

General Authority of Civil Aviation		Air Navigation Safety Leaflet Notice	
Safety & Economic Regulation	Applicability: GACA Air Navigation Services	Number: 2013/01	
		Issued: 13 February 2013	

# TECHNIQUES TO REDUCE THE INCIDENCE OF TCAS RESOLUTION ADVISORIES (RA)

## 1. Purpose

- 1.1 The purpose of this Circular is to provide information on techniques that should be applied by air traffic controllers to reduce the potential for Resolution Advisories (RAs) associated with ACAS II/TCAS II.
- 1.2 **Nothing in this safety leaflet overrides ATC or pilot responsibilities in relation to TCAS RAs.**
- 1.3 **Nothing in this safety leaflet shall prevent pilots-in-command from exercising their best judgment and full authority in the choice of the best course of action to resolve a traffic conflict or avert a potential collision.**

## 2. Background

- 2.1 The Airborne Collision Avoidance System (ACAS) II concept (implemented as Traffic alert and Collision Avoidance System (TCAS) II equipment) is an airborne avionics system which acts independently of ATC as a last resort safety net to mitigate the risk of midair collision.
- 2.2 ACAS tracks aircraft in the surrounding airspace through replies from their ATC transponders. If the system diagnoses a risk of impending collision it issues a Resolution Advisory (RA) to the flight crew which directs the pilot how best to regulate or adjust his vertical speed so as to avoid a collision. Experience, operational monitoring and simulation studies have shown that when followed promptly and accurately, the RAs issued by ACAS II significantly reduce the risk of midair collision.
- 2.3 Since the introduction of ACAS II/TCAS II there have been several incidents in KSA airspace where aircraft have initiated avoiding action in response to a TCAS Resolution Advisory (RA). In a large percentage of cases, the RA has been annunciated to the pilot, and subsequent avoiding action taken, even though the air traffic controller has applied an appropriate and valid separation minima.
- 2.2 Subsequent investigation has determined that small changes to techniques on the part of both pilots and air traffic controllers could have reduced the likelihood that a TCAS RA would have been received where appropriate separation was being applied.

## 3. Area of Application

- 3.1 The techniques discussed in this circular are applicable in all airspace within KSA.

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#### 4. Techniques to Reduce Potential for Resolution Advisories

- 4.1 Some RAs are perceived by pilots or controllers as a nuisance or unnecessary as they are generated when it is believed there is no risk of a collision. RAs are triggered if TCAS II calculates that there is a risk of impending collision between aircraft, as defined by the collision avoidance algorithms. The evaluation of whether the RA is *nuisance* is impossible in real-time (i.e. during the event) and it can only be done reliably in hindsight.
- 4.2 Pilots sometimes do not follow an RA as they believe they have the threat aircraft in sight and judge there will be sufficient separation. **In this respect, ICAO provisions are quite clear that in the event of an RA, the pilot must respond immediately by following the RA unless doing so would jeopardize the safety of the aircraft.** These provisions apply in all airspace classes and all meteorological conditions (i.e. VMC and IMC). In real-time a pilot has little chance to assess whether the traffic acquired visually is in fact the one against which the RA has been generated.
- 4.3 It is possible, however, to reduce the opportunity for an RA by recognizing the circumstances in which an RA may be generated, and adjusting technique.
- 4.4 One of the most common cases responsible for generating RAs is the situation when two aircraft are simultaneously leveling off 1000 feet apart (one climbing and one descending) or one aircraft is leveling off 1000 feet away from a level aircraft and RAs are triggered due to aircraft's high vertical speeds when approaching the cleared flight level.
- 4.5 ICAO Procedures for Air Navigation – Flight Operations (PANS-OPS Doc 8168 Volume 1) – Part VIII Paragraph 3.3 states:
- “...Pilots should use appropriate procedures by which an aeroplane climbing or descending to an assigned altitude or flight level, especially with an autopilot engaged, may do so at a rate less than 1500 ft/min throughout the last 1000 ft of climb or descent to the assigned altitude or flight level **when the pilot is made aware of another aircraft at or approaching an adjacent altitude or flight level, unless otherwise instructed by ATC.** These procedures are intended to avoid unnecessary airborne collision avoidance system (ACAS II) resolution advisories in aircraft at or approaching adjacent altitudes or flight levels. For commercial operations, these procedures should be specified by the operator....”*
- 4.6 This implies that if ATC does not provide traffic information, a pilot may climb or descend at a higher rate to cleared level.

##### **Traffic Information**

- 4.7 To increase the likelihood that pilots will slow their rate of climb or descent, controllers should ALWAYS pass traffic information in an opposite direction climb/descend situation even where an intermediate level restriction has been applied. It is also good technique to provide traffic information where two aircraft climbing and descending will pass near each other, even if an appropriate separation minima is in place.

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**Example:** “ABC123, climb FL150, expect short delay for further climb due opposite direction traffic descending”. “XYZ789, when ready descend FL160, expect short delay for further descent due opposite direction traffic climbing”. Try to avoid using the assigned level of the traffic in the same transmission as this could be misinterpreted as a level clearance instruction. If the pilot asks what level the traffic is climbing or descending to, you can pass that information.

**Increased vertical spacing**

4.8 Where there is a large vertical spacing between a climbing and a descending aircraft (e.g., aircraft leaving FL350 for and arrival, and aircraft taking-off planned to FL360) ATC should consider using intermediate level assignments which are greater than the minimum separation when opposite direction climb and descent situations occur, rather than the minimum separation.

**Example.** Aircraft A is at FL350 requesting descent. Opposite direction aircraft B is about to take-off, requesting FL360. If you assign the descending aircraft FL 160, and the climbing aircraft FL 150, both aircraft are likely to have high rates of climb or descent approaching the assigned levels, and one aircraft may get an RA. Consider assigning the descending aircraft FL200, and the climbing aircraft 12,000 ft – then re-evaluate as the aircraft approach their levels. It is likely both aircraft will slow their vertical rates approaching the assigned levels.

**Lateral segregation**

4.9 As a further matter of technique, controllers should evaluate whether or not it is feasible, within workload constraints, to adjust the heading of one or both aircraft in an opposite direction climb/descent situation (where surveillance capability is available), so that they will pass each other with an appropriate lateral spacing. For increased situational awareness, controllers should also consider passing traffic information in these situations, even though lateral separation will apply.

**Route segregation**

4.10 For the longer term, consideration should be given to reviewing route structures – particularly in terminal areas – and particularly those involving standardized arrival or departure paths – to identify potential TCAS RA ‘hot spots’. Once identified, action can be taken to adjust routes to reduce the potential for TCAS encounters.

**5. Complementary Techniques for Pilots**

5.1 In parallel with this circular, an Aeronautical Information Circular has been issued to all pilots. This Circular requests that pilots, as a matter of technique, reduce their rate of climb or descent in the last 1000 feet of a level change, to a maximum of 1500 feet/minute, regardless of traffic information. Further, pilots have been asked to consider reducing their vertical speed below 1500 feet/minute if traffic information is provided.

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5.2 It should be understood that whilst this may reduce the potential for a TCAS RA, it may not completely eliminate it. Where a pilot receives a TCAS RA he will respond as required, regardless of ATC instructions.

## 6. Additional Information

6.1 There is a considerable amount of training and educational material available worldwide on ACAS II/TCAS II. This includes:

- ACAS II Guide (January 2012)  
[www.eurocontrol.int/msa/gallery/content/public/documents/ACAS\\_guide71.pdf](http://www.eurocontrol.int/msa/gallery/content/public/documents/ACAS_guide71.pdf)
- Eurocontrol Training Presentations available at [www.eurocontrol.int/acas](http://www.eurocontrol.int/acas) (Overview of ACAS II, TCAS II version 7.1 for air traffic controllers, TCAS II version 7.1 for pilots)
- Eurocontrol ACAS II Bulletins (series of 14 documents) available at [www.eurocontrol.int/acas](http://www.eurocontrol.int/acas)
- FAA Brochure: "Introduction to TCAS II version 7.1" (February 28, 2011)  
[http://www.faa.gov/documentLibrary/media/Advisory\\_Circular/TCAS%20II%20V7.1%20Intro%20booklet.pdf](http://www.faa.gov/documentLibrary/media/Advisory_Circular/TCAS%20II%20V7.1%20Intro%20booklet.pdf)
- "The Traffic Alert and Collision Avoidance System" by James K. Kuchar and Ann C. Drumm – an article from the Lincoln Laboratory Journal (Volume 16, Number 2, 2007)

6.2 Additional information is available in the following ICAO reference documents:

- ICAO Annex 2 – Rules of the Air
- ICAO Annex 6 – Operation of Aircraft - Part I - International Commercial Air Transport
- ICAO Doc 4444 – PANS-ATM – Procedures for Air Navigation Services – Air Traffic Management
- ICAO Doc 8168 PANS-OPS - Procedures for Air Navigation Services – Aircraft Operations
- ICAO Doc 9863 - Airborne Collision Avoidance System (ACAS) Manual

## 7. Authorization

Name/Position	Signature	Date
Capt M Jamjoom Vice President Safety and Economic Regulation General Authority for Civil Aviation	<i>Original signed</i>	<i>13 February 2013</i>