Investigation report

L2012-01

Risk of Runway Collision Between Two Airliners at Helsinki-Vantaa Aerodrome on 29 December 2011

YL-RAG, SAAB 340A

SE-MDH, ATR72-212A

Onnettomuustutkintakeskus
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ISBN 978-951-836-380-7
ISSN 2242-7724
Translation: R&J Language Service

SUMMARY

RISK OF RUNWAY COLLISION BETWEEN TWO AIRLINERS AT HELSINKI-VANTAA AERODROME ON 29 DECEMBER 2011

A serious incident occurred at Helsinki-Vantaa aerodrome on Thursday, 29 December 2011 at 14:40 Finnish time. A Saab 340 aircraft operated by RAF-AVIA Airlines, call sign NEF025, was preparing to take off for a cargo flight and entered the runway. Simultaneously, a Golden Air ATR 72 aircraft, call sign BLF218, which had already been cleared to land, was approaching the runway. NEF025 had two crew members. BLF218 had 67 passengers and 4 aircrew members.

In accordance with the instructions of the air traffic control, NEF025 was taxiing to holding point RWY 22R. Since NEF025 had not contacted Aerodrome Control Tower West (TWR-W), responsible for traffic on RWY 22R, the controller switched on the red stop bar so that NEF025 would not taxi onto the runway in front of the landing aircraft. A moment after this NEF025 called TWR-W. At this time the controller informed NEF025 of the landing aircraft. NEF025 continued to taxi onto the runway past the illuminated stop bar.

BLF218 was approaching RWY 22R and received a landing clearance from the TWR controller. During the final stage of the approach the pilots of BLF218 noticed that the runway was occupied and aborted the approach. Simultaneously, also the TWR controller noticed that NEF025 had entered the runway and cleared BLF218 for a go-around.

The serious incident occurred because the flight crew of NEF025 misinterpreted the traffic information, crossed the illuminated stop bar and entered the active runway 22R without an air traffic control clearance. Inadequate multi-crew cooperation between the pilots of NEF025 was a contributing factor.

In the spring of 2012 the Latvian Civil Aviation Agency (LV CAA) organised two flight safety meetings with RAF-AVIA and audited the company's operations. As a result of the meetings and the audit LV CAA issued several recommendations for the purpose of correcting the observed anomalies. RAF-AVIA agreed to the recommendations of LV CAA.

Safety Investigation Authority, Finland (SIAF) issued five safety recommendations: two of them were directed at the Latvian Civil Aviation Agency and three at Finavia Corporation (henceforth: Finavia).

SIAF recommend that LV CAA ensure that the pilots of RAF-AVIA are familiar with the procedures related to stop bars. Furthermore, SIAF also recommended that LV CAA make certain that RAF-AVIA pilots possess sufficient multi-crew cooperation skills.

SIAF recommend that Finavia emphasise the importance of disciplined radiotelephony communications in air traffic control operations and that Finavia focus particular attention on correct readbacks. Secondly, SIAF recommended that Finavia make certain that air traffic controllers include the pertinent air traffic control clearance, as applicable, when they complement the standard radiotelephony phraseology with traffic information. SIAF also recommended that Finavia study the possibilities of introducing a runway incursion alerting system.

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ABBREVIATIONS

AIP	Aeronautical Information Publication
AOC	Aircraft Operator Certificate
AP	Airport
APN	Apron
APP	Approach Control
ATIS	Automatic Terminal Information Service
CLD	Clearance Delivery
CVR	Cockpit Voice Recorder
FMS	Flight Management System
FDR	Flight Data Recorder
GND	Ground Control
ICAO	International Civil Aviation Organisation
ILS	Instrument Landing System
LRST	Local Runway Safety Team
LVP	Low Visibility Procedure
P-RNAV	Precision Area Navigation
RWY	Runway
SMR	Surface Movement Radar
TAR	Terminal Area Surveillance Radar
TCAS	Traffic Alert and Collision Avoidance System
TWR	Aerodrome Control Tower
TWR-E	Aerodrome Control Tower East
TWR-W	Aerodrome Control Tower West
UTC	Co-ordinated Universal Time

SYNOPSIS

A serious incident occurred at Helsinki-Vantaa aerodrome on Thursday, 29 December 2011 at 14:40 Finnish time (UTC+2). A Saab 340 airliner operated by RAF-AVIA Airlines, registration YL-RAG, entered a runway on which a Golden Air ATR 72 212A airliner, registration SE-MDH, was about to land. RAF-AVIA was operating Nordflyg's cargo flight NEF025 from Helsinki-Vantaa to Mariehamn, and Golden Air was operating Blue1's scheduled passenger flight BLF218 from Oulu to Helsinki-Vantaa. NEF025 had two crew members. BLF218 had 67 passengers and 4 aircrew members.

Pursuant to Finnish Aviation Regulation GEN M1-4, the air traffic controller at Helsinki Vantaa aerodrome control tower (TWR-W) filed an Aviation Safety Report on the occurrence. The pilot-in-command of BLF218 filed a serious incident report. The pilot-in-command of NEF025 wrote a short incident report and delivered it to the Company. On the basis of that report the company's Safety Manager filed an Aviation Safety Report with LV CAA on 2 January 2012.

Safety Investigation Authority, Finland (SIAF) was informed of the occurrence on 29 December 2011 at 14:51. SIAF immediately made attempts to preserve the cockpit voice recorder (CVR) recordings. Since the CVR recording of NEF025 was not obtained it became impossible to perform a detailed analysis of multi-crew cooperation. The CVR recording of BLF218 was handed over to the investigation group.

The investigation group received the radar, radiotelephony and telephone recordings of Helsinki-Vantaa air traffic control. The pilots of NEF025 and the air traffic controller on duty at TWR-W at the time of the occurrence were interviewed in person. The pilots of BLF218 and the ATC's shift supervisors were interviewed over the telephone.

On 21 January 2012, pursuant to Section 2 of the Safety Investigation Act (525/2011), SIAF decided to initiate safety investigation L2012-01. Chief Air Safety Investigator Ismo Aaltonen was appointed as investigator-in-charge. Mr Lars Levo was appointed as team leader for the investigation group. Messrs Hannu Halonen, Mika Kosonen and Tauno Ylinen were appointed as expert members to the investigation group. Dr Päivikki Eskelinen-Rönkä, a speech and audio expert, carried out the audio analysis.

SIAF notified the ICAO (International Civil Aviation Organization), the EASA (European Aviation Safety Agency) and the EU of the occurrence, as well as the accident investigation authorities of Latvia (Traffic Accident and Incident Investigation Bureau TAIIB), Sweden (Statens Haverikommission SHK) and France (Bureau d'Enquêtes et d'Analyses BEA). The TAIIB and SHK designated their Accredited Representatives (ACC REP) to the investigation.

The investigation group requested comments on the draft final report from RAF-AVIA Airlines, the TAIIB, Golden Air, the SHK, the Finnish Transport Safety Agency (Trafi), Finavia, the EASA and interested parties. The investigation group included the comments deemed appropriate to the final report. The investigation group issues five safety recommendations in its report.

All times in this report are in Finnish time (UTC+2).

The investigation report refers to the incident aircraft by their call signs.

The material used in the investigation is archived at Safety Investigation Authority, Finland (SIAF).

1 FACTUAL INFORMATION

1.1 History of the flight

1.1.1 The traffic situation and active runways at Helsinki-Vantaa

Independent parallel approaches for runways 22L and 22R were in progress at Helsinki-Vantaa airport on Thursday afternoon, 29 December 2011. In such a situation both runways are used for landings, takeoffs mainly occur from RWY 22R. Parallel approaches are used during rush hours, which typically occur on a daily basis from approximately 14:30 to 16:00. During this time period there are fewer departures than arrivals.

When parallel approaches are in progress Helsinki-Vantaa control tower has one air traffic controller on duty to each runway: TWR-W (Aerodrome Control Tower West) and TWR-E (Aerodrome Control Tower East). TWR-E provides ATC services to traffic using RWY 04R/22L, and TWR-W to traffic using RWY 04L/22R. In addition, the manning of the control tower comprises the Clearance Delivery (CLD), which provides en-route clearances; the Ground Control (GND), which provides taxi clearances and instructions; and a Tower Coordinator (TWR COR) assisting TWR-E.

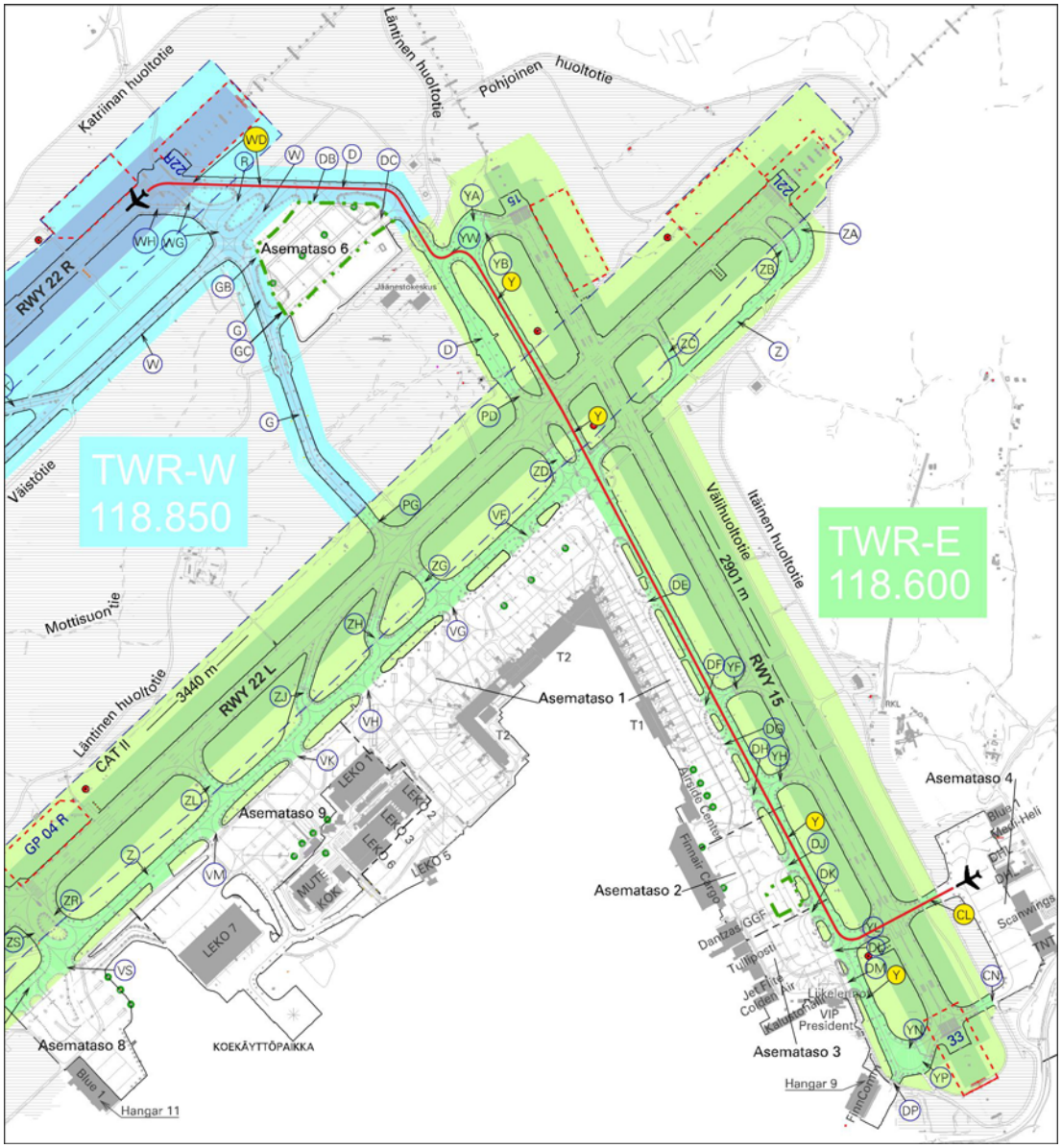

Figure 1. The taxi route of NEF025.

1.1.2 NEF025 action

NEF025 was parked on Helsinki-Vantaa Apron 4 (APN 4), from where it was about to set off for a cargo flight to Mariehamn.

At 14:25 NEF025 contacted CLD requesting a start-up clearance and an en-route clearance. CLD relayed the en-route clearance to NEF025 and told them to contact GND for the start-up clearance. Even though the Company's Aircraft Operator Certificate does not include an Airworthiness Approval for P-RNAV operations, NEF025 accepted the P-RNAV Standard Instrument Departure (SID) route. GND gave them a start-up clearance at 14:27 and a taxi clearance to holding point CL at 14:31.

At 14:33 GND told NEF025 to contact TWR-E. Then TWR-E cleared NEF025 to cross RWY 15 and to taxi to holding point Y, and to hold short of RWY 22L. At 14:36 TWR-E cleared NEF025 to cross RWY 22L and to taxi to holding point WD.

At 14:38:33 NEF025 reported it was approaching holding point WD, at which time TWR-E told them to contact TWR-W on 118.850 MHz. NEF025 did not read back this instruction. At 14:39:01 NEF025 made a call on Helsinki Radar (TAR) frequency 129.850 MHz. Helsinki Radar told NEF025 that they were on the wrong frequency and instructed them to call TWR-W on 118.850 MHz.

NEF025 decelerated and almost came to a halt at the red stop bar. The stop bar is located at approximately 80 m before holding point WD.

At 14:39:27 NEF025 contacted TWR-W. At that time the controller said: 'NEF025 one landing'. NEF025 read back: 'Landing'. Following this, NEF025 increased the taxi speed and taxied onto RWY 22R.

1.1.3 BLF218 action

BLF218, a scheduled flight from Oulu, was approaching Helsinki-Vantaa RWY 22R. At 14:39 TWR-W cleared BLF218 to land on RWY 22R. At 14:40 the pilots of BLF218 aborted the approach and initiated a go-around after noticing that RWY 22R was occupied. At its minimum BLF218 descended to 108 ft AGL (ca. 33 m) during the approach.

TWR-W cleared BLF218 to go around and reported the matter to Helsinki Approach (APP). Whilst doing so, the air traffic controller told BLF218 to contact Helsinki APP. BLF218 made another approach and landed at 14:55.

1.1.4 Air traffic control action

NEF025 remained on TWR-E frequency until having crossed RWY 22L. At 14:36 TWR-E cleared NEF025 to taxi to holding point WD. At 14:38 TWR-E told NEF025 to contact TWR-W.

TWR-W was waiting for NEF025's call on its frequency. As this did not happen, at 14:38 the controller switched on the red stop bar lights at holding point WD so as to make certain that NEF025 would not taxi onto RWY 22R. At 14:39 the controller cleared BLF218 to land on RWY 22R.

When NEF025 contacted TWR-W, the controller informed them of one landing aircraft. Shortly after this the controller noticed that NEF025 was taxiing onto the runway. He told BLF218 to abort the approach and go around. By then the pilots of BLF218 had already initiated a missed approach.

Having noticed that NEF025 had entered the runway, the controller informed them that they had only been cleared to the holding point. NEF025 did not reply. A moment later the controller said: 'NEF025 hold position'. NEF025 read back: 'Holding position RWY sorry'.

The controller told NEF025 that they had taxied onto an active runway past the illuminated stop bar without permission, and that the controller has to file a safety report. Furthermore, the controller asked the pilots of NEF025 to telephone the shift supervisor at Helsinki ATC upon landing in Mariehamn. However, the supervisor never received such a call.

1.2 Injuries to persons

There were no injuries to persons.

1.3 Damage to aircraft

There was no damage to aircraft.

1.4 Other damage

There was no other damage.

1.5 Personnel information

1.5.1 NEF025 flight crew

Pilot-in-command	Age 60.
Licence	Airline Transport Pilot's Licence (A), valid until 23 August 2012.
Ratings	All required ratings were valid.
Flight experience	All types: 16 500h, Saab 340: 650h.
Language Proficiency, English	LP (Language Proficiency) English level 4.
Medical certificate	Class 1, valid until 28 February 2012.

Co-pilot	Age 55.
Licence	Commercial Pilot Licence (A), valid until 10 September 2013.
Ratings	All required ratings were valid.
Flight experience	All types: 2 050h, Saab 340: 700h.
Language Proficiency, English	LP (Language Proficiency) English level 5.
Medical certificate	Class 1, valid until 29 June 2012.

1.5.2 BLF218 flight crew

Pilot-in-command	Age 60.
Licence	Airline Transport Pilot's Licence (A), valid until 7 March 2016.
Ratings	All required ratings were valid.
Flight experience	All types: 19 400h, ATR 72: 400h.
Language Proficiency, English	LP (Language Proficiency) English level 4.
Medical certificate	Class 1, valid until 29 June 2012.

Co-pilot	Age 27.
Licence	Commercial Pilot Licence (A), valid until 30 June 2013.
Ratings	All required ratings were valid.
Flight experience	All types: 924h, ATR 72 646h.
Language Proficiency, English	LP (Language Proficiency) English level 4.
Medical certificate	Class 1, valid until 12 October 2012.

1.5.3 Air Traffic Control personnel

ATC Controller (TWR-W)	Age 38.
Licence	Air Traffic Controller's Licence, valid until 10 June 2015.
Ratings	All required ratings were valid.
Language Proficiency, English	LP (Language Proficiency) English level 5.
Medical certificate	Air traffic controller's medical certificate, valid until 23 June 2013.

1.6 Aircraft information

1.6.1 NEF025

The Saab 340 is a twin-engine, low-wing turboprop airliner.

Type	SAAB 340A
Nationality and registration	YL-RAG
Manufacturer	Saab Aircraft AB
Owner/operator	RAF-AVIA Airlines
Certificate of Registration and Certificate of Airworthiness	Valid until 27 July 2012

1.6.2 BLF218

The ATR 72-212A is a twin-engine, turboprop high-wing airliner.

Type	ATR 72-212A
Nationality and registration	SE-MDH
Manufacturer	Avions de Transport Régional
Owner/operator	Golden Air Flyg Ab
Certificate of Registration and Certificate of Airworthiness	Valid until 25 August 2012

1.7 Meteorological information

It was raining at Helsinki-Vantaa airport. There was no snow on the ground.

Helsinki-Vantaa METAR at 14:20: Wind 200 deg 16 kts, visibility 6 km, moderate rain showers. Scattered clouds at 1200 ft (360 m), few CB clouds at 2500 ft (750 m) and broken clouds at 5000 ft (1500 m). Temperature 4°C and dew point 3°C. QNH 988 hPa.

1.8 Aids to navigation

The aids to navigation had no bearing on the occurrence. The terminal area radar and the surface movement radar were available to the ATC. Both radars were operating normally at the time of the occurrence. The investigation group received the recording of the surface movement radar picture.

1.9 Communications

The radiotelephony systems of both incident aircraft and those of Helsinki-Vantaa ATC were functioning normally. They had no bearing on the occurrence. The investigation group received the radiotelephony and telephone recordings of Helsinki-Vantaa ATC.

NEF025, departing from Helsinki-Vantaa, was parked on Apron 4. In such a case the radiotelephony between the departing aircraft and the control tower is normally conducted in the following sequence: CLD (118.125) issues the en-route clearance; GND (121.800) issues the start-up clearance and the initial taxi clearance and/or instructions; TWR-E (118.600) issues the taxi clearance to RWY 22R holding point WD, including the crossing of runways 15 and 22L; TWR-W (118.850) issues the line-up clearance to RWY 22R and the takeoff clearance.

1.10 Aerodrome information

Helsinki-Vantaa Aerodrome Reference Point coordinates are 60°19’02’’N, 024°57’48’’E. Aerodrome elevation is 179 ft (55 m).

Helsinki-Vantaa aerodrome has three runways: 04L/22R, 04R/22L and 15/33. In this serious incident both aircraft were using RWY 22R.

1.10.1 Stop bars

Stop bars are used to prevent runway incursions when Low Visibility Procedures (LVP) are in progress. In order to improve runway safety, stop bars are also nowadays used when the visibility is good.

The stop bar comprises red in-pavement light fixtures installed across the taxiway and low, elevated taxiway edge lights. There are normally 8-16 lights embedded into the pavement and two elevated stop bar lights on each edge of the TWY.

According to the Rules of the Air (OPS M1-1, 3.2.2.7.3) an aircraft taxiing shall stop and hold at all lighted stop bars and may proceed further in accordance with the air traffic control clearance when lights are switched off. As an exception, the air traffic control can permit an aircraft to cross an illuminated stop bar if the stop bar lights cannot be switched off due to a technical malfunction.

According to the Finnish Air Traffic Control Manual (LJKK, section 3.4.10.4) an illuminated stop bar means that traffic must stop. When the stop bar lights are switched off, traffic may proceed.

Helsinki-Vantaa aerodrome has instituted local instructions for the use of stop bars. They determine which stop bars, at the very least, must always be illuminated to suit the combination of the runways in use, irrespective of the meteorological conditions. In this occurrence – in compliance with the aforementioned instructions – the stop bar was not illuminated at first.

The stop bars are controlled through the aerodrome lighting control system. The air traffic controller manually switches off the stop bar after having issued an aircraft a clearance which permits the aircraft to taxi across the stop bar. While the electronic flight-progress e-Strip system and the surface movement radar do display the status of the stop bars, they cannot control the stop bars.

In practice it is technically possible to include automatic warnings in the system currently in use which would alert of moving aircraft and vehicles. One such warning could be a Stop Bar Violation alert that cautions the air traffic controller of conflicting information as regards an aircraft's position on the surface movement radar, the status of the flight on the e-Strip or the status of the stop bar. Moreover, the recommendations in Finavia's internal report (T1/2009) advocate the introduction of an alerting system as soon as possible. For example, a Runway Incursion Alerting System (RIASS) such as the one described above is in use at Schiphol Airport in Amsterdam, the Netherlands.

Figure 2. The stop bar on taxiway WD.

1.11 Flight recorders

Cockpit Voice Recorder (CVR) information from NEF025 was not available to the investigation group. The data were lost because, following the occurrence, NEF025 flew to Mariehamn. The maximum recording capacity of the CVR in question is 30 minutes.

Flight Data Recorder (FDR) information from NEF025 was not available. The missing recording was not, however, relevant to the investigation.

Cockpit Voice Recorder (CVR) data from BLF218 were available to the investigation group. Finnair Plc downloaded the information.

Finnish Aircraft Maintenance (FAM) downloaded the Flight Data Recorder (FDR) information from BLF218 at Vantaa. The investigation utilised the data.

1.12 Wreckage and impact information

The investigation group visited the site of the occurrence and assessed the perceptibility of an illuminated stop bar. The group also went to Helsinki-Vantaa control tower and studied the surface movement radar, the electronic flight-progress (e-Strip) system and the aerodrome lighting control system which, among other things, controls the stop bar lights.

1.13 Medical and pathological information

No medical or toxicological tests were conducted.

1.14 Fire

There was no fire.

1.15 Survival aspects

No rescue action was needed.

1.16 Tests and research

The investigation group asked a speech and audio expert to carry out an audio analysis of the radiotelephony.

1.17 Organisational and management information

1.17.1 RAF-AVIA Airlines

General

RAF-AVIA Airlines is a Latvian airline. The LV CAA issued the airline an Aircraft Operator Certificate (AOC), which is valid until 28 March 2013. RAF-AVIA Airlines was founded in 1990 and, for the most part, operates cargo flights from its home base in Riga, Latvia.

In Finland RAF-AVIA operates, among other things, Nordflyg cargo flights between Helsinki-Vantaa and Mariehamn. According to its statistics its fleet transported approximately 5 000 tonnes of cargo in 2010, amassing approximately 4800 flight hours in total.

The fleet of RAF-AVIA comprises eight aircraft: five AN26, one AN74-100 and two Saab 340 aircraft.

Reporting

In accordance with RAF-AVIA's Operation Manual the pilot-in-command or some other member of the crew must report an incident to the Company as soon as possible after the flight. The Flight Operations Manager must deliver the report to LV CAA and, if required, to the accident investigation authority of Latvia (TAIIB).

The pilot-in-command of NEF025 submitted a short incident report to the Company. The report was informal and omitted, among other things, the date, signature and meteorological information. On 2 January 2012, on the basis of the report the Company's Safety Manager filed an Aviation Safety Report. LV CAA received the report on 2 January 2012 and TAIIB received it on 3 January 2012.

2 ANALYSIS

2.1 General

According to statistics, runway incursions and runway excursions are the most common incidents at airports. According to Eurocontrol's EAPPRI (European Action Plan for the Prevention of Runway Incursions) publication, at least two runway incursions occur in Europe every day.

2.2 Flight crew action

2.2.1 NEF025

After TWR-E issued the following taxi clearance to NEF025: 'NEF025 via CL cross RWY15 taxi to Y hold short of RWY 22L', the pilots read it back incorrectly: 'Via Y to RWY 22L crossing approved NEF025'. This read-back can also be interpreted as permission to cross RWY 22L.

As NEF025 reported it was approaching holding point WD, TWR-E told them to contact TWR-W. NEF025 did not read this back. They mistakenly switched over to Helsinki Radar (TAR) frequency. Helsinki Radar told them that they were on the wrong frequency and advised them to call TWR-W on 118.850 MHz.

It is possible that NEF025 was on the wrong frequency right at the time when TWR-W cleared BLF218 to land on RWY 22R. As a result, the pilots of NEF025 may have had poor situation awareness regarding the aircraft that was cleared to land on RWY 22R.

The pilot-in-command of NEF025 slowed their taxi speed, almost coming to a halt at the stop bar, approximately 80 m before holding point WD. This was probably due to the illuminated stop bar, and they were also approaching their taxi clearance limit. The pilots remembered having seen the yellow runway guard lights, but not the red stop bar. Nonetheless, the surface movement radar recording shows that the red stop bar lights were illuminated as NEF025 crossed them.

When the co-pilot of NEF025 contacted TWR-W, the controller informed them: 'NEF025 one landing'. The co-pilot read back: 'Landing'. Having understood this as a line up clearance, the pilot-in-command entered the runway. The co-pilot was uncertain of the clearance, but did not confirm it from the ATC. On the basis of the radiotelephony recording, the controller did not clear NEF025 to taxi onto the runway.

According to the Rules of the Air (OPS M1-1, section 3.2.5) the flight crew must observe other traffic at the aerodrome to avoid collisions. The pilot-in-command of NEF025 stated that the co-pilot confirmed that the approach sector was clear by saying 'right side clear'. The co-pilot stated that this time the check was not done, even though it was the practice of this co-pilot to always visually check the approach sector and confirm it on the TCAS display.

The investigation revealed shortcomings in NEF025's multi-crew cooperation and communication. The co-pilot was not certain whether they had been cleared to the runway. The crew did not sufficiently communicate with regard to the possible mistake, nor did they confirm the matter from the ATC. Furthermore, NEF025 taxied across the illuminated stop bar. Moreover, they did not apply multi-crew cooperation regarding the fact that the approach sector was clear.

The missing CVR recording significantly hampered the investigation of multi-crew cooperation.

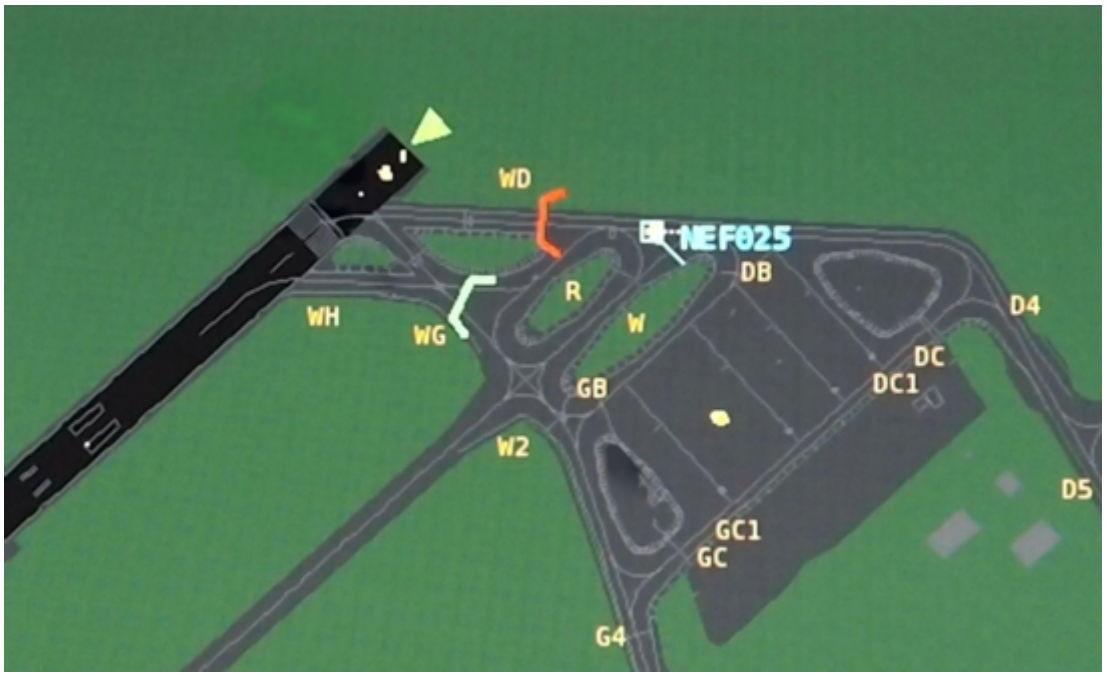

Figure 3. Surface movement radar picture showing illuminated stop bar.

2.2.2 BLF218

BLF218 was flying an ILS approach to RWY 22R. At 14:39 TWR-W cleared BLF218 to land. At 14:40 TWR-W told BLF218 to abort the approach by saying: 'BLF218 go around'. In the interview, the pilot-in-command of BLF218 said that they had already aborted the approach a moment before the controller's command and initiated a go-around, because they had noticed a Saab 340 taxiing onto the runway.

According to FDR data, the minimum height of BLF218 was 108 ft (ca. 33 m) during the approach. The height of a Saab 340 is 23 ft (ca. 7 m).

As they were passing over the Saab 340, the pilot-in-command of BLF218 noticed some text on the top of its fuselage. At that moment BLF218 was at approximately 170 ft AGL (ca. 52 m), and the vertical distance to the Saab 340 below them was approximately 150 ft (ca. 46 m).

2.3 Air traffic control action

TWR-E issued the following taxi clearance to NEF025: 'NEF025 via CL cross RWY15 taxi to Y hold short of RWY 22L'. NEF025 read it back as follows: 'Via Y to RWY 22L crossing approved NEF025'. The read-back does not contain any mention of crossing RWY 15. However, it refers to RWY 22L, which can also be interpreted as a clearance to cross RWY 22L. TWR-E did not react to the errors in the read-back. Well before NEF025 reached holding point Y TWR-E cleared them to cross RWY 22L and taxi to holding point WD. Therefore, it remains uncertain whether NEF025 would have stopped there or continued across RWY 22L.

Once NEF025 crossed RWY 22L TWR-E told them to contact TWR-W on 118.850 MHz. NEF025 did not read this back and possibly, as a result of this, they contacted Helsinki Radar on 129.850 MHz. TWR-W realised that NEF025 was proceeding on the taxiway and that there was no radio contact between TWR-W and the aircraft. On its own frequency TWR-W transmitted the following message for purposes of information: 'NEF025 this is TWR one landing before you'. While NEF025 may have heard this traffic information, there is no certainty about it.

In order to make certain that NEF025 would not taxi onto the runway the TWR-W controller switched on the red stop bar. A moment after this NEF025 contacted TWR-W which replied, as required, by using the aircraft's call sign, and provided the following traffic information: 'NEF025 one landing'. When traffic information is provided, it would be safer to repeat the air traffic control clearance, as applicable, in addition to the traffic information.

2.4 Radiotelephony communications

Aviation radiotelephony in Finland adheres to Aviation Regulation GEN T1-10, published by the Finnish Transport Safety Agency (Trafi). The Regulation includes the general aviation radiotelephony guidelines and standard radiotelephony phraseology, including examples.

The ATC and NEF025 did not adhere to standard aviation phraseology in their radiotelephony communications at all times. The flight crew of NEF025 would not always read back their air traffic control clearances, and some read-backs contained errors. In some instances the pilots of NEF025 omitted their call sign from the read-back. Air traffic controllers would not always require read-backs, nor did they correct the wrong read-backs.

According to the Aviation Regulation, the air traffic control must react to incorrect or incomplete read-backs. Traffic at Helsinki-Vantaa was getting heavier in the afternoon, the time of the occurrence. Still, increasing traffic or the ATC work load should not result in the use of non-standard phraseology.

At 14:38:33 TWR-E told NEF025 to contact TWR-W on 118.850 MHz. NEF025 did not read back this instruction, nor did the controller require a read-back. At 14:39:01 NEF025 made a call on the Helsinki Radar (TAR) frequency 129.850 MHz. Helsinki Ra-

dar told them that they were on the wrong frequency by saying: 'Check frequency it should be 118.850'. The flight crew had possibly preselected 129.850 MHz on the radio so that it would be easily selected after the takeoff.

Even though NEF025 had not yet contacted TWR-W, at 14:38:40 TWR-W transmitted the following information: 'NEF025 this is TWR, one landing before you'. At 14:39:27 NEF025 called TWR-W by saying: 'Helsinki TWR one NEF025 holding point WD RWY 22R'. The radio call contains the term 'one', the purpose of which remains unclear. TWR-W replied: 'NEF025 one landing', by which the controller attempted to inform NEF025 that their traffic included one landing aircraft.

According to the co-pilot of NEF025 the controller said 'lining', to which the co-pilot replied by reading back 'lining up'. According to the recording the co-pilot read back 'landing'. The pilot-in-command of NEF025 said that the controller said 'line up' which the crew, according to the statement of the pilot-in-command, read back as: 'lining up runway 22R'.

The investigation group asked an audio expert to acoustically analyse the ensued radiotelephony communications. Since the controller and the pilots of NEF025 disagreed about the use of the words *landing* and *lining*, the specific goal was to establish their use.

The investigation group listened to the radiotelephony recordings. On the grounds of these, corroborated by the analysis of the audio expert, the TWR-W controller used the phrase 'one landing', which NEF025 read back as 'landing'. Typically, the word *lining* is never used on its own. Rather, it is included in phrases such as *line up* or *lining up*.

Finavia investigated an incident which occurred on 2 April 2009 on RWY 22R at Helsinki-Vantaa. A departing airliner entered the runway without permission in front of an airliner which had already been cleared to land. Even in this incident the departing airliner had received the following traffic information: 'one landing before', following which they taxied onto the runway.

In view of safe operations it is important to strictly adhere to standard radiotelephony phraseology in aviation.

2.5 Language proficiency

According to the standards and norms of the International Civil Aviation Organization (ICAO) air-ground radiotelephony communications shall be conducted in the language normally used by the station on the ground or in the English language.

In order to assess the English language proficiency of pilots and air traffic controllers, they must take a language test. The results of the tests are recorded on their licences under the marking LP (Language Proficiency). Language proficiency is assessed on a scale from 1 to 6. The lowest acceptable level for an Airline Transport Pilot's Licence or an Air Traffic Controller's Licence is LP 4 (operational). Level LP 5 (extended) denotes

good proficiency and the highest level, LP 6 (expert), can be attained by a person whose language skills resemble those of a native speaker.

The proficiency of the flight crew of NEF025 was limited as regards understanding air traffic control clearances or communicating with the ATC in English. The view of the investigation group is based on the language skills of the pilots which they exhibited on the radiotelephony recordings and during the interviews. The licence of the pilot-in-command of NEF025 had the marking LP 4, and the co-pilot's LP 5, respectively. Both pilots had passed their language proficiency tests in the Czech Republic in 2011.

2.6 NEF025 flight crew situation awareness

The afternoon traffic at Helsinki-Vantaa was heavy and the parallel runways 22L and 22R were in use. Since NEF025 was parked on Apron 4, the taxi distance to holding point RWY 22R was long and included the crossing of two runways, (RWY 15 and RWY 22L). In such a situation it is particularly important that pilots carefully study runway and taxiway arrangements and the placement of holding points.

Judging by the radiotelephony recordings, due to its incorrect frequency selection, NEF025 was on Helsinki Radar frequency exactly at the time when TWR-W cleared BLF218 to land on RWY 22R. As a result of the wrong frequency, the pilots of NEF025 may have had poor situation awareness regarding the approaching aircraft that was cleared to land on RWY 22R.

The situation awareness of the flight crew of NEF025 was not altogether sufficient during the taxi phase.

2.7 Manoeuvring area design

Normally, manoeuvring areas are designed so that taxiways leading to the runways are perpendicular to the runway. This provides the pilots with an unobstructed view to the active runway and the approach sector. In certain cases the taxiways lead at an approximate 45° angle to the runway, which limits the view to the approach sector. The angle is an important factor when pilots check the approach sector before lining up.

Taxiway WD at Helsinki-Vantaa leads to RWY 22R at an approximate 45° angle. In practice, this means that it is only possible to check the approach sector from the right seat when taxiing onto RWY 22R via holding point WD. In situations like this multi-crew cooperation must make sure that, despite the limited view, the approach sector check is not left undone.

Figure 4. Taxiway WD and taxiroute of NEF025 (KTJ/Oikeusministeriö/MML).

2.8 Local RWY Safety Team (LRST)

The European Organisation for the Safety of Air Navigation (Eurocontrol) set up the Eurocontrol Runway Safety Working Group for the purpose of improving runway safety. The working group published two Action Plans for the Prevention of Runway Incursions: the EAPPRI 1.0 and 2.0. The EAPPRI 2.0 was published in 2011. In addition to Eurocontrol staff, numerous experts from all over Europe, Finland included, participated in this work.

The EAPPRI 2.0 is a comprehensive document which painstakingly details the factors that contribute to runway safety. These include *inter alia* aerodrome operator issues, communications between air traffic controllers and pilots, aircraft operator issues, air navigation service provider issues, regulatory issues and technology. In addition, the EAPPRI provides recommendations with regard to runway safety, including the actors to whom the recommendations are directed.

In accordance with the international recommendation Helsinki-Vantaa established a Local Runway Safety Team (LRST). In 2011 the LRST came together four times. Meeting minutes and Annual Reports are written. Airport, air traffic control, local airlines and service providers are represented in the team. When required, representatives of the air traffic controllers' and the airline pilots' trade unions are invited to the meetings.

As per the EAPPRI document the tasks of the LRST are, among other things, to monitor the number, type and the severity of runway incursions, identify any local problem areas and suggest improvements, and conduct runway safety awareness campaigns that focus on local issues.

The LRST can monitor the materialisation of the EAPPRI's recommendations. When it comes to this investigation, one of the EAPPRI's recommendations related to ICAO Doc 4444, which says that subsidiary phraseology should not be used as a substitute for standard radiotelephony phraseology. Rather, it should be used to complement it.

3 CONCLUSIONS

3.1 Findings

1. The pilots and air traffic controllers had valid licences and ratings.

2. The aircraft had valid airworthiness certificates.

3. Traffic was heavy at Helsinki-Vantaa and parallel approaches (22L/22R) were in use.

4. It was raining, the ground was wet and free of snow.

5. NEF025 did not read back the instruction to change over to the TWR-W frequency (118.850); it contacted Helsinki Radar (129.850) by mistake.

6. NEF025 slowed its taxi speed and almost came to a halt before the illuminated stop bar.

7. Once NEF025 contacted TWR-W the air traffic controller informed them of one landing aircraft (‘NEF025 one landing’).

8. The pilot-in-command of NEF025 interpreted the traffic information to be a clearance to taxi onto the runway. Although the co-pilot was unsure of the clearance, the pilots did not confirm this from the air traffic control.

9. NEF025 crossed the illuminated stop bar and taxied onto RWY 22R without an air traffic control clearance.

10. During the final stage of its approach to RWY 22R, BLF218 aborted the approach, initiated a go-around and made a new approach.

11. NEF025 did not correctly read back all ATC clearances. Some clearances were not read back at all.

12. Multi-crew cooperation between the pilots of NEF025 was inadequate.

13. The English language proficiency of the flight crew of NEF025 was limited as regards understanding air traffic control clearances or communicating with the ATC.

14. The TWR-W air traffic controller switched on the stop bar to make certain that NEF025 would not taxi onto the runway.

3.2 Probable causes and contributing factors

The serious incident occurred because the flight crew of NEF025 misinterpreted the traffic information, crossed the illuminated stop bar and taxied onto the active runway 22R without an air traffic control clearance. Inadequate multi-crew cooperation on board NEF025 and subsidiary phraseology which the ATC used in addition to standard phraseology were contributing factors.

4 SAFETY RECOMMENDATIONS

4.1 Safety actions already implemented

LV CAA (Latvian Civil Aviation Agency) was informed of the serious incidents that occurred to a RAF-AVIA's Saab 340 airliner on 29 December 2011 at Helsinki-Vantaa and on 14 February 2012 at Mariehamn.

On 15 February 2012 LV CAA organised a meeting with RAF-AVIA to ensure that the company continue to operate in a safe manner. In that meeting LV CAA focused attention, among other things, on Saab 340 pilot training and miscommunications with the air traffic control. LV CAA compiled a list of the detected anomalies.

The next meeting took place on 13 March 2012. The goal of the meeting was to go through the corrective action already implemented by RAF-AVIA, and the action plan to correct the remaining anomalies. During this meeting LV CAA issued six recommendations to RAF-AVIA, which the company accepted. In addition to the recommendations LV CAA carried out a quality audit on RAF-AVIA on 28-29 March 2012.

According to one of the recommendations RAF-AVIA were to stand down Saab 340-operations, effective 19 March 2012, until such date when all Saab 340 pilots had completed language and refresher training and proficiency checks. These measures were to be achieved prior to each pilot's next flight on the Saab 340. RAF-AVIA complied with the recommendation and stood down Saab 340 operations, effective 19 March 2012. LV CAA permitted RAF-AVIA to continue with Saab 340 operations, effective 30 April 2012.

4.2 Safety recommendations

1. NEF025 taxied across the red, illuminated stop bar onto an active runway.

> *Safety Investigation Authority, Finland recommend that the Latvian Civil Aviation Agency ensure that the pilots of RAF-AVIA Airlines are familiar with the procedures related to stop bars.*

2. Prior to taxiing onto the runway the flight crew of NEF025 did not verify the air traffic control clearance through multi-crew cooperation methods. Furthermore, their airspace monitoring technique was inadequate.

> *Safety Investigation Authority, Finland recommend that the Latvian Civil Aviation Agency make certain that RAF-AVIA pilots possess sufficient multi-crew cooperation skills.*

3. Strict adherence to standard phraseology in ATC radiotelephony is an important safety factor. It is equally important that air traffic controllers carefully listen to pilot readbacks and react to any possible mistakes.

Safety Investigation Authority, Finland recommend that Finavia Corporation emphasise the importance of disciplined radiotelephony communications in air traffic control operations and that Finavia focus particular attention on correct read-backs.

4. In this incident the air traffic controller used subsidiary phraseology in addition to standard radiotelephony phraseology by providing traffic information of a landing aircraft to the taxiing aircraft. The pilot-in-command interpreted this as permission to taxi onto the runway.

Safety Investigation Authority, Finland recommend that Finavia Corporation make certain that air traffic controllers include the pertinent air traffic control clearance, as applicable, when they complement the standard radiotelephony phraseology with traffic information.

5. It is technically possible to add an alerting system to Helsinki-Vantaa air traffic control that would caution the air traffic controller of conflicting information as regards an aircraft's position on the surface movement radar, the status of the flight on the e-Strip or the status of the stop bar. The recommendations in Finavia's internal report (T1/2009) also advocate the introduction of such an alerting system.

Safety Investigation Authority, Finland recommend that Finavia Corporation study the possibilities of introducing a system that alerts air traffic controllers of runway incursions.

4.3 Other observations and proposals

The Eurocontrol Runway Safety Working Group published the EAPPRI 2.0 Action Plan for the Prevention of Runway Incursions. The EAPPRI comprehensively analyses factors contributing to runway safety, many of which emerged in this investigation as well.

The EAPPRI document should be utilised at all Finnish aerodromes for the purpose of improving runway safety.

Helsinki 30.1.2013

Lars Levo

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SUM-UP OF THE COMMENTS RECEIVED TO THE DRAFT FINAL REPORT:

FINAVIA OYJ

Finavia regards that the draft final report should have used international reference documents rather than national documentation.

When it comes to air traffic control regulations, Finavia's comments state that the procedure of repeating the taxi clearance, as presented in the draft final report, does not conform to present regulations.

Finavia maintains that it would have been prudent to describe the normal radio phrases used at EFHK when transferring aircraft to other frequencies, and to evaluate the ones that were used in this situation vis-à-vis them.

According to Finavia, the air traffic controller attempted to assist the aircraft in many ways; this included the illumination of the stop bar and the provision of traffic information of the landing aircraft. As per Finavia, the right to deviate from standard phraseology, when required, is based on international ICAO documents as well as national aviation regulation.

The draft final report assessed the mistakes and shortcomings observed in radiotelephony between the air traffic control and NEF025. Finavia holds that the parties to the investigation did not receive equal treatment because safety recommendations were only issued to Finavia.

It is the opinion of Finavia that, in principle, safety recommendation number 4 should be deleted. Should, however, it be preserved, the recommendation should be directed at the Finnish Transport Safety Agency instead.

Section 4.3 of the draft final report proposes the utilisation of the EAPPRI publication at Finnish aerodromes. Finavia believes that this should be explained in more detail, as it can be interpreted as applying to only the measures of the aerodrome operator, i.e. Finavia.

FINNISH TRANSPORT SAFETY AGENCY (TraFi)

No comments

EUROPEAN AVIATION SAFETY AGENCY (EASA)

No comments

RAF-AVIA

No comments

BLUE1

No comments

LV CAA (Latvian Civil Aviation Agency)

LV CAA requested that, rather than the Latvian Ministry of Transport as mentioned in the draft final report, LV CAA be mentioned as the body that issued the airline an Aircraft Operator Certificate (AOC).