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EUROCONTROL

NET*ALERT* Newsletter
Stay tuned

Ensuring the effectiveness of Safety Nets

WELCOME

Safety nets need to keep pace with advancements in ATM. In this issue of NET*ALERT* we explore the implications of using Downlink Aircraft Parameters in STCA and the risks of transponder failure.

With the evolution of SESAR some safety nets research projects have fallen within its remit. In November we are hosting the results dissemination workshop for the PASS project (more details on page 7). The workshop is an excellent opportunity to gain an insight into the delivery of the first SESAR safety nets work.

Across the ocean in Canada, we have learnt that their implementation of MSAW includes innovative contour maps, which have already proved useful. We report on their MSAW system with the kind permission of NAV CANADA.

Finally, the EUROCONTROL Safety Nets team has travelled to Georgia and Ukraine to assist with specific safety nets projects. Read more about these visits in this issue.

Contact details for the EUROCONTROL Safety Nets team are on the back page.

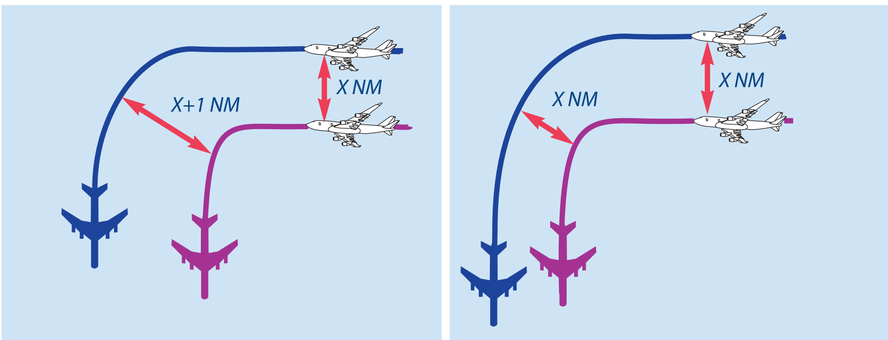
Safety nets – how will they aDAPt to the future?

New advanced concepts are currently under development that will make more efficient use of airspace and provide extra capacity to meet future traffic demand. In this article we ask what the implications might be for ground-based safety nets. We also consider whether DAPs (Downlink Aircraft Parameters) might have a role to play in enhancing those safety nets.

How future concepts could influence ground-based safety nets – an example

In Spring 2010, members of the EUROCONTROL Safety Nets team provided input into real-time trials of the Advanced Required Navigation Performance (A-RNP) concept. An element of this concept is repeatable turn performance, called "Fixed Radius Transition (FRT)" for en-route airspace and "Radius to Fix (RF)" for terminal airspace. It ensures that all A-RNP capable aircraft fly the designed turns very accurately and provides a good example of how future concepts could influence ground-based safety net operations.

Today, the radius of a turn will vary due to the unpredictable turn performance of the aircraft, meaning that, on closely-spaced routes, the distance between two aircraft tracks can vary and the spacing between the two routes must therefore be increased on any turns to allow for this. Under the A-RNP concept, aircraft turn on a repeatable and predictable path. This means that such routes no longer need to increase spacing on the turn (see figures below).



Simplified images of two aircraft turning on closely spaced routes today (left) and using repeatable turn performance (right).

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Safety nets – how will they aDAPt to the future?

continued

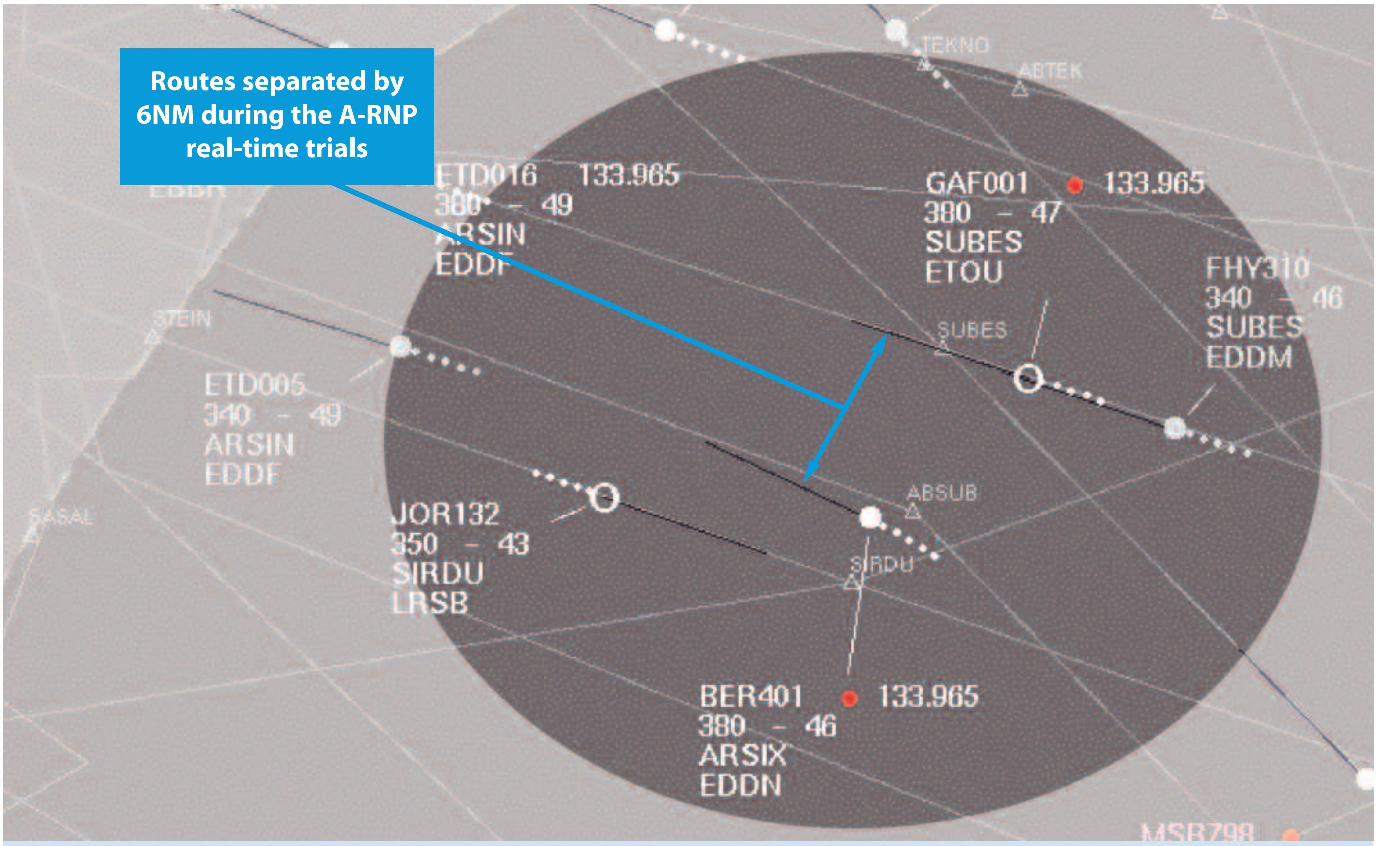
This example raises an interesting challenge for STCA. In order to be useful, the number of nuisance alerts produced by a safety net needs to be kept to a minimum. In allowing aircraft to safely operate closer together it's possible that today's STCA parameters could result in nuisance alerts being triggered. Although it may be possible to reduce these nuisance alerts by lowering the look-ahead parameters, this would reduce the safety buffer and thus the available reaction time for controllers.

If tuning look-ahead parameters alone is not enough, other solutions will therefore need to be explored. One solution could be to use enhanced safety nets which for example allow unique parameters to be applied in specific, and potentially small, areas of airspace such as where closely spaced turns occur. Another solution currently under consideration is for safety nets to make use of data available about the aircraft and, in particular, its intentions using Downlink Aircraft Parameters (DAPs).

Why use DAPs in safety nets?

DAPs provide information about an aircraft to the ground, via the aircraft transponder, for use by the ATM system. Of course, some DAPs are already well established – for example, identification and pressure altitude are available through conventional SSR coverage and used by ground-based safety nets. However, Mode S enhanced surveillance allows several more DAPs such as selected altitude, track angle rate, ground speed and true track angle.

These DAPs have the potential to enhance short term prediction by providing more accurate and timely information about how an aircraft is manoeuvring and also about its intent. Some of the DAPs are expected to improve the radar tracking and consequently the performance of ground-based safety nets. The Selected Flight Level DAP could be used to help in the prevention of level bust incidents as it would allow for an alert if there has been any misinterpretation of the Cleared Flight Level. Selected Flight Level can also be used in some cases where the Cleared Flight Level is not available. Using Selected Flight Level in this way could potentially



Aircraft operating on parallel routes separated by 6NM during the A-RNP real-time trials

Today, parallel routes are typically separated by 12NM to account for navigation inaccuracies and the unpredictable turn performance of aircraft. During the A-RNP real-time trials parallel routes were separated by 6NM. Applying the STCA parameters typically set in today's systems to these routes would probably result in a high level of nuisance alerts. Conversely, reducing the STCA look-ahead parameters, would reduce controllers' safety buffer zone.

reduce the number of STCA nuisance alerts.

Where ADS-B is used to downlink DAPs, this could enable the use of safety nets in areas without radar coverage.

The challenges of using DAPs

Aside from quality and reliability, there are some interesting practical challenges to using DAPs in ground-based safety nets. For example, even when the flight crew is complying with ATC clearance, there may still be occasions where the Selected Flight Level differs from the intended path to be flown. Good examples of this include when the aircraft is being flown manually and during final approach when pilots routinely set the Selected Flight Level to the Missed Approach Altitude in the event that a go-around takes place.

Of course, with so much dependence on the aircraft's transponder to downlink the DAPs, the consequences of transponder failure also need to be addressed (see separate box).

SESAR and DAPs

Current work on the use of DAPs by ground-based safety nets is being driven by SESAR's "Evolution of Ground-Based Safety Nets" project, which aims to identify candidate downlink parameters to enhance ground-based safety nets in both the TMA and en-route environments. Its first task was to collate the data currently used within ground-based safety nets, and identify any existing ANSP plans for incorporating further DAPs. This task was supported through a survey of SPIN members which revealed that a few ANSPs were investigating the usage of DAPs with one ANSP already using the Selected Flight Level in its STCA.

SPIN chairman Stanisław Drozdowski concludes: *"Safety nets continually need to adapt to new concepts – just as they did when RVSM was implemented. DAPs are an important part of the future enhancement of safety nets. There are challenges to be overcome, but using accurate information on an aircraft's intention should allow safety levels to be maintained despite increases in traffic levels."*

What happens when a transponder fails?

If safety nets become reliant on data provided by the aircraft transponder, then they are also reliant on the functioning of the transponder itself. Even today, pressure altitude information provided through the aircraft transponder is crucial for the operation of both ground-based and airborne safety nets as well as for automated support systems during normal operations.

Although occurrences of complete transponder failure are rare, they do happen. In 2006, a Legacy business jet was cruising towards a B737 at the same flight level over Brazil. The transponder on the Legacy was in "stand-by" mode, meaning that ATC could not see its flight level and that its TCAS was not operating. As a result of the Legacy transponder being in stand-by mode, the B737's TCAS could not detect the Legacy and, tragically, the aircraft collided head-on at FL370.

If there is a complete transponder failure then, although secondary radar will no longer detect the aircraft, the track will still be displayed in that sector if a primary radar is in operation. However, common practice is for primary radar coverage to be limited mostly to approach volumes and within 60NM of airports. Some systems also allow the actual flight level of the aircraft to be manually entered but this is not regarded as being feasible outside of low traffic environments, and could be dangerous if changes in flight level are not entered.

This said, for the majority of airspace, surveillance is dependent on aircraft tracks from secondary surveillance radars or multilateration, and in such an environment, it is essential that aircraft transponders are working properly. Also, with the growing use of ADS-B, there is a need for the crew to be warned of any failure of this equipment onboard the aircraft.

As Carlos Santos, a controller from NAV Portugal explains, there are other potential solutions:

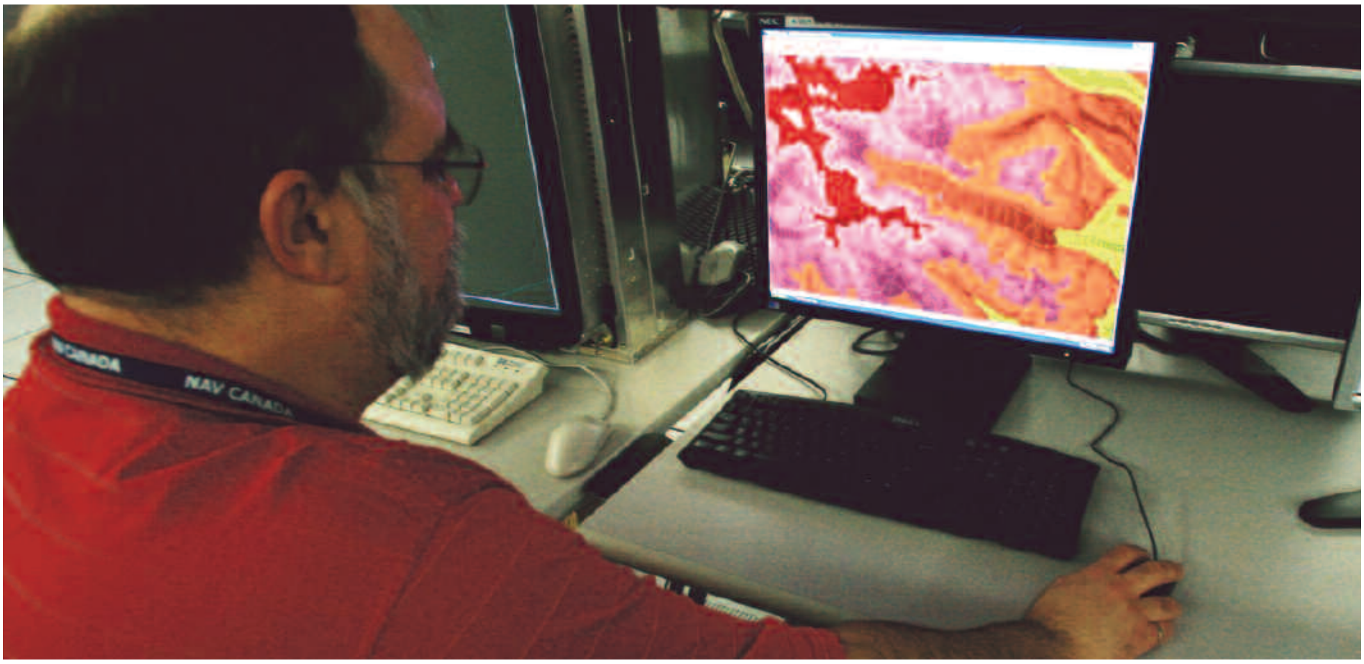
"To provide the controller with an estimate of an aircraft's position in the event of complete transponder failure, the automatic generation of flight plan tracks should be considered either when an existing surveillance track disappears or when a surveillance track is not created at a position for which an estimate exists."*

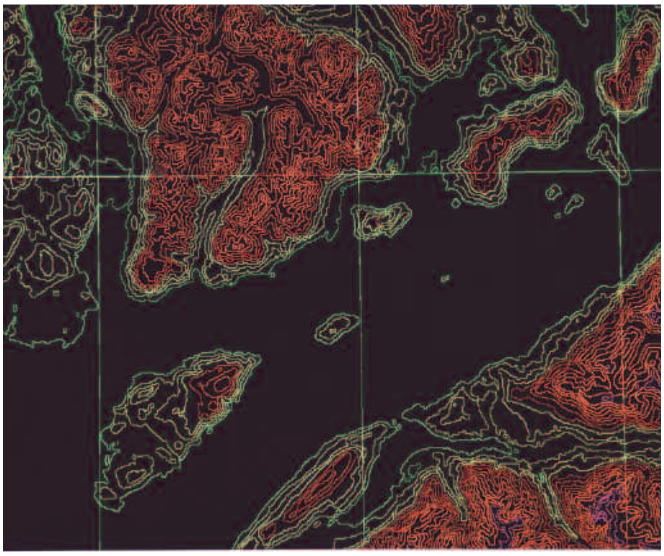
Procedures to deal with a failed transponder are only of use if it is known that the transponder has failed, so early detection is key both on the ground and in the air as Carlos Santos concludes:

"Detection of transponder failure is widely considered to be the sole responsibility of ATC. However, considering the hazardous consequences of loss of transponder for normal operations as well as for the operation of ground-based and airborne safety nets, detection of transponder failure should be the shared responsibility of pilots and controllers, possibly supported by appropriate alerts in the cockpit and at the controller working position."

* Also called pseudo tracks – tracks built with the information from the flight plan supplemented with the last known surveillance position if it exists.

MSAW
implementation in Canada





Colour coded terrain contours used by the NAV CANADA MSAW. (Source: NAV CANADA Direct Route publication)

The focus of NET*ALERT* tends to be European. However, we sometimes come across examples of practice elsewhere in the world that readers may find interesting. In this issue we share news of how the Canadian Air Navigation Service Provider NAV CANADA has implemented Minimum Safe Altitude Warning (MSAW), with some novel features not seen in Europe.

In June 2008, NAV CANADA started the test phase of an MSAW system at the Vancouver Area Control Centre. During this initial test phase, the MSAW functionality covered a 50NM radius centred on the Prince George Airport. The Vancouver ACC was chosen as the site for this initial phase because the topography of the surrounding terrain is mountainous, but also benefits from detailed terrain data which can input into the MSAW system.

In the NAV CANADA system, the MSAW alert consists of an audible alarm accompanied by a visual display of the following information:

- the height of the terrain volume that the aircraft is first predicted to enter;
- the immediate safe altitude (the cap of the highest terrain volume within a 2-minute look-ahead of the aircraft and 45° each side of the aircraft's track);
- the time-to-fly to the first terrain volume; and
- a dynamically updated display of local terrain contours, colour-coded relative to the aircraft's altitude.

"Background contours"

Although the primary role of NAV CANADA's MSAW system is to provide controllers with a visual and aural alert when an aircraft's projected flight path places it in predicted or immediate conflict with surrounding terrain, an interesting ancillary function of the system is its "background contours" feature (see images). This is a detailed colour-coded display of the terrain, which enhances the controller's situational awareness. The controller can initiate the display of terrain contours surrounding any point on the display, or these can be dynamically associated with a manoeuvring aircraft.

On the very day that MSAW went live at the Vancouver ACC, the MSAW "background contours" feature was used to help a Cessna Caravan that was in an emergency icing situation. The controller was able to relay terrain clearance information to the aircraft via another aircraft over-flying the area, and the Cessna was then able to descend below icing levels and land safely.

Agreed operating procedures

The implementation of the system has also included agreement on procedures to be used with various operators. Collaboration between NAV CANADA and the operators led to the development of compatible controller and pilot procedures (see green panel).

Implementation

To date, the full MSAW capability has been implemented in the Vancouver FIR Airports specialty and the background terrain contours are in use in the remainder of the Vancouver FIR specialties and in the Moncton FIR. The adaptations for the remaining ACCs have been drafted and it is planned to fully implement MSAW in all NAV CANADA Area Control Centres.

Compatible controller and pilot procedures

If a controller receives a MSAW notification, specific phraseology, depending on the nature of the situation, will be used to inform the pilot. The controller will provide the following information:

- terrain warning;
- altimeter (value); and
- immediate safe altitude (value).

After pilot acknowledgement, the controller will provide the aircraft with additional terrain related information, as appropriate:

- (higher/lower) terrain ahead, to your (left/right);
- minimum IFR altitude (value).

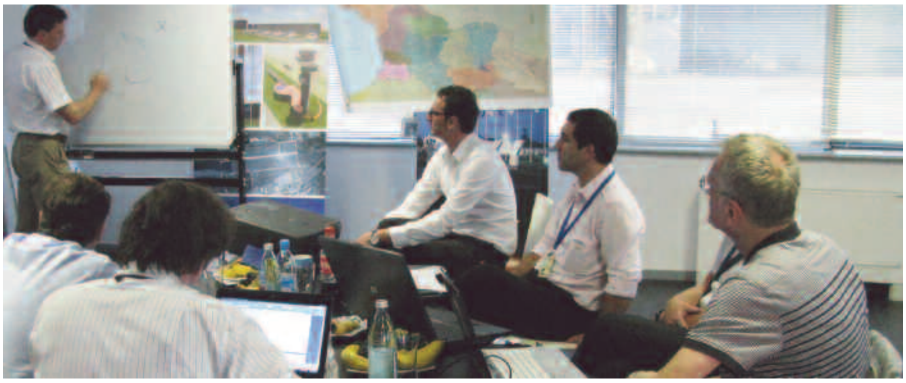
Although the prime responsibility for initiating terrain avoidance rests with the pilot, the controller may initiate terrain avoidance intervention if, in his/her judgment, it becomes apparent that the aircraft is in danger of colliding with the terrain. The instruction would be:

- turn (left/right) (number of) degrees immediately to avoid terrain; or
- climb (altitude) immediately to avoid terrain.

This article contains extracts from the Fall 2009 and October 2006 editions of NAV CANADA's Direct Route newsletter. The original articles may be accessed at the NAV CANADA website: www.navcanada.ca.

Georgia steps closer to MSAW optimisation

A safety nets case study for Georgian ANSP SAKAERONAVIGATSIA concluded with recommendations on adaptations for STCA, APW and MSAW parameter settings. The study also recommended the design of a new MSAW surface for Georgia. An early step was to organise a Functional Hazard Assessment (FHA) workshop to identify potential hazards introduced by the recommended changes. This workshop took place in Tbilisi on 28th and 29th September 2010.



FHA workshop participant illustrates a point to fellow attendees

WHAT is a Functional Hazard Assessment (FHA)?

It is a method for the identification of potential hazards and risk prevention measures.

WHY conduct a FHA?

To assess if a desired modification to a part of the ATM system (in this case, safety nets) creates the condition for new hazards and/or does not enhance safety in the way that was expected.

HOW is a FHA done?

By putting together the knowledge of experts with different back-grounds (operational, technical, safety); taking real operational scenarios and openly discussing possible hazardous situations related to the part of the system under assessment.

SESAR update

In our last issue of NET*ALERT*, we gave an overview of the SESAR safety nets related projects. To follow on from this, we will present an update on their progress in each issue.

Evolution of Ground-Based Safety Nets (P 4.8.1)	Work has commenced in work area 1: enhanced ground-based safety nets using existing down-link aircraft parameters (DAPs) in TMA and en-route environments. An initial development plan was established using inputs from a dedicated survey of the SPIN community. The development of a validation plan for the so-called V2 validation was produced. This deliverable is associated with another task that will evaluate the feasibility and options for using existing DAPs in each of the four ground-based safety nets STCA, MSAW, APW or APM. In work area 4, roadmap and guidelines for ground-based safety nets evolution, the PASS project continued its final phase. See previous editions of NET*ALERT* for more on PASS. The results will be disseminated in the workshop being held on the 23rd November 2010. *Partners: DSNA (leader), NATS, ENAV, SELEX, EUROCONTROL*
Evolution of Airborne Safety Nets (P 4.8.2)	This project saw the completion of validation plans for two work areas: ■ new possible altitude capture laws, to reduce the frequency of the notorious "high vertical speed before level off" ACAS RAs (Resolution Advisories); ■ automatic responses to ACAS RAs by coupling ACAS to the autopilot/flight director. Validation trials will now focus on the safety and performance benefits associated with the potential implementation of altitude capture laws and automatic responses to ACAS RAs. This validation will account for various traffic scenarios including aircraft type, response time, encounter geometry and altitude, vertical speed and acceleration. *Partners: DSNA (leader), NATS, EUROCONTROL*
Ground-Airborne Safety Net Compatibility (P 4.8.3)	The first work area addresses ACAS RA Downlink, specifically evaluating the possible integration of ACAS RA Downlink in procedures and the real-time controller working environment. The first tasks to be completed are as follows: ■ provide performance specifications for an ACAS monitoring system that will collect ACAS RAs downlinked from the aircraft (a prerequisite for commencing the work in project 15.4.3); ■ develop the preliminary operational concept for ATC operations including the display of ACAS RA Downlink information to the controller. The latter task was undertaken in close cooperation with a dedicated SPIN drafting group that also addresses the recommendations from the Berlin 2009 workshop on this topic. *Partners: DSNA (leader), DFS, AENA, INDRA, AIRBUS, EUROCONTROL*
ACAS Monitoring (P 15.4.3)	Using the inputs from project 4.8.3, this project started the specification work for the ACAS Monitoring system (read more about ACAS Monitoring in the February 2009 edition of NET*ALERT*). The project will produce an ACAS Monitoring system (comprising two ACAS Monitoring Ground Station Sensors and one ACAS server). The site surveys for sensor siting and installation of an ACAS Monitoring Background system in Germany are also underway. *Partners: THALES (leader), INDRA, EUROCONTROL, DFS*
Safety Nets Adaptation to New Modes of Operation (P 10.4.3)	This technical project will begin by developing a prototype aimed at enhancing STCA specifically for TMA operations. The operational requirements will be extrapolated from the EUROCONTROL Specification and Guidance material for STCA, while safety and performance requirements will be derived from the results of the PASS project. *Partners: THALES (leader), DSNA, ENAV, EUROCONTROL, INDRA, NATMIG, SELEX*

E-OCVM

The validation of a new concept must be systematic and thorough, to ensure that it meets stakeholder expectations. The E-OCVM is a framework to provide structure and transparency in the validation of ATM operational concepts as they progress from early phases of development towards implementation. Its aim is to achieve consistency in the collaboration of independent R&D organisations, aiming at a coherent approach and comparability of results across validation activities and projects, while leaving freedom to define the most practical planning and execution of individual activities. It provides validation practitioners, as well as experienced programme and project managers, with both a common understanding of what is required to perform validation and the framework necessary to collaborate effectively. The E-OCVM has been adopted by SESAR and integrated into the SESAR Development Framework.

For more information on E-OCVM, see the EUROCONTROL website:
www.eurocontrol.int/eec/public/standard_page/validation_ocvm.html

Invitation

PASS (Performance and safety Aspects of STCA full Study) was launched in 2007. Since then PASS has developed performance and safety requirements for STCA and has delivered the foundations for a safe and efficient joint concept of operations for ACAS and STCA. The project has three phases, (see panel below).

With the evolution of SESAR both Phases 2 and 3 became SESAR projects (within WP 4.8), so this workshop is an excellent opportunity to gain an insight into the delivery of the first SESAR safety nets work.

Who should attend?

- ANSPs representatives involved in operation and parameterisation of ground-based safety nets;
- State Authorities involved in standardisation, certification and approval of ground-based safety nets;
- SESAR consortium members, representing related SESAR projects;
- SPIN Sub-Group (Safety Nets Improvement Network) members;
- Industry: ATC automation systems manufacturers involved in the development of ground-based safety nets.

Phase 1 was a large scale monitoring study to understand the current operational situation in Europe and defined a typical series of events in STCA and ACAS occurrences.

Phases 2/3 developed performance and safety requirements for STCA.

Phase 3 has provided the core elements for a consistent overall concept for STCA and ACAS operations.

PASS incorporates and builds on the work of preceding studies

The PASS consortium members (Egis Avia, QinetiQ, DeepBlue and DSNA) will present the results of the study during a dissemination workshop taking place on 23rd November 2010 (from 9:30 until 16:30) at EUROCONTROL HQ in Brussels (POLLUX meeting room).

The workshop will be divided into two sessions (morning and afternoon). During the morning session the project and its methodology will be introduced. The afternoon session will be dedicated to the dissemination of the actual results.

Attendees are welcome to participate in both morning and afternoon sessions, or in the afternoon session only, according to their interest.

Acronym buster

ACAS: Airborne Collision Avoidance System

FARADS: Feasibility of ACAS RA Down-link Study

I-AM-SAFE: IAPA – ASARP Methodology for Safety net Assessment – Feasibility Evaluation

PASS: Performance and safety Aspects of STCA, full Study

STCA: Short Term Conflict Alert

To find out more about the PASS project or review reports delivered to date please visit the website: www.eurocontrol.int/safety_nets/public/standard_page/PASS.html

To see the workshop agenda or to register please visit: www.eurocontrol.int/corporate/public/event/101123_PASS_ws.html

For more information about the project or the workshop please contact PASS Project Manager Stanisław Drozdowski stanislaw.drozdowski@eurocontrol.int, phone: +32 2 7 29 3760

Safety Nets team visits colleagues in Simferopol, Ukraine

The EUROCONTROL team recently performed an assessment for UkSATSE Ukraine's ANSP, of the current safety nets at the Simferopol ACC. The EUROCONTROL Safety Nets team are now producing a report with their findings and recommendations. During a two-day meeting, the representatives of UkSATSE and Aerotechnica (the manufacturer of the Victoriya system) briefed EUROCONTROL on the implementation details of the STCA and MSAW at Simferopol. Traffic in the Simferopol area of responsibility has almost tripled since 2000 with 167,776 operations during 2009, and UkSATSE would like to ensure that safety nets are ready for further traffic growth.

Pictured: UkSATSE Safety Nets working group in Simferopol, Ukraine

Snippets

Malta: EUROCONTROL has been helping Malta Air Traffic Services (MATS) to optimise their safety nets. The work was carried out in two stages: 1) analysis of safety nets log files and system track recordings and 2) the design of a new (finer resolution) MSAW surface.

SPIN meeting: The next meeting of the SPIN Sub-Group takes place in Brussels on 24th and 25th November. On the agenda will be a debrief of the PASS workshop. If you would like to attend or find out more, please contact the Safety Nets team.

Monitoring of TCAS RAs – article published: SPIN Chairman Stanisław Drozdowski, EUROCONTROL's Doris Dehn and Philippe Louyot of DSNA have had an article about monitoring of TCAS Resolution Advisories in core European airspace published in The Air Traffic Control Quarterly journal. For further information, please contact Stanisław Drozdowski: stanislaw.drozdowski@eurocontrol.int.

ACAS bulletin: The next issue of the ACAS Bulletin is dedicated to pilot training and features an analysis of lessons learnt from TCAS RAs. It will be published shortly and can be obtained from the EUROCONTROL ACAS website (www.eurocontrol.int/acas).

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ENSURING THE EFFECTIVENESS OF SAFETY NETS