



DUTCH
SAFETY BOARD

Runway Incursion

Runway 24

Amsterdam

Airport Schiphol



Runway Incursion Runway 24 Amsterdam Airport Schiphol

Cover photograph: NustyR Air Team Images' photo stream.

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Dutch Safety Board

The aim in the Netherlands is to limit the risk of accidents and incidents as much as possible. If accidents or near accidents nevertheless occur, a thorough investigation into the causes, irrespective of who are to blame, may help to prevent similar problems from occurring in the future. It is important to ensure that the investigation is carried out independently from the parties involved. This is why the Dutch Safety Board itself selects the issues it wishes to investigate, mindful of citizens' position of independence with respect to authorities and businesses. In some cases the Dutch Safety Board is required by law to conduct an investigation.

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SUMMARY

On Saturday afternoon, 18 December 2010, a bird controller contacted Air Traffic Control at Schiphol for permission to drive his vehicle down Runway 24, which was in use, to inspect the runway for the presence of bird remains and any remaining snow and ice. The runway controller granted permission through an assistant controller. At that moment the runway controller also granted the ground controller permission to allow a Boeing 747 to cross the runway from the cargo apron. The assistant controller warned the bird controller that the Boeing 747 was crossing the runway. Meanwhile a Boeing 737 was preparing to take off from the same runway. After the Boeing 747 had crossed and vacated the runway, the runway controller issued the Boeing 737 take-off clearance, but in doing so overlooked the fact that the bird controller was still on the runway. The Boeing 737 took off from Runway 24 and flew over the Bird Control vehicle that was still driving on the take-off runway. A situation as described above, involving an aircraft taking off while another aircraft, vehicle or person is present on the take-off runway or inside the protected area thereof, is called a 'runway incursion'. In aviation runway incursions form a serious threat to safety and therefore warrant constant attention.

A runway controller can use a variety of technical and procedural instruments to warn him that a runway is occupied and cannot be used at that time for aircraft taking off or landing. What all of these instruments in the Air Traffic Control tower at Schiphol have in common is that they do not indicate *how many* vehicles or aircraft occupy, or are still occupying a runway. In this particular incident, after a Boeing 747 had crossed and vacated the runway, the runway controller switched off the warning system, overlooking the fact that the bird controller was still driving on the runway, and issued the Boeing 737 take-off clearance.

According to Air Traffic Control the Netherlands' internal regulations, aircraft that are crossing a runway-in-use must be transferred to the runway controller's frequency, unless the runway is not 'active', i.e. not 'being used for the take-off and landing of aircraft'. The internal regulations, however, do not provide a definition of the term 'active'. In this incident the aircraft that was crossing was not transferred from the ground controller to the runway controller. This in part caused the undesired situation to occur at the time of the incident whereby two aircraft and one vehicle were located on the same runway and were being monitored on three different radio communication frequencies by three different air traffic controllers, including an assistant controller.

CONSIDERATION

Introduction

Air travel is a relatively safe mode of transport. One important reason for the level of safety achieved in the aviation industry is that the parties involved have been collaborating for decades, learning from incidents and accidents and making improvements. This also applies to the Netherlands, to Amsterdam Airport Schiphol among others. An example of constructive collaboration which seeks to achieve a higher level of safety is the Schiphol Safety Platform, in which sector parties collaborate on a voluntary basis. This does not alter the fact, however, that safety can and must be improved in a number of areas. This was also brought to light by the present Dutch Safety Board investigation into an incident at Schiphol involving a Bird Control vehicle which, with the permission of Air Traffic Control, was present on a runway-in-use, but was subsequently overlooked. As a consequence, the flight crew were issued take-off clearance while the bird controller was still driving on the runway. The recurring nature of these incidents over the course of many years – during which no long-term solutions have been implemented – is a concern that must be addressed by the sector. The organisations involved and the supervisory authority both failed to take adequate measures to avoid recurrence.

Investigation

The primary research question that was formulated for this investigation is the following:

'How can we prevent or substantially reduce the frequency of incidents in which an aircraft is given clearance to take off or land while the runway is occupied?'

Immediate and underlying causes

The immediate cause of the occurrence of the incident is that the runway controller overlooked the fact that the bird controller was still on the runway. The Dutch Safety Board investigation concentrated mainly on investigating what underlying causes led the runway controller to overlook the bird controller.

The investigation found that the various technical and procedural instruments available to the runway controller to warn him that a vehicle is present on the runway are not laid down in the operating rules, and provide insufficient safeguards. Furthermore no instruments are available that show how many vehicles or aircraft are occupying the runway.

In addition, the work procedure at Schiphol was such that at the time of the incident the undesired situation could occur whereby two aircraft and one vehicle were present on the same runway while they were being monitored on three different radio communication frequencies by three different air traffic controllers, including an assistant controller.

International and European recommendations indicate that it is advisable to handle all traffic (both vehicles and aircraft) on a take-off and landing runway on a common aviation frequency and in the English language, when practicable. The intended purpose is to increase the situational awareness of all parties involved. Pilots, air traffic controllers and vehicle drivers will hear each other if all parties involved use a common aviation frequency. If an error is made by one of the parties involved, the other parties will be able to respond. At Schiphol the work procedure in this area is not in line with the international and European recommendations and furthermore deviates from the work procedure employed, among others, by Europe's three major airports.

Risk management and supervision

Not only do the parties have individual responsibility, they also have collective responsibility for the system as a whole. This is a principle that the parties endorse. If a risk posed by one party could have consequences for another party at the Airport, or if the other party concerned can contribute to controlling the risk posed by the accountable party, the parties must enable each other to do so collectively. This also means that the parties involved must, and should not be afraid to hold each other accountable for the risks.

Not only is good coordination required between the Airport, Air Traffic Control and the airline(s) to control aviation safety risks, but it is equally important that the Ministry of Infrastructure and the Environment and the Human Environment and Transport Inspectorate, which falls under the Ministry, oblige the aviation sector to adopt an integrated approach to safety and risk management. It has emerged from this investigation that they have to date not always succeeded in doing so.

Both Air Traffic Control the Netherlands and Amsterdam Airport Schiphol have a safety management system in place. The operations carried out by Air Traffic Control and the Airport in the runway area are integrated, yet their safety management systems are not aligned. While the parties in the Schiphol Safety Platform do collaborate constructively in various areas, they still continue to investigate incidents individually. The results of the individual investigations are shared and discussed in the Schiphol Safety Platform or in another consultation within the Platform, but no joint conclusions and measures are determined on the basis thereof. The Safety Board is of the opinion that the investigation of incidents that occur at the interface of the two organisations' spheres of activity, such as this particular incident, can yield joint conclusions and measures that help improve risk management. The conclusions in an internal investigation report of Amsterdam Airport Schiphol reaffirm the Safety Board's opinion. In her comments on the draft report of this investigation, the Minister of Infrastructure and Environment also strongly recommended urging the sector to jointly investigate this incident and any future incidents of a similar nature to effectively identify lessons learned and improvement areas.

The failures on the part of Amsterdam Airport Schiphol and Air Traffic Control the Netherlands that contributed to this particular runway incursion did not prompt the Human Environment and Transport Inspectorate to take effective action. Because the two organisations are certified separately in a process that lacks a sufficient focus on the interaction between the sector parties involved, the correlation between these failures failed to come to light. This is partly due to the changed role of the Inspectorate. Now more than in the past the Inspectorate pursues a risk-oriented supervision policy, based on the principle of 'trust, unless'. Irrespective of the above, the supervisory authority nonetheless forms an integral part of the system no matter what role it performs or how limited its role may be. The bottom line is to identify those parts of the system that are not functioning properly (if at all) and to urge the organisation to make improvements, responsibility for which lies with the organisation concerned.

Recommendations

The Safety Board has formulated the following recommendations:

To: Air Traffic Control the Netherlands and Amsterdam Airport Schiphol

1. Assess the procedure for vehicles on take-off and landing runways at Amsterdam Airport Schiphol against the EAPPRI and ICAO recommendations.
2. Align the safety management systems of the two organisations in areas where the parties each have inextricably linked tasks, such as the use of runways.
3. Conduct investigations into incidents at Amsterdam Airport Schiphol in such a manner that information is shared and used as a basis for determining joint conclusions and measures.

To: Air Traffic Control the Netherlands

4. Design the runway occupancy warning system such that the signals also indicate the number of vehicles or aircraft that occupy or continue to occupy the runway, and incorporate the procedure to be followed into the regulations.
5. Lay down unequivocally in the regulations when a runway-in-use should be considered 'active'.

To: Amsterdam Airport Schiphol

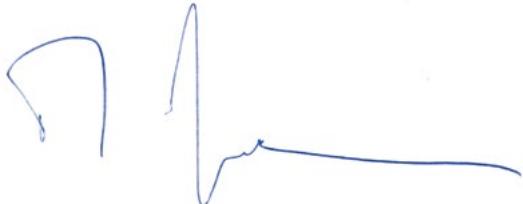
6. Structurally reduce the frequency of aircraft crossing Runway 24 midway by completing the postponed alternative aircraft route to and from the cargo apron without delay.
7. In consultation with Air Traffic Control the Netherlands, define clear parameters within which Bird Control may carry out the requisite runway inspections effectively.

To: the Schiphol Safety Platform

8. Ensure that investigations into incidents at Amsterdam Airport Schiphol are conducted in such a manner that parties share vital information and use this as a basis for jointly determining conclusions and measures.

To: the Minister of Infrastructure and the Environment

9. Decisively fulfil government responsibility for overall aviation safety. Impose sanctions, for instance, if the parties fail to adequately control the risks identified and reduce them to a level that is as low as is reasonably practicable within an agreed time frame.



T.H.J. Joustra
Chairman Dutch Safety Board



M. Visser
General Secretary

ABBREVIATIONS

AAS	Amsterdam Airport Schiphol
AIP	Aeronautical Information Publication
ALARP	As low as reasonably practicable
AO	Airside Operations
AOM	Airside Operations Manager
ATC	Air Traffic Control
CRM	Crew resource management
CTR	Control zone; local air traffic control zone
EAPPRI	European Action Plan for the Prevention of Runway Incursions
FOD	Foreign object debris is any object found on the aprons, taxiways and runways that constitutes a risk of aircraft damage.
GC	Ground controller
ICAO	International Civil Aviation Organization
ILT	Human Environment and Transport Inspectorate [Inspectie Leefomgeving en Transport], formerly IVW, see below
IVW	Inspectorate for Transport, Public Works and Water Management [Inspectie Verkeer en Waterstaat]
KLM	KLM Royal Dutch Airlines
LVC	Low visibility conditions
LVNL	Air Traffic Control the Netherlands [Luchtverkeersleiding Nederland]
MHz	Megahertz
NOTAM	Notice to Airmen
NSA	National Supervisory Authority (for aviation service providers)
OSO	Schiphol Operations Consultation [Operationeel Schiphol Overleg]
RC	Runway controller
RIASS	Runway Incursion Alerting System Schiphol
RST	Runway Safety Team Schiphol
RVGLT	National Regulations for the Safe Use of Airports and Aerodromes [Regeling veilig gebruik luchthavens en andere terreinen]

S2	Intersection of Runway 24 at Amsterdam Airport Schiphol
SARP	ICAO Standards and Recommended Practices
Schiphol TWR	Air Traffic Control tower at Amsterdam Airport Schiphol
SMS	Safety management system
SSE	Safety Significant Events
SUP	Supervisor
TRM	Team resource management
UTC	Coordinated Universal Time, the primary time standard by which the world regulates clocks and time.
VDV	Air Traffic Control Operations Manual <i>[Voorschriften Dienst Verkeersleiding]</i>
VEMER	Safety, Efficiency and Environmental Impact Assessment <i>[Veiligheid efficiency milieu effect rapportage]</i>
VpS	Schiphol Safety Platform <i>[Veiligheidsplatform Schiphol]</i>

1 INTRODUCTION

1.1 Reason for the investigation

On 18 December 2010 at 15.26¹ an aircraft took off from Runway 24 at Amsterdam Airport Schiphol while a Bird Control vehicle was on the same runway. The bird controller was present on the runway with permission from Air Traffic Control. A runway incursion² occurred when the aircraft received take-off clearance while the bird controller had not yet vacated the runway. On account of their possible consequences, runway incursions constitute one of the most serious threats to aviation safety. In the three years prior to the incident, eight incidents took place in which a bird controller had been granted permission and was still driving on a runway-in-use while take-off or landing clearance had been issued, see Appendix C. On 21 January 2012 a virtually identical incident occurred, in which an aircraft had been issued take-off clearance while a bird controller was still present on the runway.



Figure 1: The time of the incident on 18 December 2010. The Bird Control vehicle (KV2) is pictured in the foreground with the Boeing 737 that has just lifted off from Runway 24 in the background. (Source: NustyR Air Team Images' photo stream).

¹ All times in this report are local times unless stated otherwise.

² Any occurrence at an aerodrome involving the incorrect presence of an aircraft, vehicle, or person on the protected area of a surface designated for the landing and take-off of aircraft.

1.2 Purpose of the investigation

The purpose of this investigation is to gain insight into the incident and thus contribute to the structural improvement of monitoring and controlling the risk of runway incursions at Amsterdam Airport Schiphol. The primary research question defined for this investigation is:

'How can we prevent or substantially reduce the frequency of incidents in which an aircraft is given clearance to take off or land while the runway is occupied?'

The question has been broken down into seven secondary questions:

1. What is the immediate cause of the occurrence of the incident?
2. To what extent do the current procedures at Amsterdam Airport Schiphol conform to the ICAO³ and European recommendations for the prevention of runway incursions?
3. To what extent were the applicable procedures followed?
4. How is collaboration between the sector parties at Amsterdam Airport Schiphol organised?
5. To what extent are the procedures of Amsterdam Airport Schiphol and Air Traffic Control the Netherlands aligned?
6. To what extent are incidents involving both Amsterdam Airport Schiphol and Air Traffic Control the Netherlands jointly investigated?
7. What role does the supervisory authority perform and how can its role be assessed?

1.3 Scope of the investigation

This report describes, analyses and assesses the facts, the occurrence of the runway incursion, the air traffic controllers' and bird controllers' situation (the infrastructure, work processes and procedures, customary practice, etc.), their actions, and the consequential risks for the inspection of runways. The investigation also focused on the functioning of the Airport and Air Traffic Control safety management systems in preventing runway incursions. Consideration was also given to government supervision.

1.4 Investigative approach

To investigate how the parties at Schiphol undertake to prevent runway incursions and how this is assured by the parties involved, the Dutch Safety Board applied the principles of safety management for the purpose of its analysis.⁴ The following aspects are particularly important in this respect:

³ International Civil Aviation Organization.

⁴ The safety management reference framework is set out in Appendix K.

1. A safety strategy based on the available standards, guidelines and best practices, to ensure that the defined safety objectives can be achieved and actively adjusted in response to the evaluation of and investigation into accidents or near accidents.
2. The visible involvement of management in ensuring that the 'shop floor' is receptive to the continuous improvement of safety at work to help achieve safety objectives.
3. Internal and external supervision of compliance with the safety objectives.

The Dutch Safety Board also obtained information about the work procedures at several other major European airports.

1.5 Reading guide

This report consists of five chapters. Chapter 2 sets out the relevant facts of the incident and further relevant facts. It also contains a brief description of the organisations involved. Chapter 3 describes the underlying causes of the incident and contains an analysis of the facts relating to the runway incursion. The analysis answers the research questions in Chapter 1 under 1.2. Chapter 4 contains the conclusions drawn from the investigation while Chapter 5 provides recommendations.

An explanation of the investigation is set out in Appendix A. A draft version of this report was sent to the parties involved for comment. Their comments are discussed in Appendix B.

2 FACTUAL INFORMATION

2.1 Introduction

In the late afternoon of 18 December 2010 the Dutch Safety Board received a telephone call from Air Traffic Control the Netherlands reporting that a Boeing 737 aircraft had taken off from Runway 24 at Amsterdam Airport Schiphol while a Bird Control vehicle was on the same runway. The Dutch Safety Board received a written report of the incident from the Airport. The Bird Control vehicle was present on the runway with permission from Air Traffic Control. This chapter describes the facts underlying the occurrence of this incident and subsequently discusses previous Dutch Safety Board investigations into runway incursions. To conclude, the chapter describes the internal investigations conducted and measures taken following the incident by the parties involved.

2.2 Description of the incident

The bird controller with call sign Kievit 2 (KV2) contacted assistant 2⁵ for permission to drive his vehicle along take-off Runway 24, which was in use, for the purpose of inspecting the runway for the presence of birds, among other things, and any remaining ice fragments shed by aircraft. Air Traffic Control (assistant 2) granted him permission to do so. Shortly afterwards, the flight crew of a Boeing 747 that was taxiing from Apron Sierra (Apron S) requested permission to cross Runway 24 at S2. Again, Air Traffic Control (the ground controller) granted permission to do so. The runway controller warned the bird controller that the Boeing 747 was crossing the runway. He did so using the microphone of assistant 2, who at that time was on the telephone coordinating activities. After the Boeing 747 had crossed and vacated Runway 24, the crew informed the ground controller thereof. A Boeing 737 was meanwhile preparing to take-off from Runway 24. After the Boeing 747 that was crossing had vacated the runway, the runway controller issued the Boeing 737 take-off clearance. The bird controller was still on the runway at that time (see Appendix E). The Boeing 737 then took off from Runway 24 and flew over the Bird Control vehicle that was still driving on the runway. The flight crew of the departing Boeing 737 did not notice the Bird Control vehicle. The bird controller did not see the Boeing 737 during take-off nor did he consciously hear the aircraft when it flew overhead.

⁵ Assistant 2 provides general assistance in the ATC tower, including assisting the runway controller and allowing vehicles to cross and drive down runways, under the runway controller's responsibility.

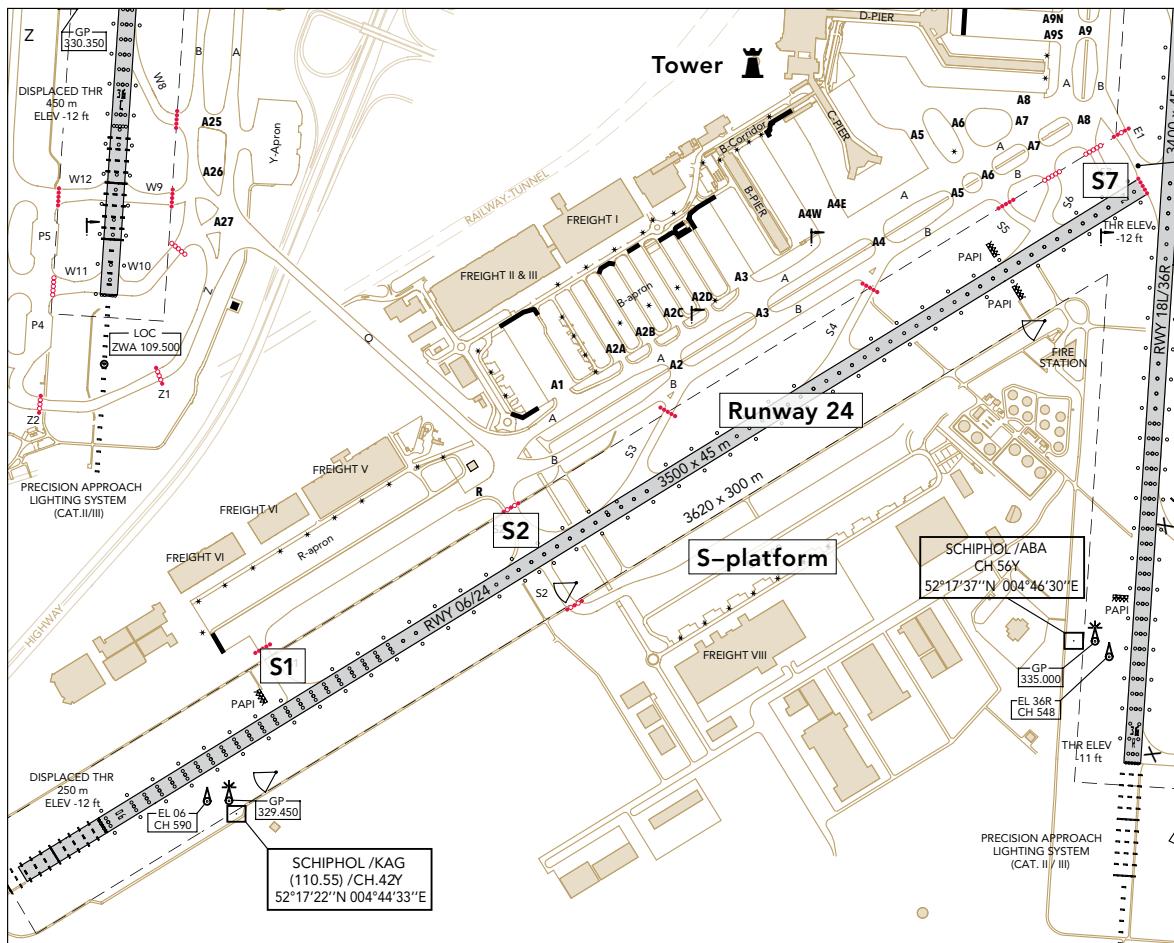


Figure 2: Runway 24 with intersections S1, S2 and S7

2.3 Parties involved and their activities

2.3.1 Amsterdam Airport Schiphol

Amsterdam Airport Schiphol is responsible for the airport infrastructure and for making available the complex of runways, taxiways and aprons ensuring they are safe for use.

Aprons and cargo sheds serving cargo traffic are located on both sides (north and south) of Runway 06/24 at Amsterdam Airport Schiphol. As stated earlier, the apron located on the south side of the runway is called Apron Sierra. Aircraft must cross Runway 06/24 via intersection S2 to travel to and from Apron S and the taxiways.

Between one and four aircraft tows⁶ need to cross a runway each day. Around 8,000 to 9,000 aircraft cross Runway 06/24 at S2 each year (=21-24 a day). The list obtained from Air Traffic Control the Netherlands shows a gradual rise in the number of aircraft crossing the runway at S2. The number more than doubled between January and July 2012. Vehicles do not need to cross Runway 06/24 at S2 but drive through a tunnel to reach the cargo apron. Airport sweepers and power shovels are occasionally driven across the runway at night to clean the cargo apron.

⁶ Aircraft towed across the airport by an aircraft tow tractor or aircraft tug are called 'tows'.

Bird Control

The tasks of a bird controller, who is employed by Amsterdam Airport Schiphol, include inspecting take-off and landing runways to check whether any birds or objects are present that constitute a risk for air traffic, such as ice fragments shed by aircraft crossing the runway. A bird controller may be deployed by Air Traffic Control, but he may also take action of his own accord. He does so to disperse birds if they are sighted near a take-off or landing runway or after a bird strike.

The bird controllers' work instructions state that '*the bird controller must drive down and inspect active⁷ take-off and landing runways if they have not been in use for 20 minutes or more, before an aircraft may again take off from or land on those runways.*' The instructions also state that '*a bird controller must regularly drive down active take-off and landing runways on his own initiative.⁸*' The work instructions furthermore state the following: '*The bird controller must drive down Runway 04-22 and other inactive take-off and landing runways at least once every two hours.*' The work instructions do not state how often bird controllers are required to inspect active take-off and landing runways. The bird controllers stated that they, in principle, do so once every two hours.

During a routine check, the bird controller inspects the entire length of the take-off or landing runway for the presence of birds and objects, the purpose of which is to prevent aircraft from incurring foreign object damage (FOD).⁹ During the interview with the bird controller it emerged that, in principle, when driving down an active runway he drives in the same direction as runway movements. He explained that the reason for doing so is that it is quicker to obtain Air Traffic Control's permission to drive down the runway.

Communications between the Air Traffic Control tower (or: the 'tower') and taxiing and other aircraft are conducted in English by ground and runway controllers on an aviation frequency. Communications between the ATC tower and the bird controller are conducted in Dutch by assistant 2 on a radiotelephone channel. This is standard procedure at Amsterdam Airport Schiphol.¹⁰

According to the work instructions, the bird controller must monitor the frequency being used by the runway controller. To quote the work instructions, this is to increase 'situational awareness' during runway inspections. The bird controller concerned had switched on several radios in his vehicle for monitoring purposes. The radios were tuned into aviation frequencies 118.100 and 121.900 MHz.¹¹ In addition he was in contact with assistant 2 in the ATC tower on radiotelephone channel 1 (known as the runway channel) and was using the OPS channel to communicate with Airport Operations.

⁷ An 'active' runway means that it is in use for aircraft taking off and landing.

⁸ Schiphol Bird Control Work Instructions A/OPS/AO/B version 5 dated 18 May 2010, pp. 15 - 17. See Appendix D.

⁹ FOD also means foreign object debris, which refers to any object found on the aprons, taxiways and runways that constitutes a risk of aircraft damage.

¹⁰ Except for Runway 18R-36L.

¹¹ 118.100 MHz – Tower frequency used for Runway 24; 121.900 MHz – Tower West ground controller (see table 1).

Frequency/ channel	118.1 MHz	121.9 MHz	Runway channel	OPS channel
In contact with	Tower frequency for Runway 24	Tower West ground controller	Assistant 2 Tower	Airport Operations Schiphol

Table 1: The frequencies and channels selected by the bird controller during the incident

It emerged from the interview with the bird controller that he had not heard the ground controller issue the Boeing 737 take-off clearance. When he proceeded to drive down Runway 24, he had indeed seen the Boeing 737 in his mirror, but paid more attention to the Boeing 747 crossing at S2 and the condition of the runway. He had turned down the volumes of the various communication channels to enable him to concentrate better on inspecting the runway. The bird controller did not leave his vehicle during the inspection and did not see the Boeing 737 take off nor did he consciously hear the aircraft when it flew overhead. When he reached the end of the runway, he reported to Air Traffic Control on the runway channel that he had completed his inspection and had vacated the runway. It was only at that moment that the ground controller realised that the bird controller was still present on the runway while the Boeing 737 had taken off.

Like an aircraft, the bird controller's vehicle contains a transponder¹², which transmitted code 'KV2'. This means that the Bird Control vehicle is more clearly visible on the radar/ground radar and code 'KV2' is shown on the radar screen. Given the good visibility conditions, in accordance with procedure the air traffic controller was looking outside and not at the radar screen. The standard lighting on the bird controller's vehicle was switched on, the orange light was flashing and furthermore an additional 'strobe light'¹³ mounted on the rear of the vehicle was switched on. The strobe light formed part of a test that was being conducted to determine whether the light increases the vehicle's visibility. The bird controller's vehicle was the only vehicle at the Airport equipped with a strobe light.

2.3.2 Air Traffic Control the Netherlands

Air Traffic Control the Netherlands is an independent administrative body, responsibility for which falls to the Minister of Infrastructure and the Environment.¹⁴ The organisation is charged with the provision of air navigation services ensuring the highest possible level of aviation safety in the Amsterdam flight information region.¹⁵ These services are provided in the interests of general aviation safety, and the safe, orderly and expeditious flow of air traffic.¹⁶

The Air Traffic Control tower guides air traffic departing from Amsterdam Airport Schiphol in the local control zone, in other words in the controlled airspace directly above and around the Airport itself.

¹² Transponders autonomously transmit a periodic signal or respond to a signal transmitted by a secondary radar system. In response they relay a signal containing information about the identity of the vehicle/aircraft which they have been built into, adding information about the course, speed, etc. where applicable. The radar, in turn, picks up this signal and further processes it.

¹³ A strobe light is a lamp that emits brief, high-intensity light flashes at intervals.

¹⁴ At the time of the incident this was the Minister of Transport, Public Works and Water Management.

¹⁵ Aviation Act, Section 5.23(1)(a).

¹⁶ Aviation Act, Section 5.12(1).

Depending on the volume of traffic, the Air Traffic Control tower is staffed by one or more ground controllers, one or more runway controllers and a number of assistant controllers. One ATC tower supervisor is in charge.

The ground controller is responsible for air traffic control in the manoeuvring area¹⁷, except for the runways that are available for aircraft taking off and landing.¹⁸ The runway controller is responsible for local air traffic control (the take-off and landing runways), with the exception of aircraft that fall under the ground controller's responsibility. Assistant 2's role is to provide general assistance in the tower. His main duties¹⁹ involve supporting the runway controller (safety net function), allowing vehicles to cross and drive on runways under the responsibility of the runway controller, and guiding vehicles in the airport's manoeuvring area under the responsibility of the ground controller. In addition, a number of his duties involve coordinating activities with various services at the Airport. Many of these activities are coordinated by telephone.

At the time of the incident the runway controller was handling air traffic landing on Runway 18C and air traffic taking off from Runways 24 and 18L. There were no disruptions in the tower and everything (equipment, processes, etc.) was working properly. The runway controller stated that the situation was "stable" and "not too busy". He was using radio communication frequencies 118.100 and 119.225 MHz. The supervisor explained that he was sitting at the supervisor's desk in the tower's operations room at the time of the incident.

A timeline of ground radar data and sound recordings in the tower were used for the purpose of reconstructing the incident, as shown in Appendix E.

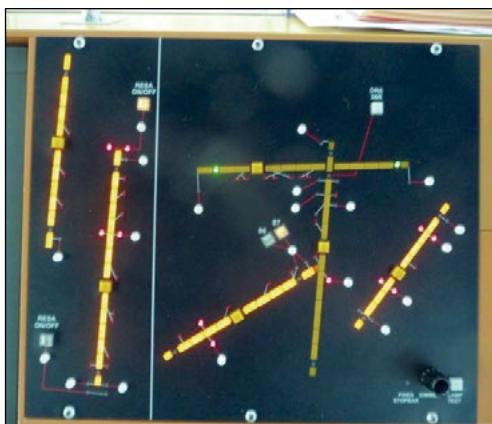


Figure 3: Runway allocation panel

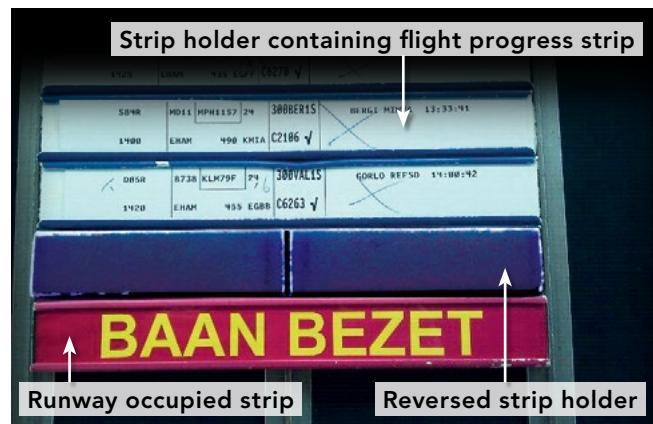


Figure 4: Strip holders

The runway controller stated that the bird controller had requested permission (via assistant 2) at Intersection S7 (see figure 2) to drive down Runway 24. The runway controller granted the request and, as required²⁰, switched on the 'runway occupied' signal for the relevant runway on the 'runway allocation panel' (see figure 3).

¹⁷ The part of the aerodrome designated for the take-off, landing and taxiing of aircraft except for the aprons (VDV 6.01).

¹⁸ Definition used in the Air Traffic Control Operations Manual (VDV).

¹⁹ VDV2, Chapter 7.01, p 2, Appendix L.

²⁰ VDV2, Chapter 7.04, p 6.

The relevant image of the runway then starts flashing on the panel and a sound is emitted by a 'ticker' (a regular ticking sound). The runway controller also reversed the strip holder with the next aircraft due to take off so that the text on the flight strip was no longer visible in the strip holder concerned to indicate that this aircraft was not permitted to take off. The strip holder contains a paper 'flight progress strip' showing the relevant flight data, such as aircraft type and flight number (see figure 4). The 'runway occupied' strip holder was added a few years ago. In addition to activating the flashing lights on the runway allocation panel, coupled with the regular sound of the 'ticker' and reversing the strip holder (the bottom of which is yellow) showing the next aircraft due to take off or land, the runway controller may insert the red 'runway occupied' strip holder (see figure 4). Incidentally, not all runway controllers do this, and in this particular case the 'runway occupied' strip holder was not used either. The Air Traffic Control Operations Manual [*Voorschriften Dienst Verkeersleiding*, hereinafter also referred to as the 'VDV'], does not incorporate any procedures for reversing the strip holder showing the next aircraft due to take off or land, nor for using the 'runway occupied' strip holder. The system used in the tower at Amsterdam Airport Schiphol does not contain a feature to indicate that several aircraft or vehicles are travelling on the runway at the same time. The air traffic controllers are aware of this particular feature of the system.

The reconstruction showed that the ground controller asked the runway controller whether the Boeing 747 that was crossing at intersection S2 was permitted to cross take-off Runway 24, which was in use. This was permitted, and when replying the runway controller said that the aircraft that was crossing was allowed to remain on the ground controller's frequency. According to the VDV, traffic that wants to cross an available runway must be transferred to the runway controller's frequency. The VDV furthermore states, in respect of crossing an available runway that is not actively being used for aircraft taking off or landing, that the runway controller may decide to relieve the ground controller from the obligation to transfer the aircraft to the runway controller.

The runway controller had already switched on the 'runway occupied' signal following the bird controller's request and had also already reversed the strip for the Boeing 737. When granting the Boeing 747 permission to cross the runway, the runway controller is also required to de-activate the relevant stop bar.²¹ When de-activating the stop bar, the 'runway occupied' signal starts to flash automatically and the ticker is also audible. In this incident the 'runway occupied' signal, however, had already been activated manually by the runway controller when he gave the bird controller permission – via assistant 2 – to drive on the runway. After the aircraft that was crossing had reported that it had vacated Runway 24, the runway controller then switched off the flashing signal on the runway allocation panel. The image of the relevant runway then lights up again and is constantly illuminated indicating that the runway may be used for the take-off and landing of aircraft. He also reversed the Boeing 737 strip holder. The runway controller stated that immediately before he had issued the Boeing 737 take-off clearance, he had quickly visually scanned the runway. While doing so he noticed that the sun was low in the south west.

²¹ A row of switchable, in-pavement, red lights installed at the entry of a take-off or landing runway which may not be passed when switched on.

The runway controller stated that he realised that a runway incursion had occurred when the bird controller reported via assistant 2 that he had vacated the runway.

The assistant had coordinated the bird controller's request with the runway controller before issuing the bird controller permission to drive down Runway 24 via radiotelephone channel 1. The reconstruction shows that as part of his work, assistant 2 conducted two telephone conversations lasting around three and a half minutes in total. He did so in between giving the bird controller permission to drive on the runway and the bird controller reporting that he had vacated the runway, a space of time of around four and a half minutes. Assistant 2 stated that in terms of visibility, conditions were good but that a lot of light was reflected by the snow, as a consequence of which the end of the runway could scarcely be seen, or not at all.

Procedure for crossing a runway-in-use

According to the VDV, one of the ground controller's tasks is to prevent collisions and unauthorised vehicles from entering take-off and landing runways unmonitored. In addition the VDV states that the ground controller must transfer a taxiing aircraft that needs to cross an active runway to the ground controller's frequency.

Runway Incursion Alerting System Schiphol (RIASS)

RIASS is a technical warning system developed under the direction of Air Traffic Control the Netherlands²², which functions as an additional safety net. It issues a warning signal in the event of a potential risk of collision on the take-off and landing runways at Amsterdam Airport Schiphol.²³ RIASS operates on the basis of multilateration.²⁴ The system only recognises aircraft and vehicles with an activated transponder. On the day of the incident RIASS was being used in the background for testing purposes, but the system did not issue a warning that was audible or visible to the air traffic controllers who were on duty. Air Traffic Control the Netherlands stated that the complete system was switched on permanently according to schedule two days after the incident. The system was officially completed and delivered on 28 October 2011.

²² Experts at Amsterdam Airport Schiphol, KLM, the Inspectorate for Transport, Public Works and Water Management, the National Aerospace Laboratory and Air Traffic Control the Netherlands jointly developed a plan to design a system on the basis of multilateration which issues a warning if a runway incursion has occurred. RIASS was designed on the basis of this system.

²³ To assess whether there is a risk of an imminent runway incursion, a system comprising virtual boxes surrounding all take-off and landing runways was devised. If a vehicle and/or an aircraft with an activated transponder enters a box reserved for an aircraft taking off or landing, the system automatically issues a warning. The initial warning is visual: i.e. white circles are shown around the traffic involved on the ATC tower radar screens. The circles then begin to flash and a voice warning follows. The system is set such that an air traffic controller in principle still has sufficient time after the acoustic signal has sounded to identify the potential risk and take action, where necessary.

²⁴ Multilateration is a radar technology that locates and identifies all vehicles and aircraft that carry a transponder.

2.3.3 Amsterdam Airport Schiphol and Air Traffic Control the Netherlands; Safety management systems

Both Amsterdam Airport Schiphol and Air Traffic Control the Netherlands have a comprehensive and detailed safety management system in place (SMS, see Appendix G for the relevant section of the SMS). The Airport safety management system provides that incidents and accidents at the Airport must be closely monitored and investigated for the purpose of learning lessons and to prevent similar incidents or accidents from occurring in the future. In its safety management system, Air Traffic Control the Netherlands too states that its aim is to learn from incident investigation in order to prevent a repetition of similar incidents.²⁵ The safety management systems of both organisations incorporate a methodology for analysing occurrences and assessing the risks of a similar occurrence. The assessment and methodology serve to determine whether additional control measures are necessary. They furthermore serve to determine whether any measures that have been taken have resulted in an adequate degree of risk control.

If the methodology used in the Amsterdam Airport Schiphol safety management system is applied to the incident investigated, the frequency of the incidents, multiplied by the effect produces a high value which is classified as 'unacceptable'. By continuing to follow the methodology, the highest classification factor, i.e. 5, is produced for 'Priority'. This classification factor is described as the 'most critical'. Air Traffic Control the Netherlands uses Safety Significant Events (SSE) as a basis, a system also used by air traffic control services in other countries. On the basis of the SSE system, in terms of incident severity Air Traffic Control the Netherlands has classified the incident as C ('separation decreasing, but there is sufficient time and distance to avoid a possible collision,' see Appendix G). Due to the fact that neither Air Traffic Control, nor the pilots, nor the bird controller detected the incident on time, the SSE system has assigned '1' (number one) to 'Detection and solution'. According to Air Traffic Control the incident is classified as '1C'. The organisation therefore considers it a 'major incident'.²⁶

2.3.4 Schiphol Safety Platform and Runway Safety Team Schiphol

All organisations that have a role in the aviation process at Amsterdam Airport Schiphol are represented in the Schiphol Safety Platform.²⁷ The Platform was established in 2003 as a consultation platform, the aim of which is to share knowledge and promote joint analysis. The participating organisations have not delegated any powers to the Schiphol Safety Platform to act on their behalf. This means that no party may formally act on behalf of the Platform. The aim of the Platform is to align the safety management systems of all parties involved as much as possible within the entire process, where beneficial and feasible (source: Schiphol Safety Platform). The organisations themselves are responsible for performing and implementing improvement activities, without government intervention.

²⁵ The objective of LVNL's occurrence assessment process is to learn from the investigation of safety occurrences to prevent similar occurrences in the future. (Safety Management at LVNL, Version 3.0, April 2011, para. 6.2; idem para. 2.3.1. Safety management activities are aimed at prevention through the identification of hazards and the introduction of risk mitigation measures before the risk-bearing event occurs and adversely effects safety performance. If nevertheless a risk-bearing event occurs, safety management should prevent the event occurring again.

²⁶ A major incident is an incident associated with the operation of an aircraft, in which safety of aircraft may have been compromised, having led to a near collision between aircraft, with ground or obstacles.

²⁷ See VpS Policy Statement, Appendix F.

To that end, a number of expert groups were established to manage specific safety topics. Amsterdam Airport Schiphol chairs the Schiphol Safety Platform and is responsible for programme management. One of the expert groups is the Runway Safety Team Schiphol (RST),²⁸ which forms part of the Schiphol Safety Platform organisation and reports to its Steering Committee. One of the RST's objectives²⁹ is to share information among the parties in the interests of safety on and around the take-off and landing runways. Chapter 2.4 further examines the topics relating to safety on and around the take-off and landing runways at Amsterdam Airport Schiphol.

In 2006 the Schiphol Safety Platform set itself the goal of halving the number of runway incursions within a five-year period (2007 – 2011). The Platform stated that even though it has not achieved its goal, the number of serious incursions (class A or B)³⁰ is declining, as a result of which the Platform's efforts are nonetheless considered to be successful. The number of runway incursions that occurred in 2006 totalled 44, three of which were serious (class B). In 2010 the total number declined to 30. In 2011 the number totalled 36, one of which was a serious incursion (class B). This means that for the first time in five years, the number of runway incursions has risen compared with the previous years (2006-2010).³¹ The Platform has extended the period for halving the number of runway incursions by two years.

As stated, initially the government was not represented on the Platform. The Human Environment and Transport Inspectorate has been taking part in the RST, which forms part of the Platform, as an observer since 2006. The Inspectorate's Director of Aviation has been attending Platform Steering Committee Meetings as an observer since 1 September 2009. The Head of the Aviation Safety Department at the Directorate-General for Accessibility of the Ministry of Infrastructure and the Environment has been attending these meetings since 2011.

2.3.5 Human Environment and Transport Inspectorate

The Human Environment and Transport Inspectorate (ILT, previously the Inspectorate for Transport, Public Works and Water Management, IVW) is charged with the supervision of Air Traffic Control the Netherlands and Amsterdam Airport Schiphol. The Inspectorate issues air traffic control organisations and airports certification on the basis of inspections and audits. Organisations holding certification must constantly demonstrate that their business processes proceed in a controlled manner. A safety certificate is awarded if the organisation complies with the rules concerning the construction, layout, equipment and use of aerodromes issued by the Minister.³² This is referred to as systemic supervision.

²⁸ The RST members comprise Amsterdam Airport Schiphol, Air Traffic Control the Netherlands, KLM (Cityhopper), Transavia, Martinair, Arkefly, the Dutch Airline Pilots Association, the Dutch Air Traffic Controllers Guild and the Inspectorate for Transport, Public Works and Water Management (observer).

²⁹ Runway Safety Team Schiphol Terms of Reference, version dated December 2010.

³⁰ Class A: a serious incident in which a collision is narrowly avoided. Class B: an incident in which separation decreased and there is significant potential for collision. See also Appendix G.

³¹ Source: Air Traffic Control the Netherlands.

³² This relates to safe and orderly operations at airports and the rules governing the safety certificate, the safety management system and the Amsterdam Airport Schiphol Operations Manual. Aviation Act, Section 8a(1-3).

Air Traffic Control the Netherlands and Amsterdam Airport Schiphol have both been awarded certification by the Human Environment and Transport Inspectorate. Air Traffic Control the Netherlands was awarded a (permanent) certificate on 5 March 2007.

To obtain certification an application must be submitted to the Human Environment and Transport Inspectorate. The application consists of an application form and a self-evaluation with individual sections in which the applicant describes how it complies with the relevant laws and regulations. The application must be accompanied by all supporting information (such as internal procedures, manuals, etc.). The certification procedure involves checking the documents, visiting the location and holding interviews to determine whether the applicant works in accordance with the self-evaluation it has submitted. Following certification, the certificate holder updates the Inspectorate of any changes in its processes. The Inspectorate visits the certificate holder regularly to verify whether these processes are being performed properly. The certificate issued to Air Traffic Control the Netherlands is valid for an indefinite period. However, the certificate holder must continue to comply with the requirements and conditions under which the certificate was granted. By way of systemic audits and product inspections the Inspectorate verifies compliance by the air navigation service provider. Scheduled changes must be submitted by the service provider to the Inspectorate for review (safety case). The number of audits and inspections are included in the Supervision Programme and are scheduled on the basis of a risk analysis. If the service provider no longer meets the criteria, the Inspectorate may demand improvement and, in the worst case, withdraw the certificate.

The supervision performed by the Inspectorate has been regulated such that the parties subject to supervision themselves carry primary responsibility for managing safety and consequently for controlling the risks, and are also held accountable for fulfilling this responsibility. According to the Inspectorate, the organisation itself has many more opportunities for detecting irregularities than could be achieved through random inspections. Consequently, the Inspectorate has adopted a more hands-off approach. If parties subject to supervision are found to have deviated from the standards and requirements, the Inspectorate may request them to take corrective and preventive measures. Supervision is the keystone in ensuring and sustaining safety to the best possible extent.

Each year the Inspectorate draws up a programme setting out the key objectives for supervision in that particular year. One of the Inspectorate's key objectives for supervision in 2011 includes runway incursions. The supervision programme broadly entails that there will be less supervision the lower the risk probability, while supervision will be intensified the higher the risk probability. This is referred to as a risk-oriented supervision policy, which is based on the principle of 'trust, unless'.

The aviation inspection programme constitutes a mix of systemic, product and theme-based supervision:

- Systemic supervision refers to the monitoring of safety systems and the safety culture at organisations by means of audits.
- Product supervision refers to aircraft inspection, for instance, or the inspection of a take-off or landing runway at an airport.

- Theme-based supervision refers to the inspection of a specific component, such as the carriage of hazardous substances or failure to prepare for a flight properly.
- The supervision programme is a basic programme. Unscheduled inspections are always possible in response to incidents, poor performance, alerts and investigations.

Amsterdam Airport Schiphol was first granted certification on 30 June 2004. The Airport must periodically reapply for the certificate, after which an admission audit is performed. In 2004, before Amsterdam Airport Schiphol was issued certification, the Inspectorate for Transport, Public Works and Water Management performed an inspection focusing on the theme of runway incursions. Among other things, it was concluded that during the inspection the situation with respect to runway incursions at the Airport at that time had been thoroughly reviewed. The results of the inspection were then shared with Air Traffic Control the Netherlands and Amsterdam Airport Schiphol, the sector parties. On 1 November 2009 the validity of the certificate was extended to 30 June 2012, and it was again extended on 1 July 2012.

In order to obtain certification Amsterdam Airport Schiphol was required to have a safety management system in place incorporating, among other things, a collaboration protocol between the airport operator (Amsterdam Airport Schiphol) and the local air navigation service provider (Air Traffic Control the Netherlands), for aerodrome traffic in the landing zone.³³ The protocol called the Schiphol Coordination Regulations [Coördinatieregeling Schiphol] was adopted on 22 December 2005. Aerodrome traffic also covers service vehicle traffic, which includes Bird Control vehicles. The agreements made with other parties on safety at and around the Airport were also required to be incorporated into the safety management system. On the basis of the latter provision, the protocol provided that a formal consultation will take place at least every six months between Amsterdam Airport Schiphol and Air Traffic Control the Netherlands concerning safety at the Airport. In its audit report findings of 10 May 2012 the Inspectorate established that this provision had not been met since the beginning of 2011 and that Air Traffic Control the Netherlands had not designated an officer for this purpose.

On 30 November 2011 the Inspectorate for Transport, Public Works and Water Management performed a theme-based inspection at Amsterdam Airport Schiphol³⁴ focusing on the prevention of bird strikes and the correlation between bird strikes and runway incursions. According to the report, prior to performing the inspection the Inspectorate examined a number of documents to gain an idea of the activities carried out by bird controllers. In its report the Inspectorate concluded that 'the activities performed by bird controllers are carried out in accordance with the work instructions for the inspection of take-off and landing runways.' In its report the Inspectorate acknowledged that bird controllers adapt their work procedure in accordance with the time available between two landing aircraft.

³³ Regulations concerning the Safe Use of Aerodromes, Article 4(m).

³⁴ Inspectorate for Transport, Public Works and Water Management, theme-based inspection 'Bird strike prevention and the correlation with runway incursions' at Amsterdam Airport Schiphol, dated 8 Dec. 2011, Version 1.0.

During an inspection round with a bird controller, it was noted that if separation between two landing aircraft is eight to ten nautical miles, a proper runway inspection is quite feasible. If separation is six nautical miles, for instance, the bird controller acknowledges that the speed at which a runway must be inspected is too high (around 140km/h), which thus calls the effectiveness of a runway inspection into question. The theme-based inspection was limited to a number of the Airport's and bird controllers' internal work instructions. The immediate and underlying causes of past runway incursions in which a bird controller was involved were not examined.

2.3.6 Boeing 737 flight crew involved in the incident

The flight crew of the departing Boeing 737 did not detect the Bird Control vehicle and the runway incursion escaped their notice entirely. The flight crew had no role in the occurrence of the accident.

2.4 Measures for controlling runway incursions

2.4.1 Introduction

Following a serious incident at Amsterdam Airport Schiphol in 1998 (referred to as the Delta incident, see Appendix H), the parties involved at the Airport (both individually and jointly in the Schiphol Safety Platform and its predecessor) undertook several initiatives to reduce the risk of runway incursions. At that time the Dutch Transport Safety Board, the Dutch Safety Board's predecessor, instituted an investigation into the Delta incident and formulated recommendations for the parties involved. The initiatives that were taken relate to the airport infrastructure, procedural measures as well as additional systems at Air Traffic Control the Netherlands. An example included building a detour for aircraft tugs without a tow to avoid them having to cross a runway. Various measures were taken concerning signs, lighting and surface markings. A ground radar system was also introduced. An important control measure is the implementation of RIASS, which was officially completed and delivered on 28 October 2011. Reducing the risk of runway incursions has been on the agenda of Air Traffic Control the Netherlands and Amsterdam Airport Schiphol since 2003. According to Air Traffic Control the Netherlands, "*communication in particular was found to be one of the main causes of the occurrence of runway incursions.*"³⁵

Apart from the measures that were taken, four activities were postponed, or partially or never carried out:

1. Postponement of the construction of Taxiway Tango;
2. Discontinuation of the Runway Control project;
3. Incomplete review and implementation of the European Action Plan for the Prevention of Runway Incursions;
4. No follow-up on the internal recommendation made by Air Traffic Control the Netherlands to review the driving direction of vehicles on a runway.

³⁵ LVNL Safety Magazine called 'Safety@LVNL' 1/2012, pp. 14 and 15.

The following paragraphs provided further information on these activities or the absence thereof.

2.4.2 Postponement of the construction of Taxiway Tango

After the Delta incident, there was a need for traffic to travel to and from Apron Sierra without having to cross an intersection or to keep this to a minimum. It had been decided to construct an additional taxiway called Tango to enable aircraft to cross Runway 06/24. In absolute terms, even though Taxiway Tango has been completed aircraft must still cross Runway 06/24, but they now cross the beginning of the runway. A key aspect of this intersection location is that the speeds of aircraft taking off are much lower at this location than at the current S2 intersection. The initial project planning schedule was based on completion in 2008/2009. However, Schiphol Group's Management Board passed a resolution to temporarily shelve all respective investments. According to Schiphol this was due to the sharp decline in the cargo market, which meant that considerably fewer aircraft needed to cross the runway. At that time completion was rescheduled to 2015. Air Traffic Control the Netherlands states that it has repeatedly stressed the importance of completing Taxiway Tango.

Schiphol Group's Management Board has indicated that construction of Taxiway Tango will begin in 2014 and that the taxiway is scheduled to be completed and put into operation on 1 March 2015.

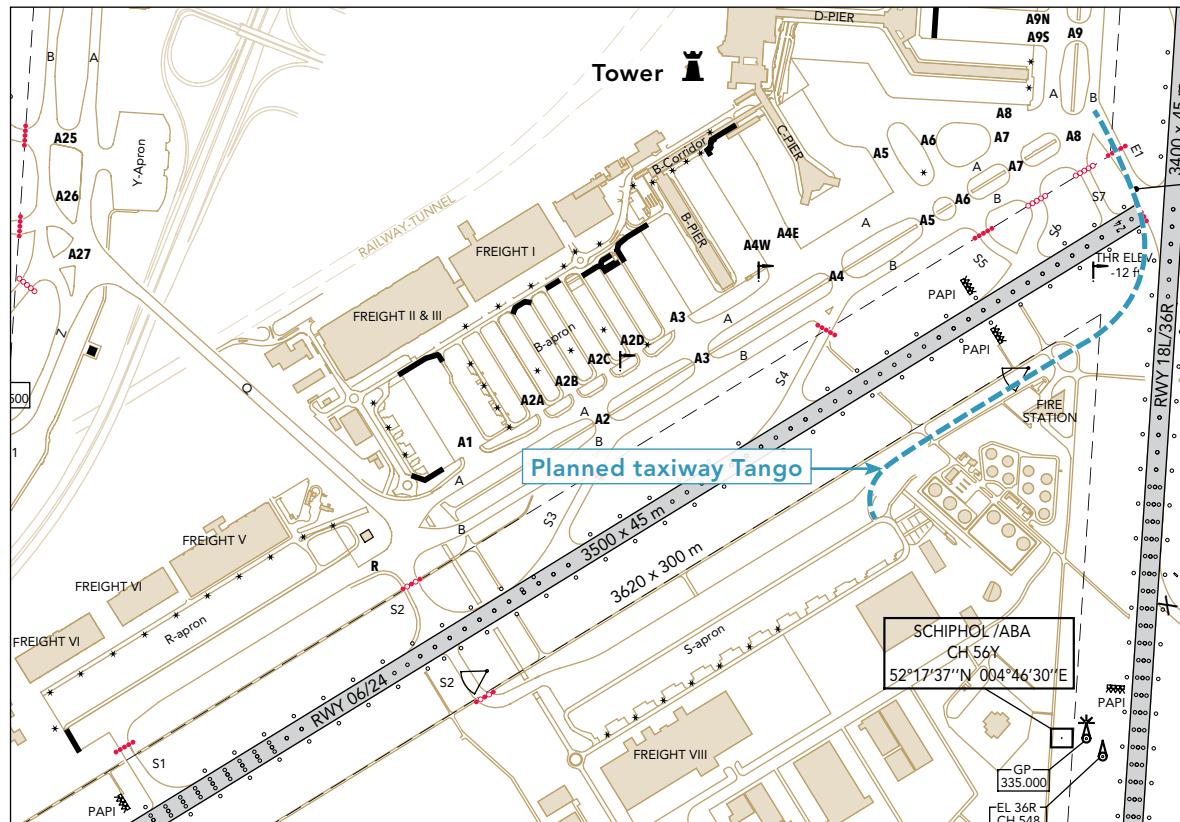


Figure 5: New Taxiway Tango scheduled for construction

2.4.3 Discontinuation of the Runway Control project

In the Dutch Transport Safety Board's report on the Delta incident, one of the recommendations included evaluating the coordination and communication procedures between Air Traffic Control and Amsterdam Airport Schiphol at that time. During the Schiphol Operations Consultation, the decision was taken in March 2001 to revise the communication procedures for vehicles driving on runways and taxiways at Amsterdam Airport Schiphol. In collaboration with Air Traffic Control the Netherlands and the Inspectorate for Transport, Public Works and Water Management, Amsterdam Airport Schiphol undertook preparations to implement direct communications between bird controllers, the drivers of aircraft tugs³⁶, and the air traffic controllers working at Air Traffic Control the Netherlands. This is referred to as 'Runway Control'. Communication was to be carried out in the English language using aviation radio channels.

The Runway Control project consisted of three phases. The first phase set out the procedures for vehicles wishing to drive down the entire length of a take-off or landing runway. The runway controller would treat the vehicles as if they were aircraft and the drivers were to communicate in the English language. Around 120 people took an adapted radiotelephony course, which concluded with an examination. The second phase related to the procedures for vehicles and aircraft tows wishing to cross a take-off or landing runway. The third phase focused on procedures for all vehicles and aircraft tows. See Appendix I for further project details.

With Air Traffic Control the Netherlands as project leader, Amsterdam Airport Schiphol, Air Traffic Control the Netherlands and the Inspectorate for Transport, Public Works and Water Management then began to implement the first phase of the Runway Control project. Implementation coincided with the opening of Runway 18R-36L at Schiphol. The latter involved a great many new procedures and adjustments. It emerged from interviews that the Operations Department at Air Traffic Control the Netherlands already doubted whether the trial was feasible even before it had begun. In the first two weeks of the trial, 16 reports were recorded in the report drawn up by the duty officer. The reports related to problems that had been identified in implementing the Runway Control project. As a consequence Air Traffic Control the Netherlands unilaterally cancelled the trial on 11 March 2003. In a letter dated 24 July 2003 Air Traffic Control the Netherlands informed the Inspectorate that the trial had been cancelled and requested that the Inspectorate consent to discontinuing it. In December 2003 the Inspectorate added a note on the letter saying 'temporarily on hold'. The Inspectorate never replied to the letter. Phases 2 and 3 of the project were not carried out.

³⁶ Drivers of aircraft tugs that tow aircraft from one location to another.

2.4.4 Incomplete review and implementation of the European Action Plan for the Prevention of Runway Incursions

EUROCONTROL published the European Action Plan for the Prevention of Runway Incursions (EAPPRI) in 2004. The Action Plan is based on ICAO Standards and Recommended Practices (SARPs). By rendering assistance in drawing up the Action Plan, the Ministry of Transport, Public Works and Water Management (now called the Ministry of Infrastructure and the Environment) has endorsed the EAPPRI as a means of contributing to the prevention of runway incursions.

A number of relevant recommendations in the document are set out below:

- Identify any potential safety benefits by carrying out runway inspections in the opposite direction to take-off movements and if appropriate, adopt this procedure.³⁷
- Improve situational awareness, when practicable, by conducting all communications associated with runway operations using aviation English.³⁸
- Improve situational awareness, when practicable, by conducting all communications associated with runway operations on a common frequency.³⁹

In general both Amsterdam Airport Schiphol and Air Traffic Control the Netherlands concur with the recommendations. In many respects the work procedure at Schiphol is in line with the recommended work procedure set out in the EAPPRI, but this does not apply to the above three points. These recommendations were not implemented. In 2005 Air Traffic Control the Netherlands assessed the recommendations in EAPPRI document 1.4 as part of a study into operational runway safety concepts at Schiphol.⁴⁰ This was not yet the case for the revised EAPPRI document, version 2.0. The Amsterdam Airport Schiphol and Air Traffic Control the Netherlands safety management systems do not state in what manner the recommendations set out in the EAPPRI documents are assessed, nor the officer responsible for doing so.

2.4.5 No follow-up on review of the driving direction of vehicles on a runway

At Amsterdam Airport Schiphol vehicles drive on an active runway in the direction of runway movements, barring a few exceptions. This consequently reduces the time in which a runway cannot be used. In the 1970s an Amsterdam Airport Schiphol regulation was in force for a time under which vehicles were required to drive in the opposite direction to runway movements.

The subject of the direction of runway movements and vehicles driving on a runway was also highlighted in an internal investigation carried out by Air Traffic Control the Netherlands in 2007.⁴¹ The investigation showed that in 2005 the regulations had been implemented for several days but were later declared permanently inapplicable.⁴²

³⁷ European Action Plan for the Prevention of Runway Incursions release 1.2 (2004), under 4.5.8. This recommendation was adopted in release 2.0 (2011) under 1.5.9.

³⁸ Idem release 2.0 under 1.3.5, release 1.2 under 4.3.5.

³⁹ Idem release 2.0 under 1.3.5, release 1.2 under 4.3.5.

⁴⁰ CONOPS Runway Safety, D/R&D 04/030 version 1.5; 20 July 2005

⁴¹ Investigation Report on Runway Incursions at Amsterdam Airport Schiphol, D/R&D 06/029 version 1.0, 16 April 2007.

⁴² In the amendment of the bird controllers' work instruction of 19 April 2007, the sentence 'in principle in the direction opposite to the direction of flight' was deleted.

During interviews it was established that some of the parties involved felt that safety takes precedence and that vehicles should therefore always drive on the runway in the opposite direction to runway movements, since this will give the vehicle driver a better view of what is happening at the beginning of the runway. The investigation carried out by Air Traffic Control the Netherlands also illustrates a situation in which this principle proved to work in practice at Amsterdam Airport Schiphol. The fact that this could encroach on runway take-off and landing capacity was named as a disadvantage. The report cites a number of examples which paint a varied picture of a number of other European airports. In its report Air Traffic Control the Netherlands recommends taking a decision on the basis of a safety study (such as a literature search), focusing on both safety and capacity. The organisation failed to follow up on its own recommendation, and the review of the desired driving direction was not carried out.

An internal investigation carried out by Amsterdam Airport Schiphol⁴³ shows that the Airport had held several discussions both internally and jointly with Air Traffic Control the Netherlands about the direction in which a bird controller should drive along an active runway. According to the Airport's report the Bird Control vehicle would be more visible if it were to drive in the opposite direction to runway movements. The vehicle's bright white lights would be much easier to see than its less bright and smaller red rear lights.

It should be noted in this context that during the 18 December 2010 incident the bird controller's vehicle was equipped with a strobe light for testing purposes. The test showed that the vehicle's visibility had not significantly improved and that the strobe light was found to be annoying by the drivers of snow clearance vehicles. It was later found that a runway incursion had still occurred, despite the strobe light. Amsterdam Airport Schiphol stated that it was decided to terminate the test in light of the above.

2.5 Runway incursions in general

2.5.1 ICAO Manual on the Prevention of Runway Incursions

The 'Manual on the Prevention of Runway Incursions' was published by ICAO in 2007. In the document's foreword, ICAO emphasises that an evolution in safety thinking has led to a change in focus, from that of the individual to that of the organisation as a whole. The document serves as guidance material and primarily aims to provide the necessary general guidelines to help draw up national or local Runway Safety programmes.⁴⁴

⁴³ Amsterdam Airport Schiphol safety investigation concerning take-off clearance while a bird controller is present on the runway, dated 28 February 2011.

⁴⁴ ICAO Manual on the Prevention of Runway Incursions, first edition, 2007, pp 1-2.

A number of relevant recommendations in the document are set out below:

- All communications associated with runway operations (vehicles, crossing traffic, etc.) should be conducted on the same frequency as utilised for the take-off and landing of aircraft.⁴⁵
- To maintain high levels of situational awareness⁴⁶ it is recommended that communications for all operations on a runway (landing, departing and crossing aircraft, vehicles crossing and runway inspections, etc.) take place on the frequency assigned for that runway.⁴⁷
- All communications associated with runway operations should be conducted in accordance with ICAO language requirements for air-ground radiotelephony communications (Annex 10 – Aeronautical Telecommunications). The use of standard aviation English at international aerodromes will improve the situational awareness of everyone listening on the frequency.⁴⁸
- To be effective a limited set of (15 to 20) phraseologies in aviation English could be identified for vehicle drivers.⁴⁹

2.5.2 ICAO Safety Management Manual

Amsterdam Airport Schiphol and Air Traffic Control the Netherlands have both used the ICAO classification to assess the severity of runway incursions.⁵⁰ ICAO has also published a document that provides guidelines for developing and implementing safety management systems. That document describes a method for determining the risk of occurrences based on severity and frequency. The ICAO document is of a general nature and does not focus solely on runway incursions. According to the method described in the ICAO Safety Management Manual, the incidents involving Bird Control are classified as 'unacceptable'.⁵¹ The Schiphol Safety Platform has meanwhile drawn up a document⁵² focusing specifically on the situation at Schiphol. The purpose of the document is to provide guidelines for the safety occurrence assessment by Air Traffic Control the Netherlands, including determining the severity and classification of a runway incursion.

2.6 Investigations into other runway incursions

Appendix I contains summaries of a number of fast-track investigations into runway incursions published by the Dutch Safety Board and its predecessor, among them the investigation into the 1998 Delta incident. The appendix also contains information about the follow-up to the recommendations. Three investigations into runway incursions in 2005 (two) and 2007 (one) involving a bird controller are also included.

⁴⁵ Idem, under 4.2.6.

⁴⁶ In this instance, situational awareness can be described as the overall picture of the situation on and around the runway controlled by the air traffic controller.

⁴⁷ ICAO Doc 9870, Manual on the Prevention of Runway Incursions, eerste druk, 2007, Appendix A, 1.6. ICAO Manual on the Prevention of Runway Incursions, first edition, 2007, pp

⁴⁸ Idem, under 4.2.5.

⁴⁹ Idem, 'Communication Best Practices', Appendix A, under 1.5.

⁵⁰ Idem.

⁵¹ ICAO Doc. 9859, Safety Management Manual, second edition 2009, Chapter 5.

⁵² Runway incursion definition, severity classification and guidance. D/S&P 11/030, version 1.0, 12 January 2012.

One of the three incident investigations shows that a deviation was made from the internal procedures of Air Traffic Control the Netherlands, which stipulate that traffic wishing to cross an active runway must be transferred to the runway controller.

In the three years preceding the incident (2008-2010), eight incidents involving a bird controller occurred (see Appendix C). Like the incident on 18 December 2010, in all of the past eight incidents a bird controller was present on or near a runway with permission from Air Traffic Control, while take-off or landing clearance had wrongly been issued. During the investigation into the 18 December 2010 incident, a further two similar incidents occurred. The last incident on Runway 06-24 took place on 21 January 2012. An aircraft was issued take-off clearance, after another aircraft had crossed the runway at S2, while the bird controller was still present on the runway. The runway controller was concurrently acting as supervisor at that time.

One of the recommendations formulated by the Safety Board in the Delta incident report was not to impose any other duties on the runway controller in addition to his main task. This was because the Safety Board had drawn the conclusion that insufficient supervision had been a causal factor in the Delta incident. In its subsequent response in 2001 Air Traffic Control the Netherlands reported to the former Netherlands Civil Aviation Authority that 'the recommendation had been followed', see Appendix I.⁵³ Air Traffic Control the Netherlands stated that it would implement the recommendation by not allowing the ATC tower supervisor to provide training while on duty, as was the case in the Delta incident.

It emerged from the runway incursions investigated in the period 2005–2007 and the two similar runway incursions in 2010 and 2012 that in day-to-day practice the supervisor's duties are often combined with the tasks of a runway controller. The ATC tower supervisor is an air traffic controller on duty who is additionally charged with providing supervision. He usually is an experienced air traffic controller.

Air Traffic Control the Netherlands stated that the purpose of the supervisor's role is not to take detailed corrective action and hence function as a safety net. Neither is this stated in the description of the ATC tower supervisor's duties and responsibilities.⁵⁴ In reality the supervisor performs a role in directing the operational process (staffing, choice of runway combinations, assigning handling capacity, etc.). Air Traffic Control the Netherlands also stated that the supervisor is not expected to be present in the ATC tower operations room at all times.

⁵³ Letter from Air Traffic Control the Netherlands to the Netherlands Civil Aviation Authority of 16 July 2001.

⁵⁴ VDV 2, 11 March 2010, Section 7.01. See Appendix L.

2.7 Action taken after the incident

The parties involved at Amsterdam Airport Schiphol stated that they all focus on the prevention of runway incursions. Both Amsterdam Airport Schiphol and Air Traffic Control the Netherlands conducted an internal investigation into the incident involving Bird Control on 18 December 2010.

Amsterdam Airport Schiphol

Amsterdam Airport Schiphol combined the investigation into the incident involving Bird Control with an investigation into a virtually identical incident that took place on 13 January 2011. The incident likewise involved a bird controller who was present on Runway 24 with permission. The investigation expresses a broader concern about issuing take-off or landing clearance while a vehicle (usually that of a bird controller) is still on the runway. The Airport's investigation concluded that it remained unclear why Air Traffic Control was unaware of the presence of the bird controller on the runway, due to the fact that not all of the required information was available to the Airport's investigation team. More insight into the processes at Air Traffic Control the Netherlands and the interaction between the air traffic controllers is required, according to the conclusion drawn in the Airport's report. Eight incidents are referred to in the introduction of an internal investigation carried out by the Airport. The report makes no mention of the underlying causes. The Amsterdam Airport Schiphol investigation has not brought about any concrete action.

Project Wave

Amsterdam Airport Schiphol launched a project called Wave for the purpose of formulating concrete preventive measures. The project was described as short-term and aimed to achieve a demonstrable result within no more than three months. The results of the project were presented to the Schiphol Safety Platform in April 2012. Amsterdam Airport Schiphol has proposed using physical strips to improve on the LVNL 'runway occupied' signal. Vehicles driving on active runways, such as those of the Airport bird controllers and the Airside Operations Manager (AOM), would then be treated in the same way as a flight and handled in the sequential order of aircraft. The Airport has further proposed that the procedures of Air Traffic Control the Netherlands be revised such that permission to cross active runways is requested in English on the same radio communication frequency as that of the relevant runway controller.⁵⁵

Air Traffic Control the Netherlands

Following its own internal investigation Air Traffic Control the Netherlands drew up a presentation for internal purposes. In the presentation the causes for the occurrence of the incident involving Bird Control (KV2) on 18 December 2010 are named as: deviating from internal procedures, using the ground controller's radio communication frequency to communicate that an aircraft was crossing an active runway, the fact that the runway controller had switched off the 'runway occupied' signal while the bird controller was still on the runway and the fact that the runway controller had reversed the flight strip for the departing Boeing 737.

⁵⁵ The third result of project Wave is the modification of intersections W11 and W12 and is not relevant to this investigation.

The sun's position, the order of priority given by assistant 2 and issuing take-off clearance while the bird controller was still on the runway are named as further causes.

The following recommendations are given in the presentation: feature the incident and the use of the 'runway occupied' strip in Safety@lvnl.nl, LVNL's online safety magazine. A further recommendation was made to start using RIASS under all circumstances. Air Traffic Control the Netherlands has implemented the latter recommendation.

Air Traffic Control the Netherlands' internal investigation shows that it focused mainly on the immediate cause, i.e. the air traffic controller having overlooked the vehicle. The aim of the recommendations is to highlight to air traffic controllers the need to ensure they do not forget anything. The underlying causes were not investigated by Air Traffic Control the Netherlands.

During the Dutch Safety Board's investigation, Air Traffic Control the Netherlands formulated the internal recommendation to increase the level of situational awareness of air traffic controllers, pilots as well as vehicles.

The recommendations correspond with the results of project Wave carried out by Amsterdam Airport Schiphol. A proposal has been made to improve audiovisual support for air traffic controllers during 'runway occupied' situations. It is furthermore recommended that the situation in which both the bird controller and the Airside Operations Manager conduct communications on the runway controller's frequency if they wish to carry out their activities on an active runway be examined to determine whether this would have a positive effect on safety. The project was concluded in May 2012. Air Traffic Control the Netherlands is still studying two recommendations resulting from project Wave. An article was published in Safety@LVNL.nl warning of the risk of forgetting the presence of a vehicle on an active runway, particularly in the event of dual runway occupancy.⁵⁶

3 ANALYSIS

This chapter examines the immediate and underlying causes of the incident and briefly discusses the relevant procedures at the three largest civil airports in Europe – Frankfurt, Paris and London. Lastly, the chapter describes a number of recent developments at Amsterdam Airport Schiphol.

3.1 Immediate cause

3.1.1 Occurrence of the runway incursion

The flashing lights of the relevant runway on the runway allocation panel runway accompanied by the sound of the 'ticker' provide the runway controller an indication that the runway is occupied and may not be used for take-offs or landings. In accordance with procedure, he had switched on these signals at the time he had given assistant 2 permission to allow the bird controller to drive down the runway. The runway allocation panel does not indicate how many vehicles or crossing aircraft are occupying a runway. He had also reversed the strip holder of the Boeing 737 that would take off first, serving as an additional indication that the runway was occupied. Even this additional indication does not show that the runway is occupied by more than one vehicle or crossing aircraft. The VDV does not state that a strip holder and the addition of the 'runway occupied' strip holder serve as further indications of runway occupancy. Partly due to the above, not all air traffic controllers use the additional indications in the same way. After the runway controller had been granted permission to allow the Boeing 747 to cross the runway, the crossing aircraft remained on the runway controller's frequency. While the Boeing 747 was crossing, the departing Boeing 737 received permission from the runway controller to enter the runway.

According to the VDV, traffic that wants to cross an available runway must be transferred to the runway controller's frequency. The VDV furthermore states, in respect of crossing an available runway which is not actively being used for the taking off or landing of aircraft, that the runway controller may determine that the ground controller does not need to transfer the aircraft to the runway controller. However, the VDV does not provide a definition of the term 'active', which consequently leaves room for interpretation. In this instance, the runway controller decided not to have the aircraft transferred because, in his opinion, the runway was inactive since the bird controller was on the runway. However, the runway controller issued an aircraft on the same runway take-off clearance barely 30 seconds later. Another reason put forward by the runway controller for not transferring crossing traffic was that the crossing aircraft was taxiing to the intersection of the inactive runway ('inactive' according to his interpretation of the Air Traffic Control Regulations) relatively fast. By changing the radio communication frequency of the aircraft, it might possibly have had to reduce speed and would have taken more time to cross the runway.

Conclusion

The term 'active runway' is not clearly defined in the Air Traffic Control Operations Manual.

As a result of not transferring crossing traffic, the undesired situation occurred in which two aircraft and one vehicle were present on the same runway and were being monitored on three different radio communication frequencies by three different persons.

When the aircraft that was crossing had vacated the runway, the runway controller switched off the 'runway occupied' indication. He also reversed the Boeing 737 strip holder. The text on the flight progress strip was again visible in the strip holder.⁵⁷ The runway controller did not use the red 'runway occupied' strip holder, nor was he under an obligation to do so. The runway controller then gave the Boeing 737, which was ready for take-off, clearance to depart while the bird controller was still present on the same runway with permission from the runway controller.

The runway controller issued both the ground controller and assistant 2 permission to allow the traffic under their charge to enter the runway. When crossing traffic or a bird controller has vacated the runway, it is standard practice to switch off the 'runway occupied' signal and to reverse the strip so that the text on the strip is again visible. The 'runway occupied' system at Amsterdam Airport Schiphol does not provide an indication of whether more than one vehicle or crossing aircraft are present on the runway whereas this situation does occur in practice. After 'reversing' the strip and switching off the 'runway occupied' signal, no further warning is given.

The 'runway occupied' signal can be activated in two different ways. It may be manually activated by the runway controller, as in the present case when he issued the bird controller permission – via assistant 2 – to proceed to inspect the runway. Another option is to switch off the relevant stop bar for an aircraft or vehicle that wants to cross a runway. Switching off the stop bar automatically activates the 'runway occupied' signal. In the first situation, the runway controller must carry out two activities to activate and de-activate the 'runway occupied' signal, i.e. activating and deactivating the signal. In a situation with a stop bar, the 'runway occupied' signal is automatically switched on and should only be switched off if the runway controller has cleared the runway for use. After a stop bar has been de-activated, the latter will prevent the runway controller from forgetting to reactivate the 'runway occupied' signal. The disadvantage is that the work procedure is not the same in all cases. This underlines the need for a proper 'runway occupied' signal that takes account of the number of vehicles and/or aircraft present on a runway.

⁵⁷ EUROCONTROL document on Air Traffic Control Situational Awareness of Occupied Runways. The document was drawn up by a working group set up following an EAPPRI recommendation. The document describes various methods used by various ATC towers to indicate 'runway occupied', including electronic means. It is striking that only the manual method indicating that a runway is occupied – by means of strip holders – expressly states that a separate strip must be used for every vehicle or aircraft present on an active runway.

Conclusion

The 'runway occupied' signal is activated in a variety of ways and does not provide any indication of dual runway occupancy.

The bird controller was monitoring several radio communication frequencies. In addition to the radiotelephone frequency (the runway channel) that he was using to communicate with assistant 2 in Dutch, he had switched on the Operations channel to communicate with Amsterdam Airport Schiphol. He was also monitoring two aviation frequencies. The bird controller had turned down the volume of the radios slightly to enable him to concentrate better on inspecting the runway. The runway controller warned him via the runway channel that a Boeing 737 was crossing intersection S2. When issuing the warning the runway controller used the microphone of assistant 2, who was on the telephone coordinating activities. The bird controller waited until the aircraft had crossed the runway before driving onward. The bird controller's vehicle was equipped with a strobe light in addition to the standard lights and flashing light. The vehicle also featured a transponder which serves as vehicle identification and improves the vehicle's visibility as seen on the radar/ground radar. However, in principle when visibility is good, as was the case at the time of the incident, the radar system is not used. Despite these measures the vehicle was not detected by the runway controller, or assistant 2, or anyone else in the ATC tower when the runway controller issued take-off clearance to the departing Boeing 737. The bird controller was at intersection S2 at that time and was driving along the runway at a speed of approximately 80km/h. At that moment, therefore, the runway inspection had not yet been completed. According to the runway controller the traffic situation was stable and it was not too busy. The radiotelephony recordings confirm this picture of the incident. The snow that was present caused light reflections, which may have reduced the visibility of the bird controller.

Although the bird controller is required to monitor the ATC tower frequency in accordance with his work instructions, the bird controller did not hear the runway controller issue take-off clearance to the departing Boeing 737. This can be explained by the fact that he had turned down the volume slightly on the radio communication equipment to concentrate on inspecting the runway. He had also failed to see that the aircraft had meanwhile proceeded to take-off. This was due in part to the fact that the bird controller was driving in the same direction as the aircraft that was taking off. The runway controller realised that a runway incursion had occurred after the bird controller had reported that he had vacated the runway via assistant 2.

The analysis of the RIASS test results (see the last section of 2.3.2) shows that the system generated a warning. In the test set-up, however, this warning could neither be seen nor heard by the runway controller. The runway controller may possibly have forgotten that the bird controller was still present on the runway on account of the limitations of the devices described above and the absence of a standard operating procedure.

Conclusion

The runway incursion occurred because the runway controller issued a Boeing 737 departing from Runway 24 take-off clearance while the bird controller was still present on the same runway with permission from the runway controller.

3.1.2 Situational awareness

In accordance with the procedures set out in the VDV, the bird controller communicated with assistant 2. The VDV also provides that an aircraft crossing an active runway must be transferred to the runway controller's frequency. The aircraft concerned was not transferred. This caused the undesirable situation to occur at the time of the incident in which two aircraft and one vehicle were present on the same runway and were being monitored on three different radio communication frequencies by three different air traffic controllers, including an assistant controller. This adversely affected the overall view of the situation on and around the runway (situational awareness) controlled by the runway controller. Consequently, the likelihood that the runway controller would switch off the warning signals after one of the two (the aircraft or KV2) had vacated the runway increased. This is what happened in the incident involving the bird controller, as a consequence of which the runway controller forgot that the bird controller was on the runway.

To reduce the number of incidents, it is vital to raise the runway controller's level of situational awareness in particular. Situational awareness will be increased by ensuring that the runway controller is in direct contact with all the traffic – both aircraft and vehicles – present on and around the runway. As a result the runway controller will not readily overlook a vehicle or aircraft. While direct contact between the runway controller and vehicles will increase the load on the runway frequency, it will alleviate the required coordination between the runway controller and assistant 2. If communications are carried out on a common frequency, all pilots and vehicle drivers directly involved in the use of the relevant runway will be able to hear each other. This will raise the level of situational awareness of all parties involved. If they are aware of the current overall situation around a specific runway, they will be able respond to a potential error on the part of the runway controller or the pilot where appropriate. This will create an additional safety barrier.

Conclusion

Failure to transfer crossing traffic from the ground controller to the runway controller adversely affected the runway controller's situational awareness. Direct contact between the runway controller and all vehicles and aircraft around the relevant runway will generally contribute to raising the runway controller's level of situational awareness as well as that of pilots and vehicle drivers.

3.1.3 Assistant 2

Assistant 2's role is to provide general assistance in the ATC tower. His key duties, according to the VDV, involve assisting the runway controller (safety net function), and to allow vehicles to cross and drive on runways, under the runway controller's responsibility. In addition, a number of his duties involve coordinating activities with various services at the airport.

The nature of the work performed by assistant 2 involves regularly conducting telephone calls with various airport departments. This was the case during the incident. In between giving the bird controller permission to enter the runway and the bird controller reporting that he had vacated the runway (around four and a half minutes), assistant 2 conducted two telephone calls lasting a total of three and a half minutes. This made it difficult for assistant 2 to continue to monitor the bird controller on the runway. Nonetheless, the description of assistant 2's duties and responsibilities includes assisting the runway controller (safety net function, see Appendix L).

Due to the number and range of duties performed by assistant 2 (guiding aircraft in the manoeuvring area, assisting the runway controller and frequently coordinating activities mainly by telephone) his level of situational awareness decreases. Consequently, assistant 2 cannot be expected to act as an effective safety net for the runway controller in all cases. During previous incidents of a similar nature assistant 2 also failed to detect and prevent a runway incursion, whether or not through the runway controller's intervention.

Conclusion

Given all the other duties that adversely affect his level of situational awareness, assistant 2 cannot be expected to act as an effective safety net for the runway controller in all cases.

3.1.4 Control measures

Air Traffic Control the Netherlands and Amsterdam Airport Schiphol are expected to identify the safety risks of runway incursions and take appropriate control measures on the basis thereof to ensure safety.

In this context, the Dutch Safety Board deems the following four main aspects important:

1. *Air traffic controller and bird controller working conditions*

The air traffic controller and bird controller must be in a position to perform their duties in a proper and safe manner.

2. *Realistic and practicable safety strategy*

A realistic and practicable safety strategy must be in place to prevent and control undesired occurrences. Such a safety strategy is based on the available standards, guidelines and best practices in the sector and on the individual insights and experiences and specific safety objectives of Air Traffic Control the Netherlands and Amsterdam Airport Schiphol.

3. *Learning from accidents and near accidents and improving safety strategy*

Safety strategy must be continuously evaluated by means of monitoring as well as conducting investigations into accidents and near accidents, which will serve as a basis for formulating improvements that can, in turn, serve as input for active management.

4. *Management guidance*

Management should ensure that the 'shop floor' is receptive to the continuous improvement of safety at work and clearly communicate deviations from procedures on the basis of clear agreements made with the parties in the surrounding area.

3.1.5 Control measures for the air traffic controller

To prevent air traffic controllers from forgetting that the runway is occupied, various systems have been developed and are employed by the Air Traffic Control tower at Schiphol:

- 'Runway occupied' signal (the lights for the relevant runway flash on the runway allocation panel, combined with a ticking sound).
- 'Runway occupied' strip.
- Reversing the strip of the next aircraft, which means that the information required for issuing clearance is not visible.

It is up to the air traffic controller to switch on these technical devices which, in turn, must ensure that he does not forget that the runway is occupied (safety net function). However, the air traffic controller might not only forget to switch on the device but also unintentionally ignore the signal function, or forget that it has been deployed. Moreover the system does not distinguish between one or several vehicles and/or aircraft present on a runway-in-use. In that case the system fails and the 'safety system' relies entirely on the user's memory. Literature clearly shows that the propensity for error is intrinsic to human behaviour.⁵⁸

⁵⁸ James Reason: Managing the Risks of Organizational Accidents, Sidney Dekker: The Field Guide to Understanding Human Error.

Although Air Traffic Control the Netherlands has conducted several risk analyses, no specific risk analysis was performed on the air traffic controller's duties in relation to the instruments available to him. This applies to dual runway occupancy in particular.

Similar incident

In 2009 an incident occurred at Cork Airport in Ireland which is highly similar to the Amsterdam Airport Schiphol incident. The runway controller was unaware that another vehicle was still on the runway when he removed the 'runway occupied' strip and issued a Boeing 737 take-off clearance. The vehicle drivers were communicating with another air traffic controller on a different frequency. The recommendations following the incident investigation included stipulating that the relevant runway frequency be used by vehicles when entering a runway, and using a separate 'runway occupied' strip for each vehicle, crossing aircraft, etc. present on the runway. These recommendations have meanwhile been implemented across the whole of Ireland.

RIASS (see the end of 2.3.2) is an important last resort safety net designed to prevent collisions, which – in accordance with the system's design – only starts functioning, however, when the runway incursion has occurred. Runway incursions involving a bird controller regularly occur at Schiphol. During the Dutch Safety Board's investigation two⁵⁹ further incidents occurred involving a bird controller. The latest incident took place in January 2012. RIASS issued a warning during that incident, whereupon the runway controller assessed the risk in line with the warning system set-up. In view of the speed of the departing aircraft, the wind and the distance between the aircraft and the Bird Control vehicle, the runway controller decided against aborting take-off.

Conclusion

Instruments used by the runway controller, such as the 'runway occupied' signal, the 'runway occupied' strip(s) and reversing the flight progress strip can reduce the risk of a runway incursion, but are unable to prevent it entirely. RIASS as the last resort safety net warns the runway controller that a runway incursion has occurred.

3.1.6 Control measures for the bird controller

Bird Control work instructions

A bird controller may be deployed by Air Traffic Control or the Airside Operations Manager, but he may also take action of his own accord. The bird controllers' work instructions state that the bird controller must drive down and inspect active take-off and landing runways if they have not been in use for 20 minutes or more for take-offs and landings. These instructions have been included under the heading 'Conditions' as a 'best efforts obligation'.

⁵⁹ One of the eight incidents referred to in the introduction occurred in January 2011.

The instructions also state that 'a bird controller must regularly drive down active take-off and landing runways on his own initiative.⁶⁰ This instruction is included under 'Background information'. The bird controller must drive down Runway 04-22 and other inactive take-off and landing runways at least once every two hours, according to the work instructions. The bird controller concerned stated that he endeavours to visually inspect an active runway every two hours. This aim is in line with the work procedure followed by the other bird controllers.

A best efforts obligation on the part of a bird controller is to inspect an active runway if it has not been used for a period of twenty minutes. The best efforts obligation for inactive runways and Runway 04-22 is to carry out an inspection at least once every two hours. However, it is up to the bird controller to take the initiative to carry out an inspection on an active take-off and landing runway, in which case the work instructions only provide that this must be done regularly. Moreover no provision has been incorporated specifying the optimum and maximum speed with which a runway inspection should be carried out (see Appendix D).

Conclusion

The bird controllers' instructions do not indicate how often active runways at Amsterdam Airport Schiphol should be inspected. No driving speed provisions have been incorporated either. The established work instructions for bird controllers are insufficiently clear on these points.

Communications with bird controllers

During interviews the bird controllers indicated that communications and the manner in which they work with the Air Traffic Control tower had improved. Nonetheless, they referred to assistant 2's failure to always adhere to the standard communication procedures as an undesirable factor. This mainly refers to assistant 2 providing incomplete readback of the permission requested by a bird controller. Failure to adhere to the standard communication procedures may also cause confusion among other parties, such as drivers of aircraft tugs.

Conducting communications with the ATC tower on the runway channel in addition to the OPS channel for the Airport, while simultaneously monitoring one or more aviation frequencies is described by the bird controllers as awkward, and difficult to do when it is busy. To illustrate the above, during a flight a pilot may only monitor one frequency on board the aircraft.⁶¹ The bird controllers are required to monitor the aviation frequency assigned to the relevant runway in addition to the frequencies they use for their own activities. As a result, the relevant bird controllers are unreasonably burdened with the task of picking up on errors made by air traffic controllers and pilots.

⁶⁰ Schiphol Bird Control Work Instructions A/OPS/AO/B version 5, dated 18 May 2010 pp. 15 and 16.

⁶¹ Pilots also monitor the emergency frequency, but in principle no communications are conducted on that frequency.

This means that – even though Air Traffic Control the Netherlands is formally responsible – in day-to-day practice responsibility for the bird controller's safety when they are present on a runway-in-use largely lies with the bird controllers themselves.

In the risk assessment conducted by Amsterdam Airport Schiphol in 2010 under the Working Conditions Act, it was established that a bird controller's *operating environment is hectic and that monitoring several frequencies is demanding (which affects one's own perception, the ability to think and respond)*. This risk assessment did not cover collision risk.

Moreover, during an interview with a group of bird controllers it emerged that a number of bird controllers feel they work in a subordinate role to air traffic controllers. Their perception of working in a subordinate role often makes them feel 'with or without good reason' that there is a barrier, as a result of which there is a lack of communication. This will not be the case if, for example, a bird controller detects a large concentration of birds on or near an active runway. He will then definitely warn Air Traffic Control and, where necessary, even have air traffic temporarily aborted. Bird controllers do sometimes feel there is a barrier in respect of another task, and that is inspecting an active runway. Bird controllers are highly service-oriented, they have a 'can do' attitude and will, if necessary, appropriately adapt their work procedure to the circumstances. This can create hazardous situations. In the interests of safety it is vital that air traffic controllers and bird controllers work as a team.⁶²

If, at the bird controller's discretion, circumstances so dictate, the bird controllers sometimes drive at high speed to carry out a quick runway inspection (up to 140km/h). This essentially rules out a proper inspection. Despite this fact, from time to time a bird controller still occasionally carries out a runway inspection at high speed. A bird controller rarely protests against the limited time he is given to inspect a runway. One of the reasons is that bird controllers perceive their role as subordinate. The work instructions do not help bird controllers in this area, as nothing has been laid down about the duration of a runway inspection and the speed at which this should be carried out.

In the context of the investigation, Amsterdam Airport Schiphol Management stated that an effective runway inspection can be carried out at a maximum speed of approximately 80km/h, and will then take about five minutes. Amsterdam Airport Schiphol Management stated that it was revising the bird controllers' work instructions.

Conclusion

Bird controllers cannot reasonably be expected to monitor several radio frequencies simultaneously in addition to their actual tasks. In addition, some bird controllers feel they work in a subordinate role to air traffic controllers. Consequently communications do not proceed optimally in all circumstances, which, in turn, increases the risk of runway incursions.

⁶² Compare Crew Resource Management (CRM) in the cockpit and Tower Resource Management (TRM) in de ATC tower.

3.2 Underlying causes

Runway incursion incidents involving bird controllers have occurred quite frequently over the past decade (three or four times a year). The safety management system in place at Air Traffic Control the Netherlands as well as at Amsterdam Airport Schiphol provides that incidents and accidents at the Airport must be closely monitored and investigated for the purpose of learning lessons and preventing recurrence. The safety management system in place at the two organisations has not yet brought about the prevention of repeated incidents with bird controllers on active runways.

Conclusion

The frequency of runway incursions involving a bird controller over the course of many years indicates that the risks are inadequately controlled in this area.

3.2.1 Inadequate runway incursion investigations by Amsterdam Airport Schiphol and Air Traffic Control the Netherlands

Processes at Amsterdam Airport Schiphol are closely linked to those of Air Traffic Control the Netherlands. Amsterdam Airport Schiphol is responsible for the infrastructure and Air Traffic Control the Netherlands uses the infrastructure.⁶³ However, to date the two organisations each conduct separate (internal) investigations into runway incursions, such as the incident involving the bird controller on 18 December 2010. When conducting investigations they do not always have disposal of all the relevant, requisite information held by the other party in order to conduct a thorough investigation. The internal investigations show that they focused mainly on the immediate cause, i.e. the air traffic controller had overlooked the vehicle. The aim of the recommendations in these investigations is to highlight to air traffic controllers the need to ensure they do not forget anything. The underlying causes were only investigated by the two organisations to a limited extent. Although the incidents recurred over the course of many years, the internal investigations do not provide recommendations aimed at conducting a fundamental review of the current work procedure.

Conclusion

The separate internal investigations performed by Amsterdam Airport Schiphol and Air Traffic Control the Netherlands into the occurrence of runway incursions focused mainly on the immediate cause of the incident. The underlying causes were investigated by the two organisations to a limited extent.

⁶³ At the request of Air Traffic Control the Netherlands, take-off runways are made available for certain periods for the take-off and landing of aircraft. If Air Traffic Control the Netherlands no longer requires a runway, responsibility for the runway is again transferred to Amsterdam Airport Schiphol.

Safety management systems at Amsterdam Airport Schiphol and Air Traffic Control the Netherlands

The investigation into the 18 December 2010 runway incursion - like the other runway incursions involving a bird controller - shows that the method described in the Amsterdam Airport Schiphol safety management system that was used to assign priority produced an outcome of 'unacceptable' and 'most critical' (see Appendix G).

Air Traffic Control the Netherlands uses Safety Significant Events (SSE) as a basis. According to the organisation, this system has classified this incident as '1C' (see Appendix G). Contrary to the Airport's system, the SSE system used by Air Traffic Control the Netherlands, does not take account of incident frequency, but determines this on the basis of expert judgement. However, the organisation does conduct safety assessments to assess the risks of changes in the Air Traffic Management system, which do factor in the frequency and (probability) of incidents occurring. In this particular case there was no change.

Regular 'Basic Safety Loop' consultations are held by Air Traffic Control the Netherlands. During the consultation meetings the participants discuss the status of incident investigations, monitor the number of outstanding recommendations, and discuss whether capacity for identifying safety issues (such as incident investigation, for instance) and capacity for resolving safety issues are still in sync. If necessary, issues are escalated to the Executive Board. A permanent item on the agenda of the consultation is the Risk Portfolio, which is a list of the major safety issues monitored continuously by Air Traffic Control the Netherlands. Runway safety is a topic that has featured on the Risk Portfolio from the outset. All the same, following the present and previous incidents involving a bird controller the safety management system failed to bring about control measures to prevent such incidents.

Similarly, the safety management system in place at Air Traffic Control the Netherlands, the design and structure of which differs from that of Amsterdam Airport Schiphol, should identify hazards at an early stage and prevent the repetition of a similar occurrence.⁶⁴ Like its counterpart at Amsterdam Airport Schiphol, the Air Traffic Control safety management system failed to bring about control measures to prevent such incidents.

Conclusion

Although Amsterdam Airport Schiphol and Air Traffic Control the Netherlands both have a certified and functioning safety management system in place, both systems failed to result in taking control measures to prevent runway incursions involving a bird controller.

⁶⁴ Safety Management at LVNL, version 3.0, April 2011, p.14; 2.3.1.

Use of internal procedures at Air Traffic Control the Netherlands

The fact that the ground controller did not transfer the Boeing 747 that was crossing to the controller (deviation from procedure) played a role in the incident. Deviations from the transfer procedure were also found to be a causal factor in previously investigated runway incursions. In one particular incident⁶⁵ the ground controller omitted to transfer the aircraft to the runway controller, which consequently adversely affected situational awareness of traffic around the runway. As stated above, the safety management system in place at Air Traffic Control the Netherlands failed to preclude such transgressions. If a safety management system functions properly, recurring deviations from procedure will be flagged. The next step is to determine whether the procedure should be adjusted. Should this not be the case, control measures should be taken to ensure that the internal regulations laid down by Air Traffic Control the Netherlands are followed. The fact that Air Traffic Control deviated from internal regulations was found to be a causal factor in several previous incidents investigated by the Dutch Safety Board, see section 2.6. The position taken by Air Traffic Control the Netherlands' Management is that the individual runway controller must have the ability to work autonomously and independently, within defined parameters.⁶⁶ In previous Dutch Safety Board investigations it was established that the Air Traffic Control Operations Manual is regularly used as a guideline, as a set of non-binding provisions, rather than regulations. This is consistent with the view of Air Traffic Control the Netherlands' Management mentioned above.

The Dutch Safety Board believes that air traffic controllers will only be able to work autonomously and independently in a safe manner if the relevant parameters have been clearly defined. This is not always the case in the VDV. An example of the above is that the VDV does not clearly set out when an available runway should be considered active. Consequently, as with the present incident, a runway may be considered inactive while around 30 seconds later an aircraft is issued clearance to take off from the same runway. Air Traffic Control the Netherlands is now rewriting the VDV to create a new Operations Manual. According to Air Traffic Control the Netherlands, the new Operations Manual will more clearly explain what the actual regulations are and what information should be regarded as guidelines. The need to do so was established by the Dutch Safety Board in previous investigations.

The VDV does not set out a procedure for using the 'runway occupied' strip and for reversing the flight progress strip to indicate that a runway is occupied. As no rules have been set out in the VDV, the air traffic controller is free to decide whether to use these aids. This creates unsafe situations because there is no clarity on the work procedure of the individual team members within the changing teams of Air Traffic Control staff. Air Traffic Control the Netherlands Management has allowed this situation to persist and has not established procedures for using the 'runway occupied' signal.

⁶⁵ Runway incursion at Amsterdam Airport Schiphol, March 2007, see Appendix H.

⁶⁶ Safety@lvnl.nl, first year of publication, number 2, pp. 4 and 5.

Conclusions

Use of the 'runway occupied' signal has not been stipulated in the regulations. Insufficiently clear internal regulations formed a causal factor in the present and previously investigated runway incursions. This was established by the Dutch Safety Board during previous investigations. Air Traffic Control the Netherlands is rewriting the regulations to create a new Operations Manual.

3.2.2 Controlling the safety risks of runway incursions at Amsterdam Airport Schiphol

Although a number of safety enhancement initiatives have meanwhile been implemented (including establishing the Schiphol Safety Platform Schiphol and the Runway Safety Team as part of the Platform, implementing RIASS and installing runway guard lights⁶⁷), the safety management systems of both Amsterdam Airport Schiphol and Air Traffic Control the Netherlands have not brought about the prevention of this type of runway incursions.

Section 3.2.1 shows that Amsterdam Airport Schiphol and Air Traffic Control the Netherlands insufficiently control the safety risks of runway incursions involving bird controllers. This is evident from the results of the individual investigations conducted by these parties. They have not looked into the underlying causes, etc. This is partly because the parties collaborate insufficiently and rarely hold each other accountable for the risks.

Not only do the parties have individual responsibility, they also have collective responsibility for the system as a whole. This is a principle that the parties endorse. If a risk posed by one party could have consequences for another party at the airport, or if the other party concerned can contribute to controlling the risk posed by the accountable party, the parties must enable each other to do so collectively. This also means that the parties involved must and should not be afraid to hold each other accountable for the risks.

In this context it is symptomatic that neither Amsterdam Airport Schiphol nor Air Traffic Control the Netherlands independently or jointly performed a risk analysis on the (individual and joint) tasks of the bird controller and/or the air traffic controller, whereas there was sufficient reason to do so on account of the recurrence of this type of runway incursion. In addition, Amsterdam Airport Schiphol, as the employer, did not perform a risk analysis of the bird controller's activities pursuant to the Working Conditions Act.⁶⁸ According to Amsterdam Airport Schiphol this is because the risk of collisions with vehicles is included in the risk of runway incursions, for which a risk analysis was carried out in 2012. See also control measures for the air traffic controller and bird controller in sections 3.1.5 and 3.1.6 respectively.

⁶⁷ Runway guard lights are yellow flashing lights positioned on each side of a taxiway warning drivers or pilots that they are approaching a take-off or landing runway.

⁶⁸ A collision involving a Bird Control vehicle was not included in a Health and Safety risk evaluation and assessment conducted in 2007 because the view taken was that aviation safety plays a role. A risk review of the fire, aviation safety and environmental aspects of the process in the relevant part of the airport was conducted at the end of 2010. Various types of collisions were identified. The collision involving a Bird Control vehicle was not named as a separate risk.

Runway Safety Team

While there are examples of successful collaborative activities in various areas in the Schiphol Safety Platform (for instance taxiing routes, thunderstorm safety procedures and the use of loading quays), this does not yet apply to incident investigation at Schiphol. In the Runway Safety Team, which forms part of the Schiphol Safety Platform, the participating parties discuss runway incursion incidents with each other and compare the conclusions of each separate investigation. Information is (partially) shared – even outside the Runway Safety Team meeting – only after the various parties have conducted their own investigation. Only the outcomes of the separate international investigations are discussed. However, no joint conclusions and measures are established.

The internal safety investigation conducted by Amsterdam Airport Schiphol into two incidents involving a bird controller states that – because the two parties do not have access to all relevant information and they have insufficient insight into each other's processes – it is not possible for each individual party to form a complete picture of the causes that have led to an incident.⁶⁹

The report conclusions include the following: '*A complete picture of the causes which led to the incident could not be obtained because of insufficient insight into the processes of Air Traffic Control the Netherlands.*' The report contains the following recommendation: *Examine how closer collaboration between Amsterdam Airport Schiphol and Air Traffic Control the Netherlands can be achieved during investigations into runway incursions.* In its response to the draft version of the Dutch Safety Board's report, the Ministry of the Infrastructure and the Environment stated: *'It is strongly recommended to urge the sector to jointly conduct a further investigation into the present and future incidents of a similar nature to effectively identify lessons learned and improvement areas.'*

Conclusion

Amsterdam Airport Schiphol and Air Traffic Control the Netherlands still insufficiently control the safety risks of repeated runway incursions involving bird controllers. The parties still collaborate insufficiently and still rarely hold each other accountable for the risks. The collaborative efforts in the Schiphol Safety Platform in this area have failed to bring about tangible improvements.

The Dutch Safety Board concurs with the sector that runway safety can be ensured through collaboration among the aviation parties in the Netherlands, such as in the Schiphol Safety Platform. After all they are the parties with the highest level of expertise. The Dutch Safety Board, however, cannot but conclude that the Schiphol Safety Platform has been unsuccessful in getting the parties involved take appropriate control measures. This is reflected in the measures that were not implemented or partially implemented following the Delta incident, see section 2.4.

⁶⁹ Conclusions and recommendations in the Amsterdam Airport Schiphol investigation into two incidents involving a Bird Control vehicle (18 December 2010 and 13 January 2011).

Apart from the measures that were taken, four activities were postponed, or were partially or never carried out:

1. Postponement of the construction of Taxiway Tango;
2. Discontinuation of the Runway Control project;
3. Incomplete review and implementation of the European Action Plan for the Prevention of Runway Incursions;
4. No follow-up on the internal recommendation made by Air Traffic Control the Netherlands to review the driving direction of vehicles on a runway.

Re 1. Postponement of the construction of Taxiway Tango

Amsterdam Airport Schiphol has stated that the construction of Taxiway Tango will go ahead. Completion is scheduled for 2015. A possible intersection at the beginning of Runway 24 to cargo Apron S is a measure for reducing the frequency of aircraft and/or vehicles crossing at S2.

Re 2. Runway Control

During the Dutch Safety Board's investigation, Amsterdam Airport Schiphol completed project Wave in April 2012. The project resulted in three improvement areas, two of which are relevant to this investigation. First, efforts will (once again) be undertaken to improve the 'runway occupied' signal. Second, a fundamental review of the current work procedure has been proposed. The proposals in this area tie in with the starting points of Amsterdam Airport Schiphol/Air Traffic Control the Netherlands/the Inspectorate for Transport, Public Works and Water Management in phase 1 of the Runway Control project in 2003 (see section 2.4.3). In presenting these proposals, Amsterdam Airport Schiphol has come back on the issue of Air Traffic Control the Netherlands unilaterally discontinuing the Runway Control trial, to which the Airport had more or less tacitly consented.

Air Traffic Control the Netherlands recently began looking into the recommended measures' potential contribution to safety. This means that well over ten years after preparing for the Runway Control project, Air Traffic Control the Netherlands will once again look into the possible positive effects on safety of bird controllers conducting direct communications with airport controllers, whereas the three largest (and numerous smaller) civil airports in Europe have meanwhile adapted their work procedures in line with the EAPPRI and ICAO recommendations.

Ad 3. European Action Plan for the Prevention of Runway Incursions (EAPPRI)

Both EAPPRI documents contain beneficial recommendations which have garnered wide support. Both Amsterdam Airport Schiphol and Air Traffic Control the Netherlands endorse the EAPPRI. While in a number of respects the work procedure at Amsterdam Airport Schiphol is in line with the recommended work procedure, in other respects it is not.

In general both Amsterdam Airport Schiphol and Air Traffic Control the Netherlands concur with the recommendations in the EAPPRI documents. In many respects the work procedure at Schiphol is in line with the recommended work procedure set out in the EAPPRI, but in a number of other important respects it is not. The above three recommendations were not implemented.

In 2005 Air Traffic Control the Netherlands assessed the recommendations in EAPPRI document 1.4 as part of a study into operational runway safety concepts at Schiphol.⁷⁰ No such assessment has as yet taken place with respect to the revised EAPPRI document, version 2.0 (which was published a year after the incident).

The EAPPRI recommendations on Runway Control were reviewed in the Safety, Efficiency and Environmental Impact Assessment [Veiligheid efficiency milieueffectrapportage, VEMER] of Runway Protection.⁷¹ It was concluded that this would have a net negative effect on safety, in particular because drivers of aircraft tugs would have a heavier workload and would feel pressurised because of having to communicate correctly.

It is striking that phase 1 of the Runway Control project in the VEMER was not considered as a separate issue. Phase 1 involved bird controllers and the Airside Operations Manager driving down the length of a runway. Crossing traffic such as aircraft tugs do not play a role in this context. The potential limitations of aircraft tug drivers are therefore irrelevant and do not explain why phase 1 has not been implemented to date.

Furthermore, according to the VEMER, providing traffic information to the relevant air traffic, as already carried out in practice, was expected to have a positive effect on situational awareness. This is only true to a certain extent; if an air traffic controller forgets a bird controller, no traffic information will be provided as to the bird controller's location.

The Amsterdam Airport Schiphol and Air Traffic Control the Netherlands safety management systems do not state in what manner the recommendations set out in the EAPPRI documents are assessed, nor the officer responsible for doing so. The responsibility for monitoring and assessing external documents of this nature has neither been set out clearly in the safety management system of Amsterdam Airport Schiphol nor that of Air Traffic Control the Netherlands. Although the latter has indicated that the EAPPRI documents are important, it was also stated that no one will be tasked with monitoring follow-up on the documents.

Global Watch

In the safety management system in place at Air Traffic Control the Netherlands, Global Watch is taken to mean monitoring relevant safety information made available worldwide, learning lessons from the information and responding to recommendations. This applies to internal recommendations made by Air Traffic Control the Netherlands and those made by external parties.⁷² The organisation featured the above incident in Cork captioned 'Runway occupied' in its online publication Safety@LVNL.⁷³ The recommendation (conducting communications on the runway frequency, including vehicles) was inserted in a text box. The incident in Ireland did not prompt Air Traffic Control the Netherlands to adjust its work procedure. The organisation's safety management system says that no formal follow-up mechanism is in place for these types of documents.

⁷⁰ CONOPS Runway Safety, D/R&D 04/030 version 1.5; 20 July 2005

⁷¹ D/R&D 04/056-I; VEMER Runway protection Volume I v1-0.doc; version 1.0; final, p. 79 et seq.

⁷² Safety Management at LVNL, S&P/2011/51631, version 3.0, April 2011, p. 20.

⁷³ Number 2/2011).

Communication procedures

The EAPRI and the ICAO Manual on the Prevention of Runway Incursions both reiterate the importance of good communications. Among other things, ICAO says that all communications relating to runway operations must be carried out in line with the ICAO language requirements for air-ground radiotelephony communications. The use of standard aviation English at international airports will improve the 'situational awareness' of all those using the frequency. In addition it is recommended that all communications associated with runway operations (vehicles, crossing traffic, etc.) should be conducted on the same frequency as utilised for the take-off and landing of aircraft. Contrary to the above recommendations, at Schiphol communications between bird controllers and Air Traffic Control are not conducted on the aviation frequency assigned to the runway-in-use, and in the Dutch language.

Procedures at a number of other European airports

During the investigation information was obtained about the current procedures at a number of other major European airports (including London Heathrow, Frankfurt Airport and Paris Charles de Gaulle). The information shows that in line with the European and ICAO recommendations, all traffic on a runway-in-use (both aircraft and vehicles) conduct communications on the aviation frequency assigned to that particular runway. See Appendix J, procedures at other airports.

Considering the stature of the organisations involved (among them the Ministry of Infrastructure and the Environment) in drawing up the EAPPRI document and the wide endorsement and application thereof, the effects of the recommendations were not examined in detail as part of this investigation.

Conclusion

At Amsterdam Airport Schiphol not all traffic on a runway conducts communications on the aviation frequency of the runway-in-use. This means that the work procedure at Amsterdam Airport Schiphol deviates from that of other large European airports, and from the European as well as ICAO recommendations.

Ad 4. Driving direction on a take-off or landing runway and the time available for a runway inspection

Vehicles drive on an active runway at Amsterdam Airport Schiphol in the direction of runway movements, barring a few exceptions. In principle, this is not the safest method because aircraft approach Bird Control vehicles from behind and aircraft are only visible to a bird controller in the mirrors of his vehicle or if he turns his head around. The EAPPRI document recommends examining the potential safety gains of carrying out runway inspections in the opposition direction to runway movements. Air Traffic Control the Netherlands has not followed up the recommendation in its 2007 safety study to examine the desired driving direction for Bird Control runway inspections, without having taken a formal decision to that end. The study was not carried out.

An immediate consequence of the above is that the decision on the driving direction – and thus weighing the safety factor against the capacity factor – lies with the individual bird controller. Each a time a bird controller proceeds to inspect a runway, he must weigh these factors in deciding on the driving direction. When carrying out an inspection in the direction of runway movements, he can start driving fairly soon after the aircraft starts moving. When carrying out an inspection in the opposite direction to runway movements, he can only start driving when the aircraft has lifted off. The latter option means that the runway will be occupied for a longer period. If he were to choose this option for safety reasons, he will not readily be granted permission for capacity reasons. A bird controller therefore generally opts to drive in the direction of runway movements. The bird controllers have found that Air Traffic Control the Netherlands will in that case be more inclined to grant them permission to enter a runway. It furthermore emerged that during an inspection carried out in the opposite direction to runway movements, for capacity reasons Air Traffic Control frequently already allows an aircraft to taxi along the runway. When this occurs, the aircraft's lights are regularly switched on, which glare and as a result blind the bird controller making it more difficult for him to judge whether the aircraft is standing still or moving. For this reason too bird controllers generally choose to carry out runway inspections in the same direction as runway movements.

The time available for a runway inspection varies. In principle sufficient time will be available to carry out an effective inspection on a runway due to start operating. The time available to inspect an active runway for the presence of FOD or birds, hence in between landing and take-off traffic, is usually limited. The Airport indicated that around five minutes will be needed to perform an effective inspection, which must be carried out at a maximum speed of approximately 80km/h. No guidelines are provided for dealing with situations in which the bird controller must wait a long time before being permitted to drive down the runway. The time needed for a runway inspection on an active runway has not been laid down in the bird controllers' work instructions. The parties have meanwhile entered into consultation about changing the situation.

In its capacity forecasts and briefing sessions, which take place at least four times every 24 hours, Air Traffic Control the Netherlands weighs up the factor of safety against capacity. This does not include the time required for scheduled runway inspections.

It should be noted that under certain circumstances the individual air traffic controllers too must weigh up the factor of safety against capacity. This was the conclusion drawn in two investigation reports published by the Dutch Safety Board in 2010.⁷⁴

⁷⁴ Near collision between an Airbus A318 and a Boeing 737, Schiphol, 6 December 2007, and Take-off from Taxiway at Schiphol, 10 February 2010.

Conclusion

Air Traffic Control the Netherlands does not take account of scheduled runway inspections in capacity planning. This therefore means that it is up to the bird controller and air traffic controller to weigh up the factor of capacity against safety when fitting in runway inspections.

3.2.3 Absence of a safety net

According to the Dutch Safety Board, the response to the recommendation in the report on the Delta incident, stating that 'additional duties should not be imposed on the ATC tower supervisor' created the impression that this recommendation had been followed and that the safety net function had improved. Following various runway incursions, the Dutch Safety Board asked Air Traffic Control the Netherlands questions about supervision and how this related to a safety net.

Air Traffic Control the Netherlands explained that it had acted on the recommendation in the Delta incident report by not allowing the ATC tower supervisor to provide training while on duty, as was the case in the Delta incident. Air Traffic Control the Netherlands also stated that the purpose of the supervisor's role is not to take detailed corrective action and thus function as a safety net. Neither is this stated in the description of the ATC tower supervisor's duties and responsibilities.⁷⁵ In reality the supervisor has a role in directing the operational process (staffing, choice of runway combinations, assigning handling capacity, etc.). Air Traffic Control the Netherlands also stated that the supervisor is not expected to be present in the ATC tower at all times.

Runway incursions occur among supervisors who do not perform any additional duties (September 2005 and 18 December 2010) and those who do perform additional duties (21 January 2012). The investigated runway incursions (involving a bird controller) show that there is no demonstrable link between the presence of a supervisor and combining a supervisor's role with that of a runway controller.

The supervisor's number and range of duties (see Appendix L) preclude the supervisor from functioning as a safety net for the other individual air traffic controllers.

However, given assistant 2's job description, he should in fact be able to act as a safety net. In effect Air Traffic Control the Netherlands says that it is important to have a safety net function to support the runway controller. This is not difficult to understand, given that it is evident from literature that account must be taken of the occurrence of human error. As previously mentioned in section 3.13, given all the other duties which adversely affect his level of situational awareness, assistant 2 cannot be expected to act as an effective safety net for the runway controller.

⁷⁵ VDV 2, 11 March 2010, Section 7.01. See Appendix L.

When additionally taking account of the previously established failures of the technical instruments available to the air traffic controller and the absence of established procedures setting out their use (section 3.1.5), the conclusion drawn is that the ATC tower process has no adequate safety net to deal with deviations to standard procedure under all circumstances. In the light of the above, combined with the failure to take control measures (section 3.2), this resulted in the occurrence of runway incursions involving a bird controller at a frequency of three or four times a year on average.

Conclusion

Air Traffic Control the Netherland does not yet control all aspects of the risks associated with runway incursions involving a bird controller at Schiphol. The existing procedures and instruments do not in all situations form an adequate safety net for potential human error on the part of the runway controller.

3.3 Supervision

System of supervision

In broad terms, the Inspectorate's role has changed. More than in the past the Inspectorate carries out a risk-oriented supervision policy, which is based on the principle of 'trust, unless'. In past decade the Aviation Inspectorate has transitioned from product supervision to more systemic supervision. This is a global trend. Systemic supervision entails performing audits and theme-based inspections to examine to what extent a business controls its processes. If a business controls its processes, it will be awarded a certificate. Air Traffic Control the Netherlands and Amsterdam Airport Schiphol have both been awarded certification by the Inspectorate for Transport, Public Works and Water Management. Regular audits and inspections are performed at agreed times to assess whether the certificate may be reissued or extended.

Despite the certification and the underlying inspections and audits, the same incidents continue to occur. Certification and the processes arising from certification for the organisations involved have not helped to prevent runway incursions involving a bird controller.

Although the Human Environment and Transport Inspectorate has indicated in its 2011 supervision programme that runway incursions form a key objective for supervision, in practice this has not (yet) translated to a higher number of specific and in-depth audits in this area. As a result of the Delta incident, the Dutch Safety Board formulated recommendations and the parties involved took measures to prevent runway incursions, a description of which can be found in sections 2.4 and 3.2.2.

On 30 November 2011 the Inspectorate for Transport, Public Works and Management performed a theme-based inspection at Amsterdam Airport Schiphol⁷⁶ focusing on the prevention of bird strikes and the correlation with runway incursions. It is striking that the relevant ICAO and EAPPRI documents do not appear on the list of documents examined by the inspectors. Only a number of work instructions were examined. The Inspectorate indicated that this is consistent with the character of the inspection.

The Dutch Safety Board finds it odd that a theme-based inspection does not involve examining to what extent the EAPPRI recommendations have or have not followed. Although EAPPRI does not contain any laws or regulations, the Ministry of the Environment and Infrastructure has indicated, by rendering assistance in drawing up the document, that it endorses the EAPPRI as a means of contributing to the prevention of runway incursions. By rendering assistance the Ministry has undertaken to promote the implementation of the EAPPRI recommendations.⁷⁷

The Inspectorate states that systemic audits involve assessing whether work instructions comply with laws and regulations. Theme-based or product inspections assume that this is the case. The above means that the EAPPRI documents are neither reviewed during audits, nor during theme-based inspections.

Although it is stated that the risk areas specifically identified in EAPPRI document 2.0 were examined with respect to the correlation with runway incursions, nothing is mentioned about communications between Air Traffic Control and the bird controllers not being conducted in accordance with the recommendations in the EAPPRI document. In the inspection report the Inspectorate states that a bird controller explained that he adapted his driving speed to the time available between two landing aircraft. As a consequence a runway is sometimes inspected at too high a speed (around 140km/h), which compromises the effectiveness of the runway inspection. However, this has not led the Inspectorate to conclude that this adversely affects safety.

This means that it is largely up to the individual controller to weigh up the factor of safety against the time available between two aircraft (capacity). While this has indeed been identified by the Inspectorate, it has not drawn the conclusion that Bird Control has a role subordinate to that of Air Traffic Control. The Inspectorate implicitly acknowledges the subordinate position of Bird Control to Air Traffic Control and capacity at the Airport.

The general picture that has emerged from the theme-based inspection is that the inspection was superficial, its scope limited and that it failed to bring to light the underlying causes of runway incursions involving a bird controller (such as not operating in accordance with the ICAO and EAPPRI recommendations at Amsterdam Airport Schiphol).

⁷⁶ Inspectorate for Transport, Public Works and Water Management, theme-based inspection 'Bird strikes and the correlation with runway incursions' at Amsterdam Airport Schiphol, dated 8 December 2011, Version 1.0.

⁷⁷ EAPPRI edition 2.0; statement of commitment: 'The organisations that contributed to this Action Plan are totally committed to enhancing the safety of runway operations by advocating the implementation of the recommendations that it contains.'

The Inspectorate has stated that the purpose of the theme-based inspection in the first instance is to examine the Bird Control work procedure on a take-off and landing runway and communications conducted between the bird controller and the runway controller at Air Traffic Control the Netherlands. The Dutch Safety Board wonders what is done with the other information collected during the inspection.

Implementation of supervision

The initially active role of the Inspectorate for Transport, Public Works and Water Management, as is evident, for instance, from its involvement in the Runway Control project and the theme-based inspection performed later, has changed to a more distant and more passive role. As a result, in the context of systemic supervision failures in the safety management systems of Air Traffic Control the Netherlands and Amsterdam Airport Schiphol have either not been identified since the discontinuation of the Runway Control project in 2003, or have been detected but not been remedied. The individual approach of the two organisations has generated insufficient structural results. The Human Environment and Transport Inspectorate has failed to take adequate action in respect of the above.

Furthermore, it is evident from several incidents that, contrary to the general rule in the Air Traffic Control Operations Manual, traffic wishing to cross an active runway is not always transferred to the runway controller. The Management of Air Traffic Control the Netherlands has responded inadequately to identified deviations and possible ambiguities in its internal procedures.

In the Dutch Safety Board's opinion, the failure of the Inspectorate to identify these shortcomings is attributable to the low key role it has continued to assume.

In this context too, the Inspectorate should assume a more proactive role as the keystone of the aviation safety chain. The Inspectorate has stated that audits and inspections are always spot checks which do not guarantee 100% coverage. Irrespective of the above, the supervisory authority nonetheless forms an integral part of the system no matter what role it performs or how limited its role may be. The bottom line is to identify those parts of the system that do not work properly (if at all) and to urge the organisation to make improvements, responsibility for which lies with the organisation concerned. This can only be achieved by identifying the defects.

Safety risk often revolves around coordination issues. The Coordination Regulations between Amsterdam Airport Schiphol and Air Traffic Control the Netherlands relate to coordination between the two organisations in the area of (supervision of) safe and orderly operations at the Airport. These Regulations, which require the consent of the Minister of Infrastructure and the Environment, can serve as an instrument to help improve coordination between the two organisations. The Dutch Safety Board is of the opinion that this instrument was insufficiently utilised. This is evident, among other things, from the Inspectorate's finding that Air Traffic Control the Netherlands had failed to appoint an officer as referred to in the Coordination Regulations for a period of well over a year. Consequently, no formal consultation as required under the Regulations was held during the same period.

The incidents involving bird controllers occur at the interface of both parties' operations. Consequently, neither party is able to individually control the overall risk. Connections, collaboration and coordination are essential. The above should be addressed by the supervisory authority. The latter failed to undertake adequate action on these issues.

Despite the fact that Dutch aviation parties recognise the need to collaborate to ensure safety, as in the Schiphol Safety Platform, the parties have had limited success in taking appropriate control measures. The collaboration in this area between Amsterdam Airport Schiphol and Air Traffic Control the Netherlands, which is still too limited, can be offset by the greater involvement of the Human Environment and Transport Inspectorate (the legal successor to the Inspectorate for Transport, Public Works and Water Management). This was not the case in the incident involving KV2.

The Ministry of Infrastructure and the Environment has stated that supervision is the keystone in ensuring and sustaining safety to the best possible extent. This means that, if the organisations fail to resolve the problem, as in the case of runway incursions involving vehicles, the government – which by its own account functions as the keystone – must intervene.

In 2006 the Inspectorate joined the Schiphol Safety Platform as an observer. A few years later the Management of both the Human Environment and Transport Inspectorate and the Ministry of Infrastructure and the Environment began attending Schiphol Safety Platform meetings as observers. The conclusion may be drawn that both the supervisory authority and the Ministry are aware of the coordination issues. However, this has not yet resulted in any tangible improvements.

Conclusion

The certification held by the organisations involved was found to provide insufficient guarantees for controlling the safety risks of runway incursions involving vehicles on a runway. The options offered in the Coordination Regulations are insufficiently utilised. A more integrated and systematic approach is required to adequately deal with such runway incursion risk. This must be addressed by the supervisory authority.

4 CONCLUSIONS

The conclusions set out below have been drawn from the investigation into the runway incursion.

Immediate causes of the occurrence of the runway incursion

1. The runway incursion occurred because the runway controller issued a Boeing 737 departing from Runway 24 take-off clearance, after other traffic had crossed the runway, while the bird controller, whom he had overlooked, was still present on the same runway with permission. The air traffic controller's overall view of the situation on and around the runway which he was monitoring was reduced because there was no direct contact between the air traffic controller and all vehicles and aircraft on and around the relevant runway. The 'runway occupied' signalling system does not distinguish between situations in which one or several vehicles and/or aircraft are present on the runway-in-use.
 - a. The aircraft taking off, the aircraft that was crossing and the bird controller were conducting communications on different aviation frequencies/channels.
 - b. The crossing traffic was not transferred to the aviation frequency of the relevant, active runway.
 - c. The term 'active runway' is not clearly defined in the Air Traffic Control Operations Manual.
 - d. The 'runway occupied' instruments in the ATC tower do not provide the runway controller any indication of the number of vehicles or aircraft that are (still) occupying the runway. No procedure has been set out in the Air Traffic Control Operations Manual for the use of the 'runway occupied' strip and for reversing the flight progress strip. Consequently, these instruments (combined with the runway allocation panel) are ineffectively utilised.

Underlying causes of the runway incursion

2. At Amsterdam Airport Schiphol bird controllers (and in certain circumstances air traffic controllers too) must make choices concerning safety and runway capacity when carrying out inspections of take-off or landing runways-in-use.
 - a. At Amsterdam Airport Schiphol not all traffic conducts radio communications on the aviation frequency of the runway-in-use. This means that the work procedure at Amsterdam Airport Schiphol deviates from that of other large European airports, and from the European as well as ICAO recommendations.

- b. At Amsterdam Airport Schiphol bird controllers are expected to monitor several aviation frequencies simultaneously when carrying out runway inspections. This is an unreasonable requirement. Moreover, some bird controllers feel they work in a subordinate role to air traffic controllers, which may negatively affect communications.
 - c. The instructions laid down for bird controllers concerning the number of times active runways at Amsterdam Airport Schiphol must be inspected, are not clear enough.
 - d. The current instruments used by the runway controller, such as the 'runway occupied' signal, the 'runway occupied' strip(s) and reversing the flight progress strip reduce the risk of a runway incursion, but are unable to prevent it entirely.
3. Safety is a key concern for both Amsterdam Airport Schiphol and Air Traffic Control the Netherlands. As regards the aspect of preventing runway incursions involving a bird controller, the risks are not yet adequately controlled. This is caused, in part, because the parties do not yet collaborate sufficiently and rarely hold each other accountable for the risks. Despite the fact that Dutch aviation parties collaborate in ensuring safety, as in the Schiphol Safety Platform, they have had limited success in taking adequate control measures.
- a. The separate internal investigations performed by Amsterdam Airport Schiphol and Air Traffic Control the Netherlands into the 18 December 20120 runway incursion focused mainly on the immediate cause of the incident. The underlying causes were investigated by the two organisations only to a limited extent. The Schiphol Safety Platform does not have the mandate to conduct a thorough investigation into the (underlying) causes of runway incursions.
 - b. The safety management systems of both Amsterdam Airport Schiphol and Air Traffic Control the Netherlands have not brought about control measures such that runway incursion incidents involving a bird controller are prevented or substantially reduced in number.
 - c. No joint evaluation was held concerning the early termination of the trial enabling aircraft and vehicles to conduct communications on the aviation frequency of the runway-in-use, nor was a further investigation performed into the desired driving direction for Bird Control runway inspections.
 - d. Apart from RIASS, which as a last resort safety net warns that a runway incursion has occurred, there is no effective safety net for a potential human error on the part of the runway controller.
 - e. Scheduled runway inspections on runways-in-use are not included in capacity planning by Air Traffic Control the Netherlands. This there means that it is up to the bird controller and the air traffic controller to weigh up the factor of capacity against safety when fitting in runway inspections.

4. The collaboration between Amsterdam Airport Schiphol and Air Traffic Control the Netherlands in the area of safety, which is still too limited, must now be addressed by the Ministry of Infrastructure and the Environment. An integrated and systematic approach at Amsterdam Airport Schiphol is required to adequately address runway incursion risk.
 - a. Failures on the part of Amsterdam Airport Schiphol and Air Traffic Control the Netherlands that contributed to the number of runway incursions involving a bird controller have not prompted the Human Environment and Transport Inspectorate to take measures which tangibly reduced these failures.
 - b. The failures in the collaboration between Air Traffic Control and Amsterdam Airport Schiphol are not evident in the certification held by both organisations and continue to exist, despite the collaboration in the Schiphol Safety Platform.
 - c. The opportunities offered in the Coordination Regulations for assuring the quality of collaboration are insufficiently utilised by the Ministry of Infrastructure and the Environment.

5 RECOMMENDATIONS

The Safety Board has formulated the following recommendations:

To: Air Traffic Control the Netherlands and Amsterdam Airport Schiphol

1. Assess the procedure for vehicles on take-off and landing runways at Amsterdam Airport Schiphol against the EAPPRI and ICAO recommendations.
2. Align the safety management systems of both organisations in areas where the parties each have inextricably linked tasks, such as the use of runways.
3. Conduct investigations into incidents at Amsterdam Airport Schiphol in such a manner that information is shared, and use this as a basis for determining joint conclusions and measures.

To: Air Traffic Control the Netherlands

4. Design the runway occupancy warning system such that the signals also indicate the number of vehicles or aircraft that occupy or continue to occupy the runway, and incorporate the procedure to be followed into the regulations.
5. Lay down unequivocally in the regulations when a runway-in-use should be considered 'active'.

To: Amsterdam Airport Schiphol

6. Structurally reduce the frequency of aircraft crossing Runway 24 midway by completing the postponed alternative aircraft route to and from the cargo apron without delay.
7. In consultation with Air Traffic Control the Netherlands, define clear parameters within which Bird Control may carry out the requisite runway inspections effectively.

To: the Schiphol Safety Platform

8. Ensure that investigations into incidents at Amsterdam Airport Schiphol are conducted in such a manner that parties share vital information, and use this as a basis for jointly determining conclusions and measures.

To: the Minister of Infrastructure and the Environment

9. Decisively fulfil government responsibility for overall aviation safety. Impose sanctions, for instance, if the parties fail to adequately control the risks identified and reduce them to a level that is as low as is reasonably practicable within an agreed time frame.

APPENDIX A

EXPLANATION OF THE INVESTIGATION

Reason for the investigation

On 18 December 2010 a runway incursion involving a civil aircraft and a bird controller occurred at Amsterdam Airport Schiphol. A runway incursion is defined as 'any occurrence at an aerodrome involving the incorrect presence of an aircraft, vehicle or person on the protected area of a surface designated for the landing and take-off of aircraft'. No one was physically injured during the incident.

Commercial public transport is one of the Dutch Safety Board's key focus areas. Passengers must be able to rely on safe transport operations. The Dutch Safety Board has previously conducted investigations into various runway incursions at Amsterdam Airport Schiphol. The 18 December 2010 incident differs from the previous runway incursions investigated because a bird controller who was carrying out a runway inspection was involved in the incident. Eight similar incidents involving a bird controller occurred in the three years preceding the incident. This prompted the Dutch Safety Board to launch an investigation. On 21 January 2012 a very similar incident occurred in which an aircraft had been issued take-off clearance while the bird controller was still on the runway. No separate investigation was conducted into this incident.

Purpose of the investigation

The purpose of this investigation is 'to gain insight into the incident and thus contribute to the structural improvement of monitoring and controlling the risk of runway incursions at Amsterdam Airport Schiphol'. The investigation specifically focuses on how the safety risks of runway incursions were controlled and how the system surrounding runway incursions was designed by the parties involved with a view to controlling the risks.

The research question in this investigation is: 'How can we prevent or substantially reduce the frequency of incidents in which an aircraft is given clearance to take off or land while the runway is occupied?'

Approach

The incident was reported to the Dutch Safety Board shortly after it had occurred. Statements from the parties involved were recorded and a technical investigation was performed among the bird controllers, and into the instruments used by the air traffic controllers, including the assistant controller, in the ATC tower. The radio communications recorded, documentation and the information available from the safety management system of the parties involved were also used. On 15 June 2011 Air Traffic Control the Netherlands and the Dutch Safety Board held a meeting and mainly discussed the timeline of the events. The Dutch Safety Board also held a presentation at Schiphol on 15 February 2012, which was attended by representatives from Amsterdam Airport Schiphol and Air Traffic Control the Netherlands. The first findings of the ongoing investigation were presented on that occasion and views were exchanged. As part of the review procedure, the organisations involved were offered the opportunity to orally explain the comments received. Lastly, a meeting chaired by a Board member of the Dutch Safety Board was organised, during which potential improvements were discussed. A limited investigation was conducted into a number of relevant current procedures at three other major European airports. It was not the intent of the investigation to provide a representative picture of the situation in the Netherlands.

Review

In accordance with the Dutch Safety Board Act a draft version of this report was submitted to all parties involved for review. See Appendix B.

Guidance Committee

The Dutch Safety Board has a permanent Aviation Committee which acts as the guidance committee during investigations into aviation incidents. The Committee is made up of external members with the relevant investigation expertise and is chaired by two members of the Dutch Safety Board. The external members sit on the Committee in a personal capacity. The Guidance Committee convened on one occasion during the investigation into the runway incursion on Runway 24 at Amsterdam Airport Schiphol to share information with the Safety Board members and the project team on the format and results of the investigation. The Committee acted in an advisory capacity during the investigation. The final responsibility for the report and the recommendations lies with the Dutch Safety Board.

The composition of the Aviation Committee is as follows:

F.J.H. Mertens (Chairman)	Dutch Safety Board, responsible for the Aviation portfolio
A. H. Brouwer-Korf (Vice-Chair)	Dutch Safety Board, Deputy responsible for the Aviation portfolio
J.T. Bakker. No participation ⁷⁸	Major General – Pilot (retired) Royal Netherlands Air Force
E.J. Burmeister	Colonel – Air Traffic Controller (retired) Royal Netherlands Air Force
J. Marijnen	Former Boeing 747 Pilot-in-Command
J.A. Mulder	Emeritus Professor, Delft University of Technology, former Boeing 767 Pilot-in-Command
H. Munniks de Jongh Luchsinger	Boeing 767 Pilot-in-Command/Instructor
J.G.W. van Ruitenbeek	Lecturer, Aerospace Engineering, InHolland University of Applied Sciences

Project team

The project team comprised the following people:

H. van Duijn	Investigation Manager
G.J. Vogelaar	Project Leader/Senior Investigator
K.E. Beumkes	Senior Investigator

⁷⁸ Due to his involvement as a member of the Supervisory Board of Air Traffic Control the Netherlands, Mr Bakker refrained from taking part in the investigation discussions.

APPENDIX B

RESPONSES RECEIVED FOLLOWING REVIEW OF THE DRAFT REPORT

In accordance with the Dutch Safety Board Act, a draft version of the full report or part thereof was submitted to the parties involved for review. The incident escaped the notice of the flight crew. In consultation with the relevant airline and the Norwegian investigation authority, it was decided to inform them of the results of the draft version of the Dutch report submitted for review. After the report has been approved and translated, the English version will be sent to both the Norwegian investigation authority and the relevant airline. The persons and parties listed below were requested to check the report for any factual inaccuracies and any information that may have been omitted.

The bird controller involved in the incident and the air traffic controllers, including the assistant controller

- Amsterdam Airport Schiphol
- Air Traffic Control the Netherlands
- Schiphol Safety Platform
- Human Environment and Transport Inspectorate
- Ministry of Infrastructure and the Environment
- National Supervisory Authority

All the parties and individuals approached responded. The responses were handled in the following manner:

- The Dutch Safety Board has incorporated corrections of factual inaccuracies, additional details as well as editorial comments (where relevant). The relevant passages were amended accordingly in the final report. These responses have not been separately included.
- The Dutch Safety Board has replied to the responses that were not included in the report. These responses are set out in the table below. In addition to the verbatim responses, the table also shows the section to which the response relates, the party or person providing the response and the Dutch Safety Board's reply. The responses have been listed by party.

Section	Party/ Response / Dutch Safety Board's reply
1.2	<p>Schiphol Safety Platform: In complex incidents such as this an immediate cause cannot be identified, and likewise the report refrains from doing so. The question should be 'what causes gave rise to the occurrence of the incident?'</p> <p>Dutch Safety Board: The report has identified both the immediate and underlying causes of the occurrence of the incident.</p>
1.2	<p>Ministry of Infrastructure and the Environment/Human Environment and Transport Inspectorate: If the current procedures are not in line with ICAO and/or European recommendations, this may imply that the situation is better or not as good. Does the investigation also focus on this problem definition?</p> <p>Dutch Safety Board: No, the investigation assumes that the widely supported and implemented ICAO and/or European recommendations are improvements. Raising this as a matter for discussion falls outside the scope of this investigation.</p>
3.1.1	<p>Air Traffic Control the Netherlands and Amsterdam Airport Schiphol: The air traffic controller had just visually scanned the runway but failed to detect the vehicle at the end of the runway, possibly because of the glittering snow.</p> <p>Dutch Safety Board: At the time the runway controller issued the Boeing 737 take-off clearance, the bird controller was located at intersection S2 and was driving along the runway at a speed of approximately 80km/h. The vehicle was not located at the end of the runway at that time.</p>
3.2.2	<p>Air Traffic Control the Netherlands and Amsterdam Airport Schiphol: The Schiphol Safety Platform is a voluntary collaboration without rank and file. The assumed lack of collaboration within the Runway Safety Team is incorrect, in our opinion. The relevance of the statement is weak: it has not been established that if 'investigations had been jointly conducted', these incidents would not have occurred. All information relating to runway incursions is shared in the RST straight away. The conclusions of the investigations are then compared.</p> <p>Dutch Safety Board: The Dutch Safety Board endorses the conclusion drawn in Amsterdam Airport Schiphol's report, which states that not jointly conducting investigations is a flaw and that this makes it difficult to obtain sufficient insight into each other's processes. In a response, the Minister of Infrastructure and the Environment also acknowledges the importance of parties jointly conducting investigations.</p> <p>If the parties do jointly conduct investigations, this will not automatically preclude the occurrence of incidents. However, investigations in which the parties jointly draw conclusions will help the relevant organisations obtain better insight in the processes. This will serve as a basis for jointly determining improvement measures.</p>

Section	Party/ Response / Dutch Safety Board's reply
3.2.2	<p>Ministry of Infrastructure and the Environment/Human Environment and Transport Inspectorate: The report mentions that all aircraft and other vehicles on a runway-in-use at the airports in London, Frankfurt and Paris conduct communications on the aviation frequency assigned to that particular runway. Has this procedure resulted in significantly reducing the number of runway incursions Is there a demonstrable causal relationship? Does the use of separate strips for crossing traffic and vehicles on an active runway as referred to in line 36 on page 69 of the draft report also play a role? Have the effects of these measures/partial measures been examined?</p> <p>Dutch Safety Board: A limited amount of information was obtained about the work procedure for vehicles on a runway at the three largest European airports. At these three airports, among others, the work procedure is in line with the ICAO and/or European recommendations. No detailed examination was conducted into the internal procedures at these airports concerning the use of flight progress strips, etc.</p>
3.2.2	<p>Schiphol Safety Platform: This conclusion is not substantiated by the underlying analysis. The factor of safety versus quality is always carefully considered in the capacity forecasts issued by Air Traffic Control the Netherlands and in the capacity briefing sessions held at least four times every 24 hours. It is not evident from the analysis that this has been taken into account.</p> <p>Dutch Safety Board: In the capacity forecasts issued by Air Traffic Control the Netherlands and during capacity briefing sessions, no time is scheduled in for inspections of active runways that must be carried out at least once every two hours.</p>

APPENDIX C

INCIDENTS INVOLVING A BIRD CONTROLLER IN 2008/2009/2010

A/SSE/Airport Authority Office
Team Incidentenonderzoek

VERTROUWELIJK

ALLEEN VOOR INTERN GEBRUIK



Inventarisatie

Start- en landingsklaringen tijdens aanwezigheid Bird Controller op baan

2008/2009/2010

Introductie

Inleiding In de periode augustus 2008 tot en met december 2010 vonden een negental voorvallen plaats waarbij sprake was van een start- of landingsklaring terwijl er een voertuig van Bird Control met toestemming op de baan aanwezig was in het kader van een baaninspectie. Tijdens het Airside Operationeel Veiligheidsoverleg (AOVO) van 21 december 2010 werd verzocht de voorvallen te inventariseren.

Doelstelling Het doel van de inventarisatie is om deze te delen met LVNL ten einde beheersmaatregelen te treffen of bestaande beheersmaatregelen aan te passen met als doel de veiligheid te vergroten.

BIRD CONTROL WORK INSTRUCTIONS

Werkinstructies A/OPS/AO

Deel 3: WI's A/OPS/AO/B

3.2.1.1 Bird Control - WI

Voor wie Deze werkinstructie is bestemd voor de Bird Controller.

Eigenaar De eigenaar van deze werkinstructie is de manager van A/OPS/AO/B.

Achtergrond-informatie Onderstaande tabel bevat de achtergrondinformatie bij deze werkinstructie:

Onderwerp	Uitwerking
Taken Bird Controller	<p>In deze instructie bestaan uw taken uit:</p> <ul style="list-style-type: none">• Constatieren of zich in het landingsterrein vogels bevinden en verzorgen van registratie naar soort, hoeveelheid en plaats.• Zoeken en verwijderen van kadavers en verzorgen van registratie naar soort, hoeveelheid, plaats en tijd.• Start- en landingsbanen controleren op aanwezigheid van vogels en FOD.• Verjagen van vogels.• Controle op de toestand van verharding en verlichting:<ul style="list-style-type: none">– Verharding, incl. oppervlaktebehandeling– Dagmarkering– Baanverlichting– Bebording incl. verlichting– Obstakelvrij zijn van de strip (incl. negatieve obstakels)– Obstakelvrij zijn van de RESA (incl. extended RESA)– Werking PAPI– FOD/water in strip• Controle op werkzaamheden die vogels aantrekken• Controle op aanwezigheid van kranen en andere obstakels in de obstakelvlakken.• Controle op aanwezigheid van standing water op banen in geval van hevige regenval <p>Noot: Gedurende het winterseizoen dient tijdens baaninspecties extra aandacht te worden besteed aan de eerste 1000 meter van de in gebruik zijnde startbanen om mogelijke opbouw van restanten de-icingvloeistof te onderkennen. Dit om ongewenste gladheidverschijnselen in vroegtijdig stadium te signaleren.</p>

Vervolg op volgende pagina

3.2.1.1 Bird Control - WI, Vervolg

Achtergrondinformatie (vervolg)

Onderwerp	Uitwerking
Controlerondes	<p>Om uw taken uit te voeren rijdt u controlerondes in het landingsterrein en op de platformen. U volgt daarbij de volgende route:</p> <ul style="list-style-type: none"> • OT-gebouw (Airport Support), langs de West, rond kop 18C, rond kop 18R, 36L, rond 36C • Rijbaan Quebec, rond kop 06, rond kop 36R, • Rijbaan Golf, • Platform Schiphol-Oost, • Rond kop 22, rond kop 27, rond kop 18L, rond kop 09 • Middenveld. <p><u>Noot:</u> delen van controlerondes kunnen in onderling overleg door meerdere Bird Controllers en / of in een andere volgorde worden gereden.</p>
Frequentie controlerondes	<ul style="list-style-type: none"> • 3 rondes gedurende uw diensttijd (8 werkuren) conform vastgestelde route en daarnaast: • Op eigen initiatief of verzoek van de Toren (LVNL/ATC) of AOM start- en landingsbanen afrijden vóór ingebruikname • Regelmatisch op eigen initiatief actieve start- en landingsbanen afrijden
Verjagingsapparatuur: terrein	<p>Om vogels te verjagen gebruikt u vogelverjagingsapparatuur. Aan weerszijden van de vijf hoofd start- en landingsbanen aan de rand van de 50 meter stroken kan het volgende staan:</p> <ul style="list-style-type: none"> • Fly-away peters • Gaskanonnen • Scaryman • Irritape
Verjagingsapparatuur: auto	<p>Ook uw voertuig is met vogelverjagingsapparatuur uitgerust:</p> <ul style="list-style-type: none"> • Een schijnwerper • En groene laser • Diverse distress calls • Grote speakers voor de distress calls • Een veldkijker • Veldkaarten • Een seinpistool met houder en patronenkist.

Vervolg op volgende pagina

3.2.1.1 Bird Control - WI, Vervolg

Achtergrondinformatie (vervolg)

Onderwerp	Uitwerking
Gebruik verjagingsapparatuur:	Voor het gebruik van de verjagingsapparatuur gelden de volgende aandachtspunten: <ul style="list-style-type: none"> • Plaats fly-away peters zodanig dat ze door de te verjagen vogels in de buurt goed zijn waar te nemen • Plaats gaskanonnen op plaatsen die extra aantrekkelijk zouden kunnen zijn voor vogels en zodanig dat zij <u>niet</u> naar de baan zijn gericht. • Ontkoppel bij transport het gaskanon van de gasfles • Gebruik de groene laser in de nacht en richt deze op de te verjagen vogels. <u>Schijn nooit</u> met de laser op het verkeer! • Richt bij gebruik van distress calls de speakers richting de te verjagen vogels en gebruik tevens lichtkogels.
Wachten vliegverkeer	In uitzonderlijke gevallen kan het voorkomen dat de Bird Controller in overleg met de verkeerstoren het vliegverkeer tijdelijk laat wachten om vogels te verjagen.

Voorwaarden

Bij deze instructie gelden de volgende voorwaarden:

Onderwerp	Voorwaarde
Bevoegdheid	U dient te beschikken over de volgende bevoegdheden: <ul style="list-style-type: none"> • Veldbevoegdheid U. • Geldige jachtakte indien afschot bevoegdheid van toepassing is • Geldige fauna-ontheffing
Benodigde kennis	U dient te beschikken over: <ul style="list-style-type: none"> • Uitgebreide kennis van het landingsterrein. • Kennis van Flora en Fauna in relatie tot de luchthaven (theoretisch jachtdiploma)
Voorwaarden afrijden start- en landingsbanen	<ul style="list-style-type: none"> • Voor het afrijden van start- en landingsbanen geldt: • Afrijden van actieve start- en landingsbaan indien deze 20 minuten (= inspanningsverplichting) niet in gebruik is geweest. • Baan 04-22 en overige niet actieve start- en landingsbanen ten minste één maal per twee uur afrijden. • Banen met ingeschakeld zwaailicht afrijden
Melding bij vogel of ander object op de baan	Indien u een melding ontvangt dat er op een startbaan een vogel of ander object is aangetroffen dient u in overleg met de Toren LVNL eerst de baan te controleren alvorens de baan weer voor het vliegverkeer kan worden gebruikt.

Vervolg op volgende pagina

3.2.1.1 Bird Control - WI, Vervolg

Voorwaarden (vervolg)

Onderwerp	Voorwaarde						
Extra melding bij inspectie baan 18L-36R	<p>De Bircontroller dient, tijdens of direct na het inspecteren van baan 18L-36R, aan de Apron Controller via OPS-2 te melden dat de baan is geïnspecteerd.</p> <p>Noot: Deze melding is een belangrijke schakel in de veiligheidsketen om te voorkomen dat de LVNL onbedoeld een baan in gebruik neemt die niet formeel beschikking is gesteld. Baan 18L-36R kent hierbij de grootste risico's omdat sleepoversteken, rijbanen E3 en E5, niet beveiligd zijn met stopbars als de baan niet formeel beschikbaar is gesteld. Het risico op een conflict tussen een gesleept vliegtuig en een ongecontroleerde start of landing is op deze baan derhalve groter dan op baan 04-22 en 06-24.</p>						
Uitluisteren TWR frequenties	<p>Om de situational awareness tijdens baaninspectie te verhogen geldt de verplichting om tijdens de baaninspectie de in gebruik zijnde TWR frequentie uit te luisteren. De verplichting geldt te allen tijde, onafhankelijk de baanstatus, zolang de baan deel uit maakt van de 'manoeuvring area'.</p> <table border="1"> <tr> <td>Runway Control Schiphol Centrum</td><td>119.225 MHz (H24 Primary freq.)</td></tr> <tr> <td>Runway Control Schiphol Centrum</td><td>118.100 MHz (H24)</td></tr> <tr> <td>Runway Control Baan 18R-36L</td><td>118.275 MHz (H24)</td></tr> </table>	Runway Control Schiphol Centrum	119.225 MHz (H24 Primary freq.)	Runway Control Schiphol Centrum	118.100 MHz (H24)	Runway Control Baan 18R-36L	118.275 MHz (H24)
Runway Control Schiphol Centrum	119.225 MHz (H24 Primary freq.)						
Runway Control Schiphol Centrum	118.100 MHz (H24)						
Runway Control Baan 18R-36L	118.275 MHz (H24)						
Wanneer verjagen	<p>U verjaagt vogels indien ze:</p> <ul style="list-style-type: none"> • zich op voor de luchthaven gevaarlijke plekken bevinden, en/of • in grote groepen gevaar op kunnen leveren. <p>Noot: U hanteert het 'zero tolerance' principe</p>						
Eerst overleg	U verjaagt vogels in overleg met de AOM en de verkeerstoren.						
Wanneer en waar lichtkogels afschieten	<p>Voor afschieten van lichtkogels op actieve banen geldt:</p> <ul style="list-style-type: none"> • In principe na toestemming van de verkeersleider LVNL (bij lichtkogels van 1 inch). • in het landingsterrein en niet op de platformen. 						

Vervolg op volgende pagina

APPENDIX E

RECONSTRUCTION OF THE INCIDENT

The following reconstruction of the incident was created on the basis of the ground radar data made available by Air Traffic Control the Netherlands and the Air Traffic Control tower sound recordings. See overleaf for the timeline drawn up by Air Traffic Control the Netherlands (UTC).

At 14.22:46 the bird controller (Kievit 2, KV2) called up assistant 2 (ASS2) requesting permission to drive down Runway 24 to carry out an inspection. The runway controller (RC) granted the request. Assistant 2 issued permission, in the following words: "KV2 has permission to drive down Runway 24 from S7". The bird controller replied at 14.23:00 in the following words: "KV2 has permission to drive down Runway 24 from S7".

According to radar data, at 14.23:14 the bird controller entered Runway 24 at S7. He subsequently inspected the runway at a speed of approximately 40km/h. Meanwhile a Boeing 747 was taxiing near the cargo pier in the direction of S2. At 14.23:36 the Boeing 747 received clearance from the ground controller (GC) to cross Runway 24.

At 14.23:49 the runway controller informed the bird controller using assistant 2's microphone, that an aircraft was going to cross Runway 24. The bird controller replied that he had received this message. The radar shows that the bird controller slowed down in order to stop at S2 and allow the Boeing 747 to cross in front of his vehicle. At 14.25:30 the Boeing 747 crossed Runway 24 while the bird controller had stopped at S2.

At 14.26:15 a Boeing 737 received take-off clearance from the runway controller. At the same time the bird controller was on Runway 24 at S2.

At 14.26:50 the Boeing 737 commenced its take-off run (its speed was then over 10 knots). The bird controller was at S1 at that moment, approximately 1,680 metres further down Runway 24, and was driving at a speed of around 80km/h.

The analysis of the data shows that at 14.26:56, RIASS, which was not yet operational and was running in a test set-up, had generated a warning. However, the warning was inaudible to the air traffic controllers due to the test set-up. At that time the Boeing 737's speed was 44.7 knots and the bird controller was meanwhile located around 2,650 metres from the start of Runway 24.

At 14.27:22 the Boeing 737 lifted off from the ground. At that moment the bird controller was located at a distance of 1,740 metres from the aircraft. The Boeing 737 then flew over the bird controller at an altitude of around 1,000 feet. At 14.27:35 the bird controller reported "KV2 clear of Runway 24".

APPENDIX F

SCHIPHOL SAFETY PLATFORM POLICY STATEMENT

Beleidsverklaring Veiligheidsplatform Schiphol



In het besef dat veiligheid de basisvooraarde is voor business continuïteit en een gezamenlijke asset is van alle partners in de luchtvaartsector, verplichten wij ons gezamenlijk en met behoud van onze individuele verantwoordelijkheid tot:

- Het pro-actief bevorderen en onderhouden van de integrale veiligheid op Schiphol door o.a. :
 - Actief te zoeken naar verbetermogelijkheden van de veiligheid.
 - Integraal veiligheidsmanagement te professionaliseren.
 - De veiligheidscultuur te stimuleren.
- Een sector veiligheidsysteem in te richten en te onderhouden gericht op de raakvlakken tussen de bedrijfsprocessen (interfaces) van de verschillende partijen op Schiphol.

Om dit doel te bereiken zullen wij:

- Eigen individuele veiligheidsmanagement systemen nauwkeurig en gewetensvol gebruiken en doorontwikkelen.
- Informatie uit bestaande en nieuwe systemen onderling uitwisselen en afstemmen.
- Veiligheid expliciet in de eigen ondernemings- en organisatiiedoelstellingen opnemen en beschouwen als integraal onderdeel van het bedrijfsproces.
- Er zorg voor dragen dat derden, wanneer ze aanwezig zijn op het luchthaventerrein en in onze opdracht werkzaamheden verrichten, voldoen aan de veiligheidsseisen die op ons zelf van toepassing zijn.
- Effectief samenwerken met alle partners in de luchtvaartsector.
- Afgestemde transparante informatie verstrekken over de resultaten van VPS aan overheid en publiek.

De hieruit voortvloeiende gezamenlijke inspanning vormt het Veiligheidsplatform Schiphol, en treedt op als het loket naar de overheid en publiek voor integrale luchtvaartveiligheid op Schiphol.

Schiphol, juli 2007. Vasgesteld door de VpS Stuurgroep.

Amsterdam Airport Schiphol
A.P.J.M. Ruiters

Martinair Holland
D. Pen

Gezamenlijke Vluchtuithandels Bedrijven
K. Winter

Schiphol Ground Handling Committee
D.J.C. Goedertiers

Luchtverkeersleiding Nederland
P. Riemens

Schiphol Airline Operating Committee
I.M. van Buuren

KLM NV
Ground Services
P.G. Ellich

Transavia.com
M. Meijer

KLM NV
Flight Operations
M.W.A. van Dorst



APPENDIX G

ICAO RUNWAY INCURSION SEVERITY CLASSIFICATION, AMSTERDAM AIRPORT SCHIPHOL RISK MATRIX AND LVNL SAFETY SIGNIFICANT EVENTS SCHEME

ICAO runway incursion severity classification

Severity class	Description
A	A serious incident in which a collision is narrowly avoided
B	An incident in which separation decreases and there is significant potential for collision, which may result in a time-critical corrective/evasive response to avoid a collision
C	An incident characterized by ample time and/or distance to avoid a collision
D	An incident that meets the definition of runway incursion such as the incorrect presence of a single vehicle, person or aircraft on the protected area of a surface designated for the landing and take-off of aircraft but with no immediate safety consequences
E	Insufficient information or inconclusive or conflicting evidence precludes a severity assessment

5.5 THIRD FUNDAMENTAL — SAFETY RISK SEVERITY

5.5.1 Once the safety risk of an unsafe event or condition has been assessed in terms of probability, the second step in the process of bringing the safety risks of the consequences of hazards under organizational control is the assessment of the severity of the consequences of the hazard if its damaging potential materializes during operations aimed at delivery of services. This is known as assessing the safety risk severity.

	Meaning	Value
Frequent	Likely to occur many times (has occurred frequently)	5
Occasional	Likely to occur sometimes (has occurred infrequently)	4
Remote	Unlikely to occur, but possible (has occurred rarely)	3
Improbable	Very unlikely to occur (not known to have occurred)	2
Extremely improbable	Almost inconceivable that the event will occur	1

Figure 5-2. Safety risk probability table

5.5.2 Safety risk severity is defined as the possible consequences of an unsafe event or condition, taking as reference the worst foreseeable situation. The assessment of the severity of the consequences of the hazard if its damaging potential materializes during operations aimed at delivery of services can be assisted by questions such as:

- a) How many lives may be lost (employees, passengers, bystanders and the general public)?
- b) What is the likely extent of property or financial damage (direct property loss to the operator, damage to aviation infrastructure, third-party collateral damage, financial and economic impact for the State)?
- c) What is the likelihood of environmental impact (spillage of fuel or other hazardous product, and physical disruption of the natural habitat)?
- d) What are the likely political implications and/or media interest?

5.5.3 Based on the considerations emerging from the replies to questions such as those listed in 5.5.2, the severity of the possible consequences of an unsafe event or condition, taking as reference the worst foreseeable situation, can be assessed using a safety risk severity table.

5.5.4 Figure 5-3 presents a typical safety risk severity table, also a five-point table. It includes five categories to denote the level of severity of the occurrence of an unsafe event or condition, the meaning of each category, and the assignment of a value to each category. As with the safety risk probability table, this table is an example presented for educational purposes only, and the same caveats expressed in 5.4.6 apply.

Severity of occurrence	Meaning	Value
Catastrophic	— Equipment destroyed — Multiple deaths	A
Hazardous	— A large reduction in safety margins, physical distress or a workload such that the operators cannot be relied upon to perform their tasks accurately or completely — Serious injury — Major equipment damage	B
Major	— A significant reduction in safety margins, a reduction in the ability of the operators to cope with adverse operating conditions as a result of increase in workload, or as a result of conditions impairing their efficiency — Serious incident — Injury to persons	C
Minor	— Nuisance — Operating limitations — Use of emergency procedures — Minor incident	D
Negligible	— Little consequences	E

Figure 5-3. Safety risk severity table

5.6 FOURTH FUNDAMENTAL — SAFETY RISK TOLERABILITY

5.6.1 Once the safety risk of the consequences of an unsafe event or condition has been assessed in terms of probability and severity, the third step in the process of bringing the safety risks of the consequences of the unsafe event or condition under organizational control is the assessment of the tolerability of the consequences of the hazard if its damaging potential materializes during operations aimed at delivery of services. This is known as assessing safety risk tolerability. This is a two-step process.

5.6.2 First, it is necessary to obtain an overall assessment of the safety risk. This is achieved by combining the safety risk probability and safety risk severity tables into a safety risk assessment matrix, an example of which is presented in Figure 5-4. For example, a safety risk probability has been assessed as occasional (4). The safety risk severity has been assessed as hazardous (B). The composite of probability and severity (4B) is the safety risk of the consequences of the hazard under consideration. Extending the discussion in 5.2, it can be seen, through this example, that a safety risk is just a number or alphanumerical combination and not a visible or tangible component of the natural world. The colour coding in the matrix in Figure 5-4 reflects the tolerability regions in the inverted triangle in Figure 5-1.

5.6.3 Second, the safety risk index obtained from the safety risk assessment matrix must then be exported to a safety risk tolerability matrix that describes the tolerability criteria. The criterion for a safety risk assessed as 4B is, according to the tolerability table in Figure 5-5, “unacceptable under the existing circumstances”. In this case, the safety risk falls in the intolerable region of the inverted triangle. The safety risk of the consequences of the hazard is unacceptable. The organization must:

- allocate resources to reduce the exposure to the consequences of the hazards;
- allocate resources to reduce the magnitude or the damaging potential of the consequences of the hazards; or
- cancel the operation if mitigation is not possible.

Risk probability		Risk severity				
		Catastrophic A	Hazardous B	Major C	Minor D	Negligible E
Frequent	5	5A	5B	5C	5D	5E
Occasional	4	4A	4B	4C	4D	4E
Remote	3	3A	3B	3C	3D	3E
Improbable	2	2A	2B	2C	2D	2E
Extremely improbable	1	1A	1B	1C	1D	1E

Figure 5-4. Safety risk assessment matrix

Suggested criteria	Assessment risk index	Suggested criteria
	5A, 5B, 5C, 4A, 4B, 3A	Unacceptable under the existing circumstances
	5D, 5E, 4C, 4D, 4E, 3B, 3C, 3D, 2A, 2B, 2C	Acceptable based on risk mitigation. It may require management decision.
	3E, 2D, 2E, 1A, 1B, 1C, 1D, 1E	Acceptable

Figure 5-5. Safety risk tolerability matrix

Aviation safety risk model

The Aviation Safety Risk Model (see overleaf) is used, among other things, within the Amsterdam Airport Schiphol safety management system to eliminate or reduce risks to an acceptable level. The essence the methodology is to perform a risk analysis of the relevant business processes on the basis of a risk assessment. The risks are quantified using the following formula: Risk = probability (of danger) x effect. Incidents are analysed by determining both the probability of an occurrence and the potential severity of the consequences of that particular occurrence. These factors are classified by means of a matrix so that the frequency of the occurrence that can lead to certain consequences can be classified as 'acceptable', 'attention,' or 'unacceptable.' An average of the number of occurrences in previous years is usually taken in order to predict the frequency of the occurrences. The severity of the consequences is determined by what could happen (in a worst case scenario).

The following outcome is produced using the methodology of Amsterdam Airport Schiphol's safety management system for the investigated incident:

1. The frequency of the number of incidents (three to four a year) produces 'four' (4) in the risk classification matrix below;
2. The potential effect of a collision between a Bird Control vehicle and a departing or landing aircraft is assessed as 'hazardous'; this produces the value of 'three' (3) in the effect classification matrix;
3. As a result, matrix number 3 'risk tolerance' produces 'Unacceptable';
4. The incidents involving the bird controllers take place on take-off or landing runways. The priority assigned to this category has the highest value of five (5). The accompanying text uses the description 'most critical'.

1.4.2 Het Risico Model Luchtvaartveiligheid

Inleiding	Een ander instrument dat wordt gehanteerd voor het identificeren van luchtvaartveiligheidsrisico's binnen bedrijfsprocessen is het Risico Model Luchtvaartveiligheid (RML).																																				
Wat is het RML?	Het RML is een methodiek voor het maken van risicoanalyses voor luchtvaartveiligheid.																																				
Toepassing	Om risico's te elimineren of tot een acceptabel niveau terug te brengen, kunnen na toepassing van het RML nieuwe veiligheidsdoelstellingen geformuleerd en/of acties uitgezet worden tijdens de Plan-fase van de Deming-cyclus. RML-uitkomsten dienen dus net als de KPI-analyse als input voor de Deming-cyclus.																																				
Risicoanalyse	Kern van de methodiek is dat er voor de relevante bedrijfsprocessen op basis van een risico-inventarisatie een risicoanalyse wordt uitgevoerd. Hierbij worden risico's gekwantificeerd volgens de volgende formule: Risico = kans (op gevaar) x effect .																																				
Onderdelen analyse	De analyse die op de geïnventariseerde risico's wordt uitgevoerd bestaat uit de volgende onderdelen: <ol style="list-style-type: none"> 1. Kansclassificatie - Wat is de kans dat risico's zich voordoen? 2. Effectclassificatie - Wat is het effect van deze risico's? 3. Bepaling risicotolerantie - Welke risico's zijn acceptabel, niet-acceptabel of verdienen aandacht? 4. Prioriteitstelling - Wat is de prioriteit van de niet-acceptabele risico's? 																																				
1. Kans-classificatie	Via de kansclassificatie wordt per risico vastgesteld wat de kans is dat het risico zich voordoet. Hierbij worden risico's verdeeld over zes categorieën van waarschijnlijkheid: <p>Opmerking: De kansclassificatie is gebaseerd op JAR-25 en doorvertaald naar het aantal vliegbewegingen. De laatste rij in onderstaande tabel is gebaseerd op het aantal vliegbewegingen (400.000) van het gebruiksjaar 2004 (november 2003 – november 2004).</p> <table border="1"> <thead> <tr> <th colspan="6">Kans classificatie</th> </tr> <tr> <th>1</th> <th>2</th> <th>3</th> <th>4</th> <th>5</th> <th>6</th> </tr> <tr> <th>Zeer onwaarschijnlijk</th> <th>Heel gering</th> <th>Gering</th> <th>Af en toe</th> <th>Geregeld</th> <th>Veelvuldig</th> </tr> </thead> <tbody> <tr> <td>Komt eigenlijk nooit voor in de gehele levenscyclus van een luchthaven</td> <td>Onwaarschijnlijk dat er iets gebeurt, maar het is niet volledig uit te sluiten</td> <td>Onwaarschijnlijk, maar kan door een combinatie van diverse gebeurtenissen en omstandigheden toch wel eens gebeuren</td> <td>Komt af en toe voor</td> <td>Kan toch een aantal keer in een jaar voorkomen</td> <td>Komt met grote regelmaat voor</td> </tr> <tr> <td>$< 1 \times 10^{-10}$ per vliegtuigbeweging</td> <td>Tussen 1×10^{-10} en 1×10^{-8} per vliegtuigbeweging</td> <td>Tussen 1×10^{-8} en 1×10^{-6} per vliegtuigbeweging</td> <td>Tussen 1×10^{-6} en 1×10^{-5} per vliegtuigbeweging</td> <td>Tussen 1×10^{-5} en 1×10^{-4} per vliegtuigbeweging</td> <td>Tussen 1 en 1×10^{-4} per vliegtuigbeweging</td> </tr> <tr> <td>--</td> <td>--</td> <td>Minder dan 1 x per 2,5 jaar</td> <td>Tot maximaal 4 x per jaar</td> <td>Tot maximaal 3 x per maand</td> <td>Meer dan 3 x per maand</td> </tr> </tbody> </table>	Kans classificatie						1	2	3	4	5	6	Zeer onwaarschijnlijk	Heel gering	Gering	Af en toe	Geregeld	Veelvuldig	Komt eigenlijk nooit voor in de gehele levenscyclus van een luchthaven	Onwaarschijnlijk dat er iets gebeurt, maar het is niet volledig uit te sluiten	Onwaarschijnlijk, maar kan door een combinatie van diverse gebeurtenissen en omstandigheden toch wel eens gebeuren	Komt af en toe voor	Kan toch een aantal keer in een jaar voorkomen	Komt met grote regelmaat voor	$< 1 \times 10^{-10}$ per vliegtuigbeweging	Tussen 1×10^{-10} en 1×10^{-8} per vliegtuigbeweging	Tussen 1×10^{-8} en 1×10^{-6} per vliegtuigbeweging	Tussen 1×10^{-6} en 1×10^{-5} per vliegtuigbeweging	Tussen 1×10^{-5} en 1×10^{-4} per vliegtuigbeweging	Tussen 1 en 1×10^{-4} per vliegtuigbeweging	--	--	Minder dan 1 x per 2,5 jaar	Tot maximaal 4 x per jaar	Tot maximaal 3 x per maand	Meer dan 3 x per maand
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--	--	Minder dan 1 x per 2,5 jaar	Tot maximaal 4 x per jaar	Tot maximaal 3 x per maand	Meer dan 3 x per maand																																

Vervolg op volgende pagina

1.4.2 Het Risico Model Luchtvaartveiligheid, Vervolg

2. Effect-classificatie

Via de effectclassificatie wordt per risico vastgesteld wat het effect is. Er zijn 4 categorieën met effecten:

Effectclassificatie			
1	2	3	4
Gering	Ernstig	Gevaarlijk	Catastrofaal
Licht persoonlijk letsel en tot max. 3 dagen verzuim	Ernstig gewond of meerdere personen met letsel	Een dode of meerdere personen ernstig gewond	Meerdere doden
Schade is minder dan 1.000.000 Euro	Schade tussen de 1.000.000 en 4.000.000 Euro	Schade tussen de 4.000.000 en 10.000.000 Euro	Schade van meer dan 10.000.000 Euro.

3. Bepaling risicotolerantie

Na het toepassen van de kans- en effectclassificatie wordt via de risicotolerantiematrix vastgesteld of een risico:

- acceptabel is;
- aandacht verdient;
- niet-acceptabel is.

Likelihood of risk occurring (see previous page)

Risico tolerantie matrix					
Waarschijnlijkheid	6	Aandacht	Aandacht	Niet-acceptabel	Niet acceptabel
	5	Acceptabel	Aandacht	Niet-acceptabel	Niet-acceptabel
	4	Acceptabel	Aandacht	Niet-acceptabel	Niet-acceptabel
	3	Acceptabel	Aandacht	Aandacht	Niet-acceptabel
	2	Acceptabel	Aandacht	Aandacht	Aandacht
	1	Acceptabel	Acceptabel	Aandacht	Aandacht
		1	2	3	4
Effect					

4. Prioriteit-stelling

Ten slotte wordt van de niet-acceptabele risico's en de risico's die aandacht verdienen de prioriteit bepaald. Hierbij worden geclasseerde risico's vermenigvuldigd met de zogenaamde wegingsfactorclassificatie. Deze wegingsfactorclassificatie is verdeeld naar het gebied waar het bedrijfsproces zich afspeelt, waarbij geldt: 5= meest kritiek, 1= minst kritiek:

Gebied	Classificatiefactor
Start- en landingsbanen	5
Taxibanen en aprons	3
VOP's	2
Randwegen (logistieke aan- en afvoerswegen)	1

LVNL Safety Significant Events scheme

The Safety Significant Events (SSE) scheme applied by Air Traffic Control the Netherlands is based on the SSE scheme developed and used by NATS, the National Air Traffic Control Services in the UK. The SSE scheme is based on classification of the resulting separation in the event of a conflict on the one hand, and the degree to which the available safety barriers have worked, on the other. A few changes were made to the above SSE scheme for the purpose of incident investigation within Air Traffic Control the Netherlands. One of the additions is the classification of unilateral incidents without a conflict situation with other traffic. Two types of schemes are used for incident classification:

1. A classification scheme for incidents occurring in the event radar separation has been applied;
2. A classification scheme for incidents occurring in the event no radar separation has been applied.

The second scheme is applied to incidents at the aerodrome or where visual or procedural separation has been applied. Both schemes use a standard classification system as shown in the following table.

		Ernst van voorval			Incident classification by LVNL	
		Separatie vermindert en betrokkenen doen alles om botsing nog maar net te voorkomen of ernst daarvan te beperken	Separatie vermindert en er is een significante kans op botsing	Separatie vermindert, maar er is voldoende tijd en afstand om een mogelijke botsing te voorkomen	Kleine of geen kans op botsing	Voorval zonder conflict
Detectie & Oplossing		A	B	C	D	E
ATC direct	4					
ATC indirect	3					
Vlieger(s) en/of veiligheidsnet in luchtvaartuig	2					
Geen (effectieve) oplossing	1					

Table 1 Standard classification system applied in the SSE scheme

Non-radar separation incident		Incident severity			Incident classification by LVNL	
		Separation decreases and those involved do everything to narrowly avoid a collision or reduce the severity thereof	Separation decreases and there is significant potential for collision	Separation decreases, but there is sufficient time and distance to avoid a potential collision	Minor or no potential for collision	Incident without a conflict
Detection and solution		A	B	C	C	E
ATC directly	4					
ATC indirectly	3					
Pilot(s) and/or safety net in aircraft	2					
No (effective) solution	1					

The horizontal categories A-E in the matrix indicate what the separation was for an incident. Category A represents the highest severity level. The vertical categories 1-4 indicate what safety barrier brought about the solution to the situation. Category 1 represents the highest severity level.

LVNL severity classification

In its analysis of incident severity, Air Traffic Control the Netherlands distinguishes between the categories of 'serious incident', 'major incident', 'significant incident' and 'no safety effect' on the basis of EASA decision 2011/017/R, GM1 SKPI Definitions and Abbreviations:

- *Serious incident*: An incident involving circumstances indicating that an accident nearly occurred. Note: The difference between an accident and a serious incident lies only in the result.
- *Major incident*: An incident associated with the operation of an aircraft, in which safety of aircraft may have been compromised, having led to a near collision between aircraft, with ground or obstacles (i.e., safety margins not respected which is not the result of an ATC instruction).
- *Significant incident*: An incident involving circumstances indicating that an accident, a serious or major incident could have occurred, if the risk had not been managed within safety margins, or if another aircraft had been in the vicinity.
- *No safety effect*: An incident which has no safety significance.
- *Not determined*: insufficient information was available to determine the risk involved or inconclusive or conflicting evidence precluded such determination.

PUBLISHED INVESTIGATIONS

This appendix provides examples of investigations published by the Dutch Safety Board and its predecessor.

December 1998 (Delta incident)⁷⁹

A serious incident occurred at Amsterdam Airport Schiphol, which had no safety effect due to the flight crew's time-critical response. The aircraft (a Boeing 767) had been issued take-off clearance while an aircraft tow (a Boeing 747) was on the same runway, Runway 24. Upon detecting the aircraft tow, the flight crew of the departing aircraft aborted take-off immediately and thus prevented a collision, which obviously could have had serious consequences. This serious incident occurred because – in the assumption that the runway was clear – the Boeing 767 flight crew were issued take-off clearance, while in reality an aircraft tow guided by a sweeper vehicle was still in the process of crossing the runway. The ATC tower supervisor on duty was aware of the aircraft tow but he did not hear take-off clearance being issued to the Boeing 767 because of a discussion about the stop bar control panel setting. As a result, he did not have a good overall view of the traffic situation and did not intervene.

Probable cause

The factors listed below played a causal role in the occurrence of the incident:

- poor weather conditions precluded Air Traffic Control from visually monitoring ground traffic;
- not enough detailed information was provided during communications conducted between the aircraft tow and the ATC tower;
- the incorrect assumption of the position and the direction in which the aircraft tow was moving;
- issuing take-off clearance without ascertaining that the runway was clear;
- insufficient collaboration and oversight.

⁷⁹ Final Report 98-85/S-14, Dutch Transport Safety Board, N193DN, Boeing 767, 10 December 1998 Amsterdam Airport Schiphol, January 2001

Recommendations addressed to Amsterdam Airport Schiphol:

1. The technical facilities for protecting runway exits at Amsterdam Airport Schiphol must be uniform, so that one standard procedure applies to all runway exits. This applies in particular to exit 2 on Runway 06-24. Meanwhile, when low visibility procedures are in force, except for taxiing aircraft, all other traffic movements to and from Apron S should be prohibited. In this context it is recommended that the standards set out in ICAO Annex 14 be applied as soon as possible.

Recommendations addressed to Air Traffic Control the Netherlands:

2. No other duties should be imposed on the supervisor in addition to his main task.
3. A checklist should be used when carrying out changes in responsibilities in the ATC tower.
4. The existing ground radar system must be equipped with a data recorder.
5. The assistant controller's work station must be equipped with a multimode screen.
6. Team resource management training must feature as a permanent component of the training programme for air traffic controllers.

Recommendations addressed to Amsterdam Airport Schiphol and Air Traffic Control the Netherlands:

7. Air traffic controllers and apron staff must take refresher courses focusing on procedures and radio communications.
8. The operating panels for stop bars and traffic lights must be redesigned and geographically assembled in such a manner that they do not create confusion.
9. The coordination and communications procedures between the Airport and Air Traffic Control should be reviewed.

The recommendations addressed to Amsterdam Airport Schiphol in the report were implemented as were the relevant recommendations addressed to Air Traffic Control the Netherlands.

May 2005

At the time of this incident the roles of runway controller, ground controller and assistant 2 were performed by one and the same person. This controller has asked for an inspection of Runway 06-24 by a bird controller (KV2). KV2 then requested permission, from his position at S7, to drive down the runway. The controller granted him permission, and KV2 provided correct readback thereof on the radiotelephone frequency. KV2 then entered the runway. The runway allocation panel showed that the runway was occupied. When the controller no longer saw the bird controller on the runway, the controller switched off the signal. The controller subsequently issued a Boeing MD11 take-off clearance for Runway 24. However, KV2 had not yet vacated the runway, but had just got out of his vehicle to remove some bird remains without reporting this to Air Traffic Control. A few minutes after take-off clearance had been issued, KV2 then reported that he had cleared Runway 24.

September 2005

Runway 24 was in use as a take-off runway. A Boeing had received take-off clearance from the runway controller. Meanwhile a bird controller (KV1) had moved from the road, Zuidelijke Randweg, to intersection S2 as he intended to cross Runway 06-24. KV1 subsequently requested permission to cross Runway 06-24. When doing so he described his position as 'Taxiway Sierra South'. Assistant 2, who at that time was handling several requests, asked who had called about Sierra South. KV1 reported that he had made the call. Assistant 2 assumed that the bird controller was located on a northerly section of the taxiway, and that he had requested permission to travel down the taxiway in a southerly direction. In reply, assistant 2 therefore gave KV1 permission for 'Sierra South'. KV1 read back the permission granted verbatim and then crossed Runway 06-24. When he arrived on the opposite side of the runway, the bird controller noticed that the aircraft had commenced its take-off run. KV1 reported to assistant 2 that he was clear of Runway 06-24. The flight crew reported to the runway controller shortly afterwards that they had seen a vehicle on the runway. The supervisor's role had been combined with that of a runway controller at the time of the incident.

March 2007

An Airbus A319 was waiting for take-off clearance on Runway 24. A Boeing 747 had landed on Runway 18R. En route to the cargo handling apron, the aircraft had to cross Runway 06-24 at intersection S2. The VDV stipulates that when a taxiing aircraft has to cross an active runway, the aircraft concerned must be transferred from the ground controller's frequency to that of the runway controller, so as to increase the pilots' situational awareness. In this instance, however, the runway controller decided against having the aircraft transferred and to leave it up to the ground controller to handle the Boeing 747 crossing the runway. The ground controller coordinated crossing permission with the runway controller. Meanwhile an Airbus A330 on Runway 18L was waiting for take-off clearance. The runway controller issued the Airbus A330 clearance for Runway 18L. The flight crew of another aircraft erroneously assumed that the clearance was intended for them and gave incorrect readback thereof: 'cleared for take-off, Runway 24L (however, Runway 24L does not exist). The Airbus 330 flight crew, for whom clearance was actually intended, failed to respond immediately to the communication for obscure reasons and additionally failed to respond to the incorrect readback given by the other flight crew. Around the time at which the incorrect readback had been given, a colleague took over from the runway controller. The incorrect readback given by the Airbus A319 flight crew escaped the notice of both the runway controller whose shift was being taken over by a colleague and the colleague taking over his shift. The Airbus A319 commenced take-off from Runway 24 and the flight crew then saw a Boeing 747 crossing. Assistant 2 saw what was happening and warned the runway controller who had just arrived, who instructed the Airbus 319 flight crew to abort take-off. No separate ATC tower supervisor was present. A visiting supervisor from the general Air Traffic Control Service was present to familiarise himself with the area.

APPENDIX I

RUNWAY CONTROL TRIAL

In collaboration with Air Traffic Control the Netherlands and the Inspectorate for Transport, Public Works and Water Management, Amsterdam Airport Schiphol undertook preparations to implement direct communications between aircraft tug drivers and the air traffic controllers working at Air Traffic Control the Netherlands. The procedure is referred to as 'Runway Control' and entails conducting communications in aviation English on aviation radio channels.

The change in the method of communication was motivated by the serious incident involving a Delta Airlines aircraft at Amsterdam Airport Schiphol in 1998. The then Dutch Transport Safety Board launched an investigation into the incident and recommended *inter alia* that an evaluation be carried out of the coordination and communication procedures at that time between Air Traffic Control the Netherlands and Amsterdam Airport Schiphol.

During the Schiphol Operations Consultation in March 2010 it was decided to revise the procedures for vehicles on runways and taxiways at Amsterdam Airport Schiphol. The Executive Board of Air Traffic Control the Netherlands stated at the outset that standard traffic control procedures implied that the ground staff concerned should conduct communications with the ATC tower in English according to standard radiotelephony procedures.

A proposal was therefore put forward during the same Schiphol Operations Consultation meeting to organise a trial radiotelephony course aimed at looking at the trainability of the ground staff concerned. To that end an adapted radiotelephony course was developed and aligned as closely as possible with day-to-day practice. In a letter dated 13 August 2001, the Executive Board of Air Traffic Control the Netherlands stated that the trial course was successful. The level attained at the end of the course was deemed sufficient for conducting radio communications after practical field training. The radiotelephony course commenced on 1 September 2002. The course was incorporated into the syllabus of the 'RT course for vehicle drivers'. In March 2003 (hence during the implementation of Phase 1 of the Runway Control project⁸⁰) some 120 people held a radiotelephony certificate.

With Air Traffic Control the Netherlands leading the project, implementation of the first phase of the Runway Control project commenced at Amsterdam Airport Schiphol on 20 February 2003. The Runway Control project consisted of three phases as follows:

⁸⁰ See next paragraph.

- Phase 1 set out the procedures for vehicles wishing to drive down the entire length of a take-off or landing runway. The vehicles conduct communications with the runway controller in English. The vehicles are treated as aircraft by the runway controller. Pre-printed flight progress strips and green strip holders designed for vehicles were available in the ATC tower. A radiotelephony syllabus containing the radiotelephony English phraseology used by the vehicle drivers had also been made available in the ATC tower.
- Phase 2 related to the procedures for vehicles and aircraft tows wishing to cross a take-off or landing runway.
- Phase 3 focused on procedures for all vehicles and aircraft tows.

The implementation of Phase 1 of the Runway Control project coincided with the implementation of numerous changes in the work procedure of Air Traffic Control the Netherlands. These related to what was referred to as the '5P procedural changes' in respect of the new 18R-36L Runway becoming operational. Air Traffic Control the Netherlands announced these changes to its staff in a four-page internal memorandum. The implementation of Phase 1 of the Runway Control project was also announced in the same operational memorandum (four lines of text).

From the start of Phase 1 of the project on 20 February 2003 to 5 March 2003, the ATC tower supervisor recorded 16 reports concerning bird controllers in the duty officer's report.⁸¹ Several reports related to their command of the English language while other reports related to the difficulty in understanding what was said on the radios used by the bird controllers at that time. It was also reported that the runway controllers had omitted to switch on the flashing lights on the runway allocation panel. Rumours had already been circulating in the Air Traffic Control Operations Department before the start of the trial that it was going to be a failure. On 1 March 2003 a runway controller noted in the duty officer report that what he had feared during the training sessions on the 5P procedural changes had turned into reality, he said that standard phraseology was not being used and that he did not want that 'rubbish' on his frequency. He also expressed the desire to discontinue Phase 1 of the Runway Control programme. A few days later another runway controller recorded that he had reverted to conducting communications with the bird controller on radiotelephony channel 1 rather than on the aviation frequency.

On 10 March 2003 the ATC tower procedure expert expressed his concern in an e-mail to the Management of Air Traffic Control the Netherlands about the difficulty in understanding vehicle drivers, based on reports recorded in the duty officer's report. The bird controllers could be clearly heard on the runway channel but not on the aviation frequency. He also stated that the quality of both the standard and non-standard radiotelephony communications conducted by vehicle drivers in English was disappointing in practice. Following discussions between the operations expert of Air Traffic Control the Netherlands and Amsterdam Airport Schiphol it was concluded that the quality of the radios could be improved, but that this would take some time.

⁸¹ During the trial the bird controller's call sign was 'checker'.

The operations expert proposed to the Management of Air Traffic Control the Netherlands that 'all previous practices be resumed until the improvements mentioned had been made'.

On 11 March 2003 – based on the reports made in the duty officer's report, a recommendation by the organisation's operations expert and an assessment in the supervisor's meeting of 10 March 2003 - Air Traffic Control the Netherlands Management postponed Phase 1 of the Runway Control project 'until such time as the quality of the conceptual element is of a level that actually conforms to the envisaged safety level of the ATC tower product.' The shelving of Phase 1 of the Runway Control project was announced to staff in an internal operational memorandum dated 13 March 2003. In a nutshell, the announcement meant reverting to the old procedure and the old call signs. Furthermore, better quality vehicle radios were required, and in consultation with Amsterdam Airport Schiphol the drivers' were required to increase their knowledge.

Following the decision, contact was sought with a manager at Amsterdam Airport Schiphol to advise him of the decision. The Inspectorate for Transport, Public Works and Water Managements was not notified of the discontinuation of Phase 1 of the Runway Control project by Air Traffic Control the Netherlands.

On 12 June 2003, Air Traffic Control the Netherlands informed the Inspectorate of the results of a focus group meeting about developments in Phase 1 of the Runway Control project.

Following a meeting between Air Traffic Control the Netherlands and the Inspectorate on 26 June 2003 about the problems with the Runway Control project, Air Traffic Control the Netherlands sent the Inspectorate a letter dated 24 July 2003. The letter contained information requested by the latter about the circumstances that had led to the postponement of procedures concerning the above and the temporary and other measures that had been taken to ensure continued safe operations.

The letter also stated that as a result of the Delta incident there was a reluctance to report incidents and that a number of more serious incidents had not been reported. The organisation described the Runway Control procedure as worthwhile. According to Air Traffic Control the Netherlands, the safety enhancements intended to be achieved by raising situational awareness could definitely be realised if all relevant players were aware of the current situation. The organisation emphasised that the measures that were to be implemented would be laid down and that the underlying principle was certainly good. However, due to the vehicle drivers' inexperience with radiotelephony, their difficulty with the English language and their lack of familiarity with operational radiotelephony procedures, the organisation deemed it inadvisable to implement the procedure. The organisation requested the Inspectorate for approval not to implement Runway Control (meaning that communications with vehicles would again be conducted via assistant 2) and promised that it would submit definitive procedures as soon as possible.

In its reply to Air Traffic Control the Netherlands on 9 July 2003, the Schiphol Safety Platform⁸² remarked that Air Traffic Control the Netherlands had unilaterally decided to discontinue the trial (i.e. Phase 1 of the Runway Control project) whereas the Platform had decided to await the results of the trial, and on the basis thereof agree on any action to be taken. The Platform said its plans had been thwarted as a result of Air Traffic Control the Netherlands discontinuing the project.

A number of internal memoranda were written by the Inspectorate. In a memorandum of 11 June 2003 the Inspectorate wrote that rumours had already been circulating in the Air Traffic Control Operations Department that 'the trial would be a failure' even before it had commenced. This was said to be possibly attributable, in part, to the simultaneous implementation of procedures for putting the new 18R-36L runway into operation.

An Inspectorate memorandum of 1 September 2003 queried the manner in which Air Traffic Control the Netherlands had postponed the project and the reluctance to report incidents. The Inspectorate also wondered why radiotelephony operating practices did not align with the theoretical course. On 1 December 2003 the Inspectorate added a note to Air Traffic Control the Netherlands' letter of 24 July 2003 stating 'temporarily on hold'. The Inspectorate did not send a response to the letter dated 24 July 2003.

At the end of 2003 the Inspectorate found that the number of runway incursion incidents at Amsterdam Airport Schiphol had risen. The Inspectorate wrote a letter to both Amsterdam Airport Schiphol and Air Traffic Control the Netherlands on 12 December 2003 asking what these parties had undertaken in response to these incidents to reverse the 'trend' it had established. The Inspectorate expressly requested a joint letter as it was keen to learn to what degree the parties had coordinated the measures to be taken.

A separate reply was initially received from the two parties. The Inspectorate then reiterated its request for a coordinated reply. From April 2004 the RST which had been set up at that time undertook to finalise the reply to the Inspectorate's December 2003 letter. Amsterdam Airport Schiphol and Air Traffic Control the Netherlands ultimately sent a joint reply to the Inspectorate on 2 August 2004. It was unclear to the Inspectorate how the measures described in the reply had been formulated and how effective they were. The Inspectorate was also keen to learn how the formal responsibilities had been established. On the basis of the above the Inspectorate felt that it had insufficient insight into whether the issue of runway incursions at Schiphol was being adequately addressed. The Inspectorate then decided to perform an inspection based around the theme of Runway Incursions.

The report of the theme-based inspection was published on 28 January 2005 and contains numerous findings. It was found, among other things, that assistant 2 has quite a high workload. It was also stated that the decision not to conduct communications in the English language had not been substantiated, and no further information was given even after repeated requests for substantiation.

⁸² The Integrated Safety Management System Schiphol was established following the Bijlmer disaster in Amsterdam in 1992. The safety management system later evolved out of the above system as a 'sector responsibility'.

It was also found that with vehicles having to frequently switch between Amsterdam Airport Schiphol and Air Traffic Control the Netherlands during operations, the likelihood of errors increases. The Inspectorate's report also observed that procedures were unilaterally abandoned without any record thereof having been made. Such decisions could not be traced back to a formal management decision.

On 1 September 2006 the Inspectorate published a report on an Audit Inspection that had been performed of progress made on the implementation of runway incursion measures. The purpose of the inspection was to determine to what extent the sector parties had adopted the recommendations made in the 'Theme-based Inspection on Runway Incursions at Schiphol' report. The overall conclusion was that the sector parties were making good progress, but also that a number of recommendations had not been adopted 'such as the implementation of radiotelephony in English on a shared frequency'.

The conclusions in the report stated that a stronger position for the Runway Safety Team would help effective decision-making and accelerate the implementation of decisions. Reference was also made to an earlier observation made in the Schiphol Safety Platform that it would help if the status, activities and scope of the Schiphol Safety Platform were bolstered. The conclusions called for scrutiny of the RST's performance, particularly the RST's decision-making powers.

An internal memorandum from the Inspectorate dated 4 April 2007 stated that while the number of runway incursions had appeared to have risen slightly in 2006, it was assumed that the increase was partly due to the fact that more incidents had been reported. The memorandum furthermore stated that 'if the Inspectorate now carries out a theme-based inspection, this will jeopardise the trust built up in reporting incidents. On top of that, this would have serious implications for the relationship between the sector and the government within the RST'.

No further action was undertaken on Runway Control by the Inspectorate after that. The work procedure carried out to date reflects the situation after the postponement of the 'Runway Control' project in March 2003.



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Geachte

In antwoord op de brief van van 13 maart 2001 (NLA/S&B/01.520 285) bericht ik u als volgt over de stand van zaken betreffende de implementatie van de aanbevelingen gedaan door de Raad voor de Transport Veiligheid in rapport 98-85/s-14.

Aanbeveling 5.1 (Actie AAS)

Technical facilities with regard to the protection of runway exits at Amsterdam Airport Schiphol should be identical to allow standard procedures for all runway crossings (in particular so with regard to exit 2 of runway 06/24). In the meantime movements to/from S-apron other than by taxiing aircraft should not be allowed during low visibility weather conditions. In this connection it is recommended to follow up ICAO Annex 14 Standards as soon as possible.
Procedures voor het kruisen naar/van het S-apron zijn gerealiseerd. Voor nader informatie verwijst ik u naar de rapportering van AAS (brief 6818 van 23 mei 2001).

Aanbeveling 5.2

Refresher training of procedures and radio communication should be provided to ATC Tower staff and platform employees.
In de recurrent trainingen 2000 hebben alle units een algemene R/T refresher training gehad.

Aanbeveling 5.3

A Tower Supervisor should not have additional duties.
Er is gehoor gegeven aan deze aanbeveling.

Aanbeveling 5.4:

Checklists should be used when changing the Tower configuration.
Haalbaarheid en nut van deze aanbeveling moeten nog nader worden onderzocht. Momenteel wordt door LVNL bezien of een checklist zoals bij NATS in gebruik is (een creditcard model) nuttig kan zijn. In het onlangs verschenen LVNL Safety Bulletin is nog eens extra aandacht besteed aan het belang van een goede overdracht.

Aanbeveling 5.5

The control panels for stopbars and traffic lights should be redesigned and integrated geographically to avoid any ambiguity.
Dit is afgerekend. Daarnaast wordt het totale stopbarbeleid herzien. Dit zal in de loop van 2002 worden afgerekend. Zie verder de eerdergenoemde rapportering van AAS.

Bezoekadres:
Stationsplein Zuid-West 1001
1117 CV Schiphol-Oost

Aanbeveling 5.6

Add a logging device to the existing groundradar.

Logging voor de huidige grondradar is gerealiseerd.

Aanbeveling 5.7

Assistant Controller positions should be equipped with a multi-mode screen.

Positie T7 wordt voorzien van een multi-mode screen. Dit wordt gerealiseerd bij de herinrichting van de toren. Dit project is vrijwel afgerond.

Aanbeveling 5.8

Team resource management training should be implemented for Air Traffic Control staff.

Voor nieuw personeel wordt dit in de training opgenomen. Team resource management kan echter alleen goed getraind worden bij zittend personeel. Dit is wel voorzien, maar nog niet gerealiseerd. Het is op dit moment ook niet voorzien in het kader van de 5P trainingen. LVNL zal opnieuw bezien of dit onderwerp alsnog in dit trainingsprogramma kan worden ondergebracht. Over de vraag of dit qua personele bezetting haalbaar is, kunnen nu nog geen uitspraken worden gedaan.

Aanbeveling 5.9

Re-evaluate present co-ordination and communication procedures between Air Traffic Control and Amsterdam Airport Schiphol.

Aan deze aanbeveling wordt gehoor gegeven. Voor nadere informatie verwijst ik u naar de rapportering van AAS. Verder is aandacht geschenken aan een correcte toepassing van de huidige procedures.

Ik vertrouw erop u met het bovenstaande voldoende te hebben geïnformeerd. Zodra er aanvullende informatie is zal deze aan u beschikbaar worden gesteld.

Hoogachtend,

Bestuurder en
Lid Directieteam LVNL

PROCEDURES AT OTHER AIRPORTS

This appendix briefly discusses a number of relevant procedures at three other major European airports. Frankfurt Airport handles communications with vehicle traffic on an active runway in the English language on the runway controller's radio frequency. No adapted course is given but vehicle drivers hold the same radio communications qualification as pilots who operate IFR flights (IFR licence). Mastering the requisite knowledge of the English language is not a problem. The courses are provided by the Airport Operator.

Incidents with a vehicle have rarely occurred since introducing communications in the English language at Frankfurt Airport for vehicles on an active runway on the runway controller's frequency. Only one incident with a vehicle on an active runway has occurred since 2005, and that was at the end of 2011. The driver believed that he had heard clearance being issued to an aircraft on that particular runway and vacated the runway on time.

At Paris Charles de Gaulle Airport, the runway controller handles communications with vehicle traffic on an active runway on his designated frequency. Like French-speaking pilots, communications with vehicle drivers are conducted in the French language. Runway occupied information is shown on all screens in the ATC tower as well as on screens in the Approach-Control room. As a further aid in preventing a runway controller from nonetheless forgetting that a vehicle is present on a runway, wind information is rendered invisible to the runway controller as long as a vehicle is on the runway. Runway controllers always provide landing aircraft – and often departing aircraft too – with information about the wind-force and wind direction. A runway controller will notice the invisibility of wind information when he issues take-off or landing clearance, which warns him that a vehicle is still on the runway.

London Heathrow Airport handles all communications with vehicle traffic and aircraft tows on an active runway on the runway controller's frequency or another aviation frequency connected to that frequency (on a connected frequency, a call on one frequency can also be heard on the other frequency). For obvious reasons, communications are always conducted in English at Heathrow Airport. Heathrow uses an electronic flight progress strip to indicate runway occupancy. Each vehicle present on an active runway and each aircraft that crosses an active runway has its own dedicated electronic strip.

APPENDIX K

REFERENCE FRAMEWORK

General

A reference framework forms an integral part of any investigation by the Dutch Safety Board. It describes the situation as may be expected on the basis of the applicable regulations, guidelines and the fulfilment of individual responsibility. Conducting assessments and identifying deviations on the basis of such a framework can help bring to light areas for improvement and/or the need for supplementary measures.

The reference framework in this report consists of two parts, the first of which covers the prevailing civil aviation laws and regulations. It also discusses international and national industry guidelines, internal company guidelines and manuals. The second part describes the Dutch Safety Board's expectations regarding the manner in which the parties involved have fulfilled their individual responsibility for safety and safety management.

This appendix distinguishes between binding laws and regulations, on the one hand, and non-binding standards, on the other. Much international legislation is not directly binding, but becomes binding when transposed into national legislation. Given that the transposition of legislation is an ongoing process in European countries, such international legislation is set out under the first category of binding laws and regulations.

Laws and regulations

The regulation of civil aviation is largely internationally oriented. This part of the reference framework is thus largely based on international regulations.

International regulations

The international regulations relevant to this investigation comprise the following:

1. The Standards and Recommended Practices set out in the annexes to the Convention on International Civil Aviation (also known as the Chicago Convention)
2. EU regulations.

Re 1 The Chicago Convention annexes

Virtually all countries across the globe are signatories to the Chicago Convention, which sets out the principles and regulations for numerous matters that are important for the development of international civil aviation.

It also forms the legal basis for the establishment of the International Civil Aviation Organisation (ICAO). The Chicago Convention features a large number of annexes that regulate a range of topics in great detail. These annexes do not have the same binding force as the Convention itself, but they do play an important part in the regulation of international civil aviation.

The annexes include the Standards and Recommended Practices. In any event, member states are required to transpose the Standards as closely as possible into their national legislation. ICAO must be notified of any deviations from a Standard. A Recommended Practice is a recommended work procedure that a member state may incorporate into national legislation. This is not mandatory, however, and a member state does not need to report that it will not incorporate a work procedure, but nevertheless is recommended to do so.

Re EU regulations

EU regulations apply directly to EU Member States and are in fact comparable with national legislation. The following regulation is relevant to this investigation:

Supervision of air navigation service providers

The National Supervisory Authority (NSA), a division of the Human Environment and Transport Inspectorate, carries out the activities⁸³ set out in the 'Single European Sky' legislative framework and performs supervision of the air navigation service providers each year pursuant to the above legislation.⁸⁴ This means that in the Netherlands the NSA is responsible for effectively performing supervision of Air Traffic Control the Netherlands.

National laws and regulations

National Regulations for the Safe Use of Airports and Aerodromes

The Regulations laid down by the Minister of Transport, Public Works and Water Management of 27 October 2009, No. CEND/HDJZ 2009/1166 (National Regulations for the Safe Use of Airports and Other Aerodromes, RVGLT) sets out rules relating to the construction, layout, equipment and safe use of airports and other aerodromes with a view to ensuring safe and orderly operations at airports and aerodromes. These regulations also apply to Amsterdam Airport Schiphol.

Aviation Act

Chapter 5 of the Aviation Act [Wet luchtvaart] sets out the relevant regulations governing air traffic, aviation safety and the aviation safety organisation.

⁸³ The European Commission has laid down requirements for the organisation of supervision, which are incorporated into EC Regulation 1315/2007 on Safety oversight in air traffic management.

⁸⁴ EC Regulation 2096/2005 of 20 December 2005 laying down common requirements for the provision of air navigation services.

Directives

Relevant manuals

Amsterdam Airport Schiphol

ICAO Annex 14, Chapter 5, and the ICAO Aerodrome Design Manual, Part 4, Chapter 9.2, set out the requirements for the lighting, markings and signs used for taxiways and runways.

Air Traffic Control the Netherlands

The regulations and procedures with which Air Traffic Control the Netherlands is required to comply, in addition to the ICAO Standards and Recommended Practices, are set out in European regulations, national legislation (see section 3.2) and in internal regulations, such as the Air Traffic Control Operations Manual (VDV). The organisation furthermore issues the Netherlands Aeronautical Information Publication (AIP) and Notices to Airmen (NOTAMs) on behalf of the Netherlands Civil Aviation Authority.

Air Traffic Control Operations Manual

The VDV summarises all the procedures, work methods, rules and regulations that operational staff at Air Traffic Control the Netherlands are required to observe in order to carry out their tasks safely and efficiently. The VDV is not subject to approval from the Netherlands Civil Aviation Authority. The VDV sets out the manner in which Air Traffic Control the Netherlands should provide air traffic control services in the Netherlands, and consists of eight parts. The Schiphol Tower/Approach section in the VDV is relevant to this investigation.

Aeronautical Information Publication

The Aeronautical Information Publication (AIP) is designed for all airmen. It includes Dutch laws and regulations, flight procedures and information on airports and aerodromes, including Air Traffic Control, take-off and departure procedures. Any amendments to the regulations, procedures or information are incorporated into the AIP.

Human Environment and Transport Inspectorate

The Inspectorate performs supervision of air navigation service providers and airspace users. The Inspectorate describes supervision in the air domain in the 'supervision scheme', and applies 1 December 2008 as the reference date. The scheme contains an explanation of the organisation of airspace and the players in the domain. It depicts the manner in which the Inspectorate has organised supervision in an annual plan and an inspection programme, its reporting method and how it measures the effect of supervision.

EAPPRI documents

The European Action Plan for the Prevention of Runway Incursions, which is based on the ICAO Standards and Recommended Practices, contains recommendations formulated by numerous European aviation organisations. The EAPPRI is published under the auspices of EUROCONTROL. The ICAO secretariat was closely involved in drawing up the document.

When implemented, the recommendations in the document will help raise the level of safety on and around take-off runways, *inter alia* by improving communication procedures and communications between pilots, air traffic controllers and vehicle drivers, thus increasing the level of situational awareness of the parties involved.

The first edition of the EAPPRI document dates from 2004. An updated version of the document was published in April 2011. Recommendations have been added to and updated in this latest edition. Among other aspects, the document highlights the importance of good quality investigation reports on runway incursions and stresses the importance of learning lessons from incidents that have taken place. Communications have again been marked as a priority in the prevention of runway incursions.

Safety management reference framework

Safety management relates to the manner in which organisations fulfil their responsibility for safety, in addition to the applicable laws and regulations, standards and guidelines. This involves aspects such as the manner in which the risks for the parties involved are identified and structurally controlled. The organisation must have a structure in place in order to implement the entire process transparently and to create opportunities for continuous improvement. This structure is referred to as the safety management system. Various accidents that have occurred in the past have brought to light that the structure of the safety management system and the manner in which the parties involved implement this system play a vital role in managing, guaranteeing and continuously improving safety.

In conducting investigations, the Dutch Safety Board applies five general safety principles to determine whether, and if so how, the parties have fulfilled their individual responsibility for safety. These safety principles are based on national and international laws and regulations and a large number of widely accepted and implemented standards.

1. Acquire demonstrable insight into the safety risks serving as a basis for safety strategy

The starting point for achieving the required level of safety is to conduct a review of the entire system and an assessment of the associated risks. This will serve as a basis for establishing which hazards need to be managed and which preventive and repressive measures should be taken to that end.

2. Demonstrable and realistic safety strategy

A realistic and practicable safety strategy (or safety policy) must be adopted for the purpose of preventing and managing undesired incidents. This safety strategy is based on the following:

- relevant current laws and regulations;
- the applicable industry standards, guidelines and best practices, the individual insight and experience of the organisation and the safety objectives defined specifically for the organisation.

3. *Implement and enforce safety strategy*

Safety strategy should be implemented and enforced, and the identified risks managed as set out below:

- a description of the manner in which the defined safety strategy is implemented, focusing on specific objectives, including the corresponding preventive and repressive measures;
- a transparent, clearly-defined division of responsibilities relating to safety on the 'shop floor' in respect of the implementation and enforcement of safety plans and measures, which information is available to all;
- a clear definition of the required staff and necessary expertise in the various roles;
- clear and active central coordination of safety activities;
- realistic training on and testing of safety strategy.

4. *Tightening safety strategy*

The safety strategy should be continuously evaluated and tightened on the basis of the following:

- carrying out periodic risk and other analyses, observation rounds, inspections and audits, which activities should in any event be performed whenever changes to basic principles are made (pro-active approach);
- a system for monitoring and investigating near accidents and accidents in the complex, and an expert analysis of these incidents (reactive approach).

Evaluations are performed on the basis of the above, and improvement areas identified which can be actively managed.

5. *Management guidance, commitment and communication*

The management of the parties/organisation involved should ensure the following:

- that internally expectations regarding the safety objectives are clearly defined and realistic, and that the 'shop floor' is receptive to the idea of making continuous improvements to safety;
- clear external communications regarding general working procedures, how these are assessed, procedures in the event of deviations and so on, based on clearly defined and documented agreements with the parties in the surrounding area.

APPENDIX L

DUTIES AND RESPONSIBILITIES

Duties and responsibilities of the officers in the ATC tower

Source: VDV 2, Chapter 6.01 pp.1 and 7.01, pp. 1 and 2.

Ground controller

The ground controller (GC) is responsible for controlling traffic in the manoeuvring area, with the exception of the available take-off and landing runways.

The GC:

- maintains communications with the flights under his control;
- issues pushback and taxiing instructions;
- during LVC, or if the runway controller (RC) or GC to whom a taxiing aircraft is transferred requests him to do so:
 - checks the aircraft type on the ground radar image;
 - where necessary, issues instructions to the pilot about using a transponder correctly;
 - where necessary, adds the aircraft type manually by entering it in the TWR system;
- transfers departing aircraft and aircraft that are to cross an available runway to the RC;
- where necessary, issues instructions to prevent collisions between one or more aircraft, and between aircraft and vehicles;
- where necessary, issues instructions to prevent uncontrolled or unauthorised entry to take-off and landing runways;
- informs pilots about changes in weather conditions and the status of aids to navigation;
- assigns remote holding positions to aircraft;
- operates the taxiway lighting;
- raises the alarm in the event of emergency.

TWR supervisor

The ATC tower supervisor (TWR-SUP) operationally manages the Tower Unit (TWR unit) and performs general coordination tasks.

The TWR SUP:

- monitors the efficient handling of traffic within the Schiphol Control Zones (CTRs);
- in consultation with the APP-SUP, ACC-SUP and FMPC, determines the handling strategy and capacity for the Schiphol TWR/APP, and ensures ATFCM measures are taken, where necessary;
- decides on requests for special flights within the Schiphol CTRs;
- takes joint decisions on and communicates measures taken at Schiphol;

- monitors the performance of staff, procedures, work methods, systems and equipment in the ATC tower (TWR).
- is in charge of handling emergency situations within the TWR operating area and coordinates all emergency activities.

Runway controller

The RC is responsible for controlling traffic in the control zone except for flights under the GC's control. The RC:

- maintains communications with the flights under his control;
- is responsible for visually monitoring, as far as possible, the compulsory separation of the aircraft under his control and other aircraft notified to him;
- where necessary, issues instructions to prevent collisions between aircraft as well as between aircraft and vehicles;
- handles inbound and outbound flights in accordance with the instructions provided by Schiphol APP;
- informs pilots about changes in weather conditions and the status of aids to navigation;
- is responsible for switching on runway and approach lighting, Precision Approach Path Indicators (PAPIs) and stop-bar lighting;
- transfers aircraft that have crossed an available runway to the GC;
- raises the alarm in the event of emergency.

Tower assistant 2

Tower assistant 2's role is to provide general assistance in the ATC tower. His key duties are as follows:

- assist the RC (safety net function);
- guide vehicles in the manoeuvring area under the GC's responsibility;
- allow vehicles to cross and drive down runways under the RC's responsibility;
- allow aircraft tows to cross runways under the RC's responsibility;
- coordinate activities with Schiphol ATC Tower West (TWR-W);
- act as an intermediary between the RC and the PT when guiding aircraft tows;
- coordinate with and provide information to airport services, external emergency services and other parties involved;
- prepare and distribute inbound strips;
- identify occupied aircraft stands;
- raise the alarm in the event of emergency;
- coordinate activities in the event of an emergency.



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