Work Area 5 / Work Package 1: Guidelines for an overall concept of operations for independent compatible STCA and ACAS systems

Performance and safety Aspects of Short-term Conflict Alert – full Study

PASS Project

Drafted by: Christian Aveneau, Beatrice Raynaud & Bernard Hasquenoph

Authorised by: Thierry Arino on 26-08-2010

RECORD OF CHANGES

Issue	Date	Detail of changes
0.1	10-06-2010	Proposed outline of the paper
0.2	25-06-2010	First draft with initial elements in all sections
0.3	05-08-2010	Mature draft with guidelines for independent compatible STCA and TCAS operations (in section 4)
1.0	26-08-2010	Comments from partners taken into account. Appendix removed.

IMPORTANT NOTE: EACH NEW VERSION SUPERSEDES THE PRECEDING VERSION, WHICH MUST BE DESTROYED OR CLEARLY MARKED *OBSOLETE VERSION* ON THE FRONT PAGE.

LIST OF DEFINITIONS

ACAS Airborne Collision Avoidance System – a system standardised in the ICAO SARPs which uses transponder replies from other aircraft to warn the pilot of a risk of impending collision

Hereafter, ACAS always refers to ACAS II – a system generating traffic advisories (TAs) and resolution advisories (RAs) in the vertical dimension, and whose carriage and operation is mandatory for many aircraft in Europe.

TCAS Traffic alert and Collision Avoidance System – aircraft equipment implementation of an ACAS

Hereafter, TCAS refers to TCAS II – the only equipment thus far compliant with the ACAS II standards.

RA Resolution Advisory – an ACAS alert that indicates to a pilot how to adjust the vertical rate of the aircraft so as to avoid a mid-air collision

Closest approach Minimum physical distance between two aircraft (slant range) involved in an encounter.

STCA Short-Term Conflict Alert – a ground-based safety net intended to assist the controller in preventing collision between aircraft by generating, in a timely manner, an alert of a potential or actual infringement of separation minima

Minimum separation Horizontal and vertical distances between two aircraft involved in an encounter at the minimum ‘propinquity’.

The propinquity value measures the horizontal and vertical distances between the aircraft in accordance with the respective separation minima applicable by ATC.

This value is commonly used in ANSP monitoring activities because it allows comparison of situations, possibly involving very different horizontal and vertical distances, using a single figure, and because it readily indicates a loss of separation where this is lower than 1.

Encounter A traffic situation involving two (or more) aircraft in which STCA and/or ACAS issued an alert

Level-off encounter	A traffic situation involving two aircraft which are ultimately vertically separated by 1,000 feet (or 2,000 feet) following the level-off of at least one of the aircraft above or below the flight level occupied by the other aircraft More precisely, a distinction can be made between: - a 'single level-off encounter' in which only one aircraft levels off above or below the level of the other aircraft; and - a 'double level-off encounter' in which the two aircraft level off at adjacent flight levels
Safety-net related occurrence	An ATM occurrence involving two (or more) aircraft in which the ground-based safety-net, i.e. STCA, or the airborne safety-net, i.e. ACAS, issued an alert
STCA occurrence	An occurrence in which the STCA system triggered an alert
RA occurrence	An occurrence in which the TCAS triggered an RA in at least one of the aircraft involved More precisely, a distinction can be made between: - a 'single TCAS RA occurrence' in which only one of the aircraft involved experienced a TCAS RA on board; and - a 'coordinated TCAS RA occurrence' in which TCAS RAs are triggered on board both aircraft, i.e. coordinated RAs
STCA-only occurrence	An occurrence in which an alert was triggered by the STCA system but not by TCAS in any of the aircraft involved
RA-only occurrence	An occurrence in which an alert was triggered by TCAS in at least one of the aircraft involved but not by the STCA system
Elementary events	STCA and/or ACAS-related events occurring during a safety-net-related occurrence (*e.g.* the alerts themselves, pilot and controller radio communications prompted by these alerts, aircraft manoeuvres in response thereto, etc.)
Avoiding instruction	A controller instruction designed to prevent loss of separation or to mitigate the effects of a loss of separation which has already occurred. It may or may not be effective. For PASS purposes, an instruction was defined as 'avoiding' if: • it occurs after the STCA was triggered; or • it uses the avoiding instruction phraseology; or • it occurs after the separation has been lost.

LIST OF ACRONYMS

ACAS	Airborne Collision Avoidance System
ACC	Area Control Centre
AI	Avoiding Instruction
ANSP	Air Navigation Service Provider
ASR	Air Safety Report
ATC	Air Traffic Control
ATCo	Air Traffic Controller
ATM	Air Traffic Management
CFL	Cleared Flight Level
DFS	Deutsche Flugsicherung
DSNA	Direction des Services de la Navigation Aérienne
EHQ	EUROCONTROL Headquarters
ESARR	EUROCONTROL Safety Regulatory Requirement
FARADS	Feasibility of RA Downlink Study
FL	Flight Level
ICAO	International Civil Aviation Organization
IFR	Instrument Flight Rules
LoS	Loss of Separation
PASS	Performance and safety Aspects of Short-term Conflict Alert – full Study
RA	Resolution Advisory
R/T or RTF	RadioTelephony
STCA	Short Term Conflict Alert
SNET	Safety Nets
SPIN	Safety nets Performance Improvement Network
TI	Traffic Information
TCAS	Traffic Alert and Collision Avoidance System
TMA	Terminal Control Area
VFR	Visual Flight Rules
VSL	Vertical Speed Limit (TCAS RA particular type)
WA	Work Area

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1. Introduction

1.1. Context and background

1.1.1. PASS (Performance and safety Aspects for Short-Term Conflict Alert – full Study) is a EUROCONTROL project with the objective to study performance and safety aspects of Short-Term Conflict Alert (STCA), including human performance aspects and consideration of interactions between operational use of STCA and Airborne Collision Avoidance System (ACAS).

1.1.2. The project is divided into three main phases, as follows:

- Phase 1: Monitoring & understanding of current situation;
- Phase 2: European STCA environment modelling & safety and performance analysis; and
- Phase 3: Enhanced modelling and analysis, synthesis and guidelines.

1.1.3. Within Phase 1, a first Work Area (WA1) provided a better understanding of the typical sequence of elementary events in encounters in which STCA and/or ACAS played a role and of the factors that have a major influence on the features of this sequence. This was achieved through the analysis of a significant number of ATC occurrences where an ACAS alert and/or an STCA alert were triggered. This monitoring activity covered as wide airspace as possible in order to reflect all types of ATC operations.

1.1.4. Within Phase 2 and 3, a second Work Area (WA2) consisted in evaluating the performance of the reference STCA using the encounter model-based methodology commonly used in ACAS safety studies such as ACASA or ASARP ([ACASA], [ASARP]) in the prospect of defining quantified performance requirements for STCA. Several STCA families with more or less time-critical parameters and more or less reduced separation thresholds have been investigated, i.e. 5 families for en-route airspace and 4 families for TMA airspace.

1.1.5. Within Phase 2 and 3, a fourth Work Area (WA4) specifically addressed the safety aspects of STCA. Both qualitative and quantitative safety analyses have been performed with a specific focus on the identification and assessment of operational factors, in addition to the environmental and technical factors, which may influence the safety of joint STCA and ACAS operations.

1.1.6. To complete Phase 3, a fifth Work Area (WA5) aims at consolidating the main project outcomes and summarising all the work performed during the three project phases. It reports about the operational, safety and performance requirements for STCA.

1.2. Scope and objectives of the document

1.2.1. As part of WA5 and more specifically its first Work Package (WP1) dealing with operational aspects, this document is intended to provide a synthesis of the factors influencing the STCA and TCAS interaction, and to derive guidelines for an overall consistent concept of operations for independent and compatible STCA and TCAS systems.

1.3. Document structure

1.3.1. Section 1 introduces the reader to the PASS project and to the present document.

1.3.2. Section 2 is a discussion about the factors influencing interactions between TCAS and STCA (i.e. ATC instructions after an STCA).

1.3.3. Section 3 describes different possible options for STCA configuration and use in order to minimize the interactions between TCAS and STCA. It discusses STCA system parameters, optional functional features, and associated procedures and working methods for the controllers.

1.3.4. Section 4 provides a set of guidelines for independent compatible STCA and TCAS operations with different possible options for ANSPs.

2. Factors influencing STCA interaction with TCAS

2.1. General

2.1.1. STCA alerts are based on predicted time to go to a loss of separation, this time being implementation dependent in Europe and typically ranging from 40s up to 2mns (the achieved time is often lower, depending on the geometry of the encounter). After the alert, the controller must have time to elaborate avoiding (or corrective) instructions and to transmit them to the flight crew before execution.

2.1.2. On the other hand, TCAS alerts (RAs) are based on a time to go to a risk of collision, this time being 35 seconds at maximum. As for STCA, the achieved time is often less, due to encounter geometry. The alert is directly addressed to the relevant flight crew for execution (typically Climb or Descend).

2.1.3. One may conclude from this that TCAS alert should always occur well after STCA alerts.

2.1.4. The findings from WA1 show that this is not the case (see [MONIT]) Three main reasons can be given:

- Operational filtering of some flight categories, or some airspace, for which the STCA does not trigger. TCAS does not use such filtering;
- Use of CFL to avoid triggering an STCA alert when an aircraft is expected to stop at this CFL before a LoS can occur. TCAS doesn't take into account this intention (example in [INF] : in one case TCAS triggers an RA well before the level bust, whereas STCA triggers only after the level bust, so that vertical separation is already lost);
- Sudden manoeuvring of one of two separated aircraft. This particular geometry often makes STCA trigger at the same time than TCAS (i.e. as late as TCAS).

2.1.5. Currently, the compatibility is mainly assured together by the flight crew following company procedures, which are compliant with ICAO rules (Pans OPS: TCAS have the precedence over ATC instructions if they are conflicting with TCAS) and appropriate ATC methods (the controller does not give instructions if the pilot has reported an RA).

2.1.6. However, as far as possible depending on the geometry, an STCA alert should better occur before a possible TCAS RA, so that the ATC instructions could be executed, and possibly avoid the TCAS RA.

2.1.7. A possibility to achieve that would be to set up a two-level STCA which would allow sufficient time for the controller to react before issuing a “critical-level” alert.

2.2. STCA parameters (and optional features)

2.2.1. The alert time may range from 2 minutes before predicted loss of 5NM / 800 feet (in en-route) down to 40 seconds before predicted loss of 1.5 NM / 500 feet (in TMA).

2.2.2. The higher the prediction time, the more time is given to the controller to react before a possible RA is issued, thus minimizing the risk of interaction between TCAS and ATC instructions. On the other hand, higher alert time result in a higher number of nuisance alerts.

2.2.3. Optional STCA features have an impact on interaction between STCA and TCAS:

- A Turning Prediction Filter predicts the trajectory of an already-turning aircraft by continuing the turn. In some situations, this allows to trigger a genuine alert earlier than a linear extrapolation. Of course, other alerts generated through this feature may be considered as nuisance if the aircraft ends its turn around the time of the alert.
- A Multi-Hypotheses feature bases the trajectory predictions on the procedural paths that an aircraft is likely to use at a given moment. It can extrapolate the potential capture of a nearby FL, the potential entry into a holding pattern, the potential turn towards a nearby fix or the interception of a runway axis... Here also, the trade-off is similar: one can win some time on genuine alerts but the number of nuisance alerts might increase.

2.3. Geometry of the encounter

2.3.1. In the general case the STCA is designed to trigger an alert before (or well before) a predicted loss of separation.

2.3.2. But in certain cases, this is not possible.

2.3.3. For example, two aircraft are flying on the same track with opposite route, and they are separated by 1000ft. If, for any reason, one aircraft suddenly starts a vertical evolution towards the other before they have passed each other, the STCA can only trigger when the vertical separation is already lost.

2.3.4. In the same way, when two aircraft are flying in proximity but normally separated by an horizontal distance of, say, 5 NM, if one aircraft starts a sudden manoeuvre towards the other, the STCA will probably trigger only when the horizontal separation is lost.

2.3.5. In both cases, there is a high probability that TCAS issue alerts (RAs) at the same time than STCA.

2.4. Use of CFL (or SFL)

2.4.1. In many cases of encounters where an aircraft is to level-off at 1000ft vertical distance from another one flying in the vicinity, the STCA triggers an alert because it projects both trajectories at less than the normal vertical separation. Indeed, the STCA is unaware of the intent of the levelling-off aircraft. These alerts are most of the time considered as “nuisance” by controllers.

2.4.2. For that reason, some STCA have been fitted with the capability to take into account the cleared Flight Level (CFL) of the considered aircraft (input by the controller). Therefore, in an encounter with level-off at 1000ft separation the STCA does not issue an alert for the considered pair of aircraft as far as the aircraft level-off normally (without busting their CFL).

2.4.3. The counterpart of this capability, when active, is that if the considered aircraft does not level-off as expected, the STCA will trigger an alert lately, when the vertical separation is already lost. This increases the risk of interaction between ATC corrective instruction and a probable (or already issued) TCAS RA.

3. Pros and cons of options for ground safety nets

3.1. Setting the STCA parameters

3.1.1. The goal is to balance the number of “nuisance” alerts, versus the risk of “missed” alerts.

3.1.2. In particular, the setting may be different according to the airspace and the type of traffic.

3.1.3. For example, alert time is usually shortened in a TMA, for departure/arrival traffic (medium speed, highly manoeuvring traffic).

3.1.4. In areas where aircraft usually fly in close proximity, such as in approach to closely spaced parallel runways, a specific tuning is required, including possible inhibitions.

3.1.5. On the other hand, alert time should be set so as to let sufficient time to the controller to elaborate a solution and transmit it to the concerned flight crew to avoid a LoS.

3.1.6. In the case the alert time is set so as to avoid a lot of “nuisance alerts”, it is likely that a significant number of genuine alerts will be issued at the very last minute or even after a LoS, so that a TCAS alert (RA) could be issued at the same time, leading to possible interaction with the ATC avoiding instructions.

3.1.7. It should therefore be assured that there is sufficient, accurate and recent information displayed to the controller (i.e. the position and altitudes refreshing rate, non overlapping data blocks, vertical and horizontal tendencies; vertical rates from Aircraft Derived Data could be also used as an improvement to the display).

3.2. Using or not trajectory information

3.2.1. The discussion deals with the use of CFL, as the most mature use of trajectory information, but parallel arguments can be made for other uses.

3.2.2. In the case of STCA without use of CFL, the controller has to deal with a lot of alert considered generally as “nuisance”. A common working method, however, consists in confirmation of the current clearances, possibly with traffic information.

3.2.3. This method helps to avoid some potential level-busts. The counterpart is that a too high number of such alerts may lead to a reduced controller’s vigilance, which would have negative effects in case of a genuine alert.

3.2.4. When using a STCA with CFL input, there is a potential of late STCA alert in the case of level-bust, with vertical separation already lost, together with an increased risk of interaction with TCAS. The controller must be aware of that risk, and apply corresponding working methods. The CWP should be fed with accurate and sufficient information, as already discussed above in 3.1.7.

3.3. Designing a 2-alert-level STCA

3.3.1. Most STCA to date have only one alerting level.

3.3.2. At least two ECAC states have implemented a 2-alert-level STCA.

3.3.3. For instance, the first level (the less critical) can be called “Predicted” or “Yellow”. The second level, more critical, can be called “Current” or “Red”.

3.3.4. By design, the first level alert occurs generally well before the second level, if it occurs. This characteristic is likely to compensate for the lack of alert with a one-level system in some encounter geometries, due to filtering or use of CFL or other.

3.3.5. A two-level system must be accompanied with clear working methods for the Controller.

3.3.6. For instance, the first level might be used to confirm current clearances, provide flight crew with traffic information, or to prompt the controller’s attention, not to give any conflicting instruction to one aircraft. If necessary, the controller could give some corrective instructions at this stage.

3.3.7. The second level should correspond to a situation where it is necessary to provide instructions, at least for immediate action, possibly for avoiding. But it is possible that shortly after, or nearly at the same time, TCAS would issue a Resolution Advisory on board one aircraft, or both. The controller should expect that the pilot may reply “Unable, TCAS RA” to the ATC instruction.

3.4. Displaying TCA RAs on the CWP

3.4.1. A possible option is to display received TCAS RA information, if deemed relevant (e.g. for “Positive” Climb or Descend RAs) through RA downlink capability.

3.4.2. By displaying TCAS RA relevant information on the CWP the controller would be informed in time that a TCAS alert is on-going in the considered aircraft, and prompted to apply corresponding working method (i.e. cease to provide ATC instructions to that aircraft).

3.4.3. However, the signification of displayed RA information must be clearly defined. In particular, considering that according to ICAO rules “*the controller ceases to be responsible for providing separation between that aircraft and any other aircraft affected as a direct consequence of the manoeuvre induced by the RA*” when the pilot reports an RA, it should be established if the RA displayed information is equivalent to an RA report by the pilot (on VHF) or not. Corresponding working methods should be defined.

3.4.4. The display of RA information can be done through the RA downlink capability of the transponders together with correspondingly equipped surveillance radar stations. See [RADL] for RA downlink performances.

4. Guidelines for independent compatible STCA and TCAS operations

4.1. Introduction

4.1.1. An overall concept of operations for independent compatible STCA and ACAS systems aims at minimising any adverse interaction that may arise from the triggering of both systems within a short timeframe, while maintaining their safety performance.

4.1.2. The concept may address STCA design (settings and features, data input and display), pilot and controller procedures and controller working methods. Because TCAS is a worldwide standardised and deployed system, it is not considered realistic to envisage, at least in a short/medium timeframe, to modify its design to improve compatibility with several different STCA systems (as currently deployed over Europe and elsewhere).

4.1.3. Minimising the adverse interactions can be done in two steps:

- Avoiding as far as practicable that a pilot be put in a situation where he is requested to react simultaneously to an ACAS RA and to a controller avoiding instruction (AI) prompted by an STCA alert.

  This can be done first by trying to ensure that only the STCA triggers during an encounter. When this is not possible, the last line of defense is to avoid that the controller transmits an AI when a TCAS RA is already active;

- Avoiding as far as practicable incompatible AI and TCAS resolutions, when it has not been possible to avoid an overlap of these resolutions.

4.1.4. Measures to address those steps are introduced and discussed below.

4.2. Avoiding TCAS intervention

4.2.1. One of the ways to avoid overlapping RA and AI resolutions is to strive to ensure that when STCA is triggered, the chain of reactions to the STCA enables to avoid TCAS intervention.

4.2.2. First, it is necessary to provide an **STCA alert in all severe encounter situations early enough** to be in a position to elaborate an AI when necessary and implement it:

- the STCA strategic inhibitions (typically when the aircraft are not following the expected trajectory) are a source of alert delays (typically when the aircraft are not following the expected trajectory) and must be considered carefully;
- the use of intent information is a source of late alerts if the intent is not complied with, or partially complied with (e.g. level busts when the STCA uses CFL/SFL information).

To prevent this risk, a two-alert-level scheme can be used, where the first alert level does not take into account the intent and is only an opportunity for the controller to consider traffic information provision or clearance confirmation in order to increase the likelihood of compliance with the intent.

To mitigate this risk, two non mutually exclusive measures may be implemented:

- the STCA can check that the current trajectory parameters are compatible with the intent, i.e. that with the current position and rates, it is still reasonably possible for an aircraft of this type to comply with the intent. If not, the STCA alert can be triggered before the intended goal is obviously passed.
- the STCA could still maintain a linear prediction (not taking the intent into account) but with reduced thresholds, allowing to retain the benefits of the use of intent when valid, but also to gain in warning time when the intent is not valid.

- the extrapolation of a current turn allows to predict a genuine conflict earlier with an aircraft crossing the turn trajectory.
- the local traffic patterns can be taken into account by the STCA. In addition of a linear trajectory prediction, the STCA can predict trajectories based on likely capture of an FL, likely turn towards a fix, likely use of a published procedure, etc.
- the manoeuvrability of an aircraft can be taken into account by the STCA. Depending on the aircraft types, the current altitude, phase of flight and ground speed, the aircraft rates of climb/descent/turn can be very different. The STCA can provide more warning time for conflicts with less manoeuvrable aircraft; this is typically what is being done through the use of reduced parameters in TMA airspace than in en-route airspace.
- the geometry of the encounter can be taken into account by the STCA. For example, conflicts with a 120° to 150° convergence angle may be less straightforward to solve horizontally than right angle or head-on conflicts. The STCA can provide more warning time for difficult geometries. Unfortunately, this cannot be done easily for all difficult geometries, and typically those resulting from sudden unexpected manoeuvres from aircraft.
- as an option to be investigated, the STCA could particularise an aircraft which is not predicted to infringe any threshold but is close enough to another aircraft that any sudden manoeuvre towards this aircraft would immediately trigger an alert (aircraft crossing with 1,000 ft separation or slow convergence situations for example). This particularisation could be displayed as the first alert level of a two-alert-level STCA or in a distinct way.

4.2.3. Second, for all severe encounter situations that require an AI, the **controller's intervention should occur quickly**:

- Reducing the number of nuisance STCA alerts allows to avoid useless controller distractions and adds more weight on the genuine alerts, hopefully resulting in controller enhanced notice of the alert and quicker intervention on genuine alerts.

It can be achieved by using trajectory intent information (either selected trajectory as known by the aircraft systems or cleared trajectory as known by the ATC systems) when predicting the aircraft trajectory. However this could lead to late STCA alerts when the aircraft is not conforming to the intended trajectory (cf. second bullet of 4.2.2).

An alternative solution could be the use of a multi-hypotheses algorithm (with both a linear prediction and possible-intents-based predictions, using reduced thresholds for the linear prediction). This solution is less effective to reduce nuisance alerts but more effective to prevent late alerts when the intent hypothesis is not valid.

- the controller has to be aware of the STCA alert as soon as possible. As the possibility of distraction exists, the STCA display design can include means to raise the controller awareness: an aural alert which enhances the STCA alerting power (for time critical alerts), a display of the alert on the adjacent sectors' CWP which can prompt another controller to notify the alert, the first alert level of a two-alert-level scheme.
- working methods can be reviewed so as to ensure that the controller systematically reacts on each STCA alert (thus reducing the likelihood of a lack of controller's intervention in case of genuine alerts). Even if the controller was aware of the conflict beforehand and was confident of his solution, the STCA alert should make him review the situation and at least issue traffic information or a clearance confirmation. Practices going in this way have been written by some ANSPs.

  As a side-effect, informing the pilot of a traffic nearby might also prompt the pilot to reduce high vertical rate when he "*is made aware of another aircraft at or approaching an adjacent altitude or flight level*" as recommended by ICAO ([PANS-OPS]) thus reducing unnecessary RAs in 1,000 feet level-off situations.
- in a future environment enabling data-link of AIs, the possibility to send the same horizontal AI to the two conflicting aircraft in one go (turning both 30° to the left for example) could allow horizontal AIs to approach the performance of vertical AIs in some situations. It is also worth noting that to be effective such an option would also require an STCA implementation with warning times compatible with the use of data-link clearances and may require additional performance requirements on the D/L interface.

4.2.4. Third, the **controller's intervention should shorten the period during which aircraft are in convergence** as much as possible. Using strong AIs (especially in the horizontal dimension) will help the pilot take the AI seriously and deviate more rapidly from its course.

4.2.5. Finally**, the pilot should be pushed to implement quickly any controller's AI**:

- the use of preventive traffic information when aircraft are converging in at least one dimension raises the pilot awareness and helps him comply rapidly with ATC instructions prompted by any STCA that may occur afterwards;

- controllers' training should emphasize the need for a clear and unrushed enunciation of AIs, allowing to avoid pilot's misunderstanding or delay due to the need of repeating the AI;
- the systematic use of words underlining the urgency of the manoeuvre ("Immediately…", "…for avoiding action") while delivering an AI will reduce the pilot's reaction time by several seconds in general.

4.3. Avoiding controller intervention on aircraft already following an RA

4.3.1. The last way to avoid overlapping RA and AI resolutions is to strive to ensure that when an ACAS RA requiring a deviation is triggered and the controller has not yet transmitted an AI in reaction to an STCA alert, the controller backs off from transmitting one.

4.3.2. In addition of the current procedure relying on pilot reports of RA-induced deviations, the display of aircraft downlinked RAs on the CWP can foster this goal. Filters might have to be implemented so as to only display genuine RAs with a potential to induce pilot deviation from the current clearance and the new procedure would need to define precisely when the controller is discharged from the responsibility of separation for the involved aircraft.

4.4. Avoiding incompatible AI and RA resolutions

4.4.1. Sometimes, the controller will issue an AI before being informed that an RA-induced deviation is occurring. The following steps can be taken to mitigate the risk of both resolutions being incompatible:

- an enhanced update rate of the radar information (through increased radar rotation rate and/or multi-radar tracks from overlapping radar coverages) helps getting the controller view (as well as, the STCA view) closer to the TCAS view. It increases the likelihood that the controller will see the same relative vertical positions of aircraft and therefore issue a compatible vertical resolution. This is especially of interest for "collision avoidance" oriented STCAs (that warn only of possible/actual infringements of significantly less than the standard separation minima) for which interaction with ACAS is more likely;
- using a way to avoid the overlap of aircraft labels on the display ensures a good data block legibility, especially when aircraft are close as in some situations where STCA triggers.
- working methods can mention that when the encounter geometry, surrounding traffic and airspace organisation allows it, the preferential use of horizontal AIs is compatible with any vertical RAs that may have occurred.

5. References

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