Investigation report

C1/2011L

Serious Incident caused by Smoke in the Cockpit North of Pori on 28 November 2011

Translation of the original Finnish language report

OH-ATL (FCM631W)

ATR 72-212A

Onnettomuustutkintakeskus
Olycksutredningscentralen
Safety Investigation Authority, Finland

Osoite / Address:	Ratapihantie 9 FI-00520 HELSINKI	**Adress:**	Bangårdsvägen 9 00520 HELSINGFORS
Puhelin / Telefon: **Telephone:**	029 51 6001 +358 29 51 6001		
Fax:	09 876 4375 +358 9 876 4375		
Sähköposti / E-post: **Email:**	turvallisuustutkinta@om.fi sia@om.fi		
Internet:	www.turvallisuustutkinta.fi www.sia.fi		

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SUMMARY

SMOKE IN THE COCKPIT NORTH OF PORI ON 28 NOVEMBER 2011

An ATR 72-212A airliner, flight FCM631W operated by Flybe Finland Plc, departed Vaasa airport for Tallinn at 11:34. There were four crew members and seven passengers on board. When the flight reached its cruising altitude dark smoke began to pour out of the aeroplane's ACARS printer. The pilots donned their oxygen masks, started an immediate descent and made the decision to land at Pori airport. The pilots declared an emergency to Area Control Centre Finland using the MAYDAY call, and requested radar vectoring to Pori.

The smoke was thick at first but it dissipated altogether during the approach. The portable fire extinguishers on board were not used. During the landing the cabin crew and the passengers assumed the brace position. After the landing the aircraft was parked at the outer edge of the apron. The incident did not result in any injuries to persons.

The smoke in the cockpit came from the ACARS system's thermal printer, located on the pedestal between the pilots. A paper clip, which showed signs of having been heated, was found inside the printer. The paper clip caused a short circuit in the printer. The smoke generation ended when the printer's circuit breaker tripped. There was no actual fire inside the printer.

Initially, the flight crew experienced problems in donning and using their oxygen masks. The oxygen masks hampered communication between the pilots and between the captain and the cabin crew. Oxygen masks used in flight simulator training are not in as good condition as those in aeroplanes.

After the flight the pilots pulled the Cockpit Voice Recorder's circuit breaker in order to preserve the recording for the investigation. They did not make a corresponding entry in the Technical Log. When the FDR data were downloaded it was noticed that the CVR's circuit breaker had been reset. Nonetheless, the information from the occurrence flight was retained because the recording capacity of the CVR is two hours.

The tower controller was not informed of the number of persons on board. This information arrived at Pori TWR just moments before the aircraft landed, but it was not relayed to the air traffic controller or the rescue personnel.

Immediately after the occurrence Flybe Finland Plc banned the use of paper clips on its entire fleet. During the investigation it was discovered that the Company's post-traumatic stress counselling instructions were limited. Likewise, Finavia Corporation's support service personnel have not been augmented.

Safety Investigation Authority, Finland issued the following two safety recommendations: That the Finnish Transport Safety Agency ensure that the validation of the oxygen masks' condition, to be carried out via subjective testing, be included in the annual flight simulator inspections, and that Finavia Corporation re-assess the training, implementation and updating of its present Critical Incident Stress Management system.

TABLE OF CONTENTS

APPENDICES

ABBREVIATIONS

ACARS	Aircraft Communication, Addressing and Reporting System
AP	Autopilot
ARINC	Aeronautical Radio Inc.
ATPL	Airline Transport Pilot Licence
CA	Cabin Attendant
CAM	Cabin Attendant Manual
CC	Chief of Cabin
CPL	Commercial Pilot Licence
CVR	Cockpit Voice Recorder
EC	Executive Controller
EFIN	Finland Flight Information Region
EFIN ACC	Area Control Centre Finland
FD	Flight Director
FDM	Flight Data Monitoring
FDR	Flight Data Recorder
FIR	Flight information region
FL	Flight Level
FMS	Flight Management System
FTS	Finnair Tecnical Services
JAR	Joint Aviation Requirements
lb	Pound
MCC	Multi Crew Co-operation
MCDU	Multifunction Control Display Unit
METAR	Aviation routine weather report
MHz	Megaherz
NM	Nautical Mile
PBE	Protective Breathing Equipment

PF	Pilot Flying
PLC	Planning Controller
PNF	Pilot not Flying
PTT	Push to Talk
SAR	Search and Rescue
SITA	Société Internationale de Télécommunications Aéronautiques
SOP	Standard Operating Procedures
SPL	Supplementary Flight Plan
STC	Supplementary Type Certificate
SUP	Supervisor
QNH	Altimeter setting to indicate elevation above mean sea level
QRH	Quick Reference Handbook
UHF	Ultra High Frequency
UIR	Upper flight information region
TAF	Aerodrome forecast
TWY	Taxiway
VHF	Very High Frequency
VMC	Visual meteorological conditions
VIRVE	Finland's Authority Radio Network

SYNOPSIS

On 28 November 2011, a serious incident occurred on a scheduled flight from Vaasa to Tallinn on a Flybe Finland-operated ATR 72 airliner. Pursuant to the ICAO Annex 13 severity classification Safety Investigation Authority, Finland categorised this occurrence as a serious incident because there was smoke in the cockpit and the pilots had to use their oxygen masks.

On 30 November 2011 Safety Investigation Authority, Finland (SIAF) launched an initial investigation which resulted in safety investigation C1/2011L being initiated on 20 December 2011. Air Safety Investigator Tii-Maria Siitonen was appointed as team leader for the investigation group, accompanied by SIAF experts Päivikki Eskelinen-Rönkä, Juha-Pekka Keidasto, Pekka Orava and Sanna Winberg.

SIAF notified the International Civil Aviation Organization (ICAO), the European Aviation Safety Agency (EASA), the European Commission (EC), the UK Air Accident Investigation Branch (UK AAIB) and the French Bureau d'Enquêtes et d'Analyses pour la Sécurité de l'Aviation Civile (BEA). The BEA designated their Accredited Representative (ACC REP) to the investigation.

The investigation group requested comments on the draft final report from Flybe Finland Plc, Finavia Corporation, Pori airport, Area Control Centre Finland, the Finnish Transport Safety Agency, the Emergency Response Centre Administration, Satakunta Police Department, Satakunta Rescue Department, the European Aviation Safety Agency (EASA), the UK Air Accident Investigation Branch (UK AAIB) and the French Bureau d'Enquêtes et d'Analyses pour la Sécurité de l'Aviation Civile (BEA). The investigation group included the comments deemed appropriate to the final report.

All times in the investigation report are in Co-ordinated Universal Time (UTC). Finnish local time at the time of the occurrence was UTC+2.

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

The investigation was completed on 11.10.2013.

1 FACTUAL INFORMATION

1.1 History of the flight

1.1.1 Foreword

An ATR 72 airliner is flown by two pilots. Two Cabin Attendants (CA) work in the cabin, one of whom is the Chief of Cabin (CC). During the takeoff and landing the CC is seated at the aft of the cabin compartment and the CA at the front.

In this particular aircraft type the cargo compartment is located between the flight deck and the cabin. There are lockable doors between the cargo compartment and the flight deck, and between the cargo compartment and the cabin. The passengers use the rear entrance door. The maximum number of passengers is 74. There were seven passengers on the occurrence flight, seated in the rear of the cabin for centre-of-gravity considerations. There were both Finns and foreigners among the passengers.

1.1.2 History of the flight

The crew had spent the previous night in Stockholm. The first flight of the day was from Bromma Stockholm airport to Tallinn, where the aircraft was refuelled for the rest of the day's consumption. From Tallinn the aircraft flew to Tampere and back to Tallinn, from where it continued to Vaasa. The last flight of the crew's shift was the one from Vaasa to Tallinn, where the crew were scheduled to spend the night.

Flight FCM631W departed Vaasa at 11:34. The co-pilot was the Pilot Flying (PF). During the climb the Crew Alerting System warned of a low fuel level (FUEL LOW LVL). The flight crew completed the procedures given in the Quick Reference Handbook (QRH). The alert cleared and the pilots noted that they had enough fuel for the safe completion of the flight.

According to the flight plan they had intended to cruise at FL 210 (21000 ft, 6400 m). The flight crew requested a clearance to FL 250 (25000 ft, 7620 m), which the Area Control Centre issued. The conditions at this altitude were more favourable to fuel economy. The flight reached its cruising altitude at 11:52. Soon after this the crew received a message on the Aircraft Communication Addressing and Reporting System (ACARS). The co-pilot told the captain that the ACARS printed was out of paper and verified the matter by opening the top cover of the printer. The captain read the message on the Flight Management System (FMS) display.

After having read the message the captain smelled something burning and the smell rapidly intensified. The co-pilot confirmed the observation. The co-pilot opened the printer's top cover at which time dark, or dark blue, smoke belched out. A red glow could also be seen inside the printer. The co-pilot closed the cover and the captain made the decision for the pilots to don their cockpit oxygen masks.

The pilots immediately initiated a descent and made the decision to land at Pori airport. When the captain was adjusting the oxygen mask the captain's glasses and headset fell onto the cockpit floor. Hence, the captain initially did not hear the co-pilot or the air traffic controller very well. The co-pilot, too, had to repeatedly adjust the headset. Once the captain managed to put the headset back on, communication between the pilots improved considerably. Nevertheless, according to the Cockpit Voice Recorder (CVR) recording, the pilots had problems in mutual communication because of the breathing noise caused by the oxygen masks.

The captain declared an emergency using the MAYDAY distress call to Area Control Centre Finland (EFIN ACC) at 11:54. The captain reported a fire in the cockpit and requested radar vectoring to Pori airport. The Executive Controller (EC) responsible for the sector issued an air traffic control clearance into the heading of 160 degrees. At this stage the controller saw from the radar monitor that the aircraft was descending through FL 165 (16500 ft, 5030 m). Moments later the controller re-cleared the aircraft to descend to 3000 ft (915 m) on Pori QNH 997 hPa. The captain, as the Pilot not Flying (PNF), was completing QRH actions and managing the radiocommunication with EFIN ACC. The co-pilot flew the aeroplane and was responsible for navigation.

After having completed the cabin service the cabin crew noticed that the aircraft was descending and that the engines were making an atypical noise for normal cruise. The captain called the cabin on the interphone and the Chief of Cabin (CC) took the call in the galley at the rear of the cabin. The CC could not make out what the captain said and, hence, decided to go to the flight deck. The CC told the other member of the cabin crew (Cabin Attendant, CA) to make certain that there were no loose items in the galley area. On the way to the cockpit the CC smelled smoke in the cargo compartment. The CC was unaware of the origin of the smoke, or whether the pilots were aware of it. The CC did not bring along any Protective Breathing Equipment (PBE) or the portable fire extinguisher from the cabin.

After opening the flight deck door the CC saw that the pilots were reading their checklists with their oxygen masks on. According to the CC there was no visible smoke in the cockpit but the smell of smoke was intense. The co-pilot said that the smell came from the printer. The CC did not don the cockpit's third oxygen mask or the headset. The captain ordered the CC to prepare the cabin for landing. The CC double-checked the order by asking whether they would make a prepared emergency landing. The captain repeated the order to prepare the cabin for landing. The CC checked the order once more and asked if they had four minutes to spare for the task. The captain answered affirmatively. The CC found it difficult to make out what the captain was saying.

The CC returned to the rear of the cabin and told the CA that they were to prepare the cabin for an emergency landing, and that they had four minutes to do so. The CC started the passenger announcement by saying that there was a smell of smoke at the front and that they would have to land at the nearest available airport. Following this the CC took out the EMC (emergency checklist) announcement folder. From the EMC checklist the CC called out the Company's published emergency announcement. In this announcement the CC only used the Finnish language.

The CA secured the cabin and instructed the passengers in assuming the 'brace for im-pact' position. The cabin crew took their assigned seats.

When the aircraft crossed the approach path of Pori RWY 30 the air traffic controller at EFIN ACC cleared the aircraft to turn right into the heading of 300 degrees. Since the pi-lots did not acknowledge the change in heading the controller suspected that the radio contact with the aircraft was lost. During the turn the pilots gained visibility with the ground at which time the EFIN ACC controller told the pilots to contact Pori TWR. The flight crew acknowledged this clearance in the normal fashion.

Following a normal landing the TWR told the pilots to taxi via TWY B (Bravo) to the outer edge of the apron. During taxiing there was a strong smell of smoke at the front of the cabin. When the aircraft came to a stop the CC told the passengers to remain seated and wait for instructions from the crew. Once the propellers had stopped, the flight crew informed the CC that the passengers could deplane normally.

The passengers disembarked and the CA, on the order of the CC, escorted them to the airport passenger terminal. After checking that there were no remaining passengers on board the CC also went to the terminal. The rescue crew came on board to check the inside of the aircraft for any fire. The captain and the incident commander agreed that the rescue service would assume leadership from then on. The flight crew pulled the Cockpit Voice Recorder's circuit breaker and, following this, they went to the passenger terminal where the cabin crew and the passengers already were.

1.1.3   Events after the flight

The crew and the passengers assembled in the passenger terminal. The captain ex-plained the events that took place in the air to the passengers in English. The condition of the passengers was assessed in the triage centre which was set up in the terminal, including any need for crisis therapy. Members of the media were also present.

The police breathalysed the captain and the co-pilot in the passenger terminal. When it was the captain's turn the alcotester malfunctioned until the third try.

The cabin crew and the passengers travelled to Helsinki on the next scheduled flight which departed soon after the incident aircraft had landed. The pilots stayed in Pori, travelling to Helsinki on a later flight.

Pursuant to Finnish Aviation Regulation GEN M1-4 the pilots filed a flight safety report regarding the incident.

1.1.4   Air traffic control action

Area Control Centre Finland (EFIN ACC)

Area Control Centre Finland's area of responsibility is divided into seven airspace sec-tors. The sector controllers at EFIN ACC work in pairs. The Executive Controller (EC) is responsible for the provision of Air Traffic Services (ATS) in his area of responsibility and implements the flow of traffic through the sector set up by the Planning Controller

(PLC). The ATC Supervisor (SUP) manages the activities of EFIN ACC and coordinates ATS and rescue services.
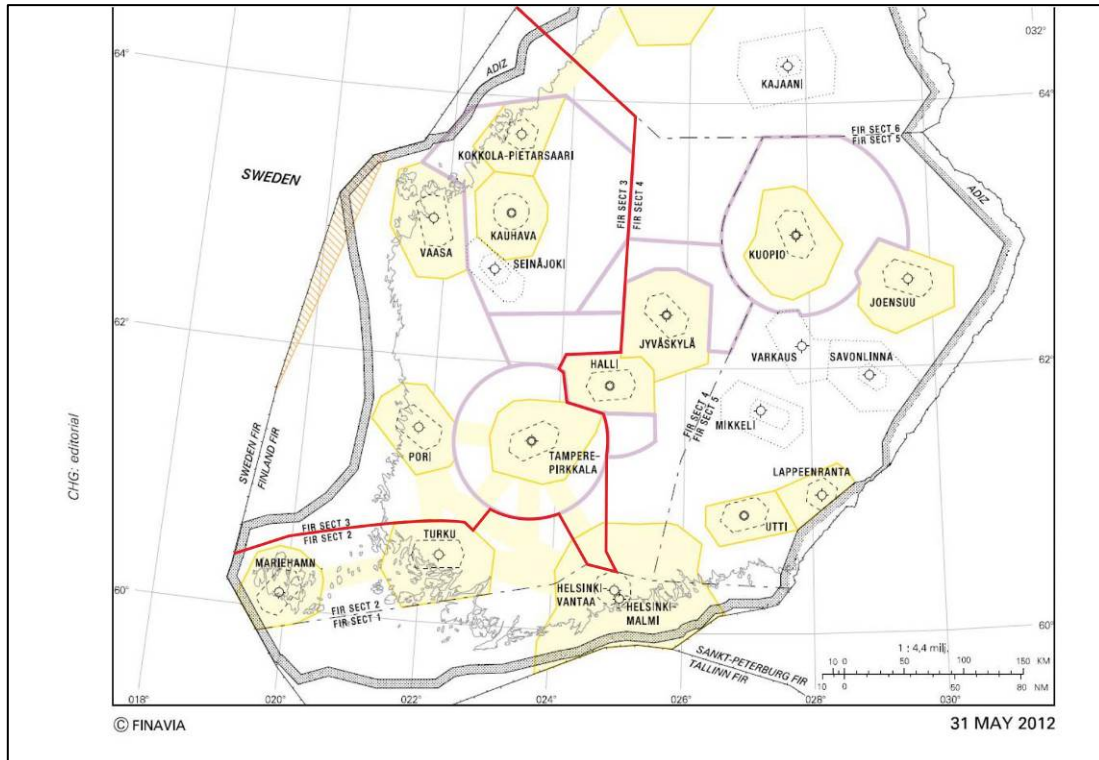
Figure 1. EFIN ACC airspace sectors in southern Finland. The boundary of Sector 3 is highlighted with the red line. © Finavia, permission 4/590/2007

At the time of the occurrence two air traffic controllers were managing the air traffic in the combined sectors 3, 4 and 5. As the volume of traffic was increasing the SUP made the decision to separate sector 3 as an isolated air traffic control sector. Sector 3 covers, among others, Vaasa and Pori airports. The intention was to assign the air traffic in this sector to two other air traffic controllers. In this situation, however, the SUP decided to delay the separation of the sector, so as to avoid any distractions in the management of the incident in question.

EFIN ACC received the distress call of FCM631W on 127.100 MHz regarding a fire in the cockpit, and the request for radar vectoring to Pori airport. The EC began to vector the aircraft and the PLC notified the SUP of the matter, and reported the incident-related information to Pori TWR by telephone. The SUP reported the incident to a Finnish Air Force Sector Operations Centre and requested that they track the flight on their radar.

Once the aircraft descended below the clouds and gained visibility with the ground EFIN ACC told it to contact Pori TWR on 119.250 MHz.

Figure 2. The track of the occurrence flight before the landing (Image: Flybe Finland Plc)

Pori Control Tower

The tower controller at Pori requested the aircraft to report on final RWY 30, and provided traffic information regarding another landing aircraft. The controller also made certain that there was no other control zone traffic on the route of the aircraft making the emergency landing. The TWR controller had not been informed of the number of persons on board.

There were two air traffic controllers and one student air traffic controller on duty at Pori TWR. During the occurrence one controller was managing air and ground traffic and the other was instructing the student controller. The instructing controller completed the alerting list, and the student controller recorded the actions. At the time of the occurrence an off-duty air traffic controller and two police officers also entered the area of the TWR.

The aircraft landed at Pori airport at 12:08. The pilots informed the TWR that the smoke had dissipated and that they could taxi to the apron. As the aircraft was landing, airport rescue unit LENTO11 was positioned at holding point D (Delta), and LENTO14 on the crossing runway. Following the TWR controller's instructions the rescue units followed the aircraft to the apron. The TWR controller did not issue taxi instructions to the normal stand but instructed the aircraft to park at the outer edge of the apron.

Following the occurrence Pori TWR and EFIN ACC cancelled the alerts they had made. Pursuant to Finnish Aviation Regulation GEN M1-4 the EFIN ACC supervisor, Pori TWR controller and Pori airport maintenance supervisor filed their respective flight safety reports, which also doubled as Finavia Corporation's internal incident and occurrence reports (PHI).

1.2 Injuries to persons

There were no injuries to persons. There were four crew members and seven passengers on board the aircraft.

1.3 Damage to aircraft

The ACARS system's thermal printer was damaged. No other damage was caused to the aircraft.

1.4 Other damage

There was no other damage.

1.5 Personnel information

1.5.1 The crew of OH-ATL

Captain   Age 62

Licences   Airline Transport Pilot's Licence (A) was valid. Class 1 medical certificate was valid.

Ratings   All required ratings were valid.

Flight experience	Last 24 hours	Last 30 days	Last 90 days	Total hours and landings
All types	8 h 34 min 9 landings	63 h 6 min 70 landings	ca 188 h 200 landings	ca 21500 h ca 25000 landings
Type	8 h 34 min 9 landings	63 h 6 min 70 landings	ca 188 h 200 landings	ca 10700 h ca 14000 landings

Co-pilot   Age 34

Licences   Commercial Pilot License (A) was valid. Class 1 medical certificate was valid.

Ratings   All required ratings were valid.

Flight experience	Last 24 hours	Last 30 days	Last 90 days	Total hours and landings
All types	8 h 34 min 9 landings	61 h 28 min 58 landings	153 h 12 min 160 landings	1193 h 34 min 1727 landings
Type	8 h 34 min 9 landings	61 h 28 min 58 landings	153 h 12 min 160 landings	959 h 55 min 1100 landings

Chief of Cabin (CC)

Age 39
Had worked as CA for approximately 6 years.
All required ratings were valid.

Cabin Attendant (CA)

Age 39
Had worked as CA for approximately 3 months.
All required ratings were valid.

1.5.2   Area Control Centre Finland

ATC Supervisor (SUP)

Age 47
All required ratings were valid.

Executive Controller (EC)

Age 52
All required ratings were valid.

Planning Controller (PLC)

Age 46
All required ratings were valid.

1.5.3   Pori Control Tower

Tower Controller

Age 50
All required ratings were valid.

Controller (on-the-job trainer)

Age 30
All required ratings were valid.

1.6   Aircraft information

Type information

Type	Twin-engine turboprop ATR 72-212A
Engines	2 x Pratt & Whitney 127M
Manufacturer	Avions de Transport Régional (ATR)
Registration	OH-ATL
Airworthiness Certificate	Valid until 16 Dec 2012
Serial Number and Year of Manufacture	no. 851, 2009
Maximum Takeoff Mass	22 500 kg (49 604 lbs)
Owner	Finncomm Finance Six Oy
Operator	Finnish Commuter Airlines Oy

Figure 3. ATR 72-212A

1.7   Meteorological information

Visual Meteorological Conditions (VMC) prevailed at Pori airport.

Pori aviation routine weather report (METAR), produced by the airport's Automatic Weather Station, as of 28 Nov 2011 at 11:50 UTC: Wind 280 deg 18 kts (9.3 m/s). Variable between 240 and 300 deg. Visibility over 10 km (5.4 NM). Scattered clouds (SCT, 2-4/8) at 3400 ft (1036 m), broken clouds (BKN, 5-6/8) at 3900 ft (1190 m). Temperature 4 ˚C, dew point -1 ˚C, and QNH 997 hPa. Braking action was good.

Aerodrome forecast (TAF) as of 28 Nov 2011 at 08:27 UTC: Wind 310 deg 15 kts (7.7 m/s), gusting to 28 kts (14.4 m/s). Visibility over 10 km (5.4 NM). Few clouds (FEW, 1-2/8) at 2500 ft (762 m), broken clouds (BKN, 5-6/8) at 4000 ft (1220 m). Thirty (30) per cent probability for a visibility of 7000 m (3.8 NM) and light rain from 14–18 UTC on 28 Nov 2011.

1.8   Aids to navigation

Pori airport provides procedural control air traffic services. Since the autumn of 2012 Pori has also provided limited radar control services.

EFIN ACC uses a network of radars which creates a radar picture by compiling the information of several radar antennae. In the vicinity of Pori the radar horizon, due to the distances between the antennae, is at approximately 3000 ft (915 m).

1.9   Communications

All radiocommunication and telephone systems at EFIN ACC and Pori airport operated normally. All recordings were made available to the investigation group.

The operation of the VIRVE network (Finland's Authority Radio Network) is addressed in more detail in subchapter 1.16.3 Finland's Authority Radio Network VIRVE.

1.10 Aerodrome information

Pori aerodrome (EFPO) is situated in western Finland, approximately two kilometres from the city centre. Scheduled and chartered flights and the Finnish Aviation Academy operate from Pori airport.

1.11 Flight recorders

Both flight recorders are activated as soon as one engine is started. In addition, the Cockpit Voice Recorder (CVR) can be energised by pushing the RCDR pushbutton. The recorders are automatically switched off ten minutes after engine cut-off.

Digital Cockpit Voice Recorder

Type	Solid State Cockpit Voice Recorder (SSCVR)
Manufacturer	L3 Communications
Part no.	2100-1020-02
Serial no.	000354263
Recording capacity	Two hours (120 minutes)

Under the EUROCAE ED-112 specification, as a minimum, the recorder must be capable of accepting the following four audio signals: (at least channel 1 and channel 4 are required):

- Channel-1: Captain's audio control panel
- Channel-2: First Officer's audio control panel
- Channel-3: Additional crew positions and cabin announcements
- Channel-4: Cockpit Area Microphone

The crew turned off the Cockpit Voice Recorder in Pori by pulling its circuit breaker. When the FDR data were being downloaded at Helsinki-Vantaa airport an SIAF investigator noticed that the CVR circuit breaker had been reset.

The CVR was removed from the aircraft and the investigation group took custody of it. The recording was downloaded at Finnair Technical Services (FTS) avionics repair shop, under the supervision of an investigator. The recorder operated normally and provided beneficial information for the investigation.

Digital Flight Data Recorder

Type	Solid State Flight Data Recorder (SSFDR)
Manufacturer	L3 Communications
Part no.	2100-4043-00
Serial no.	000511443
Recording capacity	No less than 25 hours

The investigation group had access to the flight data downloaded by the operator's Flight Data Monitoring (FDM) system. These data are roughly equivalent to flight data recorder information. The FDR does not record any Master Caution alerts.

1.12   Wreckage and impact information

The smoke in the cockpit came from the ACARS system's thermal printer located on the pedestal between the pilots. While there were no external signs of fire on the printer that was removed from the aeroplane, it had generated the pungent odour of an electrical fire. When the printer was being inspected, a 3 cm long metallic paper clip fell out, showing signs of having been heated.

The printer was sent to the repair shop: a new transformer and print head were installed. The device was then tested and found to be operating normally.

The operator's maintenance programme does not specify any requirements for printer cleaning. Nor does the manufacturer require any regular cleaning. All printers in the operator's ATR fleet were inspected and cleaned in 2011. Only dust and other comparable dirt was found. The printers will be re-inspected during the summer of 2013.
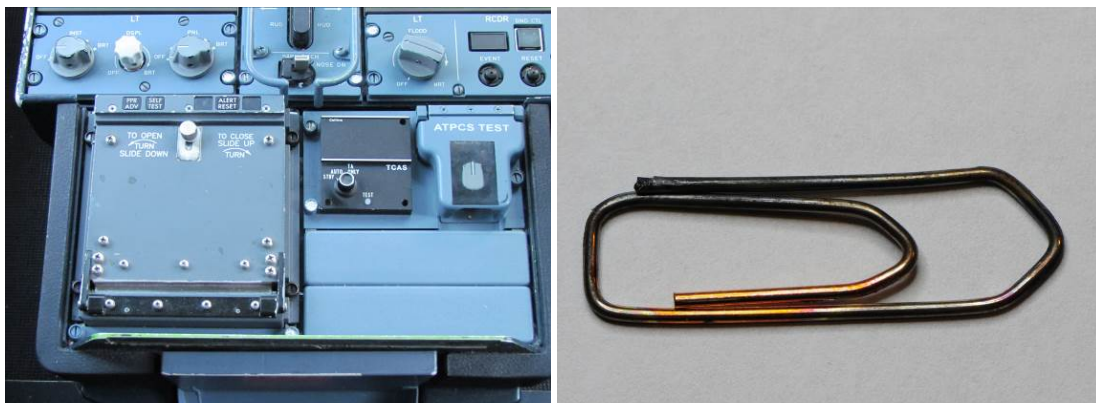
Figure 4. The printer and the paper clip.

1.13   Medical and pathological information

The police breathalysed both pilots at Pori airport with an alcotester. Both tests showed zero blood alcohol.

1.14   Fire

Although the ACARS printer belched out heavy smoke at first, there was no actual fire. The smoke dissipated before the landing. Only after the landing could smoke be smelled in the cabin compartment.

The operator's ATR 72 fleet of aircraft are fitted with Halon 1211 BCF-type (3 kg, 6.6 lb) portable fire extinguishers. One extinguisher is positioned on the flight deck behind the co-pilot's seat and two are placed at the aft of the cabin compartment. In addition, there is one water extinguisher at the front of the cabin. The crew did not use the extinguish-

ers. The crew also has access to Protective Breathing Equipment (PBE) and portable oxygen bottles.

1.15   Survival aspects

There are two rescue vehicles, callsigns LENTO11 and LENTO14, at Pori airport. The airport's own rescue equipment facilitates, among other things, smoke diving, hydraulically cutting through an aircraft fuselage, and removing small fuselage parts.

The tower alerts the airport rescue service with a combined aural/light alerting system. The alert is also relayed to the VIRVE terminals (handhelds) carried by the airport maintenance personnel on duty.

Satakunta Rescue Department was aware of the fact that the parameterisation (programming) of Pori airport's VIRVE terminals had not been completed. The incident commander/on-call chief fire officer (KARHU P3) of Satakunta Rescue Department and the airport rescue commander communicated, counter to regulations, on the VIRVE's INFO channel. The INFO channel is only reserved for communication between the Rescue Department and the Emergency Response Centre.

Satakunta ERC issued a "full emergency, aviation" alert to Satakunta Rescue Department at 11:58. The Department deployed a company-size rescue formation which encompasses the on-call chief fire officer, nine fire units, six fire tankers, a Border Guard helicopter, a medical supervisor, a medical unit and five other ambulance units. In addition, off-duty personnel were alerted. The company-size response included vehicles and personnel from regular and contract fire brigades alike.

A rescue map previously published by CAA Finland marks the spot of the meeting place for non-airport rescue service vehicles with a red triangle. This spot, a.k.a. the SAR threshold, is outside the airport perimeter fence, in front of the maintenance building. The place is indicated with asphalt paint markings and a sign.

Two rescue units, one ambulance unit and a police car drove inside the airport perimeter fence. A rescue unit P11 from Satakunta Rescue Department and both airport rescue units positioned themselves in the immediate vicinity of the parked aircraft. The police car, the incident commander (KARHU P3) vehicle and the ambulance unit parked at the edge of the apron.

Figure 5. FCM631W parked at the edge of the apron.
(Photo: Satakunta Police Department)

The smoke divers were prepared for a rescue/fire-fighting operation. After the passengers had deplaned the smoke divers only secured the inside and the outside of the aircraft. At no stage of the operation did the rescue personnel receive any information as regards the volume of fuel or the number of persons on board.

Satakunta Rescue Department set up a triage centre inside the passenger terminal where the condition of the crew and passengers was assessed. They were also offered an opportunity to talk about the occurrence.

1.16 Tests and research

1.16.1 Use of the oxygen masks

The operator's ATR type rating course syllabi require oxygen mask training in a depressurisation situation. The curriculum also includes fire and smoke training inside the aircraft. The flight simulator which the operator uses is located at the premises of Finnair Flight Academy (FFA), near Helsinki-Vantaa airport.

Pilots use active noise reducing headsets during flight that are fitted with boom-mounted microphones. Normally the captain's and the co-pilot's audio control panel interphone/radio (INT/RAD) switches are set to INT during flight. This enables communication between the pilots as well as communication between the pilots and the cabin crew through the voice-activated microphones, without having to depress the Push to Talk (PTT) pushbutton.

Figure 6. Audio control panel.

When the oxygen mask is used the headset microphone automatically switches off and the microphone inside the mask activates. In order to inhibit any communication-hampering breathing noise the INT/RAD switch must be set to OFF. After this, pilot-to-pilot communication is achieved by pushing forward the spring-loaded PTT pushbutton on the control column, or setting the INT/RAD switch to INT for the duration of communication.

The design of the oxygen mask facilitates single-hand operation. When the pilot dons his oxygen mask, he must first place the headset around his neck or on his lap. Tubular straps inflate with oxygen making it easier to don the mask. When the pilot lets loose of the mask the straps tighten the mask into place. In addition to the oxygen masks pilots can also use protective glasses. The pilots' own glasses fit under the protective glasses.

Figure 7. On the left the oxygen mask used in the ATR flight simulator and on the right the oxygen mask used in the aeroplane (OH-ATL). The straps of the oxygen masks used in the simulator had slackened through use.

During the course of the investigation it was discovered that the oxygen masks in the flight simulator are extremely worn. The tubular straps have slackened in the course of

training and they are not in as good condition as those in aeroplanes. The Finnish Transport Safety Agency is responsible for the supervision of flight simulators. The simulator in question was annually inspected as per the FSTD evaluation work order. The order designates the content of simulator inspections carried out by the supervising authority.

According to the operator, until the end of 2012 cabin crews received classroom instruction on the use of cockpit oxygen masks with standalone masks and mental training on the use of the masks inside the cockpit. As of the beginning of 2013 oxygen mask instruction continues in the classroom, in addition to which cabin crews train deploying and donning the masks inside the cockpit. Now the training also includes communicating with the pilot when oxygen masks are used. Simultaneously, the use of the cockpit's third headset is trained. This training is repeated every three years.

1.16.2 Cabin crew action

While passing through the cargo compartment at the front of the aircraft the CC smelled smoke. Having opened the cockpit door the CC saw that the pilots were wearing their oxygen masks. The CC said that the smell of smoke was intense, even though there was no visible smoke in the cockpit. The CVR recording indicates that the CC spent approximately three minutes on the flight deck. The CC did not don the cockpit's third oxygen mask, nor did the pilots offer it to the CC. Neither did the CC bring the portable fire extinguisher along from the cabin.

During the interview the captain said that the request was for the cabin crew to prepare the cabin for a normal landing. However, the CC understood this to mean an emergency landing. It was difficult for the CC to make out what the captain was saying, either on the interphone or inside the cockpit.

After having returned from the flight deck the CC explained the situation to the CA. Following this, the CC made an informal passenger announcement: that there was smoke at the front of the aeroplane, and that the pilots would have to make an emergency landing at the nearest suitable airport. The CC took out the Emergency Checklist (EMC) and began to call out the published emergency landing announcement. The announcement advises all passengers to return their seatbacks to the upright position and to stow their tray tables in the locked position, and instructs how to assume the 'brace for impact' position. While the CC was making the announcement the CA checked, as per regulation, that the passengers understood the instructions in the announcement. The CC delivered the passenger announcement only in Finnish, in an abbreviated from.

Three minutes before the landing the captain called the cabin. The captain asked the CC whether the cabin was ready for the landing. The cabin personnel took their seats, waiting for the captain's 'brace for impact' call. Since no such call ever came, the CC and the CA, on their own initiative, began to shout the regulation-specific "heads down" command.

After the landing the CC announced that the passengers should remain seated and wait for the instructions of the crew. Following engine shutdown the captain called the CC on the interphone and said that the passengers could deplane normally.

1.16.3 Finland's Authority Radio Network VIRVE

VIRVE refers to the radio network, based on the Terrestrial Trunked Radio (TETRA) standard, which is primarily being used by government and municipal officials responsible for safety. The key user groups include the emergency/fire and rescue service, Finnish Police, the Border Guard, social and health authorities, Finnish Customs and the Defence Forces.

The Emergency Response Centre reform which is underway in Finland has introduced changes to VIRVE talk groups. The parameterisation (programming) of individual VIRVE terminals started in northern Finland in May 2011. It has systematically progressed towards the south of Finland, in accordance with the different authorities' respective timetables. The VIRVE terminals at Pori airport were parameterised on 8 Dec 2011, and the project will culminate at Helsinki-Vantaa and Helsinki-Malmi airports.

The ongoing VIRVE parameterisation impacted the different authorities' radiocommunication on the day of the occurrence. Satakunta Rescue Department was already using the updated parameter database but the Pori airport VIRVE terminals were yet to be updated.

1.17 Organisations and management

Finavia Corporation

Finavia Corporation is a public corporation which maintains nearly all airports in Finland and provides air navigation services for the entire country.

Area Control Centre Finland (EFIN ACC) controls air traffic in Finland's Flight Information Region/Upper Flight Information Region (FIR/UIR). The area of responsibility consists of seven airspace sectors which, depending on the volume of traffic, can be combined or separated. The Aeronautical Rescue Co-ordination Centre of Finland operates at EFIN ACC.

In addition to Pori airport, Finavia Corporation's western aerodrome region includes the airports at Turku, Mariehamn, Tampere-Pirkkala, Kauhava, Vaasa, Kokkola and Oulu.

Flybe Finland Plc

Flybe Finland Plc is a joint venture between Finnair Corporation and the British Flybe Group PLC. The airline operates with its ATR and Embraer fleet within Finland, and from Finland to Europe.

1.18 Additional information

1.18.1 The ACARS printer

ACARS is the aeroplane's communication, addressing and reporting system. The system includes a communication antenna, a Multifunction Control Display Unit (MCDU) and a thermal printer for printing messages. The printer is located on the aft pedestal between the pilots, next to the captain's seat. The MCDUs are on both sides of the forward centre pedestal.

The system can transmit messages from the aircraft to ground stations, and receive messages on SITA or ARINC data networks. The system can receive and print weather report uplinks from airports and enroute clearances issued by ATS units at airports which have been activated and approved to use the system.

1.18.2 Trauma and trauma therapy

Trauma refers to damage to the psyche or a physical injury caused by an external source. A traumatic experience can be caused, among other things, by an air accident, near-accident or a risk thereof. The post-traumatic crisis phases include shock, reaction, recovery and reorientation. The shock phase follows the triggering event. It may be short, but it can also linger on for several days. The reaction phase lasts from a few weeks to a couple of months. In the reaction phase a person gradually attempts to make sense of what really happened. Recovery happens during the reorientation and reanalysis phase. The defusing and debriefing intervention models were created for post-traumatic stress recovery counselling.

Defusing

Defusing is a short and confidential conversation, lasting no longer than one hour. It is arranged immediately following an accident or a stressful situation. The conversation should focus on the course of events and the emotions aroused by it, if any. The objective is to normalise the situation and restore the person's functioning as soon as possible. The defusing session is led by a trained and designated peer support person or a superior, who also assesses the need for the debriefing.

Debriefing

Debriefing refers to a group session that lasts for a few hours, and is organised 1-3 days after an event. Debriefing should not be done during the very first day because the people that experienced the event, possibly still in shock, cannot benefit from it. If possible, a trained medical expert should lead the session. The debrief focuses on the experiences caused by the event and aims to prevent any post-traumatic stress reactions. Such reactions include stressful flashbacks, guilt, the so-called survivor syndrome and sleep and memory disorders. The goal of the meeting is to support the understanding of one's own reactions as well as those of the others and help ease the return to everyday routine.

Flybe Finland Plc's post-traumatic stress management system

At the time of the occurrence the operator's post-traumatic stress counselling instructions were extremely brief. Their guidebook was updated in the spring of 2012. Whereas the existing guide explains how a debriefing session should be organised, it does not distinguish between *defusing* and *debriefing*. As per the instructions the captain should organise the first debriefing session as soon as is practicable. The guide also lists the bodies responsible for follow-up action. All debriefing sessions are voluntary, but the guide strongly recommends them as they are beneficial for the preservation of one's ability to work.

Aircrew

The captain asked the cabin crew whether they needed a debriefing session. Neither cabin attendant felt it necessary immediately after the occurrence. The aircrew as a whole did not have time to discuss the occurrence as a team because the cabin attendants and the passengers flew to Helsinki on the next scheduled flight, which departed soon after the incident aircraft landed. The pilots stayed in Pori and travelled to Helsinki on a later flight.

In Helsinki the cabin crew and the flight crew were met by the Flight Operations Director and the ATR Fleet Chief. The chief of cabin operations was also there to meet the attendants. They briefly went through the events and agreed to organise a debrief at a later time suitable for the entire crew. The operator arranged the debriefing session 10 days after the incident.

Finavia Corporation's Critical Incident Stress Management system

Finavia Corporation's trauma therapy system includes the support personnel system and immediate intervention procedures. Finavia has trained volunteers for Critical Incident Stress Management (CISM). At least two support persons from each division are designated from the following business areas: ATS/AFIS and rescue service/ airport maintenance. A sufficient number of support persons, albeit no less than two, must be designated for the other business areas. The two-day, four-tier support personnel training is given by a foreign organisation, conducted in the English language.

Pori airport

The CISM support person working in the office of Pori airport went to the control tower after the occurrence and offered support services. None of the three persons working in the tower at the time of the occurrence felt the need to talk with the support person. The airport maintenance experts that participated in the rescue service operation were also offered support services. However, they too declined the offer, regarding it as unnecessary.

Area Control Centre Finland

Following the occurrence the air traffic controllers at EFIN ACC that participated in the management of the event discussed the incident among themselves. They were offered an opportunity to discuss the occurrence with a CISM-trained peer support person at the

premises. According to their account the air traffic controllers did not consider the occurrence stressful enough to warrant such discussions.

1.19   Useful or effective investigation techniques

No new investigation techniques were employed during this investigation.

2 ANALYSIS

2.1 How the paper clip ended up in the printer

Fresh meteorological data and other relevant papers concerning a flight's next leg are normally brought straight to the pilots in the cockpit during stopovers. The papers are typically bound together with a rubber band or a stapler, but paper clips have also been used.

The paper clip probably made its way into the cockpit with the papers brought to the flight crew. At some stage, when the printer's top cover was open, the paper clip must have fallen inside the device. The ACARS system's printer, located on the pedestal between the pilots, has a top cover that can be closed, however, the mechanism inside is unprotected. Any foreign object falling into the printer may come in contact with live components. The aircraft manufacturer was not aware of any previous similar events.

According to the interviews that were made during the investigation, it can happen that papers or other small loose items, among other things, may be temporarily placed on top of the pedestal. As per Company regulations any loose foreign objects that do not belong in the cockpit must always be placed in the trash bin. After the occurrence the use of any paper clips was altogether banned in the Company's fleet of aircraft.

2.2 Smoke generated by a short circuit

An arriving ACARS message activated the printer. The paper clip inside the printer created a short circuit, resulting in smoke pouring out from the printer. The co-pilot recalled seeing a red glow after having opened the top cover of the printer. There was no fire per se in the printer. The paper clip got so hot that a part of it blackened. The smoke generation ended when the printer's circuit breaker tripped which, as such, isolated the printer from the aeroplane's electric system.

In their distress call the pilots told the air traffic control that there was a fire in the cockpit. They did not cancel the emergency even though the smoke dissipated. Considering the situation they made the correct decision. There was no way for the flight crew to know whether there was a risk of fire any longer.

In all there are three portable Halon fire extinguishers and one water extinguisher in the cockpit and the cabin compartment, intended for initial stage fire-fighting. The flight crew of the incident flight considered using an extinguisher but, when the smoke dissipated, decided against it. It is sensible to use a fire extinguisher as soon as smoke appears because a crew cannot know how a situation will develop.

While on the way to the cockpit the CC did not return to the aft of the cabin to pick up an extinguisher, even though the smell of smoke was already apparent in the cargo compartment. The only extinguisher at the front of the cabin is a water extinguisher which, due to the electrical equipment, is unsuitable for extinguishing fires in the cockpit. Also,

there might be material in the cargo compartment which, during a possible fire, cannot be put out with a water extinguisher.

2.3 Use of oxygen masks

At first there was thick dark smoke in the cockpit. Upon noticing the smoke the captain immediately decided that the pilots don their oxygen masks, which guaranteed their ability to function. Once the smoke dissipated they considered the possibility of discarding their masks but the captain decided that the masks should be used all the way to the landing. This was both proper and in compliance with the operator's regulations.

The captain's first ATR 72 type rating course was completed in the late 1980s. Having flown another aircraft type in the meanwhile the captain again completed the ATR 72 type rating course in the late 2000s. The captain did not recall having been trained to use an oxygen mask during the latter course, nor during recurrent training sessions. The co-pilot had practiced the use of an oxygen mask in the flight simulator during the type rating course. Neither one of them had ever used an oxygen mask in an aeroplane. The oxygen masks used in flight simulator training are extremely worn. Stretched out through use, the slackened straps do not tighten sufficiently, nor do they properly fit on the users' face. This easily leads a pilot to use an incorrect technique in putting on the oxygen mask. As the use of oxygen masks is almost exclusively trained in a simulator, the condition of the oxygen masks used in flight simulators must be equivalent to that of oxygen masks in aircraft.

There was a third oxygen mask in the cockpit which the CC did not use while on the flight deck. The smoke had already dissipated but the strong smell of it still lingered on. The CC spent several minutes in the cockpit. It would have been advisable for the CC to use an oxygen mask because the ambient air might have contained harmful substances. Neither did the CC bring the Protective Breathing Equipment (PBE) or the portable oxygen bottle along.

2.4 Crew Resource Management

In the beginning of the incident flight Crew Resource Management (CRM) worked well in accordance with the Standard Operating Procedures (SOP). However, during the emergency, CRM no longer materialised as per the SOPs. During the reading of the QRH the captain (PNF) read the handbook and carried out the radiocommunications with the ATC units, and the co-pilot (PF) flew the aeroplane. According to the OM-B the PF is responsible for flying the aeroplane as well as navigation and radiocommunications during the reading of the QRH. The PNF is to call out and complete the actions in the QRH. When operating as per the SOP checklists the workload is evenly distributed between the pilots while they deal with the emergency. Compliance with checklists ensures safe operation.

When smoke began to build up in the cockpit the pilots decided to land as soon as possible at the nearest airport. The captain let the co-pilot fly the aeroplane and navigate until the landing. The route that they took added several minutes onto the flight time.

The length of their actual route was also affected by the fact that the smoke had dissipated and that the pilots wanted to calm the situation down. The Operations Manual Part A (OM-A) recommends that in abnormal flight situations the captain "should resume the control of the aeroplane unless he decides otherwise". The Operations Manual Part B (OM-B) states that 'In abnormal situations it is recommended, when possible, that Commander makes (sic) the landing'.

In an emergency the captain must assume active leadership in Crew Resource Management. The captain, after all, carries the responsibility over the way the entire flight is conducted. The captain should also resume the role of the Pilot Flying, especially, in an emergency.

2.5 Crew communication

Flight crew communication

During the analysis of the CVR recording it was discovered that the pilots experienced problems in their mutual communication. Their interviews corroborated this observation. Their communication was initially hampered by the fact that the captain's headset fell onto the floor of the flight deck when the oxygen mask was being donned. Once the captain managed to put the headset back on the pilots noticed that they could not hear each other on the interphone. This was probably caused by the fact that the captain's audio control panel settings were unsuitable for the use of an oxygen mask. Loud breathing sounds also degraded readability. The analysis of the CVR recording showed that this extremely strong noise distorted the electrical signal at times.

Communication between the flight crew and the cabin crew

When the captain called the cabin on the interphone the CC could not make out what the captain was saying because of the loud noise interference on the interphone. The CC decided to go to the cockpit to talk with the captain. In the interview the captain said that the request to the cabin crew was to prepare the cabin for a normal landing. Nonetheless, the CC misunderstood this as a request for a prepared emergency landing. Even though the CC double-checked the assumed order twice, the noise in the cockpit and the oxygen mask prevented the CC from correctly understanding the captain's instructions. According to the emergency checklist the CC must confirm the captain's orders.

The captain's loudspeaker was adjusted to the low setting and the captain also turned the oxygen mask a little to the side while talking to the CC. These factors together contributed to the fact that the CC did not correctly grasp the captain's intentions as regards the landing preparations.

After the emergency landing preparations the cabin crew was waiting for the 'brace for impact' call, but it never came. The captain had assumed that the cabin crew was operating in accordance with normal procedure and, therefore, the pilots did not make any emergency landing-related passenger announcements.

The Cabin Attendant Manual (CAM) addresses fire-fighting inside the aeroplane. The manual states that, regarding a cockpit fire, the cabin crew must wait for the captain's orders. During abnormal circumstances and emergencies the entire crew must remain aware of the situation. When it comes to the flow of information, clear communication between the flight crew and the cabin crew is critical.

Passenger announcements

Apart from choosing the correct language for the passenger announcement, the cabin crew prepared the cabin as per the CAM. The manual says that passenger announcements should be made in the language that the majority of the passengers understand. In this case it would have been prudent to use English because many of the passengers did not speak Finnish.

Testing the occurrence aeroplane's interphone system

The investigation group boarded the occurrence aeroplane so as to study its interphone system. The purpose was to find an answer to the problems that came up in the interviews as well those experienced in pilot-to-pilot communication and pilot-cabin crew communication.

During the visit to the aeroplane it became evident that audio control panel switch selections greatly impact communication between the pilots. When using the headset/microphone combination the INT/RAD switch must be set to INT. Then the interphone connection between the pilots will constantly be on (hot mic), eliminating the need to use the PTT pushbutton. When oxygen masks are being used the switch must be set to OFF, lest the distracting breathing noise be heard through the headsets and cockpit loudspeakers.

Prior to the time of the occurrence the captain had set the left side loudspeaker volume to low. By doing so the captain attempted to prevent any acoustic feedback. The loudspeaker volume setting is independent of headset volume. The headset volume is controlled by each channel's dedicated switch.

In the ATR both aerodynamic resonances and propeller sound generate noise in the cockpit which makes it more difficult for people to hear one another. Normally, pilots always use the headset/microphone combination in the air. During testing it was discovered that a person standing at the door of the cockpit without a headset would find it extremely difficult to hear the pilots' speech, especially when they were using their oxygen masks. The communication between the pilots and the third person can be improved by using the headset reserved for the jump seat position. It can also be improved by adjusting the loudspeaker volume, or by using the PTT pushbutton. The investigation revealed that neither aforementioned option was taken during the emergency.

According to the interviews it was very difficult to make out what the pilots were saying on the cabin interphone when they were using their oxygen masks. However, the pilots heard the speech from the cabin normally on the interphone. The testing of the system

corroborated the crew's observations. Only the pilots' audio channel is recorded as regards interphone communications between the cockpit and the cabin.

2.6 Preserving the CVR recording

After the flight the pilots pulled the Cockpit Voice Recorder's circuit breaker. However, they did not make a corresponding entry in the Technical Log as required by the OM-A. When the FDR data were downloaded it was noticed that the CVR's circuit breaker had been reset. Nonetheless, the information from the occurrence flight had been retained because the recording capacity of the CVR is two hours.

The operator must secure the retention of CVR data and emphasise its importance to the interest groups as well. Once the CVR's circuit breaker has been pulled, it is forbidden to reset it before receiving permission to do so. Pilots must always enter the pulling of the CVR's circuit breaker in the Technical Log and make certain that this information reaches the Company's organisation and interest groups.

2.7 Air traffic control action

Area Control Centre Finland (EFIN ACC)

At the time of the incident FCM631W was slightly to the north of Pori airport. Due to the increasing volume of traffic the superintendent (SUP) at EFIN ACC had already initiated the move to separate sector three into an isolated unit. When the captain made the distress call the SUP decided to postpone this action so as to prevent any distractions in managing the incident.

The executive controller (EC) began to provide radar vectoring to FCM631W in a busy traffic situation. It is important to provide individual attention to an aircraft in distress so as to make it possible to give all necessary information to the flight crew; by doing so the air traffic controller can concentrate on assisting the aircraft in distress. This is normally done by handing over the controller's other traffic to another controller, working at a different station and on a different frequency. In this case the aircraft was already so close to Pori that a handover was no longer practicable. Once below the clouds the pilots got the runway in sight and were able to continue on their own navigation. The good weather conditions and the flight crew's familiarity with the area eased their task.

Radar vectoring for an approach is not a typical task for the Area Control Centre. Such an unusual request from an aircraft in distress greatly increases the workload of the controller in a busy traffic situation. In order to ease the controller's workload the EC could have ordered the other aircraft to observe radio silence by calling out "Stop transmitting, MAYDAY". No radio silence was ordered because the situation was short-lived. When radar vectoring is provided by the ACC, the radar horizon and the maintenance of radio contact must be taken into account.

Pori Control Tower

The rescue operation started well. The ACC's planning controller (PLC) responsible for the sector called Pori TWR at 11:56:56: "FCM631W is above you, there's a cockpit fire, it will land at Pori, make the alerts". The TWR controller acknowledged this call by saying "Cockpit fire, will land here".

The manning at Pori TWR was good at the time: two licenced air traffic controllers and a student controller were on duty. This facilitated a well-functioning and efficient delegation of duties at the TWR. The duty controller was responsible for air and ground traffic. The instructing controller issued the alerts as per the alerting list, and the student controller recorded the actions.

EFIN ACC had cleared FCM631W to descend to 3000 ft (915 m) and handed it over to Pori TWR frequency. The TWR did not clear the aircraft for a visual landing, which would have permitted it to descend below 3000 ft (915 m). When the captain told Pori TWR controller "we're flying in visual over here to your west", the TWR controller replied: "FCM631W continue and report on final 30. There is a Phenom on a short final coming to a landing". The omission of a visual approach clearance in radiocommunication made no difference to the continuance of the flight.

On the ground frequency the TWR received a question regarding the number of persons on board, to which the TWR replied that they did not know. The controller did not ask the pilots to provide this information. In conjunction with the other alerts the airport briefing services were asked to provide the flight's Supplementary Flight Plan (SFP), which includes the number of persons on board. As per the alerting list this information was given at 12:07 to the controller who was issuing alerts by telephone at Pori TWR. This information was not relayed to the duty controller at Pori TWR. The aircraft landed at Pori airport at 12:08. It would have been possible to establish the number of persons on board by asking the Company in question.

When the aircraft was on the short final the TWR controller called rescue vehicle LENTO11: "And LENTO11 at D, as an exception to ground traffic rules, the aircraft is now on short final, you can follow it when it lands". A similar permission was issued to LENTO14 shortly thereafter.

Aviation VHF radiotelephony is based on ICAO's publications. In the Finnish ATC Manual (LJKK), CHAPTER 3, WORDS AND PHRASES, SUBCHAPTER 3.1 GENERAL, it says: "It is altogether forbidden to issue a so-called conditional clearance to a vehicle, i.e. a permission to enter the runway behind landing aircraft or after departing aircraft. This applies to all visual conditions. A conditional clearance cannot be issued even for one takeoff or landing." The TWR controller should have waited for the aircraft to pass the vehicle in question before giving the permission to follow the aircraft on the runway.

The duty controller felt the presence of the cooperation authorities to be a distraction, among other things, because of the background noise of their rescue-related VIRVE radiocommunication. In order to guarantee a peaceful working environment for the ATC,

cooperation partners should use the fixed emergency operations centre, which all airport have, during abnormal situations. The operations centre is designated in the airport's emergency planning manual.

2.8   Rescue service and police action

Alerts at the airport

In addition to the prescribed alerts the ATC also issued an alert over the Teleste public address system. As a result, the announcement was heard in a wider area at the airport, including the passenger terminal.

The airport maintenance personnel at Pori airport are trained to conduct security controls on departing passengers. Once the alert was issued the security screening was interrupted when two persons belonging to the rescue service had to leave the security checkpoint for their rescue vehicles. During the investigation it was discovered that, for some reason, the maintenance personnel at the security checkpoint did not hear the alert on their VIRVE terminals. Rather, they heard it over the Teleste PA system. This announcement did not specify the nature of the emergency; it only broadcast an aviation emergency. The other maintenance personnel heard the alert on their VIRVE terminals. The VIRVE terminals were tested later and found to be working normally. According to the interviews the fact that maintenance experts were conducting security controls did not slow down the activation of the rescue service.

On the day of the occurrence Pori airport was yet to start using the updated VIRVE parameterisation database. The airport's VIRVE terminals could not connect to the authorities' primary talk group. Initially, this hampered communication between Satakunta Rescue Department and the Pori airport rescue unit. Pori's VIRVE terminals were parameterised on 8 Dec 2011.

Information regarding the number of persons on board

The rescue personnel were not informed of the number of persons on board, nor of their seating arrangement in the aeroplane. This information would have aided the smoke divers in the planning and implementation of a possible rescue operation.

Approximately two weeks after the incident the Finnish Transport Safety Agency published the updated Aviation Regulation GEN M1-8 (15 Dec 2011). Subsection 6.2.1.1 RADIOTELEPHONY DISTRESS COMMUNICATIONS of the Regulation states the following: "In addition to being preceded by the radiotelephony distress signal MAYDAY (preferably spoken three times), the distress message to be sent by an aircraft in distress shall:

a)   be on the air-ground frequency in use at the time;

b)   consist of as many as possible of the following elements spoken distinctly and, if possible, in the following order:

1) name of the station addressed (time and circumstances permitting);
2) the identification of the aircraft;
3) the nature of the distress condition;
4) intention of the person in command;
5) present position, level (i.e. flight level, altitude, etc., as appropriate) and head-ing;
6) number of persons on board.

Item no. 6 "number of persons on board" is altogether new and was added to the Regu-lation during this update.

Emergency Response

Of the rescue units alerted by Pori ERC the units that made it to the airport in time in-cluded P11 (regular fire fighting unit, Pori Central Fire Station), KARHU P3 (incident commander, Pori Central Fire Station) KARHU L4 (medical supervisor, Pori Central Fire Station) and L0 (doctor ambulance, Pori Central Hospital). Ulvila Fire Station's fire fighting unit U11 arrived at the SAR threshold soon after the aircraft landed. Since the incident was soon over, the other alerts were cancelled and the units were told to return to their stations.

The alert included a sufficient number of rescue personnel and enough equipment. As the authorities did not have specific information as regards the severity of the situation, the scope of the alert was justified. The authorities were also prepared for the possibility that the aircraft might not be able to make it to the airport for a controlled emergency landing. Pori airport is located inside the urban area, close to the city centre. The possi-bility of an emergency landing must be taken into account when considering the scope of an alert.

Breathalysing the flight crew

The police breathalysed the captain and the co-pilot in the passenger terminal. The al-cotester malfunctioned and one of the pilot's breath analysis was only successful on the third attempt. The situation was embarrassing because this took place in front of the passengers and the members of the media.

2.9   Post-traumatic stress counselling

Defusing should always be provided to people having experienced a traumatic event which can encompass, for example, an air accident, aviation emergency, a serious work-related accident or a threat thereof. This incident carried the risk of a major acci-dent because there was a risk of fire on board the aircraft, and it was also flying over an urban area during the approach.

People who experience a traumatic event will later process different outcomes in their mind. They might also ponder their own action and its consequences in such situations. The interviews confirmed that defusing should be conducted in the form of peer support. A defusing session run by a peer support person in the same job is considered to be

more beneficial because the person having undergone a traumatic event knows that the peer support person is also well aware of the challenges of his job and the working environment.

Flybe Finland Plc

Inside the passenger terminal the captain explained the events that took place in the air to the passengers in English. The use of the English language was justified because most of the passengers were foreigners. The direct information which the captain provided following the occurrence probably calmed down the passengers and possibly helped prevent post-traumatic stress reactions.

The time that the aircrew could spend together at Pori was short because the cabin crew flew, as passengers, to Helsinki on the next scheduled flight. Hence, a defusing session immediately after the occurrence was not arranged for the crew.

Since the pilots travelled on a later flight to Helsinki they had more time to discuss the events. It would have been sensible for the entire crew to travel to Helsinki together. Had that been the case, the captain would have been in a better position to evaluate the need for a debriefing.

The cabin crew discussed the occurrence during their flight to Helsinki, and on their way home. Furthermore, they stayed in contact by telephone before the debriefing session, which the Company organised ten days after the occurrence. Judging from the interviews the crew would have needed the session much earlier.

he operator's OM-A states that the captain should organise a short debriefing session as soon as is practicable following an occurrence. At this time the need for crisis support should also be assessed. The operator's manual was updated in the spring of 2012. Nonetheless, the instructions are still quite brief and they do not make a distinction between *defusing* and *debriefing* sessions. No time limit is given for setting up an actual debriefing session.

Finavia Corporation

The two EFIN ACC air traffic controllers on duty at sectors 3, 4 and 5 discussed the event with the supervisor. The air traffic controllers did not consider the occurrence traumatic enough to warrant a meeting with support personnel. During an interview one of the air traffic controllers pondered whether a person, immediately after a traumatic experience, can even comprehend his own coping ability. The controller also admitted to having later contemplated the option of a more serious outcome.

The supervisors of the various personnel groups that participated in the management of the occurrence at Pori airport did not consider it necessary to organise any discussions with the CISM support person.

Within Finavia's Critical Incident Stress Management (CISM) system at least two support persons are designated from the following three business areas: air navigation ser-

vices, rescue service, and airport maintenance and other business areas. There are eight airports in the region to which Pori belongs. While the number of support persons should be six at a minimum, the investigation group's report found that there were only three support persons in the spring of 2012. No air traffic controllers were among them.

Finavia's present CISM personnel have not been augmented. Under the present system some airports do not have any support persons at all. A face-to-face meeting with a support person is a much better alternative to a person having experienced a traumatic event than a telephone conversation.

3 CONCLUSIONS

3.1 Findings

1. Flight FCM631W was a scheduled flight from Vaasa to Tallinn. There were four crew members and seven passengers on board.

2. The flight crew had valid licences and the required ratings.

3. The air traffic controllers had valid licences and the required ratings.

4. A paper clip which had fallen into the aeroplane's ACARS printer caused a short circuit causing dark smoke to pour out of the printer for a while.

5. The pilots donned their oxygen masks.

6. The pilots immediately started a descent and made the decision to land at Pori airport.

7. The oxygen masks created communication problems for the crew members.

8. The pilots did not use the cockpit's Halon extinguisher.

9. Citing a cockpit fire the captain declared an emergency (MAYDAY) to the Area Control Centre and, at the same time, requested radar vectoring to Pori airport.

10. The Area Control Centre issued a heading and a clearance altitude to the aircraft. Once the pilots gained visibility with the ground they made a visual approach to runway 30.

11. During the reading of the QRH Crew Resource Management did not materialise as per the Standard Operating Procedures.

12. The supervisor at the Area Control Centre requested a Finnish Air Force Sector Operations Centre to track the flight on their radar.

13. Pori Control Tower issued the alerts as per the alerting list.

14. During the approach there was no longer any visible smoke in the cockpit.

15. The pilots decided to use their oxygen masks all the way to the landing.

16. The cabin crew and the passengers assumed the 'brace for impact' position for the landing.

17. Counter to the Finnish ATC Manual (LJKK) the TWR controller at Pori issued a conditional clearance to the rescue units to enter the runway behind the landing aircraft before it had passed the rescue vehicles.

18. The rescue units were not informed of the number of persons on board.

19. Rather than using the normal stand, Pori ATC told the aircraft to park at the outer edge of the apron.

20. The passengers deplaned through the rear entrance door.

21. Satakunta Rescue Department set up a triage centre in the passenger terminal.

22. The police breathalysed the pilots in the passenger terminal.

23. Six passengers and the cabin crew continued the journey to Helsinki on the next scheduled flight. The flight crew travelled to Helsinki on a later flight.

24. The flight crew and the cabin crew held separate defusing sessions upon arriving in Helsinki.

25. The operator organised a debriefing session for the entire crew 10 days after the occurrence.

26. The associated air traffic controllers at the Area Control Centre were offered an opportunity to defuse the occurrence with a peer support person. However, they believed that their mutual discussions following the occurrence sufficed.

27. The persons working at Pori TWR and in airport maintenance at the time of the occurrence declined the offer for a defusing session, regarding it as unneeded.

28. When the FDR data were downloaded it was noticed that the CVR's circuit breaker had been reset. Nonetheless, all recorded information from the occurrence flight had been retained.

29. Pursuant to Finnish Aviation Regulation GEN M1-4 the flight crew, EFIN ACC supervisor, Pori TWR controller and Pori airport maintenance supervisor filed their respective flight safety reports.

30. The oxygen masks used in flight simulator training are not in as good condition as those in aeroplanes.

31. The only extinguisher at the front of the cabin is a water extinguisher which, due to the electrical equipment, is unsuitable for extinguishing fires in the cockpit

3.2   Probable cause and contributing factors

The serious incident was caused by a paper clip having fallen into the ACARS printer. An arriving ACARS message activated the printer, at which time the paper clip created a short circuit which resulted in transitory thick smoke generation.

The contributing factors included the use of paper clips in the cockpit and the unprotected mechanism inside the printer.

4   SAFETY RECOMMENDATIONS

4.1   Action already implemented

Finnish Transport Safety Agency

On 15 December 2011 the Finnish Transport Safety Agency published an updated Aviation Regulation, GEN M1-8, containing information related to distress messages. The new item concerns the number of persons on board. The update of this Aviation Regulation was already underway before the day of the occurrence.

On 1 Oct 2013 the Agency updated the work order for the FSTD evaluation which designates the content of simulator inspections carried out by the supervising authority.

Finland's Authority Radio Network

The ongoing VIRVE terminals' parameterisation impacted the different authorities' radio-communication on the day of the occurrence. Satakunta Rescue Department was already using the updated parameterisation database but the Pori airport VIRVE terminals were yet to be updated. The VIRVE terminals at Pori airport were parameterised on 8 Dec 2011.

Flybe Finland Plc

On 4 January 2012, owing to the occurrence, the operator published maintenance bulletin no. 28. The bulletin prohibits any paper clips in the aeroplane, or near the parts of an aeroplane. Rather, staplers shall be used to bind papers together.

In accordance with the authorities' regulations the operator has increased oxygen mask training. After the incident pilots started to practice the donning of oxygen masks during their annual recurrent flight simulator training sessions. In addition, the annual safety training session now includes a video shown to pilots and cabin attendants alike which shows how the oxygen mask is used, and the impact of audio control panel settings to readability. During the 2012 CRM (Crew Resource Management) training session the operator also organised a training event for flight crews and cabin crews on the topic of crew action and mutual communication when oxygen masks are being used. The lessons learned from the occurrence flight have also been utilised in other training.

As of the beginning of 2013 cockpit oxygen mask instruction for cabin crews is given in the classroom *and* in the cockpit, where the cockpit oxygen mask is deployed and donned. The training also includes communication with the pilot when oxygen masks are being used. Simultaneously, the use of the cockpit's third headset is rehearsed. This training is repeated every three years.

The operator has begun to update their post-traumatic stress counselling instructions. At the same time the distribution list of flight safety reports will be expanded so that the persons responsible for the action will sooner be able to commence defusing and de-

briefing. According to the operator the update will be completed soon after the publication of this investigation report.

4.2 Safety recommendations

1. During the investigation it was discovered that the oxygen masks used in ATR 72 flight simulator training are not in as good condition as those in aeroplanes. The training session might give the pilots the wrong impression and teach incorrect techniques in donning the mask.

   Safety Investigation Authority, Finland recommend that the Finnish Transport Safety Agency ensure that the validation of the oxygen masks' condition during the annual flight simulator inspections be carried out via subjective testing. The condition of oxygen masks used in flight simulators must be equivalent to that of oxygen masks in aircraft.

2. Finavia Corporation's Critical Incident Stress Management personnel have not been augmented. There are too few trained support personnel within the system and, therefore, peer support is often missing. Defusing sessions are not held because they have not become an integral part of the units' activities.

   Safety Investigation Authority, Finland recommend that Finavia Corporation re-assess the training, implementation and updating of its present Critical Incident Stress Management system.

4.3 Other observations and proposals

The operational premises at the Air Traffic Control should be made more calm, especially during abnormal situations. Cooperation partners should use the fixed emergency operations centre, which all airports have, during abnormal situations. The operations centre is designated in the airport's emergency planning manual. The suitability of the centre can be assessed, among other things, during SAR training and exercises.

The operator must ensure that the CVR recording be preserved until handing it over to the safety investigators.

The police breathalysed the pilots in the airport passenger terminal. Considering the protection of privacy the breath analysis should be carried out at such premises where the parties concerned can be alone.

Helsinki 11.10.2013

Tii-Maria Siitonen   Päivikki Eskelinen-Rönkä

Juha-Pekka Keidasto   Pekka Orava

Sanna Winberg

SUMMARY OF THE COMMENTS TO THE DRAFT FINAL REPORT

Finnish Transport Safety Agency *Trafi*

Trafi already uses the EASA's methodology for flight simulator qualification. The simulator in question has passed Trafi's annual evaluations. The previous inspection of this simulator, carried out in accordance with the requirements of JAR-FSTD A, was done on 14–15 Nov 2012.

Last September, the EASA audited Trafi's FSTD qualification procedures, and was happy with the manner in which said devices were being inspected. The EASA provided no negative feedback to Trafi as regards any shortcomings in oxygen mask testing. As far as Trafi knows, other European countries also inspect oxygen masks in a similar manner.

According to Trafi, this investigation report seems to provide the grounds for including subjective testing of the flight simulator's oxygen masks in each annual FSTD inspection/validation. Trafi also proposes directing the SIA's recommendation to the EASA rather than Trafi, if the intention is to issue the recommendation to an authority. Also, Trafi thinks that issuing the recommendation to the operator of the flight simulator, rather than the authority, should be considered. The recommendation should also take into account the criteria at which the condition of the oxygen masks should be validated.

Flybe Finland Plc

The Company proposed a revision in section 2.3 where it is said that the slackened straps easily lead into an incorrect oxygen masks donning technique.

In section 4.3 it is mentioned that the police breathalysed the pilots in the airport passenger terminal. From the protection of privacy point of view, breath analysis should be carried out at such premises where the parties concerned can be alone. The Company hopes that SIA bring up the matter with the members of the police in aviation accident and incident training sessions. The topic could also be included in the Company's manuals and training.

Finavia Corporation

Finavia proposes that Recommendation No 3 of the draft investigation report be revised as follows: "Safety Investigation Authority, Finland recommend that Finavia Corporation reassess its present Critical Incident Stress Management system, its implementation and any required additional resources, training arrangements for the personnel that work within the system, and the needs related to maintaining the system."

Furthermore, as regards section 4.3 Finavia states that each airport has a fixed emergency operations centre, designated in the airport's emergency planning manual. At Pori airport the centre is located on the second floor of Pori TWR building.

Emergency Response Centre Administration

No comments: the draft investigation report did not issue any safety recommendations to the ERC Administration, nor did it include any analysis with regard to the operation of the ERC Administration.

Satakunta Rescue Department

According to the comments of Satakunta Rescue Department the command authority automatically transfers to the rescue services once the aircraft lands. Other specific comments have been taken into consideration in the investigation report.

European Aviation Safety Agency (EASA)

No comments.

French Bureau d'Enquêtes et d'Analyses pour la Sécurité de l'Aviation Civile (BEA)

The engine type designator was corrected as per the comments.

According to the comments the aircraft type complies with JAR 25.851(a) requirements regarding the positioning and types of extinguishers. The aircraft manufacturer did not support the original safety recommendation of the investigation report which proposed changing all fire extinguishers in the aircraft to Halon type extinguishers.

UK Air Accident Investigation Branch (UK AAIB)

No comments.