Accident Investigation Board of Finland
Annual Report 2006

Onnettomuustutkintakeskus
Centralen för undersökning av olyckor
Accident Investigation Board

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MISSION OF ACCIDENT INVESTIGATION BOARD

The Accident Investigation Board of Finland was founded in 1996 within the Ministry of Justice. The tasks of the Accident Investigation Board are specified in the relevant act and decree which also include overall directions on the characteristics of the accidents to be investigated and the methods of investigation to be implemented.

By its investigation activities, the Accident Investigation Board intends to enhance overall safety and prevent accidents. As a result of an accident investigation, an investigation report is produced that contains safety recommendations for the competent authorities and other parties concerned. In fact the safety recommendations translate the investigators' views on the means of prevention of similar or corresponding accidents in the future. The Accident Investigation Board moreover monitors the implementation of the recommendations issued. The investigation work conducted by the Board exclusively focuses on an improvement of safety with no stances taken as for questions of culpability, responsibility or liability for damages.

It is the mission of the Investigation Board to investigate all serious accidents, serious incidents and aviation, rail, and marine accidents and incidents. The investigation of aviation accidents is based on the relevant European Council Directive and the Convention on International Civil Aviation, and the investigation of rail accidents is based on the EU Railway Safety Directive (published on April 1st, 2004). As for maritime accidents, their investigation is based on the recommendations of the International Maritime Organization (IMO).

Accident investigation focuses on the course of events of the accident, its causes and consequences as well as on the relevant rescue measures. Particular attention is paid to whether the safety requirements have been adequately fulfilled in the planning, design, manufacture, construction and use of the equipment and structures involved in the accident. It is also investigated whether the supervision and inspection has been carried out in an appropriate manner. Any eventually detected shortcomings in safety rules and regulations may call for investigation, as well. In addition to the direct causes of an accident, the accident investigation intends to reveal any contributory factors and background circumstances that may be found in the organization, the directions, the code of practice or the work methods.

In the decision-making on the commencement of an accident investigation, the degree of seriousness of the incident is considered as well as its probability of recurrence. An incident or accident or hazardous situation, with only minor consequences may also require investigation in case it sets several persons at risk and an investigation is assessed as producing important information in view of the improvement of the general safety and the prevention of further accidents. Generally speaking, the Accident Investigation Board does not investigate an incident or accident caused intentionally or by an offence.

The Accident Investigation Board is also responsible for, e.g. the maintenance of a contingency to rapidly commence an investigation, the training of new accident investigators, the producing of general instructions on the carrying out of the investigation work and on the drawing up of the investigation reports, and the participation in international cooperation in the field.

Finally the Accident Investigation Board is responsible for the printing and distribution of the investigation reports and their publishing on its web pages, www.onnettomuustutkinta.fi.

Terms

Investigation categories	
A-investigation	Serious accident
B-investigation	Accident or serious incident
C-investigation	Incident, damage or minor accident
D-investigation	Other incident
S-investigation	Safety study

Accident/incident categories	
L	Aviation accidents and incidents
R	Rail accidents and incidents
M	Marine accidents and incidents
Y	Other accidents and incidents

Investigation identifier

Each investigation is designated by an identifier that consists of four parts, such as A1/2004R.

The first part refers to the investigation category (A, B, C, D or S).
The second part is a sequence number referring to the order of the accident within its accident category in the year in question.
The third part refers to the year of the accident.
The fourth part indicates the accident category (L, R, M or Y).

E.g. A1/2004M refers to the first serious marine accident investigation in 2004.

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REVIEW 2006

A total of 60 accident investigations were completed in 2006. This figure exceeds the total for 2005, totals less than 2004 and is close to average total for the years 2003–2006. Almost half of the investigations completed were so-called category D incident or minor accident investigations. Use of the category D investigative procedure has increased in recent years and has enabled the documentation of numerous incidents which would formerly have otherwise remained undocumented. In contrast, a number of incidents which would have formerly been investigated using the more extensive category C procedure were investigated using the more cost-effective category D investigation. Wherever necessary, however, category D investigations were upgraded to category C investigations.

In addition to standard individual accident investigations, safety studies concerning several accidents were also made. Two major safety studies addressing marine accidents: *Pilotage Practice and Culture in the Light of Accidents* and *Safety of Finnish Passenger Vessel Traffic,* were completed in 2006. In the rail transport branch, a comprehensive safety study of level-crossing accidents was ongoing in 2006 and will continue in 2007. In 2006 a safety study was initiated to investigate eight roof collapse and roof damage incidents that occurred in the spring.

The number of cases investigated in 2006 totalled seven fewer than in 2005. More than half of the 61 investigations commenced were category D investigations. A total of 55 incomplete investigations were transferred to 2007, closely matching the annual target set for the number of accidents and incidents investigated. However, some investigations exceeded the one-year maximum duration target.

The number of serious accidents decreased significantly in 2006 and 2005 compared to the 2004 level. However, the conclusion cannot be drawn from this that the level of general safety has permanently improved. The smaller number of serious accidents influenced the total accident investigation expenditure, which in 2006 was about 14% less than in 2005.

A key task of the Accident Investigation Board is to monitor the implementation of the safety recommendations issued by its investigation reports. In 2006, the implementation status of around 60% of the 625 recommendations issued during 2000–2006 was known. Approximately half of the recommendations issued in aviation and rail transport investigations during 2000–2005 had been implemented by the end of 2006. Rail transport statistics are available for the entire operational period of the Accident Investigation Board (i.e. since 1996). The degree of implementation of recommendations for the entire operating period was 63%. In 2007, clarification of the implementation of recommendations will continue for marine accident investigations and, in particular, for investigations of the other accidents branch. The latter included the serious accident at Konginkangas on 19 March 2004 and the South-East Asia natural disaster of 26 December 2004, for which the majority of safety recommendations either have been implemented or their implementation is being considered.

Many of the staff of the Accident Investigation Board will reach retirement age over the next few years. Preparations for this have included, for example, further development of the operational procedure manuals and investigator guidelines completed in 2002, which were once again amended as necessary towards the end of the year. A significant addition to the provision and documentation of operating procedures was the Quality Manual which was completed in November 2006 and commissioned on 1 January 2007 for the purposes of recording experiences and eliminating procedural shortcomings. Despite the relatively high average employee age, illness absences were minimal at 1.5 days/person year. Personnel wellbeing is being more closely addressed by means of more frequent physical examinations.

International cooperation has continued to increase as the activities of the different EU transport safety authorities in developing and harmonising European accident investigation have gained momentum. 7.5% of the 11.44 person years of the Accident Investigation Board's permanent employees were spent in international cooperation in 2006. This figure is predicted to increase by up to 10% over the next few years. However, the clear majority of work, over 40% of total person years, was focussed on accident investigation. In addition to permanent employees, accident investigation work was carried out as timework by 87 external experts, the total work contribution of which was about 8 person years. A significant addition to accident investigation resources was achieved with the establishment of the position of Chief Investigator for the Other Accidents branch of investigation and the filling of this new post on 1 May 2006.

At the beginning of the year a summary of the results of the investigation report readership survey was published on the Accident Investigation Board website. Of the 500 respondents, 80% read investigation reports for professional or educational purposes. About 40% of interviewees viewed investigation reports as being of considerable vocational benefit and a further 50% viewed them as being of some vocational benefit. About 90% of respondents felt the investigation reports to be suitable in scope, professionally written and of high quality.

In the light of these excellent results, I would like to extend my sincere thanks to all accident investigation participants for their outstanding and vital contributions towards improving public safety.

Tuomo Karppinen
Director

Summary of investigations commenced in 2006

	Investigation category					
	A	**B**	**C**	**D**	**S**	**TOTAL**
Aviation	-	3	7	15	-	**25**
Rail	-	-	4	4	-	**8**
Marine	-	1	7	10	-	**18**
Other	-	3	-	6	1	**10**
TOTAL	**-**	**7**	**18**	**35**	**1**	**61**

Summary of investigations completed in 2006

	Investigation category					
	A	**B**	**C**	**D**	**S**	**TOTAL**
Aviation	-	4	8	13	-	**25**
Rail	-	-	8	4	-	**12**
Marine	-	3	7	9	2	**21**
Other	-	1	-	1	-	**2**
TOTAL	**-**	**8**	**23**	**27**	**2**	**60**

Summary of incomplete cases, 31 December 2006

	Investigation category					
	A	**B**	**C**	**D**	**S**	**TOTAL**
Aviation	-	5	5	2	-	**12**
Rail	-	1	10	-	1	**12**
Marine	-	6	12	1	2	**21**
Other	-	4	-	5	1	**10**
TOTAL	**-**	**16**	**27**	**8**	**4**	**55**

Investigation commissions

The Accident Investigation Commissions had the following memberships in 2006.

Aviation

Ismo Aaltonen, Ari Anttila, Markus Bergman, Päivikki Eskelinen-Rönkä, Juhani Hipeli, Janne Hotta, Ari Huhtala, Petri Kallio, Erkki Kantola, Markku Koivurova, Jouko Koskimies, Mikko Lahti, Erkki Lepola, Timo Lindholm, Esko Lähteenmäki, Hannu Melaranta, Juhani Mäkelä, Reijo Mäkeläinen, Arto Nissinen, Pekka Orava, Seppo Pulkkinen, Markku Roschier, Tuukka Takala, Hans Tefke, Tapani Vänttinen

Rail

Veikko Alaviuhkola, Aki Grönblom, Kati Hernetkoski, Veli-Jussi Kangasmaa, Timo Kivelä, Jukka Koponen, Sirkku Laapotti, Pertti Mikkonen, Reijo Mynttinen, Hannu Räisänen, Esko Värttiö, Kari Ylönen.

Marine

Ralf Forsberg, Ville Grönvall, Harri Halme, Markku Haranne, Mikko Härmä, Martti Heikkilä, Olavi Huuska, Sakari Häyrinen, Mikko Kallas, Heikki Koivisto, Kari Larjo, Jaakko Lehtosalo, Petteri Leppänen, Karl Loveson, Petri Luotio, Seppo Männikkö, Ari Nieminen, Veli-Pekka Nurmi, Markku Partinen, Risto Repo, Klaus Salkola, Tapani Salmenhaara, Pertti Siivonen, Toimi Sivuranta, Juha Sjölund, Sanna Sonninen, Matti Sorsa, Pirjo Valkama-Joutsen, Kai Valonen, Micael Vuorio

Other

Pekka Aho, Hannu Alén, Tor Erik Ekberg, Markku Haikonen, Heikki Harri, Kati Hernetkoski, Seppo Huovinen, Veli-Jussi Kangasmaa, Tuomo Karppinen, Esko Kaukonen, Kurt Kokko, Jukka Koponen, Markku Kortesmaa, Juha Kurenmaa, Ossi Lavonen, Matti V. Leskelä, Reijo Mynttinen, Tapani Mäkikyrö, Seppo Männikkö, Anssi Parviainen, Antti Pellinen, Erkki Reinikka, Jussi Seppälä, Jari Strengell, Seppo Suuriniemi, Kai Valonen, Heikki Ventonen, Esa Virtanen, Esko Värttiö, Kari Ylönen

PERFORMANCE

In the following, the activities of the Accident Investigation Board in 2006 are discussed in terms of the targets set by the Ministry of Justice.

Serious incident or accident investigations (category B) must be completed within one year. Incident or minor accident investigations (category C) must be completed within six months.

A total of 8 category B investigations and 21 category C investigations were completed in 2006. The average investigation time for both B and C level investigations was 15 months. The average investigation time for B-level accidents slightly exceeded the set target of one year. The six-month target investigation time for C-level accidents was clearly exceeded.

The average accident investigation time varied considerably between the different modes of transport. In aviation, the average investigation time for the four category B investigations was 12 months and for the eight category C investigations 8.5 months. The average investigation times for rail transport and marine accidents were around 20 months. If the average rail accident investigation time is calculated without the single longest investigation, the average time for the seven category C investigations was 16 months. The category B investigation carried out in the other accidents branch was completed in 11 months.

Whereas the scope of C-level investigations does not differ greatly from that of B-level investigations, their investigation times of over one year are nevertheless excessive. On the other hand, the minimum six-month investigation period target has proven too difficult to achieve. The period of circulation for comment of an investigation report lasts at least one month. In addition, finalisation of the report prior to publication often also requires one month. These points considered, over one third of the total six-month investigation time is taken up by these two stages alone. The period of time needed to carry out D-level investigations, however, is only a few months.

In aviation in 2005, the average investigation time for three category B investigations was 13 months and for eight category C investigations 9 months. The four category C rail transport investigations were completed in 11 months on average. A total of five investigations were completed in the other accidents branch of investigation, the average investigation time for which was 12 months. The average marine accident investigation times were significantly longer than this.

Investigations to be maximum one-year in duration.

In 2006 approximately as many investigations were commenced as were completed. At the end of the year, the number of incomplete investigations totalled five less than the number of completed investigations. Based on this, the goal of carrying out investigations of maximum one year duration was achieved. On the other hand, the accident investigations carried out also included some investigations which lasted more than one year, which is not in line with the said objective.

The Implementation status is known for 80% of safety recommendations issued.

In aviation and rail transport, the implementation status of recommendations is accurately known for all recommendations issued during 2000–2005. For marine accident investigations, the status of implementation is known for only 9% of recommendations issued during 2000–2006. For the other accidents branch of investigation the corresponding figure is 50%. The target is to determine the implementation status of 80% of all recommendations. This objective has not yet been achieved, as at the end of 2006 the implementation status was known for approximately 60% of all recommendations issued during 2000–2006.

Approximately half of the recommendations given for aviation and rail during 2000–2005 had been carried out by the end of 2006. The unimplemented recommendations included recommendations that take a considerable time to put into effect or recommendations for which an implementation decision had not yet been made. A total of 63% of all rail transport investigation recommendations issued since 1996 had been carried.

Drawing up of Quality Manual to be continued. The draft manual will be completed in 2006.

The Quality Manual was completed in November 2006 and commissioned on 1 January 2007 for the purposes of collecting operational experiences and eliminating existing shortcomings.

The Working Time Monitoring System (Tarmo) was commissioned on 1 January 2006.

The use of working time was monitored throughout 2006 by means of the Tarmo system. A total of 11.44 person years was recorded in the system for permanent employees. Of this figure, 41.4% was focussed on accident investigation activities and 22.3% on support functions. The clear majority of working hours, i.e. 2.39 person years, were used for the drawing up of accident investigation reports. International cooperation in the field has increased rapidly in recent years as the work of the EU's aviation, rail and marine transport safety authorities has got underway. The share of international cooperation is set to increase by a further 7.5% in the next few years. Researchers also spent a large amount time giving accident investigation and safety talks and presentations. These were recorded as "staff development" and "stakeholder cooperation" activities and accounted for 13.6% of the total working hours.

In 2006, a total of 14,282 hours, i.e. approximately 8 person years, were paid to external researchers from the allocated accident investigation budget. Permanent Accident Investigation Board employees and external researchers thus worked a combined total of around 19 person years in 2006.

AVIATION

One case of material damage occurred in air transport, eight cases of material damage in general aviation, plus eight cases of material damage in glider flying. Thirteen incidents of inflight damage of ultralight aircraft occurred, one of which resulted in a forced landing. Four fatalities occurred in aviation accidents in total.

Ten investigation commissions were appointed in 2006. A total of 17 category D investigations were commenced, two of which were changed to category C investigations.

In 2006, 12 category B and C investigations were brought to conclusion and 13 category D investigations were completed. Resources were considerably tied up by the investigation into the helicopter accident which occurred off the coast of Tallinn on 10 August 2005. The investigation was ongoing throughout the year under the directorship of the Estonia-led investigation commission.

A meeting of Nordic aviation accident investigators was held in Denmark in September, at which two investigators from Finland participated. Investigators participated in several training meetings and international meetings and seminars during the year. One of the key events was the ISASI's accident investigation seminar held in Helsinki, which featured speakers from the USA, Canada and France. The target group was accident investigators from all of the Nordic countries as well as representatives from Finnish airline companies and the Finnish Air Force and Border Guard. An investigator also participated in a cooperation meeting of the European Aviation Safety Agency (EASA) and European aviation accident investigation authorities held in Cologne, Germany, the ISASI annual meeting in Mexico and the ECAC-ACC Group meeting in Madrid.

Researchers lectured during the year at some 30 events held for authorities and aviators addressing accident investigation or air safety issues.

Investigations commenced in 2006

In 2006 the Accident Investigation Board commenced altogether 10 aviation accident and incident investigations.

Identifier	Date	Title of the investigation
B1/2006L	8.7.2006	Aircraft accident at Suomussalmi (Cessna 172, OH-CEB)
B2/2006L	10.7.2006	Aircraft accident at Sodankylä (Ikarus C42, OH-U369)
B3/2006L	8.8.2006	Aircraft accident at Hirsijärvi (Ikarus C42, OH-U396)
C1/2006L	2.2.2006	Incident at the intersection of taxiway and runway (ATR 72 ja MD 11)
C2/2006L	9.2.2006	Incident at the runway of Oulu airport (aircraft and tractor)
C3/2006L	20.2.2006	Incident involving an airliner landing at Helsinki-Vantaa airport (E 170, OH-LEE)
C4/2006L	24.3.2006	Engine failure and emergency landing at Joensuu airport (Cessna 172 P diesel, OH-CVB)
C5/2006L	29.6.2006	Incident southwest of Uusikaarlepyy involving civil and military flight units
C6/2006L	15.7.2006	Collision of two glider aircraft in Orimattila (OH-945 and OH-956)
C7/2006L	11.12.2006	Veering Off the Runway at Seinäjoki Airport (ATR42-500, OH-ATB)

Investigations completed in 2006

In 2006 the Accident Investigation Board completed altogether 12 aviation accident and incident investigations.

Identifier	Date	Title of the investigation
B2/2005L	31.1.2005	Aircraft accident at Helsinki–Vantaa airport (SE-KYH, Cessna 208B)
B3/2005L	24.7.2005	Aircraft accident in Jämijärvi (M.S. 893A, OH-SDV)
B5/2005L	2.9.2005	Helicopter accident in Paltamo (Bell 206B, OH-HLP)
B6/2005L	17.12.2005	Incident at Kuopio airport (SAAB 2000 ja ATR 72)
C2/2005L	28.6.2005	Forced landing in Sodankylä (Cessna 185, OH-CDO)
C4/2005L	19.8.2005	Helicopter accident in Hailuoto (R22, OH-HME)
C5/2005L	15.8.2005	Passenger aircraft fuel leak during flight (MD-11, OH-LGF)
C7/2005L	14.12.2005	Falling of passenger stairs at Rovaniemi airport (Airbus A321, G-OOAB)
C1/2006L	2.2.2006	Incident at the intersection of taxiway and runway (ATR 72 ja MD 11)
C2/2006L	9.2.2006	Incident at the runway of Oulu airport (aircraft and tractor)
C3/2006L	20.2.2006	Incident involving an airliner landing at Helsinki-Vantaa airport (E 170, OH-LEE)
C4/2006L	24.3.2006	Engine failure and emergency landing at Joensuu airport (Cessna 172 P diesel, OH-CVB)

B2/2005L

Aircraft accident at Helsinki–Vantaa airport 31.1.2005

On Monday 31.1.2005, an aircraft accident occurred at around 17:00 co-ordinated universal time (UTC) at Helsinki–Vantaa airport. A Swedish Cessna 208B aircraft registered SE-KYH, owned by Nord-Flyg AB and transporting air freight to Sweden, crashed into the ground within the air-side after takeoff. The pilot suffered minor injuries. The aircraft was completely destroyed. On

2.2.2005, the Accident Investigation Board Finland (AIB) decided to appoint an investigation commission, B 2/2005 L, for this accident. Air accident investigator Hannu Melaranta was named investigator-in-charge with investigators Hannu Vartiainen and Esko Tilli as members of the commission. On 17.3.2005, the AIB augmented the commission by nominating investigators Martti Lantela and Jari Hiltunen as Search and Rescue (SAR) experts.

The aircraft arrived from Sweden on 31.1.2005, landing at Helsinki–Vantaa airport around 02:47. According to standard company policy, Nord-Flyg AB operates with a two person crew. However, on the day in question the co-pilot had taken ill and the flight was flown without a co-pilot. The pilot checked in for duty at the airport at around 14:30 to prepare for the return leg. It had been snowing at the airport until 09:20 and the temperature was hovering at around zero degrees Celsius. After having arrived at the airport, the pilot began to brush the accumulated snow and frozen snow melt off the upper surfaces of the aircraft. As per his account, there was a great deal of snow and ice on the aircraft. He did not, however, manage to brush all of the impurities off of the surfaces of the aircraft. The cargo going to Sweden did not arrive in time for him to fly it to Skavsta, his primary destination. Therefore, he phoned in a change to the flight plan choosing Örebro instead as his destination. He took off from runway 22L. All went well until he reached the height of 800-1000 ft (250-300 m) and retracted the trailing edge flaps. Immediately after flap retraction, the pilot lost control of the aircraft, which began turning to the right. The pilot attempted to fly the aircraft to the end section of runway 22R to make an emergency landing but the aircraft crashed into the terrain between the runways.

Investigation revealed that the pilot did not succeed in brushing the snow and ice off of the upper surfaces of the wings, fuselage and stabilizers. When the wreckage was examined, it was estimated that the coat of snow, frozen slush and ice on the upper surface of the wings and on the sides of the fuselage varied between 0.5-1.5 cm in thickness. As the pilot retracted the flaps from the takeoff setting, the compacted snow and ice on the upper surface of the wing disturbed the lift enough to induce a stall. The aircraft rolled to the right and lost altitude. The pilot was unable to recover and the aircraft hit the ground at a shallow dive angle and was destroyed. At the ime of impact the trailing edge flaps were in the clean configuration. The Emergency Locator Transmitter (ELT) was activated in the crash. An aircraft accident alarm was immediately sounded. A Border Guard helicopter located the wreckage of the plane approximately half an hour after the accident took place.

The primary cause of the accident was that the pilot executed a takeoff with an aircraft whose aerodynamic properties were fundamentally degraded due to the accumulated ice and snow on the upper surface of the wing. During the initial climb and immediately after flap retraction, airflow separated from the surface of the wing and the pilot did not manage to regain control of the aircraft. The pilot did not recognize the stall and did not act in the manner required to recover from one or, it might be that he had not received sufficient training for such situations.

B3/2005L

Aircraft accident in Jämijärvi 24.7.2005

On Sunday, July 24th 2005 at 13.40 (Finnish time) an aircraft accident occurred near Jämi airfield where OH-SDV of type Rallye Commodore was destroyed. The accident happened during glider towing operation. The pilot of the tow plane was seriously injured in the impact. Accident Investigation Board Finland set 26.7.2005 by its decision number B3/2005L an investigation commission. Investigator Tapani Vänttinen was nominated as the investigator-in-charge and investigator Ismo Aaltonen as a member of the commission. For meteorological issues the commission heared meteorologist Tapio Tourula as a specialist.

The tow plane started towing a glider of type Puchacz from Jämi runway 27. After approximately 90° left turn 2-seater glider climbed to a position, where it lifted the tail of the tow plane up. The tow pilot released the tow line, but due to low altitude he could not recover the aircraft and it crashed into pine trees. After this the glider pilot turned left towards airfield and landed on runway 33 with tow line hanging on the hook.

It emerged during the investigation that for both pilots checking the weather during flight preparation was insufficient. Also they were not able to see approaching rain shower due low position of the take-off point. Due to rain shower the performance of the tow combination was weakened and high humidity caused thick moisture on canopy surface. Therefore the glider lost the forward visibility.

After the tow line release the glider landed on runway 33 without using airbrakes. The cause of the accident was the decision of both pilots to conduct flight in rapidly changing weather conditions. The glider drifted to a position where it lifted the tail of tow plane up. Due to low altitude the tow plane crashed into forest.

The investigation commission recommends that Finnish Civil Aviation Authority would add minimum weather requirement of 8 km visibility and 450 m cloud base to OPS M8-8 (glider demonstration flights to passengers).

B5/2005L

Helicopter accident in Paltamo 2.9.2005

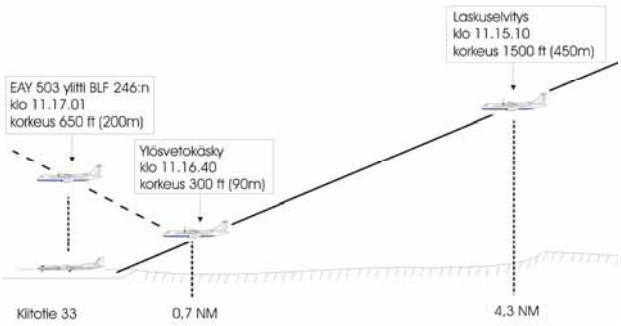
At Paltamo Metelinniemi golf course occurred September 2nd 2005 about 13.30 Finnish time a flight accident, in which a Bell 206B helicopter OH-HLP, owned and operated by First Invest Oy, fell down in a water pool during a photographing flight. Besides the pilot there were two other people in the helicopter, one of which was lightly injured. The helicopter was badly damaged. To investigate the accident the Accident Investigation Board Finland set an investigation board with investigator Juhani Hipeli nominated as its chairman and investigators Antti Kaarnamo and Jari Huhtala as members.

When the accident occurred the golf course routes were being video filmed from the helicopter's left rear seat for a presentation video. The helicopter flew following the right side of the route above the tree tops at about 150–200 ft altitude above ground at a speed of 20–30 knots. The route curves to the left and towards the end to the right. When approaching the route end the pilot felt the helicopter nose unintentionally turning to the right. He tried to recover control of the helicopter with control inputs but the turning to the right continued and the rotation speed increased. The helicopter rotated around its vertical axis an estimated 1.5 to 3.5 revolutions before the landing gear hit the water. The helicopter banked to the left and the main rotor struck into water and then into the left side of the helicopter. Then the helicopter turned upside down so that the landing gear, fuselage bottom and the tail remained partially above water. All three people were rescued by themselves from the helicopter filled with water.

According to the opinion of the investigation board the reason for ending up into an uncontrolled flight state with unintentional rotation to the right around the vertical axis was a loss of effectiveness of the helicopter tail rotor. The low flying speed, sideslip to the left when the right pedal is pushed, turn to the right, relatively high flying weight and tail wind contributed to the loss of effectiveness. The torque, imposed on the helicopter in low speed flight by the main rotor power, is balanced by the tail rotor thrust. The torque, caused by the combined contributions mentioned above, exceeded the tail rotor effectiveness leading to the unintentional rotational motion and loss of control of the helicopter. It also transpired in the investigation that the pilot had incomplete knowledge about the helicopter's handling characteristics and aerodynamics probably due to a deficient training.

The investigation board considers that the basic cause of the accident is the pilot's lacking knowledge about the helicopter's handling characteristics and aerodynamics. The pilot lost control of the helicopter when flying at low speed in tail wind a right turn with sideslip to the left, when due to the combined effects the tail rotor lost its effectiveness. The pilot did not identify the flight state and was not able to hinder the rotational motion around the vertical axis so that the helicopter fell into water. Contributing factors were the pilot's small experience in photographing flights and the tail wind.

The investigation board presents as safety recommendations that Finnish Civil Aviation Administration should take measures to increase knowledge of the reduction of tail rotor effectiveness in helicopter training programs, and that it should check the company's requirements of maintenance and should monitor compliance of the requirements.



B6/2005L

Incident at Kuopio airport 17.12.2005

At Kuopio airport occurred on Saturday December 17th 2005 about 11:17 Finnish time an incident with a Saab 2000 and an ATR 72 aircraft, operated by Blue 1 and Aero Airlines AS airlines respectively. The Saab 2000 with call sign BLF246 taxied out on a runway when the ATR 72 with call sign EAY503 was approaching the same runway having got a clearance for landing. Both aircraft were on scheduled route flights and there were altogether 63 passengers and 8 crew members on board. The Accident Investigation Board Finland set in its decision Nr B 2/2005 L an investigation commission to study the incident. Investigator Juhani Hipeli was nominated as the chairman of the commission and investigator Martti Lantela as a member of the commission.

BLF246 commenced the taxiing from the apron along the taxi way to the holding position F of runway 33 according to the cleareance from the traffic control. Simultaneously the radar controller guided the EAY503, on the way from Helsinki to Kuopio, to an ILS-approach to runway 33. The tower controller lost the eye contact to the airplane due to snow fall already considerably before the holding position. Having got the measured new friction coefficient values for the runway from the friction measuring vehicle, the tower controller read aloud the values for the taxiing BLF246. Due to the ice on the runway and the snow fallen on it the first third of the runway, at the southern end, was very slippery, the friction coefficient had a value of 0,16. On other areas of the runway the braking efficiency was good. Due to the slipperiness the crew of BLF246 renewed the take-off performance review aborting the taxiing slightly before the crossing of taxiway E. When the basis enabling the take-off was cleared up the captain of BLF246 decided to make the take-off from the beginning of runway 33 and continued to taxi towards holding position F. During the taxiing the

crew repeated the procedures for take-off from a slippery runway. The captain of BLF246 taxied, without the co-pilot or he himself noticing it, past holding position F to the take-off position of runway 33, where the co-pilot gave by radio the announcement of being ready for take-off. Because EAY503 had already slightly before got a clearance for landing, the tower controller ordered it to make a missed approach after having checked by radio that BLF246 was waiting at take-off position 33 instead of holding position 33.

In the investigation attention was paid on the rapidly and locally changing weather and the runway conditions. There was the impression that among the natural snow fall there was some fog bank, formed in the artificial snow making at Kasurila ski slope and drifting with the wind to the airfield. Snow and ice crystals falling from the mist cloud worsened locally the visibility. The relatively large changes in the friction coefficient, especially at the southern part of the runway, can be explained by the amount of snow fallen on the ice and possibly also by the type of the snow. The sparse updating of the friction coefficient values in the automatic weather information service of the Terminal Control Area may lead to incorrect information in changing conditions. It also transpired in the investigation that the check list utilized in the cockpit work does not support the crew in remembering the clearance for taxiing and an operative flight plan was not used as support for the memory.

The incident occurred as a result of the increased pilot work load of the BLF246 crew during taxiing. The increased pilot work load was caused by the renewed planning of the take-off. The concentration on the planning led to mishaps in monitoring the taxiing and the radio traffic. Taxiing to the runway in contrast to the clearance of the traffic control was a consequence. EAY503 was approaching the same runway with a clearance for landing.

Contributing factors were the rapidly changing weather and runway conditions. The snow, gathered on the ice on the runway in the intensive snow fall, created a slipperiness that caused the BLF246 crew to recheck the take-off performance still during the taxiing.

The investigation commission recommends that the Civil Aviation Authority takes action to change the traffic control procedures so that the first taxiing clearance for the departing traffic is always given not further than to the runway holding position. Hence taxiing to the runway or crossing the runway would always require a new clearance for taxiing. The investigation commission also recommends that the Civil Aviation authority would require the checklists used in the aircrafts to be revised so, that they would include a check item before entering the runway.

C2/2005L

Forced landing in Sodankylä 28.6.2005

At Tankavaara in Sodankylä community, about 15 km north of Vuotso village happened a flight accident on Tuesday June 28th 2005 at 18.26 Finnish time when the engine stopped during flight on a Cessna A185E float plane with registration sign OH-CDO, that was in private ownership and operated by commercial operator. The Accident Investigation Board Finland set June 30th 2005 through its decision Nr C 2/2005 L an investigation committee with investigator Ari Huhtala nominated as the chairman and Kari Siitonen and Juhani Mäkelä as investigation members. The committee called the commercial pilot and psychologist Matti Sorsa, to become a specialist.

The floatplane OH-CDO was intended to be flown from the lake Iso-Hirvanen, situated south of Äänekoski, to the home base at Inari lake. The take-off took place at 15.07. The route went via Kestilä and Utajärvi to west of Pudasjärvi and further slightly east of Ranua to Kemijärvi. The flight continued east of Pyhätunturi and east of Vuotso village towards Tankavaara. The altitude was 400 meters above ground. North of Tankavaara the engine of the aircraft suddenly stopped. The pilot turned immediately to the left into the direction where he came from, trying to reach towards a landing site at Vuotso channel. Simultaneously the pilot tried to start the engine without succeeding. The pilot had to make a forced landing on the marsh. After touchdown the float supports and wings struck some pine trees growing on the marsh. The nose of the right float hit a turf tuft after which the plane turned over the nose into inverted position. The pilot and the passenger were mildly hurt. The people in the vicinity of the accident site started the rescue actions. It was noted in the investigation, that it is specific for a Cessna A185E aircraft, fitted with floats and an external cargo pack, to be unstable around the vertical axis. It can lead to a situation that the airplane tends to fly in a sideslip consequently increasing the fuel consumption and the remaining reduced amount of fuel floats around in the long wing tanks. The day preceding the flight about 180 liters of fuel were filled into the aircraft wing tanks. Before refueling the pilot had estimated that there was about 60 liters of fuel in the tanks. After the refueling there was about 240 liters of fuel in the wing tanks. Moreover 57 liters of fuel were placed in three fuel cans into the external cargo pack underneath the fuselage for a possible refueling during a landing stop. However, the pilot did not check the actual amount of fuel in the wing tanks before the flight. During the flight the pilot monitored the fuel consumption. He thought about a landing stop for refueling, but based on his experience he relied readings off the fuel gages, that indicated that there should have been a sufficient amount of fuel for continuing the flight. The pilot had a strong opinion, based on his experience, that the amount of remaining fuel would be considerably more than it actually was.

Also he had relatively limited experience about long cross-country flights and he did not use a flight plan form for preparing the flight. With the help of a form he could have noted, that the amount of fuel now filled up would definitely have required a landing stop for refueling. The investigations did not show any technical defect in the aircraft.

The primary cause of the accident was the flight, carried out without a landing stop for refueling. The flight was stopped when the engine died, caused by a disturbance in the fuel supply to the engine. In spite of his efforts the pilot did not succeed in keeping the engine going and he had to make a forced landing on the marsh.

The accident investigation board does not present any safety recommendations.

C4/2005L

Helicopter accident in Hailuoto 19.8.2005

A flight accident happened in Hailuoto community near Oulu, on Friday August 19, 2005, at approximately 20.35 Finnish time. The accident occurred for a privately owned Robinson R22 BETA helicopter, registration OH-HME. The Accident Investigation Board Finland appointed August 23, 2005, in its decision C 4/2005 L, an investigation commission. Investigator Ari Huhtala was nominated as the investigator-in-charge and investigators Kari Siitonen and Juhani Mäkelä as team members. The investigation commission called Pentti Törrönen, chief of Helitour's flight operations, as a specialist.

Approximately 20.20, the pilot of the helicopter and the accompanying passenger prepared for a local flight in the vicinity of Hailuoto. At 20.35, the pilot took with the helicopter to hovering approximately one meter above the ground level and got a feeling that the helicopter does not respond to the control inputs and that he was loosing control of the helicopter. Unexpectedly the helicopter rotated vigorously to the right around its vertical axis simultaneously banking to the left and fell on the beach. The main rotor blades struck into the dune and one of the blades broke off and flew about 40 meters from the helicopter. The helicopter was considerably damaged. The pilot and the accompanying passenger were lightly injured. There were no eyewitnesses for the accident. People at the nearby summer cottages heard the start of the helicopter engine and

slightly later the changing of the engine sound. Some of the people had seen the flying rotor blade, after which they ran to the beach and noticed that the helicopter was lying with left side down on the beach, the nose towards the sea. Together with the pilot they helped the passenger, who was stuck to the cockpit, out of the helicopter and called the alarm center. The pilot and the passenger received first aid for their wounds by the people that had arrived to the scene.

The helicopter was at maximum take-off weight and controllability at take-off required larger than normal control inputs. The possibly too large control inputs to the left already before the take-off may have led to a situation, in which the helicopter immediately after leaving the ground has departed in the direction specified by the control inputs. The large corrective control inputs to the right, possibly made by the pilot, combined with the higher than normal torque moment, caused by the high take-off weight, may have led to strong swinging to the right. The rotating motion and low flying altitude of the helicopter, combined with loss of altitude, have led the left landing gear striking to the ground on its side. The collision has caused a so called dynamic collapsing to the left. Based on the investigations, no technical fault was noticed, that could have caused the accident.

The key event leading to the accident was the loss of control and the following collapsing of the helicopter to the left hand side. The too large control inputs, made by the pilot, were an immediate cause. A contributing factor may have been the alcohol, which was present in the pilot's blood.

The investigation commission does not make any safety recommendations.

C5/2005L

Passenger aircraft fuel leak during flight 15.8.2005

On August 14 to 15 2005, between 20.38 and 05.55 UTC, an incident occurred on a scheduled flight from Helsinki to Peking, when fuel started to leak from a joint in the fuel line of the left engine of an MD-11 aircraft. The aircraft, registration number OH-LGF, was owned by McDonnell Douglas Dakota Leasing, Inc and operated by Finnair Oyj. On August 24 2005, in its decision C 5/2005 L, the Accident Investigation Board Finland decided to conduct an investigation into the incident. Investigator Tapani Vänttinen was nominated as chairman and investigator Markus Bergman as a member of the investigation commission.

The left engine of the three-engine MD-11 passenger aircraft had been replaced in June 2005. During the flight fuel started to leak from the engine which had been replaced. The flight was, in spite of the leak, continued to the scheduled destination without shutting down the engine. In Peking the reason for the leak was found, the leaking joint was tightened and the aircraft returned normally back to Helsinki.

The investigation revealed that the instructions used in the installation of the main fuel hose of the engine were partly inaccurate and partly incomplete. Furthermore, the design of the joint between the main fuel hose and the engine pylon was unsatisfactory. In addition, the actions performed by the flight crew in the fuel leak situation were inadequate.

The cause of the incident was primarily an error in installation of the main fuel hose, directly causing the fuel leak, and secondarily the fact that the engine was kept running throughout the flight, in spite of the leak. Other contributing factors to the incident were the inaccuracy of the instructions used in the installation of the main fuel hose, the structure of the joint between the main fuel hose and the engine pylon and the fact that the flight crew had not practised fuel leak situations during training.

The investigation commission issued three safety recommendations. The aircraft manufacturer and the airline should revise the instructions used in installation of the main fuel hose of MD-11 aircraft engines. The aircraft manufacturer should modify the structure of the joint between the main fuel hose and the engine pylon. The airline should review its flight crew training programs to ensure that they adequately prepare pilots for fuel leak situations.

C7/2005L

Falling of passenger stairs at Rovaniemi airport on 14 December

On Wednesday 14 December 2005 at 10.17 UTC, an Airbus A321 airliner registered G-OOAH landed at Rovaniemi airport, Finland. The aircraft was operated by First Choice Airways on a charter flight from Bristol, Great Britain, with the call sign FCA536C. The aircraft was taxied to stand number nine guided by Rovaniemi airport staff. At 10.32.40, about eight minutes after the aircraft was stopped, it began to move backwards. The open aircraft door caused the passenger stairs to fall, and four persons were slightly injured.

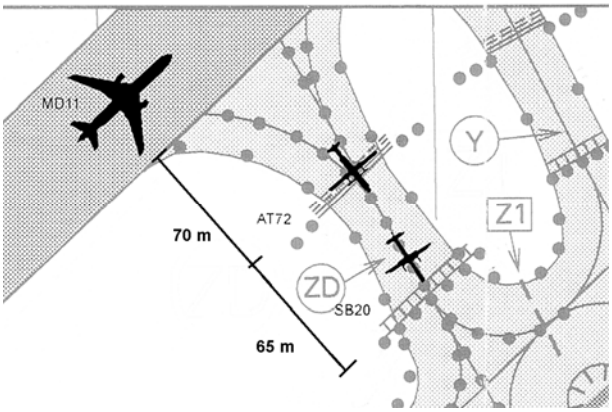
On 15 December 2005, the Finnish Accident Investigation Board decided to set up an investigation commission to investigate the incident (decision No. C 7/2005 L). Aircraft Accident investigator Jussi Haila was appointed as investigator-in-charge and Aircraft Accident Investigator Kari Siitonen as a member of the commission. The British accident investigation authority was also informed of the investigation.

After the aircraft was stopped, the ground handling staff had placed wheel chocks in front of and behind the left wheel of the nose landing gear and the left main landing gear, and pushed the passenger stairs to the front passenger door L1. The passengers started to disembark using the stairs. The co-pilot came out of the aircraft and showed a sign to the captain on the flight deck as agreed, after he had checked that the wheel chocks were in place. The captain had risen from his seat and released the parking brake. On the right side of the aircraft there was a refuelling truck, the driver of which had attached the refuelling hose to the coupling on the right wing. The co-pilot entered the necessary figures on the aircraft refuelling panel and gave the truck driver a permission to start refuelling. A forklift truck stood in front of the forward cargo door, and a baggage conveyor belt had been placed at the aft cargo door. The ground staff had started to unload the baggage. A water truck had been driven at the left side of the aircraft, under the aft fuselage. Its driver had attached the water hose into the coupling on the aircraft.

At 10.32.40, the ground staff noticed that the aircraft was moving backwards. The driver of the refuelling truck noticed that the refuelling hose was tightening and released the safety switch in his hand, which stopped the fuel flow. However, the hose was torn off from the wing, breaking the attachment. The loading supervisor and the co-pilot tried to show to the captain on the flight deck that he should engage the parking brake, but the captain was not on his seat. He was standing in the rear of the flight deck with his face towards the cabin. After hearing some noise from the passenger door he turned towards the flight deck and engaged the parking brake. At the same time, air traffic control announced by radio that the aircraft was moving. The driver of the refuelling truck and one loader had gone to the left side, crossing below the aircraft while it was moving, and tried to push wheel chocks behind the left main landing gear wheels, but the chocks slid on the icy surface and did not stop the aircraft from moving. It only came to a stop when the captain engaged the parking brake. As the aircraft was moving backwards, the door opening moved behind the passenger stairs and the handrail of the stairs got stuck to the passenger door, which caused the stairs to fall down. The other handrail slammed the passenger door and damaged it. There were 7-10 persons on the stairs when they began to fall down. The others managed to get away from the stairs, but a family with two children under 10 years of age, which were at the upper end of the stairs, fell down with them and sustained minor injuries.

The aircraft started to move because the surface at the stand was sloping. The angle of slope exceeded the maximum allowed in the standards for construction of aircraft stands. The wheel chocks could not keep the aircraft in place, but slid in front of the turning wheels due to the slippery surface and the structure and material of the chocks. The captain used the parking brake in accordance with the cockpit procedure intended for freezing conditions. However, the aircraft manufacturer has also published a standard procedure which allows the parking brake to be engaged on a slippery stand. After the incident and during the investigation, the airline has already changed the instructions given to its pilots.

The investigation commission issued eight safety recommendations



C1/2006L

Incident at the intersection of taxiway and runway 2.2.2006

On Thursday February 2nd 2006 at 16:10 UTC (Finnish time -2 hours) occurred at Helsinki-Vantaa airport an incident with FIN095 (MD11 operated by Finnair Oyj) departing on a regular flight from Helsinki to Bangkok and EAY230 (AT72 operated by Aero Airlines As) that had landed after a regular flight from Turku. Because a preceding taxiing BLF282 (SB20 operated by Blue 1 Oy) had stopped, EAY230 was compelled to stay too close to the runway 04R while FIN095 was performing the take-off.

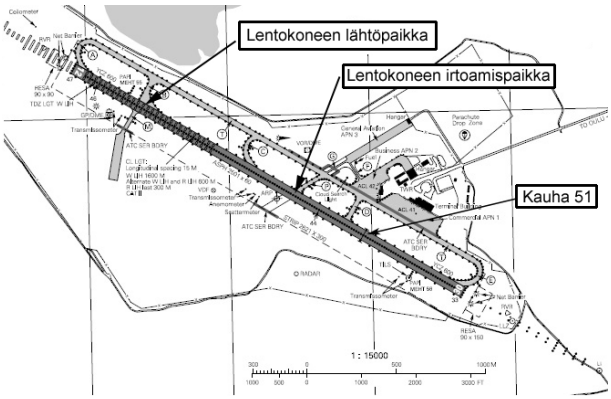
The Accident Investigation Board Finland decided February 7th 2006 to investigate the event and nominated air-traffic controller Erkki Kantola as the board chairman and airline pilot Markus Bergman and air-traffic controller Pekka Orava as board members.

Runway 04L was in use for landings and 04R for take-offs at Helsinki-Vantaa airport. BLF282 took contact with the control tower (TWR west) and got clearance for landing. After the landing it was given instructions to taxi to holding position PD to wait for crossing of runway 04R. The next approaching EAY230 got the clearance for landing and after the landing similar instructions to wait for the crossing of runway 04R. Both aircraft acknowledged the clearances properly. The control tower (TWR east) managed the departing traffic from runway 04R and the aircraft, which had landed, were transferred to the frequency of TWR east for permission to cross the runway in question. Due to departing traffic both aircraft were compelled to wait at PD and then successively got clearances to cross runway 04R to holding position ZD and to contact traffic control for taxiing (GND). The frequency for taxiing control was busy and the taxiing aircraft did not immediately get contact with it for a further clearance, but they had to stop on taxiway ZD so that EAY230 taxiing behind was partially inside the area between the sign for the holding position and the runway. Consequently the runway was not clear in a manner required for giving a clearance for take-off. The tower controller (TWR east) did not notice this but gave FIN095 a clearance for take-off from runway 04R. Consequently, during the take-off run FIN095 passed EAY230 closer than the required separation minimum.

The incident occurred because the tower controller gave a clearance for take-off from runway 04R without noticing that the runway was not clear according to the requirements. Contributing factors were, that BLF282 and EAY230 did not directly get contact at the taxiing control frequency, but had to stop at the holding position ZD given as a limit for the clearances, for which reason the taxiing of the aircraft did not proceed in a way expected by the tower controller. Besides the

controller's visual cues were hampered by snowfall, darkness and a vertical column of the control tower structure.

The investigation board gave no safety recommendations.



C2/2006L

Incident at the runway of Oulu airport 9.2.2006

On Thursday February 9th 2006 at 08:37 Finnish time an incident occurred at Oulu airport in which the runway safety margins became smaller than allowed about 660 meters from the threshold of runway 30 at the arrestor cable. A general aviation category airplane OH-KJJ (TB 20), departing from Oulu to Helsinki, passed at an altitude of 150 to 400 feet over a tractor on the runway.

The tractor in use by Air Force was cleaning the arrestor cable apparatus when Air Traffic Control gave a clearance for take off for the aircraft taking off from runway 12. The driver of the tractor was at this time outside the tractor cleaning the arrestor cable area at the runway periphery. The Air Traffic Controller noticed the occurrence immediately when the aircraft was in the air by the tractor.

The safety margin applicable at the runway was not followed, but the performance of the light aircraft was so good that no clear situation of danger arose.

The cause of the incident was the controller's mistake. He forgot to secure that the runway was clear of obstacles over its entire length when he gave a clearance for take off for the departing aircraft. Contributing factors were substantial traffic of land vehicles and on the radio due to the morning snow fall and the fact that the controller's work shift was the first operative work shift after a long training period.

C3/2006L

Incident involving an airliner landing at Helsinki-Vantaa airport on 20 February 2006

An incident occurred at Helsinki-Vantaa airport in Finland at 11:36 on 20 February 2006. At this time, two of the four main landing gear tyres burst as the aircraft flying the scheduled Finnair Oyj flight from Warsaw to Helsinki landed. Accident Investigation Board Finland (AIB) decided to appoint an investigation commission, C 3/2006 L, for this incident. Air Accident Investigator Markus Bergman was named investigator-in-charge accompanied by investigator Tapani Vänttinen as member of the commission.

As the aircraft was approaching Helsinki, the pilots inadvertently applied the emergency/parking brake lever instead of the speed brake lever. Even after the lever was released, one of the two parking brake circuits in the aircraft malfunctioned and retained pressure. The result of this was that the outermost tyres on the main landing gear burst during the landing roll. Apart from the damaged tyres, the incident did not result in damage to the aircraft or injuries to people.

The investigation revealed shortcomings in the aircraft's emergency/parking brake system, the indication and warning system as well as with airline regulations and pilot action.

The direct causal factor of the incident was a malfunction in the emergency/parking brake system. Contributing factors include the pilots' error as they applied the speed brakes, the fact that the aircraft's indication and warning system did not provide clear enough information to the pilots about the malfunction and the fact that the pilots forgot that the emergency/parking brake telltale lamp was on. The emergency/parking brake system had functioned abnormally twice before but this had been reported in the aircraft's technical log book by using a technical remark rather than a malfunction report, which was also a contributing factor to the incident as a remark did not require the technical personnel to initiate immediate fault isolation activities.

The investigation commission issued three recommendations. A recommendation was given to the aircraft manufacturer for them to redesign the emergency/parking brake system so that it be impossible for the emergency/parking brake to retain pressure when the brake lever is disengaged in the air and/or to publish a procedure according to which pilots are able to depressurise the emergency/parking brake system aloft without compromising flight safety. A second recommendation for the aircraft manufacturer was that they also redesign the emergency/parking brake warning and indication system so as to provide sufficiently detailed information to pilots of system

status and possible faults when airborne. The third recommendation was given to the airline. It was for them to issue unambiguous instructions on how to report aircraft malfunctions and how to enter technical remarks.

C4/2006L

Engine failure and emergency landing at Joensuu airport on 24 March 2006

On Friday 24 March 2006, at approximately 17:10 local time, an incident occurred at Joensuu airport, when a Cessna 172P aircraft, owned by Tervalentäjät ry and equipped with a diesel engine, was damaged in an emergency landing. The pilot, who was alone in the aircraft, sustained only minor injuries.

On 4 April 2006 the Accident Investigation Board Finland (AIBF) appointed in its decision no. C 4/2006 L an investigation commission with Chief Air Accident Investigator Esko Lähteenmäki as investigator-in-charge and investigators Hans Tefke and Tuukka Takala as members of the commission.

Before the incident flight a 200 hour scheduled maintenance check and annual inspection was performed on the aircraft. As a part of the maintenance work, the oil pressure sensor was replaced. Replacing the sensor required either the removal of the flexible intake air tube located on top of the engine or at least opening of the tube attachment clamp at the front end (intake manifold end). The mechanic opened the front end attachment and changed the sensor. After doing this he proceeded to another aircraft and asked another mechanic to bind the sensor wires and reattach the open end of the tube. Whilst attaching the tube the second mechanic noticed tension forming in it, so he loosened the aft end attachment of the tube (the attachment is an ordinary worm-drive clamp). After assembly the aft tube attachment was left untightened. After completion of the work, the first mechanic visually checked the assembly, and the tube appeared to be correctly attached. A ground test run was performed on the engine and the aircraft was released to the pilot.

According to his account, the mechanic had performed an engine test-run using the FADEC test routine. The use of maximum power during the test run was brief due to the apron surface being so slippery that the aircraft did not hold still when maximum power was applied. The engine maintenance checklist state that maximum power should be applied for 30 seconds. According to the

engine manufacturer, application of maximum power for the time specified is important and it enables the opening and the consequent detection of possible loose intake air tube attachments.

During takeoff, as the aircraft was climbing at an altitude of approximately 300 ft, the loose intake tube attachment opened completely, the flexible rubber tube was sucked in and blocked and the engine stopped instantly. The pilot performed an emergency landing into the front sector touching down into snow outside the runway area. During the flare the aircraft rolled over. The engine stopped during the initial climb after takeoff. The runway length remaining was insufficient for landing because the takeoff had been initiated from the runway midpoint. The engine stopped due to the opening of the intake tube attachment which had been left loose during maintenance. The loose attachment was not detected in the final inspection or during the engine ground test run.

The investigation commission made two safety recommendations. The commission recommended that the engine manufacturer and maintenance personnel should seal tube attachment clamps using paint marking or safety-wire, enabling an easy visual detection of opened attachments in the final maintenance inspection. The investigation commission also recommended that takeoffs with single-engine aircraft be performed using the entire takeoff distance available, from the departure end of the runway, even in cases where the minimum takeoff distance requirement indicated in the aircraft manual is less than the runway length available.

Recommendations

A total of 38 recommendations were given by aviation accident and incident investigations completed in 2006, 9 of which were issued on the basis of a category D investigation. The 2006 recommendations were directed at the following recipients:

Finnish Civil Aviation Administration (Finavia)	4
Finnish Civil Aviation Authority	7
Finnish Aeronautical Association	-
Foreign aviation authorities	1
Airports	10
Airport services	3
Government institutions	-
Airlines / flight schools	5
Pilots	-
Aircraft manufacturers	6
General recommendations	2
Investigations with no issued recommendations	3

The implementation of recommendations is monitored by means of a special monitoring programme. The programme covers all recommendations issued after the year 2000. The recommendations monitoring showed that of the 209 recommendations issued during 2000–2005, around 50% had been carried out by the end of 2006. Approximately 8% of the given recommendations were of too general a nature to enable determination of their implementation status. The decision was taken to not carry out some 15% of the recommendations, and the consideration or

implementation of around 27% of recommendations was ongoing. The implementation status was known for approximately 78% of the 247 recommendations issued during 2000–2006.

Aviation accident investigations 2002–2006

Accidents investigated	2002	2003	2004	2005	2006	TOT
Serious accidents (A-investigations)	-	-	-	-	-	**0**
Other accidents (B- and C-investigations)	15	12	12	13	10	**62**
TOTAL	**15**	**12**	**12**	**13**	**10**	**62**
Other (D-investigations)	-	-	15	22	15	**52**

Investigations as per type of accident/incident	2002	2003	2004	2005	2006	TOT
Accidents	4	2	6	7	3	**22**
Damages	5	3	1	1	3	**13**
Losses of separation	5	5	1	-	3	**14**
Other	1	2	4	5	1	**13**

Investigations as per aviation category	2002	2003	2004	2005	2006	TOT
Commercial aviation	9	8	3	8	4	**32**
Other	6	4	9	5	6	**30**

Investigations as per aircraft category	2002	2003	2004	2005	2006	TOT
Commercial aircraft	7	8	3	5	3	**26**
General aviation aircraft, helicopter	6	3	4	6	3	**22**
Hobby and ultra-light aircrafts	-	-	-	-	1	**1**
FAF aircraft	2	1	2	1	2	**8**
	-	-	3	1	1	**5**

Personal injuries		2002	2003	2004	2005	2006	TOT
Deceased	Pilot	2	1	3	2	3	**11**
	Passenger	-	3	1	12	1	**17**
	Total	**2**	**4**	**4**	**14**	**4**	**28**
Seriously injured	Pilot	2	1	1	2	-	**6**
	Passenger	-	1	1	1	-	**3**
	Total	**2**	**2**	**2**	**3**	**-**	**9**
Slightly injured	Pilot	-	1	-	1	-	**2**
	Passenger	-	1	-	3	-	**4**
	Other	-	-	-	-	-	**-**
	Total	**0**	**2**	**0**	**4**		**6**
TOTAL		**4**	**8**	**6**	**21**	**4**	**43**

RAIL

In 2006 the Accident Investigation Board of Finland commenced four level C investigations into rail transport accidents. The investigations included two freight train derailings, one freight train collision through a rail barrier and one collision between a shunting unit and a lorry resulting in injury of the shunting foreman. The ongoing safety study into level-crossing accidents also continued during the year. The study investigated 6 level-crossing accidents, one of which involved a fatality.

Eight category C investigations were completed in 2006. One of the investigations was commenced in 2002, three in 2004 and the remaining four in 2005. Six of the cases involved derailings, one a level-crossing accident involving a goods wagon and one, commenced in 2002, was an investigation into faulty safety equipment.

A total of 8 new recommendations were issued in 2006. The annual meeting on the implementation of recommendations was held on 14 February 2006 together with representatives of the VR Group and the Ministry of the Interior, and on 14 March 2006 with the Finnish Rail Administration (RHK) and the Finnish Rail Agency.

Rail accident investigators participated in two meetings of the Nordic Rail Accident Investigators (NRAI) held in Stockholm in June and Lillehammer in November. Examples of accident investigations in different countries, the recommendations issued and their implementation methods were presented at the meetings. In addition, the meetings addressed the training of rail accident investigators, legislative problems related to joint investigations and the gathering of specialist information from investigators from the different Nordic countries. Furthermore, the Chief Rail Accident Investigator participated in the meetings of the Nordic working group for rail accident investigator training.

The Chief Rail Accident Investigator also participated in meetings held by two working groups and one ad-hoc group of the European Railway Agency (ERA). Meetings of the National Investigation Bodies (NIB) were held in January, June, October and December in Lille, France. The meetings of the ad-hoc group addressing the instructions of the NIB's annual report were held in October and December in Lille. The meetings of the working group addressing the definitions and criteria related to railway safety were held in March, September and December also in Lille. The working groups will reconvene in 2007.

The Chairman and one member of the investigation commission for the level-crossing safety study participated in the International Level Crossing Symposium held in September in Montreal, Canada.

Furthermore, rail transport accident investigators participated in several training meetings and seminars held in Finland. Rail accident investigators gave lectures to its partners on accident investigation and provided workplace instruction and orientation for new, part-time investigators.

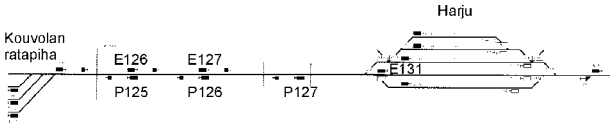
Investigations commenced in 2006

Identifier	Date	Grnds for inv.	Title of the investigation
C1/2006R	20.3.2006	iii	Derailment of locomotive and two wagons at Luumäki
C2/2006R	1.6.2006	iii	Locomotive driving trough the rail barrier
C3/2006R	13.7.2006	iii	Derailment of five freight wagons between Tuupovaara and Heinävaara
C4/2006R	15.12.2006	iii	Collision of shunting unit and articulated vehicle that injured member of train crew in Sörnainen

Grounds for investigation: i = Rail Safety Directive, ii = National law (exclusive of that specified in Article 2 of Section 2 of the Directive), iii = National law, grounds other than the Directive

Investigations completed in 2006

Identifier	Date	Grnds for inv.	Title of the investigation
C9/2002R	29.6.2002	iii	Signal malfunctioning on Kouvola-Harju section of line
C2/2004R	15.4.2004	iii	Methanol carrying wagons derailing on Kaukomarkkinat Oy's track at Hamina port
C4/2004R	11.5.2004	iii	Freight wagons derailing on Pieksämäki railway yard
C10/2004R	20.7.2004	iii	Derailment of two freight cars in Kouvola
C1/2005R	10.3.2005	iii	Collision of shunting unit and articulated vehicle in Mäntyluoto
C3/2005R	27.4.2005	iii	Derailment of a Russian freight car loaded with pellets in Eskola
C4/2005R	28.4.2005	iii	Derailment of five freight train cars in Heinävesi
C6/2005R	30.8.2005	iii	Liquid gas wagon derailing at Raahe



C9/2002R

Signal malfunctioning on Kouvola-Harju section of line on 29 June, 2002

On 29 June, 2002 the signalling equipment displayed a malfunctioning on the Kouvola–Harju section of line in Finland. The remote control operator had set the route for a train travelling from Harju toward Kouvola; nevertheless the first line block signal on the opposite running direction, i.e. from Kouvola, simultaneously displayed a "proceed" aspect.

The malfunctioning of the signal was due to a deficient signalling equipment program that manifested its shortcomings in a two-way exploitation of the connection. According to laboratory tests conducted by the equipment supplier, the signal control module displayed a malfunctioning if the data transmission connections rapidly switch over from the main connection to the back-up connection and back again.

The equipment supplier has remedied the shortcoming and the Finnish Rail Administration has approved the repair measures and the operating reliability of the equipment in terms of safety risks. Moreover the Accident Investigation Board of Finland recommends that the liability for the maintenance of signalling equipment be entirely bestowed on one single party.

C2/2004R

Methanol carrying wagons derailing on Kaukomarkkinat Oy's track at Hamina port on 15 April, 2004

On Thursday April 15, 2004, an incident took place at Hamina port: three methanol carrying Russian tank wagons derailed. As a result, the track was damaged over a length of about 50 metres.

The incident was caused by the poor condition of the track owned by Kaukomarkkinat Oy. In fact the welding of the j-form rail fastenings made of flat bar iron proved deficient, as only the ends of the fastenings had been welded to the base plates. The detaching of a few fastenings generated a chain reaction that resulted in the detaching of the outer curve fastenings over a track length of about 40 metres and in a widening of the track under the wagons.

In order to prevent similar accidents in the future, the Accident Investigation Board of Finland recommends that the condition of such privately-owned tracks and turnouts on which dangerous goods are carried be inspected once a year by a competent expert. Moreover it is recommended that the Railway Technical Rules and Regulations (RAMO) include instructions on rail fastening by means of a j-form flat bar iron.

C4/2004R

Freight wagons derailing on Pieksämäki railway yard on 11 May, 2004

On Tuesday May 11, 2004 the fifth and sixth wagons of freight train T 2211A travelling from Kouvola to Pieksämäki, derailed on Pieksämäki railway yard. The bogies of the sixth wagon were badly damaged and track was also damaged over a distance of about 80 metres.

The incident was caused by the poor condition of the track. The wooden sleepers were in poor condition and lateral deflections had generated at the rail joints. Another factor having contributed to the incident was the carriage of rails that the train was performing. In fact the first three wagons of the train that were carrying rails may have generated torsion in the rail of the outer curve and hence when proceeding, they had probably deteriorated the strength of the track.

After the incident at the incident site, about 200 new sleepers in replacement of the old ones were installed in the track and the track was reinforced and reballasted.

The Accident Investigation Board of Finland does not consider it expedient to issue any recommendations.

C10/2004R

Derailment of two freight cars in Kouvola on 30 July, 2004

On Friday July 30, 2004 at 3.12 pm, two wagons belonging to a freight train were derailed at the western end of the Kouvola passenger traffic railway yard. The freight train was travelling from the direction of Lahti. Besides the derailed wagons, three points and 60 metres of track were damaged. The accident prevented all traffic from Kouvola towards Lahti and Mikkeli until 5.45 pm. Repairing the damage caused by the accident cost over € 60,000.

The accident was caused by longitudinal forces, created by the braking freight train, which lightened the vertical load of the rear bogie of the Russian wagon situated on top of a discontinuity point on the running surface of the crossover. In addition, wear on the discontinuity points on the running surface of the crossover, the heavy brakeless wagon behind the light wagons and the train's uneven weight distribution contributed to the derailment.

Because this type of derailment is statistically rare and since locomotive engineer training covers longitudinal forces, the Accident Investigation Board of Finland does not make any new recommendations, instead issuing a reminder that locomotive engineer training should emphasise risk of derailment at curves and points.

C1/2005R

Collision of shunting unit and articulated vehicle in Mäntyluoto on 10 March, 2005

An accident took place on March 10, 2005 at a level crossing in Mäntyluoto. A shunting unit collided with an articulated vehicle crossing the tracks. The engine of the shunting unit was derailed and the articulated vehicle was damaged beyond repair. In addition, the level crossing and track equipment suffered minor damage.

The accident occured when the shunting unit was returning to Mäntyluoto from a wagon-weighing assignment. At the level crossing of the road leading to the Kemira Pigments Oy plant area, the shunting unit collided with the articulated vehicle, which had simultaneously entered the crossing. The driver of the articulated vehicle had time to notice the shunting unit approaching behind the cover of trees and to apply the brakes, but was unable to prevent the collision. The articulated vehicle collided with the right side of the engine and slid into a ditch running along the bank.

Two factors were crucial to the accident: the driver's intention not to stop at the level crossing, and defects in the braking system of the articulated vehicle which weakened the effect of the brakes. Two defects affected the brakes of the articulated vehicle simultaneously at the time of the accident, which caused the behaviour of the vehicle upon braking to surprise the driver. On account of the accident, the Accident Investigation Board recommends enhancing the maintenance of the brakes of articulated vehicles and supervision thereof.

C3/2005R

Derailment of a Russian freight car loaded with pellets in Eskola on 27 April, 2005

An accident took place in Kannus at the Eskola yard on Wednesday 27 April 2005 at 1.47 am, where the last wagon of a train loaded with pellets, travelling from Vartius to Kokkola, became derailed and detached from the train. The train had three engines and 29 Russian wagons loaded with pellets.

The accident happened when the train arrived to undertake a coupling while in motion on track three, at which point the last wagon became derailed on the outside curve and detached from the train. There were no personal injuries. Approximately ten metres of rail and railway equipment were damaged. The derailed wagon was also damaged. The accident was caused by the stiffness of the Russian Vok-type wagon's bogies, the screw attachment of the rails, the wooden sleepers and their condition, as well as the rail type and the wear on the rail on the outside curve. The stiffness of the bogies was due to wear and lack of greasing in the pivots. The worn K43 rail attached with screws to slightly worn wooden sleepers allowed the momentary widening of the rails as the bogies broke. When this happened, the space between the rails became large enough to allow the wheels on the inside curve to slip between the rails. And after that the wheels on the outside curve rose over the rail, derailing the wagon.

Worn pivots pose a direct derailment risk on worn rails, as well as an indirect one through premature wear on the wheels. Therefore the Accident Investigation Board reiterates recommendation S58, given in investigation report C 4/1996 R and reiterated in reports C 37/1997 R and C 4/2003 R The condition of the pivots of Russian wagons snd their greasing should be ensured. C4/96R/S58 Because the condition and greasing of pivots are difficult to control when undergoing border checks, the pivots of Russian wagons should be greased every time the bogies are detached from the wagon in Finland, for example to change the wheel set. The Russian party should, furthermore, be informed of the problems caused by stiff pivots. As the problem of stiff pivots is ongoing, the Rail Administration should continue its attempts to find a system to measure the stiffness of pivots at border crossing points. In addition, any pellet wagons with stiff pivots should be directed away from the third track of the Eskola yard. The third track has wooden sleepers and the rails are fastened with screws.

C4/2005R

Derailment of five freight train cars in Heinävesi on 28 April, 2005

On Tuesday May 11, 2004 the fifth and sixth wagons of freight train T 2211A travelling from Kouvola to Pieksämäki, derailed on Pieksämäki railway yard. The bogies of the sixth wagon were badly damaged and track was also damaged over a distance of about 80 metres.

The incident was caused by the poor condition of the track. The wooden sleepers were in poor condition and lateral deflections had generated at the rail joints.

Another factor having contributed to the incident was the carriage of rails that the train was performing. In fact the first three wagons of the train that were carrying rails may have generated torsion in the rail of the outer curve and hence when proceeding, they had probably deteriorated the strength of the track.

After the incident at the incident site, about 200 new sleepers in replacement of the old ones were installed in the track and the track was reinforced and reballasted.

The Accident Investigation Board of Finland does not consider it expedient to issue any recommendations.

C6/2005R

Liquid gas wagon derailing at Raahe on 30 August, 2005

On Tuesday 30 August, 2005, the rear bogie of a wagon loaded with propane gas derailed on Raahe freight yard. The wagon in question was the sixth wagon of the train and the second one of a group of six propane gas wagons. The wagon derailed when the train was being pulled from a track to another track. No personal injury was caused. The derailed bogie of the derailed liquid gas wagon and its wheelsets were damaged. The frame beam of the wagon defleated and the rear-end traction equipment was damaged. One side buffer in the front end of a liquid gas wagon that was located behind the derailed wagon, as well as its traction equipment and brake conduit were damaged. The western junction track was damaged over a length of about 30 meters from derailing turnout onwards. The eastern track was reopened for traffic the same evening while the western track had to wait yet three days. The total costs generated by the incident amounted to about € 29,000.

The derailing of the bogie of the wagon resulted from a turnout position with both blades slightly open, when the wheelsets of the bogie entered the turnout. Therefore both wheel flanges slipped between the blade and the rail. The turnout had probably failed to be turned and the point had been trailed when the wagons were pushed toward the trailing point at a low speed, and hence the turnout remained in an intermediary position. When the pulling of the wagons was commenced, the turnout started to return to its initial position and when the wheels of the third bogie entered the turnout, it had assumed an intermediary position that allowed both wheels to penetrate between the blade and the rail. The turnout having probably failed to be operated implies a human error, to which several simultaneous stress factors contributed. Moreover the system in no way prevented the performance of shunting movements while the turnout featured an erroneous or intermediary position.

Following a derailment having occurred on 5 September, 2005, a feedback meeting was held by VR, the rescue services and the police, and a decision was made to update VR's Raahe alarm and emergency notice forms and to reduce shunting work at Raahe for trainsets with liquid gas wagons.

In order to prevent similar accidents in the future, the Accident Investigation Board of Finland recommends that communications, also to Rautaruukki works, concerning rolling stock movements be operated by such a radiophone connection that VR uses in shunting work and that is recorded in a speech register. The Board also recommends that a system be designed for the safety control of manually operated turnouts, as well, so as to emit a warning signal whenever a turnout

features an erroneous position and eventually so as to prevent any entry to a turnout in an erroneous position, and that shunting work for wagons carrying dangerous goods be prohibited on marshalling yards that are not equipped with a system controlling the position of the turnouts.

Recommendations

A total of 8 new recommendations were issued in 2006. Of these, 4 were issued to the Finnish Rail Administration, 1 to the Finnish Rail Administration, VR Group and the Ministry of Transport and Communications, 1 to the Ministry of Transport and Communications and 1 to the Police Department of the Ministry of the Interior. The recommendations apply to point and track condition inspections, instructions for track attachment using J-fastenings, monitoring of the operation of licensed brake system repair shops, condition monitoring of the brakes of heavy road vehicles, safety equipment maintenance responsibility, navigation related communications, monitoring of manually operated railway points and shunting of dangerous goods wagons. The recommendations can be broken down per target category as follows:

Rolling stock	-
Track equipment	1
Traffic control equipment	1
Operating directions	6
Rescue operations	-

The 2006 recommendation implementation monitoring meetings found 11 previously issued recommendations to have been implemented. Furthermore, it was established that the distancing recommendation for mobile work machines operating at railway work sites will not be carried out. It was established that the recommendation concerning the identification vest regulation for personnel operating at accident sites cannot be implemented in its presented form, as different organisations already use their own forms of identification.

At the end of 2006 the total number of issued recommendations was 208, of which 128 (63%) had been verifiably implemented.

Implementation of recommendations during 2002–2006

Recommendation issued		**Recommendation implementation status**					
		Implemented		**Ongoing**		**Not to be implemented**	
Year	**[No.]**	**[No.]**	**[%]**	**[No.]**	**[%]**	**[No.]**	**[%]**
2002	4	0	0	3	75	1	25
2003	7	3	43	4	57	0	0
2004	10	1	10	9	90	0	0
2005	6	1	17	5	83	0	0
2006	8	0	0	8	100	0	0
TOTAL	**35**	**5**	**14,3**	**29**	**82,9**	**1**	**2,9**

Rail investigations in 2002–2006

Accidents investigated		2002	2003	2004	2005	2006	TOT
Serious accidents (A-investigations)	Collision	-	-	-	-	-	**0**
	Derailment	-	-	-	-	-	**0**
Other accidents (B- and C-investigations)	Collision	3	2	1	2	2	**10**
	Derailment	4	8	6	8	2	**28**
	Occupational accident	-	-	1	-	-	**1**
Incidents (B- and C-investigations)		4	1	2	-	-	**7**
TOTAL		**11**	**11**	**10**	**10**	**4**	**46**
Other (D-investigations)		-	-	-	-	4	**4**
Safety studies (S-investigations)		-	-	-	1	-	**1**

Personal injuries		2002	2003	2004	2005	2006	TOT
Deceased	Passenger	-	-	-	-	-	**0**
	Personnel	-	-	-	-	-	**0**
	Third party	-	-	-	2	1	**3**
	Total	**0**	**0**	**0**	**2**	**1**	**3**
Seriously injured	Passenger	-	-	-	-	-	**0**
	Personnel	-	-	2	1	1	**4**
	Third party				-	-	**0**
	Total	**0**	**0**	**2**	**1**	**1**	**4**
Slightly injured	Passenger	-	-	-	-	-	**0**
	Personnel	-	4	-	-	-	**4**
	Total	**0**	**4**	**0**	**0**	**0**	**4**
TOTAL		**0**	**4**	**2**	**3**	**2**	**11**

N.B. Since November 2005 also includes third party (level-crossing user, not pedestrian); deceased and seriously injured.

MARINE

In marine transport, 10 accident investigations and 10 category D investigations were commenced in 2006. Two of the accidents involved serious injury on vessels operating under a foreign flag. One of these was the sinking in the Baltic Sea of a ro-ro vessel which was travelling on course from Helsinki. The accident is under investigation by the Swedish accident investigation authorities, with an investigator from the Accident Investigation Board of Finland participating in the capacity of official observer.

One case concerns a fatal accident at the Port of Kotka involving the falling of a deck crane. In addition, four collision investigations have been commenced, one involving the collision of a Finnish cargo vessel and a foreign tanker in the Kiel Canal, two involve collisions with the same rand mark in the northern Baltic Sea and one a dock collision by a Finnish ro-ro passenger vessel at the Port of Tallinn. Four other accidents involved groundings and rock groundings which are categorised as two separate investigations.

Eight marine accident investigations and two safety studies were completed in 2006. In addition, two investigations by Swedish authorities in which Accident Investigation Board of Finland investigators have been working as observers were completed. Nine category D investigations were also completed in 2006.

Published safety studies include *Pilotage Practice and Culture in the Light of Accidents* and *Safety of Finnish Passenger Vessel Traffic.* A further two safety studies were also in progress. These applied to piloting on archipelago fairways and navigation bridge crew fatigue.

Among the investigations completed were four groundings or rock groundings, one collision, one overboard falling of a manned MOB boat in connection with a lifeboat exercise, one sinking of a trawler and one sinking of a pleasure boat. Two of the above incidents resulted in personal injury. Two recreational fishermen drowned in a boat accident off the coast of Kotka and two ro-ro passenger ferry crew members were injured during a lifeboat exercise at Hanko. The accident investigation of the passenger ship SUOMENLINNA II identified a further eight incidents, all of which were determined to be caused by the complexity of the new-building project. The road ferry PROSTVIK 1 and minesweeper KUHA 26 collision was investigated within the scope of the co-operation agreement signed with the Finnish Navy.

Eight of the above-mentioned investigations involved cooperation with the flag state of the vessel concerned or with the investigating authorities of the state of occurrence. Cooperation was based on the investigation guidelines of the International Maritime Organization (IMO). The investigation involved cooperation with the accident investigation authorities of Sweden, the Netherlands, Estonia and Germany.

Five separate marine accident investigations conducted over the past two years have yielded valuable experience of voyage data recorder (VDR) data decoding.

International cooperation in the investigation of marine accidents has increased in recent years. The share of investigations involving international cooperation (due to vessel being under a foreign flag or the site of accident being beyond Finnish waters) increased 42% during 1997–2003 and 63% during 2004–2006.

International guidance of shipping accident investigations is becoming increasingly detailed and binding as the revision of the IMO's marine accident investigation recommendations and the preparation of the new EU directive concerning such investigations are simultaneously in progress. The new uniform guidelines address investigation methodologies, compilation of EU-wide statistics and investigator training.

The International Maritime Organization (IMO) began updating its marine accident investigation guidelines, the Code for the Investigation of Marine Casualties and Incidents (Res.A.849(20), with the aim of updating it from a set of guidelines to a set of regulations. The Chief Marine Accident Investigator was a member of the Finnish delegation to the IMO's FSI subcommittee meeting in June, at which accident investigation results and the accident investigation guidelines reform were addressed.

The Chief Marine Accident Investigator also participated in two meetings held by the European Maritime Safety Agency (EMSA) in Lisbon in July and December. Contact with EMSA has been actively maintained.

Both marine accident investigators participated in the 15th Marine Accident Investigators' International Forum (MAIIF) held in August in Panama. The Chief Marine Accident Investigator was re-elected as Deputy Chairman of the MAIIF. The second European Marine Accident Investigators' International Forum (EMAIIF2) was held in Malta. The Chief Marine Accident Investigator is also Chairman of this annual regional MAIIF meeting.

Full-time investigators held lectures and presentations on marine accident investigation and investigation results at 14 events in Finland and abroad including, e.g., the international Human Factors & Safety seminar in Espoo, the Bridge 2006 seminar at Rauma, Finnish Fishermen's Association (SAKL) safety project events and the Finnish Emergency Services College seminar. International lectures were given, e.g., at the ICHCA International Safety Panel events in Rotterdam and MAIIF and EMAIIF meetings.

Investigations commenced in 2006

One category B marine accident investigation, seven category C investigations (9 marine accidents) and ten category D investigations were commenced in 2006.

Six accident investigations involved cooperation with foreign investigation authorities (B 1/2006 M, C 1/2006 M, C 4/2006 M, C 5/2006 M, C 6/2006 M and C 7/2006 M).

Identifier	Date	Title of the investigation
B1/2006M	11.1.2006	MS SINGELDIEP, accident at Kotka Harbor
C1/2006M	2.2.2006	MS ESTRADEN & MT WOLGASTERN, collision in Kiel Canal
C2/2006M	8.8.2006 and 10.8.2006	MS SUNDBYHOLMEN, grounding at Turku archipelago and SS UKKOPEKKA, grounding off Ruissalo
C3/2006M	1.7.2006 7.12.2006	MS PAMELA, grounding off Utö
C4/2006M	7.10.2006	MS HOBURGEN (BHS), collision with beacon Tröskeln Östra in the Baltic Sea
C5/2006M	14.10.2006	MT ARCTICA (ANT), collision with beacon Tröskeln Östra in the Baltic Sea
C6/2006M	28.10.2006	MS NORDLANDIA, collision with peer at port of Tallinn
C7/2006M	1.11.2006	MS FINNBIRCH (SWE), sinking of the vessel between Öland and Gotland (Investigation by the relevant authority in Sweden, Sjöfartsinspektion)

Investigations completed in 2006

Three category B investigations, seven category C investigations, nine category D investigations and two safety studies were completed in 2006 (two of the C-level investigations were investigations by Swedish investigation authorities in which a Finnish investigator was involved in the capacity of official observer).

Three of the investigation reports have also been published in English and one has been translated into Swedish. Two investigation reports were published only in Swedish (investigations by the Swedish Maritime Administration and other Swedish authorities).

Identifier	Date	Title of the investigation
B4/2004M	3.7.2004	Boat accident outside of Kotka
B6/2004M	9.11.2004	Ms SUPERFAST VII, Fall of an MOB boat to the sea in a drill in Hanko West Port (published also in English)
B7/2004M	12.11.2004	Ms SUPERFAST VII, Grounding off Hanko (published also in English)
C1/2004M	17.1.2004	F/V BRATTVÅG, Sinking of the vessel off Pori
C4/2004M	5.7.2004	Passenger vessel SUOMENLINNA II, Grounding in Helsinki on 5.7.2004 and seven other incidents
C9/2004M	24.11.2004	Ms CASINO EXPRESS (SWE), grounding off Umeå (Investigated by the relevant authority in Sweden, Sjöfartsinspektion) *(Published exclusively in Swedish)*
C1/2005M	20.1.2005	M/S PAULINE RUSS, Grounding in Hanko Port (published also in English)
C2/2005M	25.6.2005	S/S HEIKKI PEURANEN, Grounding at Saimaa
C4/2005M	5.10.2005	Ms SILJA SERENADE (FIN) and KBV-046 (SWE), incident at Stockholm archipelago (Investigated by the relevant authority in Sweden, Sjöfartsinspektion) *(Published exclusively in Swedish)*
C7/2005M	10.11.2005	Road ferry PROSTVIK 1, Collision with the minesweeping equipment of KUHA 26 in Storströmmen (published also in Swedish)
S1/2004M		Piloting practises and culture in the light of accidents
S2/2004M		The safety of inland passenger vessels

Incomplete investigations on 31 December 2006 included 6 category B investigations, 12 category C investigations, one category D investigation and two safety studies.

B4/2004M

Boat accident outside of Kotka 3.7.2004

Three men left from Hamina to fish at open sea outside of Haapasaari with HT-boat of 5,5 m length. Before departure they had checked the weather forecast. After a period of fishing the wind started to pick up and men decided to return to Hamina following the same route than on the way out. Chosen route left them to the wind side of the nearby islands. While approaching the area south of Kirkonmaa the height of waves grew too high for the boats seaworthiness. About one kilometre from Merikari a big wave capsized the boat and men were left swimming.

Men were wearing so called float suits and they had no life jackets. On of the men succeeded to swim to Merikari islet but the other two drowned near the boat. Survived man waited for 3 hours on the islet before passing by boat noticed him and called for help. Police and coastguard came to rescue and lifted the bodies from water and drove the rescuee to the hospital.

The cause of the accident was inadequate seaworthiness of the boat for sea condition at the time. Emergency signals were flushed away as the boat capsized and the mobile phones were flooded so the rescue was delayed. Once the alarm was made the rescue efforts started with no delay.

Investigation commission recommends float suits to be revised and use of bigger, more seaworthy boats when fishing on open seas.

B6/2004M

Ms SUPERFAST VIII, Fall of an MOB boat to the sea in a drill in Hanko West Port on 9.11.2004

While the Greek passenger vessel the SUPERFAST VIII was in Hanko Port, a drill was held onboard, in which the so-called MOB boat was lowered to the sea. When the boat had been turned over the gunwale by means of the davit on the deck, the seaman in the boat detached the charging cable of the battery from its socket. The battery cable came to the boat from the davit fastened to a support wire. The combination of the charging cable and the wire got stuck in the release lever of the suspension hook of the boat so that the hook opened. The boat dropped to the sea from a height of over 20 metres together with three crew members. All three were injured, two severely and one less severely. The boat was not damaged.

One of the maritime inspectors on the site telephoned the emergency centre, which alerted help to the site. In addition, a patrol boat was alerted from the Hanko Coast Guard Station. Emergency Services units and ambulances arrived at the scene quickly. The accident victims were brought to the shore and transported to hospital.

The aim has been to prevent the accidental opening of suspension hook of the boat by means of a security pin and further by means of a safety spring, but these were not in place when the opening took place. In the opinion of the investigators, it has not been possible for the safety spring and the security pin to come loose by accident, and so it is likely that the pins have been removed either at the beginning of the drill or they have not been in place even before the drill. The purpose is not to remove the pin until the boat is close to the surface of the water, which those in the boat have said they knew. The instructions in the boat contain no mention of the removal of the pin nor of the fact that this should not be done until after the boat has been lowered to the water.

Survival craft and rescue boat drills always include risks, which, if realised, have also resulted in numerous other severe accidents. Therefore it should be ensured onboard all vessels that the security measures are sufficient and that the boat crew each time has available to them instructions detailing the safest operating procedure.

B7/2004M

Ms SUPERFAST VII, Grounding off Hanko on 12.11.2004

The Ro-Ro passenger vessel SUPERFAST VII was on way from Rostock to Hanko on 12 November 2004. She had 140 passengers. Her cargo was trailers, trucks and cars. The vessel took a pilot between Russarö and Gustafsvärn at 19:05. The vessel reached the turning area outside the port at 19:14, when the tugboats the Ajax and the Iso-Pukki were fasted on her starboard side.

The master, the Staff Captain, the chief mate, the helmsman and the pilot were on the bridge. The master handled steering the vessel in the left wing, the chief mate observed from the right wing the distance of the vessel to the buoys on the north side of the fairway. The pilot kept contact with the tugboats. The Staff Captain was on the bridge without any actual task.

The master of the vessel and the pilot were planning to enter the port so that the vessel would be reversed to the port as the wind was from the bow and the tugboats were on the starboard side ready to push the vessel to the quay. At the turning point the vessel drifted north of the fairway and so the tugboats were asked to push the vessel south while she was reversing. As a result of this measure and, according to the master, of the wind, the vessel drifted south of the fairway.

The reversing was continued, and the efforts of the master to bring the vessel into the fairway were not successful. As the stern of the vessel was very close to the breakwater, the bow tugboat was asked to move portside. This did not succeed, because the vessel had drifted so close to the breakwater that, due to the shallowness of the water, there was no room for the tugboat.

The vessel grounded at the peak of the Hanko breakwater at 19:24, but she was able to continue her voyage to the quay, to which she was moored a little later.

The damage to the vessel did not result in danger of sinking nor in problems in stability.

The investigation revealed that the strongest background factor of the accident were the defective instructions of the Safety Management System (SMS) of the shipping company. This resulted in insufficient utilisation of the existing navigation equipment and a lack of bridge co-operation. The instructions did not contain port steering in a storm, which resulted in a defective estimation of the wind effect.

C1/2004M

F/V BRATTVÅG, Sinking of the vessel off Pori 17.1.2004

The Finnish trawler BRATTVÅG (FIN-165-T) departed January 15, 2004 from the Finnish fishing port Reposaari to fish herring in the fishing area 20 miles off the coast in the Gulf of Bothnia. As they were approaching homeport on January 17, the vessel started to get water in. The water could not be pumped out and she sunk at 07.52 hours 1,8 miles of the breakwater. The two fishermen onboard found themselves in the water with lifebelts on. They succeeded to hang with the life raft and net buoys until the local coast guard rescued them. They were transported to hospital and found to be in hypothermia but otherwise in good condition.

The vessel sunk close to the fairway and a navigational warning was given out to the mariners. A private entrepreneur bought the wreck at the sea bottom and he got it lifted up in September 2004. He later in spring 2005 towed her to Kotka where she was scrapped during the autumn 2005.

The investigators concluded that a bilge pump failure lead to the water ingress to the boat. This was because the discharge pipe was not fitted with a non-return valve.

C4/2004M

Passenger vessel SUOMENLINNA II, Grounding in Helsinki on 5.7.2004 and seven other incidents

On 5.7.2004, SUOMENLINNA II, the new vessel operating the 3 km long ferry connection between Kauppatori and Suomenlinna in Helsinki, lost its manoeuvrability and had a light bottom contact. The Accident Investigation Board initiated an investigation, during which the vessel was involved in seven other incidents. All of these incidents were addressed in the investigation.

Technical faults experienced on 5.7.2004 and 12.8.2004. On both occasions, the vessel suffered a blackout and loss of manoeuvrability. On the first occasion, this resulted in a bottom contact off the shore of the island Valkosaari. On the second occasion, the vessel collided with a bridge in Suomenlinna. These situations were caused by malfunction of the fuel system and incorrect installation of electrical cables. In both cases, the situation was compounded by faults in the diesel-electric propulsion system settings, resulting in total failure of the electrical system. There was no personal injury, and other damage was minor.

Collisions with quay in Suomenlinna on 5.10.2004 and 7.10.2004 and in Kauppatori on 17.12.2004. All three quay collisions resulted from the crew neglecting to turn off the autopilot. The system allowed turning the control levers while the autopilot was turned on and did not warn the skipper even though turning the levers had in reality no effect on the position of the rudder propeller. A total of five persons were slightly injured in the collisions. In addition, the Suomenlinna ramp was damaged beyond repair, and the latest collision made a hole in the vessel above the waterline.

Momentary losses of control on 13.12.2004, 15.12.2004, and 28.5.2005. In two cases, the loss of control was caused by abandoning an attempt to overtake another vessel due to traffic conditions. When the skipper reduced engine power in order to allow the SUOMENLINNA II to slow down, it began to turn. This happened because, after engine power was reduced, no course-keeping forces existed. One of the loss-of-control situations began after a turn, when the skipper's attempt to manoeuvre had no effect. The skipper then turned the control lever more, causing the vessel to quickly turn too much. The essential element in all three cases was the difficult manoeuvring of the vessel, mainly related to its lack of directional stability. In all cases, the skippers had all steering functions available, and they still had means to prevent potential accidents, regardless of the loss of control. There was no damage.

Summary. With the exception of one loss-of-control situation, all of the incidents involved risk factors that could be expected to occur in a new-building project. The technical problems were not

identified during the design and construction, before the vessel was taken into use. The quay collisions involved the autopilot system, when related risks had not been anticipated. However, the loss-of-control situations were caused by the fact that the parties were surprised by the vessel's properties and how difficult it was to handle, even though they could have prepared for these in advance.

As a contributing factor, the shipowner was inexperienced with newbuilding projects especially consisting of new technology. The Danish trading house acting as supplier, and the Polish shipyard were also unfamiliar with this kind of projects and it contributed to the first two incidents. The inexperience of the parties was not taken into account by the supervising authorities, who could have predicted risks of the type that occurred. The problems with the fuel system were caused by the original system design being risky from the operational standpoint. Better supervision could have affected the faulty cable installation and mistakes in the settings of the automation. For example, sufficient professional skills on the part of the electricians in the installation work should have been ensured. In addition, the integration of the machinery and propulsion automation should have been planned and performed better. When the vessel was taken into use, the training provided for the SUOMENLINNA II skippers was insufficient and too focused on normal operations. For example, it should have included more training involving exceptional situations.

Ships are normally built in small series. Accordingly, most ships can be considered prototypes. This is particularly true of the SUOMENLINNA II, because vessels of this size have never before been built equipped with electric-powered rudder propeller systems at both ends. Utilising new technology and new vessel types promotes progress in the marine technologies and provides new kinds of possibilities and characteristics for the vessel in question. On the other hand, such solutions increase the risks and require high-quality operations of all parties.

No recommendations are made on the basis of the investigation. The investigation report itself attempts to provide information on how demanding such new construction projects can be and what kinds of risks should be taken into account.

C1/2005M

M/S PAULINE RUSS, Grounding in Hanko Port 20.01.2005

The Ro-Ro passenger vessel PAULINE RUSS was on her way from Tillbury (GB) to Hanko on 20.01.2005.

The vessel took a pilot near Gustavsvärn island at 01:09 on 20 January 2005. The VTS notified the pilot that wind direction was 185° and wind speed 11-15 m/s. The ship passed buoy Hanko No. 8 at about 01:18 and arrived in the turning area at 01:24.

The vessel was turned through the right in the water area between the breakwater and the Meijerfelt buoy. The pilot also suggested the possibility of turning the vessel in port inside the breakwater, because there was plenty of room as the port was empty, but the master decided to use the other turning area. The pilot and the master did not discuss the use of tugboats.

After the turn, the vessel started reversing at a speed of about 2.5 knots towards pier No 1 while the propeller pitch was 25%. The stern steering propeller was full left and the vessel was steered by means of the bow steering propeller.

The vessel passed the breakwater at 01:30, at which point the pilot notified the master that the vessel was drifting north. Also the master had noticed that the vessel was drifting towards the red buoys north of the safe water area.

The master was steering the vessel with the control equipment in the left bridge wing and the pilot was on the lookout in the right bridge wing. There was no helmsman on the bridge. As the vessel was at the first red buoy, the pilot suggested that she had to go back out or increase speed. The master did not react to the suggestion and continued reversing towards the pier.

As the stern of the vessel was near the pier at 01:35, the bow thruster of the vessel was not able to lift the bow towards the pier with full power against the wind. The master decided to steer out of port. First he turned the rudder left and changed the propeller pitch to 60 % ahead to make the bow turn left. When he noticed that this movement resulted in the stern turning north towards the fist red buoy from the perspective of the port, he turned the wheel right, but this did not prevent the stern of the vessel from drifting on top of the buoy and slightly touching the bottom.

A reason contributing to the accident was a lack of bridge co-operation, which resulted in a deficient estimate of the wind conditions on the manoeuvrability of the vessel.

C2/2005M

S/S HEIKKI PEURANEN, Grounding at Saimaa 25.6.2005

S/S HEIKKI PEURANEN departed the private summer lodge located on the north-west side of Peuhkuri island on the accident day 25.6.2005. The meaning was to sail to Puumala's Sahalahti, to where the journey would have lasted 3–4 hours.

As the journey began, there was a firewood barge called ENEA moored to the SB side of the tugboat. Persons on the cruise stayed mainly on the vessels' deck and they were moving freely between the barge and the tugboat. The Master of the tugboat told that he was even himself on the barge when the cruise begun.

The cruise begun approximately at 16.00 and the tugboat was being manoeuvred by a person from the group. The master did not participate in the navigation at the time before accident. There was some drizzle. According to the helmsman the weather did not have influence on lookout. There was no glare.

When the pier was left behind, the course was taken to the north side of Peuhkuri island's cape. There a turn to port was taken as the idea was to bypass western bank of the island with a moderate distance. Thereafter the tugboat would have been on the fairway to the east. The idea was to turn to port so long until the island would have been completely passed. After the first turn the helmsman asked the Master if the line was okay. The Master answered affirmatively and the cruise continued.

When they had made some time next to the Peuhkuri island's western bank the tugboat's bow hit a rock approximately at 16.00 hours on the west side of the island. The bow rose upwards and the tugboat heeled over to the left. In a moment the stern hit a rock and rose upwards and the tugboat stopped completely. The vessel remained still her stern uplifted and because of this the bow sunk.

Water was leaking in trough the bow cabin's open porthole and trough the toilet, which opened straight outside. The vessel sank partly and remained on the shoal. The passengers were evacuated quickly by a pleasure boat, which was cruising nearby and the personal injuries were avoided. The tugboat was being lifted up couple some weeks later and docked for repairing.

The cause of the accident was the lack of local water area expertise outside the fairway area and erroneous visual observations. The direct reason for the sinking was the leaking of the vessel's hull. This was caused by the open porthole and the erroneous structure of the toilet.

The investigation commission recommends that more information on regulations and experience concerning this kind of pleasure crafts should be spread out to the owners and users. Voluntary surveys and manning principles should be offered by associations and societies concerned. The investigators do want to highlight the fact that a vessel's freeboard is only to the height of the lowest opening in the hull.

C7/2005M

Road ferry PROSTVIK 1, Collision with the minesweeping equipment of KUHA 26 in Storströmmen 10.11.2005

The road ferry PROSTVIK 1 departed from Retais to Pärnäinen in the Archipelago Sea after midnight. The trip was unscheduled and called by a truck driver on the Pärnäinen side. When departing the quay, master of PROSTVIK 1 noticed a passing small vessel from north to south. He had been earlier informed that outside the scheduled ferry time table until 0300 hours there will be operational rehearsal with Navy's minesweeper. This announcement had been made in Finnish. Master's mother tongue is Swedish.

The master saw lights of the passing vessel some 30 degrees on his starboard side and believed that it was safe to proceed. His estimation of the distance between vessels then was approximately 500 meters. Then he saw a blue light moving in front of his vessel and he tried to stop the vessel. Before the movement had stopped the bow end propeller stopped and it was obvious that it had caught a wire towed by the passing vessel.

After this the ferry master called on VHF Ch 16; "what happened and what he should do". Master of the minesweeper KUHA 26 answered that PROSTVIK 1 had caught in to the minesweeping equipment and suggested to return to the quay using the other propeller. The ferry master tried to do as suggested but the weather did not allow that but he got also the other propeller jammed with minesweepers cable.

PROSTVIK 1 then tried to anchor but the anchor chain got stuck, the vessel was drifting. The minesweeper went to ferry's side and then towed the ferry to a shelter area where the unit was anchored with the minesweepers anchor. The anchor started to drag and it was hoisted up. The unit was kept in safe area with KUHA 26's engine until the tug FRAM came and took the ferry to nearby repair yard's quay.

The cause of the accident was the reduced alertness, fatigue, of the ferry master. He proceeded quickly when called in the night time outside the scheduled time table. The restricted view from the bridge could be a contributing factor to that the master did not notice the lights of the sweeping equipment.

S1/2004M

Piloting practises and culture in the light of accidents

The objective of the study was to reveal generic features that would explain maritime accidents in piloting situations in the Finnish coastal waters. The material consisted of the results of ten single accident analyses. A method and indicators were developed for the analysis of the piloting practices on the bridge. Generic constraints and possibilities for piloting were analysed and situational circumstances described. The comparative analysis indicated that the piloting practices differed with regard to the indicators, and that the nature of the constraints or situational features did not explain these differences.

Drawing on literature we formulated a hypothesis that the piloting practice is dominated by the so-called traditional navigation method, deficiencies of which in the current situation would explain the accidents. The material verified this hypothesis: The prevailing piloting practice in Finland relies strongly on the traditional navigation method that has advantages in the narrow coastal waters. It does, however, not contain effective use of navigational equipment or route plans, nor co-operation based on these artefacts. It was also found out that fairway design and navigation or steering equipment do not meet the requirements of piloting, and the available technical possibilities were not fully exploited. However, signs of emergence of a new collaborative piloting practice supported by artefacts were observed.

A further historical and organisational analysis revealed generic developmental tensions of piloting. We also identified possible obstacles for development. The analysis indicated that development of a new piloting practice to meet the current circumstances – i.e. increasing ship size – is a central challenge for the domain. It was concluded that different parties should participate in the development of piloting activity. Organisations responsible for piloting ought to create new organisational and regulatory prerequisites to improve technology, practices, collaboration, and responsibility relationships of piloting.

A new accident investigation method was used in the study. This method completes the usual causal event-oriented analysis of accidents and creates new possibilities for learning from accidents and for prevention of future accidents.

S2/2004M

The safety of inland passenger vessels

The investigations carried out on inland passenger vessel accidents have shown that in the safety culture of that traffic there are still many features which in suitable circumstances can form risks for the safety.

The investigated accidents show that inadequate information and erroneous traditions have hindered the establishment of a proper safety culture within part of the ship owners. The safety levels onboard and the knowledge of the crews have been diverse. Uniform instructions and regulations for the traffic of inland vessels have been non-existent. During the last years the inland passenger traffic has been extensive and the number of passengers has increased. In spite of the fact that several small accidents have occurred the regulations, overview and improvement of the traffic safety have not received adequate attention.

The present passenger vessels are relatively old and there is a lot of variety in building materials as well as how they are equipped. The great variety in passenger vessels is due to the fact that the regulations allow traffic with very different vessels and with different levels of equipment in the same sea area. The same traffic from the same quay can be served by vessels equipped at very different levels. The EU-directive which will be in force for old, over 24 metre, passenger vessels gradually from 1.7.2006 will further widen the difference in safety and equipment. The regulations applying to the safety and construction of existing 24 metre vessels remain incoherent and allow for different interpretations.

The factors contributing to passenger safety, in addition to the equipment and construction of the vessels, are the professional skills of the crew and the response capabilities of the rescue authorities. All of those who work onboard must be capable of acting according to the plans to safeguard the safety of passengers in all circumstances.

The small number of personal injuries and the relatively small material damages in the accidents so far can have contributed to such erroneous belief that the present levels of safety are adequate. In all the investigated accidents the main contributing factors have been human. According to the accident investigations the continuous development and updating of the operational practices is necessary.

On the basis of this safety study the investigators recommend to the Finnish Maritime Administration and to the Finnish ship owners that the safety management systems are developed further and that the systems are required for all domestic passenger vessels. There are further recommendations on the development of the manning regulations and life saving appliances as well as a recommended requirement of the AIS transponders (Automatic Identification System) to all passenger vessels. Also the development of co-operation in training between different authorities is recommended.

As an appendix to this safety study are models and guidelines to the development of the safety attitudes and the safety culture.

Recommendations

Marine accident investigation reports completed in 2006 included a total of 15 safety recommendations. In addition, one safety study gave 6 recommendations. The majority of recommendations were addressed to the Finnish Maritime Administration and other maritime organisations. Several recommendations addressed more than one recipient.

A summary of issued safety recommendations is presented below according to the area of relevance together with a summary of the recipients of the recommendations.

Vessel operation directions	5
Pilotage directions	-
VTS directions	1
Directions for emergency radio communications	-
Navigation and route planning	-
Navigation channels and their marking	-
Vessel equipment and facilities	3
Vessel stability	2
Boating information campaign	4
Other	6
Total	21

Finnish Maritime Administration	15
Other authorities	5
Finnish State Pilotage Enterprise	-
Shipping companies	4
Organizations	14

Recommendation monitoring has requested and received from the Finnish Maritime Administration's Maritime Safety function information on the implementation status of 16 recommendations. 176 recommendations were issued during 2000–2006 in total.

Marine investigations in 2002–2006

Accidents investigated	2002	2003	2004	2005	2006	TOT
Serious accident (A-investigation)	-	-	-	-	-	**-**
Other accidents (B- and C-investigation)	14	11	16	8	10 (8)	**59**
TOTAL	**14**	**11**	**16**	**8**	**10**	**59**
Other (D-investigations)	-	-	4	10	10	**24**
Safety studies	1	2	1	1	-	**5**

Investigations as per accident category	2002	2003	2004	2005	2006	TOT
Grounding	6	5	8	3	4	**26**
Fire	1	1	-	1	-	**3**
Sinking	-	2	4	1	1	**8**
Collision	4	1	2	2	4	**13**
Other	3	2	2	1	1	**9**
TOTAL	**14**	**11**	**16**	**8**	**10**	**59**

Investigations as per resulting impact	2002	2003	2004	2005	2006	TOT
Deceased	4	1	2	-	3	**10**
Seriously injured	-	-	2	-	-	**2**
Slightly injured	12	-	4	-	-	**16**
Environmental damage	1	-	1	-	-	**2**

OTHER ACCIDENTS

Other Accidents, denoted by the letter Y, refers to accidents or serious incidents other than aviation, marine or rail accidents. As provided in the Act on Accident Investigation (3.5.1985/373), all serious accidents and incidents must be investigated. Furthermore, a serious incident or may be investigated if there is reason to believe that the investigation will bring about important information that may contribute to the improvement of general safety and further the prevention of accidents.

Investigation work was carried out by a total of six investigation commissions in 2006. Two investigations were commenced in 2005 and four investigation commissions were appointed during February–April 2006. Furthermore, the D category investigation procedure which has already been applied in other branches of investigation was also introduced to the investigation of other accidents. Category D investigation is applied to minor cases in which there is no cause for intervention by an investigation commission, but which may yield potentially valuable information. Information from such cases is recorded in D-level investigation forms which are collected and forwarded on a case-by-case basis to the Accident Investigation Board.

The accidents and incidents investigated by other accidents commissions in 2006 varied considerably in nature. However, one area of accidents and dangerous incidents was repeated in three investigations – building accidents and incidents. One building incident investigation, the danger of collapse of a shopping centre roof in Kuopio, Finland, was still ongoing from 2005. In March 2006 a similar incidence of concrete roof beam damage was repeated in Savonlinna and an investigation commission was appointed to investigate it. Approximately one week later several other structural failures and hazardous incidents occurred in different buildings around Finland. None of these incidents resulted in personal injury. The most serious and prominent incident was the roof collapse of a shop in Haapajärvi on 8 April 2006. The Accident Investigation Board appointed an investigation commission with the task of investigating, in addition to the Haapajärvi incident, incidents of structural damage in seven other localities. Similar safety studies have previously been carried out for bus fires and fatal fire incidents.

Three other serious incidents under investigation included a mortar incident at the Rovajärvi military firing range in Lapland on December 2005, a collision between a car transporter lorry and a bus at Pyhtä and an explosion incident at an excavation site in Espoo. Investigation of these accidents provides perspectives on safety development in fields which the Accident Investigation Board of Finland has not focussed on in recent years. The core issue in the investigation of the mortar incident was safety practices within the Finnish defence forces and, in particular, the land forces thereof. The investigation into the collision of the car transporter lorry and the bus threw light on eastbound transit traffic through Finland, which is undergoing a sharp increase. The accidents that occurred at the excavation site, which had not been previously studied, proved to be an important area of investigation. The investigation subsequently commission gained knowledge of the occurrence of several other incidents at similar sites.

Of the category D investigations, three concerned roof damages, one a chlorine leak at an indoor swimming pool, one the skidding of a bus off the road and one a holiday home fire involving four fatalities.

At the end of 2006, a total of four category B investigations, one safety study (category S investigation) and five category D investigations were incomplete. The category B investigation into the mortar incident commenced in 2005 and began its period of circulation for comment at the turn of the year. All other incomplete investigations and studies were commenced in 2006 and are expected to reach completion during the first half of 2007.

An essential improvement from the point of view of the resources and organisation of other accidents investigations took place in 2006 with the creation of the post of Chief Accident Investigator for the Other Accidents branch. The post was filled on 1 May 2006.

Investigations commenced in 2006

Identifier	Date	Title of investigation
B1/2006Y	6.2.2006	Collision involving a car transport vehicle combination and a coach at Pyhtää
B2/2006Y	31.3.2006	Collapse of inner ceiling structures of a local supermarket in Sysmä
B3/2006Y	24.4.2006	Explosion accident at construction site in Espoo
S1/2006Y	20.3.–15.4.2006	Building accidents in the late winter of 2006

In addition, six category D investigations of minor accidents or incidents were commenced in 2006.

Investigations completed in 2006

Identifier	Date	Title of investigation
B1/2005Y	18.3.2005	Threat of roof collapse in shopping centre in Kuopio

An abridged English language version of the investigation report for the serious accident that occurred at Konginkangas, Finland, in 2004 was completed in 2006. One category D investigation was completed.

B1/2005Y

Threat of roof collapse in shopping centre in Kuopio 18.3.2005

On Friday 18 March 2005, cracks were observed on the concrete roof beams of a Prisma commercial centre located in the town of Kuopio. The building dates from 1996. The situation was regarded as posing a sufficient threat of collapse that the decision was taken to evacuate all staff from the building. There were no customers in the commercial centre at the time. The emergency services were alerted of the apparent danger of collapse and emergency service units were dispatched to the building. The centre was isolated by the police and the fire brigade ensured that the building was empty. A building surveyor present on-site determined that the centre should remain closed for the time being. The damaged beams were fitted with additional supports during the weekend and the centre was re-opened to customers in the following week.

The load-bearing roof structure of the building consists of pre-tensioned single-span ridge beams supporting pre-tensioned TT slabs. The beam rows are spaced 12 metres apart and the beam supporting pillars are spaced 18 metres apart. The beams are 18 metres in length, 1.35 metres in height and span 17.76 metres.

The damage to the pre-tensioned concrete beams was caused by the absence of binding hooks from the longitudinal beam reinforcement extensions and the top of the beam. The purpose of the binding hooks is to fasten the iron reinforcement bars on the upper beam flange in the sideways position. The stress state of the upper flange of the pre-tensioned concrete beam changes from a state of tensile stress in the installation state to a state of compressive stress in the in-service limit state. The tensile beam reinforcement thus subsequently converts to compressive beam reinforcement. If the compression reinforcement bars are not held fast with binding hooks, intermittent alterations in the direction of compression stress of the upper flange at the ridge results in a shear tendency in the ridge area.

To avoid similar damage occurrences the Board of Inquiry recommends that the openness to interpretation of drawings should be eliminated and prefabrication factories manufacturing pre-tensioned concrete beams should be provided with precise information concerning the required position of binding hooks for beam upper flange reinforcement bars.

Furthermore, the Board recommends that beam heights in accordance with span-width curves must not be reduced without absolute due reason. If shorter beams are used, their dimensioning and steel reinforcement design should verified by a specialist in ridge beam engineering.

Recommendations

The March 2005 investigation into the shopping centre roof collapse hazard in Kuopio, Finland, was completed in 2006. Two safety recommendations were issued, each concerning the design of pre-tensioned concrete beams for use in roof structures.

Since the year 2000, a total of 130 recommendations have been issued on the basis of investigations by the other accidents branch. The recommendations categorised according to accident type as follows:

Building fires	30	(23 %)
Road traffic accidents	29	(22 %)
Building incidents	27	(21 %)
Bus fires	19	(15 %)
South-East Asia natural disaster (tsunami)	12	(9 %)
Fires/explosions in industry	8	(6 %)
Leak of dangerous material	5	(4 %)

The implementation monitoring of all recommendations issued since the year 2000 that was started towards the end of 2004 is still ongoing. The monitoring will continue in 2007, during which time the aim is to get the monitoring process up to date. Inquiries have been carried out among the relevant authorities regarding the implementation status of 72 recommendations in total, of which the status of approximately 65 recommendations is known. In addition, information regarding the implementation of recommendations issued by the Konginkangas serious accident (2004) and the South-East Asia natural disaster (2004) investigations was obtained from Ministry of Justice reports at the end of 2006. On the basis of the reports, the majority of recommendations have been implemented or their implementation is being considered.

Other accident investigations in 2002–2006

Accidents investigated	2002	2003	2004	2005	2006	TOT
Serious accident (A-investigation)	-	-	2	-	-	**2**
Other accidents (B- and C-investigation)	1	5	2	3	3	**14**
TOTAL	**1**	**5**	**4**	**3**	**3**	**16**
Other (D-investigations)	-	-	-	1	6	**7**
Safety studies	-	1	-	-	1	**2**

Investigation classification according to nature of incident	2002	2003	2004	2005	2006	TOT
Fires/explosions in industry	1	1	-	-	-	**2**
Military accidents/incidents	-	-	-	1	-	**1**
Structural damage incidents	-	4	1	2	5	**12**
Bus accidents/incidents	-	-	2	-	2	**4**
Natural disasters	-	-	1	-	-	**1**
Fires	-	1	-	1	1	**3**
Explosion accidents/incidents	-	-	-	-	1	**1**
Hazardous substance leakage	-	-	-	-	1	**1**

Investigation classification according to area of activity	2002	2003	2004	2005	2006	TOT
Commercial or similar activity	1	5	3	3	9	**21**
Domestic or leisure-time	-	1	1	-	1	**3**

Investigation classification according to site or object of accident	2002	2003	2004	2005	2006	TOT
Tank or piping	1	1	-	-	-	**2**
Exhibition/sports hall	-	2	-	-	-	**2**
Medium-sized shop or building of similar level of public use		1	1	1	4*	**7**
Large shop/shopping centre	-	-	-	1	1	**2**
Indoor swimming pool or bath	-	1	-	-	1	**2**
Bus/coach	-	-	2	-	2	**4**
Explosives or weapons	-	-		1	1	**2**
Natural disaster	-	-	1	-		**1**
Residential building	-	1	-	-	1	**2**
Institution (nursing/medical/welfare)	-	-	-	1	-	**1**
TOTAL	1	6	4	4	10	

* one of the four cases involves investigations into structural damages at eight different localities

Personal injuries and fatalities during 2002–2006 (category D investigations not included)

Injuries / fatalities		2002	2003	2004	2005	2006	TOT
Deceased	Employee	-	4	1	1[3]	-	**6**
	Passenger, customer or resident	-	102[1]	202[2]	-	2	**306**
	Total	**-**	**106**	**203**	**1**	**2**	**312**
Seriously injured	Employee	-	1	-	5[3]	5	**11**
	Passenger, customer or resident	-	-	20	-	-	**20**
	Total	**-**	**1**	**20**	**5**	**5**	**31**
Mildly injured	Employee	-	-	-	-	1	**1**
	Passenger, customer or resident	-	3	259[2]	-	10	**272**
	Total	**-**	**3**	**259**	**-**	**11**	**273**
TOTAL		**-**	**110**	**482**	**6**	**18**	**616**

[1] The safety study concerning fatal fire incidents investigated 95 fires, in which 105 fatalities occurred in total. Three fatalities resulting from the separately investigated explosive fire incident at the Tornio steel mill are not included in this figure. These fatalities are included in the figure of the top row (Employee).

[2] In the South-East Asia natural disaster 179 Finns died and 250 were injured. Cases of serious or mild injury are not separately classified in the investigation. The Konginkangas accident fatalities included the bus driver and 22 passengers. A further 14 passengers were seriously injured.

[3] Military service conscripts

FINANCES

The size of budget allocations to the Accident Investigation Board of Finland has remained unchanged since the year 2000. The 2006 allocation was 950,000 euros plus 13,108 euros carried over from 2005, totalling 963,108 euros. The share of labour costs was 680,875 euros, an increase on the previous year. The increase was mainly the result of the establishment of a new post, while other increases covered rises in salaries and overhead expenses. The share of travel expenses of the budget allocation is increasing due to increasing accident investigation cooperation and harmonisation within the European community.

The estimated appropriation granted for accident investigation was raised from the former 500,000 euros to 1 000,000 euros in 2006. The appropriation had been underestimated for a number of years, resulting in one or more requests for additional appropriations being made each year. The total allocation expenditure in 2006 was 934,010 euros. However, no serious accident investigations were undertaken in 2006.

The annual allocation requirement for investigation work is difficult to estimate and predict due to its dependence on the nature and number of accidents that occur. The costs of individual investigations also vary considerably.

Expenditure of the Accident Investigation Board and its accident investigation activities in 2002–2006. (financial statement data).

Vuosi	Onnettomuustutkinta-keskus	Tutkintamääräraha	Yhteensä
2002	780 007 euros	826 375 euros	1 606 382 euros
2003	792 448 euros	1 270 330 euros	2 062 778 euros
2004	831 798 euros	1 250 585 euros	2 082 383 euros
2005	846 519 euros	1 333 951 euros	2 180 470 euros
2006	938 965 euros	934 010 euros	1 872 975 euros

Allocations of Accident investigation board in 2006

Salaries	680 875 euros
Rent	92 334 euros
Other expences	165 756 euros
Total	**938 965 euros**