operate the aircraft solely by reference to the instruments. In weather conditions that exceed the sensor's capabilities, such as clouds, dense fog, or heavy rain, the pilot may not have to remove the EFVS sensor image if it provides no visual advantage over that of natural vision. However, a person performing an instrument approach using EFVS under VMC would not be able to log that approach under § 61.57(c), unless that person were using a HUD-compatible view limiting device, which enabled the person to perform the approach solely by reference to the instruments. A person would be required to comply with the safety pilot requirements in § 91.109(c) if that person performs an instrument approach with an EFVS in simulated weather conditions using a view limiting device.

[46] During this six-month grace period, a person may not act as PIC of an EFVS operation but may manipulate the controls under the supervision of a PIC properly qualified and current for the purpose of reestablishing currency. *See* Legal Interpretation, Letter to Joseph P. Carr from John H. Cassady, Assistant Chief Counsel for Regulations (Nov. 7, 1984) (discussing the second six-month period as it pertains to a pilot regaining his or her instrument currency and noting that, during this second six-month period, a pilot is prohibited from acting as PIC under IFR or below VFR minimums).

3. EFVS Recent Flight Experience

Boeing commented that proposed § 61.57(h)(1) and (h)(2)(i) should specify that persons should obtain recent flight experience and proficiency checks using the same type of EFVS and in the same category and type of aircraft, if appropriate. Boeing stated that characteristics and controls may be different among different EFVS installations, and that there may be differences in the sensor position and out-the-window view among different airplanes of the same category, such as an ERJ–170 and a Boeing B747.

While it is unclear whether Boeing is referring to category, class, and type as defined in § 1.1, the FAA has decided against requiring persons to obtain recent flight experience using the same type of EFVS in the same category, class, and type of aircraft. It believes that imposing such requirements would be unreasonable. The FAA has decided, however, to require persons to obtain recent flight experience using an EFVS in the same category of aircraft because the characteristics and controls of different categories of aircraft, such as rotorcraft and airplane, may be significantly different. From a practical perspective, operators train pilots on the specific equipment they will fly in accordance with their approved training programs. The FAA has decided to establish minimum standards in § 61.66(d) and (e), which apply to operators who may be operating a broad range of aircraft and EFVS equipment. The FAA recommends, however, that persons obtain recent flight experience using EFVS-equipped aircraft in which the pilot expects to conduct operations. The FAA also recommends that operators address training and proficiency for each specific combination of EFVS and aircraft model in their approved training programs. FSB reports also provide recommendations for training, checking, currency, recent flight experience, and special emphasis areas.

Boeing also asked the FAA for clarification about whether contact and visual approaches under IFR can satisfy the requirement for recent flight experience using EFVS. The FAA notes that although persons may conduct contact approaches and visual approaches under instrument flight rules, these approaches are not instrument approach procedures, as defined in § 1.1. Therefore, persons cannot use these approaches to meet the EFVS recent flight experience requirements of § 61.66(d).

4. Persons Authorized To Conduct EFVS Refresher Training

Section 61.66(e)(2) lists the persons authorized to conduct EFVS refresher training. This list differs from the proposed list of persons authorized to conduct EFVS proficiency checks in § 61.57(i) based on comments from Boeing and based on the FAA's own review of the proposal. More specifically, the FAA is using the term ''authorized training provider'' in paragraph (e)(2) rather than the proposed term ''authorized instructor'' as a result of Boeing's comment, and the FAA is not adopting proposed § 61.57(i)(1), (i)(2), (i)(3), or (i)(5).

Section 61.66(e)(2) requires an EFVS refresher course to be conducted by an authorized training provider who meets the training and recent flight experience requirements in § 61.66. This requirement differs from what was proposed in § 61.57(i)(4), which would have allowed authorized instructors to perform EFVS proficiency checks.[47] The FAA's description of authorized instructor in proposed § 61.57(i)(4) was confusing as evident from Boeing's comment. Boeing commented that the FAA uses different descriptions for instructors who provide initial training under proposed § 61.31(l) and those who provide proficiency checks under proposed § 61.57(i). It recommended that the FAA revise proposed § 61.57(i) to make it parallel proposed § 61.31(l), which uses the term ''authorized instructor'' to describe those who are qualified to provide initial training. As previously discussed, the FAA is using the term ''authorized training provider,'' rather than the proposed term ''authorized instructor,'' in § 61.66(a) and (b) to clarify that all EFVS training must be accomplished in accordance with an FAA approved training program under 14 CFR parts 91, 91 subpart K, 121, 125, 135, 141, or 142. The FAA agrees with Boeing that the FAA should use the same description for instructors who provide initial training under § 61.66(a) and (b) and for instructors who provide EFVS refresher training under § 61.66(e). Accordingly, the FAA is using the term ''authorized training provider'' in § 61.66(e)(2).

Section 61.66(e)(2) requires an authorized training provider to meet the training requirements of § 61.66 and, if conducting EFVS operations in an aircraft during the course of refresher training, the recent flight experience

[47] As explained above, the proposed EFVS proficiency check is now called EFVS refresher training.

requirements of § 61.66.[48] This requirement is consistent with the NPRM because proposed § 61.57(i)(4) would have required the authorized instructor to meet the training requirements for EFVS operations specified in proposed § 61.31(l) and, if conducting EFVS operations in an aircraft, meet the recent flight experience requirements of proposed § 61.57.

A person may receive an EFVS refresher course from an authorized training provider under 14 CFR parts 141 or 142.[49] Therefore, § 61.66(e)(2) encompasses instructors under parts 141 and 142.[50]

The FAA finds it unnecessary to adopt proposed § 61.57(i)(1), (i)(2), (i)(3), or (i)(5).

The FAA is not adopting proposed § 61.57(i)(1), which would have allowed FAA inspectors or designated examiners to conduct EFVS proficiency checks, because a person cannot obtain EFVS refresher training from an FAA inspector or designated examiner.

The FAA is not adopting proposed § 61.57(i)(2), which would have allowed persons who are authorized by the U.S. Armed Forces to perform EFVS proficiency checks to conduct EFVS proficiency checks under § 61.66(e), previously proposed as § 61.57(i), provided the person being administered the check was also a member of the U.S. Armed Forces. Instead, the FAA has decided to create a new paragraph, § 61.66(f), which solely addresses U.S. military pilots and former U.S. military pilots and which clarifies that EFVS proficiency checks administered in the U.S. Armed Forces may satisfy the recent flight experience requirements in § 61.66(d). This paragraph is discussed in more detail below.

The FAA is not adopting proposed § 61.57(i)(3), which would have permitted company check pilots who are authorized to perform EFVS proficiency checks under parts 121, 125, or 135, or subpart K of part 91, to administer EFVS proficiency checks to pilots who are employed by the operator or fractional ownership program manager. The FAA finds it impractical to include company check pilots in the list of persons authorized to administer EFVS refresher training. The FAA also finds it unnecessary to include persons authorized to administer EFVS training under parts 121, 125, 135, or part 91 subpart K in the list of persons authorized to administer EFVS refresher training because, as explained in section III.E.8.c.of this preamble, § 61.66(h)(3) excepts parts 121, 125 (including part 125 LODA holders), 135, and 91 subpart K pilots from the EFVS recent flight experience requirements of § 61.66(d). Rather than meeting recent flight experience requirements of § 61.66(d), or reestablishing EFVS currency under § 61.66(e), pilots conducting EFVS operations for part 91 subpart K, part 121, part 125, and part 135 operators will be checked on EFVS tasks and maneuvers under their respective parts.

Boeing commented that proposed § 61.57(i)(3) should have included contract pilots of an operator or fractional ownership program manager because some operators use contract pilots and instructors for training. While the FAA agrees with Boeing's comment, the FAA's decision to no longer adopt proposed § 61.57(i)(3) obviates addressing Boeing's concern.

The FAA is not adopting proposed § 61.57(i)(5), which would have permitted persons to perform EFVS proficiency checks if they were approved by the FAA to perform EFVS proficiency checks, as unnecessary because § 61.66(e)(2) already allows persons to provide EFVS refresher training if they are authorized by the Administrator to do so.

5. Revisions to § 61.57

The FAA is revising certain terms and concepts in § 61.57. The FAA is revising § 61.57(e)(2) and (e)(3) to correct drafting errors that occurred in a previous rulemaking. A drafting error occurred in paragraph (e)(2), which stated ''when the pilot is engaged in a flight operation under parts 91 and 121 for that certificate holder.'' A drafting error also occurred in paragraph (e)(3), which said ''when the pilot is engaged in a flight operation under parts 91 and 135 for that certificate holder.'' The FAA is revising ''and'' to ''or'' to state ''parts 91 or 121'' and ''parts 91 or 135,'' respectively.

The FAA is also revising § 61.57(e)(2) to remove a reference to § 121.435, which is currently a reserved section and has contained no requirements since March 12, 2014.[51]

6. Military Pilots and Former Military Pilots in the U.S. Armed Forces (§ 61.66(f))

The FAA is creating a new paragraph, § 61.66(f), which solely addresses military pilots and former military pilots in the U.S. Armed Forces. This new paragraph clarifies the regulations applicable to these pilots.

Under § 61.66(f), a military pilot or former military pilot in the U.S. Armed Forces is excepted from the ground and flight training requirements in § 61.66(a) and (b) if he or she can document satisfactory completion of ground and flight training in EFVS operations by the U.S. Armed Forces. This requirement differs from the NPRM, where the FAA proposed to permit EFVS proficiency checks administered in the U.S. Armed Forces in lieu of the EFVS ground and flight training requirements in paragraphs (a) and (b). A pilot obtains a proficiency check in the U.S. Armed Forces after receiving the required ground and flight training. Therefore, the FAA has decided to accept documentation of EFVS ground and flight training by the U.S. Armed Forces, rather than an EFVS proficiency check, in lieu of the ground and flight training requirements in § 61.66(a) and (b). Accordingly, the training requirements in (a) and (b) do not apply to a military or former military pilot in the U.S. Armed Forces if that person can document satisfactory completion of ground and flight training in EFVS operations by the U.S. Armed Forces. The FAA believes this change provides clarity and consistency for military pilots and former military pilots in the U.S. Armed Forces.

Under § 61.66(f)(3), a military pilot or former military pilot in the U.S. Armed Forces may satisfy the recent flight experience requirements in paragraph (d) if he or she documents satisfactory completion of an EFVS proficiency

[48] An EFVS operation is defined as an operation in which visibility conditions require the use of EFVS. If an authorized training provider will be conducting an EFVS operation in an aircraft during the course of EFVS refresher training, that authorized training provider must be EFVS current in accordance with § 61.66(d) and (e).

[49] Section 61.66(e) does not apply to operators under parts 91 subpart K, 121, 125, and 135 because § 61.66(h)(3) excepts these operators from the recent flight experience requirements of § 61.66(d).

[50] Section 61.66(e) also enables a person to receive an EFVS refresher course from an authorized training provider under part 61. The FAA is in the process of developing guidance to approve training programs conducted under part 61.

[51] Qualification, Service, and Use of Crewmembers and Aircraft Dispatchers, 78 FR 67841 (Nov. 12, 2013). Boeing commented that § 121.437 no longer exists and that the FAA should replace the regulatory reference with §§ 121.435 or 121.436. The FAA agrees with Boeing and is replacing the regulatory reference with § 121.436. A rulemaking action entitled ''Pilot Certification and Qualification Requirements for Air Carrier Operations'' (78 FR 42374) removed § 121.437 from the regulations on July 15, 2013, and added new §§ 121.435 and 121.436. Section 121.435 contained the existing certificate requirements for part 121 pilots that were in effect until July 31, 2013. After that date, the requirements of § 121.436 began to apply. The FAA notes that § 121.435 is currently reserved. Therefore, the correct regulatory reference is § 121.436. The EFVS NPRM did not reflect these changes because it was published prior to the July 15, 2013 rulemaking action.

check in the U.S. Armed Forces within 6 calendar months preceding the month of the flight. The check must be conducted by a person authorized by the U.S. Armed Forces to administer the check and the person receiving the check must have been a member of the U.S. Armed Forces at the time the check was administered. This requirement stems from proposed § 61.57(i)(2), which would have permitted EFVS proficiency checks received in the U.S. Armed Forces as a means of satisfying the recent flight experience requirements of § 61.66(d). Proposed § 61.57(i)(2) was confusing, however, because a pilot operating under part 61 would not have the option of going to a person authorized by the U.S. Armed Forces to perform EFVS proficiency checks, and a military pilot receiving an EFVS proficiency check in the U.S. Armed Forces would be receiving the check for military purposes—not for the purpose of satisfying the EFVS recent flight experience requirements of § 61.66(d). The FAA is therefore adopting new § 61.66(f)(3) to clarify that EFVS proficiency checks administered in the U.S. Armed Forces may satisfy the recent flight experience requirements in § 61.66(d).

7. Use of Full Flight Simulators (§ 61.66(g))

Section 61.66(g) states that a person may use a level C or higher full flight simulator (FFS) equipped with an EFVS to meet the flight training, recent flight experience, and refresher training requirements of § 61.66. Section 61.66(g) is consistent with the NPRM, where proposed § 61.31(l)(5), § 61.57(h)(2), and § 61.57(i) would have permitted the use of FFS to meet the flight training, recent flight experience, and proficiency check requirements of proposed § 61.31 and § 61.57. The FAA has decided to consolidate these proposed requirements into one section for clarity. Accordingly, § 61.66(g) now contains the FFS requirements for meeting the flight training, recent flight experience, and refresher training requirements of § 61.66.

The FAA is using the term ''full flight simulator'' in § 61.66(g), rather than ''simulator'' as proposed, because the term ''simulator'' in § 1.1 has been replaced with the term full flight simulator (FFS). Additionally, § 61.66(g) clarifies that the FFS must be evaluated and qualified by the National Simulator Program for EFVS operations, be qualified and maintained in accordance with part 60, or be a previously qualified device in accordance with § 60.17, and be approved by the FAA for the tasks and maneuvers that will be performed in the FFS.

If a pilot is using a level C or higher FFS to meet the flight training requirements of § 61.66, the FFS must be equipped with a daylight visual display, as proposed in § 61.31(l)(5), because § 61.66(b)(2) requires certain flight training tasks to be conducted under both day and night conditions.[52] However, the FAA is not adopting the proposed requirement that a level C or higher FFS be equipped with a daylight visual display if being used to meet the EFVS recent flight experience requirements because § 61.66(d) authorizes a pilot to complete the recent flight experience in either day or night conditions.

8. Exceptions (§ 61.66(h))

The FAA is adopting several exceptions to the flight training, recent flight experience, and refresher training requirements in § 61.66.

a. Manipulating the Controls (§ 61.66(h)(1)(i), (ii), and (iii)

Under § 61.66(b), no person may manipulate the controls of an aircraft during an EFVS operation as specified in § 91.176(a) or (b) unless that person has received and logged flight training for the EFVS operation under a training program approved by the Administrator and obtained a logbook or training record endorsement from an authorized training provider certifying that the person has satisfactorily completed the flight training. The FAA now recognizes that, without an exception, § 61.66(b) would prohibit a person from manipulating the controls of an aircraft during an EFVS operation while he or she was receiving flight training in EFVS operations under an FAA approved training program. Immediately after the pilot received the required flight training and endorsement, however, he or she would be authorized to manipulate the controls of an aircraft during EFVS operations performed on his or her own.

A pilot should be permitted to manipulate the controls of an aircraft during an EFVS operation when that pilot is receiving flight training on EFVS operations under an FAA approved training program, provided the training provider's instructor is qualified under § 61.66 to perform the EFVS operation in the category of aircraft in which the training is being conducted. Accordingly, the FAA is adding new § 61.66(h)(1)(i) to allow manipulation of the controls during flight training.

The FAA also now recognizes that, without an exception, § 61.66(d) would prohibit a person from manipulating the controls of an aircraft during an EFVS operation conducted in the course of satisfying the recent flight experience requirements specified in paragraph (d). Similarly, without an exception, § 61.66(d) and (e) would prohibit a person from manipulating the controls of an aircraft during an EFVS operation conducted during an refresher course. Accordingly, the FAA is adding exceptions in paragraphs (h)(1)(ii) and (h)(1)(iii) to permit a person to manipulate the controls of an aircraft during an EFVS operation conducted in the course of satisfying the recent flight experience requirements and in the course of completing EFVS refresher training.

If a person whose currency had lapsed were to manipulate the controls of an aircraft during an EFVS operation performed in the course of satisfying the recent flight experience requirements, another individual would have to serve as PIC of the aircraft during that EFVS operation because a person may not act as PIC during an EFVS operation unless he or she meets the recent flight experience requirements specified in paragraph (d).[53] The individual serving as PIC during the EFVS operation must be qualified under § 61.66 to perform the EFVS operation in the category of aircraft in which the flight is being conducted. Similarly, if a person were to manipulate the controls of an aircraft during an EFVS operation performed in the course of completing an EFVS refresher course, the person administering the training would have to be qualified under § 61.66 to perform the EFVS operation in the category of aircraft in which the training was being conducted.

b. Exception to Ground and Flight Training (§ 61.66(h)(2))

The FAA is adding new § 61.66(h)(2) to provide personnel involved in certain research and development, EFVS certification, and operational suitability

[52] Part 60 requires level C and level D simulators to have daylight visual scenes. See Part 60, Table A1A Minimum Simulator Requirements. However, before the FAA adopted part 60 on May 9, 2008, the FAA required only level D simulators to have daylight visual scenes. Section 61.66(g)(1) permits persons to use previously qualified devices in accordance with § 60.17. Thus, § 61.66(g)(3) expressly requires a level C or higher FFS to be equipped with a daylight visual display if being used to meet the flight training requirements of § 61.66(b). This equipment requirement is necessary because some level C simulators qualified prior to the establishment of part 60 were not required to have daylight visual scenes.

[53] The FAA notes that, under § 61.66(d), recent flight experience may be accomplished in any weather conditions not just conditions that require the use of an EFVS.

determination activities an alternate means of meeting the training requirements of § 61.66(a) and (b). The FAA finds the addition is necessary because personnel involved in such activities, all of which may be conducted in aircraft issued an experimental certificate under § 21.191, may be otherwise unable to obtain training under an FAA-approved training program, as required by § 61.66(a) and (b).[54] For example, FAA personnel involved in EFVS certification and operational suitability determination activities receive training through other processes that are provided for and specified in internal FAA Orders. These processes may differ from those specified in § 61.66(a) and (b), but are approved and used by the FAA. Another example is an applicant who seeks to certify an EFVS based on new sensor technology for which an FAA-approved training course does not yet exist and an authorized instructor who can give the training is not yet available.

Accordingly, new § 61.66(h)(2) provides that the requirements specified in § 61.66(a) and (b) do not apply if a person is conducting a flight or series of flights in an aircraft issued an experimental airworthiness certificate for the purpose of research and development or showing compliance with regulations provided the person has knowledge of the subjects specified in paragraph (a)(2) of this section and has experience with the tasks specified in paragraph (b)(2) of this section applicable to the EFVS operations to be conducted. This provides some flexibility for tasks that might be specified in § 61.66(b)(2) but are not applicable to a particular research and development or show-compliance project.

In order to qualify under the exception in § 61.66(h)(2), an applicant must submit evidence to the FAA showing that he or she complies with § 61.66(h)(2), along with his or her program letter and application for an experimental certificate. The guidance material will address circumstances in which it is appropriate for an applicant to use this alternate means of meeting the additional training required for EFVS operations under § 61.66(a) and (b), the process an applicant may follow, and other related regulatory requirements.

[54] An FAA-approved training program means training acquired under part 141 or part 142, an FAA-approved training program under part 125 or part 91 subpart K, or an FAA-approved air carrier training program.

c. Exception to Recent Flight Experience Requirements (§ 61.66(h)(3))

As noted in the NPRM, parts 121, 125, 135, and 91 subpart K operators currently authorized to conduct EFVS operations must train, check, and qualify their pilots on EFVS in accordance with their OpSpec or MSpec. Existing regulations in parts 121, 135, and 91 subpart K require operators to provide training that ensures each crewmember is qualified on new equipment, facilities, procedures, and techniques, including modifications to aircraft.[55] Part 125 does not contain training requirements for pilots;[56] however, at a minimum, any person serving as a required flightcrew member for a part 125 operator must meet the EFVS training requirements in § 61.66.[57] The regulatory requirements to train crewmembers on EFVS are transparent within the relevant operating rules in 14 CFR. However, the requirement to be qualified for EFVS operations by one of the certificate holder's check airmen is not as clearly set forth in part 121, 125, 135, or 91 subpart K. The FAA is therefore revising §§ 91.1065, 125.287, 135.293, and appendix F to part 121[58] to provide greater clarity on the checking requirements for EFVS operations. Operators authorized to conduct EFVS operations will incorporate EFVS into existing recurrent training and checking to ensure pilots remain proficient on EFVS tasks and maneuvers. Because pilots will be checked on EFVS tasks and maneuvers under part 91 subpart K, part 121, part 125, and part 135, the FAA is adding § 61.66(h)(3), which excepts parts 121, 125 (including part 125 LODA holders), 135, and 91 subpart K pilots from the EFVS recent flight experience requirements in § 61.66(d).[59]

[55] 14 CFR 91.1081(e), 121.415(g), and 135.329(e).

[56] ''Under the part 125 regulatory design, reliance is placed upon tests and checks to ensure airman are proficient. These tests and checks are adequate to ensure an acceptable level of safety in part 125.'' 45 FR 67214 (October 9, 1980).

[57] Section 61.66 sets forth the specific contents for EFVS training. An EFVS training program—whether conducted by a part 121 air carrier, a part 135 operator, a part 142 training center, or a part 141 pilot school—must at a minimum include the content set forth in § 61.66(a) through (c).

[58] Because § 61.66(g) authorizes a pilot to use a level C or higher full flight simulator (FFS) equipped with an EFVS to meet the flight training, recent flight experience, and refresher training requirements of § 61.66, the FAA is also amending appendix H to part 121 to ensure that the EFVS proficiency check requirements added to appendix F will be completed in a level C or level D FFS.

[59] Because § 61.66(h)(3) excepts part 91 subpart K, part 121, part 125, and part 135 operators from the EFVS recent flight experience requirements in § 61.66(d), these operators will never lapse under § 61.66(d), which means these operators will never have to reestablish EFVS currency under § 61.66(e).

The exception in § 61.66(h)(3) is consistent with the instrument recency provisions, namely § 61.57(e)(2) and (e)(3), which except part 121 and 135 pilots from the instrument recent flight experience specified in § 61.57(c).[60] Section 61.66(h)(3) also excepts part 91 subpart K and part 125 operators (including part 125 LODA holders) from the recent flight experience requirements in § 61.66(d) because, as a practical matter, part 91 subpart K and part 125 operators (including part 125 LODA holders) accomplish instrument proficiency checks under §§ 91.1069 and 125.291 rather than completing the instrument recency tasks specified in § 61.57(c). Section 61.66(d) is modeled after the instrument recent flight experience requirements in § 61.57. To be consistent with the practical application of §§ 61.57, 91.1069 and 125.291, and to ensure that the FAA does not impose an additional burden on part 91 subpart K and part 125 operations, the FAA is excepting them from § 61.66(d). Instead, part 91 subpart K and part 125 operators (including part 125 LODA holders) will be treated similar to part 121 and part 135 operators in terms of EFVS checking requirements, as explained above, which is consistent with the way the FAA has been treating them in EFVS authorizations since 2004.

The exception in § 61.66(h)(3) states that the recent flight experience requirements of § 61.66(d) do not apply to a pilot employed by: A part 119 certificate holder authorized to conduct operations under part 121, 125, or 135; a part 125 LODA holder authorized to conduct operations under part 125; or a fractional ownership program manager authorized to conduct operations under part 91 subpart K, when the pilot is conducting an EFVS operation for that certificate holder, LODA holder, or program manager under parts 91, 121, 125, or 135, as applicable, provided the pilot is conducting the operation in accordance with the certificate holder's OpSpec, with the LODA holder's LOA, or with the program manager's MSpec for EFVS operations.

As with the recency exceptions in § 61.57, the exception from EFVS recency requirements set forth in § 61.66(h)(3) applies only when a pilot is conducting an EFVS operation for a

Thus, the practical effect of § 61.66(h)(3) is that part 91 subpart K, part 121, part 125, and part 135 operators are also excepted from the EFVS refresher course requirements in § 61.66(e).

[60] Section § 61.66(h)(3)(i) excepts part 121 and 135 operators from the EFVS recent flight experience requirements just as § 61.57(e)(2) and (e)(3) except part 121 and 135 operators from the instrument recent flight experience requirements.

part 119 certificate holder under part 91, 121, 125, or 135, for a LODA holder under part 125, or for a fractional ownership program manager under part 91 subpart K. The pilot would be required to comply with § 61.66(d) if he or she were to conduct an EFVS operation outside of the part 119 certificate holder's, the LODA holder's, or the part 91 subpart K program manager's operations. If a pilot conducting EFVS operations for either a part 119 certificate holder, a LODA holder, or a program manager has not satisfied the recent flight experience requirements specified in § 61.66(d) within six calendar months preceding the month of his or her flight, that pilot would still be deemed EFVS current (outside of the part 119 certificate holder's, the LODA holder's, or the program manager's operations) if he or she had accomplished a check on EFVS operations under part 91 subpart K, 121, 125, or 135 by an individual described in paragraph (e)(iii), (iv), or (v), as appropriate, provided it were obtained within six calendar months preceding the month of the flight.

d. Grandfather Clause (§ 61.66(h)(4))

In the NPRM, the FAA proposed § 61.31(l)(7)(ii), which would have excepted pilots from the new EFVS ground and flight training requirements if they satisfactorily completed a training program, proficiency check, or other course of instruction applicable to EFVS operations to 100 feet above the TDZE that is acceptable to the Administrator prior to March 13, 2019. Proposed § 61.31(l)(7) was intended to decrease the regulatory burden on pilots who have been safely conducting EFVS operations to 100 feet above the TDZE under § 91.175(l) and (m) and to provide pilot schools and training centers with adequate time to develop training programs that meet the proposed training requirements.

After further consideration, the FAA finds that proposed § 61.31(l)(7)(ii) would not have sufficiently reduced the regulatory burden on operators who have been conducting EFVS operations to 100 feet above the TDZE under § 91.175(l) and (m) as it focused only on pilot qualification requirements. Because this final rule should not cause any disruption to operators or pilots who have been conducting EFVS operations under § 91.175(l) and (m), the FAA is restructuring the proposed regulations to provide an adequate transition period for operators and pilots conducting EFVS operations to 100 feet above the TDZE. Accordingly, § 91.175(n) requires persons conducting EFVS operations to 100 feet above the TDZE to comply with either § 91.175(l) and (m) or § 91.176(b) until March 13, 2018.[61] Beginning on March 13, 2018, persons conducting EFVS operations to 100 feet above the TDZE must comply with § 91.176(b) and thus the training, recent flight experience and refresher training requirements set forth in § 61.66.

The FAA is adding an exception to § 61.66(h)(5) to clarify that, notwithstanding § 91.175(l)(5), persons conducting EFVS operations to 100 feet above the TDZE under § 91.175(l) and (m) prior to March 13, 2018, are not required to comply with the new training, recent flight experience, and refresher training requirements in § 61.66. Instead, during the transition period, persons may conduct EFVS operations to 100 feet above the TDZE just as they have been under § 91.175(l) and (m).[62] The FAA believes the new transition period is consistent with the discussion in the NPRM in that it decreases the regulatory burden on persons already conducting EFVS operations to 100 feet above the TDZE and it provides pilot schools and training centers with adequate time to develop training programs that meet the proposed training requirements.

Furthermore, the FAA is adopting § 61.66(h)(4), which excepts persons from the ground and flight training requirements in § 61.66(a) and (b) if they are conducting EFVS operations under § 91.176(b) and can document that prior to March 13, 2018, they have satisfactorily completed ground and flight training on EFVS operations to 100 feet above the TDZE. The FAA notes, however, that in order to conduct EFVS operations to touchdown and rollout, these persons must still complete the supplemental EFVS training pursuant to § 61.66(c).

Section 61.66(h)(4) is consistent with the intent of proposed § 61.31(l)(7)(ii), which was to decrease the regulatory burden on pilots already conducting EFVS operations to 100 feet above the TDZE by providing them with a reasonable means of demonstrating compliance with the proposed ground and flight training requirements. The FAA restructured proposed § 61.31(l)(7)(ii), however, to clarify what is required of pilots who wish to be excepted from the new EFVS training requirements based on their previous EFVS experience. Accordingly, new § 61.66(h)(4) clarifies that pilots must be able to document that prior to March 13, 2018, they have satisfactorily completed ground and flight training on EFVS operations to 100 feet above the TDZE.[63] The FAA acknowledges the reduction in time from 24 calendar months after the effective date of the final rule to 12 months after the effective date of the final rule. The FAA reduced the cutoff date to 12 months after the effective date of the final rule to coincide with the transition period provided to operators in § 91.175(n). Reducing the duration of time to 12 calendar months should not impact operators as the FAA expects operators to comply with § 91.176(b) and § 61.66 as soon as practicable. Likewise, pilots who have received training in EFVS operations to 100 feet above the TDZE during the transition period will not be required to duplicate that training—as permitted under § 61.66(h)(4).

Furthermore, while proposed § 61.31(l)(7) was intended to provide training centers and pilot schools sufficient time to either revise or develop training programs that complied with the new training requirements; it would not have established a definitive compliance date for such persons. The FAA is therefore adopting § 91.176(b)(4) to clarify that persons conducting EFVS operations to 100 feet above the TDZE must comply with the new requirements in § 91.176(b) and § 61.66 beginning on March 13, 2018. However, the FAA encourages persons to comply with the new requirements in § 91.176(b) and § 61.66 as soon as practicable.

[61] Because persons conducting EFVS operations to 100 feet above the TDZE may comply with § 91.175(l) and (m) prior to March 13, 2018, the appropriate sections of 14 CFR, including §§ 91.175, 91.1039, 121.651, 125.325, 125.381, and 135.225, will reference both §§ 91.175(l) and 91.176. After March 13, 2018, however, § 91.175(l) and (m) will be removed from 14 CFR along with any references to these paragraphs.

[62] Although operators conducting EFVS operations under § 91.175(l) and (m) were not required to receive EFVS training, the majority of them would have received EFVS training prior to conducting EFVS operations. As explained in the NPRM, EFVS manufacturers, aircraft manufacturers, and operators have all recognized the need for pilots to receive training in the use of EFVS prior to conducting EFVS operations. In fact, non-commercial operators generally obtained EFVS training for their pilots at 142 training centers.

[63] Section 61.66(h)(4) does not require the ground and flight training on EFVS operations to have been obtained under an FAA approved training program.

F. Dispatching, Releasing, or Initiating a Flight Using EFVS-Equipped Aircraft When the Reported or Forecast Visibility at the Destination Airport Is Below Authorized Minimums (§§ 121.613, 125.361, 135.219) and Initiating or Continuing an Approach Using EFVS-Equipped Aircraft When the Destination Airport Visibility Is Below Authorized Minimums (§§ 121.651, 125.325, 125.381, 135.225)

The FAA proposed to amend the dispatch, flight release, and takeoff regulations found in §§ 121.613, 125.361, and 135.219 to permit operators authorized to conduct EFVS operations to dispatch, release, or takeoff under IFR when weather reports or forecasts indicate that weather conditions will be below the minimums authorized for the approaches to be flown at the destination airport. The FAA is no longer amending §§ 121.613, 125.361, and 135.219, as proposed, because the amendments are unnecessary as evidenced by a legal interpretation that was issued by the Assistant Chief Counsel for the Regulations Division on April 21, 2009.[64] The legal interpretation explains that authorized minimums are identified in various documents pertaining to the conduct of the flight, such as standard instrument approach procedures and operations specifications. Weather conditions at an airport must be at or above these authorized minimums at an aircraft's estimated time of arrival if the aircraft is to be dispatched or released under part 121 or 125, or a pilot takes off under IFR or begins an IFR over-the-top operation under part 135, to that location. For an EFVS operation, the controlling visibility limitation will be specified in the operator's OpSpec or LOA authorizing the use of EFVS.[65] Because the FAA interprets ''authorized minimums'' in §§ 121.613, 125.361, and 135.219 to include visibility minimums specified in OpSpecs, an operator authorized to conduct EFVS operations is already permitted to dispatch, release, or takeoff when weather reports or forecasts indicate that the weather conditions will be below the minimums authorized in the standard instrument approach procedure to be flown at the destination airport, so long as the weather conditions will be at or above the controlling visibility limitation in the OpSpec authorizing the use of EFVS.[66]

The FAA also proposed to amend §§ 121.615(a) and 125.363(a) to permit operators to dispatch or release an EFVS-equipped aircraft when weather reports or forecasts indicate that the weather conditions will be below the authorized minimums at the destination airport. The FAA is no longer amending §§ 121.615(a) and 125.363(a), as proposed, because the amendments are unnecessary as evidenced by two legal interpretations that were issued by the Assistant Chief Counsel for the Regulations Division on April 12, 2010 and May 31, 2006.[67] The legal interpretations explain that under § 121.615(a), an air carrier may dispatch an extended overwater flight to a destination airport that is forecasted to be below minimums so long as an alternate airport is forecasted to be above minimums. The FAA interprets § 125.363(a) consistently with § 121.615(a) because § 125.363(a) was based on, and contains the same language as, § 121.615(a).[68] It is therefore unnecessary to amend §§ 121.615(a) and 125.363(a) as proposed.

As originally proposed, the FAA is amending §§ 121.651, 125.325, 125.381, and 135.225 to permit operators authorized to conduct EFVS operations to initiate or continue an approach under IFR when weather reports or forecasts, or any combination thereof, indicate the weather conditions at the destination airport are below the authorized minimums for the approach to be flown. The FAA has also decided to amend § 91.1039(e), which was not originally proposed, to clarify that an EFVS operation is permitted when the landing weather minimums are less than those prescribed by the authority having jurisdiction over the airport. The FAA believes these amendments will enable operators to take full advantage of the operational capabilities provided by EFVS to improve access to runways, increase service reliability, and reduce the costs associated with operational delays, without compromising safety.

Boeing commented that when the rule becomes effective and operators obtain the appropriate authorization to conduct EFVS operations, they will be able to fly approaches to landing and rollout in virtually any weather. Boeing questioned whether performance data is currently available that demonstrates there will be a consistent positive outcome across all operators as a result of this new capability. It suggested the FAA obtain experience with one or two operators before adopting the EFVS operations to touchdown and rollout rule for all operators. It believes it is more appropriate to get performance data for a few operators using the new capability, before making it available to everyone.

The FAA disagrees. Operators have been safely conducting EFVS operations to 100 feet above the TDZE for over 12 years. This final rule is expanding these operations to include EFVS operations to touchdown and rollout and to permit operators using EFVS-equipped aircraft to dispatch, release a flight, or takeoff under IFR, and to initiate and continue an approach, when the destination airport weather is below authorized visibility minimums for the runway of intended landing. The FAA is implementing new training, recent flight experience, and proficiency requirements to ensure that pilots are trained and tested to a standard on EFVS operations and to ensure that these pilots maintain the knowledge and skills necessary to safely conduct EFVS operations. Additionally, the FAA intends to provide operating conditions and limitations in an operator's EFVS authorization to ensure the safe conduct of all EFVS operations.

Furthermore, the FAA specifically structured the EFVS regulations to provide flexibility and to enable the FAA to structure an operator's authorization to conduct new EFVS operations in a way that links equipage and system performance to specific operational capabilities. The equipment certification process will ensure the EFVS meets the equipment requirements and certification criteria for the operation for which the EFVS is intended. The operational approval process will validate the operator's ability to safely perform the EFVS operation.[69] The operational approval

[64] Legal Interpretation, Letter to Mr. James B. Hart from Rebecca B. MacPherson, Assistant Chief Counsel for Regulations (April 21, 2009); *see also* FAA Information for Operators (Info) 08050 (Sept. 25, 2008).

[65] The FAA recognizes that operators authorized to conduct EFVS operations to 100 feet above the TDZE under § 91.175 do not have visibility limitations specified in their OpSpecs or LOAs authorizing the use of EFVS. The FAA will include visibility limitations in OpSpecs or LOAs authorizing EFVS operations to 100 feet above the TDZE under § 91.176(b).

[66] While § 135.219 uses the term ''authorized IFR landing minimums'' rather than ''authorized minimums,'' the FAA interprets § 135.219 consistently with §§ 121.613 and 125.361.

[67] Legal Interpretation, Letter to Captain Gregory Unterseher from Rebecca MacPherson, Assistant Chief Counsel for Regulations (April 12, 2010); Legal Interpretation, Letter to Captain Mark Anderson from Rebecca MacPherson, Assistant Chief Counsel for Regulations (May 31, 2006).

[68] Proposal to Upgrade Regulation of Certain Large General Aviation Airplanes and Replace Commercial Operator and Air Travel Club Regulations, 44 FR 66324, 66327 (Nov. 19, 1979).

[69] AC 90–106A, Section 10, ''Operational Approval Process for EFVS Operations,'' provides an approval process for operators to demonstrate their ability to perform EFVS operations under § 91.176. The process consists of five distinct, yet

Continued

process also evaluates and monitors EFVS equipment reliability and validates the operator's ability to maintain the EFVS equipment.

Several commenters requested clarification on how the FAA intends to manage an operator's authorization to dispatch, release, or takeoff under IFR, and to initiate and continue an approach, when the destination airport weather is below authorized visibility minimums. Airbus noted that the FAA expects to manage this authorization through an operator's OpSpec, MSpec, or LOA for EFVS operations to ensure that an increase in the rate of missed approaches does not occur. It requested clarification on how the FAA will manage this expectation and what requirements this might place on airborne sensor performance. CMC Electronics, Inc. (CMC) asked the FAA to clarify how it will require OEMs to demonstrate EFVS capabilities to support these authorizations. To illustrate its concerns, CMC noted that RVR reporting does not directly relate to EFVS performance and stated that a given RVR measurement can be a result of different types of weather conditions that look the same in the visible spectrum but may lead to different performance in currently certified EFVS systems. Rockwell Collins commented that it assumes visibility limitations will appear in an operator's OpSpec, MSpec, or LOA for EFVS operations as the limitations do not appear in rule language. Rockwell Collins also asked whether it is possible to have a higher than RVR 1000 feet visibility limitation based on a lesser performing sensor, or whether there is the potential for a sensor to be given multiple approvals based on performance in different environmental conditions. Thales commented that the FAA should clearly define minimums for these operations based on EFVS sensor technology, system performance, and installation criteria to ensure equality of treatment for all applicants.

The response to these comments is that an applicant who seeks to certify an EFVS will demonstrate EFVS performance for its aircraft during the EFVS equipment certification process.[70] During that process, the FAA will determine whether an EFVS meets the equipment requirements and certification criteria for the EFVS operation it is intended to be used for (*i.e.,* an EFVS operation to 100 feet or an EFVS operation to touchdown and rollout). EFVS equipment certification criteria differ depending on the EFVS operation to be conducted. Initially the FAA plans to authorize EFVS operations to touchdown and rollout to visibilities as low as RVR 1000 feet. The FAA expects to develop touchdown and rollout authorizations in the future to lower visibilities as EFVS equipment is developed to support those operations.

In addition to the EFVS equipment certification process, the operational approval process—which verifies an operator's ability to safely perform the EFVS operation—includes a demonstration and inspection phase. During this phase, the FAA evaluates an operator's processes, procedures, and training as well as the ability of the operator's maintenance personnel and dispatchers, or persons authorized to exercise operational control, to support the EFVS operations to be conducted. This process verifies the operator's ability to conduct EFVS operations and to determine when it is appropriate to dispatch a flight, release a flight, or take off under IFR as well as initiate or continue an approach when the weather at the destination airport is below authorized minimums. In accordance with § 91.176(a)(4), the FAA may prescribe additional equipment, operational, and visibility and visual reference requirements to account for specific equipment characteristics, operational procedures, or approach characteristics through an operator's authorization to conduct EFVS operations. Accordingly, the FAA may specify minimum visibilities in OpSpecs for part 121, 125, or 135 operators to initiate and continue an approach using an EFVS-equipped aircraft when the destination airport weather is below authorized visibility minimums for the approach to be flown. Therefore, as Rockwell Collins assumed, visibility limitations will appear in an operator's OpSpec, MSpec, or LOA for EFVS operations. In response to Rockwell Collins' inquiry, it is possible to have a higher than RVR 1000-feet-visibility limitation depending on the capability of the EFVS equipment and on the EFVS operation the equipment is certified to support. Authorizations for future EFVS operations may specify other requirements under § 91.176(a)(4), depending on the EFVS operation to be conducted and the ability of the EFVS equipment to support a given EFVS operation.

The FAA disagrees with Thales that it should mandate specific minimums by regulation for EFVS operations as this would be contrary to the FAA's intent. The FAA acknowledges that EFVS performance using currently certified EFVS equipment can vary by sensor technology and design, meteorological conditions, and other factors; however, the FAA may make adjustments to an operator's EFVS authorization. Managing an authorization in this manner ensures that the FAA is able to maintain an appropriate level of safety, enables the FAA to effectively respond to new technology developments, and provides a means to tailor an authorization to fit an operator's particular EFVS capabilities. Therefore, although giving a sensor multiple approvals based on performance in different environmental conditions, as Rockwell Collins suggested, is impractical, the FAA may adjust an operator's EFVS authorization in response to certain conditions. For example, operational experience may indicate that adjustments may have to be made in response to certain meteorological conditions. Operators who plan to conduct these operations should establish operating procedures and training that account for the limitations of the EFVS and weather conditions that may exceed the sensor's ability to provide the enhanced flight visibility required to complete the approach and landing.

Eurocopter/American Eurocopter commented that the provisions of § 121.651(d) that permit a pilot to begin the final approach segment of an instrument approach procedure other than a Category II or Category III procedure at an airport when the visibility is less than the visibility minimums prescribed for that procedure should not be limited to airports that are served by an operative ILS and an operative PAR. Eurocopter asserted that LPV approaches are becoming commonplace and are the only approaches with vertical guidance available at many airfields. The commenter recommended that § 121.651(d) permit the use of WAAS/LPV, particularly with respect to EFVS operations.

The FAA is not adopting Eurocopter/American Eurocopter's recommendations because they are

related phases. The demonstration and inspection phase of the process is the major validation phase where the FAA observes and evaluates the operator's demonstration of its ability to perform in accordance with the procedures, guidelines, and parameters described in the operator's formal proposal. This phase concludes when the operator provides sufficient proof to satisfy the FAA's requirements. The demonstration and inspection phase permits new EFVS capabilities to be deployed while providing regulatory oversight and verification of system and crew performance.

[70] Part 21 contains the certification procedures for products and parts. Parts 23, 25, 27 and 29 contain the airworthiness standards for EFVS. AC 20–167A and AC 90–106A contain guidance on EFVS sensor performance and airworthiness certification appropriate to the EFVS operation to be conducted.

outside the scope of this rulemaking. The FAA did not propose to change the current requirements of § 121.651(d) with respect to non-EFVS operations. The FAA notes, however, that § 121.651(e) permits a pilot to begin the final approach segment of an Area Navigation (RNAV) (GPS) approach to the published LPV (or other applicable) minimums when the visibility is reported to be below the visibility prescribed by the instrument approach procedure when using EFVS as specified in that paragraph.

Gulfstream Aerospace Corporation commented that the FAA did not limit the use of EFVS for landing to ''certain operators.'' However, the commenter noted that the NPRM would have permitted ''certain operators'' using EFVS-equipped aircraft to dispatch, release, or takeoff under IFR, and to initiate and continue an approach, when the destination airport weather was below authorized visibility minimums for the runway of intended landing. Gulfstream commented that the FAA's use of the term ''certain operators'' makes it appear as if dispatch and takeoff using EFVS is restricted. It further stated that if this restriction applies to some operators and not others, the rationale for the distinction should be provided.

The term ''certain operators'' means persons conducting EFVS operations under part 121, 125, or 135 whose operations are subject to specific rules governing the dispatch, release, or takeoff of aircraft under IFR. Prior to this final rule, regulations prohibited these operators from dispatching, releasing, or initiating a flight under IFR when the reported or forecast visibility at the destination airport was below authorized minimums. Regulations also prohibited these operators from initiating or continuing an approach when the destination airport visibility was below authorized minimums. The FAA did not intend the term ''certain operators'' to imply that additional restrictions would be imposed upon individual operators.

Dassault Aviation noted references made by the FAA to the European Aviation Safety Agency's (EASA) reduction of ⅓ of the visibility required to conduct an approach using EFVS in EASA member states. Dassault Aviation requested that the FAA articulate its position with respect to this means of calculating visibility minimums for EFVS operations. The FAA acknowledges that EASA uses a different method to permit operators to conduct EFVS operations. However, this rulemaking only addresses EFVS operations that are subject to FAA regulations.

Rockwell Collins asked whether the FAA and EASA will attempt to harmonize EFVS approved capabilities and requirements in the future. In its comment, Rockwell Collins referred to differences between FAA and EASA regulations such as the requirements applicable to beginning an approach when the reported visibility is less than the visibility specified in the instrument approach procedure to be flown.

The FAA participates on several international committees that are tasked with addressing advanced vision system operations. Every attempt is made to harmonize those operations; however, differences in underlying operational concepts and existing regulations may preclude full harmonization of EFVS rules.

G. Revisions to Category II and III General Operating Rules To Permit the Use of an EFVS (§ 91.189)

Section 91.189 contains the general operating rules for Category II and Category III operations.[71] As originally proposed, § 91.189(d) now permits a pilot to use an EFVS in lieu of natural vision to identify the visual references required for descent below the authorized DH on a Category II or III approach. A pilot conducting a Category II or III approach in accordance with § 91.189(d) must comply with either the provisions of that paragraph for identifying required visual references using natural vision or with the provisions of § 91.176 for identifying required visual references using EFVS.[72] Also as originally proposed, § 91.189(e) now permits a pilot operating an aircraft in a Category II or III approach to continue the approach below the authorized DA/DH provided the conditions specified in § 91.176 are met.[73]

Thales commented that the revisions to § 91.189(d) are confusing when considering how an EFVS might be used during Category III operations. It stated that the amendments are applicable to Category II operations because the DH is at 100 feet, but for Category III operations where the DH is less than 100 feet, Thales believes that the rule should address this segment of the approach.

The FAA disagrees that the regulation should specifically address the use of EFVS during Category III approaches. Rather, the FAA is revising the applicable portions of § 91.189 to align it with § 91.176, which facilitates the possible future use of authorized EFVS operations during authorized Category II or Category III operations. In § 91.189(d), the FAA is amending the regulations for part 91 operators (except for part 91, subpart K operators) to permit them to use an EFVS in lieu of natural vision to identify the required visual references. Under this rule, § 91.189(e) now permits a pilot operating an aircraft on a Category II or III approach to continue the approach below the authorized DA/DH provided the conditions specified in § 91.176 are met. The FAA notes that it authorizes Category II or Category III operations through an operator's OpSpec, MSpec, or LOA. Therefore, an operator who wishes to conduct an EFVS operation during an authorized Category II or Category III operation may only do so in accordance with an OpSpec, MSpec, or LOA. The FAA is also adding paragraphs (a)(2)(xi) and (b)(2)(x) to § 91.176 to clarify the requirement for an authorization to conduct an EFVS operation during an authorized Category II or Category III operation. The FAA notes that it will develop authorizations and guidance to support future EFVS operations.

H. Pilot Compartment View Rules and Airworthiness Standards for Vision Systems With Transparent Displays Located in the Pilot's Outside Field of View (§§ 23.773, 25.773, 27.773, and 29.773)

Sections 23.773, 25.773, 27.773, and 29.773 specify the requirements and conditions under which the pilot compartment must provide an extensive, clear, and undistorted view to the pilot for safe operation of the aircraft within its operating limitations.

[71] Section 91.189(g) states that the provisions of § 91.189 do not apply to Category II or Category III operations conducted by certificate holders operating under parts 121, 125, 129, or 135, or holders of MSpecs issued in accordance with part 91, subpart K. Therefore, § 91.189 only pertains to part 91 operators other than those conducting operations under part 91, subpart K.

[72] Prior to this final rule, a pilot operating an aircraft on a Category II or Category III approach that requires the use of a DA/DH could not continue the approach below the authorized DH unless he or she had at least one of the visual references listed in § 91.189(d)(2) distinctly visible and identifiable using natural vision.

[73] The FAA notes that all of the equipment requirements and airmen certification requirements for the conduct of Category II and Category III operations will continue to apply when an EFVS is used during the conduct of those operations. The FAA also notes that an operator intending to use an EFVS to descend below DA/DH during the conduct of an authorized Category II or Category III operation will be required to revise its Category II or Category Ill manual specified in § 91.191 to reflect the use of EFVS. A person seeking to conduct authorized Category II or Category III operations where the use of EFVS is necessary to conduct those operations will have to be authorized by the Administrator.

Additionally, the regulations require that the pilot compartment be free of glare and reflection that could interfere with the normal duties of the minimum flightcrew.

When these rules were originally issued, the FAA did not anticipate the development of vision systems with transparent displays that could significantly enhance, or even substitute for, a pilot's natural vision. Vision systems are used to display an image of the external scene to the flightcrew. For over a decade, the FAA has certified vision systems for transport category aircraft that have head up displays. However, prior to this final rule, the airworthiness standards governing the pilot compartment view set forth in § 25.773 were inadequate to address the novel or unusual design features of these systems. Therefore, the FAA issued special conditions under § 21.16 to provide airworthiness standards, which were used to enable the installation of vision systems that met a level of safety equivalent to that established by the regulations. Special conditions were issued to each applicant, because special conditions only apply to individual certification projects. However, for consistency, the FAA attempted to standardize these special conditions to the maximum extent possible. With over fourteen years of experience, the process of developing special conditions for vision systems has become routine, and operational experience has shown that the certification requirements set forth in the special conditions have resulted in safe and effective vision system operations.

Based on the experience gained by the FAA in developing special conditions, the FAA is establishing airworthiness standards for vision systems with transparent displays located in the pilot's outside view for airplanes and rotorcraft. This will provide industry with known requirements for the certification of these systems and eliminate the costs resulting from the process of issuing special conditions. Accordingly, the FAA is amending §§ 23.773, 25.773, 27.773, and 29.773 to include the general requirements that were previously contained in special conditions. In recognition of the rapid development of vision system technology, these amendments permit the certification of a wide range of current and future vision systems, such as an EVS, EFVS, SVS, or CVS, and they address display methods other than a HUD, such as head mounted displays or other types of head up presentations.

1. Vision Systems and Display Methods Addressed by §§ 23.773, 25.773, 27.773, and 29.773

Under §§ 23.773(c)(2), 25.773(e)(2), 27.773(c)(2), and 29.773(c)(2), when the vision system displays imagery and any symbology referenced to the imagery and outside scene topography, including attitude symbology, FPV, and FPARC, that imagery and symbology must be aligned with, and scaled to, the external scene. This requirement marks a slight change from the NPRM where the proposed rule would have required the vision system to continuously display the imagery, attitude symbology, FPV, FPARC, and other cues, which are referenced to the imagery and external scene topography.

Thales commented that the proposed airworthiness standards would have required the FPARC to be permanently displayed along with the EFVS imagery. Thales stated that there are phases of flight where this symbology may not be necessary. It suggested the FAA require, ''flight path angle reference cue when necessary.'' Airbus submitted a similar comment, stating that § 25.773(e)(2) should provide for presenting a reduced set of aircraft flight information and flight symbology on the HUD or other equivalent display. It stated that the declutter mode should be allowed to preserve, or not interfere with, the EFVS image and outside view. Airbus's comment also applied to § 23.773(c)(2) and could have necessitated revisions to § 91.175(m) as well. Airbus proposed that § 25.773(e)(2) should permit the display of some cues to be removed depending on the flown phase.

The FAA agrees that the airworthiness standards should not require the continuous display of specific symbology, including the FPARC, in all phases of flight. The FAA's intent was not to require the display of any EFVS symbology or imagery in the airworthiness rules as these rules also address transparent display surfaces for systems other than EFVS. Instead, the FAA intended to identify those visually displayed elements, such as imagery and earth-referenced symbology, which need to be conformal—that is, scaled to and aligned with the outside view. Accordingly, the regulations do not require the continuous display of specific symbology.

However, the FAA does not agree that it should revise the operating requirements in § 91.175(m), which have been moved to § 91.176. The operating rules require specific information to be displayed to the pilot. The FAA notes, however, that EFVS typically have declutter modes available to the pilot that provide a reduced set of information when it is necessary for the safe conduct of the flight.

Eurocopter and American Eurocopter commented that the airworthiness certification rules should be more specific about which types of vision systems they address. It stated that the regulations were specific to EFVS and not to other vision systems that might be certified under these regulations. The FAA agrees with the commenter that the rule language, as proposed, would have required the continuous display of symbology and imagery that was applicable only to EFVS and not to other vision systems that might be certified under these regulations. The airworthiness requirements of §§ 23.773, 25.773, 27.773, and 29.773 apply to any vision system such as an EFVS, EVS, SVS, or CVS that uses a transparent display surface, such as a head up display, head mounted display, or other equivalent display, that is located in the pilot's outside field of view. Accordingly, the FAA is not requiring the continuous display of EFVS symbology and imagery in the airworthiness standards applicable to pilot compartment view. Sections 91.176(a)(1)(i) and (b)(1)(i), however, include specific equipment requirements that address the presentation of sensor imagery, aircraft flight information, and flight symbology for the conduct of EFVS operations.

Honeywell commented that the FAA should apply the airworthiness standards to all vision systems. It believes that applying the standards to all vision systems would potentially ease certification delays and provide a clear path to certification for proven technology that meets specified performance requirements. The FAA agrees and notes that the airworthiness standards in §§ 23.773, 25.773, 27.773, and 29.773 already address all vision systems with a transparent display surface located in the pilot's outside field of view, such as a head up display, head mounted display, or other equivalent display. The FAA also notes that AC 20–167A provides the means of compliance for certifying a vision system with a transparent display surface located in the pilot's outside field of view.

Airbus asked if the FAA would revise the pilot compartment view requirements to apply to HDD vision systems. GAMA commented that the NPRM references ''vision systems'' in several locations, which seem to describe HUD-based systems. GAMA was concerned that the use of the term ''vision systems'' may negatively impact stand-alone head down systems, such as

Synthetic Vision Systems, common in many general aviation aircraft. GAMA recommended that the FAA review its use of the term ''vision system'' and replace it with the term ''Enhanced Flight Vision System,'' as defined in § 1.1.

The FAA disagrees with GAMA. The FAA used the term ''vision system'' to include any EVS, EFVS, SVS, or CVS that uses a transparent display surface located in the pilot's outside field of view, such as a head up-display, head mounted display, or other equivalent display. The certification regulations in this rule do not apply to other vision systems that have only a head down display. Accordingly, the FAA is not revising these requirements to include HDDs.

Cessna Aircraft Company commented that the proposed certification rules pertaining to vision systems were too general and did not include all of the requirements of the operating rules. It suggested aligning the requirements of §§ 23.773(c), 25.773(e), 27.773(c) and 29.773(c) with the operating rules in terms of features and functions that are required to meet the rule, or invoke them by reference.

The FAA disagrees with the commenter. Sections 23.773(c), 25.773(e), 27.773(c), and 29.773(c) contain airworthiness requirements related to providing a safe pilot compartment view, not requirements that are specific to meeting operating rules. The airworthiness standards in these sections apply to all vision systems with transparent display surfaces located in the pilot's outside field of view. Not all of these vision systems may be used for EFVS operations. The FAA is therefore including specific equipment requirements in § 91.176 for EFVS operations. AC 20–167A contains a means of compliance for EFVS, EVS, SVS, and CVS and provides guidance material on features and functions required by the rule.

2. Pilot's Outside View—Terminology and Compensation for Interference

Sections 23.773(c)(1), 25.773(e)(1), 27.773(c)(1), and 29.773(c)(1) require the vision system display to compensate for interference with the pilot's outside field of view such that the combination of what is visible in the display and what remains visible through and around it enables the pilot using the vision system to perform the actions necessary for the operation of the aircraft as safely and effectively as he or she would without a vision system. The terminology in these requirements differs slightly from the NPRM, which used the term ''pilot's outside view,'' rather than ''field of view.''

Gulfstream Aerospace Corporation commented that the term ''pilot's outside view'' was unclear. The FAA agrees and is adopting the term ''pilot's outside field of view'' to refer to what is visible to the pilot from the pilot compartment through the windows of the flight deck looking out, primarily forward of the aircraft, but not limited to the forward field of view.

Elbit Systems of America commented that the FAA should either revise or not adopt the requirement of §§ 23.773(c)(1), 25.773(e)(1), 27.773(c)(1), and 29.773(c)(1), specifying that a vision system must compensate for interference with the pilot's outside view because it believes the requirement is ambiguous and requires clarification. The FAA disagrees and is adopting the requirement that the vision system display must compensate for the visual interference it may cause. It may compensate by providing visual content on the display and by providing EFVS controls that allow the pilot to use sensor imagery safely in a variety of lighting conditions. While it is in operation, the vision system must compensate for interference such that the combination of what is visible in the display and what remains visible through and around it enables the pilot to perform those maneuvers and procedures necessary for the safe operation of the aircraft. The rule provides the performance requirements for the system. AC 20–167A clarifies how EFVS may comply with this requirement.

3. Undistorted View Requirements

Sections 23.773(c)(2), 25.773(e)(2), 27.773(c)(2), and 29.773(c)(2) state that the pilot's view of the external scene may not be distorted by the transparent display surface or the vision system imagery. This differs slightly from what the FAA proposed based on concerns raised by commenters.

Boeing commented that the term ''undistorted'' in proposed § 25.773(e)(2) was not defined in the NPRM. Boeing asserted the term ''undistorted'' was subjective and that an applicant needs quantitative standards for certification to ensure the interpretation of the term is consistent and to ensure the applicant knows how to comply with the requirement. Boeing noted that the FAA could address this term in AC 20–167, SAE ARP–5288, or some other airworthiness standards document but asserted that a clear definition and means of compliance was necessary.

Crew Systems commented that the requirement for the display to provide an ''undistorted view of the external scene'' was excessive as it is not possible to have a see-through panel with no distortion, and suggested that the FAA require that the level of distortion could not interfere with the pilot's ability to control the aircraft trajectory with reference to the scene presented.

Elbit Systems of America stated that ''an undistorted view of the external scene'' should be consistent with other regulatory guidance. Elbit Systems contended that all optical systems have some allowable optical distortion levels and that it is not possible to produce a vision system that provides an undistorted view. Elbit pointed out that AC 20–167A allows for optical distortion, and referred to Section 4.5(c)(4)(h)(iv), which states optical distortion should be 5 percent or less across the minimal field of regard and no greater than 8 percent outside the minimal field of regard. Elbit believes the FAA should allow for some inherent optical distortion.

Based on these comments, the FAA is revising the first sentence of §§ 23.773(c)(2), 25.773(e)(2), 27.773(c)(2), and 29.773(c)(2) to require that, ''The pilot's view of the external scene may not be distorted by the transparent display surface or by the vision system imagery.'' The FAA believes that this clarifies the intent of the rule. While any see-through display may have some distortion, similar to the window panels in the flight deck of the aircraft, such distortion must be practically imperceptible to the pilot's eyes and create no adverse misleading effects on the pilot's view. The level of distortion should not interfere with or adversely affect the pilot's visual task performance. This requirement is an extension of the requirement in § 25.773(a)(1) that the pilot's view be sufficiently undistorted. AC 20–167A sets forth an acceptable means of complying with requirements applicable to optical distortion, along with AC 25–11B, appendix F.

4. Alignment of Vision System Cues and Head Mounted Display (HMD) Considerations

Sections 23.773(c)(2), 25.773(e)(2), 27.773(c)(2), and 29.773(c)(2) require that, when the vision system displays imagery and any symbology referenced to the imagery and outside scene topography, they must be aligned with, and scaled to, the external scene.

Crew Systems commented that a vision system with a transparent display surface requires alignment of the vision system cues with the external scene. It also stated that these operations require

a high degree of reliability and integrity, and that the proposal should include some mention of the effect of misalignment of the image with reference to the real world. In particular, the use of head mounted displays will require a precise alignment which in turn will place demands on the head tracker system. The commenter thought the rules should discuss equipment, systems, and installation requirements (§§ 23.1309, 25.1309, 27.1309, and 29.1309) as they apply to head tracker systems. The commenter also contended that a head tracker system should be fail operational,[74] which would impose more stringent requirements than have been required to date.

The FAA agrees with the safety intent of the comment. Image alignment should not interfere with or adversely affect the pilot's visual task performance. While all optical systems have some allowable optical distortion levels, the level of distortion cannot interfere with the pilot's ability to control the aircraft trajectory with reference to the real world. For further discussion on distortion, see the FAA's disposition of comments above in section III.H.3 of the preamble.

With respect to Crew Systems comments on head tracker systems, the FAA has not yet developed detailed criteria for head worn displays (HWD), of which the head tracker is a component. As head wearable display technology improves, AC 20–167A, and any subsequent revision, may contain the means of compliance. The FAA has tasked the Society of Automotive Engineers (SAE) with developing an aerospace standard for head wearable display performance criteria, which the FAA will consider including in the advisory circular guidance criteria. Therefore, any equipment, system, and installation criteria for a fail operational head tracker system would be included in airworthiness and operational guidance and not primarily in the pilot compartment view regulations.

The Helicopter Association International commented that the rule should address head mounted display (HMD) head tracker integrity to avoid potential misleading display of imagery or symbology resulting from head tracker misalignment.

The FAA does not agree to explicitly address HMD head tracker integrity in the rule. The performance based airworthiness standards of §§ 23.773, 25.773, 27.773, and 29.773 already address the commenter's concerns. While no HMD installation has been approved by the FAA, nor a complete set of airworthiness criteria established, the FAA does expect to develop appropriate means of compliance with applicable regulatory requirements in the future. As head-mounted or head-worn displays are developed for use in vision system operations, the FAA will develop specific guidance to assist in compliance.

ALPA commented that the rule requires an EFVS to provide an undistorted view of the external scene, yet notes ALPA pilots who have flown with EFVS report some EFVS images have parallax when viewed from off-center. Assuming parallax is considered a distortion, ALPA recommended that the FAA establish and quantify a tolerance level regarding the acceptability of parallax in EFVS landing operations.

The regulations state that the pilot's view of the external scene may not be distorted by the transparent display surface or by the vision system imagery. Guidance relating to display criteria, including parallax, is contained in AC 20–167A. As set forth in that AC, ''Parallax should not result in significant performance differences in safety-related performance parameters (*e.g.,* flare height, sink rate, touchdown location, groundspeed during landing, exit and taxi) between EFVS operations and visual operations in the same aircraft.'' AC 20–167A, Section 4–5 contains additional guidance applicable to EFVS displays.

5. Requirement To Provide a Means of Immediate Deactivation and Reactivation of Vision System Imagery

As originally proposed, §§ 23.773(c)(3), 25.773(e)(3), 27.773(c)(3), and 29.773(c)(3) require that the vision system provide a means to allow the pilot using the display to immediately deactivate and reactivate the vision system imagery, on demand, without removing the pilot's hands from the primary flight controls (yoke or equivalent) or thrust controls, and for rotorcraft, without removing the pilot's hands from the primary flight and power controls, such as cyclic and collective, or their equivalent.

FedEx Express, Gulfstream, and Elbit Systems of America recommended against including this requirement in §§ 23.773(c)(3), 25.773(e)(3), 27.773(c)(3), and 29.773(c)(3). They asserted that these regulations pertain to pilot compartment view and that it is not necessary to include these details when they are also addressed in AC 20–167.

The FAA disagrees. The control requirement of §§ 23.773(c)(3), 25.773(e)(3), 27.773(c)(3), and 29.773(c)(3) protects the pilot's view of the outside scene. If the sensor imagery were to obscure the pilot's view of the outside scene, the pilot should have a readily available means to immediately remove the sensor imagery from the HUD. Accordingly, the FAA is requiring immediate deactivation and reactivation.

Eurocopter, American Eurocopter, and GAMA commented that it is not clear whether the requirement applies to the imagery, the piloting symbology, or both. They stated that the ability to deactivate and reactivate the vision system imagery and the piloting symbology may be affected by the type of technology on which the vision system is based. As an example, they pointed out that if night vision goggles (NVGs) were used as an EVS, pilots would have to remove their hands from the flight controls to raise the goggles out of their field-of-view. They recommended that the FAA clarify in the regulations that only the imagery must be deactivated and reactivated on demand.

The FAA does not agree with the recommendation. The commenters' concerns have already been addressed because the regulations specify that the pilot must be able to immediately deactivate and reactivate only the vision system imagery on demand. The FAA notes that applicants should also comply with guidance applicable to HUD installations. In addition, NVGs are not transparent displays and are not addressed by §§ 23.773, 25.773, 27.773 and 29.773. NVGs do not meet the definition of an EFVS. Specifically, NVGs are not transparent when turned off, do not provide the required aircraft flight information and flight symbology, and are not certified to be used in lieu of natural vision to descend below DA/DH or MDA during EFVS operations under IFR. NVGs are aids to natural vision in VMC, not IMC.

Airbus commented that the certification requirement to provide the pilot with a means to immediately deactivate and reactivate the vision system imagery on demand without removing the pilot's hands from the primary flight and power controls is not relevant to all operations where an EFVS might be used. It suggested that this airworthiness certification requirement should not apply when a pilot uses an EFVS for situation awareness only, *i.e.,* when not used to conduct operations under § 91.176(a) or (b).

[74] A fail operational system is a system capable of completing the specified phases of an operation following the failure of any single system component after passing a point designated by the applicable safety analysis (*e.g.,* Alert Height).

The FAA disagrees with the commenter's proposed exception. Providing the pilot a means to immediately deactivate and reactivate the vision system imagery on demand without removing the pilot's hands from the primary flight and power controls is a minimum requirement regardless of whether the EFVS is being used for situation awareness or to conduct an EFVS operation. Because there are times when a pilot may need to quickly remove or restore the sensor imagery during a critical phase of flight, it is essential for the pilot to be able to quickly remove or restore the vision system imagery on demand without removing his or her hands from the primary flight and power controls. This requirement, therefore, protects the pilot's view of the outside scene and applies to all vision systems with a transparent display surface located in the pilot's outside field of view.

6. Vision Systems and Requirements Applicable to Duties and Maneuvers

Sections 25.773(e) and 29.773(c) state that a vision system with a transparent display surface located in the pilot's outside field of view, such as a head-up display, head-mounted display, or other equivalent display, must meet the requirements specified in paragraphs (e)(1) through (e)(4) and paragraphs (c)(1) through (c)(4), respectively, in nonprecipitation and precipitation conditions. These requirements differ slightly from the NPRM based on a comment from Sierra Nevada Corporation.

Sierra Nevada Corporation commented that §§ 25.773(e)(1) and (e)(4) and §§ 29.773(c)(1) and (c)(4) apply to the duties and maneuvers of §§ 25.773(a) and 29.773(a), which are limited to nonprecipitation conditions. Sierra Nevada Corporation thought it reasonable that the requirements would also apply during precipitation conditions. Sierra Nevada Corporation proposed that the requirements apply in any precipitation and lighting conditions — day or night—in which the EFVS is to be certified.

The FAA agrees that the requirements should apply in both precipitation and nonprecipitation conditions. Accordingly, the FAA is revising the introductory language in §§ 25.773(e) and 29.773(c) to address both precipitation and nonprecipitation conditions. Lighting, however, is addressed in other airworthiness standards.

7. Issue Papers for HUD, EFVS, EVS, SVS and CVS Installations

Rockwell Collins commented that FAA vision system issue papers [75] have identified unique EFVS issues related to system operation and safety, and inquired whether these issue papers will also be eliminated based on the new airworthiness requirements for vision systems in the rule and associated advisory circulars.

The FAA used HUD issue papers for general means of compliance with part 25 and for special conditions related to pilot compartment view. The HUD installation means of compliance issue papers are no longer necessary now that AC 25–11, Revision B was published in October 2014. AC 20–167A is used as the primary means of compliance for installations of EFVS, EVS, SVS and CVS. The special conditions for display of vision system video on the HUD will no longer be necessary after this final rule becomes effective. However, an issue paper for dual-HUD installations may still be used to address means of compliance with occupant safety regulations, such as §§ 25.562 and 25.785, until a new policy statement is published to address this topic.

8. Head Up Display (HUD) Installation and Bird Strike Requirements

Crew Systems commented that the FAA should explicitly require a fixed head up display combiner to meet the bird strike requirements of § 25.775.

The FAA disagrees. Section 25.775 addresses design and construction requirements for windshields and windows. These requirements provide an appropriate level of safety against the hazard of a bird strike, and additional requirements applicable to HUD installation would not provide any additional safety benefit.

I. Related and Conforming Amendments (§§ 91.175, 91.905, and 135.225)

The FAA did not receive any comments on the related and conforming amendments it proposed in the NPRM. The FAA is therefore adopting the related amendments as originally proposed. However, because operators may continue to comply with § 91.175(l) prior to March 13, 2018, the FAA is not adopting the conforming amendments it originally proposed to § 91.175. Instead, the FAA is amending § 91.175 to include references to both § 91.175(l) and § 91.176 until March 13, 2018. The revisions to § 91.175 are discussed in more detail below.

In § 91.175(c)(3)(vi), the FAA is revising the term ''visual approach slope indicator'' to read ''the visual glideslope indicator,'' because the term ''visual approach slope indicator'' is overly restrictive.

In § 91.176(b), which contains the regulations that were moved from § 91.175(l), the FAA is revising ''DH or MDA'' to read ''DA/DH or MDA'' to correct an inadvertent omission that occurred in a previous rulemaking.[76]

The FAA is revising § 91.905 to include § 91.176 as a rule subject to waiver. Section 91.175 was listed as one of the rules in § 91.905 that was subject to waiver, and the provisions applicable to EFVS operations to 100 feet above the TDZE were moved from § 91.175(l) and (m) to § 91.176. Section 91.176 also contains regulatory provisions applicable to EFVS operations to touchdown and rollout. As the FAA has already permitted EFVS operations to 100 feet above the TDZE to be subject to waiver, the FAA is permitting the regulations applicable to EFVS operations to touchdown and rollout also to be subject to waiver.

The FAA is revising the introductory text of § 91.175(c) to refer to both paragraph (l) of § 91.175 and § 91.176 because a person conducting an EFVS operation to 100 feet above the TDZE may comply with either the requirements specified in § 91.175(l) or § 91.176(b) prior to March 13, 2018.[77]

Additionally, § 91.175(d)(1), which references § 91.175(l), will remain in the 14 CFR until March 13, 2018. The FAA is re-designating § 91.175(d)(2) as (d)(3) and is adding a new paragraph (d)(2).[78] New paragraph (d)(2) references § 91.176 and refers to paragraphs (a)(3)(iii) and (b)(3)(iii) of § 91.176, which contain the visual references required for descent below 100 feet above the TDZE for EFVS operations to touchdown and rollout and EFVS

[75] The FAA uses issue papers to provide a structured means to address certain issues in the type certification and type validation processes. ''Issue Paper Process,'' AC No. 20–166A (Nov. 6, 2014).

[76] In a previous rulemaking, ''Area Navigation (RNAV) and Miscellaneous Amendments,'' 72 FR 31678 (Jun. 7, 2007), the FAA changed most of the references to ''DH or MDA'' in § 91.175 to ''DA/DH or MDA.'' However, it did not, as intended, change the references to ''DH or MDA'' in § 91.175(l).

[77] The requirements of paragraph (l) of § 91.175 will expire on March 13, 2018. Beginning on March 13, 2018, a person conducting an EFVS operation to 100 feet above the TDZE must comply with the requirements of § 91.176. Therefore, effective March 13, 2018, the introductory text of § 91.175(c) will be revised to reference only § 91.176.

[78] The requirements in paragraph (d)(2) were originally proposed as revisions to current paragraph (d)(1).

operations to 100 feet above the TDZE, respectively.[79]

The FAA is also revising paragraph (e)(1) of § 91.175 so that it references both paragraph (l) of that section and § 91.176.[80]

Furthermore, as discussed in section III.E.5.d of this preamble, the FAA is adding paragraph (n) to § 91.175 to provide a transition period for operators conducting EFVS operations to 100 feet above the TDZE.[81]

The FAA is also revising § 135.225, which prescribes IFR takeoff, approach, and landing minimums, to correct a drafting error that occurred when the 2004 EFVS final rule was adopted. This revision was not proposed in the NPRM. The 2004 EFVS final rule, which made revisions to § 135.225, did not account for changes made to that section by ''Regulation of Fractional Aircraft Ownership Programs and On-Demand Operations'' (Ownership and On-Demand), a final rule published in September 2003. 68 FR 54520. In Ownership and On-Demand, the FAA established the concept of ''eligible on-demand operations'' in part 135. This rule amended § 135.225 to allow eligible on-demand operations to conduct instrument approach procedures to airports without weather reporting facilities. Structurally, this exception was added as paragraph (b), existing paragraph (b) became paragraph (c), and (c) became (d). Because the paragraphs shifted down a letter, the cross reference in new § 135.225(d) was changed from (b) to (c). In January 2004, the FAA again amended § 135.225 when the agency published the EFVS final rule. The FAA intended in that rule to clarify the language pertaining to weather minimums on the final approach segment—that is, the rule text that was shifted from paragraph (c) to paragraph (d) by the September 2003 rule. However, the agency did not revise the final EFVS rule document to reflect that the paragraph designation had changed as a result of the September 2003 rule. The EFVS rule replaced paragraph (c) instead of the intended paragraph (d) creating two paragraphs in the section on weather minimums during the final approach segment and deleting the paragraph establishing what the weather must be to begin the final approach segment of an instrument approach. An FAA legal interpretation dated September 20, 2013, concluded that the current rule language was a result of a drafting error that arose because two final rules were proceeding close in time and the second rule did not account for changes made to § 135.225 by the first rule.[82] The agency did not intend for paragraphs (c) and (d) to apply to instrument approaches initiated using the exception given to eligible on-demand operations in paragraph (b). Accordingly, the FAA is now deleting paragraph (d), revising and re-designating current paragraph (c) as paragraph (d), and adding new paragraph (c).

J. Implementation

As originally proposed, for initial implementation, the FAA is authorizing EFVS operations to touchdown and rollout in visibilities as low as RVR 1,000 feet.[83] Several commenters raised concerns about the FAA's proposed implementation.

FedEx Express (FedEx), Gulfstream, GAMA, Elbit Systems of America, Honeywell, Sierra Nevada Corporation, and RTCA commented that the FAA's statement in the NPRM about the status of RTCA DO–341, ''Minimum Aviation System Performance Standards (MASPS) for an Enhanced Flight Vision System to Enable All-Weather Approach, Landing, and Rollout to a Safe Taxi Speed,'' needs to be updated. They pointed out that DO–341, which contains MASPS for an EFVS that would support EFVS operations to touchdown and rollout in visibilities down to RVR 300 feet, was completed and published on September 26, 2012.

The FAA acknowledges that RTCA DO–341 was published on September 26, 2012, and that it contains industry recommendations for an EFVS that would support EFVS operations to touchdown and rollout in visibilities down to RVR 300 feet.

FedEx, Gulfstream, GAMA, Elbit Systems of America, and Honeywell expressed concern over the FAA's proposal to limit initial implementation of EFVS operations to touchdown and rollout to visibilities of no lower than RVR 1,000 feet. They requested that the FAA clarify that the RVR 1,000 feet visibility limitation is a starting point for EFVS operations to touchdown, but that authorizations to conduct EFVS operations in visibilities of less than RVR 1,000 feet will be developed when EFVS equipment is developed and certified that supports operations in lower visibility conditions. These commenters and Dassault Aviation expressed concern over whether, or when, AC 20–167A would be revised to incorporate the RTCA DO–341 criteria, which contains MASPS for an EFVS that would support EFVS operations to touchdown and rollout in visibilities down to RVR 300 feet. The commenters also stated that if there were no plans to adopt these criteria, they saw no certification path for EFVS equipment that could enable touchdown operations in visibilities of less than RVR 1,000 feet, which could limit investment in technology and adversely affect the benefits of the new EFVS operating rule. Sierra Nevada Corporation specifically requested that the FAA provide a certification path toward lower than 1,000 RVR.

The FAA's statement in the notice that it proposed to limit initial implementation of EFVS operations to touchdown and rollout to visibilities of no lower than RVR 1,000 feet was not intended to be an end point for EFVS authorizations. The FAA fully expects to develop authorizations and enable a certification path for EFVS operations to touchdown and rollout in less than RVR 1,000 feet conditions as EFVS technology is developed that will support those operations. The FAA recognizes that MASPS, as well as an operational concept, have been developed through RTCA SC–213 for EFVS operations to touchdown and rollout in less than RVR 1,000 feet conditions. The FAA intends to include operational and airworthiness certification guidance for those EFVS operations, based in large part on the industry recommendations found in DO–341. The FAA will publish acceptable methods of compliance for these reduced-visibility operations in future revisions of AC 20–167. Any proponent may propose an alternate

[79] Effective March 13, 2018, the FAA will remove paragraph (d)(1) and re-designate paragraphs (d)(2) and (d)(3) as (d)(1) and (d)(2).

[80] Effective March 13, 2018, paragraph (e)(1) will be revised to reference only § 91.176.

[81] Effective March 13, 2018, paragraphs (l) and (m) of § 91.175 will expire and paragraph (n) will be removed from § 91.175.

[82] Legal Interpretation, Letter to Mr. Phillip Kelsey from Mark W. Bury, Acting Assistant Chief Counsel for Regulations (September 20, 2013).

[83] Airworthiness and certification criteria to support EFVS operations to touchdown and rollout in visibilities as low as RVR 1,000 feet were developed through FAA and industry participation on RTCA Special Committee 213 (SC–213). RTCA SC–213 was tasked with developing minimum aviation system performance standards (MASPS) for both EFVS operations to 100 feet above the TDZE and EFVS operations to touchdown and rollout. The FAA incorporated MASPS for EFVS operations to 100 feet above the TDZE into AC 20–167, Airworthiness Approval of Enhanced Vision System, Synthetic Vision System, Combined Vision System, and Enhanced Flight Vision System Equipment. Because the airworthiness requirements to support EFVS operations in very low visibilities would be different than those conducted in a higher visibility range, SC–213 separated the MASPS for touchdown and rollout operations into two activities—MASPS for EFVS operations to touchdown and rollout down to RVR 1,000 feet and MASPS for EFVS operations to touchdown and rollout down to RVR 300 feet. The FAA has revised AC 20–167 to incorporate MASPS for EFVS operations to touchdown and rollout down to RVR 1,000 feet and published them in AC 20–167A.

method of compliance for an EFVS that would support those operations.

FedEx, Gulfstream, GAMA, and Elbit Systems of America noted that there are ongoing FAA/ICAO activities to harmonize requirements for low visibility taxi operations in visibilities as low as RVR 300 feet and that those activities assume EFVS will be an enabler for these operations. These commenters felt the FAA should provide a statement clarifying its intent with respect to low visibility taxi operations using EFVS, especially if the FAA limits EFVS operations to touchdown and rollout to RVR 1,000 feet and does not plan to incorporate RTCA DO–341 airworthiness criteria into AC 20–167A.

The FAA participates in several activities that seek to harmonize vision system standards, concepts, and practices to the extent practicable. Those activities include the HUD, EVS, SVS, and CVS Subgroup of the ICAO Operations Panel (ICAO HESC), the All Weather Operations Harmonization Aviation Rulemaking Committee (AWOH ARC), and the RTCA SC–213. The FAA notes that the EFVS rule does not preclude the use of EFVS during taxi operations and recognizes that using an EFVS can increase situation awareness during such operations. While there is no regulatory requirement in the U.S. for an airport to have an approved Low Visibility Operation/Surface Movement Guidance and Control System Plan when the visibility falls below RVR 1,200 feet, the FAA supports voluntary development of such plans and sees the value in harmonizing those operations to the extent practicable.

Dassault Aviation noted that the FAA made reference to RTCA DO–315, which was published on December 16, 2008. Dassault Aviation suggested that the FAA refer to RTCA DO–315B, instead.

The FAA's intent in referencing RTCA DO–315 was to reference the original version of the document, which first contained the MASPS for EFVS operations to 100 feet above the TDZE. The FAA recognizes that DO–315 was revised, and at this time, system design criteria for EFVS operations to touchdown and rollout are contained in RTCA DO–315B and DO–341.

K. Miscellaneous Issues

In this section, the FAA discusses a host of unrelated issues. Some of these issues were raised by commenters. Others resulted from the FAA's own review of the NPRM.

1. Minimum Crew Requirements

Eurocopter and American Eurocopter stated that the EFVS operation specified in § 91.176(a)(2) implies a new kind of operation that could impact minimum crew requirements. It recommended that the FAA revise §§ 23.1523, 25.1523, 27.1523, 29.1523, 23.1525, 25.1525, 27.1525, and 29.1525 to reflect EFVS operations.

The FAA disagrees. The minimum flight crew requirements in 14 CFR parts 23, 25, 27, and 29 are sufficient and effective in establishing the minimum flightcrew for the aircraft; they do not need to be revised to reflect EFVS operations.

2. Failure Modes

Boeing commented that the rule does not adequately address failure modes and crew responses. Boeing stated that natural vision appears to be a mitigator for the loss of EFVS during touchdown operations down to RVR 1000 feet. Boeing believes it is circular reasoning to allow EFVS to replace natural vision, and then depend on natural vision in the event of an EFVS failure. In addition, it believes design assurance levels for different technologies, for example ILS and EFVS, need to be similar to avoid biasing in favor of one technology over the other. Boeing recommended that availability and reliability requirements be specified in the rule or in AC 20–167A. Boeing stated these clarifications and revisions are necessary so that designers and operators will know what is expected in failure cases.

The FAA finds such revisions unnecessary. The requirements of §§ 23.1309, 25.1309, 27.1309, and 29.1309 apply to failure modes, hazard classifications, and failure probabilities. AC 20–167A further addresses specific system safety considerations.

The FAA has defined a means of compliance in AC 20–167A to use EFVS to provide sufficient enhanced flight visibility to complete an instrument approach and landing in visibility conditions as low as RVR 1000 feet.

Operationally, EFVS may be used to meet enhanced flight visibility and visual reference requirements for the instrument approach as stated in the NPRM. When the enhanced flight visibility and visual reference requirements of the regulations are met, descent and operation below the DA/DH may continue. However, certification applicants should account for failures of the EFVS in IMC below DA/DH. Generally, as with loss of visibility during conventional instrument approaches, a pilot may need to do a missed approach.

3. EFVS Equipment and Operational Considerations

ALPA and an individual commented that current IR-based EFVSs can take several minutes to warm up before they are able to be used in EFVS operations, and stated that operational guidance should account for this delay when an EFVS is powered up just prior to starting an instrument approach. The individual also commented that EFVS operations will require a high degree of system reliability during adverse weather conditions, and that if the EFVS were to malfunction close to the ground, a potentially unsafe condition could exist. The commenters recommended that EFVSs should have an in-flight checking capability to confirm that the system is fully operational prior to beginning an instrument approach procedure.

The commenters concerns are already addressed in § 61.66 and AC 90–106. Section 61.66(a) and (b) specify that ground and flight training must address preflight and in-flight preparation of EFVS equipment for EFVS operations. AC 90–106A, Section 5, contains guidance applicable to training and specifies that pilots should be familiar with the warm-up requirements of the system, along with other operational considerations, crew procedures, and crew coordination items. AC 20–167A also contains guidance on EFVS system performance, including system failure notifications. EFVS malfunctions detected by the system, which can adversely affect the normal operation of the EFVS, should be annunciated. At a minimum, specific in-flight failure messages for sensor failure and frozen image should be displayed to the flight crew.

4. Applicability of Previously Collected Data or Data Submitted on the Basis of Similarity

In its proposal, the FAA noted that under the 2004 EFVS rule, an EFVS installed on a U.S.-registered aircraft conducting EFVS operations to 100 feet above the TDZE must be installed on that aircraft in accordance with an FAA type design approval, namely a type certificate, amended type certificate, or supplemental type certificate. The FAA also stated that an EFVS that is currently certified to conduct EFVS operations to 100 feet above the TDZE may not meet the airworthiness standards necessary to support EFVS operations to touchdown and rollout. Section 91.176(a)(1)(i) requires an aircraft to be equipped with an operable EFVS that meets the applicable airworthiness requirements. Thus, the

FAA will require a similar certification process for an EFVS installed on an aircraft used in EFVS operations to touchdown and rollout.

Rockwell Collins asked whether credit could be given during the certification process for previously collected data. For example, if video data was collected during a previous EFVS performance demonstration that was conducted to 100 feet above the TDZE, could the operator take credit for that data with a follow-on demonstration that focused on rollout? It stated it believes this will be an ongoing issue the FAA will need to address in a consistent manner.

The FAA cannot assume that an EFVS that was only demonstrated and approved for EFVS operations to 100 feet above the TDZE will also be acceptable as a primary system for landing and rollout. Flight demonstrations specific to EFVS operations below 100 feet above the TDZE, landing, and rollout will usually be necessary. Flight test demonstrations will be specifically focused on showing compliance with specific requirements and criteria; hence, the flight test results may not be extrapolated beyond their original purposes. EFVS flight test demonstrations conducted prior to this rulemaking did not attempt to establish the ability to use the EFVS for landing or rollout. Prior flight testing that demonstrated the performance of the sensor in coping with the reported atmospheric conditions, particularly the collection and analysis of data comparing enhanced flight visibility to flight visibility may offer useful information in support of approval of the EFVS for landing and rollout. However, the EFVS should demonstrate that it can be relied on as the primary means for operation below 100 feet above the TDZE and for the landing and rollout.

CMC commented that certification credit for demonstrated EFVS performance should be transferable to other installations that have the same EFVS configuration. CMC pointed out that the details of an EFVS installation may differ from one installation to another, and it suggested that the FAA develop a framework for addressing these differences. It stated that credit transfer from one installation to another is not intended to replace all flight tests on a new platform or installation. Instead, the credit transfer would allow for the use of applicable data that was previously collected, in addition to flight test data on the new platform, to form the basis of an EFVS performance demonstration.

CMC asserted that this framework would enable EFVS suppliers, aircraft manufacturers, and operators to utilize previous flight test investments and thereby significantly reduce certification and performance capability demonstration costs.

The applicant may follow existing provisions and practices for establishing ''similarity'' of an equipment installation from one aircraft to another by providing compliance data approved for the other aircraft. The FAA will follow existing processes to evaluate the applicability of data submitted on the basis of similarity and recognizes the benefit in reducing repetitive certification and performance demonstration costs.

However, since EFVS equipment can perform differently on dissimilar aircraft, data used to show the compliance of one installation may not be appropriate for use in demonstrating the compliance of another installation.

5. Public Aircraft Operations

In the 2004 EFVS final rule and proposed § 91.176, the FAA did not distinguish between civil aircraft operations and public aircraft operations.[84] Thus, both the 2004 EFVS final rule and proposed § 91.176 applied to public aircraft operations, other than the U.S. military. Generally, public aircraft operations are not required to meet the same certification and airworthiness requirements that are imposed on civil aircraft. U.S. military aircraft generally meet military certification and airworthiness standards. Because EFVS operations are conducted in very low visibilities below minimums, the FAA finds that there cannot be a distinction among aircraft used to conduct EFVS operations in the National Airspace System. Each aircraft that is used to conduct an EFVS operation, regardless of whether the operation qualifies as a public aircraft operation, must meet the airworthiness and certification requirements set forth in § 91.176(a) or (b), as applicable to the EFVS operation being conducted (except U.S. military aircraft). Furthermore, each pilot flightcrew member conducting an EFVS operation, regardless of whether the operation qualifies as a public aircraft operation, is required to meet the training and recent flight experience requirements of § 61.66 (except U.S. military pilots). Accordingly, the FAA is adding § 91.176(c) to clarify that public aircraft operators who choose to conduct EFVS operations under § 91.176(a) or (b) must meet the previously stated requirements. The FAA recognizes that certain public aircraft operators who choose to conduct EFVS operations under § 91.176 may have aircraft that cannot meet the FAA's certification and airworthiness requirements. The FAA will consider the ability of these public aircraft to conduct EFVS operations on a case-by-case basis.

6. Qualification Requirements for Persons Conducting EFVS Operations in the United States

Section 91.176(a)(2)(vii) describes the necessary qualifications for persons conducting EFVS operations in the United States. In the NPRM, proposed § 91.176(a)(2)(vi) would have required, just as § 91.175(l)(5)(ii) required, each required pilot flightcrew member for a foreign person to meet the requirements of the civil aviation authority of the State of the operator. Section 129.1 defines ''foreign person'' as any person who is not a citizen of the United States and who operates a U.S.-registered aircraft in common carriage solely outside the United States. The FAA is concerned that a broader population than that defined by the term ''foreign person'' in § 129.1 will conduct EFVS operations in the United States. For example, the term ''foreign person'' failed to capture persons acting as required pilot flightcrew members for foreign air carriers subject to part 129, and any persons serving as required pilot flightcrew members of foreign registered aircraft. The FAA is, therefore, revising proposed § 91.176(a)(2)(vii) to more clearly identify the categories of persons who might conduct EFVS operations in the United States, and to ensure that the regulation adequately describes the necessary qualifications for these persons.

Section 91.176(a)(2)(vii)(A) now requires each person exercising the privileges of a U.S. pilot certificate, or any person serving as a required pilot flightcrew member of a U.S.-registered aircraft, to be qualified in accordance with part 61, and as applicable, the training, testing, and qualification provisions of parts 91 subpart K, 121, 125, or 135 that apply to the operation. Section 91.176(a)(2)(vii)(B) now requires each person acting as a required pilot flightcrew member for a foreign air carrier subject to part 129, or any person serving as a required pilot flightcrew member of a foreign registered aircraft to be qualified in accordance with the training requirements of the civil aviation authority of the State of the

[84] Section 1.1 defines ''civil aircraft'' as aircraft other than public aircraft. Therefore, if a regulation applies only to civil aircraft, it does not apply to public aircraft.

operator for the EFVS operation to be conducted.

7. Economic Comments

Boeing requested that the FAA explain how it established the number of aircraft used in the economic analysis so that operators can better judge their costs.

In order to estimate the total number of affected aircraft for the NPRM, the FAA asked original EFVS equipment manufacturers and aircraft manufacturers for the information. The FAA determined the total number of EFVS-equipped aircraft based on the responses received from those manufacturers. The FAA did not obtain a future equipment estimate from Boeing although the Agency requested that Boeing provide the projected number of aircraft it plans to equip or acquire with EFVS by year from 2012 onward. Boeing also commented that it is unclear in the NPRM whether the estimated paperwork burden is per airplane, per operator, or fleetwide. It stated that it can be deduced by subsequent paragraphs, but clarification of this issue would avoid confusion and lead to a clearer understanding.

The estimated paperwork burden of $86,000 covers the entire fleet of EFVS-equipped aircraft.

An individual stated that this rule could provide benefits to student pilots; however, one challenge would be increased training costs, including EFVS training.

The decision to conduct EFVS operations addressed by this rule is voluntary and optional. Therefore, this rule will not impose costs on a trainee who chooses not to conduct EFVS operations in the future. Furthermore, the FAA believes that student pilots typically will not conduct EFVS operations during their initial training.

Airbus commented on the training requirement cost in the proposed regulatory evaluation. Airbus stated that the incremental training cost of $750 per pilot does not take into account the benefits and the reduced operational costs that would result from a dual HUD configuration. The FAA did not take dual HUD configurations into account when estimating the incremental training cost of $750 because the FAA sought to use a conservative estimate in the regulatory evaluation.

Airbus explained that it cannot comment on certification costs because Airbus has not yet applied for EFVS certification. However, in commenting on the benefits section of the proposed regulatory evaluation, Airbus asked what the FAA expects from an applicant in terms of demonstrating that ''missed approaches and delayed take-offs'' are minimized.[85] The FAA does not expect nor require an EFVS operator to demonstrate benefits in order to utilize extended EFVS capabilities. The FAA believes that enhanced EFVS capabilities will result in unquantifiable benefits, which include the reduction of ''missed approaches and delayed take-offs.''

IV. Regulatory Notices and Analyses

A. Regulatory Evaluation

Changes to Federal regulations must undergo several economic analyses. First, Executive Order 12866 and Executive Order 13563 direct that each Federal agency shall propose or adopt a regulation only upon a reasoned determination that the benefits of the intended regulation justify its costs. Second, the Regulatory Flexibility Act of 1980 (Pub. L. 96–354) requires agencies to analyze the economic impact of regulatory changes on small entities. Third, the Trade Agreements Act (Pub. L. 96–39) prohibits agencies from setting standards that create unnecessary obstacles to the foreign commerce of the United States. In developing U.S. standards, the Trade Act requires agencies to consider international standards and, where appropriate, that they be the basis of U.S. standards. Fourth, the Unfunded Mandates Reform Act of 1995 (Pub. L. 104–4) requires agencies to prepare a written assessment of the costs, benefits, and other effects of proposed or final rules that include a Federal mandate likely to result in the expenditure by State, local, or tribal governments, in the aggregate, or by the private sector, of $100 million or more annually (adjusted for inflation with base year of 1995). This portion of the preamble summarizes the FAA's analysis of the economic impacts of this final rule. We suggest that readers seeking greater details read the full regulatory evaluation, a copy of which we placed in the docket for this rulemaking.

In conducting these analyses, the FAA has determined that this final rule: (1) Has benefits that justify the costs; (2) is not an economically ''significant regulatory action'' as defined in section 3(f) of Executive Order 12866; (3) is not ''significant'' as defined in DOT's Regulatory Policies and Procedures; (4) will not have a significant economic impact on a substantial number of small entities; (5) will not create unnecessary obstacles to the foreign commerce of the United States; and (6) will not impose an unfunded mandate on state, local, or tribal governments, or other private sectors by exceeding the threshold identified above. These analyses are summarized below.

Parties Potentially Affected by this Rulemaking

- Original equipment manufacturers (OEMs) producing enhanced flight vision systems (EFVS) or other vision systems, in accordance with parts 23, 25, 27, or 29
- Persons installing EFVS or other vision systems with a transparent display surface located in the pilot's outside field of view
- Persons conducting EFVS operations under parts 91, 121, 125, 129, or part 135
- Persons conducting EFVS training

Principal Assumptions and Sources of Information

- A 10-year period for this analysis is used because this period captures all significant cost impacts
- Discount rate is 7 percent (Office of Management & Budget, Circular A–4, ''Guidelines and Discount Rates for Benefit-Cost Analysis of Federal Programs,'' October 29, 1992, p. 8, *www.whitehouse.gov/omb/circulars/index.html*)
- An average of 4 pilots assigned to each EFVS-equipped aircraft
- OEMs and two operators provided the number of EFVS-equipped aircraft
- Operators of some aircraft equipped with older EFVS units will not seek certification for EFVS to touchdown and rollout
- The estimation of the incremental training cost per person is approximately $750 based on data collected from training centers
- Certification costs of incremental EFVS capabilities to touchdown and rollout are approximately $1 million in the aggregate
- Aircraft operations over the next 10 years will grow at about 2.53% per year based on the FAA 2015 forecast (the general aviation turbojet, FAA Aerospace Forecast Fiscal Years 2015)[86].

Benefits of This Rule

Since this final rule is voluntary, the FAA expects those who choose to engage in extended EFVS operations will do so only if the expected benefit to them exceeds the cost they incur. The

[85] Airbus also asked what the FAA meant in terms of airborne sensor performance requirement. The FAA is not responding to this comment because it is outside the scope of the regulatory evaluation. The FAA reopened the comment period on August 20, 2015 to allow for comments on the regulatory evaluation only.

[86] The FAA forecast for active general aviation (GA) turbine jets is 2.53% for the period of 2015–2027.

final rule will enable expanded EFVS operations, which will increase access, efficiency and throughput in low visibility conditions, and minimize potential for missed approaches and delayed take-offs. In addition, EFVS permits low visibility operations on a greater number of approach procedure types. Changes in the U.S. aviation infrastructure,[87] such as the transition from incandescent to light-emitting diode (LED) approach lights, could potentially impact the near term benefits for persons using EFVS equipment, but may not impact future benefits of EFVS equipment designed to be interoperable with LEDs. The impact on the benefits is undetermined because both the infrastructure and EFVS capabilities are evolving. Benefits of this final rule will be realized by averting costs related to interrupted flight operations due to low visibility resulting in lost passenger time and extra fuel consumption.

Eliminating the requirement to obtain a waiver from Flight Standards when conducting certain EFVS operations will save applicants time for processing paperwork. Cost saving of waiver elimination is reflected in the FAA's paperwork reduction estimates.

Revisions to pilot compartment view requirements for vision systems with a transparent display surface located in the pilot's outside field of view will codify the current practice of issuing special conditions for each of these vision systems by providing industry with known requirements for the certification of these systems under parts 23, 25, 27, and 29. Because the revisions to pilot compartment view requirements will streamline the certification process for these vision systems by eliminating the need to issue special conditions, the FAA and applicants will save the associated time and expense. The full extent of these benefits has not been determined and therefore has not been quantified in this analysis.

Costs of This Rule

The regulatory costs attributed to the requirements are those above and beyond the current regulation and common practice. The FAA estimates compliance costs as the incremental differences in costs, resulting from the changes in training, equipment and certification requirements. Data were obtained from EFVS original equipment manufacturers, training centers, and two operators. The total incremental cost attributable to the requirements equals nominal training cost ($4.1 million) plus the initial certification cost ($1 million). The compliance cost of the equipment requirements is negligible. The total incremental cost of the final rule is approximately $5.1 million for the ten year period. The present value of that is approximately $4.1 million using a seven percent discount rate. The following table presents the summary of the regulatory costs in 2014 dollars (nominal value) and present value (PV).

Cost component	Nominal cost ($ million)	Present value at 7% ($ million)	Present value at 3% ($ million)
Training Cost	$4.1	$3.1	$3.5
Certification Cost	1	1	1
Equipment Cost			
Total	5.1	4.1	4.5

Benefit/Cost Summary

The total estimated cost of this final rule over 10 years is approximately $5.1 million nominal value or $4.1 million present value at a 7% discount rate. The annualized cost of this final rule in current dollar value is approximately a half million dollars. These estimated compliance costs will be incurred by those operators who want improved EFVS capabilities. OEMs are already proceeding with efforts to expand EFVS capabilities which, by itself, indicate the benefits of this final rule will likely exceed the costs. The revisions to pilot compartment view requirements for vision systems with a transparent display surface located in the pilot's outside field of view will not impose additional costs from those currently incurred using the special conditions process. The FAA believes the final rule will have benefits exceeding costs based on the likelihood that OEMs and operators will voluntarily incur the costs of the final rule in order to realize expected benefits.

B. Regulatory Flexibility Determination

The Regulatory Flexibility Act of 1980 (Pub. L. 96–354) (RFA) establishes ''as a principle of regulatory issuance that agencies shall endeavor, consistent with the objectives of the rule and of applicable statutes, to fit regulatory and informational requirements to the scale of the businesses, organizations, and governmental jurisdictions subject to regulation. To achieve this principle, agencies are required to solicit and consider flexible regulatory proposals and to explain the rationale for their actions to assure that such proposals are given serious consideration.'' The RFA covers a wide-range of small entities, including small businesses, not-for-profit organizations, and small governmental jurisdictions.

Agencies must perform a review to determine whether a rule will have a significant economic impact on a substantial number of small entities. If the agency determines that it will, the agency must prepare a regulatory flexibility analysis as described in the RFA. However, if an agency determines that a rule is not expected to have a significant economic impact on a substantial number of small entities, section 605(b) of the RFA provides that the head of the agency may so certify and a regulatory flexibility analysis is not required.

As stated in the initial regulatory flexibility determination, the FAA expects many small entities will benefit from this final rule. The FAA did not receive comments on the initial regulatory flexibility determination. Prior to the final rule, the regulations permitted operators to conduct EFVS operations to 100 feet above the TDZE. The final rule permits operators to use an EFVS in lieu of natural vision from 100 feet above the TDZE to touchdown and rollout. Operators under parts 91, 91 subpart K, 121, 125, and 135 may conduct EFVS operations to touchdown and rollout under the final rule. Accordingly, the final rule may affect firms operating under those parts. The SBA size standard as defined in 13 CFR 121.201, is the largest size that a

[87] FAA airport infrastructure decisions are independent from this analysis.

business (including its subsidiaries and affiliates) may be to remain classified as a small business by the SBA. The SBA size standard in each of the four North American Industry Classification System (NAICS) air transportation industries is 1,500 employees.

We estimate that 982 aircraft are currently equipped with EFVS, which includes both large and small entities. Very few part 121 and part 135 operators have installed EFVS in their aircraft. A few part 91 subpart K, 121, or 135 operators have installed EFVS in their aircraft. Most of the operators with EFVS-equipped aircraft are part 91 operators (other than part 91 subpart K operators). Many part 91 operators are small entities.

For small entities who have been conducting EFVS operations to 100 feet above the TDZE under the old regulations, but who choose not to conduct EFVS operations to touchdown and rollout, the final rule does not impose additional cost. These small entities are still eligible to conduct EFVS operations to 100 feet above the TDZE using their old EFVS equipment, which has already been certified for EFVS operations to 100 feet above the TDZE. For small entities who have been conducting EFVS operations to 100 feet above the TDZE under the old regulations, but who choose to conduct EFVS operations to touchdown and rollout, the final rule will impose no additional installation costs because most systems installed after 2006 meet the requirements for EFVS operations to touchdown and rollout. The final rule will, however, impose training costs on these small entities. We estimate a one-time training cost of $750 per pilot, which accounts for the cost of training from 100 feet above the TDZE to touchdown and rollout. The FAA finds that this estimated training cost, even if for 4 pilots per aircraft, would not have a significant economic impact on the small entities affected by the final rule, because the equipment flown is valued in the tens of millions and these owners voluntarily incur these costs.

Therefore, for the reasons discussed above, the FAA certifies that this final rule will not have a significant economic impact on a substantial number of small entities.

C. International Trade Impact Assessment

The Trade Agreements Act of 1979 (Pub. L. 96–39), as amended by the Uruguay Round Agreements Act (Pub. L. 103–465), prohibits Federal agencies from establishing standards or engaging in related activities that create unnecessary obstacles to the foreign commerce of the United States. Pursuant to these Acts, the establishment of standards is not considered an unnecessary obstacle to the foreign commerce of the United States, so long as the standard has a legitimate domestic objective, such the protection of safety, and does not operate in a manner that excludes imports that meet this objective. The statute also requires consideration of international standards and, where appropriate, that they be the basis for U.S. standards. The FAA has assessed the potential effect of this final rule and determined that the final rule will not impose obstacles to foreign commerce, as foreign exporters do not have to change their current export products to the United States; and that the final rule will impose the same costs on domestic and international entities and thus has a neutral trade impact.

D. Unfunded Mandates Assessment

Title II of the Unfunded Mandates Reform Act of 1995 (Pub. L. 104–4) requires each Federal agency to prepare a written statement assessing the effects of any Federal mandate in a proposed or final agency rule that may result in an expenditure of $100 million or more (in 1995 dollars) in any one year by State, local, and tribal governments, in the aggregate, or by the private sector; such a mandate is deemed to be a ''significant regulatory action.'' The FAA currently uses an inflation-adjusted value of $155 million in lieu of $100 million. This final rule does not contain such a mandate; therefore, the requirements of Title II of the Act do not apply.

E. Paperwork Reduction Act

The Paperwork Reduction Act of 1995 (44 U.S.C. 3507(d)) requires that the FAA consider the impact of paperwork and other information collection burdens imposed on the public. According to the 1995 amendments to the Paperwork Reduction Act (5 CFR 1320.8(b)(2)(vi)), an agency may not collect or sponsor the collection of information, nor may it impose an information collection requirement unless it displays a currently valid Office of Management and Budget (OMB) control number.

This action contains the following information collection requirements:

- Section 61.66 requires pilots to keep records of training and recent flight experience.
- Section 91.176(a) requires persons conducting operations under part 91 to conduct EFVS operations in accordance with letters of authorization for the use of EFVS.

Below, we discuss each of these information collection requirements in more detail.

The information collections in § 61.66 are already approved in OMB control number 2120–0021. The paperwork burden under § 61.66 comprises documentation of training, recent flight experience, and refresher training. The following analyses were conducted under Paperwork Reduction Act of 1995 (44 U.S.C. 3501). If some operators eventually choose to conduct EFVS operations to touchdown and rollout, the provisions of § 61.66 would result in a requirement to keep records of training, recent flight experience, and refresher training. The cost of the annualized paperwork burden is determined by multiplying the number of pilots per EFVS-equipped aircraft (four) by the number of EFVS aircraft (982) and then by the time of complying with the paperwork requirements for each pilot. Title 14 of the Code of Federal Regulations already require flight crewmembers to document and record training and aeronautical experience required to meet recent flight experience requirements. 14 CFR 61.51. Therefore, the paperwork burden resulting from § 61.66 is already accounted for in the cost estimate contained in OMB control number 2120–0021.

For ease of readability, we will explain the portion of the total cost estimate that pertains to documenting and recording EFVS recent flight experience. Operators are required to log their approaches using EFVS in 6 months in compliance with the recent flight experience requirements of the new rule. The action of logging each approach in a semiannual frequency can be done manually or electronically. We estimated the time required to complete recordkeeping by flight crewmembers would be about 0.10 hours semiannually or 0.20 hours annually. Assuming 3,928 pilots would be affected by the recordkeeping provisions of the rule, it would require about 786 hours of annual paperwork, and approximately $86,000 nominal cost at the maximum based on the average wage rate of $109 for flight crewmembers from the FAA Form 41. This hourly burden and cost is already accounted for under OMB control number 2120–0021.

The information collection in § 91.176(a) expands an existing OMB-approved collection of information that is approved under OMB control number 2120–0005. This collection of information governs information that the FAA collects in order to assure compliance with part 91. The

requirements in § 91.176(a) increase the burden of this already-existing collection of information. Section 91.176(a) pertains to EFVS operations to touchdown and rollout. Except as provided in paragraphs 91.176(a)(2)(ix) through 91.176(a)(2)(xii), a person conducting operations under part 91 must conduct the operation in accordance with a letter of authorization for the use of EFVS unless the operation is conducted in an aircraft that has been issued an experimental certificate under § 21.191 for the purpose of research and development or showing compliance with regulations. A person applying to the FAA for a letter of authorization must submit an application in a form and manner prescribed by the Administrator. Approximately 38 EFVS operators will spend about 0.5 hours annually to submit a letter of authorization to the FAA. Each paperwork hour costs approximately $23. Multiplying estimated written requests by average hour per request, we estimate the total annual paperwork burden to be 19 hours. We multiply 19 hours of paperwork burden by an estimated hour wage rate of $23 to derive the estimated annual paperwork cost burden to be $ 437. As required by the Paperwork Reduction Act of 1995 (44 U.S.C. 3507(d)), the FAA has submitted this information collection requirement to OMB for its review.

F. International Compatibility and Cooperation

In keeping with U.S. obligations under the Convention on International Civil Aviation, it is FAA policy to conform to International Civil Aviation Organization (ICAO) Standards and Recommended Practices to the maximum extent practicable. The FAA has reviewed the corresponding ICAO Standards and Recommended Practices and has identified no differences with these proposed regulations. Executive Order 13609, Promoting International Regulatory Cooperation, promotes international regulatory cooperation to meet shared challenges involving health, safety, labor, security, environmental, and other issues and to reduce, eliminate, or prevent unnecessary differences in regulatory requirements. The FAA has analyzed this action under the policies and agency responsibilities of Executive Order 13609, and has determined that this action would have no effect on international regulatory cooperation.

Harmonization. The FAA participates on several vision system committees and working groups where international harmonization of standards, concepts, and practices is accomplished to the extent practicable. RTCA SC–213 was established December 2006 and is developing operational concepts and MASPS for EFVS, EVS, SVS, and CVS. The FAA, industry representatives from the United States and other countries, and other civil aviation authorities participate on this committee. Eurocae Work Group 79 is also a joint working group with RTCA SC–213. The ICAO HESC focuses on developing definitions, standards, and guidance material pertaining to vision systems for ICAO Annex 6, Parts I–III. The FAA is a member of the ICAO HESC subgroup and actively participates in this committee's activities and output. In 2012, the FAA established the AWOH ARC. Recognizing that significant issues exist within the international aviation community and regulators regarding interoperability and standardization for low visibility operations, the FAA established the AWOH ARC to identify areas where existing criteria and guidance are inadequate or nonexistent, to develop recommendations for implementing new regulatory criteria and guidance material needed by all stakeholders, and to produce consensus positions for global harmonization. In addition to other low visibility initiatives, the AWOH ARC facilitates international understanding of EFVS operations and provides recommendations for harmonizing those operations.

G. Environmental Analysis

FAA Order 1050.1F identifies FAA actions that are categorically excluded from preparation of an environmental assessment or environmental impact statement under the National Environmental Policy Act in the absence of extraordinary circumstances. The FAA has determined this rulemaking action qualifies for the categorical exclusion identified in paragraph 5–6.6 and involves no extraordinary circumstances.

V. Executive Order Determinations

A. Executive Order 13132, Federalism

The FAA has analyzed this final rule under the principles and criteria of Executive Order 13132, Federalism. The agency determined that this action will not have a substantial direct effect on the States, or the relationship between the Federal Government and the States, or on the distribution of power and responsibilities among the various levels of government, and, therefore, does not have Federalism implications.

B. Executive Order 13211, Regulations That Significantly Affect Energy Supply, Distribution, or Use

The FAA analyzed this final rule under Executive Order 13211, Actions Concerning Regulations that Significantly Affect Energy Supply, Distribution, or Use (May 18, 2001). The agency has determined that it is not a ''significant energy action'' under the executive order and it is not likely to have a significant adverse effect on the supply, distribution, or use of energy.

VI. How to Obtain Additional Information

A. Rulemaking Documents

An electronic copy of a rulemaking document may be obtained by using the Internet—

- Search the Federal eRulemaking Portal (*http://www.regulations.gov*);
- Visit the FAA's Regulations and Policies Web page at *http://www.faa.gov/regulations_policies/* or
- Access the Government Printing Office's Web page at *http://www.gpo.gov/fdsys/*.

Copies may also be obtained by sending a request (identified by notice, amendment, or docket number of this rulemaking) to the Federal Aviation Administration, Office of Rulemaking, ARM–1, 800 Independence Avenue SW., Washington, DC 20591, or by calling (202) 267–9677.

B. Comments Submitted to the Docket

Comments received may be viewed by going to *http://www.regulations.gov* and following the online instructions to search the docket number for this action. Anyone is able to search the electronic form of all comments received into any of the FAA's dockets by the name of the individual submitting the comment (or signing the comment, if submitted on behalf of an association, business, labor union, etc.).

C. Small Business Regulatory Enforcement Fairness Act

The Small Business Regulatory Enforcement Fairness Act (SBREFA) of 1996 requires the FAA to comply with small entity requests for information or advice about compliance with statutes and regulations within its jurisdiction. A small entity with questions regarding this document, may contact its local FAA official, or the person listed under the **FOR FURTHER INFORMATION CONTACT** heading at the beginning of the preamble. To find out more about SBREFA on the Internet, visit *http://www.faa.gov/regulations_policies/rulemaking/sbre_act/*.

List of Subjects

14 CFR Part 1

Air transportation.

14 CFR Part 23

Aircraft, Aviation safety, Signs and symbols.

14 CFR Part 25

Aircraft, Aviation safety.

14 CFR Part 27

Aircraft, Aviation safety.

14 CFR Part 29

Aircraft, Aviation safety.

14 CFR Part 61

Aircraft, Airmen, Aviation safety, Reporting and recordkeeping requirements, Teachers.

14 CFR Part 91

Air carrier, Air taxis, Air traffic control, Aircraft, Airmen, Airports, Aviation safety, Charter flights, Reporting and recordkeeping requirements, Transportation.

14 CFR Part 121

Air carriers, Aircraft, Airmen, Aviation safety, Charter flights, Safety, Transportation.

14 CFR Part 125

Aircraft, Airmen, Aviation safety.

14 CFR Part 135

Air taxis, Aircraft, Airmen, Aviation safety.

The Amendment

In consideration of the foregoing, the Federal Aviation Administration amends chapter I of title 14, Code of Federal Regulations as follows:

PART 1—DEFINITIONS AND ABBREVIATIONS

■ 1. The authority citation for part 1 is revised to read as follows:

Authority: 49 U.S.C. 106(f), 106(g), 40113, 44701.

■ 2. Amend § 1.1 by adding the definition of ''EFVS operation'' in alphabetical order and by revising the definition for ''Enhanced flight vision system (EFVS)'' to read as follows:

§ 1.1 General definitions.

* * * * *

EFVS operation means an operation in which visibility conditions require an EFVS to be used in lieu of natural vision to perform an approach or landing, determine enhanced flight visibility, identify required visual references, or conduct a rollout.

Enhanced flight vision system (EFVS) means an installed aircraft system which uses an electronic means to provide a display of the forward external scene topography (the natural or manmade features of a place or region especially in a way to show their relative positions and elevation) through the use of imaging sensors, including but not limited to forward-looking infrared, millimeter wave radiometry, millimeter wave radar, or low-light level image intensification. An EFVS includes the display element, sensors, computers and power supplies, indications, and controls.

* * * * *

■ 3. Amend § 1.2 by adding the abbreviation ''VGSI'' in alphabetical order to read as follows:

§ 1.2 Abbreviations and symbols.

* * * * *

VGSI means visual glide slope indicator.

* * * * *

PART 23—AIRWORTHINESS STANDARDS: NORMAL, UTILITY, ACROBATIC, AND COMMUTER CATEGORY AIRPLANES

■ 4. The authority citation for part 23 is revised to read as follows:

Authority: 49 U.S.C. 106(f), 106(g), 40113, 44701–44702, 44704.

■ 5. Amend § 23.773 by adding paragraph (c) to read as follows:

§ 23.773 Pilot compartment view.

* * * * *

(c) A vision system with a transparent display surface located in the pilot's outside field of view, such as a head up-display, head mounted display, or other equivalent display, must meet the following requirements:

(1) While the vision system display is in operation, it must compensate for interference with the pilot's outside field of view such that the combination of what is visible in the display and what remains visible through and around it, enables the pilot to perform the maneuvers specified in paragraph (a)(1) of this section and the pilot compartment to meet the provisions of paragraph (a)(2) of this section.

(2) The pilot's view of the external scene may not be distorted by the transparent display surface or by the vision system imagery. When the vision system displays imagery and any symbology referenced to the imagery and outside scene topography, including attitude symbology, flight path vector, and flight path angle reference cue, that imagery and symbology must be aligned with, and scaled to, the external scene.

(3) The vision system must provide a means to allow the pilot using the display to immediately deactivate and reactivate the vision system imagery, on demand, without removing the pilot's hands from the primary flight controls or thrust controls.

(4) When the vision system is not in operation it may not restrict the pilot from performing the maneuvers specified in paragraph (a)(1) of this section and the pilot compartment from meeting the provisions of paragraph (a)(2) of this section.

PART 25—AIRWORTHINESS STANDARDS: TRANSPORT CATEGORY AIRPLANES

■ 6. The authority citation for part 25 is revised to read as follows:

Authority: 49 U.S.C. 106(f), 106(g), 40113, 44701, 44702 and 44704.

■ 7. Amend § 25.773 by adding paragraph (e) to read as follows:

§ 25.773 Pilot compartment view.

* * * * *

(e) *Vision systems with transparent displays.* A vision system with a transparent display surface located in the pilot's outside field of view, such as a head up-display, head mounted display, or other equivalent display, must meet the following requirements in nonprecipitation and precipitation conditions:

(1) While the vision system display is in operation, it must compensate for interference with the pilot's outside field of view such that the combination of what is visible in the display and what remains visible through and around it, enables the pilot to perform the maneuvers and normal duties of paragraph (a) of this section.

(2) The pilot's view of the external scene may not be distorted by the transparent display surface or by the vision system imagery. When the vision system displays imagery or any symbology that is referenced to the imagery and outside scene topography, including attitude symbology, flight path vector, and flight path angle reference cue, that imagery and symbology must be aligned with, and scaled to, the external scene.

(3) The vision system must provide a means to allow the pilot using the display to immediately deactivate and reactivate the vision system imagery, on demand, without removing the pilot's hands from the primary flight controls or thrust controls.

(4) When the vision system is not in operation it may not restrict the pilot

from performing the maneuvers specified in paragraph (a)(1) of this section or the pilot compartment from meeting the provisions of paragraph (a)(2) of this section.

PART 27—AIRWORTHINESS STANDARDS: NORMAL CATEGORY ROTORCRAFT

■ 8. The authority citation for part 27 is revised to read as follows:

Authority: 49 U.S.C. 106(f), 106(g), 40113, 44701–44702, 44704.

■ 9. Amend § 27.773 by adding paragraph (c) to read as follows:

§ 27.773 Pilot compartment view.

* * * * *

(c) A vision system with a transparent display surface located in the pilot's outside field of view, such as a head up-display, head mounted display, or other equivalent display, must meet the following requirements:

(1) While the vision system display is in operation, it must compensate for interference with the pilot's outside field of view such that the combination of what is visible in the display and what remains visible through and around it, allows the pilot compartment to satisfy the requirements of paragraphs (a)(1) and (b) of this section.

(2) The pilot's view of the external scene may not be distorted by the transparent display surface or by the vision system imagery. When the vision system displays imagery or any symbology that is referenced to the imagery and outside scene topography, including attitude symbology, flight path vector, and flight path angle reference cue, that imagery and symbology must be aligned with, and scaled to, the external scene.

(3) The vision system must provide a means to allow the pilot using the display to immediately deactivate and reactivate the vision system imagery, on demand, without removing the pilot's hands from the primary flight and power controls, or their equivalent.

(4) When the vision system is not in operation it must permit the pilot compartment to satisfy the requirements of paragraphs (a)(1) and (b) of this section.

PART 29—AIRWORTHINESS STANDARDS: TRANSPORT CATEGORY ROTORCRAFT

■ 10. The authority citation for part 29 is revised to read as follows:

Authority: 49 U.S.C. 106(f), 106(g), 40113, 44701–44702, 44704.

■ 11. Amend § 29.773 by adding paragraph (c) to read as follows:

§ 29.773 Pilot compartment view.

* * * * *

(c) *Vision systems with transparent displays.* A vision system with a transparent display surface located in the pilot's outside field of view, such as a head up-display, head mounted display, or other equivalent display, must meet the following requirements in nonprecipitation and precipitation conditions:

(1) While the vision system display is in operation, it must compensate for interference with the pilot's outside field of view such that the combination of what is visible in the display and what remains visible through and around it, allows the pilot compartment to satisfy the requirements of paragraphs (a) and (b) of this section.

(2) The pilot's view of the external scene may not be distorted by the transparent display surface or by the vision system imagery. When the vision system displays imagery or any symbology that is referenced to the imagery and outside scene topography, including attitude symbology, flight path vector, and flight path angle reference cue, that imagery and symbology must be aligned with, and scaled to, the external scene.

(3) The vision system must provide a means to allow the pilot using the display to immediately deactivate and reactivate the vision system imagery, on demand, without removing the pilot's hands from the primary flight and power controls, or their equivalent.

(4) When the vision system is not in operation it must permit the pilot compartment to satisfy the requirements of paragraphs (a) and (b) of this section.

PART 61—CERTIFICATION: PILOTS, FLIGHT INSTRUCTORS, AND GROUND INSTRUCTORS

■ 12. The authority citation for part 61 continues to read as follows:

Authority: 49 U.S.C. 106(f), 106(g), 40113, 44701–44703, 44707, 44709–44711, 45102–45103, 45301–45302.

■ 13. Amend § 61.57 by revising paragraphs (e)(2) and (3) to read as follows:

§ 61.57 Recent flight experience: Pilot in command.

* * * * *

(e) * * *

(2) This section does not apply to a pilot in command who is employed by a part 119 certificate holder authorized to conduct operations under part 121 when the pilot is engaged in a flight operation under part 91 or 121 for that certificate holder if the pilot in command complies with §§ 121.436 and 121.439 of this chapter.

(3) This section does not apply to a pilot in command who is employed by a part 119 certificate holder authorized to conduct operations under part 135 when the pilot is engaged in a flight operation under parts 91 or 135 for that certificate holder if the pilot in command is in compliance with §§ 135.243 and 135.247 of this chapter.

* * * * *

■ 14. Add § 61.66 to read as follows:

§ 61.66 Enhanced Flight Vision System Pilot Requirements

(a) *Ground training.* (1) Except as provided under paragraphs (f) and (h) of this section, no person may manipulate the controls of an aircraft or act as pilot in command of an aircraft during an EFVS operation conducted under § 91.176(a) or (b) of this chapter, or serve as a required pilot flightcrew member during an EFVS operation conducted under § 91.176(a) of this chapter, unless that person—

(i) Receives and logs ground training under a training program approved by the Administrator; and

(ii) Obtains a logbook or training record endorsement from an authorized training provider certifying the person satisfactorily completed the ground training appropriate to the category of aircraft for which the person is seeking the EFVS privilege.

(2) The ground training must include the following subjects:

(i) Those portions of this chapter that relate to EFVS flight operations and limitations, including the Airplane Flight Manual or Rotorcraft Flight Manual limitations;

(ii) EFVS sensor imagery, required aircraft flight information, and flight symbology;

(iii) EFVS display, controls, modes, features, symbology, annunciations, and associated systems and components;

(iv) EFVS sensor performance, sensor limitations, scene interpretation, visual anomalies, and other visual effects;

(v) Preflight planning and operational considerations associated with using EFVS during taxi, takeoff, climb, cruise, descent and landing phases of flight, including the use of EFVS for instrument approaches, operating below DA/DH or MDA, executing missed approaches, landing, rollout, and balked landings;

(vi) Weather associated with low visibility conditions and its effect on EFVS performance;

(vii) Normal, abnormal, emergency, and crew coordination procedures when using EFVS; and

(viii) Interpretation of approach and runway lighting systems and their display characteristics when using an EFVS.

(b) *Flight training.* (1) Except as provided under paragraph (h) of this section, no person may manipulate the controls of an aircraft or act as pilot in command of an aircraft during an EFVS operation under § 91.176(a) or (b) of this chapter unless that person—

(i) Receives and logs flight training for the EFVS operation under a training program approved by the Administrator; and

(ii) Obtains a logbook or training record endorsement from an authorized training provider certifying the person is proficient in the use of EFVS in the category of aircraft in which the training was provided for the EFVS operation to be conducted.

(2) Flight training must include the following tasks:

(i) Preflight and inflight preparation of EFVS equipment for EFVS operations, including EFVS setup and use of display, controls, modes and associated systems, and adjustments for brightness and contrast under day and night conditions;

(ii) Proper piloting techniques associated with using EFVS during taxi, takeoff, climb, cruise, descent, landing, and rollout, including missed approaches and balked landings;

(iii) Proper piloting techniques for the use of EFVS during instrument approaches, to include operations below DA/DH or MDA as applicable to the EFVS operations to be conducted, under both day and night conditions;

(iv) Determining enhanced flight visibility;

(v) Identifying required visual references appropriate to EFVS operations;

(vi) Transitioning from EFVS sensor imagery to natural vision acquisition of required visual references and the runway environment;

(vii) Using EFVS sensor imagery, required aircraft flight information, and flight symbology to touchdown and rollout, if the person receiving training will conduct EFVS operations under § 91.176(a) of this chapter; and

(viii) Normal, abnormal, emergency, and crew coordination procedures when using an EFVS.

(c) *Supplementary EFVS training.* A person qualified to conduct an EFVS operation under § 91.176(a) or (b) of this chapter who seeks to conduct an additional EFVS operation for which that person has not received training must—

(1) Receive and log the ground and flight training required by paragraphs (a) and (b) of this section, under a training program approved by the Administrator, appropriate to the additional EFVS operation to be conducted; and

(2) Obtain a logbook or training record endorsement from the authorized training provider certifying the person is proficient in the use of EFVS in the category of aircraft in which the training was provided for the EFVS operation to be conducted.

(d) *Recent flight experience: EFVS.* Except as provided in paragraphs (f) and (h) of this section, no person may manipulate the controls of an aircraft during an EFVS operation or act as pilot in command of an aircraft during an EFVS operation unless, within 6 calendar months preceding the month of the flight, that person performs and logs six instrument approaches as the sole manipulator of the controls using an EFVS under any weather conditions in the category of aircraft for which the person seeks the EFVS privilege. The instrument approaches may be performed in day or night conditions; and

(1) One approach must terminate in a full stop landing; and

(2) For persons authorized to exercise the privileges of § 91.176(a), the full stop landing must be conducted using the EFVS.

(e) *EFVS refresher training.* (1) Except as provided in paragraph (h) of this section, a person who has failed to meet the recent flight experience requirements of paragraph (d) of this section for more than six calendar months may reestablish EFVS currency only by satisfactorily completing an approved EFVS refresher course in the category of aircraft for which the person seeks the EFVS privilege. The EFVS refresher course must consist of the subjects and tasks listed in paragraphs (a)(2) and (b)(2) of this section applicable to the EFVS operations to be conducted.

(2) The EFVS refresher course must be conducted by an authorized training provider whose instructor meets the training requirements of this section and, if conducting EFVS operations in an aircraft, the recent flight experience requirements of this section.

(f) *Military pilots and former military pilots in the U.S. Armed Forces.* (1) The training requirements of paragraphs (a) and (b) of this section applicable to EFVS operations conducted under § 91.176(a) of this chapter do not apply to a military pilot or former military pilot in the U.S. Armed Forces if that person documents satisfactory completion of ground and flight training in EFVS operations to touchdown and rollout by the U.S. Armed Forces.

(2) The training requirements in paragraphs (a) and (b) of this section applicable to EFVS operations conducted under § 91.176(b) of this chapter do not apply to a military pilot or former military pilot in the U.S. Armed Forces if that person documents satisfactory completion of ground and flight training in EFVS operations to 100 feet above the touchdown zone elevation by the U.S. Armed Forces.

(3) A military pilot or former military pilot in the U.S. Armed Forces may satisfy the recent flight experience requirements of paragraph (d) of this section if he or she documents satisfactory completion of an EFVS proficiency check in the U.S. Armed Forces within 6 calendar months preceding the month of the flight, the check was conducted by a person authorized by the U.S. Armed Forces to administer the check, and the person receiving the check was a member of the U.S. Armed Forces at the time the check was administered.

(g) *Use of full flight simulators.* A level C or higher full flight simulator (FFS) equipped with an EFVS may be used to meet the flight training, recent flight experience, and refresher training requirements of this section. The FFS must be evaluated and qualified for EFVS operations by the Administrator, and must be:

(1) Qualified and maintained in accordance with part 60 of this chapter, or a previously qualified device, as permitted in accordance with § 60.17 of this chapter;

(2) Approved by the Administrator for the tasks and maneuvers to be conducted; and

(3) Equipped with a daylight visual display if being used to meet the flight training requirements of this section.

(h) *Exceptions.* (1) A person may manipulate the controls of an aircraft during an EFVS operation without meeting the requirements of this section in the following circumstances:

(i) When receiving flight training to meet the requirements of this section under an approved training program, provided the instructor meets the requirements in this section to perform the EFVS operation in the category of aircraft for which the training is being conducted.

(ii) During an EFVS operation performed in the course of satisfying the recent flight experience requirements of paragraph (d) of this section, provided another individual is serving as pilot in command of the aircraft during the EFVS operation and that individual meets the requirements in this section to perform the EFVS operation in the

category of aircraft in which the flight is being conducted.

(iii) During an EFVS operation performed in the course of completing EFVS refresher training in accordance with paragraph (e) of this section, provided the instructor providing the refresher training meets the requirements in this section to perform the EFVS operation in the category of aircraft for which the training is being conducted.

(2) The requirements of paragraphs (a) and (b) of this section do not apply if a person is conducting a flight or series of flights in an aircraft issued an experimental airworthiness certificate under § 21.191 of this chapter for the purpose of research and development or showing compliance with regulations, provided the person has knowledge of the subjects specified in paragraph (a)(2) of this section and has experience with the tasks specified in paragraph (b)(2) of this section applicable to the EFVS operations to be conducted.

(3) The requirements specified in paragraphs (d) and (e) of this section do not apply to a pilot who:

(i) Is employed by a part 119 certificate holder authorized to conduct operations under part 121, 125, or 135 when the pilot is conducting an EFVS operation for that certificate holder under part 91, 121, 125, or 135, as applicable, provided the pilot conducts the operation in accordance with the certificate holder's operations specifications for EFVS operations;

(ii) Is employed by a person who holds a letter of deviation authority issued under § 125.3 of this chapter when the pilot is conducting an EFVS operation for that person under part 125, provided the pilot is conducting the operation in accordance with that person's letter of authorization for EFVS operations; or

(iii) Is employed by a fractional ownership program manager to conduct operations under part 91 subpart K when the pilot is conducting an EFVS operation for that program manager under part 91, provided the pilot is conducting the operation in accordance with the program manager's management specifications for EFVS operations.

(4) The requirements of paragraphs (a) and (b) of this section do not apply if a person is conducting EFVS operations under § 91.176(b) of this chapter and that person documents that prior to March 13, 2018, that person satisfactorily completed ground and flight training on EFVS operations to 100 feet above the touchdown zone elevation.

(5) The requirements specified in this section do not apply if a person is conducting an EFVS operation to 100 feet above the touchdown zone elevation in accordance with the requirements of § 91.175(l) and (m) of this chapter prior to March 13, 2018.

§ 61.66 [Amended]

■ 15. Effective March 13, 2018, amend § 61.66 by removing paragraph (h)(5).

PART 91—GENERAL OPERATING AND FLIGHT RULES

■ 16. The authority citation for part 91 continues to read as follows:

Authority: 49 U.S.C. 106(f), 106(g), 1155, 40101, 40103, 40105, 40113, 40120, 44101, 44111, 44701, 44704, 44709, 44711, 44712, 44715, 44716, 44717, 44722, 46306, 46315, 46316, 46504, 46506–46507, 47122, 47508, 47528–47531, 47534, articles 12 and 29 of the Convention on International Civil Aviation (61 Stat. 1180), (126 Stat. 11).

■ 17. Amend § 91.175 as follows:
■ a. Revise paragraphs (c) introductory text and (c)(3)(vi);
■ b. Redesignate paragraph (d)(2) as paragraph (d)(3) and revise it;
■ c. Add new paragraph (d)(2);
■ d. Revise paragraph (e)(1); and
■ e. Add paragraph (n).

The revisions and addition read as follows:

§ 91.175 Takeoff and landing under IFR.

* * * * *

(c) *Operation below DA/DH or MDA.* Except as provided in paragraph (l) of this section or § 91.176 of this chapter, where a DA/DH or MDA is applicable, no pilot may operate an aircraft, except a military aircraft of the United States, below the authorized MDA or continue an approach below the authorized DA/DH unless—

* * * * *

(3) * * *

(vi) The visual glideslope indicator.

* * * * *

(d) * * *

(2) For operations conducted under § 91.176 of this part, the requirements of paragraphs (a)(3)(iii) or (b)(3)(iii), as applicable, of that section are not met; or

(3) For all other operations under this part and parts 121, 125, 129, and 135, the flight visibility is less than the visibility prescribed in the standard instrument approach procedure being used.

(e) * * *

(1) Whenever operating an aircraft pursuant to paragraph (c) or (l) of this section or § 91.176 of this chapter, and the requirements of that paragraph or section are not met at either of the following times:

* * * * *

(n) Before March 13, 2018, a person conducting an EFVS operation to 100 feet above the touchdown zone elevation must comply with either the requirements of paragraphs (l) and (m) of this section or with the requirements of § 91.176(b) of this part. Beginning on March 13, 2018, a person conducting an EFVS operation to 100 feet above the touchdown zone elevation must comply with the requirements of § 91.176(b) of this part. The requirements of paragraphs (l) and (m) of this section will expire on March 13, 2018.

■ 18. Effective March 13, 2018, amend § 91.175 as follows:
■ a. Revise paragraph (c) introductory text;
■ b. Remove paragraph (d)(1);
■ c. Redesignate paragraphs (d)(2) and (3) as (d)(1) and (2), respectively;
■ d. Revise paragraph (e)(1); and
■ e. Remove paragraphs (l), (m), and (n).

The revisions read as follows:

§ 91.175 Takeoff and landing under IFR.

* * * * *

(c) *Operation below DA/DH or MDA.* Except as provided in § 91.176 of this chapter, where a DA/DH or MDA is applicable, no pilot may operate an aircraft, except a military aircraft of the United States, below the authorized MDA or continue an approach below the authorized DA/DH unless—

* * * * *

(e) * * *

(1) Whenever operating an aircraft pursuant to paragraph (c) of this section or § 91.176 of this part, and the requirements of that paragraph or section are not met at either of the following times:

* * * * *

■ 19. Add § 91.176 to read as follows:

§ 91.176 Straight-in landing operations below DA/DH or MDA using an enhanced flight vision system (EFVS) under IFR.

(a) *EFVS operations to touchdown and rollout.* Unless otherwise authorized by the Administrator to use an MDA as a DA/DH with vertical navigation on an instrument approach procedure, or unless paragraph (d) of this section applies, no person may conduct an EFVS operation in an aircraft, except a military aircraft of the United States, at any airport below the authorized DA/DH to touchdown and rollout unless the minimums used for the particular approach procedure being flown include a DA or DH, and the following requirements are met:

(1) *Equipment.* (i) The aircraft must be equipped with an operable EFVS that

meets the applicable airworthiness requirements. The EFVS must:

(A) Have an electronic means to provide a display of the forward external scene topography (the applicable natural or manmade features of a place or region especially in a way to show their relative positions and elevation) through the use of imaging sensors, including but not limited to forward-looking infrared, millimeter wave radiometry, millimeter wave radar, or low-light level image intensification.

(B) Present EFVS sensor imagery, aircraft flight information, and flight symbology on a head up display, or an equivalent display, so that the imagery, information and symbology are clearly visible to the pilot flying in his or her normal position with the line of vision looking forward along the flight path. Aircraft flight information and flight symbology must consist of at least airspeed, vertical speed, aircraft attitude, heading, altitude, height above ground level such as that provided by a radio altimeter or other device capable of providing equivalent performance, command guidance as appropriate for the approach to be flown, path deviation indications, flight path vector, and flight path angle reference cue. Additionally, for aircraft other than rotorcraft, the EFVS must display flare prompt or flare guidance.

(C) Present the displayed EFVS sensor imagery, attitude symbology, flight path vector, and flight path angle reference cue, and other cues, which are referenced to the EFVS sensor imagery and external scene topography, so that they are aligned with, and scaled to, the external view.

(D) Display the flight path angle reference cue with a pitch scale. The flight path angle reference cue must be selectable by the pilot to the desired descent angle for the approach and be sufficient to monitor the vertical flight path of the aircraft.

(E) Display the EFVS sensor imagery, aircraft flight information, and flight symbology such that they do not adversely obscure the pilot's outside view or field of view through the cockpit window.

(F) Have display characteristics, dynamics, and cues that are suitable for manual control of the aircraft to touchdown in the touchdown zone of the runway of intended landing and during rollout.

(ii) When a minimum flightcrew of more than one pilot is required, the aircraft must be equipped with a display that provides the pilot monitoring with EFVS sensor imagery. Any symbology displayed may not adversely obscure the sensor imagery of the runway environment.

(2) *Operations.* (i) The pilot conducting the EFVS operation may not use circling minimums.

(ii) Each required pilot flightcrew member must have adequate knowledge of, and familiarity with, the aircraft, the EFVS, and the procedures to be used.

(iii) The aircraft must be equipped with, and the pilot flying must use, an operable EFVS that meets the equipment requirements of paragraph (a)(1) of this section.

(iv) When a minimum flightcrew of more than one pilot is required, the pilot monitoring must use the display specified in paragraph (a)(1)(ii) to monitor and assess the safe conduct of the approach, landing, and rollout.

(v) The aircraft must continuously be in a position from which a descent to a landing on the intended runway can be made at a normal rate of descent using normal maneuvers.

(vi) The descent rate must allow touchdown to occur within the touchdown zone of the runway of intended landing.

(vii) Each required pilot flightcrew member must meet the following requirements—

(A) A person exercising the privileges of a pilot certificate issued under this chapter, any person serving as a required pilot flightcrew member of a U.S.-registered aircraft, or any person serving as a required pilot flightcrew member for a part 121, 125, or 135 operator, must be qualified in accordance with part 61 and, as applicable, the training, testing, and qualification provisions of subpart K of this part, part 121, 125, or 135 of this chapter that apply to the operation; or

(B) Each person acting as a required pilot flightcrew member for a foreign air carrier subject to part 129, or any person serving as a required pilot flightcrew member of a foreign registered aircraft, must be qualified in accordance with the training requirements of the civil aviation authority of the State of the operator for the EFVS operation to be conducted.

(viii) A person conducting operations under this part must conduct the operation in accordance with a letter of authorization for the use of EFVS unless the operation is conducted in an aircraft that has been issued an experimental certificate under § 21.191 of this chapter for the purpose of research and development or showing compliance with regulations, or the operation is being conducted by a person otherwise authorized to conduct EFVS operations under paragraphs (a)(2)(ix) through (xii) of this section. A person applying to the FAA for a letter of authorization must submit an application in a form and manner prescribed by the Administrator.

(ix) A person conducting operations under subpart K of this part must conduct the operation in accordance with management specifications authorizing the use of EFVS.

(x) A person conducting operations under part 121, 129, or 135 of this chapter must conduct the operation in accordance with operations specifications authorizing the use of EFVS.

(xi) A person conducting operations under part 125 of this chapter must conduct the operation in accordance with operations specifications authorizing the use of EFVS or, for a holder of a part 125 letter of deviation authority, a letter of authorization for the use of EFVS.

(xii) A person conducting an EFVS operation during an authorized Category II or Category III operation must conduct the operation in accordance with operations specifications, management specifications, or a letter of authorization authorizing EFVS operations during authorized Category II or Category III operations.

(3) *Visibility and visual reference requirements.* No pilot operating under this section or §§ 121.651, 125.381, or 135.225 of this chapter may continue an approach below the authorized DA/DH and land unless:

(i) The pilot determines that the enhanced flight visibility observed by use of an EFVS is not less than the visibility prescribed in the instrument approach procedure being used.

(ii) From the authorized DA/DH to 100 feet above the touchdown zone elevation of the runway of intended landing, any approach light system or both the runway threshold and the touchdown zone are distinctly visible and identifiable to the pilot using an EFVS.

(A) The pilot must identify the runway threshold using at least one of the following visual references—

(*1*) The beginning of the runway landing surface;

(*2*) The threshold lights; or

(*3*) The runway end identifier lights.

(B) The pilot must identify the touchdown zone using at least one of the following visual references—

(*1*) The runway touchdown zone landing surface;

(*2*) The touchdown zone lights;

(*3*) The touchdown zone markings; or

(*4*) The runway lights.

(iii) At 100 feet above the touchdown zone elevation of the runway of intended landing and below that

altitude, the enhanced flight visibility using EFVS must be sufficient for one of the following visual references to be distinctly visible and identifiable to the pilot—

(A) The runway threshold;

(B) The lights or markings of the threshold;

(C) The runway touchdown zone landing surface; or

(D) The lights or markings of the touchdown zone.

(4) *Additional requirements.* The Administrator may prescribe additional equipment, operational, and visibility and visual reference requirements to account for specific equipment characteristics, operational procedures, or approach characteristics. These requirements will be specified in an operator's operations specifications, management specifications, or letter of authorization authorizing the use of EFVS.

(b) *EFVS operations to 100 feet above the touchdown zone elevation.* Except as specified in paragraph (d) of this section, no person may conduct an EFVS operation in an aircraft, except a military aircraft of the United States, at any airport below the authorized DA/DH or MDA to 100 feet above the touchdown zone elevation unless the following requirements are met:

(1) *Equipment.* (i) The aircraft must be equipped with an operable EFVS that meets the applicable airworthiness requirements.

(ii) The EFVS must meet the requirements of paragraph (a)(1)(i)(A) through (F) of this section, but need not present flare prompt, flare guidance, or height above ground level.

(2) *Operations.* (i) The pilot conducting the EFVS operation may not use circling minimums.

(ii) Each required pilot flightcrew member must have adequate knowledge of, and familiarity with, the aircraft, the EFVS, and the procedures to be used.

(iii) The aircraft must be equipped with, and the pilot flying must use, an operable EFVS that meets the equipment requirements of paragraph (b)(1) of this section.

(iv) The aircraft must continuously be in a position from which a descent to a landing on the intended runway can be made at a normal rate of descent using normal maneuvers.

(v) For operations conducted under part 121 or part 135 of this chapter, the descent rate must allow touchdown to occur within the touchdown zone of the runway of intended landing.

(vi) Each required pilot flightcrew member must meet the following requirements—

(A) A person exercising the privileges of a pilot certificate issued under this chapter, any person serving as a required pilot flightcrew member of a U.S.-registered aircraft, or any person serving as a required pilot flightcrew member for a part 121, 125, or 135 operator, must be qualified in accordance with part 61 and, as applicable, the training, testing, and qualification provisions of subpart K of this part, part 121, 125, or 135 of this chapter that apply to the operation; or

(B) Each person acting as a required pilot flightcrew member for a foreign air carrier subject to part 129, or any person serving as a required pilot flightcrew member of a foreign registered aircraft, must be qualified in accordance with the training requirements of the civil aviation authority of the State of the operator for the EFVS operation to be conducted.

(vii) A person conducting operations under subpart K of this part must conduct the operation in accordance with management specifications authorizing the use of EFVS.

(viii) A person conducting operations under part 121, 129, or 135 of this chapter must conduct the operation in accordance with operations specifications authorizing the use of EFVS.

(ix) A person conducting operations under part 125 of this chapter must conduct the operation in accordance with operations specifications authorizing the use of EFVS or, for a holder of a part 125 letter of deviation authority, a letter of authorization for the use of EFVS.

(x) A person conducting an EFVS operation during an authorized Category II or Category III operation must conduct the operation in accordance with operations specifications, management specifications, or a letter of authorization authorizing EFVS operations during authorized Category II or Category III operations.

(3) *Visibility and Visual Reference Requirements.* No pilot operating under this section or § 121.651, § 125.381, or § 135.225 of this chapter may continue an approach below the authorized MDA or continue an approach below the authorized DA/DH and land unless:

(i) The pilot determines that the enhanced flight visibility observed by use of an EFVS is not less than the visibility prescribed in the instrument approach procedure being used.

(ii) From the authorized MDA or DA/DH to 100 feet above the touchdown zone elevation of the runway of intended landing, any approach light system or both the runway threshold and the touchdown zone are distinctly visible and identifiable to the pilot using an EFVS.

(A) The pilot must identify the runway threshold using at least one of the following visual references–

(*1*) The beginning of the runway landing surface;

(*2*) The threshold lights; or

(*3*) The runway end identifier lights.

(B) The pilot must identify the touchdown zone using at least one of the following visual references—

(*1*) The runway touchdown zone landing surface;

(*2*) The touchdown zone lights;

(*3*) The touchdown zone markings; or

(*4*) The runway lights.

(iii) At 100 feet above the touchdown zone elevation of the runway of intended landing and below that altitude, the flight visibility must be sufficient for—

(A) The runway threshold;

(B) The lights or markings of the threshold;

(C) The runway touchdown zone landing surface; or

(D) The lights or markings of the touchdown zone.

(4) Compliance Date. Beginning on March 13, 2018, a person conducting an EFVS operation to 100 feet above the touchdown zone elevation must comply with the requirements of paragraph (b) of this section.

(c) *Public aircraft certification and training requirements.* A public aircraft operator, other than the U.S. military, may conduct an EFVS operation under paragraph (a) or (b) of this section only if:

(1) The aircraft meets all of the civil certification and airworthiness requirements of paragraph (a)(1) or (b)(1) of this section, as applicable to the EFVS operation to be conducted; and

(2) The pilot flightcrew member, or any other person who manipulates the controls of an aircraft during an EFVS operation, meets the training, recent flight experience and refresher training requirements of § 61.66 of this chapter applicable to EFVS operations.

(d) *Exception for Experimental Aircraft.* The requirement to use an EFVS that meets the applicable airworthiness requirements specified in paragraphs (a)(1)(i), (a)(2)(iii), (b)(1)(i), and (b)(2)(iii) of this section does not apply to operations conducted in an aircraft issued an experimental certificate under § 21.191 of this chapter for the purpose of research and development or showing compliance with regulations, provided the Administrator has determined that the operations can be conducted safely in accordance with operating limitations issued for that purpose.

■ 20. Amend § 91.189 by revising paragraph (d) introductory text and paragraph (e) to read as follows:

§ 91.189 Category II and III operations: General operating rules.

* * * * *

(d) Except as provided in § 91.176 of this part or unless otherwise authorized by the Administrator, no pilot operating an aircraft in a Category II or Category III approach that provides and requires the use of a DA/DH may continue the approach below the authorized decision height unless the following conditions are met:

* * * * *

(e) Except as provided in § 91.176 of this part or unless otherwise authorized by the Administrator, each pilot operating an aircraft shall immediately execute an appropriate missed approach whenever, prior to touchdown, the requirements of paragraph (d) of this section are not met.

* * * * *

■ 21. Amend § 91.905 by adding an entry for § 91.176 in numerical order to read as follows:

§ 91.905 List of rules subject to waivers.

Sec.

* * * * *

91.176 Operations below DA/DH or MDA using an enhanced flight vision system (EFVS) under IFR.

* * * * *

■ 22. Amend § 91.1039 by revising paragraph (e) to read as follows:

§ 91.1039 IFR takeoff, approach and landing minimums.

* * * * *

(e) Except as provided in §§ 91.175(l) or 91.176 of this chapter, each pilot making an IFR takeoff or approach and landing at an airport must comply with applicable instrument approach procedures and takeoff and landing weather minimums prescribed by the authority having jurisdiction over the airport. In addition, no pilot may take off at that airport when the visibility is less than 600 feet, unless otherwise authorized in the program manager's management specifications for EFVS operations.

■ 23. Effective March 13, 2018, amend § 91.1039 by revising paragraph (e) to read as follows:

§ 91.1039 IFR takeoff, approach and landing minimums.

* * * * *

(e) Except as provided in § 91.176 of this chapter, each pilot making an IFR takeoff or approach and landing at an airport must comply with applicable instrument approach procedures and takeoff and landing weather minimums prescribed by the authority having jurisdiction over the airport. In addition, no pilot may take off at that airport when the visibility is less than 600 feet, unless otherwise authorized in the program manager's management specifications for EFVS operations.

■ 24. Amend § 91.1065 by adding paragraph (g) to read as follows:

§ 91.1065 Initial and recurrent pilot testing requirements.

* * * * *

(g) If the program manager is authorized to conduct EFVS operations, the competency check in paragraph (b) of this section must include tasks appropriate to the EFVS operations the certificate holder is authorized to conduct.

PART 121—OPERATING REQUIREMENTS: DOMESTIC, FLAG, AND SUPPLEMENTAL OPERATIONS

■ 25. The authority citation for part 121 continues to read as follows:

Authority: 49 U.S.C. 106(f), 106(g), 40113, 40119, 41706, 44101, 44701–44702, 44705, 44709–44711, 44713, 44716–44717, 44722, 44732; 46105; Pub. L. 111–216, 124 Stat. 2348 (49 U.S.C. 44701 note); Pub. L. 112–95, 126 Stat. 62 (49 U.S.C. 44732 note).

■ 26. Amend § 121.651 by revising paragraphs (b) introductory text, (c) introductory text, and (d) introductory text, redesignating paragraphs (e) and (f) as paragraphs (f) and (g), and adding new paragraph (e) to read as follows:

§ 121.651 Takeoff and landing weather minimums: IFR: All certificate holders.

* * * * *

(b) Except as provided in paragraphs (d) and (e) of this section, no pilot may continue an approach past the final approach fix, or where a final approach fix is not used, begin the final approach segment of an instrument approach procedure—

(c) A pilot who has begun the final approach segment of an instrument approach procedure in accordance with paragraph (b) of this section, and after that receives a later weather report indicating below-minimum conditions, may continue the approach to DA/DH or MDA. Upon reaching DA/DH or at MDA, and at any time before the missed approach point, the pilot may continue the approach below DA/DH or MDA if either the requirements of § 91.175(l) or § 91.176 of this chapter, or the following requirements are met:

* * * * *

(d) A pilot may begin the final approach segment of an instrument approach procedure other than a Category II or Category III procedure at an airport when the visibility is less than the visibility minimums prescribed for that procedure if the airport is served by an operative ILS and an operative PAR, and both are used by the pilot. However, no pilot may continue an approach below the authorized DA/DH unless the requirements of § 91.175(l) or § 91.176 of this chapter, or the following requirements are met:

* * * * *

(e) A pilot may begin the final approach segment of an instrument approach procedure, or continue that approach procedure, at an airport when the visibility is reported to be less than the visibility minimums prescribed for that procedure if the pilot uses an operable EFVS in accordance with § 91.176 of this chapter and the certificate holder's operations specifications for EFVS operations.

* * * * *

■ 27. Effective March 13, 2018, amend § 121.651 by revising paragraphs (c) introductory text and (d) introductory text to read as follows:

§ 121.651 Takeoff and landing weather minimums: IFR: All certificate holders.

* * * * *

(c) A pilot who has begun the final approach segment of an instrument approach procedure in accordance with paragraph (b) of this section, and after that receives a later weather report indicating below-minimum conditions, may continue the approach to DA/DH or MDA. Upon reaching DA/DH or at MDA, and at any time before the missed approach point, the pilot may continue the approach below DA/DH or MDA if either the requirements of § 91.176 of this chapter, or the following requirements are met:

* * * * *

(d) A pilot may begin the final approach segment of an instrument approach procedure other than a Category II or Category III procedure at an airport when the visibility is less than the visibility minimums prescribed for that procedure if the airport is served by an operative ILS and an operative PAR, and both are used by the pilot. However, no pilot may continue an approach below the authorized DA/DH unless the requirements of § 91.176 of this chapter, or the following requirements are met:

* * * * *

■ 28. In appendix F to part 121, amend the Table by adding new entries III(c)(5), V(g), and V(h) to read as follows:

Appendix F to Part 121—Proficiency Check Requirements

* * * * *

Maneuvers/procedures	Required		Permitted			
	Simulated instrument conditions	Inflight	Visual simulator	Nonvisual simulator	Training device	Waiver provisions of § 121.441(d)
* * *	*		*	*		*
III. Instrument procedures:						
* * *	*		*	*		*
(c) ILS and other instrument approaches. There must be the following:						
* * *	*		*	*		*
(5) For each type of EFVS operation the certificate holder is authorized to conduct, at least one instrument approach must be made using an EFVS.	B	*B				
* * *	*		*	*		*
V. Landings and Approaches to Landings—						
* * *	*		*	*		*
(g) If the certificate holder is authorized to conduct EFVS operations to touchdown and rollout, at least one instrument approach to a landing must be made using an EFVS, including the use of enhanced flight vision from 100 feet above the touchdown zone elevation to touchdown and rollout	B	*B				
(h) If the certificate holder is authorized to conduct EFVS operations to 100 feet above the touchdown zone elevation, at least one instrument approach to a landing must be made using an EFVS, including the transition from enhanced flight vision to natural vision at 100 feet above the touchdown zone elevation	B	*B				
* * *	*		*	*		*

■ 29. In appendix H to part 121, amend ''Level B Training and Checking Permitted'' by revising paragraph 3. to read as follows:

Appendix H to Part 121—Advanced Simulation

* * * * *

Level B

Training and Checking Permitted

* * * * *

3. Except for EFVS operations, landings in a proficiency check without the landing on the line requirements (§ 121.441).

* * * * *

PART 125—CERTIFICATION AND OPERATIONS: AIRPLANES HAVING A SEATING CAPACITY OF 20 OR MORE PASSENGERS OR A MAXIMUM PAYLOAD CAPACITY OF 6,000 POUNDS OR MORE; AND RULES GOVERNING PERSONS ON BOARD SUCH AIRCRAFT

■ 30. The authority citation for part 125 continues to read as follows:

Authority: 49 U.S.C. 106(f), 106(g), 40113, 44701–44702, 44705, 44710–44711, 44713, 44716–44717, 44722.

■ 31. Amend § 125.287 by adding paragraph (g) to read as follows:

§ 125.287 Initial and recurrent pilot testing requirements.

* * * * *

(g) If the certificate holder is authorized to conduct EFVS operations, the competency check in paragraph (b) of this section must include tasks appropriate to the EFVS operations the certificate holder is authorized to conduct.

■ 32. Revise § 125.325 to read as follows:

§ 125.325 Instrument approach procedures and IFR landing minimums.

Except as specified in §§ 91.175(l) or 91.176 of this chapter, no person may make an instrument approach at an airport except in accordance with IFR weather minimums and unless the type of instrument approach procedure to be used is listed in the certificate holder's operations specifications.

■ 33. Effective March 13, 2018, revise § 125.325 to read as follows:

§ 125.325 Instrument approach procedures and IFR landing minimums.

Except as specified in § 91.176 of this chapter, no person may make an

instrument approach at an airport except in accordance with IFR weather minimums and unless the type of instrument approach procedure to be used is listed in the certificate holder's operations specifications.

■ 34. Amend § 125.381 by revising paragraphs (a)(2), (b), and (c) introductory text, and adding paragraph (d) to read as follows:

§ 125.381 Takeoff and landing weather minimums: IFR.

(a) * * *

(2) Except as provided in paragraphs (c) and (d) of this section, land an airplane under IFR.

(b) Except as provided in paragraphs (c) and (d) of this section, no pilot may execute an instrument approach procedure if the latest reported visibility is less than the landing minimums specified in the certificate holder's operations specifications.

(c) A pilot who initiates an instrument approach procedure based on a weather report that indicates that the specified visibility minimums exist and subsequently receives another weather report that indicates that conditions are below the minimum requirements, may continue the approach only if the requirements of § 91.175(l) or § 91.176 of this chapter, or both of the following conditions are met—

* * * * *

(d) A pilot may execute an instrument approach procedure, or continue the approach, at an airport when the visibility is reported to be less than the visibility minimums prescribed for that procedure if the pilot uses an operable EFVS in accordance with § 91.176 of this chapter and the certificate holder's operations specifications for EFVS operations, or for a holder of a part 125 letter of deviation authority, a letter of authorization for the use of EFVS.

■ 35. Effective March 13, 2018, amend § 125.381 by revising paragraph (c) introductory text to read as follows:

§ 125.381 Takeoff and landing weather minimums: IFR.

* * * * *

(c) A pilot who initiates an instrument approach procedure based on a weather report that indicates that the specified visibility minimums exist and subsequently receives another weather report that indicates that conditions are below the minimum requirements, may continue the approach only if either the requirements of § 91.176 of this chapter, or the following conditions are met—

* * * * *

PART 135—OPERATING REQUIREMENTS: COMMUTER AND ON DEMAND OPERATIONS AND RULES GOVERNING PERSONS ON BOARD SUCH AIRCRAFT

■ 36. The authority citation for part 135 continues to read as follows:

Authority: 49 U.S.C. 106(f), 106(g), 41706, 40113, 44701–44702, 44705, 44709, 44711–44713, 44715–44717, 44722, 44730, 45101–45105; Public Law 112–95, 126 Stat. 58 (49 U.S.C. 44730).

■ 37. Amend § 135.225 as follows:
■ a. Revise paragraphs (a) introductory text and (b) introductory text;
■ b. Remove paragraph (d);
■ c. Redesignate paragraph (c) as paragraph (d) and revise it;
■ d. Add new paragraph (c); and
■ e. Add paragraph (j).

The revisions and additions read as follows:

§ 135.225 IFR: Takeoff, approach and landing minimums.

(a) Except to the extent permitted by paragraphs (b) and (j) of this section, no pilot may begin an instrument approach procedure to an airport unless—

(b) A pilot conducting an eligible on-demand operation may begin and conduct an instrument approach procedure to an airport that does not have a weather reporting facility operated by the U.S. National Weather Service, a source approved by the U.S. National Weather Service, or a source approved by the Administrator if—

* * * * *

(c) Except as provided in paragraph (j) of this section, no pilot may begin the final approach segment of an instrument approach procedure to an airport unless the latest weather reported by the facility described in paragraph (a)(1) of this section indicates that weather conditions are at or above the authorized IFR landing minimums for that procedure.

(d) A pilot who has begun the final approach segment of an instrument approach to an airport under paragraph (c) of this section, and receives a later weather report indicating that conditions have worsened to below the minimum requirements, may continue the approach only if the requirements of § 91.175(l) of this chapter, paragraph (j) of this section, or both of the following conditions are met—

(1) The later weather report is received when the aircraft is in one of the following approach phases:

(i) The aircraft is on an ILS final approach and has passed the final approach fix;

(ii) The aircraft is on an ASR or PAR final approach and has been turned over to the final approach controller; or

(iii) The aircraft is on a non-precision final approach and the aircraft—

(A) Has passed the appropriate facility or final approach fix; or

(B) Where a final approach fix is not specified, has completed the procedure turn and is established inbound toward the airport on the final approach course within the distance prescribed in the procedure; and

(2) The pilot in command finds, on reaching the authorized MDA or DA/DH, that the actual weather conditions are at or above the minimums prescribed for the procedure being used.

* * * * *

(j) A pilot may begin an instrument approach procedure, or continue an approach, at an airport when the visibility is reported to be less than the visibility minimums prescribed for that procedure if the pilot uses an operable EFVS in accordance with § 91.176 of this chapter and the certificate holder's operations specifications for EFVS operations.

■ 38. Effective March 13, 2018, amend § 135.225 by revising paragraph (d) introductory text to read as follows:

§ 135.225 IFR: Takeoff, approach and landing minimums.

* * * * *

(d) Except as provided in paragraph (j) of this section, a pilot who has begun the final approach segment of an instrument approach to an airport under paragraph (c) of this section, and receives a later weather report indicating that conditions have worsened to below the minimum requirements, may continue the approach only if the following conditions are met—

* * * * *

■ 39. Amend § 135.293 by adding paragraph (i) to read as follows:

§ 135.293 Initial and recurrent pilot testing requirements.

* * * * *

(i) If the certificate holder is authorized to conduct EFVS operations, the competency check in paragraph (b) of this section must include tasks appropriate to the EFVS operations the certificate holder is authorized to conduct.

Issued under authority provided by 49 U.S.C. 106(f), 44701(a), and 44703 in Washington, DC, on November 7, 2016.

Michael P. Huerta,

Administrator.

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