Safety nets vs controller's risk perception and risk management

by Jean-Marc Flon

Automation is taking more and more hold in everyday life. This is so to say an understatement but what does that mean exactly in the ATC world and especially in the field of safety? For sure one of the obvious primary answers is the introduction of safety nets and the automatic detection of safety events.

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They are nowadays important tools and act as a supplementary safety barrier when, in the handling of traffic, something has gone wrong and especially so when detection and management of a conflict has failed. But how are these tools perceived and used by the controllers with due regard to the notion of risk management?

One first thing I have to say before entering into the matter, as this can sometimes be a criticism about the development of these tools, is that in over thirty years in ATC, I've never seen a controller taking the risk of handling traffic to the margins and waiting for a safety net alert to pop up before acting on a detected conflict. Controllers, as far as I know from experience, do not control by using safety nets and moreover these tools are not considered as an ATC tool.

So now what safety nets are we talking about? Paris CDG has been A-SMGCS Level II compliant since 2002, which means that potential conflicts on the runway are detected by the Runway Incursion Monitoring and Conflict Alert System (RIMCAS). On approach, the controllers' radar suite is equipped with a Short Term Conflict Alert (STCA) system specific to the approach. Given a situation in which triple simultaneous approaches are operated at CDG[24] as well as a high traffic density, STCA is particularly valuable. Finally, a tool specifically aimed at detecting intrusion into a defined area, the Area Proximity Warning System (APW), which was initially defined for detecting airspace infringement by VFR traffic, was implemented in 2011.

Two years ago, with the definition of a local safety action plan, CDG management decided it was time to share safety issues and the overall safety performance at CDG with those on the front line and especially watch managers. So that we have a comprehensive view of CDG's safety events and safety performance, we not only rely on submitted Safety Reports but on a thorough analysis of all events which are automatically detected by the various safety nets. After beginning this process with STCA data in 2008, RIMCAS events were added in 2012 and the local safety unit now analyses around 2500 events every year. The output from this analysis enables a better understanding of how the system works and ensures that its strengths as well as its weaknesses are more precisely identified.

2012 saw a dramatic increase in the number of Runway Incursions (RI,) which rose to 59 compared to the 46 recorded the previous year. Did that mean that suddenly there was a safety problem at CDG? Of course not. The obvious explanation was that a discrepancy existed between safety events detected through reporting and through automatic detection. It was thus demonstrated that a number of events were not being reported and suggested that there might be a dif-

24- CDG has two pairs of runways operated single mode which means 2 dedicated arrival runways for CDG plus, for westerly approaches, a similarly aligned runway at nearby Le Bourget airport, the whole in less than 3.3 NM spacing between the outer runways extended centrelines

image A

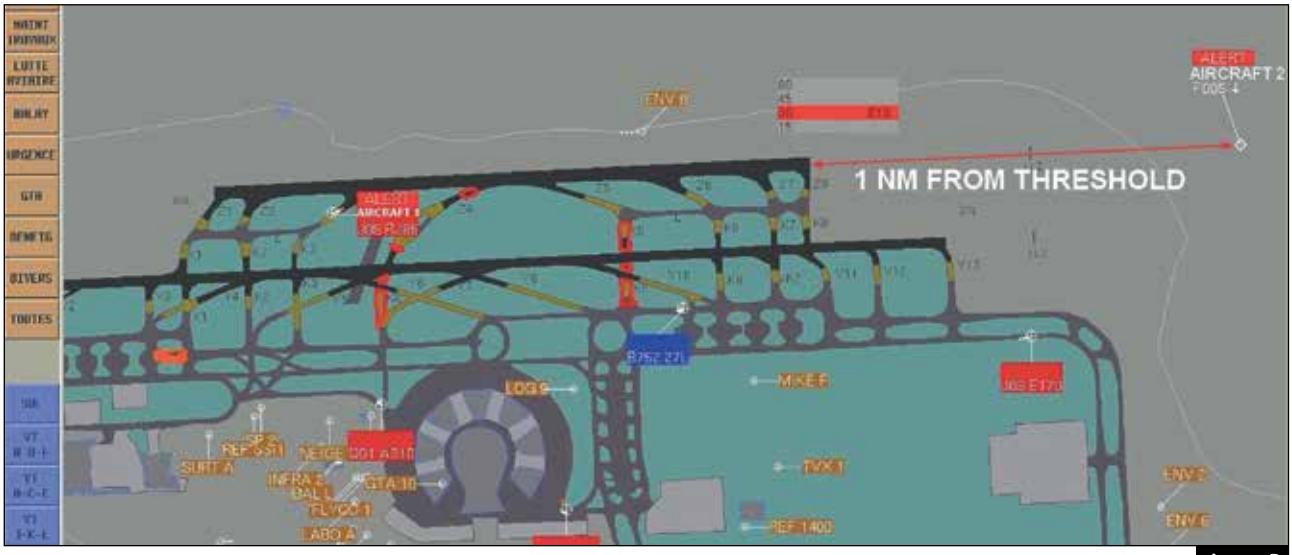

image B

ferent perception by operational controllers of what really was an RI safety event than that of the local safety unit.

To establish the underlying trends and reasons for this "performance" we had to delve more deeply into the data and refine the analysis. To support this, a management dialogue with watch supervisors was essential.

The initial discussions on what constituted safety-relevant events and how safety performance should be measured gave the clear impression of a deep rift between the views of the safety unit and those of front line operators. The use of safety nets data was seen as management "spying" on operational controllers and communicating only negative feedback on their performance no carrots, only sticks as the saying goes! The gap had to be bridged.

It was decided to differentiate categories of RI and to analyse safety performance by category. One category used was RI caused by the delivery of conflicting clearances, which was the one that saw a dramatic increase when RIMCAS event analysis began. A difference was then made between the non-intentional delivered clearances (errors) and the intentionally delivered. For this last category it was necessary to define three typologies:

- **Type 1 –** landing clearance given before the previous landing aircraft has completely vacated the same runway[25] in VMC – (see image A)
- **Type 2 –** take-off clearance given before a previously landed aircraft has completely vacated the same runway (either crossing or landing)
- **Type 3 –** landing clearance given when LVO are in place and a previous landed aircraft has not vacated the runway actives (see image B)

We were thus able to better understand the risk perception and risk management behaviour of individuals or groups of controllers. The findings could then be shared with watch managers and examine the trade-offs being made during everyday operations.

In examining these issues, a Type 1 RI could be an acceptable trade-off if instructing a go around might lead to other risks[26] such as an immediate conflict with a departing aircraft on the adjacent inner parallel runway which would have the effect of generating more pressure on the system as a whole. A similar trade off could be acceptable in the Type 2 case with mixed mode operations, in the Type 3 case with LVO in place a landing clearance

25- i.e. the landed aircraft is still in the defined runway protected area which for the RIMCAS settings are defined at 90 m from RWY centre line in normal operating conditions and 150 m in low visibility operations (LVO)
26- See EUROCONTROL & FSF Go-around Safety Forum 2013 on SKYbrary at: http://www.skybrary.aero/index.php/Portal:Go-Around_Safety and an article in FI "Second Chances" dated July 29th-August 4th 2014

Safety nets vs controller's risk perception and risk management (cont'd)

delivered before a previously landed aircraft has completely vacated the defined runway is another matter in terms of risk management (possible localiser deviation) and would indicate a distorted risk perception by the controller.

By means of this thorough analysis and management dialogue, it was possible to adopt a common view on what constituted an "acceptable" level of event risk management by a controller and take a zero tolerance position on the remainder.

One other issue is Separation Minima Infringement (SMI). Considering the simultaneous approaches operated at CDG, these are monitored very carefully and the trend of continuous improvement has considerably gained strength over the last couple of years. But are we sure that in focusing on SMI, we are not generating other risks? What if a controller keeps an aircraft too high on final approach so as to ensure separation with an aircraft and thereby creates a non-compliant approach[27] and possibly an unstable one? What are the risks and what level of safety is achieved then? As you can imagine, this issue is being carefully looked at and actions have been taken to minimise the safety risks.

An example of the consequences which can follow if an aircraft is kept high on the approach occurred at CDG on 13 March 2012[28]. Fortunately, the end result was eventually a go around but because of the lack of situational awareness on both sides on realising that the crew would not be able to land off the approach and lack of corrective actions, the consequences were potentially serious. The aircraft, an A340, was being radar vectored for a Cat III ILS approach with LVP in force. It was given a step down descent due to other traffic and was thus maintained higher than the normal 3° descent. The crew allowed their aircraft to get so far above the ILS GS that the aircraft was still at 3700 feet when 4 nm from the landing runway - over 2000 feet above the ILS glide slope. Then and with only 2 nm to go and the autopilot engaged, the aircraft suddenly pitched up with an angle of 26° and with an airspeed down to about 130 kts. Fortunately the crew then immediately disconnected the autopilot with a pitch down input before going around (see image C).

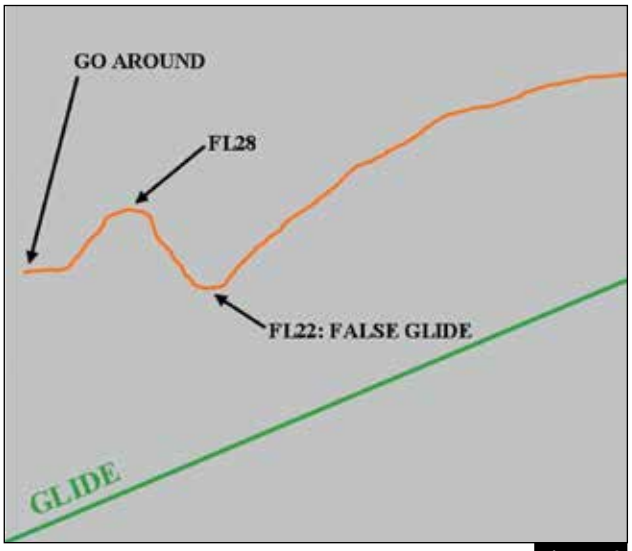

image C

The BEA (French AAIB) thoroughly analysed this serious event which, due to the high altitude on approach, was caused by the capture of a false Glide Slope signal which can occur when an aircraft is flying in an area above the 5.25° glide path. The same typology of safety event occurred at Eindhoven airport on May 31st 2013 which led to a thorough investigation on the matter by the Dutch Safety Board[29].

Despite the rarity of a scenario such as this, an action plan has been locally developed to prevent these occurrences and uses automatic detection of the most critical non-compliant and potentially unstabilised approaches. This is achieved by using the APW system to notify controllers of any non-compliant approach. Boxes are defined for each ILS approach so that the controller is notified on his radar screen as soon as an aircraft enters the defined area (see image D). This system was introduced experimentally this spring and early results, although they still have to be consolidated, appear promising.

The implementation of this tool and controllers' response to its alerts have been carefully coordinated with operators as we need to tread very carefully on this issue given that ensuring a stabilised approach is the responsibility of the pilot not ATC, we can only do our best to help the crew achieve it. But it was necessary to act also from the ATC perspective as first of all the rapid detection of such a situation is

27- A compliant approach, as defined at CDG, requires closing track to final approach of < 45° (or <30° on parallel active approaches), level flight for at least 30 seconds before the FAP, glide path interception from below and the required airspeed until the FAP that shall permit the aircraft configuration.
28- see a summary and access the Official BEA Report at:
http://www.skybrary.aero/index.php/A343,_vicinity_Paris_CDG_France,_2012_(LOC_HF)
29- see report Dutch Safety Board "Pitch-up Upsets due to ILS False Glide Slope" and articles FI "Pilots Unready for false Glide Slopes" dated July 8th-14th 2014 and AW&ST "False Promises" dated July 21st 2014.

decisive in ensuring a satisfactory level of safety allowing to enhance the situational awareness of all actors. Secondly, and as pointed out by the Dutch Safety Board, with the introduction of complex and automated on-board systems, that have dramatically improved the level of safety by adding support to the crew in dealing with difficult situations, could lead them to be too reliant on the automation provided and under certain circumstances degrade the level of safety[30], so ATC can in such circumstances be a remedial loop.

Overall, we at CDG are convinced that the introduction of safety nets in ATC and the analysis of all safety events detected through them facilitates a more comprehensive view of our safety performance and is an essential element for a performance based environment which is a concrete challenge in the aviation industry for the years to come. It enables us to identify both trends and any underlying safety issues and can be used to enable a productive dialogue with those on the operational front line which helps everyone to come to a consensus on safety and performance. Monitoring of safety net alerts is then no longer seen as an intrusion into the controllers' work but as a tool which helps to introduce objectivity into a controller's notion of risk and risk management so as to ensure that they issue clearances fully aware of the relative risks that they continually have to deal with and assess. Moreover, far from being a tool creating reliance on automation, it is a tool that leaves the operator at the forefront of decision and alerts him when need to be, issuing a final warning that helps the controller to reassess a situation, maintain a high level of situational awareness and act accordingly using his core skills in order to maintain or restore an acceptable level of safety.

30- Dutch Safety Board Report page 61 : "In that respect the Dutch Safety Board is concerned that the use of advanced automation can lead to situations where the flight crew's flight path management degrades".

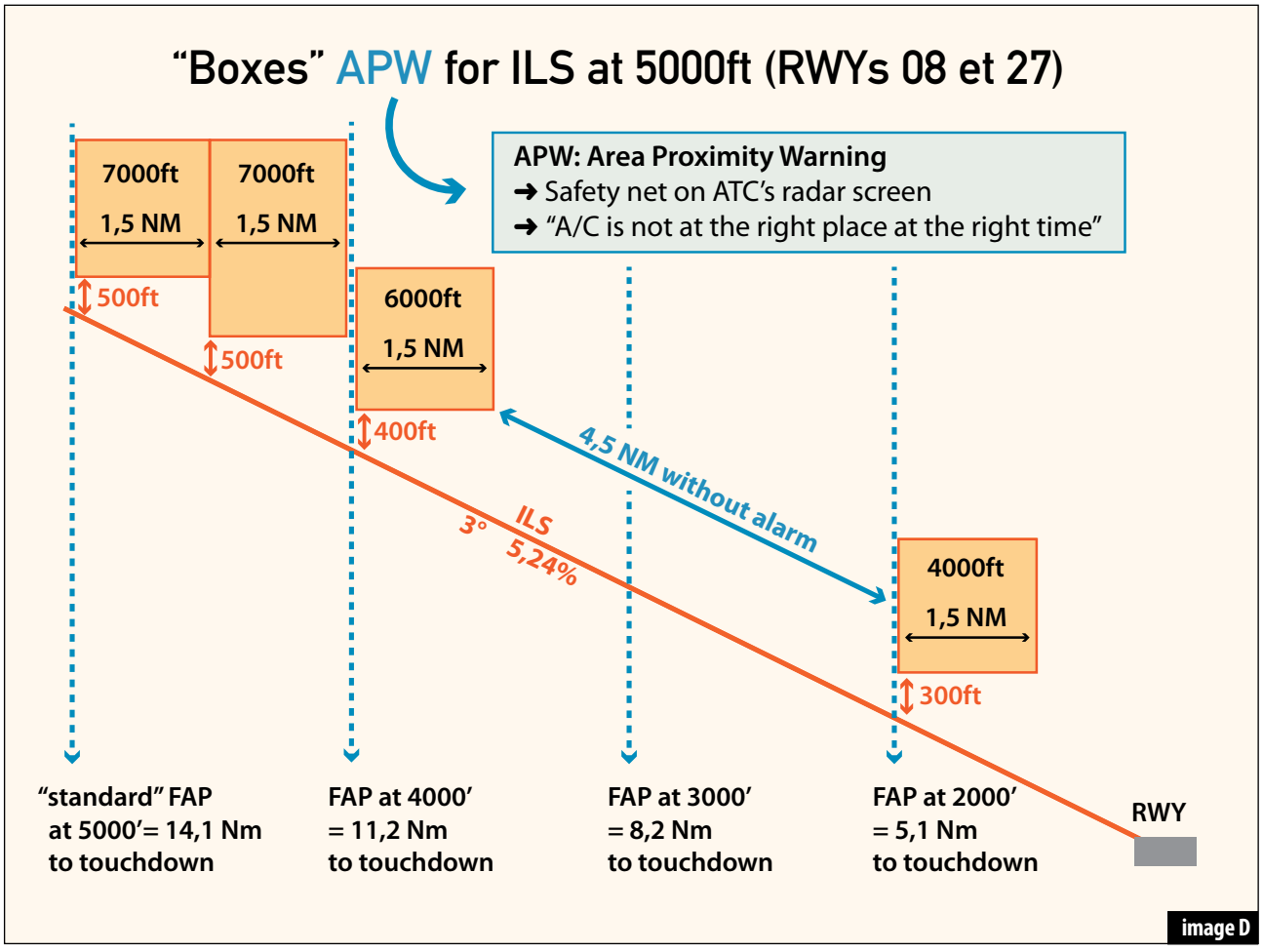

image D