



The European Organisation for Civil Aviation Equipment
L'Organisation Européenne pour l'Équipement de l'Aviation Civile

MINIMUM AVIATION SYSTEM PERFORMANCE STANDARDS (MASPS) FOR A COMBINED VISION SYSTEMS FOR HELICOPTER OPERATIONS

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FOREWORD

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CHAPTER 1

PURPOSE AND SCOPE

1.1 INTRODUCTION AND PURPOSE OF DOCUMENT

This document contains Minimum Aviation System Performance Standards for a Combined Vision System for Helicopter Operations.

Compliance with these standards is recommended as one means of assuring that the system and each subsystem will perform its intended function(s) satisfactorily under conditions normally encountered in routine aeronautical operations for the environments intended. The Minimum Aviation System Performance Standards (MASPS) may be implemented by one or more regulatory documents and/or advisory documents (e.g., certifications, authorizations, approvals, commissioning, advisory circulars, notices, etc.) and may be implemented in part or in total. Any regulatory application of this document is the sole responsibility of appropriate governmental agencies.

1.2 SCOPE OF THE DOCUMENT

This document addresses Combined Vision Systems (CVS) technologies applied to helicopter operations. While RTCA DO-315x / EUROCAE ED-179x and DO-371 / EUROCAE ED-249 documents are not specialized for a particular type of platform or mission, they were mostly written with fixed-wing platforms and operations in mind. The present document is oriented specifically towards helicopter platforms and operations. It defines performance standards for CVS over head down and transparent displays, which intended function is to provide a supplemental view of the external scene and visual references to the pilot. Such a CVS does not provide “additional operational credit” and is not intended to change the helicopter’s existing operational capability or certification basis. The pilot(s) is expected to follow the existing operational procedures and adhere to all published minimums.

1.3 STRUCTURE OF THE DOCUMENT

Chapter 1 (the current chapter) provides an explanation of the scope and purpose of this document and introduces the Combined Vision Systems for Helicopter Operations.

Chapter 2 describes the approach and methodology aspects applied for the development of this Combined Vision Systems for Helicopter Operations and outlines performance and interoperability assessments made in this document.

Chapter 3 contains the minimum performance standards and subsystem/functions that are required elements of minimum system performance in Section 2. These standards specify the required performance under the standard environmental conditions described.

Chapter 4 introduces the Interoperability Requirements applicable to the Combined Vision Systems for Helicopter Operations.

Chapter 5 describes the minimum system test procedures to verify system/application performance (e.g., end-to-end performance verification) and that subsystem performance meets the minimum performance requirements in Section 3. These system test procedures should be particularly helpful in prototyping and pre-operational trials of the system/application.

The verification procedures specified in this document are intended to be used as one means of demonstrating compliance with the performance requirements. Although specific test procedures are cited, it is recognized that other methods may be used. These alternate procedures may be used if it can be demonstrated that they provide at least equivalent information. System performance tests as they relate to operational capability are the most important test. Subsystem tests are useful as subsystems are added during system buildup and to ensure continued subsystem performance as it relates to system performance.

Appendix A is not used.

Appendix B is not used.

Appendix C contains the acronyms and definitions used throughout the document.

Appendix D provides a list of the typical visual references in support of the intended functions described in § 3.1.3.

Appendix E is the WG-79/SC-213 membership list.

1.4 RELATIONSHIP WITH ICAO DOCUMENTS

Reserved

1.5 REFERENCES

Source	Ref	Title	Date
RTCA	DO-315B	Minimum Aviation System Performance Standards (MASPS) for Enhanced Vision Systems, Synthetic Vision Systems, Combined Vision Systems and Enhanced Flight Vision Systems	22.06.11
RTCA	DO-178C	Software Considerations in Airborne Systems and Equipment Certification	13.12.11
RTCA	DO-160G	Environmental Conditions and Test Procedures for Airborne Equipment	08.12.10
RTCA	DO-254	Design Assurance Guidance for Airborne Electronic Hardware	19.04.00
RTCA	DO-276C	User Requirements for Terrain and Obstacle Data	22.09.15
RTCA	DO-200B	Standards for Processing Aeronautical Data	18.06.15
RTCA	DO-371	Minimum Aviation System Performance Standards (MASPS) for Aircraft State Awareness Synthetic Vision Systems	19.12.17
EUROCAE	ED-179B	Minimum Aviation System Performance Standards (MASPS) for Enhanced Vision Systems, Synthetic Vision Systems, Combined Vision Systems and Enhanced Flight Vision Systems	September 2011
EUROCAE	ED-12C	Software Considerations in Airborne Systems and Equipment Certification	January 2012
EUROCAE	ED-14G	Environmental Conditions and Test Procedures for Airborne Equipment	May 2011
EUROCAE	ED-98C	User Requirements for Terrain and Obstacle Data	October 2015
EUROCAE	ED-80	Design Assurance Guidance for Airborne Electronic Hardware	April 2000
EUROCAE	ED-98C	User Requirements for Terrain and Obstacle Data	October 2015
EUROCAE	ED-76A	Standards for Processing Aeronautical Data	June 2015
EUROCAE	ED-249	Minimum Aviation System Performance Standards (MASPS) for	January 2018

Source	Ref	Title	Date
		Aircraft State Awareness Synthetic Vision Systems	
FAA	AC 25-11B	Electronic Flight Displays	07.10.14
FAA	AC 29-2C MG 18	Helicopter Terrain Awareness and Warning System (HTAWS)	27.02.14
FAA	AC 20-167A	Airworthiness Approval of Enhanced Vision System, Synthetic Vision System, Combined Vision System, and Enhanced Flight Vision System Equipment	06.12.16
SAE	ARP5288	Transport Category Airplane Head Up Display (HUD) Systems	-
SAE	ARP6377 draft	Behavioral Engineering Technology Recommended Practices for Implementation of Head Worn Displays	-
SAE	ARP6023	Human Engineering Considerations for Implementing Enhanced SVS in Vertical Flight capable platforms	Sept 13
CICTT	CICTT – Phase of Flight - 1.3	Phase of Flight – Definitions and Usage Notes	April 2013

NOTE: *FAA AC 25-11B applies to Part 25 aircraft, but useful guidance may be found in it for part 23, part 27 and part 29 aircraft.*

CHAPTER 2

APPROACH AND METHODOLOGY

The efforts of EUROCAE Working Group 79 ("WG-79") began with an exhaustive consultation of stakeholders of the helicopter community in order to identify current operational characteristics and limitations in degraded visibility.

Rules and regulations applying to various types of helicopter operations were collected and studied, and limitations due to degraded visibility identified.

An internal report of EUROCAE WG-79 document was produced entitled "Current Rotorcraft Operations and the Impact of Reduced Visibility Conditions". This document describes different types of helicopter missions and the impact on those missions from the perspective of reduced visibility conditions. This document was produced in order to describe the baseline of today's concept of operations, with a view to improve capability and reduce risk in different phases of flight, by means of an avionics-based vision system. This document was not intended to suggest or develop the vision systems that might aid said operations, but rather to describe the visual aspects of how today's operations are conducted, so that future operational concept and vision systems MASPS might be deployed to address today's vision limitations. The document was organized loosely to match the European regulatory structure, from most regulated to least regulated operations. The document did not cover military operations, except for SAR and law enforcement, which are classified as (para)military in some countries. Military helicopter operating a civil mission under civilian rules will be covered in the corresponding civilian mission section. Readers interested in military helicopter operations should refer to NATO Industrial Advisory Group (NIAG) studies from Study Group 167 (SG-167) and Study Group 193 (SG-193). This document was produced in accordance with the EUROCAE WG-79 Terms of Reference current at the time of release.

The present document was developed to address augmentation of situation awareness for helicopter operations based on Visual Systems. Recommendations and requirements were developed around the identified helicopter operational paradigms by a team of subject matter experts and reviewed and discussed in many public sessions by a large group consisting of the membership of RTCA SC-213 and EUROCAE WG-79. A formal comment period was declared during which 351 comments were received, evaluated and disposed of by the group in public discussions. The document represents a consensus of best practices for this type of visual systems on today's helicopter platforms.

CHAPTER 3

SYSTEM PERFORMANCE REQUIREMENTS

3.1 INTRODUCTION

3.1.1 Definition

In order to deal with the particular needs of helicopter operations, for which such a system could provide operational benefit in all the phases of flight, the CVS definition provided by ED-179 (§ 1.2.1.3) should be amended:

"A CVS is a combination of synthetic and enhanced sensor systems, which includes database-driven synthetic vision images combined with real-time sensor images or detections superimposed and correlated on the same display. Symbology is often overlaid on the visual representation to indicate the aircraft state, provide primary flight information and/or to augment the visual scene. "

NOTE 1: *Synthetic vision images are built from databases, which usually describe terrain, obstacles, aeronautical data (such as but not limited to airports / heliports / runways / helipads) and possibly any kind of information deemed relevant to helicopter operations. The actual synthetic data to be used will depend on the particular functions supported by the systems.*

NOTE 2: *Real-time sensors considered in this document are 2D imagery sensors and 3D sensors (regardless of the technology). There is no assumption in this document regarding the number and technology of the sensors being used by the CVS.*

NOTE 3: *This document is not intended to define the way the several data sources are combined. For example, the combination may be automated or manually controlled, it may be performed at data level or at image level or both. The intent of the combination is to benefit from the capabilities of each source to provide the crew with an image as good as possible whatever the visual conditions.*

The following figure presents the diagram of a generic CVS:

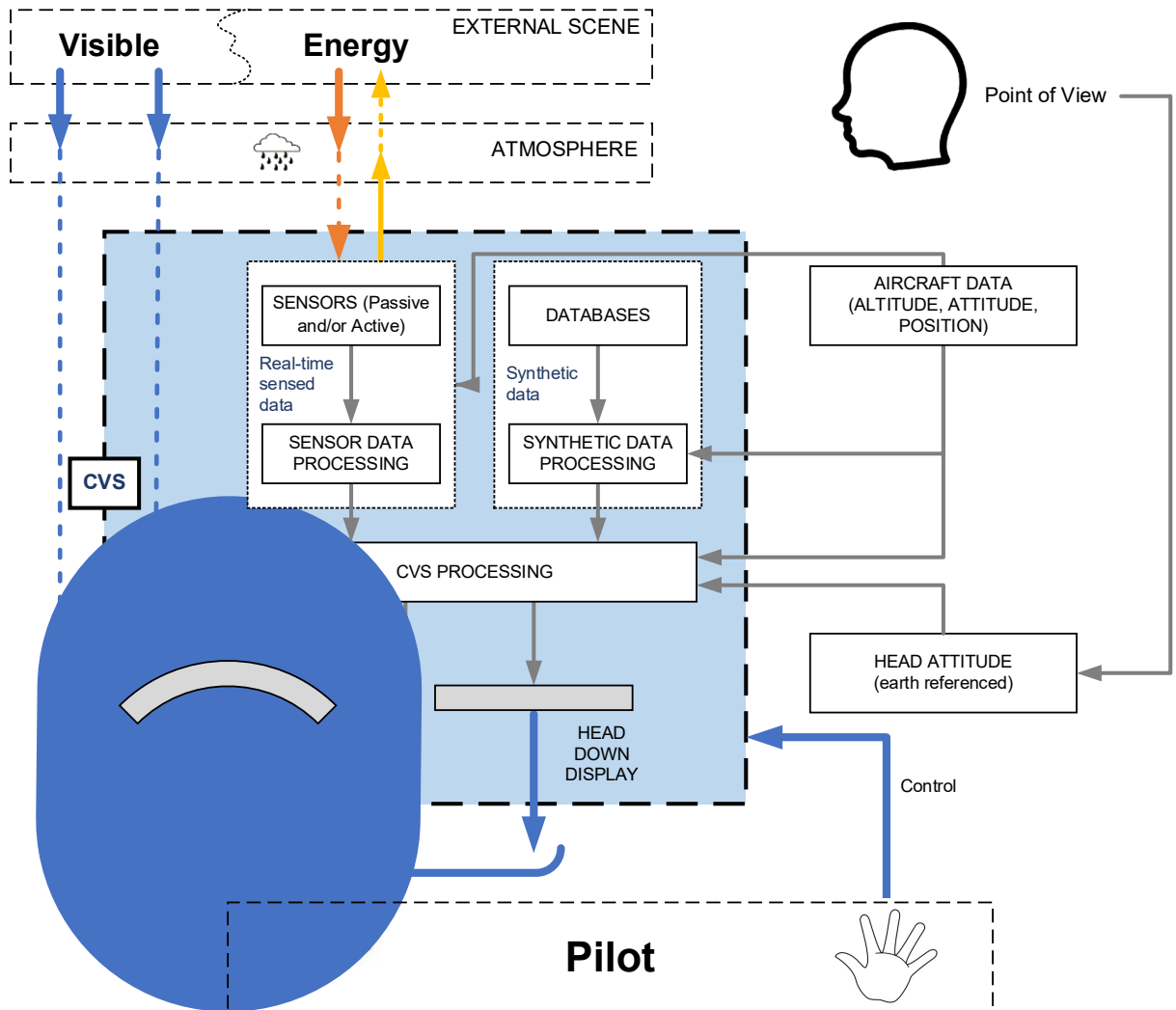


FIGURE 3-1: CVS DIAGRAM

NOTES:

- CVS is the whole system that contains a synthetic data source, one or several sensors which acquire real-time data, a way to combine them together, and a display means to the pilot, which can be either head-down or head-up (in this case it has to be a transparent display) or both.
- The transparent display is a head-worn or aircraft-attached display designed to allow the image and symbology to augment the external scene.
- In the case of a head-worn / head-mounted display, a conformal image is computed using the point of view of the pilot when looking at the external scene. Then, the head attitude with regard to the earth is required to properly build the image.
- "Sensor Data Processing" processes the data from the sensors to prepare them for the CVS processing which performs the combination with synthetic data.
- "Synthetic Data Processing" extracts from the database and processes the synthetic data to make it available for the combination.
- "CVS Processing" performs the combination from the several data sources and builds the image to be displayed to the pilot. There is in this document no assumption regarding the nature of the data that is combined (image, 3D data...).

- *Some sensors may need the altitude, aircraft position and/or attitude for the acquisition stage (e.g. to orient a directional sensor) or for the processing.*
- *The CVS will have controls for the pilot (e.g. controlling one or more sensors, controlling SVS, controlling the combination between sources, controlling display settings).*
- *“Aircraft Data” contains the complete position (latitude, longitude and altitude) of the aircraft, its attitude (pitch, roll and heading), its track, and possibly other data (e.g. speed) as required by a particular implementation.*

This standard applies to a system that combines database-driven and sensor-driven information. It is recognized that the system may allow the temporary removal of one of the information sources. While there are SVS and EVS systems for helicopter, helicopter-specific standards for such systems are not published.

3.1.2 Helicopter Operations

Helicopter operations are very diverse and can be classified as follows according to regulation:

- Commercial Air Transport Operations:
 - Offshore
 - Onshore
 - Operations with Specific Approvals:
 - Helicopter Emergency Medical Service (HEMS) (under FAA definition, this is "Helicopter Air Ambulance Services")
 - Helicopter operations with aid of Night vision imaging Systems (NVIS)
 - Helicopter Hoist Operations
 - Helicopter External-Load Operations
 - Air Tours Operations
- Commercial Specialized Operations, including agriculture, construction, photography, surveying, observation and patrol, aerial advertisement, powerline and pipeline inspection
- Search And Rescue (SAR) operations:
 - Maritime
 - Mountain
 - Land mass regions
- Law enforcement
- Firefighting
- Other helicopter operations (e.g. helicopter tourism).

Common operational features of helicopter missions are:

- Majority of flight operations conducted under VFR (as compared to IFR)
- Majority of flights conducted at low flight levels/altitudes (< 14'000ft) and often close to terrain and obstacles even during the en-route phase
 - When IFR flights are conducted they are in degraded visual conditions (e.g. at night and/or in areas where weather conditions are uncertain and possibly close to VMC minima, or atmospheric conditions such as smoke, smog, haze)
- IFR flights on specific helicopter routes such as Point-In-Space procedures (departure and arrival) from/to VFR airfields, with a visual segment
- Operations in and out of unprepared and unsurveyed landing sites, often without any ground infrastructure and limited space. Condition of landing surface often unknown and assessed visually from the air (slope, profile).

- Steep approach and departure profiles dictated by obstacles or operational reasons, resulting in flight path vectors differing from the helicopter's longitudinal axis, thus requiring a large field-of-regard
- Complex missions with high cognitive workload (e.g., several simultaneous audio inputs and communication, coordination between flight crew and assisting air or ground crew, precise manual flying, assessment of changing environment, time constraints, low power margin).

These operational features drive requirements of the CVS that are detailed within this Chapter and Chapter 4.

3.1.3

Intended function

The intended function (IF) of the Helicopter CVS is to provide a supplemental view of the external scene; that, along with flight symbology, will improve awareness of terrain, obstacles, and relevant cultural features, and enhance pilot orientation and ability to maintain control of the aircraft during all phases of flight. Additional intended functions in various phases of flight may be defined and demonstrated by the applicant to be acceptable. Examples are provided in [TABLE 3-1](#) and [TABLE 3-2](#).

TABLE 3-1: INTENDED FUNCTIONS (VFR FLIGHT)

VFR Flight		
Any Phase	IF-101	During the day, at VFR weather minimums, to provide visual references to assist the pilot in the perception of aircraft attitude and motion, which may reduce the risk of loss of control.
	IF-102	During the day in minimum VFR weather minimums, provide visual references to facilitate short-term navigation.
	IF-103	At night, provide perspective graphical terrain and obstacle information to augment external scene cues when operating in the dark over areas with few natural or cultural ground references.
	IF-105	Provide supplemental view of surrounding environment to maintain awareness of terrain and man-made objects in low altitude flight.
Taxi	IF-111	Provide a supplemental view of the external scene to provide the crew with an awareness of environment - taxiways, runways and obstacles are of particular interest
Take-Off & Initial Climb	IF-121	Provide a supplemental view of the external scene to provide the crew with an awareness of environment, mainly terrain and obstacles to reduce risk of CFIT.
En Route	IF-132	Provide a supplemental view of the external scene to provide the crew with an awareness of environment, mainly terrain and obstacles to reduce risk of CFIT.
Approach Landing	IF-141	Enable the pilot to maintain awareness of intended landing zone during approach and landing.
	IF-142	On short final, assist with the acquisition of visual references used when landing the aircraft.
	IF-143	Provide a supplemental view of the external scene to provide the crew with an awareness of environment, mainly terrain and obstacles to reduce risk of CFIT. Support awareness of off-runway path to parking.

Maneuvering	IF-151	In both day and night, in normal or degraded visual conditions, but limited to VMC, assist the pilot in the aircraft attitude perception, position awareness and lateral/longitudinal drift from ground reference.
-------------	--------	--

TABLE 3-2: INTENDED FUNCTIONS (IFR FLIGHT)

IFR Flight		
Approach & Landing	IF-042	On the final approach segment provide visual references to help the transition from instrument to visual segment.

The Appendix D provides typical / recommended visual references that a CVS should provide in order to support the intended functions detailed here above.

3.2 CVS INTEGRATION REQUIREMENTS

This section is intended to define the requirements related to the functional integration of the CVS in the cockpit.

Many requirements are common to the different types of displays, while some of them are specific to one type. Each requirement in this section is tagged to indicate to what display type it applies.

Interoperability with other systems is addressed in Chapter 4.

3.2.1 Aircraft environment

R-11030	Aircraft environment
The system shall be shown to perform its intended function in each environmental condition where system approval is desired.	
<i>Rationale</i>	<i>From DO-315B / ED-179B - § 2.1.1</i>
<i>Comment</i>	<i>For example, if the system is intended to perform in (or after exposure to) known icing conditions, a means may be required to keep the EVS sensor window clear of ice accretion.</i>
<i>Intended Functions</i>	<i>All</i>
<i>Display</i>	<i>All</i>

3.2.2 Display Type Requirements

A Combined Vision Systems (CVS) may be incorporated into differing display types installed in the cockpit, which are:

- Primary Flight Display (PFD), either head-down or head-up,

[DO-315B / ED-179B - § 1.2.1.4.1]:

“EVS/SVS/CVS Primary Displays: EVS, SVS, or CVS functionality superimposed on the Electronic Flight Instrument System (EFIS), for example the Primary Flight Display (PFD) as installed in the flight deck. In this configuration for example, the EVS, SVS, or CVS image could be merged into the sky/ground shading of the Attitude Direction Indicator as one implementation. In addition to the traditional HDD (Head-Down Display) PFD, this type of superimposed display could also be associated with a HUD or equivalent display system using EVS, SVS, or CVS capabilities.”

A head-up PFD will be a transparent display, so that the user may still view the external scene superimposed with the CVS image. This brings several consequences:

- The CVS image may contain a depiction of real world features, which must be conformal to reality to be relevant and usable,
- The CVS image must not prevent the pilot to see outside.

Moreover, due to the particular nature of helicopter operations, HUD is not expected to be usable solution for helicopters, but transparent displays will be more likely Head Worn Displays.

- Secondary Flight Display

[DO-315B / ED-179B - § 1.2.1.4.2]:

"EVS/SVS/CSV Secondary Displays: EVS, SVS, or CVS functionality that can be selected on a Multi-Function Display (MFD) or Navigation Display (ND) as one of many stand-alone type formats available in the flight deck. In other words, an EVS, SVS, or CVS image could be one selection on the MFD, while an Electrical Synoptic, for example, could be another selection on the same MFD."

R-12020	Usage on Primary Flight Display
If Primary Flight Display is used, it shall remain subject to all applicable primary flight information rules and guidance for the category of aircraft.	
<i>Rationale</i>	<i>From DO-315B / ED-179B - § 2.1.1.1.1</i>
<i>Comment</i>	
<i>Intended Functions</i>	<i>All</i>
<i>Display</i>	<i>Primary Flight Display</i>

R-12030	CSV Image interference with other displayed function
The image or loss thereof shall not adversely affect other approved display functionality.	
<i>Rationale</i>	<i>From DO-315B / ED-179B - § 2.1.1.1.2(d)</i>
<i>Comment</i>	
<i>Intended Functions</i>	<i>All</i>
<i>Display</i>	<i>All</i>

3.2.3

Display Implementation Requirements

CSV as defined and applied by this standard are installed such that they don't qualify for additional operational credit over and above that already certified. They are installed on a non-interference basis and will meet the following two regulatory requirements; 1) that they don't create or contribute to an unsafe condition, and 2) that they perform their intended function (defined in § 3.1.3).

Combined Vision Systems (CVS) require real-time sensor(s) and display that provides the visual references supporting their intended function. They also require a terrain and obstacle database and a precision navigation position for the synthetic portion of the display. The design and installation safety levels must be appropriate for the system's intended function.

R-13010	Display of CVS status
The display status of the CVS function either through crew de-selection or resulting from a failure of one of its components (e.g. failure of one sensor, database failure, frozen image...) shall be clearly indicated or made obvious to the crew.	
<i>Rationale</i>	<i>The crew must be kept aware of the relevance, quality and reliability of the information they are using.</i>
<i>Comment</i>	<i>Note: Consideration should be given to recording the CVS display status in a flight data recorder or some form of non-volatile memory.</i>

	<i>Depending on the criticality of the intended function, the applicant may choose to remove the image.</i>
<i>Intended Functions</i>	<i>All</i>
<i>Display</i>	<i>All</i>

R-13030	Terrain and obstacle conflict
The CVS shall make obvious to the crew on transparent or head down PFD potential conflict between the trajectory and terrain or obstacle.	
<i>Rationale</i>	<i>From DO-315B / ED-179B - § 2.1.2. 2</i>
<i>Comment</i>	<i>One mechanism for making such conflicts obvious on a primary display is an earth-based flight path vector.</i> <i>Note that for helicopter at very low speed, the FPV may not be valid.</i> <i>FPV depiction is beneficial for different purposes (e.g. help alignment on an landing), this particular requirement addresses intended functions related to CFIT prevention.</i>
<i>Intended Functions</i>	<i>IF-022, IF-031, IF-043, IF-121, IF-132, IF-143</i>
<i>Display</i>	<i>Primary flight display</i>

R-13040	Image Requirements
1. Topographical features shall not intersect published approach paths. 2. The pilot's view shall not be depicted below the earth's surface.	
<i>Rationale</i>	<i>From DO-315B / ED-179B - § 2.1.2.2</i>
<i>Comment</i>	
<i>Intended Functions</i>	<i>All</i>
<i>Display</i>	<i>All</i>

R-13042	Image Requirements
The scene range from the eye position to the terrain horizon shall be sufficient so as to not be misleading to the pilot.	
<i>Rationale</i>	<i>From DO-315B / ED-179B - § 2.1.2.2</i>
<i>Comment</i>	
<i>Intended Functions</i>	<i>All</i>
<i>Display</i>	<i>All</i>

R-13043	Image Requirements
Water and sky depictions shall be clearly distinguishable.	
<i>Rationale</i>	<i>From DO-315B / ED-179B - & 2.1.2.2</i>

<i>Comment</i>	
<i>Intended Functions</i>	<i>All</i>
<i>Display</i>	<i>All</i>

3.2.4 Display conformity Requirements

The CVS image is built from different sources which are combined together.

Moreover, the CVS image may be overlaid by flight information symbology generated by other systems.

Finally, the CVS image may be displayed on a transparent display, so that the image will superimpose in the pilot's view conformally with the real world.

In order to be usable, not interfere with other systems and not adversely affect the pilot's perception of the situation, sensor image and synthetic image should be conformal. When displayed on transparent display, each image should be conformal without-the-window scene. When displayed on head-down display, the images should be consistent between each other.

NOTE: *The image displayed on a head-down display may be different from the image displayed on a transparent display depending on the direction the pilot is looking to. The image displayed on the head-down display may be not aligned with the direction the helicopter is flying.*

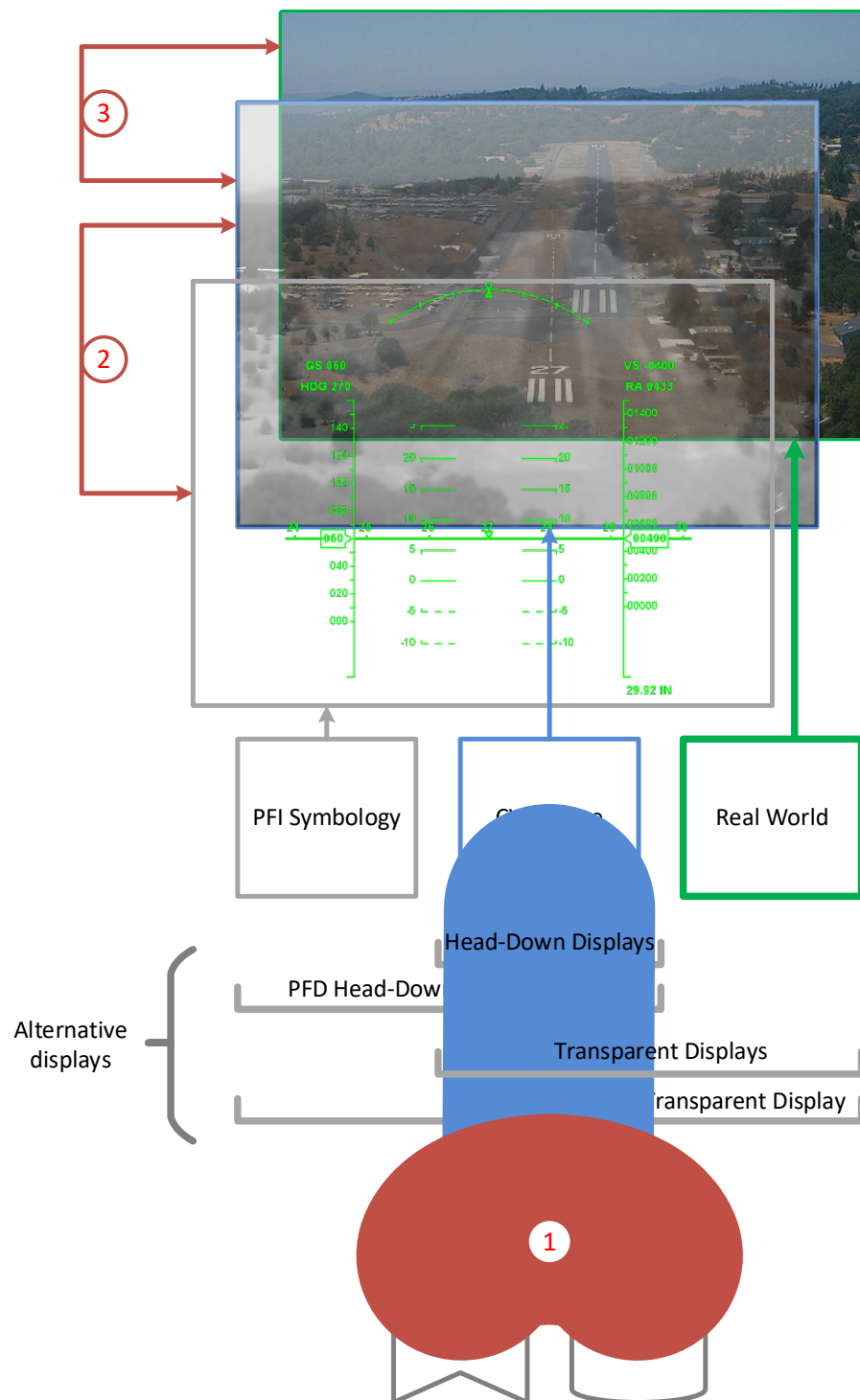
Conformal information "refers to displayed graphic information that is aligned and scaled with the outside view." ([AC 25-11B]). "Conformal means having a 1:1 angular relationship" ([SAE ARP 6023]). As a result, the degree of conformality may be quantified as the angular discrepancy between the image and the real world over which the image superimposes.

Furthermore, if two sets of conformal information are combined in the same image, they must be conformal to each other.

The conformality is affected by misregistration (due to inaccurate measure of aircraft position / attitude and/or inaccurate calibration), parallax in sensor installation and display design eye point, distortion (so the conformality is not the same at all points of the image) and latency (then the non-conformality is due to the aircraft motion between the acquisition of aircraft data and the display of the image).

If the image display is attached to the pilot's head, the conformality is also affected by the accuracy of the head position / attitude, and latency consideration also applies to the head tracking part of the system. (Latency considerations are developed in § 3.3.6.1)

The FIGURE 3-2 presents the conformality needs.



- ① Conformity between sensors and database information combined by the CVS to build the resulting image
- ② Conformity between CVS image and symbology overlaid by other avionics function (e.g. PFI)
- ③ Conformity between CVS image and real world seen through the CVS image (for Head-Up Display)

FIGURE 3-2: CONFORMALITY

R-14010	CVS image conformality with flight symbology
The CVS image shall be conformal to flight symbology where a spatial relationship exists.	
<i>Rationale</i>	<i>The purpose of conformality is to avoid the depiction to be misleading or confusing for the pilot.</i>
<i>Comment</i>	See <u>FIGURE 3-2</u> - ②. A typical symbology is the primary flight information displayed in the PFD. In this case, conformal symbology is made of FPV, attitude scales... On a transparent display, CVS image and flight symbology have to be conformal to the outside world (as a result, they will be conformal to each other).
<i>Intended Functions</i>	All
<i>Display</i>	All

R-14020	Sensed data conformality with synthetic data
The combined data (sensed data, stored onboard database) with a conformal relationship shall be sufficiently aligned so that the resulting image does not result in pilot confusion.	
<i>Rationale</i>	<i>The purpose of conformality is to not be confusing or distracting, and to not increase pilot's workload when interpreting the image.</i>
<i>Comment</i>	See <u>FIGURE 3-2</u> - ①. Depending on the technology used to combine sensed data and synthetic data, the non-conformality may have different effects on the pilot's perception. Examples are: - inconsistency at the transition (if any) between sensed data and synthetic data, - misleading or confusing depiction of an obstacle captured but not displayed at the same location by sensors and by database
<i>Intended Functions</i>	All
<i>Display</i>	All

R-14030	CVS image conformality with real world
When presented on a transparent display, the combined image (sensed data, stored onboard database) shall be conformal with the real world to sufficiently align so that the display does not result in pilot confusion.	
<i>Rationale</i>	<i>The purpose of conformality is to avoid providing the pilot with misleading information which could lead to unsafe situation and/or negatively impact pilot's decision.</i>
<i>Comment</i>	See <u>FIGURE 3-2</u> ③. Any non-conformality should not be misleading or confusing.
<i>Intended Functions</i>	All
<i>Display</i>	Transparent display

3.3 DETAILED SYSTEM REQUIREMENTS

3.3.1 System functional decomposition

Based on the CVS block diagrams (see [FIGURE 3-1](#)) previously shown in this document, the CVS functional architecture will contain the following functional elements (see [FIGURE 3-3](#)):

1. Crew interface
 - Display (Head Down or Transparent)
 - Crew Controls
 - Annunciations
2. Real-time sensed data (including sensors and data conversion)
3. Synthetic data (including databases and synthetic data processing)
4. CVS processing
5. Aircraft interface
 - Position source
 - Altitude source
 - Attitude source
 - Heading/track source

The requirements do not make assumptions on the physical architecture. In particular, requirements on the sensors function apply to acquisition and processing. Similarly, display requirements apply to display and image generation (disregarding whether the display is “smart” or “dumb”).