

TCAS II version 7.1

**An overview on the Pilots and ATC on the TCAS II
7.1 Euro version**

TCAS II version 7.1

Overview for pilots

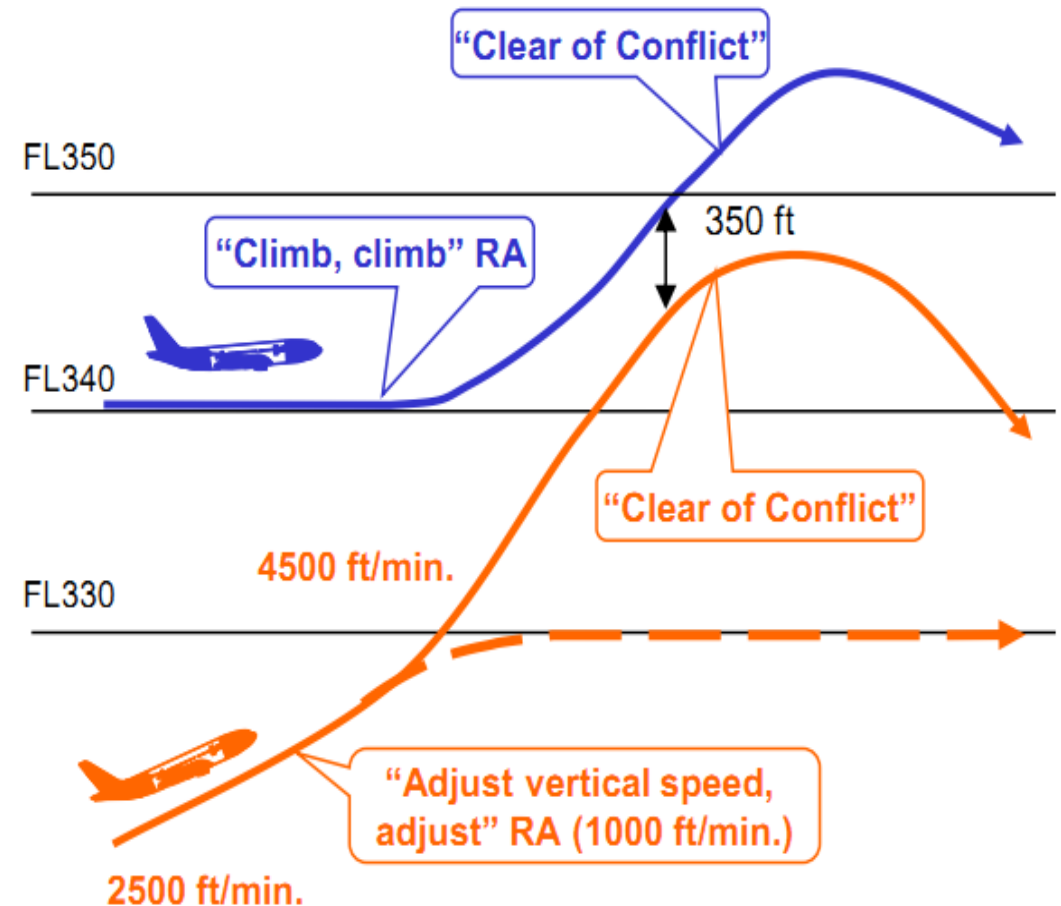
Why version 7.1?

- 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

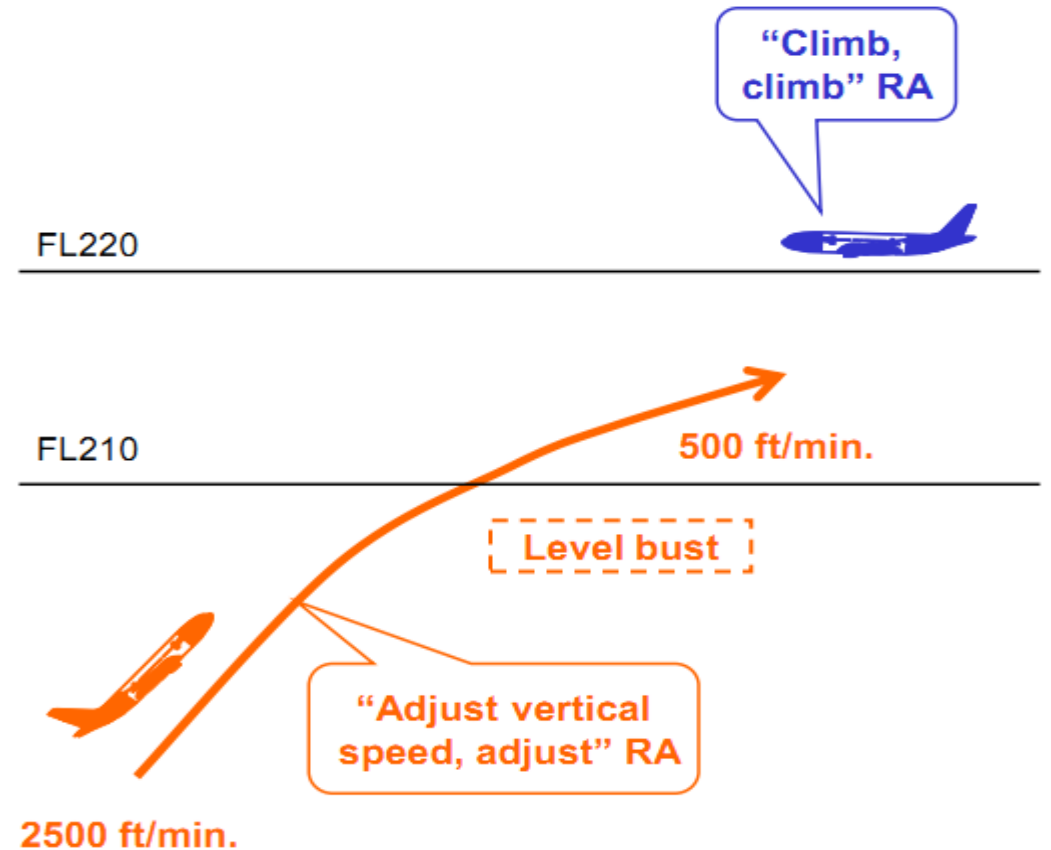
Unintentional opposite pilot response to “Adjust vertical speed, adjust” RAs

- “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



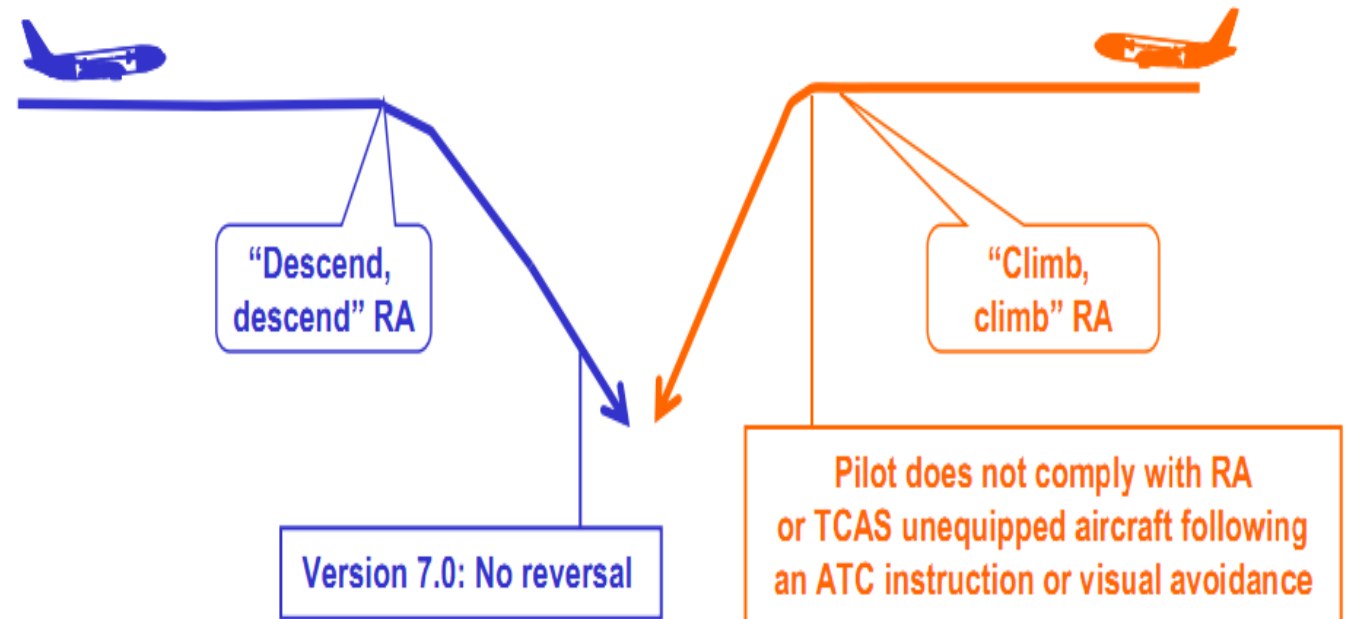
Level busts following “Adjust vertical speed, adjust” RAs

- “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 above 5700 kg Maximum Take-off Mass or with passenger seating capacity above 19 will have to be equipped from **1 March 2012**.

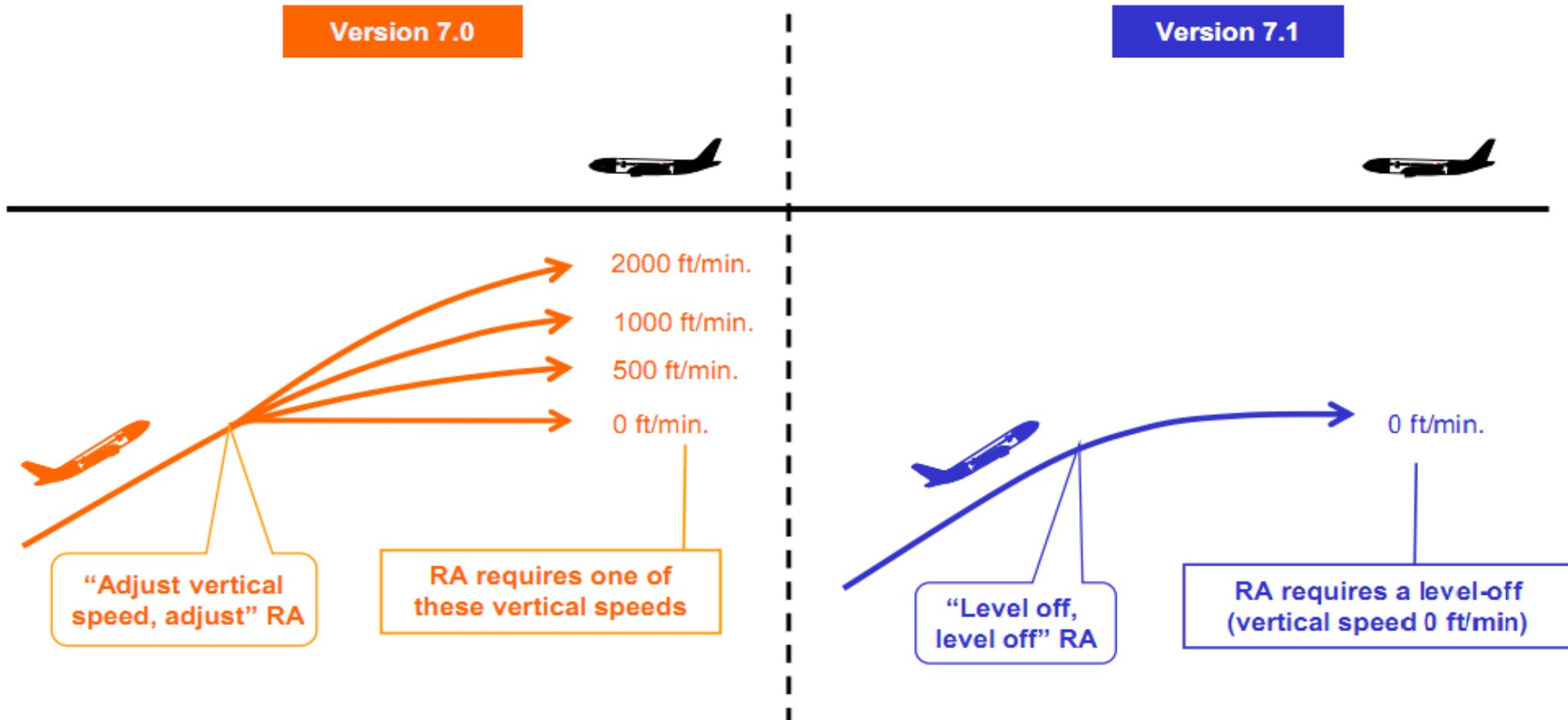
The above applies to European and foreign aircraft.

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).

“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

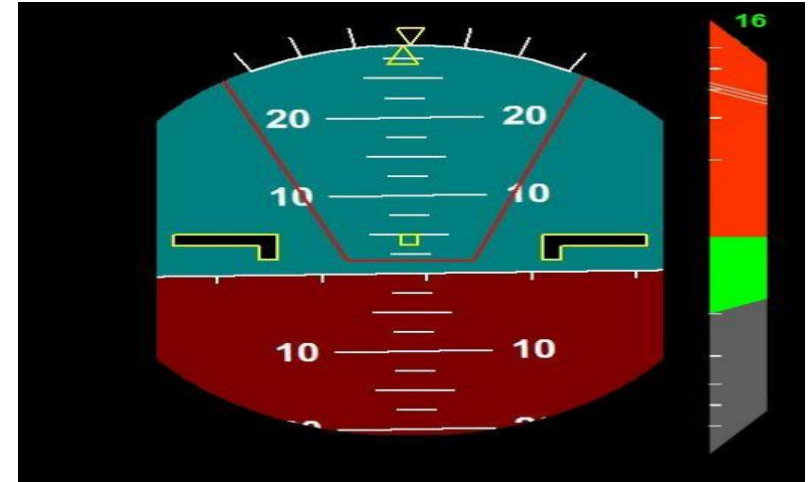
“Level off, level off” RA (2/6) Initial RA



“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.)

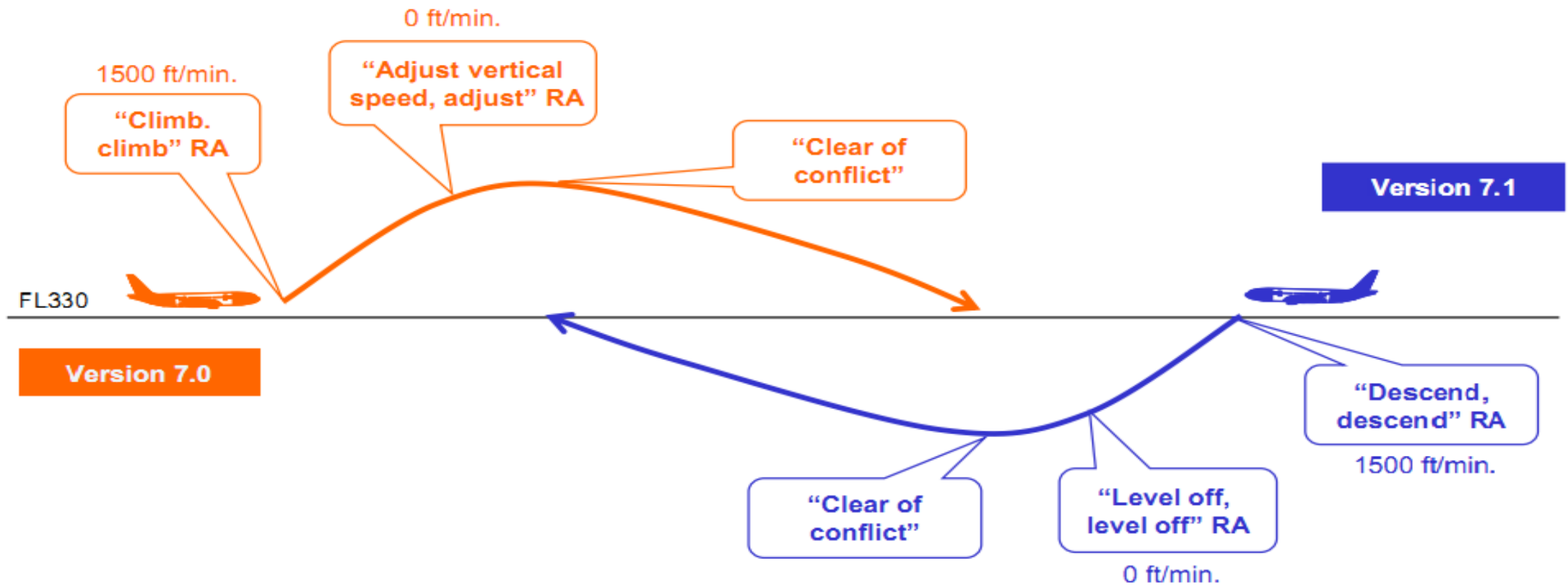


Level off,
Level off



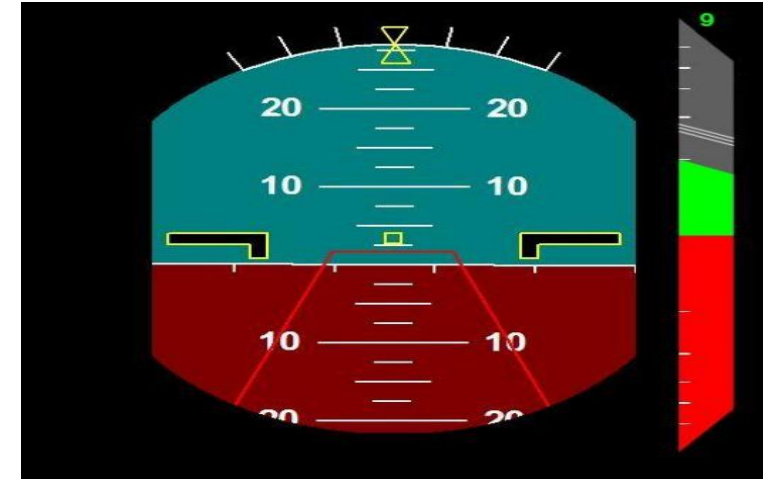
“Level off, level off” RA (4/6) Weakening RA

- A 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 (5/6) Weakening RA

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

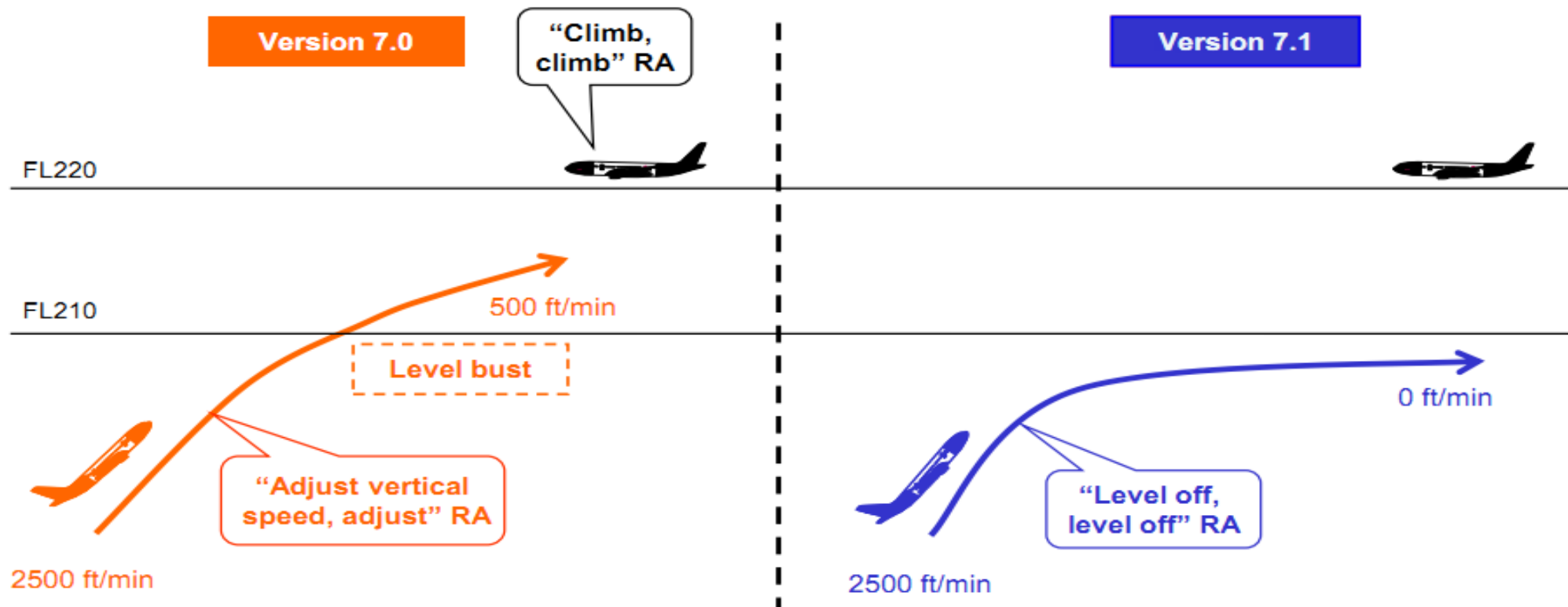


Level off,
Level off



“Level off, level off” RA (6/6)

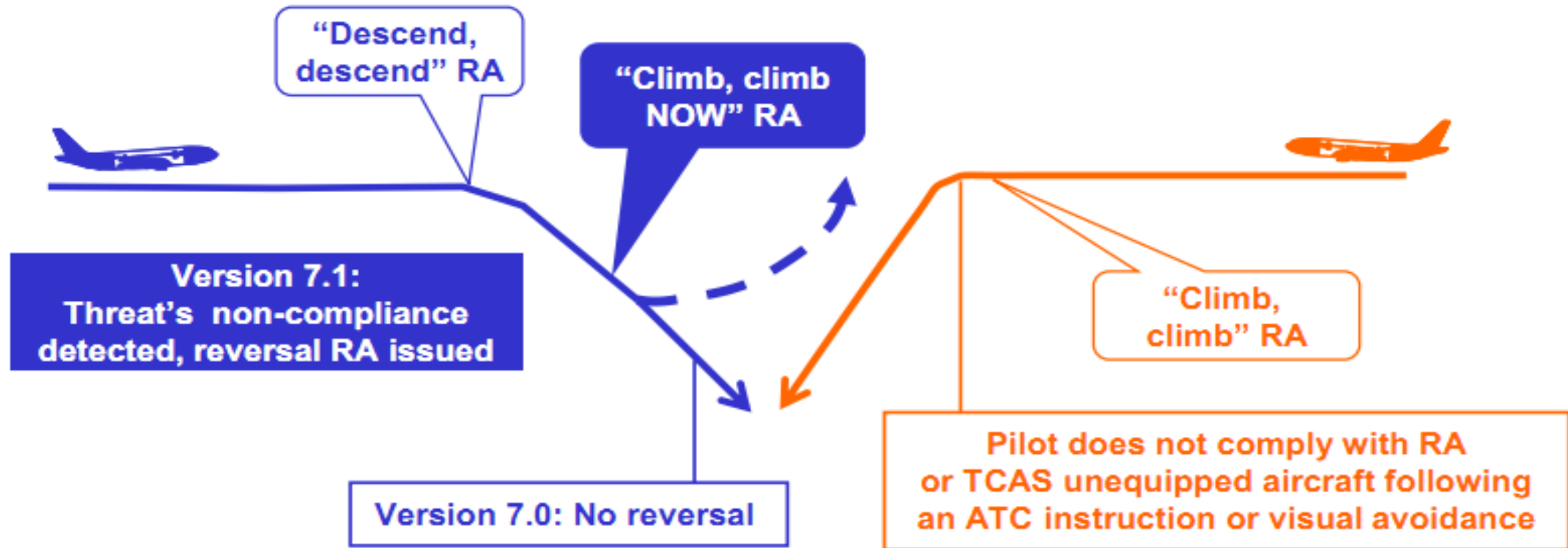
- “Level off, level off” RA will reduce instances of:
 - RAs- as follow up RAs are less likely
 - Level busts as a result of RA



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 1500 ft/min. climb or descent rate

Frequently Asked Questions (FAQ)

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.

Questions?
Need more information?



TCAS II version 7.1

Overview for air traffic controllers

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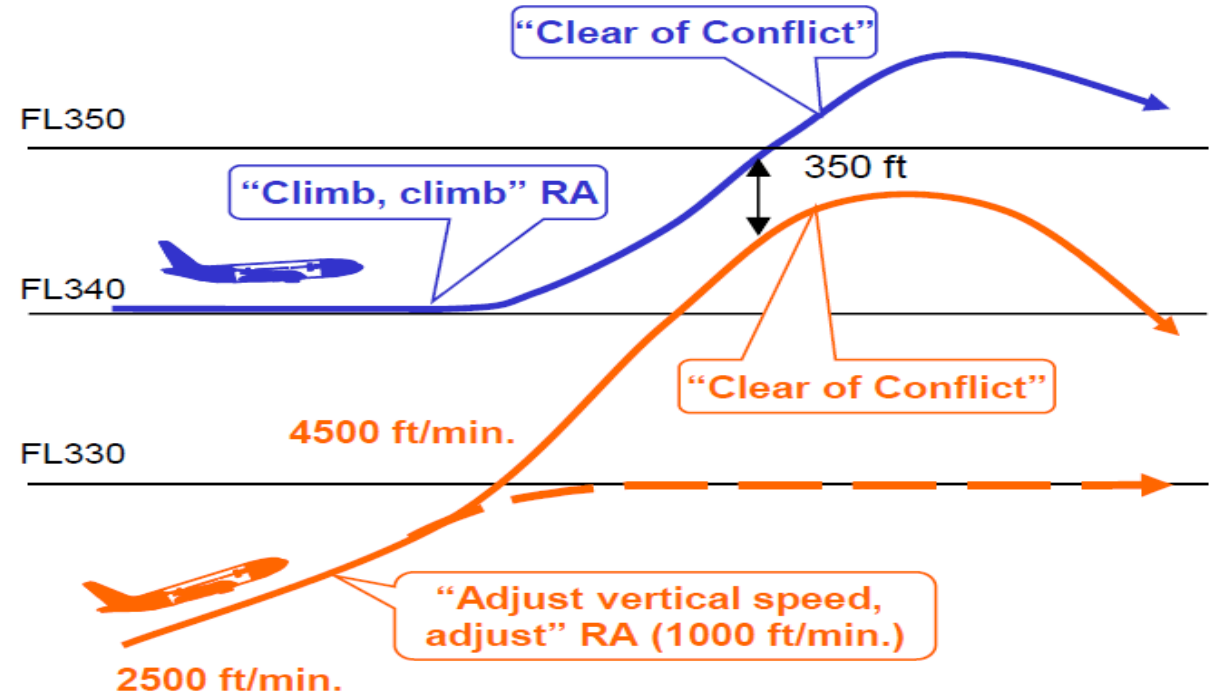
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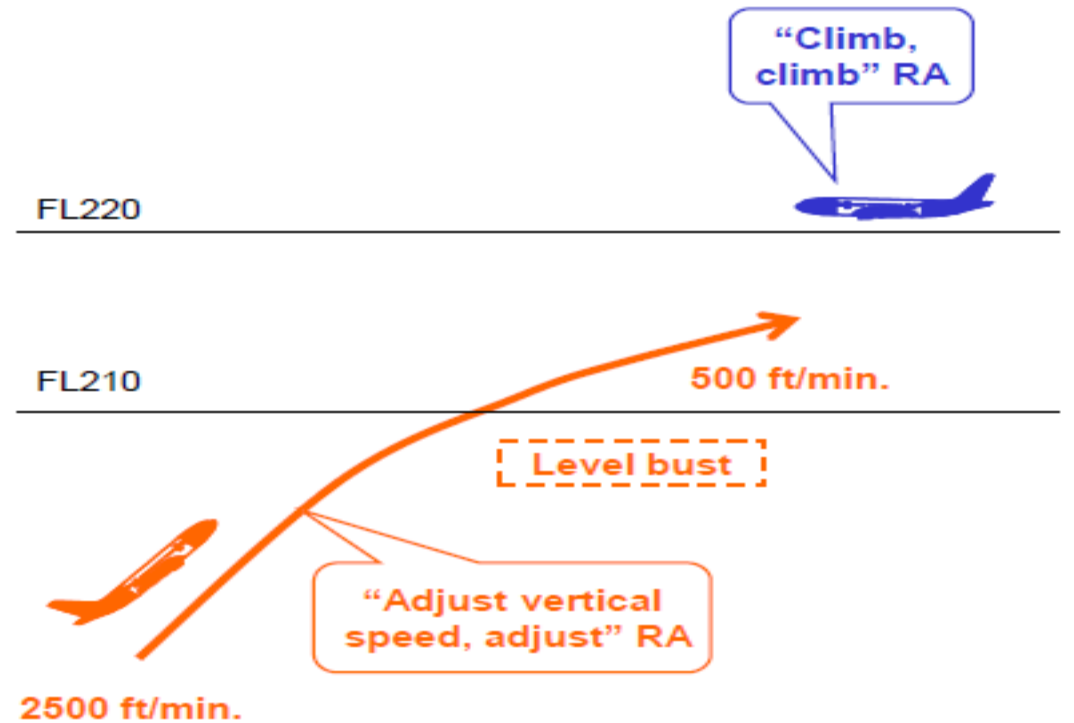
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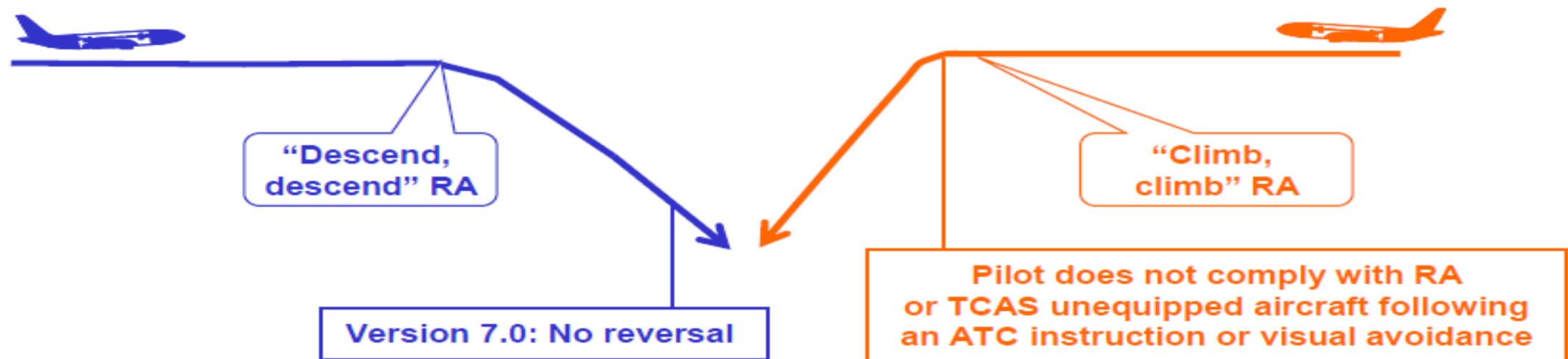
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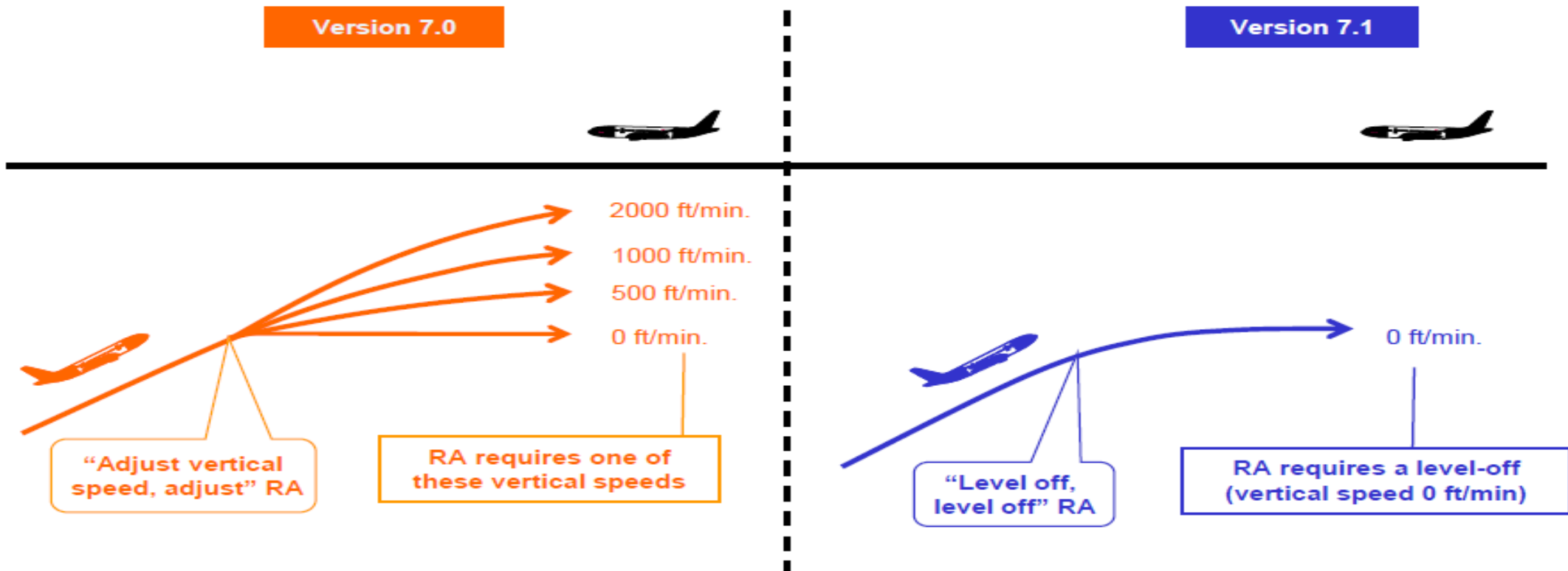


“Level off, level off” RA (1 / 5)

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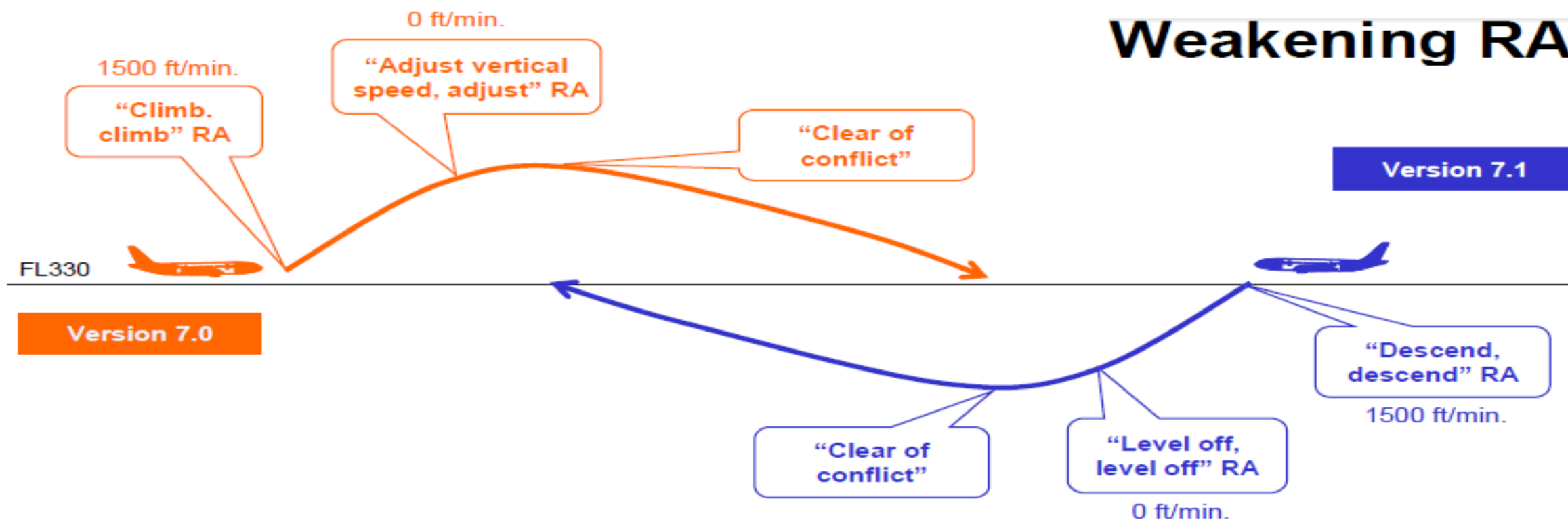
“Level off, level off” RA (2/5)

Initial RA



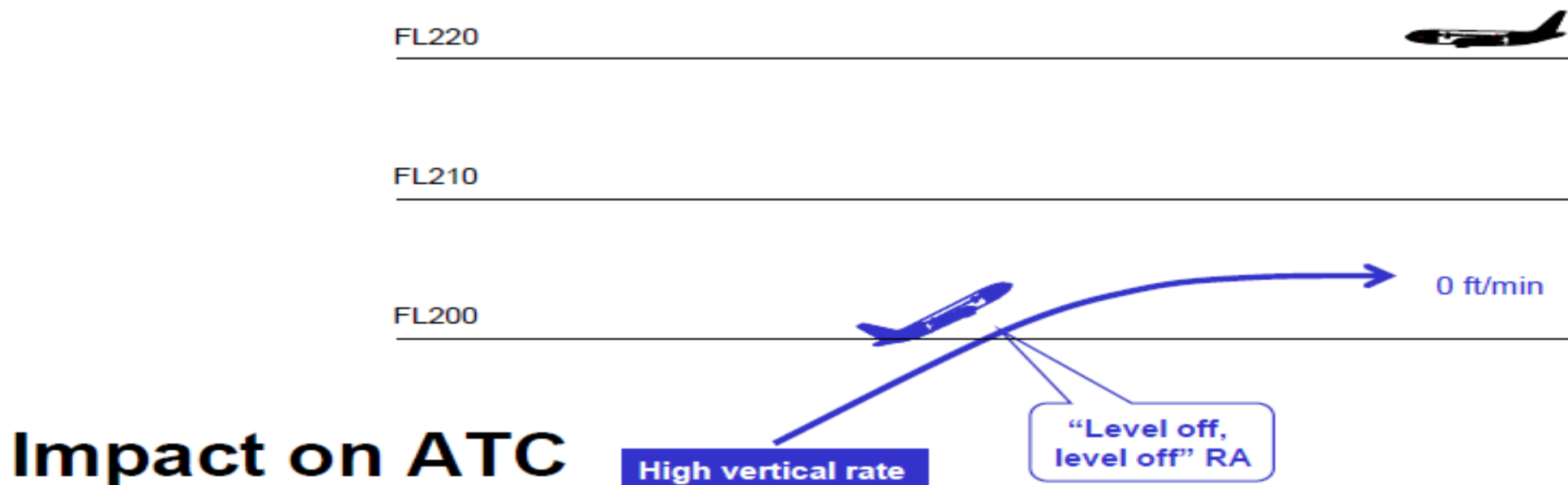
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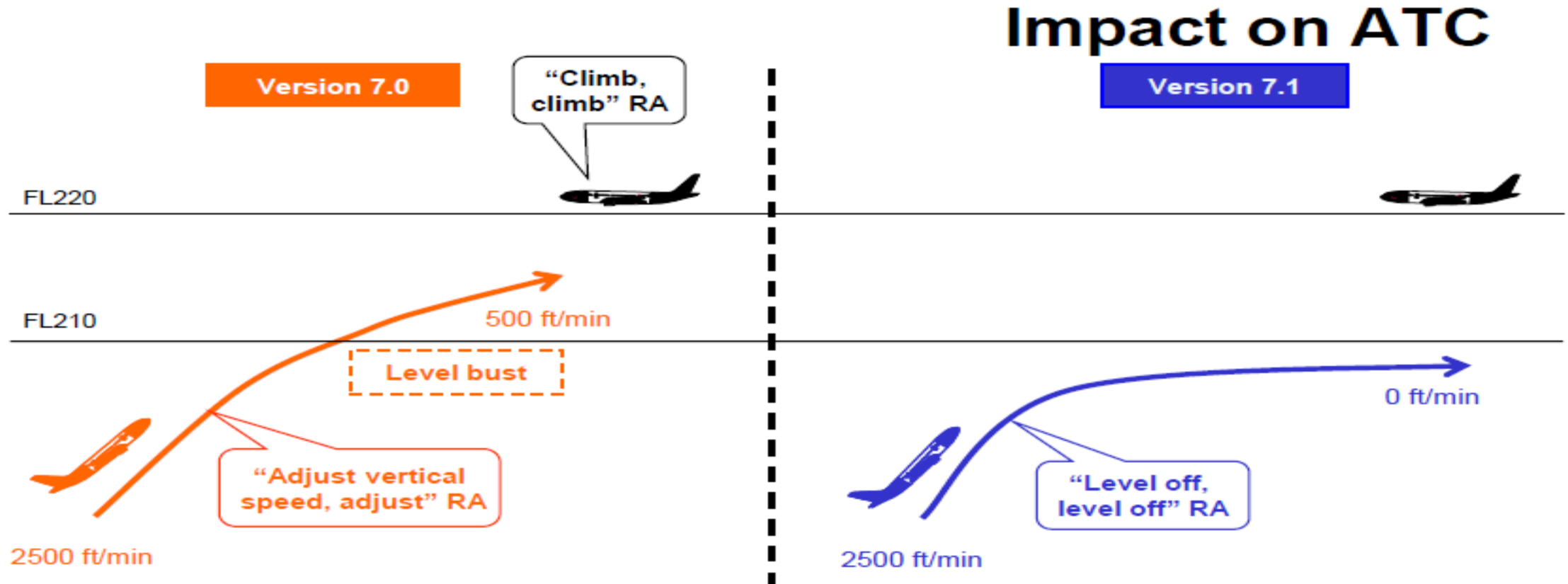
“Level off, level off” RA (4/5)

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



“Level off, level off” RA (5/5)

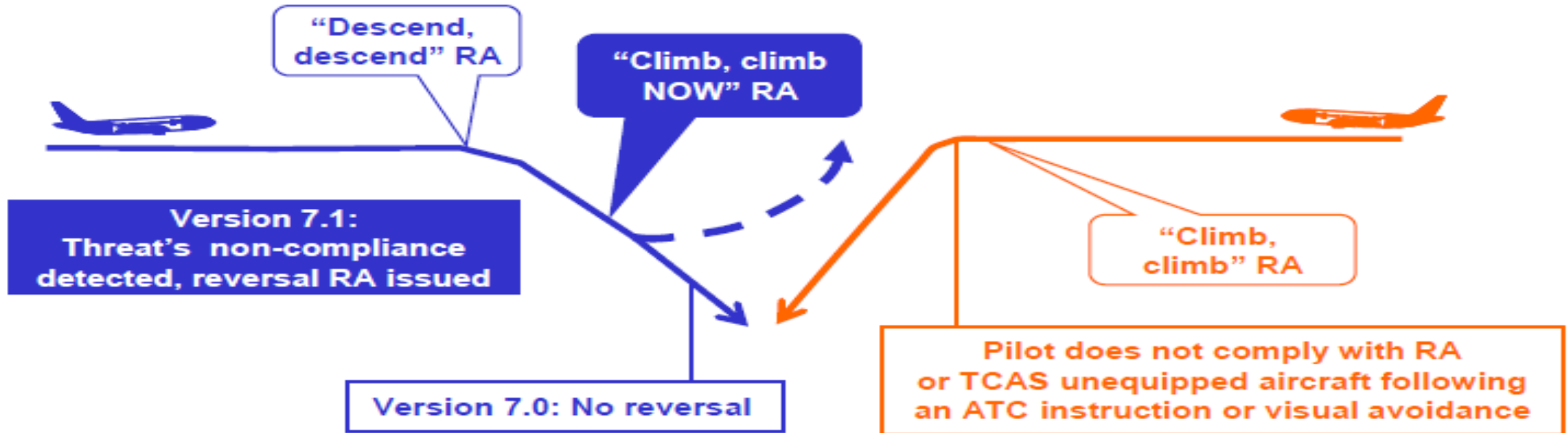
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Improvement to the reversal logic



Frequently asked questions (FAQ)

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)

Beside 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



EUROCONTROL

For more info, visit:
www.eurocontrol.int/acas

Philippine Air Carriers Compliant

Traffic Collision Avoidance System

TCAS II version 7.1



No. of Aircraft	Aircraft Type	Status
15	A330-300	All equipped with TCAS version 7.1
17	A321-231	All equipped with TCAS version 7.1
23	A320-200	19 aircrafts with TCAS version 7.1 and 4 aircrafts on-going retrofit. Target date of completion will be on November 2015.
6	A340-300	Three (3) aircraft are already compliant with Version 7.1 Three(3) aircraft are On-going installation



No. of Aircraft	Aircraft Type	Status
8	ATR 72-212	All equipped with TCAS II version 7.1
10	A319-111	On going retrofit of TCAS II version 7.1
31	A320-214	24 aircrafts equipped with TCAS II version 7.1 while 7 aircrafts on-going retrofit
6	A330-343	All equipped with TCAS II version 7.1

ICAO ANNEX 10

- Currently, the only commercially available implementations of ICAO Standards for ACAS II are...

TCAS II Versions 7.0

TCAS II Version 7.1 (Traffic Alert and Collision Avoidance System)

ICAO ANNEX 10 – States that new ACAS installation after 01 January 2014 must be Version 7.1 before January 2017.

A presentation reference to the agenda item
6/9. A report on the TCAS II Euro version 7.1
compliance by Philippine Air Carriers