Swiss Accident Investigation Board SAIB
Annual Report 2013


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Swiss Accident Investigation Board SAIB

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1 Editorial

The Swiss Accident Investigation Board (SAIB) is gaining momentum.

On the occasion of the merger of the Aircraft Accident Investigation Board (the AAIB) and the Investigation Office for Rail and Navigation (UUS) at the end of 2011, the Federal Council instructed DETEC to evaluate the organisational form of the SAIB. One specific question was posed: whether the chosen form of the official commission should be retained. If necessary, an explicit legal basis would have to be created for this purpose.

The external body mandated to carry out the evaluation came to the conclusion that the independence of the SAIB is the fundamental precondition for the functioning of the investigative authority which was being set up. To this end it examined the various aspects of independence in detail. The report drawn up in the spring of 2013 states that the chosen legal form of an extraparliamentary commission constitutes the appropriate form to meet the requirements of the institutional, functional and personal independence of accident investigations derived from the international and national legal basis.

The Federal Council decided in June 2013 that the SAIB would continue as an extraparliamentary commission. The corresponding inclusion of a legal basis is envisaged in the context of the ongoing second revision of the Aviation Act.

This means that the path is clear for the SAIB to complete its organisational structuring, which is already well advanced, and to focus on its contribution to improving safety through its safety investigations.

André Piller, President of the Executive Board

2 Management Summary

The evaluation of the Swiss Accident Investigation Board which began in 2012 was completed in the reporting year. It showed that the chosen legal form of the SAIB as an extraparliamentary commission is appropriate and in particular ensures the independence necessary for a safety investigation authority. Further findings from this analysis were incorporated into the structure of the new organisation and assist in the continuous improvement of the SAIB's activities.

The present annual report includes for the first time a compilation of all the safety recommendations which were issued by the SAIB during 2013. These are provided with a brief introduction, as well as the reason why they were formulated to the respective supervisory authority. Each of these safety recommendations is also accompanied – where available – by information on the implementation status.
On the basis of the statistical data, an analysis of meaningful data over a period of several years was also undertaken for the first time. For aircraft with a maximum take-off mass of less than 5700 kg, for helicopters and for gliders it was thus possible to determine accident rates for the years 2007 to 2013 and to define trends. Regarding railway accidents trends of the actual event figures of different accident categories were analysed. The annual report also provides detailed insights into the methodology of how this analysis was produced.

In 2013, a total of 1355 notifications about accidents and dangerous events were received by the SAIB. An analysis of these notifications led to the opening of 76 safety investigations which will result in a final report. Seventy-two investigations of accidents and serious incidents were able to be concluded and a further 98 clarifications and summary investigations of events of lesser importance were carried out.

Within the framework of its investigations, the SAIB issued a total of 43 safety recommendations in 2013.

To facilitate readability of the annual report, all statistical data and compilations have been provided in the form of annexes.

3 Vision and Strategy of the SAIB

In the reporting year, the SAIB defined its vision and the strategy which guides all its activity:

Vision

We are a recognised and reliable partner in the national safety system for civil aviation and public transport and we contribute significantly to maintaining a high safety standard and generating a preventive attitude.

Strategy

1. We investigate accidents and serious incidents in civil aviation and public transportation as an independent investigative agency of the federal government.

2. We fulfil our mandate competently and in a timely manner and are a credible partner in the national safety system for civil aviation and public transportation.

3. We highlight detected safety deficits and contribute to remedying them by way of safety recommendations.

4. We communicate professionally and transparently and safeguard the positive perception of the SAIB.

5. We implement international standards and norms and understand our role within a network of national and international partners.

6. We place value on responsible and qualified employees and support them with targeted training and professional development.

4 Management

4.1 Achievement of 2013 targets

The Executive Board had laid down the following objectives for the reporting year:

A complete revision of the SAIB Ordinances

The General Secretariat of the Department (GS-DETEC) has initiated a complete revision of the existing SAIB-relevant Ordinances (Aircraft Accident Investigation, Accident Investigation and Organisation of the SAIB) and of the possibility of unification into a single Ordinance. A first draft was submitted at the end of 2013 for comments by the SAIB. In this way the SAIB management could be fully included in the revision process.

Completion of the management documentation (processes, business rules)

The management decided to adopt Rules of Organisation and Operation (ROO) which describe all business processes as well as the tasks, competences and responsibilities of the different agencies. The draft was discussed in the last quarter of 2013 within the management and prepared for comment within the Divisions. The ROO will enter into force in the course of 2014.

Implementation and life of the new organisation

Management's concern to organise investigation procedures and reporting in the Divisions according to uniform standards and quality criteria was taken up and given further consideration by the Head of the Office. Standardisation of the core processes is still incomplete and will need to be further developed over the next few years.

Evaluation of the external evaluation commissioned by the GS-DETEC

In their analysis, in addition to assessing the legal form, the external auditors placed special emphasis on the following points:

– the independence of the SAIB: Anchoring it as an ICS process;
– organisation of the SAIB: regulation of the details falling outside the Ordinances;
– regulation of communication: Definition of competencies for the different management levels;
– collaboration of the Executive Board with the Head of the Office: examining the subject matter and demarcation of responsibilities.

As a conclusion, it can be stated that the findings of the auditors were fully integrated into the drafting of the ROO, which already incorporated existing directives regarding finances and communications.

4.2 Finances

The Swiss Accident Investigation Board had at its disposal a budget of CHF 10.98 million in the reporting year. CHF 9.496 million were actually spent. This amount covers the entire personnel and operating expenditure of the SAIB. As is generally customary in other countries, the activities of the safety investigation authority are funded almost exclusively by public funds and constitute a service provided by the State to improve the safety of transportation. Consequently, all SAIB products, in particular the final reports of investigations, are provided free of charge on the internet. Printed and bound copies of these reports can be purchased individually or by subscription if required. The sale of these printed products raised a sum of CHF 49,300 in 2013 and represents the SAIB's only regular source of revenue. In addition, in 2013 there was a one-off revenue of CHF 550,000 from the sale of the service's old helicopter.

4.3 Outlook for 2014

The key areas for 2014 were derived from the assessment of the need for action and defined in the targets:

Consolidation of the organisational structure

With the introduction of the Rules of Organisation and Operation (ROO), all operational sequences and processes are regulated, as well as the responsibilities of employees. The overall framework for the structures of the SAIB is to be confirmed and renewed by extensive participation in the revision process of the SAIB Ordinance.

The manuals for the investigative activity within the Divisions are to be derived from the ROO or adapted appropriately.

In addition, there are also potential synergies for the Divisions in the use of the Central Services to be explored.

Positioning of the SAIB through maintenance of the existing network of relationships and its expansion

The valuable contacts for the mutual exchange of information with the supervisory authorities and with the key companies in the public transport sector should continue to be maintained. In addition, contacts with accident investigation authorities in neighbouring countries and with the EASA should be made.

Standardisation of processes and the understanding of quality within the Divisions

Working according to uniform standards and in accordance with common quality criteria within the Divisions remains an ongoing optimisation process. This also includes improvement in the quality of the reports and the tracking of safety recommendations.

5 Office

5.1 Personnel

Aviation Division

The full-time professional personnel of the Aviation Division did not change in 2013 and consisted of five investigators plus two female employees and one male employee of the secretariat.

In July 2013, a day of mountain training in the Bernese Oberland, in the region of Brünig, was conducted under the direction of the mountain detachment of the Air Force of the Swiss Army.

A seminar also took place in November 2013 for the experts; among other things it focused on the correct conduct at accident sites. At the end of 2013, this pool of experts comprised a total of 81 part-time investigators which are at the disposal of the SAIB-AD if needed.

Rail and Navigation Division

The full-time professional personnel of the Rail and Navigation Division was unchanged and consisted of three investigators and one female employee of the secretariat. One investigator attended the basic course for safety investigations held at Cranfield University (UK). Another investigator completed the postgraduate course in rail investigation techniques at the same university.

With regard to the opening of the cross-city link in Zurich, an inspection of this route was organised under the direction of the SBB, in order to become familiar with the specific features of these civil engineering works. In order to be able to initiate an investigation without delay in an emergency, a visit was organised to the access points on the new line for all on-call investigators.

5.2 Investigation Activity

Aviation Division

A total of 976 notifications were received by the Aviation Division in 2013. These events were assessed according to the provisions of the legislation; in the case of unintentional convergences of two aircraft in particular (airprox), additional technical resources were employed to assess the risk.

In the majority of cases, it was possible to analyse recording devices in the organisation's own laboratory in Payerne, enabling a precise analysis of the history of the flight.

On the basis of these clarifications, 21 investigations of accidents and 18 investigations of serious incidents were opened, including 10 airproxes with a high or significant risk of collision. Additionally 26 events were summarily investigated. During the same period, 43 investigations were concluded and the corresponding final report was published (cf. Annex 1). As part of the activities of the Aviation Division, 30 safety recommendations were issued.

In 2013, three total losses of commercially operated helicopters occurred within one week, with the loss of eight lives.

Rail and Navigation Division

2013 was an above-average year in relation to the number of notified events and the seriousness of the events. In both Neuhausen and Granges-Marnand, collisions occurred between two trains, causing one death and numerous injuries. Both collisions occurred because stop signals were passed. The fairly old safety systems were unable to prevent these collisions. Therefore these accidents involving collisions and nearmisses in recent years are comparable, where the existing safety systems were also unable to prevent stop signals from being passed. Various events were not reported immediately but only later, when the extent of the damage became known, resulting in extensive follow-up investigations. The reason for such delayed notifications is predominantly due to the fact that the extent of the material damage can be difficult to determine, even by experts at the site.

In 2013, the Rail and Navigation Division received a total of 379 notifications of accidents or hazards. Thirty-seven investigations of accidents and hazardous situations which lead to a final report were initiated. Seventy-two other events were analysed and the investigation was concluded with a memorandum. During the reporting year, the Rail and Navigation Division issued 23 safety recommendations and 29 investigations were completed and the final report published (cf. Annex 2).

6 Safety recommendations

In the first half of the last century accidents in the transport sector were mostly investigated by the respective supervisory authorities. However, since these may be involved in the occurrence of an accident or a hazardous situation as a result of their activity, a separation of tasks and powers developed, in particular since the foundation of the International Civil Aviation Organisation (ICAO) in 1944: in most countries, in addition to the supervisory authority, an independent State safety investigation body also exists, which is expected to clarify impartially the reasons for an accident or a serious incident. On the basis of the abovementioned separation of powers, however, the investigation body cannot itself mandate measures to improve safety, but only propose these. This is achieved by the safety investigation authority – in Switzerland the SAIB – highlighting a possible existing safety deficit to the competent supervisory authority within the framework of an interim or final report and corresponding safety recommendations. It is then up to the competent supervisory authority, together with the transport sectors concerned, to decide whether and how the safety recommendations are to be implemented.

In 2003 the European Union established the European Aviation Safety Agency (EASA), which is intended, on behalf of the Member States, to provide uniform and binding rules on aviation safety in the European aviation sector. Since that time the EASA has been increasingly involved in exercising its authority, particularly in the areas of technology, flight operations, air traffic control and aerodromes. The national supervisory authorities primarily play an executive and mediating role and their exclusive competency extends more and more only to the nationally regulated aspects of civil aviation. Since Switzerland has decided to participate in the EASA, this change also applies to Swiss civil aviation. For this reason, the Swiss accident investigation authority addresses its safety recommendations, depending on the area of jurisdiction, to the EASA or the Federal Office of Civil Aviation. Because since 1 February 2012 (EU) Directive No. 996/2010 of the European Parliament and of the Council dated 20 October 2010 concerning the investigation and prevention of accidents and incidents in civil aviation and the repeal of Directive 94/56/EC is also directly applicable in Switzerland, the recipients

of safety recommendations, pursuant to Article 18, are obliged to confirm receipt of the corresponding transmission letter to the SAIB and to inform it within 90 days after transmission of the safety recommendation of any measures taken and where applicable the time required for their implementation or, if no measures are taken, to inform it of the reasons for this.

There follows a compilation of all safety recommendations issued by the SAIB during 2013 within the framework of interim or final reports. The motive for the respective recommendation is provided in the form of a brief description of the respective accident or serious incident, as well as the safety deficit which the SAIB has determined. The implementation status as of 30 April 2014 can be found at the end of each safety recommendation. From October 2014 a new area in the SAIB's homepage will show the actual implementation status of safety recommendations.

Pursuant to article 25 paragraph 5 of the Ordinance on Notification and Investigation of Accidents and Serious Incidents in the Operation of Public Transport (VUU CC 742.161), all Rail and Navigation Division safety recommendations are addressed to the Federal Office of Transport (FOT).

6.1 Aviation Division

Safety Recommendation No. 444, 27.08.2013

BPS (ballistic parachute system) aircraft are currently identified by a small triangular decal. This decal warns of the risks a BPS can involve, and tells emergency rescue crews to call the telephone number in the USA printed on the decal before starting rescue work on the wreckage.

Safety recommendation
Above all, BPS aircraft should be clearly and uniquely identifiable as such. The aircraft must be marked by a large triangular hazard warning decal approx. 40 cm on a side on the fuselage. This decal warns in prominent colours that the aircraft has a BPS installed in or on it which may put rescue workers at risk, and that, before starting rescue work, they must call REGA's telephone number printed on the decal which will tell them how to proceed. Other precautions required are:

- The location of the rocket firing aperture must be indicated on the aircraft shell.
- The shell must be marked in such a manner that rescue workers can see where they can cut the fuselage open.

If they are in any doubt as to whether a given aircraft has a BPS on board, rescue workers must assume it has.

Implementation status
Response pending

Safety Recommendation No. 445, 27.08.2013

When air accidents are reported, there is currently no direct way of knowing whether BPS (ballistic parachute system) -equipped aircraft are involved.

Safety recommendation
The Federal Office of Civil Aviation (FOCA)'s website should add to the details displayed in the section on aircraft registration whether an aircraft is equipped with BPS or not.
If an accident is reported, SAIB/REGA staff could then check whether BPS equipped aircraft are involved in the accident and highlight the risks they present right from when they pass on the accident report.

Implementation status
Response pending

Safety Recommendation No. 446, 27.08.2013

BPS (ballistic parachute system) rockets exposed to slowly rising temperatures (SCO) may explode.

Safety recommendation
BPS rockets must be fitted with heat indicators as close to the rocket motor as possible (e.g. Telatemp). These heat indicators change colour if they exceed a given temperature. Checking the heat indicators must be included in aircraft ground checklists, for example.

Implementation status
Response pending

Safety Recommendation No. 447, 27.08.2013

Residual shelf lives of BPS (ballistic parachute system) are currently not checked systematically.

Safety recommendation
Checking the residual shelf life of a BPS must be included in aircraft checklists and/or maintenance schedules and in aircraft documents, allowing for whether maximum permitted storage/working temperatures are exceeded for any significant length of time.

Implementation status
Response pending

Safety Recommendation No. 448, 27.08.2013

The release mechanism handle is mounted in the aircraft cockpit. The release cable transmits to the igniter unit, releasing the recovery system. The rocket and igniter unit are often mounted directly behind the seats.
Accidental pulling of this release cable could set off the rocket, even if the handle is secured in place.

Safety recommendation
BPS manufacturers should check whether a cutout system could be used to separate the igniter unit from the rocket.

Implementation status
Response pending

Safety Recommendation No. 449, 27.08.2013

Currently, neither airfield managers nor their fire brigades know whether they have any BPS (ballistic parachute system) -equipped aircraft on site, and if so in which hangar.

Safety recommendation
There must be a plan of the aircraft hangars at an airfield, in its control tower and/or the fire brigade crew rooms, which clearly marks the location of any BPS aircraft.
Hangars, which have BPS aircraft, must be identified clearly, so the callout crew can respond accordingly if a hangar fire breaks out.
Hangars must have maximum thermometers, so supervisors can check what temperatures have been reached.

Implementation status
Response pending

Safety Recommendation No. 450, 27.08.2013

Many pilots and owners of aircraft equipped with BPS (ballistic parachute system) have no idea what hazards BPS could involve.

Safety recommendation
The Federal Office of Civil Aviation should ensure that pilot training programmes include details of how BPS work.

Implementation status
Response pending

Safety Recommendation No. 451, 27.08.2013

Rescue/fire brigade crews often do not take any safety precautions in relation to BPS (ballistic parachute system) when working and are neither informed nor trained.
In an aircraft accident, those inside may be badly injured, and rescue crews have to be able to complete their work within a useful time; procedures involving telephone information from a BPS specialist via a number in the USA is impracticable.

Safety recommendation
All rescue services are to be trained on the potential risks of BPS.
For this, it is essential to distinguish between:
1. Training airport emergency response crews
2. Cantonal police, emergency ambulances and fire-fighters
3. Cantonal disposal crews via cantonal police
4. Search and Rescue (SAR) crews

Implementation status
Response pending

Safety Recommendation No. 452, 27.08.2013

Hangar fires can involve extreme temperatures which could cause BPS (ballistic parachute system) rockets on BPS-equipped aircraft which are not involved directly in the fire to explode. Rescue and firefighting personnel must be informed of the potential hazards associated with BPS and reminded of the risks. In particular, as well as the usual safety precautions the temperatures reached in the hangar should be measured or monitored and a safe distance kept from the BPS-equipped aircraft.

Safety recommendation
If the temperatures reached are less than 90 °C
If the temperatures indicated by the max. thermometer are less than 90 °C, or it is safe to assume no temperatures in excess of 90 °C have been reached, the heat indicators on the rockets have to be checked taking appropriate precautions. If the heat indicators confirm no temperatures over 90 °C have been reached, the emergency services can switch to standard operating procedures.

If the temperatures reached are assumed to be in excess of 90 °C
If temperatures in excess of 90 °C have been reached, or if it is assumed that high temperatures have been reached, the emergency team leader must assume there is a risk of the rocket exploding.
The emergency team leader must ensure that all parties involved remain at a safe distance, that the area of risk is cordoned off and that a disposal specialist is called in.

Implementation status
Response pending

Safety Recommendation No. 453, 27.08.2013

On the basis of acute danger of explosion, the US Federal Aviation Administration suggests keeping a safe radius of 300 ft (approx. 100 m) around wreckage during recovery operations.

Safety recommendation
Aircraft involved in accidents which catch fire must be cooled intensively from a safe distance. This could prevent BPS rockets exploding as rescue teams approach wreckage.

Implementation status
Response pending

Safety Recommendation No. 454, 27.08.2013

During rescue activities it is possible for the rocket to be set off unintentionally thereby firing the parachute from the wreckage in a dangerous manner. Blocking the release handle with a safety bolt is inadequate as it cannot be excluded that the release cable could be under tension, prearming the firing unit firing pin. Sudden relaxing of the cable could cause the rocket to fire. Splitting the release cable could be dangerous.
The same applies when servicing and repairing BPS (ballistic parachute system) -equipped aircraft as it is possible that a rocket could be set off by accident.

Safety recommendation
Blocking the release cable
One possibility would be to block the release cable as close to the igniter unit as possible. This could be done using crimp pliers, for example, crimping the release cable to the cable sheath and so blocking it.

Safety cover over rocket
Investigations should be made to see if a safety cover can be made, from a strong shielding material such as Kevlar, for example, which could then be put over the rocket before starting to work on an aircraft or wreckage. This would work rather like body armour: if the rocket went off accidentally, the safety cover would contain it.

Implementation status
Response pending

Safety Recommendation No. 455, 01.05.2013

On 16 February 2011 a Citation C525 overshot the end of runway 07 at Grenchen regional airport (LSZG) and collided with obstacles. The accident is attributable to the fact that the expected acceleration during the take-off roll was not achieved because the parking brake was set.
The investigation identified the absence of a warning device indicating a set parking brake on initiation of the take-off roll as a contributory factor.

Safety recommendation
The Federal Office of Civil Aviation (FOCA) and the European Aviation Safety Agency (EASA) respectively should develop a technical solution together with the licensing authority for the Cessna C525 type, which warns the crew when the take-off roll is initiated with the parking brake set.

Implementation status
Response from EASA pending

Safety Recommendation No. 459, 29.01.2013

On 26 August 2010, a PA-32R-300 aircraft (HB-PRE) took off on a private flight from Saanen to Zurich. Due to corrosion and wear damage there was a significant loss of engine power and the aircraft subsequently gained hardly any height and finally crashed. All three occupants were fatally injured. The engine manufacturer recognised as early as the 1960s that corrosion damage may occur to its engines, especially if the aircraft is rarely used or is subject to particular climatic conditions. By means of technical message TM 02.020-30 the Federal Office of Civil Aviation (FOCA) considers the application of the operating times recommended by the manufacturer for aircraft up to a max. take-off mass of 5700 kg for private operation as non-mandatory and delegates the responsibility to the operator. A distinction between commercial and private operation does not make sense from a technical view-point.

Safety recommendation
The FOCA and the competent foreign authorities should consider measures which ensure that recommendations of the manufacturers regarding operating hours and calendar-based due dates are integrated into the maintenance programmes that are approved by the authorities, regardless of whether aircraft are operated commercially or privately.

Implementation status
Response pending

Safety Recommendation No. 461, 04.02.2013

After an approach on the instrument landing system for runway 10 in St. Gallen-Altenrhein with only partially extended flaps, an Embraer Phenom 300 overran the end of the runway after landing, broke through the runway fencing and came to a halt in a cornfield. The aircraft rolled over a road running perpendicular to the runway centreline, just behind a public transport bus.

Safety recommendation
The Federal Office of Civil Aviation (FOCA) should ensure that on all Swiss aerodromes, in a hazard identification, also the endangering to third parties, at least in the immediate vicinity of the aerodrome, is determined and that appropriate measures will be taken to minimise it.

Implementation status
In a letter dated 3 April 2013, the Federal Office of Civil Aviation (FOCA) reports that a hazard identification and risk assessment with mitigation planning is being undertaken as part of the safety management system (SMS) on all Swiss airports including St. Gallen-Altenrhein; the impact on third parties in the immediate vicinity of the aerodrome is already being incorporated. Therefore the safety recommendation is not necessary, or rather it has already been implemented. The SAIB assesses the implementation with regard to this matter to be inadequate to date.

Safety Recommendation No. 462, 24.10.2013

Air traffic control cleared the crew of a flight to descend to a lower flight level. At the same time, a different flight level was entered into the system by air traffic control. The crew correctly entered the clearance they had been given into their system and the flight was transferred to the next area control centre where they were expected at a different flight level. As a result, a dangerous convergence occurred with another flight.
Both aircraft were equipped with a transponder, which transmitted the flight level set in the aircraft's system to the radar stations. However, for technical reasons this data cannot currently be used by Swiss air traffic control to trigger an alert in the event of any discrepancy.

Safety recommendation
The Federal Office of Civil Aviation should ensure that within Swiss air traffic control a system is implemented which is able, in the event of a discrepancy between the air traffic control altitude clearance (cleared flight level) and the setting in the aircraft (selected altitude), to trigger an alarm.

Implementation status
In December 2013, skyguide commissioned the enhanced surveillance cleared level adherence (EHS CLAM) function in the Zurich and Geneva area control centres (ACC), thereby implementing the safety recommendation. This modification was part of a "common controller cockpit" skyguide programme and was tested and approved by the Federal Office of Civil Aviation before introduction.

Safety Recommendation No. 463, 07.02.2013

On 10 September 2010 a hazardous convergence occurred between a Saab 2000 aircraft on a visual approach to runway 19 at Lugano airport and a Swiss Air Force PC-7 training aircraft. The commercial aircraft had to fly an avoidance manoeuvre because of the traffic alert and collision avoidance system (TCAS). The analysis of the serious incident and an anonymous survey as part of the investigation suggest that a significant proportion of flight crews have insufficient knowledge of the consequences of the concept of utilisation of class D airspace and the way the onboard TCAS safety network functions.

Safety recommendation
The Federal Office of Civil Aviation should ensure that training courses to acquire all levels of licences provide sufficient knowledge to enable the licence holders to understand and implement the practical consequences of traffic alert and collision avoidance systems (TCAS) as well as the utilisation concept of Class D airspace.

Implementation status
Response pending

Safety Recommendation No. 464, 07.02.2013

On 10 September 2010 a hazardous convergence occurred between a Saab 2000 aircraft on a visual approach to runway 19 at Lugano airport and a Swiss Air Force PC-7 training aircraft. The commercial aircraft had to fly an avoidance manoeuvre because of the traffic alert and collision avoidance system (TCAS). The analysis of the serious incident and an anonymous survey as part of the investigation suggest that a significant proportion of flight crews have insufficient knowledge of the consequences of the concept of utilisation of class D airspace and the way the onboard TCAS safety network functions.

Safety recommendation
The Federal Office of Civil Aviation should, in cooperation with the Air Force and relevant aviation associations, develop simple and effective means of updating and en-

hancing the knowledge of flight crews regarding the use of TCAS and flying in mixed air space

Implementation status
Response pending

Safety Recommendation No. 465, 25.02.2013

On 12 August 2011 the aircraft Aero AT-3 R100, registration HB-SRA, had to execute an emergency landing near the village of Worb/BE as a result of a fuel shortage. The investigation revealed as contributing factors to the cause the following technical deficiencies:
- Inadequate design of the measurement system for indicating the amount of fuel.
- Incorrect information from the manufacturer concerning the tank capacity.

Safety recommendation
The European Aviation Safety Agency (EASA) should ensure that the design of the fuel quantity indication system and the manufacturer information relating to the fuel tank capacity are reviewed and corrected for the entire fleet of the aircraft model Aero AT-3 R100.

Implementation status
Response from EASA pending

Safety Recommendation No. 466, 16.05.2013

On 11 August 2012 a near-collision occurred in the Zurich terminal area between an Airbus A340-313 commercial aircraft and an ASW 20 glider because on the one hand the glider had flown into controlled airspace without clearance and on the other hand air traffic control had allowed the commercial aircraft to descend too low. The traffic alert and collision avoidance system (TCAS) on the A340-313 was unable either to issue a traffic advisory (TA) or to generate a resolution advisory (RA) because the glider was not equipped with a transponder. For the same reason the air traffic control radar system could not detect the glider and this meant that on the one hand the air traffic control officer (ATCO) could at no time perceive it and on the other hand the air traffic control short-term conflict alert system (STCA) could not warn the ATCO of the dangerous convergence.

Safety recommendation
The Federal Office of Civil Aviation should, where appropriate, in cooperation with the supervisory authorities of neighbouring States surrounding Swiss airspace, define airspace in which only aircraft which are equipped with a functioning and activated transponder are allowed to fly (transponder mandatory zones – TMZ). These TMZ should include the control areas and terminal areas and constitute vertical or horizontal buffer zones with regard to this airspace.

Implementation status
Not implemented: The Federal Office of Civil Aviation expressed scepticism on implementation in a letter dated 5 August 2013 in response to the interim report dated 17 May 2013.

Safety Recommendation No. 467, 16.05.2013

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Safety recommendation
The Federal Office of Civil Aviation should take effective measures in conjunction with the relevant aviation associations and, where appropriate, in cooperation with the supervisory authorities of neighbouring countries, in particular in the environs of major Swiss airports, which ensure that general aviation pilots consistently respect the boundaries of controlled airspace.

Implementation status
Not implemented: the Federal Office of Civil Aviation, in a reply dated 5 August 2013 responding to the interim report dated 17 May 2013, stated that prior to the serious incident, much had already been done to prevent airspace violations. No additional measures have been taken since the serious incident.

Safety Recommendation No. 468, 16.05.2013

On 11 August 2012 a near-collision occurred in the Zurich terminal area between an Airbus A340-313 commercial aircraft and an ASW 20 glider because on the one hand the glider had flown into controlled airspace without clearance and on the other hand air traffic control had allowed the commercial aircraft to descend too low. The investigation revealed that airspace violations involving aircraft equipped with a transponder had occurred regularly and in relatively large numbers in recent years. Furthermore, there was also evidence of airspace violations by gliders; the systematic detection of these had not been attempted to date.

Safety recommendation
The Federal Office of Civil Aviation should, together with the air navigation service provider skyguide, the relevant aviation associations and, where appropriate, in cooperation with the supervisory authorities of neighbouring countries, develop measures to ensure that airspace violations involving also aircraft that are not equipped with transponders are systematically detected and that the associated risks can be reduced.

Implementation status
Not implemented: the Federal Office of Civil Aviation, in a letter dated 5 August 2013 in response to the interim report dated 17 May 2013, stated that to date no suitable methods of detecting such air-space violations exist, apart from the voluntary SWANS reporting system.

Safety Recommendation No. 469, 19.06.2013

Control of a glider was lost during a winch launch. The fact that the flaps had not been locked before take-off and had then automatically extended contributed to this.

Safety recommendation
The Federal Office of Civil Aviation (FOCA) should ensure that when licensing gliders in the future a safety device is provided which prevents accidental extension of the flaps without the pilot performing additional manipulations.

Implementation status
Response pending

Safety Recommendation No. 470, 02.09.2013

On 19 May 2012 at 17:35 local time, an ASW 28-18 glider had an accident on the Falknishorn mountain. The pilot was seriously injured by the impact; however, he was able to exit the aircraft on his own. Swift medical care would have been essential. However, the wreckage was only located approximately six hours after the accident, and rescuers did not arrive until approximately 13 hours after the accident; the pilot had died in the meantime. The investigation indicated that the glider had been recognised as overdue only with a considerable delay and had carried an emergency transmitter of a fairly old design, which made locating it more difficult.

Safety recommendation
The Federal Office of Civil Aviation, in conjunction with the relevant aviation associations, should develop simple operational and technical measures that are economical to implement, in order to ensure that injured glider pilots can be located quickly.

Implementation status
Response pending

Safety Recommendation No. 471, 31.07.2013

On 17 August 2011, the instructor at the FIN position took over control of the crossing of two aircraft. He issued two radar headings to SWR 194W in order to cross the runway 23 approach centre line. Moments later, a conflict arose between SWR 194W and AUF 331, which was established on the ILS. A STCA alert was triggered, but only at the PRE and APC positions. As a result, the instructor at the FIN position did not receive the visual or audible STCA alert and was informed of the conflict only by the trainee in the PRE position and the APC controller.

Safety recommendation
The Federal Office of Civil Aviation should request technical adaptations which would make it possible to have available STCA alerts originating from other control positions.

Implementation status
Response pending

Safety Recommendation No. 472, 29.08.2013

On 16 December 2011 a hazardous convergence occurred between a Saab 2000 commercial aircraft and a C510 Mustang executive aircraft on the approach to Lugano airport, under instrument meteorological conditions, in level flight. The altitude information for both aircraft on the radar display (DFTI) in Lugano indicated altitudes to the air traffic control officer which were based on atmospheric pressure and the transition level (TL) for Zurich. Because the atmospheric pressure difference between Zurich and Lugano was substantial, the altitude information on the DFTI did not correspond to the actual altitudes in flight and made it difficult for the air traffic control officer to maintain an overview. This design defect in the system constitutes a considerable risk from the viewpoint of aviation safety.

Safety recommendation
The Federal Office of Civil Aviation should, together with the air navigation service provider skyguide, ensure that correct data is displayed at least on all radar systems which are intended, among other things, for use in emergency situations.

Implementation status
Response pending

Safety Recommendation No. 473, 05.08.2013

On 11 August 2011 a hazardous convergence occurred in the Emmen military aerodrome terminal area between a Mooney M20J aircraft and a Swiss Air Force Eurocopter AS532 helicopter. During the investigation it was found that although civil and military air traffic control are integrated into one organization, military air traffic control, as opposed to civil air traffic control, is not equipped with the ground-based short-term conflict alert (STCA) system.

Safety recommendation
The Federal Office of Civil Aviation should ensure, in conjunction with the air navigation service provider skyguide, that a ground-based conflict alert system is also available on Air Force aerodromes.

Implementation status
Response pending

Safety Recommendation No. 474, 05.08.2013

On 11 August 2011 a hazardous convergence occurred in the Emmen military aerodrome terminal area between a Mooney M20J aircraft and a Swiss Air Force Eurocopter AS532 helicopter. During the investigation it was found that the Eurocopter AS532 Cougar helicopter involved in the serious incident had no system to warn of or prevent collisions, even though this aircraft type is equipped with a modern digital cockpit. The reason for this is that for the operation of state aircraft there are waivers which allow safety equipment which has long been standard for civil aircraft in a similar category to be dispensed with. Since in Switzerland in particular, numerous military aircraft are operated for the most part in civil airspace, this lack of equipment constitutes a considerable risk for all airspace users.

Safety recommendation
Together with the Air Force, the Federal Office of Civil Aviation should ensure that those Air Force aircraft, which operate for the most part in civil airspace, are also equipped with collision alert systems that are compatible with civil standards.

Implementation status
Response pending

Safety Recommendation No. 475, 22.10.2013

Since 2005 four similar accidents have occurred in a heli-skiing environment; in the case of each of the individual accidents no safety recommendation was issued. A collision with the terrain in the context of heli-skiing operations in the high mountains in critical weather conditions is a common factor in all the accidents. Three of the four accidents occurred as a result of loss of visual references. The fourth accident occurred during an attempt to land in critical wind conditions. The following contributory factors were ascertained in all the investigations: pilots' limited flying experience, operation of the helicopter close to its performance limits, and in some cases operational pressure.

Safety recommendation
The Federal Office of Civil Aviation (FOCA) should ensure that, during helicopter pilots' training and continuing training, specific training on the decision-making process is provided at all levels.

Implementation status
Response pending

Safety Recommendation No. 476, 11.10.2013

On 27 September 2013 a Bombardier DHC-8-402 aircraft was forced to make a landing at Zurich with the main gear extended and nose gear up due to a malfunction of the nose landing gear.
The investigation revealed that a cover plate which protects two sensors which indicate whether the landing gear is under load – weight on wheel (WOW) – was found squeezed between the lower and the upper drag strut of the nose landing gear, impeding extension of the nose landing gear. As it was not possible to date to prove that the investigated case was an isolated event, there is a probability that nose gears of comparable design could also be affected.

Safety recommendation
Transport Canada and the European Aviation Safety Agency, together with the aircraft and the landing gear manufacturers, should take appropriate measures in order to facilitate early detection of damaged weight on wheel cover plates on nose landing gears in levered suspension configuration.

Implementation status
Partially implemented: In a letter dated 28 January 2014, Transport Canada (TC) responded to the SAIB interim report dated 11 October 2013 describing measures which the aircraft manufacturer has implemented or will implement in future.

Safety Recommendation No. 477, 11.10.2013

On 27 September 2013 a Bombardier DHC-8-402 aircraft was forced to make a landing at Zurich with the main gear extended and nose gear up due to a malfunction of the nose landing gear.
The investigation revealed that a cover plate which protects two sensors which indicate whether the landing gear is under load – weight on wheel (WOW) – was found squeezed between the lower and the upper drag strut of the nose landing gear, impeding extension of the nose landing gear. As it was not possible to date to prove that the investigated case was an isolated event, there is a probability that nose gears of comparable design could also be affected.

Safety recommendation
Transport Canada and the European Aviation Safety Agency, together with the aircraft and the landing gear manufacturers, should assess the risks involved with the installation of weight on wheel cover plates on nose landing gears in levered suspension configuration and take appropriate preventive measures.

Implementation status
Partially implemented: In a letter dated 28 January 2014, Transport Canada (TC) responded to the SAIB interim report dated 11 October 2013 describing measures which the aircraft manufacturer has implemented or will implement in future.

6.2 Rail and Navigation Division

Safety Recommendation No. 17, 02.05.2013

On 29 January 2012, support 17 of the Turren–Schönbüel 4-seater chairlift tipped over during the out-of-service run before commencement of operation. As a result, four chairs in supports 15–16 became jammed. The cable was derailed. The layer of snow which was slowly sliding downhill had compressed support 17 with its base. When the installation was constructed, the overall stability of the substrate for support 17 was not examined; only the local compression below the support. Due to the layer of clayey silt which was encountered, the initial stability of the slope was already low, even without the influence of the support.

Safety recommendation
Support 17 should not be constructed in the same position owing to the geotechnical conditions (depth of rock, poor material characteristics of the unconsolidated rock, questionable stability of the slope)

Implementation status
The safety recommendation has been implemented. The capacity of the installation has been reset to 25% of the initial number of chairs. Support 17 is therefore no longer required.
The installation's operating permit was suspended by the FOT by its decision of 26 March 2013 because of operational safety deficiencies.

Safety Recommendation No. 18, 02.05.2013

On 29 January 2012, support 17 of the Turren–Schönbüel 4-seater chairlift tipped over during the out-of-service run before commencement of operation. As a result, four chairs in supports 15–16 became jammed. The cable was derailed. The layer of snow which was slowly sliding downhill had compressed support 17 with its base. In the winter of 2011/2012 the snow pressure on the support had a far greater impact than had been assumed in 1999 when it was designed.

Safety recommendation
If support 17 were to be rebuilt in the same position, the provision of measures to protect against sliding snow should be examined. The foundation and the support should be dimensioned to cope with the forces due to sliding snow.

Implementation status
The safety recommendation did not have to be implemented. The capacity of the installation was reset to 25% of the initial number of chairs. Support 17 is therefore no longer required.
The installation's operating permit was suspended by the FOT by its decision of 26 March 2013 because of operational safety deficiencies.

Safety Recommendation No. 20, 30.04.2013

On 19 March 2012 a fire broke out onboard the PostAuto Schweiz AG bus serving route 1245 in the municipality of Develier. The bus was destroyed as a result. The fire broke out because the air conditioning system was overloaded, as the cooling was insufficient on two condensation fan motors. To ensure optimal cooling of these motors, they must be properly maintained.

Safety recommendation
The four electric motors of the air conditioning system on the roof of this vehicle type should be serviced regularly. This maintenance should take into account the fact that the electric motors are exposed to a significant extent to the effects of the weather such as heat, cold and air pollution.

Implementation status
Implemented.

Safety Recommendation No. 21, 30.04.2013

On 19 March 2012 a fire broke out onboard the PostAuto Schweiz AG bus serving route 1245 in the municipality of Develier. The bus was destroyed as a result. The fire broke out because the air conditioning system was overloaded, as the cooling was insufficient on two condensation fan motors. If the thermal fuses had responded, the thermal overloading of the motors could have been avoided.

Safety recommendation
An independent company should be commissioned to check the electrical control system of the motors and its protection.

Implementation status
The vehicles are being checked within the framework of the periodic maintenance programme for 2014.

Safety Recommendation No. 27, 28.11.2013

On Sunday, 19 August 2012 at approximately 17:30 local time, a gas cylinder with a capacity of 300 litres exploded in St. Imier. This, along with eleven other gas cylinders, was being stored on a flatcar, standing beside a building used by rail passengers. Under the effects of the prevailing heat, the pressure of the propane gas in the tank had increased until the explosion occurred. With all probability, the gas container had been filled beyond the permissible filling limit of 80%.
Since this type of container is not fitted with relief valves, in the event of a temperature increase the pressure is not limited by a reduction in the excess pressure.

Safety recommendation
The logistics for the refilling and exchange of gas tanks with a capacity of 300 litres should be amended so that directive SBB D-I 50026 can be complied with.

Implementation status
Implemented.

Safety Recommendation No. 28, 02.05.2013

On Tuesday, 28 August 2012 at approximately 09:10 local time, an employee of a private construction group suffered a fatal accident in the Simplon tunnel.
Work in the rail sector is increasingly being carried out by private companies. It was ascertained that despite existing safety arrangements the associated dangers are underestimated by the private sector.

Safety recommendation
Indepth instructions and directives must ensure that the necessary attention is paid by private companies to the specific dangers in the railway sector.

Implementation status
According to Transport Ordinance FDV R 300.1 para. 2.1. 7, only trained and certified personnel may be deployed on driving activities. According to RTE 20100 para. 2.3.5.1 safety managers of private companies must complete training including an examination. The FOT considers the requirements laid down in the rules and regulations to be adequate and therefore considers the safety recommendation to have been implemented.

Safety Recommendation No. 30, 18.06.2013

On Monday 10 December 2012, train 4623, en route from Fleurier towards Travers, left Couvet station on track 2, even though the group departure signal B indicated stop. At the same time, train 4616 from Travers was approaching to enter Couvet station. The two trains came to a standstill shortly after the exit points, a few metres from each other. The exit points had been forced open by train 4623.
The group departure signal, which is additionally equipped with open position indicators, is located after the exit points. Its location does not allow a train to stop before it passes onto the track. The additional "open position indicator" signals are not fitted with a safety device.

Safety recommendation
The SAIB recommends that the "open position indicators" FB1-2 and FC1-2 be equipped with Eurobalises.

Implementation status
The company will install Eurobalises by December 2014 in order to secure the FB1-2 and FC1-2 "open position indicators".

Safety Recommendation No. 31, 15.08.2013

On Saturday, 26 January 2013, a fatal accident occurred at approximately 14:25 local time at the mountain station of the Hesisbol-"Wilde Maa", Hoch Ybrig chairlift. The hip strap hanging from a female snowboarder's backpack became trapped in the backrest.

Safety recommendation
The wearing of backpacks on backs during travel on chairlifts must be forbidden, with warning signs.

Implementation status
The safety recommendation was implemented. On 2 June 2014, in a circular, the FOT requires operators of chairlifts to provide warnings about the wearing of backpacks on backs when travelling on chairlifts, by installing appropriate signage before the 2014/15 winter season.

Safety Recommendation No. 32, 15.08.2013

On Saturday, 26 January 2013, a fatal accident occurred at approximately 14:25 local time at the mountain station of the Hesisbol-"Wilde Maa", Hoch Ybrig chairlift. The supervisor who was overseeing the arrival of chairs and disembarkation at the mountain station was distracted by a boy who wanted to disembark too early, and dangerously, from the next chair to arrive.

Safety recommendation
It must be examined whether, by moving the seating position of the supervisor inside the office to the right, the overview of the monitored area can be optimised for both alighting and arriving skiers.

Implementation status
The safety recommendation is being implemented.
The FOT has inspected the control room at the abovementioned chairlift and found it to be adequate. However, at the time of the next supervisory activity it will invite the company to check once again the positioning of supervisory personnel inside the control room.
In addition, as part of the audit of cableway companies, the FOT will recommend checking the locations of supervisory personnel with a view to ensuring an optimal overview of the surveillance area.

Safety Recommendation No. 33, 15.08.2013

On Saturday, 26 January 2013, a fatal accident occurred at approximately 14:25 local time at the mountain station of the Hesisbol-"Wilde Maa", Hoch Ybrig chairlift. The hip strap hanging from a female snowboarder's backpack became trapped in the backrest.

Safety recommendation
It must be examined whether the accidental suspension of objects on the chair can be prevented by design changes.

Implementation status
The safety recommendation is being implemented.
The chairs are certificated safety components. The manufacturer is based in Austria. The FOT has informed the Austrian supervisory authority about this cableway accident and requested it to take any further measures if needed.

Safety Recommendation No. 34, 22.08.2013

On Thursday, 21 February 2013, motor coach Be 115, on a shunting run, collided with two vehicles which were parked on track 5 in front of the depot in Planchy. The two vehicles were pushed approximately 13 metres. The foremost of these vehicles broke through the doors of the depot. Of the six people who were on the railcar, one suffered slight hand injures.
During the approach, the train driver began to brake, whereupon he realised that the deceleration was insufficient. He released the brakes, in order then to initiate more forceful braking. The loss of time caused by such a manipulation had a significant impact on the braking distance during the final stages of the convergence. After his examination, the train driver had been deployed in the company on duties other than driving vehicles and only rarely had the opportunity to drive older vehicles. It was difficult for the company to prove that the minimum number of hours, as laid down in the FOT directives, had been complied with.

Safety recommendation
A system for monitoring the minimum number of driving hours should be introduced which allows traceability of the completed driving time.

Implementation status
Implemented by the company.

Safety Recommendation No. 35, 19.12.2013

On Monday 6 May at 11:14 local time in Goldach, on the Seestrasse level crossing on the Rorschach–Romanshorn line, a collision occurred between S7 train 23743 and an articulated lorry. The articulated lorry was on the level crossing, which was protected by flashing light signals and barriers. It is equipped only with one barrier on each side and in addition they are not parallel to the track because of the S bend over the level crossing. The truck could therefore be encased between the barriers.

Safety recommendation
The Horn side of the level crossing is to be equipped with an additional drive system with a barrier. As a result, in addition to the short time of the flashing warning light, the hazardous travel distance between the barriers could also be reduced. At least for trucks, this would prevent the barriers reaching their final position, because they would be resting on the truck and so no clearance for a train would be issued.

Implementation status
Will take place in the 2nd quarter of 2016

Safety Recommendation No. 37, 06.12. 2013

On Saturday 15 June 2013 in Neirivue, Freiburgische Verkehrsbetriebe (Transports publics fribourgeois – TPF) train 14978 fatally injured an eight-year old child who was about to cross an unprotected level crossing with her scooter. Despite a warning whistle and the initiation of rapid braking, it was not possible to avoid the collision. The fact that there is an unprotected level crossing in the centre of a village, and even next to a school, represents an increased risk for children.

Safety recommendation

The FOT should require that this rail crossing for pedestrians is protected by signals or mechanisms which ensure that it can be crossed and used safely (Annex 5, Art. 37b of the Rail Ordinance).

Implementation status

A study on the improvement of this crossing is currently in progress. The TPF company decided to construct an underpass. In 2015, the company will submit a corresponding assessment to the FOT. It is intended to start the work in 2016. The safety recommendation is therefore being implemented appropriately.

7 Analysis

7.1 Analysis of the statistical data of the Aviation Division

The Aviation Division has designed and created a database with accident and aircraft movement figures which date back to 2007. These data now make it possible to make certain statements about the development of aviation safety in Switzerland.

The mediumterm goal is to expand the database. More detailed analyses, for example relating to training accidents or serious incidents, should then be possible.

Definitions, method and conceptual considerations

Measured variable

In its accident statistics, the Aviation Division compares not absolute but relative accident figures, termed accident rates. In other words, no consideration is given to how many accidents have occurred. Rather, consideration is given to how many accidents per 1 million aircraft movements have occurred. The figures for accidents and aircraft movements always refer to a specific year and a specific category of aircraft. Accident rates have the advantage that they allow comparisons over a longer period of time, even if the exposure[1] changes over this period. Since exposure typically varies less than the number of accidents, however, the advantage of a rate as a measured variable is less distinct for a period of only a few years.

In the case of accident rates, it is important that the only accidents included are those whose corresponding exposure is also included. Thus, for example, the take-off and landing of a flight from Friedrichshafen (D) over Switzerland to Grenoble (F) is not included in the air movement statistics of the FOCA. If this aircraft then has an accident in Switzerland, this accident cannot be included in the analysis in question. This is because the FOCA aircraft movement statistics are included in the accident statistics as part of the measured variable. This condition is taken into account in the current accident statistics. A

[1] Here, this corresponds to the number of aircraft movements.

similar situation results from flights originating in Switzerland and flying to a foreign country or from flights originating in a foreign country and flying to Switzerland: Accidents which happen during flights from Switzerland to a foreign country or from a foreign country to Switzerland may happen over foreign territory. In such cases, the accident is not always reported to the SAIB (there is also no legal requirement to do so). Therefore, because of the fact that certain accidents concerning flights of this kind remain unknown to the SAIB, to be consistent, the corresponding exposure must not become part of the measured parameter. This condition is also accounted for in the accident statistic at hand.

Components of the measured variable

Accident

For an event in aviation to be classified as an accident, the event must be known to the SAIB. As soon as the SAIB becomes aware of an event, a check will be carried out as to whether it meets the conditions of an accident as defined in Article 1 of the Ordinance on the Investigation of Accidents and Serious Incidents[2]. Again, only those events which are classified as an accident in which at least one person was significantly or fatally injured and which was not caused intentionally are included in the present analysis. The definitions of serious and fatal injuries are also provided in Article 1 of the Ordinance.

The reason for including only accidents involving serious or fatal injuries in the accident statistics is that the estimated number of unreported cases of accidents not involving significant or fatal injuries is not negligible. If one were to include all accidents – or even serious incidents – in the statistics, the observed numbers would certainly be greater and statistical statements could be made more easily, but the statements would describe the reporting culture and reporting methodology rather than safety.

Aircraft movement

Aircraft movements are used to quantify exposure for the accident statistics. Figures for aircraft movements are provided by the FOCA. The FOCA collects these figures using forms which have had to be completed and submitted from 2007 onwards by most aerodromes and heliports.

Take-offs and landings are usually considered to be aircraft movements, so a flight from A to B results in two movements; however, the term is not defined in greater detail by the FOCA.

The following types of movements are not recorded by the collection procedure carried out by the FOCA:

- movements on certain military aerodromes;
- off-airfield movements, such as, for example outside landings by gliders or off-airfield landings and take-offs by helicopters in the course of aerial work operations;
- take-offs and landings abroad, even if the flight flies over Swiss territory in the meantime.

Movements on Basel-Mulhouse-Freiburg airport are recorded by the FOCA but are not included in the SAIB analysis. This airport is not situated on Swiss territory. Therefore accidents which occur on and within the French environs of this airport, need not be reported to the SAIB and nor are they investigated by the SAIB.

Whether the number of aircraft movements is the correct or best variable for quantifying exposure in the aviation sector is a subject of discussion among safety experts. Possible alternative variables for quantification of exposure include flight hours or flight kilometres. The

[2] Ordinance on the Investigation of Aircraft Accidents and Serious Incidents dated 23 November 1994 (status as of 1 November 2011), SR 748.126.3

number of aircraft movements is the most reliably recorded comparison variable for Switzerland and is therefore used for the statistics. The selected reference variable must be noted when making statistical statements, as depending on variable, certain statements are not meaningful (cf. Admissibility of further statements and comparisons).

Aircraft category
A distinction is made between the following aircraft categories in the accident statistics:
– powered airplanes with a maximum take-off mass of 5700 kg;
– gliders, including motor gliders and touring motor gliders;
– helicopters.

No statistics are produced for powered airplanes with a maximum take-off mass of more than 5700 kg or for air-ships, hot-air balloons and tethered balloons, because of the extremely small numbers of cases.

Statistical method
Measured data values are frequently random variables with a "normal" distribution about a mean value[3]. It is assumed that such a distributed random variable applies to annual collected accident figures and accident rates respectively. In order to make a statement about whether a data value for a particular year is located inside or outside a range regarded as usual, the multiple z of the estimated standard deviation σ was calculated for all annual accident rates.

$$Z = \frac{r_{2013} - \bar{r}_{2007\ bis\ 2013}}{\sigma}$$

With r_{2013} = accident rate for 2013 and $\bar{r}_{2007\ bis\ 2013}$ = mean value of the accident rates for 2007 to 2013.

The standard deviation σ was estimated using the "n-1" method (corrected sample standard deviation) where n = 7. In the standard normal distribution, the range between -1 σ and +1 σ is considered as the usual range. 68.3% of all real observations fall between such defined interval boundaries. Values lower than -1 σ are considered as an improvement in safety; values greater than +1 are considered as a deterioration in safety.

Admissibility of further statements and comparisons
Care must be taken if further interpretation of the statistics is attempted. There is a risk of making inadmissible statements. For example, because of the partially different collection of aircraft movements, it is unwise to compare the safety of the three evaluated aircraft categories on the basis of the data presented in the figure at the end of this chapter. For the same reason, caution is also required when comparing figures from abroad. Definitions and delimitations may be different in other countries.

Errors
Certain errors in the statistics were unavoidable and mostly occur in the collection of the data basis. For example, military aircraft movements on civil aerodromes are included in the FOCA aircraft movement statistics, though accidents involving military aircraft are not included in the accident rate. Similarly, accidents are not included in the statistics if they have occurred

[3] "Normal" represents a Gaussian curve.

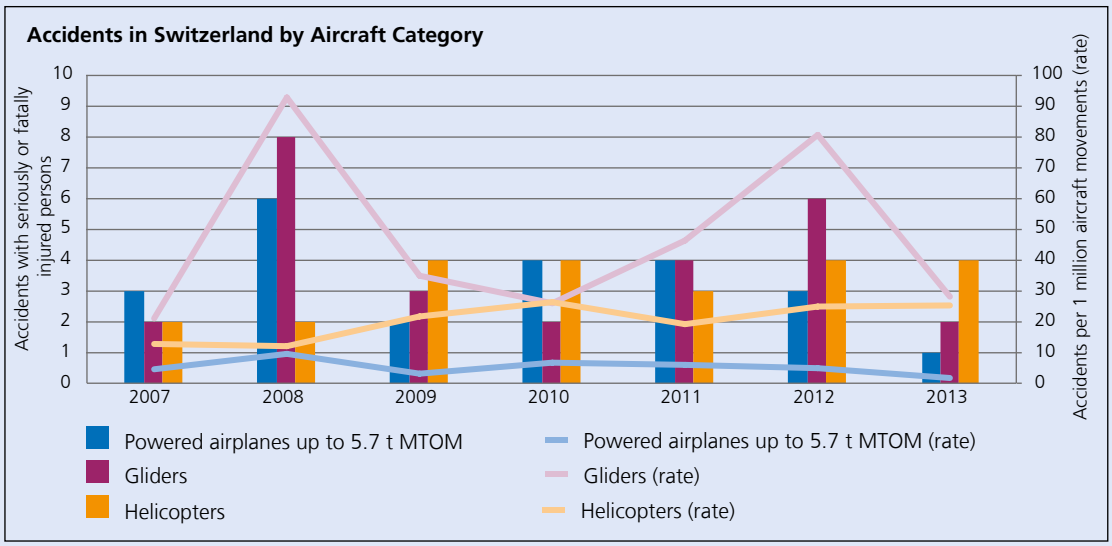
over foreign territory during a flight from Switzerland to Switzerland. This is so, even though the take-off and landing of such a flight is included in the statistics.
The SAIB is convinced, however, that any errors are so minor that the validity of the statements made below is not significantly impaired.

Statements concerning aviation safety

In summary it can be stated: 2013 was an average or slightly above-average year in terms of safety for Swiss civil aviation.
An analysis of the accident statistics using the methods and criteria described above produces the following results:

- For powered airplanes with a maximum take-off mass up to 5700 kg, the accident rate was approximately 1.7 accidents per million aircraft movements. This corresponds to approximately -1.4 σ in the standard normal distribution and is therefore within the range of unusually low accident rates.
- For gliders, the accident rate was approximately 28 accidents per million aircraft movements. This corresponds to approximately -0.7 σ in the standard normal distribution and is therefore within the usual range of the years 2007 to 2013.
- For helicopters, the accident rate was approximately 25 accidents per million aircraft movements. This corresponds to approximately +0.8 σ in the standard normal distribution and is within the usual range for the years 2007 to 2013.

If the unusually low accident rate for powered airplanes with a take-off mass up to 5700 kg is not actually due to chance, we can assume an improvement in safety for this category of aircraft. It is not possible to determine from the existing statistical data where this improvement in safety originates.
The following figures shows the absolute numbers of accidents and the accident rates for the three aircraft categories analysed in the years 2007 to 2013.



Absolute numbers of accidents and the accident rates for the three aircraft categories in the years 2007 to 2013.

7.2 Analysis of the statistical data of the Rail and Navigation Division

The Rail and Navigation Division has designed and created a database with numbers of events dating back to 2007. This data now makes it possible to make certain statements about the development of safety in relation to the operation of railways, buses and cable railways in Switzerland. The medium-term goal is to expand the database. Thus, for example, the inclusion of exposure data should reflect safety, adjusted for the transport service provided.

Measured variable, method and comparisons

Measured variables

In its event statistics, the Rail and Navigation Division compares absolute figures for events. A distinction is made between the following categories of events in the event statistics:

- Collisions on protected level crossings
- Collisions on unprotected level crossings
- Other collisions
- Derailments
- Fires

All reported events are fed into the event statistic, i.e. regardless of whether the event met the definition of "accident" according to Article 2 of the VUU[4] and regardless of whether an investigation was opened.

Statistical method

Measured data values are frequently random variables with a "normal" distribution about a mean value[5]. It is assumed that annually collected numbers of events constitute such a distributed random variable. In order to make a statement about whether a data value for a particular year is located inside or outside a range regarded as usual, the multiple z of the estimated standard deviation σ was calculated for all annual numbers of events.

$$Z = \frac{r_{2013} - \bar{r}_{2007\ bis\ 2013}}{\sigma}$$

[4] Ordinance on the Reporting and Investigation of Accidents and Serious Incidents in the Operation of Public Transport (VUU) of 28 June 2000 (as of 1 November 2011), SR 742.161

[5] "Normal" represents a Gaussian curve.

where r_{2013} = number of events in the year 2013 and $\bar{r}_{2007\ bis\ 2013}$ = mean value of the numbers of events for 2007 to 2013.

The standard deviation σ was estimated using the "n-1" method (corrected sample standard deviation) where n = 7. In the standard normal distribution, the range between -1 σ and +1 σ is considered as the usual range. 68.3% of all real observations fall between such defined interval boundaries. Values lower than -1 σ are considered as an improvement in safety; values greater than +1 are considered as a deterioration in safety.

Admissibility of other statements and comparisons

Due to partial differences in the obligation to report events, due to possible differences in reporting cultures as well as due to differences regarding definitions and requirements for an event's entry in the statistic, caution should be exercised when comparing the figures with those of other organisations or countries. This specifically applies to the safety statistics of the Swiss Federal Office of Transport and the Swiss Federal Statistical Office. Inadmissible statements may result.

Statements concerning the safety of railways, buses and cableways

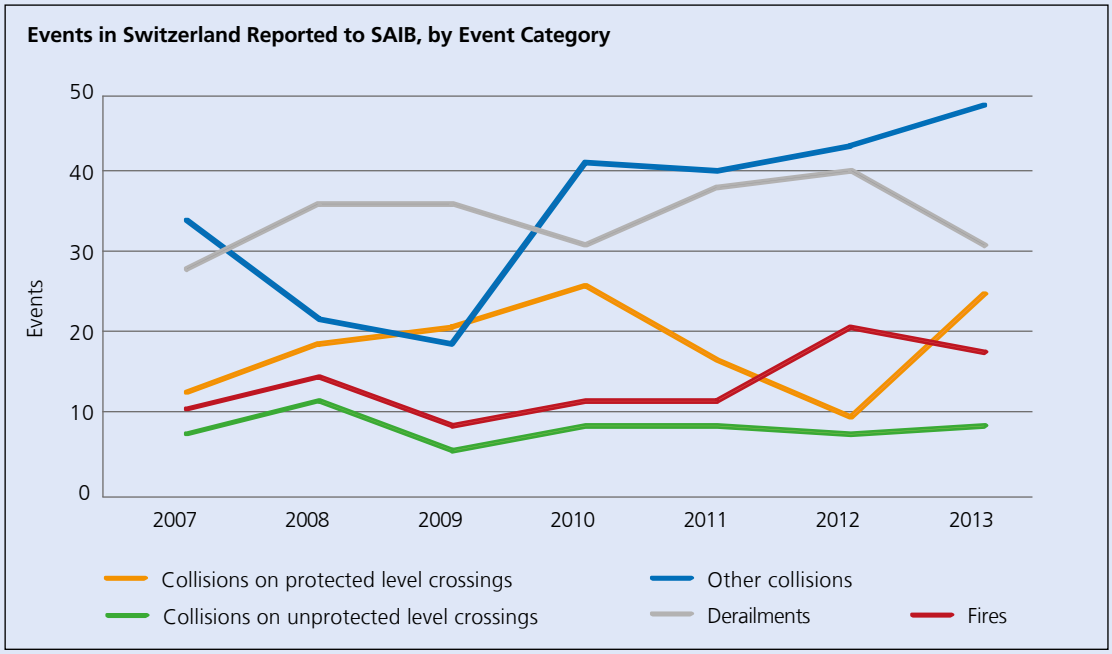
In brief, the SAIB notes the following: 2013 was an average to below-average year in terms of safety for the operation of railways, buses and cableways in Switzerland.

An analysis of the event statistics using the methods described above produces the following results:

- There were 24 collisions on protected level crossings. This corresponds to approximately +1.1 σ in the standard normal distribution and thus lies within the range of unusually high numbers of events.
- There were 8 collisions on unprotected level crossings. This corresponds to approximately +0.2 σ in the standard normal distribution and is therefore within the usual range for the years 2007 to 2013.
- There were 47 other collisions. This corresponds to approximately +1.2 σ in the standard normal distribution and is therefore within the range of unusually high accident rates.
- There were 30 derailments. This corresponds to approximately -0.8 σ in the standard normal distribution and is therefore within the usual range for the years 2007 to 2013.
- There were 17 fires. This corresponds to approximately +0.9 σ in the standard normal distribution and is therefore within the usual range for the years 2007 to 2013.

If the unusually high number of collisions on protected level crossings and the unusually high number of other collisions is in fact not attributable to coincidence, an evolved reporting culture or other statistical errors, one can assume a deterioration in safety for these two categories of events.

The following diagram shows the event numbers for the five event categories analysed for the years 2007 to 2013.



Event numbers for the five event categories analysed for the years 2007 to 2013.

Annexes

Annexes

Annex 1: List of published final reports of the Aviation Division of the Swiss Accident Investigation Board in 2013

Annex 2: List of published final reports of the Rail/Navigation Division of the Swiss Accident Investigation Board in 2013

Annex 3: Statistical information Aviation Division

Annex 4: Statistical information Rail and Navigation Division

Annex 1

List of published final reports of the Aviation Division of the Swiss Accident Investigation Board in 2013

Number	Identification	Date	Location
2092	Airprox AFR1242/TAP945B	01.07.2008	Geneva
2120	HB-XND	05.06.2010	Zermatt/VS
2145	Airprox DLH03K/EZY529Y	08.07.2010	Geneva
2148	BPS-System		
2156	HB-VOV	16.02.2011	Grenchen
2157	Airprox T332/HB-DHI	11.08.2011	Emmen
2159	F-PEPU	06.08.2009	Samedan/GR
2160	HB-PRE	26.08.2010	Oey, Gde Saanen/BE
2161	N177EA	14.03.2011	Saanen
2162	Airprox N994GP/N8KR	12.03.2011	Geneva
2163	HB-OXI	26.07.2011	Lommis/TG
2164	Summ. Berichte 2011		
2165	Airprox GWI2529/HHN201	10.06.2011	VOR FRI
2166	Airprox CFG366/QTR020	25.10.2010	VOR TRA
2167	Airprox SWR75PE/A939	10.09.2010	Lugano
2168	HB-ZAM	19.05.2011	Niederösch/BE
2169	HB-SRA	12.08.2011	Worbboden/BE
2171	Summ. Berichte 2012		
2172	HB-ZGI	07.11.2011	Ardez/GR
2173	HB-PMN	14.03.2012	Glacier de Tsanfleuron /VS
2174	HB-ZES	18.10.2011	Bourg-St-Pierre /VS
2175	G-BBEF	14.10.2011	Fontaines-sur-Grandson/VD
2176	HB-LOT	10.11.2011	Cottens/FR
2177	HB-1967	06.10.2012	Amlikon LSPA
2178	HB-XYI	11.11.2010	Lanzenhäusern
2179	HB-3393	19.05.2012	Maienfeld/GR
2181	G-ZAPN	26.12.2011	Aéroport de Sion/VS
2182	HB-QHJ	25.06.2011	Fisibach/AG
2183	Airprox EZS98DJ/AZA23B	06.08.2011	Geneva
2184	Airprox SWR194W/AUF331	17.08.2011	Geneva
2185	Airprox NJE262Q/HB-SBE	30.08.2011	Sion
2186	HB-2331	10.04.2012	Innerthal/SZ
2187	HB-1902	27.07.2012	Glarus Nord
2188	HB-UVT	20.09.2012	Lausanne La Blécherette/VD
2189	Airprox DWT9401/MXY451	16.12.2011	Lugano
2190	HB-ZHI	17.02.2011	Glacier de Tsanfleuron
2191	HB-ZKK	21.03.2012	Claridenfirn/GL
2192	HB-ZCM	11.05.2012	Camorino/TI
2193	HB-CFW	13.09.2011	Buttwil/AG
2194	HB-KPG	09.03.2012	Geneva airport
2195	HB-PGA	28.04.2012	Tatroz/FR
2196	HB-OIA	12.06.2012	Hilfikon/AG
2198	HB-2124	26.05.2012	Hütten/ZH

Annex 2

List of published final reports by the Rail and Navigation Division of the Swiss Accident Investigation Board in 2013

Number	Type of operation	Type of accident	Date	Location
12052402	Rail	Collision	24.05.12	Zweilütschinen
12051102	Bus	Fire	11.05.12	Evolène
11062901	Rail	Derailment	29.06.11	Lucerne
11092501	Rail	Collision	25.09.11	Rothenburg-Sempach
11100601	Rail	Collision	06.10.11	Olten
12011501	Rail	Accident to person	15.01.12	Matzingen
12012901	Cable railway	Cable railway event	29.01.12	Lungern
12030801	Rail	Collision	08.03.12	Autigny
12031901	Bus	Fire	19.03.12	Develier
12061301	Rail	Fire	13.06.12	Mezzovico-Rivera
12062101	Rail	Collision	21.06.12	Oberwinterthur
12082802	Rail	Accident at work	28.08.12	Simplon
12081901	Rail	Sonstiges	19.08.12	St-Imier
12091902	Rail	Near accident / train endangerment	19.09.12	Chavornay
12092801	Bus	Collision	28.09.12	Lausanne
12111402	Rail	Accident at work	14.11.12	Koblenz
12121201	Rail	Collision	12.12.12	Lenzburg
12100901	Rail	Accident at work	09.10.12	Zofingen
12121001	Rail	Near accident / train endangerment	10.12.12	Couvet
2013012601	Cable railway	Cable railway event	26.01.13	Hoch Ybrig
2013020402	Rail	Collision on protected rail crossing	04.02.13	Le Chenit
2013020102	Rail	Collision	01.02.13	Zürich Giesshübel
2013022701	Rail	Collision	27.02.13	Basel Bad. Bf.
2013022102	Rail	Collision	21.02.13	Bulle
2013030703	Rail	Derailment	07.03.13	Geneva
2013051301	Rail	Derailment	13.05.13	Schwyz
2013051303	Rail	Collision on protected rail crossing	13.05.13	Urnäsch-Waldstatt
2013061501	Rail	Collision on unprotected rail crossing	15.06.13	Neirivue
2013050603	Rail	Collision on protected rail crossing	06.05.13	Goldach

Annex 3

Statistical data, Aviation Division

Contents

1. Preliminary remarks

Aircraft accident investigation seeks to prevent similar accidents and serious incidents by clarifying the circumstances and causes.

The legal assessment of accidents is not the subject of the investigation or investigation reports.

The following annual statistic includes all investigated accidents and serious incidents to Swiss civil registered aircraft at home and abroad, as well as foreign-registered aircraft in Switzerland.

Accidents involving parachutists, hang gliders, kites, paragliders, tethered balloons, unmanned balloons and model aircraft are not subject to investigation.

2. Definitions

A number of terms which are of significance are explained below, in accordance with the Ordinance on Investigation of Aircraft Accidents and Serious Incidents.

Aircraft accident

Occurrence in the operation of an aircraft, if a person is inside it with the intention of making a flight:

(a) in which a person inside or outside of the aircraft is seriously injured or killed; or

(b) in which the aircraft suffers damage which substantially adversely affects stability, performance or the flight characteristics and generally requires usually major repair work or replacement of the damaged component; or

(c) in which the aircraft is lost or the wreckage is inaccessible.

The following are not deemed to be aircraft accidents:

Deaths and injuries which are not directly related to the operation of an aircraft; deaths and injuries to people who are unjustifiably outside the areas intended for crew and passengers; in addition, engine failures and damage limited to only one engine, its auxiliary power units or the propeller blades; damage to panels, minor deformation or small holes in the outer skin; damage to the wingtips and rotor blade tips, antennas, tyres or brakes.

Serious injury

Injury suffered by a person in an aircraft accident and which has one of the following characteristics:

(a) it requires a hospital admission within seven days and of more than 48 hours;

(b) it consists of a bone fracture; simple fractures of fingers, toes or nose are excluded;

(c) it consists of cuts or lacerations which result in heavy bleeding, damage to a nerve, a muscle or a tendon;

(d) it results in damage to an internal organ;

(e) it consists of 2nd or 3rd degree burns or burns covering more than 5% of the surface of the body;

(f) it is attributable to detectable infectious substances or harmful radiation.

Fatal injury
Serious injury resulting in death within 30 days of the accident.

Large aircraft
Aircraft with a maximum permissible take-off mass (MTOM) of at least 5700 kg, classified in the standard airworthiness category, transport subcategory, or which has more than ten seats for passengers and crew.

Country of registration
State in whose aircraft register the aircraft is registered.

Country of manufacture
The State or States which have certified the airworthiness of the prototype.

Operator State
State in which the air traffic operator has its headquarters or its permanent seat.

3. Tables and figures

3.1 Aircraft accidents and serious incidents involving Swiss-registered aircraft, inventory of the aircraft and list the deceased

Year	Number of registered aircraft [1)]	Flight hours [1)]	Flight personnel Licences[1)]	Number of accidents investigated	Number of accidents with summary investigations	Total number of accidents	Number of serious incidents (incl. Airprox)	Airprox investigated [2)]	Total number of accidents and serious incidents	Number of deceased
2002	4030	844 389	17 754	24	26	50	12	13	62	16
2003	3972	873 540	16 936	38	32	70	18	19	88	24
2004	3893	749 535	16 382	29	34	63	10	14	73	14
2005	3841	768 643	15 501	22	37	59	12	9	71	15
2006	3822	715 572	15 368	27	31	58	10	7	68	10
2007	3813	766 557	15 076	23	20	43	4	6	47	12
2008	3765	784 548	14 691	28	19	47	5	6	52	11
2009	3685	842 017	14 973	26	17	43	4	3	47	5
2010	3705	793 592	15 313	21	16	37	8	4	45	8
2011	3709	873 548	12 855 [3)]	21	24	46	13	8	59	13
2012	3657	875 708	12 840	22	20	42	23	10	65	22
2013	**3620**	**933 752**	**11 871**	**28**	**16**	**44**	**20**	**11**	**64**	**15**

[1)] Reference: Federal Office of Civil Aviation (FOCA)

[2)] Incl. Airprox involving foreign-registered aircraft

[3)] Based on the Air Navigation Act, no more student pilot licences are issued since 01.04.2011

3.1.1 Swiss-registered aircraft with MTOM > 5700 kg

Year	Number of registered aircraft[1)]	Flight hours[1)]	Number of accidents investigated	Number of accidents with summary investigations	Total number of accidents	Number of serious incidents (incl. Airprox)	Airprox investigated[2)]	Total number of accidents and serious incidents	Number of deceased
2002	304	490 555	3	0	3	12	13	15	0
2003	257	504 998	3	0	3	18	19	21	0
2004	248	435 820	1	0	1	10	14	11	0
2005	241	445 228	0	0	0	12	9	12	0
2006	248	434 050	1	0	1	8	7	9	0
2007	260	393 368	3	0	3	0	5	3	1
2008	285	385 686	1	0	1	3	5	4	0
2009	293	394 055	0	0	0	4	3	4	0
2010	303	419 323	0	0	0	6	3	6	0
2011	299	458 225	0	0	0	9	8	9	0
2012	294	475 786	0	0	0	11	7	11	0
2013	**290**	**540 826**	**1**	**0**	**1**	**11**	**8**	**12**	**0**

[1)] Reference: Federal Office of Civil Aviation (FOCA)

[2)] Incl. Airprox involving foreign-registered aircraft

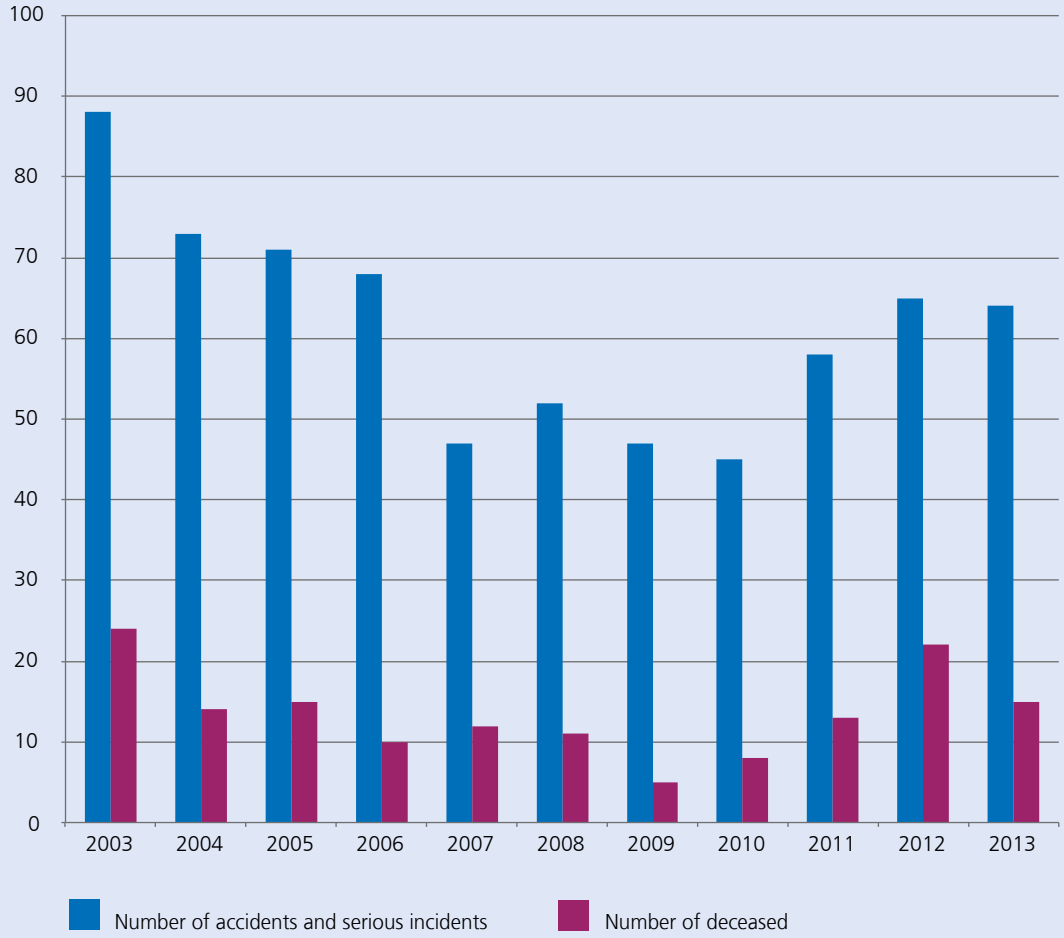
3.1.2 Swiss-registered aircraft with MTOM ≤ 5700 kg

Year	Number of registered aircraft[1)]	Flight hours[1)]	Number of accidents investigated	Number of accidents with summary investigations	Total number of accidents	Number of serious incidents (incl. Airprox)	Airprox investigated[2)]	Total number of accidents and serious incidents	Number of deceased
2002	3726	353 834	21	26	47	0	0	47	16
2003	3715	368 542	35	32	67	0	0	67	24
2004	3645	313 715	28	34	62	0	0	62	14
2005	3600	323 415	22	37	59	0	0	59	15
2006	3574	281 522	26	31	57	2	0	59	10
2007	3553	373 189	20	20	40	4	1	44	11
2008	3480	398 862	27	19	46	2	1	48	11
2009	3392	447 962	26	17	43	0	0	43	5
2010	3402	374 269	21	16	37	2	1	39	8
2011	3410	415 323	22	24	46	3	0	49	13
2012	3363	399 922	22	20	42	12	3	54	22
2013	**3330**	**392 926**	**27**	**16**	**43**	**9**	**3**	**52**	**15**

[1)] Reference: Federal Office of Civil Aviation (FOCA)

[2)] Incl. Airprox involving foreign-registered aircraft

3.1.3 Graphical overview of accidents and serious incidents involving Swiss-registered aircraft, inventory of the aircraft and list the deceased



3.2 Accident data and persons involved in accidents – reporting period 2012 / 2013

3.2.1 Accidents and serious incidents involving Swiss-registered aircraft in Switzerland and abroad, and foreign-registered aircraft in Switzerland according to their category, including and excluding injuries to persons

	Accidents and serious incidents involving Swiss-registered aircraft						Accidents and serious incidents involving Swiss-registered aircraft						Accidents and serious incidents involving foreign-registered aircraft					
	in Switzerland						abroad						in Switzerland					
	Total		Persons injured		Persons not injured		Total		Persons injured		Persons not injured		Total		Persons injured		Persons not injured	
	2013	2012	**2013**	2012	**2013**	2012	**2013**	2012	**2013**	2012	**2013**	2012	**2013**	2012	**2013**	2012	**2013**	2012
Total	**53**	56	**9**	11	**44**	45	**11**	9	**3**	4	**8**	5	**11**	7	**0**	2	**11**	5
Aircraft with MTOM ≤ 2250 kg	**16**	28	**2**	3	**14**	25	**2**	4	**0**	2	**2**	2	**5**	2	**0**	1	**5**	1
Aircraft with MTOM 2250–5700 kg	**4**	0	**0**	0	**4**	0	**1**	1	**0**	1	**1**	0	**0**	0	**0**	0	**0**	0
Aircraft with MTOM > 5700 kg	**8**	8	**0**	0	**8**	8	**4**	2	**0**	0	**4**	2	**5**	2	**0**	0	**5**	2
Helicopter	**16**	9	**4**	4	**12**	5	**1**	0	**1**	0	**0**	0	**0**	0	**0**	0	**0**	0
Motor gliders and gliders	**7**	10	**2**	4	**5**	6	**1**	2	**1**	1	**0**	1	**1**	3	**0**	1	**1**	2
Balloons and airships	**2**	1	**1**	0	**1**	1	**2**	0	**1**	0	**1**	0	**0**	0	**0**	0	**0**	0

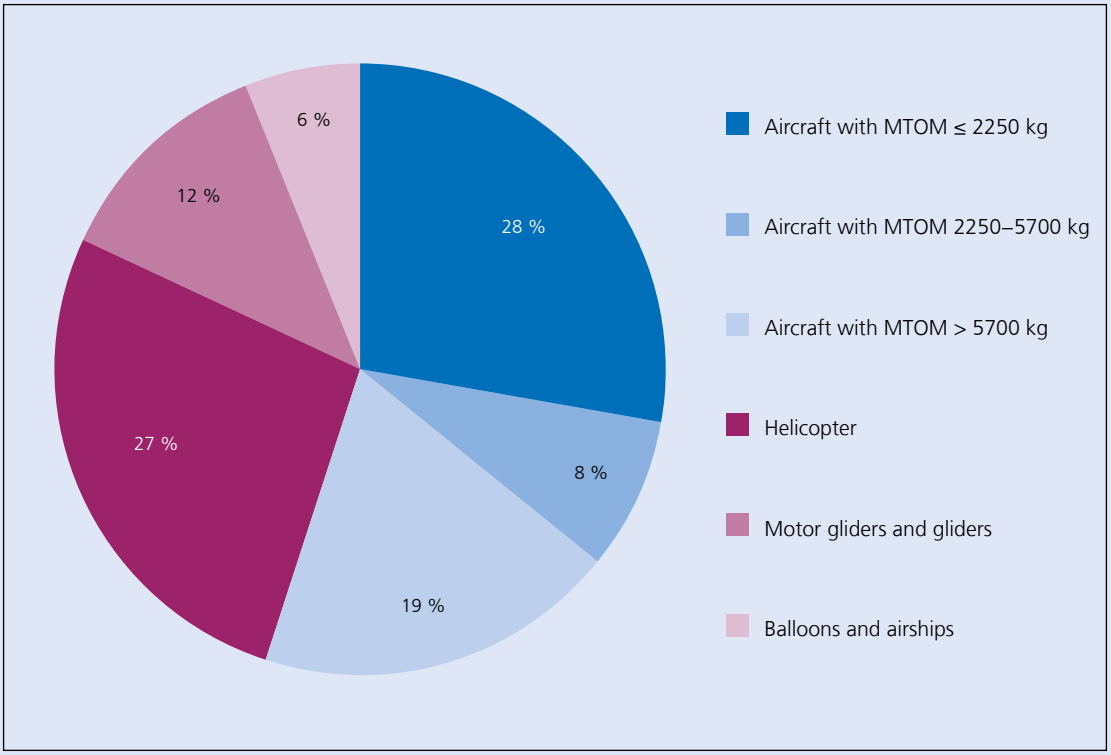
3.2.2 Aircraft inventory and accidents / serious incidents involving Swiss-registered aircraft

	Number of registered aircraft [1] (01.01.2014)		Total number of accidents / serious incidents	
	2013	2012	**2013**	2012
Aircraft with MTOM ≤ 2250 kg	**1458**	1461	**18**	32
Aircraft with MTOM 2250–5700 kg	**176**	167	**5**	1
Aircraft with MTOM > 5700 kg	**290**	294	**12**	10
Helicopter	**312**	326	**17**	9
Motor gliders and gliders	**1000**	1022	**8**	12
Balloons and airships	**384**	387	**4**	1
Total	**3620**	3657	**64**	65

[1] Reference: Federal Office of Civil Aviation (FOCA)

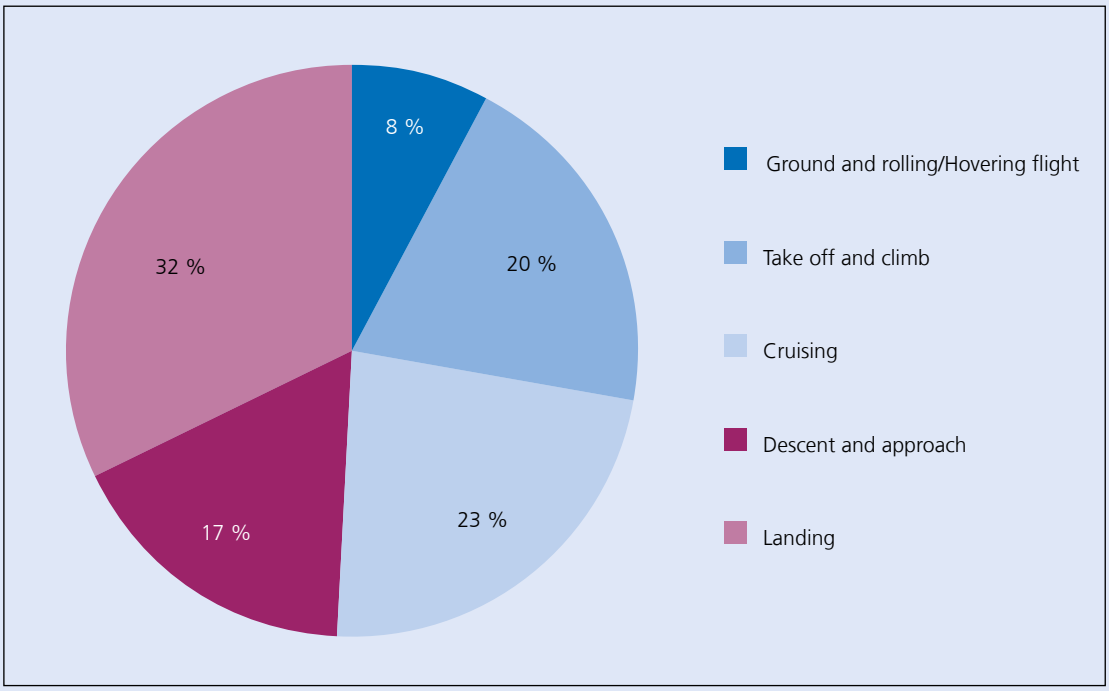
3.2.3 Accidents and serious incidents involving Swiss-registered aircraft according to category of aircraft

	2013	2012
Aircraft with MTOM ≤ 2 250 kg	**28%**	49 %
Aircraft with MTOM 2 250–5 700 kg	**8 %**	2 %
Aircraft with MTOM > 5 700 kg	**19 %**	15 %
Helicopter	**27 %**	14 %
Motor gliders and gliders	**12 %**	18 %
Balloons and airships	**6 %**	2 %



3.2.4 Flight phase (accidents and serious incidents involving Swiss-registered aircraft in Switzerland and abroad, and foreign-registered aircraft in Switzerland)

	Ground and rolling/ Hovering flight		Starting and climb		Cruising		Descent and approach		Landing		Total	
	2013	2012	**2013**	2012	**2013**	2012	**2013**	2012	**2013**	2012	**2013**	2012
Aircraft with MTOM ≤ 2250 kg	**0**	3	**7**	6	**1**	4	**3**	6	**12**	15	**23**	34
Aircraft with MTOM 2250–5700 kg	**1**	0	**0**	0	**2**	1	**0**	0	**2**	0	**5**	1
Aircraft with MTOM > 5700 kg	**1**	0	**3**	6	**6**	3	**5**	2	**2**	1	**17**	12
Helicopter	**4**	2	**3**	2	**3**	2	**3**	3	**4**	0	**17**	9
Motor gliders and gliders	**0**	0	**2**	3	**4**	6	**1**	0	**2**	6	**9**	15
Balloons and airships	**0**	0	**0**	1	**1**	0	**1**	0	**2**	0	**4**	1
Total	**6**	5	**15**	18	**17**	16	**13**	11	**24**	22	**75**	72



3.2.5 Persons involved in accidents according to their function for accidents and serious incidents involving Swiss-registered aircraft in Switzerland and abroad, and foreign-registered aircraft in Switzerland

	Accidents and serious incidents involving Swiss-registered aircraft in Switzerland													
	Total		Aircraft with MTOM ≤ 2250 kg		Aircraft with MTOM 2250–5700 kg		Aircraft with MTOM > 5700 kg		Helicopter		Motor gliders and gliders		Balloons and airships	
	2013	2012	**2013**	2012	**2013**	2012	**2013**	2012	**2013**	2012	**2013**	2012	**2013**	2012
Accidents/ Serious incidents	**53**	56	**16**	28	**4**	0	**8**	8	**16**	9	**7**	10	**2**	1
Deceased	**14**	15	**4**	7	**0**	0	**0**	0	**8**	4	**1**	4	**1**	0
Crew	**5**	9	**2**	2	**0**	0	**0**	0	**2**	3	**1**	4	**0**	0
Passengers	**9**	6	**2**	5	**0**	0	**0**	0	**6**	1	**0**	0	**1**	0
Third persons	**0**	0	**0**	0	**0**	0	**0**	0	**0**	0	**0**	0	**0**	0
Persons seriously injured	**12**	3	**2**	1	**0**	0	**0**	0	**5**	2	**1**	0	**4**	0
Crew	**5**	2	**1**	1	**0**	0	**0**	0	**2**	1	**1**	0	**1**	0
Passengers	**7**	1	**1**	0	**0**	0	**0**	0	**3**	1	**0**	0	**3**	0
Third persons	**0**	0	**0**	0	**0**	0	**0**	0	**0**	0	**0**	0	**0**	0

	Accidents and serious incidents involving Swiss-registered aircraft abroad													
	Total		Aircraft with MTOM ≤ 2250 kg		Aircraft with MTOM 2250–5700 kg		Aircraft with MTOM 2250–5700 kg		Helicopter		Motor gliders and gliders		Balloons and air-ships	
	2013	2012	**2013**	2012	**2013**	2012	**2013**	2012	**2013**	2012	**2013**	2012	**2013**	2012
Accidents/ Serious incidents	**11**	9	**2**	4	**1**	1	**4**	2	**1**	0	**1**	2	**2**	0
Deceased	**1**	7	**0**	2	**0**	4	**0**	0	**0**	0	**1**	1	**0**	0
Crew	**1**	3	**0**	1	**0**	1	**0**	0	**0**	0	**1**	1	**0**	0
Passengers	**0**	4	**0**	1	**0**	3	**0**	0	**0**	0	**0**	0	**0**	0
Third persons	**0**	0	**0**	0	**0**	0	**0**	0	**0**	0	**0**	0	**0**	0
Persons seriously injured	**2**	3	**0**	3	**0**	0	**0**	0	**1**	0	**0**	0	**1**	0
Crew	**1**	1	**0**	1	**0**	0	**0**	0	**1**	0	**0**	0	**0**	0
Passengers	**1**	2	**0**	2	**0**	0	**0**	0	**0**	0	**0**	0	**1**	0
Third persons	**0**	0	**0**	0	**0**	0	**0**	0	**0**	0	**0**	0	**0**	0

	Accidents and serious incidents involving foreign-registered aircraft in Switzerland													
	Total		Aircraft with MTOM ≤ 2250 kg		Aircraft with MTOM 2250–5700 kg		Aircraft with MTOM > 5700 kg		Helicopter		Motor gliders and gliders		Balloons and air-ships	
	2013	2012	**2013**	2012	**2013**	2012	**2013**	2012	**2013**	2012	**2013**	2012	**2013**	2012
Accidents/ Serious incidents	**11**	7	**5**	2	**0**	0	**5**	2	**0**	0	**1**	3	**0**	0
Deceased	**0**	1	**0**	0	**0**	0	**0**	0	**0**	0	**0**	1	**0**	0
Crew	**0**	1	**0**	0	**0**	0	**0**	0	**0**	0	**0**	1	**0**	0
Passengers	**0**	0	**0**	0	**0**	0	**0**	0	**0**	0	**0**	0	**0**	0
Third persons	**0**	0	**0**	0	**0**	0	**0**	0	**0**	0	**0**	0	**0**	0
Persons seriously injured	**0**	1	**0**	1	**0**	0	**0**	0	**0**	0	**0**	0	**0**	0
Crew	**0**	1	**0**	1	**0**	0	**0**	0	**0**	0	**0**	0	**0**	0
Passengers	**0**	0	**0**	0	**0**	0	**0**	0	**0**	0	**0**	0	**0**	0
Third persons	**0**	0	**0**	0	**0**	0	**0**	0	**0**	0	**0**	0	**0**	0

Annex 4

Statistical data for the Rail/Navigation Division

Contents

1. Tables

1.1 Accidents involving persons and accidents at work

	2010			2011			2012			2013		
Number of reports / call-outs	344			324			373			379		
Investigations initiated	76			58			42			37		
Accidents involving persons Railways total (not including cableways)	**62**			**59**			**67**			**51**		
Persons injured	**†**	**S**	**L**	**†**	**S**	**L**	**†**	**S**	**L**	**†**	**S**	**L**
in a train / tram	1	48	16	–	–	1	–	1	1	–	–	–
while boarding / alighting	–	5	1	1	6	5	–	–	6	–	–	6
in stations	10	8	7	7	12	8	9	10	10	9	9	4
outside stations	18	9	3	8	12	2	15	11	4	13	10	5
other	4	6	30	–	–	2	–	–	–	–	–	–
Suicides* or attempted suicides* reported to SAIB	**68***			**43***			**59***			**81***		
Accidents at work	**8**			**10**			**15**			**16**		

Key to statistics below:

† = Fatalities

S = Severe casualties

L = Minor injuries

*) Suicides included in our statistics were initially reported to us as accidents involving persons.

1.2 Collisions and derailments

	2010			2011			2012			2013		
Collisions total	**40**			**39**			**42**			**47**		
train-train / tram-tram	8 / 4			10 / 2			7 / 0			6 / 7		
with machinery (digger, crane etc.)	2			2			3			4		
with buffers	4			4			3			2		
with parked vehicles	5			3			6			7		
with road vehicles	17			14			20			14		
with other things				4			3			7		
Collisions on level crossings total	**33**			**24**			**16**			**33**		
Persons injured on	**†**	**S**	**L**	**†**	**S**	**L**	**†**	**S**	**L**	**†**	**S**	**L**
manned crossings	2	3	10	1	4	6	1	1	6	4	9	6
unmanned crossings	–	4	3	2	3	2	–	3	2	2	3	15
Derailments total	**30**			**37**			**39**			**30**		
passenger train journeys	5			4			6			4		
goods train journeys	2			3			2			2		
shunting	19			22			19			20		
maintenance vehicles	2			3			8			3		
trams	2			5			4			1		

Key to statistics below:

† = Fatalities

S = Severe casualties

L = Minor injuries

1.3 Near accidents, shunting accidents and fire

	2010	2011	2012	2013
Near accidents / endangerment	**43**	**45**	**44**	**47**
Shunting accidents	**9**	**6**	**1**	**4**
Fires total	**11**	**11**	**20**	**17**
railway vehicles	8	8	9	12
scheduled buses	3	3	10	5
cableways	–	–	1	–
Various	**26**	**41**	**47**	**38**
sabotage / vandalism	2	4	2	6
accidents involving dangerous goods	4	3	2	5
high-voltage accidents	3	6	7	9
other	17	28	36	18

1.4 Ship accidents, events involving cableways

	2010			2011			2012			2013		
Ships total	**0**			**2**			**1**			**3**		
Accidents involving persons Cableways total	**10**			**0**			**3**			**4**		
Persons injured in	†	S	L	†	S	L	†	S	L	†	S	L
cable cars	–	1	–	–	–	–	–	–	–	–	–	–
chairlifts	–	6	2	–	–	–	–	1	2	1	–	2
draglifts	–	1	3	–	–	–	–	–	–	–	–	–
Other cableway incidents (not including accidents at work)	**4**			**1**			**9**			**1**		
crash of cabin / chair	1			–			–			–		
deropement	1			–			2			–		
rope failures	–			–						–		
other	2			1			7			1		

Key to statistics below:

† = Fatalities

S = Severe casualties

L = Minor injuries



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