# Safety Letter

# Airborne Collision Avoidance System - ACAS

## ACAS/TCAS

Airborne collision avoidance systems are designed to improve safety by acting as a ' last resort ' method of preventing mid air collisions by recommending pilots to manoeuvre in the **vertical plane** when a risk of collision is detected.

The concept for an airborne collision avoidance system, which is independent from ATS systems emerged in 1955. In the early 1980s ICAO started work on the development of standards for an **"Airborne Collision Avoidance System" (ACAS).** The definition is found in the ICAO Annex 10, Volume IV.

The US FAA made a decision in 1981 to develop and introduce a collision avoidance system capable of recommending evasive manoeuvres in the vertical plane to cockpit crew. This system is called **"Traffic Alert and Collision Avoidance System" (TCAS).**

Today "TCAS II v.7.0" offers the same functionality as ICAO has specified in SARPS for an "ACAS II".

**ACAS II**

### ACAS II can issue two types of advisories:

- **Traffic Advisory (TA).** TAs warn flightcrew to be ready for a potential **Resolution Advisory** and for helping the crew visual search for the intruder aircraft. The TA is triggered between 20 and 48 seconds before closest point of approach (CPA).
- **Resolution Advisory (RA).** RA is an advisory to the flightcrew to execute avoidance manoeuvres in the **vertical plane** activated between 15 and 35 seconds before CPA.



## Editorial

It is now well proven that ACAS offers significant safety benefits. For example in a situation where two aircraft are equipped with ACAS **and both pilots follow their RAs**, the risk of collision is reduced by a factor of 25.

The number of RAs has increased significantly in the last two years in Europe. This is a result of increased ACAS availability as airlines comply with the ACAS mandatory carriage applicable as from 1 January 2000, the continued traffic growth and airspace changes introduced for the implementation of RVSM.

It is therefore imperative to ensure that the operations of the ACAS safety net continues to be fully compatible with the ATM environment as it will change to become more efficient and respond to the demand.
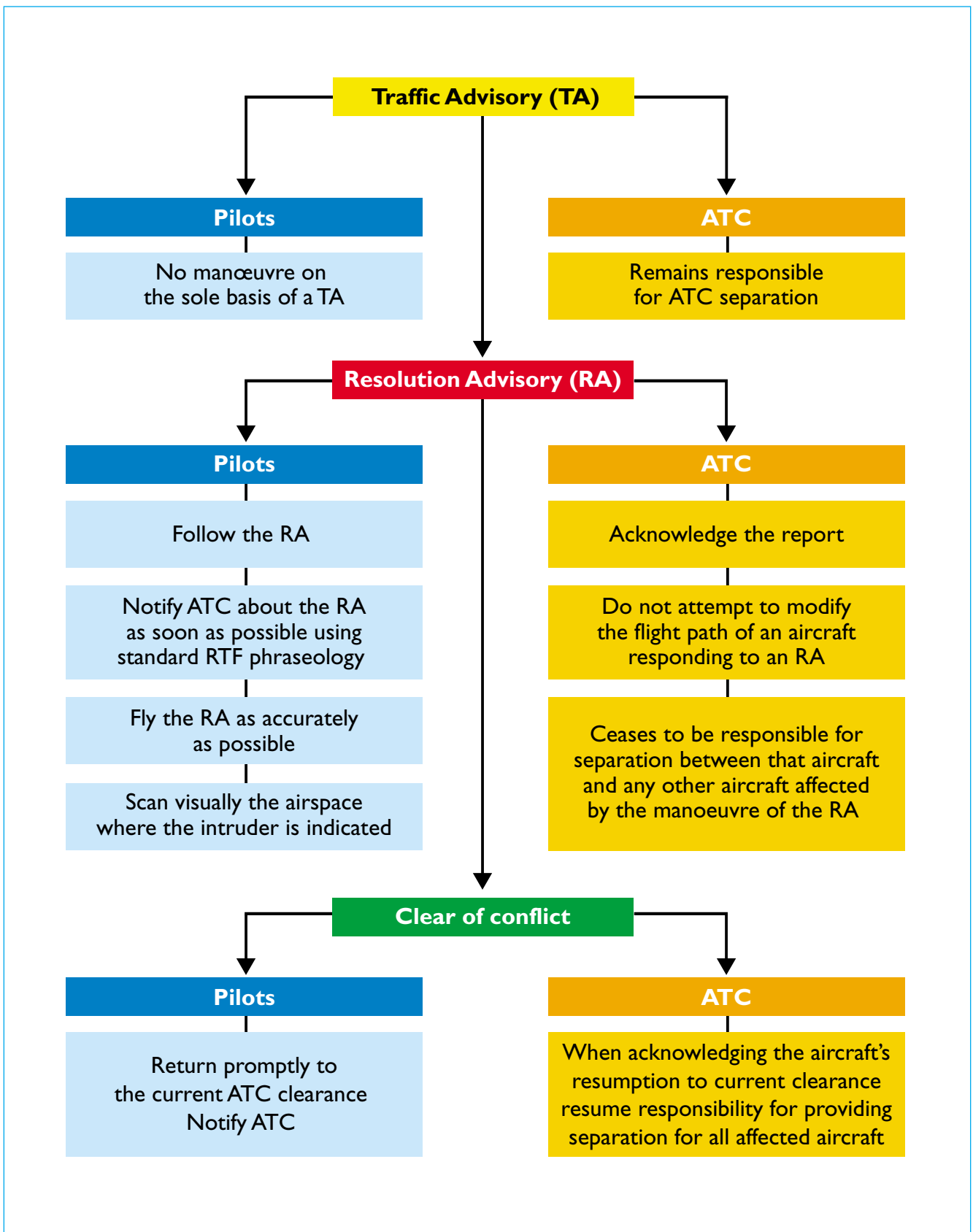
Accordingly, EUROCONTROL conducted four regional seminars aimed at gathering expert experience from Airlines and ANSPs. Recommendations were made during these workshops to improve ACAS usage and 4 areas for improvement of ACAS operations across Europe were also identified:

- Training of pilots and controllers
- Monitoring and Reporting
- ACAS/RVSM interactions
- Military interception

The findings of these seminars are set out in this issue of the EUROCONTROL Safety Letter with the objective of raising awareness across the ECAC area in order to maximise the safety benefit provided by the operation of ACAS.

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# Interaction ATC and Pilots during an ACAS event

**Traffic Advisory (TA)**

| Pilots | ATC |
|---|---|
| No manœuvre on the sole basis of a TA | Remains responsible for ATC separation |

**Resolution Advisory (RA)**

| Pilots | ATC |
|---|---|
| Follow the RA | Acknowledge the report |
| Notify ATC about the RA as soon as possible using standard RTF phraseology | Do not attempt to modify the flight path of an aircraft responding to an RA |
| Fly the RA as accurately as possible | Ceases to be responsible for separation between that aircraft and any other aircraft affected by the manoeuvre of the RA |
| Scan visually the airspace where the intruder is indicated | |

**Clear of conflict**

| Pilots | ATC |
|---|---|
| Return promptly to the current ATC clearance Notify ATC | When acknowledging the aircraft's resumption to current clearance resume responsibility for providing separation for all affected aircraft |

## *Inappropriate Response to RAs Seriously Degrades ACAS Safety Benefits*

# Appropriate response to RAs

Aircraft Operators should strongly encourage pilots to follow RAs whilst explaining ACAS constraints and limitations.

Pilots should be made aware of:

- the potential benefits of reducing rates of climb/descent when approaching their cleared Flight Levels;
- the importance of telling ATC that they are following an RA as soon as possible.

Finally, it should be made clear to pilots that ACAS traffic display is not designed as a means to maintain separation.

Air Navigation Service Providers should make controllers aware of the importance of not interfering with a manoeuvre in response to an RA.



## ACAS Implementation Monitoring

### The monitoring should be continued

- To identify ACAS/ATC compatibility problems: a high incidence of RAs at specific locations may indicate a potential airspace design or safety issue;
- To monitor ACAS system performance;
- To monitor specific technical issues.

## ACAS Training

### ACAS Training should be reinforced for both Pilots and Controllers

- ACAS should be included for both ab initio and continuation training;
- Training for ATCOs and pilots should ensure that the responsibilities of pilots and ATCOs are made clear during an RA event;
- Training should be delivered to civil and military pilots and ATCOs.

### Available Training Material & Tools

- ICAO - ACAS Performance-Based Training Objectives.
- JAA TGL11 - Guidance for Operators.
- ACAS Training Brochure (Eurocontrol ACAS Programme).
- ACAS Operator in the European RVSM Environment (Eurocontrol ACAS Programme).
- RITA (Replay Interface of TCAS Advisories).
  RITA is a dynamic graphical tool showing TCAS occurrence from both pilots and controllers perspective. Available on www.eurocontrol.int/acas
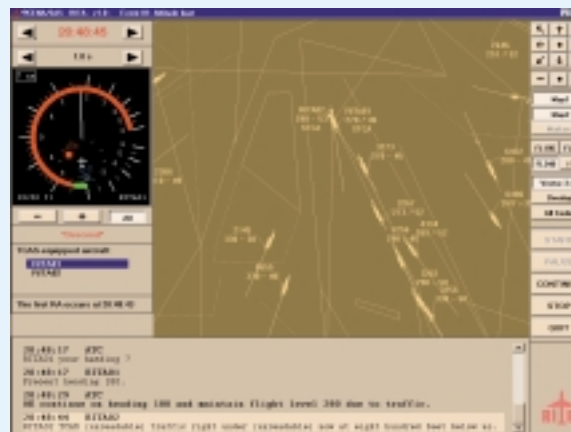
## ACAS and RVSM

TCAS V6.04a, despite its safety benefits, is incompatible with RVSM operations as it generates an increase in nuisance TAs and RAs. Aircraft Operators whose aircraft are TCASII equipped but not subject to ACASII equipage are recommended to equip their aircraft with TCAS V7.0 as soon as possible.



- Interim assessments by the ACAS Programme, since the implementation of RVSM, have not indicated any evidence to suggest that TCAS is generating any major problems within RVSM airspace. The improved height keeping performance of RVSM approved flights is beneficial to ACAS performance.
- Within RVSM airspace, unless there are differing instructions within National AIPs, aircraft should climb/descend in accord with normal flight profiles except when approaching the cleared flight level.

- ICAO is developing guidance material in order to prevent unnecessary RAs associated with high vertical rates. The guidance will advise pilots that when traffic information is provided by ATC the rate of climb or descent should be less than 1500 ft per min when approaching 1000ft above or below the cleared flight level

## Military Interception

Implement recommendations of ICAO State Letter AN13/38. OPEN-01/114 (21 November 2001). Reiterated advice to civil and military authorities:

- 20 NM interceptor suppress transmission of pressure altitude (Mode C replies or in the AC field of Mode S replies)
- Review procedures:
  - Annex 2     Rules of the Air + Appendix 1&2;
  - Annex 11;
  - Doc9433     Manual Concerning Interception of Civil Aircraft;
  - Doc9554     Manual Concerning Safety Measures Relating to Military Activities Potentially Hazardous to Civil Operations.

### Reference to ACAS in ICAO documents

- Annex 2 - Chapter 3, paragraph 3.2.2, Right-of-way.
- Annex 6 - Part I-paragraph 6.18, Aeroplanes required to be equipped with an airborne collision avoidance system (ACAS II), and paragraph 6.19, Aeroplanes required to be equipped with a pressure-altitude reporting transponder.
- Annex 10 - Volume IV, Attachment A, paragraph 3.5.8.10.3, Contrary pilot response to RAs.
- Annex 11 - Chapter 2, paragraph 2.25, Establishment of requirements for carriage of pressure-altitude reporting transponders.
- Doc4444 - Chapter 15, Section 15.6.3, Procedures in regard to aircraft equipped with airborne collision system (ACAS).
- Doc7300  Article 3 bis….in case of interception, the lives of persons on board and the safety of aircraft must not be endangered.
- Doc8168 - Volume I, Part VIII, Chapter 3, Operations of ACAS equipment.
- Doc7030 - Section 16, Use of Airborne Collision Avoidance System (ACAS).
- State Letter AN 7/1.3.72-97/77 dated 8 August 1997 -  Attachment E, page E-10, paragraph 12, provides guidance to pilot action when ATC instructions to manoeuvre conflict with an ACAS resolution advisory.
- State Letter AN 11/19-02/82 dated 30 August 2002 - ACAS Provisions and Operational Procedures.

We would like to thank ATSA, Bulgarian CAA, NAV Portugal and Swedish CAA for their strong support in organising the ACAS workshops

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