Flight Technologies and Procedures Division

EFVS

SVS

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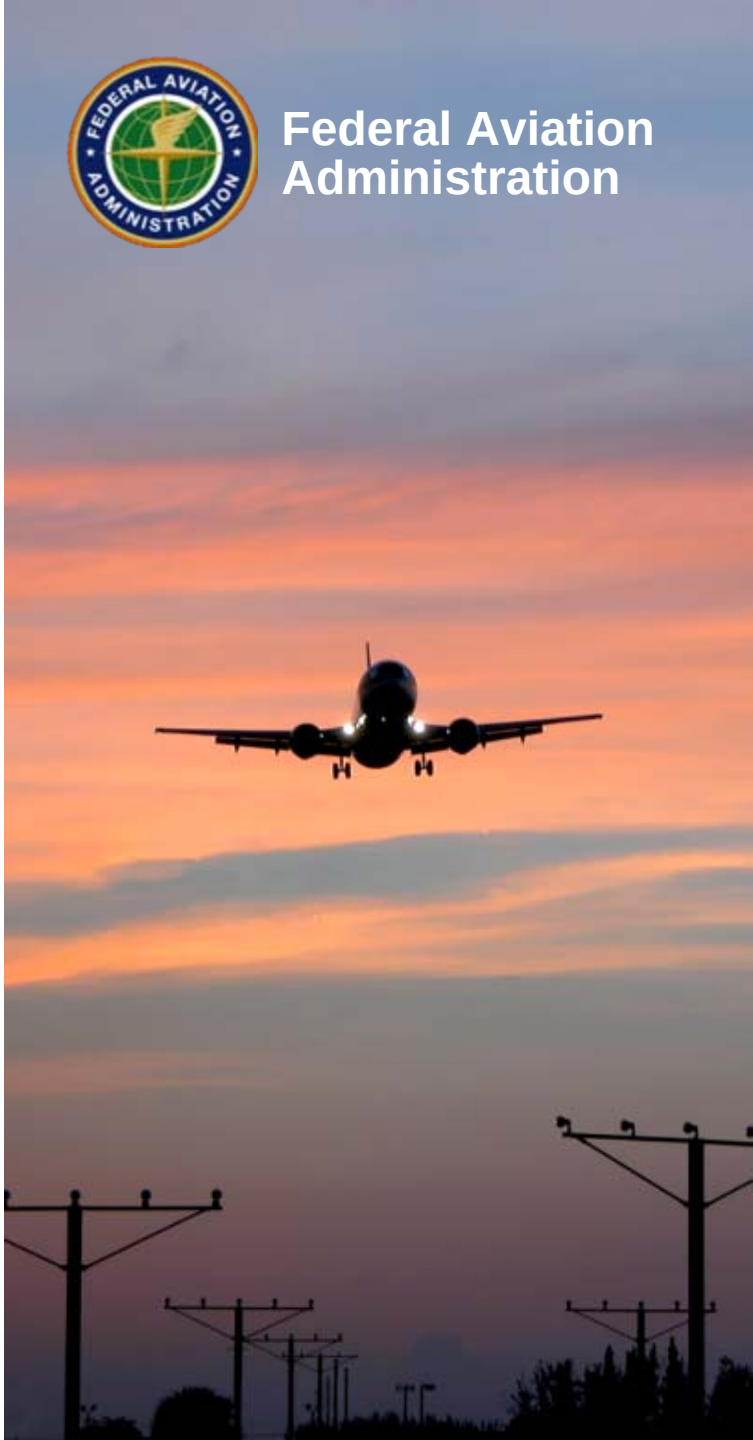
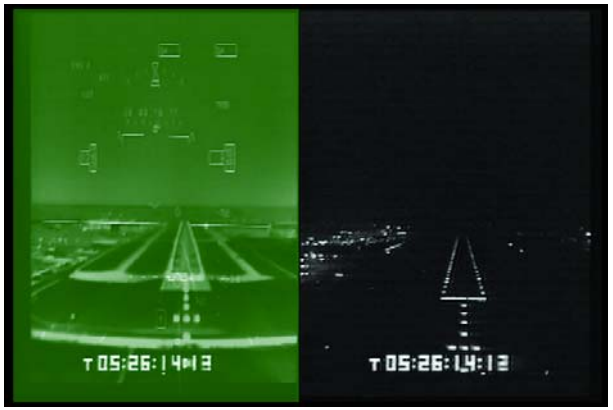
Federal Aviation Administration



Overview

- **Enhanced Flight Vision System (EFVS)**
- **Synthetic Vision System (SVS)**

Technology Evolution

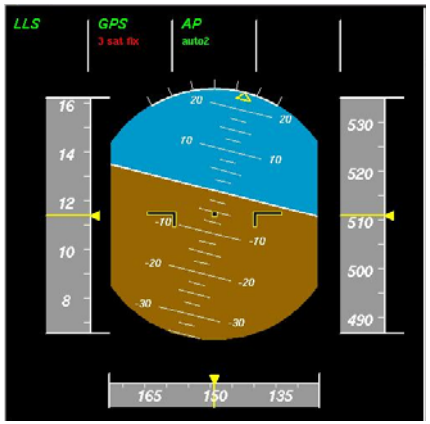


Combined EFVS/SVS

SVS Primary Flight Displays

Emerging EFVS Capabilities

Legacy



HUD

Introduction to Enhanced Flight Vision System (EFVS)

Enhanced Flight Vision Systems (EFVS)

- **14 Code of Federal Regulations (CFR) 1.1 defines EFVS as –**

  "Enhanced Flight Vision System (EFVS) Means an Electronic Means to Provide a Display of the Forward External Scene Topography (the Natural or Manmade Features of a Place or Region Especially in a Way to Show their Relative Positions and Elevation) Through the Use of Imaging Sensors, such as a Forward Looking Infrared, Millimeter Wave Radiometry, Millimeter Wave Radar, Low Light Level Image Intensifying."

HUD + Sensor Imagery = EFVS

EFVS System Requirements

- **May receive inputs from an airborne navigation or flight guidance system**
- **Display characteristics and dynamics suitable for manual control of the aircraft**
- **Displayed imagery and flight symbology CANNOT adversely obscure outside view or field of view through cockpit windscreen**

NOTE: HUD is a Required Element of EFVS. Head Down Displays Containing Sensor Imagery DO NOT Currently Qualify for Operational Credit.

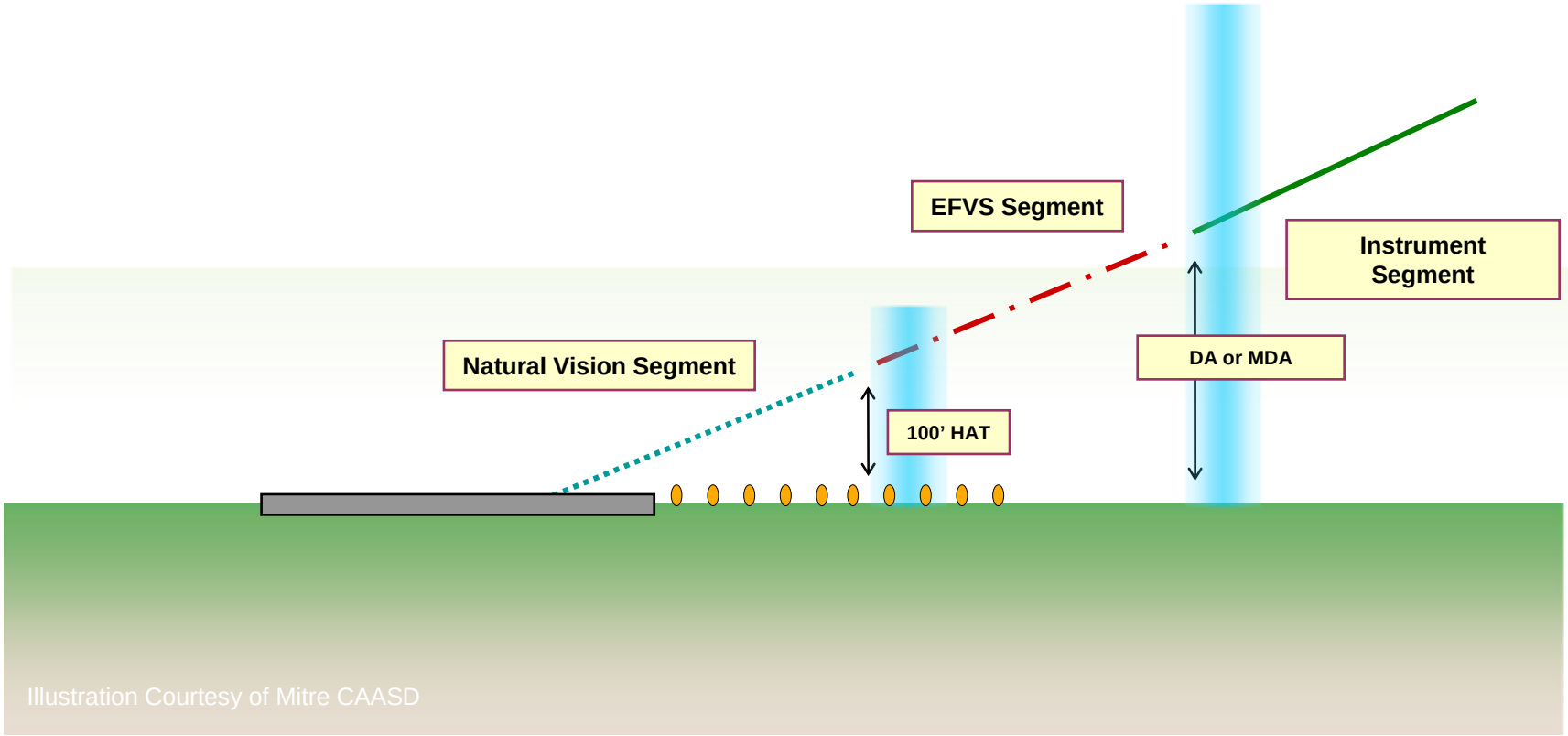
Benefits of Enhanced Flight vision Systems (EFVS)

- **Enhances low visibility flight and ground operations**
- **Increases access, efficiency and throughput at many airports when low visibility is a factor**
- **Reduces infrastructure necessary to support low visibility operations**
- **Provides a real time display of outside world in low visibility conditions using imaging sensors**

MD-10 EFVS Installation

EFVS Operational Concept

Operational Concept for EFVS



EFVS Operational Requirements

- **Aircraft must be <u>continuously</u> in a position from which a descent to landing can be made**
  - **On the intended runway**
  - **At a normal rate of descent**
  - **Using normal maneuvers**
  - **For Parts 121/135 operators, descent rate allows touchdown to occur within Touchdown Zone**

EFVS Operational Requirements

- **EFVS does not lower the minima – DA/DH or MDA is the same as that specified by the instrument approach procedure**
- **Enhanced flight visibility cannot be less than that required by the instrument approach procedure**
- **Required visual references must be distinctly visible and identifiable (lighting, marking, etc.)**

EFVS Operational Requirements

- **EFVS must be an approved system**
  - An FAA type design approval -OR-
  - For foreign-registered aircraft, EFVS must comply with the requirements of the U.S. regulations
- **The pilot must be qualified to use an EFVS**
  - Parts 119 and 125 certificate holders – Applicable Training, Testing and Qualification Provisions of Parts 121, 125 and 135
  - Part 91 Subpart K Operators – Training Required
  - Foreign persons – IAW Civil Aviation Authority of the State of the Operator

Synthetic Vision Systems

Synthetic Vision Systems (SVS)

- **14 CFR 1.1 defines SVS as**

  " A Synthetic Vision System (SVS) is an <u>ELECTRONIC MEANS</u> to display a SYNTHETIC VISION IMAGE of the external scene topography to the flight crew"

  – **SVS Image is COMPUTER GENERATED, NOT a "REAL-TIME" image like that produced by EFVS**

  – **Requires a terrain and obstacle database, a precise navigation solution, and a display**

Benefits Associated with SVS Technology Include:

- **Increased position awareness in all weather and illumination conditions (day/night) for surface and flight operations**
- **Increased terrain awareness, especially in mountainous terrain**
- **Provides obstacle information**
- **Provides cues for “next action” planning when the external scene is not visible**
- **Provides for a more efficient visual search**

SVS Displays

- **SVS image can be displayed on either Head-Down Display or Head-Up Display (HUD)**
  - **To Date, SVS has only been certified on Head-Down Displays**
  - **SVS has NOT been approved for operational credit**
  - **SVS is currently approved for situation awareness only**

SVS Displays

- **What's next for SVS displays?**
  - **Development efforts to display a synthetic image on a HUD are currently underway**
  - **Operational credit using SVS on Head-Up and Head-Down displays is currently being evaluated**
    - Proof of Concept application for SVS head down
    - Proof of Concept application for SVS head up
  - **Combined Vision Systems (CVS) could combine a "real time" sensor image with a synthetic image**

Current Status

EFVS Rulemaking

- **EFVS Notice of Proposed Rulemaking (NPRM)**
  - Contains proposals to expand operational credit for EFVS
  - Expected to be published soon for public comment
- **AC 90-106 Revisions**
  - Draft AC 90-106A will provide operational guidance material related to new provisions contained in the EFVS NPRM
  - Draft AC will be available for public comment along with EFVS NPRM
- **AC 20-167 Revisions**
  - Draft AC 20-167 will provide EFVS equipment certification criteria related to new provisions contained in the EFVS NPRM
  - Draft AC will be available for public comment along with the EFVS NPRM

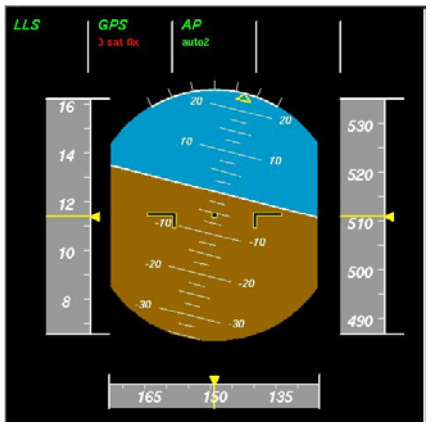
FAA, Industry, & Harmonization Activities

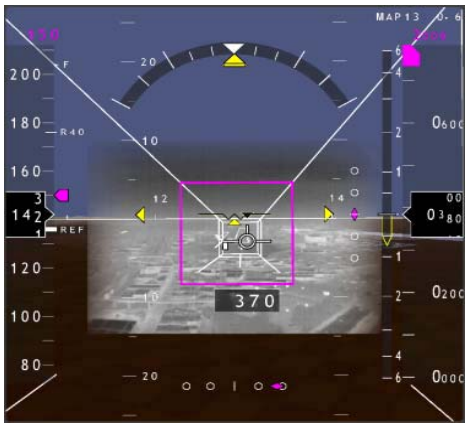
- **RTCA SC-213 / Eurocae WG-79**
  - **Joint FAA, Eurocae, and Industry Committee**
  - **Future MASPS**
    - Criteria for EFVS to touchdown down to RVR 3000
    - Criteria for SVS for lower than standard minima (other than SA CAT I ILS)
- **ICAO HESC Sub Group**
  - ICAO HUD, EVS, SVS, and CVS Sub Group of the ICAO Ops Panel

Enhanced Flight Vision System (EFVS)
Synthetic Vision System (SVS)

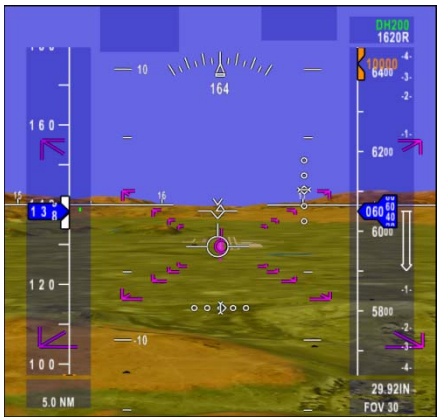
Yesterday

Today

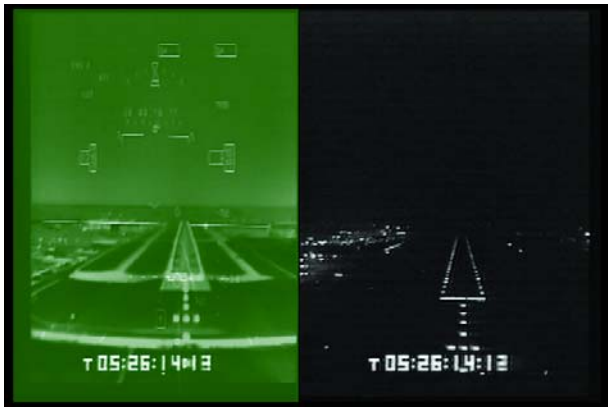




Combined EFVS/SVS



SVS Research Efforts Underway



Emerging EFVS Capabilities

Thank You!

Enhanced Flight Vision Systems (EFVS)

- **Operating rules provide detail on EFVS system and operational requirements:**
  - –§ 91.175 (l) and (m)
  - –§ 121.651
  - –§ 125.381
  - –§ 135.225

Guidance Policy Update

- **AC 120-29A / AC 120-28D Combination**
  - Extensive duplication and out of date info
  - Performance based (satellite) operations removed/GLS operations added / updated
  - Approval processes updated
  - New operations added
    - SA CAT I / II, Hybrid ops, SVS ops
  - Will coordinate with new update of EU-OPS and CS-AWO

EFVS Guidance Material

- **AC 90-106 –**
  - Operational requirements for EFVS operations conducted below DA/DH or MDA down to 100 feet above touchdown zone or runway threshold elevation
- **AC 20-167 –**
  - Equipment certification criteria for EFVS operations conducted under 14 CFR 91.175(l) and (m)

SVS Guidance Material

- **AC 20-167**
  - **Equipment certification criteria for EFVS operations conducted under 14 CFR 91.175(l) and (m).**
- **AC 23-26**
  - **Synthetic vision and pathway depictions on the primary fight display for Part 23 aircraft (small airplanes).**

RTCA SC-213 / Eurocae WG-79 Activities

- **RTCA SC-213 / Eurocae WG-79**
  - **Joint FAA, Eurocae, and Industry Committee**
  - **Published RTCA DO-315B MASPS**
    - Contains Minimum Aviation System Performance Standards (MASPS) for EVS, SVS, and CVS for situation awareness (no operational credit)
    - Contains MASPS for EFVS operations to 100 feet under existing 14 CFR 91.175(l) and (m)
    - Contains MASPS for EFVS operations to touchdown down to RVR 1000

RTCA SC-213 / Eurocae WG-79 Activities

- **RTCA SC-213 / Eurocae WG-79**
  - **Joint FAA, Eurocae, and Industry Committee**
  - **Published RTCA DO-315B MASPS**
    - Contains Minimum Aviation System Performance Standards (MASPS) for EVS, SVS, and CVS for situation awareness (no operational credit)
    - Contains MASPS for SVS operations that would be conducted on a Special Authorization CAT I ILS approach (RVR 1400 and 150 ft. DH)
      - The FAA has not approved SVS for operational credit on an SA CAT I ILS approach
      - In the U.S., SVS is currently approved for situation awareness only