NETALERT NEWSLETTER

It's time for action

Ensuring the Effectiveness of Safety Nets

November 2009

Improving safety nets
in the South Caucasus

© Google Earth Pro

Aram Tunyan, Safety Manager for ARMATS

***T**he Safety Nets team has been holding joint seminars with a number of ANSPs to share knowledge and experience of ground-based safety nets. In some instances, those seminars lead to requests for further support from EUROCONTROL. In this article, we interview Aram Tunyan, Safety Manager for Armenia Air Traffic Services (ARMATS), to find out about the safety nets project currently underway.*

STCA area of operations (in green)

WELCOME

This is the 7th edition of NET*ALERT*. When we first decided to produce a newsletter, we wondered if there would be enough things to write about. We need not have worried – safety nets for ATC are of increasing priority across Europe. Our team is working with action-oriented air navigation service providers who want to see progress and one such provider, ARMATS, is featured in our front page article.

EUROCONTROL support can take many forms, not just hands-on help. Inside this issue of NET*ALERT* we report on a new proof-of-concept tool we have developed, which could save you time and effort in defining surfaces for Minimum Safe Altitude Warning (MSAW) systems. Please do get in touch if you are interested in using it.

NET*ALERT*, is the safety nets newsletter for people working in airlines, air traffic control centres, and the organisations that support them. It is distributed in hard copy and is also available in pdf soft copy format on our website.

INSIDE

Overview of ARMATS safety nets

The ARMATS ATC system includes a number of ground-based safety nets all of which operate using slightly modified factory default settings.

- Short-Term Conflict Alert (STCA): The ARMATS ATC system has a limit of four co-ordinates to define the STCA area of operation which extends well beyond the Yerevan FIR. A significant number of nuisance alerts are generated outside of the FIR due to aircraft regarded by the STCA as 'non-RVSM compliant'.
- Minimum Safe Altitude Warning (MSAW): Provides warning of potential conflicts with the terrain around the three highest peaks in Armenia.
- Danger Areas Infringement Warning (DAIW) - otherwise known as Area Proximity Warning (APW): Provides warnings of potential infringements into established danger areas.
- Approach Path Monitor (APM): Not installed. After two incidents on final approach, configuring MSAW to operate as an APM is being evaluated. Under this scenario, APM would have the same single warning time used by MSAW and DAIW.

Q. Can you tell us more about the work on optimising parameter settings for STCA?

A. The review of STCA parameters primarily focuses upon its use in RVSM airspace which was implemented in the South Caucasus (including Armenia, Azerbaijan and Georgia) in 2005.

Our STCA operates well beyond the boundary of the Yerevan FIR. Monitoring has shown that 83% of all STCA alerts were nuisance alerts attributable to aircraft regarded as 'non-RVSM compliant' operating in RVSM airspace mainly outside of the FIR. This naturally frustrates controllers and makes them lose faith in the system. The task here is to analyse all contributory factors leading ☞

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continued

to the large number of nuisance alerts and re-parameterise STCA accordingly. Potential solutions include revising the RVSM/ STCA area, modifying the flight plan (FPL) activation time for inbound aircraft or adjusting the vertical separation parameters for STCA.

Additionally, a very small number of nuisance alerts are caused where one aircraft is on final approach and another aircraft is on the airport surface with an active transponder. Here, increasing the base level of STCA operations is a possible area of investigation.

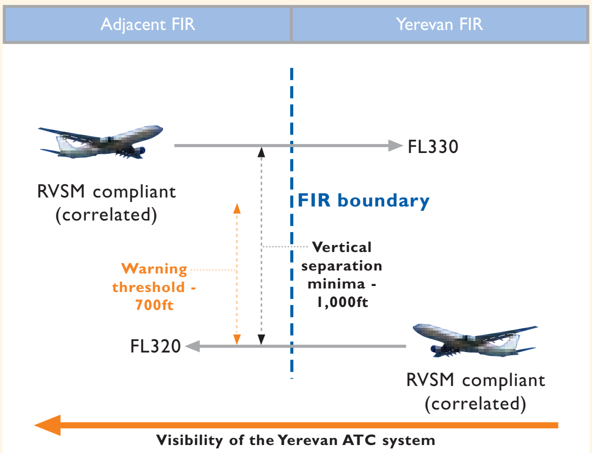
Q. What about APM, DAIW and MSAW?

A. We are investigating the modification of MSAW to operate as an APM on final approach. EUROCONTROL is supporting us with this, and the work is initially focussing on Yerevan international airport. If successful, it will extend to Gumri airport at a later date.

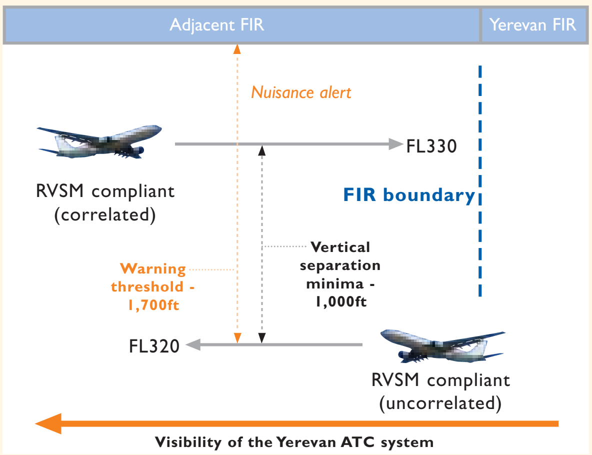
The ARMATS system has a single 'look ahead' prediction time for MSAW and DAIW which would also apply to APM as well. This presents a particular challenge for us because APM requires a 'zero' warning time since it operates when the aircraft is in close proximity to the ground. For a successful outcome, we need to find solutions that ensure all three safety nets provide timely warnings.

DAIW is used to provide warnings of potential infringements into established danger areas. If the single 'look ahead' parameter for DAIW and MSAW were reduced to 'zero', we would probably need to investigate an additional artificial 'buffer area' around this kind of airspace. MSAW is used by ARMATS to provide warning of potential conflicts with the terrain around the three highest peaks in Armenia. The vertical 'buffer' over the peaks is 2,000 feet with a warning time of 1 minute. As only one of these peaks is close to the Yerevan international airport, a first step is to investigate whether we need to make any changes to MSAW.

STCA nuisance alerts in RVSM airspace



The ARMATS ATC system uses flight plan information to determine if aircraft are RVSM compliant. Where flights plans of aircraft are 'correlated' as being RVSM compliant, an ATC vertical separation minimum of 1,000 feet and a system warning threshold of 700 feet is applied by the STCA logic.



When an aircraft leaves the Yerevan FIR, its flight plan is terminated by an ATCO and regarded as 'uncorrelated' by the ATC system. The system now regards the aircraft as non-RVSM compliant and applies a 2,000 feet vertical separation minima and 1,700 feet warning threshold in the STCA logic.

As the ATC vertical separation minimum is 1,000 feet and STCA is using the threshold for non-RVSM compliant aircraft, a nuisance alert occurs.

Q. What are your planned next steps?

A. EUROCONTROL will first carry out a review of our safety nets and report their findings. ARMATS will then decide on the appropriate solution(s) by taking account of all relevant safety, operational and economic factors. EUROCONTROL will then be notified of the preferred options in order to carry out a safety assessment analysis.

Q. What will be the benefits of the joint ARMATS-EUROCONTROL project?

A. Developing appropriate solutions for each of our safety nets will allow ARMATS to improve safety performance, promote trust in the Safety Management System and help to reduce staff workload. Accordingly, I would like to extend the appreciation of ARMATS to all of those involved in this important project.

Q. Finally, what advice would you give to others on the use of safety nets?

A. Safety nets are a vital part of the ATM system and provide the last barrier to prevent serious incidents. For even the most advanced ATM systems it is vital to adapt ground-based safety nets to local conditions and tune their parameters correctly. This requires input from operational, technical and safety experts. After successful implementation it remains vital for safety related staff to continue to monitor safety net performance and share the lessons learned with others.

This article has been produced with the kind support of ARMATS.

PolyGen
A new solution for defining MSAW surfaces

EUROCONTROL has developed a proof-of-concept tool called PolyGen that allows MSAW surfaces to be defined more accurately and with less effort using digital terrain data as an input.

Defining MSAW surfaces

MSAW is typically configured as a series of predefined volumes of airspace, or polygons, each with a fixed ceiling height. Together, a group of polygons forms the 'MSAW surface'. When an aircraft is predicted to penetrate this surface, an alert is immediately generated and displayed to the controller.

A typical MSAW system will allow between 64 - 256 polygons to be defined. These are usually defined manually by, for example, using topographical maps or based on the minimum vectoring altitudes used by ATC. However, this is time consuming and can result in oversized polygons which then leads to excessive nuisance alerts.

Some MSAW systems allow the import of digital terrain data. The data is typically stored in the MSAW system as a fine resolution grid (typically 1NMx1NM) of elevation values. This type of data represents the terrain better than hand constructed polygons and provides for much better alerting performance. However, the problem is that the majority of MSAW systems do not allow digital terrain data to be imported.

How PolyGen helps

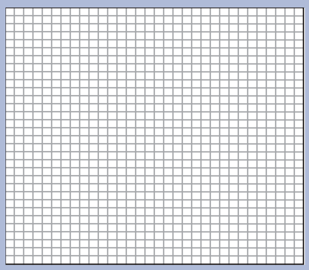
PolyGen has been developed for just these kind of MSAW systems. It enables their MSAW surfaces to be developed more quickly and accurately using digital terrain data (see panel right).

PolyGen can be used to review and optimise existing MSAW surfaces as well as support the installation of a new system. As EUROCONTROL project manager Hans Wagemans explains: *"PolyGen helps ANSPs to produce a baseline* ☞

How PolyGen works – simplified overview

Step 1: Load and validate digital terrain data

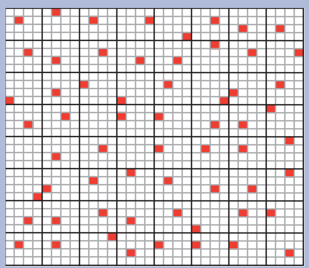
Digital terrain data covering MSAW area of operation is loaded into PolyGen and validated. The data is effectively a highly detailed grid of elevation values.



Raw digital terrain data

Step 2: Reduce complexity of the terrain data

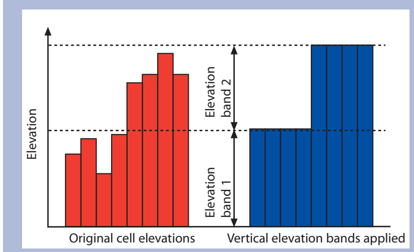
The terrain data is overlaid on a grid of cells. Each cell is defined by an identifier, the latitude and longitude of each corner and an elevation. Each cell will contain several digital terrain elevation values, the greatest of which defines the elevation of the cell.



Raw digital terrain data overlaid on the PolyGen cells (greatest elevation for each cell marked in red)

Step 3: Apply vertical elevation bands

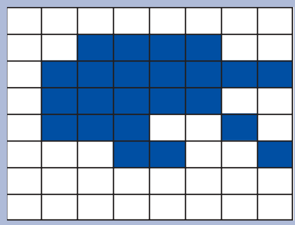
Depending on data accuracy, the elevation of each cell could be defined to the nearest metre. To increase the probability of the terrain being described within 64-256 polygons, cells need to be grouped into vertical elevation bands. The user defines the margins for the vertical bands according to the terrain data. The bands do not need to be equally spaced.



Applying elevation bands

Step 4: Group cells with matching terrain information

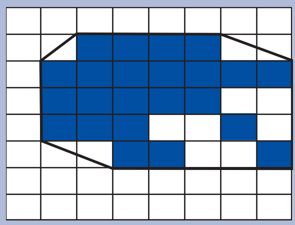
Clusters of cells in the same vertical elevation band are identified.

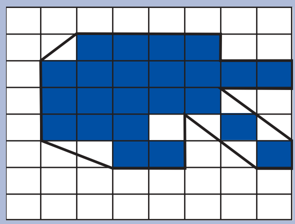


Identifying clusters of cells in the same vertical band

Step 5: Construct the polygon

Polygons are constructed for each cluster. How closely each polygon follows the cluster of cells is dependent on the total number of vertices that can be defined in the MSAW system.

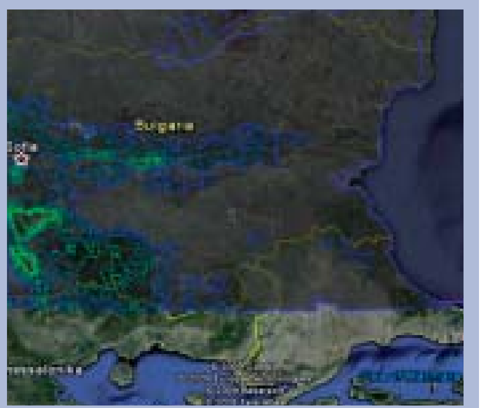




MSAW polygon dimensions determined by system vertices limits

Step 6: Combine all MSAW polygons

All of the polygon clusters are combined to give the MSAW surface.



All polygon clusters combined into an MSAW surface (green and blue lines)

Iterative approach

If the MSAW surface produced exceeds the number of polygons or vertices that can be defined by the MSAW system, the process is repeated by increasing the size of the grid cells in Step 2.

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MSAW surface which optimally captures the shape of the terrain and reduces the probability of nuisance alerts. It saves time, compared to the usual methods. However, activities such as defining inhibition areas where MSAW will not operate and independently checking the polygons against the underlying terrain, still have to take place manually."

Validation success

The PolyGen prototype is being validated with the help of ATSA Bulgaria and Georgian ANSP Sakaeronavigatsia. As Alexander Trubitsin, Head of Sakaeronavigatsia's ATC Automation Systems Department of explains, *"PolyGen has been invaluable in the review of our existing MSAW surfaces. The advantage of PolyGen is the significant reduction in time and effort to create MSAW surfaces. Running PolyGen with different sets of parameters makes it quick and easy to find an optimum polygon solution".*

Are you interested?

Hans Wagemans concludes *"Feedback from ATSA Bulgaria and Sakaeronavigatsia has been very positive. We think PolyGen could be of use to other ANSPs as well and are urging interested organisations to contact us."*

PolyGen: Produces an MSAW surface taking account of the number of polygons and vertices that can be defined by the system. In many respects, PolyGen can be seen as an input to an MSAW "testbed".

MSAW testbed: Fast-time simulation of MSAW. Recorded radar tracks are used to test that MSAW parameters, such as warning times and surfaces, capture relevant alerts and produce minimal nuisance alerts.

For further information contact Hans Wagemans (hans.wagemans@eurocontrol.int).
This article has been produced with the kind support of QinetiQ

Approach Path Monitor

preventing incidents

Here is another real-life example of an incident where safety nets would have provided a timely warning.

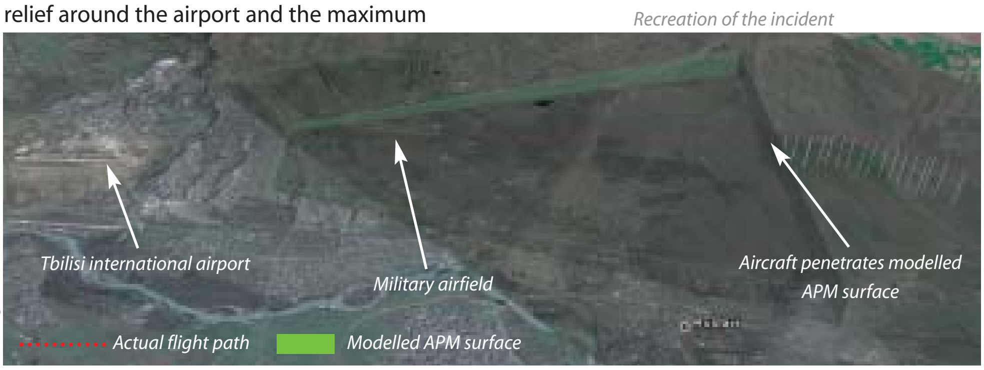
Tbilisi 2008: A Boeing 737 passenger aircraft on an ILS (Instrument Landing System) approach to Tbilisi's international airport, reported 'ILS established', but later deviated from the glide path and mistakenly landed at a nearby military airfield whose runway had been damaged during the recent conflict.

The Georgian ANSP Sakaeronavigatsia operates Minimum Safe Altitude Warning (MSAW). However, due to the complex geographical relief around the airport and the maximum number of polygons that can be specified for the system, MSAW is inhibited in the Tbilisi TMA and would not have alerted controllers to the incident.

At the request of Sakaeronavigatsia, EUROCONTROL have recreated the incident with an Approach Path Monitor (APM) operating at Tbilisi's international airport. The analysis shows that had an APM been in use it would have provided a timely alert of the deviation from the planned approach path.

Sakaeronavigatsia are currently investigating the possibility of implementing APM at Tbilisi.

Recreation of the incident



In Brief

■ SESAR up and running: Work has started on safety nets within the SESAR programme under WP4.8. The focus of the work is on enhancing ground-based and airborne safety nets and ensuring compatibility between the two. Work on ground-based safety nets is planned to include making use of improved surveillance infrastructure and down linked aircraft parameters. By the end of 2009 scoping work should be complete. We will keep you posted on developments.

■ SPIN in Berlin: The SPIN Sub-Group recently met in Berlin (28-29 October). The focus of the meeting was to agree a way forward for RA Downlink in light of the workshop conclusions made the previous day.

■ And in Poland … The Safety Nets team has provided technical support to PANSA, the Polish ANSP. Having made initial technical recommendations the team will assist with further tuning of the Pegasus_21 system safety nets in the future.

■ MSAW: The Italian Air Safety Board (ANSV) has released a report on an incident in 2005 when a B737 made an unplanned and unstable approach to Rome Ciampino airport in poor weather. During its approach the aircraft descended to an altitude of 370 feet while still approximately 11km from the runway. Among the various safety issues highlighted by the investigation was the need for better minimum safe altitude warnings. A version of the report, written in Italian, can be requested from the ANSV website (http://www.ansv.it/)

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