Getting the best out of APW

By Dijana Pasic

Airspace infringements remain one of the top safety issues. Whilst efforts are being made to raise pilots' awareness in order to minimise the numbers of airspace infringements, it is worth examining whether the ATC ground-based safety nets can play a better role in alerting controllers about airspace infringements.

In this article, I will look at different types of airspace infringement and how ATC ground based safety nets can be improved to provide controllers with alerts of airspace infringements before they occur.

So what could be done at system level to reduce airspace infringement events?

Currently, many ATC ground systems are equipped with a safety net that warns controllers in situations when aircraft are predicted to penetrate or have already penetrated a designated airspace volume without clearance. The airspace volume in question could be a restricted/danger/prohibited area or even designated parts of controlled airspace.

This safety net, depending on the implementation, is called Area Proximity Warning (APW), Danger Area Infringement Warning (DAIW), Restricted Area Intrusion (RAI) or Controlled Airspace Infringement Tool (CAIT). The alert is provided at the controller's working position and the resolution of the situation is left entirely to the controller's decision – there is no resolution advisory.

The APW can be used to warn controllers when an aircraft is about to infringe (or has already infringed) the designated airspace area. A typical example is a civil aircraft penetrating military airspace, see Figure 1, which can pose a significant risk to the civil aircraft and additionally to any aircraft operating within the military area.

Area Proximity Warning (APW):

Ground-based safety net intended to warn the controller of unauthorised penetration into an airspace volume by generating, in a timely manner, an alert of a potential or actual infringement of the required spacing to that airspace volume.

Ref: EUROCONTROL Specification for APW. Edition 0.5

Another concept of use of this safety net is to warn controllers when an unauthorised aircraft is about to infringe or is already infringing controlled airspace. A typical example is a VFR flight penetrating controlled airspace or a military aircraft leaving a military exercise area without clearance. Although in these cases the controllers probably do not have two-way communication with the infringing flight, sufficient warning time can enable them either to act on the flight under their control or to initiate coordination in regards to the infringing flight.

Some APW systems provide 2 different levels of alert with a different display for each level. For example, when an aircraft is about to penetrate a restricted area, the APW alert at the controller's working position could be displayed in yellow. When the aircraft has already penetrated the restricted area, the APW alert could be displayed in red - see Figure 1.

How does APW work?

APW uses surveillance data (including tracked pressure altitude information) and flight plan data to predict any potential airspace infringements. Either Mode C or Mode S data can be used to make a prediction in the vertical dimension. Environment data and parameters are used to define the airspace volumes and the parameters for alert delivery.

APW makes use of data from:

- the flight data processing system to determine which flights are eligible for alert generation using aircraft type and category of flight;
- affected sectors to display alerts to all controller working positions concerned;
- cleared /blocked flight levels – and manually entered flight levels if altitude information is not available;

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Figure 1

Defining:

the initial step of the lifecycle is the definition of roles and responsibilities (ideally a team that consist of operational, technical and safety experts) inside the organisation and the definition of the operational requirements of APW.

Implementing:

next step is taking a decision about the APW procurement. This phase is mostly performed by engineers and technical experts. System verification is performed either when implementing a new APW from scratch or when enhancing an existing APW.

Optimising:

the third phase is aimed at optimising the system in order to meet the operational requirements identified in the first phase. It also addresses validating the system before making it fully operational. This phase relies on close collaboration between technical staff and operational experts.

Operating:

When APW is considered to be validated or optimised, adequate training is provided to both Controllers and engineers. Once APW is fully operational, a set of parallel processes are put in place: Collection of feedback from Controllers, Analysis of Pilots/Controllers reports, Monitoring of APW performance and Maintenance. All this requires a close collaboration between operational and technical staff. Safety experts should also be involved, to ensure that the APW role is adequately considered in evaluating the whole safety performance of the ANSP.

Ref: EUROCONTROL Guidance Material for APW. Edition 1.0

Figure 2

- recorded aircraft RVSM status to determine the defined spacing from the airspace volume.

In addition to APW alerts, controllers are normally provided with information on the availability of APW. They also have the option to inhibit APW alerting for a specific radar track or group of tracks, e.g. one based on the SSR code group.

One of the most demanding tasks when improving the performance of any safety net is to achieve the best balance between the length of the warning time and nuisance alert rate. Increasing the warning time, depending on the conflict geometry, could create more nuisance alerts. On the other hand, reducing the number of nuisance alerts may result in insufficient warning time or even lead to some conflicts being missed. It is definitely not a one-off activity and it requires a team of technical and operational staff working together.

How does APW interact with other safety nets?

APW works in conjunction with the Short Term Conflict Alert. STCA alerts controllers in situations of potential or actual infringement of separation minima and so helps prevent collisions between aircraft, whilst the APW does this indirectly by predicting or detecting unauthorised airspace volume penetration. Very often, STCA is disabled within airspace such as restricted/danger/prohibited areas which are normally protected by APW so as to reduce the nuisance alert rate. For example, military traffic flying within a military area could create a lot of STCA nuisance alerts. In order to still help protect the surrounding traffic, the APW is activated in the segregated area and alerts occur for any departure from or penetration into that defined airspace volume.

Why do we need safety nets?

Even the best systems fail. Safety nets help prevent incidents from developing into significant incidents or even accidents, and serve as "another pair of eyes".

Can we improve APW performance?

Many controllers will have already had experience of APW and have probably sometimes had questions about its performance.

In order to get the best out of APW and improve its performance, it is important to follow a defined lifecycle. The lifecycle, see Figure 2, represents an ideal process to be followed by ANSPs to implement and maintain a satisfactory level of APW protection during normal operations.

The Safety Nets Performance Improvement Network Sub Group (SPIN) has developed the specification and guidance material for ground-based safety nets including Area Proximity Warning (APW). The documents are available at www.eurocontrol.int/safety-nets.