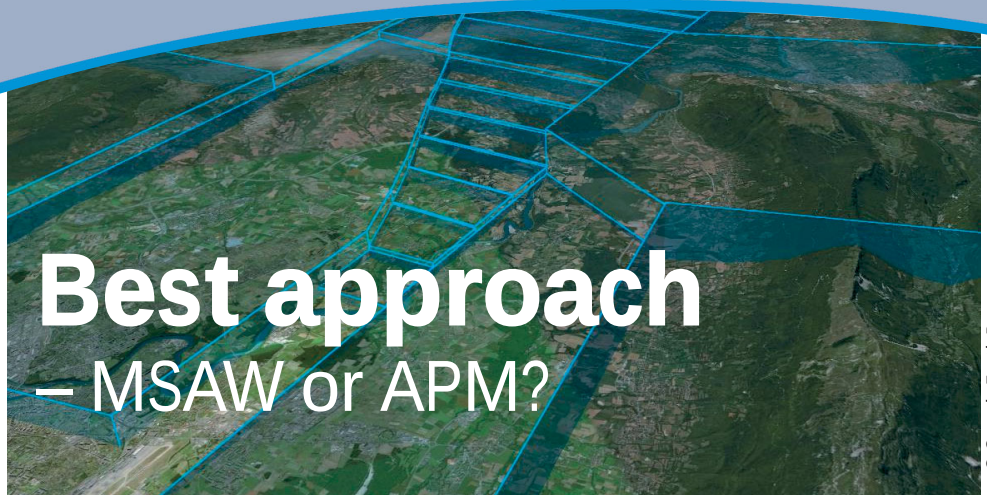
NET*ALERT* NEWSLETTER

*It's time for action*

ENSURING THE EFFECTIVENESS OF SAFETY NETS

November 2008



# Best approach – MSAW or APM?

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## WELCOME

NET*ALERT*, is the Safety Nets newsletter for people working in airlines, air traffic control centres, and the organisations that support them.

Standardisation is an important element of ensuring the effectiveness of Safety Nets. This has been proven already in our work with STCA. (See In Brief on back page). Now that experience is extending to other Safety Nets. This fourth issue of NET*ALERT* shares with you some of the practical research that is being done to support the standardisation work. It also previews some important training and awareness material developed to help 'spread the message'.

Thank you for lending your support to this initiative by reading NET*ALERT* and passing it on to others in your organisation.

Please contact us if you have experience to share or questions to ask. Our details are on the back page.

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The first issue of NET*ALERT* reported on a study into the feasibility of extending the use of Minimum Safe Altitude Warning (MSAW) in Swiss airspace. We can now report on a parallel study comparing the performance of the skyguide MSAW system tailored for use on the final approach at Geneva, with that of a typical Approach Path Monitor (APM) system.

*When an aircraft penetrates a polygon, an alert is immediately generated and displayed to the controller*

Skyguide operates MSAW in the vicinity of Geneva and Zurich airports. The system is configured as a series of predefined volumes of airspace, or polygons, within approximately 30 NM of the airport (see over) and each with a fixed ceiling height. When an aircraft penetrates a polygon, an alert is immediately generated and displayed to the controller. To minimise nuisance alerts, flights associated with pre-defined VFR and military SSR codes or flights performing visual approaches can be suppressed.

### Configuring MSAW to operate as an APM

At Geneva, skyguide engineers and controllers have defined a "staircase" of polygons on each final approach path so they can operate MSAW as an APM, thereby providing an alert when an aircraft deviates below a user-defined approach profile. However, Rod Howell a Safety Nets expert from QinetiQ who conducted the study under contract to EUROCONTROL, noted that APM and MSAW are configured differently:

*"A typical APM system has an alerting threshold defined by a funnel shape; aircraft above or below the approach funnel produce an alert. While the skyguide MSAW works very well on approach, it was not specifically designed for this purpose, unlike APM, and requires considerably more effort to configure."*

Howell continues: *"We used a fast-time APM/MSAW model to replicate the operation of both Safety Nets on final approach at Geneva, enabling skyguide to compare the performance of their MSAW with a typical APM system."*

Firstly, an APM approach funnel was configured with the same final approach operating ranges as the Geneva MSAW "staircases". Recordings of approach tracks from Geneva were used to determine whether MSAW and APM produced alerts for the same track, and where this was the case, the point of alert (distance from touchdown, altitude and deviation below the glide slope) was compared. Subsequent work tuned the APM to try and outperform MSAW (see table and images overleaf for an explanation of parameters) and investigated the optimal boundary for a joint APM/MSAW operation.

### Balancing warning time and nuisance alerts

Rod Howell explains the tuning work further: *"On final approach there may be little time* ☞

# Best approach

*continued*

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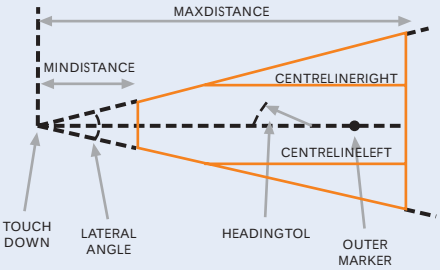
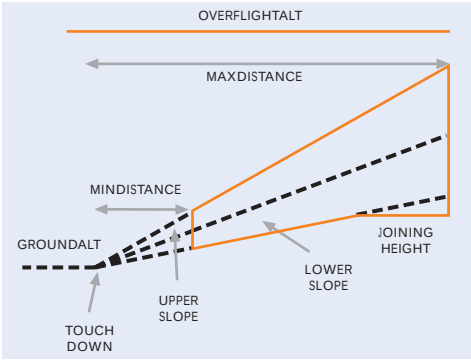
*Birds Eye view of the current MSAW polygons in use at Geneva (altitude in feet)*

*between a detected deviation below the nominal approach path and a potential controlled flight into terrain (CFIT). Fine tuning of parameters to achieve the correct balance between warning time and nuisance alerts is therefore critical. This is demonstrated by our study which shows certain parameter thresholds exist beyond which the alert rate is too high."* Referring to the investigation of the APM/MSAW boundary Howell explains: *"Currently MSAW has inhibition volumes on the very final stages of approach to suppress the terrain-related alerts that would otherwise occur for almost every arrival. By developing a joint MSAW/APM operation we determined that using APM approach funnels could reduce the current inhibition volumes and the time an aircraft is outside the coverage of a Safety Net. Furthermore, it was considered that the best point for APM to take over from MSAW is once an aircraft intercepts the localiser. This does lead to a slight penalty in APM performance as the alerting tolerance between the track heading and final approach heading has to be increased to minimise MSAW nuisance alerts for aircraft with a significant descent rate turning late on to the Geneva approach path."*




*APM funnel – plan view*

Rod Howell summarises the study conclusions: *"Specific to skyguide, we found that only small increases in alerting performance were achieved when the APM was tuned to outperform MSAW. On their own, these improvements were not enough to justify the cost of a new APM. This is testament to the expertise of skyguide in configuring their MSAW. We were also able to produce valuable conclusions for the other ANSPs as part of our specification work* (see pink panel)*."*




*APM funnel – side view*

**Learning Points: APM & MSAW on approach**

- APM is considerably easier than MSAW to set up and tune for the final approach segment.
- It is highly recommended to use APM for the final approach segment and not extend MSAW to a role for which it was not designed.
- When procuring APM, insist on sufficient flexibility to tune the approach funnel definitions.
- Test and tune APM off-line, with an MSAW/APM model, prior to operational validation.
- Do not consider MSAW and APM in isolation, tune the boundary between the two systems to achieve the best performance.

| APM parameter | Purpose | Tested in this study |
|---|---|---|
| Lower slope | APM alert generated if an aircrafts vertical position is below the lower slope (the upper slope was not used in this study). | Y |
| Minimum/maximum distance | Minimum/maximum distance from the runway threshold that the APM funnel is effective. | Y |
| Joining height | Modifies the shape of the funnel to account for many aircraft intercepting the nominal approach path whilst in level flight. | Y |
| Heading tolerance | Tolerance between track heading and the final approach heading. Tracks outside the tolerance are not processed. | Y |
| Centreline right/left | Tracks only processed if an aircraft is within a given lateral distance from the runway centreline. | N |

# Further work on MSAW & APM

As part of the work preparing specifications and guidance material for MSAW and APM, two further studies have been undertaken to answer some final questions before the specifications are finalised.

### ICAO terminology

Questions relating to definitions used in the MSAW and APM specifications have been addressed by a review of ICAO terminology.

Twenty-five terms related to altitude, elevation, height and level have been reviewed across 14 ICAO documents to check the definitions for consistency, correct use and interrelationships. Most terms were found to be defined and used correctly, but some anomalies were found. The SPIN Sub Group is currently studying the recommendations made to resolve the anomalies and whether to request action from ICAO.

### Terrain and Obstacle Data

ICAO Annex 15 obliges States to publish digital databases of terrain and obstacle data to a defined accuracy in order to support applications, including MSAW and APM. Populating such databases to the required accuracy is demanding and expensive. EUROCONTROL's Terrain and Obstacle Data (TOD) working group has issued a questionnaire to capture the data requirements for different applications, including MSAW and APM. In response, a second study has identified realistic ranges for accuracy requirements for terrain and obstacle data needed by MSAW and APM taking into account the accuracies of surveillance data, altimeter errors and QNH/temperature errors for optimum warning times in the range 20 to 60 seconds. The results have been provided back to the TOD working group.

# New awareness package
## for safety nets

*Screen shots taken from the awareness package*

In Issue 3 of NET*ALERT* we reported that the first module of a computer-based Safety Nets Awareness Package was on show at the Safety Nets workshop held in May. We had positive feed-back at the time and our work on the package has progressed well.

The Safety Nets Awareness Package comprises three computer-based learning modules to familiarise the user with Safety Nets and to help them to understand how STCA can be deployed. Its goal is to help every country in ECAC to have a correctly installed, fully functional STCA system.

The package contains three modules. The first, **"Effective Safety Nets"**, is a ten-minute introduction to Safety Nets which begins with an overview of the need for Safety Nets and describes the different airborne and ground-based Safety Nets available as well as highlighting some of the common concerns raised by controllers. The remainder of the module focuses on STCA and shows that STCA can provide benefits if correctly installed and maintained. It explains the basics of the system, highlighting issues which impact the effective use of STCA (for example nuisance alerts). It emphasizes the need for fine-tuning in a local environment and for controllers to understand the strengths and limitations in order to ensure effectiveness and to develop trust in the system.

Finally, the module considers future developments of the system and introduces EUROCONTROL guidance material available.

The second module, **"STCA Lifecycle"**, takes the user through the lifecycle of a typical STCA. It describes the recommended approach to be followed when implementing or changing an STCA system going through the four stages of the lifecycle:

1. Defining – operational requirements, policy and safety case;
2. Implementing – addressing procurement or enhancement and verification;
3. Optimising – tuning to the local environment eg to maximise the number of wanted alerts with sufficient warning time whilst reducing the number of nuisance alerts;
4. Operating – training and performance monitoring.

The module aims to raise awareness of the complexity of deploying and maintaining an STCA system and to draw attention to guidance material available.

The third module, "**Key Points"**, is a five-minute summary of the two other modules to be used as a summary of the complete training session or a standalone awareness-raising module for senior management.

The Awareness Package also includes a navigation help function, a summary of acronyms used and a library containing Safety Nets material produced by EUROCONTROL.
The first module has been completed and the second and third modules are due to be finalised by the end of 2008. The package will soon be available as an e-Learning course via IANS website: http://elearning.eurocontrol.int. Once an e-Learning account has been created, the user will be able to track their progress on the course and restart from where they left off if they prefer to complete the course in stages.

The package is also available on request and can even be tailored for specific purposes.

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# Revisions proposed
## for safety nets training

A major review and consultation on the Common Core Content for ATCO Initial Training has concluded that further clarification about the role and purpose of Safety Nets should be provided. It also confirmed that terminology and definitions should be aligned to help distinguish between ACAS, ground-based Safety Nets and controller tools. This will all help with the harmonisation process – which can only be good for the effectiveness of Safety Nets.

*September 2008 workshop in progress*

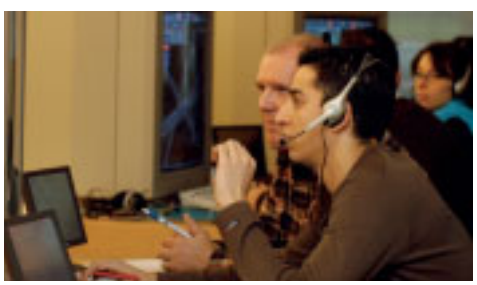
During the consultation process, several ANSPs proposed that additional training objectives should be developed for Safety Nets:

- to define the purpose of Safety Nets in the operational and safety contexts;
- on the high level principles of Safety Net performance (limitations and deficiencies), effective parameterisation, and HMI to better facilitate ATCO trust and acceptance of Safety Nets;
- for each Safety Net (ie STCA, APW, APM, MSAW) on applying appropriate operational procedures dependent on the operational context.

The review body found merit in these ideas and suggested that they be considered for Unit training.

A stakeholder consultation workshop, presenting the outcome of the formal consultation, took place in September 2008.

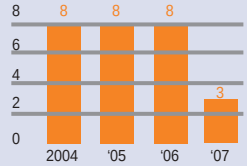
The new EUROCONTROL Specification for the ATCO Common Core Content Initial Training sets out the minimum training requirements for the achievement of a Student Air Traffic Controller Licence in accordance with Directive (EC) No 2006/23 (mandatory in EU Member States) and ESARR 5 (mandatory in the ECAC area). Once the Specification has been signed by the Director General of EUROCONTROL it will be forwarded to the European Commission which will consider an amendment to the ATCO Licensing Directive.



## In Brief

■ **Safety Nets in Bulgaria:** from November the EUROCONTROL Safety Nets team will begin working with the Air Traffic Services Authority (ATSA) of Bulgaria. The team will work with ATSA to optimise its MSAW and STCA systems.

■ **STCA success:** The Maastricht Upper Area Control Centre annual report shows that in 2007 there were 3 Category B incidents compared with 8 in each of the 3 preceding years. The annual report states that this: *"significant improvement is mainly due to the implementation of an enhanced short-term conflict alert system, and improvements in the process for incorporating recommendations resulting from operational incident investigations".*




■ **Specifications on their way**... The specifications for the remaining Safety Nets went through their final review by the SPIN Sub Group at the end of October. These are expected to be published by the end of the year.

■ **Lessons learned:** The FAA has established a new online safety library that teaches "lessons learned" from some of the world's most historically significant air accidents. The Lessons Learned library, in its initial release, lists 11 major accidents that made an impact on the aviation industry. The FAA's goal is to stock the library with another 40 historically significant accidents by the end of 2009. http://accidents-ll.faa.gov/

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