SAFETY REGULATION GROUP

# FLIGHT CREW TRAINING NOTICE

**06/2009**

**Applicability:** **RETRE, TRIE, TRE, SFE, TRI, SFI**

**Effective:** **Immediate**

## AIRBORNE COLLISION AVOIDANCE SYSTEM (ACAS) TRAINING

1 The purpose of this Flight Crew Training Notice (FCTN) is to highlight the training the International Civil Aviation Organization (ICAO) considers desirable for crews to gain optimum understanding of the theoretical aspects of ACAS operation and maximum operating skill in understanding and responding to ACAS indications.

2 During the implementation of ACAS several operational issues were identified that were attributed to deficiencies in pilot training programmes. To address these deficiencies the Appendix to this FCTN details a set of performance based training objectives for ACAS pilot training. The training objectives cover the following:

- Theory of operation.
- Pre-flight operations.
- General in-flight operations.
- Response to Traffic Advisories (TA).
- Response to Resolution Advisories (RA).

3 Any queries as a result of this FCTN should be addressed to Manager Flight Crew Standards at the following e-mail address: trainingstandards@caa.co.uk.

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**Manager Flight Crew Standards**

**26 October 2009**

**Source Reference:** ICAO Doc 9863 Airborne Collision Avoidance System (ACAS) Manual, Chapter 5.

**Publications affected:** None applicable.

**Review: March 2010**

**APPENDIX**

**PERFORMANCE BASED TRAINING OBJECTIVES FOR ACAS PILOT TRAINING**

## 1 Training Objectives

1.1 The training objectives should cover the following:

- Theory of operation.
- Pre-flight operations.
- General in-flight operations.
- Response to TAs.
- Response to RAs.

1.2 These training objectives are further divided into:

- Academic training.
- Manoeuvre training.
- Initial training.
- Recurrent training.

## 2 Academic Training

2.1 This training is typically conducted in a classroom using both computer-based training (CBT) aids and ACAS documentation. The required level of knowledge should be confirmed by means of a written test or interactive CBT questions.

2.2 **Theory of Operation**

The pilot must demonstrate an understanding of the following:

- Surveillance – the range of interrogation by the ACAS of other transponder equipped aircraft. The maximum range of surveillance may be reduced by large numbers of ground interrogators and/or ACAS-equipped aircraft to as little as 4.5 NM.
- Collision avoidance:
    - What influence the modes of transponder have on the TA presentation.
    - When an RA will only be issued against aircraft that are reporting altitude and only in the vertical plane.
    - How an RA against an ACAS-equipped intruder is co-ordinated to ensure complementary RAs are issued.
    - When the failure to respond to an RA deprives the aircraft of the collision protection provided by the ACAS equipment. Additionally during a co-ordinated RA encounter the failure of one aircraft to manoeuvre in accordance with the RA renders the other aircraft's ACAS less effective than if the first aircraft were not ACAS-equipped.
    - When manoeuvring in a direction opposite to that indicated by an RA is likely to result in further reduction in separation. This is particularly true in the case of a co-ordinated RA encounter.
- Advisory thresholds:
    - A knowledge of the criteria for the issue of TAs and RAs.
    - How ACAS advisories are based on time to Closest Point of Approach (CPA) rather than distance.
    - When separation standards provided by Air Traffic Control (ATC) are different from those against which ACAS issues alerts.
    - The thresholds for issuing a TA or RA vary with altitude. The thresholds are larger at higher altitudes.

  - How RAs are chosen to provide the desired vertical separation at CPA. As a result, RAs can instruct a climb or descent through the intruder aircraft's altitude.

- The limitations of the ACAS equipment:
  - ACAS will neither track nor display aircraft that are not equipped with a transponder, have an inoperable transponder or have a Mode A transponder.
  - A knowledge of which aircraft system or instrumentation failures will lead to the automatic failure of the ACAS.
  - Due to limited azimuth resolution, the bearing information displayed by ACAS is not sufficiently accurate to support the initiation of horizontal manoeuvres based solely on the traffic display.
  - That stall warning, Terrain Awareness Warning System (TAWS) and wind shear warnings take precedence over ACAS advisories. When a TAWS or wind shear warning is active the ACAS will automatically switch to TA-only mode with the aural annunciation inhibited.
  - ACAS will neither display nor give alerts against intruders with a vertical speed in excess of 10,000 feet per minute, for example rapidly climbing or descending military aircraft.
  - ACAS may not display all proximate traffic in areas of high-density traffic.
  - Some aircraft within 380 feet Above Ground Level (AGL) may not be displayed.
- The conditions under which certain functions of ACAS are inhibited:
  - Heights above the ground at which various RAs are inhibited.
  - Heights above the ground at which all aural annunciations are inhibited.
  - Altitudes and configurations under which climb and increase climb RAs are inhibited. Manoeuvring in the required sense of the RA, even when the aeroplane performance is not sufficient to satisfy full compliance with the climb rate required by the RA, will still reduce the risk of collision.

### 2.3 Operating Procedures

The pilot must demonstrate the knowledge required to operate ACAS and interpret the information presented by ACAS. The training should achieve the following:

- Enable the pilot to correctly operate the ACAS controls:
  - Use of the self-test function.
  - Use of the traffic display range selection depending on the air traffic environment and its use to reduce the display range to increase display resolution when an advisory is issued.
  - Recommended use of the 'Above/Below' mode selector during climbs and descents.
  - If available, the proper selection of the display of absolute or relative altitude and the associated limitations
- Enable the pilot to correctly interpret the information displayed by ACAS:
  - Other and proximate traffic.
  - Non-altitude reporting traffic.
  - No bearing TAs and RAs.
  - Off-scale TAs and RAs.
  - RAs – information displayed on the traffic display and the meaning of the red and green areas on the RA display.
  - Knowledge of when the green areas will and will not be displayed.
  - An understanding of the RA display limitations, i.e. if a vertical speed tape is used and the range of the tape is less than 2,500 feet per minute, how an increase rate RA will be displayed.
  - How a 'Track Up' display will require the pilot to make a mental adjustment for drift when assessing relative bearing of a potential threat.

- Ensure that the pilot has an understanding of the use of TA-only mode including:
  - A knowledge of the operator's guidance for the use of TA-only mode.
  - The reason for using this mode and situations in which its use may be desirable.
  - That TA aural annunciations are inhibited below 500 feet AGL.
- Ensure that pilots know the combined crew actions when responding to TAs and RAs including:
  - Crew duties when a TA is issued.
  - Crew duties and call-outs when responding to an RA with a clear definition of who will fly the aircraft during a response to an RA.
  - When in receipt of simultaneous and conflicting instructions to manoeuvre from ATC and an RA, the RA is followed and ATC are notified using the standard phraseology.
  - Communications with ATC during an RA.
  - Conditions under which an RA will not be followed and who will make that decision.
- Ensure that pilots are aware of the requirements for reporting an RA to ATC and other authorities.

**3 Manoeuvre Training**

3.1 The training of pilots to correctly respond to ACAS displayed information is best conducted in a full flight simulator equipped with ACAS. The simulator should have controls and displays that are similar in appearance and operation to those in the aircraft.

3.2 If the operator does not have access to an ACAS-equipped simulator, the initial training should be conducted by means of interactive CBT. The ACAS display and controls should be similar to those on the aircraft the pilot will fly. The interactive CBT display should display scenarios in real time. The pilot must be able to identify when the correct response has been made and what response should have been made following an incorrect response.

3.3 The manoeuvre training should cover a broad variety of scenarios so that the crews can experience the full capability of the ACAS equipment. This training should also include demonstrations of the consequences of slow or late response, and manoeuvring in opposition to the direction of the displayed RA.

- TA response:
  - The division of duties between the pilot flying and the pilot monitoring.
  - The proper interpretation of the displayed information – bearing, range, data tag and trend arrow.
  - The visual search for the traffic causing the TA.
  - Not to manoeuvre solely based on the ACAS displayed information due to azimuth resolution limitations.
  - When visual acquisition is attained, the right of way rules used to maintain or attain safe separation.
  - To ensure that no unnecessary manoeuvres are initiated and that the limitations of making manoeuvres based solely on visual acquisition are understood.
- RA response:
  - The division of duties between the pilot flying and the pilot monitoring.
  - The proper interpretation of the displayed information.
  - For an RA response requiring a change in vertical speed, it is initiated in the correct direction within five seconds of the RA being displayed.
  - For increase rate, reversal, weakening and strengthening RAs the vertical speed modification or reversal manoeuvre is initiated within two and a half seconds of the RA being displayed.
  - The recognition of altitude crossing encounters and the proper response to these RAs.

- For RAs that do not require a change in vertical speed, the vertical speed needle or pitch angle remains outside the red area of the RA display.
- For maintain rate RAs, the vertical speed is not reduced. Pilots should recognise that a maintain rate RA may result in crossing through the intruder's altitude.
- If a justified decision is made not to follow an RA, the resulting vertical rate is not in a direction opposite to the sense of the displayed RA.
- The deviation from the current clearance is minimised by levelling the aircraft when the RA weakens or when 'Clear of Conflict' is annunciated and a prompt return to the current clearance is executed.
- When possible an ATC clearance is complied with while responding to an RA. For example, if the aircraft can level at the assigned altitude while responding to a reduce climb or reduce descent RA, it should be done.
- A knowledge of the ACAS multi-aircraft logic and that ACAS can optimise separation from two aircraft by climbing or descending towards one of them.
- A prompt response is made when a climb RA is issued at the aircraft's maximum altitude, even if the rate of climb demanded cannot be achieved.

## 4 Initial Training

4.1 The pilot's understanding and competence in the operation of ACAS should be checked in a full flight simulator equipped with an ACAS display and controls that are similar to those in the aircraft the pilot will fly. The simulator should be able to generate a range of scenarios that include:

- Initial RAs requiring a change in vertical speed.
- Initial RAs that do not require a change in vertical speed.
- Maintain rate RAs.
- Altitude crossing RAs.
- Increase rate RAs.
- RA reversals.
- Weakening RAs issued while the aircraft is at the maximum altitude.
- Multi-aircraft RA encounters.

4.2 If an operator does not have access to an ACAS-equipped full flight simulator then the pilot's understanding and competence in the operation of ACAS should be checked using interactive CBT with an ACAS display and controls similar in appearance and operation to those in the aircraft the pilot will fly. The CBT should include all types of RAs in paragraph 4.1 above.

## 5 Recurrent Training

5.1 ACAS recurrent training ensures that pilots maintain the appropriate knowledge and skills in the operation of ACAS. The recurrent training should be integrated into and/or conducted in conjunction with other established recurrent training programmes.

5.2 The recurrent training should include significant issues and operational concerns that have been identified by the operator.

5.3 Recurrent training should include both academic and simulator manoeuvre training and address any significant issues identified by line operations, equipment or procedural changes or operations in airspace where high numbers of TAs and RAs have been reported.

5.4 ACAS monitoring programmes periodically publish findings from the analyses of ACAS events. The results of these analyses typically discuss technical and operational issues and are therefore a good source of information that should be included in the planning of the recurrent training.

5.5 Where recurrent training is conducted in a simulator, pilots should fly all the RA scenarios listed in paragraph 4.1 above over a four-year period.

5.6 Where recurrent training is conducted using CBT, pilots should fly all the RA scenarios listed in paragraph 4.1 above over a two-year period.