



交通部民用航空局 核定採用國際飛航標準

**主旨：民用航空運輸業及普通航空業之平視顯示儀或增強目視系統
(The Requirements of Head Up Display (HUD) or Enhanced
Vision System (EVS) for Civil Air Transport and General
Aviation Operations)**

發行日期： 2019.07.10	依據： 民用航空法第 41 條之 1 第 2 項； 航空器飛航作業管理規則第 113 條之 1 第 2 項及第 248 條之 1 第 2 項	編號： NO.2
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一、適用對象

民用航空運輸業及飛航國際之普通航空業飛機與直昇機。

二、說明

交通部民用航空局核定採用 ICAO Annex 6 Part I 4.2.8.1.1、6.24 及 Attachment H、ICAO Annex 6 Part II 2.2.2.2、2.4.15 及 Attachment 2.B、ICAO Annex 6 Part III, Section II 2.2.8.1.1、4.16 及 Attachment I、ICAO Annex 6 Part III, Section III 2.2.1.1、4.11 之標準。

三、符合性

民用航空運輸業及飛航國際之普通航空業之航空使用人，其飛機與直昇機裝備之平視顯示儀或增強目視系統應符合本文件第四節之規定。

四、作業標準

- (一) 民用航空運輸業飛機之平視顯示儀或增強目視系統，採用 ICAO Annex 6 Part I (第 11 版第 43 次修訂) Chapter 4, 4.2.8.1.1、Chapter 6, 6.24 及 Attachment H，如附件一。
- (二) 國際線普通航空業飛機之平視顯示儀或增強目視系統，採用 ICAO Annex 6 Part II (第 10 版第 36 次修訂) Section 2. GENERAL AVIATION OPERATIONS, Chapter 2.2, 2.2.2.2、2.4.15 及 Attachment 2.B，如附件二。
- (三) 民用航空運輸業直昇機之平視顯示儀或增強目視系統，採用 ICAO Annex 6 Part III (第 9 版第 22 次修訂) Section II INTERNATIONAL COMMERCIAL AIR TRANSPORT, Chapter 2, 2.2.8.1.1、Chapter 4, 4.16 及 Attachment I，如附件三。
- (四) 國際線普通航空業直昇機之平視顯示儀或增強目視系統，採用 ICAO Annex 6 Part III (第 9 版第 22 次修訂) Section III INTERNATIONAL GENERAL AVIATION, Chapter 2, 2.2.1.1、Chapter 4, 4.11 及 Attachment I，如附件四。
- (五) 前述核定採用 ICAO Annex 6 之作業標準僅限於平視顯示儀及增強目視系統，同文所提之自動降落系統 (automatic landing system)、合成目視系統 (synthetic vision system, SVS) 及組合目視系統 (combined vision system, CVS) 不在本文核定範圍內。然所屬航空器若具備這些功能或裝備，仍建議參考 ICAO Annex 6 之作業標準實施。

五、取代資訊

無。

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附件一 Annex 6, Operation of Aircraft Part I — International Commercial Air Transport — Aeroplanes, Chapter 4.2.8.1.1 & 6.2.4 & Attachment H

CHAPTER 4 FLIGHT OPERATIONS 4.2 OPERATIONAL CERTIFICATION AND SUPERVISION 4.2.8 Aerodrome operating minima

4.2.8.1.1 The State of the Operator may approve operational credit(s) for operations with aeroplanes equipped with automatic landing systems, a HUD or equivalent displays, EVS, SVS or CVS. Such approvals shall not affect the classification of the instrument approach procedure.

Note 1.— Operational credit includes:

- a) for the purposes of an approach ban (ICAO Annex 6 Part I, 4.4.1.2), a minima below the aerodrome operating minima;*
- b) reducing or satisfying the visibility requirements; or*
- c) requiring fewer ground facilities as compensated for by airborne capabilities.*

Note 2.— Guidance on operational credit for aircraft equipped with automatic landing systems, a HUD or equivalent displays, EVS, SVS and CVS is contained in Attachment H and in the Manual of All-Weather Operations (Doc 9365).

Note 3.— Information regarding a HUD or equivalent displays, including references to RTCA and EUROCAE documents, is contained in the Manual of All-Weather Operations (Doc 9365).

CHAPTER 6. AEROPLANE INSTRUMENTS, EQUIPMENT AND FLIGHT DOCUMENTS OPERATIONS

6.24 AEROPLANES EQUIPPED WITH AUTOMATIC LANDING SYSTEMS, A HEAD-UP DISPLAY (HUD) OR EQUIVALENT DISPLAYS, ENHANCED VISION SYSTEMS (EVS), SYNTHETIC VISION SYSTEMS (SVS) AND/OR COMBINED VISION SYSTEMS (CVS)

6.24.1 Where aeroplanes are equipped with automatic landing systems, a HUD or equivalent displays, EVS, SVS or CVS, or any combination of those systems into a hybrid system, the use of such systems for the safe operation of an aeroplane shall be approved by the State of the Operator.

Note.— Information regarding a HUD or equivalent displays, including references to RTCA and EUROCAE documents, is contained in the Manual of All-Weather Operations (Doc 9365).

6.24.2 In approving the operational use of automatic landing systems, a HUD or equivalent

displays, EVS, SVS or CVS, the State of the Operator shall ensure that:

- a) the equipment meets the appropriate airworthiness certification requirements;
- b) the operator has carried out a safety risk assessment of the operations supported by the automatic landing systems, a HUD or equivalent displays, EVS, SVS or CVS;
- c) the operator has established and documented the procedures for the use of, and training requirements for, automatic landing systems, a HUD or equivalent displays, EVS, SVS or CVS.

Note 1.— Guidance on safety risk assessments is contained in the Safety Management Manual (SMM) (Doc 9859).

Note 2.— Guidance on operational approvals is contained in Attachment H.

ATTACHMENT H. AUTOMATIC LANDING SYSTEMS, HEAD-UP DISPLAY (HUD) OR EQUIVALENT DISPLAYS AND VISION SYSTEMS

Supplementary to Chapter 4, 4.2.8.1.1, and Chapter 6, 6.24

INTRODUCTION

The material in this attachment provides guidance for certified automatic landing systems, HUD or equivalent displays and vision systems intended for operational use in aeroplanes engaged in international air navigation. These systems and hybrid systems may be installed and operated to reduce workload, improve guidance, reduce flight technical error and enhance situational awareness and/or obtain operational credits. Automatic landing systems, HUD or equivalent displays and vision systems may be installed separately or together as part of a hybrid system. Any operational credit for their use requires a specific approval from the State of the Operator.

Note 1.— “Vision systems” is a generic term referring to the existing systems designed to provide images, i.e. enhanced vision systems (EVS), synthetic vision systems (SVS) and combined vision systems (CVS).

Note 2.— Operational credit can be granted only within the limits of the airworthiness approval.

Note 3.— Currently, operational credit has been given only to vision systems containing an image sensor providing a real-time image of the actual external scene on the HUD.

Note 4.— More detailed information and guidance on automatic landing systems, HUD or equivalent displays and vision systems is contained in the Manual of All-Weather Operations (Doc 9365). This manual should be consulted in conjunction with this attachment.

1. HUD AND EQUIVALENT DISPLAYS

1.1 General

1.1.1 A HUD presents flight information into the pilot's forward external field of view without significantly restricting that external view.

1.1.2 Flight information should be presented on a HUD or an equivalent display, as required for the intended use.

1.2 Operational applications

1.2.1 Flight operations with a HUD can improve situational awareness by combining flight information located on head-down displays with the external view to provide pilots with more immediate awareness of relevant flight parameters and situation information while they continuously view the external scene. This improved situational awareness can also reduce errors in flight operations and improve the pilot's ability to transition between instrument and visual references as meteorological conditions change.

1.2.2 A HUD may be used to supplement conventional flight deck instrumentation or as a primary flight display if certified for this purpose.

1.2.3 An approved HUD may:

- a) qualify for operations with reduced visibility or reduced RVR; or
- b) replace some parts of the ground facilities such as touchdown zone and/or centre line lights.

1.2.4 The functions of a HUD may be provided by a suitable equivalent display. However, before such systems can be used, the appropriate airworthiness approval should be obtained.

1.3 HUD training

Training and recent experience requirements for operations using HUD or equivalent displays should be established by the State of the Operator. Training programmes should be approved by the State of the Operator and the implementation of the training should be subject to oversight by that State. The training should address all flight operations for which the HUD or equivalent display is used.

2. VISION SYSTEMS

2.1 General

2.1.1 Vision systems can display electronic real-time images of the actual external scene achieved through the use of image sensors, i.e. EVS, or display synthetic images, which are derived from the on-board avionic systems, i.e. SVS. Vision systems can also consist of a combination of these two systems, called combined vision systems (i.e. CVS). Such a system may display

electronic real-time images of the external scene using the EVS component of the system. The information from vision systems may be displayed head-up and/or head-down. Operational credit may be granted to vision systems which are appropriately qualified.

2.1.2 Light emitting diode (LED) lights may not be visible to infrared-based vision systems. Operators of such vision systems will need to acquire information about the LED implementation programmes at aerodromes where they intend to operate. More details about the consequences of LED lights are contained in the Manual of All-Weather Operations (Doc 9365).

2.2 Operational applications

2.2.1 Flight operations with EVS allow the pilot to view an image of the external scene obscured by darkness or other visibility restrictions. The use of EVS will also allow acquisition of an image of the external scene earlier than with natural, unaided vision, hence providing for a smoother transition to references by natural vision. The improved acquisition of an image of the external scene may improve situational awareness. It may also qualify for operational credit if the information from the vision system is presented to the pilots in a suitable way and the necessary airworthiness approval and specific approval by the State of the Operator have been obtained for the combined system.

2.2.2 Vision system imagery may also enable pilots to detect other aircraft on the ground, terrain or obstructions on or adjacent to runways or taxiways.

2.3 Operational concepts

2.3.1 Instrument approach operations include an instrument phase and a visual phase. The instrument phase ends at the published MDA/H or DA/H unless a missed approach is initiated. Using the EVS or CVS does not change the applicable MDA/H or DA/H. The continued approach to landing from MDA/H or DA/H will be conducted using visual references. This also applies to operations with vision systems. The difference is that the visual references will be acquired by use of an EVS or CVS, natural vision or the vision system in combination with natural vision (see Figure H-1).

2.3.2 Down to a defined height in the visual segment, typically at or above 30 m (100 ft), the visual references may be acquired solely by means of the vision system. The defined height depends on the airworthiness approval and specific approval by the State of the Operator. Below this height the visual references should be solely based on natural vision. In the most advanced applications, the vision system may be used down to touchdown without the requirement for natural vision acquisition of visual references. This means that such a vision system may be the sole means of acquiring visual references and can be used without natural vision.

2.4 Vision systems training

Training and recent experience requirements should be established by the State of the Operator. Training programmes should be approved by the State of the Operator and the implementation of the training should be subject to oversight by that State. Training should address all flight operations for which the vision system is used.

2.5 Visual references

2.5.1 In principle, the required visual references do not change due to the use of an EVS or CVS, but those references are allowed to be acquired by means of either vision system until a certain height during the approach as described in 2.3.1.

2.5.2 In States that have developed requirements for operations with vision systems, the use of visual references have been regulated and examples of this are provided in the Manual of All-Weather Operations (Doc 9365).

EVS operations

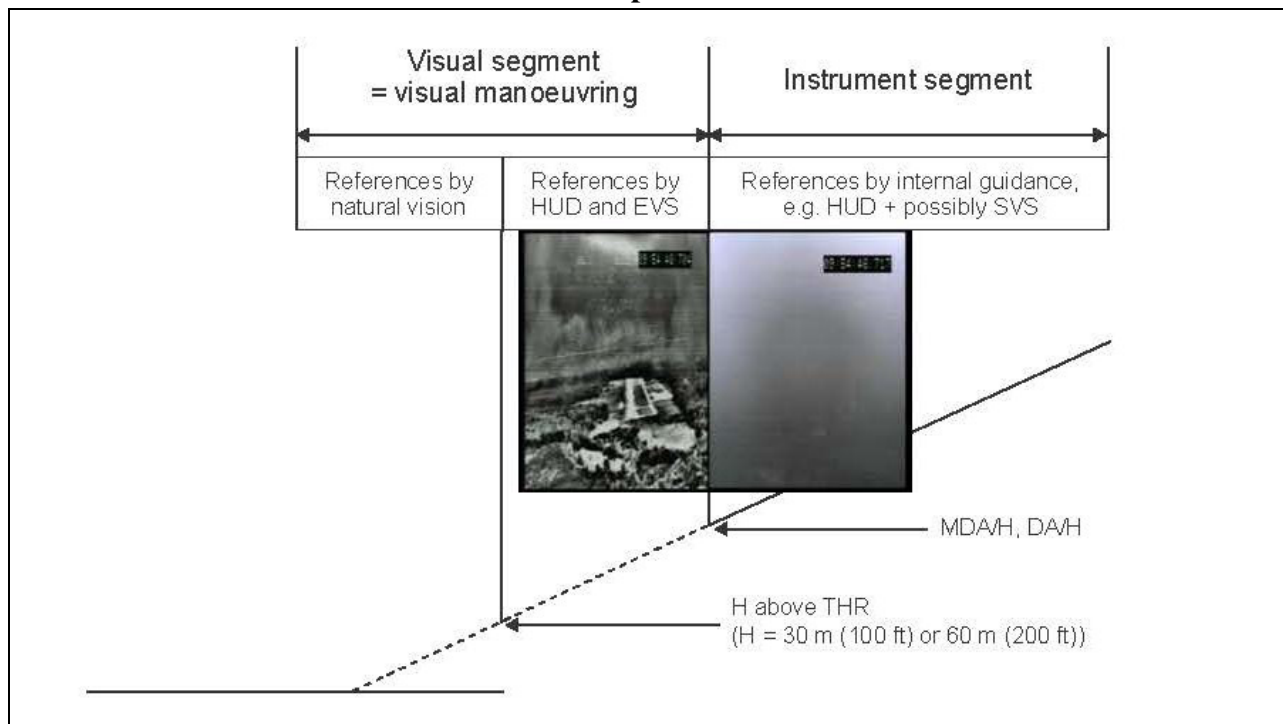


Figure H-1. EVS operations — transition from instrument to visual references

3. HYBRID SYSTEMS

A hybrid system generically means that two or more systems are combined. The hybrid system typically has improved performance compared to each of the component systems, which in turn may qualify for operational credit. The inclusion of more systems in the hybrid system normally enhances the performance of the system. The Manual of All-Weather Operations (Doc 9365) contains some examples of hybrid systems.

4. OPERATIONAL CREDITS

4.1 Aerodrome operating minima are expressed in terms of minimum visibility/RVR and MDA/H or DA/H. When aerodrome operating minima are established, the combined capability of the aeroplanes equipment and on-ground infrastructure should be taken into account. Better equipped aeroplanes may be able to operate into lower natural visibility conditions, lower DA/H and/or operate with less ground infrastructure. Operational credit means that the aerodrome operating minima may be reduced in case of suitably equipped aeroplanes. Another way to grant operational credit is to allow visibility requirements to be fulfilled, wholly or partly, by means of the on-board systems. HUD, automatic landing or vision systems, which were not available at the time when the criteria for aerodrome operating minima were originally established.

4.2 The granting of operational credits does not affect the classification (i.e. Type or Category) of an instrument approach procedure since they are designed to support instrument approach operations conducted using aeroplanes with the minimum equipment prescribed.

4.3 The relation between the procedure design and the operation can be described as follows. The OCA/H is the end product of the procedure design which does not contain any RVR or visibility values. Based on the OCA/H and all the other elements such as available runway visual aids, the operator will establish MDA/H or DA/H and RVR/visibility, i.e. the aerodrome operating minima. The values derived should not be less than those prescribed by the State of the Aerodrome.

5. OPERATIONAL PROCEDURES

In accordance with Chapter 6, 6.24.2 the operator should develop suitable operational procedures associated with the use of an automatic landing system, a HUD or an equivalent display, vision systems and hybrid systems. These procedures should be included in the operations manual and cover at least the following:

- a) limitations;
- b) operational credits;
- c) flight planning;
- d) ground and airborne operations;
- e) crew resource management;
- f) standard operating procedures; and
- g) ATS flight plans and communication.

6. APPROVALS

6.1 General

Note.— When the application for a specific approval relates to operational credits for systems not including a vision system, the guidance on approvals in this attachment may be used to the extent applicable as determined by the State of the Operator.

6.1.1 The operator that wishes to conduct operations with an automatic landing system, a HUD or an equivalent display, a vision system or a hybrid system will need to obtain certain approvals as prescribed in the relevant SARPs. The extent of the approvals will depend on the intended operation and the complexity of the equipment.

6.1.2 Systems that are not used for an operational credit or otherwise critical to the aerodrome operating minima, e.g. vision systems used to enhance situational awareness may be used without a specific approval. However, the standard operating procedures for these systems should be specified in the operations manual. An example of this type of operation may include an EVS or an SVS on a head-down display that is used only for situational awareness of the surrounding area of the aeroplane during ground operations where the display is not in the pilot's primary field of view. For enhanced situational awareness, the installation and operational procedures need to ensure that the operation of the vision system does not interfere with normal procedures or the operation or use of other aeroplane systems. In some cases, modifications to these normal procedures for other aeroplane systems or equipment may be necessary to ensure compatibility.

6.1.3 The Standard in Chapter 6, 6.24.1, requires that the use of an automatic landing system, a HUD or an equivalent display, EVS, SVS or CVS or any combination of those systems into a hybrid system, should be approved by the State of the Operator when those systems are used “for the safe operation of an aeroplane”. When operational credits are granted by the State of the Operator as per the Standard in Chapter 4, 4.2.8.1.1, the use of that system becomes essential for the safety of such operations and is subject to a specific approval. The use of these systems solely for enhanced situational awareness, reduced flight technical error and/or reduced workload is an important safety feature, but does not require a specific approval.

6.1.4 Any operational credit that has been granted should be reflected in the operation specifications for the type or individual aeroplane as applicable.

6.2 Specific approvals for operational credit

6.2.1 To obtain a specific approval for operational credit, the operator will need to specify the desired operational credit and submit a suitable application. The content of a suitable application should include:

- a) *Applicant details.* The AOC holder's company name, AOC number and email.
- b) *Aircraft details.* Aircraft make(s), model(s) and registration mark(s).

- c) *Operator's vision system compliance list.* The contents of the compliance list are included in the Manual of All-Weather Operations (Doc 9365). The compliance list should include the information that is relevant to the specific approval requested and the registration marks of the aircraft involved. If more than one type of aircraft/fleet is included in a single application, a completed compliance list should be included for each aircraft/fleet.
- d) *Documents to be included with the application.* Copies of all documents to which the operator has made references should be included in the application. There should be no need to send complete manuals; only the relevant sections/pages should be required. Additional guidance material can be found in the Manual of All-Weather Operations (Doc 9365).
- e) *Name, title and signature.*

6.2.2 The following items should be covered in a vision systems compliance list:

- a) reference documents used in compiling the submission for approval;
- b) flight manual;
- c) feedback and reporting of significant problems;
- d) requested operational credit and resulting aerodrome operating minima;
- e) operations manual entries including MEL and standard operating procedures;
- f) safety risk assessments;
- g) training programmes; and
- h) continuing airworthiness.

Expanded guidance on these items is contained in the Manual of All-Weather Operations (Doc 9365).

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**附件二 Annex 6, Operation of Aircraft Part II — International
General Aviation — Aeroplanes SECTION 2. GENERAL AVIATION
OPERATIONS, Chapter 2.2.2.2 & 2.4.15 & Attachment 2.B**

CHAPTER 2.2 FLIGHT OPERATIONS

2.2.2 Operational management

2.2.2.2 Aerodrome operating minima

2.2.2.2.1.1 The State of Registry may approve operational credit(s) for operations with aeroplanes equipped with automatic landing systems, a HUD or equivalent displays, EVS, SVS or CVS. Such approvals shall not affect the classification of the instrument approach procedure.

Note 1.— Operational credit includes:

- a) for the purposes of an approach ban (ICAO Annex 6, Part II, 2.2.4.1.2), a minima below the aerodrome operating minima;*
- b) reducing or satisfying the visibility requirements; or*
- c) requiring fewer ground facilities as compensated for by airborne capabilities.*

Note 2.— Guidance on operational credit for aircraft equipped with automatic landing systems, a HUD or equivalent displays, EVS, SVS and CVS is contained in Attachment 2.B and in the Manual of All-Weather Operations (Doc 9365).

Note 3.— Information regarding a HUD or equivalent displays, including references to RTCA and EUROCAE documents, is contained in the Manual of All-Weather Operations (Doc 9365).

**CHAPTER 2.4 AEROPLANE INSTRUMENTS, EQUIPMENT AND FLIGHT
DOCUMENTS**

2.4.15 Aeroplanes equipped with automatic landing systems, a head-up display (HUD) or equivalent displays, enhanced vision systems (EVS), synthetic vision systems (SVS) and/or combined vision systems (CVS)

2.4.15.1 Where aeroplanes are equipped with automatic landing systems, a HUD or equivalent displays, EVS, SVS or CVS, or any combination of those systems into a hybrid system, criteria for the use of such systems for the safe operation of an aeroplane shall be established by the State of Registry.

Note.— Information regarding a HUD or equivalent displays, including references to RTCA and EUROCAE documents, is contained in the Manual of All-Weather Operations (Doc 9365).

2.4.15.2 In establishing operational criteria for the use of automatic landing systems, a HUD or equivalent displays, EVS, SVS or CVS, the State of Registry shall ensure that:

- a) the equipment meets the appropriate airworthiness certification requirements;
- b) the operator/owner has carried out a safety risk assessment associated with the operations supported by the automatic landing systems, a HUD or equivalent displays, EVS, SVS or CVS;
- c) the operator/owner has established and documented the procedures for the use of, and training requirements for, automatic landing systems, a HUD or equivalent displays, EVS, SVS or CVS.

Note 1.— Guidance on safety risk assessments is contained in the Safety Management Manual (SMM) (Doc 9859).

Note 2.— Guidance on establishing operational criteria is contained in Attachment 2.B.

ATTACHMENT 2.B

AUTOMATIC LANDING SYSTEMS, HEAD-UP DISPLAY (HUD) OR EQUIVALENT DISPLAYS AND VISION SYSTEMS

Supplementary to 2.2.2.2 and 2.4.15

INTRODUCTION

The material in this attachment provides guidance for certified automatic landing systems, HUD or equivalent displays and vision systems intended for operational use in aircraft engaged in international air navigation. These systems and hybrid systems may be installed and operated to reduce workload, improve guidance, reduce flight technical error and enhance situational awareness and/or obtain operational credits. Automatic landing systems, HUD or equivalent displays and vision systems may be installed separately or together as part of a hybrid system. Any operational credit for their use requires a specific approval from the State of Registry.

Note 1.— “Vision systems” is a generic term referring to the existing systems designed to provide images, i.e. enhanced vision systems (EVS), synthetic vision systems (SVS) and combined vision systems (CVS).

Note 2.— Operational credit can be granted only within the limits of the airworthiness approval.

Note 3.— Currently, operational credit has been given only to vision systems containing an image sensor providing a real-time image of the actual external scene on the HUD.

Note 4.— More detailed information and guidance on automatic landing systems, HUD or equivalent displays and vision systems is contained in the Manual of All-Weather Operations (Doc 9365). This manual should be consulted in conjunction with this attachment.

1. HUD AND EQUIVALENT DISPLAYS

1.1 General

1.1.1 A HUD presents flight information into the pilot's forward external field of view without significantly restricting that external view.

1.1.2 Flight information should be presented on a HUD or an equivalent display, as required for the intended use.

1.2 Operational applications

1.2.1 Flight operations with a HUD can improve situational awareness by combining flight information located on head-down displays with the external view to provide pilots with more immediate awareness of relevant flight parameters and situation information while they continuously view the external scene. This improved situational awareness can also reduce errors in flight operations and improve the pilot's ability to transition between instrument and visual references as meteorological conditions change.

1.2.2 A HUD may be used to supplement conventional flight deck instrumentation or as primary flight displays if certified for this purpose.

1.2.3 An approval HUD may:

- a) qualify for operations with reduced visibility or reduced RVR; or
- b) replace some parts of the ground facilities such as touchdown zone and/or centre line lights.

1.2.4 The functions of a HUD may be provided by a suitable equivalent display. However, before such systems can be used, the appropriate airworthiness approval should be obtained.

1.3 HUD training

Training and recent experience requirements for operations using HUD or equivalent displays should be established by the State of Registry. The training should address all flight operations for which the HUD or equivalent display is used.

2. VISION SYSTEMS

2.1 General

2.1.1 Vision systems can display electronic real-time images of the actual external scene achieved through the use of image sensors, i.e. EVS, or display synthetic images, which are derived from the on-board avionic systems, i.e. SVS. Vision systems can also consist of a combination of these two systems called combined vision systems (CVS). Such a system may display electronic

real-time images of the external scene using the EVS component of the system. The information from vision systems may be displayed head-up and/or head-down. Operational credit may be granted to vision systems which are appropriately qualified.

2.1.2 Light emitting diode (LED) lights may not be visible to infrared-based vision systems. Operators of such vision systems will need to acquire information about the LED implementation programmes at aerodromes where they intend to operate. More details about the consequences of LED lights are contained in the Manual of All-Weather Operations (Doc 9365).

2.2 Operational applications

2.2.1 Flight operations with EVS allow the pilot to view an image of the external scene obscured by darkness or other visibility restrictions. The use of EVS will also allow acquisition of an image of the external scene earlier than with natural, unaided vision, hence providing for a smoother transition to references by natural vision. The improved acquisition of an image of the external scene may improve situational awareness. It may also qualify for operational credit if the information from the vision system is presented to the pilots in a suitable way and the necessary airworthiness approval and specific approval by the State of Registry have been obtained for the combined system.

2.2.2 Vision system imagery may also enable pilots to detect other aircraft on the ground, terrain or obstructions on or adjacent to runways or taxiways.

2.3 Operational concepts

2.3.1 Instrument approach operations include an instrument phase and a visual phase. The instrument phase ends at the published MDA/H or DA/H unless a missed approach is initiated. Using the EVS or CVS does not change the applicable MDA/H or DA/H. The continued approach to landing from MDA/H or DA/H will be conducted using visual references. This also applies to operations with vision systems. The difference is that the visual references will be acquired by use of an EVS or CVS, natural vision or the vision system in combination with natural vision.

EVS OPERATIONS

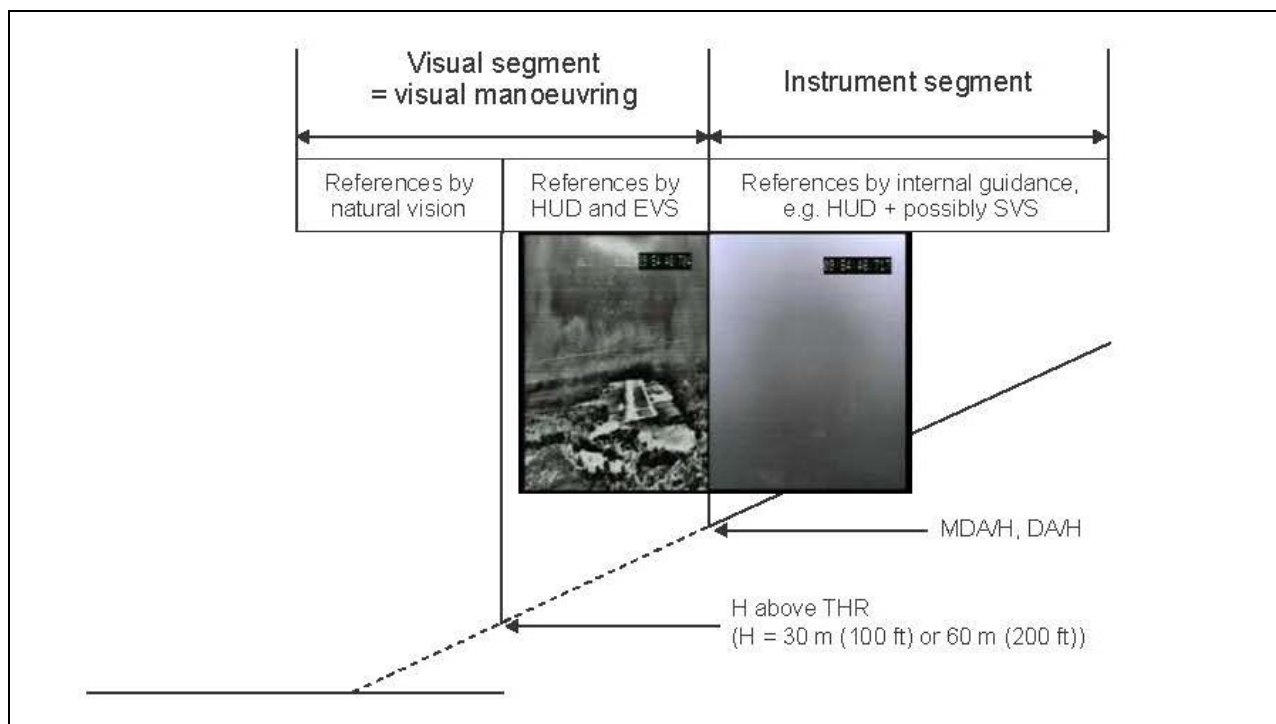


Figure 2.B-1. EVS operations — transition from instrument to visual references

2.3.2 Down to a defined height in the visual segment, typically at or above 30 m (100 ft), the visual references may be acquired solely by means of the vision system. The defined height depends on the airworthiness approval and specific approval by the State of Registry. Below this height the visual references should be solely based on natural vision. In the most advanced applications, the vision system may be used down to touchdown without the requirement for natural vision acquisition of visual references. This means that such a vision system may be the sole means of acquiring visual references and can be used without natural vision.

2.4 Vision systems training

Training and recent experience requirements should be established by the State of Registry. Training should address all flight operations for which the vision system is used.

2.5 Visual references

2.5.1 In principle, the required visual references do not change due to the use of an EVS or CVS, but those references are allowed to be acquired by means of either vision system until a certain height during the approach as described in 2.3.2.

2.5.2 In States that have developed requirements for operations with vision systems, the use of visual references have been regulated and examples of this are provided in the Manual of All-Weather Operations (Doc 9365).

3. HYBRID SYSTEMS

A hybrid system generically means that two or more systems are combined. The hybrid system typically has improved performance compared to each of the component systems, which in turn may qualify for operational credit. The inclusion of systems in the hybrid system normally enhances the performance of the system. The Manual of All-Weather Operations (Doc 9365) contains some examples of hybrid systems.

4. OPERATIONAL CREDITS

4.1 Aerodrome operating minima are expressed in terms of minimum visibility/RVR and MDA/H or DA/H. When aerodrome operating minima are established, the combined capability of the aircraft equipment and on-ground infrastructure should be taken into account. Better equipped aircraft may be able to operate into lower natural visibility conditions, lower DA/H and/or operate with less ground infrastructure. Operational credit means that the aerodrome operating minima may be reduced in case of suitably equipped aircraft. Another way to grant operational credit is to allow visibility requirements to be fulfilled, wholly or partly, by means of the on-board systems. HUD, automatic landing or vision systems, which were not available at the time the criteria for aerodrome operating minima were originally established.

4.2 The granting of operational credits does not affect the classification (i.e. Type or Category) of an instrument approach procedure since they are designed to support instrument approach operations conducted with aircraft with the minimum equipment prescribed.

4.3 The relation between the procedure design and the operation can be described as follows. The OCA/H is the end product of the procedure design, which does not contain any RVR or visibility values. Based on the OCA/H and all the other elements such as available runway visual aids, the operator will establish MDA/H or DA/H and RVR/visibility, i.e. the aerodrome operating minima. The values derived should not be less than those that may be prescribed by the State of the Aerodrome.

5. OPERATIONAL PROCEDURES

In accordance with Chapter 2.4, 2.4.15.2, the operator should develop suitable operational procedures associated with the use of an automatic landing system, a HUD or an equivalent display, vision systems and hybrid systems. These procedures should be included in the operations manual and cover at least the following:

- a) limitations;
- b) operational credits;
- c) flight planning;

- d) ground and airborne operations;
- e) crew resource management;
- f) standard operating procedures; and
- g) ATS flight plans and communication.

6. APPROVALS

6.1 General

Note.— When the application for a specific approval relates to operational credits for systems not including a vision system, the guidance on approvals in this attachment may be used to the extent applicable as determined by the State of Registry.

6.1.1 The operator that wishes to conduct operations with an automatic landing system, a HUD or equivalent display, vision system or hybrid system will need to meet certain criteria and, in some instances, obtain specific approvals (see Chapter 2.2, 2.2.2.2 and Chapter 2.4, 2.4.15). The extent of the approvals will depend on the intended operation and the complexity of the equipment.

6.1.2 Systems may be used to improve situational awareness without a specific approval. However, the standard operating procedures for these systems should be specified in the operations manual or equivalent document. An example of this type of operation may include an EVS or an SVS on a head-down display that is used only for situational awareness of the surrounding area of the aircraft during ground operations where the display is not in the pilot's primary field of view. For enhanced situational awareness, the installation and operational procedures need to ensure that the operation of the vision system does not interfere with normal procedures or the operation or use of other aircraft systems. In some cases, modifications to these normal procedures for other aircraft systems or equipment may be necessary to ensure compatibility.

6.1.3 Chapter 2.2, 2.2.2.2.1.1 states that operational credits based on the use of an automatic landing system, a HUD or an equivalent display, EVS, SVS or CVS or any combination of those systems into a hybrid system, should be specifically approved.

6.1.4 The Standard in Chapter 2.4, 2.4.15 requires the State of Registry to establish criteria for the use of an automatic landing system, a HUD or an equivalent display, EVS, SVS or CVS or any combination of those systems into a hybrid system "for the safe operation of an aeroplane" and specifies such criteria. When operational credits are granted by the State of Registry as per the Standard in Chapter 2.2, 2.2.2.2.1.1, the use of that system becomes essential for the safety of those operations and approval of the use of such systems is part of the operational credit specific approval. The use of these systems solely for enhanced situational awareness, reduced flight technical error and/or reduced workload is an important safety feature, but does not require a specific approval.

6.1.5 Any operational credit that has been granted should be reflected in the specific approval template and be carried on board the particular aeroplane.

6.2 Specific approvals for operational credit

6.2.1 To obtain operational credit the operator will need to specify the desired operational credit and submit an application in accordance with Chapter 2.1, 2.1.4. The content of a suitable application should include:

- a) *Applicant details.* The official name and any business or trading name(s), address, mailing address, email address and contact telephone/fax numbers of the applicant.
- b) *Aircraft details.* Aircraft make(s), model(s) and registration mark(s).
- c) *Operator's vision system compliance list.* The contents of the compliance list are included in the Manual of All-Weather Operations (Doc 9365). The compliance list should include the information that is relevant to the approval requested and the registration marks of the aircraft involved. If more than one type of aircraft/fleet is included in a single application, a completed compliance list should be included for each aircraft/fleet.
- d) *Documents to be included with the application.* Copies of all documents to which the operator has made references should be included in the application. There should be no need to send complete manuals; only the relevant sections/pages should be required. Additional guidance material can be found in the Manual of All-Weather Operations (Doc 9365).
- e) *Name, title and signature.*

6.2.2 The following items should be covered in a vision systems compliance list:

- a) reference documents used in compiling the submission for approval;
- b) flight manual;
- c) feedback and reporting of significant problems;
- d) requested operational credit and resulting aerodrome operating minima;
- e) operations manual (or an equivalent document) entries including MEL (where applicable) and standard operating procedures;
- f) safety risk assessments;
- g) training programmes; and
- h) continuing airworthiness.

Expanded guidance on these items is contained in the Manual of All-Weather Operations (Doc 9365).

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附件三 Annex 6, Operation of Aircraft Part III — International Operations — Helicopters Section II, International Commercial Air Transport, Chapter 2.2.8.1.1 & 4.16 & Attachment I

CHAPTER 2. FLIGHT OPERATIONS

2.2 Operational certification and supervision

2.2.8 Heliport or landing location operating minima

2.2.8.1.1 The State of the Operator may approve operational credit(s) for operations with helicopters equipped with automatic landing systems, a HUD or equivalent displays, EVS, SVS or CVS. Such approvals shall not affect the classification of the instrument approach procedure.

Note 1.— Operational credit includes:

- a) for the purposes of an approach ban (ICAO Annex 6, Part III, Section II, 2.4.1.2), a minima below the heliport or landing location operating minima;*
- b) reducing or satisfying the visibility requirements; or*
- c) requiring fewer ground facilities as compensated for by airborne capabilities.*

Note 2.— Guidance on operational credit for aircraft equipped with automatic landing systems, a HUD or equivalent displays, EVS, SVS and CVS is contained in Attachment I and in the Manual of All-Weather Operations (Doc 9365).

Note 3.— Information regarding a HUD or equivalent displays, including references to RTCA and EUROCAE documents, is contained in the Manual of All-Weather Operations (Doc 9365).

Note 4.— Automatic landing system — helicopter is an automatic approach using airborne systems which provide automatic control of the flight path, to a point aligned with the landing surface, from which the pilot can transition to a safe landing by means of natural vision without the use of automatic control.

CHAPTER 4. HELICOPTER INSTRUMENTS, EQUIPMENT AND FLIGHT DOCUMENTS

4.16 HELICOPTERS EQUIPPED WITH AUTOMATIC LANDING SYSTEMS, A HEAD-UP DISPLAY (HUD) OR EQUIVALENT DISPLAYS, ENHANCED VISION SYSTEMS (EVS), SYNTHETIC VISION SYSTEMS (SVS) AND/OR COMBINED VISION SYSTEMS (CVS)

4.16.1 Where helicopters are equipped with automatic landing systems, HUD or equivalent displays, EVS, SVS or CVS, or any combination of those systems into a hybrid system, the use of

such systems for the safe operation of a helicopter shall be approved by the State of the Operator.

Note 1.— Information regarding a HUD or equivalent displays, including references to RTCA and EUROCAE documents, is contained in the Manual of All-Weather Operations (Doc 9365).

Note 2.— Automatic landing system — helicopter is an automatic approach using airborne systems which provide automatic control of the flight path, to a point aligned with the landing surface, from which the pilot can transition to a safe landing by means of natural vision without the use of automatic control.

4.16.2 In approving the operational use of automatic landing systems, a HUD or equivalent displays, EVS, SVS or CVS, the State of the Operator shall ensure that:

- a) the equipment meets the appropriate airworthiness certification requirements;
- b) the operator has carried out a safety risk assessment of the operations supported by the automatic landing systems, a HUD or equivalent displays, EVS, SVS or CVS; and
- c) the operator has established and documented the procedures for the use of, and training requirements for, automatic landing systems, a HUD or equivalent displays, EVS, SVS or CVS.

Note 1.— Guidance on safety risk assessments is contained in the Safety Management Manual (SMM) (Doc 9859).

Note 2.— Guidance on operational approvals is contained in Attachment I.

ATTACHMENT I. AUTOMATIC LANDING SYSTEMS, HEAD-UP DISPLAY (HUD) OR EQUIVALENT DISPLAYS AND VISION SYSTEMS

Supplementary to Section II, Chapter 2, 2.2.8.1.1, and Chapter 4, 4.16

INTRODUCTION

The material in this attachment provides guidance for certified automatic landing systems, HUD or equivalent displays and vision systems intended for operational use in helicopters engaged in international air navigation. These systems and hybrid systems may be installed and operated to reduce workload, improve guidance, reduce flight technical error and enhance situational awareness and/or obtain operational credits. Automatic landing systems, HUD or equivalent displays and vision systems may be installed separately or together as part of a hybrid system. Any operational credit for their use by commercial air transport operators requires a specific approval from the State of the Operator, and the State of Registry for general aviation operators.

Note 1.— “Vision systems” is a generic term referring to the existing systems designed to provide images, i.e. enhanced vision systems (EVS), synthetic vision systems (SVS) and combined vision systems (CVS).

Note 2.—“Automatic landing system-helicopter” is an automatic approach using airborne systems which provide automatic control of the flight path, to a point aligned with the landing surface, from which the pilot can transition to a safe landing by means of natural vision without the use of automatic control.

Note 3.— Operational credit can be granted only within the limits of the airworthiness approval.

Note 4.— Currently, operational credit has been given only to vision systems containing an image sensor providing a real-time image of the actual external scene on the HUD.

Note 5.— More detailed information and guidance on automatic landing systems, HUD or equivalent displays and vision systems is contained in the Manual of All-Weather Operations (Doc 9365). This manual should be consulted in conjunction with this attachment.

1. HUD AND EQUIVALENT DISPLAYS

1.1 General

1.1.1 A HUD presents flight information into the pilot’s forward external field of view without significantly restricting that external view.

1.1.2 Flight information should be presented on a HUD or an equivalent display, as required for the intended use.

1.2 Operational applications

1.2.1 Flight operations with a HUD can improve situational awareness by combining flight information located on head-down displays with the external view to provide pilots with more immediate awareness of relevant flight parameters and situation information while they continuously view the external scene. This improved situational awareness can also reduce errors in flight operations and improve the pilot’s ability to transition between instrument and visual references as meteorological conditions change.

1.2.2 A HUD may be used to supplement conventional flight deck instrumentation or as a primary flight display if certified for this purpose.

1.2.3 An approved HUD may:

- a) qualify for operations with reduced visibility or reduced RVR; or
- b) replace some parts of the ground facilities such as touchdown zone and/or centre line lights.

1.2.4 The functions of a HUD may be provided by a suitable equivalent display. However, before such systems can be used, the appropriate airworthiness approval should be obtained.

1.3 HUD training

Training and recent experience requirements for operations using HUD or equivalent displays should, for commercial operators, be established by the State of the Operator and for general aviation operators by the State of Registry. For commercial air transport operations, the training programmes should be approved by the State of the Operator and the implementation of the training should be subject to oversight by that State. The training should address all flight operations for which the HUD or equivalent display is used.

2. VISION SYSTEMS

2.1 General

2.1.1 Vision systems can display electronic real-time images of the actual external scene achieved through the use of image sensors, i.e. EVS, or display synthetic images, which are derived from the on-board avionic systems, i.e. SVS. Vision systems can also consist of a combination of these two systems, called combined vision systems, i.e. CVS. Such a system may display electronic real-time images of the external scene using the EVS component of the system. The information from vision systems may be displayed head-up and/or head-down. Operational credit may be granted to vision systems which are appropriately qualified.

2.1.2 Light emitting diode (LED) lights may not be visible to infrared-based vision systems. Operators of such vision systems will need to acquire information about the LED implementation programmes at aerodromes where they intend to operate. More details about the consequences of LED lights are contained in the Manual of All-Weather Operations (Doc 9365).

2.2 Operational applications

2.2.1 Flight operations with EVS allow the pilot to view an image of the external scene obscured by darkness or other visibility restrictions. The use of EVS will also allow acquisition of an image of the external scene earlier than with natural, unaided vision, hence providing for a smoother transition to references by natural vision. The improved acquisition of an image of the external scene may improve situational awareness. It may also qualify for operational credit if the information from the vision system is presented to the pilots in a suitable way and the necessary airworthiness approval and specific approval by the State of the Operator or State of Registry have been obtained for the combined system.

2.2.2 Vision system imagery may also enable pilots to detect other aircraft on the ground, terrain or obstructions on or adjacent to runways or taxiways.

2.3 Operational concepts

2.3.1 Instrument approach operations include an instrument phase and a visual phase. The

instrument phase ends at the published MDA/H or DA/H unless a missed approach is initiated. Using the EVS or CVS does not change the applicable MDA/H or DA/H. The continued approach to landing from MDA/H or DA/H will be conducted using visual references. This also applies to operations with vision systems. The difference is that the visual references will be acquired by use of an EVS or CVS, natural vision or the vision system in combination with natural vision.

2.3.2 Down to a defined height in the visual segment, typically at or above 30 m (100 ft), the visual references may be acquired solely by means of the vision system. The defined height depends on the airworthiness approval and specific approval by the State of the Operator or State of Registry. Below this height the visual references should be solely based on natural vision. In the most advanced applications, the vision system may be used down to touchdown without the requirement for natural vision acquisition of visual references. This means that such a vision system may be the sole means of acquiring visual references and can be used without natural vision.

EVS operations

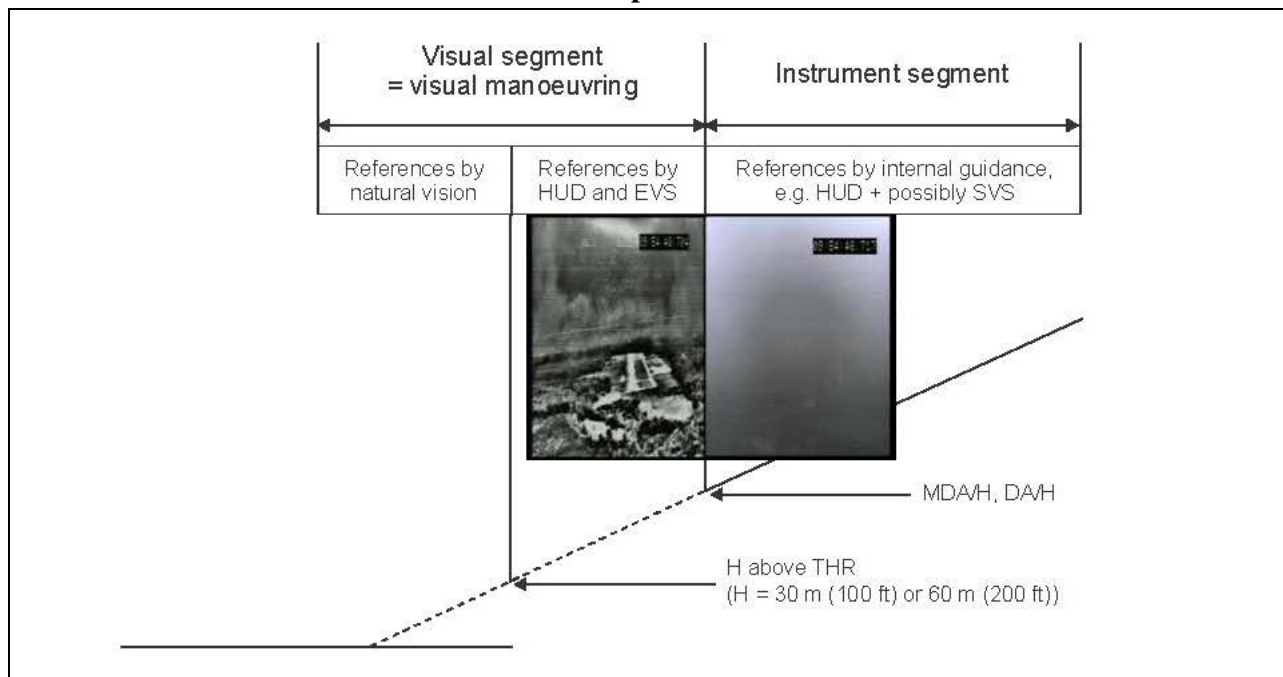


Figure I-1. EVS operations — transition from instrument to visual references

2.4 Vision systems training

Training and recent experience requirements should be established by the State of the Operator for commercial operators and the State of Registry for general aviation operators. For commercial operators, the training programmes should be approved by the State of the Operator and the implementation of the training should be subject to oversight by that State. Training should address all flight operations for which the vision system is used.

2.5 Visual references

2.5.1 In principle, the required visual references do not change due to the use of an EVS or CVS, but those references are allowed to be acquired by means of the vision system until a certain height during the approach as described in 2.3.2 (see Figure I-1).

2.5.2 In States that have developed requirements for operations with vision systems, the use of visual references have been regulated and examples of this are provided in the Manual of All-Weather Operations (Doc 9365).

3. HYBRID SYSTEMS

A hybrid system generically means that two or more systems are combined. The hybrid system typically has improved performance compared to each of the component systems, which in turn may qualify for operational credit. The inclusion of more systems in the hybrid system normally enhances the performance of the system. The Manual of All-Weather Operations (Doc 9365) contains some examples of hybrid systems.

4. OPERATIONAL CREDITS

4.1 Aerodrome operating minima are expressed in terms of minimum visibility/RVR and MDA/H or DA/H. When aerodrome operating minima are established, the combined capability of the helicopters equipment and on-ground infrastructure should be taken into account. Better equipped helicopters may be able to operate into lower natural visibility conditions, lower DA/H and/or operate with less ground infrastructure. Operational credit means that the aerodrome operating minima may be reduced in case of suitably equipped helicopters. Another way to grant operational credit is to allow visibility requirements to be fulfilled, wholly or partly, by means of the on-board systems. HUD, automatic landing or vision systems, which were not available at the time when the criteria for aerodrome operating minima were originally established.

4.2 The granting of operational credits does not affect the classification (i.e. Type or Category) of an instrument approach procedure since they are designed to support instrument approach operations conducted using helicopters with the minimum equipment prescribed.

4.3 The relation between the procedure design and the operation can be described as follows. The OCA/H is the end product of the procedure design, which does not contain any RVR or visibility values. Based on the OCA/H and all the other elements such as available runway visual aids, the operator will establish MDA/H or DA/H and RVR/visibility, i.e. the aerodrome operating minima. The values derived should not be less than those prescribed by the State of the Aerodrome.

5. OPERATIONAL PROCEDURES

In accordance with Section II, 4.16.2 and Section III, 4.11.2, the operator should develop

suitable operational procedures associated with the use of an automatic landing system, a HUD or an equivalent display, vision systems and hybrid systems. The procedures should be included in the operations manual and cover at least the following:

- a) limitations;
- b) operational credits;
- c) flight planning;
- d) ground and airborne operations;
- e) crew resource management;
- f) standard operating procedures; and
- g) ATS flight plans and communication.

6. APPROVALS

6.1 General

Note.— When the application for a specific approval relates to operational credits for systems not including a vision system, the guidance on approvals in this attachment may be used to the extent applicable as determined by the State of the Operator for commercial operators and the State of Registry for general aviation operators.

6.1.1 The operator that wishes to conduct operations with an automatic landing system, a HUD or an equivalent display, a vision system or a hybrid system will need to obtain certain approvals as prescribed in the relevant SARPs. The extent of the approvals will depend on the intended operation and the complexity of the equipment.

6.1.2 Systems that are not used for an operational credit or otherwise critical to the aerodrome operating minima, e.g. vision systems used to enhance situational awareness may be used without a specific approval. However, the standard operating procedures for these systems should be specified in the operations manual or an equivalent document. An example of this type of operation may include an EVS or an SVS on a head-down display that is used only for situational awareness of the surrounding area of the helicopter during ground operations where the display is not in the pilot's primary field of view. For enhanced situational awareness, the installation and operational procedures need to ensure that the operation of the vision system does not interfere with normal procedures or the operation or use of other aircraft systems. In some cases, modifications to these normal procedures for other helicopter systems or equipment may be necessary to ensure compatibility.

6.1.3 The Standard in Section II, 4.16, requires that for commercial air transport operations, the use of an automatic landing system, a HUD or an equivalent display, EVS, SVS or CVS or any combination of those systems into a hybrid system, should be approved when those systems are used “for the safe operation of a helicopter”. When operational credits are granted by the State of the Operator as per the Standard in Annex 6, Part I, 2.2.8.1.1, the use of that system becomes essential for the safety of such operations and is subject to a specific approval. The use of these systems solely for enhanced situational awareness, reduced flight technical error and/or reduced workload is an important safety feature, but does not require a specific approval.

6.1.4 For commercial air transport operations, any operational credit that has been granted should be reflected in the operation specifications for the type or individual helicopter as applicable.

6.1.5 For general aviation operations, the Standard in Section III, 4.11, requires the State of Registry to establish criteria for the use of an automatic landing system, a HUD or an equivalent display, EVS, SVS or CVS or any combination of those systems into a hybrid system for the safe operation of the helicopter and specifies such criteria. When operational credits are granted by the State of Registry as per the Standard in 2.2.1.1, the use of that system becomes essential for the safety of those operations and approval of the use of such systems is part of the operational credit specific approval. The use of these systems solely for enhanced situational awareness, reduced flight technical error and/or reduced workload is an important safety feature, but does not require a specific approval.

6.1.6 For general aviation operations, any operational credit that has been granted should be reflected in the specific approval template and be carried on board the particular helicopter.

6.2 Specific approvals for operational credit

6.2.1 To obtain an approval for operational credit, the operator will need to specify the desired operational credit and submit a suitable application. The content of a suitable application should include:

- a) *Applicant details.* For AOC holders, the company name, AOC number and email address. For other operators, the official name and any business or trading name(s), address, mailing address, email address and contact telephone/fax numbers of the applicant.
- b) *Aircraft details.* Aircraft make(s), model(s) and registration mark(s).
- c) *Operator’s vision system compliance list.* The contents of the compliance list are included in the Manual of All-Weather Operations (Doc 9365). The compliance list should include the information that is relevant to the approval requested and the registration marks of the aircraft involved. If more than one type of aircraft/fleet is included in a single application, a completed compliance list should be included for each aircraft/fleet.

- d) *Documents to be included with the application.* Copies of all documents to which the operator has made references should be included in the application. There should be no need to send complete manuals; only the relevant sections/pages should be required. Additional guidance material can be found in the Manual of All-Weather Operations (Doc 9365).
- e) *Name, title and signature.*

6.2.2 The following items should be covered in a vision systems compliance list:

- a) reference documents used in compiling the submission for approval;
- b) flight manual;
- c) feedback and reporting of significant problems;
- d) requested operational credit and resulting aerodrome operating minima;
- e) operations manual (or an equivalent document) entries including MEL (where applicable) and standard operating procedures;
- f) safety risk assessments;
- g) training programmes; and
- h) continuing airworthiness.

Expanded guidance on these items is contained in the Manual of All-Weather Operations (Doc 9365).

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**附件四 Annex 6, Operation of Aircraft Part III — International
Operations — Helicopters Section III, International General Aviation,
Chapter 2.2.1.1 & 4.11 & Attachment I**

CHAPTER 2. FLIGHT OPERATIONS

2.2 HELIPORT OR LANDING LOCATION OPERATING MINIMA

2.2.1.1 The State of Registry may approve operational credit(s) for operations with helicopters equipped with automatic landing systems, a HUD or equivalent displays, EVS, SVS or CVS. Such approvals shall not affect the classification of the instrument approach procedure.

Note 1.— Operational credit includes:

- a) for the purposes of an approach ban (ICAO Annex 6, Part III, Section III, 2.6.3.2), a minima below the heliport or landing location operating minima;*
- b) reducing or satisfying the visibility requirements; or*
- c) requiring fewer ground facilities as compensated for by airborne capabilities.*

Note 2.— Guidance on operational credit for aircraft equipped with automatic landing systems, a HUD or equivalent displays, EVS, SVS and CVS is contained in Attachment I and in the Manual of All-Weather Operations (Doc 9365).

Note 3.— Information regarding a HUD or equivalent displays, including references to RTCA and EUROCAE documents, is contained in the Manual of All-Weather Operations (Doc 9365).

Note 4.— Automatic landing system — helicopter is an automatic approach using airborne systems which provide automatic control of the flight path, to a point aligned with the landing surface, from which the pilot can transition to a safe landing by means of natural vision without the use of automatic control.

**CHAPTER 4. HELICOPTER INSTRUMENTS, EQUIPMENT AND FLIGHT
DOCUMENTS**

**4.11 HELICOPTERS EQUIPPED WITH AUTOMATIC LANDING SYSTEMS, A
HEAD-UP DISPLAY (HUD) OR EQUIVALENT DISPLAYS, ENHANCED VISION
SYSTEMS (EVS), SYNTHETIC VISION SYSTEMS (SVS) AND/OR COMBINED VISION
SYSTEMS (CVS)**

4.11.1 Where helicopters are equipped with automatic landing systems, HUD or equivalent displays, EVS, SVS or CVS, or any combination of those systems into a hybrid system, criteria for the use of such systems for the safe operation of a helicopter shall be established by the State of

Registry.

Note.— Information regarding a HUD or equivalent displays, including references to RTCA and EUROCAE documents, is contained in the Manual of All-Weather Operations (Doc 9365).

4.11.2 In establishing operational criteria for the use of automatic landing systems, a HUD or equivalent displays, EVS, SVS or CVS, the State of Registry shall require that:

- a) the equipment meets the appropriate airworthiness certification requirements;
- b) the operator/owner has carried out a safety risk assessment associated with the operations supported by the automatic landing systems, a HUD or equivalent displays, EVS, SVS or CVS;
- c) the operator/owner has established and documented the procedures for the use of, and training requirements for automatic landing systems, a HUD or equivalent displays, EVS, SVS or CVS.

Note 1.— Guidance on safety risk assessments is contained in the Safety Management Manual (SMM) (Doc 9859).

Note 2.— Guidance on establishing operational criteria is contained in Attachment I.

ATTACHMENT I.

AUTOMATIC LANDING SYSTEMS, HEAD-UP DISPLAY (HUD) OR EQUIVALENT DISPLAYS AND VISION SYSTEMS

Supplementary to Section III, Chapter 2, 2.2.1.1 and Chapter 4, 4.11

INTRODUCTION

The material in this attachment provides guidance for certified automatic landing systems, HUD or equivalent displays and vision systems intended for operational use in helicopters engaged in international air navigation. These systems and hybrid systems may be installed and operated to reduce workload, improve guidance, reduce flight technical error and enhance situational awareness and/or obtain operational credits. Automatic landing systems, HUD or equivalent displays and vision systems may be installed separately or together as part of a hybrid system. Any operational credit for their use by commercial air transport operators requires a specific approval from the State of the Operator, and the State of Registry for general aviation operators.

Note 1.— “Vision systems” is a generic term referring to the existing systems designed to provide images, i.e. enhanced vision systems (EVS), synthetic vision systems (SVS) and combined vision systems (CVS).

Note 2.— “Automatic landing system-helicopter” is an automatic approach using airborne systems which provide automatic control of the flight path, to a point aligned with the landing surface, from which the pilot can transition to a safe landing by means of natural vision without the

use of automatic control.

Note 3.— Operational credit can be granted only within the limits of the airworthiness approval.

Note 4.— Currently, operational credit has been given only to vision systems containing an image sensor providing a real-time image of the actual external scene on the HUD.

Note 5.— More detailed information and guidance on automatic landing systems, HUD or equivalent displays and vision systems is contained in the Manual of All-Weather Operations (Doc 9365). This manual should be consulted in conjunction with this attachment.

1. HUD AND EQUIVALENT DISPLAYS

1.1 General

1.1.1 A HUD presents flight information into the pilot's forward external field of view without significantly restricting that external view.

1.1.2 Flight information should be presented on a HUD or an equivalent display, as required for the intended use.

1.2 Operational applications

1.2.1 Flight operations with a HUD can improve situational awareness by combining flight information located on head-down displays with the external view to provide pilots with more immediate awareness of relevant flight parameters and situation information while they continuously view the external scene. This improved situational awareness can also reduce errors in flight operations and improve the pilot's ability to transition between instrument and visual references as meteorological conditions change.

1.2.2 A HUD may be used to supplement conventional flight deck instrumentation or as a primary flight display if certified for this purpose.

1.2.3 An approved HUD may:

- a) qualify for operations with reduced visibility or reduced RVR; or
- b) replace some parts of the ground facilities such as touchdown zone and/or centre line lights.

1.2.4 The functions of a HUD may be provided by a suitable equivalent display. However, before such systems can be used, the appropriate airworthiness approval should be obtained.

1.3 HUD training

Training and recent experience requirements for operations using HUD or equivalent displays

should, for commercial operators, be established by the State of the Operator and for general aviation operators by the State of Registry. For commercial air transport operations, the training programmes should be approved by the State of the Operator and the implementation of the training should be subject to oversight by that State. The training should address all flight operations for which the HUD or equivalent display is used.

2. VISION SYSTEMS

2.1 General

2.1.1 Vision systems can display electronic real-time images of the actual external scene achieved through the use of image sensors, i.e. EVS, or display synthetic images, which are derived from the on-board avionic systems, i.e. SVS. Vision systems can also consist of a combination of these two systems, called combined vision systems, i.e. CVS. Such a system may display electronic real-time images of the external scene using the EVS component of the system. The information from vision systems may be displayed head-up and/or head-down. Operational credit may be granted to vision systems which are appropriately qualified.

2.1.2 Light emitting diode (LED) lights may not be visible to infrared-based vision systems. Operators of such vision systems will need to acquire information about the LED implementation programmes at aerodromes where they intend to operate. More details about the consequences of LED lights are contained in the Manual of All-Weather Operations (Doc 9365).

2.2 Operational applications

2.2.1 Flight operations with EVS allow the pilot to view an image of the external scene obscured by darkness or other visibility restrictions. The use of EVS will also allow acquisition of an image of the external scene earlier than with natural, unaided vision, hence providing for a smoother transition to references by natural vision. The improved acquisition of an image of the external scene may improve situational awareness. It may also qualify for operational credit if the information from the vision system is presented to the pilots in a suitable way and the necessary airworthiness approval and specific approval by the State of the Operator or State of Registry have been obtained for the combined system.

2.2.2 Vision system imagery may also enable pilots to detect other aircraft on the ground, terrain or obstructions on or adjacent to runways or taxiways.

2.3 Operational concepts

2.3.1 Instrument approach operations include an instrument phase and a visual phase. The instrument phase ends at the published MDA/H or DA/H unless a missed approach is initiated. Using the EVS or CVS does not change the applicable MDA/H or DA/H. The continued approach

to landing from MDA/H or DA/H will be conducted using visual references. This also applies to operations with vision systems. The difference is that the visual references will be acquired by use of an EVS or CVS, natural vision or the vision system in combination with natural vision.

2.3.2 Down to a defined height in the visual segment, typically at or above 30 m (100 ft), the visual references may be acquired solely by means of the vision system. The defined height depends on the airworthiness approval and specific approval by the State of the Operator or State of Registry. Below this height the visual references should be solely based on natural vision. In the most advanced applications, the vision system may be used down to touchdown without the requirement for natural vision acquisition of visual references. This means that such a vision system may be the sole means of acquiring visual references and can be used without natural vision.

EVS operations

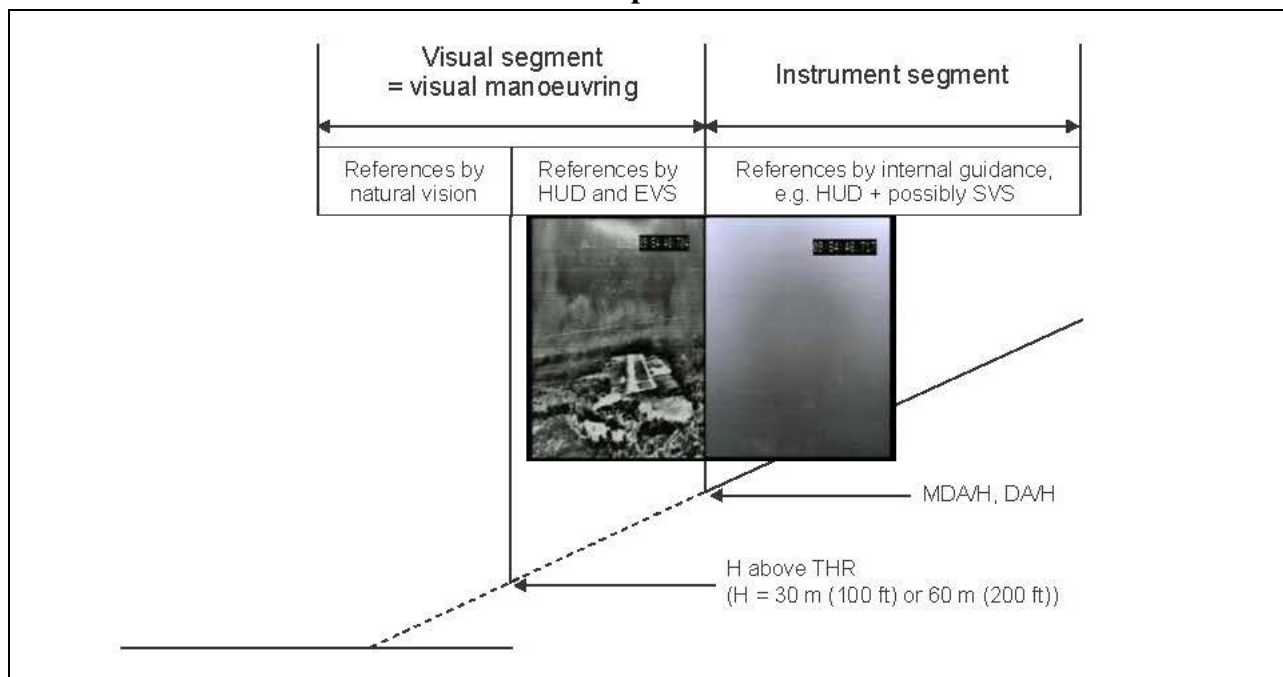


Figure I-1. EVS operations — transition from instrument to visual references

2.4 Vision systems training

Training and recent experience requirements should be established by the State of the Operator for commercial operators and the State of Registry for general aviation operators. For commercial operators, the training programmes should be approved by the State of the Operator and the implementation of the training should be subject to oversight by that State. Training should address all flight operations for which the vision system is used.

2.5 Visual references

2.5.1 In principle, the required visual references do not change due to the use of an EVS or CVS, but those references are allowed to be acquired by means of the vision system until a certain

height during the approach as described in 2.3.2 (see Figure I-1).

2.5.2 In States that have developed requirements for operations with vision systems, the use of visual references have been regulated and examples of this are provided in the Manual of All-Weather Operations (Doc 9365).

3. HYBRID SYSTEMS

A hybrid system generically means that two or more systems are combined. The hybrid system typically has improved performance compared to each of the component systems, which in turn may qualify for operational credit. The inclusion of more systems in the hybrid system normally enhances the performance of the system. The Manual of All-Weather Operations (Doc 9365) contains some examples of hybrid systems.

4. OPERATIONAL CREDITS

4.1 Aerodrome operating minima are expressed in terms of minimum visibility/RVR and MDA/H or DA/H. When aerodrome operating minima are established, the combined capability of the helicopters equipment and on-ground infrastructure should be taken into account. Better equipped helicopters may be able to operate into lower natural visibility conditions, lower DA/H and/or operate with less ground infrastructure. Operational credit means that the aerodrome operating minima may be reduced in case of suitably equipped helicopters. Another way to grant operational credit is to allow visibility requirements to be fulfilled, wholly or partly, by means of the on-board systems. HUD, automatic landing or vision systems, which were not available at the time when the criteria for aerodrome operating minima were originally established.

4.2 The granting of operational credits does not affect the classification (i.e. Type or Category) of an instrument approach procedure since they are designed to support instrument approach operations conducted using helicopters with the minimum equipment prescribed.

4.3 The relation between the procedure design and the operation can be described as follows. The OCA/H is the end product of the procedure design, which does not contain any RVR or visibility values. Based on the OCA/H and all the other elements such as available runway visual aids, the operator will establish MDA/H or DA/H and RVR/visibility, i.e. the aerodrome operating minima. The values derived should not be less than those prescribed by the State of the Aerodrome.

5. OPERATIONAL PROCEDURES

In accordance with Section II, 4.16.2 and Section III, 4.11.2, the operator should develop suitable operational procedures associated with the use of an automatic landing system, a HUD or an equivalent display, vision systems and hybrid systems. The procedures should be included in the

operations manual and cover at least the following:

- a) limitations;
- b) operational credits;
- c) flight planning;
- d) ground and airborne operations;
- e) crew resource management;
- f) standard operating procedures; and
- g) ATS flight plans and communication.

6. APPROVALS

6.1 General

Note.— When the application for a specific approval relates to operational credits for systems not including a vision system, the guidance on approvals in this attachment may be used to the extent applicable as determined by the State of the Operator for commercial operators and the State of Registry for general aviation operators.

6.1.1 The operator that wishes to conduct operations with an automatic landing system, a HUD or an equivalent display, a vision system or a hybrid system will need to obtain certain approvals as prescribed in the relevant SARPs. The extent of the approvals will depend on the intended operation and the complexity of the equipment.

6.1.2 Systems that are not used for an operational credit or otherwise critical to the aerodrome operating minima, e.g. vision systems used to enhance situational awareness may be used without a specific approval. However, the standard operating procedures for these systems should be specified in the operations manual or an equivalent document. An example of this type of operation may include an EVS or an SVS on a head-down display that is used only for situational awareness of the surrounding area of the helicopter during ground operations where the display is not in the pilot's primary field of view. For enhanced situational awareness, the installation and operational procedures need to ensure that the operation of the vision system does not interfere with normal procedures or the operation or use of other aircraft systems. In some cases, modifications to these normal procedures for other helicopter systems or equipment may be necessary to ensure compatibility.

6.1.3 The Standard in Section II, 4.16, requires that for commercial air transport operations, the use of an automatic landing system, a HUD or an equivalent display, EVS, SVS or CVS or any

combination of those systems into a hybrid system, should be approved when those systems are used “for the safe operation of a helicopter”. When operational credits are granted by the State of the Operator as per the Standard in Annex 6, Part I, 2.2.8.1.1, the use of that system becomes essential for the safety of such operations and is subject to a specific approval. The use of these systems solely for enhanced situational awareness, reduced flight technical error and/or reduced workload is an important safety feature, but does not require a specific approval.

6.1.4 For commercial air transport operations, any operational credit that has been granted should be reflected in the operation specifications for the type or individual helicopter as applicable.

6.1.5 For general aviation operations, the Standard in Section III, 4.11, requires the State of Registry to establish criteria for the use of an automatic landing system, a HUD or an equivalent display, EVS, SVS or CVS or any combination of those systems into a hybrid system for the safe operation of the helicopter and specifies such criteria. When operational credits are granted by the State of Registry as per the Standard in 2.2.1.1, the use of that system becomes essential for the safety of those operations and approval of the use of such systems is part of the operational credit specific approval. The use of these systems solely for enhanced situational awareness, reduced flight technical error and/or reduced workload is an important safety feature, but does not require a specific approval.

6.1.6 For general aviation operations, any operational credit that has been granted should be reflected in the specific approval template and be carried on board the particular helicopter.

6.2 Specific approvals for operational credit

6.2.1 To obtain an approval for operational credit, the operator will need to specify the desired operational credit and submit a suitable application. The content of a suitable application should include:

- a) *Applicant details.* For AOC holders, the company name, AOC number and email address. For other operators, the official name and any business or trading name(s), address, mailing address, email address and contact telephone/fax numbers of the applicant.
- b) *Aircraft details.* Aircraft make(s), model(s) and registration mark(s).
- c) *Operator’s vision system compliance list.* The contents of the compliance list are included in the Manual of All-Weather Operations (Doc 9365). The compliance list should include the information that is relevant to the approval requested and the registration marks of the aircraft involved. If more than one type of aircraft/fleet is included in a single application, a completed compliance list should be included for each aircraft/fleet.
- d) *Documents to be included with the application.* Copies of all documents to which the operator has made references should be included in the application. There should be no

need to send complete manuals; only the relevant sections/pages should be required.

Additional guidance material can be found in the Manual of All-Weather Operations (Doc 9365).

e) *Name, title and signature.*

6.2.2 The following items should be covered in a vision systems compliance list:

- a) reference documents used in compiling the submission for approval;
- b) flight manual;
- c) feedback and reporting of significant problems;
- d) requested operational credit and resulting aerodrome operating minima;
- e) operations manual (or an equivalent document) entries including MEL (where applicable) and standard operating procedures;
- f) safety risk assessments;
- g) training programmes; and
- h) continuing airworthiness.

Expanded guidance on these items is contained in the Manual of All-Weather Operations (Doc 9365).

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