



# Opinion No 15/2016

## Terrain awareness warning systems operation in instrument flight rules and visual flight rules, and terrain awareness warning systems for turbine-powered aeroplanes of less than 5 700 kg maximum certified take-off mass able to carry six to nine passengers

RELATED NPA/CRD 2015-21 — RMT.0371 & RMT.0372 (OPS.078 (A) & (B))

### EXECUTIVE SUMMARY

This Opinion addresses a safety issue related to terrain awareness warning systems (TAWs).

There are three safety recommendations (SRs) related to the Opinion: ITAL-2009-001, SPAN-2012-010, and FRAN-2009-009. ITAL-2009-001 states that TAWs would have reduced the probability of occurrence of the aircraft accident, similarly to SPAN-2002-010, and FRAN-2009-009 proposes to require operators to develop a policy and procedures for the use of a TAWs dependent on the flight rules (instrument flight rules (IFR)/visual flight rules (VFR)).

The specific objective is to reduce the probability of accidents categorised as a controlled flight into terrain (CFIT) for turbine-powered airplanes having a maximum certified take-off mass (MCTOM) of less than 5 700 kg and a maximum operational passenger seating configuration (MOPSC) between six and nine.

This Opinion proposes a regulatory change to Regulation (EU) No 965/2012. The proposal affects newly manufactured aeroplanes performing commercial air transport (CAT) operations by requiring them to be equipped with a TAWs.

The proposed changes are expected to increase safety by further reducing CFIT-related accidents.

<b>Action area:</b>	CFIT		
<b>Affected rules:</b>	Regulation (EU) No 965/2012		
<b>Affected stakeholders:</b>	Aircraft/equipment manufacturers, air operators (CAT, NCC, NCO, SPO) of aeroplanes, national aviation authorities (NAAs)		
<b>Driver:</b>	Safety	<b>Rulemaking group:</b>	Yes
<b>Impact assessment:</b>	Full	<b>Rulemaking Procedure:</b>	Standard

● EASA rulemaking process milestones



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## 1. Procedural information

### 1.1. The rule development procedure

The European Aviation Safety Agency (EASA) developed this Opinion in line with Regulation (EC) No 216/2008<sup>1</sup> (hereinafter referred to as the 'Basic Regulation') and the Rulemaking Procedure<sup>2</sup>.

This rulemaking activity is included in the EASA 5-year Rulemaking Programme<sup>3</sup> under rulemaking task RMT.0371 & RMT.0372 (OPS.078 (A) & (B)). The scope and timescales of the task were defined in the related Terms of Reference (ToR<sup>4</sup>).

The *draft* text of this Opinion has been developed by EASA based on the input of Rulemaking Group (RMG) RMT.0371 & RMT.0372 (OPS.078 (A) & (B)). All interested parties were consulted through NPA 2015-21<sup>5</sup>. 34 comments were received from interested parties, including industry and NAAs.

EASA has addressed and responded to the comments received on the NPA. The comments received and the EASA responses thereto are presented in Comment-Response Document (CRD) 2015-21<sup>6</sup>.

The *final* text of this Opinion (i.e. Explanatory Note) and the draft regulation has been developed by EASA. The draft rule text proposed by EASA is published on the EASA website<sup>7</sup>.

The major milestones of this rulemaking activity are presented on the title page.

### 1.2. The next steps in the procedure

This Opinion contains the proposed amendments to Regulation (EU) No 965/2012<sup>8</sup> (hereinafter referred to as the 'Air OPS Regulation') and their potential impacts. It is submitted to the European Commission to be used as a technical basis in order to prepare an EU regulation.

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<sup>1</sup> 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>).

<sup>2</sup> 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>).

<sup>3</sup> <https://www.easa.europa.eu/document-library/rulemaking-programmes>

<sup>4</sup> [https://www.easa.europa.eu/document-library/terms-of-reference-and-group-compositions?search=0371&date\\_filter%5Bvalue%5D%5Byear%5D=&=Apply](https://www.easa.europa.eu/document-library/terms-of-reference-and-group-compositions?search=0371&date_filter%5Bvalue%5D%5Byear%5D=&=Apply)

<sup>5</sup> In accordance with Article 52 of the Basic Regulation and Articles 6(3) and 7 of the Rulemaking Procedure.

<sup>6</sup> <http://easa.europa.eu/document-library/comment-response-documents>

<sup>7</sup> <http://easa.europa.eu/document-library/opinions>

<sup>8</sup> 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) (<http://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1478532925310&uri=CELEX:32012R0965>).



## 2. Explanatory Note

### 2.1. Issues to be addressed

TAWSs aim to prevent CFIT accidents, where a properly functioning aeroplane under the control of a fully qualified and certified crew is flown into terrain (or water or obstacles) with no apparent awareness by the crew. TAWSs have contributed to a reduction in the rate of accidents of these types.

#### 2.1.1 Issue 1

Enabled TAWSs significantly reduce the rate of accidents categorised as a CFIT. However, the Air OPS Regulation only requires this equipment for turbine-powered aeroplanes having an MCTOM in excess of 5 700 kg or an MOPSC of more than nine. This requirement has been inherited from Council Regulation (EEC) No 3922/91<sup>9</sup> (EU-OPS 1.665).

Following a fatal accident on 24 February 2004 involving a Cessna C-550, operated in CAT, the Italian 'Agenzia Nazionale per la Sicurezza del Volo' (ANSV) recommended to require such systems also for turbine-powered aeroplanes of less than 5 700 kg MCTOM that are able to carry six to nine passengers. The accident report states in particular that the accident would have had a low probability of occurrence if the aeroplane had been equipped with such a system.

In 2009, another accident, also in CAT, occurred in Germany involving a Piper aircraft that collided with the terrain, resulting in the death of the pilot. This accident, together with the one mentioned above, is considered relevant for this RMT even though no safety recommendation was addressed to EASA.

As for the aforesaid Italian accident, the related accident report also states that a TAWS would have reduced the probability of an accident occurrence. Additionally, the Flight Safety Foundation (FSF) refers in this report to the lack of a ground proximity warning system (GPWS) or TAWS as a factor affecting 'situational awareness and, therefore, terrain awareness'.

Whereas EASA Annual Safety Review 2014 shows CFITs as one of the causes that led to several accidents in 2013 (including fatal and non-fatal), the taxonomy of the EASA occurrence database does not allow to read the accident narratives when performing a search. It is, therefore, difficult to estimate the real number of accidents and incidents that could have been prevented using a TAWS. Indeed, only the two above-mentioned accidents, in Italy and Germany, appear when performing a search for the last 10 years. Another factor that contributes to this difficulty is the lack of in-flight recording systems in General Aviation (GA), resulting in inability to determine the cause of the accident in some cases.

The International Civil Aviation Organization (ICAO) recommends in its Annex 6, Part I, Section 6.15.5 that 'All turbine-engined aeroplanes of a maximum certified take-off mass of 5 700 kg or less and authorized to carry more than five but not more than nine passengers should be equipped with a ground proximity warning system which provides the warnings of 6.15.8 a) and c), warning of unsafe terrain clearance and a forward looking terrain avoidance function'. A similar provision exists in ICAO Annex 6, Part II, Section 2.4.11.2: 'All turbine-engined aeroplanes of a maximum certified take-off mass

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<sup>9</sup> Council Regulation (EEC) No 3922/91 of 16 December 1991 on the harmonization of technical requirements and administrative procedures in the field of civil aviation (OJ L 373, 31.12.1991, p. 4) (<http://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1480348874192&uri=CELEX:01991R3922-20120408>).



of 5 700 kg or less and authorized to carry more than five but not more than nine passengers should be equipped with a ground proximity warning system which has a forward looking terrain avoidance function'. Whereas these provisions were adopted by the Federal Aviation Administration (FAA) in the form of a requirement, they have not been introduced so far into the European Union (EU) rules. Indeed, Annex IV (Part-CAT) and Annex VI (Part-NCC) to the Air OPS Regulation only require this equipment for turbine-powered aeroplanes having an MCTOM of more than 5 700 kg or an MOPSC of more than nine, as well as to retrofit such equipment to engine-powered aeroplanes with an MCTOM of more than 5 700 kg or an MOPSC of more than nine.

In addition, it should be noted that this issue is included in the European Aviation Safety Plan (EASP) 2012-2015, under action item No AER3.6.

### 2.1.2 Issue 2

Although TAWS warnings have proven to be an effective mitigation of CFIT accidents, such systems rely on correct flight crew response, up-to-date terrain databases and software, as well as a source of information feeding into them. Outdated databases and deactivation of the software system, ignoring TAWS warnings, or an inappropriate response to those warnings can still put the aircraft at risk of an accident.

In the past, although pilots received ground proximity warning system (GPWS) warnings while flying in VFR, they may have considered that they could still clear the obstacle. In some cases, this led the pilots to assume that GPWSs generated false alarms. This second issue, therefore, is related to the lack of confidence of certain flight crews in the GPWS due to its use both in VFR and IFR.

After research performed by the FSF showing that pilots often delay in reacting to GPWS warnings, the UK CAA conducted a study (UK FODCOM 06/2007) revealing that GPWSs produce seven times more false and nuisance warnings than genuine hard warnings.

AMC3 ORO.MLR.100 to Annex III (Part-ORO) to the Air OPS Regulation contains the development of procedures for the use of TAWSs in the operations manual, but it does not make a distinction between VFR and IFR. In June 2008, a DHC6 aeroplane descended under the minimum sector altitude (MSA) to avoid flying into an active cloud while performing an instrument landing system (ILS) approach to the Pointe-à-Pitre airport. As a result of this incident, the French 'Bureau d'Enquêtes et d'Analyses (BEA) pour la Sécurité de l'Aviation civile' recommended EASA through SR FRAN-2009-009 to require operators to develop a policy and procedures for the use of TAWSs dependent on the flight rules.

TAWSs are a substitute for GPWSs. Updated information received from the industry shows that modern TAWSs are more reliable than old GPWSs, and that pilots tend to trust the former more. Nevertheless, it was only old GPWSs that generated a large amount of false alarms, which led pilots to often delay reactions to GPWS warnings and, in some cases, to ignore them. Additionally, the frequency of such situations without any visual reference to the ground is assumed to be extremely improbable.

## 2.2. Objectives

The overall objectives of the EASA system are defined in Article 2 of the Basic Regulation. This proposal will contribute to the achievement of the overall objectives by addressing the issues outlined in Chapter 2. The specific objective of this proposal is, therefore, to improve TAWSs efficiency in reducing CFIT accidents, maintaining a uniform and high safety level with cost-efficient rules.



### 2.3. Outcome of the consultation

After closing of the NPA 2015-21 consultation, and as already mentioned above, EASA received 34 comments from stakeholders, including industry and NAAs.

Whereas commenters generally support this rulemaking action, there was a request to further extend the requirement of installing TAWSs to non-commercial operators. However, this option was discarded due to proportionality issues regarding the GA. Three commenters, two of them representing NAAs, also requested retrofitting commercial aeroplanes with TAWSs, but the large cost of retrofit outweighed the minor safety benefit and, therefore, this option was also discarded. EASA, nevertheless, considering the benefits of this option, will be issuing a recommendation for all aeroplanes within the scope of the RMT to install the equipment on a voluntary basis.

The rest of the relevant comments were requests for clarification on the NPA, i.e. on how the options were selected, on the standards applicable to the equipment, the sources of data, the results of the survey, as well as on the applicability of the requirement to parachute operations.

### 2.4. Summary of the IA

Although it is considered that CFITs are still one of the main causes of accidents in Europe, data showed only two fatal CFIT accidents with aircraft within the scope of this RMT. This is the reason why it is considered that for all IA options, the safety impact would be very low.

Following the recommendation put forward by ICAO Annex 6, the FAA requires that aircraft within the scope of this RMT be equipped with at least a TAWS B. This could potentially justify why, even if it is not mandatory in Europe, all new aeroplanes within the scope of this RMT are fitted with a TAWS B (or A), and that a significant number of aircraft of the existing fleet have been retrofitted with a TAWS B (or A) or a non-certified terrain awareness capability (data collected by EASA in 2015 from manufacturers and operators). Moreover, this could explain the worldwide reduction<sup>10</sup> of CFIT accidents in the most recent years compared to the past, when aircraft were delivered without being fitted with this feature.

While studying the different options, a matrix was created to assess all possibilities. In analyzing all potential scenarios, similar results were delivered for some of them, which led EASA to consider the four final options:

- Option 0: ‘Do nothing’;
- Option 1: ‘Forward-fit TAWSs for commercial operations’;
- Option 2: ‘Forward-fit and retrofit TAWSs for commercial operations’; and
- Option 3: ‘Forward-fit and retrofit TAWSs for all operations’.

The favoured option of the RMG was Option 0, which implies no regulatory action. The RMG saw no case for action as all new aeroplanes are fitted with a TAWS B. The absence of TAWSs was only one of the causal factors for two accidents in a period of 10 years, which the RMG considered not providing enough safety risk, thus not justifying the mandate for action. Additionally, the terrain awareness capability is inherent in every typical avionics modernisation that operators may undertake (e.g. for

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<sup>10</sup> [http://lessonslearned.faa.gov/ll\\_main.cfm?TabID=3&LLID=43&LLTypeID=2](http://lessonslearned.faa.gov/ll_main.cfm?TabID=3&LLID=43&LLTypeID=2)

performance-based navigation (PBN) capability); therefore, although a TAWS is highly desirable, the RMG concluded that regulating its installation would only reflect a common practice already employed by industry and, in this context, no rulemaking action was considered necessary.

However, the arguments justifying the mandate's redundancy may on the contrary also justify the necessity of laying down a requirement for TAWSs installation as this would have no impact on newly manufactured aeroplanes performing commercial operations. On the other hand, establishing this requirement for aeroplanes performing non-commercial operations was considered to be overregulating and non-proportionate. Consequently, based on all the above and the result of the assessment of all impacts, Option 1 was the preferred option. Furthermore, this Option supports a practice already implemented by industry, possibly due to the FAA mandate, having only a very low economic impact.

By contrary, Option 1 would ensure through the new requirement that the operator maintains the functionality of a TAWS operative. In that case, there is a risk, although minor, that the operators decide not to repair the system and/or to deactivate it. Therefore, it could be questioned why EASA decided not to adopt a mitigation measure that has an almost non-existent cost-related impact, and not to establish a requirement that only mirrors an industry practice.

On the downside, the negative economic impact that would result from requiring both commercial and non-commercial aeroplanes within the scope of this RMT to be retrofitted with a TAWS B (Option 2 and Option 3) is not compensated by the safety benefit gained, especially for the GA, where those two Options are considered to be overregulating and non-proportionate. Therefore, for Options 2 and 3, it would be more appropriate to require in any case that an aeroplane be equipped with a terrain awareness capability that does not have to be specifically a TAWS B. This would differ from what is required by the FAA or recommended by ICAO, but it is justified by the fact that avionics available and fitted in existing aircraft have significantly improved compared to the TAWS specification considered when developing the relevant FAA and ICAO standards some years ago. However, this possibility was discarded because, as there is no definition of 'TAWS-like', there is no guarantee that this system will offer the same level of protection as a TAWS A or B. Additionally, old-fleet aircraft not equipped with a TAWS will retire in the forthcoming years, thus minimising the safety risk. Moreover, whatever type of TAWS is required, the transition period that would be needed to appropriately implement the requirement for existing aeroplanes would probably allow most of the aeroplanes not fitted with the system to retire, thus making this requirement unnecessary. Hence, Options 2 and 3 were not favoured.

For further detailed information on the IA, please refer to NPA 2015-21<sup>11</sup>.

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<sup>11</sup> <http://www.easa.europa.eu/document-library/notices-of-proposed-amendment/npa-2015-21>



## 2.5. Overview of the proposed amendments

The amendment to be introduced into Regulation (EU) No 965/2012 will require turbine-powered aeroplanes, performing commercial operations, for which the individual certificate of airworthiness (CofA) is first issued after 1 January 2019, having an MCTOM of 5 700 kg or less and an MOPSC of six to nine, to be equipped with a TAWS that meets the requirements for Class B equipment, as specified in any acceptable standard. To this end, a new requirement will be inserted in this regard into both CAT.IDE.A.150 and SPO.IDE.A.130.

Done at Cologne, on 15 December 2016

[signed by]

Patrick Ky

Executive Director



### 3. References

#### 3.1. Affected regulations

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)

#### 3.2. Related decisions

- 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 2014/018/R of the Executive Director of the Agency of 24 April 2014 adopting Acceptable Means of Compliance and Guidance Material to Part-SPO of Regulation (EU) No 965/2012 ‘AMC and GM to Part-SPO’

#### 3.3. Reference documents

- ICAO Annex 6, Part I ‘International Commercial Air Transport — Aeroplanes’ and Part II ‘International General Aviation — Aeroplanes’
- Italian ANSV Accident Investigation Report (OE-FAN 24/02/2004)
- German BFU Accident Investigation Report (BFU 3X004-09)
- Spanish CIAIAC Accident Investigation Report (A-07/1998)
- French BEA Accident Investigation Report (Nov2-I080628)



#### 4. Appendix

Appendix to Opinion No 15/2016 'TAWs operation IFR and VFR, and TAWs for turbine-powered aeroplanes of less than 5 700 kg MCTOM able to carry six to nine passengers' — CRD 2015-21

