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NETALERT - the Safety Nets newsletter

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WELCOME

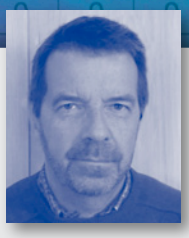
As our skies become ever busier and technology evolves, so too must our aviation safety nets. This issue of NET*ALERT* explores both the new safety nets being developed to keep pace with the changing ATM environment and how we can ensure that existing safety nets can continue to best serve airspace users.

Following the update on ACAS X presented in the last edition of NET*ALERT*, in this issue we talk to Bill Booth, Chairman of EUROCAE WG-75, to find out more about the next steps in the implementation of ACAS Xa and Xo. On this topic, make sure you keep a lookout for the ACAS Xa verification study workshop being organised by EUROCAE WG-75 next year.

TCAS Resolution Advisories are another focal point. We provide an overview of the many sources of information that can be used to collect data and investigate incidents involving TCAS RAs. Using an illustrative example, we show how data collected from various sources explained what really happened during this event and facilitated the identification of corrective actions.

Finally, a short update is provided on the status of the ICAO Ground Based Safety Net Manual.

ACAS Xa - moving forwards



Bill Booth

Bill joined EUROCONTROL in 2007. He is Chairman of EUROCAE WG-75 Standards Group for Traffic Alert and Collision Avoidance (TCAS) and co-Chair of the Joint-Group with the USA. He leads the European Safety Net Applied Research project consortium "CAPITO" which consists of Air Navigation Service Providers (ANSPs) and industry.

*NET*ALERT23*, published in May 2018, provides a general update on ACAS X. For this issue we ask Bill Booth to tell us about the latest developments for ACAS Xa/Xo, the successor to TCAS II.*

What is the purpose of ACAS Xa/Xo?

ACAS Xa is the specific variant of ACAS X that makes active interrogations to establish the distance to intruders. It will use the same antennas and displays, and the same range of Resolution Advisories (RAs) as TCAS II. On the whole, there will be no change in the way RAs are displayed and announced to the pilots with the exception of Maintain Vertical Speed RAs, which are no longer announced to the pilot for those RAs requiring the crew to maintain their current vertical rate.

ACAS Xo is designed for situations in which ACAS Xa is unsuitable and may generate an unacceptable number of nuisance alerts. An example is reduced separation operations, such as closely spaced parallel approaches.

Who oversees the development of ACAS Xa/Xo in Europe?

Several stakeholders are involved but ultimately, EASA (European Aviation Safety Agency) instigates the process for changing regulations. This will be based on a statement of acceptability in the EUROCAE WG-75 forum. EUROCAE WG-75 was tasked to deliver the ACAS Xa/Xo MOPS (Minimum Operational Performance Specifications) as a joint RTCA and EUROCAE activity. The MOPS were published in the autumn of 2018. In addition, the WG will develop a MASPS (Minimum Aircraft System Performance Specification) defining requirements for the interoperability of the different designs of the collision avoidance system. The acceptability criteria for Europe were developed as part of

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ACAS Xa – moving forwards

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SESAR (Single European Sky ATM Research). The European Evaluation of ACAS Xa will be performed as an exercise in SESAR Project 11 (CAPITO), with the cooperation of all the project partners.

Are the results of preliminary verification and validation studies already available?

Results from US studies are available and are positive. They show that ACAS Xa detects and alerts pilots more accurately and reliably than TCAS II. For verification in Europe, a similar study focusing on operations in European airspace will be delivered to EUROCAE WG-75 and published in early 2019. The workshop to assess the results of this verification study is currently being organised, with the exact date to be released shortly.

What work is being undertaken to integrate ACAS X into ICAO regulations?

The timely availability of the ACAS Xa/Xo MOPS allows for the material to be integrated in the next update to ICAO Annex 10 and ICAO Manual. The current Manual specifically refers to aspects only relevant to TCAS but now, both TCAS and ACAS Xa/Xo systems will be addressed. The ICAO ACSG (Airborne Collision Sub Group) group has already started to work on this.

What are the next steps for EUROCAE WG-75?

The Collision Avoidance System Interoperability MASPS being developed by the group are in the pre-Final Review and Comment (FRAC) phase and will be followed by a formal FRAC process. The aim is to publish in mid 2019.

The focus then moves to ACAS Xu. This system is designed for collision avoidance of Remotely Piloted Aircraft Systems (RPAS). The EUROCAE WG-75 ACAS Xu sub-group discusses developments, European analysis and modelling performed in the context of SESAR Project 11 (CAPITO). The sub-group plans to participate in joint activities with RTCA SC-147 (TCAS), RTCA SC-228 (MOPS for Unmanned Aircraft Systems) and EUROCAE WG-105 (Unmanned Aircraft Systems) to further ACAS Xu developments.

Coming soon

EUROCAE WG-75 will be organising a workshop on ACAS X in the first half of 2019. The aim of this event will be to assess the results of the verification study of ACAS Xa in European skies. Operational expertise will provide a key input to such assessments. Attendance from a diverse range of Air Navigation Service Providers, aircraft operators and professional associations is therefore warmly welcomed and actively encouraged.

The 'save-the-date', including date and location, will be announced by EUROCONTROL in due course.

2019 Safety Forum - Safety & Procedures

Invitation

You are cordially invited to join fellow aviation professionals at the **7th Annual Safety Forum** which takes place at EUROCONTROL's headquarters in Brussels on the 4-5 June 2019. This year's event will be dedicated to Safety & Procedures.

Over 250 front line professionals and those who train and manage them will be able to hear presentations and discuss the Safety Forum's findings on Safety & Procedures. The Forum will exchange industry best practice that can promote and improve the creation and application of safe procedures. During breakout sessions attendees will brainstorm ideas that can further improve the procedure creation and application process.

The organising committee is currently inviting submissions from speakers willing to present on the following topics (although original suggestions are also welcome):

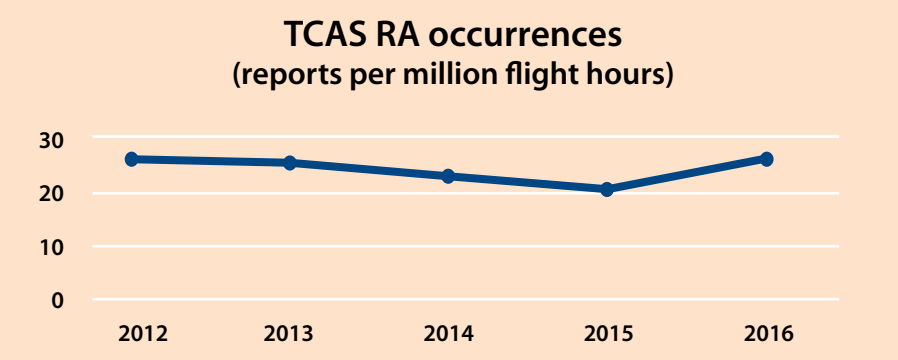
- **From drawing board to published regulation** – How are procedures created and implemented? How is the need for procedures identified?
- **Procedural shortcomings** – Which situations cannot be covered by procedures? Which hazards and risks cannot be captured in safety assessments? How do you recover from inadequate procedures?
- **Technology and science** – How can application of scientific methods help to create procedures? How can we monitor effectiveness of procedures?

The closing date for submissions is Thursday 31 January 2019. Further information can be found at https://www.skybrary.aero/index.php/Portal:Safety_and_Procedures.

If you are unable to present but would still like to attend the 2019 Safety Forum, we would encourage you to do so. Attendance at the Safety Forum is free of charge and you will benefit from detailed, tailored safety knowledge and intelligence. Please monitor the Forum's SKYbrary page for registration details and the agenda.

Investigating – TCAS RAs

Investigating TCAS RA occurrences can help us understand the contributing factors and opportunities for safety improvements. However, to get an accurate picture of what happened and why, it's important to gather information from the full range of available sources, or risk being left with more questions than answers!



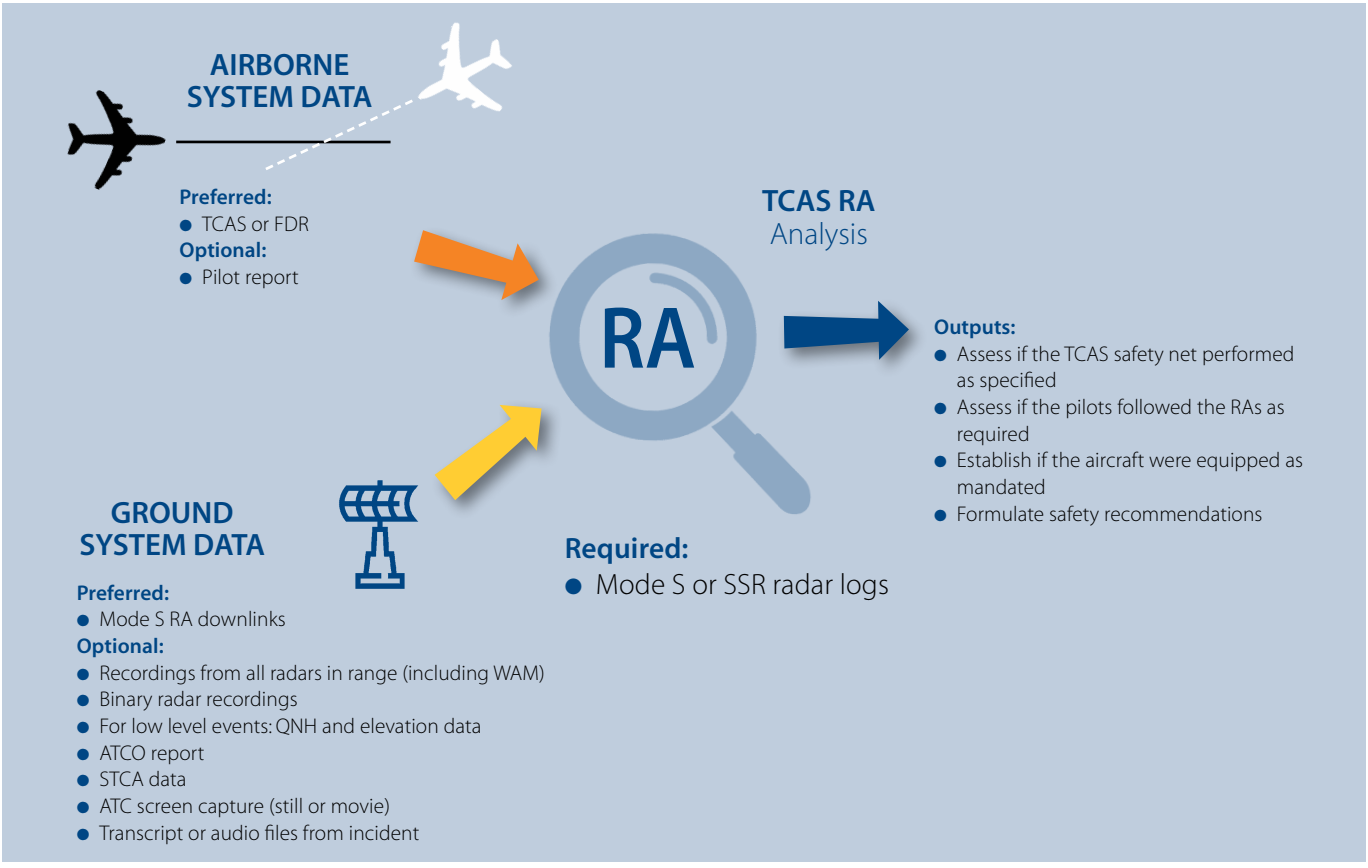
The number of TCAS Resolution Advisories (RAs), as shown in the EUROCONTROL Annual Safety Report (2017), has remained more or less constant over the last few years. RAs are rare, but when they occur, they evolve quickly and can take pilots and Air Traffic Controllers (ATCOs) by surprise. Air crews are trained for these situations but responding to TCAS RAs remains stressful. This may affect the pilots' precise recollection of the events when completing their report of the incident, usually several hours later. Although pilot and ATCO reports are important in the investigation process, several sources of evidence should be considered to ensure the most accurate results of the investigation.

On the ground, most of the data can usually be obtained from Mode S radars. Not only do they provide information of aircraft position and altitude, they also record RA messages downlinked from an aircraft's transponder. The RA messages contain information about the type of RA as well as the identity or position of the threat aircraft. The Mode S data however, will be recorded every 4-5 seconds (corresponding to the radar antenna rotation cycle); therefore, the exact timing of the RA will be unknown. If available, WAM (Wide Area Multilateration) recordings should be used as their update cycles are more frequent.

In the absence of Mode S recordings, any radar data can be used providing it contains position and altitude information. The radar data will be then used to recreate and simulate TCAS RAs using dedicated software[1] .

The ground recordings are best supplemented by airborne data coming from TCAS or Flight Data Recorders (FDR). However, Air Navigation Service Providers (ANSPs) would need to liaise with the airlines involved in the incident to acquire this data. The FDR can be used to validate the position of the aircraft recorded by ground surveillance sensors and cross check the ground recorded or recreated RAs.

Once an investigation is complete, the findings should be acted upon to help



[1]Currently, EUROCONTROL is using the InCAS tool for recreating and simulating RAs for investigations and research. As InCAS is no longer upgradable, its successor CAVEAT (Collision Avoidance Evaluation and Assessment Tool) is being developed and expected to be released in 2020.

Investigating – TCAS RAs

continued

prevent similar incidents from occurring again. Safety recommendations can take the form of additional pilot/ATCO training, safety net tuning, or raising awareness about particular type of events. The conclusions may also reveal previously unknown problems with the equipment.

There are several possible root causes for RAs and understanding these is essential to maintain safety. A prompt and thorough investigation of an incident, using all available evidence, will enable lessons to be learnt. Additional information sources can improve the fidelity of the analysis, and help uncover factors that may not be immediately obvious from the pilot and ATCO reports.

EUROCONTROL can assist ANSPs, airlines and aviation authorities with the analysis of TCAS RAs, especially in the investigations of more complex or less obvious cases. Please address your enquiries to acas@eurocontrol.int.

Case Study of TCAS RA Investigation

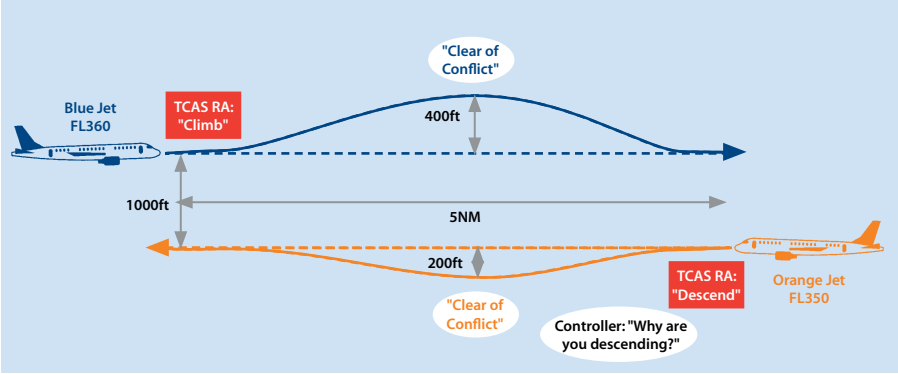
Scenario: A Blue Jet is maintaining FL360 heading south while an Orange Jet is flying north at FL350. When the aircraft are 5 NM head-on, the Blue Jet reports responding to a Climb RA against traffic below. The controller informs the Blue Jet crew that the Orange Jet is 1000 feet below in level flight in the opposite direction. Simultaneously, the controller observes that the Orange Jet is descending and when questioned the Orange Jet crew reports they are responding to a Descend RA. The Blue Jet climbs 400 feet and the Orange Jet descends 200 feet before both report Clear of Conflict and return to their cleared levels. There is no other traffic around and the reasons for the RAs are unclear as both aircraft were maintaining their cleared levels. Both flight crews and the controller file incident reports.

Conclusions: The examination of radar data and Mode S RA downlink messages revealed that indeed both aircraft received the RAs as reported by the pilots. It was evident that TCAS determined that the aircraft were threats to one another, but the radar data could not explain why.

To support the investigation, the Orange Jet operator provided recordings from the dedicated TCAS recorder with which this aircraft was equipped with. The airborne data showed that the Orange Jet altitude reports fluctuated when the aircraft were approaching head on: the Orange Jet altitude jumped up 800 feet for 3 seconds which triggered RAs on both aircraft, for the TCAS system, both aircraft appeared to be only 200 feet apart. A short altitude variation like that can often go undetected by ground systems if they occur between update cycles or can be even rejected by the tracker as not credible.

The altitude fluctuation was reported to the carrier's maintenance.

Using both airborne and ground recordings provided an explanation as to why these unexpected RAs were generated and allowed follow up action with the airline concerned.



ICAO Manual – on Ground-based Safety Nets

ICAO continues to develop the Manual on Ground-Based Safety Nets (GBSNs). Input is being provided by a group of industry experts, including representatives from Air Navigation Service Providers, National Authorities and professional associations, under the review of the ICAO secretariat. EUROCONTROL Ground Based Safety Nets specifications and guidance material have been used extensively during the development of the Manual.

The Manual aims to:

1 Assist ANSPs in determining whether they should implement GBSNs and provide guidance on planning, implementation, operation (including training), monitoring and optimisation of GBSNs.

2 Aid regulators in establishing appropriate provisions associated with the implementation of GBSNs and the related oversight processes.

Recent feedback from the ICAO secretariat has indicated that further work is required to augment the operational information included in the Manual. For that reason the release date has not yet been fixed.

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ENSURING THE EFFECTIVENESS OF SAFETY NETS