U.S. Department of Transportation
Federal Aviation Administration

Advisory Circular

Subject: Enhanced Flight Vision Systems | **Date:** 3/2/17 | **AC No:** 90-106A
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This advisory circular (AC) provides information about using an enhanced flight vision system (EFVS) in lieu of natural vision while conducting instrument approach operations. It addresses dispatching and releasing aircraft for EFVS operations and explains the requirements for conducting EFVS operations to 100 feet above the touchdown zone elevation (TDZE) and EFVS operations to touchdown and rollout. This AC also explains how to obtain an operations specification (OpSpec), management specification (MSpec), or letter of authorization (LOA) to conduct those EFVS operations that require an approval.

We have made every attempt to write EFVS regulations that are performance based and not limited to a specific sensor technology. The regulations accommodate future growth in real-time sensor technologies used in most EFVSs and maximize the benefits of rapidly evolving instrument approach procedures (IAP) and advanced flight deck technology to increase safety and access during low-visibility operations.

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1 INTRODUCTION.

1.1 Purpose. This advisory circular (AC) provides flight planning, operational, training, and recent flight experience guidance for enhanced flight vision system (EFVS) approach operations. For those operations that require a specific approval from the Federal Aviation Administration (FAA), it explains how to obtain an operations specification (OpSpec), management specification (MSpec), or letter of authorization (LOA) to conduct EFVS operations.

1.2 Cancellation. AC 90-106, Enhanced Flight Vision Systems, dated June 2, 2010, is canceled.

1.3 Applicability. This AC applies to all operators using EFVSs to conduct approach operations. This AC also applies to operators who dispatch or release a flight under Title 14 of the Code of Federal Regulations (14 CFR) part 121, release a flight under 14 CFR part 125, or take off under instrument flight rules (IFR) under 14 CFR part 135 for the purpose of conducting an EFVS operation. In addition, this AC applies to EFVS-equipped part 121, 125, or 135 operators who are permitted to begin or continue an approach for the purpose of conducting an EFVS operation when the destination airport weather is below the visibility minimums prescribed for the instrument approach procedure (IAP) to be flown.

Note: The International Civil Aviation Organization (ICAO) and other foreign Civil Aviation Authorities (CAA) use the term “Enhanced Vision System (EVS)” rather than the term “enhanced flight vision system (EFVS),” which is used by the FAA. Both terms refer to a vision system that pilots use in lieu of natural vision to conduct certain specified operations. You should not confuse the term “EVS” in this context with an EVS that is not permitted to be used in lieu of natural vision to descend below decision altitude (DA)/decision height (DH) or minimum descent altitude (MDA) (see paragraph 1.4.4).

1.4 Scope.

1.4.1 This AC describes acceptable means, but not the only means, for an operator to obtain authorization to conduct EFVS operations. This AC does not alter regulatory requirements.

1.4.2 The paragraphs in this AC provide information on the following subject areas:

1. Regulatory background of EFVS operations;
2. Types of EFVS operations;
3. Concept of operation associated with each type of EFVS operation;
4. Equipment required by the operating rule to conduct EFVS operations;
5. Enhanced flight visibility, visual reference, and other operational requirements for conducting EFVS operations;

6. Training, recent flight experience, refresher training, proficiency check, and competency check requirements for EFVS operations;
7. Provisions that permit part 121, 125, or 135 operators using EFVS-equipped aircraft to dispatch, release a flight, or take off under IFR for the purpose of conducting an EFVS operation;
8. Parts 121, 125, and 135 requirements for initiating and continuing an approach for the purpose of conducting an EFVS operation when the visibility is less than the visibility minimums prescribed for the IAP to be flown;
9. Maintenance requirements;
10. Exceptions to certain EFVS operating requirements of 14 CFR part 91, § 91.176 and certain EFVS pilot requirements of 14 CFR part 61, § 61.66;
11. Compliance dates;
12. EFVS requirements pertaining to public aircraft operations; and
13. How to obtain an OpSpec/MSpec/LOA to conduct EFVS operations that require an approval.

1.4.3 For simplicity, because the EFVS training, qualification, and recency-of-experience requirements are contained in parts 61, 135, and appendices F and H to part 121, the terminology used in this AC is consistent with those regulations. Air carriers with an Advanced Qualification Program (AQP) should use the content of this AC in conjunction with AC 120-54, Advanced Qualification Program.

1.4.4 This AC does not address the use of an EVS which does not meet the requirements necessary to be considered an EFVS (see paragraph 4). An EVS is an electronic means to provide the flightcrew with a sensor-derived or enhanced image of the external scene using millimeter wave radar, Forward Looking Infrared (FLIR), or other sensor technologies to provide a real-time image of the external scene. An EVS may present a sensor image on a head-down display (HDD), but it may not be able to present the sensor image and flight symbology in the same scale and alignment as the outside view. It is important to note that an EVS can also use a Head-Up Display (HUD) as its display element, yet still not meet the regulatory requirements for an EFVS. While an EVS that uses an HDD or HUD may provide situation awareness to the pilot, it does not meet the operating requirements for EFVS under § 91.176; § 91.1039; part 121, § 121.651; part 125, § 125.381; or part 135, § 135.225. Consequently, a pilot cannot use an EVS in lieu of natural vision to descend below DA/DH or MDA.

1.4.5 This AC does not address the use of Synthetic Vision Systems (SVS) or synthetic vision guidance systems (SVGS). Unlike an EFVS, an SVS does not provide a real-time sensor image of the outside scene and does not meet the requirements for EFVS operations. A pilot, therefore, cannot use a synthetic vision image on an HDD or HUD in lieu of natural vision to descend below DA/DH or MDA.

1.4.6 An EFVS can be integrated with SVS, also known as a combined vision system (CVS). Such a system can be used to conduct EFVS operations if all of the requirements for an EFVS are satisfied and the SVS image does not interfere with the pilot's ability to see the external scene, to identify the required visual references, or to see the sensor image.

1.5 Transition Period. March 21, 2017 to March 13, 2018.

1.5.1 Prior to December 13, 2016, the regulations for EFVS operations to 100 feet above the touchdown zone elevation (TDZE) were located in § 91.175(l) and (m). The EFVS final rule published on December 13, 2016 revised these regulations and moved them to § 91.176(b). To provide an adequate transition period for operators to comply with the new requirements of § 91.176(b), § 91.175(n) permits operators conducting EFVS operations to 100 feet above the TDZE to comply with either § 91.175(l) and (m) or § 91.176(b) prior to March 13, 2018. The requirements of § 91.175(l) and (m) will expire on March 13, 2018. Beginning on this date, operators who conduct EFVS operations to 100 feet above the TDZE must comply with § 91.176(b) and the requirements of § 61.66. Operators are encouraged to comply with § 91.176(b) and § 61.66 as soon as practicable within the transition period.

1.5.2 Operators who have an OpSpec, MSpec, or LOA to conduct EFVS operations under § 91.175(l) must be issued a new authorization under § 91.176(b) to continue operations beyond the transition period. Part 121, 125, or 135 operators who obtain a new authorization may request provisions for dispatch, flight release, or takeoff under IFR to be added to their authorizations. They may also request provisions to be added to their authorizations for beginning or continuing an approach when the reported visibility is less than the visibility minimums prescribed for the IAP to be flown. Paragraph 10.2 provides additional information on how to obtain this authorization.

1.5.3 The transition period also provides authorized training providers with adequate time to revise or develop training programs that meet the training requirements for EFVS operations. Paragraphs 5 and 6 contain additional information pertaining to training, recent flight experience, and proficiency requirements for EFVS operations.

2 REGULATORY BACKGROUND, DEFINITIONS, AND TYPES OF EFVS OPERATIONS.

2.1 EFVS Regulatory Background.

2.1.1 The requirements for operating below DA/DH or MDA under IFR on instrument approaches to civil airports are contained in §§ 91.175 and 91.176. The FAA has modified these requirements over the years to enable aircraft operations during reduced visibility conditions while maintaining a high level of safety. For many years, descent below DA/DH or MDA could only be accomplished using natural vision (refer to § 91.175(c)). On January 9, 2004, the FAA published a final rule in the Federal Register (FR), 69 FR 1620, Enhanced Flight Vision Systems. The rule permitted EFVSs to be used in lieu of natural vision to continue descending below DA/DH or MDA to 100 feet above the TDZE on an IAP that is flown using published straight-in landing

minimums other than Category (CAT) II or CAT III. At and below 100 feet, however, the lights or markings of the threshold or the lights or markings of the touchdown zone (TDZ) had to be distinctly visible and identifiable to the pilot using natural vision. A pilot could not continue to descend below 100 feet by relying solely on the EFVS sensor imagery. The 2004 final rule also established equipment requirements for EFVS operations and introduced definitions for EFVS and enhanced flight visibility.

2.1.2 On December 13, 2016, the FAA published a final rule in the FR, 81 FR 90126, Revisions to Operational Requirements for the Use of Enhanced Flight Vision Systems (EFVS) and to Pilot Compartment View Requirements for Vision Systems. The revised rule permits a pilot to use an EFVS in lieu of natural vision to continue descending below 100 feet to touchdown and rollout under certain conditions. This final rule also amended the visual reference requirements for both EFVS operations conducted below DA/DH or MDA down to 100 feet and for EFVS operations conducted below DA/DH to touchdown and rollout.

2.1.3 In addition to permitting a pilot to use EFVS in lieu of natural vision to descend below DA/DH to touchdown and rollout, the 2016 final rule contained other amendments that affect EFVS operations. The FAA amended the definition of EFVS in 14 CFR part 1, § 1.1 to more precisely describe an EFVS and added a definition for EFVS operation. The FAA also addressed provisions that permit operators who conduct EFVS operations under part 121, 125, or 135 to use EFVS-equipped aircraft to dispatch, release, or take off under IFR. It also specified the conditions under which a part 121, 125, or 135 operator of an EFVS-equipped aircraft may begin an approach when the weather is reported to be below authorized minimums for the approach to be flown. The FAA amended part 61 to require initial ground and flight training and establish recent flight experience and refresher training requirements. It also amended the proficiency check and competency check requirements of §§ 91.1065, 125.287, and 135.293, and appendix F to part 121 to include tasks appropriate to the EFVS operations the certificate holder is authorized to conduct. As part of this rulemaking action, the FAA also amended the regulations to permit operators to use an EFVS during CAT II and CAT III approaches.

2.1.4 Finally, the 2016 final rule consolidated all of the EFVS requirements in part 91 into new § 91.176. The FAA moved and restructured the regulations for EFVS operations to 100 feet that were located in § 91.175(l) and (m) to § 91.176.

2.1.5 It is important to understand that the EFVS regulations contained in § 91.176 do not specify visibility limitations. Part 91 operators (other than part 91 subpart K (part 91K)) may conduct EFVS approach operations to 100 feet above the TDZE without any specific approval. For all other operations, the EFVS regulatory framework enables the FAA to approve and manage EFVS operations to an appropriate visibility based on the demonstrated capability of the EFVS equipment and an operator's ability to perform the EFVS operations for which they seek specific approval. This regulatory framework permits the FAA to specify visibility and other operating conditions and limitations through an operator's OpSpec/MSpec/LOA for EFVS operations.

2.2 Definition of an EFVS. Imaging-sensor technologies can offer significant advantages in both safety and capability for low-visibility flight operations. Section 1.1 defines an EFVS as "…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."

2.3 Purpose of an EFVS.

2.3.1 An EFVS uses a transparent HUD or equivalent display to combine flight information, flight symbology, navigation guidance, and a real-time image of the external scene to the pilot on one display. Imaging sensors, which may be based on FLIR, millimeter wave radiometry, millimeter wave radar, low-level light intensification, or other real-time imaging technologies, produce a real-time image of the outside scene. Depending on atmospheric conditions and the strength of energy emitted and/or reflected from the outside scene, an EFVS can enable a pilot to see the approach lights, visual references associated with the runway environment, and other objects or features that might not be visible using natural vision alone.

2.3.2 During an instrument approach, the purpose of the EFVS image is to enhance the pilot's ability to detect and identify the visual references for the runway of intended landing before they are visible naturally out the windscreen (see Figure 1, View During an Approach with EFVS (Left) and Without EFVS (Right)). Combining the flight information, navigation guidance, and sensor imagery on a HUD or equivalent display allows the pilot to continue looking forward along the flightpath throughout the entire approach, landing, and rollout. The overall purpose of an EFVS is to enable a pilot to use enhanced vision imagery in lieu of natural vision to descend below DA/DH or MDA. Use of an EFVS may improve safety by enhancing situation and position awareness, providing visual cues to maintain a stabilized approach, and minimizing missed approaches. Even in situations where the flight visibility under § 91.175(c)(2) is sufficient for a pilot to use natural vision to descend below DA/DH or MDA, an EFVS may provide useful visual cues for enhanced situation awareness.

Figure 1. View During an Approach with EFVS (Left) and Without EFVS (Right)

(Images courtesy of the National Aeronautics and Space Administration (NASA) Langley Research Center.)

2.4 Definition of an EFVS Operation. Sections 91.175(c) and 91.176(a) and (b) specify two means of operating visually below DA/DH in the visual segment of an IAP. One means is by using natural vision under § 91.175(c), and the other is by using enhanced vision provided by an EFVS under § 91.176(a) and (b). Section 1.1 of the regulations 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 a rollout." This definition establishes the conditions under which an EFVS is required to conduct specific operations.

2.5 Types of EFVS Operations.

2.5.1 There Are Two Types of EFVS Approach Operations:

2.5.1.1 EFVS Operations to Touchdown and Rollout. An EFVS operation to touchdown and rollout is an operation in which the pilot uses the enhanced vision imagery provided by an EFVS in lieu of natural vision to descend below DA or DH to touchdown and rollout (see Figure 2, Operational Concept for EFVS Operation to Touchdown and Rollout). These operations may be conducted only on IAPs that have a DA or DH. You can find the regulations for EFVS operations to touchdown and rollout in § 91.176(a). An operator's OpSpec/MSpec/LOA to conduct EFVS operations to touchdown specifies a visibility minimum for the operation, based on the demonstrated performance of their system. This AC describes a method to demonstrate the ability to conduct EFVS operations to touchdown in visibilities down to Runway Visual Range (RVR) 1,000 feet. Operators may demonstrate improved performance and obtain authorization to conduct EFVS operations in even lower visibilities provided their airworthiness approval is appropriate for the EFVS operation to be conducted. Paragraph 4.1 contains

additional information about EFVS operations to touchdown and rollout and associated EFVS requirements.

Figure 2. Operational Concept for an EFVS Operation to Touchdown and Rollout

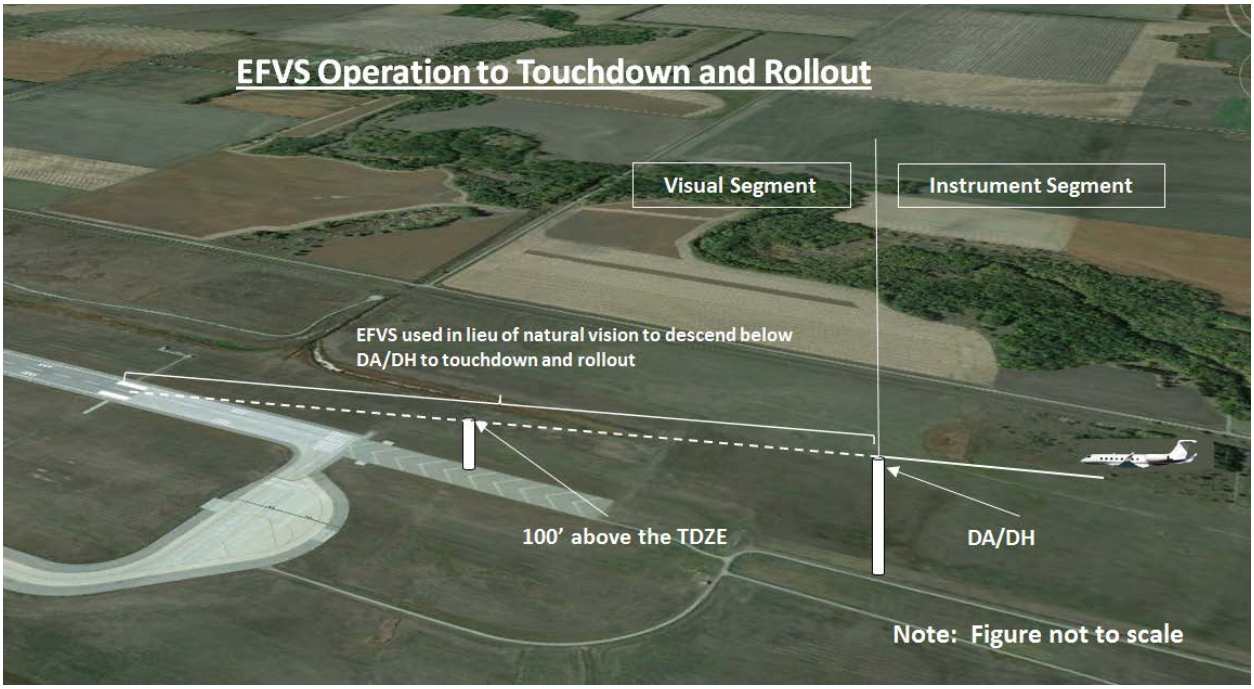

Photo obtained from Google Earth.

2.5.1.2 EFVS Operations to 100 feet Above the TDZE. An EFVS operation to 100 feet above the TDZE is an operation in which the pilot uses the enhanced vision imagery provided by an EFVS in lieu of natural vision to descend below DA/DH or MDA down to 100 feet above the TDZE (see Figure 3, Operational Concept for an EFVS Operation to 100 Feet Above the Touchdown Zone Elevation). Natural vision must be used to descend below 100 feet above the TDZE. These operations may be conducted on IAPs that have a DA/DH or MDA. You can find the regulations for EFVS operations to 100 feet above the TDZE in § 91.176(b). Paragraph 4.2 contains additional information about EFVS operations to 100 feet above the TDZE and associated EFVS requirements.

Figure 3. Operational Concept for an EFVS Operation to 100 Feet Above the Touchdown Zone Elevation

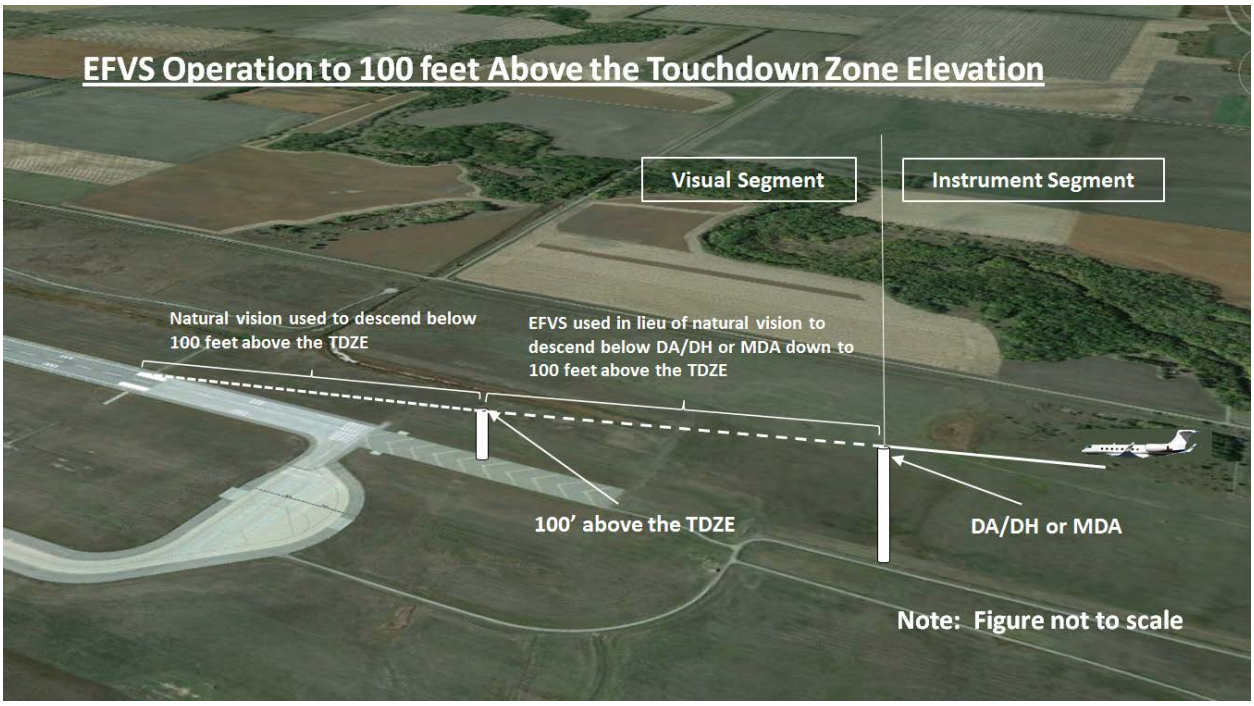

Photo obtained from Google Earth.

3 FLIGHT PLANNING AND BEGINNING OR CONTINUING AN APPROACH UNDER IFR USING EFVS-EQUIPPED AIRCRAFT.

3.1 Flight Planning for Parts 91 and 91K Operators. Flight planning for the purpose of conducting an EFVS operation is the same as flight planning for any other approach and must consider the forecast weather at the destination. The fuel requirements for flight in IFR conditions specified in § 91.167 apply to EFVS operations.

3.2 Flight Planning for Parts 121, 125, and 135 Operators. To minimize the potential of not being able to visually acquire the runway and complete an approach during poor visibility conditions, part 121, 125, and 135 operators are prohibited from beginning or continuing an approach procedure when the reported visibility is less than that prescribed for the instrument approach (refer to §§ 121.651, 125.325, 125.381, and 135.225). To minimize the risk of diverting, these operators also can only dispatch a flight, release a flight or takeoff under IFR when the forecast weather is at or above the authorized minimums at the estimated time of arrival at the airport or airports to which the operator has been dispatched or released (refer to §§ 121.613, 125.361, and 135.219). This same operating principle applies to EFVS operations. A part 121, 125, or 135 operator may dispatch a flight, release a flight, or take off under IFR for the purpose of conducting an EFVS operation when the forecast weather is at or above the authorized EFVS operational minimums at the estimated time of arrival at the airport or airports to which the operator has been dispatched or released. Therefore, they can be reasonably assured

that the pilot will be able to see the required visual references using the EFVS at the destination. The demonstrated performance of the EFVS defines the EFVS operational minimums specified in the operator's OpSpec or LOA for EFVS operations. The OpSpec for part 121, 125, or 135 operators and the LOA for part 125 Letter of Deviation Authority (LODA) holders authorizes a visibility for dispatching or releasing a flight and for beginning or continuing an approach. Paragraph 10.2 provides additional information on how to obtain or amend this authorization.

4 EFVS OPERATIONAL CONCEPTS.

4.1 EFVS Operations to Touchdown and Rollout (§ 91.176(a)).

4.1.1 Aircraft Eligibility.

4.1.1.1 An EFVS installed on a U.S.-registered aircraft used to conduct an EFVS operation to touchdown and rollout must be operable and must conform to an FAA-type design approval (a type certificate (TC), amended TC, or Supplemental Type Certificate (STC)). A foreign-registered aircraft used to conduct EFVS operations that does not have an FAA-type design approval 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 requirements of ICAO Annex 6.

4.1.1.2 The EFVS must meet the requirements in § 91.176(a)(1). These requirements are described in paragraphs 4.1.1.3 through 4.1.1.7 and include:

1. Imaging sensors that display the forward external scene to the pilot. These may include but are not limited to FLIR, millimeter wave radiometry, millimeter wave radar, or low-light level image intensification.
2. A display that presents the aircraft flight information, features, and characteristics required by the regulations such that they are clearly visible to the pilot flying (PF) in his or her normal position and line of vision looking forward along the flightpath. This is typically a HUD, but could also be a head-worn display if such a display provides all of the required information and conforms to the out-the-window view. An HDD does not meet the regulatory requirement for the EFVS display element because it is not a head-up presentation and does not allow the pilot to seamlessly incorporate the external scene as it becomes visible using natural vision.

4.1.1.3 At a minimum, the EFVS must display the following specific aircraft flight information:

- Airspeed;
- Vertical speed;

- Aircraft attitude;
- Heading;
- Altitude;
- Height above ground level (AGL);
- Command guidance as appropriate for the approach to be flown;
- Path deviation indications;
- Flight Path Vector (FPV) cue;
- Flight Path Angle Reference Cue (FPARC); and
- Flare prompt or flare guidance, as appropriate to the aircraft.

4.1.1.4 The regulations also specify that the EFVS imagery, attitude symbology, FPV, FPARC, and other cues that are referenced to the imagery and external scene topography must be conformal. That is, they must be aligned with and scaled to the external view. In addition, the FPARC must be selectable by the pilot to the desired descent angle for the approach and be suitable for monitoring the vertical flightpath of the aircraft. The EFVS must display the sensor imagery and aircraft flight information and flight symbology so that they do not adversely obscure the pilot's outside view or field of view through the cockpit window. 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. Finally, the display characteristics and dynamics must be suitable for manual control of the aircraft.

4.1.1.5 The EFVS must present height AGL such as that provided by a radio altimeter (RA) or another device capable of providing equivalent performance. The supplementary information provided by an RA below 100 feet contributes to altitude awareness and can be used to help perform the flare and landing during EFVS operations that are conducted to touchdown and rollout.

4.1.1.6 For aircraft other than rotorcraft, the EFVS must present flare prompt or flare guidance, as appropriate to the aircraft. As specified in AC 20-167, Airworthiness Approval of Enhanced Vision System, Synthetic Vision System, Combined Vision System, and Enhanced Flight Vision System Equipment, each applicant for type design approval should demonstrate acceptable touchdown performance for their particular EFVS implementation using either flare prompt or flare guidance. This requirement is necessary to provide the pilot with additional information to conduct the flare maneuver during conditions of low visibility that may be encountered during EFVS operations to touchdown and rollout.

4.1.1.7 When a minimum flightcrew of more than one pilot is required, the aircraft must also be equipped with a display that provides the pilot monitoring (PM) with EFVS sensor imagery. Any symbology displayed must not adversely obscure the sensor imagery of the runway environment. The PM display may be a HUD, an HDD, or a head-mounted display.

4.1.1.8 An operator can determine the eligibility of their aircraft by referring to the Airplane Flight Manual (AFM) (or Airplane Flight Manual Supplement (AFMS)) or the Rotorcraft Flight Manual (RFM) (or Rotorcraft Flight Manual Supplement (RFMS)). Aircraft that have been shown to meet the requirements for EFVS approach operations to touchdown and rollout will have in their AFM(S) or RFM(S) a statement of compliance to AC 20-167 as an EFVS Landing System or an EFVS Landing and Rollout System.

4.1.1.8.1 An EFVS Landing System has been demonstrated to land and roll out while all system components are working, but may have failure modes that result in the loss of EFVS capability. As such, the flight visibility should be adequate to complete the touchdown and rollout or conduct a go-around in the event the system fails. A visibility of RVR 1000 feet is adequate for this purpose.

4.1.1.8.2 An EFVS Landing and Rollout System has been demonstrated to land and roll out while all system components are working, and in the event of any component failure. Such systems can qualify for even lower visibility, since it is very unlikely the pilot would need to revert to natural vision. A landing and rollout system may be dependent on additional equipment, operational, and visibility and visual reference requirements to account for specific equipment characteristics, operational procedures, or approach characteristics.

4.1.1.9 The AFM(S) or RFM(S) may specify limitations applicable to the installed EFVS equipment and may contain information about conditions that were demonstrated during certification of the EFVS. Demonstrated conditions pertinent to the EFVS may consist of sensor performance information or other conditions that were demonstrated during certification in accordance with AC 20-167. (Refer to AC 20-167, Appendix F, Sample Airplane Flight Manual (AFM) Supplement.) An EFVS that meets the criteria for EFVS operations to touchdown may also be used to conduct EFVS operations to 100 feet above the TDZE.

4.1.2 Approaches Approved for EFVS Operations to Touchdown and Rollout.

4.1.2.1 A pilot may conduct an EFVS operation to touchdown and rollout on any Standard Instrument Approach Procedure (SIAP) or special IAP provided the minimums used for the particular approach to be flown include a DA or DH (e.g., precision or APV approach).

4.1.2.2 A pilot is not permitted to conduct EFVS operations on an instrument approach that has a circle-to-land maneuver. The EFVS may not be used to satisfy the § 91.175(e)(2) requirement that an identifiable part of the airport be distinctly visible to the pilot during a circling maneuver at or above MDA or while descending below MDA from a circling maneuver, or for conducting a visual approach. The pilot must accomplish this using natural vision. A pilot may use an EFVS to supplement natural vision and improve situation awareness at any time.

4.1.2.3 Instrument approach criteria, procedures, and appropriate visual references have not yet been developed for straight-in landing operations below DA/DH under IFR to heliports or platforms. EFVS cannot be used in lieu of natural vision to descend below published minimums on copter approaches to a point in space (PinS) followed by a "proceed visual flight rules (VFR)" visual segment, or on approaches designed to a specific landing site using a "proceed visually" visual segment. Currently, EFVS operations in rotorcraft can be conducted only on IAPs that are flown to a runway.

4.1.2.4 Under § 91.176(a), operators who have been issued OpSpec C073, MSpec MC073, or 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 Nonprecision Approaches (NPA) that use an MDA as a DA/DH in accordance with C073.

4.1.2.5 Sections 91.176 and 91.189 permit an authorized EFVS operation to be conducted during an authorized CAT II or CAT III operation.

4.1.3 Enhanced Flight Visibility Requirements for EFVS Operations to Touchdown and Rollout.

4.1.3.1 For EFVS operations to touchdown and rollout conducted under §§ 91.176, 121.651, 125.381, and 135.225, 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 pilot determines that the enhanced flight visibility observed by use of an EFVS is not less than the visibility prescribed in the IAP the pilot is using. The EFVS requirements for enhanced flight visibility under § 91.176(a) were constructed to be analogous to the flight visibility requirements for natural vision under § 91.175(c). To descend below DA/DH or MDA using natural vision under § 91.175(c), a pilot must make a determination that the flight visibility observed from the flight deck is not less than what is prescribed in the IAP being flown. To descend below DA/DH using an EFVS under § 91.176(a), a pilot must make a determination that the enhanced flight visibility observed by using an EFVS is not less than what is prescribed by the IAP being flown. In terms of determining flight visibility or enhanced flight visibility,

the difference is in what the pilot uses to make the determination. In one case, the pilot is using natural vision. In the other case, the pilot is using an EFVS.

4.1.3.2 Understanding the regulatory basis for determining flight visibility and enhanced flight visibility is important. On January 8, 1981, the FAA published 46 FR 2291, Takeoff and Landing Minimums, in which it clarified the conditions under which a pilot may approach and land at an airport when the weather conditions do not allow the pilot to see the runway until shortly before landing (46 FR 2291, at 2287-88). The determination of flight visibility is a separate action from that of identifying required visual references, and is different from ground-reported visibility. Suitable flight visibility is necessary to ensure the aircraft is in a position to continue the approach and land, and to see and avoid any obstructions in the visual segment. On January 9, 2004, the FAA published 69 FR 1620, in which it set forth the requirement for a pilot to determine enhanced flight visibility before descending below DA/DH or MDA. The rationale for determining enhanced flight visibility in the 2004 final rule is similar to the rationale for determining flight visibility in the 1981 final rule. Additionally, the regulatory requirements and pilot tasks associated with both types of operations are similar.

4.1.3.3 It is important to understand that, for a prescribed visibility value, the "sight picture" of the relevant visual references that the pilot can see looking forward along the flightpath from the flight deck should be similar whether the pilot is using natural vision or an EFVS. Even though the reported visibility or the visibility observed using natural vision may be less, as long as the EFVS provides the required enhanced flight visibility and a pilot meets all of the other requirements, the pilot can continue descending below DA/DH using the EFVS. Pilots should receive training on how to assess enhanced flight visibility and what the "sight picture" of relevant visual references should be. How much of the forward scene, consisting of the Approach Light System (ALS) or other elements, a pilot sees at DA/DH under prescribed visibility conditions depends on individual IAP construction (geometry, threshold crossing height (TCH), slant range distance from the flight deck to relevant visual references, etc.), cockpit cutoff angle, and other relevant factors. As visibility conditions decrease, the ability of an EFVS to "see through" those conditions may also decrease depending on what type of EFVS sensor technology is used. It is important to note that there are differences in the appearance and configuration of ALSs and these should be discussed during training as well as during approach briefs. It is the pilot's responsibility to ensure the enhanced flight visibility is adequate to safely perform the EFVS operation being conducted.

4.1.3.4 The enhanced flight visibility requirement for EFVS operations to touchdown and rollout under § 91.176(a) is also applicable to that portion of the visual segment at and below 100 feet above the TDZE. That is, the enhanced flight visibility cannot be less than what is specified in the IAP being flown from DA/DH through touchdown and rollout.

4.1.4 Visual Reference Requirements for EFVS Operations to Touchdown and Rollout.

4.1.4.1 To descend below DA/DH, the following visual references specified in § 91.176(a)(3)(ii) for the runway of intended landing must be distinctly visible and identifiable to the pilot using the EFVS:

4.1.4.1.1 The ALS (if installed); or

4.1.4.1.2 The following visual references in both items 1 and 2 below:

1. The runway threshold, identified by at least one of the following:
   - The beginning of the runway landing surface;
   - The threshold lights; or
   - The runway end identification lights (REIL).
2. The TDZ, identified by at least one of the following:
   - The runway TDZ landing surface;
   - The TDZ lights;
   - The TDZ markings; or
   - The runway lights.

4.1.4.2 The main differences for an EFVS operation compared to an operation using natural vision are that the Visual Glide Slope Indicator (VGSI) lights cannot be used as a visual reference, and the pilot must be able to see both the threshold and TDZ if the approach lights are not visible.

4.1.4.3 At 100 feet above the TDZE of the runway of intended landing and below that altitude, the pilot using EFVS must be able to distinctly see and identify one of the following visual references specified in § 91.176(a)(3)(iii):

- The runway threshold;
- The lights or markings of the threshold;
- The runway TDZ landing surface; or
- The lights or markings of the TDZ.

4.1.4.4 A pilot who conducts an EFVS operation to touchdown and rollout can continue to descend below 100 feet relying solely on the EFVS sensor image to identify the required visual references provided the other operating requirements of § 91.176(a) are met. If the EFVS fails during any portion of the approach, the pilot may not continue unless the requirements for an approach without EFVS are satisfied. For EFVS operations to touchdown and rollout that are authorized to visibilities as low as 1000 RVR, the required

visibility ensures that the pilot will have adequate natural vision to continue the approach and land once descending below 100 feet above the TDZE.

4.1.4.5 Table 1, Required Visual References, summarizes the visual references a pilot must see using both natural vision and EFVS.

Table 1. Required Visual References

Required Visual References Using *Natural Vision*	**Required Visual References Using an *Enhanced Flight Vision System (EFVS)***
Descent below DA/DH or MDA under 14 CFR § 91.175(c) – At least **one** of the following references using natural vision: Approach light system (ALS) Threshold Threshold markings Threshold lights Runway end identifier lights (REIL) Visual Approach Slope Indicator (VASI) Touchdown zone (TDZ) TDZ markings TDZ lights Runway Runway markings Runway lights	**Descent below DA/DH or MDA under § 91.176 (a) or (b) –** The following references, using the EFVS: ALS ***OR*** BOTH paragraphs A and B A. The runway threshold, identified by at least one of the following: Beginning of the runway landing surface, Threshold lights, or REILs **AND** B. The TDZ, identified by at least one of the following: Runway TDZ landing surface, TDZ lights, TDZ markings, or Runway lights.
At and below 100 feet above the TDZE under § 91.175(c) – At least **one** of the following visual references: ALS, as long as the red terminating bars or red side row bars are also distinctly visible and identifiable Threshold Threshold markings Threshold lights REILs VASI TDZ TDZ markings TDZ lights Runway Runway markings Runway lights	**At and below 100 feet above the TDZE under § 91.176(a) or (b) –** At least **one** of the following visual references using natural vision for EFVS operations to 100 feet above the touchdown zone elevation (TDZE) or using an EFVS for EFVS operations to touchdown and rollout: The runway threshold, The lights or markings of the threshold, The runway TDZ landing surface, or The lights or markings of the TDZ.

4.1.5 Go-Around Considerations.

4.1.5.1 During an EFVS operation to touchdown and rollout, a pilot must initiate a go-around at or below DA/DH whenever:

1. The enhanced flight visibility is less than the visibility minimums prescribed for the IAP the pilot is flying;
2. The required visual references for the runway of intended landing are no longer distinctly visible and identifiable to the pilot using the EFVS imagery (or natural vision in the event of EFVS failure);
3. The aircraft is not in a position from which a descent to a landing can be made on the intended runway, at a normal rate of descent, using normal maneuvers; or
4. The descent rate of the aircraft would not allow touchdown to occur within the TDZ of the runway of intended landing.

4.1.6 Other Operating Requirements for EFVS Operations to Touchdown and Rollout.

4.1.6.1 To conduct an EFVS operation to touchdown and rollout, the aircraft must be equipped with, and the PF must use, an operable EFVS as described in paragraph 4.1.1. When a minimum flightcrew of more than one pilot is required, the display of EFVS sensor imagery to the PM provides common situation awareness. The PM would carry out his or her normal approach monitoring tasks and use the display of EFVS sensor imagery to confirm the required visual references, verify visual acquisition of and alignment with the runway of intended landing, and assist in determining that the runway is clear of aircraft, vehicles, or other obstructions. Paragraph 4.1.1.7 and AC 20-167 discuss the requirements applicable to the PM display.

4.1.6.2 Each required pilot flightcrew member must have adequate knowledge of, and familiarity with, the aircraft, the EFVS, and the procedures to be used. Paragraphs 5 and 6 address pilot training, proficiency and competency checks, recent flight experience, and refresher training requirements.

4.1.6.3 The FAA requires an OpSpec, MSpec, or LOA, as appropriate to the operator, to conduct EFVS operations to touchdown and rollout. Paragraph 10 addresses authorization and operational approval requirements in more detail.

4.2 EFVS Operations to 100 Feet Above the TDZE (§ 91.176(b)).

4.2.1 Aircraft Eligibility.

4.2.1.1 An EFVS installed on a U.S.-registered aircraft used to conduct an EFVS operation to 100 feet above the TDZE must be operable and must conform to an FAA type design approval (a TC, amended TC, or STC). A foreign-registered aircraft used to conduct EFVS operations that does not have

an FAA type design approval 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 requirements of ICAO Annex 6.

4.2.1.2 The EFVS must meet the requirements in § 91.176(b)(1). These requirements are described in paragraphs 4.2.1.3 and 4.2.1.4 and include:

1. Imaging sensors that display the forward external scene to the pilot. These may include, but are not limited to, FLIR, millimeter wave radiometry, millimeter wave radar, or in low-light level image intensification.
2. A display that presents the aircraft flight information, features, and characteristics required by the regulations such that they are clearly visible to the PF in his or her normal position and line of vision looking forward along the flightpath. This is typically a HUD, but could also be a head-worn display if such a display provides all of the required information and conforms to the out-the-window view. An HDD does not meet the regulatory requirement for the EFVS display element because it is not a head-up presentation and does not allow the pilot to seamlessly incorporate the external scene as it becomes visible using natural vision.

4.2.1.3 At a minimum, the EFVS must display the following specific aircraft flight information:

- Airspeed;
- Vertical speed;
- Aircraft attitude;
- Heading;
- Altitude;
- Command guidance as appropriate for the approach to be flown;
- Path deviation indications;
- FPV cue; and
- FPARC.

4.2.1.4 The regulations also specify that the EFVS imagery, attitude symbology, FPV, FPARC, and other cues that are referenced to the imagery and external scene topography must be conformal. That is, they must be aligned with and scaled to the external view. In addition, the FPARC must be selectable by the pilot to the desired descent angle for the approach and be suitable for monitoring the vertical flightpath of the aircraft. The EFVS must display the sensor imagery and aircraft flight information and flight symbology so that they do not adversely obscure the pilot's outside view or field of view through the

cockpit window. 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. Finally, the display characteristics and dynamics must be suitable for manual control of the aircraft.

4.2.1.5 Unlike an EFVS that is used to conduct EFVS operations to touchdown and rollout, an EFVS that is used to conduct EFVS operations to 100 feet is not required to have an RA, is not required to display flare prompt or flare guidance, and does not have to provide a PM display.

4.2.1.6 An operator can determine the eligibility of their aircraft by referring to the AFM(S) or RFM(S). Aircraft that have been shown to meet the requirements for EFVS approach operations to 100 feet above the TDZE will have in their AFM(S) or RFM(S) a statement of compliance to AC 20-167 as an EFVS Approach System.

4.2.1.6.1 An EFVS approach system has been demonstrated to conduct approach operations to 100 feet above the TDZE while all system components are working, but may have failure modes that result in the loss of EFVS capability. Above 100 feet above the TDZE, the pilot is expected to conduct a go-around if the EFVS fails. Descent below 100 feet above the TDZE through touchdown and rollout is conducted using natural vision, so any failure of the EFVS should not prevent the pilot from completing the approach and landing.

4.2.1.7 The AFM(S) or RFM(S) may specify limitations applicable to the installed EFVS equipment and may contain information about conditions that were demonstrated during certification of the EFVS. Demonstrated conditions pertinent to the EFVS may consist of sensor performance information or other conditions that were demonstrated during certification in accordance with AC 20-167. (Refer to AC 20-167, Appendix F.) An EFVS that has been certified only for EFVS operations to 100 feet above the TDZE cannot be used to conduct EFVS operations to touchdown and rollout.

4.2.1.8 The AFM(S) or RFM(S) for an EFVS that was approved prior to December 13, 2016 may reference § 91.175(l). This means the EFVS was certified for EFVS operations to 100 feet above the TDZE. The regulations pertaining to EFVS operations to 100 feet above the TDZE were previously located in § 91.175(l) and were later moved to § 91.176(b).

4.2.2 Approaches Approved for EFVS Operations to 100 Feet Above the TDZE.

4.2.2.1 A pilot may conduct an EFVS operation to 100 feet above the TDZE on any SIAP or special IAP, except for a circling approach. The EFVS may not be used to satisfy the § 91.175(e)(2) requirement that an identifiable part of the airport be distinctly visible to the pilot during a circling maneuver at or above MDA or while descending below MDA from a circling maneuver, or for

conducting a visual approach. The pilot must accomplish this using natural vision. A pilot may use an EFVS to supplement natural vision and improve situation awareness at any time.

4.2.2.2 Instrument approach criteria, procedures, and appropriate visual references have not yet been developed for straight-in landing operations below DA/DH or MDA under IFR to heliports or platforms. EFVS cannot be used in lieu of natural vision to descend below published minimums on copter approaches to a PinS followed by a "proceed VFR" visual segment, or on approaches designed to a specific landing site using a "proceed visually" visual segment. Currently, EFVS operations in rotorcraft can be conducted only on IAPs that are flown to a runway.

4.2.2.3 Operators who have been issued OpSpec C073, MSpec MC073, or LOA C073 may conduct EFVS operations to 100 feet above the TDZE on certain NPAs that use an MDA as a DA/DH in accordance with C073.

4.2.3 Enhanced Flight Visibility Requirements for EFVS Operations to 100 Feet Above the TDZE.

4.2.3.1 For EFVS operations to 100 feet above the TDZE conducted under §§ 91.176, 121.651, 125.381, and 135.225, 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 TDZE unless the pilot determines that the enhanced flight visibility observed by use of an EFVS is not less than the visibility prescribed in the IAP the pilot is using. The EFVS requirements for enhanced flight visibility under § 91.176(b) were constructed to be analogous to the flight visibility requirements for natural vision under § 91.175(c). To descend below DA/DH or MDA using natural vision under § 91.175(c), a pilot must make a determination that the flight visibility observed from the flight deck is not less than what is prescribed in the IAP being flown. To descend below DA/DH or MDA using an EFVS under § 91.176(b), a pilot must make a determination that the enhanced flight visibility observed by using an EFVS is not less than what is prescribed by the IAP being flown. The difference between determining flight visibility and enhanced flight visibility is in what the pilot uses to make the determination. In one case, the pilot is using natural vision. In the other case, the pilot is using an EFVS. The regulatory basis for enhanced flight visibility is discussed in more detail in paragraph 4.1.3.2.

4.2.3.2 It is important to understand that, for a prescribed visibility value, the "sight picture" of the relevant visual references that the pilot can see looking forward along the flightpath from the flight deck should be similar whether the pilot is using natural vision or an EFVS. An EFVS often produces the required enhanced flight visibility when the reported visibility or the visibility observed using natural vision is much less. The point of this discussion is that even though the reported visibility or the visibility observed using natural vision

may be less, as long as the EFVS provides the required enhanced flight visibility and a pilot meets all of the other requirements, the pilot can continue descending below DA/DH or MDA using the EFVS. Pilots should receive training on how to assess enhanced flight visibility and the "sight picture" for relevant visual references. How much of the forward scene, consisting of the ALS or other elements, a pilot sees at DA/DH or MDA under prescribed visibility conditions depends on individual IAP construction (geometry, TCH, slant range distance from the flight deck to relevant visual references, etc.), cockpit cutoff angle, and other relevant factors. As visibility conditions decrease, the ability of an EFVS to "see through" those conditions may also decrease depending on what type of EFVS sensor technology is used. It is important to note that there are differences in the appearance and configuration of ALSs and these should be discussed during training as well as during approach briefs. It is the pilot's responsibility to ensure the enhanced flight visibility is adequate to safely perform the EFVS operation being conducted.

4.2.3.3 At and below 100 feet above the TDZE, a pilot must transition to natural vision to identify the required visual references in order to continue descending. In this portion of the visual segment, the flight visibility using natural vision has to be sufficient for one of the required visual references specified in § 91.176(b)(3)(iii) to be distinctly visible and identifiable. The enhanced flight visibility requirement, based on the visibility for the IAP, also applies below 100 feet even though the EFVS cannot be used to identify required visual references below 100 feet.

4.2.4 Visual Reference Requirements for EFVS Operations to 100 Feet Above the TDZE.

4.2.4.1 To descend below DA/DH or MDA, the following visual references specified in § 91.176(b)(3)(ii) for the runway of intended landing must be distinctly visible and identifiable to the pilot using the EFVS:

4.2.4.1.1 The ALS (if installed); or

4.2.4.1.2 The following visual references in both items 1 and 2 below:

1. The runway threshold, identified by at least one of the following:
   - The beginning of the runway landing surface;
   - The threshold lights; or
   - The REILs.
2. The TDZ, identified by at least one of the following:
   - The runway TDZ landing surface;
   - The TDZ lights;

- The TDZ markings; or
- The runway lights.

4.2.4.2 The main differences for an EFVS operation compared to an operation using natural vision are that the VGSI lights cannot be used as a visual reference, and the pilot must be able to see both the threshold and TDZ if the approach lights are not visible.

4.2.4.3 At 100 feet above the TDZE of the runway of intended landing and below that altitude, the pilot must be able to distinctly see and identify one of the following visual references specified in § 91.176(b)(3)(iii) without reliance on the EFVS:

1. The runway threshold;
2. The lights or markings of the threshold;
3. The runway TDZ landing surface; or
4. The lights or markings of the TDZ.

4.2.4.4 As stated above, a pilot cannot continue to descend below 100 feet above the TDZE by relying solely on the EFVS sensor image to identify the required visual references. The pilot may continue to use the EFVS as long as the pilot can see the required visual references that he or she would normally see through the windscreen with natural vision. This enables the pilot to continue to benefit from the HUD guidance and the additional situation and position awareness provided by the sensor image on the EFVS display. However, the pilot must base the decision to continue descending below 100 feet above the TDZE solely on seeing the required visual references through the EFVS display by means of natural vision. Table 1 compares the visual references a pilot must see to descend below DA/DH or MDA and 100 feet above the TDZE using both natural vision and EFVS.

4.2.5 Go-Around Considerations.

4.2.5.1 During an EFVS operation to 100 feet above the TDZE, a pilot must initiate a go-around at or below DA/DH or MDA whenever:

1. The enhanced flight visibility is less than the visibility minimums prescribed for the IAP the pilot is flying;
2. The required visual references for the runway of intended landing are no longer distinctly visible and identifiable to the pilot using the EFVS imagery (or natural vision in the event of EFVS failure);
3. The required visual references for the runway of intended landing are no longer distinctly visible and identifiable to the pilot using natural vision when descending below 100 feet above the TDZE;

4. The aircraft is not in a position from which a pilot can make a descent to a landing on the intended runway, at a normal rate of descent, using normal maneuvers; or
5. The descent rate of the aircraft would not allow touchdown to occur within the TDZ of the runway of intended landing for operations conducted under part 121 or 135.

4.2.6 Other Operating Requirements for EFVS Operations to 100 Feet Above the TDZE.

4.2.6.1 To conduct an EFVS operation to 100 feet above the TDZE, the aircraft must be equipped with, and the PF must use, an operable EFVS as described in paragraph 4.2.1. If the aircraft is equipped with a display of sensor imagery for the PM, an operator should develop procedures for using the display, and the PM should receive training on those procedures.

4.2.6.2 Each required pilot flightcrew member must have adequate knowledge of, and familiarity with, the aircraft, the EFVS, and the procedures to be used. Paragraphs 5 and 6 address pilot training, proficiency and competency checks, recent flight experience, and refresher training requirements.

4.2.6.3 The FAA requires an OpSpec, MSpec, or LOA, as appropriate, to conduct EFVS operations to 100 feet above the TDZE under 14 CFR parts 91K, 121, 125, 129, and 135. The FAA does not require part 91 operators (other than part 91K operators) to obtain an LOA to conduct EFVS operations to 100 feet above the TDZE. Paragraph 10 addresses authorization and operational approval requirements in more detail.

4.3 Considerations for EFVS Operations.

4.3.1 EFVS Sensor Performance. During some reduced visibility conditions, an EFVS can display imagery that may significantly improve a pilot's capability to detect approach lights and visual references of the runway environment that may not otherwise be visible using natural vision. In some weather conditions, however, imaging sensor performance can be variable just as visual performance can be variable using natural vision. A pilot may be able to see very well in some directions, but not in others, and the ability to see may change dramatically during an approach. For this reason, a pilot must ensure that the appropriate enhanced flight visibility using an EFVS exists throughout the EFVS approach operation. He or she should be able to see in all directions within the EFVS field of view and not just on one sightline. Additionally, pilots using an EFVS should be careful not to conclude that the flightpath is free of obstacles because no obstacles are distinctly visible in the image. Paragraph 4.3.5 contains additional information about the visual segment obstacle clearance.

4.3.2 Special IAPs. Operators that have a specific approval from the FAA to conduct instrument approaches using special IAPs should evaluate those instrument procedures to determine their compatibility with EFVS operations. Special IAPs are frequently dependent on the ability of the operator to meet certain requirements that may include,

but are not limited to, aircraft performance, aircraft equipage, airport facility equipment, crew training, or other requirements. These procedures also may have nonstandard features such as nonstandard final approach course alignment, nonstandard descent gradients, or other features that may or may not be compatible with the conduct of EFVS operations.

4.3.3 Stabilized Approach. NPA design may require pilots to comply with more than one minimum altitude during the Final Approach Segment (FAS). Descending to each minimum altitude, and leveling off at that altitude requires multiple thrust, pitch, and altitude adjustments inside the final approach fix (FAF), thereby increasing pilot workload and the potential for error during a critical phase of flight. This practice, commonly referred to as "dive and drive," can result in extended level flight as low as 250 feet above the obstacle environment in instrument meteorological conditions (IMC). The concept of a stabilized approach has been widely promoted as a means to help eliminate controlled flight into terrain (CFIT). The goal is to have the aircraft in the proper landing configuration, at the proper approach speed, and on the proper flightpath before descending below the minimum stabilized approach height. AC 91-79, Mitigating the Risks of a Runway Overrun Upon Landing, considers minimum stabilized approach height to be 1000 feet above the airport elevation or TDZE during IMC.

1. One method used to fly a stable path on an NPA procedure is the continuous descent final approach (CDFA) technique. AC 120-108, Continuous Descent Final Approach, and the ICAO Manual of All Weather Operations contain guidance on the use of CDFA on NPAs.
2. A stable approach is important to increase the likelihood the aircraft is in a position and configuration to land when reaching the DA/DH. For this reason, EFVS operations to touchdown and rollout require the use of stabilized approaches and are conducted only on certain types of IAPs.

4.3.4 Offset Approaches.

4.3.4.1 Criteria contained in the U.S. Standard for Terminal Instrument Procedures (TERPS) permit IAPs to be offset from the runway centerline (RCL). A non-Area Navigation (RNAV) NPA, for example, can be offset up to 30 degrees from the RCL and cross the final approach course up to 5200 feet from the runway threshold. A Global Positioning System (GPS) or RNAV (GPS) approach with lateral navigation (LNAV) or LNAV/vertical navigation (VNAV) minimums can be offset as much as 15 degrees from the RCL, and an instrument landing system (ILS) or localizer performance with vertical guidance (LPV) approach can be offset as much as 3 degrees. A pilot who conducts an NPA should verify lateral alignment with the RCL before descending from the MDA because actual lateral course alignment can vary depending upon facility type, distance from the facility, or signal variations that can cause an offset from the intended course centerline. Pilots should be especially knowledgeable of the approach conditions and approach course alignment when considering whether to rely on EFVS during an instrument approach with an offset final approach course. Depending upon the

combination of crosswind correction, approach course offset, and the lateral field of view provided by a particular EFVS, the required visual references may or may not be within the pilot's view looking through the EFVS upon reaching the missed approach point (MAP). Operators should also be aware of the increased potential for non-conformal HUD symbology of the runway outline at higher offset angles.

4.3.5 Visual Segment Obstacle Clearance.

4.3.5.1 To assure a safe obstacle clearance margin, certain nonprecision instrument approaches may require a pilot to visually identify known obstacles near the normal approach path when maneuvering in the visual segment for landing. Because imaging sensor performance can be variable in some weather conditions, pilots using an EFVS should be careful not to conclude that the flightpath is free of obstacles because no obstacles are distinctly visible in the image. This is no different than visual performance using natural vision, which can also be variable in certain weather conditions. Additionally, a pilot must ensure that the appropriate enhanced flight visibility using an EFVS exists throughout the EFVS approach operation and that he or she can see in all directions within the EFVS field of view, not just along one sightline. It is the pilot's responsibility to see and avoid obstacles. This section provides additional information about obstacle protection.

4.3.5.2 Precision approaches (e.g., ILS/LPV) or approaches with computed vertical paths (e.g., LNAV/VNAV) provide the highest level of safety for both obstacle clearance and controlled rate of descent. If there is no published vertical guidance to a runway, the use of the FPV and FPARC on the EFVS display may assist the pilot in flying a vertical path to the runway, but that path may not be clear of all obstacles. Since the aircraft is in the visual segment of the approach, it is incumbent on the pilot to select an appropriate vertical path. The presence of a charted vertical descent angle (VDA) does not guarantee obstacle protection in the visual segment and does not change any of the requirements for flying an NPA. The published VDA is for information only, and is strictly advisory in nature.

4.3.5.3 Additional information for the visual segment below the MDA is provided if a visual descent point (VDP) is published and descent below the MDA is started at or after the VDP. VDPs provide pilots with a reference for the optimal location to begin descent from the MDA, based on the designed VDA for the approach procedure, assuming the required visual references are visible.

4.3.5.4 The use of a VGSI can help the pilot determine if the aircraft is in a position to make a descent from the MDA or DA. However, a VGSI is predicated on seeing color, and EFVS imaging sensors do not currently image color. While color can be seen through the HUD using natural vision, an EFVS image can sometimes make it difficult to interpret the VGSI. Pilots may turn the sensor

image on the HUD on or off for the display of information that provides the best situation awareness for the approach being conducted.

4.3.6 Missed Approach Obstacle Clearance.

4.3.6.1 The published missed approach procedure provides obstacle clearance only when the missed approach is initiated from or above the DA/DH, or at the MAP. It assumes a climb rate of 200 feet/nautical mile (NM), unless a higher climb gradient is identified on the procedure. If the pilot initiates a go-around at a point below DA/DH or after the MAP, obstacle clearance is not necessarily provided by following the published missed approach procedure.

4.3.6.2 In low-visibility conditions, the operating requirements ensure a very low go-around rate below DA/DH or after the MAP. For EFVS operations, the FPARC and FPV reduce the likelihood of a go-around caused by not being in a position to continue the approach and land. Another important component is the required flight visibility, specified as part of an EFVS touchdown and rollout approval or in the conditions to initiate the approach for part 121, 125, and 135 operators.

4.3.6.3 When initiating a go-around below DA/DH or after the MAP, the use of EFVS can significantly improve safety by enabling the pilot to see terrain or obstacles that might not be visible using natural vision alone.

4.3.7 Light Emitting Diode (LED) Lighting. LEDs provide maintenance and efficiency advantages compared to incandescent lights. They are used in obstruction lights and airport lighting, and are being considered for use in ALSs. Infrared (IR)-based EFVSs are not able to sense LEDs, since most of them do not emit IR radiation. An EFVS also images the runway environment and runway markings, however, all of which are visual references permitted to be used to descend below DA/DH or MDA. Pilots should be familiar with the lighting at their destination, and any corresponding limitations of their EFVS.

4.3.8 International EFVS Operations.

4.3.8.1 Currently, most foreign CAAs require a specific approval to conduct EFVS operations. As a result, a foreign CAA may require a U.S. operator who wishes to conduct EFVS operations in their country to obtain an FAA-issued authorization. Part 91 operators (other than part 91K operators) are not required to obtain an LOA to conduct EFVS operations to 100 feet above the TDZE within the United States. A part 91 operator conducting EFVS operations to 100 feet above the TDZE outside of the United States may request an LOA from the FAA. The FAA strongly recommends that operators contact the CAA of each country in which they plan to conduct EFVS operations to determine the equipment requirements, operational approval requirements, and requirements for conducting EFVS operations, since those requirements may be different from those of the United States. Operators of

U.S.-registered civil aircraft that are conducting operations outside of the United States must comply with § 91.703 and other applicable regulations pertaining to operations that are conducted outside the United States.

4.3.8.2 ICAO Annex 6, Parts I, II, and III contain information about international operations using EFVS (referred to as EVS in Annex 6). The ICAO Manual of All-Weather Operations (ICAO Doc 9365) contains additional guidance. The AIP issued by a particular State may also contain information about EFVS operations in that country.

4.4 EFVS Operations Conducted by Public Aircraft Operators.

4.4.1 Public aircraft operators, other than those operating military aircraft, must meet the same EFVS requirements as civil aircraft. This includes the requirement for the EFVS to conform to an FAA-approved type design and for their pilots to be trained and proficient. Paragraphs 5 and 6 contain additional information about EFVS training and recent flight experience requirements.

4.4.2 Military aircraft are not subject to the FAA's operating or airworthiness requirements for EFVSs.

4.5 EFVS Operations Conducted for the Purpose of Research and Development or Showing Compliance With Regulations. The FAA recognizes that aircraft manufacturers and EFVS system developers have a need to use EFVS in a variety of weather conditions for research and development and for flight testing in conjunction with an aircraft certification project. These operations may be conducted with an EFVS that does not have a type design approval in accordance with the operating limitations of their experimental airworthiness certificate or the flight test plan. The operation itself must still comply with all of the EFVS operating requirements.

5 PILOT TRAINING REQUIREMENTS FOR EFVS OPERATIONS.

5.1 Regulatory Requirement for Training.

5.1.1 Pilot training requirements for EFVS operations can be found in § 61.66. The ground and flight training requirements of § 61.66 apply to any person manipulating the controls of an aircraft or acting as pilot in command (PIC) of an aircraft during an EFVS operation. The ground training requirements also apply to any person serving as a required pilot flightcrew member (who does not manipulate the controls) during an EFVS operation to touchdown and rollout. Exceptions to these requirements can be found in § 61.66(f) and (h) and are discussed in more detail in paragraphs 5.7, 5.9, and 5.10 of this AC. 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 CAA of the State of the Operator.

5.1.2 In addition to the EFVS training guidance provided in this AC, operators and training providers should refer to the FSB report for the EFVS-equipped aircraft they will be flying, if such a report is available. The FAA Aircraft Evaluation Group (AEG) makes determinations of operational suitability during the certification process to ensure EFVS equipment meets operational needs for use within the National Airspace System (NAS). In addition, AEGs accomplish an operational evaluation to determine any training, checking, and currency requirements specific to the aircraft/EFVS equipment installation. Aircraft specific training, checking, and currency needs will be reflected in the FSB report specific to the aircraft. If a FSB report does not exist for the aircraft, an Operational Suitability Report (OSR) may be published. You can find FSB reports at http://fsims.faa.gov/PICResults.aspx?mode=Publication&doctype=FSB%20Reports.

5.2 EFVS Ground Training.

5.2.1 Under § 61.66(a)(1), any pilot who manipulates the controls of an aircraft or any pilot who acts as PIC of an aircraft during an EFVS operation must receive and log ground training appropriate to the category[1] of aircraft for the EFVS operation to be conducted. For EFVS operations to touchdown and rollout, any required pilot flightcrew member also must receive ground training. For EFVS operations to 100 feet above the TDZE that are conducted under part 91 (except for part 91K), the PM[2] is not required to receive ground training. However, the PM should familiarize himself or herself with the subjects in § 61.66(a)(2) and paragraph 5.2.2 of this AC. Under parts 91K, 121, 125, and 135, the PM must be adequately trained in the aircraft, crewmember position, and type of operation in which the flightcrew member serves; therefore, the PM must receive EFVS ground training. (Refer to §§ 121.401, 121.415, 125.287, 135.323, 135.329, and 91.1073.) Exceptions to the EFVS ground training requirements are discussed in paragraphs 5.7, 5.9, and 5.10. Ground training must be received from an authorized training provider under a training program approved by the FAA. Under § 61.66, an authorized training provider is one that provides EFVS training in accordance with an FAA-approved training program under 14 CFR part 91, 91K, 121, 125, 135, 141, or 142. Additionally, a person receiving ground training must obtain 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. AC 61-65, Certification: Pilots and Flight and Ground Instructors, contains sample endorsements for use by authorized training providers when endorsing logbooks or training records.

5.2.2 Ground training must consist at least of the following subjects:

5.2.2.1 Regulations that relate to EFVS flight operations and limitations, including EFVS limitations in the AFM(S) or RFM(S) (§ 61.66(a)(2)(i)). Training on this topic should include:

[1] In § 1.1, "category," as used with respect to the certification, ratings, privileges, and limitations of airmen, means a broad classification of aircraft. Examples include: airplane, rotorcraft, glider, and Lighter than Air (LTA).
[2] Section 61.66 uses the term "required pilot flightcrew member." However, the FAA is using the term "pilot monitoring (PM)" to be consistent with other FAA documents and guidance materials.

1. EFVS regulations in §§ 1.1; 61.66; 91.175(c) exception for EFVS operations, (d)(1), (e)(1), and (n); 91.176; 91.189(d); 91.1039; 91.1065; 121.407; 121.409; 121.441; 121.613; 121.651; 125.287; 125.325; 125.361; 125.381; 135.219; 135.225; 135.293; and appendices F and H to part 121, as applicable;
2. IAPs permitted to be used for EFVS operations under § 91.176(a) and (b);
3. Equipment required by the operating rule;
4. Enhanced flight visibility requirements (§ 91.176(a)(3)(i) and (b)(3)(i), as applicable);
5. Visual reference requirements and what the "sight picture" of relevant visual references should be (§ 91.176(a)(3) and (b)(3), as applicable); and
6. AFM(S) or RFM(S) statements that specify the type of EFVS operation the EFVS equipment is certified to conduct, system description, conditions and limitations associated with operating the EFVS, demonstrated conditions, and EFVS sensor performance information, if provided.

5.2.2.2 EFVS sensor imagery and required aircraft flight information and flight symbology (§ 61.66(a)(2)(ii)).

5.2.2.3 EFVS display, controls, modes, features, symbology, annunciations, and associated systems and components (§ 61.66(a)(2)(iii)). Training on this topic should include:

1. Use of on/off switch "clear" mode.
2. Warmup requirements, system alignment, display adjustments for brightness and contrast, contrast differences between daytime and nighttime approach conditions and display field of view.
3. Understanding and interpreting HUD symbology during EFVS operations.
4. Importance of cross-checking the HUD instrumentation presentations against the EFVS sensor image:
   - Recognition of malfunctions of the navigation equipment.
   - Recognition of improper presentation of elements in the visual scene during the approach.
5. EFVS system limitations.

6. Proper use of aircraft flight directors (FD) and autopilots during EFVS operations:
   - Autopilot minimum use height considerations.
   - Altitude alerting systems during EFVS operations.
7. Use of barometric and/or radio altitude at low altitudes, including temperature correction if applicable.
8. Use of the FPV cue and FPARC.
9. Use and limitations of supplementary or advisory vertical information for situation awareness below DA/DH or MDA.

5.2.2.4 EFVS sensor performance, sensor limitations, scene interpretation, visual anomalies, and other visual effects (§ 61.66(a)(2)(iv)). Training on this topic should include:

1. The specific sensor technology, sensor performance in varying weather conditions, the sensor's ability to detect or not detect obstacles in the environment, and limitations where sensor performance can be variable and unpredictable;
2. Visual anomalies such as "noise," "blooming," parallax, thermal crossover, and other visual effects; and
3. EFVS sensor limitations associated with specific types of lighting such as incandescent lamps and LEDs.

5.2.2.5 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 (§ 61.66(a)(2)(v)). Training on this topic should include:

1. Flight planning, dispatch, or flight release considerations and procedures applicable to the operator's EFVS operations when flying into very low visibility conditions;
2. IAP considerations:
   - Beginning or continuing an IAP when the visibility is reported to be less than the visibility minimums prescribed for the procedure to be flown;
   - Use of EFVS on precision approaches, approaches where vertical guidance is part of the procedure design, and NPAs;
   - Special considerations associated with conducting an EFVS operation on a special IAP (for operators that have a specific approval to conduct those procedures);

- Offset angles associated with various IAPs, including DA in a turn, where the runway may be outside the EFVS field of view;
- Effect of crosswinds on EFVS field of view, including the use of caged and uncaged modes (if applicable) in crosswind conditions;
- Understanding of published VDAs, published VDPs, operator-calculated points for descent below MDA, VGSI angles, and the significance of VDA and VGSI angles that are not coincident; and
- Obstacle clearance awareness, including the potential for close-in obstacles on NPAs with no published VDP.

3. Transition from EFVS imagery to natural vision for detecting required visual references;
4. Normal and rejected landings, including loss of visual cues from the runway, TDZ, and rollout area;
5. Approach and landing considerations during EFVS operations when land-and-hold-short operations (LAHSO) are being conducted.
6. Detecting runway incursions;
7. Missed approach considerations below DA/DH or MDA and after passing the MAP, including obstacle clearance awareness;
8. Duties of the PF and PM, crew briefings, procedures, callouts, and coordination items for EFVS operations, including annunciation of published minimums and operation below the DA/DH or MDA.

5.2.2.6 Weather associated with low visibility conditions and its effect on EFVS performance (§ 61.66(a)(2)(vi)).

5.2.2.7 Normal, abnormal, emergency, and crew coordination procedures when conducting EFVS operations (§ 61.66(a)(2)(vii)).

5.2.2.8 Interpretation of approach and runway lighting systems and their display characteristics when using an EFVS (§ 61.66(a)(2)(viii)). Training on this topic should include:

- ALSs;
- Runway lighting systems;
- Taxiway lighting systems; and
- Lighting and marking associated with Low-Visibility Operations (LVO)/Surface Movement Guidance and Control System (SMGCS) operations.

5.3 EFVS Flight Training.

5.3.1 Under § 61.66(b)(1), any pilot who manipulates the controls of an aircraft or any pilot who acts as PIC of an aircraft during an EFVS operation must receive and log flight training appropriate to the category of aircraft for the EFVS operation to be conducted. For EFVS operations that are conducted under part 91 (except for part 91K), the PM is not required to receive flight training; however, the PM should familiarize himself or herself with the tasks in § 61.66(b)(2) and paragraph 5.3.2 of this AC. Under parts 91K, 121, 125, and 135, the PM must be adequately trained in the aircraft, crewmember position, and type of operation in which the flightcrew member serves; therefore, the PM must receive EFVS flight training as appropriate to the assigned duties during EFVS operations. (Refer to §§ 121.401, 121.415, 125.287, 135.323, 135.329, and 91.1073.) Exceptions to the EFVS flight training requirements are discussed in paragraphs 5.7, 5.9, and 5.10. Additionally, flight training must be received from an authorized training provider under a training program approved by the FAA. The pilot must obtain a logbook or training record endorsement from that provider certifying that he or she is proficient in the use of EFVS. Flight training must be appropriate to the category of aircraft for which the person is seeking the EFVS privilege. AC 61-65 contains sample endorsements for use by authorized training providers when endorsing logbooks or training records.

5.3.2 Flight training must include at least the following tasks:

5.3.2.1 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 (§ 61.66(b)(2)(i)). Training on this topic should include:

- Importance of the “design eye position” in acquiring the proper EFVS image; and
- Crew briefings, procedures, callouts, and coordination items for preflight and inflight preparation of EFVS equipment.

5.3.2.2 Proper piloting techniques associated with using EFVS during taxi, takeoff, climb, cruise, descent, landing, and rollout, including missed approaches and balked landings (§ 61.66(b)(2)(ii)). Training on this topic should include:

- Crew briefings, procedures, callouts, and coordination items for EFVS operations;
- Missed approach procedures: all engines and engine inoperative; and
- Use of on/off switch “clear” mode.

5.3.2.3 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 (§ 61.66(b)(2)(iii)). Training on this topic should include precision

approaches, approaches where vertical guidance is part of the procedure design, and nonprecision instrument approaches (as applicable to the operator's OpSpec/MSpec/LOA):

1. In day and night visual meteorological conditions (VMC) and IMC;
2. Under various ceiling and low-visibility conditions;
3. Using the FPV cue and FPARC during instrument approaches;
4. Using different approach lighting configurations;
5. Under various crosswind conditions;
6. To the extent practicable, approach to airports where there is a lack of airport visual cues, no RCL lights, and no TDZ lights using the FPV cue and FPARC;
7. IAPs flown to flare, touchdown, and rollout consistent with the operator's OpSpec/MSpec/LOA to conduct EFVS operations to 100 feet above the TDZE or EFVS operations to touchdown and rollout;
8. Maximum offset angles associated with the various types of IAPs the FAA has authorized the operator to conduct and that are consistent with the operator's OpSpec/MSpec/LOA or the equipment limitations of the AFM(S) or RFM(S); and
9. Use of caged and uncaged modes in crosswind conditions.

5.3.2.4 Determining enhanced flight visibility (§ 61.66(b)(2)(iv)). Training on this topic should include determining enhanced flight visibility over a range of actual or simulated low-visibility conditions.

5.3.2.5 Identifying required visual references appropriate to EFVS operations (§ 61.66(b)(2)(v)). Training on this topic should include identifying required visual references over a range of actual or simulated low-visibility conditions. Flight training scenarios should provide an opportunity for pilots to experience what the "sight picture" of relevant visual references should be.

5.3.2.6 Transitioning from EFVS sensor imagery to natural vision acquisition of required visual references and the runway environment (§ 61.66(b)(2)(vi)).

5.3.2.7 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) (§ 61.66(b)(2)(vii)).

5.3.2.8 Normal, abnormal, emergency, and crew coordination procedures when using an EFVS (§ 61.66(b)(2)(viii)). Training on this topic should include crew procedures for using the PM display if such a display is installed in the operator's aircraft.

5.4 Supplementary EFVS Training.

5.4.1 Section 61.66(c) requires supplementary EFVS training when a person seeks to conduct additional EFVS operations for which they have not received training. For example, a pilot who is already trained to conduct EFVS operations to 100 feet 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, the pilot would be required to complete only that portion of the full training program addressing the differences between the two operations.

5.4.2 In this case, the pilot must receive and log the supplementary ground and flight training appropriate to the additional EFVS operation to be conducted. The supplementary training must be received from an authorized training provider under a training program approved by the FAA. The pilot also must obtain a logbook or training record endorsement from that provider certifying that he or she is proficient in the use of EFVS. Flight training must be appropriate to the category of aircraft for which the person is seeking the EFVS privilege.

5.5 EFVS Recurrent Training. Recurrent training should include a review of EFVS subjects and tasks.

5.6 Other Requirements and Considerations Pertaining to EFVS Training.

5.6.1 Section 61.66 provides minimum training standards for a broad range of operators who may be operating various types of aircraft and EFVS equipment. In addition to § 61.66, operators must also comply with any training required for their particular type of operation, such as operations conducted under part 121, 125, 135, or 91K. While training for EFVS operations under § 61.66 is specific to the category of aircraft, parts 121, 125, 135, and 91K require pilots to be adequately trained in the aircraft, crewmember position, and type of operation in which the flightcrew member serves. These operators must address training and proficiency for each EFVS/aircraft installation and their EFVS operations. Pilots operating large and turbine powered multiengine airplanes under part 91 subpart F that require a type rating should obtain appropriate type-specific training that addresses any EFVS system differences that may exist.

5.6.2 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. (However, based on the special rules in § 125.296, a part 125 operator may not use a part 141 pilot school to meet other training, testing, or checking requirements under part 125.) Alternatively, a part 125 operator may submit an EFVS training program to the FAA for approval.

5.6.3 Under part 141, the FAA may approve an EFVS training course in accordance with part 141, § 141.11 and appendix K, 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 part 141 appendix K.

5.6.4 Training providers should follow existing processes for developing new training curricula on the subjects and tasks in § 61.66 and for qualifying instructors to provide the training.

5.6.5 A pilot must receive training that is specific to the EFVS operation they will conduct: EFVS operations to touchdown and rollout, EFVS operations to 100 feet above the TDZE, or both (refer to § 61.66(a), (b), and (c)). Training can be integrated or provided separately if an operator chooses to conduct both types of EFVS operations.

5.6.6 Pilots should be trained and proficient on the various types of IAPs they plan to use for EFVS operations. Some non-RNAV NPAs, for example, can be offset by as much as 30 degrees. It is important for operators to receive training on the range of offset angles they may encounter during EFVS operations and at various standard and lower-than-standard visibilities. Paragraph 4.3.4 addresses offset angles associated with specific IAPs. EFVS training conducted in a full flight simulator (FFS) should consist of realistic training scenarios.

5.6.7 If flight training is conducted in aircraft, flight instructors should ensure that both the equipment in the aircraft and the visual conditions for the flight are appropriate for safely conducting and/or supervising the flight. For example, a PM display is not required for EFVS operations that are conducted to 100 feet above the TDZE. Under some visibility conditions, an instructor who does not have a PM display may not have access to the same visual information the PF has and may not be able to safely supervise the flight. Flight training in aircraft should be planned and structured to appropriately address the equipment available in the aircraft and the visibility conditions under which the training can be safely accomplished.

5.7 Military Pilots and Former Military Pilots in the U.S. Armed Forces. The FAA training requirements for EFVS operations 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 by the U.S. Armed Forces (refer to § 61.66(f).

5.8 Public Aircraft Operators. Except for U.S. military pilots, pilots who conduct operations for public aircraft operators must meet the training requirements of § 61.66. EFVS operations conducted by public aircraft operators are also addressed in paragraph 4.4.

5.9 Credit for Previous Training and Transition Period for Complying With the Training Requirements of § 61.66.

5.9.1 Pilots who can document that they have satisfactorily completed training on EFVS operations to 100 feet above the TDZE any time prior to March 13, 2018 are not required to receive new training for these operations. Additionally, training received prior to this date is not required to be obtained under an FAA-approved training program. Operators who already conduct EFVS operations to 100 feet, who also wish to conduct EFVS

operations to touchdown and rollout, must complete the supplementary EFVS training required by § 61.66(c). Supplementary training must be received from an authorized training provider under an FAA-approved training program.

5.9.2 EFVS training providers must develop or revise training programs to comply with § 61.66. Additionally, parts 91K, 121, 125, and 135 operators conducting EFVS operations to 100 feet under § 91.175(l) must transition to authorizations that are referenced to § 91.176(b). To accommodate these requirements, the FAA has provided a transition period during which an operator may continue to conduct EFVS operations to 100 feet under § 91.175(l). While an operator is conducting EFVS operations under § 91.175(l) during the transition period, the requirements of § 61.66 do not apply (refer to § 61.66(h)(5)). Training programs must comply with § 61.66 and operators must complete the transition to new authorizations that are referenced to § 91.176(b) prior to March 13, 2018.

5.10 Exceptions to the EFVS Training Requirements in § 61.66.

5.10.1 Manipulating the Controls During Flight Training. Section 61.66(b) prohibits a person from manipulating the controls of an aircraft during an EFVS operation under § 91.176(a) or (b) unless that person has completed the training described above. An exception in § 61.66(h)(1)(i) permits a pilot to manipulate the controls during flight training provided the instructor meets the requirements to perform the EFVS operation in the category of aircraft for which the training is being conducted. Before conducting EFVS operations in aircraft, flight instructors should ensure that both the equipment in the aircraft and the visual conditions for the flight are appropriate for safely conducting and/or supervising the flight.

5.10.2 Flights Conducted in Aircraft Issued an Experimental Certificate for Purposes of Research and Development or Showing Compliance to Regulations.

5.10.2.1 Section 61.66(h)(2) provides personnel involved in certain research and development, EFVS certification, and operational suitability determination activities an alternate means of meeting the ground and flight training requirements of § 61.66(a) and (b). This is necessary because personnel involved in such activities, all of which may be conducted in aircraft issued an experimental certificate under 14 CFR part 21, § 21.191, may be unable to obtain training under an FAA-approved training program, as required by § 61.66(a) and (b). 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.

5.10.2.2 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. The training requirements do not apply if there is no appropriate training program that has been approved by the FAA, and a person is

conducting flights in an aircraft issued an experimental airworthiness certificate for the purpose of research and development or showing compliance with regulations. In this case, the person must still have knowledge of the ground training subjects in § 61.66(a)(2) and have experience with the flight training tasks in § 61.66(b)(2) that are 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 addition, the FAA recommends these persons also obtain training using an EFVS for which a training program exists.

5.10.2.3 For an applicant to qualify under the exception in § 61.66(h)(2), an FAA-approved training course must not yet exist that is relevant to the planned operation. An applicant must be able to show that he or she complies with § 61.66(h)(2) and should be able to produce the program letter and application for experimental certificate if asked.

5.11 Requirements for FFSs Used to Provide EFVS Training.

5.11.1 EFVS flight training may be accomplished in an aircraft or in an FFS. If an FFS is used, it must meet the requirements of § 61.66(g). The FFS must be qualified as a Level C or higher FFS, and be equipped with an EFVS. The FFS must be equipped with a daylight visual display to support both day and night conditions. The FFS must also be evaluated and qualified by the FAA's NSP for EFVS operations, be qualified and maintained in accordance with 14 CFR 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.

5.11.2 FFS settings and EFVS training should address the EFVS operation(s) the operator is authorized to conduct and should reflect the range of IAPs and operating conditions expected to be encountered during EFVS operations. The FFS's out-the-window visibility settings and EFVS enhanced flight visibility settings should be adjustable and should be set to realistic values during training.

6 RECENT FLIGHT EXPERIENCE, PROFICIENCY CHECK, COMPETENCY CHECK, AND REFRESHER TRAINING REQUIREMENTS FOR EFVS OPERATIONS.

6.1 EFVS Recent Flight Experience and Refresher Training Requirements for Part 91 Operators (Other Than Part 91K Operators).

6.1.1 Pilots conducting EFVS operations under part 91 (other than part 91K operators) must comply with the EFVS recent flight experience requirements of § 61.66(d). The EFVS recent flight experience requirements are structured to closely resemble the instrument recent flight experience requirements in § 61.57(c) with respect to the 6 calendar-month timeframe.

6.1.2 Section 61.66(d) requires a pilot to perform and log six instrument approaches using an EFVS within 6 calendar-months before the month in which an EFVS operation is conducted. The pilot must be the sole manipulator of the controls, and the flight must be conducted in the category of aircraft for which the pilot is seeking the EFVS privilege. The instrument approaches can be conducted during the day or night under any weather conditions, and one approach must terminate in a full stop landing. Pilots who are authorized to conduct EFVS operations to touchdown and rollout must conduct the full stop landing using the EFVS. Contact approaches and visual approaches that are conducted under IFR cannot be used to establish EFVS currency. These approaches are not IAPs, as defined in § 1.1.

6.1.3 The 6 calendar-month period begins when a pilot satisfactorily completes ground and flight training. During this first 6-month period, the pilot is EFVS current and is qualified to conduct EFVS operations. Provided he or she meets all of the other requirements to serve as PIC, the pilot also may serve as PIC during an EFVS operation. During this first 6-month period, the pilot must conduct six instrument approaches using an EFVS to maintain currency.

6.1.4 If the pilot fails to perform six instrument approaches during the first 6-month period, meaning that EFVS currency has lapsed for less than 6 calendar-months, the pilot has an additional 6-month period to reestablish EFVS currency. During this second 6-month period, the pilot must complete the EFVS recent flight experience tasks specified in § 61.66(d) which are described above. These tasks may be accomplished in any weather conditions. During the second 6-month period, however, the pilot may not act as PIC of an aircraft during an EFVS operation. The pilot may conduct an EFVS operation only under the supervision of a PIC who is qualified and current.

6.1.5 If the pilot fails to reestablish EFVS currency during the second 6-month period, meaning that EFVS currency has lapsed for more than 6 calendar-months, he or she may reestablish EFVS currency only by satisfactorily completing an EFVS refresher course. The refresher course must be FAA-approved, must consist of the ground and flight training subjects and tasks in § 61.66(a) and (b), and must be category specific. The EFVS refresher course must be conducted by an authorized training provider whose instructor meets the training requirements of § 61.66. If EFVS operations are conducted in an aircraft, the instructor must meet the recent flight experience requirements of § 61.66(d).

6.1.6 The requirements of § 61.66(d) do not 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 IAPs. Section 61.66(d) is structured to enable pilots to satisfy both the instrument experience requirements of § 61.57(c) and the EFVS experience requirements during the same flight or series of flights, if a pilot chooses to do so. Requirements for logging instrument experience are different from those for logging EFVS experience. Pilots who plan to log instrument experience and EFVS experience during the same flight or series of flights must meet the requirements of both §§ 61.57(c) and 61.66(d) for logging experience.

6.1.7 Before conducting EFVS operations in aircraft for the purpose of maintaining or reestablishing currency, pilots, safety pilots, and flight instructors should ensure that both the equipment in the aircraft and the visual conditions for the flight are appropriate for safely conducting and/or supervising the flight. For example, a PM display is not required for EFVS operations that are conducted to 100 feet above the TDZE. Under some visibility conditions, a safety pilot or an instructor who does not have a PM display may not have access to the same visual information the PF has and may not be able to safely supervise the flight. Currency flights in aircraft should be planned and structured to appropriately address the equipment available in the aircraft and the visibility conditions under which the flights can be safely accomplished. AC 61-98, Currency Requirements and Guidance for the Flight Review and Instrument Proficiency Check, contains guidance and considerations for conducting instrument currency flights and for organizing and sequencing required tasks and maneuvers. Concepts and considerations in AC 61-98 can also be used to plan and structure EFVS currency flights.

6.1.8 Sections 61.66(d) and (e) provide minimum standards for a broad range of operators who may be operating various types of aircraft and EFVS equipment. While the FAA requires pilots to obtain recent flight experience using an EFVS in the same category of aircraft in which the pilot expects to conduct operations, the FAA recommends that operators also address recent flight experience and proficiency for each EFVS/aircraft installation the pilot will operate.

6.2 Proficiency Check and Competency Check Requirements for Operators Conducting EFVS Operations Under Part 91K, 121, 125, or 135.

6.2.1 Section 61.66(h)(3) states that the recent flight experience requirements of § 61.66(d) and the refresher training requirements of § 61.66(e) do not apply to a pilot employed by:

- A 14 CFR 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 91K.

6.2.2 These requirements do not apply provided 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, and the pilot is conducting the operation in accordance with the certificate holder's OpSpec, the LODA holder's LOA, or the program manager's MSpec for EFVS operations. Rather than meeting recent flight experience requirements of § 61.66(d), or reestablishing EFVS currency under § 61.66(e), pilots conducting EFVS operations for parts 91K, 121, 125, and 135 operators are checked on EFVS tasks and maneuvers under their respective operators' programs. Section 121.441 and part 121 appendix F contain proficiency check requirements for pilots conducting EFVS operations under part 121. Sections 91.1065, 125.287, and 135.293 contain competency check requirements for pilots conducting EFVS operations under parts 91K, 125, and 135.

6.2.3 The exception from EFVS recency requirements applies only when a pilot is conducting an EFVS operation for a 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 91K. If a pilot conducts an EFVS operation outside of the part 119 certificate holder's, the LODA holder's, or the part 91K program manager's operations, that pilot must comply with § 61.66(d). However, if the pilot has satisfactorily completed a check on EFVS operations under part 91K, 121, 125, or 135 within the preceding 6 calendar-months, the pilot could use the check to meet the § 61.66(d) requirement.

6.3 Using a Proficiency Check From the U.S. Armed Forces to Satisfy the Recent Flight Experience Requirements of § 61.66(f). A military pilot or former military pilot in the U.S. Armed Forces may satisfy the recent flight experience requirements of § 61.66(d) if he or she can document 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 must have been 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.

6.4 Public Aircraft Operators. Section 91.176(c)(2) requires a public aircraft operator, other than the U.S. military, to meet the recent flight experience requirements of § 61.66 for EFVS operations. This applies to pilot flightcrew members or any other person who manipulates the controls of an aircraft during an EFVS operation when a public aircraft operation is being conducted.

6.5 Transition Period for Complying With the Recent Flight Experience and Refresher Training Requirements of § 61.66.

6.5.1 Prior to December 13, 2016, the regulations for EFVS operations to 100 feet above the TDZE were located in § 91.175(l) and (m). The EFVS final rule published on December 13, 2016 revised these regulations and moved them to § 91.176(b).

6.5.2 To provide an adequate transition period for operators to comply with the new requirements of § 91.176(b), § 91.175(n) permits persons conducting EFVS operations to 100 feet above the TDZE to comply with either § 91.175(l) and (m) or § 91.176(b) prior to March 13, 2018.

6.5.3 Section 61.66(h)(5) also excepts operators who are conducting EFVS operations to 100 feet above the TDZE under § 91.175(l) and (m) from the recent flight experience and refresher training requirements of § 61.66 prior to March 13, 2018.

6.5.4 The requirements of § 91.175(l) and (m) will expire on March 13, 2018; therefore, beginning on this date, operators who conduct EFVS operations to 100 feet above the TDZE must comply with § 91.176(b) and the requirements of § 61.66. Operators are encouraged to comply with §§ 91.176(b) and 61.66 as soon as practicable within the transition period.

6.6 Use of an FFS to Meet the Recent Flight Experience Requirements of § 61.66. Requirements pertaining to the use of an FFS to meet the recent EFVS flight experience requirements of the regulations can be found in § 61.66(g). A Level C or higher FFS equipped with an EFVS must be used, and the FFS must be evaluated and qualified for EFVS operations by AFS-205. The regulations do not require 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, since the flights may be conducted in either day or night conditions. The FFS must be qualified and maintained in accordance with part 60, or a previously qualified device, as permitted in § 60.17. The FFS must also be approved by the Administrator for the tasks and maneuvers. EFVS recent flight experience acquired in a FFS should consist of scenarios and FFS settings that represent the conditions under which the operator is authorized to conduct EFVS operations.

7 TRAINING FOR DISPATCHERS AND OTHER PERSONS AUTHORIZED TO EXERCISE OPERATIONAL CONTROL FOR EFVS OPERATIONS.

7.1 Dispatch, Flight Release, and Flight Following Considerations. This paragraph addresses training for dispatchers and other persons authorized to exercise operational control for EFVS operations. Paragraph 3 contains additional information about flight planning and beginning or continuing an approach under IFR using EFVS-equipped aircraft.

7.1.1 To ensure that an approach and landing can be successfully completed using EFVS, it is essential that dispatchers and other persons authorized to exercise operational control fully understand the capabilities and limitations of the specific EFVS equipment installed in the operator's aircraft. Unique weather conditions that cause variability in how an EFVS sensor performs or weather conditions that exceed the sensor's ability to provide the enhanced flight visibility required to complete the approach and landing should be considered. Operators who do not have dispatch or flight release personnel should be aware of weather and operational factors that could affect EFVS performance when they are considering takeoff under IFR, or when conditions at their destination airport are forecasted or reported to be below visibility minimums for the approach to be flown. Operational planning and continuous monitoring of weather conditions at the destination airport are especially important under these circumstances.

7.1.2 Dispatchers and other persons authorized to exercise operational control also should consider air traffic flow to the destination airport and other low visibility operations that may be in progress. When CAT II or CAT III operations are being conducted to a specific runway, for example, a pilot who wishes to conduct an EFVS operation to a different runway might not be cleared by air traffic control (ATC) to do so. This could be due to traffic flow or other conditions.

7.2 Initial Training for Dispatchers and Other Persons Authorized to Exercise Operational Control. Initial training for dispatchers and other persons authorized to exercise operational control should consist of the following:

7.2.1 Regulatory requirements applicable to the EFVS operation(s) the operator will conduct (e.g., EFVS operations to 100 feet above the TDZE or EFVS operations to touchdown and rollout):

1. Operational concept for EFVS operations to 100 feet above the TDZE or EFVS operations to touchdown and rollout, as appropriate to the operator's OpSpec or LOA to conduct EFVS operations;
2. Regulatory requirements for EFVS operations contained in §§ 91.175(d)(1) and (e)(1); 91.176; and 91.189(d) and (e);
3. Regulatory requirements contained in §§ 121.613, 121.615, 125.361, 125.363, and 135.219, as applicable, for dispatch, flight release, or takeoff under IFR for the purpose of conducting an EFVS operation;
4. Regulatory requirements contained in §§ 121.651, 125.325, 125.381, and 135.225, as applicable, for initiating or continuing an approach when the reported visibility is below the minimum visibility prescribed for the IAP to be flown;
5. IAPs approved and not approved for EFVS operations to 100 feet above the TDZE and EFVS operations to touchdown and rollout;
6. Enhanced flight visibility requirements contained in § 91.176(a) and (b);
7. Visual reference requirements contained in § 91.176(a) and (b);
8. OpSpec or LOA requirements pertinent to the EFVS operation the pilot will conduct; and
9. Exemptions or deviations from the regulations that pertain to the use of EFVS, if any.

7.2.2 AFM(S) or RFM(S) material pertinent to EFVS operations:

1. Type of EFVS operation the operator's aircraft is certified to conduct; and
2. EFVS system description and operating limitations.

7.2.3 Sensor technology, performance, and limitations:

1. Understanding the specific EFVS sensor technology or technologies installed on the operator's aircraft;
2. EFVS sensor performance in varying weather conditions;
3. EFVS sensor limitations, including variable, unpredictable, or unusual performance characteristics;
4. Weather conditions that exceed the EFVS sensor's ability to provide the enhanced flight visibility required to complete the approach and landing;

5. The EFVS sensor's ability to detect or not detect obstacles in the environment; and
6. EFVS sensor performance and limitations associated with specific types of lighting such as incandescent lamps and LEDs.

7.2.4 Dispatch or flight release requirements for the purpose of conducting an EFVS operation.

7.2.5 Considerations for diverting to alternate airports.

7.2.6 Procedures for re-dispatch en route with respect to EFVS operations.

7.2.7 Minimum equipment list (MEL)/Configuration Deviation List (CDL) dispatch/flight release requirements and considerations.

7.2.8 Use and limitations of supplementary or advisory vertical information for situation awareness below DA/DH or MDA.

7.2.9 Operational considerations associated with offset final approach courses, displaced thresholds, DA in a turn, and the use of an MDA as a DA/DH in accordance with C073 (if issued to the operator) and the operator's OpSpec/MSpec/LOA to conduct EFVS operations.

7.2.10 Effect of crosswinds on EFVS field of view for approaches aligned with the RCL and for approaches with inbound courses that are offset from the RCL.

7.2.11 Runway, taxiway, and ALS configurations.

7.3 Recurrent and Differences Training for Dispatchers and Other Persons Authorized to Exercise Operational Control. Recurrent training for dispatchers and other persons authorized to exercise operational control should consist of the same subject areas covered by initial training. Differences training for a new EFVS system or a new EFVS operation should address the areas specified in paragraph 7.2 and any additional material pertinent to the EFVS or the EFVS operation to be conducted.

8 AIRCRAFT QUALIFICATION AND MAINTENANCE PROGRAM REQUIREMENTS.

8.1 General. This section contains guidance on aircraft qualification and maintenance program requirements for EFVS operations to 100 feet above the TDZE and EFVS operations to touchdown and rollout. Operators should address these requirements in applications to conduct EFVS operations. Paragraph 10 contains additional information about the application process.

8.2 Applicability. Operators who conduct EFVS operations should submit an application that addresses the aircraft qualification and maintenance requirements specified in this paragraph. Part 91 operators (other than part 91K operators) who conduct only EFVS operations to 100 feet above the TDZE are not required to submit an application that addresses these requirements; however, their EFVS must comply with the equipment

requirements of § 91.176(b)(1). Additionally, a part 91 operator (other than a part 91K operator) of a U.S.-registered aircraft must maintain their aircraft in accordance with the maintenance, preventive maintenance, and alterations requirements specified in 14 CFR parts 91 and 43 (refer to §§ 43.1(a)(1) and 91.401).

8.3 Aircraft Qualification Requirements. An EFVS installed on a U.S.-registered aircraft used to conduct EFVS operations to 100 feet above the TDZE and EFVS operations to touchdown and rollout must be operable and installed in accordance with an FAA type design approval (a TC, amended TC, or STC) (refer to § 91.176(a)(1)(i) and (b)(1)(i)). EFVS equipment used for operations conducted under § 91.176(a) or (b) are not eligible for field approval. Foreign-registered aircraft with an EFVS that is certified to a foreign airworthiness standard must meet all of the requirements in § 91.176 in order to be used in EFVS operations in the United States. Proposals for authorization to conduct EFVS operations to 100 feet above the TDZE or EFVS operations to touchdown should contain the following documentation and information to establish aircraft qualification for EFVS operations:

1. Applicable EFVS airworthiness documentation that indicates the EFVS was installed pursuant to an FAA type design approval.
2. For foreign-registered aircraft, applicable EFVS airworthiness documentation that indicates the EFVS meets the applicable airworthiness requirements. (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 requirements of ICAO Annex 6. The EFVS-equipped foreign-registered aircraft must meet all of the requirements in § 91.176, including the equipment required by the EFVS operating rule, in order to be used in EFVS operations in the United States.)
3. EFVS manufacturer's instructions for continued airworthiness (ICA) as accepted by the FAA.
4. Proposed MEL revisions, if applicable, listing any limitations associated with EFVS operations to 100 feet above the TDZE or EFVS operations to touchdown and rollout.

8.4 Maintenance Requirements. Except for operators conducting EFVS operations to 100 feet above the TDZE under part 91 (other than part 91K operators), all applications submitted for an OpSpec/MSpec/LOA to conduct EFVS operations should include documentation that addresses the maintenance requirements contained in this section.

8.4.1 Applications to conduct EFVS operations should include the following as applicable:

1. The operator's maintenance program, or equivalent for part 91, should incorporate the EFVS manufacturer's ICA, as accepted by the FAA, and identify any special techniques, maintenance/inspection frequencies, and test equipment required to support the continued airworthiness of the system.
2. Indicate whether the EFVS maintenance program, or equivalent, is integrated into an existing approved maintenance program (e.g., lower landing minimums program) or a separate program.
3. Identify how maintenance personnel will be trained and qualified on the EFVS and the method to record and maintain their qualifications.
4. Procedure for EFVS software distribution and loading if not specified by the manufacturer's ICAs.
5. Procedures used to maintain system configuration control including parts pooling and borrowing.
6. Procedures for EFVS discrepancy reporting and recording.
7. Procedures for MEL and logbook pertaining to upgrade/downgrade/deferral of the EFVS. (An EFVS may have a discrepancy that prohibits it from being used for EFVS operations to touchdown, but not from being used for EFVS operations to 100 feet. For example, an EFVS operation to touchdown cannot be conducted if the display of sensor imagery to the PM is inoperative, but an EFVS operation to 100 feet could be conducted.)
8. Procedures for MEL (remarks section, limitations, upgrade/downgrade) that ensure the EFVS status is placarded properly and clearly documented in the aircraft logbook.
9. Procedures for notification between maintenance control, engineering, flight operations, and dispatch, or equivalent, when an aircraft's EFVS status changes.
10. Procedures to ensure the downgrade of an aircraft's EFVS status, if applicable, when maintenance was performed on the EFVS by nonqualified persons.
11. Procedures to monitor and identify aircraft with chronic EFVS discrepancies and restrict the aircraft from EFVS operations until appropriate corrective action and tests have been performed.
12. Procedures for return to service of an EFVS following routine/nonroutine maintenance or completion of corrective action, including but not limited to:
    - Required tests for return to service;
    - Functional flight test requirements;

- Component mount or rack removal/installation; and
- Structural damage or modification affecting EFVS optical alignment or system performance.

13. Integration of the EFVS program into the operator's Continuing Analysis and Surveillance System (CASS) or reliability programs to monitor total system performance that includes sampling.

8.4.2 Maintenance personnel should be familiar with the operator's approved EFVS program (or equivalent), their individual responsibilities with respect to that program, and the availability of any resources within or outside of the maintenance organization necessary to ensure program effectiveness.

9 MAINTENANCE TRAINING FOR EFVS OPERATIONS. This paragraph contains guidance on maintenance personnel training requirements for EFVS operations to 100 feet above the TDZE and EFVS operations to touchdown and rollout. Unless otherwise specified, operators should address these requirements in applications to conduct EFVS operations. Paragraph 10 contains additional information about the application process.

9.1 Maintenance Training. Maintenance personnel should be knowledgeable of the operator's EFVS program. Operator and contract maintenance personnel, including mechanics, maintenance controllers, avionics technicians, and inspection/quality assurance (QA) personnel should receive initial and recurrent training to establish and maintain an effective EFVS maintenance program.

9.1.1 Applications submitted for an OpSpec/MSpec/LOA to conduct EFVS operations to 100 feet above the TDZE (excluding part 91 operators other than part 91K operators) or EFVS operations to touchdown and rollout should address the following maintenance training items:

1. Identify the person(s) responsible for ensuring EFVS maintenance and inspection personnel are properly trained, knowledgeable, and current.
2. Identify how the EFVS training will be conducted (i.e., in-house or via an outside training provider).
3. Include policy and procedures that address the qualification requirements of EFVS maintenance and inspection personnel.
4. Identify the methods and techniques used to conduct initial and recurrent training (e.g., instructor-led training, computer-based training (CBT), or on-the-job training (OJT)).
5. Identify the procedures used to record and maintain the training required for initial and recurrent EFVS qualifications.

6. Include the EFVS maintenance and inspection training curriculum that addresses the following topics:

   - Operational overview clearly defining the difference between operations to 100 feet above the TDZE and operations to touchdown and rollout;
   - EFVS system overview;
   - EFVS maintenance and inspection procedures;
   - EFVS personnel training and qualification requirements for EFVS operations to 100 feet above the TDZE and EFVS operations to touchdown and rollout;
   - EFVS operations to 100 feet above the TDZE and EFVS operations to touchdown and rollout upgrade/downgrade procedures, including applicable status change notifications;
   - MEL procedures;
   - Test equipment and use;
   - Return to service tests and procedures; and
   - EFVS parts handling procedures, including handling of outside vendor parts.

10 OPERATIONAL APPROVAL PROCESS FOR EFVS OPERATIONS.

10.1 Approval Process Overview. Certificate holders, operators, and program managers who wish to conduct EFVS operations must submit an application for operational approval to the FAA. Certificate holders, operators, and program managers may want to schedule a preapplication meeting with the certificate-holding district office (CHDO), certificate management office (CMO), or the Flight Standards District Office (FSDO). This meeting provides the operator with an opportunity to discuss the requirements for operational approval. Approval of the operator's proposal results in the issuance of an OpSpec, MSpec, or LOA, as appropriate, to conduct EFVS operations under § 91.176(a), § 91.176(b), or both.

10.2 Authorizations to Conduct EFVS Operations.

10.2.1 Authorizations for EFVS Operations to 100 Feet Above the TDZE. The FAA requires an OpSpec/MSpec/LOA for persons conducting EFVS operations to 100 feet above the TDZE under part 91K, 121, 125, 129, or 135 (refer to § 91.176(b)(2)(vii) through (ix)). Part 91 operators (other than part 91K operators) are not required to obtain an LOA to conduct EFVS operations to 100 feet above the TDZE in the United States. Part 91 operators (other than part 91K operators) who conduct EFVS operations to 100 feet above the TDZE outside the United States may request an LOA to facilitate foreign CAA approval.

10.2.2 Authorizations for EFVS Operations to Touchdown and Rollout. The FAA requires an OpSpec/MSpec/LOA for persons conducting EFVS operations to touchdown and rollout under part 91, 91K, 121, 125, or 135 (refer to § 91.176(a)(2)(viii) through (xi)). Under § 91.176(a)(2)(x), an authorization is also required for foreign air carriers subject to

part 129 who wish to conduct EFVS operations to touchdown and rollout in the United States.

10.2.3 Additional EFVS OpSpec/LOA Provisions for Part 121, 125, and 135 Operators. The OpSpec/LOA for part 121, 125, or 135 operators may authorize a visibility for dispatching or releasing a flight under §§ 121.613 and 121.615, releasing a flight under §§ 125.361 and 125.363, or taking off under IFR under § 135.219. The operator's OpSpec/LOA for EFVS operations may also contain provisions for beginning or continuing an approach when the visibility is reported to be less than the visibility minimums prescribed for the IAP to be flown. To qualify for these provisions, operators who plan to conduct these operations under either § 91.176(a) or (b) should present their procedures and training for pilots, dispatchers, flight release personnel, and other personnel authorized to exercise operational control. An operator's procedures and training should consider the limitations of the EFVS the operator will use and the weather conditions that may exceed the sensor's ability to provide the enhanced flight visibility required to complete the approach and landing. An operator must be able to demonstrate that it has the ability to determine when it is appropriate to dispatch a flight, release a flight, or take off under IFR for the purpose of conducting an EFVS operation and that its dispatch and flight release procedures appropriately support EFVS operations.

10.2.4 EFVS Sensor Performance and OpSpec/LOA Provisions for Parts 121, 125, and 135 Operators. An operator conducting EFVS operations under part 121, 125, or 135 should present EFVS sensor performance information with their proposal to conduct EFVS operations under either § 91.176(a) or (b). The sensor performance information should characterize the enhanced flight visibility or the visual advantage produced by the EFVS over a range of representative visibility and weather conditions. The operator's authorization to dispatch, release a flight, or take off under IFR or to begin or continue an approach will be based on this sensor performance information. EFVS sensor performance information may be information that was demonstrated for the aircraft and documented in the AFM(S) or RFM(S), additional data the Original Equipment Manufacturer (OEM) or operator may have collected through an operational evaluation with respect to the EFVS sensor's ability to perform in low visibility conditions, or other data or information the FAA might find acceptable. AC 20-167 contains additional information about EFVS performance demonstrations. The purpose of requiring EFVS sensor performance information is to increase the likelihood of a successful EFVS operation at the destination airport.

10.3 Application to Conduct EFVS Operations.

10.3.1 Application Process. This paragraph describes the application process for operators conducting EFVS operations under part 91, 91K, 121, 125, or 135. The application process for operators conducting EFVS operations under part 129 is described in paragraph 10.5. After meeting with the CHDO, CMO, or FSDO, as applicable, operators

should submit an application to conduct EFVS operations consisting of the following information and documentation:

1. Application letter describing the type of EFVS operation(s) to be conducted (i.e., EFVS operations to 100 feet above the TDZE, EFVS operations to touchdown and rollout, or both);
2. Description of aircraft and EFVS equipment the operator proposes to use for EFVS operations;
3. EFVS airworthiness documentation that shows the EFVS was installed in accordance with the applicable airworthiness requirements;
4. Evidence that the applicant has reviewed and addressed the recommendations specified in the applicable FSB report for the aircraft and EFVS installation, if an FSB report exists for that aircraft and EFVS installation;
5. EFVS provisions contained in the AFM(S) or RFM(S), Airplane Operations Manual (AOM), Flight Operations Manual (FOM), pilot's operating handbook (POH), or quick reference handbook (QRH), as applicable;
6. MEL for EFVS operations and any proposed changes, if the operator seeks MEL relief for EFVS;
7. If the operator conducts EFVS operations under part 121, 125, or 135, the operator should describe how it plans to conduct flight planning, dispatch, or flight release activities, as applicable, and address operational procedures pertaining to beginning and continuing an approach when the visibility is reported to be less than the visibility minimums prescribed for the IAP to be flown;
8. EFVS sensor performance information. The operator should provide EFVS sensor performance information as described in paragraph 10.2.4;
9. EFVS operating procedures: checklists, crew coordination and monitoring procedures, callouts, crew briefings, and nonnormal operations and procedures related to EFVS;
10. Proposed EFVS flightcrew training: ground training, flight training, supplementary training, and recurrent training;
11. For operations under part 121 or 135, proposed checking for EFVS during § 121.441 proficiency checks or § 135.293 competency checks, as applicable;
12. Procedures and training program, as applicable, for dispatchers and other persons authorized to exercise operational control for EFVS operations;
13. Maintenance program (or, as applicable, the aircraft or equipment manufacturer's ICAs), policies, procedures, and training pertaining to EFVS;
14. OpSpec/MSpec/LOA sought by the operator and any proposed amendments; and
15. Proposed plan for demonstrating the operator's ability to perform EFVS operations. The plan should address EFVS system availability; training for

pilots, maintenance personnel, and dispatchers or other personnel authorized to exercise operational control; maintenance and inspection procedures and programs; and dispatch and flight release procedures for EFVS operations. The operator's plan should include a proposed time period and a specified number of flights for demonstrating their ability to achieve the objectives outlined in paragraph 10.4.

10.3.2 Application Requirements for Part 91 Operators Seeking an LOA for EFVS Operations to 100 Feet Above the TDZE Outside the United States. Part 91 operators (other than part 91K operators) conducting EFVS operations to 100 feet above the TDZE outside of the United States may request an LOA from the FAA. The operator should present the FSDO or CHDO with documentation showing that the aircraft is equipped with an EFVS that meets the applicable equipment requirements of § 91.176(b)(1).

10.4 Observing and Evaluating the Operator's Ability to Perform EFVS Operations.

10.4.1 The FAA's process for approval and acceptance includes observing and evaluating the operator's ability to perform the proposed operation(s) in accordance with the procedures, guidelines, and parameters described in the operator's formal proposal. This paragraph describes what operators conducting EFVS operations under part 91, 91K, 121, 125, or 135 must demonstrate during this phase. This paragraph does not apply to operators conducting EFVS operations under part 129. During this phase, the operator should demonstrate that:

1. Its maintenance training, maintenance program (if applicable), and maintenance procedures support acceptable levels of EFVS equipment availability and performance in line operations;
2. Its checklists and procedures for conducting EFVS operations are adequate;
3. EFVS provisions, procedures, checklists, and flightcrew duties and responsibilities are appropriately documented and incorporated into its manuals;
4. The approved EFVS ground and flight training (and proficiency/competency checks for part 121 or 135) provides its flightcrews with the knowledge, skills, and competency to safely conduct EFVS operations;
5. Its flightcrews are able to conduct EFVS operations in accordance with the regulations, applicable operating conditions or limitations, and the operator's OpSpec/MSpec/LOA. The flightcrews should be able to demonstrate in-flight, or through an acceptable simulation, the competence necessary to safely conduct these operations; and
6. The training and procedures for dispatch personnel or other persons authorized to exercise operational control provides an understanding of the EFVS regulations, the operator's OpSpec/MSpec/LOA, the capabilities and limitations of the specific EFVS equipment installed in the operator's aircraft, the unique weather conditions that cause variability in how an EFVS sensor performs, and the weather conditions that may exceed the sensor's ability to

provide the enhanced flight visibility required to complete an approach and landing.

10.4.2 Observing and evaluating the operator's ability to conduct EFVS operations includes a demonstration period of sufficient length and scope to achieve the objectives discussed in paragraph 10.4. Demonstrations may be conducted in line operations, during training flights, or during aircraft type or route proving runs. Demonstration requirements may consider criteria and special emphasis items from FSB reports applicable to the EFVS and aircraft installation, previous operator service experience with EFVS, experience other operators may have with a specific EFVS/aircraft installation, experience the operator's crews have with EFVS, and other factors the FAA deems appropriate.

10.4.3 During the observation and evaluation period, EFVS trained and qualified flightcrews conduct instrument approaches in aircraft using the EFVS. Maintenance personnel and dispatchers or other persons authorized to exercise operational control that are used to support the demonstration flights must have completed EFVS training and must use the operator's EFVS procedures for their respective areas. Use of the EFVS during this demonstration period may require the issuance of an OpSpec, MSpec, or LOA for EFVS operations. If an operator proposes to conduct EFVS operations under both § 91.176(a) and (b), a single demonstration period of sufficient length to demonstrate both types of EFVS operations may be conducted. Operators who intend to conduct HUD to touchdown or autoland operations during EFVS approach or landing demonstrations may do so only if the AFM(S) does not prohibit the operation and the operator has been issued OpSpec/MSpec C061, Flight Control Guidance Systems for Automatic Landing Operations Other Than Categories II and III (autoland), or OpSpec/MSpec C062, Manually Flown Flight Control Guidance System Certified for Landing Operations Other Than Categories II and III (HUD to touchdown).

10.4.4 During the observation and evaluation period, the operator should also conduct a sufficient number of approaches and landings to successfully demonstrate that the EFVS was available and operational for 95 percent of the flights, and that flightcrew use of the EFVS during the instrument approaches revealed no operational difficulties. EFVS availability for purposes of the demonstration is defined as an EFVS that is fully operational and fully supports the EFVS operation from start of descent on an IAP through touchdown and rollout. The operator should provide a monthly report to the CHDO, CMO, or FSDO, as appropriate, detailing the number of approaches flown using the EFVS, number of times the EFVS was not available and fully operational for those flights, number of EFVS failures during the demonstration period, maintenance irregularities, and other operational difficulties. At the end of the demonstration period, the operator will provide a report of cumulative findings to the CHDO, CMO, or FSDO, as appropriate.

10.4.5 If the EFVS is not available and fully operational for 95 percent of the flights or if an excessive number of operational difficulties or EFVS failures occur during the demonstration period, the demonstration period should be extended and action that directly addresses the deficiency should be considered. Such action could include adjustments to procedures or training for pilots, dispatchers or other personnel authorized

to exercise operational control, or maintenance personnel. It could also include applying wind limitations, limiting the type or offset angle of the approaches to be flown, or other appropriate adjustments. In some cases, EFVS availability of less than 95 percent may be acceptable if clear corrective action proves that a higher availability rate is attainable.

10.4.6 The FAA recognizes it is impractical to require a fixed time period and a fixed number of approaches and landings for the observation and evaluation period that would apply to all operators. Some operators, for example, may be able to demonstrate their ability to achieve the objectives in paragraph 10.4 over a 4-month period of time and 50 approaches and landings. Others may require less time and fewer approaches, and still others may require more time and a greater number of approaches. The length of the observation and evaluation period and the number of approaches and landings that should be conducted are dependent on fleet size, access to runways with appropriate IAPs, the operator's previous experience with EFVS operations, the FAA's experience with the operator, and other factors. An operator has successfully completed the observation and evaluation period when it has provided enough data to establish that it met the goals of the demonstration period.

10.4.7 When all outstanding items are resolved and the operator has demonstrated its ability to successfully conduct EFVS operations, the FAA issues an OpSpec, MSpec, or LOA, as appropriate, for EFVS operations under § 91.176(a), § 91.176(b), or both.

10.5 Approval Process for EFVS Operations Conducted by Operators of Foreign-Registered Aircraft under Part 129.

10.5.1 A foreign-registered aircraft used to conduct EFVS operations that does not have an FAA type design approval must be equipped with an operable EFVS that meets the applicable airworthiness requirements. That is, foreign-registered aircraft must be equipped with an EFVS that meets the appropriate airworthiness certification requirements and has been approved by either the State of the Operator or the State of Registry (refer to § 91.176(a)(1)(i) and (b)(1)(i)). In addition, the 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.

10.5.2 The appropriate International Field Office (IFO) is responsible for authorizing operators of foreign-registered aircraft to conduct EFVS operations in the United States. This authorization is based primarily on an EFVS authorization from the State of the Operator. The major components of the application to conduct EFVS operations in the United States should include:

1. Application letter;
2. Description of aircraft and equipment proposed to be used for EFVS operations;

3. Airworthiness documentation;
4. AFM(S) or RFM(S) provisions for EFVS. Foreign-registered aircraft used by a foreign air carrier for EFVS operations within the United States should have AFM(S) or RFM(S) provisions reflecting an appropriate level of EFVS capability that meets the display, features, and requirements of § 91.176;
5. MEL approval, including any EFVS provisions. (FAA-approved MEL required for U.S.-registered aircraft.) In accordance with part 129, § 129.14(b), no foreign air carrier or foreign person may operate a U.S.-registered aircraft with inoperable instruments or equipment unless a Master Minimum Equipment List (MMEL) exists for the aircraft type, and the foreign operator submits for review and approval its aircraft MEL, based on the MMEL, to the FAA. For EFVS operations, the foreign operator should take the EFVS system and components into consideration during MEL submission, review, and approval, if the foreign operator is seeking MEL relief for EFVS;
6. EFVS operational approval issued by the CAA of the State of the Operator;
7. EFVS training program approval issued by the CAA of the State of the Operator;
8. Maintenance program approval, including EFVS provisions. (FAA-approved maintenance program required for U.S.-registered aircraft.) In accordance with § 129.14, "each foreign air carrier and each foreign person operating a U.S.-registered aircraft within or outside the United States in common carriage must ensure that each aircraft is maintained in accordance with a program approved by the Administrator." This maintenance program should contain maintenance provisions for EFVS equipment; and
9. OpSpecs and any proposed amendments the operator is seeking.

10.5.3 U.S. and foreign regulations with respect to EFVS operations may differ. Foreign air carriers operating aircraft under part 129 in the United States should be familiar with the equipment and operating requirements of the U.S. regulations. Additionally, foreign operators that expect to conduct all of the approach operations authorized by § 91.176 should provide training appropriate to the approach operations to be conducted and should be authorized by their CAA to conduct those operations.

10.5.4 EFVS operations conducted under part 129 in U.S.-registered aircraft solely outside the United States in common carriage by a foreign person or a foreign air carrier do not require operational approval; however, those operations must comply with those sections of part 129 specified in § 129.1(b).

10.6 Waivers From § 91.176.

10.6.1 Section 91.903 states that the Administrator may issue a Certificate of Waiver (CoW) authorizing the operation of aircraft in deviation from any rule listed in that subpart if the Administrator finds that the proposed operation can be safely conducted under the terms of the CoW. Section 91.176 is listed in § 91.905 as a rule subject to waiver. A CoW may not be issued for any operation conducted under part 121, 125, 129, or 135.

10.6.2 Operators who seek a CoW from § 91.176 must complete FAA Form 7711-2, Application for Certificate of Waiver or Authorization, and submit it to the FSDO with responsibility over the area where the operator's principal business office is located. The application should be submitted a minimum of 30 days before the waiver is needed. In addition to FAA Form 7711-2, the FAA may request additional supporting documentation necessary to process the application.

11 AC FEEDBACK FORM. For your convenience, the AC Feedback Form is the last page of this AC. Note any deficiencies found, clarifications needed, or suggested improvements regarding the contents of this AC on the Feedback Form.

APPENDIX A. ACRONYMS AND ABBREVIATIONS

A.1 Acronym Definition

	Acronym	Definition
1.	14 CFR	Title 14 of the Code of Federal Regulations
2.	AC	Advisory Circular
3.	AEG	Aircraft Evaluation Group
4.	AFM	Airplane Flight Manual
5.	AFMS	Airplane Flight Manual Supplement
6.	AFM(S)	Airplane Flight Manual or Airplane Flight Manual Supplement
7.	AFS	Flight Standards Service
8.	ALS	Approach Light System
9.	AOM	Airplane Operations Manual
10.	CAA	Civil Aviation Authority
11.	CAT I	Category I
12.	CAT II	Category II
13.	CAT III	Category III
14.	CFIT	Controlled Flight into Terrain
15.	CFR	Code of Federal Regulations
16.	CHDO	Certificate-Holding District Office
17.	CMU	Certificate Management Unit
18.	CoW	Certificate of Waiver
19.	DA	Decision Altitude
20.	DH	Decision Height
21.	EASA	European Aviation Safety Agency
22.	EFVS	Enhanced Flight Vision System
23.	EVS	Enhanced Vision System
24.	FAA	Federal Aviation Administration
25.	FAF	Final Approach Fix
26.	FFS	Full Flight Simulator
27.	FLIR	Forward Looking Infrared
28.	FOM	Flight Operations Manual
29.	FPARC	Flight Path Angle Reference Cue

30. FPV Flight Path Vector
31. FSB Flight Standardization Board
32. FSDO Flight Standards District Office
33. GPS Global Positioning System
34. GS Glideslope
35. HDD Head-Down Display
36. HUD Head-Up Display
37. IAP Instrument Approach Procedure
38. ICA Instructions for Continued Airworthiness
39. IFO International Field Office
40. IFR Instrument Flight Rules
41. ILS Instrument Landing System
42. IMC Instrument Meteorological Conditions
43. LED Light-Emitting Diode
44. LNAV Lateral Navigation
45. LOA Letter of Authorization
46. LODA Letter of Deviation Authority
47. LPV Localizer Performance with Vertical Guidance
48. LVO Low-Visibility Operations
49. MAP Missed Approach Point
50. MASPS Minimum Aviation System Performance Standards
51. MDA Minimum Descent Altitude
52. MEL Minimum Equipment List
53. MMEL Master Minimum Equipment List
54. MSpec Management Specification
55. NAS National Airspace System
56. NSP National Simulator Program (AFS-205)
57. OpSpec Operations Specification
58. PAR Precision Approach Radar
59. PF Pilot Flying
60. PIC Pilot in Command
61. PM Pilot Monitoring
62. POH Pilot’s Operating Handbook

63. POI	Principal Operations Inspector
64. QRH	Quick Reference Handbook
65. REIL	Runway End Identification Lights
66. RFM	Rotorcraft Flight Manual
67. RFMS	Rotorcraft Flight Manual Supplement
68. RFM(S)	Rotorcraft Flight Manual or Rotorcraft Flight Manual Supplement
69. RFSD	Regional Flight Standards Division
70. RNAV	Area Navigation
71. RVR	Runway Visual Range
72. SCO	Special Certification Office
73. SIAP	Standard Instrument Approach Procedure
74. SMGCS	Surface Movement Guidance and Control System
75. STC	Supplemental Type Certificate
76. SVGS	Synthetic Vision Guidance System
77. SVS	Synthetic Vision System
78. TC	Type Certificate
79. TCH	Threshold Crossing Height
80. TDZ	Touchdown Zone
81. TDZE	Touchdown Zone Elevation
82. TERPS	Terminal Instrument Procedures
83. VDA	Vertical Descent Angle
84. VDP	Visual Descent Point
85. VFR	Visual Flight Rules
86. VGSI	Visual Glide Slope Indicator
87. VNAV	Vertical Navigation

APPENDIX B. DEFINITIONS

For the purpose of operations under this advisory circular (AC), this appendix provides the following definitions:

B.1 Aircraft Evaluation Group (AEG). A Flight Standards Service (AFS) field element that helps support the certification and operational suitability determinations of new and modified type-certificated (TC) products. AEGs are the primary AFS liaison between AFS elements and the accountable aircraft certification directorate and/or the manufacturers. AEGs may be collocated with an accountable directorate or one of its elements.

B.2 Amended Type Certificate (TC). An amended TC is issued when the holder of the TC receives Federal Aviation Administration (FAA) approval to modify an aircraft design from its original design. An amended TC approves not only the modification, but also how that modification affects the original design.

B.3 Authorized Training Provider. Under Title 14 of the Code of Federal Regulations (14 CFR) part 61, § 61.66, an authorized training provider is one that provides enhanced flight vision system (EFVS) training in accordance with an FAA-approved training program under 14 CFR part 91, 91 subpart K (part 91K), 121, 125, 135, 141, or 142.

B.4 Certificate-Holding District Office (CHDO). An FAA Flight Standards District Office (FSDO), certificate management office (CMO), International Field Office (IFO), or certificate management unit (CMU) assigned by the FAA to have oversight responsibility for a particular certificate holder.

B.5 Enhanced Flight Visibility. The average forward horizontal distance from the flight deck of an aircraft in flight at which a pilot using an EFVS may clearly distinguish and identify prominent topographical objects by day or night.

B.6 Enhanced Flight Vision System (EFVS). An installed aircraft system that 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 (FLIR), 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.

B.7 Enhanced Vision System (EVS). An electronic means to provide the flightcrew with a sensor-derived or sensor-enhanced image of the external scene (e.g., millimeter wave radar or FLIR).

B.8 Flight Standardization Board (FSB). A designated group of operations inspectors who develop recommended pilot training, checking, and currency specific to an aircraft type.

B.9 Glideslope (GS). Vertical guidance for an aircraft during approach and landing.

B.10 Head-Down Display (HDD). A display or suite of displays that provide control, performance, and navigation information that is presented to the pilot on conventional head-down instrumentation, or integrated electronic flight displays.

B.11 Head-Up Display (HUD). An aircraft system that provides head-up guidance to the pilot during flight. It includes the display element, sensors, computers, power supplies, indications, and controls. It may receive inputs from an airborne navigation system or flight guidance system. This system allows the pilot to look for the outside visual references in the same location as they appear in the EFVS image.

B.12 Master Minimum Equipment List (MMEL). A list of equipment that the FAA has determined may be inoperative under certain operational conditions and still provide an acceptable level of safety. The MMEL contains the conditions, limitations, and procedures required for operating the aircraft with these items inoperative. The MMEL is used as a starting point in the development and review of an individual operator's minimum equipment list (MEL).

B.13 Minimum Equipment List (MEL). The MEL is a list derived from the MMEL for a particular make and model of aircraft by an individual operator. The operator's MEL takes into consideration the operator's particular aircraft configurations, operating procedures, and conditions with certain inoperative equipment.

B.14 Natural Vision. The means by which a pilot observes objects without benefit of any vision-enhancing technology (except personal corrective lenses).

B.15 Nonprecision Approach (NPA) Procedure. A Standard Instrument Approach Procedure (SIAP) for which no electronic GS information is provided.

B.16 Precision Approach Procedure. An SIAP for which an electronic GS information is provided, such as instrument landing system (ILS) and precision approach radar (PAR).

B.17 Special Instrument Approach Procedure (IAP). An IAP authorized for use only by an air carrier or some other segment of the aviation industry that is not published in the Federal Register (FR) and is identified as a "Special Procedure." Special Procedures may be developed for public or private use based on aircraft performance, aircraft equipment, or crew training, and may require the use of landing aids, communications, or weather services not available for public use.

B.18 Standard Instrument Approach Procedure (SIAP). An IAP promulgated under 14 CFR part 97.

B.19 Straight-In Nonprecision Approach (NPA). An approved IAP in which the final approach course alignment and descent gradient permits authorization of straight-in landing minimums. The angle of convergence of the final approach course and the extended runway centerline (RCL) will not exceed 30 degrees (15 degrees for Area Navigation (RNAV)/global positioning system (GPS)) and the point of intersection will normally be within 5,200 feet outward from the runway threshold. The maximum descent gradient is 400 feet/nautical mile (NM).

B.20 Straight-In Precision Approach. An approved IAP in which the final approach course alignment does not exceed 3 degrees of the extended RCL.

B.21 Supplemental Type Certificate (STC). An STC is issued for a major design change to a TC when the change is not so extensive as to require application for a new TC, except that the holder of a TC for a product may apply for amendment of the original TC.

B.22 Synthetic Vision. A computer-generated image of the external scene topography from the perspective of the flight deck that is derived from aircraft attitude, high-precision navigation solution, database of terrain, obstacles, and relevant cultural features.

B.23 Synthetic Vision Guidance System (SVGS). SVGS is a combination of flight guidance display technology and high precision position assurance monitors. The SVGS flight instrument display provides a continuous, geospatially correct depiction of the external scene topography, including obstacles, augmented by the display of the runway of intended landing. The SVGS display may be implemented on a head-down primary flight display (PFD) and/or a HUD. SVGS includes additional symbology elements, integrity and performance monitors, and annunciations that support and enable low visibility operations. Additional flight instrument symbology and monitors to assure accurate rendering of the external scene are included.

B.24 Synthetic Vision System (SVS). An electronic means to display a synthetic vision image of the external scene topography to the flightcrew. An SVS display does not provide an independent, real-time source of forward scene information.

B.25 Touchdown Zone (TDZ) Elevation (TDZE). The highest elevation in the first 3,000 feet of the landing surface. TDZE is indicated on the IAP chart when straight-in landing minimums are authorized.

B.26 Type Certificate (TC). A design approval that certifies that an applicant’s design for a new (or new model) aircraft, engine, or propeller meets the minimum FAA requirements. It includes the type design, the operating limitations, the Type Certificate Data Sheet (TCDS), the applicable regulations the type design was certified to, and any other conditions or limitations required in 14 CFR subchapter C.

APPENDIX C. RELATED REGULATIONS AND GUIDANCE

C.1 Applicable 14 CFR Parts:

- Part 1, § 1.1.
- Part 23, § 23.773(c).
- Part 25, § 25.773(e).
- Part 27, § 27.773(c).
- Part 29, § 29.773(c).
- Part 61, § 61.66.
- Part 91, §§ 91.175(c), (d), and (e)(1); 91.176; 91.189(d) and (e); 91.905; 91.1039; and 91.1065.
- Part 121, §§ 121.407, 121.409, 121.441, 121.613, 121.615(a), and 121.651, and Appendices F and H.
- Part 125, §§ 125.287, 125.325, 125.361, 125.363(a), and 125.381.
- Part 135, §§ 135.219, 135.225, and 135.293.

C.2 Related Documents (current editions).

C.2.1 ACs. You can find the following ACs at http://www.faa.gov/regulations_policies/advisory_circulars:

- AC 20-167, Airworthiness Approval of Enhanced Vision System, Synthetic Vision System, Combined Vision System, and Enhanced Flight Vision System Equipment.
- AC 25-11, Electronic Flight Displays.
- AC 61-65, Certification: Pilots and Flight and Ground Instructors.
- AC 91-79, Mitigating the Risks of a Runway Overrun Upon Landing.
- AC 120-28, Criteria for Approval of Category III Weather Minima for Takeoff, Landing, and Rollout.
- AC 120-29, Criteria for Approval of Category I and Category II Weather Minima for Approach.
- AC 120-54, Advanced Qualification Program.
- AC 120-57, Surface Movement Guidance and Control System.
- AC 120-71, Standard Operating Procedures and Pilot Monitoring Duties for Flight Deck Crewmembers.
- AC 120-108, Continuous Descent Final Approach.

C.2.2 FAA Orders. You can find the following FAA Order at http://www.faa.gov/regulations_policies/orders_notices:

- FAA Order 8000.94, Procedures for Establishing Airport Low-Visibility Operations and Approval of Low-Visibility Operations/Surface Movement Guidance and Control System Operations.

C.2.3 Information for Operators (InFO). You can find the following InFO at http://www.faa.gov/other_visit/aviation_industry/airline_operators/airline_safety/info/:

- 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.

C.2.4 Flight Standardization Board (FSB) Reports. You can find FSB reports pertaining to EFVS-equipped aircraft at http://fsims.faa.gov/PICResults.aspx?mode=Publication&doctype=FSB%20Reports.

C.2.5 National Simulator Program (NSP) Information. You can find information about the FAA's NSP (AFS-205) at http://www.faa.gov/about/initiatives/nsp/.

C.2.6 ICAO Documents. You can find the following ICAO documents on the ICAO Publications website at http://www.icao.int/publications/Pages/default.aspx:

- Annex 6, Operation of Aircraft. Annex 6 and pertinent attachments contain information about EVS operational credit and specific approval to conduct those operations.
- Manual of All Weather Operations.

C.2.7 RTCA Documents. The following RTCA documents are available from RTCA Inc., at 1150 18th St. NW, Suite 910, Washington, DC 20036, by telephone at 202-833-9339, by fax at 202-833-9434, or at http://rtca.org/index.asp:

- DO-315, Minimum Aviation System Performance Standards (MASPS) for Enhanced Vision Systems, Synthetic Vision Systems, Combined Vision Systems and Enhanced Flight Vision Systems.
- DO-341, Minimum Aviation System Performance Standards (MASPS) for an Enhanced Flight Vision System to Enable All-Weather Approach, Landing and Roll-Out to a Safe Taxi Speed.

C.2.8 SAE Documents. The following SAE documents are available from SAE International at 400 Commonwealth Drive, Warrendale, PA 15096-0001, by telephone at 877-606-7323, or online at http://www.sae.org:

- Aerospace Standard (AS) 5703, Minimum Performance Standard for Enhanced Vision System.
- AS 8055, Minimum Performance Standard for Airborne Head Up Display (HUD).

C.2.9 State Aeronautical Information Publications (AIP). Specific policies and procedures related to EFVS operations are published in individual state AIPs.

Advisory Circular Feedback Form

If you find an error in this AC, have recommendations for improving it, or have suggestions for new items/subjects to be added, you may let us know by contacting the Flight Technologies and Procedures Division (AFS-400) at 9-AWA-AFS400-Coord@faa.gov or the Flight Standards Directives Management Officer at 9-AWA-AFS-140-Directives@faa.gov.

Subject: AC 90-106A, Enhanced Flight Vision Systems

Date: _____

Please check all appropriate line items:

☐ An error (procedural or typographical) has been noted in paragraph _____ on page _____.

☐ Recommend paragraph _____ on page _____ be changed as follows:

_____

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☐ In a future change to this AC, please cover the following subject:
(Briefly describe what you want added.)

_____

_____

☐ Other comments:

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