Investigation report

B 6/2001 L
Translation of the Finnish original report

Serious aircraft incident in Turku terminal control area, Finland on 13.8.2001

OH-SAE, SAAB SF340A

OH-SAS, SAAB 2000

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ABBREVIATIONS

ACC	Area control centre
ALL	All labels
APP	Approach
ATS	Air Traffic Service
B-RNAV	Basic Area Navigation
CA	Collision Alert
CB	Cumulonimbus
CVR	Cockpit voice recorder
DFDR	Digital Flight Data Recorder
DME	Distance Measuring Equipment
FEW	Few (1-2/8)
FIN	Finnish
FL	Flight Level
FT	Feet
GEN	General
HPA	Hectopascal
ILS	Instrument Landing System
IFR	Instrument Flight Rules
JAR	Joint Aviation Requirements
KT	Knot(s)
MSL	Mean Sea Level
MSSR	Monopulse Secondary Surveillance Radar
NAV (display)	Navigation page
NDB	Non-directional Radio Beacon
NM	Nautical Miles
PEL	Aviation licences
PF	Pilot Flying
PNF	Pilot Not Flying
QNH	Altimeter sub-scale setting to obtain elevation when on the ground
RA	Resolution Advisory
SAR	Search And Rescue
SCT	Scattered (3-4/8)
TA	Traffic Advisory
TCAS	Traffic Collision Avoidance System
TMA	Terminal Control Area
TWR	Tower
VOR	VHF omnidirectional radio range

SYNOPSIS

On Monday 13 August 2001 at 16.09 Finnish local time (all times in the report are Finnish local time) a serious aircraft incident took place in Turku terminal control area, when a SAAB 2000 commercial transport aeroplane, call sign KFB 422, operated by Oy Air Botnia Ab, descended according to the air traffic control clearance through the level used by a SAAB SF340A commercial transport aeroplane, call sign KFB 411, operated by Oy Air Botnia Ab.

On Tuesday 14 August 2001 the Accident Investigation Board (AIB) was notified of the incident by an incident report made by an air traffic controller in Turku.

On Thursday 16 August 2001 the Accident Investigation Board decided to carry out an investigation and appointed a commission by decision B 6/2001 L. AIB specialist, air traffic controller Mr Erkki Rissanen was appointed as an investigator-in-charge and AIB specialists airline pilot Timo Uramaa and air traffic controller Ari Huhtala were appointed as members of the commission.

The investigation is based on the Investigation of Accidents Act (373/1985) and Decree (79/1996), ICAO Annex 13 and the Council of the European Union directive 1994/56/EC.

The report was sent for comments according to the Investigation of Accidents Decree (79/1996) to the Finnish Civil Aviation Administration's Flight Safety Authority on 31 October 2001. The received statement has been taken into account and attached to the final report. Statement is available only in finnish in the the Finnish original report.
The investigation was closed on 8 January 2002.

1 FACTUAL INFORMATION

1.1 History of the flight

On Monday 13 August at 13.00 a change of shift took place at Turku aerodrome control tower and approach control unit (TWR/APP). A duty controller and a rating trainee came to the evening shift. The trainee started working at the desk under the duty controller's surveillance.

At 14.24 Turku TWR/APP had reserved airspace for parachuting activities from the area control centre (ACC). The space was bound on all sides by the control zone and the upper limit was flight level 135. At the time of the incident the airspace reservation was still active, but there was no parachuting activity and the air traffic density was low.

When KFB 411, departing for a scheduled flight from Turku to Mariehamn, called Turku tower at 15.58.32, only a Piper PA34 (registration SEGPX), arriving from the direction of Mariehamn was on the air traffic control's radio frequency and within its responsibility area.

Turku TWR/APP cleared SEGPX to descent to 4000 feet on QNH 1001. To the departing KFB 411 it gave 3000 feet as an initial altitude with an addition *"odota lisää reitillä" ("expect more en route")*. KFB 411 departed at 16.01. After verifying that the two aircraft had passed each other the air traffic control cleared SEGPX to continue descent to 2200 feet and KFB 411 to climb to flight level 80, which was the cruising level announced in its flight plan.

Turku TWR/APP had information about the scheduled flight KFB 422 from Stockholm on a flight progress strip. The estimated arrival time of the aircraft to LIETO NDB was 16.16 and ACC had cleared it to descent to flight level 100 in accordance with a Letter of Agreement between the ATC units.

KFB 411 requested at 16.04.39 permission to fly track 260º or to freely avoid CB-clouds in the Turku terminal control area. Turku allowed the aircraft to freely avoid clouds and notified ACC about this at 16.05.00. During the same telephone contact ACC said that KFB 422 would now contact and be released to Turku. At this time the aircraft was 38 NM from RUSKO VOR/DME descending through flight level 140.

The term "released" means that the aircraft can still be cleared for descent, but it cannot be turned off its route until it has reached the receiving unit's responsibility area.

At 16.06.03 Turku TWR/APP asked SEGPX to report when it would cross LIETO NDB outbound and at the same time requested the aircraft's altitude. The aircraft reported just passing LIETO outbound and descending through 2700 feet. This altitude information confirmed to the air traffic control that it could, with regard to this aircraft, clear KFB 422 to 3200 feet. This altitude guarantees to the approaching aircraft an altitude that

corresponds to the missed approach procedure, which is 2200 feet for the ILS approach to runway 26.

KFB 422 called Turku tower at 16.06.42 and reported descending through flight level 115 to flight level 100. The controller gave KFB 422 an inbound clearance*: "Good afternoon Botnia four one, correction four two two, you are cleared to LIETO via RUSKO, continue descent to three thousand two hundred feet, QNH one zero one…correction one zero zero one, expect visual approach two six, no delay".* The air traffic controller cleared KFB 422 through the clearance altitude of KFB 411, which was flying in the opposite direction. The duty controller, who was very close to the trainee controlling the traffic, did not notice the mistake the trainee had made.

The air traffic control requested at 16.07.43 KFB 411 to report when it would be following radial 248. The aircraft reported to be just following radial 247 and passing through flight level 73. Turku requested the aircraft to report when passing PERKA. KFB 411 reported that it would do so and slightly later reported maintaining flight level 80. As a reply to the message Turku asked for the distance of KFB 411. The aircraft did not respond immediately but reported at 16.08.53: *"Ja torni meillä TCAS:si antaa traffic-varoituksen, me kaarretaan vasempaan, meillä on pinta kaheksan nolla, tuo näyttää tuo kakstonninen tulevan vastaan."* (*"And tower, we are receiving a traffic warning from our TCAS, we are turning left, we have level eight zero, that two thousand seems to be heading straight on us").* At 16.09.11 KFB 411 reported: *"Ja nyt ei oo vaaraa" ("And now there's no risk")* and a moment later*: Sopiiko nousta lentopinnalle yheksän nolla?" ("Is it ok to climb to flight level niner zero?").The a*ir traffic control cleared the aircraft as requested.

The duty controller did not notice the situation until he heard KFB 411's report on the TCAS advisory. The situation had already progressed to a stage where the air traffic controller did not any longer have a chance to change the course of events.

KFB 411 had had a 12 NM scale on the TCAS screen, when the opposite aircraft appeared on it. When the distance between the two aircraft was approximately 8-9 NM, KFB 411's pilots established visual contact with the opposite aircraft. The visual contact was maintained until the two aircraft had passed each other. Based on the TCAS, the pilots noticed that the opposite aircraft was descending through flight level 90. TCAS indicated a traffic advisory (TA). The aircraft's pilot in command, who was seated on the left side and acted as the pilot flying (PF), decided to take avoiding action and turned approximately 40º left to heading 210º. The TCAS also indicated a resolution advisory (RA) "CLIMB" when the pilot started to turn. The pilot started to climb while turning.

KFB 422 also received a traffic advisory (TA) about the opposite aircraft from their TCAS. The pilots switched the TCAS page onto the NAV display of the flight guidance system and noticed that the essential traffic was approximately 5 NM straight ahead and slightly below them. After that the pilots also established visual contact with the opposite aircraft. The TCAS indicated resolution advisory (RA) "MAINTAIN VERTICAL SPEED" almost at the same time when the pilots noticed that the opposite aircraft turned left. The aircraft's pilot in command, seated on the right side and acting as the pilot not flying

(PNF) had just prepared to take piloting responsibility and to perform an avoiding turn right. A captain trainee, who was acting as the pilot flying (PF), occupied the left seat in the cockpit.

When the 1000 feet altitude separation was lost, the distance between KFB 411 and KFB 422 was 6.1 NM. When the two aircraft were at the same altitude, the distance between them was 3.1 NM. When KFB 411 started its avoiding turn, the distance was 2.4 NM, and the shortest distance between the aircraft was 1.1 NM.

KFB 411 reported passing PERKA at 16.11.41, and Turku instructed it to contact Tampere Radar. KFB 422 reported at 16.12.54: *"And tower Botnia four two two field in sight, we are three thousand two hundred feet."* Due to an aircraft performing approach ahead, KFB 422 had to make an ILS approach. It landed on runway 26 at 16.22.

The pilots in command of both aircraft filled out the Airline Operator's ACAS/TCAS report forms. The air traffic controller made a report on the incident in accordance with Aviation Regulation GEN M1-4 as required by the Flight Safety Authority. In addition to this the air traffic controller made an internal occurrence and observation report (PHI) to the CAA Air Navigation Services Department and made an entry about the incident in the air traffic control diary. Turku did not inform ACC of the incident.

1.2 Injuries to persons

There were 30 passengers and 3 crew members on board KFB 411 and 27 passengers and 3 crew members on board KFB 422. No one was injured.

1.2 Damage to aircraft

No damage.

1.4 Other damage

No damage.

1.5 Personnel information

1.5.1 Air traffic control personnel

Duty controller:	Male, 49 years
Licence:	Air traffic controller, valid until 22 March 2002
Medical certificate:	FIN 1, valid until 22 March 2002
Ratings:	All required ratings were valid

Air traffic controller trainee:	Male, 23 years
Licence:	No air traffic controller's licence
Medical certificate:	No valid medical certificate
Ratings:	No valid ratings

1.5.2 Aircraft personnel

Crew of KFB 411

Pilot in command:	Male, 34 years
Licence:	Airline transport pilot's licence, valid until 3 November 2005
Medical certificate:	JAR class 1, valid until 15 April 2002
Ratings:	All required ratings were valid
First officer:	Male, 27 years
Licence:	Commercial pilot's licence, valid until 11 May 2005
Medical certificate:	JAR class 1, valid until 15 December 2001
Ratings:	All required ratings were valid

Crew of KFB 422

Pilot in command:	Male, 44 years
Licence:	Airline transport pilot's licence, valid until 2 May 2004
Medical certificate:	Class 1 (Sweden), valid until 22 September 2001
Ratings:	All required ratings were valid
Captain trainee:	Male, 32 years
Licence:	Airline transport pilot's licence, valid until 11 July 2006
Medical certificate:	JAR class 1, valid until 30 November 2001
Ratings:	All required ratings were valid

1.6 Aircraft information

KFB 411

SAAB SF340A, 33 seats, transport category aircraft equipped with two turboprop engines.

Nationality and registration:	Finland, OH-SAE
Owner:	340 Leasing Ltd
Operator:	Oy Air Botnia Ab
Manufacturer:	SAAB Aircraft Corporation
Type:	SAAB SF340A
Serial number:	117
Manufacturing year:	1988
Engines:	2 GE-CT7-5A2 turboprops
Certificate of airworthiness valid:	Until 31 August 2004.

KFB 422

SAAB 2000, 47 seats, transport category aircraft equipped with two turboprop engines.

Nationality and registration:	Finland, OH-SAS
Owner:	Swedish Aircraft Holdings AB
Operator:	Oy Air Botnia Ab
Manufacturer:	SAAB Aircraft Corporation
Type:	SAAB 2000
Serial number:	44
Manufacturing year:	1997
Engines:	2 Rolls Royce AE2100 turboprops
Certificate of airworthiness valid:	Until 31 March 2004.

1.7 Meteorological information

Turku airport weather on 13 August 2001 at 15.50:

10 minutes average wind 250 degrees 10 knots, variation 210-280 degrees 6-14 knots, visibility 30 kilometres, clouds FEW (1/8 SC) 1600 FT, SCT (4/8 CU) 2400 FT, SCT (4/8 CI) 25000 FT, temperature 18.5°C, dewpoint 12.5°C, QNH 1001.3 hPa.

Weather at the incident site:

There were some clouds in the area, but according to the pilots the visibility was good. It was daytime.

1.8 Aids to navigation

Both aircraft were B-RNAV-certified.

1.9 Communications

There were three aircraft on the radio frequency of Turku air traffic control at the time in question. Radio communications with the arriving aircraft, SEGPX and KFB 422, were in English. The departing KFB 411 began the communications in Finnish, and radio traffic was carried on in Finnish even though there was already one aircraft using English as communication language on the radio frequency. The language of communication between air traffic control and KFB 411 was changed into English only after KFB 422 had entered the frequency.

KFB 411's reports about receiving a TCAS advisory, taking avoiding action and clearing of the conflict were again given in Finnish.

The radio communications were conducted on Turku tower frequency 118,300 MHz. This radio frequency is, according to the Civil Aviation Administration's ATS instruction and regulation, COM 2, (31.12.1996), limited to be used only within a 25 NM radius and with flight level 40 as an upper limit. According to all parties involved, radio reception was good and there were no disturbances on the frequency.

Because Finnish was used as the communication language, the pilot in command of KFB 422, who was not Finnish, could not understand the report about a TCAS advisory from KFB 411. Neither did he understand the report about taking the avoiding action, but the other pilot of the aircraft had to translate the messages into English.

The phrases used were mainly in accordance with the standard phraseology. Phrases concerning the avoiding action, however, were not completely in accordance with standard phraseology.

All radio communications are included in the reference material of this report.

1.10 Aerodrome information

The co-ordinates of Turku aerodrome are 60º30'53" N 022º15'42" E and the elevation is 49 metres. The length of the asphalt covered runway 08/26 is 2500 metres and the width is 60 metres. The equipment of the aerodrome had no influence on the event.

1.11 Flight recorders

KFB 411

The aircraft was equipped with a digital flight data recorder (DFDR) Lockheed 10077A 500-803 and a cockpit voice recorder (CVR) L-3 Communication Corp. 93A 100-83.

KFB 422

The aircraft was equipped with a digital flight data recorder (DFDR) L-3 Communication Corp. S 800-300-00 and a cockpit voice recorder (CVR) L-3 Communication Corp. PS 200-0012-00.

1.12 Location of the incident and investigation of the aircraft

The incident occurred within Turku terminal control area, on radial 248 from RUSKO VOR and approximately 20 NM from RUSKO DME, on the centreline of ATS route T86 on flight level 80.

The lower limit of Turku terminal control area at the incident site is 1500 ft MSL and the upper limit is flight level 95. The area is under the responsibility of Turku tower and approach control and the ATS airspace classification is D.

The aircraft were not examined.

1.13 Medical information

No medical investigations were conducted.

1.14 Fire

No fire broke out.

1.15 Survival aspects

The incident caused no SAR actions.

1.16 Detailed investigations

1.16.1 Material

The investigation material includes ACAS/TCAS report forms filled out by the pilots in command of the aircraft and the incident report made by the air traffic controller, interviews of all parties concerned, radar records, radio and telephone records and information from documents, instructions and previous investigation reports.

The background material consists of interviews and visits to ATC unit and offices.

The material collected about the incident was nearly adequate for the investigation board to form a detailed conception of the incident. It must be noted, however, that the air traffic control office is not equipped with any recording system that would have confirmed the actions in the ATC. For these parts the material is based on interviews of the parties involved. The records from the flight recorders on the aircraft were not available, because the records had not been removed. The recorded information would have been useful for finding out about flight crew actions.

1.16.2 Investigation of radar records

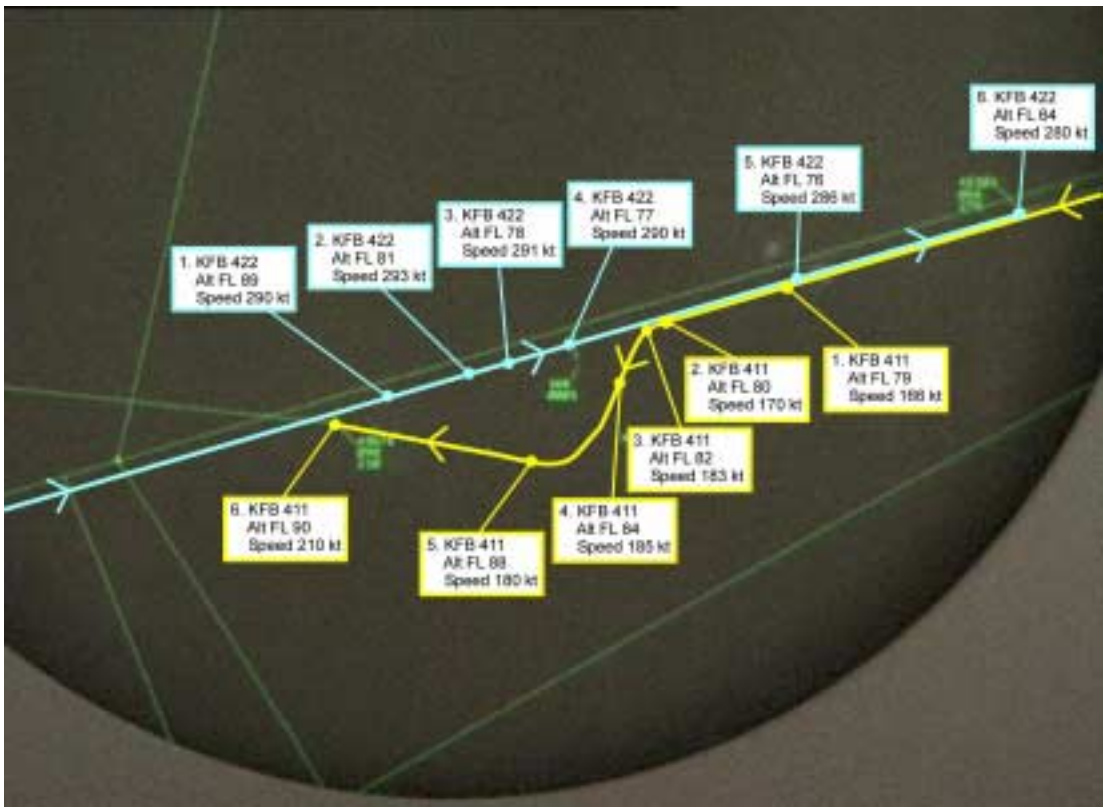
Preliminary radar record viewing took place in Tampere ACC on 16 August, and the record was videoed on 17 August. The record was analysed on 30 August.

Already at the preliminary viewing the investigators noticed that the ACC's radar controller shifted KFB 422 to the HOLD mode at 16.06.00, immediately after the radio communication and air traffic control responsibility were transferred to Turku air traffic control. In the HOLD mode the radar symbol of the aircraft changes, the label disappears and the information on it is moved to a separate HOLD list. In this case the radar does not give any CA warning, and therefore the radar controller did not notice the risk of collision. At the time of the shift KFB 422 was descending through flight level 140 and its distance from RUSKO VOR/DME was 38 NM. At that time the aircraft was still in the ACC's responsibility zone and under its control.

Because of the facts described above the record was videoed in the ALL LABELS mode. In this mode every aircraft equipped with a transponder has a label on the radar screen. In this mode only the transponder code, flight altitude and ground speed are shown on the label. In the ALL LABELS mode the system gave the normal CA warning at 16.08, when the distance between the two aircraft was 12 NM.

The ground speeds, altitudes and distances between the two aircraft in this investigation report, and the flight tracks and times in Picture 1 are based on the MSSR record from Tampere ACC.

The lack of a CA warning on the air traffic controller's working screen in a situation where one of the aircraft had been shifted to the HOLD mode gave a reason to investigate the functions of the secondary surveillance radar. Tampere ACC was requested to test and report whether the radar gives a warning when an aircraft is in the HOLD mode and uses code 7500, 7600 or 7700. According to the report from Tampere ACC, the alerts given by these codes work properly also when an aircraft is in the HOLD mode. The report from Tampere ACC is in Appendix 2 to this report.



Picture 1. Sequence of events based on the radar record:

1. 16.08.30 1000 feet vertical separation is broken. Distance between aircraft 6.1 NM.

2. 16.09.09 Aircraft on the same level. Distance between aircraft 3.1 NM.

3. 16.09.15 KFB 411 begins avoiding turn left. Distance between aircraft 2.4 NM.

4. 16.09.33 Closest distance between aircraft 1.1 NM.

5. 16.10.10 1000 feet vertical separation re-established

6. 16.11.05 KFB 411 returns on route.

1.17 Organisation and management of air traffic services

Air traffic services in Finland are provided, instructed and performed by the Civil Aviation Administration, except for flight information zones of certain municipal aerodromes. In practice air traffic services are provided by different air traffic service units, each in its area of responsibility.

Turku air traffic control is a combined tower and approach control unit. Usually the unit is manned by one air traffic controller, who provides both tower and approach services. Turku air traffic control has no radar.

The air traffic control utilises different navigation aids when providing air traffic services. It also receives additional information from a radar monitor in the air traffic control office. The Civil Aviation Administration's Air Navigation Services Department has published on 1 February, 2001, an ATS instruction and regulation RAC 59 concerning the use of the monitor. The monitor may not be used for separation, but only as an informative aid to assist in the air traffic controller's work.

The responsibility area of Turku air traffic control consists of a control zone and a terminal control area. All parts of the area are bounded by Tampere ACC's responsibility area. Turku air traffic control can also reserve other controlled airspace for its use.

Turku air traffic control is commonly used for air traffic controllers' on-the-job training because of its suitable equipment and traffic.

1.18 Additional information

1.18.1 Training of the air traffic controller

The air traffic control trainee who worked in Turku air traffic control had successfully completed AVIA COLLEGE's air traffic controller's course that ended on 1 June 2001. The course had taken 75 weeks, of which the basic period was 21 weeks, the tower period 31 weeks and the approach control course 23 weeks. The tower period included altogether eight weeks of on-the-job training in different ATC units. The average grade for theory subjects on the air traffic controller's course must be at least 2 on a scale from one to five. Every simulator exercise on the course is evaluated using a grade "excellent", "good", "satisfactory", "passable" or "failed". AVIA COLLEGE's instructions require that a trainer accepted by the College and appointed in writing supervises the trainee's work during the practice in different ATC units. In Turku the trainers have been appointed for the task. The on-the-job training shift must be evaluated on a training supervision form.

Having completed the course the trainee was performing on-the-job training of at least three months as required by Aviation Regulation PEL M3-10, paragraph 7.3.2, to get an air traffic control rating. According to PEL M3-10, paragraph 7.1.2, practical on-the-job training must be carried out under the supervision of an appointed and appropriately qualified air traffic controller. These air traffic controllers are not appointed in writing in Turku.

The CAA's Air Navigation Services Department has published on 31 October 1994 an on-the-job training instruction, which requires a study book or a supervision form to be used. However, the supervision form was not used to monitor the progress of on-the-job training for various ratings.

2 ANALYSIS

2.1 Analysis of the event

Turku air traffic control gave to KFB 411, departing for Mariehamn, an en route clearance with an initial altitude of 3000 feet with an addition “expect more en route”. The clearance does not meet the requirements of the Finnish Air Traffic Controller’s Manual. The Manual states that the cruising altitude assigned to controlled IFR flights must be such that it guarantees the aircraft staying in controlled airspace also in case of a radio communication failure. (ATCM chapter IV, paragraph 4.1).

After verifying that KFB 411 and SEGPX had passed each other, the air traffic control cleared KFB 411 to climb to flight level 80.

ACC released KFB 422 arriving from Stockholm to Turku tower when the aircraft was 38 NM from RUSKO VOR/DME on flight level 140 descending to flight level 100. The controller gave KFB 422 an inbound clearance to descend to 3200 feet on QNH 1001 through the clearance altitude of KFB 411 departing to the opposite direction. The strips in the strip bay were in correct order and the markings in them corresponded with the clearances given.

In the investigators’ opinion, the air traffic control trainee paid attention to the altitude information of 2700 feet given by SEGPX, which was approaching as number one, when issuing KFB 422’s clearance altitude. However, he did not consider KFB 411, which he had cleared to climb to flight level 80. The duty controller did not notice the mistake the trainee had made.

KFB 411 informed the tower of the TCAS traffic advisory (TA), reported “turning left” and began the climb ordered by the TCAS resolution advisory (RA) ”CLIMB”. The pilot did not report beginning the climb as required by the Radio Communications Guide. After approximately 20 seconds KFB 411 informed that the hazardous situation was over, and a moment later requested permission to climb to flight level 90.

The pilot-in-command of KFB 411 decided on the direction of the avoiding turn based on visual contact with the opposite traffic, which was slightly right of the aircraft’s longitudinal axis. The direction of the turn was against the Rules of the Air, Chapter 3, Paragraph 3.2.2.2. However, Chapter 2, Paragraph 2.3.1 of the Rules of the Air allows the pilot-in-command to deviate from the Rules when it is absolutely necessary for safety. The pilot-in-command of the aircraft saw that the left turn was the safest choice under the circumstances.

The crew of KFB 422 had received a traffic advisory (TA) from the TCAS and established visual contact with the opposite traffic, which was straight ahead of the aircraft. The pilot in command, who was not Finnish, sat on the right seat in the cockpit and operated as pilot not flying (PNF). He considered taking piloting responsibility and commencing an avoiding turn to the right, because he had not understood KFB 411’s information in Finnish about making an avoiding turn left.

The TCAS on KFB 422 indicated a resolution advisory (RA) ”MAINTAIN VERTICAL SPEED” almost at the same time when the pilots observed the opposite traffic turning left. If the pilot in command would have performed the avoiding turn right, according to the Rules of the Air, the risk of collision would have been obvious.

The duty controller and the controller trainee did not notice the situation until they heard KFB 411’s information about their TCAS advisory. The air traffic control did not have any longer an opportunity to intervene in the event.

2.2 On-the-job training of air traffic controllers

According to Aviation Regulation PEL M3-10 paragraph 7.1.2, the practical training required for obtaining ratings included in the air traffic controller’s licence must be performed under the supervision of a specifically appointed and qualified air traffic controller. The supervising air traffic controllers are not appointed in writing in Turku. Moreover, a supervision form required in the instructions published by the Air Navigation Services Department on 31 October 1994 was not used to monitor the progress of on-the-job training.

In the investigators’ opinion the airport should appoint in writing the air traffic controllers qualified to supervise trainees. The air traffic control units should also comply with on-the-job training instructions published by the Air Navigation Services Department. At airports several different controllers supervise the practical training, and if written forms are not used, the transfer of information from one supervisor to another concerning the trainee’s progress and various events during the training is not adequate.

When applying to the air traffic control course an applicant must have a valid medical certificate. A valid certificate is also required when applying for or renewing a rating or a licence. No requirements for medical certificates have been issued concerning the students’ practical training in the air traffic control course. In the investigators’ opinion the tasks and the nature of operations definitely require a valid medical certificate.

2.3 Radio usage

According to the ATS Instructions and Procedures COM 2, dated 31 December, 1996, the radio frequency of Turku tower 118.300 MHz is limited to be used only within a 25 NM radius below flight level 40. This area does not cover the whole responsibility area of Turku air traffic control. Similar restrictions are not complied with at several other aerodromes. Another radio frequency, 121.100 MHz, which covers the whole responsibility area, has also been reserved for Turku.

2.4 Analysis of radar records

ACC switched KFB 422 to the HOLD mode immediately after the aircraft’s radio contact had been handed over to Turku air traffic control. The aircraft was descending through

flight level 140 and its distance from RUSKO VOR/DME was 38 NM. When an aircraft is in the HOLD mode, a CA warning is not shown.

In the investigators' opinion an aircraft should not be switched to the HOLD mode until it reaches the next ATS unit's responsibility area.

3 CONCLUSIONS

3.1 Findings

1. The cockpit crews of both aircraft had valid licences and required ratings.
2. The duty controller had a valid licence and required ratings. He had not, however, been specifically appointed as a supervisor for practical training not included in the air traffic control course.
3. A rating trainee, who did not have an air traffic controller's licence or ratings, provided the air traffic services.
4. The duty controller was responsible for the trainee's work.
5. Turku airport did not have any specifically appointed and qualified practical training supervisors as required by Aviation Regulation PEL M3-10, paragraph 7.1.2.
6. Study books or supervision forms as required by on-the-job training instructions published by the Air Navigation Services Department were not used in Turku air traffic control.
7. Both aircraft had valid flight plans.
8. Both aircraft were, at the time of the incident, in the responsibility area and radio frequency of Turku tower and approach control.
9. The air traffic control trainee cleared KFB 422 to descend through the clearance altitude of KFB 411.
10. The duty controller did not notice the mistake.
11. KFB 422 had been shifted to the HOLD mode on ACC radar and thus the radar gave no CA warning.
12. Both aircraft complied with their clearances before the incident.
13. Both aircraft received a traffic advisory and a resolution advisory from their TCAS systems.
14. All pilots had visual contact with the essential traffic.
15. KFB 411 performed an avoiding turn left against the Rules of the Air, Chapter 3, Paragraph 3.2.2.2.
16. When the two aircraft were on the same level, they were on opposing tracks, the distance between them was 3.1 NM and their closing speed was 463 KT.
17. The minimum horizontal distance between the two aircraft was 1.1 NM, when the vertical distance between them was 700 FT. The aircraft had passed through each other's flight levels.
18. The primary radio frequency of Turku tower, 118.300 MHz, was used outside the coverage defined by ICAO.

3.2 Cause of the incident

The incident was caused by a mistake the air traffic control trainee made and the duty controller did not notice. Neither the investigators nor the persons involved were able to determine the cause of the mistake.

4 SAFETY RECOMMENDATIONS

1. An aircraft should not be transferred to the HOLD mode on radar before it reaches the responsibility area of the next ATS unit.

2. In air traffic services English should be used as the communication language as far as practicable, in case any aircraft on the frequency uses English in radio communications.

3. The instructors supervising practical training for ATC ratings should be appointed, and shift-specific records should be kept of the training.

4. The Civil Aviation Administration should specify its instructions on the validity of air traffic control trainees' medical certificates.

5. The Civil Aviation Administration should take action concerning the air traffic control units' primary radio frequencies, so that they would cover the entire responsibility area of the ATC unit in question.

Helsinki, 8 January 2002

Erkki Rissanen Timo Uramaa Ari Huhtala

REFERENCES

The following material is stored at the Accident Investigation Board, Finland:

1. Decision of the Accident Investigation Board no. B 6/2001 L, dated 16.8.2001
2. Combined PHI/GEN M1-4 reports from the air traffic control
3. ACAS/TCAS reports from the aircraft
4. Preliminary analysis of the incident from Turku airport
5. Interview reports
6. Extracts from air traffic control diary
7. Flight progress strips from Turku air traffic control
8. Weather information
9. Information on the licences of the staff
10. Airworthiness certificates of the aircraft
11. Telephone and radio communication recordings
12. Radar recording from Tampere ACC
13. Comments on the preliminary draft