WHY TCAS DOWNLINKING **IS A BAD IDEA**

by Duncan Auld

People are often surprised if they learn of IFATCA's objections to downlinking TCAS RAs to controller working positions. Yet it's true, it is one of the Federation's most outspoken policies. It is worded as follows in our manual:

IFATCA is opposed to down linking of any advisories generated by ACAS. If downlinking of ACAS Resolution Advisories becomes mandated, then IFATCA can only accept this provided that the following criteria are met: Clear and unambiguous controller legal responsibilities; Downlink should be without delay; ATC systems to be able to receive, process and display the down link to the appropriate control positions; compatibility with all ground based safety nets; nuisance and false alerts must be kept to an absolute minimum; and ACAS should only be considered as a 'safety net'.

Let's analyse this in a bit more detail. The policy firstly demands that clear and unambiguous controller legal responsibilities are defined before such a system should be implemented. If Überlingen has taught us anything, it is that vague and incomplete statements of who does what when a TCAS RA is triggered can be a recipe for disaster. In a Review of ICAO Procedures, the 2007 RA Downlink Safety Assessment concluded that *"the existing ICAO procedures are inconsistent and should be reviewed. The issue of unclear controller responsibilities before and – even more – after the potential implementation of RA Downlink was also discussed (…) Current ICAO procedures do not contain provision for operational use of RA downlink."* [1]

Yet proponents of downlinking RAs, and ANSPs who have 'jumped the gun' and implemented it, are doing just that by not clarifying either where the controller's responsibility for separation ceases or where this responsibility is handed back. If a controller sees that a corrective TCAS RA has been triggered but a pilot contrary to TCAS procedures, should he or she do or say something? An even greater concern is that even though the ATM system can show that there's an RA active, this is not a confirmation that the pilot is reacting. In the current ICAO documentation the controller clearly remains responsible for

1- FARADS (Feasibility of ACAS RA Downlink Study) Close-out Report, EUROCONTROL, 2007, p7. https://www.eurocontrol.int/sites/default/files/publication/files/farads-close-out-report-version-10-20070514.pdf Accessed 15/09/2015

separation provision until the pilot verbally reports the TCAS RA to ATC.

The verbal report of a TCAS RA by a crew conveys the following three points to the ATCOs:

1) Yes, a TCAS RA is present;
2) Yes, we are following the RA;
3) Our manoeuvre makes us deviate from the current ATC-clearance.

Currently, the automatic downlink of a TCAS RA to ATC does not confirm any of the three points. Until all the above-mentioned issues are explicitly standardised at the ICAO level, IFATCA has no other option but to reject the idea of downlinking RAs to the controller.

Downlink should be without delay, as the more latency (delay) we have until the RA-messages reach the ATM-System and the operators, the less these messages are operationally relevant. ANSPs, such as DFS in Germany have proven that it is technically feasible to transmit TCAS downlink messages with almost no delay. In order to achieve this, extensive ground-infrastructure adaptations and developments are required (e.g. using Mode-S and listening to the various TCAS-transmissions). False or ghost TCAS squitter continues to be a serious concern, even if a lot of progress has been made to filter them out. It will be up to ANSPs to establish their own methods to differentiate bogus RAs from the real ones. While engineers tell us it's no problem to filter these out, there is a clear legal (and technical) dilemma: filter too much and risk missing a real one, or filter too little and risk overloading the controller with RAs that are simply not present in the cockpit!

That the down-linked TCAS RAs should be processed and displayed at the appropriate Controller Working positions speaks for itself. In order to achieve this the ATM system must be adapted to make sure that the addressing of the RA-messages to the correct Controller Working Positions (CWP) is achieved.

This task will generate delays or latency within the ATM System, but this is the price to be paid to avoid ATCO overloads, de-sensitisation and a loss of operator confidence in system warnings.

Even trickier will be the interaction with ground-based safety nets such as, for instance, with STCA (Short Term Conflict Alert). Which alerts should get precedence if they sound at approximately the same time? How can an HMI ensure that the different alerts are not interfering with each other and that they are clearly understood as such by the ATCOs working the affected flights? How will a controller prioritise them and make sure that all relevant procedures are followed correctly? What happens in cross-border cases, where one controller sees the RA-information but the colleagues in an adjacent centre or sector don't? Given the multitude of different ATC systems and HMIs, all this will require a tailored approach in each instance to ensure that these alerts are placed in the correct operational context. If this is not done correctly, it clearly will increase the safety risks dramatically – including confusing and/or contradictory ATC instructions reaching the crew.

And lastly, ACAS/TCAS was considered from inception to be a Safety Net that was completely and totally independent, in particular of all ground systems (TCAS was designed as a stand-alone airborne Safety Net). The downlinking of TCAS RAs, even if only meant to increase the situational awareness of controllers, clearly violates this principle. To show the alerts of the independent airborne Safety Net on-ground can create more hazards and may lead to uncertainties - worse even - it could create confusion. The more players and parties get informed about a last-chance safety warning, the more risk and possibilities for confusion, unexpected actions or even contradictions are created.

Experience, as well as TCAS-monitoring has shown that the existing TCAS procedures are working quite well; that controllers have become far less inclined to interfere with an announced TCAS RA and that pilots have also become less inclined to react to a controller's instruction (when this interferes or contradicts) with a TCAS RA shown in the cockpit. This implies that the strongest argument used by proponents of such a system is no longer valid. It was much more so when TCAS was introduced… but not anymore…. Current monitoring shows too that crew reactions to TCAS RAs are not yet totally flawless and manoeuvres are not always performed as required by procedure. The same can be said for ATCO-reactions: ATC-operators don't always stay hands off as required once a TCAS RA is announced on the frequency. So there is a clear need for much more TCAS-training for pilots, but also ATCO-training must be maintained or even enhanced (including simulator based training).

Another approach to 'TCAS improvement' is the Airbus initiative of coupling TCAS RAs with the autopilot. This in itself is much more beneficial than downlinking RAs - the former clearly makes quicker reactions and more accurate compliance much more likely, thereby limiting the impact on the ATC system and ATC provision of separation. Generally speaking the Airbus solution makes sure that all TCAS RA assumptions and requirements are met. That all TCAS RAs are followed correctly, meaning within the time frame allotted and within the commanded vertical constraints. This is a huge safety improvement!

Another system, also developed and certified by Airbus is called TCAP – TCAS Alert Prevention. It imposes new altitude capture laws on autopilots or Flight Directors (FD) by automatically reducing the rate of climb/descent before a level off. TCAP is reducing the vertical rate in the final 1000 feet before level-off and, by doing so, is reducing in a significant manner the number of TCAS RAs. Such level-off encounters, which are usually preventive TCAS RAs (where no deviation from the current ATC-clearance is required) make up about two-thirds of all monitored TCAS RAs in busy European and North American continental airspace. The TCAP system is another very promising safety enhancement that is improving the overall safety of the aviation system. A TCAS RA shown or reported to ATC is always a critical situation. The ATCO must remain hands-off for the duration of the TCAS RA event and this is clearly a loss of control and a serious limiting factor for ATC service provision.

And for the ground based ATM-systems, there would be a far greater safety benefit if every ATC system had a functioning and well-tuned HMI that included a predictive conflict alert system. This way, emphasis would be given to addressing the cause rather than trying to fight the symptoms. IFATCA believes that efforts should be concentrated on all the above-mentioned safety improvements, instead of running for risky short-term patches that will bring much more complexity into the system and have unintended or unexpected consequences that could have a tragic outcome …

DUCAN **AULD**

is the Executive Vice President Technical for IFATCA. In addition to his current work as an operational air traffic controller in Sydney terminal control, he has operated as an oceanic and area (both radar and non-radar) controller. He holds a Masters Degree in Aviation Management and serves as a technical expert on some ICAO Panels.