European Aviation Safety Agency

# Notice of Proposed Amendment 2018-06(A)

## All-weather operations

RMT.0379


**EXECUTIVE SUMMARY**

The objective of rulemaking task (RMT).0379 is to modernise the European Union (EU) aviation regulatory framework applicable to all-weather operations (AWOs) so it ensures the highest level of safety while enabling efficiency gains based on the latest technological advancements. It addresses in a coordinated manner all relevant disciplines: initial airworthiness, air operations, flight crew licensing and aerodromes. It proposes a performance- and risk-based approach, as much as feasible, considering also the appropriate balance between performance-based and prescriptive principles (depending on the type of air operations (CAT, NCC, NCO, and SPO).

This NPA proposes to update the AWO-relevant rules in many aviation domains such as airworthiness (CS-AWO), air operations (Commission Regulation (EU) No 965/2012), aircrew (Commission Regulation (EU) No 1178/2011) and aerodromes (Commission Regulation (EU) No 139/2014, including CS-ADR.DSN). The main aim has been to allow for a better integration of the regulatory requirements related to the operational use of new, advanced technology — either developed already or to be developed in the future — such as, for example, enhanced flight vision system (EFVS), as well as the application of some advanced new operational procedures, which may support AWOs.

Significant focus has been invested in developing resilient rules, which are not technology-dependent. A particular attention was paid to the development of requirements enabling the use of EFVS to the maximum extent possible (e.g. use of EFVS for landing). A new concept of 'light operational credits' for EFVS 200 operations, not requiring the use of specific low-visibility procedures (LVPs), has also been introduced.

The proposed changes are expected to maintain safety, reduce the regulatory burden, increase cost-effectiveness, improve harmonisation (e.g. with the Federal Aviation Administration (FAA)), and achieve as much as feasible alignment with the Standards and Recommended Practices (SARPs) of the International Civil Aviation Organization (ICAO).

NPA 2018-06 is divided in four parts. The present sub-NPA(A) includes:

— the procedural information pertaining to the regulatory proposal;
— the presentation of the issue under discussion;
— the impact assessment as well as the hazard identification and risk assessment; and
— the proposed actions to support implementation.

The other sub-NPAs are organised as follows:

— sub-NPA(B) – initial airworthiness (CS-AWO);
— sub-NPA(C) – air operations and aircrew; and
— sub-NPA(D) – aerodromes.


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| **Action area:** | Airlines, air operators other than airlines | | |
| **Affected rules:** | AMC/GM to the Air OPS Regulation (Commission Regulation (EU) No 965/2012); AMC/GM to the Aircrew Regulation (Commission Regulation (EU) No 1178/2011); AMC/GM to the aerodromes rules (Commission Regulation (EU) No 139/2014, including CS-ADR-DSN); and CS-AWO | | |
| **Affected stakeholders:** | manufacturers, maintenance organisations (MOs), air operators, approved training organisations (ATOs), aerodrome operators, ATM/ANS, Member States | | |
| **Driver:** | Level playing field | **Rulemaking group:** | No |
| **Impact assessment:** | Light | **Rulemaking Procedure:** | Standard |


| 9.12.2015 | 13.7.2018 | 2019/Q2 | 2020/Q2 | 2020/Q4 |
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# 1. About this NPA

## 1.1. How this NPA was developed

The European Aviation Safety Agency (EASA) developed this NPA in line with Regulation (EC) No 216/2008[1] (hereinafter referred to as the 'Basic Regulation') and the Rulemaking Procedure[2]. This rulemaking activity is included in the EASA 5-year Rulemaking Programme[3] under RMT.0379.

RMT.0379 was initiated with the publication of the related Terms of Reference (ToR) and Concept Paper RMT.0379 Issue 1[4] on 9 December 2015. For the development of the implementing rules (IRs), the accelerated procedure[5] is applied; for the development of the acceptable means of compliance (AMC), guidance material (GM) and certification specifications (CSs), the standard rulemaking procedure is followed. As part of the accelerated procedure, EASA has already consulted its Advisory Bodies (ABs) on the regulatory impact assessment (RIA) and the description of operations (DoOs). In the context of the second consultation phase (focused consultation), EASA consulted on the proposed amendments to the IRs only. In addition, EASA provided responses to the comments received during the AB consultation and presented the subsequent amendments to the RIA and the DoOs.

The text of this NPA has been developed by EASA based on the input of the Experts' Task Force Groups (air operations, airworthiness, and aerodromes). It is hereby submitted to all interested parties[6] for consultation.

## 1.2. How to comment on this NPA

Please submit your comments using the automated **Comment-Response Tool (CRT)** available at **http://hub.easa.europa.eu/crt/**[7].

The deadline for submission of comments is **15 October 2018.**

## 1.3. The next steps

Following the closing of the public commenting period, EASA will review all comments.

Based on the comments received EASA will:

— update the proposed text of the affected CSs/AMC & GM;

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1 Regulation (EC) No 216/2008 of the European Parliament and of the Council of 20 February 2008 on common rules in the field of civil aviation and establishing a European Aviation Safety Agency, and repealing Council Directive 91/670/EEC, Regulation (EC) No 1592/2002 and Directive 2004/36/EC (OJ L 79, 19.3.2008, p. 1) (http://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1467719701894&uri=CELEX:32008R0216).

2 EASA is bound to follow a structured rulemaking process as required by Article 52(1) of Regulation (EC) No 216/2008. Such a process has been adopted by the EASA Management Board (MB) and is referred to as the 'Rulemaking Procedure'. See MB Decision No 18-2015 of 15 December 2015 replacing Decision 01/2012 concerning the procedure to be applied by EASA for the issuing of opinions, certification specifications and guidance material (http://www.easa.europa.eu/the-agency/management-board/decisions/easa-mb-decision-18-2015-rulemaking-procedure).

3 http://easa.europa.eu/rulemaking/annual-programme-and-planning.php

4 https://www.easa.europa.eu/system/files/dfu/ToR%20and%20Concept%20Paper%20RMT.0379%20Issue%201.pdf

5 In accordance with Article 16 of MB Decision No 18-2015.

6 In accordance with Article 52 of Regulation (EC) No 216/2008 and Articles 6(3) and 7) of the Rulemaking Procedure.

7 In case of technical problems, please contact the CRT webmaster (crt@easa.europa.eu).

— issue an opinion (developed on the basis of the focused consultation and taking into account the comments received to the AWO NPA) containing the proposed amendments to Regulations (EU) Nos 965/2012, 1178/2011 and 139/2014; the opinion will be submitted to the European Commission, which will use it as a technical basis in order to prepare an EU regulation; and

— for sub-NPA(B) issue a decision containing CS-AWO to which the related comment-response document (CRD) will be annexed.

Following the adoption of the regulation, EASA will issue the associated decisions containing the related AMC & GM.

The comments received and the EASA responses for sub-NPAs (A), (C) and (D) will be reflected in CRDs. The CRDs will be annexed to the opinion.

# 2. In summary — why, what and when

## 2.1. Why we need to change the rules — issue/rationale

The existing rules in the relevant aviation domains regulating AWOs:

— do not sufficiently address technological advancements;

— do not fully support new operational concepts;

— are in some areas not anymore aligned with the ICAO SARPs — for example, they do not efficiently address the concept of operational credits;

— are not completely consistent across the different domains, obstructing thus the use of the full potential of certified products and systems as well as reaping the full safety and economic benefits; and

— have been drafted without a consistent cross-domain hazard identification and risk assessment which should provide a guarantee that all safety risks have been identified, properly addressed, and mitigated across all affected domains.

In addition to the above, the results of the harmonisation efforts with the FAA, especially the results of the All Weather Operations Harmonization Aviation Rulemaking Committee (AWOHARC) work, have not yet been considered in the development of the EU regulatory framework.

**Related safety issues (safety risk portfolio and safety recommendations)**

This RMT does not directly address any issue from the relevant safety risk portfolio or any particular safety recommendations (SRs).

**Exemptions[8] in accordance with Article 14 'Flexibility provisions' of Regulation (EC) No 216/2008**

There have been no exemptions pertinent to the scope of this RMT.

**Alternative means of compliance (AltMoC) relevant to the content of this RMT**

There have been no AltMoC having an impact on the development of this RMT content.

**ICAO and third countries references relevant to the content of this RMT**

ICAO Annex 3 — Meteorological service for international air navigation: the definition of 'visibility' has been proposed for ensuring that the meaning of 'visibility' used by pilots is the same as that used by meteorological services, aerodromes and air traffic services.

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[8] Exemptions having an impact on the development of this RMT content and referring to:
— Article 14.1: Measures taken as an immediate reaction to a safety problem;
— Article 14.4: Exemptions from substantive requirements laid down in the Basic Regulation and its implementing rules in the event of unforeseen urgent operational circumstances or operational needs of a limited duration;
— Article 14.6: Derogation from the rule(s) implementing the Basic Regulation where an equivalent level of protection to that attained by the application of the said rules can be achieved by other means; and
— Article 22.2(b): Individual flight time specifications schemes deviating from the applicable certification specifications which ensure compliance with essential requirements and, as appropriate, the related implementing rules.

ICAO Annex 6 — Operation of Aircraft (Part I — International Commercial Air Transport — Aeroplanes; Tenth Edition, July 2016): the relevant new definitions have been taken into account (e.g. aerodrome operating minima (Annex 6, 4.2.8.1) in case of 2D and 3D instrument approach operations, as well as certain principles such as operational credit(s) (for operations with aeroplanes equipped with automatic landing systems (ALSs), head-up displays (HUDs) or equivalent displays, an EFVS, synthetic vision systems (SVSs) or combined vision systems (CVSs)); the new classification of the instrument approach operations (as Type A and Type B from ICAO Annex 6, 4.2.8.3.) has been also included; finally, the definitions of 'decision altitude (DA) or decision height (DH)' as well as that of 'final approach segment (FAS)' have been transposed.

ICAO Doc 9365 — Manual of All-Weather Operations, Fourth Edition, July 2016: the criteria such as aerodrome operating minima, provision of facilities and services at aerodromes, basic requirements for the aeroplane and flight crew (operating procedures), surface movement guidance and control of aeroplanes and vehicles, minima for approach and landing operations, example of visibility credit for enhanced vision systems have been considered.

Other ICAO documents considered during this rulemaking task:

ICAO Doc 4444 — Procedures For Air Navigation Services — Air Traffic Management, 6th Edition, 2016

ICAO Annex 14 — Aerodromes (Volume I — Aerodrome Design and Operations), 7th Edition, 2016

ICAO Annex 14 — Aerodromes (Volume II— Heliports), 4th Edition, 2013

ICAO Doc 9830 — Advanced Surface Movement Guidance and Control Systems (A-SMGCS) Manual, 1st Edition, 2004

ICAO Doc 8168 — Procedures For Air Navigation Services — Aircraft Operations (Volume I — Flight Procedures), Fifth edition, 2006: the definition of circling approach and a straight-in approach has been also transposed, 5th Edition, 2006

ICAO Doc 8168 — Procedures For Air Navigation Services — Aircraft Operations (Volume II — Construction of Visual and Instrument Flight Procedures), 6th Edition, 2014

ICAO EUR Doc 013 — European Guidance Material On Aerodrome Operations Under Limited Visibility Conditions, 5th Edition,2016

ICAO Expert Group — Flight Operations Panel (FLTOPSP) / All Weather Operations Sub Group (AWO-SG) (Flight Operations Panel/ Third Meeting, Montreal, 24 to 28 October 2016, Agenda Item 4.6): the conclusions provided in this document have been considered in developing this NPA. The paper provides the concept of operations for performance-based aerodrome operating minima (PBAOM). The higher performance capabilities of new and improved avionics could mitigate some of the performance requirements of the ground-based navigation equipment. The underlying principle is that the minima will be predicated upon the combined capabilities of the ground and airborne facilities. This ICAO paper addresses also operational credits, which are already described in ICAO Annex 6, paragraph 4.2.8.1.1. As stipulated in the paper, operational credits can refer to lowering of the aerodrome operating minima (RVR and/or DH) for the purposes of an approach ban, reducing the visibility requirements, or requiring less demanding ground facilities as the overall performance can be achieved by enhanced airborne capabilities (one application of operational credits may be represented by the use of an EFVS). It is important to understand that when using the concept of PBAOM, a distinction should be made between a 'basic aircraft' (an aircraft with the minimum equipment required for the type and/or category of approach and landing operation intended) and an 'advanced aircraft' (an aircraft with equipment in addition to that required for the 'basic aircraft', as e.g. auto-flight systems capable of coupled approaches and/or autoland, HUD or equivalent displays, EFVS, CVS, and SVS).

ICAO Annex 10 — Aeronautical Telecommunications (Volume I — Radio Navigation Aids): SARPs for the global navigation satellite system (GNSS).

ICAO Paper GNSSP-WP-8, Validation of GBAS CAT I Accuracy: A GLS Model and Autoland Simulations for Boeing Airplanes, presented at the ICAO Global Navigation Satellite Systems Panel, Working Group B Meeting, Seattle, WA, May 29 - June 9, 2000.

SESAR project — AAL EFVS operation with operational credit: impact on ATM-Aerodrome

**Differences between the content of this RMT and ICAO SARPs, FARs, etc.**

The proposed rules are considerably aligned with the ICAO framework (SARPs and guidance material); however, differences may exist in the technical details.

With regard to the instrument approach operations as referred in ICAO Annex 6 (Operation of Aircraft Part I — International Commercial Air Transport — Aeroplanes; Tenth Edition, July 2016), this RMT introduces in the context of the Type B instrument approach operation a common CAT III approach operation without further subdividing into the subcategories CAT IIIA, CAT IIIB, and CAT IIIC, as is the case of the currently published ICAO approach classification; ICAO and the FAA, however, have initiated a proposal to eliminate these CAT III-related subcategories from the definition.

This NPA proposes a definition for 'low-visibility operations (LVOs)', which is featured in the regulations applicable for each domain (air operations, aircrew, aerodromes, etc.), in order to ensure a common understanding across the entire regulatory system. This term is currently not defined in ICAO standards; however, there is a comparable definition in the ICAO AWO Manual.

Detailed specifications for approving the special authorisation category 1 (SA CAT I) operations (ref. EU regulatory material in this RMT) have been developed considering the actual needs of the aviation industry; however, there is no relevant reference in the ICAO SARPs. This topic has been brought forward at IACO level in order to implement changes at their level which should minimise to a great extent any misalignment in this field.

## 2.2. What we want to achieve — objectives

The following objectives have been identified:

Taking a performance- and risk-based approach, the objectives of the proposed EU regulatory framework in the area of AWOs are to:

— provide for safety, efficiency and consistency across all aviation domains, based on common operational concepts and a common method for systemic hazard assessments;

— foster safety and efficiency gains that new technologies and operational experience offer (established industry standards are taken into account as much as feasible); and

— promote harmonisation with the ICAO SARPs and documents, and with rule developments in the FAA and other major regulators, as far as possible.

The AWO Project aims to achieve a harmonised approach in all affected aviation domains. To this end, it addresses airworthiness, air operations, aircrew, and aerodrome design and operations aspects under RMT.0379, whereas air traffic management (ATM)/air navigation services (ANS) are addressed under the currently ongoing RMT.0464[9].

**Overview of the applicable framework**

— The conduct of all-weather operations (AWOs) involves many different components which interact with one another:

- hardware (such as aircraft and the equipment installed on the aircraft — airborne equipment or at aerodromes — ground equipment);
- software (such as computer codes or operating procedures used by personnel), and some of these components are represent; and
- liveware (i.e. the people who operate the system, e.g. air traffic controllers (ATCOs), pilots, maintenance personnel).

For AWOs to be conducted safely, each component of the system must perform as intended and must interact correctly with the other components of the overall system.

— In order to apply a common basis for the development of consistent rules across the different relevant domains, the AWO project has adopted a classification of standard operations, classified in terms of lowest aerodrome operating minima. Having set this basis, the concept of operations with operational credits has been introduced with the purpose of enabling the best use of the available technological solution (either airborne or ground-based) and/or advanced operational procedures by providing operational flexibility beyond the limits of standard operations.

— The main reason behind the description of operations with operational credits is the need to specify the required performance for such operations. Consequently, the requirements should be as much as possible technology-independent and performance-based, providing thus the relevant principles and criteria at IR level and the supporting technical details at AMC & GM or CS level.

— To satisfy the AWOs' safety objectives and criteria, the different system components must comply with the relevant requirements which are identified with the support of the common hazard identification and risk assessment methodology.

**Principles**

The principles applied by EASA for the development of the proposed draft changes to the AWO rules should ensure that the requirements will enable the use of newly developed technology and/or

[9] Please refer to Opinion No 03/2018(available at https://www.easa.europa.eu/document-library/opinions/opinion-032018).

evolved procedures in the framework of ICAO terminology of classifying the approach operations as 'Type A' or 'Type B':

— Operations with the operational credits: the main aim of the AWO project is to introduce the appropriate regulatory framework for the concept of operations with operational credits. The introduction of this concept should enable the best use of new technologies and provide further operational flexibility beyond the limits of standard operations. For approach operations, an operational credit could be applied to the instrument and/or visual segment; the scope of operational credits should not be limited to airborne equipment as operational credits may also be granted on the basis of enhanced ground-based equipment (e.g. airborne radar approach operations are current examples of such operational credits).

— Technology-independent required performances for certain types of operations with operational credits: considering a performance- and risk-based development concept, all requirements should be technology-independent as much as feasible; however, the appropriate performance criteria shall be required.

— Demonstration of the required performances: The required performances shall be successfully demonstrated. This demonstration includes active contribution of both, the airborne equipment as well as ground equipment taking into account the relevant weather conditions. The aircraft certification process shall play a very important role.

## 2.3. How we want to achieve it — overview of the proposals

### Overview

The proposed changes to the relevant IRs and related CSs, AMC and GM enable the use of new technologies and provide operational flexibility beyond the limits of the established standard operations; the new regulatory material should be, as much as possible, technology-independent, performance-based and safety-objective-oriented. In terms of rules' resilience, the proposed rules should not need to be further amended over the next years when new technologies, new products or new operational concepts will be available.

The concept of operations with operational credits on the basis of either new technologies or newly developed operational principles should be broadly made possible by the proposed IRs. The related AMC, GM and CSs should provide the means for implementation and any future developments, both in terms of new technologies and operational procedures, should be appropriately addressed without changing the requirements stipulated in the IRs.

The proposed changes have a cross-domain nature, and are based on common operational concepts and cross-domain systemic hazard identification and risk assessments.

### Total system approach

It is essential that all regulations that impact the introduction of the new types of operations are appropriately considered. For example, the OPS proposed amendments to the existing rules (e.g. SPA.LVO.110) should be interfaced with the relevant CS-AWO (airworthiness) and CS-ADR-DSN (aerodromes) requirements.

Note: In the context of how RMT.0379 AWO interlinks with CS AWO and CS ADR DSN are addressed. CS-AWO has been rewritten taking a performance-based approach and thus the technical content is stipulated in the AMC (Book2); a similar approach has been taken in CS-ADR-DSN.

Considering traditional way of addressing the AWO approvals and operations, interfaces should be mostly addressed from an operational perspective.

For example, the aircraft OEM will be required to carry out an assessment on the interface between the aircraft navigation system and the worst case ILS performance (defined in ICAO Annex 10) in terms of localiser deviation and glide path deviation and the outcome of this assessment should be presented in the AFM. Based on the ILS performance offered by the aerodrome, the operator will verify that the classification and performance of the intended runway is compatible with the AFM prior to conducting SA CAT I operations.

An overview of already identified main topics of changes and/or expected impact (necessary adaptations to the current rules, rules under development (through NPAs) or foreseen rules as part of future development) may be summarised as follows:

— Consideration of the potential new equipment installed on board the aircraft: airworthiness (CS-AWO) and flight crew licensing (Part-FCL);

— Potential use of the relevant new procedures: air operations (general parts like Definitions, Part-ARO and Part-ORO; technical parts like Part-CAT, Part-SPA, Part-NCC, Part-NCO and Part-SPO) and flight crew licensing (Part-FCL);

— Consideration of the possible impact of the ground equipment with other aerodrome infrastructure (e.g. change in radio altimeter operating area requirements) and aerodrome operational procedures: aerodrome design criteria (CS-ADR-DSN) and aerodrome operating requirements (Part-ADR.OPS);

— The potential need of the additional meteorological (MET) data might be needed: meteorological services requirements (Part-MET);

— New approach procedures types affect air space design requirements (Part-ASD) as well as requirements for air traffic services (Part-ATS) and single European rules for the air (SERA), as well as ATCO training; and

— Possible impact stemming for the potential need of new/additional aeronautical data (data to support SVS guidance): Part-AIS and Part-DAT as well as possible impact of the redesigned air traffic flow management (ATFM).

**Impact on aerodromes**

The impact on aerodromes depends on the type of operations considered:

— To support SA CAT I operations, the following 'technical issues' were considered: improvements of visual aids as approach lights, upgrading of non-visual aids, that is navigation aids (as, for instance, ILS CAT I) ensuring signal integrity down to a DH of 150 ft), establishment of sensitive areas, secondary power supply and switch-over time, radio altimeter (RA) pre-threshold area, OFZ, LVPs, AIP updates, etc. For an aerodrome, it should be a business case which leads towards the decision to either establish such a standard which will enable the SA CAT I operation or not.

*Note: Based on the ILS facility performance made available to air operators by the aerodrome operator and taking into account the AFM data capturing the assessment result carried out by the aircraft OEM (the interface between the aircraft navigation system and the worst case ILS performance defined in ICAO Annex 10 in terms of localiser deviation and glide path deviation), the operator will verify that the classification and performance of the intended runway was compatible with the AFM prior to conducting SA CAT I operations.*

— To support EFVS to touchdown operations, the following 'technical issues' were considered: visual aid as approach lights, runway lights, runway centre line lights, taxiway lights; non-visual aid as navigation aids, secondary power supply with 1 sec switch-over time, serviceability levels as of CAT I, automated measurement of the touchdown RVR, radio altimeter pre-threshold area, OFZ, LVPs, AIP updates, etc.

When the proposed amendments to ADR rules have been considered, the related issues with ATS have been also taken into consideration.

*Note: It has been considered whether it is necessary to position certain relevant rules on low visibility in ANS and ADR regulations in the same parts (e.g. either in the part of organisation requirements (OR), or in the part of technical requirements (TR)) or not (e.g. LVPs in ADR rules are foreseen in the part of ADR.OPS and in ATS rules in the part of TR providing a link to the OR through an AMC).*

**Potential impact on ATM/ANS**

The AWO-related topics potentially interfacing with the content of ATM/ANS regulatory material (main reference represented by Regulation (EU) 2017/373[10]) have been considered either in the context of the ongoing ATM/ANS regulatory activities (e.g. Opinion No 03/2018 'Requirements for air traffic services' (RMT.0464) and for ASD in the context of Opinion No 02/2018 'Technical requirements and operating procedures for airspace design, including flight procedure design' (RMT.0445)) or will be addressed — if necessary — in the context of other ATM/ANS ongoing and upcoming RMTs.

The following candidate topics were identified:

— Part-ATS — Subpart ATS.OR

Coordination between aerodrome operators and ATS providers is expected to be properly addressed in ATS.OR.110; AMC4 specifically stipulates the necessity to establish arrangements between the ATS provider and the ADR operator to define responsibilities for the LVOs; this complements the requirements provided in ATS.TR.265, concerning the control of aerodrome surface traffic in conditions of low visibility. Requirements of this Subpart stipulate further the obligation of providing relevant information on conditions and operations status. For instance, ATS.OR.520 'Information on aerodrome conditions and the operational status of associated facilities' introduces the obligation for the information concerning temporary hazards on the

[10] Commission Implementing Regulation (EU) 2017/373 of 1 March 2017 laying down common requirements for providers of air traffic management/air navigation services and other air traffic management network functions and their oversight, repealing Regulation (EC) No 482/2008, Implementing Regulations (EU) No 1034/2011, (EU) No 1035/2011 and (EU) 2016/1377 and amending Regulation (EU) No 677/2011 (http://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1516614735343&uri=CELEX:32017R0373)

movement area and facilities. Furthermore, ATS.OR.525 'Information on the operational status of navigation services' requires that ATS providers are timely informed of the operational status of radio navigation services and visual navaids. Similarly, points ATS.OR.510 and ATS.OR.515 prescribe the availability of relevant meteorological information for APP, TWR and AFIS units.

— Part-ATS — Subpart ATS.TR

AMC1 ATS.TR.150 'Aeronautical ground lights' stipulates the operational needs for ground lights and the associated GM1 to AMC1 describes the technical details of aeronautical ground lighting (approach lighting, runway lighting, obstacle lighting, taxiway lighting, stop bars). AMC1 ATS.TR.205(c) 'Provision of ATC service' prescribes the obligation of aerodrome controllers to 'control on all flight operations on and in the vicinity of an aerodrome, as well as on vehicles and personnel on the manoeuvring area, should be continuously maintained'; it additionally foresees the use of ATS surveillance system for aerodrome control to augment visual observation of traffic in low-visibility conditions. ATS.TR.240 'Control of persons and vehicles at controlled aerodromes 'in point (b) establishes the requirements to be applied when LVPs are in operation, including the need for the application of a prescribed separation minimum between vehicles and aircraft taxiing on the manoeuvring area. ATS.TR.245 'Use of surface movement surveillance equipment at aerodromes' prescribes the use of an A-SMGCS or other suitable surveillance equipment by the aerodrome ATS in to ensure or to supplement visual observation of the traffic in the manoeuvring area, and the associated GM1 indicates the use of surface movement radar information in surface movement control. ATS.TR.265 'Control of aerodrome surface traffic in conditions of low visibility' specifies the principles to be applied to ensure safe holding of aircraft/vehicles at intersection of taxiways and prescribes the determination and the approval of longitudinal separation on taxiways and mandates the establishment of specific procedures for CAT II/III operations and for departures with an RVR of less than 550 m; AMC1 ATS.TR.265(b) on the 'Procedures for control of aerodrome traffic in LVOs' complements the specification by establishing the details to be addressed by the procedures for aerodrome control in CAT II/III conditions (e.g. RVR values, minimum ILS/MLS equipment, other facilities, minimum spacing between arriving/departing aircraft, between aircraft and vehicles/person on the manoeuvring area, etc.).

— Part-MET

Relevant ATS requirements dealing with weather conditions should be generally applicable; however, requirements related to the weather conditions should appropriately considered from the AWO point of view to prevent potential inconsistencies or ambiguous interpretation of the MET-related notions and terms in different regulations (e.g. Part MET of Regulation (EU) 2017/373 and the AWO NPA).

— Part-ASD

A possible impact on the flight procedure criteria and obstacle protections of the SA CAT I operations with a 150 ft DH, as well as charting and naming of such approaches together with the associated phraseology for SA CAT I and EFVS should be considered.

— Part-PERS

The AWO matters related to the SA CAT I and the EFVS should not cause differences on current ground personnel rules, so Part PERS should not be impacted.

— Part-ATFM

Considering the specificities of the European ATM network, in the conditions when LVOs are carried out at an aerodrome and the maximum capacity of this aerodrome is reached, as a consequence special operational procedures might be needed to regulate the traffic at this aerodrome. Such procedures should be included in the network operations handbook; in the further there might be a need for a consideration of update of the existing ATFM operating procedures to be updated in order to capture specific AWO impact.

— Part-AIS

AIS/AIM and DAT rules address the quality of data; Opinion No 02/2018 proposes to update Part-AIS of Regulation (EU) 2017/373; it introduces, in particular, rules and AMC which are applicable to SVSs through GM1 to AIS.TR.350, AIS.TR.355, AIS.TR.360 'Terrain and obstacle data'.

*Note: ICAO data quality requirements (DQRs), covered in ICAO Annex 15, Appendix 7 and partly in Appendix 8, and in the near future in the Annex 15 Data Catalogue, were used as a baseline for the EASA rules; DQRs in this context are not specified on the basis of specific end-user applications; they are specified under the understanding that they would be fit to support the most stringent use of this data. The fact that these applications may evolve or that new applications may need to be added, could indeed have an impact on the established DQRs. Therefore, the DQRs need to be assessed whether requirements need to be made more stringent or if new requirements need to be added; in the context of the AWO RMT, the data quality aspect pertaining to newly introduced operations with operational credits has not been specifically addressed. Potentially, there might be a need to assess whether the ICAO Annex 15 provisions are sufficient in this case.*

— Part-DAT

In the future, further considerations related to the case when SVS is used for the guidance (data processed to model the outside environment) might be needed; specifically, it might be reviewed whether there should be any recording needs of displayed data in the cockpit (e.g. from the accident investigation point of view) or would it be possible to reconstruct the scenario on the basis of the EFVS and the recorded data taken in accordance with the existing provisions.

CS-ACNS has not been specifically addressed in the scope of the current task; considering that integrated performance-based navigation (PBN) operations coupled with EFVS/CVS/SVS could allow operations with operational credits, it might be feasible in the future to consider introduction of the reference to the performance of the navigation systems as identified during the certification process.

**Third-country operator (TCO)**

Existing TCO rules do not foresee a possibility for TCOs to obtain additional operational approvals to those issued by their competent authority. There is no specific basis enabling, for example, obtaining an SA CAT I approval in accordance with the intended EU AWO regulatory content. Taking into account that certain differences with regard to the exact definitions and specifications of operations with operational credits could exist among States which have implemented such a concept, it might become appropriate to tackle the topic of how to ensure that the potential gaps in criteria and related technical requirements for operations with operational credits in different aviation systems (e.g. Europe, USA, Australia) are properly addressed (e.g. a case when an US operator with the SA CAT I approval issued by the FAA requests the SA CAT I privilege in the environment of EU regulatory system).

## 2.4. What are the expected benefits and drawbacks of the proposals

This RMT introduces the possibility to apply the new principles together with relevant technology without mandating either equipment or procedural elements. Enabling operations with operational credits should enhance the overall efficiency while maintaining a high level of safety.

The complete impact assessment was already published on 18 November 2016 in the context of the focused consultation pertaining to the proposed changes at IR level[11].

An updated impact assessment will be provided as part of the Opinion stemming from the AWO Project.

## 2.5. Proportionate approach to the level of flexibility in the requirements depending on the type of operations

### General overview

The main concept followed in this RMT is the development of performance- and risk-based rules applicable to AWOs; however, the proportionality criterion among the different types of operations is considered as well, especially with regard to the capabilities of identifying and mitigating risks as appropriate to the level of complexity (e.g. Part-NCC versus Part-CAT).

The main development concept should ensure maintaining the rules with relevant safety impact at IR level. However, taking into account the specific characteristics of various sectors of the civil aviation industry, as captured by the different technical Parts of the air operations rules (Part-CAT, Part-NCC, Part-NCO, and Part-SPO), a different balance between the technical details stipulated at either IR or AMC level has been applied in accordance with the principle of proportionality. In Part-CAT the technical details are at AMC level, whereas in other technical Parts these technical details are at IR level. The reason for the difference is the intent to allow more flexibility based on use of the safety management principles in the operational domain regulated by Part-CAT. Such approach allows operators to use the concept of alternative means of compliance (AltMoC) instead of direct use of the AMC for demonstrating compliance with the IRs. AltMoC shall be based on safety assessments and, as already required, the operators shall obtain a prior approval from the competent authority. However, for the other types of operations (as e.g. Part-NCC, and Part-NCO, etc.), the described principle of Part-CAT cannot be applicable and the relevant rules must have an adequate enforceability.

[11] http://www.easa.europa.eu/newsroom-and-events/events/awo-consultation-workshop — Second phase of focused consultation, in continuation to the AWO Consultation Workshop

**Use of technological benefits of the EFVS as light operational credits ('EFVS 200 operation' and potential consideration of 'EFVS 100 operation')**

Through this NPA, the principles of the EFVS have been proposed for introduction into the European regulatory system to enable the full deployment of the newly developed technologies; this provides also alignment with the term used by the FAA regulatory system.

An EFVS refers to aircraft-installed systems which provide an enhanced view of the external environment with specific functionalities required by the relevant airworthiness requirements to enable operations with operational credits. The EFVS represents an electronic means to provide the flight crew with a real-time sensor-derived or enhanced display of the external scene topography (the natural or manmade features of a place or region especially presented in a way that shows 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 HUD or an equivalent display system. It should be certified according to the newly applicable airworthiness requirements (amended CS-AWO) and an operator should obtain the necessary approval (amended OPS IRs) for enabling the EFVS to be used for EFVS operations with operational credits.

Considering the current technical capabilities of the EFVS, an additional concept of 'EFVS operations' as operations where EFVS is used in place of natural visual reference for approach or landing, rather than just to improve situational awareness, has been further developed. This new concept introduces the use of the 'light operational credit' for operations which could be considered as the non-LVOs despite the fact that certain technical benefits of the EFVS are used in conditions of reduced visibility.

Considering that certain operations qualified as 'normal' and 'non-LVO' operations have been conceptually agreed and this should be applicable for operations identified with an RVR of 550 m and a DA/H of 200 ft. These 'normal' operations should allow the advantageous of the EFVS use below the aerodrome published DH to the 'predetermined minimum height' of 200 ft taking into account the RVR minimum defined in accordance with the EFVS approved performance by the certification process (but not lower than 550 m).

The new definition of 'EFVS 200 operation' has been developed describing a particular type of operation with EFVS, whereby, subject to compliance with specific requirements, operators will be permitted to conduct certain EFVS operations without needing a specific approval (SPA). Such operations may be conducted only in CAT I or better meteorological conditions (i.e. non-LVOs) and down to a height of 200 ft above the runway threshold (the approach may only be continued below 200 ft if the pilots have 'natural' visual reference).

EASA has modified the initial draft regulatory AWO text in relevant parts of the OPS IRs (e.g. Part-CAT and Part-NCC — Part-SPA does not specify the 'normal' operational procedures) to accommodate the above-described type of operations in the regulatory text. 'EFVS 200' is intended to be incorporated in Part-SPO and published in scope of the AWO-NPA Phase 2. As such type of operations should not be considered LVOs, no specific approval should be required (by Part-SPA). This very recent modification of the already drafted rules should cater for business jet operators interested for such 'light OPS credit' without the need to access an airport only with demanding CAT II or III (e.g. the use of properly certified HUD) approach procedures.

For the operators aiming for the maximum possible use of the high EFVS technology ('EFVS-Approach (EFVS-A)' and 'EFVS-Landing (EFVS-L)'), a relevant special approval for the LVOs should be issued (in accordance with Part-SPA), allowing operators to access an airport during the low-visibility conditions, when the cloud ceiling is below a DA/H of 200 ft and/or the visibility is less than 550 m, that is down to 100 ft (with EFVS-A) and down to touchdown with a reduced RVR of 300 m/1 000 ft (with EFVS-L). The operating requirements for EFVS have been adapted to allow the 'EFVS-L' operations (alignment with the published FAA regulations).

In order to obtain the flight crew competencies for using an EFVS, the relevant set of requirements has been set-up; less demanding training and checking requirements should be foreseen for the 'EFVS 200 operations' with the characteristic RVR of 550 m and the DH/DA of 200 ft compared to the typical 'EFVS operations' with the LVO nature (operations down to a DH/DA of 100ft and/or with an RVR of less than 550 m or even for the operations using EFVS down to the touchdown).

The developed concept of 'EFVS 200' as proposed in this AWO NPA Phase 1 has been presented to ICAO OPS panel; the concept has been found very feasible.

The concept of 'EFVS 200' might experience further evolution into 'EFVS 100' (if so supported by the received comments). 'EFVS 100' should enable operations of the EFVS down to a DH/DA of 100 ft without a dedicated special approval; however, the system shall be appropriately certified (dual HUD required) and the operator should be the holder of an adequate LVO special approval (e.g. CAT II or CAT III).

**General Aviation (part-NCO) aspects**

<u>General</u>

When addressing the General Aviation (GA)-related content of the AWOs, considerations were mainly focused on Part-NCO of the OPS regulatory material.

During the development of the AWO OPS regulatory material, it has been gradually more and more firmly identified that the same methodology as the one used for drafting Part-CAT and Part-SPA (or even the methodology adapted for the use in Part-NCC) is not suitable for General Aviation.

The scope of analysis needed for the development of the proposed changes to Part-NCO, and the need for a proper deployment and engagement of the relevant experts of the GA community, as well the necessity to set up appropriate specific criteria and have them confirmed, has led to the conclusion that the NCO specificities should be addressed by a dedicated Task Force group, nominated as 'Sub-task force group for AWO matters in Part-NCO' under the umbrella of the existing AWO OPS Task Force group.

<u>Main principles of technical nature</u>: The appropriate competence attested with the Instrument Rating of GA pilots' should represent the backbone for the GA operations in certain AWO conditions; already from general operational point of view but especially considering the operations of GA in IFR conditions and applying AWO principles. The relevant rules should have an encouraging impact on the GA community to fly in the IFR instead of forcing them into the VFR.

<u>Level of safety</u>: The level of safety and the operational environment of GA have had a significant impact on the development of Part-NCO; the assumption of the lower acceptable level of safety in the domain of Part-NCO, compared to the domains of Part-CAT and Part-NCC, should also be recognised.

The type of certain GA operations should be carefully considered from different operational points of view, especially the risk interactions. There needs to be a distinction between the case when Part-NCO operations are carried-out in the 'isolated environment' of the GA aviation/pure Part-NCO operations, (e.g. one light, piston engine aeroplane operating at the local airfield) and the case when a Part-NCO operator 'interfaces' with or even 'penetrates' into the demanding environment of an aerodrome used largely by airlines (operating in the regime of LVOs).

*IFR access to smaller aerodromes:* IFR access to smaller aerodromes should be considered having regard to the advent of new technologies as GNSS, SBAS (in Europe, EGNOS), etc. It is desirable and cost-effective to enable IFR using instrument approach procedures (IAPs) at aerodromes where only VFR was previously possible due to the very limited facilities for weather reporting and characteristics of the non-instrument runways. It is important that the newly developed regulatory proposal does not require unrealistic safety for NCO at these aerodromes, driving them back into a more hazardous VFR operational regime.

*Pilot as a decision-maker:* Pilot decision-making is a fundamental principle of the GA Roadmap. The level of regulatory protection provided should depend upon the ability of those exposed to risk to exercise control over that risk. For NCO, the premise is that the operator is the pilot-in-command and the pilot-in-command in NCO has direct control over the risk to which he or she is exposed.

When taking into account the pilot decision role in the NCO environment, it should be considered that the majority of GA AWO-related accidents could be attributed to reckless disregard of impacting risks, rather than due to bad or weak judgment by prudent operators in marginal cases.

*Potential safety principles of approaches:* There should be a distinction between the operational behaviour in the instrument segment and in the visual segment:

— adherence to DH/MDH is needed for the instrument segment to ensure an adequate level of safety;

— safety of the visual segment is primarily achieved by a pilot assessment at or before DH/MDH; visual reference has been acquired and the conditions are such that it can be maintained.

*Go-around risk:* For NCO, a go-around, if visual reference is not acquired, does not present an unacceptable risk and does not present the problem of competitive erosion of safety. GA should be treated differently from CAT on the assessment and control of risk, as for CAT we could assume that a go-around, if visual reference is not acquired, bears some additional risk, and an objective metric for deciding whether an approach should be attempted is necessary to avoid the erosion of safety.

*LVTO for NCO:* The requirement for an approval under Part-SPA for low-visibility take-off (LVTO), i.e. take-off in a visibility of less than 400 m, might introduce/represent a significant restriction for NCO. There is limited practical experience about the handling of such cases. Only a few applications and prospective applications for such operations by NCO have been launched, obviously representing difficulties and operational costs for NAAs in order to approve such operations. It could be seen that there is no sound data clarity as to the level of safety for such an operation, little experience in NAAs of assessing such applications, etc.

## 2.6. Helicopter operations and the AWO concept

Helicopter AWO-related matters, taking into account all the specificities of the helicopter's design, equipment and operations, will be addressed in the AWO-NPA Phase 2. Detailed references for the AWO development related to the helicopter operations will be provided in ToRs Issue 2.

Traditionally, helicopter operators do not conduct large-scale AWOs. Considering the specificities of the helicopter operations, there have been certain natural limiting factors for deploying the AWO concept. Already flying in instrument meteorological conditions (IMC) might have constraints taking into account the established operational limits for helicopter operations. Typically, European CAT helicopter operators holding an approval for instrument flight rules (IFR) operations operate to CAT I approach minima. Statistically, less than 10 % of these operators hold an approval for LVTO operations with an RVR less than 400 m.

The introduction of:

— required navigation performance (RNP) 0.3,

— point-in-space approaches (PinS), and

— new technologies,

has opened possibilities and triggered more interest of the helicopter community to conduct IFR operations.

Several helicopter models are now equipped with avionics that are equivalent to those fitted in the latest generation of large aeroplanes used in airline activities.

Having regard to all those changes, there is a growing tendency to apply the AWO concept in helicopter operations as well. From the EASA point of view, there is a significant need to carry-out in the context of the AWO project a dedicated analysis regarding helicopter operations.

Considering the whole context of helicopter operations and available airborne and ground equipment, the most feasible would be to initially introduce the appropriate formal basis for the development of the helicopter operations' procedures for Type A operations:

— approach based on PinS,

— approach with vertical guidance (APV), and

— specific radar approaches (e.g. offshore airborne radar approaches (ARA)),

considering the minima determination method for different type of operations (for example, CAT and NCC minima for the onshore operations.

Helicopter issues potentially pertaining to AWOs will not be dealt with only in the context of this RMT.0379, but also in the context of two other RMTs, that is RMT.0573 'Fuel planning and management' (e.g. consideration of the landing alternates on the fuel planning for IFR flights) and RMT.0325 'HEMS performance and public interest sites'.

It might happen that a continuation on AWO issues in the helicopter domain would be needed and should continue beyond the already scheduled envisaged Phase 2 of the current AWO RMT.0379. In such a case, an OPS RMT dealing with regular updates might be used as a formal placeholder in order to process such AWO issues).

CAT I operations to heliports/helidecks are challenging (otherwise, they would have been already widely in use by now) and typically, for the time being, not demonstrated by the OEM in scope of the certification process.

As an orientation reference, there are quite many helideck-equipped fixed installations and a significant number of mobile drilling rigs in the North Sea. Those helidecks are not designed to a common standard, although it is acknowledged that the UK CAA CAP 437 is a generally accepted guidance. ICAO Annex 14 Volume II and the ICAO Heliport Manual are not transposed in a consistent manner throughout Europe, and despite these offshore operations being carried out under IFR and IMC, in several countries they take place in the 'unclassified airspace', without the support of any air traffic services (ATS).

A similar rationale applies to heliports located at hospitals, on the number of which EASA has no data available. It is estimated that there are around 2 500 hospital heliports in Europe, of which only a very limited number are supporting IFR operations.

Despite all the significant factors to be considered, there is a potential and a need for the appropriate formal framework for helicopter operations with operational credits in Europe as well. However, the approach would require a very cautious consideration of all the specificities of helicopter operations (e.g. helicopter operating minima in SERA and air operations requirements, new performance-based approach classification; helicopter performance classes, certification in category A, IFR certification, offshore airborne radar approaches (ARA), IFR departure and approach procedure design, performance based navigation, etc.).

## 2.7. Proposed changes to AMC/GM to Regulation (EU) 2017/373

An explanation of already identified and potential interfaces between the AWO topics and ATM/ANS issues is provided in Section 5.6. Overview of the AWO-affected issues/topics in view of the inter-domain dependency.

Note: Apart from a reference to SERA.3210, there are no requirements for ATS providers in respect of LVOs; nevertheless, EASA transposed in the context of RMT.0464 'Requirements for air traffic services' parts of ICAO Annex 11 and of ICAO Doc 4444 related to the provision of ATS; the proposed IRs contain requirements for LVPs, and are included in Opinion No 03/2018.

# 3. Impact assessment (IA)

## 3.1. Reference

The full regulatory impact assessment (RIA) was already published on 18 November 2016 in the context of the focused consultation pertaining to the proposed changes at IR level. The document is accessible through the EASA website in 'events' page Newsroom & Events / Past events under the title "09 Nov – 11 Nov 2016 - AWO Consultation Workshop", that is:

http://www.easa.europa.eu/newsroom-and-events/events/awo-consultation-workshop

and within the scope of the documents under subtitle "Second phase of focused consultation, in continuation to the AWO Consultation Workshop / Event Proceedings / Documents for the second phase of focused consultation".

## 3.2. Overview

Considering the specific characteristics of this RMT, which is setting up a regulatory framework to enable the use of new technologies through the principle of operational credits, the related RIA further identifies and assesses the main rationale behind this approach. It assesses the impact on the following areas: safety, economy, environment, social aspects, general aviation (GA) and proportionality, and better regulation and harmonisation with other States.

Considering that the set-up objective of this RMT is to enable the use of new technologies through the principle of operational credits, this 'option' is the one in line with the main task objective; the other two 'options', that is the one taking no regulatory action and the one mandating the use of new technology, have been analysed and included in the RIA.

Enabling operations with operational credits would enhance the overall network efficiency because weather-related diversions to CAT II/III aerodromes could be reduced. Lower operating minima will also benefit air navigation service providers (ANSPs) by offering more flexibility in selecting the efficient arrival patterns with regard to arrival rates in reduced visibility conditions. Furthermore, it is assumed that air operators could benefit from the reduction of costs incurred by weather-related delays, diversions and cancellations.

The RIA also contains aerodrome-related statistics for the European airspace. The vast majority of airports used by airlines support CAT I operations as their lowest approach category. This implies that there is a good potential for operations with operational credits in Europe. It is assumed that quite many of these CAT I aerodromes could support operations with lower operating minima without significant infrastructure investments.

This document also includes case studies for air operators in order to further assess benefits and costs of operations with operational credits.

## 3.3. What is the issue

The following deficiencies have been identified:

— The current rules do not sufficiently address technological advancements and do not fully support new operational concepts;

— In some areas, EU rules are not anymore aligned with the ICAO SARPs; furthermore, the new ICAO approach classification needs to be transposed into all domains; and

— Existing rules (conventional LVOs as well as other AWOs) have been drafted in a domain-centric manner.

**No exemptions**[12] **in accordance with Article 14 'Flexibility provisions'** of Regulation (EC) No 216/2008 are pertinent to the scope of this RMT.

There are no **alternative means of compliance (AltMoC)** relevant to the content of this RMT.

### 3.3.1. Safety risk assessment

The core objective of this RMT is not to address safety issues but to improve efficiency and to ensure level playing field considering the principle of proportionality. Nevertheless, the analysis includes an assessment of occurrences data.

No specific SRs addressed to EASA through aircraft accident investigation report(s) published by the designated safety investigation authority[13] are considered in the context of this RMT.

### 3.3.2. Who is affected

Potentially affected stakeholders by the issue are: aircraft manufacturers, maintenance organisations (MOs), air operators in the CAT, NCC, NCO and SPO domains, aerodromes (also 'secondary aerodromes' providing services to e.g. business aviation, etc.), ANSPs, and Member States.

The current situation and regulatory conditions do not raise public concern or stir controversy among the general public.

### 3.3.3. How could the issue/problem evolve

The relevant technology for LVOs, as well as the related operational practices will be in continuous development. If no action is taken, there would be no civil aviation rules enabling the use of new technology by obtaining operational credits. The existing AWO-related rules will remain inconsistent across the various domains and partly incomplete; EU aviation safety rules will remain non-harmonised with the ICAO SARPs and with the most relevant rules of certain States, especially bilateral partners.

## 3.4. What we want to achieve — objectives

The operational objectives of this proposal are as follows:

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[12] Exemptions having an impact on the development of this RMT content and referring to:
- — Article 14.1: Measures taken as an immediate reaction to a safety problem
- — Article 14.4: Exemptions from substantive requirements laid down in the Basic Regulation and its implementing rules in the event of unforeseen urgent operational circumstances or operational needs of a limited duration;
- — Article 14.6: Derogation from the rule(s) implementing the Basic Regulation where an equivalent level of protection to that attained by the application of the said rules can be achieved by other means;
- — Article 22.2(b): Individual flight time specifications schemes deviating from the applicable certification specifications which ensure compliance with essential requirements and, as appropriate, the related implementing rules.

[13] Regulation (EU) No 996/2010 of the European Parliament and of the Council of 20 October 2010 on the investigation and prevention of accidents and incidents in civil aviation and repealing Directive 94/56/EC (OJ L 295, 12.11.2010, p. 35) (http://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1494843364894&uri=CELEX:32010R0996).

— The EU regulatory framework in the area of AWOs should provide for safety, efficiency and consistency across all aviation domains, relying on a performance- and risk-based approach; it should also be based on common operational concepts and a common method for systemic hazard assessments;

— Manufacturers, air operators and aerodrome operators should be able to benefit from the safety and economic advantages that new technologies and operational experience offer. Considering this, established industry standards should be taken into account; and

— The AWO Project should be used to promote harmonisation with the ICAO SARPs and documents, and with rule developments in the FAA and other major regulators, as far as possible.

## 3.5. How it could be achieved — options

To follow the established standard approach/principle of the RIA, the following possible approaches (named 'options' for the purpose of the RIA) have been analysed:

**Table 1: Possible options**

| Option No | Short title | Description |
|---|---|---|
| 0 | No action | Take no regulatory action<br>No safety rules available for the use of new vision and guidance systems.<br>New vision and guidance systems cannot be used for obtaining operational credits.<br>AWO rules remain inconsistent and partly incomplete across domains.<br>Rules remain not harmonised with ICAO standards and with rules of those States having a more developed regulatory framework. |
| 1 | Enabling | Enable the use of technologies in the domain of AWOs such as flight path control automation, new vision and flight guidance systems, etc. for operations with operational credits and ensure consistency of the AWO rules across all domains.<br>Develop a consistent regulatory framework across all domains for the use of new vision and flight guidance systems on a voluntary basis.<br>Develop a regulatory framework for operational credits.<br>Ensure consistency of the AWO rules across all domains through a common reference document which describes certain types of operations in a cross-domain manner.<br>Ensure consistency with ICAO standards and with the rules of other States as far as possible. |

| | | |
|---|---|---|
| 2 | Mandating | Mandate the use of new vision and flight guidance systems in certain areas, and ensure consistency of the AWO rules across all domains.<br>Develop a consistent regulatory framework across all domains for the mandatory use of new vision and flight guidance systems.<br>Develop a regulatory framework for operational credits.<br>Ensure consistency of the AWO rules across all domains through a common reference document which describes certain types of operations in a cross-domain manner.<br>Ensure consistency with ICAO standards and with the rules of other States as far as possible. |

Considering that the set-up objective of this RMT is the enablement of the use of new technologies through the principle of operational credits, Option 1 is the one in line with this objective as it provides for the optimal combination of safety and efficiency benefits and offers the required flexibility for future technological advancements.

The proposal has a positive an impact on Member States' obligations towards ICAO as it increases harmonisation. It also harmonises the EU requirements with third-country requirements (FAA).

## 3.6. Methodology and data

Data was collected via several sources including surveys addressed to affected stakeholders. The analysis also benefits from the case studies developed and included in the RIA.

## 3.7. What are the impacts

Only impacts of the concept of enabling the new technologies and operational practices without mandating new issues (formally referred to as Option 1) are summarised in this NPA; for more details, please refer to the original published version of the RIA, including an analysis of the other options. Option 1 would also allow to a much higher extent the application of globally harmonised rules. Furthermore, this option allows to draft rules in a more performance-based manner and to improve the provisions which could be misinterpreted.

### 3.7.1. Safety impact

This option would provide manufacturers, air operators, ATOs, aerodrome operators and ANSPs with incentives to further invest in equipment to enable air operations with enhanced vision and flight guidance systems using EFVSs, SVSs, CVSs, HUDs or equivalent systems, autoland systems or hybrids of the systems already mentioned.

These investments are considered to enhance safety. These systems will provide improved situational awareness to the flight crew and will be also (or primarily) used during normal operations, where operational credits are not needed. This is expected to reduce the number of accidents and incidents caused by the loss of situational awareness.

Furthermore, operational rules would be aligned with the ICAO standards as much as feasible and would provide for a consistent reference for global operations.

This option would not raise any safety concern.

### 3.7.2. Environmental impact

This option creates significant environmental benefits by enabling operations in shorter routes, and by reducing the number of delays and diversions, the consequential additional fuel burn, as well as noise and gas emissions.

### 3.7.3. Social impact

Pilots would be trained to use new technologies and could improve their qualifications and knowledge.

High-level jobs could be created through research and development activities for new technologies undertaken by manufacturers.

Should the new systems lead to an increase in efficiency for air operators and, as a consequence, an increase in business and flights, additional jobs could be created by the need for additional pilots and flight crew.

Accessibility to small aerodromes during marginal meteorological conditions could be improved and, therefore, this could provide a positive stimulus for the development of the respective regions.

Furthermore, accessibility to heliports could be improved without major infrastructure investments (e.g. hospital heliports where a very limited number is equipped to accommodate IFR operations).

### 3.7.4. Economic impact

**Manufacturers**

This option provides manufacturers with the opportunity to better market newly developed vision and flight guidance systems.

Furthermore, this option may provide manufacturers with the positive incentive to continue or even increase research and development investments in new technologies resulting thus to technology which will increase safety and efficiency.

In addition, updated and harmonised CSs will reduce the costs for the certification of new products as well as for the development of new ones.

This option does not directly create costs because manufacturers will not be obliged to develop new vision and flight guidance systems or apply new certification standards for ongoing or completed certification projects.

Moreover, several manufacturers have already developed new vision and flight guidance systems[14].

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14 A manufacturer provided data on the extent to which EFVS/SVS/CVS/HUDs and autoland technologies are installed in its aircraft. According to said data, HUDs are implemented in some aircraft types (and planning to install it in new types over the next years) while autoland is installed in all its aircraft delivered from 2015 onwards. As regards the cost, interesting figures have been provided; further reference is made in the case studies.

**Air operators**

Enabling operations with operational credits (such as SA CAT I, or operations using EFVS/CVS) would provide a greater availability of suitable destination and alternate aerodromes during periods of reduced visibility.

This would effectively reduce the number of weather-related delays, cancellations or diversions of flights to CAT II/III aerodromes. It would also permit shorter routings and reduced fuel costs, a faster return to scheduled operations, and fewer passenger inconveniences.

In the case study on weather-related diversion costs, a magnitude of costs is provided. In the scenario analysed, a total cost of EUR 5 615 309 for the period from January 2015 till May 2016 for air operators has been estimated. This shows the potential benefits for air operators that could avoid diversions by using new vision and flight guidance systems.

Since the investment in new vision systems is not mandated, this option would not directly create costs.

However, if an operator wishes to perform operations with operational credits based on enhanced vision and flight guidance systems, additional costs would apply. These costs may vary for operators already approved or not for CAT II/III operations.

For an air operator conducting CAT II operations, the incremental costs for commencing SA CAT I operations will be minimal provided that the same technology (e.g. autoland or HUD) is used for both types of operation. The only cost incurred in this scenario will be the management time taken to establish operating procedures, select suitable aerodromes, amend manuals, design training, and prepare an application for approval to the competent authority.

For operators not approved for CAT II/III operations, additional costs incurred would be comparable to those for a specific approval for CAT II operations. The operator would have, among others, to obtain a specific approval; cover potential additional investment and maintenance costs for vision and flight guidance systems; cover additional initial and recurrent training for pilots and other relevant personnel; and cover costs for potentially drafting new operating procedures and amending the minimum equipment list (MEL).

As regards the additional costs for operations with operational credits based on EFVS, an estimate is provided in the case study on ‘Air operators’. The costs shown are quite low: initial costs EUR 21 624, and annual recurring costs EUR 1 002.

In addition, for operations involving ‘instrument approach procedures (IAPs)’ not based on standard PANS-OPS CAT I criteria or aerodromes not meeting the specifications to support CAT I operations, operational assessment would be necessary.

Costs incurred by rule changes for improving the overall consistency across domains and with ICAO standards are negligible. These changes may require minor amendments to the OM.

**Pilots, ATOs**

Pilots would be trained and qualified to use new technologies. Such pilots may benefit from a competitive and consequently economic advantage compared to pilots not trained in new vision and flight guidance systems.

ATOs, in case they deliver training on behalf of the operator (in accordance with ORO.GEN.205), may benefit from potential additional revenues by expanding training to new technologies.

ATOs, in case they deliver training on behalf of the operator (in accordance with ORO.GEN.205), would have to prepare training material and equipment suitable for the training of operations with operational credits.

It is assumed that the training costs for pilots for the use of new technologies will be borne by the air operator.

**ANSPs, aerodrome operators**

Airborne modern vision and flight guidance systems permit lower aerodrome operating minima on CAT I runways.

Aerodromes which currently support only CAT I approach operations to a DA/H of 200 ft and an RVR of 550 m could support approach operations down to a DA/H of 150 ft and an RVR of 400 m (SA CAT I) and/or operations with a DA/H of 200 ft and an RVR of 300 m (EFVS & CVS) without the infrastructure investments and associated maintenance costs necessary for CAT II facilities. Therefore, these aerodrome operators could improve access to their aerodromes without significant additional investments and maintenance costs.

Aerodromes which support CAT II/III approach operations could operate at SA CAT I minima instead of only CAT I minima in case CAT II/III facilities are downgraded.

Furthermore, enabling SA CAT I or operations using EFVS/CVS on aerodromes only supporting CAT I operations, would enhance the overall network efficiency because weather-related diversions to CAT II/III aerodromes could be effectively reduced.

ANSPs could also benefit from lower minima as they would be provided with more flexibility in selecting the most efficient arrival patterns to maximise arrival rates in reduced visibility conditions.

Since aerodrome operators and ANSPs are not obliged to support operations with operational credits based on enhanced vision and flight guidance systems, this option does not directly create costs.

Costs incurred by rule changes for improving the overall consistency across domains and with ICAO standards are minor. These changes may require minor amendments to manuals.

However, additional costs would apply if an aerodrome operator and an ANSP wish to support operations with operational credits based on enhanced vision and flight guidance systems, depending on whether the aerodrome has been already approved to support CAT II/III operations or not.

For aerodromes which are already approved for CAT II/III operations, no significant additional costs would apply. For SA CAT I operations, it would be necessary to verify that the CAT II procedure can be applied and then to publish an SA CAT I procedure in the AIP. For operations using EFVS, the aerodrome should provide additional information in the AIP concerning the status of LED lights.

For aerodromes which are not approved for CAT II/III operations, additional costs would apply; however, significantly less than for supporting CAT II operations. There should be no significant investment costs required for the facilities. The aerodrome operator together with the ANSP may have to ask for an amendment of their certificate to allow for operations in low-visibility conditions. This may involve the development of new or amendment of existing LVPs to support operations with operational credits. There may also be the need for additional training for the aerodrome operator and ANSP staff and for amendments to their manuals. Furthermore, the support of operations with operational credits should be mentioned in the AIP.

SA CAT I operations will depend on the capabilities of the on-board equipment to provide equivalent information to the flight crew, such as runway centre line (RWY CL) lights and simple TDZ lights. If the on-board equipment cannot provide equivalent information, adequate upgrading of the ground equipment would be needed.

#### 3.7.5. General Aviation and proportionality issues

For GA, and in particular for NCC operations, the use of new vision and flight guidance systems could provide safety and economic benefits as described above in the sections addressing safety and economic impacts.

Investment in the use of new vision and flight guidance systems may not be economically feasible, in particular for NCO operations.

### 3.8. Conclusion

**Comparison of options**

The preferred option, supported by the in-depth analysis of impacts presented in the full RIA, is to develop the relevant regulatory material as enabler of use of the relevant new technologies and principles without mandating any new element.

**Sensitivity analysis**

The subject RMT does not represent a sensitive case as it introduces the formal framework for enabling the use of new technologies and principles without mandating any new element.

### 3.9. Monitoring and evaluation

Monitoring is a continuous and systematic process of data collection and analysis with regard to the implementation/application of a rule/activity. It generates factual information for future possible evaluations and impact assessments (IAs) and helps to identify actual implementation issues. Based on the preferred option of this NPA, EASA proposes to monitor the uptake of the new technologies enabled thanks to this new regulatory framework and the benefits for operators and aerodromes (for example, number of aircraft with ‘autoland’ technology installed). This could be done by national aviation authorities (NAAs) and/or EASA via various tools, including questionnaires.

Furthermore, this proposal might be subject to interim/ongoing/ex post evaluation that will assess the performance of the adopted rules, taking into account ex ante analysis made in this IA. The decision whether an evaluation is necessary will also depend on the monitoring results.

# 4. Hazard identification and risk assessment (HIRA)

## 4.1. Introduction

In order to ensure proper consideration of the interactions among the different components involved in the AWOs (aircraft, aerodromes, operational procedures, involved personnel, etc.), the Systems-Theoretic Process Analysis (STPA) methodology was applied. The total system for AWOs, including the interactions among the different components, is described in terms of systems theory as a network of controllers and controlled processes; some of these controllers influence the nature of the system development structure which establishes the context within which AWOs are conducted, while other controllers constitute the system operations' structure that directly controls AWOs in real time.

## 4.2. AWO system description

The adopted STPA methodology represents a hazard analysis technique based on systems thinking and a model of accident causation based on systems theory rather than reliability theory[15]; the systems theory was developed to deal with the complexity of modern systems where safety-critical elements are too complex for complete analysis and too organised for statistics; the systems theory deals with properties (called emergent properties) that can only be handled adequately holistically, taking into account all the technical and social aspects; these properties arise in the relationships and interactions among system components or behavioural events; the systems theory treats systems as a whole and not the components and events separately. To facilitate the use of this model, a description of the 'total AWO system' has been developed in terms of systems theory.

The system may be described in terms of a system development structure and a system operations' structure. The system development structure determines the nature of the different elements of the system, such as approved organisations, personnel, regulations, operating manuals, work instructions and operational practices. The system operations' structure determines how the system operates in 'real time', i.e. while an aircraft is conducting AWOs.

The AWO system may be considered as comprising multiple, interlinked 'control loops'. Within each loop, a controller executes control actions on, and receives feedback from, a controlled process. Within the system, there is a 'cascade of controllers' where the controlled process from one control loop triggers other controllers within the system. This cascade of controllers may be considered to include some controllers that are involved in the development of the system and some that are involved in the operation of the system in real time. Both system development and system operation are relevant to the AWO Project.

[15] For a full description of the systems theory and the STPA methodology, please refer to 'Engineering a Safer World — Systems Thinking Applied to Safety' by Nancy G. Leveson, published by the MIT Press in 2011, and to 'An STPA Primer' (Version 1) by Nancy Leveson, published in 2013.

**System development structure**

The following controllers have been identified within the AWO system development structure:

— regulatory authorities (for example, EASA and the European Commission) that develop regulatory material;

— competent authorities (for example, the national aviation authorities of the Member States) that certify and approve organisations;

— approved (and certified) organisations; these include design organisations, MOs, air operators, training organisations, ANSPs, aerodrome operators;

— operational management within approved organisations; and

— operational staff.

All these controllers take actions (such as developing regulations, operating manuals or work instructions), which influence the nature of the control structure. These controllers receive feedback based on operational experience, audits, inspections, etc. and thus the system is constantly changing. They do not have a role in the system operations' structure as they do not have control over aircraft conducting AWOs in real time.

**System operations' structure**

The system operations' structure involves 'operations control' within an approved organisation as one controller providing control actions to the flight crew, who in turn provide control actions to the aircraft either directly through the flight controls or indirectly through the auto-flight control systems. Other controllers in the system operations' structure include ATCOs, aerodrome operators and ANSPs. Feedback processes within the system operations' structure are the aircraft instruments and navigation displays, reports sent by the aircraft or pilots to the operations control, or ATC and air traffic surveillance systems.

At each level of this system there are, in reality, many different controllers and multiple, interlinked control loops.

## 4.3. Accidents and hazards

The objective of analysing the 'total system' and developing regulations is to eliminate hazards and reduce the risk of accidents. The following definitions have been established for the AWO Project based on the Systems-Theoretic Accident Model and Processes (STAMP)/STPA methodology[16]:

— **Accident:** Any event resulting to injuries and/or damages to property and/or equipment[17].

— **Hazard:** A system state or set of conditions that, together with a particular set of worst-case environmental conditions, will lead to an accident.

[16] The definitions of 'hazard' and 'accident' used here are specific to the STPA methodology and are not consistent with the ICAO standards or EU regulations relating to safety management.

[17] According to the STPA methodology, the definition of accident can include 'mission loss'. For the purposes of the AWO Project, this has been excluded from the definition of accident. The hazard analysis, therefore, considers only safety-related outcomes rather than operational disruption or commercial loss.

The following hazards have been identified in relation to the AWO system:

— H1: loss of control in flight (LOC-I), upset when airborne;

— H2: loss of separation with terrain while airborne;

— H3: loss of separation with flying objects when airborne;

— H4: loss of separation with obstacles on the ground;

— H5: loss of control on the ground (LOC-G) during landing and take-off;

— H6: loss of control on the ground (LOC-G) during taxiing;

— H7: un-stabilised approach; and

— H8: loss of separation with aircraft or vehicle on the ground.

## 4.4. Safety constraints

The STAMP/STPA methodology generates safety constraints that must be complied with in order to prevent a system hazard. These safety constraints form the starting point from which the rules will ultimately be derived. The generation of a complete set of safety constraints relies on the depth and quality of the system analysis, which in turn are influenced by the available resources (e.g. time, expertise). Also, compliance with all the safety constraints might not be always feasible due to external factors (e.g. available technology and financial cost). Therefore, following the hazard identification and the generation of safety constraints, the 'imperfections' of the system in operation become part of its design assumptions. These 'imperfections' shall be monitored for their validity and shall be eliminated over time, when feasible.

The high-level safety constraints generated so far are as follows:

— S1: the aircraft shall be under control when airborne (instrument and visual segment);

— S2: the aircraft shall maintain adequate separation from terrain before landing;

— S3: the aircraft shall maintain adequate separation from flying objects when airborne;

— S4: the aircraft shall maintain adequate separation from obstacles on the ground;

— S5: the aircraft shall remain under control during landing and take-off;

— S6: the aircraft shall remain under control during taxiing[18];

— S7: the aircraft shall remain stabilised during approach;

— S8: the aircraft shall maintain adequate separation from aircrafts or vehicles on the ground.

## 4.5. Application of the STPA methodology

The control structure considers that every controller follows a process model for managing its control actions. Once the high-level hazards are identified, they can be translated into safety requirements or

[18] For helicopter operations, this relates to hovering/manoeuvre to the take-off/landing zone. A roll-out or rolling landing is only performed as part of an emergency procedure in case of engine failure (in case of multi-engine helicopters) or other controllability failures, but these failures are not considered in these safety constraints.

constraints that apply to the system design. **The hazard analysis is here primarily focused on the flight crew** who is the front line actor dealing with clearly observable unacceptable hazards. For instance, the pilot will logically take actions to correct a vertical deviation displayed on the guidance system during an ILS approach before this becomes a collision with the ground.

### 4.5.1. Process variables

In order to further refine the analysis of the various hazards linked to each control loop, process variables have been included to specify the context in which each control action is activated. Two main process variables are considered:

— the first one is the phase of flight (approach above the DH (instrument phase) — between the DH and the flare (visual references acquired), the flare, the landing roll, the taxiing, the go-around, etc.); this phase of flight can differ for the pilot and the navigation system depending on the context of information made available to each of them (sensors of the automatic flight control system can suggest a different context than the one perceived by the pilot in case of erroneous radio-altimeter information);

— the second main process variable considered is the type of taxiing/take-off/approach performed (e.g. CAT I, SA CAT I, etc.) and/or the related instruments qualification in use.

### 4.5.2. Inadequate control flows

The hazard analysis follows the STPA methodology for the different ‘control loops’ within the AWO system. The hazard analysis considers the control actions that may be taken by different controllers, the actuators available, and the sensors providing feedback. From these control actions, ‘unsafe control actions’ are derived.

These are the actions that could result in a system hazard. The types of unsafe actions are as follows:

— An unsafe control action is provided that creates a system hazard;

— A required control action is not provided to avoid a hazard;

— A potentially safe control action is provided too late, too early or in the wrong order;

— A continuous safe control action is provided for too long or is stopped too soon; and

— An unsafe condition can also exist when a control action is provided but not followed.

These ‘unsafe control actions’, with variations depending on the process variables selected, are used to derive ‘inadequate control flows’ (ICFs). For each ICF, the interfaces with other controlled processes are considered and the causal factors are evaluated. These can lead to further ICFs.

All the unsafe control actions establish the safety requirements that are needed to validate the proposed regulatory requirements, and the ICFs identify the hazards that have to be adequately addressed by the proposed rules.

The following assumptions are made:

— The core objective of the task of each controller is to keep the aircraft on its approach or departure path and land, take-off and taxi safely;

— The system is composed of qualified flight crew, approved operators with a valid air operator certificate (AOC), aircraft with a valid certificate, and approved ANS with qualified ATCOs;

— As long as no human deficiency is identified, it is expected that operators (flight crew, ATCOs) respond to all information presented in the form of visual cues and warnings in an appropriate and faithful manner;

— As long as no technical deficiency is identified, it is expected that systems respond to single failures as per their certification or qualification criteria and system logic;

— The analysis is limited to new operational credits developed in this AWO concept and the evolution from conventional precision instrument departure and approach. The experience in conducting conventional PAs is credited to validate the safety of the existing system.

### 4.5.3. Unsafe control actions (UCAs)

The list of controlled actions is established. The system is mainly centred on the aircrew to manage safety-critical hazards. The core tasks assigned to the pilot is to fly, navigate, communicate and manage the flight using either manual or automated controls in the context of AWO. For each unsafe controlled action, the process variables further refine the context in which it takes place. The feedback loop before the DH (assumption is that no visual reference is established) might differ from the feedback loop after the DH where visual references have been established.

The detailed list of tasks considered for each controller cannot be presented in this document. An example of the UCAs for the pilots clustered in their task to fly manually is given below.

| Control actions | Not providing | Providing causes hazard | Too early/too late, wrong order | Stopping too soon, applying too long |
|---|---|---|---|---|
| CA.101 Pilot provides control to change L/V flight path when deviation occur | UCA.101.1 Pilot does not provide control to change L/V flight path when deviation occurs above the DH.<br><br>UCA.101.2 Pilot does not provide control to change L/V flight path when deviation occurs between the DH and the flare<br><br>UCA.101.3 Pilot does not provide control to change L/V flight path when | UCA.101.7 Pilot provides control to change L/V flight path when established on flight path above the DH<br><br>UCA.101.8 Pilot provides control to change L/V flight path when established on flight path between the DH and the flare<br><br>UCA.101.9 Pilot provides control to change L/V flight path when established on flight path at the flare | UCA.101.12 Pilot lagged or provides a wrong change to L/V flight path and increase deviations above the DH<br><br>UCA.101.13 Pilot lagged or provides a wrong change to L/V flight path and increase deviations between the DH and the flare<br><br>UCA.101.14 Pilot lagged or provides a wrong change to L/V flight path and increase deviations at the flare<br><br>UCA.101.15 Pilot | |

| Control actions | Not providing | Providing causes hazard | Too early/too late, wrong order | Stopping too soon, applying too long |
|---|---|---|---|---|
| | deviation occurs during the flare<br>UCA.101.4 Pilot does not provide control to change L/V flight path when deviation occurs during landing roll<br>UCA.101.5 Pilot does not provide control to change L/V flight path when deviation occurs during taxiing<br>UCA.101.6 Pilot does not provide control to change L/V flight path when deviation occurs during take-off roll | UCA.101.10 Pilot provides control to change L/V flight path when established during landing roll<br>UCA.101.11 Pilot provides control to change L/V flight path when established during take-off roll | lagged or provides a wrong change to L/V flight path and increase deviations during landing roll<br>UCA.101.16 Pilot lagged or provides a wrong change to L/V flight path and increase deviations during take-off roll | |
| CA.102<br>Pilot provides control to change airspeed | UCA.102.1 Pilot does not provide control to change airspeed when speed deviation occurs above the DH<br>UCA.102.2 Pilot does not provide control to change airspeed when speed deviation occurs above the DH<br>UC.102.3 Pilot does not provide control | UCA.102.5 Pilot at Vref provides control to change airspeed before landing roll | UC.102.6 Pilot lagged at providing control to change airspeed approaching Vs<br>UC.102.7 Pilot lagged at providing control to change airspeed at go-around | |

| Control actions | Not providing | Providing causes hazard | Too early/too late, wrong order | Stopping too soon, applying too long |
|---|---|---|---|---|
| | to change airspeed when speed deviation occurs at the flare<br>UCA.102.4 Pilot does not provide control to brake during landing roll | | | |
| C3 …. | | | | |

### 4.5.4. Causal factors and control flaws

Identification of causal factors and control flaws has to be performed.

For each unsafe controlled action (UCA), the inadequate control flows (ICFs) and its origin are then established.

| UCA ID | UCA | Hazardous | ICF ID | ICF source | ICFs |
|---|---|---|---|---|---|
| UCA.101.1 | Pilot does not provide control to change L/V flight path when deviation occurs above the DH | Y | UCA.101.1.1 | 1. Pilot instruments | Guidance on displays/instruments — Not provided or incorrect |
| | | Y | UCA.101.1.2 | 1. Pilot instruments | Aircraft height/altitude on displays/instruments — Not provided or incorrect |
| | | Y | UCA.101.1.3 | 1. Pilot instruments | Enhanced ground proximity warning system (EGPWS) — Not provided or incorrect |
| | | Y | UCA.101.1.4 | 1. Pilot instruments | Deviation warning — Not provided or incorrect |
| | | Y | UCA.101.1.5 | 1. Pilot instruments | System status — Not provided or incorrect |
| | | Y | UCA.101.1.6 | 2. Enhanced displays | EFVS or CVS on displays/HUDs — Not provided or incorrect |
| | | Y | UCA.101.1.7 | 3. Air operator | Automation policy and training — Insufficient |
| | | Y | UCA.101.1.8 | 3. Air operator | Stabilisation criteria — Insufficient |
| | | Y | UCA.101.1.9 | 3. Air operator | crew resource management (CRM) — Insufficient |
| | | Y | UCA.101.1.10 | 3. Air operator | AIS system availability (AFL, NAVAIDS) — Not provided or incorrect |
| | | Y | UCA.101.1.11 | 4. ANS | Wind real-time information — Not provided |
| | | Y | UCA.101.1.12 | 4. ANS | Provides vectors and altitude clearance — Not provided or incorrect |
| | | Y | UCA.101.1.13 | 5. Infrastructure | ILS/GNSS signal - Not provided or incorrect |
| | | Y | UCA.101.1.14 | 6. Aircraft | Crosswind — Not informed |
| | | Y | UCA.101.1.15 | 6. Aircraft | Windshear — Not informed |

This enables a global review of all the interactions of the control flows listed and checking that the hazards are properly mitigated in all circumstances.

### 4.5.5. End-result of the hazards review

The end-result of this hazards review is presented in the table below.

| Source | ICFs | Mitigation measure |
|---|---|---|
| 1. Pilot instruments | Aircraft airspeed on displays / instruments | Stall warning, maximum operation speed/maximum operating Mach number, or flap limits, should be displayed to provide the flight crew with a quick-glance sense of speed<br>CS 25.207 Stall warning<br>Independent source of information to resolve inconsistencies between primary instrument displays.<br>Pilot flying must be able to remove/deselect misleading airspeed.<br>Pilot must be informed/alerted to a significant misalignment between different aircraft computed airspeeds.<br>There should be a means to verify the correctness of sensor input data.<br>Each display should have independent sensors and power supplies. |
| 1. Pilot instruments | Aircraft height / altitude on displays / instruments | Deviations monitoring is always associated with CRM monitoring, altitude and attitude coupling. CRM ensures pilot not-flying monitors the height/altitude that is provided to the pilot flying for errors.<br>Pilot flying must cross-check height guidance with other instruments.<br>Independent source of information to resolve inconsistencies between primary instrument displays.<br>Pilot flying must be able to remove/deselect misleading airspeed.<br>Pilot must be informed/alerted to a significant misalignment between different aircraft computed airspeeds.<br>There should be a means to verify the correctness of sensor input data.<br>Each display should have independent sensors and power supplies. |
| 1. Pilot instruments | Attitude on displays/ instruments | <u>Airborne until the ground</u><br>Cause due to sensor failure, computation/processing error, inertial reference system (IRS) common cause failure<br>Deviations monitoring is always associated with CRM monitoring, altitude and attitude coupling. Pilot not-flying monitors and helps the pilot flying to detect attitude deviations.<br>Aircraft equipped with GPWS will receive terrain warnings in cases of abnormal descent rates.<br>Independent source of information to resolve inconsistencies between primary flight displays (PFDs).<br>There should be a means to verify the correctness of sensor input data.<br>Pilot must be able to remove/deselect erroneous display/guidance.<br>Pilot must be informed/alerted to a navigation error or inability of the |

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| | | system to determine position within defined limits.<br>Each display should have independent sensors and power supplies.<br>Aircraft equipped with flight envelope protection<br>CS 25.1333 (b)<br>(b) Equipment, systems, and installations must be designed so that sufficient information is available to assure control of the aeroplane in airspeed, altitude, direction and attitude by one of the pilots without additional flight crew action after any single failure or combination of failures that is not assessed to be extremely improbable.<br>2. Airspeed, altitude, and direction display systems. The reliability and independence of the displays used to show compliance with CS 25.1333(b) should be sufficient to ensure continued safe flight and landing appropriate to the intended operation of the aeroplane. |
| 1. Pilot instruments | Deviation warning | <u>From above DH to flare</u><br><u>CAT II/III</u><br>Deviation monitoring, clear visual indication at each pilot's station. |
| 1. Pilot instruments | EGPWS | <u>From above DH to flare</u><br>CAT.IDE.A.150 Terrain awareness warning system (TAWS)<br>(a) Turbine-powered aeroplanes having an MCTOM of more than 5 700 kg or an MOPSC of more than nine shall be equipped with a TAWS that meets the requirements for Class A equipment as specified in an acceptable standard.<br>(b) Reciprocating-engine-powered aeroplanes with an MCTOM of more than 5 700 kg or an MOPSC of more than nine shall be equipped with a TAWS that meets the requirement for Class B equipment as specified in an acceptable standard.<br>TAWS/radar altimeter (RAlt) is an AMC for not applying the CFDA technique.<br>Class A excessive downwards glideslope deviation warning for vertical navigation (VNAV) guidance. |
| 1. Pilot instruments | Flight mode annunciator | Mitigations inter-related with CRM, call-out, crew training on automation policy and safety management system (SMS). |
| 1. Pilot instruments | Flight prompt | <u>Between DH and flare</u><br>The radio altimeter operating area is determined in CS ADR-DSN.B.205 and additional guidance is provided in GM1 ADR DSN.B.205. However, there are instances where it is impracticable to establish such an area. This has an effect on the DH.<br>Concerning the provision of electronic terrain and obstacle data, reference is made to AMC1 ADR.OPS.A.005. Furthermore, NPA 2016-02 contains requirements for the integrity of the aeronautical data.<br><u>CAT II/III</u><br>All height call-outs below 200 ft above the aerodrome threshold elevation are determined by the use of a radio altimeter or other |

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| | | device capable of providing equivalent performance.<br>Terrain/runway database must be uploaded correctly and integrity checked before use. |
| 1. Pilot instruments | Flight management system (FMS) | ILS setting must be checked |
| 1. Pilot instruments | Guidance on displays / instruments | <u>Above DH only</u><br>Cause due to sensor failure, computation/processing error, navigational position error due to failure, NAV radio failure.<br>Common cause failure associated with the pilot flying<br>ILS receiver failure deviations monitoring is always associated with CRM monitoring, altitude and attitude coupling. CRM ensures pilot not-flying monitors the L/V path guidance followed for errors.<br>Aircraft equipped with GPWS will receive terrain warnings in cases of abnormal descent rates.<br>Pilot flying must cross-check L/V flight path guidance with other instruments.<br>Independent source of information to resolve inconsistencies between PFDs.<br>There should be a means to verify the correctness of sensor input data.<br>Pilot must be able to remove/deselect erroneous display/ guidance<br>Pilot must be informed/alerted to a navigation error or inability of the system to determine position within defined limits.<br>Each display should have independent sensors and power supplies.<br>CS 25.1333 (b)<br>(b) Equipment, systems, and installations must be designed so that sufficient information is available to assure control of the aeroplane in airspeed, altitude, direction and attitude by one of the pilots without additional flight crew action after any single failure or combination of failures that is not assessed to be extremely improbable.<br>2. Airspeed, altitude, and direction display systems. The reliability and independence of the displays used to show compliance with CS 25.1333(b) should be sufficient to ensure continued safe flight and landing appropriate to the intended operation of the aeroplane. |
| 1. Pilot instruments | Landing configuration warning | Crediting of existing provisions |
| 1. Pilot instruments | System status | Failure mode should be detected especially when referring to single failure |

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|---|---|---|
| 2. Enhanced displays | EFVS or CVS on displays/HUDs | Cause due to sensor failure, computation/processing error, navigational position error due to failure, NAV radio failure, ILS receiver failure.<br>Pilot flying must cross check L/V flight path guidance with other instruments.<br>CRM ensures pilot not-flying monitors the L/V path guidance followed for errors.<br>Independent source of information/display in the event of a loss of vertical path guidance to be provided.<br>Independent source of information to resolve inconsistencies between PFDs.<br>Pilot flying must be able to remove/deselect misleading display/image.<br>Pilot flying must initiate a go-around if HUD error is detected above the DH.<br>Pilot must be informed/alerted to a significant misalignment between the aircraft position and the defined flight path.<br>Aircraft equipped with GPWS will receive terrain warnings in cases of abnormal descent rates.<br>There should be a means to verify the correctness of sensor input data.<br>The flight crew must be advised of failed aircraft systems or components affecting the decision to continue to use the display/HUD.<br>Terrain/runway database must be uploaded correctly and integrity checked before use.<br>Pilot must be informed/alerted to a navigation error or inability of the system to determine position within the defined limits.<br>Sensor system sources for instrument flight information should be consistent between the HUD and the head-down displays (HDDs) used by the same pilot.<br>Each display should have independent sensors and power supplies.<br>The EFVS/CVS shall be certified for the intended operation, and the performance of the sensors for different meteorological conditions shall be demonstrated and specified in the AFM.<br>The AFM shall specify a height above the threshold below which natural vision shall be available.<br>SA CAT II permits an RVR as low as 1 200 ft (375 m) and a conservative SA CAT I at 400 m.<br>It is anticipated that approaches to a CAT I runway could be initially permitted to a lowest RVR of 300 m. This number comes from the system design limitation of EFVS MASPS DO-315A. |

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|---|---|---|
| 2. Enhanced displays | Real -time image of external scene topography on displays / HUD | Common cause failure associated with the displays/HUD frozen image on displays/HUD<br>Pilot flying must cross-check L/V flight path guidance with other instruments.<br>CRM ensures pilot not-flying monitors the L/V path guidance that is provided to the pilot flying for errors.<br>Independent source of information to resolve inconsistencies between primary instrument displays.<br>Pilot flying must be able to remove/deselect misleading display/image<br>Pilot flying must initiate a go-around if HUD error is detected above DH.<br>Pilot must be informed/alerted to a significant misalignment between the aircraft position and the defined flight path.<br>Aircraft equipped with GPWS will receive terrain warnings in cases of abnormal descent rates.<br>There should be a means to verify the correctness of sensor input data.<br>Pilot must be able to remove/deselect frozen display/image<br>The flight crew must be advised of failed aircraft systems or components affecting the decision to continue to use the display/HUD.<br>Each display should have independent sensors and power supplies. |
| 3. Air operator | Airport familiarisation | ORO.FC.105(c). In the case of commercial operations of aeroplanes and helicopters, the pilot-in-command/commander or the pilot, to whom the conduct of the flight may be delegated, shall have had initial familiarisation training of the route or area to be flown and of the aerodromes, facilities and procedures to be used. This route/area and aerodrome knowledge shall be maintained by operating at least once on the route or area or to the aerodrome within a 12-month period. |
| 3. Air operator | AIS system unavailability (AFL, NAVAIDS) | Crediting of existing provisions |
| 3. Air operator | Automation policy and training | Competent authority approval required.<br>Flight crew need additional training at an ATO to qualify for operations below DH or 200 ft. Specific crew training (ground and FSTD) required.<br>Minimum crew of two pilots is required.<br>The air operator must conduct operational demonstration prior to approval.<br>The air operator must have a certain level of experience in operating the given aircraft type (e.g. 6 months).<br>The air operator must have a process for continuous monitoring of the success rate of AWO approaches. |

| | | |
|---|---|---|
| | | The air operator's SMS evaluates hazards from all components of the system, not just hazards internal to the air operator. |
| 3. Air operator | CRM | Pilot flying must cross-check instruments guidance with other instruments.<br>CRM ensures pilot not-flying monitors the speed that is provided to the pilot flying for errors. |
| 3. Air operator | Standard operating procedures (SOPs) on DH | Air operations, CAT II 'The air operator must have a process for continuous monitoring of the success rate of AWO approaches.'<br>CAT III<br>Visual reference of three centre line lights required at the DH (RVR 200 m).<br>If the DH is specified, then visual reference of one centre line light is required (CAT III with fail-operational flight control). |
| 3. Air operator | Stabilisation criteria | CAT III<br>Approach shall be automatically flown to touchdown (except for approved HUD).<br>Specified RVRs required for TDZ and MID.<br>With fail-passive flight control, the pilot shall be able to manually land or perform a go-around.<br>Eligible aerodromes and runways verified. |
| 4. ANS | Missed approach instruction | Availability of approach charts<br>This is not addressed yet in the aerodrome rules. NPA 2016-02 addresses the issue of publication of the aeronautical charts from the AIS/aeronautical information management (AIM) perspective; however, the responsibility to ensure that approach charts are available should be with the aerodrome operator. |
| 4. ANS | Provides vectors and altitude clearance | Crediting of existing provisions |
| 4. ANS | RVR real-time information | Regulation (EU) 2017/373 requires instrumented systems for CAT II/III runways and CAT I subject to the decision of the competent authority.<br>AMC to this Regulation provide reporting positions<br>LVPs shall be established and in force for air operations with an RVR below 550 m.<br>RVR reporting available below 800 m visibility.<br>CAT II<br>ATC required.<br>ATC has suitable RVR display equipment. 2 RVR reporting positions.<br>CAT III<br>RVR reporting available. 3 RVR reporting positions. |

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|---|---|---|
| 4. ANS | Taxiing guidance and monitoring | The aerodrome shall establish LVPs |
| 4. ANS | Visual aids real-time status | <u>CAT II</u><br>2 RVR reporting positions. |
| 4. ANS | Wind real-time information | Regulation (EU) 2017/373, MET.OR.205 addresses the provision of real-time surface wind information.<br>ATS.OR.515, as proposed in NPA 2016-09, requires the existence of wind surface displays. |
| 5. Infrastructure | ILS / GNSS signal | The protection of ILS sensitive areas is covered under the AMC/GM to the aerodrome rules.<br>ILS certified to Class II/D/2<br>Certification of navaids is not yet covered. This could be covered under AMC or at CS, which needs to be developed<br>Availability of approach charts<br>This is not addressed yet in the aerodrome rules. NPA 2016-02 addresses the issue of publication of the aeronautical charts from the AIS/AIM perspective; however, the responsibility to ensure that approach charts are available should be with the aerodrome operator.<br>Pilot must be informed/alerted to a navigation error or inability of the system to determine position within the defined limits.<br><u>CAT II</u><br>For ILS-supported approaches, sensitive areas to be protected from aircraft and vehicles.<br>ILS certified to Class II/D/2.<br>OCA/H published in accordance with PANS-OPS.<br>Approach charts available<br><u>CAT III</u><br>LVPs in place<br>Information on status of relevant systems provided to pilots |
| 5. Infrastructure | Visual aids | Runway, infrastructure, approach and runway lights and marking in accordance with CS-ADR-DSN/ICAO Annex 14 for CAT I PA runways.<br>Maximum switch-over time for approach lights 15 seconds<br>Visual aids for CAT II/III runways are included in CS-ADR.DSN<br><u>CAT II or CAT III</u><br>Runway, infrastructure, approach and runway lights and marking in accordance with CS-ADR-DSN/ICAO Annex 14 for CAT II<br>LVPs in place<br><u>LVTO I</u><br>LVPs in place. |

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| | | Maximum switch-over time for runway end, centre line lights and stop bars 1 second.<br><br><u>LVTO II</u><br><br>Maximum switch-over time for other runway lights, essential taxiway lights and obstacle lights 15 seconds.<br><br>Below an RVR of 150 m, 15 m spacing runway centre line lights required.<br><br>LVPs for taxiing consider RVRs. The RVR is measured only for runway. It is not a useful measure of the difficulty of taxiing. The aerodrome operator should determine the ability to taxi using visual reference, but how? This can only be done by the aircraft operator based upon the entire system (ATM, aerodrome, operator).<br><br>The 75 m RVR minimum for take-off considers the assisted infrared and colour-wide angle camera development. |
| 6. Aircraft | Crosswind | Crediting of existing provisions |
| 6. Aircraft | Windshear | Crediting of existing provisions |
| 7. AFCS sensors | Deviation monitoring | CS 25.1329(h) When the flight guidance system is in use, a means must be provided to avoid excursions beyond an acceptable margin from the speed range of the normal flight envelope. |
| Aircraft manufacturer | CS-25 compliance | Basic autopilot (AP) safety objectives.<br><br>Basic airworthiness requirements (see Chapter 6 of Appendix 2 AC 120-29A, edition 2002).<br><br>If installed, the basic airworthiness (AW) requirements are a prerequisite for any equipment. Equipment mentioned below shall comply with the applicable standards as mentioned in the associated ETSOs.<br><br>CS-25 (in particular CS 25.1309, 1301, 1322, 1329), including the relevant AMC.<br><br>Pilot to be able to safely bring the aeroplane at DA/H 200 ft or above from which it can be landed safely within the TDZ of the runway and/or to safely perform a go-around (position is defined in such a way that the pilot may be able to make a correction; performance criteria are therefore aircraft-dependent (e.g. large transport aircraft vs business jet). |
| Aircraft manufacturer | CS-AWO Autoland compliance | Equipment: CS-AWO 321 and AC 120-xls Chapter 3.4 and Appendix 4.<br><br>CS-AWO 321(a)(5) requires excessive deviation alerts; however, according to the FAA, AC 120-xls, para 3.16, an excessive deviation alert is not required.<br><br>Autoland: CS-AWO 321 and AC-120 xls and Appendix 4.<br><br>Aircraft shall be capable of clearing obstacles following a missed approach at any height.<br><br>Roll-out control/guidance system required (RVR below 200 m)<br><br>CAT IIIB<br><br>Fail-operational roll-out flight control system required for an RVR |

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| | | below 125 m. |
| Aircraft manufacturer | CS-AWO compliance | CS-AWO<br>Performance criteria are in CS-AWO 231 and the associated AMC.<br>Safety objective CS-AWO 201. Additional safety objectives criteria are in the 'failure conditions' section of CAT 2 of CS-AWO.<br>Equipment (navigation display, FD, AFCS, HUD): CS-AWO 221 and AC 120-xls Chapter 3.3 and Appendix 3.<br>CS-AWO 221(i) and 236 require excessive deviation alerts; however, according to the FAA AC 120-xls para 3.16, an excessive deviation alert is not required.<br>See also CS-AWO 206.<br>Navigation sensors: AC 120-XLS (ILS, GLS, MLS). |

# 5. Proposed actions to support implementation

The following actions are foreseen:

— EASA Circular (*primarily targeted audience: competent authorities, industry)*

Development of the related guidance material ('safety material') for contributing to the implementation of the AWO regulatory material

— Detailed explanation with *clarification* and indicated hints on the EASA website *(competent authorities, industry)*

Development of the related guidance material ('safety material') for contributing to the implementation of the AWO regulatory material

— Dedicated thematic workshops/*sessions (competent authorities, industry)*

Presentation of and discussion on the developed related guidance material ('safety material') for contributing to the implementation of the AWO regulatory material

- CAT OPS community;
- NCC OPS community;
- NCO OPS (GA) community;
- helicopter OPS community; and
- ADR community.

— Combination of the above selected means *(competent authorities, industry)*

Please refer above.

# 6. References

## 6.1. Related regulations

**Air operations**

Commission Regulation (EU) No 965/2012 of 5 October 2012 laying down technical requirements and administrative procedures related to air operations pursuant to Regulation (EC) No 216/2008 of the European Parliament and of the Council (OJ L 296, 25.10.2012, p. 1).

**Aircrew**

Commission Regulation (EU) No 1178/2011 of 3 November 2011 laying down technical requirements and administrative procedures related to civil aviation aircrew pursuant to Regulation (EC) No 216/2008 of the European Parliament and of the Council (OJ L 311, 25.11.2011, p. 1).

**Aerodromes**

Commission Regulation (EU) No 139/2014 of 12 February 2014 laying down requirements and administrative procedures related to aerodromes pursuant to Regulation (EC) No 216/2008 of the European Parliament and of the Council (OJ L 44, 14.2.2014, p. 1).

**ATM/ANS**

Commission Implementing Regulation (EU) No 1034/2011 of 17 October 2011 on safety oversight in air traffic management and air navigation services and amending Regulation (EU) No 691/2010 (OJ L 271, 18.10.2011, p. 15).

Commission Implementing Regulation (EU) No 1035/2011 of 17 October 2011 laying down common requirements for the provision of air navigation services and amending Regulations (EC) No 482/2008 and (EU) No 691/2010 (OJ L 271, 18.10.2011, p. 23).

Commission Implementing Regulation (EU) No 2017/373 of 1 March 2017 laying down common requirements for providers of air traffic management/air navigation services and other air traffic management network functions and their oversight, repealing Regulation (EC) No 482/2008, Implementing Regulations (EU) No 1034/2011, (EU) No 1035/2011 and (EU) 2016/1377 and amending Regulation (EU) No 677/2011.

**SERA**

Commission Implementing Regulation (EU) No 923/2012 of 26 September 2012 laying down the common rules of the air and operational provisions regarding services and procedures in air navigation and amending Implementing Regulation (EU) No 1035/2011 and Regulations (EC) No 1265/2007, (EC) No 1794/2006, (EC) No 730/2006, (EC) No 1033/2006 and (EU) No 255/2010 (OJ L 281, 13.10.2012, p. 1).

## 6.2. Affected decisions (CSs, AMC and GM)

### Initial/continuous airworthiness

Decision No. 2003/6/RM of the Executive Director of the Agency of 17 October 2003 on certification specifications, including airworthiness codes and acceptable means of compliance, for all weather operations (« CS-AWO »)

Decision 2013/031/R of the Executive Director of the Agency of 17 December 2013 adopting Certification Specifications for Airborne Communications Navigation and Surveillance (CS ACNS) 'CS-ACNS Initial Issue'

### Air operations

Decision N° 2012/015/Directorate R of the Executive Director of the Agency of 24th October 2012 on Acceptable Means of Compliance and Guidance Material to Commission Regulation (EU) No 965/2012 of 5 October 2012 laying down technical requirements and administrative procedures related to air operations pursuant to Regulation (EC) No 216/2008 of the European Parliament and of the Council — 'Guidance Material to Annex I – Definitions'

Decision 2014/025/R of the Executive Director of the Agency of 28 July 2014 adopting Acceptable Means of Compliance and Guidance Material to Part-ARO of Regulation (EU) No 965/2012 and repealing Decision 2014/014/R of the Executive Director of the Agency of 24 April 2014 'AMC and GM to Part-ARO — Issue 3'

Decision 2014/017/R of the Executive Director of the Agency of 24 April 2014 adopting Acceptable Means of Compliance and Guidance Material to Part-ORO of Regulation (EU) No 965/2012 and repealing Decision 2012/017/R of the Executive Director of the Agency of 24 October 2012 'AMC and GM to Part-ORO — Issue 2'

Decision 2014/015/R of the Executive Director of the Agency of 24 April 2014 adopting Acceptable Means of Compliance and Guidance Material to Part-CAT of Regulation (EU) No 965/2012 and repealing Decision 2012/018/R of the Executive Director of the Agency of 24 October 2012 — 'AMC and GM to Part-CAT – Issue 2'

Decision N° 2012/019/Directorate R of the Executive Director of the Agency of 24th October 2012 on Acceptable Means of Compliance and Guidance Material to Commission Regulation (EU) No 965/2012 of 5 October 2012 laying down technical requirements and administrative procedures related to air operations pursuant to Regulation (EC) No 216/2008 of the European Parliament and of the Council — 'Acceptable Means of Compliance and Guidance Material to Part-SPA'

Decision N° 2013/021/Directorate R of the Executive Director of the Agency of 23 August 2013 on adopting Acceptable Means of Compliance and Guidance Material for Non-commercial operations with complex motor-powered aircraft (Part-NCC)

### Aircrew

Decision No°2011/016/R of the Executive Director of the European Aviation Safety Agency of 15 December 2011 on Acceptable Means of Compliance and Guidance Material to Commission Regulation (EU) No 1178/2011 of 3 November 2011 laying down technical requirements and administrative procedures related to civil aviation aircrew pursuant to Regulation (EC) No 216/2008 of the European Parliament and of the Council 'Acceptable Means of Compliance and Guidance Material to Part-FCL'

Decision No° 2012/006/Directorate R of the Executive Director of the Agency of 19th April 2012 on Acceptable Means of Compliance and Guidance Material to Commission Regulation (EU) No 1178/2011 of 3 November 2011 laying down technical requirements and administrative procedures related to civil aviation aircrew pursuant to Regulation (EC) No 216/2008 of the European Parliament and of the Council 'Acceptable Means of Compliance and Guidance Material to Part-ARA'

Decision No° 2012/007/Directorate R of the Executive Director of the Agency of 19th April 2012 on Acceptable Means of Compliance and Guidance Material to Commission Regulation (EU) No 1178/2011 of 3 November 2011 laying down technical requirements and administrative procedures related to civil aviation aircrew pursuant to Regulation (EC) No 216/2008 of the European Parliament and of the Council 'Acceptable Means of Compliance and Guidance Material to Part-ORA'

Decision No° 2012/010/Directorate R of the Executive Director of the Agency of 4th July 2012 on the certification specifications for aeroplane flight simulation training devices

Decision No° 2012/011/Directorate R of the Executive Director of the Agency of 26th June 2012 on the certification specifications for helicopter flight simulation training devices

Executive Director Decision 2016/008/R of 2 May 2016 amending the Acceptable Means of Compliance and Guidance Material to Part-FCL and Part-ARA of Commission Regulation (EU) No 1178/2011, and the Acceptable Means of Compliance and Guidance Material to Part-ORO and Part-ARO of Commission Regulation (EU) No 965/2012 'Part-FCL (PBN) — Amendment 2, Part-ARA (PBN, ARA.MED) — Amendment 3 Part-FCL (Learning Objectives (LOs)) — Amendment 2 Part-ORO — Issue 2, Amendment 7, Part-ARO (OCC for MPL) — Issue 3, Amendment 2'

Executive Director Decision 2017/022/R of 8 December 2017 amending Acceptable Means of Compliance and Guidance Material to Part-FCL, Part-ARA and Part-ORA of Regulation (EU) No 1178/2011 'AMC/GM to Part-FCL — Amendment 3, AMC/GM to Part-ARA — Amendment 4, AMC/GM to Part-ORA — Amendment 4'

**Aerodromes**

Executive Director Decision 2017/021/R of 8 December 2017 issuing Certification Specifications and Guidance Material for Aerodrome Design (CS ADR-DSN) 'CS ADR-DSN — Issue 4'

Decision 2014/012/R of the Executive Director of the Agency of 27 F.ebruary 2014 adopting Acceptable Means of Compliance and Guidance Material to Regulation (EU) No 139/2014 'AMC/GM for Aerodromes — Initial Issue'

Executive Director Decision 2017/017/R of 10 July 2017 amending Acceptable Means of Compliance and Guidance Material to Regulation (EU) No 139/2014 'AMC/GM to Authority, Organisation and Operations Requirements for Aerodromes – Amendment 2'

**ATM/ANS**

Decision 2013/031/R of the Executive Director of the Agency of 17 December 2013 adopting Certification Specifications for Airborne Communications Navigation and Surveillance (CS ACNS) 'CS-ACNS Initial Issue'

**SERA**

Executive Director Decision 2015/014/R of 3 July 2015 adopting Guidance Material on the implementation of the remote tower concept for single mode of operation

Decision 2013/013/R of the Executive Director of the European Aviation Safety Agency of 17 July 2013 adopting the Acceptable Means of Compliance and Guidance Material to Commission Implementing Regulation (EU) No 923/2012 of 26 September 2012 laying down the common rules of the air and operational provisions regarding services and procedures in air navigation and amending Implementing Regulation (EU) No 1035/2011 and Regulations (EC) No 1265/2007, (EC) No 1794/2006, (EC) No 730/2006, (EC) No 1033/2006 and (EU) No 255/2010 'Acceptable Means of Compliance and Guidance Material to the rules of the air'

## 6.3. Other reference documents

**ICAO and FAA regulatory material**

— ICAO Annex 1 — Personnel Licensing (10th Edition, July 2006)

— ICAO Annex 3 — Meteorological Service for International Air Navigation (6th Edition, July 2007)

— ICAO Annex 4 — Aeronautical Charts (11th Edition, July 2009)

— ICAO Annex 6 — Operation of Aircraft (9th Edition, July 2010)

— ICAO Annex 10 —Aeronautical Telecommunications (6th edition, July 2006)

— ICAO Annex 11 — Air Traffic Services (13th Edition, July 2001)

— ICAO Annex 14 — Aerodromes (7th Edition, 2016)

— ICAO Annex 14 — Aerodromes (7th Edition, 2016)

— ICAO Annex 15 — Aeronautical Information Services (15th Edition, July 2016)

— ICAO Doc 4444 — Procedures For Air Navigation Services — Air Traffic Management, 6th Edition, 2016

— ICAO Doc 8168 — Procedures For Air Navigation Services — Aircraft Operations, 5th Edition, 2006

— ICAO Doc 9365 — Manual of All-Weather Operations, 3th Edition, 2013

— ICAO Doc 9261 — Heliport Manual, 3rd Edition, 1995

— ICAO Doc 9830 — Advanced Surface Movement Guidance and Control Systems (A-SMGCS) Manual, 1st Edition

— ICAO EUR Doc 013 — European Guidance Material on Aerodrome Operations under Limited Visibility Conditions, 5th Edition,2016

— FAA Order No 8400.13D — Procedures for the Evaluation and Approval of Facilities for Special Authorization Category I Operations and All Category II and III Operations, 2009

— FAA Order No 8260.3B — United States Standard for Terminal Instrument Procedures (TERPS) with Changes 1-26, 1976

— FAA Order No 8260.19F — Flight Procedures and Airspace, 2014

— FAA Notice No 8260.74 — Special Authorization (SA) Category (CAT) I Instrument Landing System (ILS) Missed Approach Procedure Evaluation and Documentation Requirements, 2014

— FAA Order No 8200.1D — US Standard Flight Inspection Manual (USSFIM) with CHG 1, 2015

— FAA Order No 6750.24E — Instrument Landing System and Ancillary Electronic Component Configuration and Performance Requirements, with Change 1 @ 2, 2012

— FAA Order No JO 6750.57A — Instrument Landing System Continuity of Service Requirements and Procedure, with Change 1, 2009

— FAA Part 23

— FAA Part 25

— FAA Part 91

— FAA Part 121

— FAA Part 129

— FAA Part 135

— FAA AC No 120-xls

— FAA AC No 90-CAT I

— FAA AC No 90-106 — Enhanced Flight Vision Systems, 2010

— FAA AC No 20-167 — Airworthiness Approval of Enhanced Vision System, Synthetic Vision System, Combined Vision System, and Enhanced Flight Vision System Equipment, 2016

— FAA AC No 150/5300-13A — Airport Design, 1989/2012

**Standardisation bodies**

— RTCA DO-315A — Minimum Aviation System Performance Standards (MASPS) for Enhanced Vision Systems, Synthetic Vision Systems, Combined Vision Systems and Enhanced Flight Vision Systems, 2010

— RTCA DO-359 — Minimum Aviation System Performance Standard (MASPS) for Synthetic Vision Guidance Systems, 2015

— RTCA DO-341 — Minimum Aviation System Performance Standards (MASPS) for an Enhanced Flight Vision System to Enable All-Weather Approach, Landing and Roll-Out to a Safe Taxi Speed, 2012

— EUROCAE ED 179 — Minimum Aviation System Performance Standards (MASPS) for Enhanced Vision Systems, Synthetic Vision Systems, Combined Vision Systems and Enhanced Flight Vision Systems, 2008

— SAE International ARP6023 — Human Engineering Considerations for Implementing Enhanced Synthetic Vision Systems in Vertical Flight Capable Platforms, 2013

— SAE International ARP5677 — Human Engineering Considerations for Airborne Implementation of Enhanced Synthetic Vision Systems, 2012