Incident report

C 2/2002 L

Translation of the Finnish original report

Loss of separation south east of Helsinki-Vantaa, Finland on 11.1.2002

RA11962 Antonov An -12

OH-LBU Boeing B757

CONTENTS

Other investigation material is stored at the Accident Investigation Board, Finland.

ABBREVIATIONS

APP	Approach radar controller
ARR	Arrival radar controller
DEP	Departure radar controller
FDR	Flight data recorder
ICAO	International Civil Aviation Organization
NM	Nautical mile
MTOW	Maximum take-off weight
QNH	Air pressure on mean sea level
RA	Resolution advisory
RNAV	Area navigation
SSR	Secondary surveillance radar
TA	Traffic advisory
TCAS	Traffic alert and collision avoidance system

SYNOPSIS

On Friday 11.01.2002 at 15.55 (Finnish time is used in this investigation report) a loss separation occurred south east of Helsinki-Vantaa airport when An -12 cargo aircraft RA11962 call sign VVA9023 used by Aviast Joint Stock Ltd and Boeing B757 airliner OH-LBU call sign FIN1942 used fy Finnair passed approximately 0.25 nautical miles (NM) from each other with vertical separation being 700 feet.

The Accident Investigation Board (AIB), Finland was informed of the incident on 12.01.2002 when it received the incident reports filed by the commander of FIN1942 as well as Helsinki-Vantaa APP (approach) and DEP (departure) radar controllers.

On 15.01.2002 the Accident Investigation Board decided to perform an investigation of the incident and appointed by letter C 2/2002 L as investigators Airline pilot mr. Jussi Haila and Air traffic controller mr. Erkki Kantola. The incident investigation was conducted accordance with Finnish legislation (Act 373/1985) and the Decree (79/1996), ICAO Annex 13 and Council of European Union Directive 1994/56/EY.

FIN1942 copilot and two APP air traffic controllers were heard by the investigators on 17.01.2002, FIN1942 commander on 21.01.2002 and the DEP air traffic controller on 29.01.2002 Aviast J.S.C. delivered an incident report filed by the commander of VVA9023 on 23.01.2002.

The Helsinki-Vantaa Win radar recordings connected to the incident were placed at investigators disposal.

The final draft of this aircraft incident report was sent for comments to the Russian Aviation Authority as well as to the Finnish Flight Safety Authority according to ICAO Annex 13 on 16.5.2002. The received comment of Finnish Flight Safety Authority has not affected on the final report.

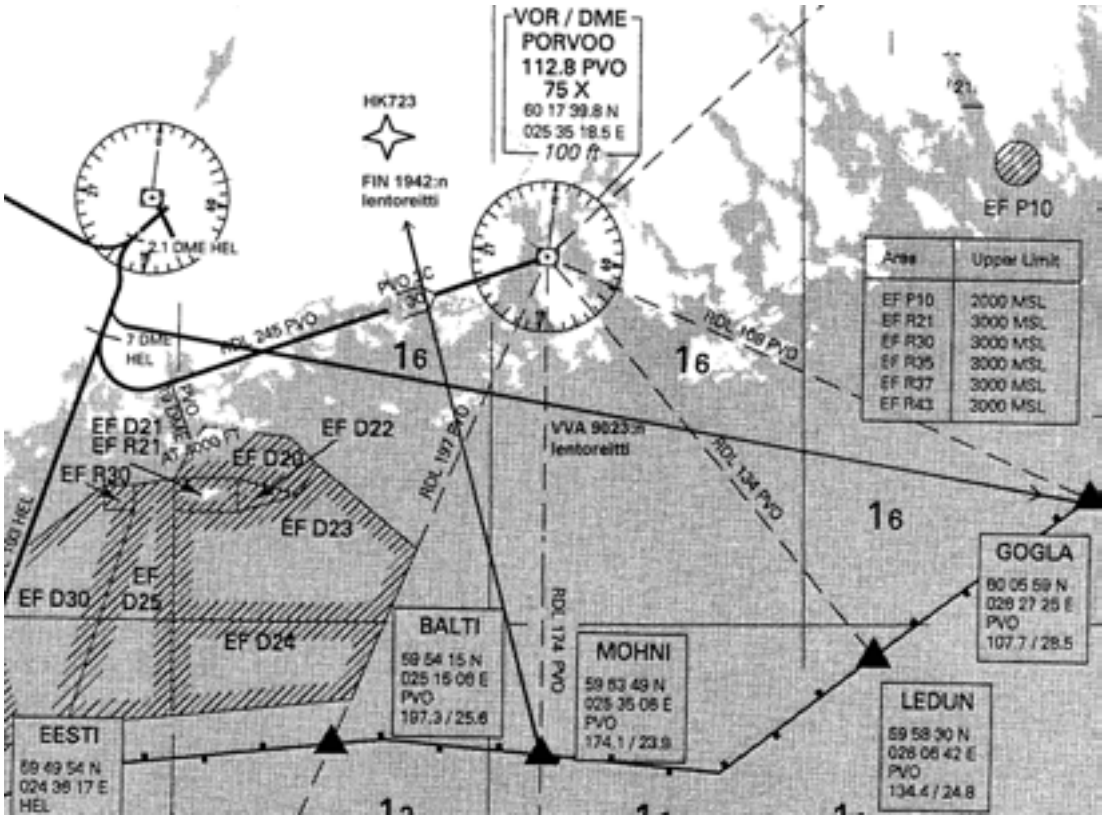
The investigation was closed on 14.8.2002.

1 FACTUAL INFORMATION

1.1 Course of events

Boeing B757 with call sign FIN1942 bound for Helsinki-Vantaa contacted Helsinki Approach (APP) at 15.51.05. APP issued inbound clearance via RNAV standard arrival route PVO1E via point HK723 and clearance to descent to the flight level 80 after passing the entry point MOHNI. Co-pilot acted as piloting pilot and commander as monitoring pilot.

An-12 with call sign VVA9023 bound for Samara, Russia, departed at 15.50.05 from runway 22 following the standard instrument departure route PVO3C. According to the instruction included the departure route the aircraft contacted Helsinki departure radar controller (DEP) at 15.50.50 and informed to be airborne: *"Helsinki approach, VVA9023, good afternoon, is airborne".*



Picture 1. Routes of the aircraft

Before departure VVA9023 had selected transponder code 2136, which was incorrect. DEP requested the aircraft to change the correct code 2030. VVA9023 changed the code which after DEP reported to have radar contact and confirmed that the aircraft was passing altitude 2500 feet. DEP then cleared it to climb to flight level 70 and fly direct to exit point GOGLA.

At 15.55.00 both FIN1942 and VVA9023 reported reaching cleared flight levels 80 and 70. Radar detection of both air traffic controllers matched with the reports of the aircraft and they both perceived that the required altitude separation was valid. After this both air traffic controllers were paying attention to other traffic.

At 15.56.05 FIN1942 informed on APP frequency that they are taking evasive manoeuvre due to another aircraft. The flight crew had with their TCAS-system monitored the climb of VVA9023 and found it to be climbing close to the RA-area (resolution advisory), where TCAS gives evasion instruction. The pilots of FIN1942 also had visual contact with An-12. When the altitude separation was approximately 500 feet and An-12 seemed to continue its climb, the flight crew of FIN1942 decided to take evasive manoeuvre upwards.

According to the statement of the co-pilot, who was piloting the aircraft, the maximum altitude in the evasion was approximately flight level 86. According to him An-12 disappeared below their nose during the evasion and he no longer saw it.

When FIN1942 had informed of the evasion at 15.56.05 the APP controller immediately cleared it to flight level 90 and allowed it to turn at pilots discretion. At 15.56.10 the DEP controller commanded VVA9023 to descend immediately to flight level 70: *"VVA9023, descend to flight level 70, you are passing 75… descend immediately"*. At 15.56.15 in its replay VVA9023 reported to maintain flight level 70: *"Roger, VVA9023… maintaining flight level 70"*. 15.56.20 detection of DEP radar controller indicated it to be at flight level 73: *"Roger, receiving 73 now".* After this the altitude indication of VVA9023 changed to zero for approximately 20 seconds. When the altitude indication returned, it showed flight level 70. The aircraft passed each other from a distance of approximately 0,25 NM with altitude separation of 700 feet according to the radar recording.

The commander of VVA9023 told in his report, delivered by Aviast J.S.C, that air traffic control had given clearance to flight level 70. During the climb the commander told to have kept an eye on an aircraft coming from two o'clock direction. When VVA9023 reached flight level 70, according to the commander's report, it got in to moderate turbulence which lifted the aircraft about 200 feet above the flight level 70 for a couple of seconds. Simultaneously the commander received a yellow TCAS-warning *"Traffic, traffic"* for approximately 1-2 seconds. VVA9023 immediately returned to the cleared flight level and received no other warnings. The commander told the air traffic control had ordered them to maintain flight level 70, which they did. After approximately 40-50 seconds they passed an opposite aircraft, which after air traffic control cleared VVA9023 to flight level 150.

According to the FDR recording (flight data recorder) of FIN1942 the aircraft started evasion upwards from flight level 80 at 15.56.06. The maximum altitude during the evasion was 8659 feet on altimeter setting 1013,25 mbar at 15.56.31. After that the aircraft descended back to flight level 80.

The commander of FIN1942 and both air traffic controllers filed a report of the incident.

1.2 Basic information

1.2.1 Aircraft

VVA9023 was a four-engine cargo aircraft of type Antonov An-12 with maximum takeoff weight (MTOW) 61000kg. FIN1942 was a twin-engine jet airliner of type Boeing B757 with passenger configuration of 227 seats, MTOW 115666kg.

1.2.2 Types of operations

VVA9023 was a cargo flight from Helsinki-Vantaa to Samara, Russia. FIN1942 was a charter flight from Dubai to Helsinki-Vantaa.

1.2.3 Number of occupants

There were 10 crewmembers on board VVA9023. There were 216 passengers and seven crewmembers on board FIN1942.

1.2.4 Injuries to persons

No one was injured

1.2.5 Damage to aircraft

The aircraft were not damaged

1.2.6 Other damage

There was no other damage

1.2.7 Personnel

Commander of VVA9023:	Male
Licenses:	Airline transport pilot, first class
Medical certificate:	No information received
Ratings:	No information received

Aviast J.S.C. has not delivered information of the flying experience of the flight crew.

Co-pilot of VVA9023:	Male, 47 years
Licenses:	Airline transport pilot, valid
Medical certificate:	No information received
Ratings:	No information received.
Navigator of VVA9023:	Male, 44 years
Licenses:	Navigator, valid

Medical certificate:	No information received
Ratings:	B-RNAV.

Radio-operator of VVA9023: Male, 37 years

Licenses:	Radio operator
Medical certificate:	No information received.

Flight mechanic of VVA9023: Male, 49 years

Licenses:	Flight mechanic
Medical certificate:	No information received.

Commander of FIN1942: Male, 47 years

Licenses:	Airline transport pilot, valid until 18.8.2005
Medical certificate:	JAR class 1, valid until 26.2.2002
Ratings:	All required ratings were valid.

Total flying experience of the commander was approximately 12000 hours, of which approximately 1000 hours on B757.

Co-pilot of FIN1942: Male, 32 years

Licenses:	Airline transport pilot, valid until 1.7.2005
Medical certificate:	JAR class 1, valid until 1.7.2002
Ratings:	All required ratings were valid

Total flying experience of co-pilot was approximately 5000 hours, of which approximately 400 hours on B757.

Departure radar controller: Female, 40 years

Licenses:	Air traffic controller, valid until 24.3.2002
Medical certificate:	FIN class 1, valid until 1.3.2002
Ratings:	All required ratings were valid.

Approach radar controller: Male, 37 years

Licenses:	Air traffic controller, valid until 1.6.2002
Medical certificate:	JAR class 2, valid until 9.5.2002
Ratings:	All required ratings were valid.

Approach radar controller trainee: Male, 37 years

Licenses:	Air traffic controller, valid until 21.11.2003
Medical certificate:	Air traffic controller, valid until 21.11.2003

Ratings: APP controller was training under the supervision of the licensed radar controller for radar rating.

1.2.8 Weather

Over North Europe and the Baltic area there was a large and weak high pressure. Over Finland the weather was almost clear. There were some stratus clouds over the Baltic area and southern Sweden. The edge of the overcast area stayed in east westerly direction over the Gulf of Finland. The winds were weak, at flight levels 50 and 100 there was westerly wind of 20-25 knots. Over the Finnish area there were nor weather fronts neither convection clouds.

METAR of Helsinki-Vantaa airport on 11.1.2002 at 15.50:

Wind 240 degrees five knots, visibility more than 10 km, clouds few 900 feet bkn 10000 feet, temperature +1 ºC, dew point –1 ºC, air pressure QNH 1015, no significant change expected (nosig).

1.2.9 Weight and balance

The weight and balance of the aircraft were on permitted area. The total amount of fuel in the aircraft was approximately 13000 kg.

1.2.10 Recordings

Recordings of the Helsinki-Vantaa airport Win radar were available for the investigation. Pictures 2 and 3 are extracts from the recording.

The investigators have listened the radio communication from recordings of Helsinki-Vantaa airport. Radio communications was in English and in accordance to the radio communication procedures. Radio communication between VVA9023 and DEP-radar controller is in appendix 1.

The FDR-recording of FIN1942 was at disposal in the investigation. FDR does not record traffic advisory information of TCAS.

1.3 Investigations

Investigation material includes incident reports of the radar controllers and the commander of FIN1942, extracts of logbooks of Helsinki air traffic control, flight strips, air traffic controllers and aircraft flight crew information, hearings of pilots of FIN1942 and the air traffic controllers on duty in APP-control at the time of the incident, the written report of the commander of VVA9023, analyzed information of the FDR-recordings of FIN1942, meteorological information during the incident of Helsinki-Vantaa airport and filed information from the airlines to the investigators.

The investigation material has been sufficiently detailed in order to get the view of the course of events.

1.4 Organization and management

Aviast J.S.C is an international freight service company, that has operated yearly a few charter cargo flights from Helsinki-Vantaa. The company headquarters are in Moscow.

The airline announced in their own investigations that the cause of the incident was *"low precise pilotage by the aircraft"*. According to the company's report the commander of VVA9023 had retired and the flight crew has received additional training including written examinations concerning aviation regulations of Finland and Europe and an additional An-12 simulator training.

2 ANALYSIS

2.1 ATC actions

At the time of the incident all working positions of Helsinki-Vantaa Approach air traffic control were in operation. At the APP radar position was a trainee working under the supervision of a licensed radar controller. The traffic density was low.

There was incoming traffic from south and south west. APP controller decided in his traffic solution to take FIN1942 coming from south to approach as number one. The controller cleared it to descend to flight level 80, to follow the RNAV standard arrival route PVO1E and to maintain high speed. The aircraft coming from southwest were cleared to descend down to flight levels 90 and 100. Other traffic approaching from west was already close to the airport and on the frequency of the arrival radar (ARR).

FIN1942 reported reaching flight level 80 at 15.55.00.

At 15.34.30 VVA9023 contacted Helsinki-Vantaa ground control and requested for start-up and en route clearance. Ground controller issued VVA9023 start-up permission and en route clearance, which included a transponder code. The aircraft read back the clearance and the code correctly. According to the Helsinki-Vantaa instructions the en route clearance should have been requested on the clearance delivery frequency meant for that purpose.

VVA9023 departed at 15.50.20 from runway 22 and followed PVO3C standard departure route. DEP and APP had agreed that it would initially be cleared to flight level 70 vertically separated to FIN1942 cleared to flight level 80. There was no need for separation to other approaching traffic. VVA9023 had selected an incorrect transponder code (2136). When the aircraft was airborne DEP noticed the incorrect code and requested it to change to code 2030. The aircraft changed the code and DEP reported radar contact and confirmed VVA9023 presently passing altitude 2500 feet. DEP then cleared VVA9023 to climb to flight level 70 and fly direct to exit point GOGLA. The aircraft acknowledged the clearances correctly.

In the first radio contact with the air traffic control unit the aircraft should report the present altitude as precisely as possible. That enables the verification of the C-mode altitude presented on the radar display and the altitude reported by the aircraft, which after the C-mode information can be used for vertical separation. Allowed error tolerance between the aircraft report and radar detection is +\-300 feet.

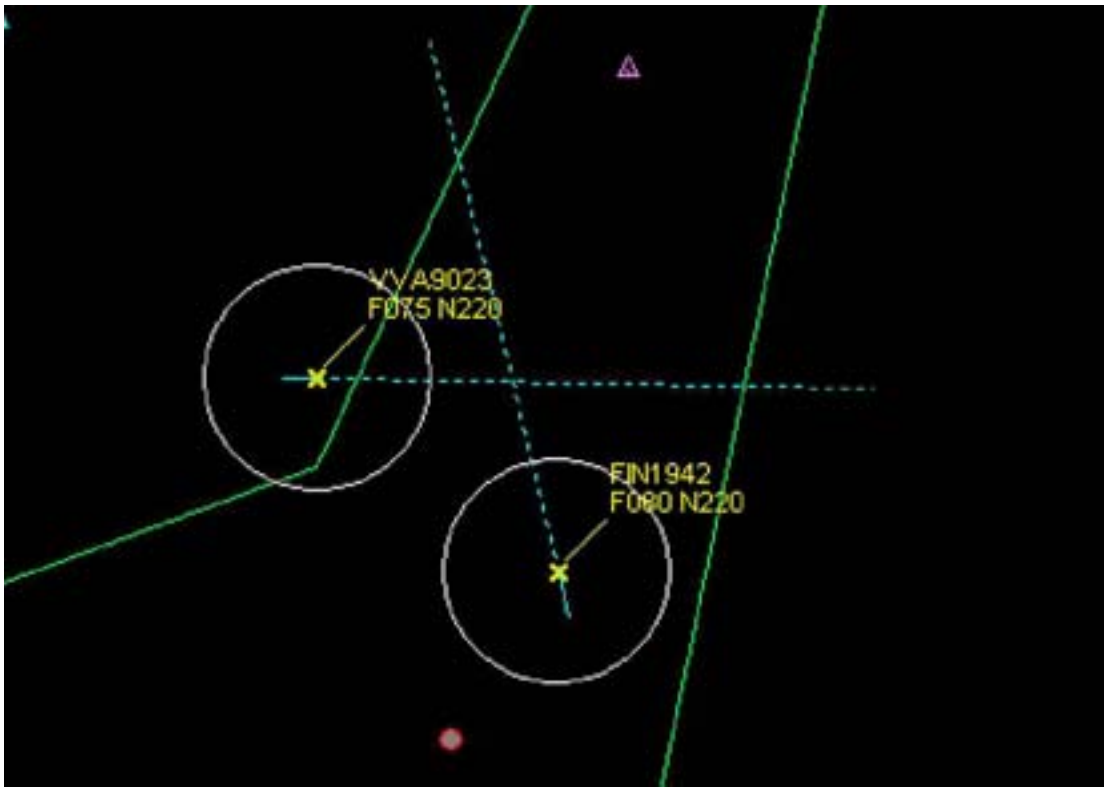
VVA9023 reported at 15.55.00 reaching flight level 70. DEP controller observed from his radar its altitude being level 68, which matched with the report.

She advised the aircraft to maintain flight level 70, which it acknowledged by saying: *"Maintaining level 70, Victor Victor Alfa".* The radio communication procedure words

"passing, reaching, maintaining" used by VVA9023 give the impression that the user understands their meaning and context.

The altitude separation between FIN1942 and VVA9023 should have been in order according to the aircraft reports and the radar detection.After this both controllers, DEP and APP, were paying their attention to other traffic on the radar screens.

Less than a minute later, at 15.56.05, the cockpit crew of FIN1942 and both controllers noticed that VVA9023 had not maintained flight level 70, but was passing flight level 75 climbing. The distance between the aircraft was about four nautical miles and their flight paths were crossing. In addition to this the commander of FIN1942 had visual contact of VVA9023. According to his statement he found An-12 continuing its climb.



Picture 2. Positions and C-mode altitudes of the aircraft in the beginning of the evasion

Despite that the TCAS-system of FIN1942 had not yet given evasion instruction and the air traffic control had not yet had time to interfere, the cockpit crew decided to take evasive manoeuvre by a gentle climb over VVA9023. The commander informed the APP controller, who gave them clearance to climb to flight level 90 and allowed it to turn at pilots discretion. The horizontal evasion was possible, hence other incoming traffic was far enough in south west although at the same flight level.

Simultaneously the DEP controller ordered VVA9023 to descent immediately back to flight level 70. She used the procedure phrase *"immediately"* which according to the radio communication procedures stresses the immediate action.

VVA9023 reported maintaining flight level 70, but the recordings available indicate that it was still at flight level 73. VVA9023 informed neither TCAS warning nor visual contact of an another aircraft.

Neither did VVA9023 react to DEP controllers announcement that she would make an incident report of the case.

2.2 Action of flight crews

2.2.1 Action of VVA9023 cockpit crew

Aviast J.S.C has not put to the investigators disposal a report of the crew's duties during the flight. The investigators presume that the task of the commander and the co-pilot was to fly the aircraft, the radio-operator took care of radio communications and passed the messages over to the other crew, the navigator handled the air navigation and the flight mechanic took care of his own tasks.

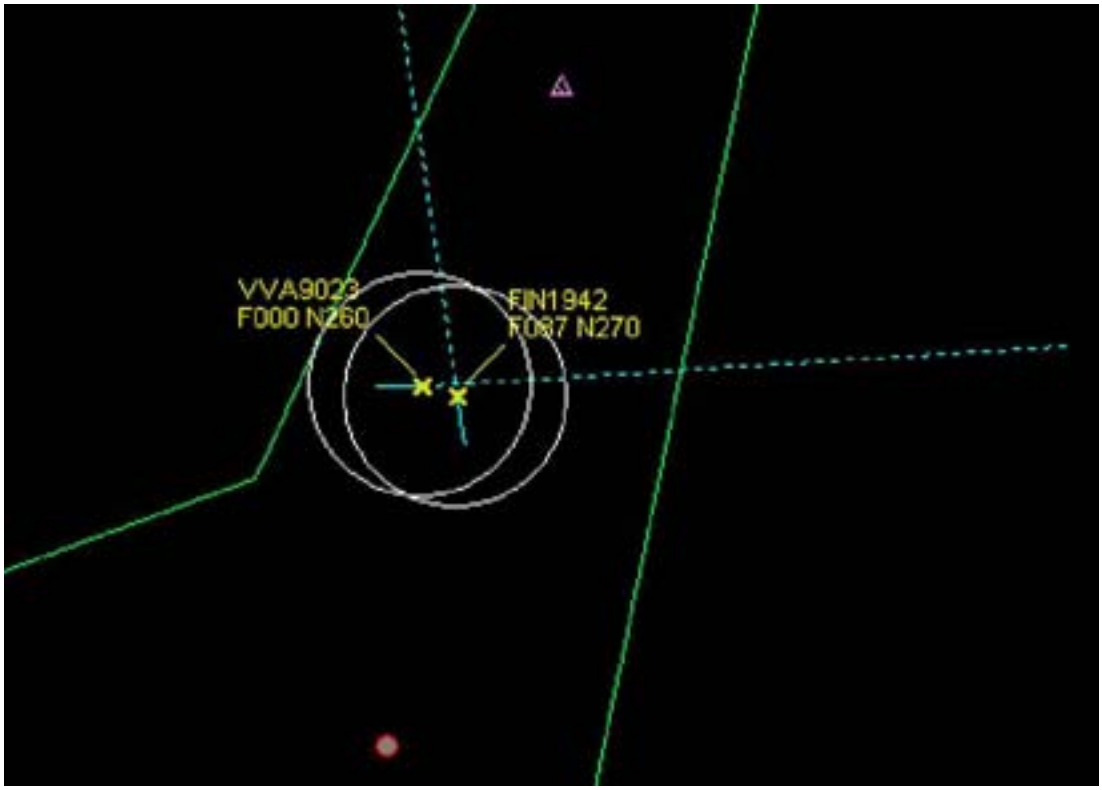
VVA9023 did not request clearance prior to engine start-up on the Delivery radio frequency meant for that purpose, but contacted Helsinki Ground, which gave them en route clearance and permission to start. VVA9023 acknowledged the SSR code 2030 (transponder code) correctly.

After departure the SSR code of VVA9023 was 2136. Since the code was acknowledged correctly, the incorrect code seemed to be due insufficient co-operation of the crew.

At 15.55.00 VVA9023 reported: *"VVA9023 reaching level 70".* The DEP controller found that the altitudes reported by the aircraft and detected by the radar were corresponding each other. At 15.56.10 DEP controller noticed that VVA9023 was at flight level 75 and ordered: *"VVA9023 descend to flight level 70, you are passing 75… descend immediately".* At the same time FIN1942 reported of evasion of another aircraft. VVA9023 continued its climb after the radio operator's report of reaching flight level 70. The commander stated in his written report that moderate turbulence had lifted the aircraft approximately 200 feet above the cleared level. According to the commander at same time also came the TCAS TA (traffic advisory) and the aircraft returned to flight level 70. The commander's statement and air traffic control recordings do not match with each other. According to the recordings the air traffic controller found one minute and 10 seconds after VVA9023 reported reaching flight level 70, that it was at flight level 75. Also the TCAS of FIN1942 indicated the altitude separation between the aircraft being 500 feet. According to FDR-recording of FIN1942 it was flying exactly on flight level 80. During the incident the weather at Helsinki-Vantaa was clear, there were neither weather fronts nor convection clouds. At flight levels 50 and 100 the wind was from west 20-25 knots. According to other aircraft's pilots there were no turbulence.

At 15.56.10 when the air traffic controller ordered VVA9023 to descend to flight level 70, the aircraft did not descend immediately. According to the radar recording it maintained flight level 74-73 for approximately 20 seconds, which after C-mode altitude indication of

VVA9023 disappeared for approximately 20 seconds from radar screen. When the altitude indication resumed, the aircraft was at flight level 70. The reason for altitude indication disappearance could not be solved during the investigation. Possible reasons could be either communication interruption between the transponder of VVA9023 and SSR radar or that the transponder of VVA9023 did not send the C-mode information at that time.



Picture 3. The positions and C-mode altitudes of the aircraft at the passing moment

Because VVA9023 continued climb after reporting of reaching flight level 70, the communication between the crewmembers did not go in an appropriate way. The cause of the incident may also have been insufficient cockpit procedures or inadequate following of the cockpit procedures. Communication language between the radio-operator and air traffic control was English whereas the mutual communication of the crewmembers was held in Russian. It is possible that the other crew did not comprehend the clearances in English or following the clearances was delayed due to insufficient co-operation within the crew. The airline should check their cockpit procedures and verify that the crews follow them.

The navigation of VVA9023 was inaccurate. At 15.52.00 the air traffic control cleared it direct to exit point GOGLA."…*direct to point GOGLA*". Magnetic course from clearance point to GOGLA was 105 degrees. At 16.02.40 the air traffic controller gave the aircraft a track to GOGLA: "*VVA9023 track to GOGLA point is now 124*". At 16.03.00 the air traffic gave VVA9023 radar heading to GOGLA: *"VVA9023 turn right heading 130".* At

16.04.00 the air traffic controller gave one more track*: "VVA9023 track to GOGLA is now 150 and you have three and half miles to GOGLA…".*

2.2.2 Action of FIN1942 cockpit crew

At 15.52.35 Fin1942 acknowledged the inbound clearance PVO1E direct to way point HK 723 and the descent clearance to flight level 80. At 15.55.00 the aircraft reported reaching the cleared level. The weather at Helsinki-Vantaa was fine and pilots were expecting a short approach and descent. Therefore they were keeping an eye on navigation display, which shows TCAS traffic below them and they saw an aircraft approaching from left below them. The co-pilot acted as piloting pilot. When the vertical separation between the approaching aircraft and FIN1942 was less than 1000 feet and seemed to decrease, the commander began to lookout towards the approaching aircraft. He got visual contact of An-12, when the distance according to the commander was approximately two nautical miles. At that time An-12 was at about horizon level and seemed to be coming towards. TCAS gave TA *("traffic")* of the approaching aircraft. Then also the co-pilot got visual contact of the other aircraft. Since An-12 seemed to continue on its flight path and vertical separation was only 500 feet, the pilots decided to take evasion upwards based on TCAS TA and visual observation. The commander reported to the air traffic control of the evasion and the co-pilot disconnected auto pilot and steered the aircraft to climb. The air traffic controller gave clearance to flight level 90 and permission to turn if necessary. FIN1942 climbed up to flight level 87. When the pilots found that the aircraft had passed each other, FIN1942 returned back to flight level 80. Horizontal evasion was not necessary.

The pilots of FIN1942 acted safety minded and observed the surrounding airspace assisted by TCAS and by keeping lookout. Based on observations the evasion before TCAS RA instruction was the correct action. There was enough time for the evasion and the situation did not turn dangerous.

3 CONCLUSIONS

3.1 Findings

1. The air traffic controllers had required licenses and ratings valid.

2. At the APP working position there was a rating trainee under the supervision of a qualified trainer.

3. The FIN1942 crew had the required licenses and ratings valid.

4. The information of the licenses and ratings of VVA9023 crew was partly incomplete.

5. VVA9023 requested and received en route clearance on Ground control frequency.

6. VVA9023 acknowledged the transponder code correctly, but had incorrect code in departure.

7. VVA9023 acknowledged the cleared flight level 70 correctly and reported of reaching it.

8. The air traffic controllers perceived the vertical separation between the aircraft being in order.

9. VVA9023 did not level off flight level 70, but continued climb.

10. The crew of FIN1942 observed the climb of VVA9023 on TCAS display and by visual contact.

11. The crew of FIN1942 decided to take evasive manoeuvre already before TCAS gave RA instruction. The decision was based on TCAS TA and visual observations.

12. When the evasion started the vertical separation between the aircraft was 500 feet and seemed to decrease.

13. There was no risk of collision due to having enough time for evasion.

14. APP and DEP controllers noticed at the same time that VVA9023 was at flight level 75. Both interfered in the situation.

15. VVA9023 reported of being all the time at flight level 70.

16. The C mode altitude information of VVA9023 disappeared from the radar screen for approximately 20 seconds.

3.2 Cause of the incident

Loss of vertical separation took place, when VVA9023 continued climb above the cleared flight level. Situation did not develop dangerous, because FIN1942 took evasive manoeuvre of VVA9023.

4 SAFETY RECOMMENDATIONS

The airline Aviast Stock Joint Company Limited should:

Improve its cockpit procedures and flight crews' cockpit co-operation, so that the flight crew would have identical comprehension of contents and realizations of the air traffic control clearances.

Helsinki 14.8.2002

Jussi Haila

Erkki Kantola

RADIO COMMUNICATIONS ON DEPARTURE RADAR FREQUENCY 119.1

Time (UTC)	Station	Message
13.50.50	VVA	Helsinki approach VVA 9023 good afternoon is airborne.
13.51.00	DEP	VVA 9023 you have wrong squawk, recycle 2030 please.
	VVA	2030 checking.
13.51.25	DEP	VVA 9023 confirm squawking now 2136, receiving 2136.
13.51.40	VVA	Checking now checking.
13.51.45	DEP	VVA 9023 now radar contact, confirm passing 2500.
13.51.50	VVA	Affirmative madam passing 2500 VVA 9023.
13.52.00	DEP	Roger, continue climb to flight level 70 and set course initially direct to point GOGLA.
	VVA	Climbing to flight level 70 direct to GOGLA VVA 9023.
	DEP	Radar.
13.55.00	VVA	VVA 9023 reaching level 70.
	DEP	Roger, maintain.
	VVA	Maintaining level 70 VVA.
13.56.10	DEP	VVA 9023 descend to flight level 70, **you are passing 75… descend immediately.**
13.56.15	VVA	Roger, VVA 9023….maintaining flight level 70.
13.56.20	DEP	Roger, receiving 73 now.
	VVA	Aah…. all right (pushing push-to-talk button two times)
13.57.00	DEP	VVA9023 now climb flight level 150.
13.57.10	VVA	Climbing flight level 150 VVA 9023.
14.02.40	DEP	VVA 9023 track to GOGLA point is now 124.
14.03.00	DEP	VVA 9023 turn right heading 130.
	VVA	Right heading 130 VVA9023.
14.04.00	DEP	VVA 9023 track to GOGLA is now 150 and you have three and half miles to GOGLA, maintain flight level 150 resume own navigation, contact Petersburg 135.4, and sir, I will file a report of your climbing too high.
14.04.20	VVA	VVA 9023 maintaining 150 contact 135.4, thank you madam, good bye.
	DEP	Good bye.