

WHY DISPLAY TCAS RESOLUTION ADVISORIES AT CONTROLLER WORKING POSITIONS





by Tony Licu

When TCAS was introduced into operations, the ATC community generally had a negative attitude towards it. *Will it interfere with our work? We are doing an excellent job, so why do we get it over here? Do I want or need to know about it?* Questions like these were on people's minds. In this article I will look at what has changed since then by examining possible answers to the above questions from different perspectives. Because when anything is commonly agreed about what is known as 'RA downlink', it is the fact that it's a controversial topic!

Because we can do it

It is indeed technically feasible to display RAs at controller working positions. TCAS was designed to downlink sufficient information in real-time and this information was originally intended primarily to enable the monitoring of TCAS performance. Over the years various studies were performed into the practicality and usefulness of displaying RA information to controllers but none of these demonstrated convincing benefits.

Widespread deployment of Mode S radars added a new dimension. Some ATC system manufacturers added RA downlink as a standard feature to their off-the-shelf products. This gave their customers a difficult choice: switch it on or switch it off?

Some ANSPs decided to switch RA downlink on. Some ANSPs decided to switch RA downlink off or are still undecided. EUROCONTROL offered support to early adopters and worked with many of them to ensure that their use of RA downlink was sound and safe.

Perhaps the decisive factor for many early adopters was the legal aspects. Information about RAs is now readily available, so what could be the legal implications of withholding this information from controllers when having such information could make a difference to the outcome of a close encounter? Unfortunately there is no clear answer to this question, it would be for a judge to decide in the court room of the jurisdiction concerned.

Because it increases situational awareness

Pilots are explicitly allowed to deviate from ATC clearances and instructions when in receipt of a TCAS RA. Controllers need to know when this happens because it changes their responsibilities. However, when faced with a RA, pilots are expected to follow the established priority of 'Aviate, Navigate, Communicate' in that order. Consequently, and confirmed by studies, this means that pilot reports of an RA are often delayed.

When asked, some pilots answer that they have never experienced an RA other than in the simulator and in most simulator exercises, pilots are not caught by surprise. Other traffic will often not appear on the Navigation Display, so if an aircraft symbol appears, it is likely to suggest that an RA encounter may well be imminent. Other pilots answer that they have experienced occasional RAs during flight and often have a clear recollection of what happened. In other words and also confirmed in studies, RA events are rare, cause a high workload at an unexpected moment and may be stressful. There are other factors influencing the timing of pilot reports and explanations for frequent errors like using a wrong callsign, omitting the callsign or more generally using wrong phraseology.

RA downlink can alleviate some of these problems with pilot reports. The reason for a deviation from clearance is immediately clear without need for the added pilot workload involved in communication and wrong phraseology is no longer a factor. Traffic information can be given by the controller when considered appropriate, but with 'Clear of Conflict' still pending, opinions on this are divided.

Although ICAO provisions acknowledge the possibility of the display RA information to controllers, there are no other provisions. In other words, the only possibility today is to use RA downlink "For Information Only", which is the usage by all early adopters we know of and they are generally satisfied with that. Of course ICAO provisions could be changed to enable other use. It currently seems unlikely that RA downlink will be globally implemented in the foreseeable future so it cannot (yet) replace the pilot report. But an attractive option, for some at least, RA downlink could be "Same as Pilot Report". There are others who say "Don't Even Think about It" in response to the idea of RA downlink because it could encourage a controller to intervene during an event in which they must hold back.

Because it could prevent accidents

It is now 13 years ago a Tupolev Tu-154 and a Boeing 757 were on crossing tracks at the same flight level near Überlingen (Lake Constance) in Southern Germany. The Tu-154 crew followed their ATC instruction to descend and continued to do so even after they had received a TCAS 'Climb' RA. The 757 crew also descended their aeroplane but did so in compliance with the TCAS RA they had received. The two aircraft collided and all on board perished.

In simple terms TCAS works as follows. It tracks nearby aircraft and estimates horizontal miss distances, vertical miss distances and the times when these will occur. If these fall below defined thresholds, TCAS assumes that a collision may occur with what is now a threat aircraft. From this moment on the TCAS collision avoidance logic determines every second what is now the best vertical escape manoeuvre, based on the estimated vertical miss distance. If the other aircraft is also TCAS equipped, a coordination process between the two TCAS systems ensures that the generated RAs are complementary. If necessary, a vertical sense reversal can occur or the target vertical rate can change.

In the Überlingen collision, no TCAS vertical sense reversal occurred because of a flaw in the logic. During the encounter the estimated vertical miss distance remained smaller than 100 feet, which prevented a reversal. This issue was already known but making and approving changes to complex avionic equipment is time consuming. Only very recently the deployment of TCAS version 7.1, which amongst other things fixes this flaw, was completed in Europe and it will still take some time until this is the case worldwide.

As in all accidents there are many factors that played a role. TCAS is part of a socio-technical system in which roles and responsibilities are not always clear-cut and procedures are sometimes ambiguous. It is beyond the scope of this article to address all aspects, but the Überlingen accident investigation report did recommend further development of RA downlink, which brings us back on topic.

It is not surprising that controllers – and sometimes pilots – have strong opinions about RA downlink. Their professional associations, IFATCA and IFALPA, have formulated positions but my reading of these opinions is that neither is opposed to RA downlink provided that roles and responsibilities are clear.

In the case of "for information only" use of RA downlink, the fear is that in the case of a collision, the mere fact of having RA information could be used against ATC. Ironically, as mentioned earlier, not having RA information could also be used against ATC. In both cases, individuals working in different parts of an ATC organisation involved might, in some countries, find themselves held responsible and open to prosecution, which further complicates the issue.

The "Same as Pilot Report" principle gets much support. However, an argument which has been used against it is that

a crew could have overriding safety reasons for not following an RA and expect ATC to continue to provide separation. In any case ICAO provisions would have to be changed to enable use of this principle and that is a time-consuming process with an unpredictable outcome.

The main argument against "Don't Even Think about It", the possible consequences of withholding readily available information, has already been made.

Because we agree to do it

The ATC attitude towards TCAS is now more positive than it was 25 years ago. For controllers and pilots alike, to err is human. TCAS II has made a significant contribution to safety in collision-risk situations and the seeds of Just Culture are bringing results in many organisations by alleviating the fear of unjustified discipline for "honest mistakes".

Early adopters report that RA downlink is not a game-changer. Controllers don't particularly feel that they need it but almost unanimously wouldn't like it removed from their screens once they've experienced it. In an experimental validation environment, they reported that RA downlink information was welcome in many situations and not disturbing in the remaining ones. More generally, there is both practical experience and scientific evidence that RA downlink increases situational awareness.

Will the aviation community ever reach agreement on the topic? Probably not any time soon. But I have observed during the years after Überlingen that the debate has gradually changed from emotional to rational, and rational debates usually lead to sound decisions. One decision has already been made – the technical aspects of RA downlink will be improved in ACAS X. But for now, we all agree to disagree about the use of this capability! 

TONY LICU

is Head of the Safety Unit within the Network Manager Directorate of EUROCONTROL. He leads the deployment of safety management and human factors programmes of EUROCONTROL. He has extensive ATC operational and engineering background (Masters Degree in avionics).

