NETALERT NEWSLETTER

It's time for action

ENSURING THE EFFECTIVENESS OF SAFETY NETS

Optimising STCA for military ATC
Case study gets results

WELCOME

Welcome to the second issue of NETALERT, a four-monthly news update for people working in airlines, air traffic control centres, and the organisations that support them.

NETALERT is written by EUROCONTROL's Safety Nets team to increase awareness of how safety nets work, how they interact, and what is being done to help with implementing and enhancing them.

Thank you for lending your support to this initiative by reading NETALERT and passing it on to others in your organisation. We have received requests for additional copies from several service providers and have been happy to oblige.

Do please give us your feedback on this publication and the topics that interest you. You can find our contact details on the back page or visit our website at www.eurocontrol.int/safety-nets

A study conducted as part of the preparation work for the EUROCONTROL STCA Specification guidance materials has proven the practical value of optimising STCA for local conditions. In this case, it was the particular requirements of military ATC and aircraft that were addressed, delivering a radical reduction in the number of nuisance alerts and making the system 'useful' to controllers again.

Through its membership of the SPIN Task Force, the Belgian Military ATC at ATCC Semmerzake collaborated with EUROCONTROL to analyse the alerts on its own STCA system and find solutions to optimise it for Belgian Military airspace. The study also enabled the EUROCONTROL Safety Nets team to validate and improve the draft specification and guidance material, in particular the STCA Reference System described in Appendix A of the specification.

Military aircraft regularly carry out activities that civil aircraft do not, for example formation flying (causing nuisance alerts amongst elements of the formation) or fast jets simultaneously executing high performance manoeuvres (making the flight trajectory unpredictable). These activities mean that a different set up is needed for military STCA systems.

ATCC Semmerzake's Tom Van Heuverswyn explains: "Setting up a military STCA in the same way as civil operations simply led to excessive false and nuisance alerts. This made the STCA unusable for military flights and, on many occasions, resulted in STCA being switched off. The challenge was to apply the same basic principles, but set the algorithms and parameters to ensure a prediction ☞
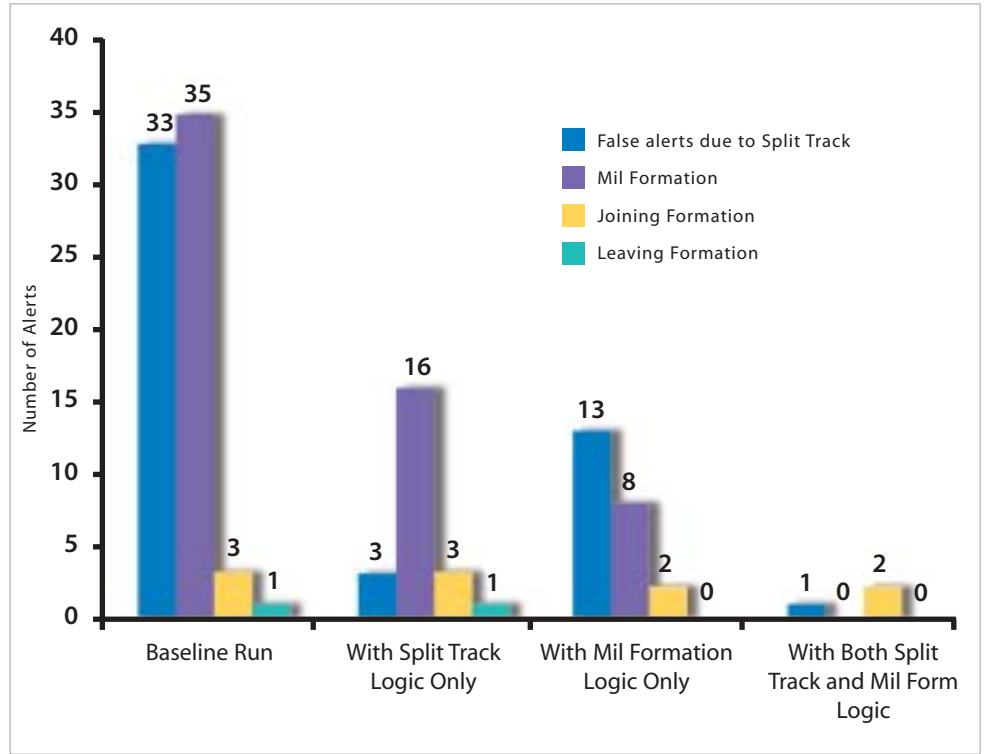
Optimising STCA for military ATC

Case study gets results

continued

time that enabled the system to be useful for the controller".

The study team collected and analysed track recordings, developed a simulation of the ATCC Semmerzake STCA system, applied new algorithms and parameters to the simulator and then measured the results. In addition, two Belgian Air Force F16s reconstructed scenarios where it was known that the STCA could be optimised, and again the team recorded track data and STCA alerts.

They found a number of situations where STCA performance could be improved. These included: military aircraft flying in formation, dog-fighting, or manoeuvring close to civil aircraft in neighbouring airways and military aircraft interactions with VFR aircraft. When modelled, the split track and military formation logic proved to be very effective at

Number of alerts with various improvements to the STCA model

suppressing nuisance alerts in these situations, although less effective for alerts arising from aircraft joining a formation, since these alerts look like any converging conflict between aircraft.

The solutions developed needed to be effective without undue negative effects on wanted alerts. To consider this, a Functional Hazards Assessment (FHA) Workshop was organised with attendees from a wide variety of backgrounds to identify hazards of the potential solutions and estimate their severity.

Since completing the study, the Belgian Air Force has taken measures to incorporate the proposed solutions in their STCA system and are continuing their cooperation with the Safety Nets team, this time in the context of the APW safety net.

Situation	Background	Proposed solution
Prediction time	Nuisance alerts due to the 5 minute prediction time.	Reduction of prediction time to 2 minutes.
Military aircraft flying in formation	Nuisance and false alerts from military aircraft flying in formation.	Application of 'military formation' and 'split tracks' algorithms.
Military aircraft dog-fighting	Nuisance alerts between aircraft dog-fighting (not modelled).	Mode A codes to denote specific types of military training. Within defined volumes of airspace, STCA alerts do not occur between aircraft with the designated training codes (not modelled).
Alerts with civil aircraft	Nuisance alerts between military aircraft in exercise areas and civil aircraft in neighbouring airways.	Different STCA prediction times applied to boundaries with civil airspace.
Interactions with VFR aircraft	Nuisance alerts with VFR aircraft either not under ATCC Semmerzake control or not equipped with Mode C transponders.	Much narrower STCA parameters applied below specified flight levels. Mode A code list specifying minimum and maximum assumed flight levels for VFR aircraft.

The Optimisation of STCA and Hazard Assessment of STCA for ATCC Semmerzake are both part of the guidance material developed by EUROCONTROL to support the EUROCONTROL specification for STCA. Both documents are available on the EUROCONTROL website.
http://www.eurocontrol.int/safety-nets/public/standard_page/stca_01.html
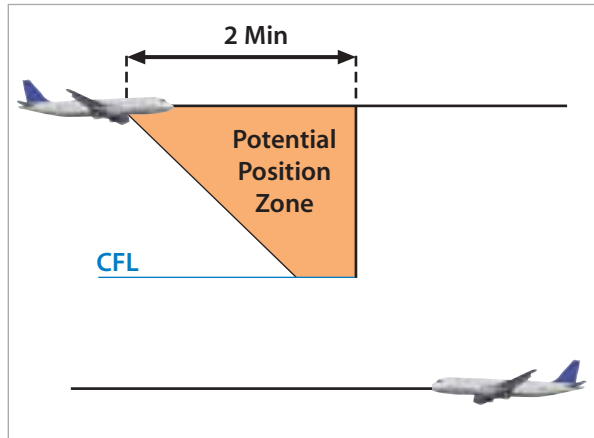F16 photographs supplied courtesy of Peter "Patja" Stams

STCA success at Maastricht

Issue 1 of NET*ALERT* looked at the official consultation for the new EUROCONTROL STCA specification. In this article we feature an STCA system already compliant with the specification: the STCA implemented at the EUROCONTROL Maastricht Upper Area Control Centre (MUAC) in January 2007.

The decision to implement a new STCA was both system-related and driven by the operational need for an STCA in the MUAC Fallback System. However, implementing a new STCA naturally offered the opportunity for enhancements, particularly in improving the trade-off between warning time and nuisance alerts. It was also very important to maintain the user satisfaction levels achieved by the old STCA, particularly as Maastricht has over 25 years experience of using STCA. As Micha Janssen a Surveillance Data Processing Engineer working with the new STCA explains: *"Maastricht controllers were very happy with the previous STCA and this confidence continues. There are no differences in the alerts seen on the controller HMI and, with a small exception, the overall operational concept remains the same. Now the system is implemented, validation and monitoring is performed by controllers during operations. Any abnormal behaviour observed in the STCA is reported and analysed by the in-house engineering team."*

Enhancements to the new STCA include use of a conflict probability model, use of Cleared Flight Levels (CFL) in level flight, full synchronisation with the ARTAS tracking system and improved vertical trajectory prediction (see table).

The new STCA has been developed with future enhancements in mind. Micha Janssen explains: *"It has the flexibility to easily extend its functionality in the future. For example, we have*

Use of Cleared Flight Level intention in level flight

the potential to define a specific parameter set for each region of airspace in which the STCA operates, to fine-tune trajectory prediction for turning aircraft or to extend the conflict geometry and probability concepts."

One enhancement planned for the near future is an upgrade to the way STCA accounts for the Reduced Vertical Separation Minimum (RVSM) capability of aircraft, specifically in relation to reducing the unwanted level of nuisance alerts with aircraft outside the boundary of MUAC airspace. Adds Micha Janssen: *"This enhancement still needs operational approval and a safety case. Once these hurdles are cleared, it should provide a further step to improving the performance of STCA here at MUAC."*

What do users think? The view from the MUAC operations room …

"We have taken a little while to get settled with the new STCA as the old filters were a little more pessimistic in displaying conflicts. However, we have now adjusted to the new STCA and we appreciate that if a conflict is displayed then there is a good chance that we will have to intervene to resolve the issue."

"There are two big changes that we enjoy in the operations room. Firstly, with the CFL evoked STCA trigger, an alert is triggered upon input of the *climb/descent clearance rather than waiting for the aircraft to start the manoeuvre as in the previous system. With the workload we have and the interface, we are making these inputs at the same time as talking to the pilot, and the instant feed-back we receive gives ample time to withdraw the clearance. Secondly, the STCA is now a stand-alone system and is also integrated into the Fallback System. This gives us a great sense of comfort should we find ourselves using this system during main system maintenance or for some other reason."*

Enhancement	Detail
Use of conflict probability model	Significant optimisation of the detection of conflicts by improving the trade-off between the warning time and the rate of nuisance alerts.
Use of Cleared Flight Levels in level flight	The new STCA accounts for potential conflicts should an aircraft in level flight start to climb or descend to its Cleared Flight Level (CFL) – see figure above. This provides an earlier alert trigger as the STCA starts looking for potential conflicts when the CFL is input rather than waiting until a Mode C code change is detected. A potential downside is an increase in nuisance alerts resulting from CFLs being input prior to the start of a climb or descent. However the improvement in warning times provides a net positive effect.
Full synchronisation with ARTAS	STCA processes track updates as soon as they are received from ARTAS, improving the reaction time of the new STCA by up to five seconds. This is significant when conflicts are predicted with a very small warning time (e.g. level busts).
Improved vertical trajectory prediction	New STCA has improved vertical trajectory prediction capabilities by calculating its own rate of climb/descent rather than using data provided by ARTAS.

Micha's article on the new STCA used at Maastricht UAC can be found in the Winter 2006 Edition of Skyway (http://www.eurocontrol.int/epr/gallery/content/public/docs/skyway_winter_2006/38_39.pdf)

APW specification:
Getting closer!

Hot on the heels of its draft specification for MSAW (Minimum Safe Altitude Warning), the SPIN Task Force is now working on APW (Area Proximity Warning). Also known as DAIW: (Danger Area Infringement Warning), APW is a ground-based safety net used to predict and alert the controller to the imminent or actual unauthorised entry of an aircraft into a restricted/danger/prohibited area. A typical example is a civil aircraft infringing military airspace, which can pose a significant risk to both the infringing aircraft, and to any operations within the restricted area.

APW can operate in an environment where access to airspace may be permanently or temporarily prohibited in the context of flexible use of airspace. Its functionality is already a standard feature of many ATC systems and making it operational should be reasonably straightforward. APW is relatively easy to configure compared to other tools, for example the airspace definitions needed in APW are much simpler than the terrain definitions needed in MSAW.

The APW specification will set out minimum requirements for the design and configuration of APW and be supported by guidance material. As with STCA (see cover story), the focus will be on optimising the trade-off between alert time and the number of nuisance warnings generated. EUROCONTROL plans for the APW Specification and related guidance material to be ready by end 2008.

The Airspace Infringement Safety Initiative, which focuses on the infringement of con-trolled airspace by VFR traffic, has received input from the SPIN Task Force on APW. EUROCONTROL's Alexander Krastev explains: *"In my view the safety improvement potential of APW is higher in the mitigation, rather than in the prevention phase. Setting the parameters for an early warning will lead to a lot of nuisance alerts. The standardisation work being undertaken by EUROCONTROL will help address this issue.*

Moreover in the majority of infringements communication may not be established at all. However, a timely warning to the controller about an actual or imminent infringement can enable him to initiate coordination with other units (eg. Flight Information Service) and, where available, receive basic flight plan data. He can establish contact with the infringing aircraft before a conflict occurs as well as implement avoiding action in coordination with the pilot of the other aircraft in case of conflict."

You can find out more about the Airspace Infringement Causal Factors Study in Safety Letter No 3 from the Airspace Infringement Initiative. www.eurocontrol.int/safety

Airspace Infringement:

How big is the problem?
- Reported airspace infringements have more than doubled since 2001 – reaching over 1500 reported incidents by European States in 2005.
- 40% of these infringements are classified as having serious, major and significant severity safety impact.
- General aviation is involved in approximately 80% of the reported infringements and is a fast developing aviation sector.

Why is it important?
- An infringement can disrupt flight operations. It can increase workload due to the need to break an approach, change aircraft sequence for landing or implement other contingency measures.
- An infringement leading to loss of separation may cause loss of control due to wake vortex encounter and even injuries to passengers or crew when violent manoeuvres are needed to avoid the other aircraft.
- The worst case scenario – is mid-air collision.

"We cannot afford to do nothing".

In Brief

- **STCA & ACAS Interactions.** Swiss DETEC's Andrea Muggli, together with EUROCONTROL's Martin Griffin, are presenting a paper entitled "STCA & ACAS: Interactions and Interoperability" at the European Aviation Safety Seminar, taking place from 10-12 March in Bucharest. www.flightsafety.org/seminars.html

- **I-AM-SAFE concludes positively.** A recent study investigating whether the ACAS encounter model methodology could be similarly applied to STCA to establish quantified performance requirements has been completed with encouraging results (see our website). The team has now launched a follow-on study to develop performance and safety requirements for STCA and provide the core elements of an overall concept for STCA and ACAS operations. More news next time.

- **STCA specification.** The final STCA Specification was released on 22 November 2007. Conclusions and documentation can be found on our website. On the same day, the ICAO amendment 5 of PANS-ATM, clarifying the purpose of STCA also entered into force.

- **Interested in SPIN?** In recognition of the importance of its work, the SPIN Taskforce will take on a new lease of life this summer and open its doors to new members! If you would like to become involved in **S**afety nets **P**erformance **I**mprovement **N**etwork please contact the Safety Nets team.

- **Workshop Invitation.** Join safety managers, regulators and other industry specialists at the 2nd Safety Nets Workshop, taking place on the 27 May 2008 at Eurocontrol HQ, Brussels. Receive new study results and briefings, and contribute your views. To take part visit: www.eurocontrol.int/netalert

Contact us by phone:
Ben Bakker (+32 2 729 3146),
Stan Drozdowski (+32 2 729 3760) or
Hans Wagemans (+32 2 729 3334); or by
email: safety-nets@eurocontrol.int