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CAT II, CAT III AND LOW VISIBILITY OPERATIONS

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ALL WEATHER (CAT II, CAT III AND LOW VISIBILITY) OPERATIONS

SECTION 1 POLICY & GENERAL INFORMATION

1.1 Purpose

This Advisory Circular (AC) provides information and guidance material that should be used by air operator certificate (AOC) holders and non-commercial and specialist operators to ensure compliance with All Weather Operations (AWO) requirements, including the required approvals for low visibility take-off, approach and landing operations.

This Advisory Circular provides information for operators to assist them in ensuring they meet continuing airworthiness requirements as well as operational requirements for low-visibility operations.

Note In certain cases low visibility operations can be referred to as 'all weather operations' (AWOPS or AWO). ICAO Document 9365, Manual of All-Weather Operations, defines AWO as "Any surface movement, take-off, departure, approach or landing operations in conditions where visual reference is limited by weather conditions".

For the purposes of this order and to align with Specific Approval terminology, the term Low Visibility Operations (LVO) will be used.

The LVO approval requirements are applicable to all types of operation:

- All Commercial air transport (CAT) operators holding an Air Operator Certificate (AOC)
- Non-Commercial (General Aviation Operators)
- Aerial Work/Specialist operations

1.2 References

Note: The user should always check the latest validity of all relevant reference documents and the technical standards therein.

The following Uganda Civil Aviation Regulations (UCARs) are applicable to LVO operations

- The Civil Aviation (Operation of Aircraft – Commercial Air Transport) Regulations, 2022
- The Civil Aviation (Aircraft Instrument and Equipment) Regulations, 2022
- The Civil Aviation (Air Operator Certification and Administration) Regulations, 2022
- The Civil Aviation (Airworthiness of Aircraft) Regulations 2022
- The Civil Aviation (Rules of the Air) Regulations, 2020
- The Civil Aviation (Personnel Licensing) Regulations, 2022
- The Civil Aviation (Safety Management) Regulations, 2022

The following CAA Advisory and Guidance documents are applicable to LVO Operations

- FORM: CAA-GEN027-LVO Assessment Worksheet
- CAA-MAN-OPS001-Flight Operations Inspector Manual
- CAA-AC-OPS-030 -Operating Minima for aeroplane & helicopter operations
- CAA-AC-OPS-050 -Air Operator Flight Data Analysis Programme
- CAA-AC-OPS-043 -Guidance for air operators in establishing a flight safety documents system
- Other relevant LVO and operations with operational credits publications:
- ICAO Annex 2: Rules of the Air
- ICAO Annex 6, Operation of Aircraft
- ICAO Annex 8, Airworthiness
- ICAO Annex 10 — Aeronautical Telecommunications (Volume I — Radio Navigation Aids);
- ICAO Annex 14 — Aerodromes (Volume I — Aerodrome Design and Operations);
- ICAO Doc 8168 — PANS - OPS — Procedures for Air Navigation Services — Aircraft Operations;
- ICAO Doc 9365 — Manual of All-Weather Operations;
- ICAO Doc 9476 — Manual of surface movement guidance and control systems (SMGCS);
- ICAO Doc 9157 — Aerodrome Design Manual;
- ICAO Doc 9328 — Manual of RVR Observing and Reporting Practices;
- ICAO EUR Doc 013 — European Guidance Material on All Weather Operations at Aerodromes;
- EASA AWO Implementation Manual V1.0 (Q42022)
- ECAC Doc 17, Issue 3; and
- CS-AWO All-Specifications All-Weather operations (EASA)
- The ICAO Airworthiness Manual (Doc 9760) contains guidance on the level of performance and reliability of aircraft systems and on overall continuing airworthiness aspects.

1.3 Introduction

The Civil Aviation (Operation of Aircraft-Commercial Air Transport Aeroplanes) Regulations, 2022 relate to or deal specifically with the requirements pertaining to the granting of an LVO approval by the Authority (UCAA).

These requirements (expanded upon in this Advisory Circular) include the following: type Certification/Design and Airworthiness/Maintenance Considerations, and Operational Approval requirements.

In terms of further detail, aircraft equipment, flight dispatch, operating procedures, training requirements as well as continuing airworthiness & maintenance requirements are all relevant.

1.4 Terminology (Abbreviations & Definitions)

Abbreviations

2D	two-dimensional
3D	three-dimensional
ACAS	Airborne collision avoidance system
AFCS	Automatic flight control system
AFM	Aeroplane flight manual
AIC	Aeronautical information circular
AIP	Aeronautical information publication
AIS	Aeronautical information service
ALS	Approach lighting system
AOC	Air operator certificate
AOM	Aerodrome operating minima
APV	Approach procedure with vertical guidance
A-SMGCS	Advanced surface movement guidance and control system
ATC	Air traffic control
ATIS	Automatic terminal information service
ATS	Air traffic services
AVG	Advisory vertical guidance
AWO	All-weather operations
BALS	Basic approach lighting system
BARO-VNAV	Barometric vertical navigation
Cat I	Category I
Cat II	Category II
Cat III	Category III
CDFA	Continuous descent final approach
CFIT	Controlled flight into terrain

CMV	Converted meteorological visibility
CRM	Collision risk model
CS	Certification specifications (EASA)
CVFP	Charted visual flight procedures
CVS	Combined vision system
DA	Decision altitude
DA/H	Decision altitude/height
DDM	Difference in depth of modulation
DH	Decision height
DME	Distance measuring equipment
EASA	European Aviation Safety Agency
EDTO	Extended diversion time operations
EFVS	Enhanced flight vision system
EFVS-A	Enhanced flight vision system used for approach
EFVS-L	Enhanced flight vision system used for landing
EVS	Enhanced vision system
FAF	Final approach fix
FAP	Final approach point
FAS	Final approach segment
FALS	Full approach lighting system
FATO	Final approach and take-off
FMS	Flight management system
FOR	Field of regard
FSTD	Flight simulation training device
GBAS	Ground-based augmentation system
GLS	GBAS landing system
GNSS	Global navigation satellite system
HATh	Height above threshold
HIALS	High intensity approach lighting system
HUD	Head-up display
HUDLS	Head-up display landing system
IALS	Intermediate approach lighting system
IAS	Indicated airspeed
IFR	Instrument flight rules
ILS	Instrument landing system
IMC	Instrument meteorological conditions
IR	Instrument Rating

ISA	International standard atmosphere
JAR	Joint aviation requirements
LDA	Landing distance available
LED	Light emitting diode
LOC	Localizer
LNAV	Lateral navigation
LP	Localizer performance
LPV	Localizer performance with vertical guidance
LVO	Low-visibility operations
LVP	Low-visibility procedures
LVTO	Low-visibility take-off
MALS	Medium intensity approach lighting system
MALSF	Medium intensity approach lighting system with sequenced flashing lights
MALSR	Medium intensity approach lighting system with runway alignment indicator lights
MAPt	Missed approach point
MDA	Minimum descent altitude
MDA/H	Minimum descent altitude/height
MDH	Minimum descent height
MEL	Minimum equipment list
MET	Meteorological
METAR	Aviation routine weather report
MID	Runway mid-point
MLS	Microwave landing system
MOC	Minimum obstacle clearance
MSL	Mean sea level
MTBO	Mean time between outages
NALS	No approach lighting system
NDB	Non-directional beacon
NOTAM	Notice to airmen
NPA	Non-precision approach
OCA	Obstacle clearance altitude
OCA/H	Obstacle clearance altitude/height
OCH	Obstacle clearance height
OFZ	Obstacle-free zone
OTS CAT II	Other than standard category II
PA	Precision approach
PAR	Precision approach radar

PBN	Performance-based navigation
RCLL	Runway centre line lights
RNAV	Area navigation
RNP	Required navigation performance
RTZL	Runway touchdown zone lights
RVR	Runway visual range
SA CAT I	Special authorization category I
SA CAT II	Special authorization category II
SALS	Simple approach lighting system
SALSF	Simple approach lighting system with sequenced flashing lights
SAp	Stabilised approach
SARPs	Standards and Recommended Practices
SBAS	Satellite-based augmentation system
SID	Standard instrument departure
SIGMET	Significant weather report
SMGCS	Surface movement guidance and control system
SPECI	Aerodrome special meteorological report
SRA	Surveillance radar approach
SSALF	Simplified short approach lighting system with sequenced flashing lights
SSALR	Simplified short approach lighting system with runway alignment indicator lights
SSALS	Simplified short approach lighting system
STAR	Standard instrument arrival
SVR	Slant visual range
SVS	Synthetic vision system
TDZ	Touchdown zone
TDZE	Touchdown zone elevation
THR	Threshold
TODA	Take-off distance available (aeroplanes)
VDF	Very high frequency direction-finding station
VDP	Visual descent point
VFR	Visual flight rules
VGSI	Visual glideslope indicators
VIS	Visibility
VMC	Visual meteorological conditions
VNAV	Vertical navigation
VOR	Very high frequency omnidirectional radio range

Definitions

Where the following terms are used in this AC, they have the meaning indicated:

Advisory vertical guidance. Vertical path deviation guidance indications provided as a non-essential aid to help pilots meet barometric altitude restrictions on 2D instrument approach operations.

Aerodrome operating minima. The limits of usability of an aerodrome for:

a) take-off, expressed in terms of runway visual range and/or visibility and, if necessary, cloud conditions;

b) landing in two-dimensional (2D) instrument approach operations, expressed in terms of visibility and/or runway visual range minimum descent altitude/height (MDA/H) and, if necessary, cloud conditions; and

c) landing in three-dimensional (3D) instrument approach operations, expressed in terms of visibility and/or runway visual range and decision altitude/height (DA/H) as appropriate to the type and/or category of the operation.

Alert height. A height above the runway threshold based on the characteristics of the aeroplane and its fail operational landing system, above which a Cat III operation would be discontinued and a missed approach initiated if a failure occurred in one of the redundant parts of the landing system, or in the relevant ground equipment.

All-weather operations. Any surface movement, take-off, departure, approach or landing operations in conditions where visual reference is limited by weather conditions.

Alternate aerodrome. An aerodrome to which an aircraft may proceed when it becomes either impossible or inadvisable to proceed to or to land at the aerodrome of intended landing. Alternate aerodromes include the following:

Take-off alternate. An alternate aerodrome at which an aircraft can land should this become necessary shortly after take-off and it is not possible to use the aerodrome of departure.

En-route alternate. An aerodrome at which an aircraft would be able to land after experiencing an abnormal or emergency condition while en-route.

Destination alternate. An alternate aerodrome to which an aircraft may proceed should it become either impossible or inadvisable to land at the aerodrome of intended landing.

Note.— The aerodrome from which a flight departs may also be an en-route or a destination alternate aerodrome for that flight.

Approach ban point. The point from which an instrument approach shall not be continued below 300 m (1 000 ft) above the aerodrome elevation or into the final approach segment unless the reported visibility or controlling RVR is above the aerodrome operating minima.

Automatic flight control system (AFCS) with coupled approach mode. An airborne system which provides automatic control of the flight path of the aeroplane during approach.

Automatic landing system. The airborne system which provides automatic control of the aeroplane during the approach and landing.

Categories of aeroplanes. The following five categories of aeroplanes have been established based on 1.3 times the stall speed in the landing configuration at maximum certificated landing mass:

Category A — less than 169 km/h (91 kt) IAS

Category B — 169 km/h (91 kt) or more but less than 224 km/h (121 kt) IAS

Category C — 224 km/h (121 kt) or more but less than 261 km/h (141 kt)

Category D — 261 km/h (141 kt) or more but less than 307 km/h (166 kt) IAS

Category E — 307 km/h (166 kt) or more but less than 391 km/h (211 kt) IAS.

Ceiling. The height above the ground or water of the base of the lowest layer of cloud below 6 000 m (20 000 ft) covering more than half the sky.

Circling approach. An extension of an instrument approach procedure which provides for visual circling of the aerodrome prior to landing.

Combined vision system. A system to display images from a combination of an enhanced vision system (EVS) and a synthetic vision system (SVS).

Commercial air transport operation. An aircraft operation involving the transport of passengers, cargo or mail for remuneration or hire.

Continuous descent final approach (CDFA). A technique, consistent with stabilized approach procedures, for flying the final approach segment of a non-precision instrument approach procedure as a continuous descent, without level-off, from an altitude/height at or above the final approach fix altitude/height to a point approximately 15 m (50 ft) above the landing runway threshold or the point where the flare manoeuvre should begin for the type of aircraft flown.

Converted meteorological visibility (CMV). A value (equivalent to an RVR) which is derived from the reported meteorological visibility.

Current fuel/energy scheme. means the approved fuel/energy scheme that is currently used by the operator

Decision altitude (DA) or ***decision height (DH).*** A specified altitude or height in a 3D instrument approach operation at which a missed approach must be initiated if the required visual reference to continue the approach has not been established.

Note 1.— Decision altitude (DA) is referenced to mean sea level (MSL) and decision height (DH) is referenced to the threshold elevation or touchdown zone elevation as appropriate for the State of the Aerodrome.

Note 2.— The required visual reference means that section of the visual aids or of the approach area which should have been in view for sufficient time for the pilot to have made an assessment of the aircraft position and rate of change of position, in relation to the desired flight path. In Cat III operations with a decision height the required visual reference is that specified for the particular procedure and operation.

Note 3.— For convenience where both expressions are used they may be written in the form “decision altitude/height” and abbreviated “DA/H”.

Enhanced *flight vision system (EFVS).* A term used by some States to identify an EVS system to display electronic real-time images of the actual external scene achieved through the use of image sensors.

Notes: Display can be real-time sensor derived or an enhanced display of the external scene topography (the natural or man-made features of a place or region especially in a way to show their relative positions and elevation) through the use of imaging sensors; an EFVS is integrated with a flight guidance system and is implemented on a head-up-display or an equivalent display system; if an EFVS is certified according to the applicable airworthiness requirements and an operator holds the necessary specific approval, then it may be used for EFVS operations and may allow operations with operational credits.

EVS operation*.* Means an operation in which visibility conditions require an EFVS to be used instead of natural vision in order to perform an approach or landing, identify the required visual references or conduct a roll-out

EFVS 200 operation. Means an operation with an operational credit in which visibility conditions require an EVS to be used down to 200ft above the FATO or runway threshold. From that point to landing, natural vision is used. The RVR shall not be less than 550m.

Enhanced vision system (EVS). A system to display electronic real-time images of the actual external scene achieved through the use of image sensors.

Note.— EVS does not include night vision imaging system (NVIS).

Fail-operational automatic landing system. An automatic landing system is fail-operational if, in the event of a failure, the approach, flare and landing can be completed by the remaining part of the automatic system.

Fail-operational hybrid landing system. A system which consists of two or more independent landing systems and in the event of failure of one system, guidance or control is provided by the remaining system(s) to permit completion of the landing.

Note.— A fail-operational hybrid landing system may consist of a fail-passive automatic landing system with a monitored head-up display which provides guidance to enable the pilot to complete the landing manually after failure of the automatic landing system.

Fail-passive automatic landing system. An automatic landing system is fail-passive if, in the event of a failure, there is no significant deviation of aeroplane trim, flight path or attitude but the landing will not be completed automatically.

Final approach. That part of an instrument approach procedure which commences at the specified final approach fix or point, or where such a fix or point is not specified:

a) at the end of the last procedure turn, base turn or inbound turn of a racetrack procedure, if specified; or

b) at the point of interception of the last track specified in the approach procedure, and ends at a point in the vicinity of an aerodrome from which:

    1) a landing can be made; or

2) a missed approach procedure is initiated.

Final approach segment. That segment of an instrument approach procedure in which alignment and descent for landing are accomplished.

Flight visibility. The visibility forward from the cockpit of an aircraft in flight.

GLS. An instrument approach operation that is based on GBAS.

Ground-based augmentation system (GBAS). An augmentation system in which the user receives augmentation information directly from a ground-based transmitter.

Head-up display (HUD). A display system that presents flight information into the pilot's forward external field of view.

Head-up display (HUD) approach and landing guidance system (HUDLS). An airborne instrument system which presents sufficient information and guidance in a specific area of the aircraft windshield, superimposed for a conformal view with the external visual scene, which permits the pilot to manoeuvre the aircraft manually by reference to that information and guidance alone to a level of performance and reliability that is acceptable for the category of operation concerned.

Hybrid system. Two or more systems that are combined and regarded as one system for performance purposes.

ILS critical area. An area of defined dimensions about the localizer and glide path antennas where vehicles, including aircraft, are excluded during all ILS operations.

Note.— The critical area is protected because the presence of vehicles and/or aircraft inside its boundaries will cause unacceptable disturbance to the ILS signal-in-space.

ILS sensitive area. An area extending beyond the critical area where the parking and/or movement of vehicles, including aircraft, is controlled to prevent the possibility of unacceptable interference to the ILS signal during ILS operations.

Note.— The sensitive area is protected against interference caused by large moving objects outside the critical area but still normally within the airfield boundary.

Instrument approach operations. An approach and landing using instruments for navigation guidance based on an instrument approach procedure. There are two methods for executing instrument approach operations:

a) a two-dimensional (2D) instrument approach operation, using lateral navigation guidance only; and

b) a three-dimensional (3D) instrument approach operation, using both lateral and vertical navigation guidance.

Note.— Lateral and vertical guidance refers to guidance provided either by a ground-based radio navigation aid, or by computer-generated navigation data from ground-based, space-based, self-contained navigation aids or a combination of these.

Instrument approach procedure. A series of predetermined manoeuvres by reference to flight instruments with specified protection from obstacles from the initial approach fix, or where applicable, from the beginning of a defined arrival route to a point from which a landing can be completed and thereafter, if a landing is not completed, to a position at which holding or en-route obstacle clearance criteria apply. Instrument approach procedures are classified as follows:

a) Non-precision approach (NPA) procedure. An instrument approach procedure designed for 2D instrument approach operations Type A.

Note.— Non-precision approach procedures may be flown using a continuous descent final approach (CDFA) technique. CDFAs with advisory vertical guidance calculated by on-board equipment (see PANS-OPS (Doc 8168), Volume I, Part I, Section 4, Chapter 1, 1.8.1) are considered 3D instrument approach operations. CDFAs with manual calculation guidance of the required rate of descent or with advisory vertical are considered 2D instrument approach operations. For more information on CDFA refer to PANS-OPS (Doc 8168), Volume I, Sections 1.7 and 1.8.

b) Approach *procedure with vertical guidance (APV)*. A performance-based navigation (PBN) instrument approach procedure designed for 3D instrument approach operations Type A.

c) *Precision approach (PA) procedure*. An instrument approach procedure based on navigation systems (ILS, MLS, GLS and SBAS Cat I) *designed* for 3D instrument approach operations Type A or B.

Instrument flight rules (IFR). A set of rules governing the conduct of flight under instrument meteorological conditions.

Note.— IFR specifications are found in Chapter 5 of Annex 2 — Rules of the Air*. Instrument flight rules may be followed in both IMC and VMC.*

Instrument meteorological conditions (IMC). Meteorological conditions expressed in terms of visibility, distance from cloud, and ceiling, as defined in Annex 2 , less than the minima specified for visual meteorological conditions.

Note.— The specified minima for visual meteorological conditions are contained in Chapter 4 of Annex 2.

Instrument runway. One of the following types of runways intended for the operation of aircraft using instrument approach procedures:

Non-precision approach runway. A runway served by visual aids and non-visual aid(s) intended for landing operations following an instrument approach operation type A and a visibility not less than 1 000 m.

Precision approach runway, Cat I. A runway served by visual aids and non-visual aid(s) intended for landing operations following an instrument approach operation Type B with a decision height (DH) not lower than 60 m (200 ft) and either a visibility not less than 800 m or a runway visual range not less than 550 m.

Precision approach runway, Cat II. A runway served by visual aids and non-visual aid(s) intended for landing operations following an instrument approach operation Type B with a decision height (DH) lower than 60 m (200 ft) but not lower than 30 m (100 ft) and a runway visual range not less than 300 m

Precision approach runway, Cat III. A runway served by visual aids and non-visual aid(s) intended for landing operations following an instrument approach operation Type B to and along the surface of the runway and:

A — intended for operations with a decision height lower than 30 m (100 ft), or no decision height and a runway visual range not less than 175 m.

B — intended for operations with a decision height lower than 15 m (50 ft), or no decision height and a runway visual range less than 175 m but not less than 50 m.

C — intended for operations with no decision height and no runway visual range limitations.

Note 1.— Visual aids need not necessarily be matched to the scale of non-visual aids provided. The criterion for the selection of visual aids is the conditions in which operations are intended to be conducted.

Note 2.—Paragraph 2.1.16 of this manual describes the relationship between the definition of instrument runways and aerodrome operating minima.

Localizer performance (LP). A Type A instrument approach operation that utilizes SBAS lateral guidance.

Localizer performance with vertical guidance (LPV). A 3D Type A or Type B instrument approach operation that utilizes SBAS lateral and vertical guidance. SBAS Cat I is an example of a 3D Type B LPV.

Low-visibility operations (LVO). Approach operations in RVRs less than 550 m and/or with a DH less than 60 m (200 ft) or take-off operations in RVRs less than 400 m.

Low-visibility procedures (LVP). *S*pecific procedures applied by an aerodrome for the purpose of ensuring safe operations during Cat II and III approach operations and/or low-visibility take-offs.

Low-visibility take-off[1] (LVTO). A term used on air operation referring to a take-off on a runway where the RVR is less than 400 m.

Minimum descent altitude (MDA) **or** ***minimum descent height (MDH).*** A specified altitude or height in a 2D instrument approach operation or circling approach operation below which descent must not be made without the required visual reference.

Note 1.— Minimum descent altitude (MDA) is referenced to MSL and minimum descent height (MDH) is referenced to the aerodrome elevation or to the threshold elevation if that is more than 2 m (7 ft) below the aerodrome elevation. A minimum descent height for a circling approach is referenced to the aerodrome elevation.

Note 2.— The required visual reference means that section of the visual aids or of the approach area which should have been in view for sufficient time for the pilot to have made an assessment of the aircraft position and rate of change of position, in relation to the desired flight path. In the case of a circling approach the required visual reference is the runway environment.

[1] Note: the Regulation defines a LVTO as a take-off with an RVR of less than 550m

Note 3. — For convenience when both expressions are used they may be written in the form "minimum descent altitude/height" and abbreviated "MDA/H".

Missed approach point (MAPt). That point in an instrument approach procedure at or before which the prescribed missed approach procedure must be initiated in order to ensure that the minimum obstacle clearance is not infringed.

Missed approach procedure. The procedure to be followed if the approach cannot be continued.

MLS critical area. An area of defined dimensions about the azimuth and elevation antennas where vehicles, including aircraft, are excluded during all microwave landing system (MLS) operations.

Note.— The critical area is protected because the presence of vehicles and/or aircraft inside its boundaries will cause unacceptable disturbance to the guidance signals.

MLS sensitive area. An area extending beyond the critical area where the parking and/or movement of vehicles, including aircraft, is controlled to prevent the possibility of unacceptable interference to the MLS signals during MLS operations.

Note.— The sensitive area provides protection against interference caused by large objects outside the critical area but still normally within the airfield boundary.

Non-instrument runway. A runway intended for the operation of aircraft using visual approach procedures or an instrument approach procedure to a point beyond which the approach may continue in visual meteorological conditions.

Obstacle clearance altitude (OCA)* or *obstacle clearance height (OCH). The lowest altitude or the lowest height above the elevation of the relevant runway threshold or the aerodrome elevation as applicable, used in establishing compliance with appropriate obstacle clearance criteria.

Note 1.— Obstacle clearance altitude is referenced to MSL and obstacle clearance height is referenced to the threshold elevation or in the case of non-precision approach procedures to the aerodrome elevation or the threshold elevation if that is more than 2 m (7 ft) below the aerodrome elevation. An obstacle clearance height for a circling approach procedure is referenced to the aerodrome elevation.

Note 2. — For convenience when both expressions are used they may be written in the form "obstacle clearance altitude/height" and abbreviated "OCA/H".

Obstacle-free zone (OFZ). The airspace above the inner approach surface, inner transitional surfaces, and balked landing surface and that portion of the strip bounded by these surfaces, which is not penetrated by any fixed obstacle other than a low-mass and frangibly mounted one required for air navigation purposes.

Performance-based navigation (PBN). Area navigation based on performance requirements for aircraft operating along an ATS route, on an instrument approach procedure or in a designated airspace.

Note.— Performance requirements are expressed in navigation specifications (RNAV specification, RNP specification) in terms of accuracy, integrity, continuity and functionality needed for the proposed operation in the context of a particular airspace concept.

Procedure turn. A manoeuvre in which a turn is made away from a designated track followed by a turn in the opposite direction to permit the aircraft to intercept and proceed along the reciprocal of the designated track.

Note 1.— Procedure turns are designated "left" or "right" according to the direction of the initial turn.

Note 2.— Procedure turns may be designated as being made either in level flight or while descending, according to the circumstances of each individual instrument approach procedure.

Required navigation performance (RNP). A statement of the navigation performance necessary for operation within a defined airspace.

Note.— Navigation performance and requirements are defined for a particular RNP type and/or application.

Runway-holding position. A designated position intended to protect a runway, an obstacle limitation surface, or an ILS/MLS critical/sensitive area at which taxiing aircraft and vehicles shall stop and hold, unless otherwise authorized by the aerodrome control tower.

Note.— In radiotelephony phraseologies, the expression "holding point" is used to designate the runway-holding position.

Runway visual range (RVR). The range over which the pilot of an aircraft on the centre line of a runway can see the runway surface markings or the lights delineating the runway or identifying its centre line.

Satellite-based augmentation system (SBAS). A wide coverage augmentation system in which the user receives augmentation information from a satellite-based sensor.

Stabilized approach. An approach which is flown in a controlled and appropriate manner in terms of configuration, energy and control of the flight path from a pre-determined point or altitude/height down to a point 15 m (50 ft) above the threshold or the point where the flare manoeuvre is initiated, if higher.

State of Registry. The State on whose register the aircraft is entered.

State of the Aerodrome. The State in whose territory the aerodrome is located.

State of the Operator. The State in which the operator's principal place of business is located or, if there is no such place of business, the operator's permanent residence.

Surveillance radar. Radar equipment used to determine the position of an aircraft in range and azimuth.

Synthetic vision system (SVS). A system to display data-derived synthetic images of the external scene from the perspective of the flight deck.

Touchdown zone (TDZ). The portion of a runway, beyond the threshold, where it is intended landing aeroplanes first contact the runway.

Type A Instrument approach operation. Means an instrument approach operation with an MDH or a DH at or above 250ft

Type B Instrument approach operation. Means an operation with a DH below 250ft. Type B instrument approach operations are categorized as:

a) Category I (CAT I): A DH not lower than 200ft and with either a visibility not less than 800m or an RVR not less than 550m

b) Category II (CAT II): A DH lower than 200ft but not lower than 100ft, and an RVR not less than 300m

c) Category III (CAT III): A DH lower than 100ft or no DH, and an RVR less than 300m or no RVR limitation

Vertical navigation (VNAV). A method of navigation which permits aircraft operation on a vertical flight profile using altimetry sources, external flight path references, or a combination of these.

Visibility. Visibility for aeronautical purposes is the greater of:

a) the greatest distance at which a black object of suitable dimensions, situated near the ground, can be seen and recognized when observed against a bright background;

b) the greatest distance at which lights in the vicinity of 1 000 candelas can be seen and identified against an unlit background.

Note 1.— The two distances have different values in air of a given extinction coefficient, and the latter b) varies with the background illumination. The former a) is represented by the meteorological optical range (MOR).

Note. 2.— The definition applies to the observations of visibility in local routine and special reports, to the observations of prevailing and minimum visibility reported in METAR and SPECI and to the observations of ground visibility.

Visual approach. An approach by an IFR flight when either part or all of an instrument approach procedure is not completed and the approach is executed by visual reference to terrain.

Visual flight rules (VFR). A set of rules governing the conduct of flight under visual meteorological conditions.

Note.— VFR specifications are found in Chapter 4 of Annex 2.

Visual meteorological conditions (VMC). Meteorological conditions expressed in terms of visibility, distance from cloud, and ceiling, as defined in Annex 2, equal to or better than specified minima.

Note.— The specified minima for visual meteorological conditions are contained in Chapter 4 of Annex 2.

Visual segment surface (VSS). Vertically, the VSS originates at the runway threshold height and has a slope of 1.12 degrees less than the promulgated approach procedure angle. The lateral surface of the VSS is defined in PANS-OPS, Volume II.

Visual segment for take-off. The value of 125 m RVR for take-off with 15 m centre line light spacing has been selected because flight deck geometry means that this will provide at least a

90-m visual segment for the large majority of aircraft types. In a 90-m visual segment the pilot is expected to be able to see six centre line light intervals (seven centre line lights) at 15 m spacing once lined up on the runway centre line.

SECTION 2 REQUIREMENTS

2.1 Introduction- Low-visibility operations and operations with operational credits

The operator shall conduct the following operations only if they are approved by the UCAA:

a) take-off operations with visibility conditions of less than 400 m RVR;

b) instrument approach operations in low-visibility conditions; and

c) operations with operational credits, except for EFVS 200 operations, which shall not be subject to a specific approval.

For each of the above core areas at 2.1 (a) to (c), guidance is provided below, although it is important that the user of this AC should always check the latest validity of all relevant reference documents and the technical standards therein.

Note: Take-off operations are classified as normal take-off operations with an RVR at or above 550m and 'LVTO operations' with an RVR below 550m. Only LVTO operations in an RVR less than 400m require a specific approval.

2.1.1 Low-visibility take-off (LVTO) operations – Aeroplanes in an RVR of less than 400m

The table 1 below sets out the RVR requirements against the facilities that are required according to a particular RVR.

Table 1

Minimum RVR	Facilities
300 m (day)	Centre line markings; and Runway edge lights.
300 m (night)	Centre line markings; and Runway edge lights; and Runway end lights or centre line lights
150 m	Centre line markings; and Runway end lights; and Runway edge lights; and Runway centre line lights
125 m	Centre line markings; and Runway end lights; and Runway edge lights (spaced 60m or less); and Runway centre line lights (spaced 15 m or less)

The table above is applicable to multi-engine aeroplanes which, in the event of a critical engine failure at any point during take-off, can either stop or continue the take-off to a height of 1500ft above the aerodrome while clearing obstacles by the required margins.

Note: In realty the table is relevant to most large commercial air transport types but if the subject aeroplane is not able to meet the above criteria, the following would apply:

For multi-engined aeroplanes that are not able to comply with the above performance criteria, there may be a need to land immediately and to see and avoid obstacles. Such aeroplanes may be operated to the take-off minima shown in table 2 below, but with the marking and lighting criteria shown in the table above (RVR versus facilities) provided that they are able to comply with the applicable obstacle clearance criteria, assuming engine failure at the height specified:

Table 2 - LVTO operations with aeroplanes — assumed engine failure height versus RVR

Assumed engine failure height above the take-off runway (ft) versus RVR (m)	
Less than 50	Not less than 200
More than 50 but less than 100	Not less than 300

2.1.1(a) Additional notes – Take-offs in RVR less than 400m

a) The reported RVR value representative of the initial part of the take-off run can be replaced by pilot assessment.

b) The minimum RVR specified in Table 1 or 2 should be achieved for all reporting points representative of the parts of the runway from the point at which the aircraft commences the take-off until the calculated accelerate-stop distance from that point.

2.1.2 Take-Offs in an RVR of less than 125 m

a) For LVTO operations with an RVR of less than 125 m, the following additional elements should apply:

  1) The runway has centre line lights spaced at intervals of 15 m or less;

  2) If an ILS signal is used for lateral guidance, the ILS localiser signal meets the requirements for category III operations, unless otherwise stated in the AFM;

  3) If an ILS signal is to be used, low-visibility procedures (LVPs) include protection of the runway and, where an ILS localiser signal is used, it should include protection of the ILS- sensitive area unless otherwise stated in the AFM; and

  4) If a GLS signal is used for lateral guidance, the GLS performance type meets the requirements for category III operations (GAST D and to GBAS point to which guidance is required), unless otherwise stated in the AFM.

    (a) For LVTO operations with an RVR of less than 125 m, the reported RVR should be not less than the minimum specified in the AFM or, if no such minimum is specified, not less than 75 m.

(b) The minimum required RVR should be achieved for all reporting points representative of the parts of the runway from the point at which the aircraft commences the take-off until the greater of the calculated take-off distance or accelerate-stop distance from that point.

(c) The reported RVR value representative of the initial part of the take-off run can be replaced by pilot assessment.

Note: The value of 125m RVR for take-off with 15m centre line light spacing has been selected because flight deck geometry means that this will provide at least a 90-m visual segment for the large majority of aircraft types . In a 90-m visual segment the pilot is expected to be able to see six centre line light intervals (seven centre line lights) at 15m spacing one lined up on the runway centre line.

2.2 Instrument approach operations in low-visibility conditions

General – The different types of approach and landing operations are classified according to the lowest DH (or MDH) and RVR applicable to the approach type. The classification of approach types does not depend on the technology used for the approach. The lowest minima specified do not take account of 'operational credits' that may allow for lower operating minima.

The classification does not subdivide CAT III operations into CAT IIIA, IIIB, and IIIC. The actual minima applicable to any operation depends on the aircraft equipment and the specific LVO approval held by the air operator.

The AFM for aircraft certified for CAT III operations will state the lowest usable DH, or no DH. Some AFMs may refer to the previous ICAO classifications as follows:

- CAT IIIA: a DH lower than 30m (100ft) or no DH and an RVR not less 175m
- CAT IIIB: a DH lower than 15m (50ft) or no DH and an RVR less than 175m but not less than 50m, and
- CAT IIIC: no DH and no RVR limitations (Note CAT IIIC is not used in the EU as a descriptor, and the minimum RVR in EU Regulations is 75m)

Where an operational credit allows operation to lower-than-standard minima, this is not considered a separate approach classification.

2.2.1 Category II Operations

For CAT II operations, the following should apply:

a) The DH should be determined by the use of a radio altimeter or other device capable of providing equivalent performance and be not lower than the highest of

1) the minimum DH specified in the AFM, if stated;

2) the applicable obstacle clearance height (OCH) for the category of aircraft;

3) the DH to which the flight crew is qualified to operate; or

4) 100 ft, or

b) The lowest RVR minima to be used are specified in Table 3 below

Table 3 - CAT II operation minima: RVR (m) versus (ft)

Aircraft categories		Auto-coupled or HUD to below DH*	
		A, B, C	D
DH (ft)	100-120	300	300/350*
	121-140	400	400
	141-199	450	450

*An RVR of 300 m may be used for a Category D aeroplane conducting an autoland or using HUDLS to touchdown.

2.2.2 Category III Operations

For CAT III operations, the following should apply:

a) For operations in which a DH is used, the DH should be determined by the use of a radio altimeter or other device capable of providing equivalent performance and be not lower than:

   1) the minimum DH specified in the AFM, if stated;

   2) the DH to which the flight crew is qualified to operate.

b) Operations with no DH should only be conducted if:

   1) operation with no DH is specified in the AFM;

   2) there is no published information indicating that the approach aid or aerodrome facilities cannot support operations with no DH; and

   3) the flight crew is qualified to operate with no DH.

c) The lowest RVR to be used should be determined in accordance with Table 4 below

Table 4 - CAT III operations minima: RVR (m) versus DH (ft)

DH (ft)	Roll-out control/guidance system	RVR (m)*
50-99	Not required	175
0-49 or no DH	Fail-passive	125
	Fail-operational	75

Note: Concerning RVR For a fail-passive or HUD roll-out control system, a lower RVR value (no lower than 75 m) can be used if stated in the AFM provided that the equipment demonstrated such capability as part of the certification process. This is provided that the operator has implemented the appropriate operating procedures and training.

2.2.3 Instrument approach operations in low-visibility conditions — effect on landing minima of temporarily failed or downgraded equipment for approach operations with a Decision Height (DH) below 200 ft.

It is of paramount important that operators, procedurally and from a training perspective account for failed or downgraded equipment. Technical information is shown below, it guides what is acceptable in this regard: Both Tables 5 & 6 are relevant, table 5 pertains to CAT II/III operations and Table 6 to approaches using operational credits.

a) Only those facilities mentioned in Table 5 below should be acceptable to be used to determine the effect of temporarily failed of downgraded equipment on the required RVR for CAT II/III approach operations. When interpreting this information, the following conditions should be applied:

b) The following conditions should be applied to Table 5:

   1) multiple failures of runway/FATO lights other than those indicated in Table 5 are not acceptable;

   2) failures of approach and runway/FATO lights are acceptable at the same time, and the most demanding consequence should be applied;

   3) for approach operations with a DH below 200 ft, a combination of deficiencies in runway/FATO lights and RVR assessment equipment are not permitted; and

   4) failures other than ILS, GLS and MLS affect RVR only and not DH.

Table 5 - Failed or downgraded equipment — effect on landing minima Category II/III operations

Failed or downgraded equipment	Effect on landing minima			
	CAT III no DH	CAT III DH<50ft	CAT III DH>=50ft	CAT II
Navaid stand-by transmitter	Not allowed	RVR 200 m	No effect	
Outer marker (ILS)	No effect if the required height versus glide path can be checked using other means, e/g/ DME fix			
Middle marker (ILS)	No effect			
DME	No effect if replaced by RNAV (GNSS) information or the outer marker			
RVR assessment systems	At least one RVR value to be available on the aerodrome	On runways equipped with two or more RVR assessment units, one may be inoperative		
Approach lights	No effect	Not allowed for operations with DH>50ft		Not allowed
Approach lights except the last 210m	No effect			Not allowed
Approach lights except the last 420m	No effect			
Standby power for approach lights	No effect			
Standby power for runway lights with 1-second switchover time	No effect No effect	Not allowed	**Day**: RVR 550m **Night**: RVR 550m	**Day**: RVR 550m **Night**: RVR 550m
Edge lights	No effect	**Day:** no effect **Night:** RVR 550m	**Day:** No effect **Night:** RVR 550m	**Day:** no effect **Night:** not allowed
Threshold lights	No effect	No effect	**Day:** no effect	**Day:** no effect
Runway end lights	No effect if centre line lights are serviceable			
Centre line lights	**Day:** RVR 200m **Night:** Not allowed	Not allowed	**Day:** RVR 300m **Night:** RVR 400m	**Day:** RVR 350m **Night:** RVR 550m (400m with HUD or auto-land**)**
Centre line lights spacing increased to 30m	RVR 150m		No effect	
TDZ lights	**No effect**	**Day:** RVR 200m **Night:** RVR 300m	**Day:** RVR 300m **Night:** RVR 550m, 350m with HUD or auto-land	
Taxiway light system				

Table 6 - Failed or downgraded equipment — effect on landing minima operational credits

Failed or downgraded equipment	Effect on landing minima			
	SA CAT I	SA CAT II	EFVS-A	EFVS-L
Navaid stand-by transmitter	No effect			
Outer marker (ILS)	No effect if replaced by height check at 1 000 ft			
Middle marker (ILS)	No effect			
RVR assessment systems	On runways equipped with two or more RVR assessment units, one may be inoperative			
Approach lights	Not allowed	Not allowed	As per IAP	As per IAP
Approach lights except the last 210 m	Not allowed	No effect	As per IAP	As per IAP
Approach lights except the last 420 m	No effect	No effect	As per IAP	As per IAP
Standby power for approach lights	No effect			
Edge lights	**Day:** No effect	**Day:** no effect	As per IAP	As per IAP
	Night: not allowed	**Night:** RVR 550 m	As per IAP	As per IAP
Threshold lights	**Day:** No effect	**Day:** no effect	As per IAP	As per IAP
	Night: not allowed	**Night:** RVR 550 m	As per IAP	As per IAP
Runway end lights	No effect if centre line lights are serviceable		As per IAP	
Centre line lights	**Day:** RVR 400 m	**Day:** RVR 300 m	As per IAP	As per IAP
	Night: RVR 550 m	**Night:** RVR 400 m	As per IAP	As per IAP
Centre line lights spacing increased to 30 m	No effect	No effect	As per IAP	As per IAP
TDZ lights	**Day:** no effect	**Day:** RVR 300 m	As per IAP	
	Night: no effect	**Night:** RVR 350 m	As per IAP	
Taxiway light system	No effect			

2.2.4 Instrument approach operations in low-visibility conditions — classification of standard approach operations

The different types of approach and landing operations are classified according to the lowest DH (or MDH) and RVR applicable to the approach type. The classification of approach types does not depend on the technology used for the approach. The lowest minima specified do not take account of 'operational credits' that may allow for lower operating minima.

The classification does not subdivide CAT III operations into CAT IIIA, IIIB, and IIIC. The actual minima applicable to any operation depends on the aircraft equipment and the specific LVO approval held by the air operator.

The AFM for aircraft certified for CAT III operations will state the lowest usable DH, or no DH. Some AFMs may refer to the previous ICAO classifications as follows:

- CAT IIIA: a DH lower than 30 m (100 ft) or no DH and an RVR not less than 175 m;
- CAT IIIB: a DH lower than 15 m (50 ft) or no DH and an RVR less than 175 m but not less than 50 m; and
- CAT IIIC: no DH and no RVR limitations.

Where an operational credit allows operation to lower-than-standard minima, this is not considered a separate approach classification.

2.2.5 Instrument approach operations in low-visibility conditions - equipment certification for low-visibility approach operations other than EFVS

Operators should always refer to EASA CS-AWO for the actual certification specifications requirements in respect to low visibility operations, certain information is provided below:

Aircraft suitable for low-visibility approach operations are certified according to the minimum usable DH which is stated in the AFM.

Certification specifications (CS-AWO) allow for systems to be certified for SA CAT I, CAT II or CAT III operations. Systems certified for CAT III operations may specify:

- a lowest usable DH of:
- less than 100 ft but not less than 50 ft;
- less than 50 ft; or
- no DH.

Legacy systems may be described as capable of 'CAT 3A' or 'CAT IIIA' operations. This implies a minimum DH of less than 100 ft but not less than 50 ft. Systems described as capable of 'CAT 3B' or 'CAT IIIB' may be certified for a DH of less than 50 ft or no DH.

Operations to a DH of less than 100 ft but not less than 50 ft will typically require a fail-passive automatic landing system or a HUDLS or equivalent system. Operations to a DH of less than 50 ft will require a fail-operational landing system, a fail-passive go-around system, automatic thrust control and either automatic ground roll control or ground roll guidance using a HUDLS. For no DH operations, a fail-passive or fail-operational ground roll control system is required.

The RVR required for SA CAT I, CAT II and SA CAT II approach operations is determined by the DH and the aircraft approach speed category. The RVR required for CAT III approach operations is determined by the DH and the capability of the ground-roll control system. Operations with fail-passive roll control systems require a greater RVR than operations with fail-operational ground control systems because the pilots would need to have sufficient visibility to maintain lateral control in the event of a system failure

2.3 Operations with operational credits - special authorisation Category I (SA CAT I)

In this section the focus will be on operations with operational credits, inspectors need to be aware this is another area they may have to assess, other than normal approach categorisations.

General – The concept of operations with operational credits

For each specific class of standard take-off or approach operations, a standard combination of airborne equipment, aerodrome infrastructure and equipment, and procedures (system components) needs to be available to ensure the required performance of the total system.

In real-life operations, one or more system components may exceed the required standard performance. The aim of the concept of operations with operational credits is to exploit such enhanced performance to provide operational flexibility beyond the limits of standard operations.

In certain circumstances it may be possible to achieve the required system performance without some standard items being available by using other enhanced equipment or procedures. In order to apply an operational credit, it is necessary that the equipment or procedures employed mitigate effectively the shortcomings in other system components.

Another application of operational credits is to use the enhanced performance of certain system components to allow operations to lower than the standard minima. For approach operations, an operational credit can be applied to the instrument or the visual segment or both.

It is important to understand, that where an operational credit allows operation to lower than standard minima, this is not considered a separate approach classification

Combined Vision Systems

A combined vision system (CVS) consisting of an EVS and SVS can be approved for EFVS operations if it meets all the certification requirements for an EVS

2.3(a) Special authorization category I (SA CAT I) operations.

Introduction – SA CAT I operations

SA CAT I is an operational credit that exploits a navigation solution with superior performance to that required for standard CAT I by extending the instrument segment of CAT I approach operations. This navigation solution may be an ILS installation with the necessary performance coupled to a suitably certified Autoland system or a HUD or equivalent display system or SVGS.

The extended instrument segment means that the DH can be reduced from the standard minimum of 200 down to 150 ft. The lower DH allows a corresponding reduction in the RVR required for the approach.

SA CAT I is not a separate approach classification; it is an operational credit applied to a CAT I operation.

2.3(a)(i) For special authorisation category I (SA CAT I) operations, the following should apply:

a) The DH of an SA CAT I operation should not be lower than the highest of:

   1) the minimum DH specified in the AFM, if stated;

   2) the applicable OCH for the category of aeroplane;

   3) the DH to which the flight crew is qualified to operate; or

   4) 150 ft.

b) Where the DH for an SA CAT I operation is less than 200 ft, it should be determined by the use of a radio altimeter or other device capable of providing equivalent performance.

c) The following visual aids should be available:

   1) approach lights as specified in Table 8;

   2) precision approach (PA) runway markings;

   3) category I runway lights.

d) The lowest RVR should not be lower than the higher of:

   1) the minimum RVR specified in the AFM, if stated; or

   2) the RVR specified in Table 7 below.

Table 7 - SA CAT I operation minima RVR (m) versus approach lighting system

Class of light facility		FALS	IALS	BALS	NALS
DH (ft)	150-160	400	500	600	700
	161-200	450	550	650	750
	201-210	450	550	650	750
	211-220	500	550	650	800
	221-230	500	600	700	900
	231-240	500	650	750	1000
	241-249	550	700	800	1100

2.3(b) Special authorization category II (SA CAT II) operations.

Introduction – SA CAT II operations

SA CAT II is an operational credit that applies to the visual segment of an approach conducted where aerodrome, runway and approach lighting systems do not meet the usual requirements for a CAT II precision lighting system. SA CAT II exploits the performance of a suitably certified HUDLS or autoland system. The DH will be the same as for standard CAT II, and the required RVR will depend on the class of light facility installed.

SA CAT II is not a separate approach classification; it is an operational credit applied to a CAT II operation usually in a CAT I runway.

2.3(b)(i) For special authorisation category II (SA CAT II) operations, the following should apply:

a) The DH should be determined by the use of a radio altimeter or other device capable of providing equivalent performance, if so determined by the aircraft certification process, and be not lower than the highest of:

1) the minimum DH specified in the AFM, if stated;

2) the applicable OCH for the category of aeroplane;

3) the DH to which the flight crew is qualified to operate; or

4) 100 ft.

b) The following visual aids should be available:

1) approach lights as specified in Table 8

2) precision approach runway markings;

3) category I runway lights.

c) The lowest RVR minima to be used are specified in Table 8 below:

Table 8

Class of light facility		FALS	IALS	BALS	NALS
DH (ft)	100-120	350	450	600	700
	121-140	400	500	600	700
	141-160	400	500	600	750
	161-199	400	550	650	750

2.3(c) EFVS operations to a runway.

Introduction & technical background – EFVS operations (see appendix 2)

2.3(c)(i) When conducting EFVS operations to a runway:

a) the DA/H used should be the same as for operations without EFVS;

b) the lowest RVR minima to be used should be determined:

1) in accordance with criteria specified in the AFM for the expected weather conditions; or
2) if no such criteria are specified, by reducing the RVR determined for operation without the use of EFVS/CVS in accordance with Table 9 below;

c) where the lowest RVR to be used, determined in accordance with (b), is less than 550 m, then this should be increased to 550 m unless LVPs are established at the aerodrome of intended landing;

d) where the EFVS is part of a CVS, it is only the EFVS element that should provide the operational credits. The other part of the CVS, the synthetic vision system (SVS), should not provide operational credits.

Table 9 - Operations using EFVS/CVS – RVR/CMV reduction

RVR/CMV (m) required without the use of EFVS	RVR/CMV (m) with the use of EFVS
550	350*
600	400*
650	450*
700	450*
750	500*
800	550
900	600
1000	650
1100	750
1200	800
1300	900
1400	900
1500	1000
1600	1100
1700	1100
1800	1200
1900	1300
2000	1300
2100	1400
2200	1500
2300	1500
2400	1600
*Reported RVR should be available (no CMV conversion)	

SECTION 3 Specific Approval Criteria

This section guides inspectors on what they should expect an Operator to demonstrate to the UCAA in respect to an application for a low visibility operation(s) approval.

To obtain a specific approval, the operator shall demonstrate that:

a) for low-visibility approach operations, LVTO operations in an RVR less than 125 m and operations with operational credits, the aircraft has been certified for the intended operations;

b) the flight crew members are competent to conduct the intended operation and a training and checking programme for the flight crew members and relevant personnel involved in the flight preparation is established.

c) operating procedures for the intended operations have been established;

d) has established the relevant operating minima

e) any relevant changes to the minimum equipment list (MEL) have been made;

f) any relevant changes to the maintenance programme have been made and account has been taken of the relevant airworthiness requirements and limitations;

g) has processes to ensure that only runways and instrument procedures suitable for the intended operations are used;

h) procedures have been established to ensure the suitability of aerodromes, including instrument flight procedures, for the intended operations, and

i) for the intended operations, a safety assessment has been carried out, and performance indicators have been established to monitor the level of safety.

j) the operator has established a system for data collection, evaluation and trend monitoring for low visibility operations, including those for which there is an operational credit, and

k) the operator has instituted appropriate procedures in respect of continuing airworthiness (maintenance and repair) practices and programmes

3.1.1 Operating procedures for LVOs

In this section detail will be provided on the operational considerations that are relevant to a low visibility operation and the corresponding procedures that are required.

Note: There is a close relationship between the procedures an operator sets out and the training it provides to its crews and other operational staff on them. UCAA inspectors should account for this as they process an LVO application.

Prior to commencing an LVO, the pilot-in-command/commander should be satisfied that:

a) the status of visual and non-visual facilities is as required;

b) if LVPs are required for such operations, LVPs are in effect; and

c) the flight crew members are appropriately qualified.

3.1.1 Operating procedures — General

a) Operating procedures should be established for all types of LVOs and operations with operational credits for which an operator is seeking approval. The operating procedures should:

   1) be consistent with the AFM;

   2) be appropriate to the technology and equipment to be used;

   3) specify the duties and responsibilities of each flight crew member in each relevant phase of flight;

   4) ensure that flight crew workload is managed to facilitate effective decision-making and monitoring of the aircraft; and

   5) minimise, as much as practical, the deviation from normal procedures used for routine operations (non-LVOs).

b) Operating procedures should include:

   1) the required checks for the satisfactory functioning of the aircraft equipment, both before departure and in flight;

   2) the correct seating and eye position;

   3) determination of aerodrome operating minima;

   4) the increment to be added to minima for use by pilots-in-command/commanders who are new to the aircraft type, if applicable;

   5) the effect on aerodrome operating minima of temporarily failed or downgraded ground equipment;

   6) the effect on aerodrome operating minima of the failure or change of the status of any aircraft systems;

   7) when the LVPs at the aerodrome are required. LVPs are required:

      i. for low-visibility flight approach operations;

      ii. for LVTOs with RVR less than 400 m.

If an operator selects an aerodrome with equivalent procedures, where the term ‘LVPs’ is not used (e.g. regional procedures), the operator should verify that suitable procedures are established to ensure an equivalent level of safety to that achieved at approved aerodromes. This situation should be clearly noted in the operations manual or procedures manual, including guidance to the flight crew on how to determine that the suitable procedures are in effect at the time of an actual operation. Note: the AFM may state that some elements of LVPs are not required and therefore the equivalent level of safety may be established on that basis;

   1) a requirement for an ‘approaching minima’ call-out to prevent inadvertent descent below the DA/H;

2) the requirement for height call-outs below 200 ft to be based on the use of a radio altimeter or other device capable of providing equivalent performance, if applicable;

3) the required visual references;

4) the action to be taken in the event of loss of the required visual references; and

5) the maximum allowable flight path deviations and action to be taken in the event that such deviations occur.

c) Operators should include operating procedures in the relevant section of their operations manual(s), whether OMA (General) OMB (Type) OMC (Route/Area) or OMD (Training).as required.

3.1.2 Operating procedures — CAT II

For CAT II operations, the following should apply:

a) The flight crew should consist of at least two pilots.

b) The approach should be flown using a certified system as identified in the AFM.

c) If the approach is flown using autopilot, for a manual landing the autopilot should remain engaged until after the pilot has achieved visual reference.

d) All height call-outs below 200 ft above the runway threshold elevation should be determined by the use of a radio altimeter or other device capable of providing equivalent performance.

e) The DH should be determined by the use of a radio altimeter or other device capable of providing equivalent performance, if so determined by the aircraft certification process.

f) At DH, the following visual references should be distinctly visible and identifiable to the pilot:

1) a segment of at least three consecutive lights, which are the centre line of the approach lights or TDZ lights or runway centre line lights or edge lights or a combination of these; and

2) a visual reference that should include a lateral element of the ground pattern, such as an approach lighting crossbar, or the landing threshold, or a barrette of the TDZ lighting unless the operation is conducted using a HUD or an equivalent system to touchdown.

3.1.3 Operating procedures — CAT III

For CAT III operations, the following should apply:

a) The flight crew should consist of at least two pilots.

b) The approach should be flown using a **certified system** as identified in the AFM.

c) All height call-outs below 200 ft above the runway threshold elevation should be determined by the use of a radio altimeter or other device capable of providing equivalent performance.

d) For operations in which a DH is used, the DH should be determined by the use of a radio altimeter or other device capable of providing equivalent performance, if so determined by the aircraft certification process.

e) At DH, the following visual references should be distinctly visible and identifiable to the pilot:

   1) for operations conducted either with fail-passive flight control systems or with the use of an approved HUD or equivalent display system: a segment of at least three consecutive lights, which are the centre line of the approach lights, or TDZ lights, or runway centre line lights, or runway edge lights, or a combination of these; and

   2) for operations conducted either with fail-operational flight control systems or with a fail- operational hybrid landing system using a DH: at least one centre line light to be attained and maintained by the pilot.

   3) For operations with no DH, there is no specification for visual reference with the runway prior to touchdown.

3.1.4 Operating procedures — SA CAT I

For SA CAT I operations, the following should apply:

a) The approach should be flown using a certified system as identified in the AFM.

b) All height call-outs below 200 ft above the runway threshold elevation should be determined by the use of a radio altimeter or other device capable of providing equivalent performance.

c) The DH should be determined by the use of a radio altimeter or other device capable of providing equivalent performance, if so determined by the aircraft **certification** process.

d) At DH the following visual references should be visible to the pilot:

   1) a segment of at least three consecutive lights, which are the centre line of the approach lights, or TDZ lights, or runway centre line lights, or runway edge lights, or a combination of these; and

   2) a visual reference that should include a lateral element of the ground pattern, such as an approach lighting crossbar, or the landing threshold, or a barrette of the TDZ lighting unless the operation is conducted utilising an approved HUD or an equivalent system usable down to 120 ft above the runway threshold.

3.1.5 Operating Procedures — SA CAT II

For SA CAT II operations, the following should apply:

a) The flight crew should consist of at least two pilots.

b) The approach should be flown using a **certified** HUDLS or autoland system as identified in the AFM.

c) All height call-outs below 200 ft above the runway threshold elevation should be determined by the use of a radio altimeter or other device capable of providing equivalent performance.

d) The DH should be determined by the use of a radio altimeter or other device capable of providing equivalent performance, if so determined by the aircraft certification process.

e) At DH the visual references should be distinctly visible and identifiable to the pilot:

   1) a segment of at least three consecutive lights, which are the centre line of the approach lights or TDZ lights, or runway centre line lights, or runway edge lights or a combination of these;

   2) a visual reference that should include a lateral element of the ground pattern, such as an approach lighting crossbar, or the landing threshold, or a barrette of the TDZ lighting.

3.1.6 Operating procedures — EFVS operations to a runway

For EFVS operations to a runway, the following should apply:

a) The approach should be flown using a certified EFVS-A or EFVS-L as identified in the AFM.

b) The pilot flying should use the EFVS throughout the approach.

c) In multi-pilot operations, the pilot monitoring should monitor the EFVS-derived information.

d) The approach between the final approach fix (FAF) and the DA/H should be flown using vertical flight path guidance mode (e.g. flight director).

e) The approach may be continued below the DA/H provided that the pilot can identify on the EFVS image either:

   1) the approach light system; or

   2) both of the following:

      i) the runway threshold identified by the beginning of the runway landing surface, the threshold lights or the runway end identifier lights; and

      ii) the TDZ identified by the TDZ lights, the TDZ runway markings or the runway edge lights.

f) Unless the aircraft is equipped with a certified EFVS-L, a missed approach should be executed promptly if the required visual reference is not distinctly visible and identifiable to the pilot without reliance on the EFVS by the following height above the threshold:

   1) the height below which an approach should not be continued if natural visual reference is not acquired by the crew as stated in the AFM; or

2) if the AFM does not specify such a height, 100 ft.

3.1.7 Specific approval criteria (autopilot failure at or below DH in fail-passive CAT III operations)

Although aircraft flight manual(s) and type procedures manuals will typically guide on the exact procedures that apply, a relevant consideration is autopilot failure at a critical stage of the approach – certain notes are shown below:

For operations to actual RVR values less than 300 m, a missed approach procedure is assumed in the event of an autopilot failure at or below DH. This means that a missed approach procedure is the normal action. However, the wording recognises that there may be circumstances where the safest action is to continue the landing. Such circumstances include the height at which the failure occurs, the actual visual references, and other malfunctions. This would typically apply to the late stages of the flare. In conclusion, it is not forbidden to continue the approach and complete the landing when the pilot-in-command/commander determines that this is the safest course of action. The operator's policy and the operational instructions should reflect this information.

SECTION 4 Safety Assessment — Monitoring, Data Collection And Performance Indicators

Fundamental to an LVO application is that it is an evidence based process, whereby the applicant operator gathers data in order to allow its aircraft equipment, procedures, flight crew training and aircraft maintenance programme to be tested with hazards identified and after due risk assessment, mitigations put in place.

Prior to commencing LVOs or operations with operational credits, an operator should demonstrate to the CAA that such operations will achieve an acceptable level of safety. This requires the operator to gather data from operations using the relevant systems and procedures and conduct safety assessments taking that data into account

4.1.1 The baseline approach to the required safety assessment is set out below:

a) The operator should monitor LVOs and operations with operational credits in order to validate the effectiveness of the applicable aircraft flight guidance systems, training, flight crew procedures, and aircraft maintenance programme, and to identify hazards.

b) Data should be collected whenever an LVO or an operation with an operational credit is attempted regardless of whether the approach is abandoned, is unsatisfactory, or is concluded successfully. The data should include records of the following:

   1) occasions when it was not possible to commence an approach due to deficiencies or unserviceability's of related airborne equipment;

   2) occasions when approaches were discontinued, including the reasons for discontinuing the approach and the height above the runway at which the approach was discontinued;

   3) occasions when system abnormalities required pilot intervention to ensure a continued approach or safe landing;

4) landing performance, whether or not the aircraft landed satisfactorily within the desired touchdown area with acceptable lateral velocity or cross-track error. The approximate lateral and longitudinal position of the actual touchdown point in relation to the runway centre line and the runway threshold, respectively, should be recorded.

c) Data about LVOs should be collected by means of the operator's flight data monitoring programme supplemented by other means including reports submitted by flight crew. Operators that do not have a flight data monitoring programme should use reports submitted by flight crew as the primary means of gathering data.

d) Performance indicators should include the following:

1) the rate of unsuccessful low-visibility approaches, i.e. the number of attempted approaches terminating in discontinued approaches, approaches where pilot intervention was required to ensure a continued approach or safe landing or where landing performance was unsatisfactory, compared to the number of low-visibility approaches attempted;

2) measures of performance of the airborne equipment for low-visibility approaches or operations with operational credits;

3) safety performance indicators related to other specific risks associated with LVOs.

e) The following information should be retained for at least 5 years:

1) the total number of low-visibility approaches or operations with an operational approval attempted or completed, including practice approaches, by aircraft type; and

2) reports of unsatisfactory approaches and/or landings, by runway and aircraft registration, in the following categories:

i. airborne equipment faults;

ii. ground facility difficulties;

iii. missed approaches because of air traffic control (ATC) instructions; or

iv. other reasons.

4.1.2 Safety Assessment prior to obtaining an approval – Supporting Detail

a) The operator applying for the approval of low-visibility approach operations should determine the minimum number of approaches required to gather sufficient data to demonstrate an acceptable level of safety and the time period over which such data should be gathered.

b) If an operator is applying for more than one LVO approval or an approval for operation with operational credits for a particular aircraft type, then data gathered from operations using the systems and procedures designed for one classification of operations or operation with operational credits may be used to support the application for another classification of operations or operation with operational credits provided the following elements are similar:

1) type of technology, including:

   i. flight control/guidance system (FGS) and associated displays and controls;

   ii. flight management system (FMS) and level of integration with the FGS;

   iii. use of HUD or an equivalent display system; and

   iv. use of EFVS;

2) operational procedures, including:

   i. alert height;

   ii. manual landing/automatic landing;

   iii. no DH operations;

   iv. use of HUD or an equivalent display system in hybrid operations; and

   v. use of EFVS to touchdown; and

3) handling characteristics, including:

   i. manual landing from automatic or HUD or an equivalent display system guided approach;

   ii. manual missed approach procedure from automatic approach; and

   iii. automatic/manual roll-out.

c) An operator holding an approval for low-visibility approach operations or operations with operational credits may use data gathered from approaches conducted using one aircraft type to support an application for approval for a different aircraft type or variants provided the following elements are similar:

1) type of technology, including the following:

   i. FGS and associated displays and controls;

   ii. FMS and level of integration with the FGS;

   iii. use of HUD or an equivalent display system; and

   iv. use of EFVS;

2) operational procedures, including:

   i. alert height;

   ii. manual landing/automatic landing;

   iii. no DH operations;

   iv. use of HUD or an equivalent display system in hybrid operations; and

   v. use of EFVS to touchdown; and

3) handling characteristics, including:

   i. manual landing from automatic or HUD or an equivalent display system guided approach;

   ii. manual missed approach procedure from automatic approach; and

   iii. automatic/manual roll-out.

4.1.3 Specific Approval – Successful approach & landing criteria An approach may be considered to be successful if:

1) from 500 ft to start of flare:

   i. speed is maintained within +/- 5 kt of the intended speed, disregarding rapid fluctuations due to turbulence;

   ii. no relevant system failure occurs; and

2) from 300 ft to DH:

   i. no excess deviation occurs; and

   ii. no centralised warning gives a missed approach procedure command (if installed).

a) A landing may be considered to be successful if:

   1) no relevant system failure occurs;

   2) no flare failure occurs;

   3) no de-crab failure occurs (if installed);

   4) longitudinal touchdown is beyond a point on the runway 150 m after the threshold and before the end of the touchdown zone (TDZ) (750 m from the threshold);

   5) lateral touchdown with the outboard landing gear is not outside the TDZ edge;

   6) sink rate is not excessive;

   7) bank angle does not exceed a bank angle limit; and

   8) no roll-out failure or deviation (if installed) occurs.

4.1.4 Safety Performance Monitoring – Data Gathering

See appendix 3 for expanded detail on data gathering

SECTION 5 Aerodrome-related requirements, including instrument flight procedures

As has been highlighted an assessment of a LVO application has system wide implications – one of these is an assessment that the aerodrome of intended use is suitable.

The operator shall ensure that only aerodromes, including instrument flight procedures, suitable for the intended operations are used for LVOs and operations with operational credits.

See appendix 4 & 5 for supporting detail.

5.1.1 Suitable aerodromes — assessment — aeroplanes

a) The assessment of the suitability of an aerodrome, including instrument flight procedures, for the intended operations comprises the availability of:

   1) suitable navigation facilities and associated instrument flight approach procedures;

2) suitable aerodrome operating procedures, including LVPs, and the compatibility with the intended aircraft operations; and

3) suitable runway and runway environment characteristics and facilities.

b) The assessment of the suitability of an aerodrome, including instrument flight procedures, for the intended operations should be made by means of one or a combination of the following:

1) An assessment of previous operational data for the particular aerodrome, runway and instrument flight procedures. This entails the verification of the availability of previous operational data, such as records of approaches flown in the same aerodrome, with the same procedures and aircraft type.

2) A desktop assessment of the:

i. aerodrome data;

ii. instrument flight procedures; and

iii. the aircraft data and capabilities.

This desktop assessment compares aircraft data and capabilities and the aerodrome and instrument approach characteristics. If the aircraft data is compatible with the aerodrome and instrument approach procedure characteristics, the aerodrome and runway should be considered suitable for the intended LVO;

3) An operational assessment

This is meant to be used if the suitability of the aerodrome for the intended operations could not be positively assessed by means of the other methods. In that case, an operational assessment becomes necessary, and actual flights should be performed. The operational assessment should consider the level of complexity of the aerodrome characteristics.

5.2 Assessment of previous operational data (Aerodrome related)

a) Previous operational data refers to data from:

1) the operator itself, or when not available;

2) the following entities:

i. the State of the aerodrome or the competent authority (UCAA) issuing the operator's LVO

ii. approval;

iii. the type certificate holder of the aircraft; or

iv. other operators.

b) Previous operational data should only be used if:

1) it concerns the same runway and there were no relevant changes to the runway and runway environment;

2) it is derived in accordance with Table 10 below for the intended operation; and

3) there is no safety concern for such operation.

c) Previous operational data may be credited to an aircraft if it is from:

1) the same aircraft make and model, unless the credit from the same aircraft make and model is restricted by any of the entities in point (a)(2); or

2) another aircraft model, if stated in the AFM or additional data from the TC/STC holder.

Table 10

Intended operation	Operation from which previous operational data was derived – subject to the conditions specified in points (c), (d) and (e)	Remark
SA CAT I – automatic landing	CAT I/II/III — automatic landing SA CAT I — automatic landing SA CAT II — automatic landing LTS CAT I — automatic landing	Automatic landing in hybrid systems may also be used
SA CAT I — HUDLS	CAT II/III — HUDLS SA CAT I — HUDLS SA CAT II — HUDLS LTS CAT I — HUDLS	
SA CAT II — automatic landing	CAT II/III — automatic landing SA CAT II — automatic landing	Automatic landing in hybrid systems may also be used
SA CAT II — HUDLS	SA CAT II — HUDLS CAT II/III — HUDLS	
CAT II — HUD to below DH with manual landing	CAT II — HUD to below DH with manual landing CAT II or CAT III — automatic landing CAT II or CAT III HUDLS SA CAT II HUDLS	Data related to the LSAA should only be used in the case of HUDLS or automatic landing
CAT II — auto-coupled to below DH with manual landing	CAT II — auto-coupled to below DH with manual landing CAT II or CAT III — automatic landing SA CAT II automatic landing	
CAT II — automatic landing	CAT II — automatic landing SA CAT II — automatic landing CAT III automatic landing	Automatic landing in hybrid systems may also be used
CAT II — HUDLS	CAT II or CAT III — HUDLS SA CAT II — HUDLS	
CAT III — HUDLS	CAT III — HUDLS	
CAT III— automatic landing	CAT III — automatic landing	If the hybrid system uses automatic landing, then the data may be used as any CAT III system.
CAT III — hybrid system	CAT III — hybrid system based on same components	
EFVS operations requiring flare prompt or flare command, i.e. EFVS-L	EFVS operations requiring flare prompt or flare commands	

Note: Previous operational data should be based on the same kind of xLS (e.g. ILS to ILS, MLS to MLS or GLS to GLS). Data related to landing system performance derived from infrastructure systems with lower performance may be used on systems with higher performance (e.g. data derived from a CAT II ILS may be used on a CAT III ILS). However, an ILS may qualify a GLS operation under the following conditions:

- The performance of the ILS installation on which the data is based can only be credited to the ILS point promulgate.
- An ILS facility performance category II installation can only be credited an operation using GAST C.
- An ILS facility performance category III installation can only be credited to an operation GAST C or GAST D.

Note: When the operator wishing to use an aerodrome where its relevant data for the purpose of LVO is not provided or some data is not provided, the operator should develop procedures to collect or develop the necessary data. The procedure should be specific to the State of the aerodrome or the area of operation and should be approved by the UCAA.

In appendix 4, there is a schematic of the Aerodrome related requirements & instrument flight procedures assessment criteria

5.3 Desktop assessment — aerodrome data, instrument flight procedure and aircraft data and capabilities

a) The desktop assessment should correspond to the nature and complexity of the operation intended to be carried out and should take into account the hazards and associated risks inherent in these operations.

b) The assessment should include the AFM or additional data from the TC/STC holder, instrument flight procedures and aerodrome data. For landing systems, the runway or airport conditions should include as a minimum:

   a) the approach path slope;

   b) the runway elevation;

   c) the type of xLS navigation means intended to be used;

   d) the average slope of the LSAA; and

   e) the ground profile under the approach path (pre-threshold terrain). The distance should be calculated from the published threshold. It should be 300 metres, unless otherwise stated by the AFM or additional data from the TC/STC holder, the State of the aerodrome or AIP data, or the |UCAA issuing the operator’s LVO approval.

   Note: The above points assume a CAT II or CAT III runway. For other types of runways, the operator may need to consider other factors.

c) In addition to (g), additional elements may need to be included in the assessment if stated by:

   a) the AFM, or additional data from the TC/STC holder; or

   b) the State of the aerodrome or AIP data; or

   c) the competent authority (UCAA) issuing the operator’s LVO approval.

   d) For EFVS operations, the following applies:

   If the system used to perform an EFVS operation contains a flare cue, each aircraft type/equipment/runway combination should be verified before authorising the use of

EFVS-L, on any runway with irregular pre-threshold terrain (not within the certification assumption for pre-threshold terrain), if the LSAA presents significant slope change.

5.4 Operational assessment

When performing an operational assessment, the operator should verify each aircraft type and runway combination by successfully completing the determined number of approaches and landings according to the process in point (l) below and the conditions determined in Table 11.

Table 11

Type of approach	RVR/VIS
CAT III	CAT II conditions if the approach was previously successfully assessed in CAT II operations
CAT II & CAT III	CAT I conditions
EFVS-A	As per instrument approach no EFVS credits
SA CAT I & SA CAT II	CAT I conditions

a) The operational assessment should validate the use and effectiveness of the aircraft flight guidance systems, and operating procedures for the intended operation applicable to a specific instrument flight procedure and runway.

b) The process to determine the number of approaches and landings should be based on identified risks and agreed with the competent authority (UCAA), and comprise the following steps:

   a) Identify the risks related to the landing system (based on the AFM or additional data from the TC/STC holder) which may include limitations in the conditions during the operational assessment (e.g. to perform the assessment under a non-commercial flight).

   b) Determine complexity of the runway based on:

      i. a set of criteria based on the certification assumptions identified in the AFM or additional data from the TC/STC holder;

      ii. availability and quality of runway data supporting the risk assessment;

      iii. other known factors identified.

c) Scale the number of required approaches based on complexity.

d) The operational assessment may be performed in a commercial flight.

   a) If the operator has different variants of the same type of aircraft, utilising the same landing systems, the operator should show that the variants have satisfactory operational performance, but there is no need to conduct a full operational assessment for each variant/runway combination.

   b) The operator may replace partially or completely the approaches and landings to a particular runway, if approved by the competent authority (UCAA), with:

      3) simulations made by the aircraft manufacturer or approved design organisations, if the terrain is properly modelled in the simulation;

e) a verification using an FSTD, if the FSTD is suitable for the operational assessment.

5.5 Additional verification of the suitability of runways for EFVS operations

a) The assessment of the suitability of the aerodrome should include whether the approach and runway lights installed (notably incandescent or LED lights) are adequate for the EFVS equipment used by the operator.

b) Additionally, the operator should assess obstacles for the following operations:

   a) NPA procedures;

   b) APV;

   c) category I PA procedures on runways where an OFZ is not provided; and

   d) approach procedures not designed in accordance with PANS-OPS or equivalent criteria.

c) The assessment in point (b) should determine whether:

   a) obstacle protection can be ensured in the visual segment from DA/H to landing, without reliance on visual identification of obstacles or in the event of a balked landing; and

   b) obstacle lights installed (notably incandescent or LED lights) are adequate for the EFVS equipment used by the operator.

d) If the assessment determines that:

   a) obstacle clearance cannot be ensured in the visual segment without reliance on visual identification of obstacles, the operator should not authorise EFVS operations to that runway or restrict the operation to the type and/or category of instrument approach operations where obstacle protection is ensured.

Note: Obstacles of a height of less than 50 ft above the threshold may be disregarded when assessing the VSS

a) obstacle protection is not assured in the event of a go-around initiated at any point prior to touchdown, the operator should not authorise the operation unless procedures to mitigate the risk of inadequate obstacle protection are developed and implemented.

b) If the AFM stipulates specific requirements for approach procedures, the operational assessment should include a determination of whether these requirements can be met.

SECTION 6 Suitable instrument flight approach procedures

a) CAT II instrument approach operations should only be conducted using a CAT II IAP.

b) CAT III instrument approach operations should only be conducted using a CAT III IAP.

c) SA CAT I operations should only be conducted using a SA CAT I IAP or, if not available, a CAT I IAP that includes an OCH based on radio altimeter.

d) SA CAT II operations should only be conducted using a SA CAT II IAP or, if not available, a CAT II IAP.

e) EFVS operations should only be conducted using an IAP which is offset by a maximum of 3 degrees unless a different approach offset is stated in the AFM.

SECTION 7 Runway and runway environment — navigation facilities — approach operations other than EFS operations

a) For CAT II instrument approach operations, a PA runway category II or category III should be used. The following visual aids should be available:

   1) category II approach lights;

   2) standard runway markings;

   3) category II runway lights.

b) For CAT III instrument approach operations, a PA runway category III should be used. The following visual aids should be available:

   1) category III approach lights;

   2) standard runway markings;

   3) category III runway lights.

c) For SA CAT I operations:

   1) where an ILS or MLS or GLS is used, it should not be promulgated with any restrictions affecting its usability and should not be offset from the extended centre line;

   2) where an ILS or GLS is used, it should be at least the minimum ILS or GLS classification stated in the AFM and meet any of the required minimum performance parameters stated in the AFM;

   3) the glide path angle is 3.0º; a steeper glide path, not exceeding 3.5 º and not exceeding the limits stated in the AFM, can be approved provided that an equivalent level of safety is achieved; and

   4) runway markings, category I approach lights as well as runway edge lights, runway threshold lights, and runway end lights should be available.

d) For SA CAT II operations:

   1) where an ILS or MLS or GLS is used, it should not be promulgated with any restrictions affecting its usability and should not be offset from the extended centre line;

   2) where an ILS or GLS is used, the following applies:

      i. if the AFM provides such data, the minimum ILS or GLS classification stated in the AFM; or

      ii. when such data is not provided:

         (A) where an GLS is used, it should be certified to at least GAST-C and to the GBAS point D;

(B) where an ILS is used, it should be certified to at least class II/D/2;

3) the glide path angle is 3.0º; a steeper glide path, not exceeding 3.2º, can be approved provided that the operator demonstrates an equivalent level of safety; and

4) the following visual aids should be available:

i. standard runway markings, category I approach lights as well as runway edge lights, runway threshold lights and runway end lights; and

ii. for operations with an RVR of less than 400 m, centre line lights.

7.1.1 Collect and develop airport data not contained in the AIP — aeroplanes

When the operator wishing to use an aerodrome where its relevant data for the purpose of LVO is not provided or some data is not provided, the operator should develop procedures to collect or develop the necessary data. The procedure should be specific to the State of the aerodrome or the area of operation and should be approved by competent authority.

SECTION 8 Suitable aerodromes — assessment — availability of suitable navigation facilities

As detailed the assessment of the suitability of an aerodrome, including instrument flight procedures, for the intended operations comprises the availability of suitable navigation facilities and associated instrument flight approach procedures.

When assessing the availability of suitable navigation facilities, the following information is relevant.

a) Classification for ILS: the ILS classification, e.g. 'III/E/4', II/T/3, 'I/C/2', etc., is defined in ICAO Annex 10 Volume 1 by using three characters:

1) I, II or III: this character indicates conformance to the facility performance category which is usually associated with the approach operational category.

2) A, B, C, T, D or E: this character defines the ILS points to which the localiser/glide path has been verified to be conformal to the course structure of a localiser CATII/III or glide path CAT II/III (where glide path is always limited to T).

3) 1, 2, 3 or 4: this number indicates the level of integrity and continuity of service. The integrity relates to the trust which can be placed in localiser or glide path not radiating false guidance signals. The continuity of service relates to the rarity of signal interruptions. The minimum levels of integrity and continuity of service are represented by a single descriptor 'level' which would typically be associated as follows:

i. Level 1: the localiser's or glide path's integrity or continuity of service have not been demonstrated or they have been demonstrated but at least one of them does not meet the level 2 requirements.

ii. Level 2 is the performance objective for ILS equipment used to support LVOs when ILS guidance for position information in the landing phase is supplemented by visual cues/references.

iii. Level 3 is the performance objective for ILS equipment used to support operations which place a high degree of reliance on ILS guidance for positioning through touchdown.

iv. Level 4 is the performance objective for ILS equipment used to support operations which place a high degree of reliance on ILS guidance throughout touchdown and roll-out.

Further information may be found in ICAO Annex 10 Volume 1.

b) GBAS facility classification (GFC)

The facility classification, e.g. i.e. ‘C/G1/35/H’, refers to the station serving all approaches to a given airport and is defined in ICAO Annex 10 Volume 1 using four elements:

1) Facility approach service type (FAST): (A-D) indicate the service types supported by the navigation facility, i.e. ‘C’ means FAST C, which denotes a facility meeting all the performance and functional requirements necessary to support GBAS approach service type (GAST) C. GAST C has been designed to meet requirements for CAT I as well as, with additional constraints, CAT II. GAST D has been designed to meet requirements for CAT III. A downgrade from GAST D to C is possible and announced in the avionics.

2) Ranging source types: these indicate what ranging sources are augmented by the ground subsystem. i.e. ‘G1’ means GPS (‘G2’: SBAS, ‘G3’: GLONASS, ‘G4’: reserved for Galileo, etc.).

3) Facility coverage: this defines the outer horizontal coverage of the GBAS positioning service expressed in nautical miles. ‘0’ is for facilities that do not provide positioning service. The facility coverage for position service does not indicate the coverage for the GBAS approach service. The information on the coverage for the approach service is contained in the ‘Service volume radius from the GBAS reference point’ to the nearest kilometre or nautical mile as described in point (d) below.

4) Polarisation: this indicates the polarisation of the VHF Data Broadcast (VDB) signal. E indicates elliptical polarisation (option), and H indicates horizontal polarisation (standard). Aircraft operators that use vertically polarised receiving antennas will have to take this information into account when managing flight operations, including flight planning and contingency procedures.

Further information may be found in ICAO Annex 10 Volume 1.

c) Approach facility designation (AFD) for GBAS

The approach facility designation, e.g. ‘EDDF/G25A/20748/S/C’ or ‘ABCD/XABC/21278/150/CD’, describing parameters for an individual approach procedure, is defined in ICAO Annex 10 using five elements:

1) GBAS identification: 4-character facility identifier, e.g. ABCD.

2) Approach identifier: 4-character approach identifier, e.g. XABC.

3) Channel number: 5-digit channel number (20 001–39 999) associated with the approach.

4) Approach service volume: this indicates the inner limit of the service volume either by a numerical value in feet corresponding to the minimum decision height (DH), e.g. ‘150’, or by the GBAS points (i.e. A, B, C, T, D, E, or S). The GBAS points are equivalent to the ILS points, where ‘S’ is only specific to GBAS and denotes the stop end of the runway.

5) Supported service types: these designate the supported GBAS service types (A-D). Further information may be found in ICAO Annex 10 Volume 1.

d) Service volume radius from the GBAS reference point

Maximum use distance (D_{max}): the maximum distance (slant range) from the GBAS reference point to the nearest kilometre or nautical mile within which pseudo-range corrections are applied by the aircraft system.

Note: This parameter does not indicate the distance within which VHF data broadcast field strength requirements for the approach service are met.

Further information may be found in ICAO Annex 10 Volume 1.

e) ‘**Type of xLS navigation means**’ means the facilities external to the aircraft and the associated limitations (if any) which have been used as the basis for certification.

8.1 See Appendix 5 for further detailed guidance on the assessment of suitable aerodromes and runway environment characteristics.

SECTION 9 **Flight crew competence**

a) The operator shall ensure that the flight crew are competent to conduct the intended operations.

b) The operator shall ensure that each flight crew member successfully completes training and checking for all types of LVOs and operations with operational credits for which an approval has been granted. Such training and checking shall:

1) include initial and recurrent training and checking;

2) include normal, abnormal and emergency procedures;

3) be tailored to the type of technologies used in the intended operations; and

4) take into account the human factor risks associated with the intended operations.

c) The operator shall keep records of the training and qualifications of the flight crew members.

d) The training and checking shall be conducted by appropriately qualified personnel.

9.1 Competence of the flight crew for the intended operations — experience in type or class, or as pilot-in-command/commander

To ensure that the flight crew is competent to conduct the intended operations, the operator should assess the risks associated with the conduct of low-visibility approach operations by pilots new to the aircraft type or class and take the necessary mitigations. Where such mitigations include an increment to the visibility or RVR for LVOs, this should be stated in the operations manual.

Note: As general guidance, the operator may use the following reference to assess the experience in type or class or as pilot-in-command/commander.

a) Before commencing CAT II operations, the following guidance applies to pilots-in-command/commanders or pilots to whom conduct of the flight may be delegated, who are new to the aircraft type:

  1) 50 hours or 20 sectors on the type, including LIFUS; and

  2) 100 m should be added to the applicable CAT II RVR minima when the operation requires a CAT II manual landing to touchdown until:

    i. a total of 100 hours or 40 sectors, including LIFUS, has been achieved on the type; or

    ii. a total of 50 hours or 20 sectors, including LIFUS, has been achieved on the type where the flight crew member has been previously qualified for CAT II manual landing operations with an operator;

  3) 100 m may be added to the applicable CAT II RVR minima when the operation requires the use of CAT II HUDLS to touchdown until:

    iii. a total of 40 sectors, including LIFUS, has been achieved on the type; or

    iv. a total of 20 sectors, including LIFUS, has been achieved on the type where the flight crew member has been previously qualified for CAT II HUDLS to touchdown with an operator.

  The sector provision in point (a)(1) may always be applicable; the hours on type or class may not fulfil the provisions.

b) Before commencing CAT III operations, the following additional provisions may apply to pilots-in-command/commanders or pilots to whom conduct of the flight may be delegated, who are new to the aircraft type:

  1) 50 hours or 20 sectors on the type, including LIFUS; and

  2) 100 m may be added to the applicable CAT II or CAT III RVR minima unless they have been previously qualified for CAT II or III operations with an operator, until a total of 100 hours or 40 sectors, including LIFUS, has been achieved on the type.

9.2 Competence of the flight crew for the intended operations — recent experience for EFVS operations

To be considered competent to conduct EFVS operations:

a) Pilots should complete a minimum of two approaches on each type of aircraft operated using the operator's procedures for EFVS operations during the validity period of each operator proficiency check or periodic demonstration of competence unless credits related to recent experience when operating more than one type are defined. When the operator is approved for both EFVS-L and EFVS-A, a minimum of one approach in each EFVS operation should be completed.

b) If a flight crew member is authorised to operate as pilot flying and pilot monitoring during EFVS operations, the flight crew member should complete the required number of approaches in each operating capacity.

9.3 Competence of the flight crew for the intended operations — recent experience for SA CAT I, CAT II, SA CAT II and CAT III approach operations

To be considered competent:

a) Pilots authorised to conduct low-visibility approach operations or operations with operational credits should complete at least two approaches using the operator's procedures for low-visibility approach operations or operations with operational credits, during the validity period of each operator proficiency check or periodic demonstration of competence, unless credits related to recent experience when operating more than one type are defined.

b) If the operator is approved for more than one piece of aircraft equipment used (e.g. autoland, HUD, auto-coupled approach with manual landing, SVGS, etc.), pilots should complete at least one additional approach in the lowest approved RVR (either to go-around or landing) for each piece of aircraft equipment used during the validity period of each operator proficiency check or periodic demonstration of competence (e.g. two approaches CAT II with autoland and one CAT II with auto-coupled to below DH with manual landing, two CAT II autoland and one CAT II HUD to below DH with manual landing or vice versa) unless credits related to recent experience when operating more than one type are defined.

c) Pilots authorised to conduct low-visibility approach operations or operations with operational credits using HUDLS or equivalent display systems to touchdown should complete two approaches (e.g. an operator approved for CAT II/III HUDLS will do two CAT III HUDLS; other examples would be two CAT III autoland and two CAT III HUDLS to touchdown, two SA CAT II autoland and two SA CAT II HUDLS, or when combining several LVOs and equipment, two CAT III autoland and one CAT II auto-coupled to below DH with manual landing and two CAT III HUDLS to touchdown) using the operator's procedures for low-visibility approach operations or operations with operational credits using HUDLS, during the validity period of each operator proficiency check or periodic demonstration of competence unless credits related to recent experience when operating more than one type are defined.

d) If a flight crew member is authorised to operate as pilot flying and pilot monitoring, the flight crew member should complete the required number of approaches in each operating capacity.

9.4 Initial training for LVTO in and RVR less than 400 M

The operator should ensure that the flight crew members have completed the following training and checking prior to being authorised to conduct take-offs in an RVR below 400 m unless credits related to training and checking for previous experience in LVTOs on similar aircraft types:

a) A ground training course including at least the following:

   1) characteristics of fog;

   2) effects of precipitation, ice accretion, low-level wind shear and turbulence;

   3) the effect of specific aircraft/system malfunctions;

   4) the use and limitations of RVR assessment systems;

   5) procedures to be followed and precautions to be taken with regard to surface movement during operations when the RVR is 400 m or less and any additional procedures required for take-off in conditions below 150 m;

   6) qualification requirements for pilots to obtain and retain approval to conduct LVOs; and

   7) the importance of correct seating and eye position.

b) A course of FSTD/flight training covering system failures and engine failures resulting in continued as well as rejected take-offs. Such training should include at least:

   1) normal take-off in minimum approved RVR conditions;

   2) take-off in minimum approved RVR conditions with an engine failure:

      i) for aeroplanes, between V1 and V2 (take-off safety speed) or as soon as safety considerations permit; and

   3) take-off in minimum approved RVR conditions with an engine failure:

      i) for aeroplanes, before V1 resulting in a rejected take-off.

c) The operator approved for LVTOs with an RVR below 150 m should ensure that the training specified in (b) is carried out in an FSTD. This training should include the use of any special procedures and equipment.

d) The operator should ensure that a flight crew member has completed a check before conducting LVTOs in RVRs of less than 150 m. The check should require the execution of:

   1) at least one LVTO in the minimum approved visibility;

   2) at least one rejected take-off at minimum approved RVR in an aircraft or FSTD.

For pilots with previous experience with an operator of LVTOs in RVRs of less than 150 m, the check may be replaced by successful completion of the FSTD and/or flight training specified in (a), (b) and (c).

9.5 Initial training and checking for SA CAT I, CAT II, SA CAT II and CAT III approach operations

Operators should ensure that flight crew members complete the following training and checking before being authorised to conduct SA CAT I, CAT II, SA CAT II and CAT III approach operations unless credits related to training and checking for previous experience on similar aircraft types are defined:

a) For flight crew members who do not have previous experience of low-visibility approach operations requiring an approval under this Subpart with an operator:

    1) A course of ground training including at least the following:

        i. characteristics and limitations of different types of approach aids;

        ii. characteristics of the visual aids;

        iii. characteristics of fog;

        iv. operational capabilities and limitations of airborne systems to include symbology used on HUD/HUDLS or equivalent display systems, if appropriate;

        v. effects of precipitation, ice accretion, low level wind shear and turbulence;

        vi. the effect of specific aircraft/system malfunctions;

        vii. the use and limitations of RVR assessment systems;

        viii. principles of obstacle clearance requirements;

        ix. the recognition of failure of ground equipment or in satellite approaches, the loss of signal in space and the action to be taken in the event of such failures;

        x. procedures to be followed and precautions to be taken with regard to surface movement during operations when the RVR is 400 m or less and any additional procedures required for take-off in conditions below 150 m;

        xi. the significance of DHs based upon radio altimeters and the effect of terrain profile in the approach area on radio altimeter readings and on automatic approach/landing systems. This applies also to other devices capable of providing equivalent information;

        xii. the effect of the pre-threshold terrain and LSAA on airborne landing systems;

        xiii. the significance of alert height, if applicable, and action in the event of any failure above and below the alert height;

        xiv. qualification requirements for pilots to obtain and retain approval to conduct LVOs;

        xv. the importance of correct seating and eye position; and

        xvi. the significance of LVPs or equivalent procedures.

2) A course of FSTD training and/or flight training in two phases as follows:

i. Phase one (LVOs with aircraft and all equipment serviceable) — objectives

(A) understand the operation of equipment required for LVOs;

(B) understand the operating limitations resulting from airworthiness certification;

(C) practise the monitoring of automatic flight control systems and status annunciators;

(D) practise the use of HUD/HUDLS or equivalent display systems, where appropriate;

(E) understand the significance of alert height, if applicable;

(F) become familiar with the maximum lateral and vertical deviation permitted for different types of approach operation;

(G) become familiar with the visual references required at DH;

(H) master the manual aircraft handling relevant to low-visibility approach operations;

(I) practise coordination with other crew members; and

(J) become proficient at procedures for low-visibility approach operations with serviceable equipment.

ii. Phase one of the training should include the following exercises:

(A) the required checks for satisfactory functioning of equipment, both on the ground and in flight;

(B) the use of HUD/HUDLS or equivalent display systems during all phases of flight, if applicable;

(C) approach using the appropriate flight guidance, autopilots, and control systems installed on the aircraft to the appropriate DH and transition to visual flight and landing;

(D) approach with all engines operating using the appropriate flight guidance, autopilots and control systems installed on the aircraft, including HUD/HUDLS or equivalent display systems, down to the appropriate DH followed by a missed approach, all without external visual reference;

(E) where appropriate, approaches using autopilot to provide automatic flare, hover, landing and roll-out; and

(F) where appropriate, approaches using approved HUD/HUDLS or equivalent display system to touchdown.

iii. Phase two (low-visibility approach operations with aircraft and equipment failures and degradations) — objectives

(A) understand the effect of known aircraft unserviceability including use of the MEL;

(B) understand the effect of failed or downgraded equipment on aerodrome operating minima;

(C) understand the actions required in response to failures and changes in the status of automatic flight control/guidance systems including HUD/HUDLS or equivalent display systems;

(D) understand the actions required in response to failures above and below alert height, if applicable;

(E) practise abnormal operations and incapacitation procedures; and

(F) become proficient at dealing with failures and abnormal situations during low-visibility approach operations.

iv. Phase two of the training should include the following exercises:

(A) approaches with engine failures at various stages of the approach;

(B) approaches with critical equipment failures, such as electrical systems, auto-flight systems, ground or airborne approach aids and status monitors;

(C) approaches where failures of auto-flight or flight guidance systems, including HUDLS or equivalent display systems, require either:

(a) reversion to manual control for landing or go-around; or

(b) reversion to manual control or a downgraded automatic mode control for go-around from the DH or below, including those which may result in contact with the runway.

This should include aircraft handling if, during a CAT III fail-passive approach, a fault causes autopilot to disconnect at or below the DH when the last reported RVR is 300 m or less;

(D) failures of systems that will result in excessive lateral or vertical deviation both above and below the DH in the minimum visual conditions for the operation;

(E) incapacitation procedures appropriate to low-visibility approach operations; and

(F) failures and procedures applicable to the specific aircraft type.

v. FSTD training should include:

(A) for approaches flown using HUDLS or equivalent display systems, a minimum of eight approaches;

(B) otherwise, a minimum of six approaches.

vi. For aircraft for which no FSTDs representing the specific aircraft are available, operators should ensure that the flight training phase specific to the visual scenarios of low-visibility approach operations is conducted in a specifically approved FSTD. Such training should include a minimum of four approaches. Thereafter, type-specific training should be conducted in the aircraft.

3) A check requiring the completion of at least the following exercises in an aircraft or FSTD:

   i. Low-visibility approaches in simulated instrument flight conditions down to the applicable DH, using the flight guidance system. Standard procedures of crew coordination (task sharing, call-out procedures, mutual surveillance, information exchange and support) should be observed. For CAT III operations, the operator should use an FSTD approved for this purpose;

   ii. Go-around after approaches as indicated in (2) at any point between 500 ft above ground level (AGL) and on reaching the DH; and

   iii. Landing(s) with visual reference established at the DH following an instrument approach. Depending on the specific flight guidance system, an automatic landing should be performed.

4) For operators for which LIFUS is required, practice in approaches during LIFUS, as follows:

   i. For low-visibility approach operations using a manual landing:

      (A) if a HUDLS or equivalent display system is used to touchdown, four landings, or if the training required by (a)(2) was conducted in an FSTD qualified for zero flight-time training (ZFTT), two landings;

      (B) otherwise, three landings, or if the training required by (a)(2) was conducted in an FSTD qualified for ZFTT, one landing;

   ii. For low-visibility operations using autoland:

      (A) if the training required by (a)(2) was conducted in an FSTD qualified for ZFTT, one landing, or none if the fight crew member successfully completed a type rating based on ZFTT;

      (B) otherwise, two landings.

   iii. For flight crew members who have previous experience of low-visibility approach operations requiring an approval under this Subpart with an operator, when changing to an aircraft for which a new class or type rating is required, within the same operator:

5) A course of ground training as specified in (a)(1), taking into account the flight crew member's existing knowledge of low-visibility approach operations.

   1) A course of FSTD and/or flight training, as specified in (a)(2) above. If the flight crew member's previous experience of low-visibility approach operations is on a type where the following were the same or similar:

      i) the technology used in the flight guidance and flight control system;

      ii) operating procedures;

      iii) handling characteristics; and

      iv) the use of HUD/HUDLS or equivalent display systems,

then the flight crew member may complete an abbreviated course of FSTD and/or flight training.

6) An abbreviated course should meet the objectives described in (a)(2), need not include the number of approaches required by (a)(2)(v), but should include at least the following number of landings:

   i. if a HUDLS or an equivalent display system is utilised to touchdown, then four approaches including a landing at the lowest approved RVR and a go-around; or

   ii. otherwise, two approaches including a landing at the lowest approved RVR and a go-around.

b) For flight crew members who have previous experience of low-visibility approach operations requiring an approval under this Subpart with an operator, when joining another operator:

   1) A course of ground training as specified in (a)(1), taking into account the flight crewmember's existing knowledge of low-visibility approach operations.

   2) A course of FSTD and/or flight training as specified in (a)(2) above. If the flight crew member's previous experience of low-visibility approach operations is on the same aircraft type and variant, or on a different type or variant where the following were the same or similar:

      i. the technology used in the flight guidance and flight control system;

      ii. operating procedures;

      iii. handling characteristics; and

      iv. the use of HUD/HUDLS or equivalent display systems,

      then the flight crew member may complete an abbreviated course of FSTD and/or flight training. Such an abbreviated course should meet the objectives described in (a)(2), need not include the number of approaches required by (a)(2)(v), but should include at least the following number of landings:

      (A) if a HUDLS or an equivalent display system is utilised to touchdown, then four approaches including a landing at the lowest approved RVR and a go-around; or

      (B) otherwise, two approaches including a landing at the lowest approved RVR and a go-around.

   3) Practice in approaches during LIFUS as required by (a)(3) above unless the flight crew member's previous experience of low-visibility approach operations is on the same aircraft type and variant.

9.6 Initial training and checking for EFVS operations

Operators should ensure that flight crew members complete the following training and checking before being authorised to conduct EFVS operations unless credits related to training and checking for previous experience on similar aircraft types are defined:

a) For flight crew members who do not have previous experience of EFVS operations requiring an approval under this Subpart with an operator:

   1) A course of ground training including at least the following:

i) characteristics and limitations of HUDs/HUDLSs or equivalent display systems including information presentation and symbology;

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

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

iv) the interpretation of EFVS imagery;

v) the interpretation of approach and runway lighting systems and display characteristics when using EFVS;

vi) weather associated with low-visibility conditions and its effect on EFVS performance;

vii) pre-flight planning and selection of suitable aerodromes and approach procedures;

viii) principles of obstacle clearance requirements;

ix) the use and limitations of RVR assessment systems;

x) normal, abnormal and emergency procedures for EFVS operations;

xi) the effect of specific aircraft/system malfunctions;

xii) procedures to be followed and precautions to be taken with regard to surface movement during operations when the RVR is 400 m or less;

xiii) for EFVS-L, the effect of the pre-threshold terrain and LSAA on airborne landing systems;

xiv) human factors aspects of EFVS operations;

xv) qualification requirements for pilots to obtain and retain approval for EFVS operations; and

xvi) the significance of LVPs or equivalent procedures when operating below RVR 550 m.

2) A course of FSTD training and/or flight training in two phases as follows:

i) Phase one (EFVS operations with aircraft and all equipment serviceable) — objectives:

(A) understand the operation of equipment required for EFVS operations;

(B) understand operating limitations of the installed EFVS;

(C) practise the use of HUD/HUDLS or equivalent display systems;

(D) practise the set-up and adjustment of EFVS equipment in different conditions (e.g. day and night);

(E) practise the monitoring of automatic flight control systems, EFVS information and status annunciators;

(F) practise the interpretation of EFVS imagery;

(G) become familiar with the features needed on the EFVS image to continue approach below the DH;

(H) practise the identification of visual references using natural vision while using EFVS equipment;

(I) master the manual aircraft handling relevant to EFVS operations including, where appropriate, the use of the flare cue and guidance for landing;

(J) practise coordination with other crew members; and

(K) become proficient at procedures for EFVS operations.

i. Phase one of the training should include the following exercises:

(A) the required checks for satisfactory functioning of equipment, both on the ground and in flight;

(B) the use of HUD/HUDLS or equivalent display systems during all phases of flight;

(C) approach using the EFVSs installed on the aircraft to the appropriate DH and transition to visual flight and landing;

(D) approach with all engines operating using the EFVS, down to the appropriate DH followed by a missed approach, all without external visual reference;

(E) where appropriate, approaches using approved EFVS to touchdown.

ii. Phase two (EFVS operations with aircraft and equipment failures and degradations) – objectives:

(A) understand the effect of known aircraft unserviceabilities including use of the MEL;

(B) understand the effect of failed or downgraded equipment on aerodrome operating minima;

(C) understand the actions required in response to failures and changes in the status of the EFVS including HUD/HUDLS or equivalent display systems;

(D) understand the actions required in response to failures above and below the DH;

(E) practise abnormal operations and incapacitation procedures; and

(F) become proficient at dealing with failures and abnormal situations during EFVS operations.

iii. Phase two of the training should include the following exercises:

(A) approaches with engine failures at various stages of the approach;

(B) approaches with failures of the EFVS at various stages of the approach, including failures between the DH and the height below which an approach should not be continued if natural visual reference is not acquired, requiring either:

(a) reversion to head-down displays to control missed approach; or

(b) reversion to flight with no, or downgraded, guidance to control missed approaches from the DH or below, including those which may result in a touchdown on the runway;

(C) incapacitation procedures appropriate to EFVS operations; and

(D) failures and procedures applicable to the specific EFVS installation and aircraft type.

iv. FSTD training should include a minimum of eight approaches.

v. If a flight crew member is to be authorised to operate as pilot flying and pilot monitoring during EFVS operations, then the flight crew member should complete the required FSTD training for each operating capacity.

3) For operators for which LIFUS is required by regulatory requirements, practice in approaches during LIFUS, as follows:

i) if EFVS is used to touchdown, four landings; or

ii) otherwise, three landings.

4) For flight crew members who have previous experience of EFVS operations requiring an approval under this Subpart with an operator, when changing to an aircraft for which a new class or type rating is required, with the same operator:

5) A course of ground training as specified in (a)(1), taking into account the flight crewmember's existing knowledge of low-visibility approach operations.

6) The course of FSTD and/or flight training required by (a)(2) above. If the flight crew member's previous experience of low-visibility approach operations is on a type where the following were the same or similar:

i) the technology used in the EFVS sensor, flight guidance and flight control system;

ii) operating procedures; and

iii) handling characteristics,

then the flight crew member may complete an abbreviated course of FSTD and/or flight training. Such an abbreviated course should meet the objectives described in (a)(2), need not include the number of approaches required by (a)(2)(v), but should include at least the following number of landings:

i) for EFVS to touchdown, four approaches including a landing at the lowest approved RVR and a go-around, or

ii) otherwise, two approaches including a landing at the lowest approved RVR and a go-around.

b) For flight crew members who have previous experience of EFVS operations requiring an approval under this Subpart with an operator, when joining another operator:

1) A course of ground training as specified in (a)(1), taking into account the flight crew member's existing knowledge of low-visibility approach operations.

2) The course of FSTD and/or flight training required by (a)(2) above. If the flight crew member's previous experience of EFVS operations is on the same aircraft type and variant with the same EFVS or on a different type or different EFVS where the following were the same or similar:

   i) the technology used in the EFVS sensor, flight guidance and flight control system;

   ii) operating procedures; and

   iii) handling characteristics, then the flight crew member may complete an abbreviated course of FSTD and/or flight training.

3) Such an abbreviated course should meet the objectives described in (a)(2), need not include the number of approaches required by (a)(2)(v), but should include at least the following number of landings:

   i) for EFVS to touchdown, four approaches including a landing at the lowest approved RVR and a go-around, or

   ii) otherwise, two approaches including a landing at the lowest approved RVR and a go-around.

4) Practice in approaches during LIFUS as required by (a)(3) above unless the flight crew member's previous experience of low-visibility approach operations is on the same aircraft type and variant.

9.7 Recurrent checking for LVTO, SA CAT I, CAT II, SA CAT II and CAT III approach operations

a) The operator should ensure that the pilots' competence to perform LVOs for which they are authorised is checked by completing at least the following exercises:

1) One or more low-visibility rejected take-off at minimum approved RVR at least once over the period between two operator proficiency checks or once at every periodic demonstration of competence.

2) Pilots authorised for LVTO operations in an RVR of less than 150 m should additionally conduct at least one LVTO in the minimum approved visibility at each required operator proficiency check or periodic demonstration of competence.

3) One or more low-visibility approaches in simulated instrument flight conditions down to a point between 500 ft AGL and the threshold (e.g. applicable DH), followed by go-around, at each required operator proficiency check or periodic demonstration of competence; and

4) One or more low-visibility approach and landings with visual reference established at the DH at each required operator proficiency check or periodic demonstration of competence.

   (a) Pilots authorised to conduct CAT III operations on aircraft with a fail-passive autoland system, or HUDLS or equivalent, should complete a missed approach at least once over the period of three consecutive operator proficiency checks or demonstrations of competence as the result of an equipment failure at or below the DH when the last reported RVR was less than 300 m.

(b) CAT III approach operations should be conducted in an FSTD. Other exercises may be conducted in an FSTD or aircraft.

9.8 Differences training for LVTO, SA CAT I, CAT II, SA CAT II and CAT III approach operations

a) The operator should ensure that the flight crew members are provided with differences training or familiarisation whenever they are required to conduct low-visibility approach operations or operations with operational credits requiring an approval under this Subpart for which they are not already authorised, or whenever there is a change to any of the following:

1) the technology used in the flight guidance and flight control system;

2) the operating procedures including:

i. fail-passive/fail-operational;

ii. alert height;

iii. manual landing or automatic landing;

iv. operations with DH or no DH operations;

3) the handling characteristics;

4) the use of HUD/HUDLS or equivalent display systems;

5) the use of EFVS.

b) The differences training should:

1) meet the objectives of the appropriate initial training course;

2) take into account the flight crew members' previous experience

9.9 Recurrent checking for EFVS operations

a) The operator should ensure that the pilots' competence to perform EFVS operations is checked at each required demonstration of competence or operator proficiency check by performing at least two approaches of which one should be flown without natural vision, to the height below which an approach should not be continued if natural visual reference is not acquired.

b) If a flight crew member is authorised to operate as pilot flying and pilot monitoring during EFVS operations, then the flight crew member should complete the required number of approaches in each operating capacity.

9.10 Differences training for EFVS operations

a) The operator should ensure that the flight crew members authorised to conduct EFVS operations are provided with differences training or familiarisation whenever there is a change to any of the following:

 1) the technology used in the EFVS sensor, flight guidance and flight control system;

 2) the operating procedures;

 3) the handling characteristics.

b) The differences training should:

 1) meet the objectives of the appropriate initial training course;

 2) take into account the flight crew members' previous experience.

9.11 Flight crew training

a) The number of approaches referred to above represents the minimum number of approaches that the flight crew members should conduct during initial and recurrent training and checking. More approaches or other training exercises may be required in order to ensure that flight crew members achieve the required proficiency.

b) Where flight crew members are to be authorised to conduct more than one kind of LVOs including operations with operational credits for which the technology and operating procedures are similar, there is no requirement to increase the number of approaches in initial training if the training programme ensures that the flight crew members are competent for all operations for which they will be authorised. Where flight crew members are to be authorised to conduct more than one kind of LVOs including operations with operational credits using different technology or operating procedures, then the required minimum number of approaches should be completed for each different technology or operating procedure.

c) Where flight crew members are authorised to conduct more than one kind of LVOs including operations with operational credits for which the technology and operating procedures are similar, then there is no requirement to increase the number of approaches flown during recurrent checking. However, where flight crew members are authorised to conduct more than one kind of LVOs including operations with operational credits using different technology or operating procedures, then the required number of approaches should be completed for each different technology or operating procedure.

d) Flight crew members are required to complete initial and recurrent FSTD training for each operating capacity for which they will be authorised (e.g. as pilot flying and/or pilot monitoring). A pilot who will be authorised to operate in either capacity will need to complete the minimum number of approaches in each capacity.

e) Approaches conducted in a suitably qualified FSTD and/or during a proficiency check or demonstration of competence may be counted towards the recent experience requirements. If a flight crew member has not complied with the recent experience requirements above, the required approaches may be conducted during recurrent training, an operator proficiency check or a periodic check of competence either in an aircraft or on an FSTD.

9.12 Recurrent training and checking for EFVS operations

In order to provide the opportunity to practise decision-making in the event of system failures and failure to acquire natural visual reference, the recurrent training and checking for EFVS operations is recommended to periodically include different combinations of equipment failures, go-around due to loss of visual reference and landings.

9.13 Initial training and checking for SA CAT I, CAT II, SA CAT II and CAT III approach operations

The ground training referred to in points (a)(1)(i) and (iv) of 2.4.2 may include:

a) airborne and ground equipment:
   1) technical requirements;
   2) operational requirements;
   3) operational reliability;
   4) fail-operational;
   5) fail-passive;
   6) equipment reliability;
   7) operating procedures;
   8) preparatory measures;
   9) operational downgrading; and
   10) communications; and

b) procedures and limitations:
   1) operating procedures; and
   2) crew coordination.

SECTION 10 Operating procedures

a) The operator shall establish procedures and instructions to be used for LVOs. These procedures and instructions shall be included in the operations manual or procedures manual and contain the duties of flight crew members during taxiing, take-off, approach, flare, landing, rollout and missed approach operations, as appropriate.

b) Prior to commencing an LVO, the pilot-in-command/commander shall be satisfied that:

   1) the status of the visual and non-visual facilities is sufficient;

2) appropriate LVPs are in force according to information received from air traffic services (ATS);

3) flight crew members are properly qualified.

See Worksheet for detailed requirements

10.1 Minimum equipment

a) The operator shall include the minimum equipment that has to be serviceable at the commencement of an LVO in accordance with the aircraft flight manual (AFM) or other approved document in the operations manual or procedures manual, as applicable.

b) The pilot-in-command/commander shall be satisfied that the status of the aircraft and of the relevant airborne systems is appropriate for the specific operation to be conducted.

SECTION 11 LVO – Airworthiness & Certification Considerations

11.1 Introduction & Background (Airworthiness & Certification)

EASA CS-AWO sets out the certification specifications requirements for All-Weather operations. Operators should always refer to CS-AWO for the actual requirements.

Aircraft suitable for low-visibility approach operations are certified according to the minimum usable DH, which is stated in the AFM.

Certification Specifications (CS-AWO) allow for systems to be certified for SA CAT I, CAT II or CAT III operations. Systems certified for CAT III operations may specify:

- a lowest usable DH of:
- less than 100 ft but not less than 50 ft
- less than 50 ft; or
- no DH

Legacy systems may be described as capable of ‘CAT 3A’ or ‘CAT IIIA' operations. This implies a minimum DH of less than 100 ft but not less than 50 ft. Systems described as capable of ‘CAT 3B’ or ‘CAT IIIB’ may be certified for a DH of less than 50 ft or no DH.

Operations to a DH of less than 100 ft but not less than 50 ft will typically require a fail-passive automatic landing system or a HUDLS or equivalent system. Operations to a DH of less than 50 ft will require a fail-operational landing system, a fail-passive go-around system, automatic thrust control and either automatic ground roll control or ground roll guidance using a HUDLS. For no DH operations, a fail-passive or fail-operational ground roll control system is required.

The RVR required for SA CAT I, CAT II and SA CAT II approach operations is determined by the DH and the aircraft approach speed category. The RVR required for CAT III approach operations is determined by the DH and the capability of the ground-roll control system. Operations with fail-passive roll control systems require a greater RVR than operations with fail-operational ground control systems because the pilots would need to have sufficient visibility to maintain lateral control in the event of a system failure.

11.1.1 Aircraft Certification for the Intended Operations

a) Aircraft used for LVTO in an RVR of less than 125 m should be equipped with a system certified for the purpose.

b) Aircraft used for low-visibility approach operations should be equipped in accordance with the applicable airworthiness requirements and certified as follows:

1) For CAT II operations, the aircraft should be certified for CAT II operations.

2) For CAT III operations, the aircraft should be certified for CAT III operations.

3) For SA CAT I, the aircraft should be certified for SA CAT I operations.

4) For SA CAT II, the aircraft should be certified for CAT II operations and be equipped with HUDLS or fail-passive autoland or better.

5) For EFVS operations, the aircraft should be equipped with a certified EFVS-A or EFVS-L.

11.1.2 Aircraft Certification – Equipment eligible for low visibility take-off in an RVR less than 125m

Systems that are used to qualify for take-off in an RVR less than 125 m typically allow the pilot to use the external visual cues as well as instrumented guidance to track the runway centre line. The kind of systems in use today include paravisual display (PVD) and HUD. It is expected that EFVSs will be certified for take-off guidance in the future. Where the PVD or HUD uses an ILS localiser signal as reference, the ILS sensitive area must be protected by the LVPs at the aerodrome.

11.1.3 Determination of a successful approach and landing (CS-AWO)

Further detail in EASA CS AWO.A.ALS.106, CS AWO.B.CATII.113 and AMC AWO.B.CATII.11

11.1.4 Airworthiness Requirements

The operator shall include in his application to the Authority relevant pages of the AFM, TC, STC, TCDS and/or the aeroplane operations manual attesting that the aeroplane meets the relevant airworthiness requirements and performance criteria for, the relevant Category of operation (for example Category II (CAT II) and/or Category III (CAT III) operations as well as auto-land capabilities) See above for supporting detail.

The operator shall also include any promulgated limitations or procedures necessary for safe operation, such as:

a) DA/H or AOM or AFM limitations;

b) Minimum airborne equipment prior to commencement of the AWO approach, including MEL and related maintenance procedures relating to equipment requirements for LVO operations

c) Equipment operating procedures and sequences;

d) Aircraft performance data; and

e) Any factors affecting the aeroplane AWO operations.

f) Continuing Airworthiness Maintenance Procedures (CAMP)

g) The operator shall maintain the aeroplane in accordance with the approved CAMP with specific programmes for lower landing minima or low visibility take-off. The CAMP should include at least the following:

   i. Maintenance procedures to ensure continued airworthiness relative to low visibility operations;

   ii. Procedure to revise and update the maintenance programme.

h) The MCM / MOE / company procedures should contain high level procedures relating to the management and control of LVO, including:

   i. Control of modification status of critical components

   ii. Setting alert levels in system reliability monitoring – including the recording and analysis of equipment failures

   iii. A list of critical components

   iv. Licensing / Training / Authorisation of certifying staff Initial and recurrent training – including that of maintenance staff

   v. Upgrade / Downgrade procedures – ensuring the operator / continuing airworthiness management organisation is kept informed of the LVO status of the aircraft.

   vi. Cockpit placards

   vii. Flight Crew / Flight Operations notification

   viii. Personnel to follow the operator's maintenance procedure to approve an aircraft's return to service.

   ix. Operating limitations resulting from airworthiness certification

   x. Technical log / Technical Log procedures to ensure control the LVO status of the aircraft.

The maintenance provider must ensure the maintenance and calibration of test equipment. Therefore the operator / continuing airworthiness organisations needs to have assessed this as part of their assessment / acceptance of the maintenance provider.

Contracted maintenance - The operator is responsible for ensuring that contracted organisations and personnel are appropriately trained, qualified and authorized

Training: The operator shall also ensure that maintenance personnel are trained (initial and recurrent) in accordance with training programmes approved by the authority.

SECTION 12 APPLICATION FOR APPROVAL

The operator shall arrange to meet the Authority as soon as possible, at least 90 working days in advance of his plan to engage in all-weather operations.

The Authority's 5-step structured process is applicable and it comprises: Pre-application meeting, Formal application, Document evaluation/assessment, Flight proving/validation and Award or rejection of application.

The application package should include the following items:

a) Application letter with statement on operating experience, types of aircraft and currently approved Instrument Approach Procedure (IAP);

b) AWO category applied for and with the relevant minima, LVP if applicable;

c) List of destination and alternate aerodromes with categorization approved for AWO operations;

d) Relevant pages of AFM, Operations manual stating operator operating policy and/or procedures and, training programmes; and

e) Proposed timeline, if any, for the completion of aeroplane and crew qualification.

Before issuing an approval for low-visibility operations (LVOs), the UCAA should verify that the applicant has demonstrated compliance with the applicable requirements:

a) taken account of the relevant airworthiness requirements and limitations;

b) established the relevant aerodrome operating minima;

c) established and documented the relevant operating procedures;

d) established and conducted adequate training and checking programmes;

e) adopted the minimum equipment list (MEL) for the LVOs to be undertaken;

f) processes to ensure that only runways and instrument procedures suitable for the intended operations are used; and

g) established and conducted the relevant risk assessment and monitoring programmes.

h) Ensure all the continuing airworthiness arrangements are in place to support the intended LVO operation.

UGANDA CIVIL AVIATION AUTHORITY
DIRECTOR
SAFETY, SECURITY AND ECONOMIC REGULATION

____

Uganda Civil Aviation Authority

APPENDIX 1 - LOW-VISIBILITY OPERATIONS AND OPERATIONS WITH OPERATIONAL CREDITS

Establishment of Minimum RVR for approach operations with a DH below 200 ft.

General

1. When establishing minimum RVR for CAT II and CAT III operations, operators should pay attention to the following information that originates in ECAC Doc 17 3rd Edition, Subpart A. It is retained as background information and, to some extent, for historical purposes although there may be some conflict with current practices**.**

2. Since the inception of precision approach and landing operations various methods have been devised for the calculation of aerodrome operating minima in terms of DH and RVR. It is a comparatively straightforward matter to establish the DH for an operation but establishing the minimum RVR to be associated with that DH so as to provide a high probability that the required visual reference will be available at that DH has been more of a problem.

3. The methods adopted by various States to resolve the DH/RVR relationship in respect of CAT II and CAT III operations have varied considerably. In one instance there has been a simple approach that entailed the application of empirical data based on actual operating experience in a particular environment. This has given satisfactory results for application within the environment for which it was developed. In another instance a more sophisticated method was employed which utilised a fairly complex computer programme to take account of a wide range of variables. However, in the latter case, it has been found that with the improvement in the performance of visual aids, and the increased use of automatic equipment in the many different types of new aircraft, most of the variables cancel each other out and a simple tabulation can be constructed that is applicable to a wide range of aircraft. The basic principles that are observed in establishing the values in such a table are that the scale of visual reference required by a pilot at and below DH depends on the task that he/she has to carry out, and that the degree to which his/her vision is obscured depends on the obscuring medium, the general rule in fog being that it becomes more dense with increase in height. Research using flight simulation training devices (FSTDs) coupled with flight trials has shown the following:

    i. most pilots require visual contact to be established about 3 seconds above DH though it has been observed that this reduces to about 1 second when a fail-operational automatic landing system is being used;

    ii. to establish lateral position and cross-track velocity most pilots need to see not less than a three light segment of the centre line of the approach lights, or runway centre line, or runway edge lights;

    iii. for roll guidance most pilots need to see a lateral element of the ground pattern, i.e. an approach light cross bar, the landing threshold, or a barrette of the touchdown zone; and

    iv. to make an accurate adjustment to the flight path in the vertical plane, such as a flare, using purely visual cues, most pilots need to see a point on the ground which has a low or zero rate of apparent movement relative to the aircraft.

v. With regard to fog structure, data gathered in the United Kingdom over a 20 year period have shown that in deep stable fog there is a 90 % probability that the slant visual range from eye heights higher than 15 ft above the ground will be less than the horizontal visibility at ground level, i.e. RVR. There are at present no data available to show what the relationship is between the slant visual range and RVR in other low visibility conditions such as blowing snow, dust or heavy rain, but there is some evidence in pilot reports that the lack of contrast between visual aids and the background in such conditions can produce a relationship similar to that observed in fog.

a) CAT II Operations

The selection of the dimensions of the required visual segments that are used for CAT II operations is based on the following visual provisions:

1) a visual segment of not less than 90 m will need to be in view at and below DH for pilot to be able to monitor an automatic system

2) a visual segment of not less than 120 m will need to be in view for a pilot to be able to maintain the roll attitude manually at and below DH; and

3) for a manual landing using only external visual cues, a visual segment of 225 m will be required at the height at which flare initiation starts in order to provide the pilot with sight of a point of low relative movement on the ground.

Before using a CAT II ILS for landing, the quality of the localiser between 50 ft and touchdown should be verified

b) CAT III fail-passive Operations

1) CAT III operations utilising fail-passive automatic landing equipment were introduced in the late 1960s and it is desirable that the principles governing the establishment of the minimum RVR for such operations be dealt with in some detail.

2) During an automatic landing the pilot needs to monitor the performance of the aircraft system, not in order to detect a failure that is better done by the monitoring devices built into the system, but so as to know precisely the flight situation. In the final stages the pilot should establish visual contact and, by the time the pilot reaches DH, the pilot should have checked the aircraft position relative to the approach or runway centre line lights. For this the pilot will need sight of horizontal elements (for roll reference) and part of the touchdown area. The pilot should check for lateral position and cross-track velocity and, if not within the pre-stated lateral limits, the pilot should carry out a missed approach procedure. The pilot should also check longitudinal progress and sight of the landing threshold is useful for this purpose, as is sight of the touchdown zone TDZ lights

   Where a fail-operational automatic landing and roll-out system is used, it is not considered necessary for the pilot to check the lateral position and cross-track velocity, and thus it is not necessary for the visual reference requirements to include horizontal elements of the lighting system.

3) In the event of a failure of the automatic flight guidance system below DH, there are two possible courses of action; the first is a procedure that allows the pilot to complete the landing manually if there is adequate visual reference for him/her to do so, or to initiate a missed approach procedure if there is not; the second is to make a missed approach procedure mandatory if there is a system disconnect regardless of the pilot's assessment of the visual reference available

i. If the first option is selected then the overriding rule in the determination of a minimum RVR is for sufficient visual cues to be available at and below DH for the pilot to be able to carry out a manual landing. Data presented in ECAC Doc 17 showed that a minimum value of 300 m would give a high probability that the cues needed by the pilot to assess the aircraft in pitch and roll will be available and this should be the minimum RVR for this procedure.

ii. The second option, to require a missed approach procedure to be carried out should the automatic flight-guidance system fail below DH, will permit a lower minimum RVR because the visual reference provision will be less if there is no need to provide for the possibility of a manual landing. However, this option is only acceptable if it can be shown that the probability of a system failure below DH is acceptably low. It should be recognised that the inclination of a pilot who experiences such a failure would be to continue the landing manually but the results of flight trials in actual conditions and of simulator experiments show that pilots do not always recognise that the visual cues are inadequate in such situations and present recorded data reveal that pilots' landing performance reduces progressively as the RVR is reduced below 300 m. It should further be recognised that there is some risk in carrying out a manual missed approach procedure from below 50 ft in very low visibility and it should therefore be accepted that if an RVR lower than 300 m is to be approved, the flight deck procedure should not normally allow the pilot to continue the landing manually in such conditions and the aircraft system should be sufficiently reliable for the missed approach procedure rate to be low.

4) These criteria may be relaxed in the case of an aircraft with a fail-passive automatic landing system that is supplemented by a head-up display that does not qualify as a fail-operational system but that gives guidance that will enable the pilot to complete a landing in the event of a failure of the automatic landing system. In this case it is not necessary to make a missed approach procedure mandatory in the event of a failure of the automatic landing system when the RVR is less than 300 m.

c) CAT III fail-operational operations – with a DH

1) For CAT III operations utilising a fail-operational landing system with a DH, a pilot should be able to see at least one centre line light.

2) For CAT III operations utilising a fail-operational hybrid landing system with a DH, a pilot should have a visual reference containing a segment of at least three consecutive lights of the runway centre line lights.

d) CAT III fail operational operations - with no DH

1) For CAT III operations with no DH the pilot is not required to see the runway prior to touchdown. The permitted RVR is dependent on the level of aircraft equipment.

2) A CAT III runway may be assumed to support operations with no DH unless specifically restricted as published in the AIP or NOTAM

APPENDIX 2 - INTRODUCTION & TECHNICAL BACKGROUND– EFVS OPERATIONS

a) EFVS operations, if approved, exploit the improved visibility provided by the EFVS to allow an operational credit applied to the visual segment of an instrument approach. An EFVS cannot be used to extend the instrument segment of an approach and thus the DH for operation with an EFVS is always the same as for the same approach conducted without an operational credit.

b) EFVS operations require specific approval from the CAA in accordance with Part-SPA. However, other EFVS operations may be conducted by operators and without a specific approval if specifically covered in accordance with Part-CAT, Part-NCC or Part-SPO (e.g. 'EFVS 200').

c) Equipment for EFVS operations

   1) In order to conduct EFVS operations, a certified EFVS is used. An EFVS is an enhanced vision system (EVS) that also incorporates a flight guidance system and displays the image on a HUD or an equivalent display. The flight guidance system will incorporate aircraft flight information and flight symbology.

   2) For operations for which a minimum flight crew of more than one pilot is required, the aircraft will also be equipped with a suitable display of EFVS sensory imagery for the pilot monitoring the progress of the approach.

   3) Legacy systems may be certified as 'EVS with an operational credit'. Such a system may be considered an EFVS used for approach (EFVS-A).

   4) Aircraft holding a type certificate issued by a third country may be certified for operations equivalent to EFVS operations. Specific approval for an operational credit for EFVS operations will be available only if the operator can demonstrate that the equipment meets all the requirements for certification in accordance with CS-AWO.

   5) For approaches for which natural visual reference is not required prior to touchdown, the EFVS (EFVS used for landing (EFVS-L)) will additionally display:

      i. flare prompt or flare guidance information; and

      ii. height AGL

d) Suitable approach procedures

For types of approach operation, refer above in Section 5 to 'Additional verification of the suitability of runways for EFVS operations' .

EFVS operations may be used for 3D approach operations. These may include operations based on non-precision approach (NPA) procedures, approach procedures with vertical guidance and PA procedures including approach operations requiring specific approvals, provided that the operator holds the necessary approvals.

An NPA procedure flown using vertical guidance from computer-generated navigation data from ground-based, space-based, self-contained navigation aids, or a combination of these may be considered a 3D instrument approach operation, so EFVSs may be used for NPA procedures provided that vertical guidance is available to the pilot.

Offset approaches

The extent to which EFVSs can be used for offset approaches will depend on the FOV of the specific system. Where an EFVS has been demonstrated to be usable with a final approach track offset more than 3 degrees from the runway centre line, this will be stated in the AFM.

Instrument approach procedures (IAPs) may have the final approach course significantly offset from the centre line of the runway and still be considered 'straight-in approaches'.

Many approach procedures with an offset final approach course are constructed so that the final approach course crosses the runway centre line extended well out from the runway. Depending on the construction of a particular procedure, the wind conditions and the available FOV of a specific EFVS installation, the required visual references may not come into view before the aircraft reaches the DH.

Circling approaches

EFVSs incorporate a HUD or an equivalent system so that the EFVS image is visible in the pilot's forward external FOV. Circling operations require the pilot to maintain visual references which may not be directly ahead of the aircraft and may not be aligned with the current flight path. EFVSs cannot therefore be used in place of natural visual reference for circling approaches.

e) For aerodrome operating minima for EFVS operations refer above to sections 2 and 3. The performance of EFVSs depends on the technology used and weather conditions encountered. The minimum RVR for an approach is based on the specific capabilities of the installed equipment in the expected weather conditions, so the RVR for a particular operation is determined according to criteria stipulated in the AFM.

Tables have been provided to allow calculation of an appropriate RVR for aircraft where the AFM does not contain criteria to determine the minimum usable RVR. This table has been developed after an operational evaluation of two different EVSs both using infrared sensors, along with data and support provided by the Federal Aviation Administration (FAA). Approaches were flown in a variety of conditions including fog, rain and snow showers, as well as at night to aerodromes located in mountainous terrain. Table 10 contains conservative figures to cater for the expected performance of infrared sensors in the variety of conditions that might be encounter.

f) The conditions for commencement and continuation of the approach are in accordance with legal requirements as set out in Uganda Civil aviation Regulations.

Pilots conducting EFVS operations may commence an approach and continue that approach below 1 000 ft above the aerodrome or into the final approach segment (FAS) if:

1) the reported RVR or converted meteorological visibility (CMV) is equal to or greater than the lowest RVR minima determined; and

2) all the conditions for conducting EFVS operations are met.

If any equipment required for EFVS operations is unserviceable or unavailable, then the conditions for conducting EFVS operations would not be satisfied, and the approach cannot be commenced. Operators may develop procedures for flight crew to follow in the event of unserviceability arising after the aircraft descends below 1 000 ft above the aerodrome or into the FAS. Such procedures should ensure that the approach is not continued unless the RVR is sufficient for the type of approach that can be conducted with equipment that remains available. In the event of failure of the equipment required for EFVS operations, a go-around would be executed unless the RVR reported prior to commencement of the approach was sufficient for the approach to be flown without the use of EFVS in lieu of natural vision.

g) EFVS image requirements at the DA/H are specified above. The requirements for features to be identifiable on the EFVS image in order to continue approach below DH are more stringent than the visual reference requirements for the same approach flown without EFVS. This is necessary because the EFVS might not display the colour of lights used to identify specific portions of the runway and might not consistently display the runway markings. Any visual approach path indicator using colour-coded lights may be unusable.

h) Obstacle clearance in the visual segment

The ‘visual segment’ is the portion of the approach between the DH and the runway threshold. In the case of EFVS operations, this part of the approach may be flown using the EFVS image as the primary reference and there may be obstacles that are not always identifiable on an EFVS image. Approach procedures designed in accordance with PANS-OPS criteria is required to ensure that the visual segment is protected for obstacles by the visual segment surface (VSS) that extends from 60 m before the threshold to the location of the OCH. Procedures not designed in accordance with PANS-OPS may have not been assessed for terrain or obstacle clearance below the OCH and may not provide a clear vertical path to the runway at the normally expected descent angle. SA CAT I and CAT II/III runways, that subject to EU aerodrome regulations are required to provide an OFZ, which offers protection from obstacles in the visual segment. Standard CAT I runways may also provide an OFZ and if not, the lack of an OFZ shall be indicated, according to ICAO Annex 4, normally on the approach chart.

i) Visual reference requirements at minimum height to continue approach without natural visual reference

For operations other than EFVS to touchdown, natural visual reference is required before landing. The objective of this requirement is to ensure that the pilot will have sufficient visual reference to land. The visual reference should be the same as the one required for the same approach flown without the use of EFVS. The specific height at which this is required will depend on the capability of the aircraft installation and will be specified in the AFM. For aircraft certified for EFVS operations but where no such height is specified in the AFM, natural visual reference is required by a height of 100 ft above the threshold elevation.

Specific EFVSs may have additional requirements that must be fulfilled at this height to allow the approach to continue, such as a requirement to check that the elements of the EFVS display remain correctly aligned and scaled to the external view. Any such requirements will be detailed in the AFM

j) Use of EFVS to touchdown

In order for the use of EFVS to touchdown to be approved, the EFVS will provide flare prompt or flare guidance (EFVS-L). This mitigates the fact that a 2D image and a narrow FOV displayed by the EFVS may cause erroneous perceptions of depth or height. The EFVS will also display height above the runway by the use of a radio altimeter or other device capable of providing equivalent performance. Unless the operator has verified that the terrain ahead of the threshold and landing system assessment area (LSAA) slope is suitable for the use of a radio altimeter, such a system should not be relied upon to provide accurate information about the height of the aircraft above the runway threshold until the aircraft is over the runway surface

k) Go-around

A go-around will be promptly executed if the required visual references are not maintained on the EFVS image at any time after the aircraft has descended below the DA/H or if the required visual references are not distinctly visible and identifiable using natural vision after the aircraft is below the minimum height to continue approach without natural visual reference (if applicable). It is considered more likely that an operation with EFVS could result in initiation of a go-around below the DA/H than the equivalent approach flown without EFVS. Operators involved in EFVS operations should keep records of the number of successful and unsuccessful approaches using EFVS in order to detect and act on any undesirable trends.

For category II and III PA procedures designed in accordance with PANS-OPS criteria, obstacle protection is provided for a go-around initiated below the DH (balked landing) by means of an obstacle free zone (OFZ). An OFZ may also be provided for category I PA procedures. Where an OFZ is not provided for a category I PA, this may be indicated on the approach chart. NPA procedures and approach procedures with vertical guidance provide obstacle clearance for the missed approach based on the assumption that the missed approach is executed at or above the DH. The DH should be located at or before the MAPt

APPENDIX 3 - SAFETY PERFORMANCE MONITORING – DATA GATHERING

1.0 Data Gathering

a) Data gathering for safety performance monitoring of LVOs and operations with operational credits will need to include sufficient information for the operator to identify hazards and assess the risks associated with LVOs and operations with operational credits.

b) The following data relating to LVOs and operations with operational credits may be gathered via flight crew reports, flight data monitoring or other means, as appropriate:

   a) date and time;

   b) aircraft details (type and registration);

   c) airport, approach procedure, final approach and take-off area (FATO) and/or runway used;

   d) the type of LVO or operation with operational credits attempted or completed;

   e) weather conditions including wind, reported RVR and natural phenomena that restrict visibility;

   f) the reason for a discontinued approach (if applicable);

   g) details of any pilot intervention to ensure a continued approach or safe landing;

   h) adequacy of speed control;

   i) trim at time of automatic flight control system disengagement (if applicable);

   j) compatibility of automatic flight control system, flight director and raw data;

   k) an indication of the position of the aircraft relative to the centre line when descending through to 100 ft;

   l) touchdown position relative to the TDZ;

   m) an assessment of the sink rate, lateral velocity and bank angle at touchdown;

   n) the nature of any problems encountered by the crew in relation to operating procedures or training; and

   o) any human factors issues that arose in relation to the operation.

   p) Where data is gathered as part of the operator's flight data monitoring programme, procedures should be established to ensure that information that is only available directly from the flight crew or other sources (e.g. weather information) is captured.

   q) In order to assess the risks associated with LVOs and operations with operational credits, operators may consider hazards with the potential to result in the following unacceptable safety outcomes:

      (a) loss of control in flight;

      (b) runway overrun or excursion;

      (c) controlled flight into terrain;

      (d) runway incursion and ground collision; and

(e) airborne conflict.

c) Operators’ safety control processes will ensure that LVOs and operations with operational credits:

a) meet the safety objectives and performance standards established in the operator’s safety policy

b) achieve at least the same level of safety as operations other than LVOs and operations without operational credits; and

c) have a continuously improving safety performance.

d) Two methods to determine the rate of unsuccessful low-visibility approaches are described below:

(a) Fail/pass method (binary): the rate of unsuccessful low-visibility approaches determined should not exceed 5 %. If the unsuccessful operations appear to occur on a given aircraft, aircraft series or runway, specific mitigation measures need to be established and a separate specific rate may need to be calculated and monitored. Note: the term ‘aircraft series’ is explained above. Operators may choose to apply a lower rate than 5 %.

(b) Continuous method: this method may be selected by operators with a flight data monitoring programme. This methodology is more refined and allows identifying undesirable trends earlier and possibly before they become severe. This method applies an event monitoring methodology in which the deviations from the nominal performance are categorised according to their severity (severity index). For each event (criterion), a level of deviation may be defined as follows:

i) Low (‘green’: the deviation is small and within the limits of nominal behaviour. No action is required.)

ii) Medium (‘yellow’): the deviation is above the criteria for low (‘green’) and below the criteria for high (‘red’). No corrective action should be required based on an isolated occurrence; however, a corrective action should be taken if the situation does not improve, or a negative trend is identified. The monitoring should then focus on the particular runway or aircraft series or combination of those.

iii) High (‘red’): the deviation is undesirably high. Investigation and corrective action should be undertaken even based on an isolated occurrence. The threshold for level high (‘red’) may be based on the criteria above.

1.0.1 Data gathering for safety assessment prior to obtaining an approval

a) General

The intention of the safety assessment is to validate the use and effectiveness of the applicable aircraft flight control and guidance systems, procedures, flight crew training and aircraft maintenance programme. The intention is not to repeat the statistical analysis required for certification of equipment, but rather to demonstrate that the various elements of the ‘total system’ for LVOs work together for a particular operator.

b) Data gathering for safety assessment — LVTOs

1) If the procedures used for LVTOs are not significantly different from those used for standard take-offs, it may be sufficient for operators to conduct only a small number of take-offs using the procedures established for LVTOs for the purpose of data gathering. The following could be considered as a minimum:

   i. For LVTOs in an RVR of 125 m or more if procedures are similar to those used for standard take-offs: 1 take-off;

   ii. For LVTOs in an RVR of less than 125 m or any other LVTOs using specific procedures: 10 take-offs.

2) An operator holding an approval for LVTOs on one aircraft type and applying the approval for LVTOs on another type or variant may use data from LVTOs conducted on the first type if the following are similar:

   i. level of technology, including flight deck displays, HUD or an equivalent guidance system;

   ii. operational procedures; and

   iii. handling characteristics.

c) Data gathering for safety assessment — approach operations with a DH below 200 ft

The data required for the safety assessment needs to be gathered from approaches conducted in a representative sample of expected operating conditions. The operator needs to take seasonal variations in operating conditions such as prevalent weather, planned destinations and operating bases, and ensure that the approaches used for data gathering are conducted over a sufficient period of time to be representative of the planned operation.

In order to ensure that the data is representative of planned operations, approaches are conducted at a variety of airports and runways. If more than 30 % of the approaches are conducted to the same runway, the operator may increase the number of approaches required and take measures to ensure that the data is not distorted.

The number of approaches used for data gathering will depend on the performance indicators and analysis methods used by the operator. The operator will need to demonstrate that the operation for which approval is sought will achieve an acceptable level of safety. The following figures may be considered a minimum for an operator without previous experience of low-visibility approach operations:

   i. for approval of operations with a DH of not less than 50 ft: 30 approaches;

   ii. for approval of operations with a DH of less than 50 ft: 100 approaches.

Approaches conducted for the purpose of gathering data in order to conduct a safety assessment prior to obtaining an LVO approval may be conducted in line operations or any other flight where the operator’s procedures are used. Approaches may also be conducted in an FSTD if the operator is satisfied that this would be representative of the operation.

The data gathered from these approaches will only be representative if all required elements of the total system for LVOs are in place. These include not only operating procedures and airborne equipment, but also airport and ATC procedures and ground- or space-based navigation facilities. If the operator chooses to collect data from approaches conducted without all required elements in place, then the data analysis takes into account the effect of at least the following:

1) air traffic services (ATS) factors including situations where a flight conducting an instrument approach is vectored too close to the FAF for satisfactory lateral and vertical path capture, lack of protection of ILS sensitive areas or ATS requests to discontinue the approach;

2) misleading navigation signals such as ILS localiser irregularities caused by taxiing aircraft or aircraft overflying the localiser array;

3) other specific factors that could affect the success of LVOs that are reported by the flight crew.

d) Safety considerations for approaches used for data gathering

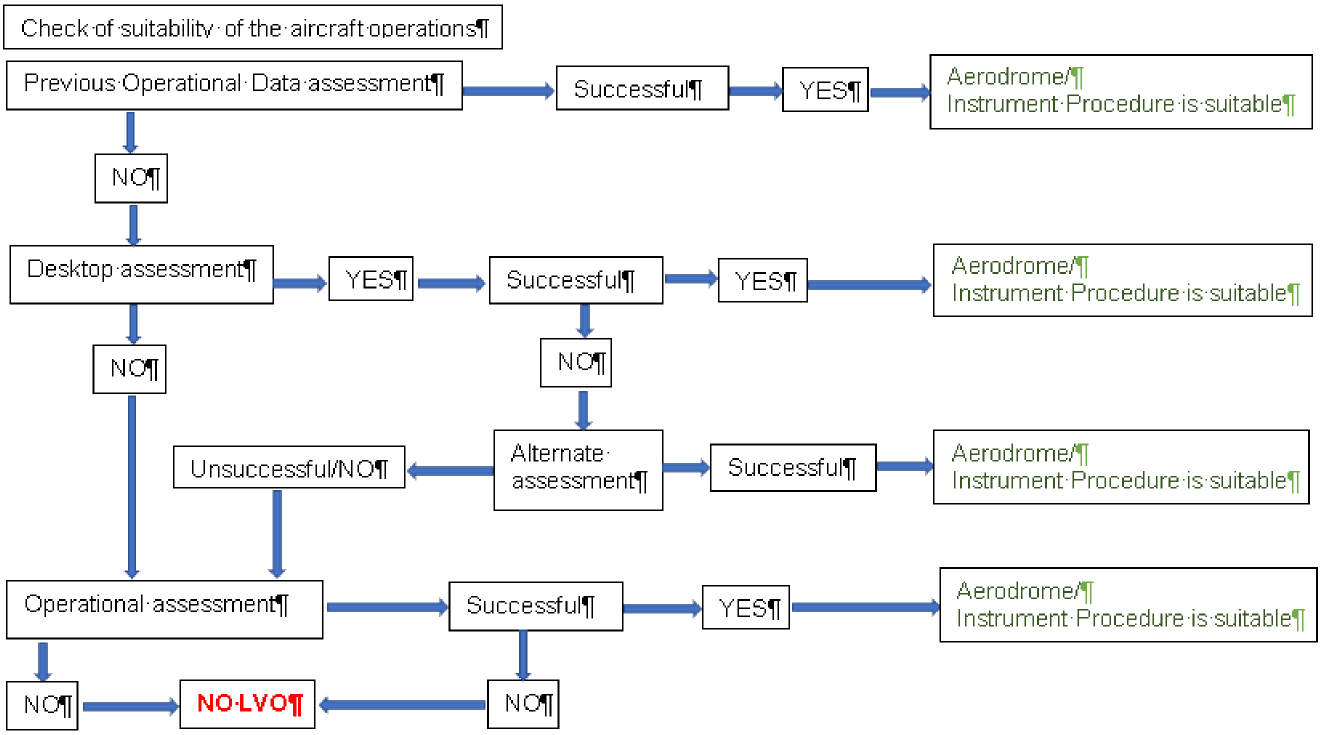
If an operator chooses to collect data from approaches conducted without all required elements of the total system for LVOs in place, then the operator takes actions to ensure an acceptable level of safety.

e) Sharing of data: operators may use data from other operators or aircraft manufacturers to support the safety assessment required to demonstrate an acceptable level of safety. The operator applying for a specific approval would need to demonstrate that the data used was relevant to the proposed operation.

f) It is expected that operators will have more than 6 months or at least 1 000 hours of total operational experience on the aircraft model before they can have sufficient data to set up meaningful performance indicators and establish whether planned LVOs would achieve an acceptable level of safety.

APPENDIX 4 - AERODROME RELATED REQUIREMENTS AND INSTRUMENT FLIGHT PROCEDURES ASSESSMENT CRITERIA (REFERENCED TO SPA.LVO)

A diagram with a schematic of the assessment described above '*Aerodrome-related requirements, including instrument flight procedures'* is provided below:



APPENDIX 5 - ASSESMENT OF SUITABLE RUNWAY AND RUNWAY ENVIRONMENT CHARACTERISTICS

a) As detailed above the assessment of the suitability of an aerodrome, including instrument flight procedures, for the intended operations comprises the availability of suitable runway and runway environment characteristics.

b) For operations based on radio altimeter or other device measuring the height over the ground:

  i. the suitability of the indication of the DH should be based on data covering the actual DH location. This indication should be expected to be stable and continuous;

  ii. The suitability of the indication of the alert height (where applicable) should be based on data covering the actual alert height location. This indication should be expected to be stable and continuous.

  iii. The primary source of information to determine the suitability should be the precision approach terrain chart (PATC). If the information is not conclusive, the operator may collect and develop airport data not contained in the AIP. More information can be found above.

c) For runways intended to be used for CAT III, CAT II, SA CAT II and SA CAT I operations, the State of aerodrome should provide a PATC. More information is provided above.

d) There should be a radio altimeter operating area for runways intended to be used for EFVS-L, CAT III, CAT II, SA CAT II and SA CAT I operations. The ICAO aerodrome provisions detail that the radio altimeter operating area extends to at least 300 m from the runway threshold with a width of 60 metres on either side of the extended centre line of the runway. The width may be reduced to not less than □ 30 metres if such a reduction does not affect the safety of aircraft operations as assessed by the aerodrome operator in cooperation with affected stakeholders. Slope changes should be kept to a minimum.

e) Information on pre-threshold terrain and its effect on radio altimeters and automatic flight control systems (AFCS) is contained in the Manual of All-Weather Operations (ICAO Doc 9365, Section 5.2.).

1.1 Suitable aerodromes — assessment — previous operational data — runway and runway environment

a) As detailed above previous operational data should only be used to assess the suitability of an aerodrome for the intended operations when it concerns the same runway and there were no relevant changes to the runway and runway environment.

b) Relevant changes to the runway and runway environment may include changes to:

  1) the pre-threshold terrain, including the radio altimeter operating area;

  2) runway dimensions;

  3) the average slope of the landing system assessment area (LSAA);

  4) visual aids including approach lights and runway lights;

1) the obstacle free zone (OFZ);

2) the visual segment surface (VSS) — only relevant for operational credits in the visual segment (EFVS).

1.2 Suitable aerodromes — assessment — previous operational data provided by the state of the aerodrome

a) As detailed above the assessment of the suitability of an aerodrome, including instrument flight procedures, for the intended operations, may be made considering previous operational data for the particular aerodrome, runway and instrument flight procedures.

b) The following guidance is provided for the assessment of suitability of aerodromes for LVOs or operations with operational credits.

c) If a State provides data related to airports or runways in its territory that are suitable for CAT II or CAT III operations with a specific aircraft model or group of aircraft models, those airports or runways may be considered suitable subject to regulatory requirements.

Note: A CAT II or CAT III approved runway does not necessarily mean that the airport is suitable (see above) as the aerodrome's provisions may not ensure that the requirements for certain aircraft models are fulfilled.

d) If a State provides data related to airports or runways in its territory that are found suitable for SA CAT I or SA CAT II, those airports or runways may be considered suitable subject to regulatory requirements.

e) If a State provides data related to airports or runways in its territory that are approved for CAT II/III operations but are designated as restricted or non-standard or irregular, those designated runways should be considered not suitable. The remaining CAT II/III runways of that State may be considered regular.

f) A CAA may provide data related to airports or runways that can be considered suitable for defined LVOs. The suitability statement could be credited by operators under the oversight of that authority.

1.3 Suitable aerodromes — assessment — previous operational data — terminology: make, model, series and variant

The following terms, in accordance with the ICAO Commercial Aviation Safety Team (CAST) taxonomy, are often used:

a) Aircraft make: The aircraft make is the name assigned to the aircraft by the aircraft manufacturer when each aircraft was produced. In most cases, the aircraft make is the common name of the aircraft manufacturer; for example, Airbus, Boeing, Embraer, etc.

b) Aircraft model: An aircraft model is an aircraft manufacturer's designation for an aircraft grouping with a similar design or style of structure. In EASA type certificate data sheet (TCDS), this means the aircraft type certificate; for example, A330, B777.

c) Aircraft series: An aircraft series is an aircraft manufacturer's designation to identify differences within an aircraft model grouping. It provides a further specification to the aircraft type; for example, B777-232 where the series is the number 232. Some manufacturers define the so- called master series: An aircraft master series creates a grouping of similar aircraft series for analytical purposes and to identify aircraft series that share airworthiness properties. A master series contains aircraft series from within one aircraft model. For example, A320-100 and A320-200: the A320-100 master series only has one series (A320-111), while the A320-200 master series has many series (211, 212, 214, 215, 216, 231, 232, 233).

d) Aircraft variant: a variant defines different sets of limiting structural masses (e.g. MTOW, MLW, MZFW, etc.) within a series. For example, A320-232-007 or the A330-243 RR engine's variant 052. Variants are not covered in the ICAO Cast taxonomy; however, they may be specified in the EASA TCDS.

e) More information can be found in ICAO documentation under: https://www.icao.int/publications/DOC8643/Pages/Search.aspx?msclkid=a28160bbd09311ecbbe633ef5f1957a4 and http://www.intlaviationstandards.org/.

1.4 Suitable aerodromes — desktop assessment — data not provided in the AFM

5(a) When the AFM or additional data from the TC/STC holder does not provide the information needed the operator may contact the TC/STC holder to request such information. Otherwise the operator may seek to use previous operational data or perform operational demonstration in accordance with further information provided above.

1.5 Suitable aerodromes — desktop assessment — use of previous operational data

In-service consolidated experience from already successfully demonstrated and consistently used runways with the specific aircraft type and with the same intended operations (typically CAT II/III) could be used to support the desktop assessment. The assessment criteria, for pre-threshold terrain variation and LSAA slope, could then be defined by the prevailing complexity of the runway on which the operator already has in-service experience and where sufficient operational flight data is available to prove adequate performance of the automatic landing system.

1.6 Suitable aerodromes — desktop assessment — aerodrome data sources

As detailed above, the assessment of the suitability of an aerodrome, including instrument flight procedures, for the intended operations, may be made by a desktop assessment, that should consider aerodrome data.

Some aerodrome data sources follow:

a) Type A and Type B aerodrome obstacle charts

Aerodrome obstacle charts come in two forms. Type A and B charts may be combined, and the chart is called aerodrome obstacle chart (ICAO Comprehensive). Where a terrain and obstacle chart is provided in electronic form, there is no need to provide Type A or B aerodrome obstacle charts.

b) Type A aerodrome obstacle chart (ICAO Annex 4, Chapter 3)

Type A aerodrome obstacle charts are found at most aerodromes approved for LVOs. The function of the Type A chart is to enable an operator to comply with the performance operating limitations in Annex 6. The Type A chart does not have to be provided if there are no take-off obstacles, but a note informing about this is needed according to ICAO Annex 4. The elevation is given to the nearest half-metre or nearest foot. Linear dimensions are shown to the nearest half metre.

c) Type B aerodrome obstacle chart (ICAO Annex 4, Chapter 4)

Type B aerodrome obstacle charts contain information about the elevation (at the centre line) of both runways plus the elevation at each significant change of the slope of the runway. The function of the Type B chart is:

1) the determination of minimum safe altitudes/heights including those for circling procedures;

2) the determination of procedures for use in the event of an emergency during take-off or landing;

3) the application of obstacle clearing and marking criteria; and

4) the provision of source material for aeronautical charts. Elevations and linear dimensions are shown to the nearest half metre.

d) Aerodrome terrain and obstacle Chart – ICAO (Electronic) (ICAO Annex 4, Chapter 5)

The function of this chart is to:

1) enable an operator to comply with the operating limitations of Annex 6, Part I, Chapter 5, and Part III, Section II, Chapter 3, by developing contingency procedures for use in the event of an emergency during a missed approach or take-off, and by performing aircraft operating limitations analysis; and

2) support the following air navigation applications:

   i. instrument procedure design (including circling procedure);

   ii. aerodrome obstacle restriction and removal; and

   iii. provision of source data for the production of other aeronautical charts.

Note that this chart may also contain the information required for the PATC.

According to ICAO Annex 4, from November 2015, this chart is made available for aerodromes regularly used by international aviation. The chart is made available in printed form on request.

e) Aerodrome chart (ICAO Annex 4, Chapter 13)

According to ICAO Annex 4, an aerodrome chart is provided for aerodromes regularly used by international aviation. The function of this chart is to provide information to facilitate the ground movement of aircraft and in general also to provide essential operational information.

This chart contains information about the height of the threshold and, for PA runways, the highest point of the TDZ. This information may also be included in the text part of the AIP, Chapter AD2 (normally paragraph 2.12 – Runway Physical Characteristics). The elevation is provided to the nearest half metre.

f) Precision approach terrain chart (PATC) (Annex 4, Chapter 6)

According to ICAO Annex 4, a PATC is made available for all PA runways Categories II and III at aerodromes used by international civil aviation, except where the requisite information is provided in the aerodrome terrain and obstacle chart — ICAO (Electronic). The chart includes:

i. a plan showing contours at 1 m (3 ft) intervals in the area 60 m on either side of the extended centre line of the runway, to the same distance as the profile, the contours to be related to the runway threshold;

ii. an indication where the terrain or any object thereon, within the plan defined in (i), differs by +/- 3 m in height from the centre line profile and is likely to affect a radio altimeter;

iii. a profile of the terrain to a distance of 900 m from the threshold along the extended centre line of the runway. Where the terrain at a distance greater than 900 m from the runway threshold is mountainous or otherwise significant to users of the chart, the profile of the terrain should be shown to a distance not exceeding 2 000 m from the runway threshold.

g) Summary

1) For the determination of runway slopes, the aerodrome obstacle chart, preferably the combined version, appears to provide the best information. The PATC appears to be the best source to determine the elevations and slopes in the approach area.

2) If the information provided by different parts of the AIP is inconsistent, this may indicate an error in the data and should be reported to the State of aerodrome or AIP issuing authority, unless the inconsistency is insignificant. It should however be noted that there may be different requirements for accuracy and resolution between different AIP charts or sections, which might cause values to differ slightly.

3) It may be difficult to conclusively state which chart is best for determining the runway slope in each case, but the primary source of information is the AIP, and therein the aerodrome obstacle chart and the PATC. As the aerodrome terrain and obstacle chart – ICAO (Electronic) becomes more available, it will probably take over as the primary source of information about both runways and pre-threshold terrain.

1.7 Suitable aerodromes — operational assessment — process to determine the number of approaches and landings — aeroplanes

When performing an operational assessment to determine the suitability of an aerodrome for the intended operations, the operator should have a process to determine the number of approaches and landings, in accordance with the information provided above. The following guidance provides examples of criteria that can be used to evaluate level complexity of the runway versus a landing system for the purpose of the determination of the number of approaches and landings. Depending on the landing system used, some criteria might not be relevant, or others might need to be considered.

a) Pre-threshold terrain profile

The typical length of pre-runway threshold is calculated from the published threshold (displaced threshold if present) to 300 m on the extended centre line unless otherwise specified by the AFM or additional data from the TC/STC holder, the State of the aerodrome or AIP data, or the UCAA issuing the operator's LVO approval. The complexity of the pre-threshold terrain profiles is described as follows:

i) Simple

(A) approximately ± 1 m variation from runway threshold elevation in the typical length; or

(B) previous experience in more constraining pre-threshold terrain in the same aircraft type or variant.

ii) Moderate

(A) presence of ARAS; or

(B) approximately ± 1 m variation from runway threshold elevation within the last 60 m prior to runway threshold; and

(C) prior to 60 m and up to typical length:

– moderate rising slope (less than 7 % rising); or

– moderate 'sea wall' (less than 3 m).

iii) Complex

(A) approximately ± 2 m variation from runway threshold elevation within the last 60 m prior to runway threshold; and

(B) prior to 60 m and up to typical length:

– significant rising slope (up to 15 % rising); or

– significant 'see wall' (up to 6 m); or

– significant change of slope (rising then descending or descending then rising close to the limit values).

iv) Very complex

Outside any of the limits defined above for complex pre-threshold terrain profiles.

Note: The term 'sea wall' refers to sudden changes of terrain elevation that typically occur when runway thresholds are located near the sea. Sea level may change due to tides. Other cases of sudden terrain elevation may occur in other cases, a slope of 100 % may be considered as comparable to 'sea wall' (e.g. Boston USA).

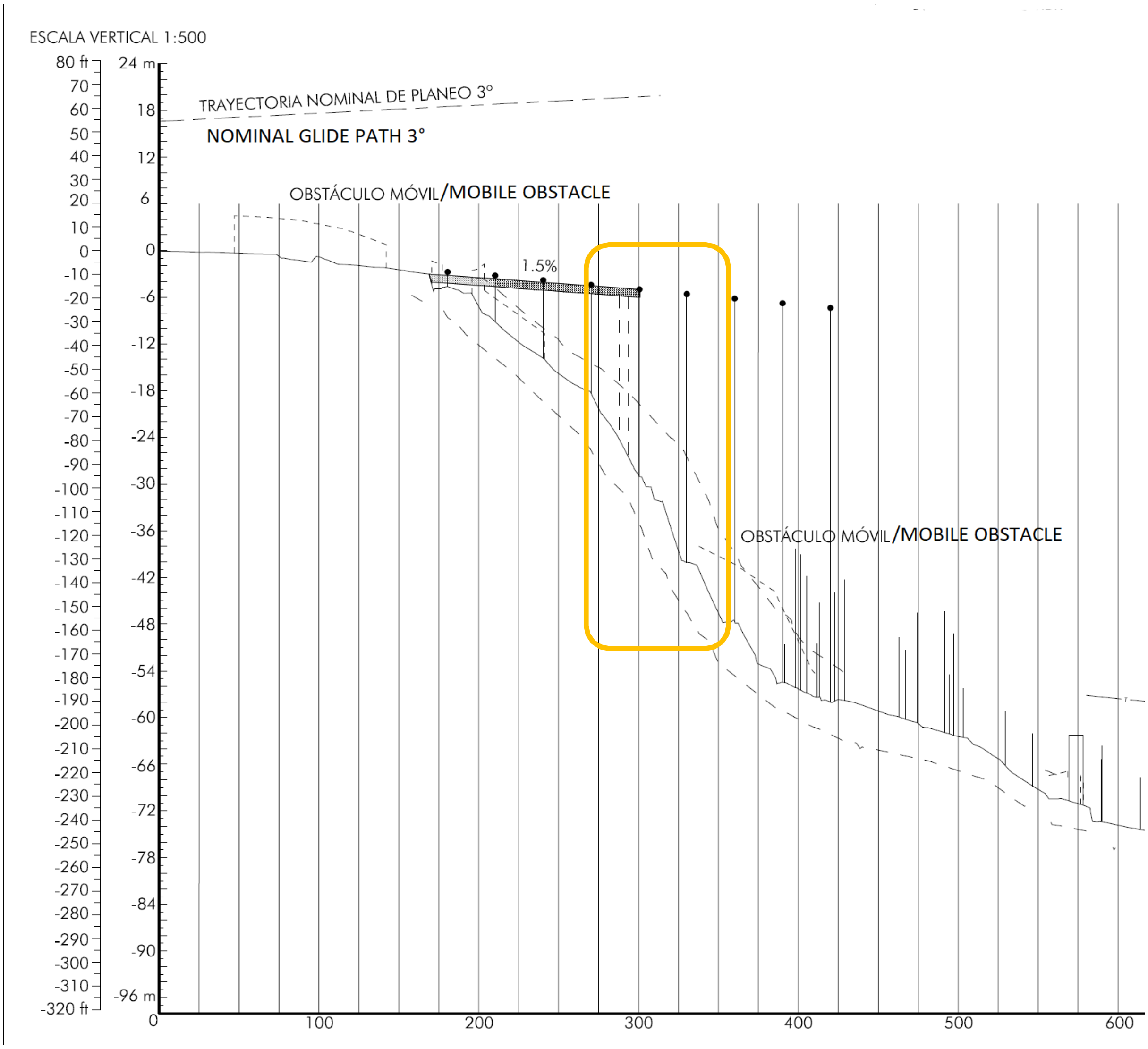


Figure 0: Typical example of 'very complex' with greater than 6 m 'sea wall' at 300 m (Asturias, LEAS 29 dated 2007) that after suitability assessment and due to the presence of ARAS, may be changed to **'moderate'**

Example: A pre-threshold terrain with the following features would be considered as 'moderate'.

1) Less than 1 m variation of pre-threshold terrain elevation from runway threshold elevation, in the area from runway threshold up to 100 m prior to runway threshold

2) Less than 3 m variation of pre-threshold terrain elevation from runway threshold elevation, in the area from 100 m prior to runway threshold up to 300 m prior to runway threshold

3) Landing system assessment area (LSAA) slope

Note: 600 metres after the threshold is the standard length; however depending on the landing system, other lengths might be relevant.

Although not recommended by ICAO Annex 14 Volume 1, slope variation in the LSAA can exist (refer to point 3.1.15 to point 3.1.18) and represent a factor of risk to be considered. For the purpose of determining the relevant parameters characterising slope and slope variation, the following definitions may be used (Figure 1):

– Mean LSAA slope: Slope computed from runway threshold elevation up to runway elevation at 600 metres after the threshold.

– Deviation from mean LSAA slope: greatest elevation difference between any runway elevation inside LSAA and mean LSAA slope.

–

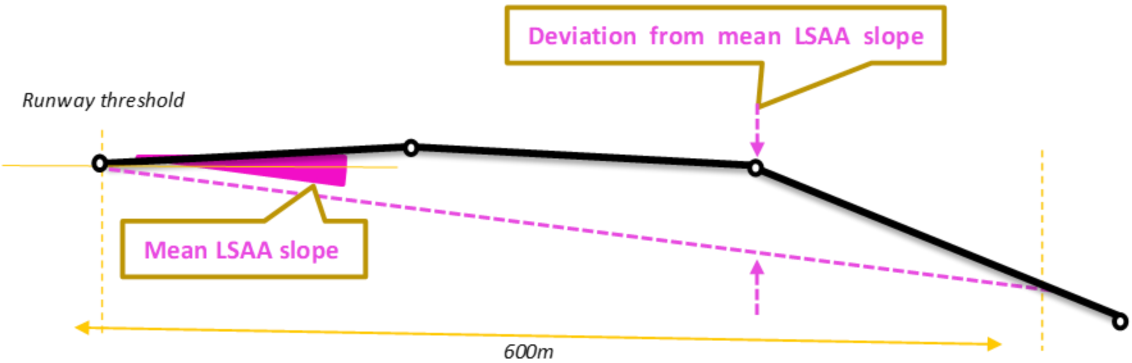


Figure 1: Mean LSAA slope & Deviation from mean LSAA slope

Note: Published runway profiles usually contain the position and elevation of each significant runway longitudinal slope change. Elevation at other location can be interpolated assuming straight slope between each published elevation. The highest/ lowest elevation of the LSAA might not be the one where the deviation from mean LSAA slope is the greatest.

i. Simple

(A) Approximately + 0.4 % mean LSAA slope and less than 1 m (3 ft) variation around mean LSAA slope; or

(B) previous experience in more constraining touch down condition in the same aircraft type or variant.

ii. Moderate

Approximately + 0.8 % mean LSAA slope and less than 2 m (6 ft) variation around mean LSAA slope.

iii. Complex

Approximately ± 1.0 % mean LSAA slope and less than 4 m (12 ft) variation around mean LSAA slope.

iv. Very complex

v. Outside any of the limits defined above.

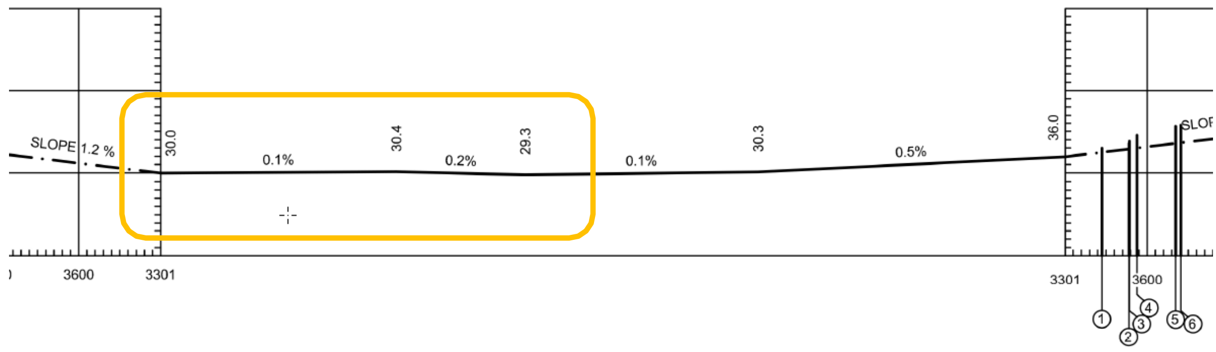


Figure 2: Typical example of 'simple' LSAA Slope (ESSA 01L dated 2018)

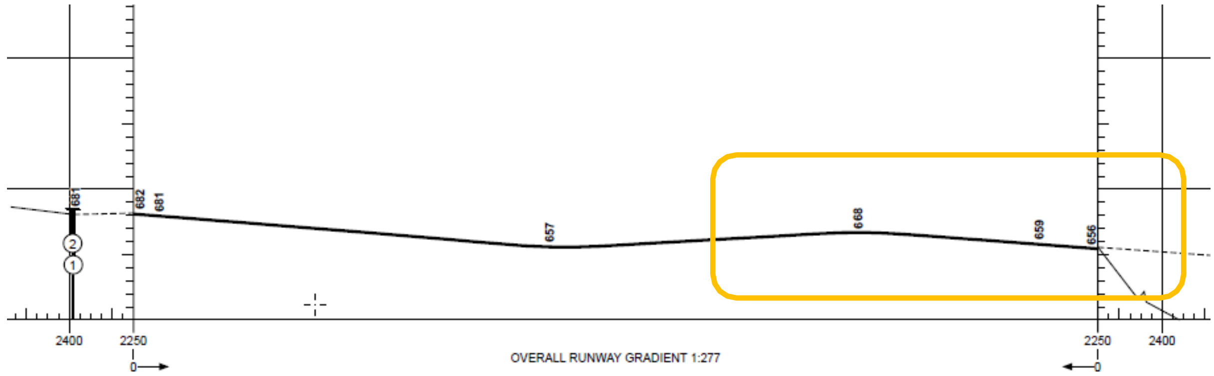


Figure 3: Typical example of 'moderate' LSAA slope due to variation around mean LSAA slope greater than 1 m but lower than 2 m (EGNM 32 dated 2018)

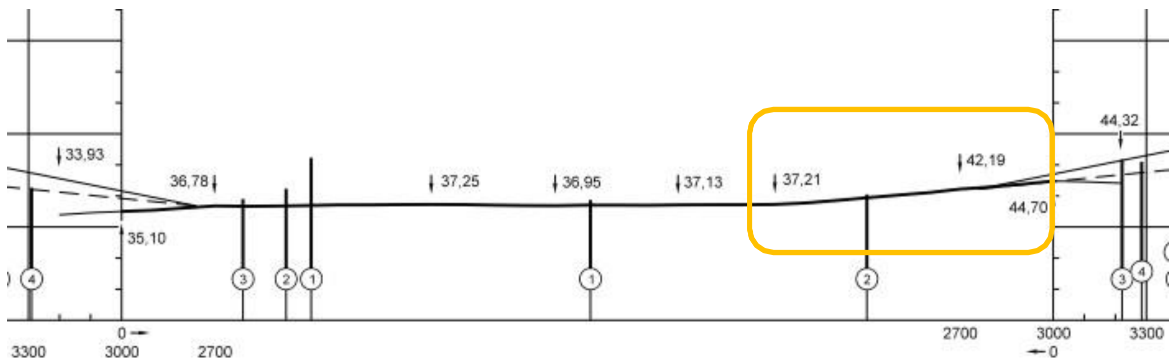


Figure 4: Typical example of 'complex' mean LSAA slope greater than 0.8 % but lower than 1 % (EDD 23L dated 2009)

Operational assessment programme: the following guidance provides examples of typical flight programmes than can be used to demonstrate suitability of a landing system using the operational assessment method, considering the overall level of runway irregularities.

Note: For CAT II operations with no use of autoland nor guidance for the flare manoeuvre, the programmes could be alleviated.

The flight programmes are expected to depend on the level of runway irregularities. The table below provides examples of criteria that can be used to determine the level of runway irregularities.

Level of runway irregularities to scale the flight programme

Pre-threshold / LSAA slope	Simple	Moderate	Complex	Very complex
Simple	Simple	Moderate	Complex	Very complex
Moderate	Moderate	Moderate	Complex	Very complex
Complex	Complex	Complex	Complex	Very complex
Very complex	Very complex	Very complex	Very complex	Very complex

1. Simple runway

For simple runways, unless other factors can be identified as a source of concern, no in- flight approach and landing may be required.

2. Moderate runway

For moderate runways, a minimum of one successful approach/landing using the procedures, equipment and operationally relevant heights (DH/AH) for the intended operations is performed in the meteorological conditions described in Table 10 above. More approaches could be required if any issue is identified during this approach/landing.

3. Complex runway

For complex runways, an initial minimum of three approaches/landings using the procedures, equipment and operationally relevant heights (DH/AH) for the intended operations is performed in the meteorological conditions described in Table 10, with at least one of the landings close to the maximum landing weight for the intended operation and the other two with other different conditions; for example, with a mid-weight in one and low weight in another or with different or wind conditions or aircraft configuration flap full/flap 3, or a combination of them. The flights for the assessment are conducted by pilots designated by the operator with defined minimum experience and qualifications, with procedures defined for the purpose. More approaches could be required if any issue is identified during these approaches/landings.

4. Very complex runway

For very complex runways, an initial minimum of four to six approaches/landings using the procedures, equipment and operationally relevant heights (DH/AH) for the intended operations is performed in the meteorological conditions described in Table 10 in typical aircraft weight conditions in flights with no commercial passengers.

If no anomaly is observed after the first four to six approaches/landings, extend the condition progressively close to the maximum landing weight for the intended operation with at least 15 successful approaches or landings and report any anomalies with the

meteorological conditions described in Table 10 and with different conditions, for example with different range of weight conditions (high, mid, low) or with different wind conditions or aircraft configuration flap full/flap 3, or a combination of them. The flights for the assessment should be conducted by pilots designated by the operator with defined minimum experience and qualifications, with procedures defined for the purpose.

a) Operational assessment successful criteria

1) Data to be recorded

To assess adequate performance of the landing system, some form of quantitative data should be recorded and reviewed with the UCAA as verification of performance. Acceptable methods of data collection include but are not limited to:

i. Record of wind conditions and touch down point (can be observation).

ii. Record of pertinent landing system parameters (typically from a digital flight data recorder, quick-access recorder or equivalent) with sufficient sampling rate (typically higher than 1 sample per second) for the part of the flight paths of interest (typically from 300 ft height above touch down through de-rotation after touch down) including typically:

- barometric altitude;
- radio altitude;
- glide path error;
- vertical speed;
- elevator command;
- pitch attitude;
- throttle position/thrust commanded;
- airspeed;
- mode transition or engagement.

iii. Photo or video recording of pertinent instrument or instrument and outside view allowing post-flight replay and review of the above parameters.

2) Data review and analysis to assess acceptable performance

The final approach, flare and touch down profile should be reviewed with the UCAA to ensure suitability of at least each of the following:

i. suitability of the resulting flight path;

ii. acceptability of any flight path deviation from the nominal path (e.g. glide path deviation, deviation from nominal flare profile);

iii. proper mode switching;

iv. suitable touch down point;

v. suitable sink rate at touch down;

vi. proper flare initiation altitude;

vii. suitability flare quality (e.g. no evidence of early or late flare, no over-flare or under flare, no undue 'pitch down' tendency at flare initiation or during flare, no flare oscillation, no abrupt flare, no inappropriate pitch response during flare, no unacceptable floating tendency, or other unacceptable characteristic that a pilot could interpret as a failure or inappropriate response of the landing system);

viii. no unusual flight control displacement (e.g. elevator control input spikes or oscillation);

ix. appropriate throttle/thrust retard (e.g. no early or late retard, no failure to retard, no undue reversal of retard, no undue pitch/thrust coupling);

x. appropriate speed decay in flare (e.g. no unusually low speed risking high pitch attitude and tail strike, no excessive float, appropriate seed decay even if well above Vref at flare initiation due to planned wind or gust compensation);

xi. proper mode initiation or mode transition relating to altitude or radio altitude inputs (e.g. crosswind alignment).

1.8 Suitable aerodromes — operational assessment — verification using an FSTD

a) When performing an operational assessment to determine the suitability of an aerodrome for the intended operations, the operator may replace partially or completely the approaches and landings by a verification using an FSTD, if the FSTD is suitable for the operational assessment, in accordance with the criteria above.

Using an FSTD to support an operational assessment can be useful when, for example, terrain criteria would qualify as 'complex' or 'very complex' (level of runway irregularities according to the criteria above.

FSTDs are usually designed with the objective of replicating the aspects relevant to the scope of flight training associated with the type and level of the FSTD qualification. FSTDs are usually not designed to be used in the context of an operational assessment of the aerodrome for the intended operations, and there may be limits to what an FSTD may be used for. It should be ensured that the capabilities of the FSTD can support the objectives of the operational assessment.

When using an FSTD, any relevant differences between the real aircraft and the FSTD should be taken into consideration. A full flight simulator (FFS) Level D certified for zero flight time training is generally the most suitable for such use.

<u>To apply a verification using an FSTD, a suitable FSTD should be used</u>

b) An FSTD should only be used if it is from:

the same aircraft make and model, unless the same aircraft make and model is restricted by any of the entities above or another aircraft model, if stated in the AFM or additional data from the TC/STC holder.

The following factors should be considered:

1) Aircraft systems

The FSTD replicates the aircraft system in regard to the configuration and behaviour of the approach system or landing system. It covers all systems that are relevant and includes — as a minimum — the guidance and control systems, the relevant displays and the automatic call-outs.

The FSTD may be composed of actual aircraft components or simulated components either by the aircraft manufacturer or by another supplier (e.g. the FSTD manufacturer). If a version or standard of a system or component differs from the aircraft, the operator verifies with the TC/STC holder whether the differences have an impact on the performance or behaviour of the approach system or landing system.

2) Pre-threshold and runway terrain

The aircraft operator ensures that all relevant pre-threshold and runway profile data is fed into the FSTD and is presentative of the real world. This could mean that additional features may need to be implemented in the terrain database of the FSTD, as the certification specifications for FSTDs require a realistic topography only for a very limited number of aerodromes.

If the pre-threshold terrain includes an artificial radio altimeter surface (ARAS), the ARAS may be verified in the FSTD, if it can be shown for this ARAS that the actual echoes of the radio altimeters can be adequately reproduced in the FSTD. This may be done by using flight data.

3) Navigation facilities and associated instrument flight approach procedures

All relevant navigation facilities for the instrument flight approach procedures need to be adequately represented in the FSTD. It has to be taken into account that the FSTD representation of the signal in space is usually not realistic in the sense of the signal propagation and is limited to being a straight line in space, which is adequate for training purposes. Some FSTDs support, as a simulation feature for a failure case, a parallel displacement of target approach path; however, dynamic displacements (bends) or VHF noise in the signal are usually not simulated.

If the operation depends on a navigation aid, the use of the FSTD should be limited to the published service volume of the real-world navigation aid. The use of the FSTD outside this space is usually not meaningful as the signal performance and quality of the real- world navigation aid is not known.

4) Runway environment characteristics and facilities

Whenever the flight operation relies on visual references in both natural or enhanced vision to control or monitor the flight path or to identify relevant obstacles, all relevant environment characteristics and facilities need to be suitably represented. In the case of an EFVS, the visual advantage of the system needs to be representative of the EFVS presentation in the aircraft. This could mean that additional features may need to be implemented in the visual database of the FSTD, as the certification specifications for FSTD require a realistic scenery only for a very limited number of aerodromes.

c) Scope of FSTD verification

The minimum scope of the FSTD verification may be based on the level of runway irregularities as above (scaled approach).

1.9 Suitable aerodromes — assessment — collect and develop airport data not contained in the AIP — aeroplanes

An AIP should be the primary means to collect the necessary data to perform the assessment of aerodromes for the intended operation. However, sometimes the relevant data may not be available. In that case, the requirements above establishes that the operator should develop procedures to collect or develop the necessary data.

In this context, the operator may use surveys and/or collected data from aeroplane sensors or data recorders. This method could be typically used to determine the pre-threshold terrain profile and partially the LSAA if not published by a State authority.

These options should be part of the LVO approval and could include, among others:

a) data from appropriate sensors (e.g. radio altimeter, GNSS position, LOC/GS deviations);

b) data collected from appropriate sensors stored in recorders;

c) FDM data, if appropriate.

Sensors and data accuracy, including recorded sampling rate, should be considered in the usage of the collected data.

When defined in the approval, the respective data might be used for other airplane types.

1.10 Suitable aerodromes — suitable instrument approach procedures (IAPs) — SA CAT I and SA CAT II

ICAO design criteria for IAPs are contained in PANS-OPS (Doc 8168), Volume II.

The design criteria for SA CAT I are the same as those used for standard CAT I approaches, except that the procedures used for SA CAT I should have an OCH based on radio altimeter height loss, since the use of a radio altimeter or other device capable of providing equivalent performance to determine the DH is prescribed.

PANS-OPS Volume II contains the following statement about OCH based on the use of a radio altimeter: 'If the radio altimeter OCA/H is promulgated, operational checks shall have confirmed the repeatability of radio altimeter information.' To assist in assessing the suitability of the approach area for the use of a radio altimeter, aerodromes may produce a precision approach terrain chart (PATC). Such a chart is a standard requirement for CAT II/III runways. The criteria for the PATC are contained in ICAO Annex 4, which explains the function as follows: 'The chart shall provide detailed terrain profile information within a defined portion of the final approach so as to enable aircraft operating agencies to assess the effect of the terrain on DH determination by the use of radio altimeters.' A DH of 150 ft is located approximately 600 m before the threshold on a 3^{o} glide path.

For SA CAT I operations, the instrument approach chart should contain an OCH based on the use of a radio altimeter or other device capable of providing equivalent performance, and the information in Part C of the operations manual must contain a DH based on the use of a radio altimeter. This procedure may be titled ‘SA CAT I’ or ‘CAT I’.

For SA CAT II, the situation is similar. The design criteria are identical to those for CAT II approaches in PANS-OPS, the only exception being the lack of some lighting systems. The OCH and DH are based on the use of a radio altimeter or other device capable of providing equivalent performance.

Since some of the lighting systems are missing, it is unlikely that a State will publish the instrument approach chart as CAT II or OTS CAT II but preferably as SA CAT II, even though the design criteria are the same. If a State, however, promulgates such an instrument approach as CAT II, it can be used for SA CAT II operations.

SA CAT II operations can be conducted on regular CAT II runways and following CAT II procedures.

1.11 Suitable aerodromes — verification of the suitability of runways for EFVS operations

a) EFVS operations allow operation below the DA/H without ‘natural’ visual reference. Obstacles may not be obvious to the crew using the EFVS and thus the approach descent slope used has to ensure that obstacle protection will be provided in the visual segment.

b) When operating below the DA/H, pilots rely on the EFVS and, for EFVS-A operations, the pilot flying will need to acquire ‘natural’ visual reference at some point prior to touchdown (typically 100 ft above the threshold elevation). EFVS operations may present a higher probability of initiating a go-around below the DA/H than non-EFVS operations, depending on the equipment used.

c) The purpose of the assessment of the suitability of aerodromes of Instrument Approach Procedures (IAPs) is to confirm that clearance from terrain and obstacles will be available at every stage of the approach including the visual segment and, in the event of a go-around initiated below the DH, the missed approach segment. The assessment of the visual segment should be done with reference to the visual segment surface (VSS).

d) If a runway and an approach has been promulgated as suitable for EFVS operations, it may be assumed that the required obstacle clearance for the instrument segment and obstacle protection for the visual segment is assured and that the lighting systems are suitable. For EFVS-L operations, the pre-threshold terrain and LSAA need to be evaluated with regard to the function of flare cues or flare commands. Additionally, for runways not promulgated as suitable for EFVS operations, the operator may include the switch-over time for electrical power supply for the approach or runway lights in the safety assessment.

e) US TERPS and ICAO Doc 9905 ‘Required Navigation Performance Authorisation Required (RNP AR) Procedure Design Manual’ describe procedure design criteria that may be considered equivalent to PANS-OPS.

f) Procedures not designed in accordance with PANS-OPS may have not been assessed for obstacle protection below the OCH and may not provide a clear vertical path to the runway at the normal descent angle. IAPs do not ensure obstacle clearance if a go-around is initiated below the DA/H. If an obstacle free zone (OFZ) is established, obstacle protection is provided for the go-around manoeuvre.

g) For approach procedures where obstacle protection is not assured for a balked landing, operational procedures available to the operator could include one or more of the following actions:

   a) continue to the end of the runway and follow a published departure procedure for the landing runway (standard instrument departure or omnidirectional departure) in the event of a go-around below the DA/H;

   b) require that a go-around should be executed promptly if the required visual reference is not distinctly visible and identifiable to the pilot without reliance on the EFVS by a height above the threshold that will ensure that obstacle protection. This height might be greater than 100 ft or the height below which an approach should not be continued if the flight crew does not acquire natural visual reference as stated in the AFM;

   c) develop an alternative lateral profile to be followed in the event of a go-around below the DA/H; and

   d) impose an aircraft mass restriction for EFVS operations so that the aircraft can achieve a sufficient missed approach climb performance to clear any obstacles in the missed approach segment if a go-around is initiated at any point prior to touchdown.

h) The terrain/obstacle clearance required in the missed approach phase for EFVS operations should be no less than for the same approach flown without EFVS.

i) Certain EFVSs may have additional requirements for the suitability of the runways to be used. These could include verification of the accuracy of charting information for the runway threshold or the type of approach lighting installed (incandescent or LED). The assessment of the suitability of aerodromes should include the verification that all such requirements can be satisfied before EFVS operations are authorised for a particular runway.

END