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Final report RL 2012:16

Serious incident between an aircraft with registration OO-DJX and a service vehicle at Landvetter Airport, Västra Götaland county, on 8 September 2011

Ref no: L-96/11

27/08/2012

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1. LfV¹
2. The Swedish Transport Agency's
Civil Aviation Department

Final report RL 2012:16

The Swedish Accident Investigation Authority (Statens haverikommission, SHK) has investigated a serious incident that occurred on 8 September 2011 at Landvetter Airport, Västra Götaland county, involving an aircraft with registration OO-DJX and a service vehicle.

In accordance with Regulation (EU) No 996/2010 on the investigation and prevention of accidents and incidents in civil aviation, the SHK investigation team hereby submits a final report on the results of the investigation.

The Swedish Accident Investigation Authority respectfully requests to receive, by November 30, 2012 at the latest, information regarding measures taken in response to the recommendations included in this report.

On behalf of the Swedish Accident Investigation Authority,

Hans Ytterberg

Nicolas Seger

¹ LfV is a state-owned public enterprise which conducts air traffic services in Sweden for civilian and military clients.

General observations

The Swedish Accident Investigation Authority (Statens haverikommission – SHK) is an independent authority with the task of investigating accidents and incidents with the aim of improving safety. SHK accident investigations are intended to clarify, as far as possible, the sequence of events and their causes, as well as damages and other consequences. The results of an investigation shall provide the basis for decisions aiming at preventing a similar event from occurring again, or limiting the effects of such an event. The investigation shall also provide a basis for assessment of the performance of rescue services and, when appropriate, for improvements to these rescue services.

SHK accident investigations thus aim at answering three questions: *What happened? Why did it happen? How can a similar event be avoided in the future?*

SHK does not have any supervisory role and its investigations do not deal with issues of guilt, blame or liability for damages. Accidents and incidents are, therefore, neither investigated nor described in the report from any such perspectives. Therefore, accidents and incidents are neither investigated nor described in the report from any such perspective. These issues are, when appropriate, dealt with by judicial authorities or e.g. by insurance companies. The task of SHK also does not include investigating how persons affected by an accident or incident have been cared for by hospital services, once an emergency operation has been concluded. Measures in support of such individuals by the social services, for example in the form of post crisis management, also are not the subject of the investigation.

Investigations of aviation incidents are governed mainly by Regulation (EU) No 996/2010 on the investigation and prevention of accidents and incidents in civil aviation. The investigation is carried out in accordance with Annex 13 of the Chicago Convention.

The investigation

SHK was notified on 9 September 2011 that a serious incident had occurred involving an aircraft with registration OO-DJX and a service vehicle on 8 September at 1141 hrs at Landvetter Airport, Västra Götaland county.

The incident has been investigated by SHK represented by Mr Hans Ytterberg, Chairperson, Mr Nicolas Seger, Investigator in Charge, and Mr Jens Ohlsson, Investigator specializing in Human and Organisational Factors.

The investigation team of SHK was assisted by Ms Gerd Svensson as an expert specializing in Human and Organisational Factors, Mr Bengt Persson as an expert in Air Traffic Service and Mr Christer Magnusson as a sound expert.

The investigation was followed by Mr Göran Skirby, Swedish Transport Agency.

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| | |
|--|---|
| <i>Aircraft: registration and type</i> | OO-DJX, AVRO 146-RJ85 |
| <i>Class/Airworthiness</i> | Normal, Certificate of Airworthiness and valid ARC |
| <i>Operator</i> | Brussels Airlines |
| <i>Time of occurrence</i> | 08-09-2011, 1141 hrs in daylight. Note: All times are given in Swedish daylight saving time (UTC ² + 2 hrs) |
| <i>Place</i> | Landvetter Airport, Västra Götaland county, (pos 57°39'N 012°17'E; 154 m above sea level) |
| <i>Type of flight</i> | Scheduled flight |
| <i>Weather</i> | According to SMHI's analysis: wind 220°/12 kts, visibility 10 km, 3-4/8 Cumulonimbus ³ with the cloud base at 1,600 feet, temp/dewpoint 14/10° C, QNH ⁴ 995 hPa |
| <i>Persons on board:</i> | |
| <i>crew members</i> | 4 |
| <i>passengers</i> | 81 |
| <i>Injuries to persons</i> | None |
| <i>Damage to aircraft</i> | None |
| <i>Other damage</i> | None |
| <i>Commander:</i> | |
| <i>Age, licence</i> | 34, ATPL ⁵ (A) |
| <i>Flying hours on type</i> | 3,530 hours |
| <i>Flying hours previous 90 days</i> | 127 hours on type |
| <i>Number of landings previous 90 days</i> | 43 on type |
| <i>Co-pilot:</i> | |
| <i>Age, licence</i> | 24 years old, CPL ⁶ (A) |
| <i>Flying hours on type</i> | 1,149 hours |
| <i>Flying hours previous 90 days</i> | 184 hours on type |
| <i>Number of landings previous 90 days</i> | 58 on type |

Sequence of events

The aircraft was taking off from runway 21 at Landvetter Airport at the same time as a service vehicle approached the right-hand edge of the runway. The service vehicle stopped around 40 metres from the aircraft's lift-off point.

The vehicle RMS726 was on NORRA GENVÄGEN (see Fig. 1), which is situated west of the runway at Landvetter Airport, in order to drive out onto the runway. As the air traffic controller (AD2 – trainee with instructor) had in-

² UTC - Universal Time Co-ordinated is a reference for the exact time anywhere in the world.

³ CB - Cumulonimbus – Thundercloud.

⁴ QNH - Atmospheric pressure adjusted to sea level.

⁵ ATPL- (Airline Transport Pilot Licence) is a licence required to be able to fly as a commander in commercial air traffic on board aircraft with more than one pilot.

⁶ CPL- (Commercial Pilot Licence) is an airline licence required to be able to fly as a second pilot (First Officer) in commercial air traffic on board aircraft with more than one pilot.

structed the driver of the vehicle to wait for approximately 15 minutes, the driver decided in the meantime to drive to the point for GP03⁷ via RÅDJURSVÄGEN, which the driver informed the air traffic controller of. After 10-15 minutes, the driver of the vehicle called the tower and informed it that he was once again at NORRA GENVÄGEN. The air traffic controller (AD2) responded and instructed RMS726 to hold position. At the same time, two more vehicles were waiting to drive out onto the runway; service vehicles 238 and 235, on taxiway F, which is situated east of the runway. Soon after, the air traffic controller (AD2) and the instructor handed over the work to a colleague so that they could go to lunch. The colleague relieving them was informed that RMS726 was located by KIOSK 211⁸.

Around four minutes later, the air traffic controller (AD1) gave the aircraft with call signal BEL 17F take-off clearance for runway 21. When the aircraft was rolling, the service vehicles were given clearance from AD2 – in the order 238 and 235 first, then RMS726 – to drive out onto the runway, whereupon 238 and 235 left the taxiway and drove out onto the runway from taxiway F.

RMS726, which at this point was on NORRA GENVÄGEN, started to drive towards the runway, whereupon the driver perceived a light from the left at the same time as he heard a rumbling noise. He spotted the aircraft which was taking off and stopped immediately.

At this point, RMS726 was 27 metres from the white stripes at the side of the runway and 50 metres from the runway centre line, and was therefore in zone 2 (see Figure 4), all according to information from the aviation safety coordinator at Landvetter Airport.

The aircraft taking off completed take-off, and neither the commander (PIC⁹) nor the co-pilot (FO¹⁰) noticed the vehicle in the proximity of the runway.

⁷ GP – (Glide Path) Glide path transmitter, together with a localizer (LLZ), provides the pilot with information on the position during approach.

⁸ KIOSK211 - Transformer substation.

⁹ PIC - Pilot in Command - Commander.

¹⁰ FO - First Officer - Co-pilot.

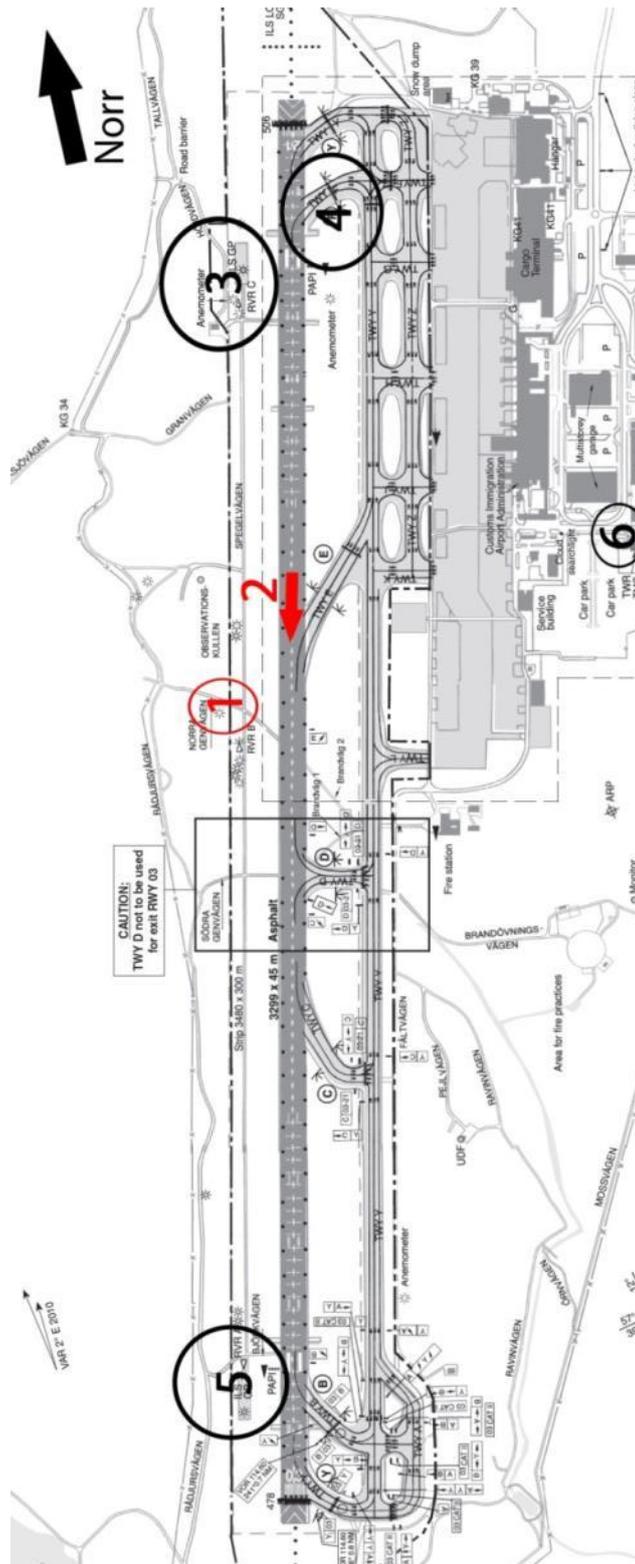


Fig. 1. Ground map of Landvetter Airport. The markings indicate the approximate positions and directions of the ground vehicles and the aircraft at the time of the incident. 1. RMS726, 2. Aircraft performing take-off, 3. KIOSK211, 4. Service vehicles 238+235, 5. GPO3, 6. Air control tower.

Operative conditions

Runway Incursion

ICAO's¹¹ definition of Runway Incursion is as follows:

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. The protected area consists of the runway and a buffer zone around this.

According to the document *European Action Plan for the Prevention of Runway Incursions* (EAPPRI), version 2, (updated April 2011), there are on average two runway incursions per day in Europe. It is also stated that roughly half of all reported cases of runway incursions are connected to conditional clearance and incomplete read-back (i.e. repetition of a received message with the purpose of checking that it has been correctly understood).

Aviation safety management

LFV¹² uses and SMS¹³ manual, which constitutes a basis for the central system for safety management. The manual acts as a tool for ensuring that LFV's aviation safety goals are observed. In the publication *LFV och flygsäkerheten* [LFV and aviation safety], LFV's two overall aviation safety goals are defined as follows:

Goal 1: *LFV shall not contribute to any incident which leads to the serious injury or death of persons.*

Goal 2: *The number of incidents in which LFV's part in an incident has been classified A or B. For the year 2011 the target is a maximum of eight incidents, of which the number of incidents classified as A may not exceed two.*

The ATS¹⁴ Landvetter's local operations manual (Dhb), Part II, Organization and safety culture, 2.1. states:

The local work of aviation safety is dependent on a sound safety culture in accordance with ANS¹⁵ Dhb Part II Chapter 2. It places great responsibility on the individual operator to maintain his or her quality with respect to operative performance and fitness for service.

In the publication *LFV och flygsäkerheten* from 2011, the term "safety culture" is defined as follows:

Safety culture is formed by the attitudes, perceptions, values and norms of individuals, groups and the organization as a whole. A sound safety culture is characterized by the endeavour to increase safety, irrespective of the individual style of management or commercial pressure. But aviation safety

¹¹ ICAO - International Civil Aviation Organization.

¹² LFV is a state-owned public enterprise which conducts air traffic services in Sweden for civilian and military clients.

¹³SMS - Safety Management System.

¹⁴ ATS - Air Traffic Services.

¹⁵ ANS - Air Navigation Services.

must never become a matter of mere routine. It is an issue which must continually be kept alive – in every aspect of work and in every decision. It is about having a proactive approach to safety in the operations. Within LFV there is an open attitude to discussing deviations and incidents in a transparent and constructive manner.

Air traffic controllers

In the tower at Landvetter Airport, there were three air traffic controller positions, AD1, AD2 and AD3 (see Fig. 2). At the time of the incident, two positions were open according to the configuration for basic staffing, i.e., AD2 put together with AD3 and AD1 as a separate position. AD1 was manned by an individual air traffic controller who was responsible for the runway as well as incoming and outgoing traffic. AD2 was manned by a trainee and instructor, who were responsible for taxiing, clearance and vehicle traffic. The instructor was positioned just behind the trainee in AD2. Minutes before the present incident, the instructor and trainee were relieved by an individual air traffic controller so that they could go to lunch.

The trainee began his traineeship in the Landvetter tower in June 2011 and the instructor underwent instructor training in April 2011. They had worked together in this manner three times previously. The air traffic controller who relieved the trainee and the instructor had worked at Landvetter for 11 years.

During interviews, information has come forth that at the time of the present incident there was a traffic load typical for the lunchtime rush. It has also been learned that the air traffic controllers found the audibility of RMS726 was at times limited.

A helicopter was situated in the control zone (CTR¹⁶) east of the air control tower (TWR) and there were cumulonimbus clouds (CB) in the airspace around the airport. The service vehicles RMS726 as well as 238 and 235 were positioned in the proximity of the runway system. AD1 had asked AD2 to keep a watch on the helicopter, with consideration for the visual separation between the helicopter and incoming air traffic.

RMS726 intended to carry out maintenance work within the manoeuvre area, and vehicles 238 and 235 were tasked with checking the alarm functions connected to the lighting around the runway system. The alarm signals consisted of both visual and auditory indications at the air traffic controllers' work stations in TWR.

Aids for the air traffic controllers in TWR included binoculars, flight progress boards (FPB¹⁷) and ground movement radar. A design limitation in the radar coverage meant that only traffic on asphalt surfaces within the manoeuvre area were visible on the radar.

¹⁶ CTR - Control zone, that part of the airspace most closely surrounding the airport.

¹⁷FPB - Flight Progress Board, consisting of one or more strip panels (Ref: LFV Central Operations Manual).

During interviews air traffic controllers in the tower stated that binoculars were not used to scan the area or look for vehicles, as there was no uncertainty over where the vehicles were positioned.

ANS Dhb 1-1-1, General requirements and guidelines, states the following concerning the area of responsibility for On-the-Job Training Instructors:

An On-the-Job Training Instructor (OJTI) supervising a trainee at a work position is also responsible for the trainee's actions. It is hereby the obligation of the OJTI, with consideration for the prevailing circumstances, to decide to what extent he/she shall intervene or take over the trainee's performance of duties.

During the interview, the instructor stated that he felt a greater load when having a trainee than when working alone. In the context of a discussion of the various influential factors of workload, the instructor mentioned the alarm signals that were being tested, the helicopter in CTR and the weather. According to the instructor's statement, these factors, in combination with the role of supervising the trainee, could have had an impact on the instructor's workload, though the person in question described the level of impact as minor.



Fig. 2. The Landvetter tower - placing of the air traffic controller positions AD1, AD2 and AD3 (Photo: SHK. The picture was taken on a different occasion).

Vehicle management

ATS Landvetter Dhb Part III-S17, Vehicle management, 3.1, states, among other things, that:

AD2 shall obtain permission from AD1 for each individual vehicle movement which concerns the runway and zone I (and zone II and zone III, if the weather is below limit values). AD1 uses the phrase "Kör ut på banan" [Drive out onto the runway] when AD2 has permission to have the vehicle drive out onto the runway. AD2 informs AD1 when the runway is accessible for traffic and uses the phrase "Banan fri" [Runway free].

During the course of the investigation, it has emerged that permission to drive out onto the runway was given for several vehicles in one and the same sentence. The permission from AD1 to AD2 did not specify which ground vehicles were referred to (see Fig. 3 below).

| | | |
|---------|------------|--|
| 0939:57 | AD1 | Perhaps them there can come out again after my Regional landing. |
| 0940:08 | 044 | Ground, Swedestar 044 vacating on D. |
| 0940:14 | AD1 & AD2 | [Short discussion about whether the ground vehicles can drive out before Regional] |
| 0940:31 | AD1 | Bee-Line 17F wind is 240, 10 knots, runway 21, cleared for take-off. |
| 0940:36 | 17F | Cleared for take-off runway 21, Bee-Line 17F. Goodbye. |
| 0940:41 | AD1 | Bye bye. |
| 0940:42 | AD1 to AD2 | Drive out behind him and we'll see ... |
| 0941:00 | AD2 | 238 and accompanying, drive out onto the runway. |
| 0941:03 | 238 | Driving out onto the runway, 238 and accompanying. |
| 0941:06 | AD2 | RMS726, drive out onto the runway. |
| 0941:09 | 726 | Driving out onto the runway RMS726. |
| 0941:11 | AD1 | Where was he? |

Fig. 3. Transcript of the sound recording from TWR (time given in UTC).

Clearance was required for vehicles which were to go to GPO3, but not for vehicles which were to go to KIOSK 211.

During the interview, the trainee explained that he wrote *GPO3* on the vehicle strip¹⁸ in connection with RMS726's notification that he intended to drive there. At the time of the incident, there was no instruction for the geographical position to be indicated on the strip, but according to interviews with the air traffic controllers, it has emerged that this nevertheless often took place. Neither trainee nor instructor was able to provide an explanation during interviews as to why they did not observe the position information given by the driver of RMS726 over the radio.

¹⁸ Vehicle strip - Paper strip for marking ATS data on FPB.

Handover

The sound recording from TWR examined by SHK reveals that the trainee in AD2 told the relief that RMS726 was positioned at GPO3. It was also revealed that the instructor immediately corrected the information and told the relief that RMS726 was positioned by KIOSK211. During interviews, it has been discovered that the instructor also pointed to KIOSK211 in connection with the verbal correction.

ATS Landvetter Dhb Part III-So1, General requirements and guidelines, 8 (Handover of position), states that:

The position log has a checklist for handover. When being relieved, the air traffic controller in the position shall use the checklist, which consists of the following points: Runways, Open, Technical equipment, Significant weather, Airspace status, LVP¹⁹, Filter setting and other notes in Notepad, Lost list, Traffic situation and Accept. When relieving at the TMC²⁰, any information on FLOG shall also be conveyed. To be able to follow the list in the position log and give the recipient a chance to absorb the information, it is important that this is not done too quickly. Ensure that the position is opened up in good time; it is important that both sender and recipient are in agreement as to when the responsibility is transferred.

According to the interviewed personnel, the checklist in the position log was used.

During the interviews, it has not emerged that the relieving air traffic controller had seen the note, GPO3, which the trainee, according to his own statement, wrote on the strip in connection with RMS726's notification that he was driving to GPO3 during his waiting time.

Through both interviews and sound recordings from the tower, it emerged that in connection with both RMS726's giving his position on NORRA GENVÄGEN and the handover between the air traffic controllers, there was a conversation of a private nature between the air traffic controllers.

There are no regulations concerning conversations of a private nature while performing air traffic services. In commercial aviation, the Sterile Cockpit Rule applies, which entails, among other things, that there must be no conversations of a private nature during critical phases of a flight, normally below an altitude of 10,000 feet, during take-off and landing, outward flight, approach and driving on the ground.

¹⁹ LVP - Low Visibility Procedures.

²⁰ TMC - Terminal Control Centre - body which carries out area control service and approach control service within the terminal area and control zone (Ref: Central Dhb).

Zones

The strip area at the sides of the runway are divided into zones (see Fig. 4).
(*Rullbana = Runway, Centrumlinje = Centre Line, Zon = Zone*)

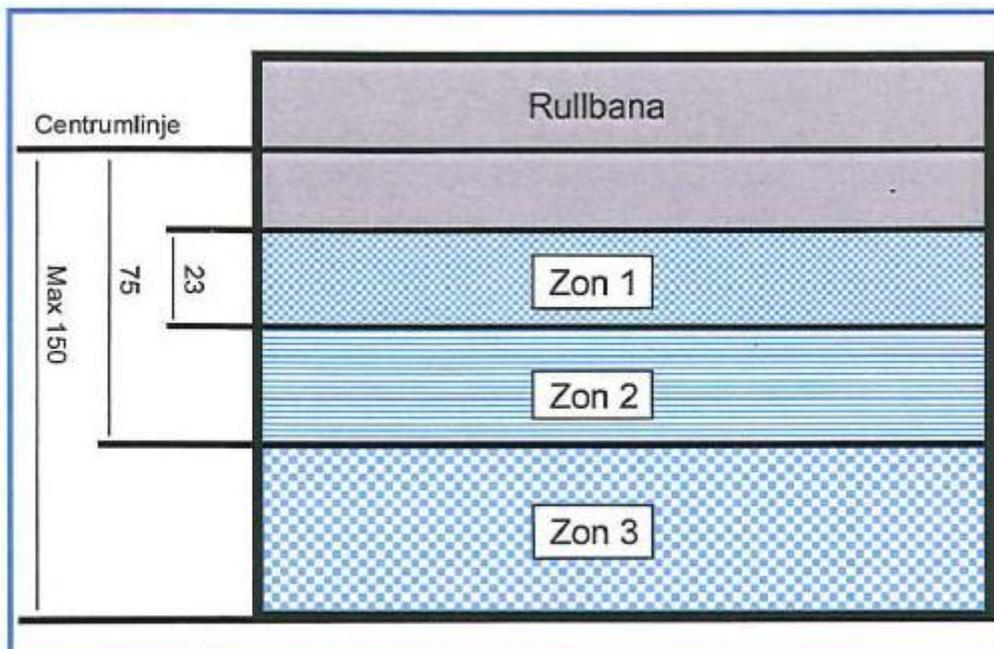


Fig. 4. Zone division.

ATS Landvetter Local Dhb Part III-S07, Air Traffic Control Service 11.12, states the following:

- *Zone 1 runs from the edge of the runway to 23 m from the same.*
- *Equipment/vehicles are not permitted when the runway is open for traffic.*
- *Zone 2 runs from the outer edge of zone 1 to 75 m from the runway centre line.*

Equipment/vehicles are permitted to be present in zone 2 under the following conditions:

- *dry runway,*
- *crosswind component of max 15 kts,*
- *visibility of min 8 km/cloud cover height min 1,500 ft,*
- *moveable equipment,*
- *max height 5 m.*
- *Zone 3 runs outwards from the outer edge of zone 2 to the edge of the strip, max 150 m from the runway centre line.*

Service vehicle RMS726

The Central Operations Manual for Division ANS, Part 3, Section 18, Chapter 10, 3.1 states the following:

A vehicle that wishes to drive in the manoeuvre area shall identify itself on the first communication and state its position, intended destination and, where necessary, route. For driving out onto and crossing runways, special

permission is required. Every permission to drive in or stop in the manoeuvre area shall be read back by the vehicle. Instructions to hold position or maintain a certain distance from the runway shall also be read back. Unless otherwise established at a particular airport, the vehicle must without request report when the runway, runway system and/or manoeuvre area has been left. ATS can also request other reports on a vehicle's position or operation.

During the investigation, it has emerged that the Air Traffic Services at Landvetter apply the aforementioned central regulatory framework and have therefore not established any other provisions. It is not evident from the sound recording from TWR, examined by SHK, that the driver of RMS726 informed TWR when he left GPO3 to return to NORRA GENVÄGEN. Nor, according to the air traffic controllers in TWR, did they receive information that RMS726 had left GPO3. It is however evident that the driver reported when he was once again on NORRA GENVÄGEN, though this message did not prompt the trainee in the tower to request the driver of the vehicle to repeat the message, despite the trainee's later statement that RMS726 was heard poorly (see Fig. 5).

| | | |
|---------|-----------------|--|
| 0935:36 | 726 | Landvetter tower RMS 726. |
| 0935:40 | AD2, trainee | RMS 726 from the tower. |
| 0935:43 | 726 | ... on norra genväg and wish to drive out onto the runway in order to measure the Localizer, if there is a window now. |
| 0935:51 | AD2, trainee | Yes, that is understood. Hold position RMS 726, I will contact you. |
| 0935:56 | 726 | Understood, I am holding position here. RMS 726. |

Fig. 5. Transcript of the sound recording from TWR (time given in UTC).

The driver of the vehicle used RÅDJURSVÄGEN to make his way between GPO3 and NORRA GENVÄGEN. RÅDJURSVÄGEN and parts of NORRA GENVÄGEN are outside of the boundaries of the manoeuvre area, and ground vehicles are therefore authorized to move freely there. KIOSK211 is also outside of the boundaries of the manoeuvre area. GPO3 lies within the boundaries of the manoeuvre area and ground vehicles therefore require permission from air traffic control to drive to that point.



Fig. 6. The vehicle RMS726 (Photo: Swedavia).

According to Landvetter Airport's aviation safety coordinator, there were 27 metres between RMS726 and the edge line of the runway when the vehicle stopped. At the time of the incident, there were signs marking where it was permitted for vehicles to move without permission from air traffic control.

The driver of RMS726 spoke Swedish with an English accent. The air traffic controllers at Landvetter explained that RMS726 tended to stay by KIOSK211. According to interviews with the driver of RMS726, the rotating warning lamp on the roof of the vehicle was activated when the incident occurred.

According to Air Traffic Services at Landvetter, vehicles from Eltel Networks AB (including RMS726) were the only external actors with permission to move on the aprons and manoeuvre area at Landvetter without escort requirements. Swedavia was responsible for and provides the prescribed training for vehicle drivers who come into contact with aprons and the manoeuvre area at Landvetter Airport.

The driver of RMS726 had a valid qualification in accordance with Swedavia's regulations concerning prescribed training, driving permit level 2 (KK).

Measures taken

LFV

A operational disturbance report (DA) was sent immediately in connection with the incident. In the afternoon of the same day, a briefing about the present incident was held for the personnel going on shift. Two operational messages from unit management (OMA) concerning *vehicle management* and *clarification manoeuvre area* were also handed out.

The OMA – Vehicle management included the following:

”When clearance is given for a vehicle to drive out onto the runway when aircraft are on or within immediate proximity of the runway, link roads or the vehicle position shall be included in the clearance.”

”Due to the incident, CO wishes to remind operative personnel of the importance of monitoring vehicles with the use of FPB and there writing down the vehicle's position.”

The OMA – Clarification manoeuvre area included the following:

”Among other things, it has emerged that there is sometimes uncertainty over whether clearance is required to drive to the GP buildings 03/21.”

”As the GP buildings are located within the boundaries of the manoeuvre area, clearance is required to drive there. The driver of the vehicle shall also report when leaving the area, as this means leaving the manoeuvre area.”

According to information received by SHK, there are plans to introduce a new signal control in the winter of 2012, which would mean that the airport can reduce the number of vehicle roads that connect to the runway and thus reduce the risk of runway incursion. Proposals have also been made for the logical numbering of vehicle roads in order to facilitate the handling of vehicle traffic.

In October 2011, LFV launched a phraseology campaign (Frasse 2) with the aim of making workers aware of and motivating them to use correct phraseology.

The report *Flygsäkerhetsanalys [Aviation safety analysis] Program Airport City (Landvetter)*, published on 05-04-2011, states the following:

At present there is no MLAT system at the airport, but there may be in the future (Arlanda already has MLAT).

MLAT can be used as a standalone system or as an augmentation of the ground radar system. The system is based on various receptors positioned at the airport which can calculate and present the position of aircraft by communicating with the aircrafts' transponder.

MLAT can also be used to monitor the airspace near the airport. According to LFV ANS, the planned construction work will not entail any negative limitations on the implementation of MLAT at Landvetter. The receptors' positioning can be adapted to the conditions prevailing when the installation of the system is carried out.

During interviews with air traffic control at Landvetter, it has emerged that implementation of MLAT²¹ is desirable as it would facilitate the identification of vehicles, among other things. According to LFV, this measure would also provide radar coverage of the area to the west of the runway.

²¹MLAT - Multilateration - A system based on various receptors positioned at the airport which can calculate and present the position of aircraft by communicating with the aircraft's transponder.

LFV recently carried out the project “Harmonisering av FPB” [Harmonization of FPB] with the purpose of revising the design of the flight progress boards for air traffic.

In addition to the aforementioned measures, LFV carried out an internal investigation of the present incident.

Conclusions

When RMS726 reported its position on NORRA GENVÄGEN, neither the trainee nor the instructor apprehended the information. When the trainee thereafter informed the relief that RMS726 was located at GPO3, the instructor corrected this statement with the incorrect information that RMS726 was instead by KIOSK211. The relieving air traffic controller did not question the information as the person in question assumed that the information stated during handover was correct.

SHK has not found any regulations concerning the practical application of binoculars as an aid in TWR, but it cannot be eliminated that RMS726 would have been discovered on NORRA GENVÄGEN if the binoculars had been used to scan the terrain. As there were no instructions concerning the strips' containing information on geographical position, there was no basis for the air traffic controllers to check this particular information in connection with a handover.

At the same time as RMS726 notified his position on NORRA GENVÄGEN, another vehicle was located by KIOSK211. As it was not unusual for RMS726 to be located by Kiosk211 in particular, it is probable that the air traffic controllers' attention was turned to KIOSK211 due to their subconscious expectations. The conversations of a non-operative nature between the personnel in TWR may have contributed to both the instructor and the trainee being distracted from apprehending the position stated by RMS726, as well to the trainee neither asking the driver of the vehicle to repeat his position nor himself making a note of the stated position on the strip. Also, the instructor's ability to follow up on what occurred may have been limited by the private conversations that were going on.

It has not been possible to establish during the course of the investigation what the perceived limitation of RMS726's audibility was due to and therefore microphone technology, radio shadow as a result of the vehicle's geographical position in the runway system, or the vehicle driver's accent cannot be eliminated as conceivable contributing circumstances.

The fact that the driver of RMS726 left GPO3 without reporting was a deviation from the instruction in ANS Dhb and cannot be ruled out as having contributed to the air traffic controllers' reduced focus on the movement of RMS726.

It cannot be ruled out that the separate granting of permission from AD1 to AD2 for each individual vehicle would have resulted in both AD1 and AD2 noticing the position and in a visual search for RMS726.

An endeavour to limit disruptive elements in a demanding environment, in which the individual's attention is a fundamental prerequisite for performing safe work, should be the basis of all safety work which includes operative decision-making. In an operative environment characterized by safety aspects, a temporary shift of mental focus is to the detriment of attention. In the operative air traffic controller's working environment, the prioritization of aviation safety is also downgraded by implication.

To unreservedly forbid conversations between air traffic controllers on duty together during periods in which there is a varying workload and constant demand for collaboration is probably not practically feasible, nor would it improve the dynamic which constantly places demands on, and which in many cases requires, verbal communication between the air traffic controllers.

To emphasize, in a far too one-sided a manner, individual responsibility and judgment as crucial to the quality of fitness for service is not optimal for working environments such as those air traffic controllers serve in. LFV should therefore, within the scope of the safety culture work, develop and establish clear guidelines for conversations of a private nature at a work position during the course of operative work. Such guidelines shall constitute a clear support for the individual operative air traffic controller to consistently adhere to while collaborating with other operative air traffic controllers during a shift.

SHK is of the opinion that the introduction of a sterile concept for air traffic controllers during certain phases while in an operative position would contribute to increased aviation safety. Air traffic controllers would thereby work under conditions which correspond to the sterile concept already applied within commercial aviation. It cannot be considered reasonable for only one party in a situation with two-way radio communication to apply the sterile concept.

Recommendations

LFV is recommended to:

- Develop and establish clear guidelines within the scope of its safety culture work, for conversations of a private nature during the course of operative work, in order to introduce a sterile concept for air traffic controllers during certain phases when in an operative position.
(RL 2012:16 R1)

The Swedish Transport Agency is recommended to:

- Take measures to ensure the use of a sterile concept for air traffic controllers during certain phases when in an operative position.
(RL 2012:16 R2)