THERE IS NO CAUSE FOR ALARM IF YOU HAVE SOME INFORMATION ON ALERTS TO BEGIN WITH

by Roger Lane

TWO SCENARIOS BASED ON ACTUAL EVENTS

1. It is night time, the controller has lined an aircraft up on Runway 27, a taxiing aircraft takes a wrong turn and then doesn't reply, the controller is busy coordinating with a colleague and trying to contact the wayward taxiing aircraft when another flight calls " finals Runway 27", it is cleared to land and a short time afterwards 2 aircraft are destroyed and 34 people dead.
2. An aircraft has just landed in thick fog (Low Visibility Procedures are in force) and clears the runway and is transferred to the Ground Controller. Another flight is cleared to take off from the same runway. The arriving aircraft is given instructions to taxi but the flight crew are unfamiliar with the airport layout and turn left too early, taking them on a taxiway that leads them back onto the runway. The flight crew sense something is wrong and stop as they enter the runway just in time to hear the departing aircraft pass metres above them. Luckily nobody was injured this time ….

Introduction

In Europe most major airports now have an Advanced Surface Movement Guidance and Control System **(A-SMGCS)** with:

- **Surveillance** which allows the Controller to see the position and identification of mobiles on the airport surface.
- **Runway Incursion Monitoring System (RIMS)**, which provides the controller with a short term conflict alert, triggering 30-45 seconds before potential impact depending on the weather conditions and based on the surveillance position of the mobiles.

In addition to A-SMGCS, other systems such as Electronic Flight Strips **(EFS)** has been installed at many European airports which means that instructions, such as Cleared to Line Up, Take Off and Land, given by the controller are now available electronically and can be integrated with other data such as flight plans, surveillance, routing, published rules and procedures. The integration of this data allows the system to monitor the information and when inconsistencies are detected, the controller can be alerted via the HMI or audibly with a buzzer. The main benefit of this **is the early detection** of controller, and flight crew / vehicle driver errors which, if not detected and resolved, might result in a hazardous situation. The system is then able to predict a possible incident and alert the controller at an earlier stage than the RIMS.

Background

In 2006 EUROCONTROL launched the Integrated Tower Working Position (ITWP) project to study the integration of the existing main system components used by an Controller into a simplified more efficient working environment and to address key issues resulting from the Runway Safety project conducted by EUROCONTROL.

A major and import
ant part of the study was also the development of Human Machine Interface (HMI) functional specifications and prototyping of the A-SMGCS functions -Surveillance, RIMS, Routing, Guidance and Planning at the level of the controller Interface including new Airport

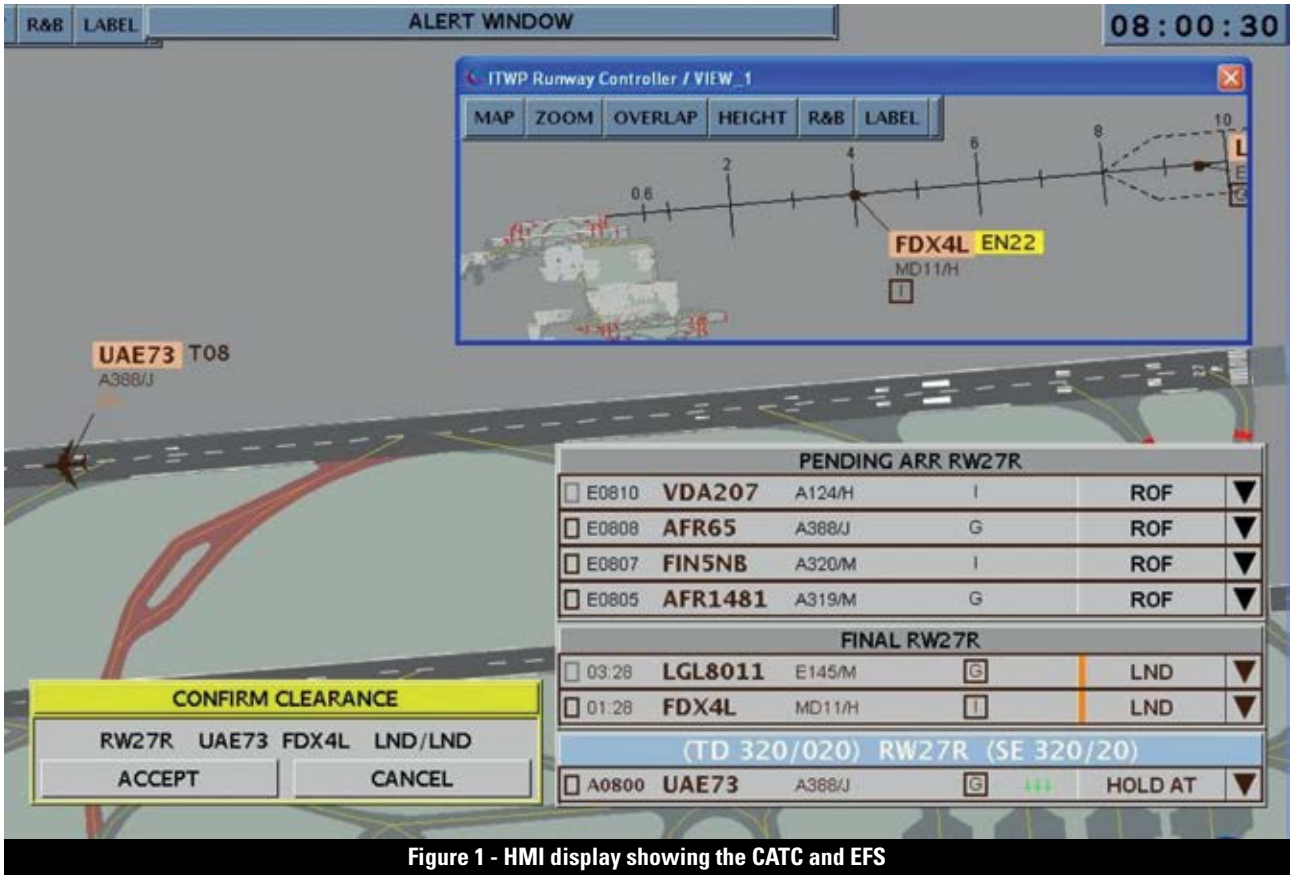

Figure 1 - HMI display showing the CATC and EFS

Safety Nets that predict potential surface and runway conflicts.

SESAR project 06.07.01 (Airport Safety Support Tools for Pilots, Vehicle Drivers and Controllers) continued the development and validation of the concept resulting in the following 2 new categories of alerts:

- **Conflicting ATC Clearances (CATC)**
- **Conformance Monitoring Alerts for Controllers (CMAC).**

The concept has been validated using the European Operational Concept Validation Methodology (E-OCVM) and several different validation exercises have been conducted by different SESAR partners. These Airport Safety Nets are now part of the European Implementation – Pilot Common Project (PCP) and 21 major European airports have been identified to implement them.

Conflicting ATC Clearances (CATC)

In the first example at the beginning of this article the Controller cleared an aircraft to land when another flight was already occupying the same runway. Neither of the flight crews nor the controller realised the error; and the result was that one aircraft landed on top of the other.

For various reasons, humans can be easily distracted and they then simply forget that they have done something or they believe a situation is different to what it actually is. I have to admit to once starting to pour orange juice on my cereals at breakfast as I was tired and thinking of several things I had to do that morning whilst also watching something interesting on the TV news! To avoid controllers having these "senior moments" it is possible to integrate the clearances they make with the surveillance position of the mobiles that they are controlling. **However, this requires a strict way of working where the clearance, such as Cleared to Land, is input on the EFS at almost the same moment it is passed on the radio frequency.**

As the system knows the position of the mobiles and the next possible clearances it is possible to program certain rules which will allow the HMI to show the controller which clearances are possible and which

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ones are considered as a CATC (in the image above a small orange vertical line is displayed on the EFS next to the FDX4L LND (Cleared to Land) button due to the fact that there is another aircraft UAE73 on the runway).

If the controller doesn't notice the indication on the HMI or chooses to ignore it, they will still receive a pop up window asking them to confirm the input of such a clearance (in Figure 1 this is the yellow box in the bottom left corner).

The detection of CATC will be performed by the ATC system and depending on the situation, some or all of the following data will need to be known by the ATC system:

- The clearances given to the mobiles concerned (Cleared to Land, Cleared to Take Off, Line Up, Enter or Cross. If conditional clearances are used then it will be necessary to be able to input these into the system as well.
- The assigned runway.
- The assigned holding point.
- The route of the mobile/s.
- The position of the mobile/s using A-SMGCS Surveillance data (e.g. position, velocity, track angle…) correlated to flight plans on the mobiles concerned.

Conformance Monitoring Alerts for Controllers (CMAC)

In the second example at the start of the article the flight crew take a wrong turn that leads them back onto the runway. This can be avoided if the cleared route of the aircraft is known to the system and the controller is alerted when a deviation is detected. In this case an Alarm would have triggered and a controller could have prevented the incident occurring by instructing the flight crew to stop the aircraft.

The introduction of EFS means that the instructions given by the controller are now available electronically and can be integrated with other data such as flight plan, surveillance, routing, published rules and procedures. This integration allows the system to monitor the situation and if any inconsistencies are detected, the controller can be alerted via the HMI or audibly. **The current A-SMGCS RIMS will still exist as the last minute warning system based on the position of the mobiles.**

When a potentially hazardous situation is detected, the A-SMGCS will provide the controller with the same two types of alert as RIMS, namely 'INFORMATION' and 'ALARM':

- **INFORMATION:** This means that a potentially hazardous situation may occur. The tower controller can therefore use their skill and experience to resolve the incident without using a drastic action such as issuing a "go around". If successful, there will be no alarm; if unsuccessful the alarm will be triggered and be presented on the HMI.
- **ALARM:** This means that a critical situation exists and that immediate action is necessary. An alarm will also trigger an audio warning (e.g. buzzer) in case the controller is not looking at the HMI at the time.

ROUTE DEVIATION	An aircraft deviates from cleared route on a taxiway (RED Alarm if the deviation occurs close to an active runway).
RWY/TWY TYPE	An assigned runway or taxiway is not suitable for the aircraft type e.g. runway is too short.
STATIONARY	A mobile has received a clearance and fails to move within a specified elapsed time.
RWY CLOSED	An assigned runway is closed (RED Alarm if mobile is on the RWY).
TWY CLOSED	The taxi route is planned to go through a closed taxiway (RED Alarm if mobile enters the taxiway).
NO PUSH/TAXI CLR	An aircraft pushes back or taxis without clearance.
NO CONTACT / NO TRANSFER	An aircraft has reached a defined point without being assumed transferred by the controller.
HIGH SPEED	An aircraft exceeds a specified maximum taxi speed.
RWY INCURSION	An unauthorised mobile is in the runway protected area (e.g. NO LINE UP/CROSS/ENTER clearance).
NO TAKE OFF CLR	An aircraft begins take-off without a clearance.
NO LAND CLR	An aircraft is on short finals to a runway without a landing clearance.
STATIONARY IN RPA	An aircraft that has landed and is within the RPA and does not move for 30seconds.
RED STOP BAR CROSSED	A mobile crosses a RED stop bar.

Table 1

The alerts can be displayed on the EFS, the radar/track label and in a dedicated alert window on the screen. **It is recommended that all alerts are displayed in the alert window until they have been resolved**. In the case where more than one alert is triggered for the same mobile it is recommended to display the alert with the highest priority only in the radar/track label and /or EFS, bearing in mind that all the alerts are always being displayed in the Alert Window.

The CMAC Alerts that have been developed and validated within the SESAR Programme are shown in Table 1.

SESAR validations have identified the following key issues that must be considered before implementation:

- The display of alerts will be subject to local agreement and operations.
- The number of false or nuisance alerts must be kept to a minimum so that controllers do not become complacent and ignore them.
- Where (which controller position) and when to display needs to be agreed at a local level.
- It is recommended to use the same colours as those used with RIMS for the different stages of alert (e.g. RED and YELLOW) and use the SESAR text when displaying the different types of Alert.

Conclusion

The new CATC and CMAC Alerts have been developed taking into account many actual incidents/accidents and simulations have proved that they could have been prevented if the new alerts had been in operation. Introducing these Alerts in addition to the existing RIMS Alerts will allow controllers to identify potential incidents and resolve them before a dangerous situation arises where the current RIMS alert would be triggered. In trial the new alerts have received very positive feedback and a few already have been implemented at some airports. The implementation of all of the alerts will significantly enhance the safety at any airport especially where there are high intensity runway operations and busy ground movements.

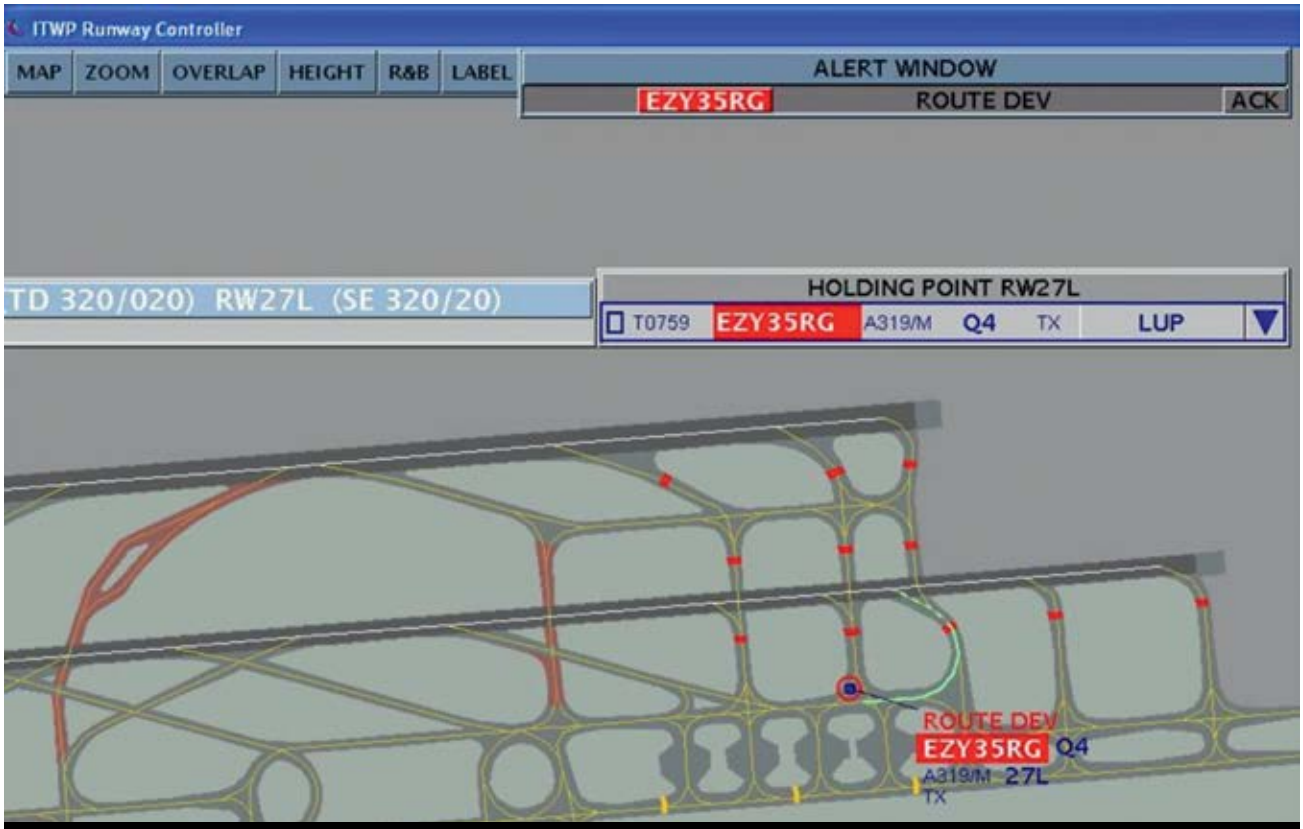

Figure 2: A Route Deviation Alert where the aircraft has turned too early; this triggers an ALARM because it's close to an active runway