



EUR 058-22/WG110-23  
RTCA Paper No. 047-22/SC237-020

Summary of the  
EUROCAE Working Group 110/ RTCA SC 237 (Meeting 12)  
Helicopter Terrain Awareness Warning Systems (HTAWS) for Onshore Operations

**DATE:** 1<sup>st</sup> – 3<sup>rd</sup> February 2022

**PLACE:** Webex

**CONTACT:**

Rebecca Morrison [RMorrison@rtca.org](mailto:RMorrison@rtca.org)

ATTENDEES:

The following people attended all or part of the webex:

Organisation	First name	Last name	Email address
Airbus Helicopters Deutschland GmbH	Dietmar	Kleinitz	<a href="mailto:dietmar.kleinitz@airbus.com">dietmar.kleinitz@airbus.com</a>
Airbus Helicopter USA	Paul	Dunlap	<a href="mailto:paul.dunlap@airbus.com">paul.dunlap@airbus.com</a>
Bell RTCA Chair	Michael	Deer	<a href="mailto:mdeer@bellflight.com">mdeer@bellflight.com</a>
Collins Aerospace	Philippe	Salmon	<a href="mailto:philippe.salmon@rockwellcollins.com">philippe.salmon@rockwellcollins.com</a>
EASA	Eric	Bennett	<a href="mailto:eric.bennett@easa.europa.eu">eric.bennett@easa.europa.eu</a>
EASA	Raffaele	Di Caprio	<a href="mailto:raffaele.dicaprio@easa.europa.eu">raffaele.dicaprio@easa.europa.eu</a>
EUROCAE	Sebastian	Reschenhofer	<a href="mailto:sebastian.reschenhofer@eurocae.net">sebastian.reschenhofer@eurocae.net</a>
FAA	Rich	Adler	<a href="mailto:Richard.Adler@faa.gov">Richard.Adler@faa.gov</a>
Honeywell	Darin	Fala	<a href="mailto:Darin.Fala@honeywell.com">Darin.Fala@honeywell.com</a>
Honeywell EUROCAE Chair	Yasuo	Ishihara	<a href="mailto:yasuo.ishihara@honeywell.com">yasuo.ishihara@honeywell.com</a>
Honeywell	Jim	Mulkins	<a href="mailto:jim.mulkins2@honeywell.com">jim.mulkins2@honeywell.com</a>
Honeywell	Gary	Ostrom	<a href="mailto:gary.ostrom@honeywell.com">gary.ostrom@honeywell.com</a>
Leonardo	Luca	Savino	<a href="mailto:luca.savino@leonardocompany.com">luca.savino@leonardocompany.com</a>
RTCA	Rebecca	Morrison	<a href="mailto:RMorrison@rtca.org">RMorrison@rtca.org</a>
Saab	Mikaela	Lokatt	<a href="mailto:mikaela.lokatt@saabgroup.com">mikaela.lokatt@saabgroup.com</a>
Saab	Stefan	Blom	<a href="mailto:stefan.blom@saabgroup.com">stefan.blom@saabgroup.com</a>
Sikorsky	Bob	Endrizzi	<a href="mailto:robert.j.endrizzi.jr@lmco.com">robert.j.endrizzi.jr@lmco.com</a>
Sikorsky	John	Judge	<a href="mailto:john.h.judge@lmco.com">john.h.judge@lmco.com</a>
Sikorsky	Jared	Kloda	<a href="mailto:jared.r.kloda@lmco.com">jared.r.kloda@lmco.com</a>
Sikorsky	Steve	Schellberg	<a href="mailto:steve.schellberg@lmco.com">steve.schellberg@lmco.com</a>
Thales	Stephane	Fleury	<a href="mailto:stephane.fleury@fr.thalesgroup.com">stephane.fleury@fr.thalesgroup.com</a>
Transport Canada Civil Aviation	Travis	Brooks	<a href="mailto:travis.brooks@tc.gc.ca">travis.brooks@tc.gc.ca</a>
UK CAA	Dave	Howson	<a href="mailto:dave.howson@caa.co.uk">dave.howson@caa.co.uk</a>
UK CAA EUROCAE Secretary	Mark	Prior	<a href="mailto:mark@mpriorconsulting.com">mark@mpriorconsulting.com</a>

## 1 Introductions

Mike Deer welcomed everyone to the meeting.

### 1.1 Announcements

Mike Deer announced the sad death of 2 members of the Committee.

#### Erik Oltheten

Erik had been a member of the Committee since the first meeting in 2018. He had provided valuable inputs on a number of topics and especially around defining the Mode 7 envelopes. His ready wit and technical insight will be missed by the Committee.

#### Harold Summers

Harold had represented the Helicopter Association International (HAI) over many sessions. His welcome assistance to the Committee had supported HAI's goal of improving safety in the rotorcraft industry.

### 1.2 Changes to the Committee

Gary Ostrom announced that he was leaving Honeywell but hoped to be involved in future meetings. Gary had been a member of the Committee from the outset and was thanked for his valuable support.

## 2 IPR/Membership Callouts and Introductions

Rebecca Morrison (RM) showed the mandatory slides which explain the obligations of members and covered administrative aspects of the meeting. Sebastian Reschenhofer was not present at the start of the meeting, so Rebecca stated that EUROCAE placed similar obligations on members.

## 3 Previous Meeting Minutes

Actions arising from the previous meetings were discussed. The Minutes from Meeting 11 were accepted with minor changes.

### Actions from Meeting 11

Action Reference	Action	By Whom	By Date
11.2	To produce a presentation on the issues associated with implementing a FLTA Mode.	Saab	Closed – presentation on agenda
11.3	All airframe OEMs to review the ED-285/DO-376 Mode 1 Caution	Airframe OEMs	Open

	and Warning Envelopes against their product performance.		
11.4	All airframe OEMs to review the ED-285/DO-376 Mode 3 Envelopes against their product performance and certified take-off profiles.	Airframe OEMs	Open
11.5	Sikorsky to review Mode 7A/B and Mode 1 alerting for presenting at the next meeting.	Sikorsky	Closed – presentation on agenda
11.6	The Group to review the available accident data and assess the benefits of the alert envelopes.	All Group Members	Open

Note: The Minutes are recorded by topic and not necessarily in a chronological order.

#### **4 Discussion on Possible Improvements to FLTA Mode/DO-309**

##### **4.1 FAA Programme**

Rich Adler (FAA) gave a presentation on the FAA Alaska and Proximate Terrain Ops Safety Project. This work is based on Automatic Ground Collision System (Auto-GCAS). The system uses technologies where NASA owns the IPR and data.

One of the proposals in the presentation was for a new Class D/ GCAS system for fixed-wing aircraft providing lateral escape manoeuvres. This is highly relevant for helicopter onshore operations, where a vertical climb into IMC is often not a valid option due to terrain, airspace or icing restrictions. Class D/ GCAS would require revised MOPS, TSO and inclusion in the Operational regulations. It is also expected that the addition of lateral escape manoeuvres will help to reduce nuisance alerts.

##### **Action 12.1**

**FAA (Rich Adler) to provide a copy of the presentation slides.**

**Date: Copy provided 2 Feb 2022 - Closed**

Rich Adler informed the Group that Mark Skoog had previously worked for NASA on the GCAS project and was now an independent consultant; he would be a reliable source of information on the system. Yasuo Ishihara asked if there would be any costs or access issues obtaining any data associated with GCAS.

#### **Action 12.2**

**FAA (Rich Adler) to clarify with NASA if there would be any costs or access restrictions concerning any GCAS data.**

**Date: By next meeting**

#### **4.2 SAAB FLTA Presentation**

Mikaela Lokatt (SAAB) gave a presentation titled, Enabling Nuisance Free CFIT Protection in Low Level Operations. The presentation noted that civil TAWS using a FLTA function are suited to operations near to airports, but low-level operations away from airports result in a high nuisance alert rate. There are current military systems which are designed for low level operations and do not produce an unacceptable level of nuisance alerts. Mikaela identified the potential use of advanced algorithms to reduce nuisance alerts but noted that the aircraft position and terrain data source both need to be sufficiently accurate.

Presenting the TAWS data to the flight crew, along with the reliability of that data, needs to be considered as part of the system design.

#### **Action 12.3**

**SAAB (Mikaela Lokatt) to provide a copy of the presentation slides.**

**Date: Copy provided 1 Feb 2022 - Closed**

Mikaela offered to review the FLTA function and GCAS at the requirements level.

#### **Action 12.4**

**SAAB (Mikaela Lokatt) to review the FLTA function and Auto-GCAS at the requirements level and report at the next meeting.**

**Date: At next meeting**

#### **4.3 Terrain Database**

A discussion followed on the requirements for an accurate terrain database, with sufficient resolution, to provide a timely warning whilst minimising nuisance alerts. Members noted

that the aircraft position accuracy was also important, which can be difficult to achieve using GPS alone in masked terrain or higher latitudes.

#### **4.4 Work to Update DO 309**

The Group discussed how improvements to the DO 309 MOPS could be proposed, whilst still respecting the current TORs. It was agreed that work on identifying improvements to the FLTA function and DO 309 could continue in parallel with the primary task of defining onshore GPWS MOPS.

A number of points were discussed. The work of the Data Alteration Group (EUROCAE WG 44/RTCA SC217) should be monitored as they are shortly to update DO 200 Rev C. Database resolution was discussed and it was noted that DO 309 does not currently contain any accuracy or resolution requirements, merely stating that “*the manufacturer shall demonstrate that the accuracy and resolution of the terrain and obstacle database is suitable for the intended operation*”. Yasuo Ishihara informed the group that there was a hook to a Reduced Protection Mode in DO 309 (2.2.2.4 e) which could be utilised to reduce nuisance alerts. It was accepted that the aim should be to define a combination of onshore GPWS and FLTA functions which optimise the warning envelopes whilst constraining nuisance alerts to an acceptable level. It was generally agreed that a GCAS type system providing lateral avoidance guidance was the optimum solution. It was also agreed that GCAS should be a separate optional function (not modifying the existing FLTA requirements) within the HTAWS MOPS.

Rebecca Morrison advised that if the Group felt it necessary, the TORs could be updated to take account of any additional tasks not fully covered by the current scope of work. The delivery timescale for any suggested improvements to the FLTA function and DO 309 could be extended beyond the delivery date for the GPWS modes in 2023.

## **5 Review of GPWS Modes**

### **5.1 Mode 1**

In response to Action 11.3, Bob Endrizzi (Sikorsky) presented a comparison between the legacy Mode 1 Envelope and the ED-285/DO-376 Mode 1 Envelope using S92 operational

flight data. The legacy Mode 1 Envelope is conservative and would provide a late warning in many cases. However, the ED-285/DO-376 Mode 1 Envelope generated a large number of nuisance alerts when applied to onshore operational flight data. Steep onshore approaches were not compatible with the ED-285/DO-376 Envelope as the nuisance alert rate would be high. Certified LPV approaches can result in a 9° approach angle with a rate of descent of circa 1200 ft/min. A discussion then followed on whether a variable Mode 1 Envelope could be developed, which would be modified for steep autopilot-coupled approaches. Another suggestion was to inhibit Mode 1 when Mode 5 was active, as FLTA can provide a high rate of descent alert. Dave Howson reminded the Group that pilot reaction time needs to be taken into account when setting an alert envelope.

Note: This closes Action 11.3 for Sikorsky, but the Action is still open for the other airframe manufacturers.

## **5.2 Mode 3**

Sikorsky confirmed that the ED-285/DO-376 Mode 3A and 3B Envelopes did not conflict with the S92 Flight Manual profiles.

Steve Schellberg asked whether an alert should still be issued if the pilot had made a corrective action but was still inside the alert envelope. For example, a Don't Sink Caution could still be generated whilst the aircraft was climbing, thereby confusing the crew. An action was placed on the Group to review this question.

### **Action 12.5**

**All to review when an alert should be inhibited, after a correction has been made by the pilot, but the aircraft is still inside the alert envelope.**

**Date: By next meeting**

The data presented for Modes 1 and 3 were very helpful. As the S92 is used predominantly in the offshore role, Bob Endrizzi agreed to investigate if S76 data was available for a similar analysis. The S76 is more widely used in the corporate and HEMS roles and so could provide representative onshore data.

## **Action 12.6**

**Sikorsky (Bob Endrizzi) to identify if S76 data is available for analysis.**

**Date: By next meeting**

Note: This closes Action 11.4 for Sikorsky, but the Action is still open for the other airframe manufacturers.

## **6 Mode 7A**

Bob Endrizzi displayed a number of slides which the Group had viewed at previous meetings. These showed when the CAP 1519 Mode 7 Cautions would have been activated.

There was general agreement that Mode 7A could be implemented for onshore operations but would need to use a variable envelope, tailored to aircraft performance, due to the large variation in aircraft mass, pressure altitude and temperature encountered during onshore operations.

## **7 Update on UK CAA HTAWS Implementation Plans**

Dave Howson provided an update on UK CAA activity to implement improved Offshore HTAWS. He thanked the OEMs for their responses but noted that some had not replied to his request for information on their timescales and costs for implementing the CAP 1519 and ED-285/DO-376 Envelopes. Based on the replies received, the CAA has prepared an Impact Assessment, which was with their Better Regulation Unit for review. The documentation for the Rule change will be sent to the Department of Transport and, all being well, the mandate will be issued in December 2022. The intended implementation date for the updated Modes 1-6 will be 1<sup>st</sup> January 2024; these can be either CAP 1519 or ED-285/DO-376 compliant. Mode 7A will be required from 1<sup>st</sup> January 2025 and 'new' HTAWS installations will need to be ED-285/DO-376 compliant from this date. This change will be effected through an update to regulation SPA HOFO 160(C).

Some OEMs expressed a concern that the timescales were too tight and would result in additional costs to the helicopter operators, as the updates would have to take place



outside the planned software and equipment upgrade cycles. Dave Howson stated that the proposed scheme was intended to be fully consistent with the replies received from OEMs to the consultation. He added that he would be replying to each OEM individually (due to the commercially sensitive nature of the information), responding to the OEMs' comments and outlining the CAA's proposed scheme. This will provide an opportunity to correct any misunderstandings and to comment on the CAA's proposal.

Mike Deer expressed a concern that the UK CAA was going against the consensus of the Group by requiring the implementation of Mode 7A. Dave Howson stated that the case for requiring Mode 7A in the UK was very strong and the UK CAA had a number of Air Accident Investigation Branch Safety Recommendations which had to be resolved. He added that, from the CAA's perspective, the UK is simply taking up the option of Mode 7A and is not changing the MOPS. He considered this to be similar to the suggestion to include GCAS functionality as an option in DO-309 which is then available for regulators to adopt as and where appropriate.

## **8 Future GPWS Work**

Yasuo Ishihara identified future tasks on updating Onshore GPWS Modes.

### **Mode 1**

The envelope will require updating for onshore use. Awaiting information from Action 11.3

### **Mode 2**

No change or can be deleted. Dave Howson noted that Mode 2 should be available as an option for use when FLTA functionality is not available.

### **Mode 3**

Awaiting information from Action 11.4.

### **Mode 5**

Currently no change. Including LPV approaches alongside ILS approaches would be advantageous.

### **Mode 6**

Possible action to remove the fixed callouts which are viewed by some as nuisance alerts. Onshore operations are not required to have fixed callouts, which some regulatory regimes mandate for offshore operations.

### **Mode 7**

Mode 7A might need a revision as it is designed to provide a Caution when deviating from a stabilised offshore approach. Mode 7B will not require a change as it warns of a Vortex Ring State which is always undesirable.

### **8.1 Correction**

It was pointed out that the ED-285/DO-376 MOPS contained an error in Figure 3-9 showing an incorrect Caution Envelope for Mode 4A, where the indicated envelope was misaligned with the numeric values. Rebecca Morrison explained the RTCA process for making a minor change and said that EUROCAE followed a similar process.

- The Meeting agreed to issue DO 376 Change 1 with a corrected Figure 3-9.
- A change to the TORs was agreed, which will be submitted to the PMC for off-cycle approval.
- It was agreed that an OC/Frac could be initiated once a ballot is run with the pages that will be presented for Change 1.
- Once the ballot is approved without objection, and the PMC approves the TOR update, the FRAC/OC will be initiated. The planned FRAC/OC date is 14<sup>th</sup> February 2022 – 31<sup>st</sup> March 2022.
- ~~Forty five days later~~ After the commenting period, a plenary session can close the FRAC/OC.
- Approved publication of the change can take place at the next plenary session, after resolving any comments.

Rebecca was due to meet Sebastian Reschenhofer and would discuss the required EUROCAE action.

After Meeting Note: Rebecca Morrison provided an updated TOR covering this action. It was accepted by the Co-Chairs.

## 9 Dates and Location of Future Meeting

It was decided that the next meeting would take place 26<sup>th</sup>-28<sup>th</sup> April 2022. Currently the plan is to meet virtually, but this decision will be reviewed by the Co-Chairs closer the date. The next in-person meeting can

## 10 Any Other Business

Nil

## 11 Close

The meeting closed on the 3<sup>rd</sup> February 2022.

## 12 Decisions and Actions

The following actions were raised during the meeting:

Action Reference	Action	By Whom	By Date
12.1	Provide a copy of the GCAS presentation slides.	FAA (Rich Adler)	Closed
12.2	Clarify with NASA if there would be any costs or access restrictions concerning any GCAS data.	FAA (Rich Adler)	By next meeting
12.3	Provide a copy of the FLTA presentation slides.	SAAB (Mikaela Lokatt)	Closed
12.4	Review the FLTA function and GCAS at the requirements level and report at the next meeting.	SAAB (Mikaela Lokatt)	At next meeting
12.5	Review when an alert should be inhibited, after a correction has been made by the pilot, but the aircraft is still	All Group Members	By next meeting

	inside the alert envelope.		
12.6	Identify if S76 data is available for analysis	Sikorsky (Bob Endrizzi)	By next meeting

The following actions are still outstanding from Meeting 10

Action Reference	Action	By Whom	By Date
11.3	All airframe OEMs to review the ED-285/DO-376 Mode 1 Caution and Warning Envelopes against their product performance.	Airframe OEMs	By next meeting
11.4	All airframe OEMs to review the ED-285/DO-376 Mode 3 Envelopes against their product performance and certified take-off profiles.	Airframe OEMs	By next meeting
11.6	The Group to review the available accident data and assess the benefits of the alert envelopes.	All Group Members	By next meeting

Mark Prior

Secretary, SC 237/WG-110