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Update on Investigation of Aircraft Accident on CPA 780 on 13 April 2010 (Airbus A330-342 Registration Mark B-HLL)

Aircraft type: Airbus A330-342
Registration: B-HLL
Year of manufacture: 1998
Number and type of engines: 2 Rolls-Royce Trent 700 turbofans
Date and time of accident: 13 April 2010 at 1343 hours local time (0543 UTC)
Place of accident: Hong Kong International Airport (VHHH)
Nature of Accident: CPA 780 declared a Mayday when approaching VHHH with control problem on both engines. The aircraft landed on runway 07L at a groundspeed of 230 knots, with No. 1 engine stuck at about 70 % N1 and No. 2 engine stuck at about 17 % N1. Five main tyres were deflated after the aircraft came to a complete stop on the runway. After confirming from the rescue leader that there was fire and smoke on the wheels, the commander initiated an emergency evacuation of passengers.
Type of flight: Scheduled Public Transport
Persons on board: Crew : 13 Passenger : 309
Fatalities: Nil
Serious Injuries: Crew : Nil Passenger : One
Commander’s license: Hong Kong Airline Transport Pilot’s License (Aeroplanes)
Commander's age: 35 years

Commander's experience: 7,756 hours (of which 2,601 were on type)

Other crew Flight Deck: One Co-pilot Cabin: 11 Cabin Crew

Source of information: Inspector's Investigation

1. (All times are in UTC. Surabaya time is UTC+7 hours and Hong Kong time is UTC+8 hours) The Hong Kong Civil Aviation Department (CAD) issued the Accident Bulletins 1/2010 and 3/2010 on 6 May 2010 and 11 August 2010 respectively regarding the investigation of the loss of thrust control encountered by CPA780 on 13 April 2010. This Update Bulletin provides further available information as the investigation progresses.

**ECAM Messages Experienced During Flight**

2. As previously reported, at 0158 hr, the aircraft was leveling off at Flight Level (FL) 390, the Electronic Centralised Aircraft Monitoring (ECAM) caution message “ENG 2 CTL SYS FAULT” was annunciated. The associated ECAM information “ENG 2 SLOW RESPONSE” was also shown for crew awareness. The analysis of the Flight Data Recorder (FDR) and Quick Access Recorder (QAR) data, Post Flight Report (PFR) and Aircraft Condition Monitoring System (ACMS) reports indicated that the ECAM message was associated with a higher than normal current demand to control the Main Metering Valve (MMV) in the No. 2 engine Fuel Metering Unit (FMU).

3. At 0316 hr, the ECAM caution message “ENG 2 CTL SYS FAULT” reappeared when the aircraft was levelling off at FL380. The associated ECAM information “AVOID RAPID THR CHANGES” was shown for crew awareness. On this occasion the ECAM message was associated with a higher than normal current demand in the Variable Stator Vane Controller (VSVC) controlling the airflow through the No. 2 engine compressor.
4. At 0519 hr, during the descent to FL230 for arrival to VHHH, the ECAM caution message “ENG 1 CTL SYS FAULT” was annunciated. This message was also associated with a higher than normal current demand to control the MMV but in this instance on the No. 1 engine FMU. An ECAM caution message “ENG 2 STALL” followed within a short period of time, indicating a surge within the No. 2 engine. The commander moved the No. 2 thrust lever to idle position and advanced the No. 1 thrust lever to Maximum Continuous Thrust (MCT) position in accordance with the Airbus procedures.

5. At 0530 hr, the ECAM caution message “ENG 1 STALL” was annunciated. The commander moved the No. 1 thrust lever to idle position. He then tested the engines by gently advancing and retarding the thrust levers. However, only No. 1 engine responded with stepped increase in N1 and did not reduce when the thrust lever was retarded. No. 2 engine remained at idle during the test. In an attempt to recover No. 2 engine control, the crew carried out a shutdown and restart on No. 2 engine in accordance with the Flight Crew Operating Manual (FCOM) procedures. However, the engine could only operate at sub-idle condition for the remainder of the flight. The No. 1 engine was stuck at approximately 74% N1 during the approach and reduced to about 70% N1 at touchdown. The No. 2 engine remained stuck at about 17% N1 throughout the approach and landing.

6. Taking into account the circumstances of the occurrence, Airbus continues to review the operational implications of this event to establish what additional information can be provided to flight crews.

**Probable Cause of the Abnormal Engine Performances**

7. All the FDR data, QAR data, the PFR and the ACMS reports were reviewed and analysed. There was no evidence of unusual command signal from the Electronic Engine Control (EEC), the manual thrust, and the auto thrust systems. The engine fuel system components were subject to detailed examination. This revealed that the MMV in the FMU of both engines were seized at positions consistent with the corresponding final engine power. The VSVC from No. 2 engine was also found seized. These seizures were caused by contaminant in the form of fine spherical particles...
(spheres), evidence of which was found throughout the engine fuel system and in fuel samples from the aircraft tanks. The abnormal engines performance during the flight was believed to have been caused by stiction and eventual seizure of the MMV.

**The Contaminant**

8. The spheres that seized the MMV of the FMU of both engines were in the order of 5 to 20 microns in size. In other areas of the fuel system, spheres of 30 microns in size were also identified. Analysis showed that the spheres contained carbon, oxygen, sodium, chlorine, and sulphur and were mainly sodium polyacrylate, which was consistent with the super absorbent polymer (SAP) material used in the filter monitors on a fuelling dispenser. Further analysis revealed the presence of crystalline sodium chloride on the surface of some spheres.

9. Such spheres were also present in the hose end strainer of the dispenser JUA06 used for refuelling the accident flight at Surabaya Juanda International Airport (WARR). Examination and analysis indicated that the spheres could not have been generated within the aircraft. Such contamination was believed to be related to the fuel uplifted at Stand No. 8 through dispenser JUA06. The investigation so far is not able to establish how the spheres were exactly created and how they could enter into the aircraft.
2011 Runway Safety Report

Zurich Airport
1. Editorial

With its complex runway layout and many runway crossings, Zurich Airport poses a particular challenge in operating terms.

The present 2011 Runway Safety Report is intended to illustrate what incidents occurred at Zurich Airport in the three-year period between 2008 and 2010, how appropriate corrective action was taken in response and what further actions are currently planned.

In particular, this third edition of the Runway Safety Report is designed to pursue the three following objectives:

1. to provide data on runway incursions, runway excursions and runway confusions that can serve as benchmarks for Zurich Airport operations
2. to formulate recommendations for further improving the safety of runway operations at Zurich Airport
3. to promote an awareness and understanding of these issues among prime airport partners, and ensure that the correct conclusions are drawn and lessons learned from the incidents that occur.

As well as preventing runway incursions, runway excursions are a further concern for the Zurich Runway Safety Team. In global terms, runway excursions (overruns and veer-offs) are responsible for more deaths than runway incursions. In view of this, a corresponding study is being launched this year into runway excursions at Zurich Airport, the causes behind them and the risks they may pose.

Our 2011 Runway Safety Report should make a further contribution to learning from the incidents of the past, improving runway safety at Zurich Airport and thereby enhancing the safety of our overall flight operations.

Stefan Conrad
Chief Operating Officer
Flughafen Zürich AG
2. The Zurich Runway Safety Team

2.1. Duties and responsibilities

The Zurich Runway Safety Team (ZRST) is an intercompany body consisting of representatives from Skyguide, SWISS, Lufthansa, Flughafen Zürich AG and the business aviation community, and is tasked with initiating and coordinating actions at Zurich Airport on the runway safety front. By doing so, the ZRST aims to minimise the occurrence of runway incursions, runway excursions and runway confusions at Zurich Airport.

In working towards these objectives, the ZRST uses the European Action Plan for the Prevention of Runway Incursions devised and developed by Eurocontrol as the foundation of its activities.

In concrete terms, the ZRST’s work entails:

- monitoring the implementation and observance of ICAO standards, recommendations and best practices (ICAO Doc. 9870: Manual on Prevention of Runway Incursions)
- adopting the recommendations of the Eurocontrol Action Plan for the Prevention of Runway Incursions within a binding timeframe, and monitoring the status thereof at two-yearly intervals
- being informed via the Runway Incursion Investigation Team (RIIT) about all runway incursions that occur at Zurich Airport, and passing on any proposals for corrective action to the RIIT for its consideration
- ensuring that lessons are learned and actions taken as a result of any runway incursions that occur, and that all the persons and units involved are duly informed thereof
- identifying potential runway safety hazards, devising appropriate proposals for corrective action and lobbying for their adoption
- compiling the Zurich Airport Runway Safety Report every two years
- conducting runway safety awareness campaigns that are targeted at air traffic controllers, pilots, the staff of the airport operator and any third parties involved
- promoting and encouraging, in CRM terms, an intercompany understanding and appreciation of the importance of runway safety among controllers, pilots, the staff of the airport operator and any third parties involved
- initiating, coordinating, managing and monitoring intercompany projects that are relevant to runway safety.

2.2. Composition (as of March 2011)

The Zurich Runway Safety Team currently comprises:

Marc Keusch / Flughafen Zürich AG (FZAG)  Christoph Lüönd / Skyguide
Thomas Bolleter / FZAG  Markus Seger / Swiss
Manuela Durussel /Swiss  Claudio Di Palma / Skyguide
Peter Frei / FZAG  Martin Schilt / Federal Office of Civil Aviation (FOCA)
Hansjörg Herzog / Jet Aviation Ltd.  Peter Tschümperlin / FOCA
Daniel Hess / Lufthansa  Johannes Kalupner / FZAG
Pascale Kirtz / Skyguide  Pascal Wegmann / Lufthansa
Heinz Koch / FZAG  Peter Zahner / FZAG
3. Runway safety statistics

3.1. Runway incursions

3.1.1. Frequency of runway incursions

NB: The rise in FAA runway incursion rates from 2005 onwards is due to the FAA’s adoption of the ICAO definition of a runway incursion from that year onwards (see also the 2008 Runway Safety Report).
3.1.2. Runway incursions by severity

The majority (13) of the runway incursions that occurred at Zurich Airport between 2008 and 2010 were low-risk Category D incidents. Four Category C (low to medium risk) incursions occurred during the period. In two cases there were uncontrolled situations, but had no further repercussions because there was no other traffic in the immediate vicinity. Zurich Airport did not suffer any Category B (high risk) or Category A (near-collision) runway incursions in the period concerned. The last Category A runway incursion at Zurich occurred in 2004. So in terms of the risk posed by such incidents, Zurich Airport has not suffered a single dangerous runway incursion for the past six years.
3.1.3. Runway incursions by type

In accordance with ICAO requirements, runway incursions are classified into three incursion types (see above). In view of the vital importance of clarifying the reasons for every runway incursion which occurs, it must be concluded that the number of vehicle and pedestrian deviation runway incursions has increased at Zurich Airport in the past three years.

To a large extent, this increase can be attributed to the more consistent recording of the data concerned and the adoption of the new RIMCAS facility. This vehicle and pedestrian deviation category also includes incidents which fall under the definition of a runway incursion but essentially have nothing to do with runway safety, and could just as easily be described as violations of the Protected Area.

The pilot deviation and operational deviation categories account for only a small proportion of the total recent runway incursions at Zurich Airport. But, as is typical of these types, some of them must be described as higher-risk incidents.

On the whole, Zurich has a higher proportion of vehicle and pedestrian deviation runway incursions than most other airports in the ESRA region.

Analysis of runway incursions between 2008 and 2010:

- The incident data for the past three years show a clear increase in the number of vehicle and pedestrian deviation runway incursions at Zurich Airport. One prime cause of such incidents is a lack of adequate training. But the issuance of airside driving permits should also be reappraised. The incidents reported further suggest that the drivers and pedestrians concerned are insufficiently aware of the existing or modified airside procedures.
• The individuals involved in the **vehicle and pedestrian deviation** runway incursions reported are a varied group, ranging from airfield maintenance staff to airport authority and planning personnel, employees from an outside company and emergency services personnel.

• Four of the runway incursions which occurred between 2008 and 2010 posed a certain risk. In the first, which must be classified as gross negligence, a driver who had lost his bearings crossed a runway twice; in the second and the third, the cockpit crew crossed a runway without permission after misunderstanding a tower instruction; and in the fourth, a vehicle was still on the runway as an aircraft was approaching to land. In the two cases, the actions were uncontrolled; but, since no other participants were immediately involved, no major risk was posed.

• The **pilot deviation** category is one in which business and general aviation tend to feature prominently. Zurich Airport suffers an average of one business jet runway incursion a year.

• Only one runway incursion which must be classified as an **operational deviation** occurred during the 2008-2010 three-year period.
### 3.1.4. Runway incursions (2008-2010) by location

<table>
<thead>
<tr>
<th>Location</th>
<th>Incursions</th>
</tr>
</thead>
<tbody>
<tr>
<td>10/23 1634</td>
<td>1</td>
</tr>
<tr>
<td>10/28 ES</td>
<td>1</td>
</tr>
<tr>
<td>10/28 JS</td>
<td>1</td>
</tr>
<tr>
<td>16/34 R7</td>
<td>1</td>
</tr>
<tr>
<td>16/34 R8</td>
<td>1</td>
</tr>
<tr>
<td>16/34 E9</td>
<td>1</td>
</tr>
<tr>
<td>16/34 E6</td>
<td>1</td>
</tr>
<tr>
<td>19/28 H2</td>
<td>1</td>
</tr>
<tr>
<td>19/28 JS</td>
<td>1</td>
</tr>
<tr>
<td>19/28 JN</td>
<td>2</td>
</tr>
</tbody>
</table>

**Circle:** site of a runway incursion in the period concerned

**Number:** number of runway incursions at this location
3.2. Factors that may contribute to runway incursions

3.2.1. Number of runway crossings

Airport layout design factors – such as the number of runway crossings, the locations of runway entries and exits and the placement of the runways, signs and markings – have a major influence on the occurrence of runway incursions. In Zurich, the placement of Runway 28 between the northern and the southern apron areas is of particular significance, since it results in a relatively high number of aircraft taxiing across the runway. Runway crossings are now recorded using SAMAX data. The new system was introduced in summer 2010.

3.2.2. Frequent changes of radio frequency

A second key factor in the incidence of runway incursions at Zurich Airport is the high number of changes of radio frequency required.

Flughafen Zürich AG’s Apron North and Apron South operations use two different frequencies, as do the airport’s apron and tower (skyguide) control functions. As a result, an aircraft landing on Runway 14 will need to change its radio frequency three times before it reaches its Apron South stand. An aircraft leaving the Apron South zone for a departure on Runway 16 will also have to make three frequency changes before it takes off. These multiple changes of frequency add to the cockpit workload, and can deflect crews’ attention from other taxiing concerns.

3.3. Runway excursions

In addition to preventing runway incursions, the Zurich Runway Safety Team also deals with any runway excursions which occur at Zurich Airport. A project on this issue will be launched in the course of 2011 with the aim of determining the prime and contributing factors in runway excursions at the airport.

Only one runway excursion occurred at Zurich Airport in the 2008-2010 period. The incident occurred on 26 April 2008, and was duly reported to the Swiss Aircraft Accident Investigation Bureau (BFU). The incident involved an Antonov An-2 which, after landing on Runway 34, left the runway just before Taxiway E8. The pilot was able to steer the aircraft back onto the tarmac using its own power, and finally rejoined Runway 34 via Taxiway R8. The pilot parked the aircraft in Sector 7 as envisaged. No damage was incurred to the aircraft or the airport infrastructure.
4. **Actions to enhance runway safety**

4.1. **The 2010 Road Map**

Below is an overview of the actions already taken, those still being (or to be) considered and those not taken to enhance runway safety at Zurich Airport. The status of these actions is reappraised annually and modified accordingly by the Zurich Runway Safety Team. All the actions concerned are intended to help reduce the incidence of runway incursions/excursions at the airport.

**Actions taken since the 2008 Runway Safety Report:**

- Protected Area defined and established
- Runway 28 holding point revised
- Taxiway Echo South revised (road markings)
- stop bars harmonised (Cat. I/II/III bars combined for Runway 16/34)
- coherent red stop bar policy implemented (vehicles included)
- stop bar process instructions revised
- technical adjustments made to multi-vehicle mode
- runway guard light alignments checked
- red stop bars provided at all runway entries (except Taxiway A holding point for departures on Runway 28 and VMC approaches)
- runway incursion database developed / Runway Incursion Investigation Team established
- runway safety awareness campaigns conducted (DVDs, flyers)
- RIMCAS Level II introduced, and in operation since May 2010
- RAAS installed about SWISS aircraft since 2009
- vehicles being gradually equipped with VeeLos (scheduled for completion by spring 2011).

**Actions still being/to be considered:**

<table>
<thead>
<tr>
<th>Action</th>
<th>Status</th>
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<tbody>
<tr>
<td>Adoption of &quot;one runway – one frequency – one language&quot;</td>
<td>Currently pending with the FOCA.</td>
</tr>
<tr>
<td>Monitoring the user concept, especially its impact on the number of runway crossings</td>
<td>More detailed analysis now almost complete.</td>
</tr>
<tr>
<td>Comparison of AIP with actual situation</td>
<td>Reappraisals constantly in progress; transfer of safety-relevant information to LIDO/Jeppesen charts also being checked.</td>
</tr>
<tr>
<td>Analysis of the risk of runway excursions at Zurich Airport</td>
<td>An external study to determine the risks posed by possible runway excursions at Zurich Airport will be commissioned in 2011.</td>
</tr>
<tr>
<td>Intensified collaboration between Skyguide (in charge of air traffic management) and Flughafen Zürich AG (in charge of Apron Control)</td>
<td>CRM courses being planned for 2012.</td>
</tr>
<tr>
<td>Runway 28 taxi bypass</td>
<td>An extensive analysis should be conducted of the possible benefits of providing a bypass taxiway of Runway 28 for taxiing aircraft. Alternative actions will also be considered.</td>
</tr>
<tr>
<td>Possible provision of a de-icing pad south of Runway 28</td>
<td>An in-house study will be commissioned in 2011 to identify possible alternative de-icing pad locations.</td>
</tr>
<tr>
<td>Issue</td>
<td>Status/Details</td>
</tr>
<tr>
<td>---------------------------------------------------------------------------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Clarification of manoeuvring area limits</td>
<td>The Apron/Taxiway Steering Group will compile and assess the advantages and disadvantages of reassigning responsibilities according to safety criteria in the course of 2011.</td>
</tr>
<tr>
<td>Reassignment of departures from Runway 34 to Runway 32</td>
<td>The corresponding proposal is currently being finalised, with a view to making the change to coincide with the cutover to the 2011 summer schedules.</td>
</tr>
<tr>
<td>Adoption of Active Taxi Guidance System (Option I)</td>
<td>A corresponding project team has not yet been formed.</td>
</tr>
<tr>
<td>RIMCAS (routing/evidence)</td>
<td>Following initial operating experience with the existing RIMCAS Level II, a further development of this additional safety net should also be considered.</td>
</tr>
<tr>
<td>Runway 28 Engineered Materials Arrestor System (EMAS)</td>
<td>The runway-end safety area (RESA) of Runway 28 only complies with the ICAO 90-metre standard, and not with the 240-metre recommendation. A feasibility and cost/benefit analysis should clarify here whether the risk of a runway overrun can be reduced to ALARP (as low as reasonably practicable).</td>
</tr>
<tr>
<td><strong>Actions not taken:</strong></td>
<td><strong>Status</strong></td>
</tr>
<tr>
<td>Assessment of Active Taxi Guidance System (Option III)</td>
<td>The adoption of an actively-managed “follow the green” taxi guidance system at Zurich Airport will not be further pursued, in view of the airport’s layout and multiple operating concepts.</td>
</tr>
<tr>
<td>Alert Beacons</td>
<td>This additional safety net has been considered by the Zurich Runway Safety Team. The Team concluded that the RIMCAS system currently meets the requirements of ensuring safe operations. The Team also wishes to avoid introducing an additional system specifically for Zurich.</td>
</tr>
</tbody>
</table>
4.2. Specific actions from the 2008 Road Map

The four actions described below are intended to help make the Zurich Airport system safer. In concrete terms, they should help to reduce the number of runway incursions and runway confusions, or even eliminate these entirely.

4.2.1. The Runway Incursion Monitoring and Collision Avoidance System

Skyguide and Flughafen Zürich AG jointly introduced a new ground collision warning system for Zurich Airport on 31 May 2010. The same system has been in use at Geneva Airport since December 2009. Skyguide and Zurich and Geneva airports are among the first operators in Europe to adopt such a system.

The new Runway Incursion Monitoring and Conflict Alert System (RIMCAS) supports air traffic controllers in their monitoring and management of the movements of aircraft and vehicles on the airport’s runway, taxiway and roadway network. RIMCAS is fed the data it needs from various sources such as radar and sensors. The system then uses these data to constantly calculate the positions of all the aircraft and vehicles on or near the airport’s runways, taxiways and roadways. In doing so, it also identifies any possible movement conflicts as they emerge, and alerts the tower controllers to these by issuing audio and visual signals.

Developing a ground collision warning system is a complex and extensive affair. Unlike in the air, such systems must contend with various possible sources of interference on the ground, such as surrounding buildings or the natural topography, any of which can distort the aircraft and vehicle positioning data obtained. These sources of interference can also trigger false alarms. So to ensure its reliability, the new RIMCAS facility was subjected to extensive development and exhaustive testing before it was put into operation.

A similar collision warning system (known as Short-Term Conflict Alert or STCA) helps alert controllers as early as possible to any emerging critical situations in the air, and has been in operation at skyguide’s Zurich and Geneva area control centres for several years now. The use of such systems on the ground, however, is a new development.

4.2.2. The Runway Awareness and Advisory System

The Runway Awareness and Advisory System (RAAS) supports cockpit crews by providing them with information about the position of their aircraft in relation to the airport’s runways. RAAS thus helps to avoid runway incursions and confusions, and provides the crew with timely acoustic warnings and reminders during their taxi, takeoff, final approach, landing and runway exit manoeuvres. The system can, for instance, issue an alert if an aircraft erroneously attempts to take off on a taxiway instead of the runway assigned.

RAAS is a further development of the Enhanced Ground Proximity Warning System (EGPWS). RAAS works in combination with the aircraft’s GPS and on-board sensors to process the airport data stored in the EGPWS and monitor the aircraft’s movements. RAAS also uses the existing EGPWS voice and audio technology to generate its acoustic warnings.

RAAS can serve as a useful worktool both on the ground and in the air. It must, however, be regarded as a supplementary aid for the cockpit crew. The guidance it provides cannot be used for navigation purposes. And nor can RAAS be used to guide the aircraft around the airport while it is on the ground: the system is not equipped with the latest airport and runway status (via NOTAMs etc.), and is thus unable to incorporate factors such as temporary runway closures into the guidance it provides.
4.2.3. The Protected Area

The Protected Area (see Annex 1) is designed to protect Zurich Airport’s runways for departing and arriving aircraft. It also provides a clear foundation for identifying and investigating runway incursions. The Protected Area entered into effect on 1 November 2010.

For the Protected Area, the following provisions apply:

- **Width**: Cat II/III Runways 14/32 and 16/34 => 90 metres from the centreline (10m more)
  - Cat I Runway 10/28 => 75 metres from the centreline (as before)
- **Length**: All runways => 150 metres from the threshold (new)
- **Taxiways**: Here the black-and-yellow stop bars are the clear boundary to the Protected Area.

Access to the Protected Area is only permitted for persons who have completed their FUNK driving training, and only after corresponding clearance has been obtained from Zurich Tower via the “Blue 1” radio channel.

The boundary to the Protected Area is indicated on all access roads by a barrier chain and “vehicular access prohibited” signs (see Figure 1). The boundary is also marked on the grassed areas beside the runways by the placement of posts marked “PROTECTED AREA” at regular intervals (see Figure 2).

4.2.4. Harmonising the stop bars at Zurich

As a result of previously-applicable ICAO norms, the stop bars used on the taxiways at Zurich Airport did not all follow the same model or pattern. With the Cat I stop bars, for instance, some were at 75 metres and others were at 90 metres from the runway centreline.

Using as a basis the new requirements specified in Annex 14 relating to the Obstacle-Free Zone (OFZ) stipulating the minimum distance of 107.5 metres that a hazard must be from the runway centreline for Code F aircraft (such as the Airbus A380), as well as the new values applicable to the Sensitive Area of the Runway 16 ILS localiser, the Stop Bar Harmonisation Project has now standardised the runway holding positions throughout the Zurich Airport area.

The amalgamation of the Cat I/II/III holding positions was completed at the beginning of October 2010, when this was done for Runway 16/34.
The corresponding work also saw the removal of the familiar **RWY AHEAD** marking for Runway 16/34, since this did not conform to ICAO standards (the RWY AHEAD markings are still in place for Runway 10/28). Figure 3 shows the new-style stop bars, which comply with the relevant ICAO standards.

![New ICAO-standard stop bar with runway identifier](image)

**Figure 3:** new ICAO-standard stop bar with runway identifier
4.3. Assessment of the effectiveness of the actions taken to date

Most of the actions that have been taken to date at Zurich Airport to prevent runway incursions are aimed at raising awareness of the stop bars as a final protective measure before the runway is reached. With a view to ensuring maximum consistency here, the stop bars for Runway 16/34 were harmonised in 2010 to provide a single stop bar for Cat I, II and III.

A further move saw the establishment on 1 November 2010 of the Protected Area, which will enable a consistent access prohibition policy to be pursued to keep the airport’s runways free of unauthorised aircraft, vehicles and pedestrians. Summer 2010 also brought the adoption of RIMCAS (Level II), which provides controllers with a further safety net for ensuring safe runway operations.

In addition to these infrastructural and technological innovations, major efforts have also been made to raise general awareness over the past two years. These have involved the provision of flyers and a runway safety film, each specifically aligned to particular target groups, along with a reassessment of whether the diagrams shown in the AIPs correspond to the realities on the ground. Further plans on this front for the years ahead include joint CRM courses for Skyguide’s air traffic and tower controllers and the apron controllers of Flughafen Zürich AG.

Further actions, such as implementing an active taxi guidance system, adopting the “one runway – one frequency – one language” policy and installing alert beacons, have been considered by the Zurich Runway Safety Team, with a subsequent decision not to pursue them further at the present time. With regard to the alert beacons, initial experience of working with these has now been acquired at Manchester Airport. At Zurich it was decided not to continue along this path, not least because adopting the new system would have itself raised new risks and dangers. In a similar vein, the adoption of runway entrance lights makes little sense at Zurich Airport, given the existence of the red stop bars. But threshold hold lights could well be installed some time in the future to provide an additional safety net.

On the runway excursion front, particular attention will need to be paid to Runway 28 in view of its envisaged greater use. For safety reasons, the priority must continue to be to assign the best runway to operate on given the current weather conditions. This, however, could entail bigger changes to the approach regime, and could not be effected too easily under the present operating concept. In this connection, a project group was formed under the auspices of the FOCA at the end of 2010 to consider the entire issue of airport operations in tailwind conditions. The final report on the “Runway 28 Upgrade” project (including a corresponding implementation plan) should also be presented in the course of 2011. The results and findings from both these studies should then enable appropriate actions to be evaluated, in accordance with the ALARP principle.

If we look at the runway incursions that have occurred over the past three years, the most noticeable trend is the increase in the number of incidents involving vehicles and pedestrians. The incidents attributable to controllers or pilots are in a clear minority. In view of this, care needs to be taken to ensure that the actions above have their due and desired effect on vehicle drivers and pedestrians, too. The main feature of this particular group is their sheer heterogeneity; and, as a result, specific action will need to be taken that is carefully tailored to the situations and the persons/units/companies concerned. Here, too, such activities should include constant further (and refresher) training and awareness-raising among the groups involved.

In conclusion, we can state without fear of contradiction that the measures currently in place at Zurich Airport have made and continue to make a valuable contribution to preventing runway incursions. Thanks to the actions taken and the efforts and endeavours of all the various stakeholders, not a single Category A or B runway incursion has occurred at Zurich since 2004. Despite this, however, every case of a runway incursion must still be individually investigated, and any actions deemed necessary must be taken as a result, in response to the specific incident concerned and within the broader context and perspective of Zurich Airport’s overall operating system.
5. Outlook

As well as appraising EAPPRI Report 2.0, the Zurich Runway Safety Team will be occupying itself with further processing, developing and refining the medium-term issues concerning the use of Runway 28, the ongoing monitoring of the user concept (and the processes involved therein) and its ramifications, infrastructural improvements and technical modifications in the years ahead.

For the first few months of 2011, the prime focus of the Team’s runway incursion deliberations will be on the vehicle/pedestrian type of incursion. This will entail identifying the main factors at work in such cases, striving to eliminate any systemic weaknesses or shortcomings and initiating corrective actions wherever necessary and feasible.

On the runway excursion front, particular attention will need to be paid to Runway 28, in view of its envisaged more extensive operational use. In more testing conditions, long-haul flights can quickly reach the runway’s operating limits. A study should now be conducted into the risk factors associated with veer-offs and overrun such as tailwind conditions and runway contamination. And, together with the further system partners and the FOCA, possible approaches and solutions here should be subjected to a thorough, systematic and objective examination.

There are currently no immediate measures which must urgently be adopted at Zurich in connection with the above. Work will also continue on further developing and refining the actions already taken. The existing runway safety risks are well known to the units responsible, and corresponding actions have already been taken in line with the ALARP principle to mitigate the threats posed.

Despite the airport’s complex layout and the high expectations its users have of its personnel in operational terms, flight operations can continue to be provided safely at Zurich, and with a prime focus on runway safety aspects and concerns. Meanwhile, innovations and operational modifications will continue to be analysed by the bodies created for precisely these ends, such as the Airside Systems Workgroup, the Taxiway Indication Workgroup and the local Runway Safety Team.
Annex 1 – Protected Area
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