



# TCAS II version 7.1

## Overview for pilots

Version 1.2 - 24 July 2014

*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.*

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History of changes		
Version 1.0	12 January 2012	First release
Version 1.1	27 February 2013	Updated Resources section.
Version 1.2	24 July 2014	Updated hyperlinks

# How to use this presentation?

- Use page up/page down keys to move from one slide to the other
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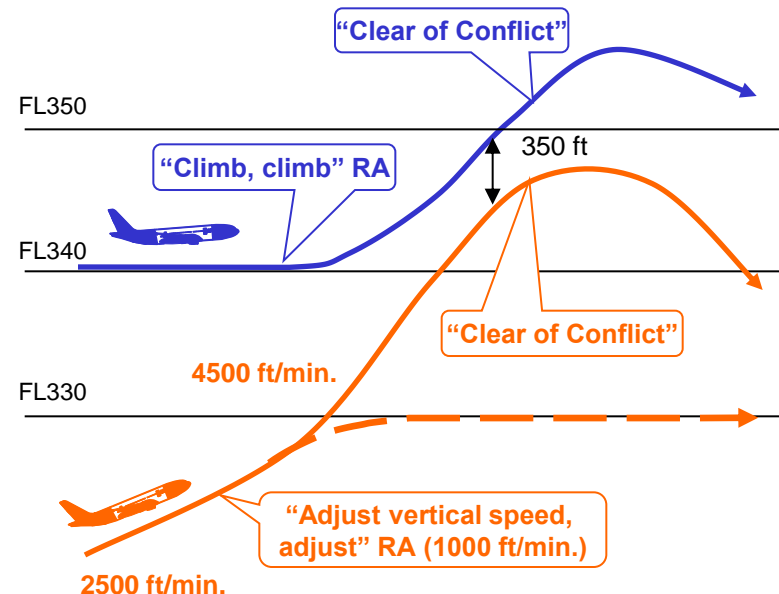
# Why version 7.1?

- 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

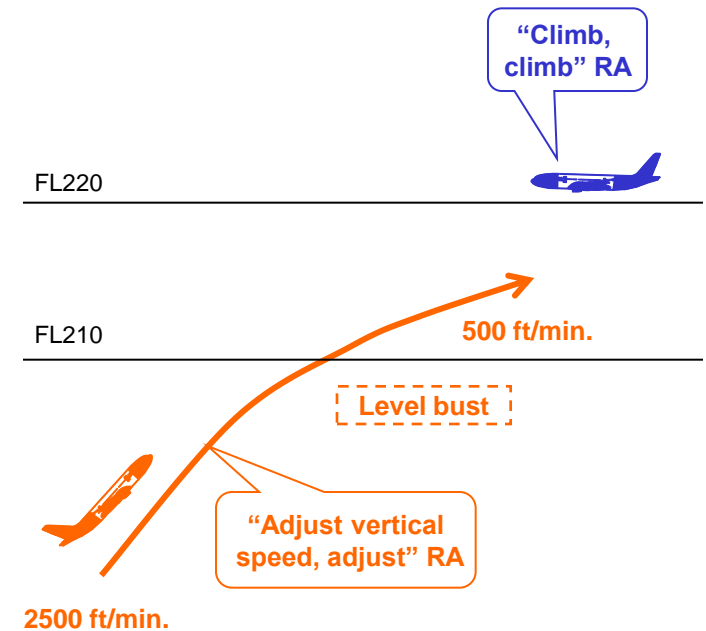
# Unintentional opposite pilot response to “Adjust vertical speed, adjust” RAs

- “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



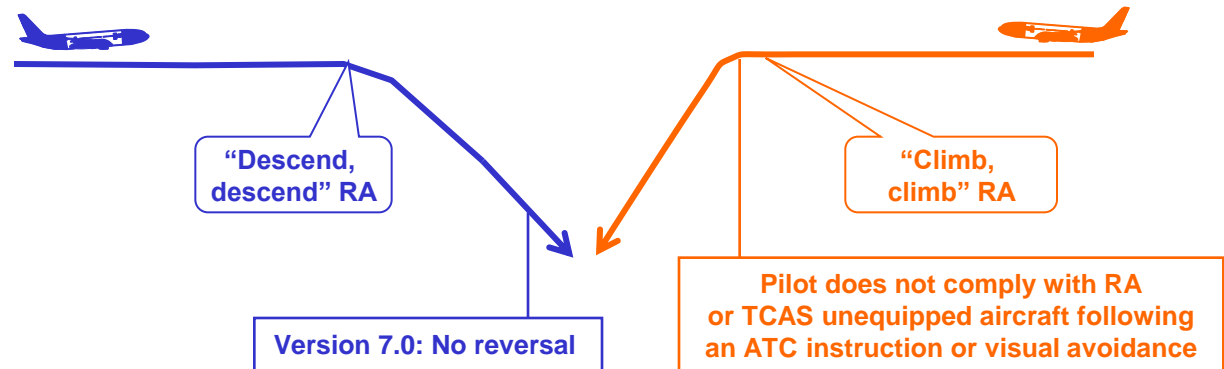
# Level busts following “Adjust vertical speed, adjust” RAs

- “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 Implementing Rule 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?

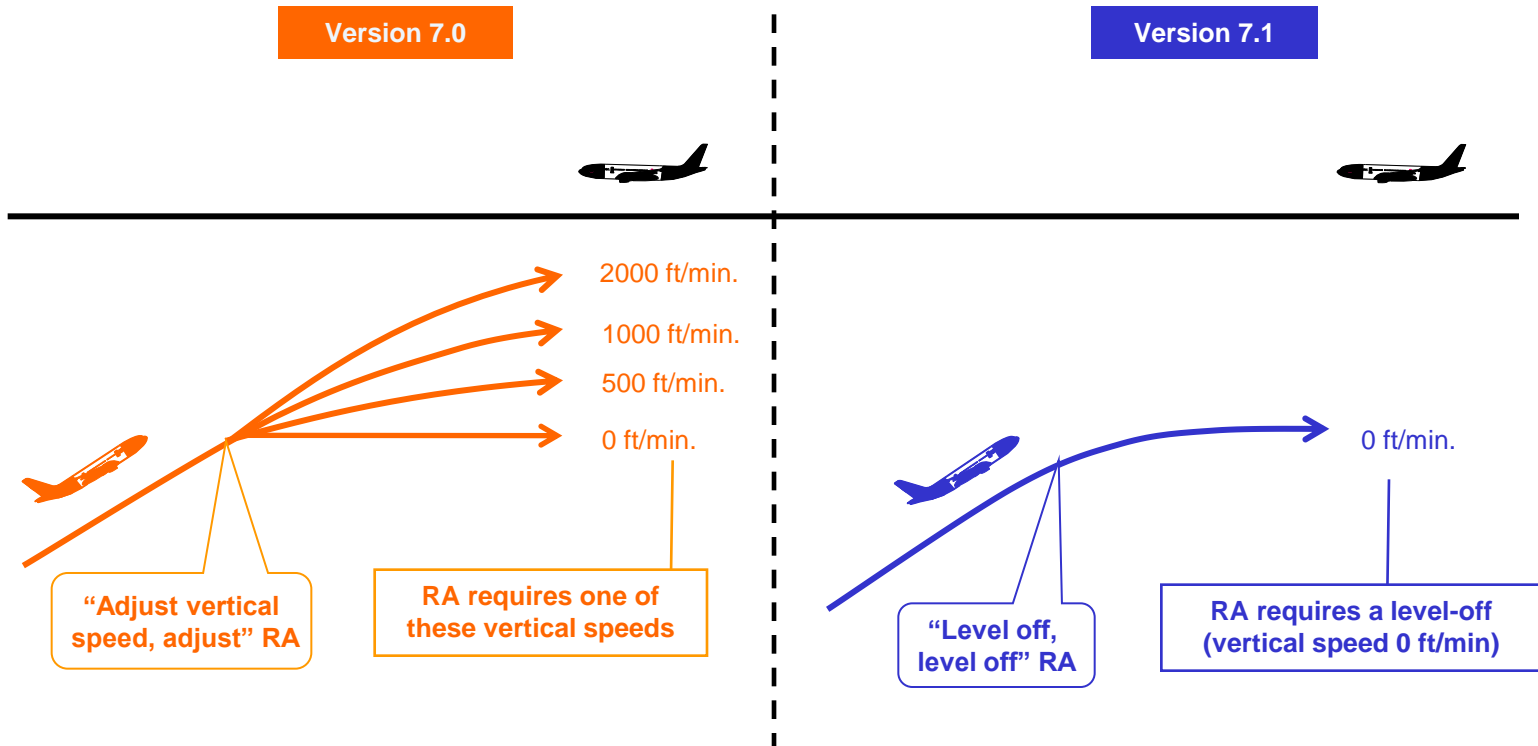
- [“Level off, level off” RA](#)
- [Improvements to the reversal logic](#)

## “Level off, level off” RA (1/6)

- 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 (2/6)

## Initial RA



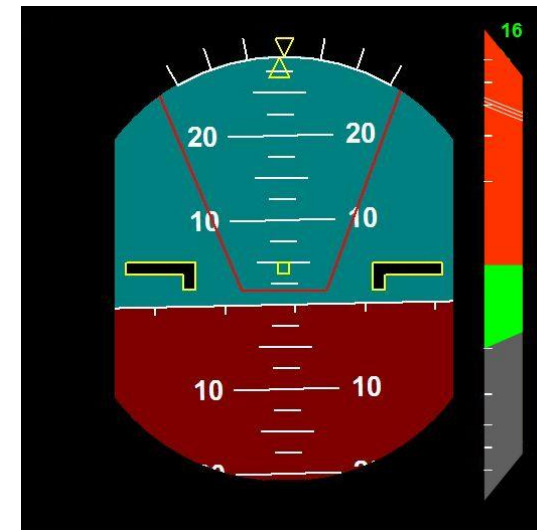


# “Level off, level off” RA (3/6)

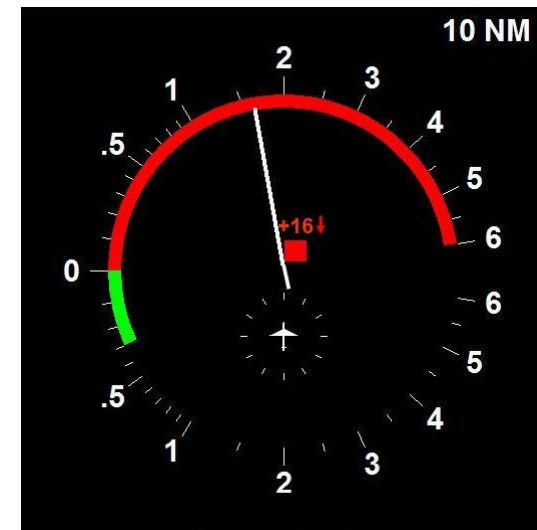
## Initial RA

### Pilot actions

- **Reduce the vertical rate to 0 ft/min**  
(i.e. level off)
- The level off must be achieved **promptly**, not at the standard next flight level (e.g. FL200, FL210, etc.)



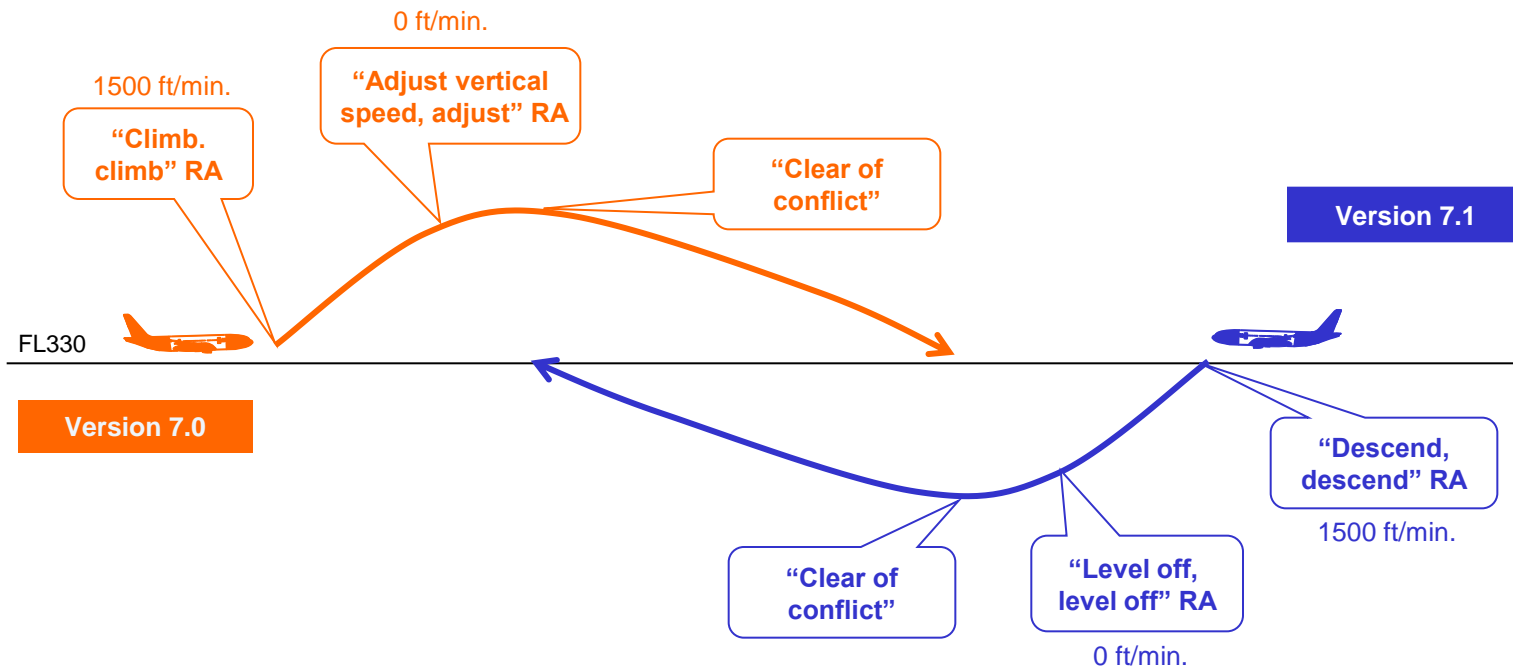
Level off,  
level off



Note: Generic displays are shown.

# “Level off, level off” RA (4/6) 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

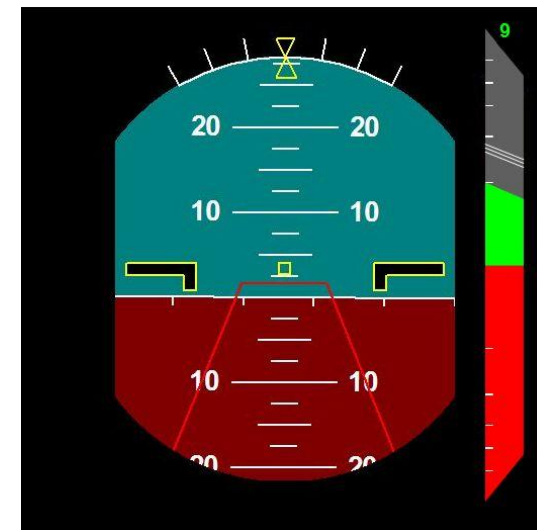


Note: Versions 7.0 and 7.1 are compatible

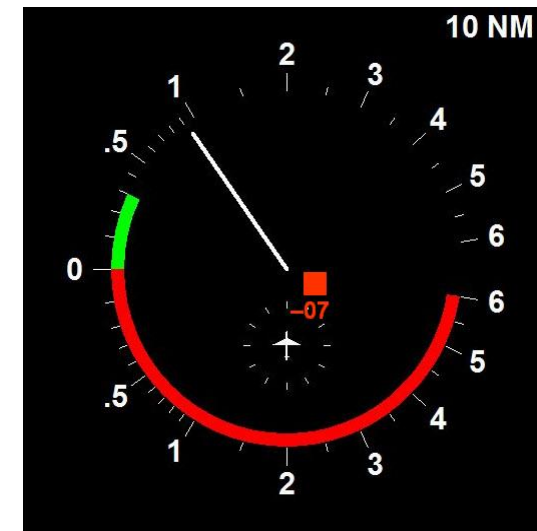
## “Level off, level off” RA (5/6) Weakening RA

- Weakening RA (typically subsequently to Climb or Descend RA)
- **Reduce the vertical rate to 0 ft/min** (i.e. level off)
- The level off must be achieved **promptly**, not at the standard next flight level

Note: Generic displays are shown.

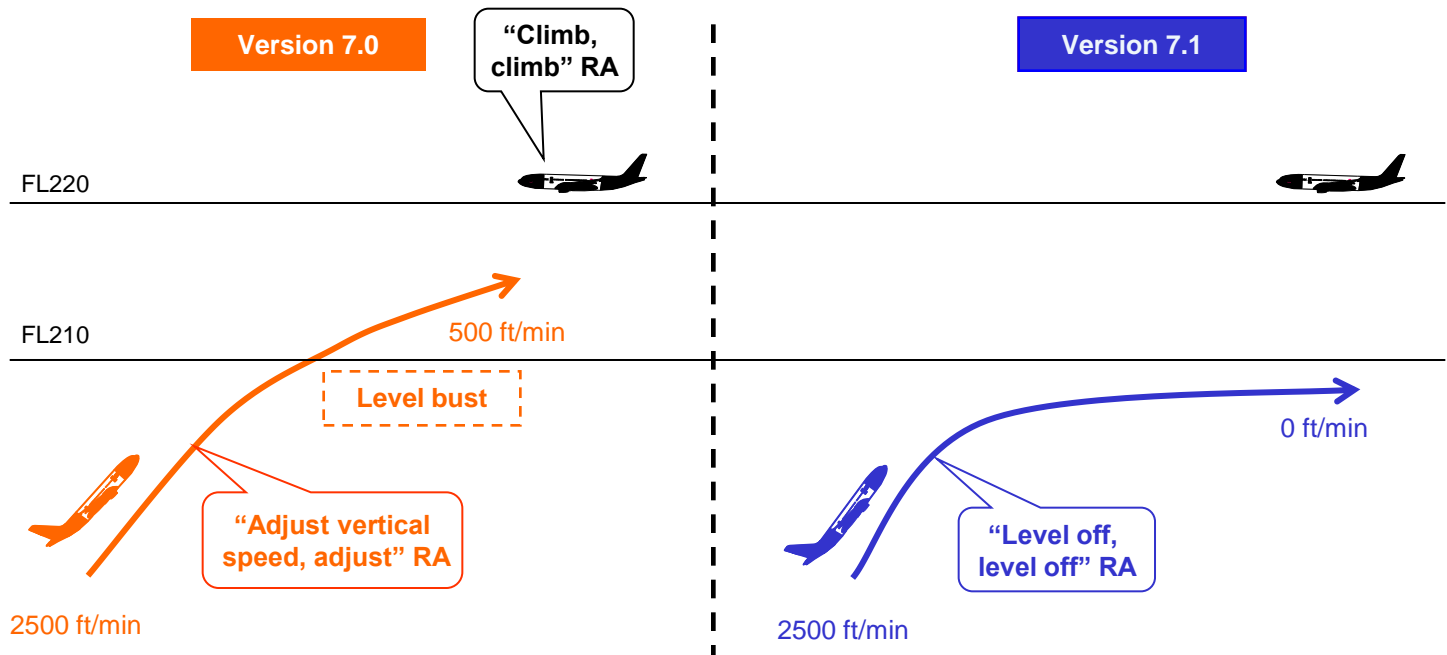


Level off,  
level off



# “Level off, level off” RA (6/6)

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

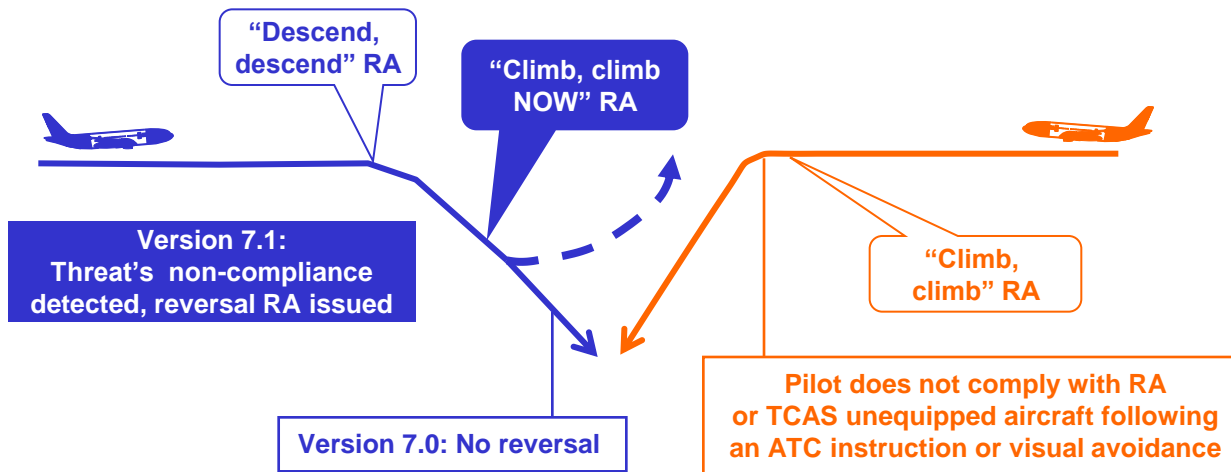


## Improvement to the reversal logic (1/3)

- Version 7.1's improved reversal logic recognizes situations when two converging aircraft:
  - remain within 100 feet
  - 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 current RA



# Improvement to the reversal logic (2/3)



## Improvement to the reversal logic (3/3)

- Improvement to the reversal logic is transparent for pilots

No change to the required pilot actions:

- **Always follow the RA:** Follow the RA even if the RA is contradictory to ATC instructions
- **Respond to reversal RAs** within 2.5 seconds. Reversal RAs require a 1,500 ft/min. climb or descent rate

# Frequently Asked Questions (FAQ)

1. [What pilot training is required?](#)
2. [What actions are required by aircraft operators?](#)
3. [More Frequently Asked Questions...](#)

# What pilot training is required?

Before the new version of TCAS is deployed to their fleets Aircraft Operators should ensure that crews are:

- aware of the TCAS version upgrade
- trained on the new “Level off, level off” RA and understand how to respond correctly to this RA

There are no other differences (visible to pilots) between version 7.0 and version 7.1.

# What actions are required by aircraft operators?

Aircraft Operators should ensure that TCAS version 7.1 is deployed on their fleet according to the mandate.

Aircraft Operators should also ensure that their flight crews understand the new features version 7.1 brings and are trained on correct responses to “Level off, level off” RAs.

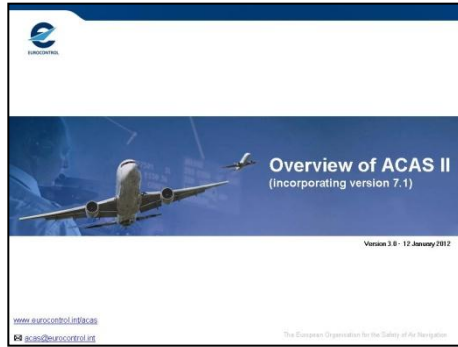
# More Frequently Asked Questions...

Available on the EUROCONTROL website:

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

# Additional training resources (1/2)

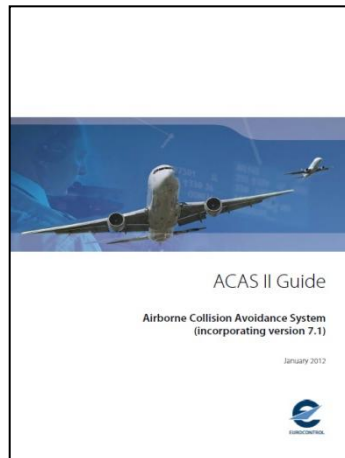
Available from [www.eurocontrol.int/acas](http://www.eurocontrol.int/acas) and [www.skybrary.aero](http://www.skybrary.aero)



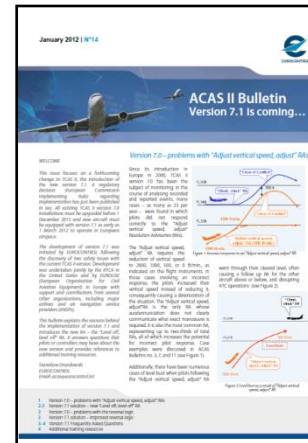
Overview of ACAS II (presentation)



TCAS II version 7.1 for controllers (presentation)



ACAS II Guide



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

# Additional training resources (2/2)

## EUROCONTROL ACAS II Bulletins



<a href="#">1 - Follow the RA! (July 2002)</a>	<a href="#">9 - Frequently Asked Questions (July 2007)</a>
<a href="#">2 - RAs and 1000 ft level-off manoeuvres (March 2003)</a>	<a href="#">10 - When ATC meets TCAS II (November 2007)</a>
<a href="#">3 - Wrong reaction to "Adjust Vertical Speed" RAs (October 2003)</a>	<a href="#">11 - ACAS world is moving on (May 2010)</a>
<a href="#">4 - TCAS II and VFR traffic (May 2004)</a>	<a href="#">12 - Focus on pilot training (February 2011)</a>
<a href="#">5 - Controller and Pilot ACAS regulation and training (October 2004)</a>	<a href="#">13 - Reversing to resolve (September 2011)</a>
<a href="#">6 - Incorrect use of the TCAS traffic display (March 2005)</a>	<a href="#">14 - Version 7.1 is coming (January 2012)</a>
<a href="#">7 - The Dos and Don'ts of TCAS II Operations (March 2006)</a>	<a href="#">15 - Not so fast... (May 2012)</a>
<a href="#">8 - TCAS II Operations in European RVSM Airspace (May 2006)</a>	<a href="#">16 - "Traffic, traffic" - TCAS Traffic Advisories (December 2012)</a>

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All EUROCONTROL ACAS II Bulletins are and available from:  
[www.eurocontrol.int/acas](http://www.eurocontrol.int/acas) and [www.skybrary.aero](http://www.skybrary.aero)



# Questions? Need more information?

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