AVIATION SAFETY REVIEW FINLAND 2011

TraFi

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Foreword

Kari Wihlman | Director General

THE FINNISH TRANSPORT SAFETY AGENCY, TRAFI, is the authority in charge of the safety and environmental issues of the entire transport system. The agency was created in early 2010, when separate safety authorities for different transport modes were combined.

In many respects, aviation can be considered a forerunner in transport safety. In aviation, safety is considered to take priority with regard to other operations. Other forms of transport have a lot to learn from this, and established principles in aviation, such as "Just Culture", "Airmanship" and "Fit to Fly", are gradually being applied to other modes of transport.

However, aviation safety should not be taken for granted, and a high safety level cannot be maintained without continuous work on safety. In addition, changes in the society and industry affect the safety situation. The authorities should remain continuously up-to-date and should be able to prevent any deterioration of the safety situation as operating models and practices change. At its best, safety work is good cooperation with operators in the industry; the decisions reached guarantee the vitality of the industry and, most importantly, the safety of the passengers. ■

Mikael Hägglblom/Trafi

Review by the Director General of Civil Aviation:

Pekka Henttu | Director General, Compliance

Towards a new authority approach

Learning has been and continues to be the basis of aviation safety work. At first, the focus of learning from aviation accidents was on the enhancement of technical reliability and requirements. In the early decades of aviation safety work, the scope of operation was limited, the target being the aircraft and its use. One of the prerequisites of the rapid progress of aviation has been the continuous development of aviation safety work and its expansion to cover the entire aviation system, including the equipment, all operators involved and their activities – in other words, all the elements making aviation possible at every level. Aviation safety work, continuously promoting the improvement of aviation safety, has evolved into a very complex and multidimensional activity. It is quite clear that the "fruit on the lower branches" of aviation safety have already been picked. The field of aviation – commercial air transport in particular – is strictly and exhaustively regulated. It has become more and more difficult to achieve significant new added value in safety by means of new regulatory measures.

The products of regulation, the official requirements, are a means to delineate a legal framework for aviation. In general terms, this means that the further away from the framework of these requirements a party operates, the higher the risk of accidents. Unfortunately, accidents also happen within this framework, in other words, even when the requirements are complied with. Mere compliance with regulations is therefore not a sufficient dimension for the development of aviation safety work. It seems that a safety culture based on compliance is nearing its saturation point.

In its development work and organisational structures, Trafi aims to support the new way of operation, a risk-based safety authority approach. Traditionally, in all modes of transport, aviation included, the authority approach has been to focus on the supervision of compliance with requirements. Compliance monitoring still constitutes the basic element of safety work, but the operators are given an increasingly responsible role in ensuring their own compliance with requirements. If this fails, the operational preconditions of the person or the organisation must be reassessed. Trafi's risk-based mode of operation means scaling activities, such as oversight, in proportion to the content and extent of the operation, proper timing, and allocation of resources on the basis of safety risk assessment. This calls

for highly developed safety risk assessment methods. On one hand, the identified risks guide the monitoring work and, on the other hand, they produce information for risk-identification and impact assessment of measures taken. Generally speaking, safety risks cannot be fully eliminated without stopping flying. However, the probability of the realisation of a risk can be reduced, provided that the right measures are found. In order

to identify these, one also needs understanding of social phenomena, such as economic development and competition, and information and experience of the everyday reality of aviation. In our role as a safety authority, we strive to identify increased risks, to find measures to reduce these in particular, and to monitor the effectiveness of measures implemented as a continuous process.

The building of our organisation and the development of our operations have also been steered by the new authority requirements (AR) imposed by EASA and the finalised State Safety Programme (SSP) required by ICAO. The safety indicators specified for the State Safety Programme are an excellent, maybe even an essential tool in our future aviation safety work. Our aim is to learn and grow into a safety authority approach relying on extensive exploitation of the risk-based mode of operation, and to achieve as high impact and efficiency in our work as possible. Impact requires measures.

Aviation safety work within organisations

Present state

As regards commercial air transport, the situation awareness of aviation safety – where we are and the direction of development – is good in Finland and in all of Europe. A good level of safety has been achieved and maintained. To be precise, aviation companies and their staffs have achieved and, first and foremost, maintained that level.

In terms of general aviation in Finland, however, we have failed to achieve a sufficient level of safety. The statistics of general aviation accidents, serious incidents, incidents and occurrences included in this report convey a harsh message: the safety mechanisms have failed regrettably often, but, luckily, they have also often functioned correctly. The field of operation in general aviation is scattered. Operators still remain hard to reach, as they are often individual persons. As regards general aviation, separate measures have been taken to lower the risk level and new modes of operation have been sought, safety co-operation with the Finnish Aeronautical Association in particular.

There is plenty of work for all operators, organisations, and individual aviators, both professional and amateur. Aviation safety work is never done. It requires relentless development, resolve, and determination to reach a good level of safety and to maintain it.

Aviation organisations have been or will be set a requirement for a safety management system (SMS) by ICAO. In Europe, this requirement will be implemented via EASA's rules. Like the SSP for authorities, the SMS for organisations will include a set of indicators for measuring safety.

In the operators' organisations, the management and all elements of the management system – not the SMS alone – are clear focus areas for the work of authorities, in addition to the targets identified on the basis of risk assessment. With respect to this, Trafi will launch regular meetings with the management of aviation organisations in 2013. In these meetings, the engagement of the management in safety work will be assessed and the actual powers of the accountable manager to make finance-related decisions verified.

Safety culture is a trend word in the arena of the safety debate. The debate on what it means and what it consists of is always a good starting point for safety work.

A balanced set of values

From the perspective of aviation safety, the challenge is finding a generally acceptable state of balance between safety and other values, such as the environment, finances, smoothness of operation, and security, in such a manner that, in a conflict situation, more weight is put on safety than on the rest of the values. It is clear that a balanced set of values means higher expenses for the organisations, and investments in training, equipment, and infrastructure.

A conflict or unbalance may develop between various values, often in favour of finances. In such a case, it is likely that safety and environmental work is considered an obstacle for business operations. In the prevailing situation, it is necessary that the organisations actually commit themselves to achieving this balanced set of values. Each managing director keeps an eye on the financial parameters and indicators in their

company, and hopefully also on the development of safety indicators, once they have been specified for the company.

The setting of operational values should be part of the debate on the company's safety culture.


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Threat scenarios

The fierce competition between airlines that can partly be considered unhealthy puts the values of the management of an organisation – if they have been specified – to the test. The prerequisite for continuing operation, that is, survival, is cutting costs, for instance by outsourcing operations. When this is implemented in a controlled manner, it is possible to maintain the safety culture and promote its development in such a way that no gaps are left in safety management. "Chained" subcontracting, on the other hand, is particularly difficult, perhaps even impossible, with regard to safety management. The areas of responsibility become obscured. Questionable methods in regard to compliance with requirements may become a tempting alternative in order to further reduce costs, since implementing real monitoring in chained, supranational subcontracting is difficult in practice. In my view, even the latest requirements set for the administration of aviation organisations are insufficient to cover a situation in whiwch the organisation is internally fragmented and operations have been organised through subcontracting chains, and supranational ones in particular. In the prevailing competitive situation, reducing costs is even a key for survival, but, from the perspective of responsibilities and safety management, it must be implemented in a controlled manner. The internal fragmentation of airline companies is a safety hazard.

Cost cuts concern all cost factors, including crew costs. This results in cost optimisation in crew utilisation, which in practice means continuous, maximal crew utilisation. Fatigue of crew members may constitute an aviation safety threat, unless the new duty time limitations and rest requirements that the EASA is currently preparing succeed in curbing the rise in the risk level, for example, by extensive use of fatigue management practices.

Passenger's rights

The passenger's most important right is the right to safe air travel. ■

Photo: Mika Huisman

Reporting as a basis for safety work

Heli Koivu | Director, Transport Analysis

Why is reporting necessary?

Based on international and national regulations, aviation operators must report to the Finnish aviation authorities any accidents, serious incidents and occurrences that have taken place in Finland. Accidents and serious incidents must be reported both to Trafi and the Safety Investigation Authority, and occurrences to Trafi. Similar incidents outside Finland must also be reported if they involve a Finnish aircraft or if the operations are based on an air operator certificate issued in Finland (Aviation Regulation GEN M1–4).

In Trafi, all reports are received, assessed, classified, and saved to the European aviation authorities' ECCAIRS database, which has been in use in Finland since 2005. Names of persons are not saved in the database, and only some of the case details are visible there. The database is only accessible to persons who are employed by civil aviation authorities and tasked with analysing flight safety. Over the last few years, the reporting culture has improved and the number of reports increased. In 2011, more than 4,500 air safety reports were received.

In December 2011, Trafi sent a bulletin on safety reporting to organisations operating in commercial air transportation. The bulletin included a comprehensive summary of reporting regulations for persons and organisations operating in the field of aviation. Further information on reporting and analyses, safety bulletins, and safety indicators can be found on Trafi's website (Aviation / Services). The site also includes contact details and an online form for reporting (flight safety report form).

Why is reporting worthwhile?

Reporting is the sharing of experiences on a larger scale. Based on the safety information it provides, we can learn from each other's mistakes. Not everything is worth trying yourself! As an aviation authority, Trafi can influence any deficiencies found once it has received enough definite information. At the same time, reporting is a means for a single aviator to influence safety and have their view of the incident documented.

Changes in the number of incidents and numerous reports on the same defect help in detecting adverse trends. However, even a single report can provide important information. The better the report answers **the five W's (who, what, when, where, why),** the easier it is to find the means and measures that Trafi will take or require.

Investigation of accidents and serious incidents reveals vital information with regard to safety. Alongside the investigation conducted by the Safety Investigation Authority (OTKES), Trafi assesses the need for immediate action by the authorities immediately after the incident. Instead, analysis of occurrences and less serious incidents is preventive safety work, which is specifically aimed at preventing serious incidents and accidents.

Just culture and confidentiality

In Trafi, flight safety reports are processed and analysed in the Transport Analysis department, which is deliberately separate from oversight and inspection activities. Abiding by the principles of just culture, information is processed confidentially. Professionals with an aviation background and practical experience in their own area (flight operations, airworthiness, air navigation) work with reporting and analysis. They understand that mistakes may occur even if training, experience and attitude were in order.

One of the definitions of 'just culture' reads: "An atmosphere of trust where people are encouraged, even rewarded, for providing essential safety-related information, but in which they are also clear about where the line must be drawn between acceptable and unacceptable behaviour" (James Reason). This means that reporting is not a 'wild card' for doing whatever anyone likes. On the other hand, there is an atmosphere where one need not be afraid of making mistakes: the feedback on the mistakes made will be used to prevent similar cases in the future.

Progress in the development of the safety culture is owed to the admission that to err is human. With this in mind, operating procedures should be planned so as to reduce the possibility of errors. On the other hand, sufficient safeguards and preventive measures must be available to prevent incidents and accidents as a result of errors.

Chapter 13, section 134 of the Aviation Act, "Use of occurrence information", protects the person submitting the flight safety report and sets limits on authorities and operators.

Analysis and risk assessment – from information to action

Investing in safety analysis in Trafi is a direct result of the international development trends in transport safety. Increased information on human performance and limitations is available, along with information on the effect that the activities of organisations and their underlying risks have on safety. This has sparked a need for a new type of thinking in addition to safety work focused on regulations and the monitoring of compliance with them.

Safety is approached as an entity, through safety management system thinking, and it is regarded as a process in which safety-related information is collected and analysed systematically and extensively, risks are identified and their level is assessed, and measures that improve safety are taken to mitigate risks. It is important to monitor the effects of the measures and, when necessary, to take new corrective measures. This is how an unbreakable safety management loop is created. In the loop, tasks, responsibilities, and the parties behind them are defined in detail. This is the current trend and, to an increasing extent, also something that is required of both operators and the authorities.

The incident and occurrence analysis methods are constantly being developed. Safety-related information is received from several different sources. The safety analyses produced by Trafi particularly focus on discovering the causal factors of incidents and the safeguards that failed in the situations. In addition, an attempt is made to identify the resistant safeguards or the factors that prevented the incident from developing into an accident. In this way, trends that impair safety can be detected and preventive measures identified.

The high safety level that has been reached in aviation is no coincidence. The dynamically changing field requires that the authorities also keep up with the changes and anticipate safety threats. In addition to more widely known threats to safety, analyses should focus on new concerns, such as exceptional weather conditions, the effects of economic changes, or fatigue management. To an increasing extent, safety information is utilised with cooperation and harmonisation at a pan-European level and globally: the problems are international, and solutions are found together. In addition, it is important to develop indicators that measure safety in support of the analyses.

The information produced by safety analyses will also be used in safety communications, but there, the information is grouped in larger entities, so that the identification of an individual case or operator is prevented. Safety work is conducted in close cooperation with the operators and stakeholders, because everyone has the same objective: to keep the level of aviation safety high! ■

Responsible traffic – organisation structured to support the vision

IN THE BEGINNING OF YEAR 2012, Trafi moved into a functional organisation shaped according to the core processes. Regulatory duties associated with the safety and environmental friendliness of all transport modes – the whole transport system – are handled in co-operation between four different sectors.

The Transport System sector manages the preparation of the Agency's operational policies and other strategies. It is also responsible for Trafi's preparedness and safety system as well as risk management.

The Regulation sector handles the Agency's international relations, co-operation and regulatory duties.

The Compliance sector provides the licensing, approval and examination services as required from the Agency and is responsible for supervision and oversight.

The Data Resources sector manages the data resources related to the transport system, gathers and disseminates data, provides IT and related services and maintains registers.

Trafi has also appointed directors specifically responsible for each mode of transport, who are in charge of overall monitoring and coordination within their respective transport sectors. The directors responsible for each transport mode make sure that the co-operation with customers and stakeholders runs smoothly, both at national and international level.

Trafi Organisation as of 1.1.2012

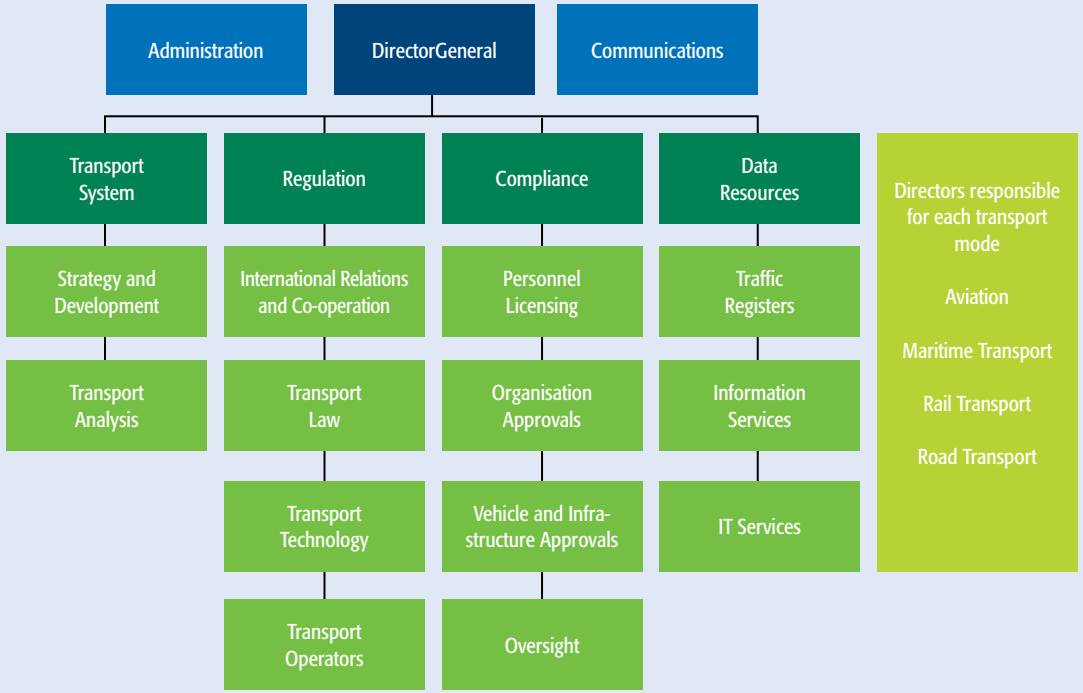


Photo: Finavia

1 Co-operation between aviation authorities in Europe

1.1 European Aviation Safety Agency (EASA)

The European Aviation Safety Agency is the centrepiece of aviation safety in the European Union, tasked with promoting the highest standards of safety and environmental protection in civil aviation.

Over the years, air transport has become the safest mode of travel. As air transport continues to grow, Europe needs a common system guaranteeing the continued safety of air transport and its conformity to principles of sustainable development. National authorities will continue to be charged with the majority of operative duties, including the airworthiness certification of individual aircraft and pilot licences. EASA is tasked with developing common European safety and environmental regulations. The agency monitors compliance with standards by carrying out inspections in Member States and ensures the availability of the required technical expertise, training and research.

EASA is also charged with type certification, for example of specific aircraft models, engines and components that can be used within the European Union. Common requirements, cost-efficient services and a centralised liaison body benefit the entire aviation industry.

Photo: Mika Huisman

The key duties of the agency currently include the drafting of safety legislation, the consulting of the Commission and Member States on technical questions, inspections, training, and standardisation programmes to ensure the uniform application of European aviation safety legislation in all Member States. The duties also include the safety and environmental type certification of aircraft, engines and components, the approval and monitoring of organisations involved in aircraft design, production and maintenance in non-EU Member States, as well as information gathering, analysis and research geared towards improved aviation safety.

The Agency's duties have been expanded to include additional key duties relating to safety regulations, such as rules and procedures in civil aviation, aircrew licensing regulations in Member States, and authorisation of third country operators. These changes have entered into force April 2012.

Future expansion will also include responsibility for safety regulation regarding airports and air traffic management systems.

1.2 Network of Analysts (NoA)

The European Aviation Safety Agency has recently established a Network of Analysts (NoA) to provide a formal process to analyse safety data at a European level. In its early stages, the membership of the NoA will be drawn from the National Aviation Authorities (NAAs) and Investigation Authorities of all EASA Member States.

The noa will focus on the following areas of work:

- Understanding what barriers exist to the provision of the best possible safety data and developing ways to improve safety data across Europe.
- Agreeing the classification of accidents in EASA MS.
- Carrying out analysis of safety data to support the European Aviation Safety Plan (EASp) and State Safety Plans, as well as identifying emerging issues for possible inclusion in the future.
- Sharing experiences, good practice and developing safety analysis projects across Europe to enable the European Aviation Community to exploit the ECCAIRS European Central Repository for the benefit of all.
- Providing analysis support to existing EASA groups such as the European Strategic Safety Initiative (ESSI) and the European Human Factors Advisory Group (EHFAG).
- Trafi has been actively involved in launching the network, and its Safety Analysis Department is represented both in NoA and in its LOC-I Subgroup (Loss of Control In-Flight).

1.3 Flight data monitoring (FDM) programme

In a flight data monitoring programme, digital flight data from routine operations is collected and used proactively to improve flight safety. It includes the technical solutions for gathering the data, data analysis, and use of the results for the purposes required by the accident prevention and flight safety programme (see EU-OPS 1.037). The data shall be used in a confidential and non-punitive manner in accordance with the principles of "just culture". Although flight data monitoring programmes are only required by European air operation rules for large aeroplanes (over 27 000 kg maximum certificated take-off mass), they have proved to be very beneficial for operators of lighter aeroplanes and helicopters as well.

FDM is an excellent tool in flight safety work. In the future, the system will further increase in significance, after the technical and regulatory issues now under development are solved. FDM alone does not provide sufficient information on the progress of the flight or any deviations from normal operations but, together with a functional reporting culture, is an efficient means to monitor the safety of operations, address any safety threats and improve operational procedures. New useful applications for FDM analysis emerge all the time; certain issues can e.g. be analysed at each airport separately for safety risk assessment purposes, or FDM data can be utilised when introducing changes to Standard Operating Procedures . Besides safety benefits, FDM analysis may also bring cost savings. FDM is a valuable tool even for accident investigation and for the analysis and reconstruction of serious incidents.

European Authorities Coordination Group on Flight Data Monitoring, EAFDM

EASA and the national aviation authorities have established an FDM expert group (EAFDM), in which Trafi has been actively involved right from the beginning. EAFDM aims to help national authorities to foster the use of FDM data for improving safety both by operators and by authorities. EASA has also set up a working group with European airlines (European Operators Flight Data Monitoring, EOFDM) with similar objectives. EOFDM works under the aegis of ECAST (European Commercial Aviation Safety Team). In 2012, EOFDM held the first conference in Cologne, in which EAFDM was actively involved both as regards the content and the arrangements. The conference brought together a large number of representatives from airlines,

aircraft manufacturers, pilot associations and regulators. The importance of co-operation for the development of flight data monitoring was widely recognised.

Part of the European Aviation Safety Programme (EASP) is the European Aviation Safety Plan (EASp). It is an annually updated four-year plan, which evaluates issues affecting safety at EU level and defines actions for different operators (European Commission, EASA, Eurocontrol, member states etc.). The current Safety Plan covers the period 2012–2015. The European Aviation Safety Plan 2012–2015 contains two new safety actions, which are linked to FDM and Safety Performance Indicators (SPI).

States should set up a regular dialogue with their national aircraft operators on flight data monitoring (FDM) programmes, with the objectives of:

- Promoting the operational safety benefits of FDM,
- Fostering an open dialogue on FDM implementation that takes place in the framework of just culture,
- Encouraging operators to include in their FDM programmes FDM events relevant for the prevention of RE, MAC, CFIT and LOC-I, or other issues of national concern,
- Agreeing with operators, on a voluntary basis, regular reporting of standardized FDM events related to SSP top priorities.

EASA should:

- Foster actions by States which contribute to improving the implementation of FDM programmes by their national operators, and
- Assist States initiate the standardisation of FDM events relevant to SSP top safety priorities."

Finland has been implementing the actions listed above through the activities of its national FDM Group and by incorporating the incident types RE, MAC, CFIT and LOC-I (runway excursion, mid-air collision, controlled flight into terrain and loss of control in flight) into its national aviation safety indicators. More information on EAFDM's work can be found on the EASA website.

FDM Operators Group Finland

The national FDM expert group of Finland was set up in February 2010. It meets twice a year, convened by Trafi. The group has representatives from Finnish airlines, the Safety Investigation Authority, Finavia and the Air Force. The FDM group freely discusses current aviation safety issues based on the participants' FDM analysis. In the group, airlines can benefit from each other's experience in the use of FDM and share best practices. It is also a means to harmonise FDM analysis in Finland, and provides an opportunity for open dialogue between authorities and operators e.g. as regards the utilisation of FDM data for developing safety indicators as well as in regulation and oversight.

1.4 Accident and Incident Reporting Systems; ECCAIRS

ECCAIRS (European Co-ordination Centre for Accident and Incident Reporting Systems) is a co-operative network of European aviation authorities and accident investigation bodies. The network is managed by the Joint Research Centre of the European Commission under the assignment of the Directorate General for Mobility and Transport (DG MOVE).

Occurrence reports received by aviation authorities are stored in the national ECCAIRS database for processing and analysis. The reports are de-identified in order to secure the highest level of confidentiality for the reporter. The Finnish civil aviation authority's database has been in use since 2005 and currently contains over 12,300 occurrences.

A limited amount of information is supplied to the pan-European database for a common analysis carried out by EASA. The database precludes the identification of individual reports or reporters. Occurrence reporting in civil aviation is regulated by Directive 2003/42/EC of the European Parliament and of the Council, and dissemination of occurrence information by European Commission Regulation (EC) no 1330/2007.

Photo: Mikael Häggblom/Trafi

2 Finnish Aviation Safety Programm

For ensuring and developing safety, it is essential that both aviation organisations and the supervising authority systematically manage their safety actions. The International Civil Aviation Organization ICAO divides safety management into two areas of responsibility: the Member State's duty to enact applicable aviation legislation, establish a supervising authority and develop appropriate mechanisms for oversight (State Safety Programme) and the operators' and service providers' duty to create and implement a safety management system to support the safety of their operations. As regards the implementation of safety management system requirements, Finland has progressed in accordance with the schedules defined by the European Aviation Safety Agency, EASA.

The Finnish Aviation Safety Programme (FASP) describes how safety-related functions are organised in Finland. The programme also serves as an instrument for presenting the complex set of regulations governing different sectors of aviation clearly as a single entity, with the aim to enhance aviation safety. The Finnish Aviation Safety Programme entered into force on 8 April 2012.

The latest version of the Finnish Aviation Safety Programme is available on the Finnish Transport Safety Agency's website: www.trafi.fi/turvallisuus/liikenteen_analyysit.

2.1 Acceptable level of safety

A central part of the Aviation Safety Programme is defining an acceptable level of safety through safety performance targets (SPT) and safety performance indicators (SPI). The safety performance targets indicate the minimum level of safety to be achieved by service providers in their operations. The achievement of safety standards is monitored using safety indicators associated with each performance target.

The acceptable level of safety is defined based on international and European studies on the most significant risk factors in aviation, taking into account specific national features.

Safety is monitored on three levels (tiers). The first tier is the highest and refers to the consequences – accidents, serious incidents and fatalities. Preventing these is the key target of all flight safety work. The means to achieve this target are proactive: the second tier refers to monitoring those types of incidents that, at the international level, have been found to most often lead to tier 1. The last, third tier examines the causal factors of 2-tier incidents in more detail, and also aims to identify any emerging threats well in advance. At each tier, safety performance targets are determined for mitigating the causal factors, and safety performance indicators are used to monitor how the targets are achieved.

Every aviation organisation must observe the safety performance targets as far as they concern their own operations. They must assess what measures are required of them to achieve the target, determine the necessary safety actions and implement them.

The functionality of safety performance targets and indicators is evaluated once a year, when the need to update the Finnish Aviation Safety Programme is assessed. In the same context, any safety targets defined at the joint European level are also taken into account.

The Finnish Transport Safety Agency uses the information derived from safety performance indicators to identify any areas of increased risk, and takes measures to mitigate the risks where necessary.

Photo: Mika Huisman

3 Status of safety performance indicators 2011

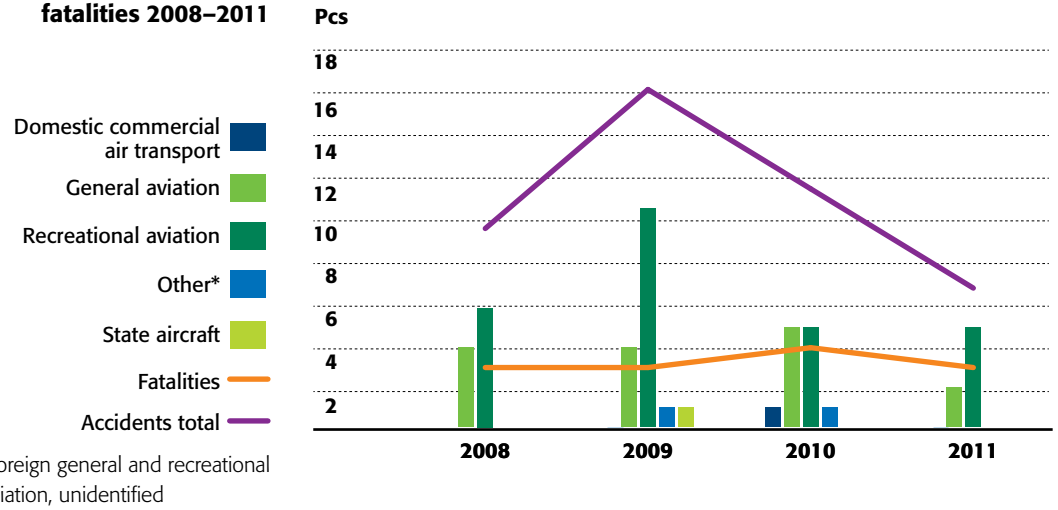
For the purposes of safety monitoring, civil aviation operations are classified into foreign and domestic commercial air transportation, general aviation (including aerial work), recreational aviation, state aviation, and other aviation activities, which includes foreign general and recreational aviation as well as unidentified aircraft. In addition, the safety status of air navigation services and airport organisations is also monitored.

3.1 Tier 1: Accidents, serious incidents and fatalities

Accidents and fatalities

In 2011, Finnish aircraft were involved in seven accidents, in which three persons were killed. None of the accidents occurred in commercial aviation. The two fatal accidents occurred to sailplanes in recreational aviation.

Civil aviation accidents and fatalities 2008–2011



*foreign general and recreational aviation, unidentified

During the period 2008–2011, there were 46 civil aviation accidents, which resulted in 13 fatalities. All fatal accidents and most of the other accidents occurred in general and recreational aviation.

When analysing the causal factors on the basis of investigations carried out by the Safety Investigation Authority and the occurrence data, it can be concluded that pilot error was the most common cause. It is the most significant causal factor particularly in recreational aviation. Another frequent cause was aircraft technical malfunction.

Most accidents occurred either during take-off or landing. Of the 46 accidents during the past four years, 14 occurred on instruction flights in general or recreational aviation, most often on student pilots' solo flights.

Compared with the previous years, the total number of accidents went down in 2011 in general aviation and other sectors, but there was no similar trend in recreational aviation.

Serious incidents

Over the period 2008–2011, the total number of serious incidents has remained almost the same. In commercial air transport, a slightly decreasing trend can be seen. On the other hand, the num-

ber of serious incidents in general and recreational aviation clearly increased from year 2010.

In 2011, there were 45 incidents classified as serious. Most of them occurred during approach, landing or take-off. Serious incidents may involve one or more aircraft.

Most of the serious incidents (30) involved only one aircraft.

In domestic commercial air transport, there were six of such incidents in 2011. The causal factors included various technical malfunctions, pilot error, smoke on board and weather conditions.

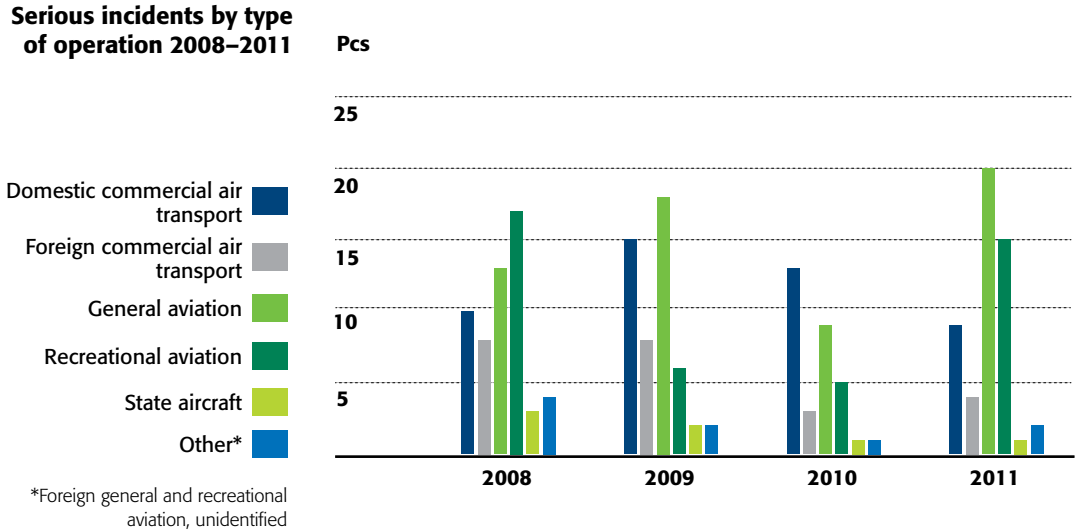
In general and recreational aviation, serious incidents involving a single aircraft were most often caused by pilot or ATC actions, and in recreational aviation, also by aircraft technical malfunctions.

More than one aircraft was involved in 15 of the serious incidents. These incidents usually involved two general aviation aircraft, or one general aviation aircraft and one recreational aircraft. Commercial air transport was involved in three incidents. Most incidents involving more than one aircraft are near misses during the flight. The second most common type of incident is runway incursion by an aircraft or vehicle, i.e. it enters an active runway without permission or against instructions.

The background for errors committed by individual aviators in a certain situation is complex, and it is often impossible to determine a single cause. However, an incident may often be due to an insufficient or incorrect image of the situation, leading for instance to a near miss. On the other hand, in general and recreational aviation, incidents often occur to pilots with a low number of total flight hours or little recent experience, which may lead to inability to take correct action in unforeseen situations. Pilot errors may also be caused by deficiencies in flight instruction or the safety culture of the organisation.

In 2011, domestic commercial air transport companies flew a total of 290,000 hours. Based on that, it can be calculated that there were three serious incidents per every 100,000 flight hours. In general aviation, the total number of flight hours was about 50,000 and in recreational aviation 35,000. The average number of serious incidents per 100,000 flight hours was 40 in general aviation and 43 in recreational aviation.

Serious incidents by type of operation 2008–2011



*Foreign general and recreational aviation, unidentified

3.2. Tier 2 safety indicators

Tier 2 safety indicators are based on those types of incidents causing the largest number of accidents and serious incidents also at international level. The higher the number of certain incidents is, the more likely it is to lead to a serious incident or accident at some time. By monitoring these types of incidents, we aim to detect any growing trends and to intervene proactively by analysing the direct and indirect causal factors of such incidents and trying to find effective safeguards.

Runway excursions (RE)

In 2011, there were a total of 14 runway excursions in Finland. None of them occurred in commercial air transport, but involved mostly recreational but also general aviation aircraft. One runway excursion caused an accident and one resulted in a serious incident. The most common causal factors included hard landings, wind conditions, slippery runways, and various technical malfunctions.

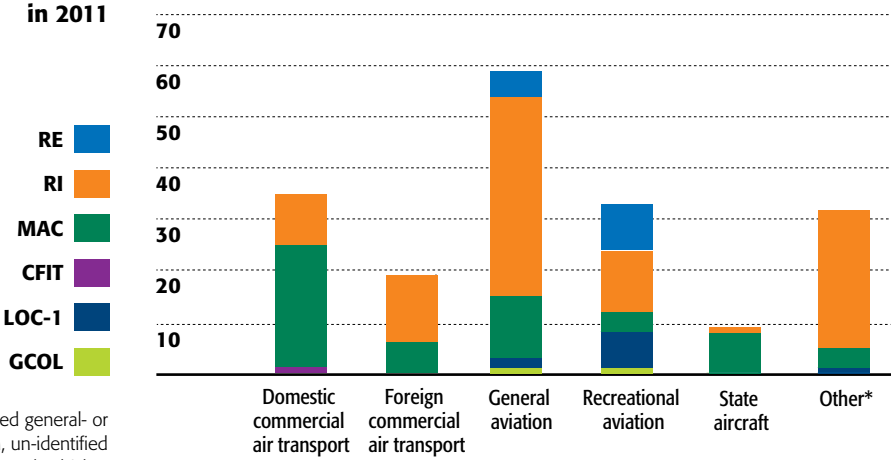
Runway incursions (RI)

Runway incursions, i.e. situations where an aircraft, ground vehicle or person entered an active runway or other area used for take-off or landing without permission or against instructions, occurred in 102 cases in 2011. None of them resulted in an accident. Serious incidents occurred in six cases, of which three were caused by general aviation aircraft, two by recreational aircraft and one by an aircraft used in foreign commercial air transportation. ATC actions directly contributed to the incident in two cases, both of which occurred at Helsinki-Malmi Airport.

Approximately half of the reported runway incursions occurred at Helsinki-Vantaa and Helsinki-Malmi airports, and the remaining half at other airports. In proportion to the number of movements, however, Helsinki-Vantaa was below the average for all airports and Malmi just at the average. It is notable that a large number

Photo: Shutterstock

Tier 2 safety indicators in 2011



*Foreign registered general- or recreational aviation, un-identified aircrafts and ground vehicles.

of runway incursions were caused by ground vehicles or persons.

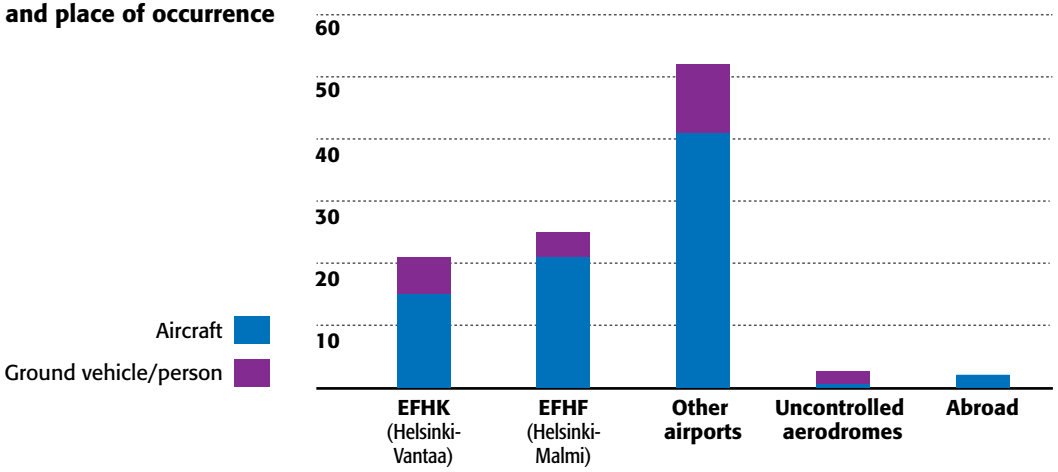
Runway incursions have been found to be one of the most significant risk factors of accidents and serious incidents. A runway incursion caused, for instance, the most disastrous aviation accident of all times at Tenerife airport in 1977, killing 583 people, and the accident at Milan Linate airport in 2001 with 114 fatalities.

According to statistics, there are on average two runway incursions in Europe each day. Eurocontrol, the European Organisation for the Safety of Air Navigation, has drafted the European Action Plan for Prevention of Runway Incursions (EAPPRI), aiming to reduce the number of runway incursions by operational recommendations. Most of the recommendations of EAPPRI have also been implemented in Finland.

Mid-air collisions and near misses (MAC)

In 2011, there were 49 incidents where the aircraft flew so close to each other or the terrain that the cases were classified as mid-air collisions or near misses. One of them resulted in an accident and 10 in a serious incident. The accident occurred in recreational aviation, as two sailplanes collided with each other. In another accident in 2011, a sailplane hit a vulture in the air and crashed, but it is not classified as MAC by definition.

Runway incursions by cause and place of occurrence



Two of the serious incidents also involved a commercial aviation aircraft. One of them occurred within Helsinki-Malmi Airport control zone between an ambulance helicopter and a general aviation aircraft, and the other in Spain, where a Finnish aircraft had to make an avoidance manoeuvre based on a TCAS resolution advisory.

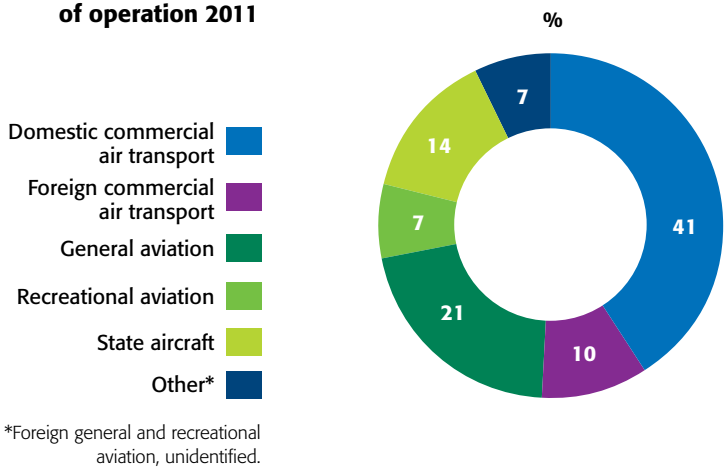
The other serious incidents took place mainly at Helsinki-Malmi Airport, and involved general aviation and recreational aircraft flying under visual flight rules (VFR). Most of the incidents occurred during the busy summer months.

Near misses occurred most often at Malmi and Helsinki-Vantaa airports, but the types of incidents were very different. At Malmi Airport, the traffic is mainly general and recreational flights under VFR, and the aircraft are not separated from each other but only provided traffic information. At Helsinki-Vantaa, most of the traffic is commercial air transportation operating under instrument flight rules (IFR), for which the ATC provides separation from each other and from other traffic.

Most of the incidents at Helsinki-Vantaa involved loss of separation. In many of them, ATC action was a contributing factor. In addition, airspace infringements by general aviation aircraft caused two near misses at Helsinki-Vantaa.

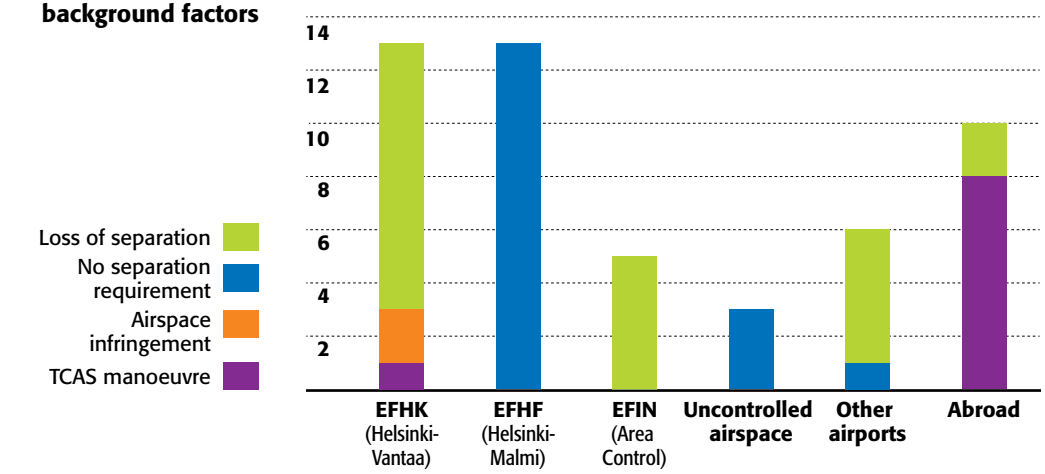
The causal factors of near misses at Malmi Airport were complex. In general, it can be concluded that the busy traffic and large number of instruction flights often lead to situations where a rather inexperienced pilot needs to act in rapidly changing circumstances. In that case, the

MAC by type of operation 2011



*Foreign general and recreational aviation, unidentified.

MAC – location and background factors



pilot's image of the traffic situation may remain insufficient despite the traffic information provided by ATC.

In autumn 2011, Trafi carried out an analysis of incidents at Malmi Airport. Among the causal factors identified were e.g. the complex and confined airspace and the large number of flight operations and different operators. Moreover, it was concluded that the RNAV approach procedure brings an aircraft performing an instrument approach straight into the aerodrome traffic circuit. The airport operator Finavia has implemented several actions to reduce the number of incidents. By summer 2012, no near miss incidents have been reported from Malmi Airport.

The number of near misses that occurred abroad was also high in 2011. Most of the cases concerned a resolution advisory from the TCAS system. The severity of the incident could not be ascertained in all cases, for which reason all reports were classified as near misses.

Controlled flight into or towards terrain (CFIT)

There was only one CFIT incident in 2011. In that case, a business aircraft on a commercial air transport flight under IFR descended significantly below the minimum flight altitude. A contributing factor was that the flight crew forgot to change the altimeter pressure setting when required.

Photo: Tapani Maukonen/Trafi

Loss of control in-flight (LOC-I)

In total, 10 cases of loss of control in flight were reported in 2011. LOC-I is also often a contributing factor to runway excursions and other incidents. In many runway excursions that occurred last year, the chain of events began when the pilot momentarily lost control of the aircraft during take-off or landing e.g. because of a gust of wind or piloting error, which in turn led to a hard landing and runway excursion. On the other hand, mid-air collisions or near misses may result in loss of control of the aircraft. This happened in 2011 in two accidents; in one of them, two sailplanes collided, and in the other, a sailplane hit a vulture in-flight, both leading to a LOC-I situation.

Most LOC-I incidents occurred in recreational aviation. Besides mid-air collisions, contributing factors included weather conditions and errors in the use of landing flaps.

Ground collision (GCOL)

In 2011, two incidents were reported where an aircraft had hit another aircraft or vehicle when taxiing outside the runway or other area used for take-off. In one of the incidents, a seaplane hit a navigation buoy, and in the other, a general aviation aircraft hit a stairway left at the apron.

4 Commercial air transport

4.1 Situation in Europe and worldwide compared to Finland

Commercial air transport operations involve the transportation of passengers, cargo and mail for remuneration or hire. In addition to scheduled and charter traffic, commercial air transport also covers sight-seeing flights. Of the total number of hours in commercial air transport, however, scheduled and charter flights account for about 96%. This review focuses on that sector.

Fatal accidents in scheduled passenger and cargo operations

(Accidents involving at least one aircraft with MTOM over 2 250 kg. Source for information concerning other states than Finland: EASA Annual Safety Review 2011.)

At the moment, the safety level in commercial air transport is relatively high throughout the world. When looking at the ten-year average (2002–2011) of fatal accidents, the same high safety level with EASA Member States is shared by North America, Australia, New Zealand and East Asia. The lowest safety level is found in


Photo: Mika Huisman

Photo: Mika Hutsman

Africa, where the number of accidents in proportion to the traffic volume is 27 times higher than in EASA Member States. North America and EASA states lead the comparison with the same figure: 1.6 fatal accidents per 10 million flights. The drop in the figure for EASA states from 3.3 to 1.6 is mainly due to the fact that the exceptionally high accident rate of 11.7 recorded by EASA countries in 2001 is no longer included in the comparison.

During the past three years, the number of fatal accidents for EASA Member State airlines has been one accident in 2009, no fatalities in 2010 and one accident in 2011. Year 2010 was the first in history without any fatalities. In an accident that occurred at Cork airport in Ireland in February 2011, six people were killed. The corresponding figures for non-EASA operators were considerably higher: 39, 47 and 45.

The most frequent type of fatal accidents to EASA operators in 2002–2011 was loss of control in-flight (LOC-I). The next categories were controlled flight into terrain (CFIT), fire on the ground, technical malfunctions (not involving the engine), and engine technical malfunctions. For non-fatal accidents, the most prominent categories were abnormal runway contact, technical malfunctions not involving the engine, ground handling operations and runway excursions. As a very recent trend, the number of CFIT and accidents related to engine technical malfunctions has started to decrease, whereas LOC-I accidents are on the increase.

Two fatal accidents occurred to commercial helicopter operators in EASA Member States in 2011, which represents 15% of the figure for the entire world. During the period 2002–2011, helicopter operators of EASA countries had 25 fatal accidents, of which 13 in HEMS operations (Helicopter Emergency Medical Services). The most frequent category of fatal accidents for EASA helicopter operators (2002–2011) was CFIT, followed by intentional low-altitude operations excluding take-off and landing. For non-fatal accidents, the most common categories were technical malfunctions not involving the engine, as well as LOC-I and CFIT.

In Finland, fatal accidents in commercial air transport operations are extremely rare, both as regards aeroplanes and helicopters. The latest fatal accident occurred in helicopter operations in 2005, killing 14 people.

4.2 Safety of commercial air transport operations in Finland

For the purpose of risk-based targeting of oversight and maintaining the safety level, the safety situation of commercial air transport operations in Finland cannot be assessed on the basis of accidents, since there were no accidents at all e.g. in years 2008, 2009 and 2011. One accident occurred in 2010 in which one person sustained serious injuries. Instead, it is more reasonable to look at serious incidents, incidents and occurrences.

In recent years, Finnish operators and aircraft operated in Finland have had 13–20 serious incidents per year (see Chapter 3.1). When comparing the types of incidents, technical malfunctions not involving the engine stand out as the most prominent category, while the other incident types are less frequent and more evenly distributed. The root causes of serious incidents resulting from technical malfunctions are, however, often related to persons and organisations. As regards incidents and occurrences, the share of technical malfunctions is only 20–30%. The rest is related to operational procedures and human factors.

Winter operations

One of the particular features in Finnish aviation is operating in winter conditions, which may often be harsh. This poses special problems, but has also developed special expertise. In recent years, a few serious incidents have occurred in which unfamiliarity with winter operations has been a contributing factor. Finnish operators are accustomed to winter conditions, but as air traffic grows more international, the number and range of foreign operators flying to Finland increases. A growing number of these airlines have no experience of winter operations. To ensure flight safety,

it is essential to be aware of this issue and to take it into consideration e.g. in ATC operations. Finnish operators should pay attention to winter operations in their lease agreements, when buying external training services and when employing and training pilots who may not have been operating in winter conditions before. As regards the safety of winter operations, it can be concluded that the number of incidents related to aircraft de-icing and anti-icing was growing at an alarming rate in 2010, but the situation improved in 2011.

Ground handling

Incidents and occurrences related to aircraft de-icing and other ground operations are closely monitored. Growing traffic volumes and airport congestion at an international level pose new challenges for the fluency and safety of ground operations. Since at the same time, the recent trend is to outsource and subcontract many functions, often in chains involving several organisations, active and systematic measures are needed to maintain a high level of safety. Good safety culture, confidential and supportive attitude towards occurrence reporting, using occurrence data for the improvement of operations, adequate staff training and instructions, as well as consideration of safety aspects when concluding agreements are key factors in the prevention of incidents. Complying with the safety management principles throughout the whole ground handling chain provides a safe basis for flight operations.

Stress and urgency

The nature of a pilot's work involves a certain number of urgent and sometimes unforeseen situations, in which he or she must be able to operate efficiently and safely. Nevertheless, urgency in aviation can be said to have increased in recent years. Traffic growth, tight schedules, increased tasks in the cockpit, congestion, complex taxi routes and increasing number of runway crossings all add to the possibility of human errors. Improvements in technology may bring both risks and safety benefits: complex aircraft systems are a challenge to pilots, but on the other hand, highly developed systems provide added safety value. The purpose of high-quality training and well-designed procedures (e.g. Standard Operating Procedures and radio phraseology) is to prepare pilots for any situations they may encounter and minimise the possibility of human error.

Signs of all factors listed above are particularly visible in incidents and occurrences related to the take-off phase. Some of them are estimated to be causal factors even in serious incidents, especially in 2010. In year 2011, the number of these incidents decreased, but the issue still deserves attention. The most critical stage is line-up on the runway. When analysing take-offs with e.g. incorrect trim or flap settings, wrong configuration or false mass or speed data in the aircraft Flight Management System (FMS), similar factors could be found in the background. In many cases, the pilots' normal work flow had been disrupted during taxiing and especially in its final stages, for instance when reading the checklist. Air traffic control (ATC) may have deviated from standard phraseology or procedures, or a repetitive stage of work, which would normally remind the pilots of the following step, has been inadvertently left out for some reason. In a busy situation, where both pilots need to perform several tasks at the same time, even a small distraction may impair monitoring.

To prevent incidents and occurrences where stress and urgency are a contributing factor, it is essential to remember that for maintaining situational awareness, at least one pilot should concentrate on monitoring the environment even if the other carries out other tasks. On the other hand, it is also important that any changes made during taxiing (take-off runway or intersection, mass and balance calculation, new take-off clearance) are carefully monitored and cross-checked. Even in case of urgency and time pressure, the line-up and take-off phases should always be kept calm so that all tasks can be performed without the pilots' situational awareness being impaired. The importance of proper work rhythm and good crew resource management is particularly highlighted. Furthermore, ATC also plays a key role in reducing flight crew stress and urgency. If line-up and take-off clearances are always issued using standard phraseology and only after the plane is ready in the correct position, and communication is restricted to a minimum in the critical stages of taxiing (runway crossings and line-up), the risk of human errors is considerably reduced.

Training

Whether it comes to operations in winter conditions, at busy international airports or any other flight operations, good basic training as well as adequate and correctly targeted refresher training are key to ensuring the safety of operations. Besides meeting the regulatory requirements on content and quantity, special attention should be paid to the quality of training. Reducing the amount of training too much because of economic pressures is short-sighted business management. It is also important to address any risk factors identified through occurrence reports and the analysis of other sources of safety data. The aviation sector is going through a change; airline pilots increasingly come from different countries, different operational cultures and different training organisations. Even if all pilots meet the same international training requirements, it is particularly important to make sure that the own company procedures are adequately trained. In about 70–80% of all incidents and occurrences in aviation, the main cause is related to human factors. Many of these cases could have been avoided by efficient Crew Resource Management (CRM) and monitoring (see e.g. Chapter 4.3).

Photo: Mika Huisman

4.3 Level bust

A level bust occurs when an aircraft fails to fly at the level to which it has been cleared, regardless of whether actual loss of separation from other aircraft or the ground results. A level bust is defined as any unauthorized vertical deviation of more than 300 feet from an air traffic control (ATC) clearance (within RVSM 200 feet).

In 2011 there were 61 reported level busts. 41 of them occurred in Finland, of which 19 at Helsinki-Vantaa and 7 in area control centre (ACC) airspace. 20 cases occurred to Finnish aircraft abroad. Air traffic management (ATM) contribution can be seen as a causal factor in 8 cases in Finland and in 5 cases abroad.

In 2011 there was only one incident that was classified as serious. The crew of a Finnish aircraft flying in Russian airspace failed to select the correct altimeter setting and descended below the minimum safe altitude during approach.

Most of the level busts are caused by transport category aircraft. They occur mainly because

of linguistic difficulties, that is, the non-standard use of radiotelephone phraseology (RTF) by both pilots and ATC. The second biggest cause is the lack of cockpit resource management (CRM). The pilots need to cross check and back up each other's work: this is especially important since a previous case study on level busts revealed, for example, several instances where the altimeter setting was incorrect. This could have led to a potentially dangerous situation, especially during the approach phase. It is fundamentally important to be cautious operating in the metric environment particularly during approach, landing and take-off, if the usual working environment is in feet. For example Russia started using feet instead of metres below the transition altitude as recently as 17 November 2011.

Most of the level busts occur either in the climb or approach phase, when numerous instructions are issued by ATC. This highlights the need for a careful readback/hearback process, where both pilots and ATC carefully monitor that the right instructions have been received and understood. When dealing with foreign operators, pilots' language skills are again the biggest cause for confusion. The fact that instrument charts vary in layout and logic in different countries adds to the problem.

Vigilance and good quality RTF, as well as good CRM, are the key issues for avoiding level busts. This should be highlighted to commercial pilots as well as general aviation pilots. Proper knowledge of aviation English helps to resolve unclear situations, whether it comes to transmitting or receiving complex clearances or understanding the local procedures and documentation.

4.4 Laser interference is a growing safety threat

Laser (Light Amplification by Stimulated Emission of Radiation) interference is becoming an increasing concern in aviation. Laser beams can impair a pilot's vision during critical phases of flight, such as takeoff, landing and low level flight. Lasers can distract the pilot and cause temporary incapacitation and vision problems, including temporary flash blindness, blurred vision or even permanent damage to the retina.

There have not been any reports of lasers causing aircraft accidents, but incidents involving laser interference are increasing sharply around the world (See chart 1). The number of incidents in Finland is still fairly low compared to other countries, but the trend is unfortunately similar. The increasing trend may be partly due to technology advances but often to simple ignorance. Hand-held laser devices are easy and inexpensive to obtain, and people therefore consider them toys.

A five milliwatt green laser (the maximum output for any device labeled and sold as an office laser pointer) can distract pilots from as far as three kilometres away. A 125 mW laser may cause distraction from a distance of more than 18 kilometres. The human eye is more sensitive to green laser, which has a shorter wavelength than red or blue laser.

Pilots should be aware of the possibility of laser interference. If you encounter laser interference, follow the old principle 'Aviate, Navigate

	2011	2010	2009	2008	2007
Finland	57	35	15	9	0
USA	3 591	2 836	1 527	615	358
UK	2 300	1 400	742	178	29
Canada		182	108	62	21
Sweden		128	87	5	0
Norway		155	119	5	0

Chart 1. Reported laser interferences 2007-2011 in selected countries. The figures for Finland include incidents that occurred in Finland or involved Finnish aircraft.

and Communicate'. Keep your eyes protected and avoid looking directly into the beam. Inform ATC of the interference and report the occurrence after the flight in accordance with the procedures outlined in Aviation Regulation GEN M1–4.

In Finland, 57 cases of laser interference were reported in 2011. The number of incidents grew especially towards the end of the year. More than half of the laser interferences occurred near Helsinki-Vantaa Airport, and some 80% of them took place during approach or take-off. Trafi takes the problem seriously and has increased the provision of information on this subject. In April 2012, Trafi sent an enquiry to aircraft operators, asking how they had taken the laser threat into account in their own operations. We have also assessed the adequacy of the current regulatory framework and taken further measures where necessary.

Laser interference is punishable by law

Laser interference is punishable as such, even if it has not caused any actual hazard to the aircraft, crew or passengers.

If the use of a laser pointer results in damage, all provisions in the Criminal Code protecting the life and health of people become applicable, including those about causing bodily injury or death. The offender would naturally also be responsible for any significant financial damage. More detailed information on the punishability of laser interference is available on Trafi's website.

Photo: Shutterstock

Photo: Mikael Häggblom/Trafi

4.5 Runway safety affected by Foreign Object Debris (FOD)

FOD is an aviation term used to describe debris on or around an aircraft, or damage caused to an aircraft (Foreign Object Damage). FOD includes a wide range of loose material, including hardware, vehicle and aircraft parts, tools, pavement fragments, rocks, sand, pieces of luggage, and even wildlife. FOD is found at terminal gates, cargo aprons, taxiways, runways, and engine run-up pads. Typically, the damages caused by FOD to an aircraft are engine failures when FOD is sucked into the engine, or tyre failures when the aircraft rolls over debris. For example, the cost to repair a FOD-damaged engine can easily exceed EUR 1 million.

Awareness and training against FOD

Promotion and Awareness Programmes can significantly help reduce FOD by improving staff information, feedback and involvement. For example, in cases of suspected tyre blast or loss of tyre tread, quick notification by the pilot is essential for the airport to be able to remove the possible FOD.

Training is a tremendous awareness tool that is not always given the priority and forethought it deserves.

Technologies for detecting and removing FOD on runways in Finland

Visual inspection, by car or by foot, is the most common means of FOD inspection. During the winter season, regular sweeping/brushing of the snow helps to remove FOD, but is not an airtight method due to the high rate of aircraft operations in between such clean-up operations.

New technology has brought more possibilities to find FOD from runways. A FOD radar is a practical way for continuous oversight of large areas, but systems currently available are not functional in local weather conditions, such as snowy/slushy runways. Magnetic bars that are attached to inspection vehicles collect only certain steel particles, and consequently do not provide full protection against FOD.

The issue has been highlighted through the mandatory occurrence reporting system. Based on an evaluation of the reported occurrences both on the runway and at ramp areas, appropriate action has been taken to ameliorate the situation.

Gravity of the problem

The consequences of FOD can be very serious to aviation safety. The fatal accident of Air France Concorde on 25 July 2000 was caused by a small piece of titanium from an aircraft that departed earlier. During takeoff, one of the tyres of the Concorde was burst by the debris, leading to structural failure of the wing fuel tank which led to a fuel leak and a fire. The aircraft crashed killing all onboard.

Although accidents are very rare, and have not occurred in Finland, there have been several cases where a FOD could have led to such an event. For example between years 2008 and 2011 there were 18 reports on aircraft parts, 16 reports on unidentified parts or materials and 4 reports on tools, including a power drill, found on runways. The high number of reports (10) concerning animals, mostly deer, at the airport area and on runways may indicate that the areas are inadequately fenced.

Mikael Häggblom/Trafi

5 General aviation

5.1 Situation in Europe

According to EASA's Annual Safety Review 2011, the number of fatal accidents in general aviation and aerial work (involving aeroplanes and helicopters with a maximum certificated take-off weight, MTOW, over 2250 kg) increased in Europe. Clearly the most frequent accident category in general aviation was loss of control in-flight (LOC-I), while e.g. the share of technical malfunctions was considerably smaller. In aerial work, the category with the highest number of fatal accidents was intentional low altitude operations, excluding take-off and landing, while LOC-I was the second largest category.

5.2 Safety of general aviation in Finland

Aeroplanes

The number of serious incidents in general aviation rose from 2010, but the number of accidents clearly decreased. In 2011, there were 20 serious incidents and one accident, in which no one was injured. The accident occurred during a touch-and-go landing on an instruction flight, when the student pilot, for an unknown reason, pulled the gear up while the plane was still in the ground run. Runway excursions caused four serious incidents, but no accidents. The growth in the number of serious incidents mainly resulted from near mid-air collisions at Helsinki-Malmi Airport.

The number of runway incursions involving general aviation aircraft increased by 54% from the previous year. In 2011 there were 43 incursions, which resulted in three serious incidents but no accidents. Half of the reported runway incursions occurred at Helsinki-Malmi Airport. One of the factors contributing to the growth of runway incursions at Malmi was the adjustment of taxiing procedures which had been in use for a long time. Many pilots have acted "from old memory" in accordance with the earlier procedures.

Accidents and serious incidents in general aviation 2008–2011

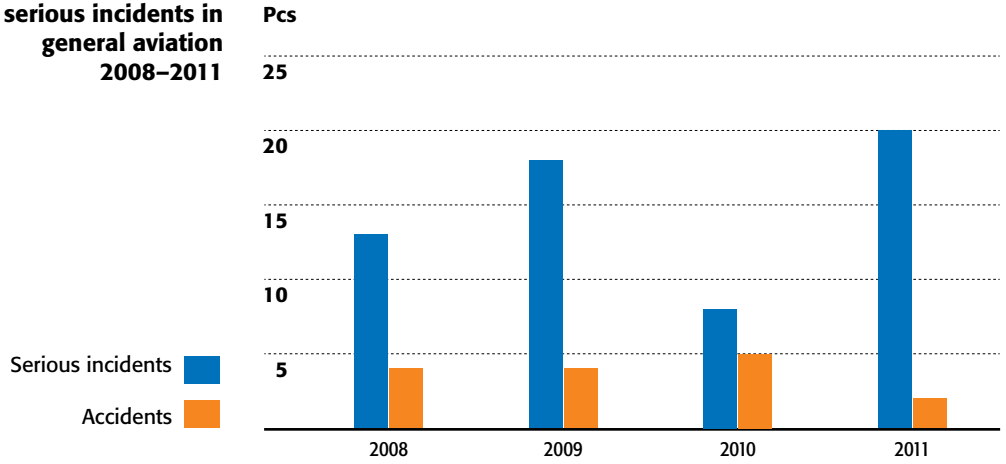



Photo: Mika Huisman

In general, the most significant causal factor for runway incursions was misinterpretation of clearances. For example, the pilot may mistake a route clearance for take-off clearance or mix up a clearance to taxi to holding point with a clearance to line up.

Helicopters

In 2011, helicopters were involved in four serious incidents and one accident, in which the pilot and passenger were slightly injured. Both the accident and one of the serious incidents were due to loss of control in flight (LOC-I). The other incidents comprised a near mid-air collision between an ambulance helicopter and a general aviation aircraft at Helsinki-Malmi Airport, fuel starvation during hover and a runway incursion.

5.3 Airspace infringements in Finland

Airspace infringements in Finland

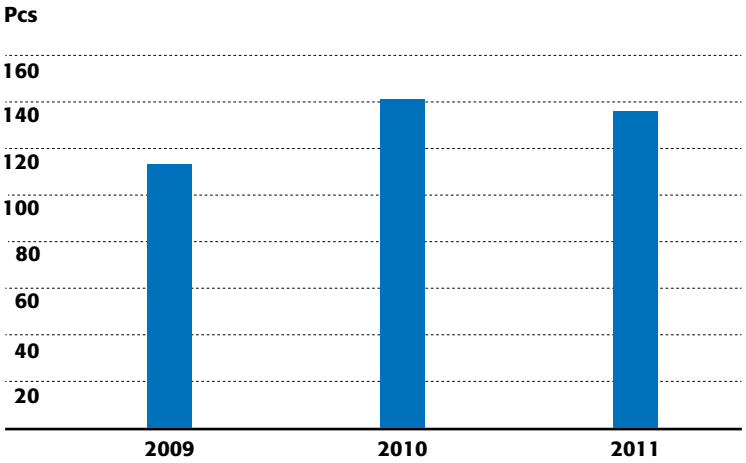
The increase of airspace infringements is one of the most worrying trends in recent years. An airspace infringement occurs when an aircraft penetrates an area into which special clearance is required without having such clearance. Factors often contributing to airspace infringements include insufficient knowledge of airspace structures and operational procedures, poor navigation skills, inadequate flight preparation (e.g. outdated charts) and deficiencies in communication with ATC.

An airspace infringement may lead to the aircraft getting too close to another aircraft or into another aircraft's wake vortices. Wake turbulence may cause loss of control of the aircraft. In the worst case, the situation may require an abrupt avoidance manoeuvre or even lead to a collision.

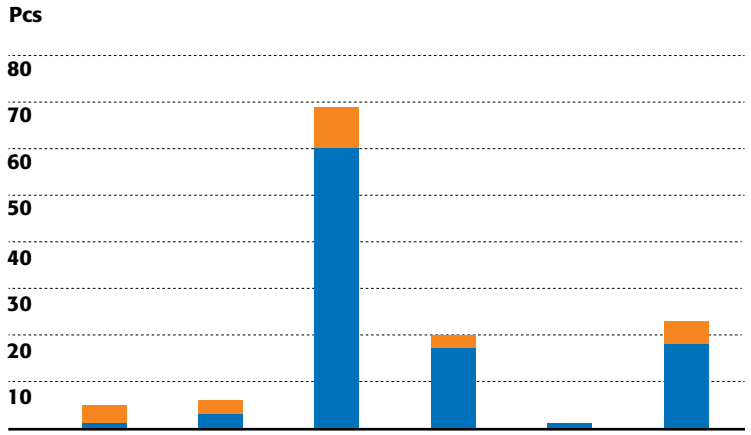
The aircraft may also get into an area where activities dangerous to the flight are carried out (such as firing, blasting, military exercises or unmanned aerial vehicle operations). Several incidents occurred in 2011, where an aircraft flew into an active danger area with the result that the firings had to be interrupted.

In addition, airspace infringements may interfere with other traffic in controlled airspace by increasing pilot and controller workload. An airspace infringement may, for instance, cause disruption or unnecessary missed approaches to commercial traffic, so that the flight must be cleared for a new approach. Such disruptions also add to the costs and negative environmental impacts of aviation e.g. by increasing fuel consumption. Only between June and September last year, there were 16 airspace infringements within the terminal control area (TMA) and control zone of Helsinki-Vantaa Airport, causing inbound large aircraft to go around or change their flight path. In September 2011 a light aircraft strayed into the Helsinki TMA and caused a serious incident, of which the Safety Investigation Authority of Finland (OTKES) started an initial investigation on 16.9.2011. The Investigation

Airspace infringements in Finland 2009–2011



Airspace infringements by type of operation and subject of i nfringement 2011



Airspace restrictions

Controlled airspace

*Foreign general and recreational aviation, unidentified.

Report C8/2010 concerning airspace infringements was completed in August 2012.

Infringements are common particularly in the airspace around Helsinki-Vantaa Airport, and they quite often occur on instruction flights. Airspace users should be made aware of the potentially severe consequences of infringements into controlled airspace. This goal can be achieved by providing more information on the consequences and appropriate safety distances, organising seminars and information meetings, providing training and improving co-operation between different operators in the field.

In autumn 2011, Trafi set up a special working group to investigate the causes of the problem and find out solutions. At the group's initiative in June 2012, Trafi sent all pilot licence holders and training organisations a letter addressing the potential dangers of airspace infringements, their causes and necessary corrective actions. Moreover, the Agency decided to continue providing information on the issue through different media and by promotional visits. An extensive study about the effects of the use of transponder in preventing airspace infringements and possible need to change the current situation is also under way.

Photo: Shutterstock

6 Recreational aviation

Recreational aviation *continues in popularity, especially as regards microlight aircraft operations. In 2011, the number of flight hours in recreational aviation grew from the previous year. Unfortunately, also the number of serious incidents increased.*

6.1 Serious incidents and accidents in recreational aviation

The number of serious incidents rose sharply in 2011 and was more than double the number in 2010. On the other hand, there were fewer accidents and fatalities. In two cases a microlight aircraft was involved in an incident with a fixed-wing aircraft.

6.2 Microlights

The number of serious incidents to microlight aircraft almost doubled from 2010 to 2011. The incidents were mainly runway excursions, losses of control, and technical problems. Typical incidents included hard landings, incorrect use of flight controls, engine failures and subsequent forced landings, and the misinterpretation of weather conditions (for example wind direction and speed). In all cases there was substantial damage to the airframe; mostly to the landing gear, propellers and wing structures. Since a microlight aircraft combines a light airframe with a relatively large power plant, piloting the aircraft can be challenging. It is also notable that in most cases the pilot was fairly inexperienced, which adds to the challenge of controlling the microlight.

In 2011, there was one accident but fortunately no fatalities, although the aircraft was badly damaged.

6.3 Gliders and motor gliders

There were three accidents and one serious incident in 2011, compared to two accidents and one serious incident in 2010. Two of the 2011 accidents were fatal. In the first instance two gliders collided whilst competing in the Finnish Championship race, resulting in one casualty. Both gliders were destroyed. The second accident occurred when a vulture hit a glider in the north of Spain. Both pilots were killed and the glider was destroyed.

The third accident occurred when the pilot miscalculated the distance to run to touchdown. The glider stalled and crashed into nearby woods. Luckily the pilot survived, but the glider was damaged.

In general, the flying season for gliders is relatively short, and the airspace reserved for gliders can get crowded. This can be potentially hazardous as pilots fly in the same area searching for thermals.

Photo: Mikael Häggblom/Trafi

6.4 Co-operation between Trafi and the Finnish Aeronautical Association

A new kind of working relationship was established in the beginning of 2011, when Trafi and the Finnish Aeronautical Association (SIL) agreed that all occurrence reports regarding parachuting activity will be handled by SIL. Furthermore, in the spring of 2012 Trafi and SIL signed an agreement about principles and practices, according to which SIL will assist in analysing occurrence data concerning recreational aircraft.

The Finnish Aeronautical Association was founded in 1919. It is the national and central organisation of sport aviation in Finland. The sphere of activity of SIL includes ten different air sport disciplines: powered flying, gliding, experimental flying, microlight flying, hang gliding, paragliding, parachuting, ballooning, ascending parachutes and aeromodelling. SIL has over 260 member organisations (clubs) and about 10 000 members. The clubs are fairly evenly distributed over the whole of Finland, from Hanko to Ivalo and from Vaasa to Joensuu.

7 Air navigation services and aerodromes

Air navigation *service units provide the services necessary to air traffic in the air and at aerodrome manoeuvring areas. Airport service companies, on the other hand, attend to the needs of air transport on the ground. Both operators play a central role in ensuring the safety and smooth flow of air traffic.*

7.1. Safety of air navigation services in 2011

In 2011, Finland had four providers of air navigation services. The largest service provider was Finavia Corporation, which offered air traffic services, weather services, aeronautical information services, and communication, navigation and surveillance services. At Seinäjoki Airport, the Rengonharju-säätiö (Rengonharju foundation) provided air traffic services and weather services, while at Mikkeli Airport, these services were offered by the city of Mikkeli. In addition, the Finnish Meteorological Institute provided weather services.

In 2011, approximately 1,700 occurrence reports were submitted by air navigation services.

Reports submitted by air navigation services in 2011

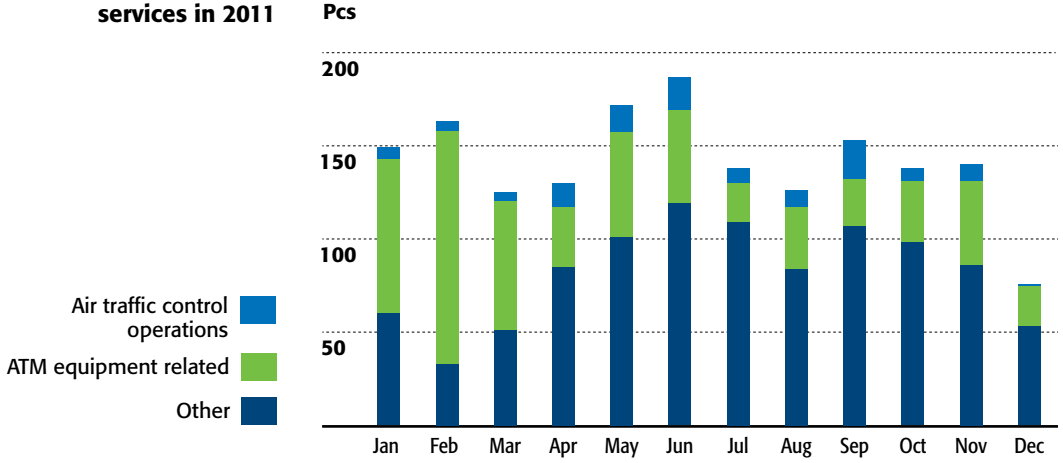


Photo: Finavia

Approximately half of the reports pertained to air navigation service operations. Other reports were related to the operations of the pilots or to technical problems in the aircraft, airport maintenance operations, bird strikes, and laser interference.

Reports concerning air navigation services were divided into reports on malfunctions in air navigation technical systems and reports on the operations of air traffic controllers or flight information service officers.

With regard to air navigation technical systems, the majority of reports were related to the Eurocat air traffic control system. In the main, reports pertained to various problems in the system's internal flight data coordination, the combination of radar targets and flight plan data, and the occasional disappearance of radar targets from the Eurocat radar display.

In late November 2010, the operations of Rovaniemi and Tampere Area Control Centres (ACC) were merged into a single Area Control Centre Finland in Tampere, and Rovaniemi ACC was closed down. This change was not notably visible in the number of reports.

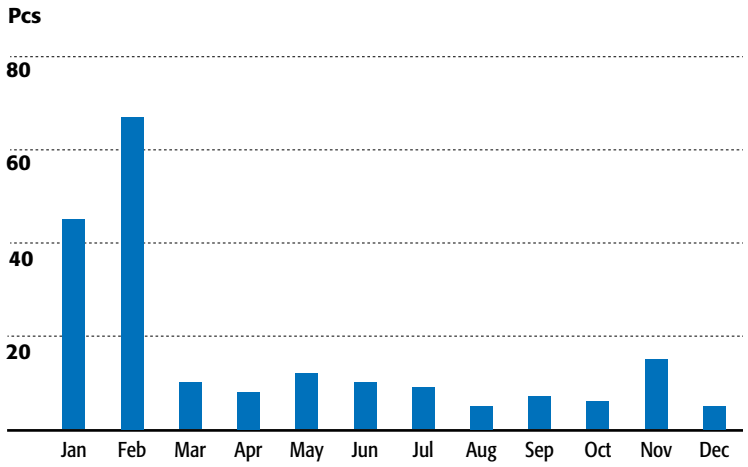
In late 2010, Finavia concentrated its pre-flight information services for several airports into a centralised briefing centre at Helsinki-Vantaa Airport. When the operations began, the number of reports pertaining to the briefing services (mainly related to the processing of flight plans) increased slightly and this trend continued in 2011.

During 2010, an automated weather observation system was introduced at the airports of Oulu, Pori, Turku, Vaasa, Jyväskylä, Kuopio, Rovaniemi and Tampere-Pirkkala. Previously, a person working in pre-flight information services had made the observations based on the information produced by observation systems and visual assessment of the weather. The introduction of the system was visible as a significant increase in the number of reports related to weather observations, and this number remained high in 2011. Approximately 200 reports concerning automated weather observation were submitted in 2011. Nearly all the reports related to the differences between the weather observations produced by the system and the visual observations made by the pilot or air traffic controller, particularly in winter conditions. In the main, the weather data produced by the system 'opted to be on the safe side'. In other words, the actual weather was better than that notified by the system. The introduction of automated weather observation cannot be considered to have caused notable safety effects, but the system was found to need development so that it would serve users better.

In year 2011, the Ministry of Transport and Communications decided to centralise the production of aviation weather services in Finland to the Finnish Meteorological Institute, which has been in charge of weather observations at airports as of 1 June 2012.

Significant trends that affected the operations of air navigation services in 2011 included a

Number of reports regarding automated weather observations 2011



high number of airspace infringements, particularly near Helsinki-Vantaa Airport; incidents at Helsinki-Malmi Airport; and an increase in laser interference.

As a whole, there were no accidents in 2011, which could be directly linked to the operations of air navigation services. Air traffic control operations were a contributing factor in a total of seven serious incidents in Finland; in two, indirectly and in five, directly. All cases occurred at Malmi airport to general aviation aircraft. Incidents in the busy traffic of Malmi airport have been noted and, with respect to air navigation services, Finavia has implemented several measures to improve the situation. These measures are described in more detail in Chapter 4.

7.2. Safety of airports in 2011

Airport maintenance personnel, who are responsible for the maintenance of the runways and aprons, as well as ground handling companies, play an important role in ensuring safety. In Finland, airport services are mainly provided by Finavia and, as smaller operators, the Rengonharju-säätiö at Seinäjoki airport and the city of Mikkeli at Mikkeli airport. Ground handling services are offered by several companies at different airports. In addition, there are several private aerodromes in Finland.

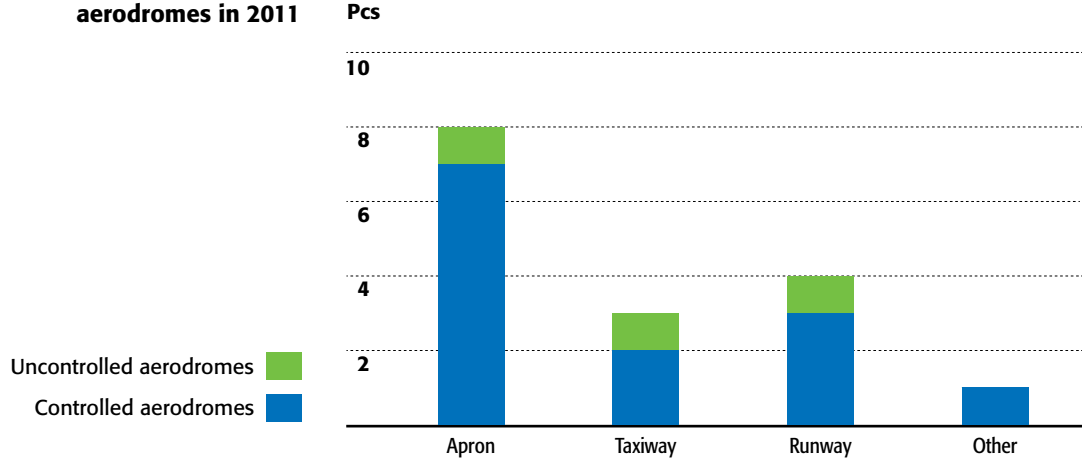
For the safety of aircraft, airport maintenance is crucial, particularly during the winter. In Finland, runways are generally kept in a good condition also in winter. In 2011, 17 incidents related to the condition of the runways, taxiways or aprons were reported, 14 of which occurred in controlled aerodromes and the rest in uncontrolled aerodromes. The majority of reports pertained to the slipperiness of apron areas. The possibility of accidents caused by slippage is relatively high at airports in northern Finland, where a lot of charter traffic is handled in the winter from countries where operations in winter conditions are rare.

The number of runway incursions caused by maintenance vehicles or personnel has steadily increased over the recent years. From 2010 to 2011 the number of incursions doubled. Naturally, maintenance often needs access to the runway, but particular attention should be paid to reducing the number of such runway incursions, since a vehicle on the runway causes just as big a danger to air traffic as another aircraft.

In 2011, there were no accidents or serious incidents caused by airport maintenance operations. In one accident in recreational aviation, a contributing factor was too long grass on the grass runway of an uncontrolled aerodrome.

The ground handling companies mainly operate in the vicinity of the aircraft. A situation in which several planes are handled simultaneously (cleaning, fuelling, loading/unloading of luggage, transport of passengers between the plane and terminal, catering, de-icing and anti-icing) is particularly challenging and also increases the possibility of accidents. Even a small knock or

Reports related to the condition of aerodromes in 2011



dent may have a major impact on the operation of the aircraft, in addition to the costs caused by the damage. Increased attention should be paid to the appropriate reporting and prevention of such accidents in ground operations. In 2011, 40 cases were reported in which a ground handling vehicle or other equipment hit an aircraft. The majority of incidents in Finland occurred at Helsinki-Vantaa Airport.

There were no accidents or serious incidents due to the operations of ground handling organisations.

Photo: Shutterstock

7.3 Single European Sky (SES) and Functional Airspace Blocks (FAB)

Development of the Single European Sky began at the beginning of the 21st century, when the European Commission compiled an action plan regarding the implementation of SES. The Single European Sky project aims to prevent and remove hindrances caused by air traffic delays and the congestion of airspace in many EU member states. The most important goal of the project is to increase the capacity of the air traffic management system. In addition to more accurate timetables and less air traffic emissions, increased capacity helps achieve more direct flight routes and savings in flight times.

Based on the regulation laying down a performance scheme for air navigation services and network functions, the EU Commission has issued goals for environmental impact, system capacity, and cost-effectiveness in 2012–2014. Finland drew up a national performance plan for 2012–2014 in the summer of 2011. Air navigation services, offered by designated air traffic service and weather service providers, have been set national performance goals so that they are integrated as a part of the union-level goals.

A technological corner stone for the Single European Sky project is the Single European Sky Air Traffic Management Research programme, SESAR, which was launched by the Commission, member states, and Eurocontrol in cooperation. By standardising and combining the member states' different systems, equipment, and operations, SESAR aims to modernise European air traffic management and to achieve technical harmonisation. SESAR seeks to develop a high-performance air traffic control infrastructure for the Union, ensuring the safe and environmentally friendly development of air traffic.

One of the key elements of SES is the establishment of functional airspace blocks, FABs. These FABs are intended to improve air traffic

safety, reduce environmental impacts caused by air traffic, and promote the overall performance of the air transport system by improving air traffic management.

A FAB refers to an airspace block established irrespective of national borders, based on operative demands. In a functional airspace block, the provision of air navigation services and related operations is performance-based and optimised, which allows for closer cooperation between air navigation service providers or, when appropriate, the use of one service provider.

Finland is participating in a project that seeks to establish a functional airspace block (North European Airspace Block, NEFAB) together with Estonia, Latvia and Norway.

NEFAB, a functional airspace block comprising the airspace of Estonia, Finland, Latvia and Norway

This map shows the geographical airspace that is encompassed by 'NEFAB', which is the functional airspace block comprising the airspace of Estonia, Finland, Latvia and Norway.

NEFAB will be a key contributor to the vision of the Northern Dimension and the Single European Sky performance targets – an efficient gateway between the North Atlantic Region, the Russian Federation, and the Single European Sky.

NEFAB will deliver benefits to airspace users through optimal airspace solutions and service provision arrangements, in coordination with neighbouring FABs and third states.

The establishment of NEFAB requires closer cooperation between national supervisory authorities, who aim to harmonise regulatory processes and instructions in the NEFAB area. The objective is to avoid overlapping authority operations, so that the same approval and supervision processes do not have to be repeated separately in each contracting state, but the system approval and oversight is performed in cooperation between all the national supervisory authorities at NEFAB-level. Taking expertise and available resources into account, tasks could also be divided between authorities. This procedure is considered to bring savings in resources in the long term. In addition, closer cooperation creates excellent opportunities to identify best practices and to improve the quality and efficiency of regulatory and supervisory activities through this.

Harmonisation of procedures and improved compatibility of air navigation systems are considered to improve aviation safety. More efficient exchange of safety information helps to identify possible safety threats related to the systems and to implement joint measures that improve safety in an appropriate and integrated manner.

Appendix 1: Definitions

ACAS (Airborne Collision Avoidance System) means a system that provides alerts on a risk of mid-air collision and meets the requirements specified for ACAS II systems (version 7) in Volume IV, Chapter 4 of Annex 10 to the Convention on International Civil Aviation. The system is based on exchange of data between aircraft transponders, and uses this data to provide alerts and advisories of other aircraft flying close by. A system that meets the requirements for ACAS II is known as TCAS (Traffic Collision Avoidance System). The system provides either alerts (TA – Traffic Advisory) or instructions for avoidance (RA – Resolution Advisory).

Accident means an occurrence associated with the operation of an aircraft which, in the case of a manned aircraft, takes place between the time any person boards the aircraft with the intention of flight until such time as all such persons have disembarked, or in the case of an unmanned aircraft, takes place between the time the aircraft is ready to move with the purpose of flight until such time it comes to rest at the end of the flight and the primary propulsion system is shut down, in which:

a) a person is fatally or seriously injured as a result of:
   - being in the aircraft, or,
   - direct contact with any part of the aircraft, including parts which have become detached from the aircraft, or,
   - direct exposure to jet blast,

except when the injuries are from natural causes, self-inflicted or inflicted by other persons, or when the injuries are to stowaways hiding outside the areas normally available to the passengers and crew; or

b) the aircraft sustains damage or structural failure which adversely affects the structural strength, performance or flight characteristics of the aircraft, and would normally require major repair or replacement of the affected component, except for engine failure or damage, when the damage is limited to a single engine, (including its cowlings or accessories), to propellers, wing tips, antennas, probes, vanes, tires, brakes, wheels, fairings, panels, landing gear doors, windscreens, the aircraft skin (such as small dents or puncture holes) or minor damages to main rotor blades, tail rotor blades, landing gear, and those resulting from hail or bird strike, (including holes in the radome); or

c) the aircraft is missing or is completely inaccessible (Regulation (EU) No 996/2010).

Aerial work means an aircraft operation in which an aircraft is used for specialised services suchas:

a) flights related to agriculture and forestry;
b) flights related to construction work;
c) aerial photography and mapping flights;
d) survey flights;
e) power line inspection and clearing flights;
f) towing of aircraft or other objects;
g) parachuting flights;
h) rescue services, traffic surveillance, forest fire patrol and fire fighting or other similar duties

Note: For the classification of reports, general aviation and aerial work are handled as a single category.

CFIT (Controlled flight into or towards terrain) means a situation where an airworthy aircraft under the control of the flight crew is flown unintentionally into terrain, obstacles or water, or a similar near miss.

Commercial air transport means an aircraft operation involving the transport of passengers, cargo or mail for remuneration or hire.

Domestic commercial air transport means an operation involving the transport of passengers, cargo or mail for remuneration or hire with Finnish aircraft or under an air operator certificate issued in Finland.

GCOL (Ground collision) means a situation where an aircraft collides with another aircraft, vehicle, person, structure or other obstacle when moving in other parts of the movement area than the runway.

General aviation means an aircraft operation other than a commercial air transport operation or an aerial work operation. Note: For the classification of reports, general aviation and aerial work are handled as a single category. Recreational aviation is handled as a separate category of its own.

Foreign commercial air transport means an operation involving the transport of passengers, cargo or mail for remuneration or hire with other than Finnish aircraft or under an air operator certificate issued elsewhere than in Finland.

LOC-I (Loss of control in flight) means a situation where the control of the aircraft is lost or the aircraft significantly deviates from its intended flight path during the flight.

Recreational aviation means flying with sailplanes, powered sailplanes, ultralight aircraft, autogyros and hot air balloons, hang gliding and paragliding, and parachute jumping. Note: If passengers are transported against remuneration on a hot air balloon flight, it is regarded as commercial air transport. This publication does not deal with hang gliding, paragliding or parachute jumping.

Runway excursion means a situation where an aircraft departs the runway in use during the take-off or landing run. The excursion may be intentional or unintentional.

Runway incursion means unauthorised or otherwise incorrect presence of an aircraft, vehicle or person on the runway or within its protected area.

Serious incident means an incident involving circumstances indicating that there was a high probability of an accident and is associated with the operation of an aircraft, which in the case of a manned aircraft, takes place between the time any person boards the aircraft with the intention of flight until such time as all such persons have disembarked, or in the case of an unmanned aircraft, takes place between the time the aircraft is ready to move with the purpose of flight until such time it comes to rest at the end of the flight and the primary propulsion system is shut down (ICAO Annex 13 and Regulation (EU) No 996/2010).

State aircraft means an aircraft used to perform the duties of the customs, the police or the Border Guard. Note: This publication does not account for any accidents, incidents or occurrences in military aviation, unless they have also involved civil aircraft or had an effect on civil aviation.

Printed matter

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