

TCAS RA pilot compliance online assessment tool

User guide

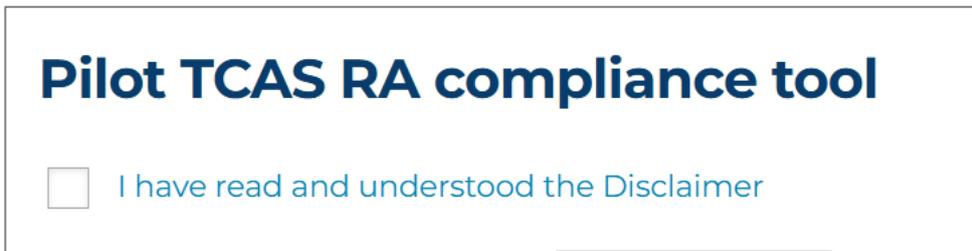
1 Introduction

- 1.1 The RA Compliance online Tool allows a user to assess the extent to which a pilot, who receives a single-sense TCAS RA, has responded (by constraining or changing the aircraft's vertical speed) in a standard manner.
- 1.2 For a specific RA the user indicates whether it is:
 - an initial RA;
 - or a subsequent RA;and provides:
 - the version of ACAS (TCAS Version 7.0; TCAS Version 7.1; or ACAS Xa CP1);
 - the vertical sense of the RA ("Upward"; or "Downward");
 - the strength of the RA (from a drop-down list);
 - the vertical rate of the aircraft when the RA was issued (in fpm); and, for "Maintain Vertical Speed" RAs:
 - the vertical speed required by the RA (in fpm);and, for "Maintain Vertical Speed" RAs:
 - the vertical speed required by the RA (in fpm).
- 1.3 For the evaluation the user supplies:
 - the time after the RA at which the evaluation is required (in seconds); and
 - the vertical rate of the aircraft at this time (in fpm).
- 1.4 Given the above details, the tool evaluates the compliance of the vertical rate achieved, by using "Method B" that takes account the fact that an acceleration phase, after a nominal response delay and at a nominal acceleration, is expected before the required vertical rate is achieved. This method is detailed in the IATA/EUROCONTROL Guidance Material.
- 1.5 The nominal response delay and nominal acceleration constitute the "standard pilot response" which is implicit in the collision avoidance algorithms and is detailed in the ACAS SARPs (section 4.4.2.5 of Aeronautical Telecommunications, Annex 10, Volume IV – Surveillance and Collision Avoidance Systems', 5th Edition, ICAO, Jul 2014 (ISBN 978 92 9249 537 4):

- for an initial corrective RA, the pilot is assumed to initiate a response to the RA after a delay of 5s and to accelerate the aircraft to the required vertical rate with an acceleration of 0.25g;
- for a subsequent corrective RA, the pilot is assumed to initiate a response to the changed RA after a delay of 2.5s and to accelerate the aircraft to the required vertical rate with either:
- an acceleration of 0.25g, for 'normal' RAs; or
- an acceleration of 0.35g, for 'exigent' RAs ('reverse-rate' RAs and 'increase-rate' RAs).
- The value of g (the acceleration due to gravity) is taken as 9.80665 m/s² (= 32.174 ft/s² = 1920.4 fpm/s) as per the ICAO standard atmosphere model (Source: Manual of the ICAO Standard Atmosphere', Doc. 7488/3, 3rd Edition, ICAO, 1993 (ISBN 92-9194-004-6).

2 Getting started

- 2.1 Before using the online tool, you should read the Disclaimer which can be access by clicking on the link at the top of the page. You must confirm that you understand the Disclaimer by ticking (selecting) the box adjacent to the disclaimer link (see Figure 1).

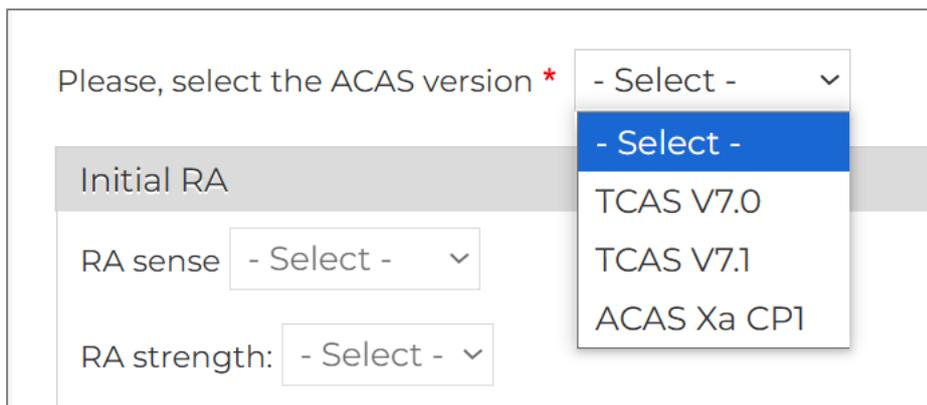


Pilot TCAS RA compliance tool

I have read and understood the Disclaimer

Figure 1: Confirmation of the Disclaimer.

- 2.2 Only when the Disclaimer box has been ticked, the user can enter the details of the RA and the response that they wish to evaluate.
- 2.3 For all the menu selection, a brief description of the required inputs is provided if you hover a mouse cursor over the menu field.
- 2.4 At the top of the page, select from the pull down menu the version of ACAS with which the aircraft was equipped: TCAS II version 7.0, TCAS II version 7.1 or ACAS Xa CP1 (Figure 2).



Please, select the ACAS version *

Initial RA

RA sense - Select -

RA strength: - Select -

- Select -

- Select -

TCAS V7.0

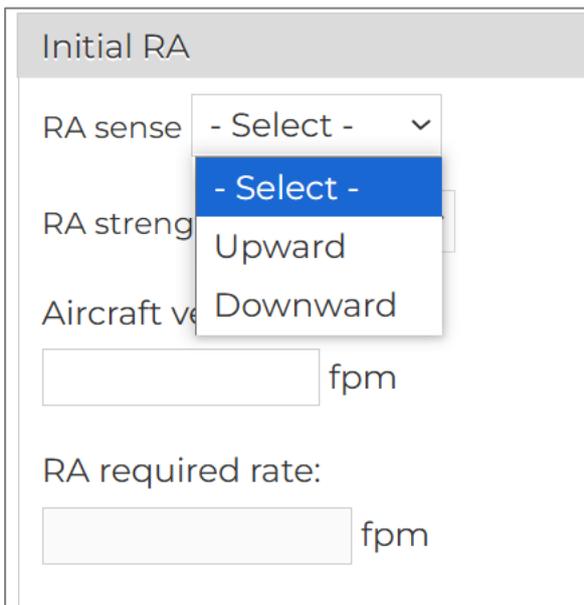
TCAS V7.1

ACAS Xa CP1

Figure 2: ACAS version selection.

3 RA details

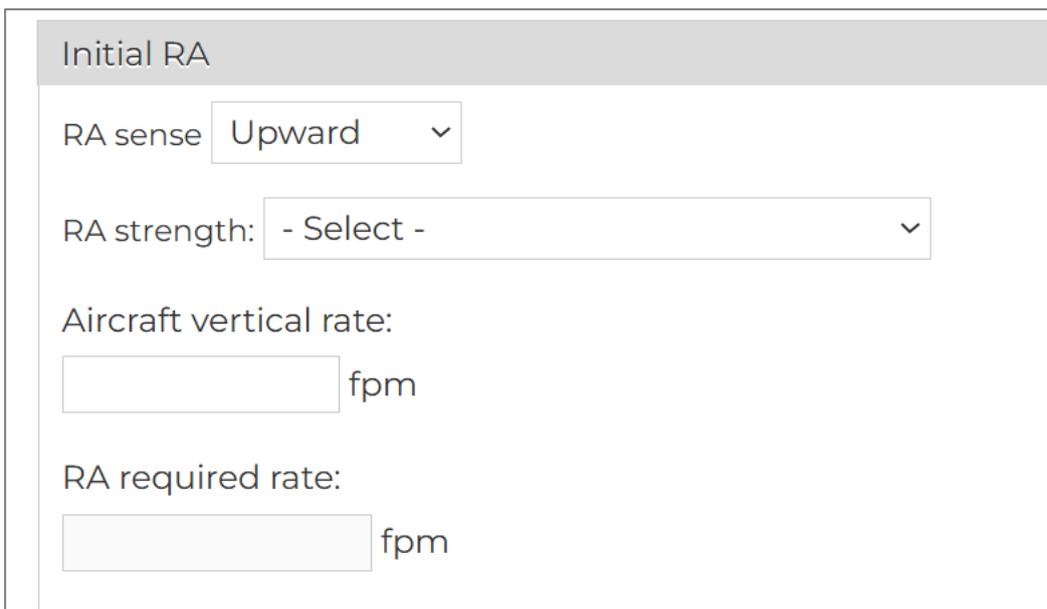
- 3.1 First, the analysis of Initial RAs will be conducted. An "Initial RA" is an RA occurring when, immediately prior to the RA, no aircraft constituted a threat. The alert will end with a "Clear of conflict" indication or a change to the RA (strengthening, weakening or reversal). If after the "Clear of conflict" indication another RA occurs (even if against an aircraft that was previously a threat) this will be another Initial RA.
- 3.2 Select an RA vertical sense: upward or downward (see Figure 3). The selected sense appears in the "RA sense" field.



The screenshot shows a window titled "Initial RA". It contains several input fields and dropdown menus. The "RA sense" dropdown menu is open, showing three options: "- Select -" (highlighted in blue), "Upward", and "Downward". Below the dropdown menu, there are two input fields labeled "Aircraft vertical rate" and "RA required rate:", both followed by "fpm".

Figure 3: Initial RA sense selection.

- 3.3 Then, in the next line select the RA strength from the pulldown menu (the pulldown list contains only the RAs applicable to the type of collision avoidance system and the RA sense that the user has selected).



The screenshot shows the same "Initial RA" window. The "RA sense" dropdown menu is now closed and shows "Upward". The "RA strength:" dropdown menu is open, showing "- Select -" as the selected option. The "Aircraft vertical rate" and "RA required rate:" input fields remain empty and are followed by "fpm".

Figure 4: Initial RA details menus.

- 3.4 In the "Aircraft vertical rate" field, enter using your keyboard the vertical rate of the aircraft in feet per minute at the time when the initial RA was generated. Enter a negative value for a descent rate (i.e. the number must be preceded by the minus sign "-"). For aircraft flying level the value "0" must be entered (Figure 4).
- 3.5 If the selected RA strength is "Maintain Vertical Speed" or "Crossing Maintain Vertical Speed", the "RA required rate" field will become active, and you must enter the vertical rate value in fpm required by the RA. That value should be obtainable from FDM or FDR.
- 3.6 Once the "Evaluate initial RA" button has been selected, a generic cockpit display of the RA can be viewed in the Initial RA section. The corresponding RA's aural annunciation is provided underneath the cockpit display. N.B. This is a generic representation of the RA display – the actual display on the aircraft might be on an IVSI, a vertical speed tape, and/or pitch cues on the PFD (Figure 5).

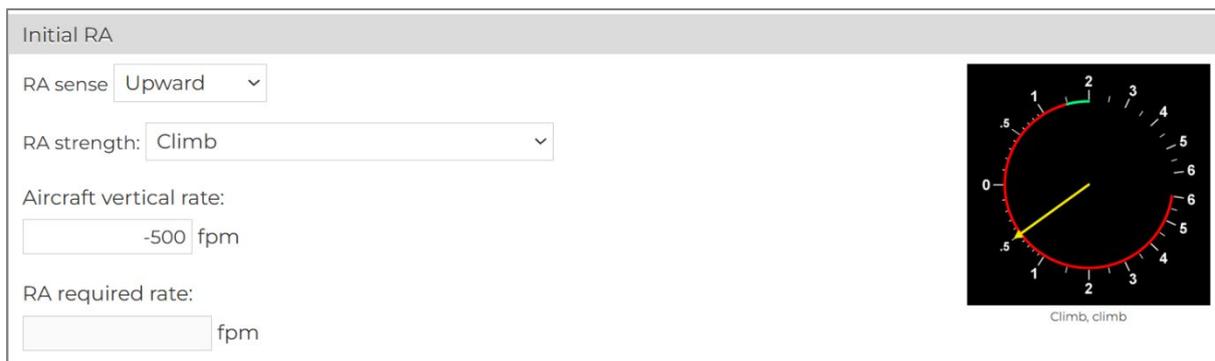


Figure 5: Representation of RA a generic cockpit display.

- 3.7 If the RA required rate value is inconsistent with a Maintain Vertical Speed RA (i.e., magnitude less than 1500 fpm or differs by more than 200 fpm from the aircraft vertical rate) the field will be shaded yellow (Figure 6).

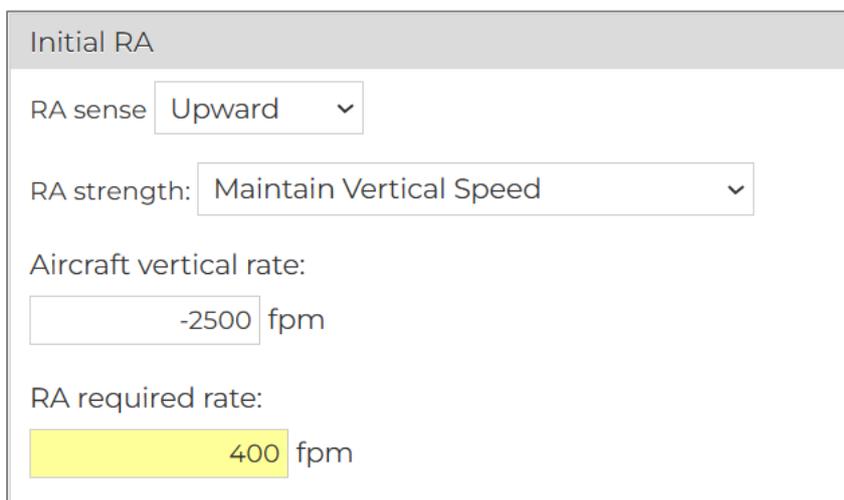


Figure 6: Inconsistent RA required rate highlighted for a Maintain Vertical Speed RA.

4 Compliance evaluation – initial RA

- 4.1 Within each RA analysis box are three independent Evaluation boxes. Any, or all, of these boxes can be used to evaluate up to three responses to the single RA (Figure 7).

The screenshot displays a web interface for compliance evaluation. It features three columns, each representing an evaluation box. Each box contains a 'Time of evaluation' field with a numeric input and a unit of 'seconds', an 'Achieved vertical rate' field with a numeric input and a unit of 'fpm', and a 'Compliance' box with a colored status indicator. Below the evaluation boxes are three buttons: 'RESET', 'EVALUATE INITIAL RA!', and 'DOWNLOAD AS PDF'.

Evaluation 1	Evaluation 2	Evaluation 3
Time of evaluation: 6 seconds	Time of evaluation: 8 seconds	Time of evaluation: 10 seconds
Achieved vertical rate: -900 fpm	Achieved vertical rate: 100 fpm	Achieved vertical rate: 1500 fpm
Compliance NO RESPONSE	Compliance WEAKLY FOLLOWED	Compliance FOLLOWED

RESET EVALUATE INITIAL RA! DOWNLOAD AS PDF

Figure 7: Evaluation of compliance with an initial RA at three separate instants.

- 4.2 Enter the “Time of evaluation” in one of the boxes. For an Initial RA, this is the time, in seconds, since the instant at which the RA was generated. The Evaluation 1 time must be an integer equal to or greater than 6.
- 4.3 Enter the “Achieved vertical rate” in the corresponding cell, in feet per minute. This is the vertical rate of the aircraft at the time of the evaluation. Enter a negative value for descent rates (i.e., the number preceded by the minus sign “-”). For aircraft flying level the value “0” must be entered.
- 4.4 Repeat these steps for Evaluation 2 and Evaluation 3, if needed.
- 4.5 To evaluate the compliance click the “Evaluate initial RA!” button.
- 4.6 The compliance will be calculated using “Method B”, is shown as colour-coded text in cells within the “Compliance” box. See the description of Method B in the Guidance Material for the explanation of compliance evaluation.
- 4.7 The results of compliance evaluation can be saved as a PDF file by clicking “Download as PDF” button.
- 4.8 Once the evaluation is complete, press the “Reset” to clear all the fields or close the browser window.

5 Compliance evaluation – subsequent RAs

- 5.1 A subsequent RA is any modified RA issued during an encounter after the initial RA but before a Clear of Conflict indication. A subsequent RA can be weakening, strengthening, or reversed sense RA (Figure 8).
- 5.2 Enter the “Time of evaluation” in one of the boxes. For a subsequent RA, this is the time in seconds, since the instant at which the subsequent RA was generated (i.e., changed), rather than since the instant at which the corresponding initial RA was generated). The Evaluation 1 time must be an integer equal to or greater than 6.
- 5.3 To evaluate pilot’s compliance with a subsequent RA, follow the same steps as described above for the initial RA evaluation.

Evaluation 1	Evaluation 2	Evaluation 3
Time of evaluation: <input type="text" value="6"/> seconds	Time of evaluation: <input type="text" value="8"/> seconds	Time of evaluation: <input type="text" value="10"/> seconds
Achieved vertical rate: <input type="text" value="1200"/> fpm	Achieved vertical rate: <input type="text" value="300"/> fpm	Achieved vertical rate: <input type="text" value="-2900"/> fpm
Compliance OPPOSITE	Compliance WEAKLY FOLLOWED	Compliance EXCESSIVE
RESET	EVALUATE SUBSEQUENT RA!	DOWNLOAD AS PDF

Figure 8: Evaluation of compliance with an initial RA at three separate instants.

6 More information

6.1 For any questions, bug reports or more information contact EUROCONTROL at acas@eurocontrol.int.