

# TCAS II version 7.1

## Overview for air traffic controllers

Version 1.0 - 12 January 2012

*Note: This presentation material has been designed to support the training of people involved in the use of the Airborne Collision Avoidance System (ACAS). However, it is not, per se, designed for the complete training of controllers or pilots. The principal and essential technical and operational features of ACAS are introduced. For a deeper knowledge, the reader is advised to refer to documentation listed in the Resources section.*

*The information contained in this presentation and EUROCONTROL ACAS II Bulletins is considered to be accurate at the time of publishing and is subject to change.*

#### **DISCLAIMER**

©2012 The European Organisation for the Safety of Air Navigation (EUROCONTROL).

This document is published by EUROCONTROL for information purposes. It may be copied in whole or in part provided that EUROCONTROL is mentioned as a source and to the extent justified by the non-commercial use (not for sale). The information in this document may not be modified without prior written permission from EUROCONTROL. The use of this document is at user's sole risk and responsibility. EUROCONTROL expressly disclaims any and all warranties with respect to the document, expressed or implied.

Additionally, the disclaimer available under [www.eurocontrol.int/acas](http://www.eurocontrol.int/acas) applies to the information contained in this presentation.

History of changes		
Version 1.0	12 January 2012	First release

# How to use this presentation?

- Use page up/page down keys to move from one slide to the other
- Jump directly to another section using the tabs at the top of the screen
- Check [www.eurocontrol.int/acas](http://www.eurocontrol.int/acas) to see if there is an updated version of this presentation available
- Please submit any comments/questions regarding this presentation material to: [acas@eurocontrol.int](mailto:acas@eurocontrol.int)

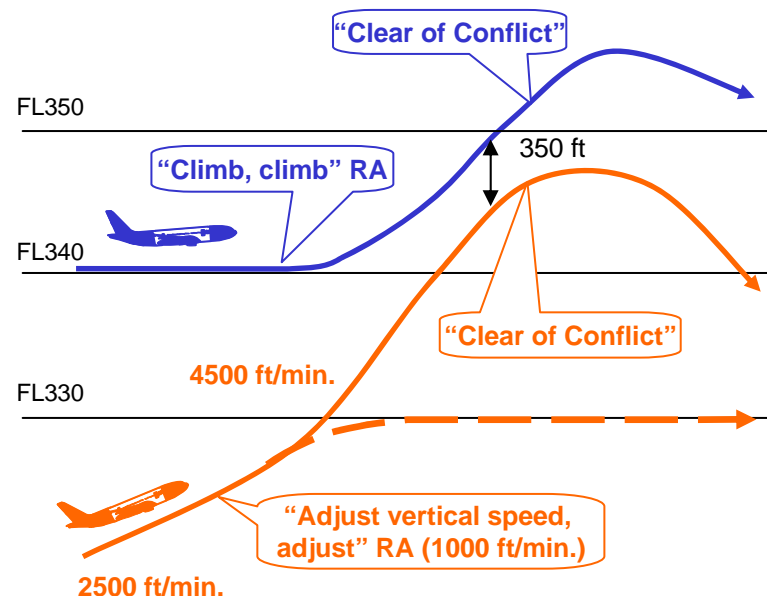
# Why version 7.1?

- TCAS II version 7.0 mandated in Europe since 2000
- Safety issues identified in version 7.0:
  - [Unintentional opposite pilot response to “Adjust vertical speed, adjust” RAs](#)
  - [Level busts following “Adjust vertical speed, adjust” RAs](#)
  - [Flaws in the reversal logic](#)
- TCAS II version 7.1 will address these safety issues
  - [“Level off, level off” RA](#)
  - [Improvements to reversal logic](#)

Note: TCAS versions are backwards compatible

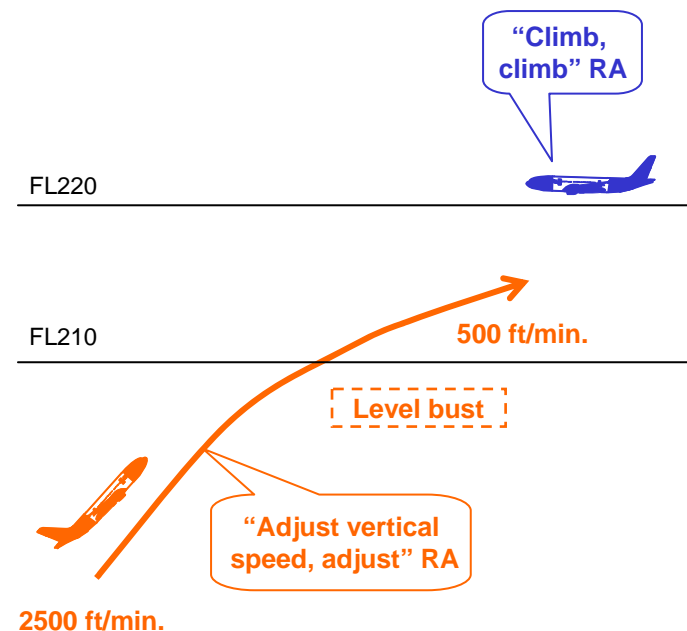
# Unintentional opposite pilot response to “Adjust vertical speed, adjust” RAs

- “Adjust vertical speed, adjust” RAs always require reduction of vertical speed
  - The only RA that does not clearly communicate what exact manoeuvre is required
- Numerous cases reported when pilots unintentionally increased vertical speed responding to “Adjust vertical speed, adjust” RAs
  - Accidents avoided by chance



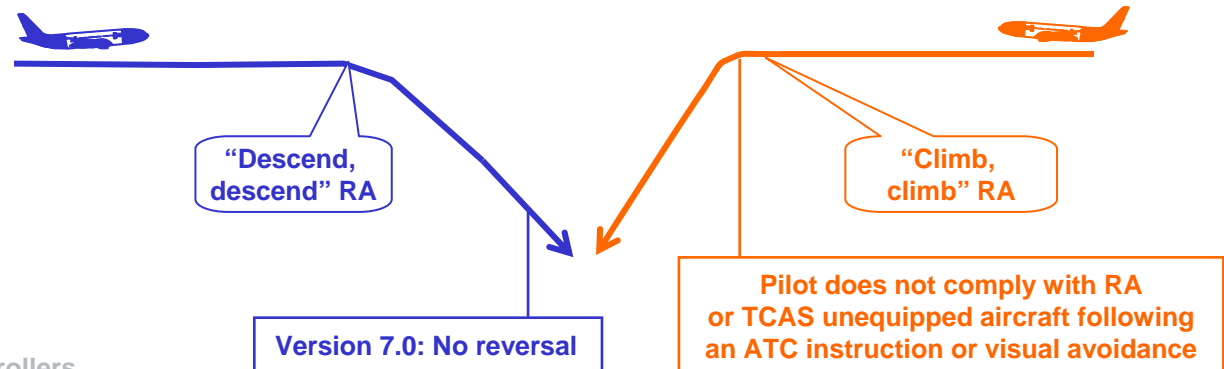
# Level busts following “Adjust vertical speed, adjust” RAs

- “Adjust vertical speed, adjust” RAs often unnecessarily affected ATC operations
  - Contribution to level busts (in situations where otherwise there would not have been a level bust)
  - Pilots following “green arc” not levelling off at the cleared level
  - Reason for RAs on the other aircraft



# Flaws in reversal logic

- Version 7.0 will not reverse an RA if two aircraft converging in altitude remain within 100 feet
  - One aircraft is not responding to RA; or
  - One aircraft is not equipped and follows ATC instruction or visual avoidance
- Contributory factor in 2 accidents:
  - 2001 Yaizu accident
  - 2002 Überlingen midair collision
  - Several other serious events reported



# Who & When?

**Aircraft currently equipped** with version 7.0 will need to be upgraded to version 7.1 before **1 December 2015** in order to continue to operate in European Community airspace.

**All new aircraft<sup>1</sup>** above 5,700 kg Maximum Take-off Mass or with passenger seating capacity above 19 will have to be equipped from **1 March 2012**.

The above applies to European and foreign aircraft.

Note: The EU mandate sets an earlier equipage requirements than those published in ICAO Annex 10 (i.e. 1 January 2014 new installations, 1 January 2017 existing units).

<sup>1</sup> Aircraft with an individual certificate of airworthiness issued after 1 March 2012.



# What's new?

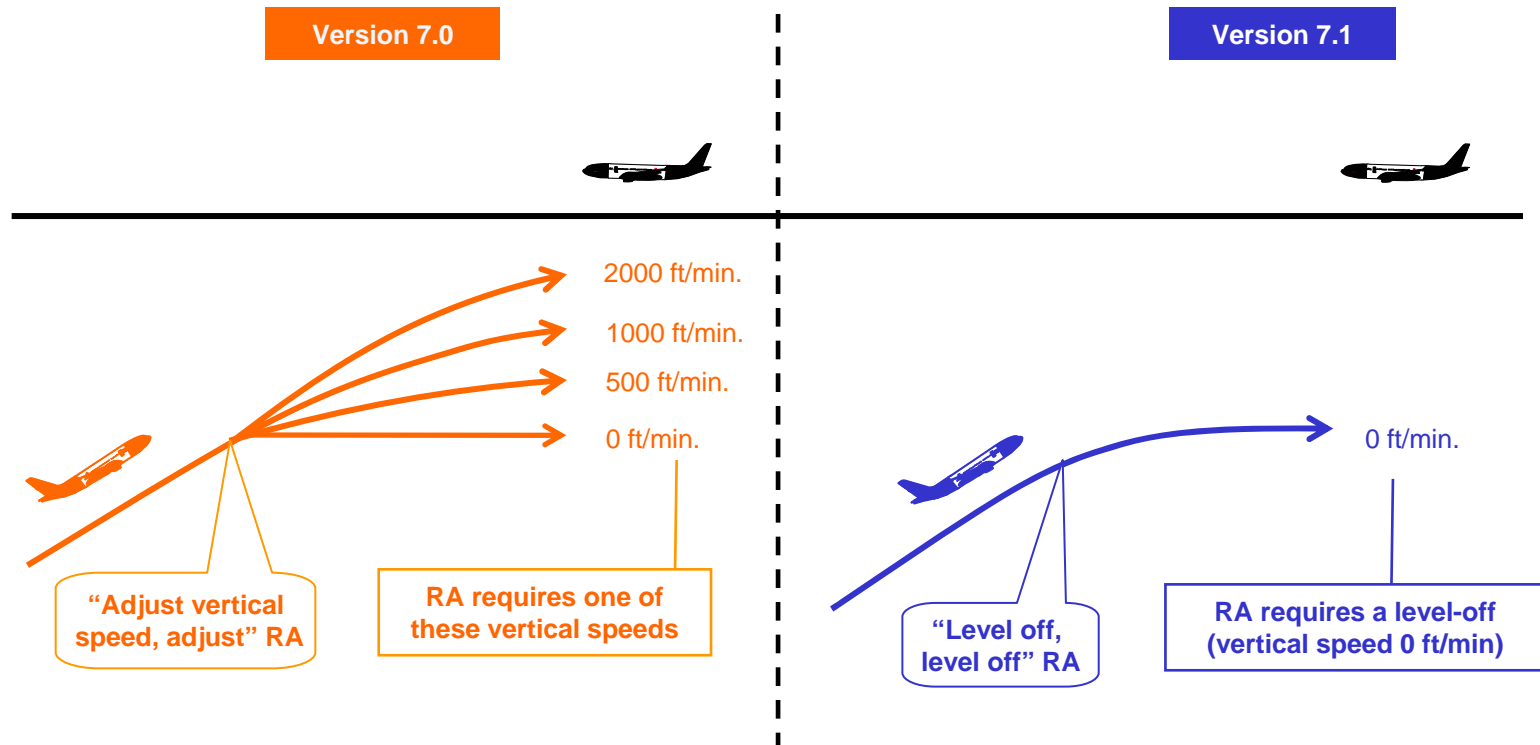
- [“Level off, level off” RA](#)
- [Improvements to the reversal logic](#)

## “Level off, level off” RA (1/5)

- New RA introduced in version 7.1: **“Level off, level off”**
- Pilots will reduce the vertical rate to 0 ft/min (i.e. level off)
- **The level off is to be achieved promptly, not at the next flight level**
- It replaces the existing “Adjust vertical speed, adjust” RA to address the issue of unintentional incorrect pilot responses
- Applies to both:
  - [Initial RAs](#)
  - [Weakening RAs](#)

# “Level off, level off” RA (2/5)

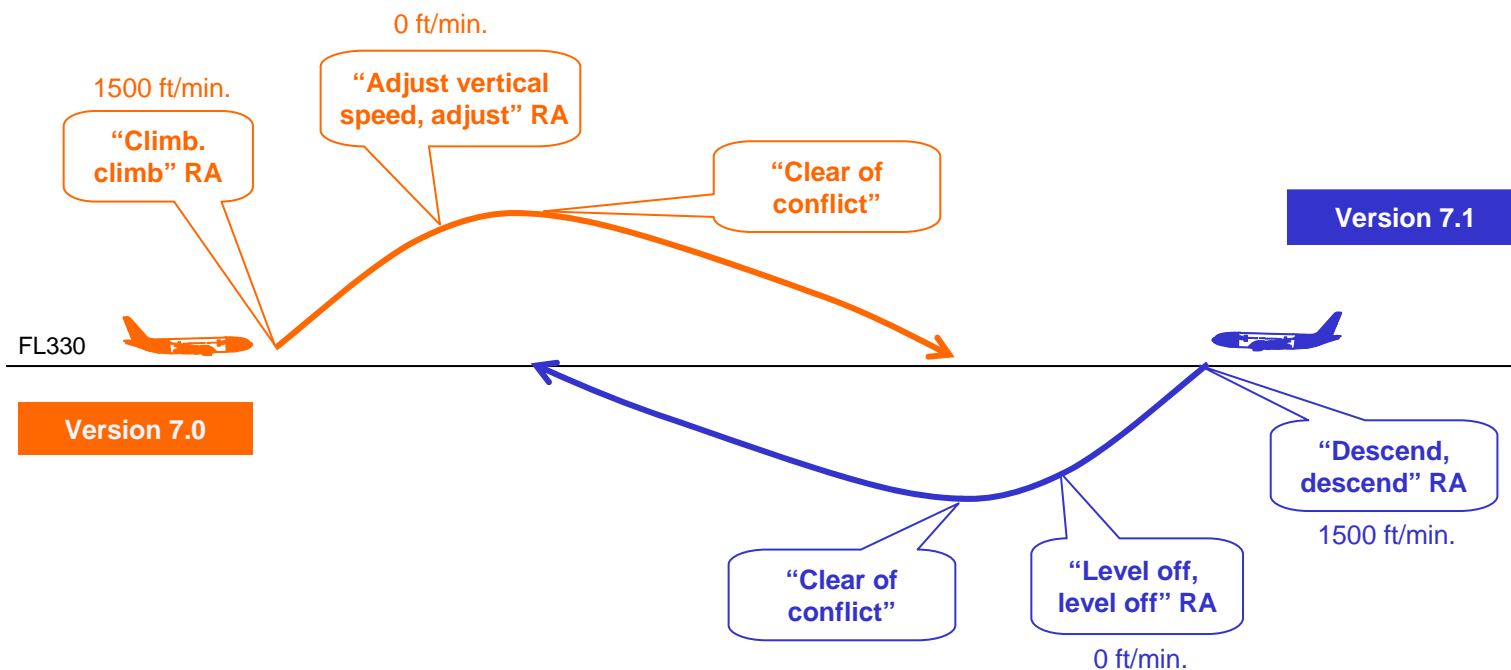
## Initial RA



# “Level off, level off” RA (3/5)

## Weakening RA

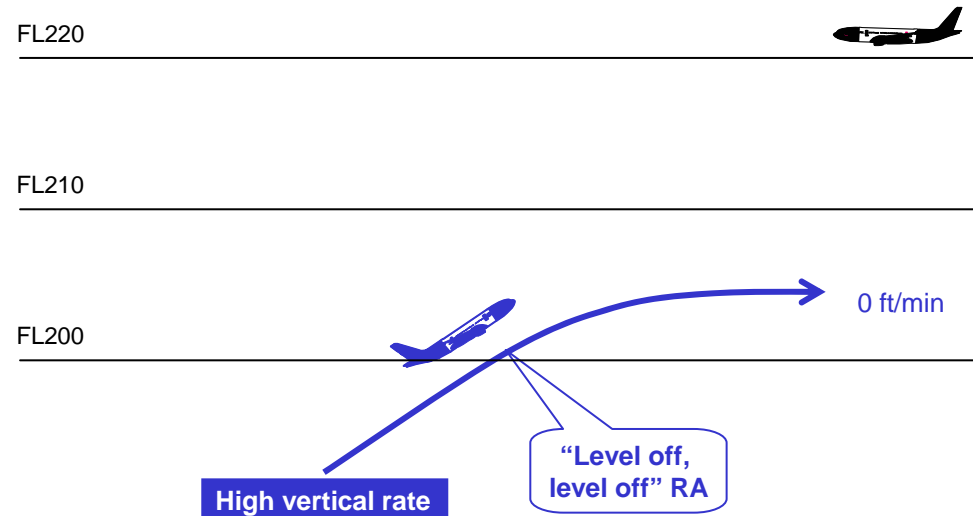
- An RA will weaken when vertical spacing increases following the initial RA
  - In version 7.0 the weakening RA also always requires a level off



## “Level off, level off” RA (4/5)

### Impact on ATC

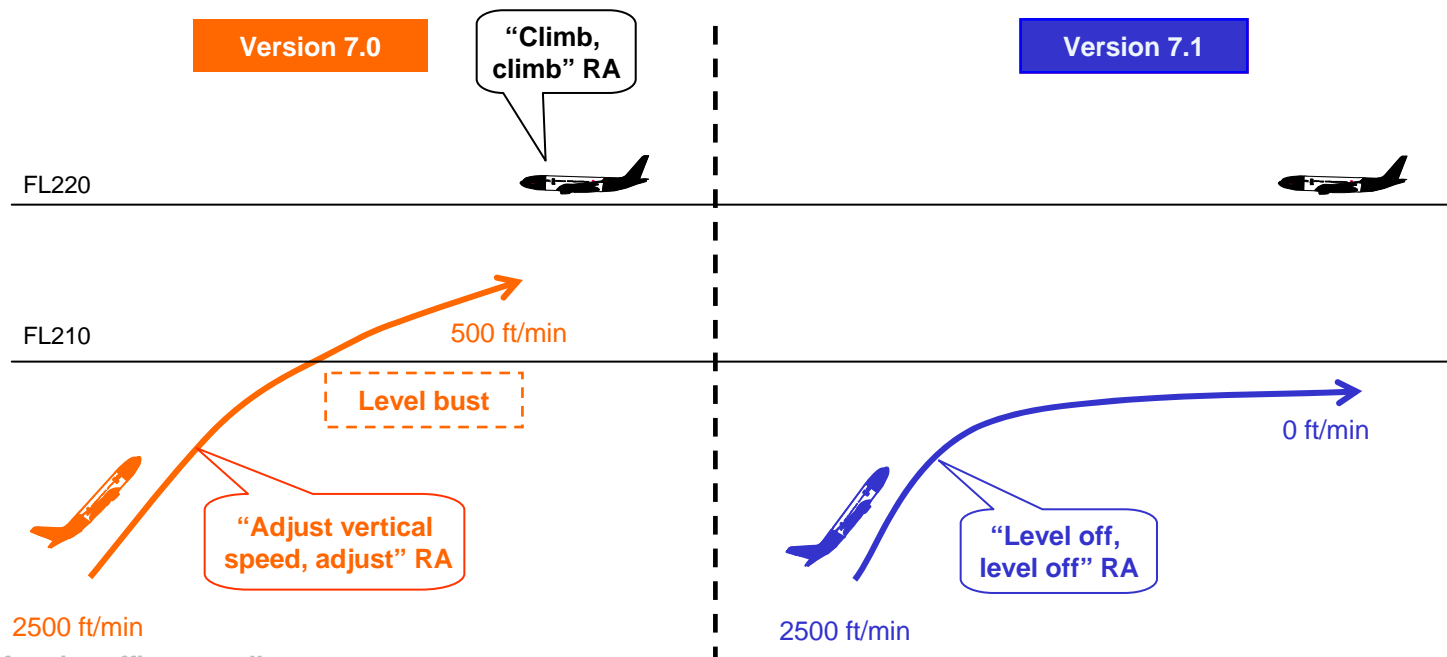
- Prompt level off will result in some aircraft levelling off hundreds of feet before their cleared level while responding to this RA
- “Level off, level off” RA will not induce conflicts with third party aircraft more frequently than the current version of TCAS



# “Level off, level off” RA (5/5)

## Impact on ATC

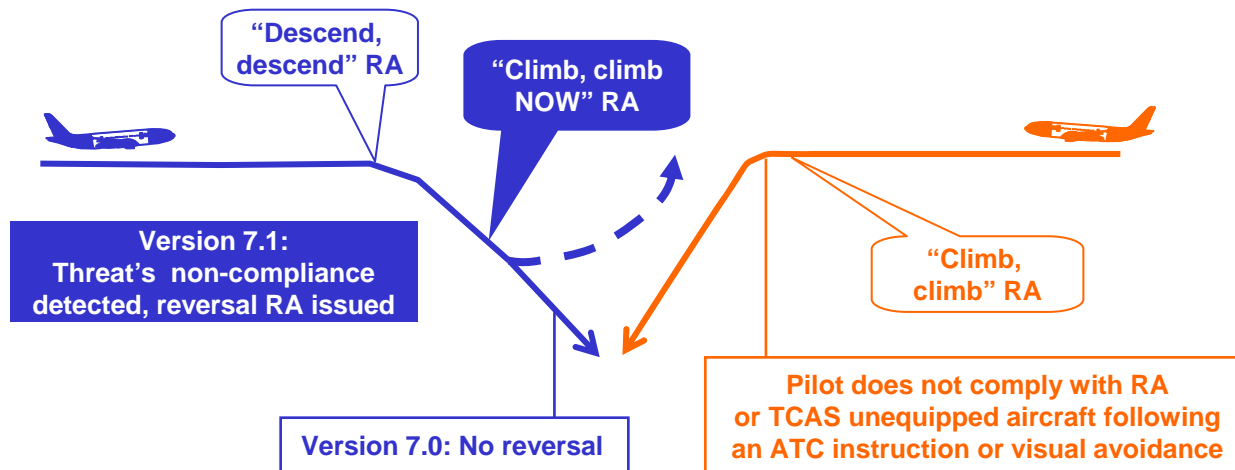
- “Level off, level off” RA will reduce instances of:
  - RAs – as follow up RAs are less likely
  - Level busts as a result of RA



## Improvement to the reversal logic (1/2)

- Version 7.1's improved reversal logic recognizes situations when two aircraft:
  - remain within 100 feet and converge
  - one aircraft is not responding to the RA or is not equipped
- A reversal RA (i.e. "Climb, climb NOW" or "Descend, descend NOW") will be issued to the aircraft that is correctly responding to the previous RA
- Improvement to the reversal logic is transparent for pilots and controllers

## Improvement to the reversal logic (2/2)





# Frequently Asked Questions (FAQ)

1. [What controller training is required?](#)
2. [How do I know which version of TCAS the aircraft operates?](#)
3. [Can an aircraft operate without serviceable TCAS?](#)
4. [More Frequently Asked Questions...](#)

# What controller training is required?

Air Navigation Service Providers should ensure that air traffic controllers are:

- aware of the TCAS version upgrade
- understand the effect the new “Level off, level off” RA will have on ATC operations (i.e. there will be some instances of premature level-offs by aircraft following the RA)

Besides that there are no differences (visible to pilots and controllers) between version 7.0 and version 7.1.

# How do I know which version of TCAS the aircraft operates?

There is no need for ATC to know which version of TCAS the aircraft operates. In Europe there is no requirement to indicate in the flight plan which version of TCAS the aircraft operates.

TCAS versions are compatible, so proper TCAS-TCAS coordination will take place in coordinated encounters.

The provision of air traffic services to aircraft equipped with TCAS shall be identical to those that are not equipped.

# Can an aircraft operate without serviceable TCAS?

In Europe an aircraft may operate under the Minimum Equipment List (MEL) provisions with TCAS II inoperative for up to 10 calendar days.

In German airspace the time period during which TCAS II may be inoperative is reduced to 3 days. National regulators may impose more restrictive deadlines for some operators or parts of airspace.

In Europe, there is no requirement to notify ATC or to make a remark in the flight plan about TCAS II being inoperative.

# More Frequently Asked Questions...

Available on EUROCONTROL website:

[www.eurocontrol.int/acas](http://www.eurocontrol.int/acas)

# Additional training resources (1/2)

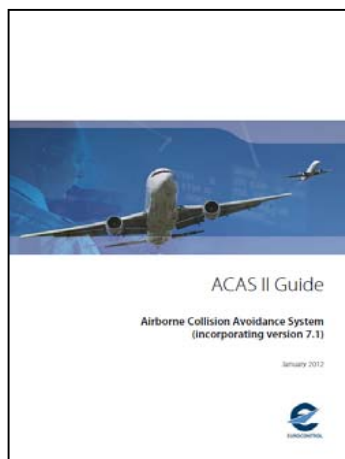
Available from [www.eurocontrol.int/acas](http://www.eurocontrol.int/acas) (click on the picture below to access the publication directly)



Overview of ACAS II  
(presentation)



TCAS II version 7.1 for pilots  
(presentation)



ACAS II Guide



ACAS II Bulletin no. 14  
Version 7.1 is coming...

# Additional training resources (2/2)

## EUROCONTROL ACAS II Bulletins



The information contained in the EUROCONTROL ACAS II Bulletins is accurate at the time of publishing but is subject to change.

<a href="#">1 - Follow the RA! (July 2002)</a>	<a href="#">8- TCAS II Operations in European RVSM Airspace (May 2006)</a>
<a href="#">2 - RAs and 1000 ft level-off manoeuvres (March 2003)</a>	<a href="#">9 - Frequently Asked Questions (July 2007)</a>
<a href="#">3 - Wrong reaction to "Adjust Vertical Speed" RAs (October 2003)</a>	<a href="#">10 - When ATC meets TCAS II (November 2007)</a>
<a href="#">4 - TCAS II and VFR traffic (May 2004)</a>	<a href="#">11 - ACAS world is moving on (May 2010)</a>
<a href="#">5 - Controller and Pilot ACAS regulation and training (October 2004)</a>	<a href="#">12 - Focus on pilot training (February 2011)</a>
<a href="#">6 - Incorrect use of the TCAS traffic display (March 2005)</a>	<a href="#">13 - Reversing to resolve (September 2011)</a>
<a href="#">7 - The Dos and Don'ts of TCAS II Operations (March 2006)</a>	<a href="#">14 - Version 7.1 is coming (January 2012)</a>

Click on a link above to access a specific issue.

All EUROCONTROL ACAS II Bulletins are available from:

[www.eurocontrol.int/acas](http://www.eurocontrol.int/acas)

# Questions? Need more information?

[www.eurocontrol.int/acas](http://www.eurocontrol.int/acas)

 [acas@eurocontrol.int](mailto:acas@eurocontrol.int)