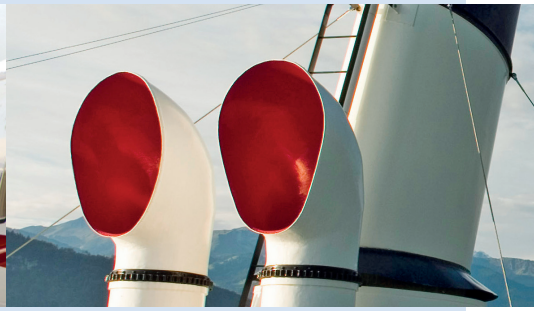
Swiss Transportation Safety Investigation Board STSB
Annual Report 2023

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1 Editorial

The steady rise in the number of safety-related incidents reported to the Swiss Transportation Safety Investigation Board (STSB) over the past ten years plateaued in 2023. The large number of incidents reported once again placed a heavy burden on the investigation service. The STSB has introduced a wide range of measures to deal with the high number of notifications and ongoing safety investigations and the associated capacity challenges. These measures are now having an effect, even if it will be some time before it can be said that the situation is normal, especially in the field of aviation.

The public, transport sector and respective supervisory authorities have access to the results of the safety investigations in the form of high-quality reports, which will thus help to further improve safety in the various modes of transport. The work of the STSB is also confirmed in a brief report by the National Council Control Committee (CC), which looked into the STSB's management and scope of operations. The CC emphasised the importance of Switzerland having a competent and independent investigative body. It confirmed that the STSB has a high level of expertise. The CC's recommendations are primarily aimed at improving the conditions in which the STSB operates, e. g. boosting staff resources on the Board and in the Investigation Bureau. The task now is to implement these recommendations while upholding the organisation's two most important assets: its expertise and autonomy.

Pieter Zeilstra,
President of the extra-parliamentary commission

2 Management Summary

The STSB received 2,128 incident notifications in the year under review. Following assessment, these resulted in 32 new investigations.
A total of 29 extensive and 33 summary investigations were completed during the year, and one interim report was published on ongoing investigations.
In the course of those extensive investigations, both completed and still in progress, the STSB identified safety deficits that led it to issue 17 safety recommendations and 15 safety advices. These figures are distributed as follows across the different modes of transport:

In 2023, the STSB received a report of an incident involving maritime navigation. No investigation was launched and no reports published.

The number of incidents reported in the year under review totalled 2,128, a similarly high figure to the previous year and significantly higher than in previous years. The majority of notifications came from the aviation sector (1,803).

	Aviation	Public transport
Incidents reported	1803	325
Opened investigations	24	8
Interim reports published	0	1
Extensive investigations completed	22	7
Summary investigations completed	31	2
Safety recommendations issued	12	5
Safety advices issued	10	5

The STSB completed 62 investigations, slightly more than in the previous year (56). A further 10 investigations were discontinued. In the Aviation Division, 89 investigations were pending at the end of 2023 (previous year: 135), while in the Rail/Navigation Division 19 remained outstanding (previous year: 20).

3 The SUST

3.1 Remit

The STSB investigates incidents in civil aviation, public transport and maritime navigation in accordance with the requirements of applicable national and international laws, in particular the Swiss Ordinance on the Safety Investigation of Transport Incidents (OSITI; SR *742.161*). 'Incidents' refers to accidents and serious incidents. The STSB can also investigate other events if this can make a significant contribution to improving safety.

The investigations consist of an independent examination of the technical, operational and human circumstances and causes that led to the incident. The findings are intended to help prevent similar incidents in the future. As stated explicitly in the Swiss Railways Act (RailA; SR *742.101*) and the Swiss Aviation Act (AviA; SR *748.0*), questions of blame and liability are beyond the scope of the investigations.

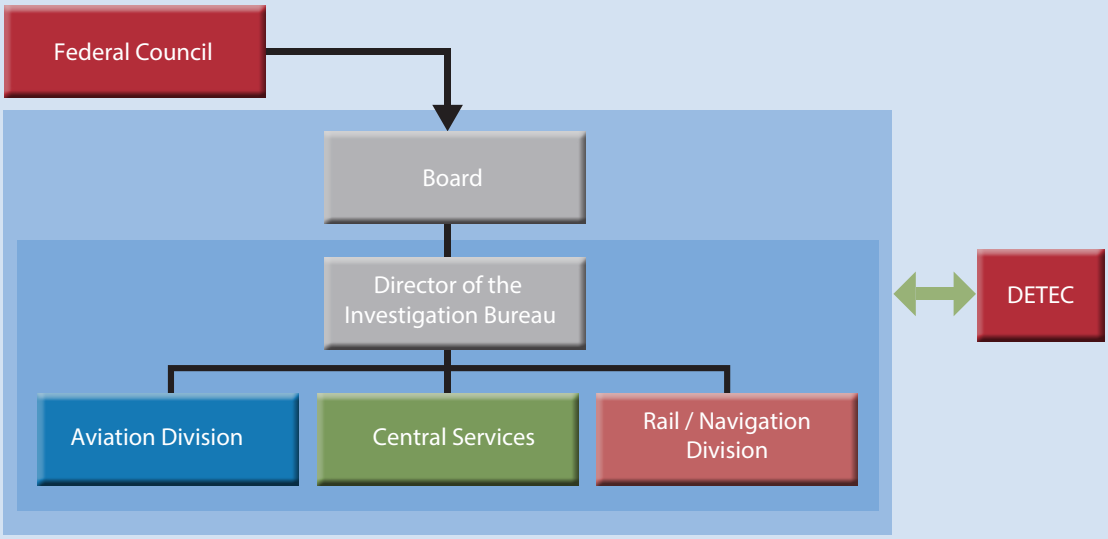
Where the STSB establishes safety deficits in the course of its investigations, it issues safety recommendations to the competent supervisory authorities, or safety advices to the companies, bodies or organisations concerned. The task then is to determine what measures are appropriate to reduce or eliminate the risks attached to the deficit that has been identified. The authorities do this as part of their supervisory activities, the companies as part of their safety management systems.

The STSB collates and publishes the findings of investigations in the form of reports aimed at professionals in the sectors concerned and the interested public. They are explicitly not aimed at law enforcement authorities.

The STSB forms part of the overall transport safety framework in Switzerland. This is made up of companies, authorities and organisations, such as transport operators, manufacturers, vehicle keepers, safety investigation bodies, supervisory authorities, accreditation and certification bodies, conformity assessment bodies, and others. Each element of the system helps to ensure the safety of its particular mode of transport by performing specific tasks that are assigned to it under the relevant legal provisions.

3.2 Organisation

The STSB is structured as an extra-parliamentary commission under Articles 57a57g of the Swiss Government and Administration Organisation Act (GAOA; SR *172.010*). The Board is appointed by the Federal Council. It comprises three independent experts from the relevant fields within the transport sector, and has an Investigation Bureau which is responsible for conducting the investigation process. Administratively, the STSB is attached to the General Secretariat of the Federal Department of the Environment, Transport, Energy and Communications (DETEC), although it acts independently.



3.3 Performance targets

The Federal Administration's New Management Model (NMM) was introduced on 1 January 2017. It is designed to strengthen administrative management at all levels and to increase the transparency and manageability of performance. Within the framework set by the NMM, the STSB defined the following projects, initiatives and performance targets for the year under review:

Projects and initiatives

Revision of the Ordinance on the Safety Investigation of Transport Incidents (OSITI; SR *742.161*):

The OSITI must be revised as a result of changes to international legislation and because ambiguities and partial contradictions have been identified. Furthermore, the reporting process is to be simplified (reduction in different ways of reporting) and suggestions from the report by the National Council control committee (subcommittee FDFA-DETEC-N) on improving a culture of confidentiality (just culture) are to be incorporated. A draft of the revised ordinance was drawn up in 2023. The consultation process will be launched in 2024, once the proposal has been finalised by the DETEC General Secretariat. The revised ordinance is due to come into effect on 1 January 2025.

Performance targets

The STSB sets itself challenging performance targets regarding the application of the latest recognised investigation methods and the swift publication of investigation findings.

Targets and indicators	2023 TARGET	2023 ACTUAL	2024 PLAN
Conformity assessment: The internal guidelines and procedures in the Aviation Division are in line with the latest international requirements.			
One conformity assessment procedure annually in accordance with ICAO Annex 13, EU Regulation No 996/2010 (yes/no)	yes	yes	yes
Rapid conduct of safety investigations: By applying suitable measures, the STSB ensures that incident investigations are conducted promptly and in compliance with the law.			

Prompt completion of safety investigations concerning serious incidents and accidents involving aircraft (%, minimum)	50	4	50
Prompt completion of safety investigations concerning serious incidents and accidents involving railways, buses and boats (%, minimum)	50	44	50

The targets for the prompt completion of safety investigations were not met. As already explained in previous annual reports, there is a conflict between the quantitative measurement criteria of the target of completing safety investigations rapidly (50%) and the STSB's internal objective of reducing pending cases by working through older investigations. The decision to concentrate on working through older pending cases generates a relatively higher proportion of reports for which the set deadlines cannot be met. In 2023 this target was missed by a large margin for aviation incidents. There are still several older investigations which have not yet been processed. It will take another two to three years to clear this backlog. However, the number of open investigations was significantly reduced (135 open investigations in Aviation at the end of 2022 to 89 at the end of 2023).
The Aviation Division received a record number of notifications in 2023 (see Sections 4.1 and 4.2). In assessing the notifications received, the highest priority is always given to whether the relevant incident should be investigated. The high number of notifications and the generally increasing effort associated with these assessments (due to having to evaluate recording devices) leads to fewer resources being available to carry out investigations. Recording devices can take several months to evaluate, depending on the circumstances of the incident, which leaves only a few months to carry out the actual investigation within the stipulated 12-month deadline (18 months for incidents involving aircraft over 5.7 t).

3.4 Resources

The STSB had a budget of approximately CHF 7.8 million available in 2023. Of this, CHF 3.9 million was earmarked for personnel expenses, and CHF 3.9 million for material and operating expenses. The latter item included CHF 1.7 million for external services. The STSB uses this to finance investigations conducted by external experts and specialist organisations. Approximately 10% of the budget was not used up, primarily because several positions remained vacant (fluctuation gains).

As is also usual in other countries, the work of the STSB is a basic service provided by the state to improve safety. It is therefore almost exclusively publicly funded. Consequently, all STSB products, and in particular the final reports on investigations, are provided free of charge on the internet.

The head of the Investigation Bureau, Tobias Schaller, retired in mid-2023 and was succeeded by Stephan Eder. At the end of 2023, the STSB Investigation Bureau had a staff of 17 (16.2 FTEs). In 2024, an additional investigator-in-charge position will be created, fully funded from the global budget (transfer from material expenses to staff expenses).

In its investigative activities, especially when specific specialist skills are required, the STSB can also call upon the support of around 130 external contract investigators.

4 Investigations and findings

4.1 Overview of investigations by the entire Investigation Bureau

The STSB received 2,128 notifications in the year under report. Following assessment, these resulted in 32 new investigations. A total of 29 extensive and 33 summary investigations were completed during the year, and one interim report was published on ongoing investigations. In the course of those extensive investigations, both completed and still in progress, the STSB identified safety deficits that led it to issue 17 safety recommendations and 15 safety advices. These figures are distributed as follows across the different modes of transport:

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Incidents reported	1803	325
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The STSB received five notifications of an incident concerning maritime navigation in 2023. No investigation was launched and no reports published.

The number of incidents reported in the year under review totalled 2,128, a similarly high figure to the previous year and significantly higher than in previous years. The increase in notifications in the aviation sector levelled out in 2023 to a stable high number. It can be assumed that the sector has adapted its processes and procedures to the requirements of the EU reporting regulation (EU 376-2014), which was published in 2014 and came into force at the end of 2015.

The Rail/Navigation Division received notifications in the range of the average of the last eight years.

The STSB completed 62 investigations, slightly more than in the previous year (56). A further 10 investigations were discontinued.

4.2 Aviation

The STSB received 1,803 notifications of incidents in aviation during 2023. Each of these was reviewed in terms of its potential preventive value. In many cases, additional technical aids were brought in to assess the danger in incidents that were thought to be serious, especially aircraft proximity hazards (airproxes), where there is a risk of collision between two aircraft. These preliminary enquiries resulted in a total of 13 accident investigations and 11 serious incident investigations, including 4 airproxes involving a high or significant risk of collision. An extensive investigation was opened for 17 incidents, whilst the initial investigation findings suggested a summary investigation for 7 events.

There were 53 investigations completed and their findings published in 22 final and 31 summary reports. The final reports contained 12 safety recommendations and 10 safety advices (Section 5.2).

There was one accident involving an aircraft registered in Switzerland in the reporting year. Three people suffered fatal injuries as a result of this.

Based on the objective of an investigation and the mandate to use the available resources in such a way that the greatest possible effect can be achieved, the STSB Investigation Bureau reviewed the pending cases and identified those where it became apparent in the course of the investigations that, for various reasons, the potential preventive value was low. In the process, 10 cases were identified in which the investigation was discontinued in order to fulfil the requirement of effective and purposeful use of the funds.

4.3 Public transport

Railways and tram

The STSB received 289 notifications of safety-related incidents concerning trains (261) and trams (28) in 2023. An investigator-in-charge attended the scene in 23 cases. An analysis of the notifications with a view to their potential preventive value resulted in an investigation being opened in eight cases. These concerned four derailments, two fire incidents and one incident each in the categories ‘near-miss/train

hazard', 'runaway train' and 'collision: shunting movement with obstruction'.

A total of five extensive and two summary investigations were completed last year. An interim report was drawn up. In response to the safety deficits identified during the extensive investigations, the STSB addressed three safety recommendations to the supervisory authority and four safety advices to the carriers/infrastructure managers (Section 5.3).

Extensive investigations were required to determine the cause of the derailment of two passenger train compositions in a storm event – which occurred almost simultaneously but at different locations – and into that of a goods train in the Gotthard Base Tunnel. These investigations were not yet completed in 2023.

Cableways

There were 15 notifications of safety-related events involving cableways during the reporting year. An investigator-in-charge attended the scene in one case. The evaluation of the notifications received did not reveal any potential for an investigation, so none was opened.

Buses

Twelve bus-related incidents were reported in 2023. The evaluation of the notifications received did not reveal any potential for an investigation, so none was opened.

One detailed investigation was concluded and a report published. The report contained a safety advice addressed to companies procuring new vehicles.

Inland navigation

Eight notifications of inland navigation incidents were submitted to the STSB in 2023. In two cases, investigators travelled to the scene to conduct a preliminary assessment. None of the notifications suggested that an investigation would lead to prevention; therefore no investigation was opened.

One detailed investigation was concluded and a report containing two safety recommendations to the supervisory authority was published.

4.4 Maritime navigation

In the reporting year, one notification was received regarding an incident in maritime navigation but this did not fulfil the criteria for opening an investigation. No reports for this mode of transport were published in 2023.

5 Safety recommendations and safety advices

5.1 General

In the first half of the last century, accidents in the transport sector were usually investigated by the supervisory authority for the mode of transport concerned. However, since these may be involved in causing an accident or a hazardous situation as a result of their activity, a separation of tasks and powers has prevailed over the course of recent decades. In most countries, in addition to the supervisory authority, an independent, state-run safety investigation body exists, which is expected to impartially clarify the reasons for an accident or a serious incident. In Switzerland, the Railways Act (RailA; SR *742.101)* and the Aviation Act (AviA; SR *748.0)* provide the legal framework for such an independent safety investigation body.

Because of the separation of powers, an investigation body does not itself mandate safety measures to the relevant authorities. These retain their full responsibility. The safety investigation body – the STSB in Switzerland – identifies any safety deficits and issues the corresponding safety recommendations in an interim or final report to the relevant supervisory authority or government department. It is then up to the body to which the safety recommendation was directed to decide – along with the stakeholders concerned – whether and how the safety recommendations should be implemented. This principle applies to all modes of transport for which the STSB is responsible for investigating incidents. International and thus national legal foundations contain different arrangements for individual modes of transport, however. These affect the specific steps that are taken and are described below.

The EU established the European Union Aviation Safety Agency (EASA) in 2002. The EASA's mission is to provide uniform and binding rules on aviation safety in the European aviation sector on behalf of the member states. Here, the national supervisory authorities primarily play an executive and mediating role and their exclusive competence is increasingly limited solely to

the nationally regulated aspects of civil aviation. For this reason, the STSB addresses its safety recommendations concerning aviation to either the EASA or the Federal Office of Civil Aviation (FOCA), depending on the area of competence. In individual cases the authority to act to rectify a safety deficit may lie with another authority in Switzerland or abroad. In these cases the STSB addresses its safety recommendation to the competent authority concerned.

Regulation by the EU is becoming increasingly important for the railways, in particular where technical and operational interoperability in international transport is concerned. Meanwhile, responsibility for overseeing railway safety essentially lies with the national safety supervisory authority, which in Switzerland is the Federal Office of Transport (FOT). However, since June 2019, the European Union Agency for Railways (ERA) has issued safety certificates and market authorisations for vehicles, and given its approval for train control and train safety projects. As a further result of the changes to the legal foundations in the railway sector, other authorities and organisations also take on a supervisory role alongside the national authority. These include the Swiss Accreditation Service (SAS), as well as certification bodies for companies that are responsible for maintenance. The STSB addresses its safety recommendations to that authority or body whose mandate gives it the power to implement or order action on the basis of the recommendation submitted to it.

Safety objectives and requirements for cableway installations and their operation are governed by the EU Cableways Regulation (EU) 2016/424 dated 9 March 2016. However, supervision and enforcement lie fully within the remit of the national supervisory authority, which in the case of federally licensed cableways is the FOT. STSB recommendations are therefore addressed to this authority.

The regulations applying to licensed inland navigation in Switzerland are primarily national ones. Consequently, recommendations from the STSB are addressed to the FOT as the national supervisory authority for safety.

With regard to maritime navigation, the European Union established the European Maritime Safety Agency (EMSA) in 2002. Its mission is to reduce the risk of accidents at sea, the pollution of the seas through maritime navigation and the loss of human life at sea. EMSA advises the European Commission on technical and scientific matters concerning the safety of maritime traffic and in relation to preventing the pollution of the seas by ships. It plays a part in the ongoing drafting and updating of legislative acts, the monitoring of their implementation and in assessing the efficacy of existing measures. However it has no authority to issue directives to Switzerland specifically. Any safety recommendations from the STSB are therefore addressed to the Swiss Maritime Navigation Office (SMNO) as the national supervisory authority.

Having received a safety recommendation, the addressee notifies the STSB of the action it intends to take to rectify the safety deficit, as well as a timeline for its implementation. The feedback from the addressees and the current implementation status can be found on the STSB website (https://www.sust.admin.ch/en/safety-recommendations/aviation or https://www.sust.admin.ch/en/safety-recommendations/rail-navigation).

Occasionally, an investigation brings safety deficits to light that cannot be eliminated by amending rules or regulations or by direct supervisory activity, but rather by changing or improving awareness of risk. In these cases the STSB formulates safety advice which is addressed to particular transport-related stakeholder or interest groups. This is intended to help the companies, people and organisations concerned to identify a risk and the associated action that is required. The legal foundations do not provide for feedback on the implementation of measures taken in response to safety advices. Unlike safety recommendations, safety advices are not published separately on the STSB website.

All of the safety recommendations and safety advices issued by the STSB in interim or final reports during 2023 are set out below. To aid understanding, these are accompanied by a brief description of both the incident concerned and the safety deficit which is to be eliminated

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5.2 Aviation

Collision over Dittingen (BL), 23.08.2015

Two microlight aircraft in a formation of three collided north-east of Dittingen airfield (LSPD) during a public flying display.

Safety deficit
The European Aviation Safety Agency (EASA) does not stipulate that specific authorisation is required to perform formation flights, as it does for aerobatic flights. There are no binding guidelines or syllabuses for theoretical and practical training in formation flying.

Safety recommendation No 537, 30.05.2023
The European Aviation Safety Agency (EASA) should take appropriate measures to ensure that systematic theoretical and practical training and corresponding authorisation are required for formation flying.

Safety deficit
Pilots wishing to take part in public air shows in Switzerland must have a display authorisation in accordance with the current guidelines of the Federal Office of Civil Aviation (FOCA). Display authorisations were issued by the FOCA in accordance with the guidelines of the Joint Aviation Authorities (JAA) and, since February 2016, on the basis of its own guideline DA 10.01, once the pilot had undergone theoretical and practical training and a skills test.
In many European countries, including Germany, there are no equivalent regulations and the authorities in these countries do not issue display authorisations. The training and flying skills of pilots from these countries are therefore not standardised or evident. The FOCA allowed pilots who did not have display authorisation to participate in public flight displays on a case-by-case basis.

Safety recommendation No 538, 30.05.2023
The European Aviation Safety Agency (EASA) should take appropriate measures to ensure that internationally standardised guidelines for public flight displays are applied in all member states. These guidelines should set out the conditions for obtaining display authorisation, describe the theoretical and practical training and check pilots' knowledge and flying skills. They should also define the requirements for granting special formation display authorisations.

Safety deficit
The stated purpose of the Federal Office of Civil Aviation's directive on flying event requirements is to ensure the safety of third parties. The version of the directive in force at the time of the accident did not contain the requirement to conduct a risk assessment or to indicate what measures were taken to ensure the safety of third parties outside the display area.

Safety recommendation No 539, 30.05.2023
The Federal Office of Civil Aviation (FOCA) should ensure the assessment of hazards and the evaluation of risks to third parties during public air shows and require the organiser to take precautionary measures to ensure safety.

Accident involving a drone, Irchel (ZH), 09.05.2019

Approximately two minutes after take-off from the University of Zurich premises in Irchel, the M2 V9 drone's flight termination system was automatically activated, the parachute released and the drone made an emergency landing. After the parachute was released, the canopy suspension line ruptured and the drone fell unchecked to the ground in the wood and was destroyed.

In the interim report of 17 June 2019 on this incident, safety recommendations Nos 553 and 554 were addressed to the Federal Office of Civil Aviation (FOCA). These were published in the 2019 annual report.

Safety deficit
As the investigation showed, the impact energy of the drone, regardless of its load, was significantly higher than the value of 80J used in practice to date.

Safety recommendation No 587, 06.06.2023
The Federal Office of Civil Aviation (FOCA) should take appropriate measures to ensure that the impact energy of a drone gliding to the ground on a parachute does not pose a significant risk of injury to third parties on the ground.

Safety deficit
As the investigation showed, the flight controller firmware, based on ArduCopter 3.5.0-rc5 software, was only able to use two of the three available inertial measurement units (IMUs) to control the drone. As a result, the flight controller software lacked resilience, i. e. the ability not to fail completely in the event of malfunctions or failures of individual components, and was unable to maintain control of the drone.
This resilience could only be achieved from software version 3.6.12 onwards with the configuration of the safety-critical parameter ('*EK2_IMU_MASK = 7*'), published as Service Bulletin SB 0000002 in the flight controller manufacturer's discussion forum.
In the accident on 25 January 2019 involving the largely identical drone SUI-9909 (cf. summary report), the flight termination system (FTS) was immediately triggered as the GPS signal was lost. As the investigation showed, the drone's flight attitude was still stable at this point and it might therefore still have been possible to land the drone under motor power, either manually controlled under VLOS or autonomously.
In practice, flight-critical parameters such as the ambient temperature and humidity are not taken into account when operating under extreme weather conditions. If this were the case, a flight mission could be cancelled early or might not carried out at all under certain conditions.

Safety recommendation No 588, 06.06.2023
The Federal Office of Civil Aviation (FOCA) should ensure that service bulletins regarding flight-critical components or their software are complied with by operators of drones flown in higher-risk scenarios – in particular for BVLOS flights (beyond visual line of sight) over populated areas.

Safety recommendation No 589, 06.06.2023
The Federal Office of Civil Aviation (FOCA) should ensure that the manufacturer revises the conditions for triggering

the automatic FTS so that suitable contingency procedures are in place to ensure controlled flight termination, before the parachute is released and the drone descends to the ground in an uncontrolled manner.

Safety recommendation No 590, 06.06.2023
The Federal Office of Civil Aviation (FOCA), together with the operator or manufacturer, should take appropriate organisational or technical measures to ensure that drones do not take off in unsuitable weather conditions that could lead to problems such as condensation or ice.

Safety deficit
In the case of a conventional quadrocopter with four rotors, such as the M2 V9 drone investigated here, the failure of one rotor inevitably leads to the drone crashing or to the triggering of the automatic flight abort system. Drones with six or more rotors have a significantly lower likelihood of failure.

Safety recommendation No 591, 06.06.2023
The Federal Office of Civil Aviation (FOCA) should ensure that the manufacturer strives to introduce a back-up propulsion concept, especially for flights over populated areas, in order to reduce the likelihood of propulsion-related failure due to material wear or exogenous factors such as bird strikes.

Safety deficit
As the investigation showed, the flight controller firmware, based on ArduCopter 3.5.0-rc5 software, was only able to use two of the three available inertial measurement units (IMUs) to control the drone. As a result, the flight controller software lacked resilience, i. e. the ability not to fail completely in the event of malfunctions or failures of individual components, and was unable to maintain control of the drone.
This resilience was only available after the release of software version 3.6.12, with the configuration of the safety-critical parameter (‘*EK2_IMU_MASK = 7*’), published as Service Bulletin SB 0000002 in the flight controller manufacturer’s discussion forum.
At a later date, the manufacturer stipulated that all copter operators must use at least ArduCopter 4.x and SB2 parameters, regardless of the age of the flight controller, without specifying a release date.

Safety advice No 44, 06.06.2023
Target group: Manufacturers of drone components and associated software
Manufacturers of drones and drone components should ensure that service bulletins relating to drone components or their associated software are clearly listed, labelled with an identifier and an issue date, and that the date of any revisions is clear to operators. Operators should also be promptly informed when a service bulletin is published.

Accident involving a motor glider on take-off at Dierdorf special airfield (EDRW), Germany, 17.10.2021

On an SF 25C motor glider the right control stick broke directly above the weld seam at the transmission joint so that it could no longer be used to control the aileron and elevator. The design was such that the aileron, but not the elevator, could still be controlled with the left stick. The crew, who were unaware that the control stick was broken, therefore lost control of the motor glider during the take-off run. The aircraft hit the ground hard, collided with a tree and came to a halt heavily damaged.

In order to ensure an impartial investigation, the German Federal Bureau of Aircraft Accident Investigation (BFU) delegated the matter to the Swiss Transportation Safety Investigation Board (STSB).

In the interim report of 21 December 2021 on this incident, Safety Recommendation No 581 was addressed to the European Union Aviation Safety Agency (EASA). This was published in the 2021 annual report.

Safety deficit
The motor glider was manufactured in 1977. The investigation revealed that the broken steel rod was heavily corroded on the inside and therefore weakened.
Other glider models of comparable design and manufactured during the same time period also experienced structural failure due to material fatigue or other signs of ageing. In older aircraft of similar design, the maintenance manuals usually do not contain any maintenance specifications

in relation to material fatigue and ageing for older aircraft with high operating times. Such specifications are however necessary to ensure the airworthiness of ageing aircraft. It is particularly important to check basic components of an aircraft for signs of ageing, such as the flight controls and structural elements.
A standardised process for establishing a special inspection programme for older general aviation aircraft at the level of the supranational supervisory authority does not yet exist.

Safety recommendation No 586, 28.03.2023
The European Union Aviation Safety Agency (EASA) should establish maintenance specifications in relation to material fatigue and ageing for older aircraft with high operating times and of a similar design type to the Scheibe SF 25.

Dangerous approach in the terminal manoeuvring area at Sion (VS), 18.12.2020

A business jet flying under instrument flight rules (IFR) as it approached runway 25 at Sion airport and a motorised aircraft in cruise flight came dangerously close to each other within the temporary terminal manoeuvring area (TMA) at an altitude of around 12,500ft asl.

Safety deficit
Several dangerous approaches have been observed in class E airspace around Sion aerodrome, particularly within the Sion temporary TMA between aircraft operating under instrument flight rules (IFR) on approach to Sion and those operating under visual flight rules (VFR). Air traffic control has also recognised the entire area as a hotspot.
The Sion temporary TMA cannot be activated at short notice via voice radio but instead only after prior publication via a Notice to Airmen (NOTAM) and the Daily Airspace Bulletin Switzerland (DABS). As a result, IFR traffic approaching and departing must pass through class E airspace where VFR traffic – which is not in contact with air traffic control and which air traffic control or collision warning systems may not identify – is expected.

Safety recommendation No 585, 31.10.2023
The Federal Office of Civil Aviation (FOCA) should, as soon as possible, take appropriate measures to reduce the risk of dangerous approaches in the Sion TMA resulting from the presence of IFR traffic in class E airspace, for example by permanently activating the current TMA via NOTAM ('TMA TEMPO') or by establishing a TMA that can be activated at short notice via voice radio if required ('TMA HX').

Safety deficit
Several dangerous approaches have been observed in class E airspace around Sion aerodrome, particularly within the Sion temporary TMA between aircraft operating under instrument flight rules (IFR) on approach to Sion and those operating under visual flight rules (VFR).
The temporary TMA Sion is not normally activated. Accordingly, no Notice to Airmen (NOTAM) has been published in this regard and there is no entry in the Daily Airspace Bulletin Switzerland (DABS) indicating an activated TMA in Sion. Crews flying into Sion under IFR or VFR in this airspace may not be aware of this.

Safety advice No 52, 31.10.2023
Target group: Flight crews approaching Sion under IFR
Flight crews approaching Sion under IFR should inform themselves in advance of the status of the temporary TMA Sion via NOTAM and DABS. A NOTAM is published and there is an entry in DABS whenever this temporary TMA is activated. Conversely, if this information is not available, the temporary TMA is not activated. In this case, the flight path under IFR leads through class E airspace up to the Sion aerodrome control zone boundary approximately 5NM before the start of runway 25.
In class E airspace, VFR traffic that is not in contact with the Sion aerodrome control tower and that may not have an activated transponder must be expected at all times. The principle of '*see and avoid*' applies in order to avoid collisions.

Safety advice No 54, 31.10.2023
Target group: Flight crews flying under VFR within the temporary TMA at Sion
The temporary TMA at Sion is not normally activated (no NOTAM or entry in DABS). IFR approaches to Sion take place within the boundaries of this temporary TMA, and so VFR traffic must expect an increased volume of IFR traffic here. The '*see and avoid*' principle to avoid collisions generally applies in class E airspace. In order to increase the situational awareness of all parties involved, it is advisable to contact the Sion site traffic manager even if the TMA is not activated.

Loss of control of a business jet, 15 km south-east of Briançon, Hautes-Alpes (France), 18.12.2019

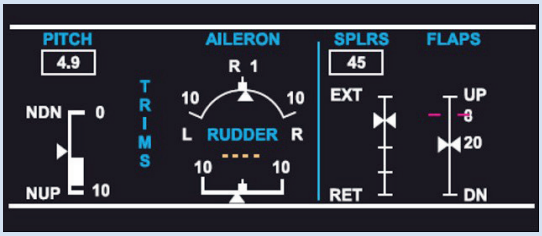
While cruising at flight level 400, the pilots of a Learjet 45 were alerted to a warning indicating failure of the autopilot. When they switched to manual flight mode in accordance with the checklist, the aircraft began to roll abruptly to the left. These movements were difficult to control and were

exacerbated by Pilot Induced Oscillations (PIO). The pilots realised that the spoilerons were not responding correctly to the manually entered roll commands and disabled their functioning by pulling one of the two circuit breakers. The roll oscillations stopped and the aircraft became stable and manoeuvrable.

Safety deficit
The investigation revealed that the function of the spoilerons on this aircraft was inverted: the spoileron on the left wing extended instead of that on the right wing and vice versa.
The aircraft had been modified in accordance with Bombardier Service Bulletin SB 45-27-20 ATA-27-60; this improves the reliability of the spoileron system but removes the control wheel master switch (MSW) function, which allows pilots to push the spoilerons down in the event of uncontrolled movements of the aircraft around the yaw and roll axis. This function is the central element of the Roll or Yaw Axis Uncommanded Motion checklist and requires a systematic search for the cause of the uncontrolled movement.
The investigation revealed that this checklist had not been updated to reflect the changes made by the application of the Service Bulletin and therefore no longer served the purpose of mitigating operational malfunctions of the aircraft.

Safety recommendation No 593, 12.09.2023
The US Federal Aviation Administration (FAA) should ensure that the manufacturer updates checklists to reflect changes in a service bulletin.

Safety deficit
The investigation revealed that the reversal of the spoileron function caused by a maintenance error had not been recognised by any of the flight crews flying the aircraft before the serious incident occurred. In the synoptic display on the flight control page, the position indices of the left and right spoilerons are grouped around a single vertical axis and can easily be confused. When checking the spoilerons before take-off, pilots are therefore likely to 'fall victim' to a confirmation bias, confusing the indices and confirming the deployment sequence that they believe to be true.



Safety recommendation No 594, 12.09.2023
The US Federal Aviation Administration (FAA) should ensure that the manufacturer modifies the flight control display to minimise the possibility of confusion between the left and right spoilerons; this recommendation should apply to all aircraft equipped with similar displays.

Safety deficit
During the investigation, essential information such as the deflections of the primary flight controls were not listed under the flight data recorder (FDR) parameters. The aircraft's dynamic behaviour could only be analysed indirectly, via the movements of the spoilerons and the roll.

Safety advice No 47, 12.09.2023
Target group: Manufacturer
The manufacturer should ensure that the essential flight data is part of the recorded parameters of the FDR.

Near-collision between a motorised aircraft and a formation of two Swiss Air Force fighter aircraft, 2 km southwest of Altendorf (SZ), 15.05.2019

A single-engine light aircraft, flying under visual flight rules, was descending towards the southern approach sector of the uncontrolled Wangen-Lachen aerodrome when two Swiss Air Force fighter aircraft, flying at high speed, in formation and also under visual flight rules, crossed its flight path at a distance of around 100 metres horizontally and 15 metres vertically.

Safety deficit
The 'see and avoid' principle to avoid collisions reaches its limits at high flying speeds. With an increased volume of uncontrolled air traffic in class G and E airspace, there is therefore an increased risk of collision during fighter aircraft operations.

Safety advice No 50, 28.11.2023
Target group: Military Aviation Authority MAA
The Military Aviation Authority (MAA) should take measures to limit the risk of collision when fighter aircraft fly at high speeds in class G and E airspace, for example by providing general traffic instructions to fighter aircraft in class G and E airspace.

Safety advice No 51, 28.11.2023
Target group: General aviation pilots
General aviation pilots should ensure that their aircraft are equipped with a transponder and that it is always switched

on so that pilots of fast-flying fighter aircraft in particular are warned of dangerous approaches in good time and can take evasive action.

Accident involving a Bücker Bü 131B 'Jungmann' aircraft, Altwegacker, Subingen (SO), 20.07.2021

The aircraft entered a spin that the pilot was unable to complete and collided with the ground.

Safety deficit
Even well-trained and experienced pilots are often unable to recognise unexpected flight conditions with unusual flight attitudes, and cannot return the aircraft to a normal flight attitude within a reasonable period of time.

Safety advice No 46, 24.01.2023
Target group: Pilots without aerobatic experience
Training in aerobatics or an introduction to recognising, preventing and ending unusual flight attitudes with large bank angles or large positive or negative pitch angles in the entire speed range (upset recovery training) is therefore recommended for every pilot as a safety-enhancing measure.

Take-off accident involving a powered aircraft at Beromünster aerodrome (LU), 12.06.2020

The aircraft took off at too low a speed, whereupon the available take-off power was insufficient to accelerate it or bring it into a climb. An emergency landing was unavoidable; the aircraft overturned in a field of tall grass.

Safety deficit
Incidents may occur during take-off particularly on aerodromes with challenging conditions and relatively short runways on which the available take-off distance is insufficient to ensure a safe take-off. Similarly, landings on short runways may result in runway overrun because the available landing distance is too short. The cause of these incidents is usually overly optimistic assumptions regarding the performance of the aircraft or an inappropriate take-off or landing technique that does not make optimum use of the aircraft's performance. In addition, certain aircraft types, especially older ones, only have relatively simple performance data, which does not allow the pilot to make sufficiently informed decisions in every situation.

Safety advice No 48, 04.04.2023
Target group: Pilots operating aircraft at aerodromes with short runways
It is recommended to create generous safety margins for performance calculations for take-off and landing on short runways and in challenging ground or weather conditions, and that the operation of the aircraft in question be adapted to the calculated performance values and the prevailing conditions, for example by reducing the load. Furthermore, the procedures for short take-offs and landings of the respective aircraft types should be safely mastered.

Helicopter landing accident on the Petersgrat mountain landing site (VS), 13.05.2017

While attempting to land a helicopter in murky and low-contrast light conditions in the high mountains on an area of snow with no points of reference, the pilot lost control of the flight attitude and the helicopter tipped onto its left side. The rotor blades hit the cabin roof and practically tore it away completely at the front. The pilot was fatally injured on the head. The passengers sustained minor or no injuries and were able to free themselves from the wreckage.

Safety deficit
The main switch of the emergency locator transmitter (ELT) was in the OFF position. The ELT was therefore unable to transmit any signals.

The flight operations company that had chartered the helicopter to the pilot provided backpacks with appropriate equipment for flights in mountainous areas, including handheld radios. However, no such backpack was on board. The passengers and pilot did not have suitable equipment with them for survival in the mountains.
The pilot of another helicopter in the area of the accident spotted the helicopter lying on its side shortly after the accident and, after providing initial assistance, called the rescue services, which considerably sped up the rescue of the passengers, as it was not possible for the passengers themselves to raise the alarm due to the lack of network coverage for mobile phones in the area of the accident.
Investigations into the helicopter's whereabouts would not otherwise have been launched until the flight operations company's IT system had reported the helicopter as overdue almost three hours after the accident. Any search and rescue operation would certainly have taken several hours, during which time the passengers would have had to wait at over 3,000 m above sea level without suitable equipment.

Safety advice No 49, 24.10.2023
Target group: Pilots, flight instructors, flight operations companies, flight schools, owners and operators of aircraft

All air traffic participants and all others directly involved should put measures in place to ensure that the alert is raised and survivors are rescued as quickly as possible in the event of an accident. All aspects of this topic are examined in detail in STSB Study No 3 on the organisation and effectiveness of the civil aviation search and rescue service (SAR) in Switzerland.
As it can still take several hours for emergency services to arrive at the scene of an accident, special attention should be paid to ensuring that all aircraft occupants are properly equipped. Mountain and survival training would be useful, at least for those who regularly fly in the mountains.

Collision with a high-voltage power line near Prati della Gerra, Arbedo-Castione (TI), 03.12.2018

A helicopter collided with the earth cable of a high-voltage power line after take-off, was severely damaged and had to make an emergency landing.

Safety deficit
The pilot was fundamentally aware of the high-voltage power line but had not noticed the obstacle due to restricted situational awareness.
The helicopter was not equipped with a collision warning system that could have alerted the crew to the obstacle.

Safety advice No 55, 12.12.2023
Target group: Owners, keepers and pilots of helicopters
Helicopters should be equipped with a collision warning system that warns the crew of obstacles. The federal government is currently supporting the installation of such systems under the Special Financing of Air Transport budget.

5.3 Railways

Collision of a goods train with the bucket of a road-rail excavator in Zurich Vorbahnhof (ZH), 16.04.2019

On 16 April 2019 at 23:58, the locomotive of a goods train entering Zurich marshalling yard from Zurich Wiedikon collided with the bucket of a road-rail excavator shortly after the entry signal. No persons were injured. The locomotive of the goods train was damaged.

The collision between a goods train and the bucket of a road-rail excavator in Zurich marshalling yard on 16 April 2019 was caused by the road-rail excavator being transported in a way not permitted by operational regulations, during which the operator failed to notice that the upper cab of the road-rail excavator was slowly tilting inwards into the profile of the goods train while standing still over a prolonged period of time.

The following contributed to the accident:
- The lack of vehicle-specific operating rules governing the use of the road-rail excavator in railway operations.
- Inadequate vehicle-specific training regarding the types of movement of the road-rail excavator permitted in railway operations.

Other factors:
The specifications of the operating licence had not been included in any regulations.

Safety deficit
The investigations showed that the employees had insufficient knowledge of how to use the vehicle in railway operations. This resulted in the vehicle moving in an unacceptable and unsafe way and profile damage.

Safety recommendation No 182, 04.04.2023
Within the framework of safety monitoring, the Federal Office of Transport (FOT) should review how all parties involved are provided with and instructed about operating licence conditions and restrictions relevant to the operation of construction service vehicles. The FOT should also review how compliance with such conditions and restrictions are checked in practice.

Derailment of a shunting movement in Brig (VS), 06.07.2022

On 6 July 2022 at 15:58, an indirectly guided shunting movement passed a dwarf signal showing 'Stop' in Brig (VS) and derailed shortly afterwards on the active derailer. The four-axle tank wagon, loaded with hazardous goods, hit the ballast bed and overturned. The shunting supervisor travelling on the running board was trapped under the tank wagon and was fatally injured. No dangerous goods escaped.

The derailment of a shunting movement on 6 July 2022 in Brig marshalling yard is due to the shunting supervisor's failure to react to the signalling at the dwarf signals and to the clearly visible derailer, as a result of which the shunting movement passed a dwarf signal showing 'Stop' and was subsequently derailed by the active derailer.
The following factors contributed to the accident:
The shunting supervisor was not aware of anything that would prevent him manoeuvring the train to its destination.

The following risks were identified during the investigation:
- In practice, the information provided by the radio track transmitter is hardly ever used.
- When closed, the hinged panel on the derailed tank wagon indicating dangerous goods – which in this case was incorrect – did not have a suitable securing device to prevent it from opening unintentionally.

Safety deficit
In this accident, no use was made of the option of using the transmitter in the LISA device[1] to inform the driver that only a partial route had been set. During the investigation, it was found that this option is rarely used.

Safety advice No 35, 15.08.2023
Target group: Shunting supervisors who work with the LISA radio track transmitter during shunting communication.
Railway undertakings using the LISA device's radio track transmitter should encourage users to make greater use of the information it provides – in particular the fact that it can indicate a partial route set.

Safety deficit
Because several routes can be requested simultaneously by the same shunting supervisor, uncertainties arise if the routes are not fully travelled. It cannot always be clearly communicated when these routes are cancelled.

Safety advice No 36, 15.08.2023
Target group: Shunting supervisors who work with the LISA radio track transmitter during shunting communication.
Railway undertakings should instruct users not to request several routes at the same time if it is not possible to cover the entire route.

[1] LISA: The abbreviation stands for 'Light and Integrated Shunting Accessory'.

Safety deficit
When closed, the hinged panel on the derailed tank wagon indicating dangerous goods – which in this case was incorrect – did not have a suitable securing device to prevent it from coming undone unintentionally. The hinged panel is affixed by folding it upwards and sliding two bolts shut. There is no additional means of securing it. Because the affixing mechanism is so simple, even minor vibrations can cause the panel to come undone. In the event of an incident, the emergency services are unable to provide assistance immediately if it is first necessary to clarify what type of dangerous goods are actually in the vehicle.

Safety advice No 37, 15.08.2023
Target group: Vehicle keepers who operate wagons that display the dangerous goods sign on a hinged panel.
Vehicle owners should check whether hinged panels indicating dangerous goods have a securing device that prevents them coming undone unintentionally and, if necessary, retrofit an adequate device.

Safety deficit
The former voice output 'Attention, partial destination' in previously used analog shunting radio is no longer available for shunting communication with LISA. It is not very practical for shunting supevisors to have to consult a display to obtain such information, and so this information option is now rarely used.

Safety advice No 38, 15.08.2023
Target group: Railway undertakings that are replacing LISA shunting communication with a new generation of devices. Railway undertakings which in future replace LISA devices with new communication devices should consider introducing a model which has additional voice output of safety-relevant information, as this is more practical in actual use.

Derailment of a goods train in the Gotthard Base Tunnel in Faido (TI), 10.08.2023 (interim report)

On 10 August 2023, several goods wagons in a northbound goods train derailed in the Gotthard Base Tunnel near the Faido multifunction station. Very extensive damage was caused to the infrastructure and rolling stock. Several fragments of a wheel disc belonging to one of the derailed freight wagons were found some way ahead of the derailment site.

Safety deficit
Wheel discs are safety-critical components, the failure of which can directly give rise to a serious accident.
Regardless of the original cause of a crack in the wheel disc, once it appears, it slowly expands in the wheel. With an increasing number of load cycles, it expands continuously until the wheel breaks in the wheel centre.
The state of the art in train control equipment currently available in Switzerland's rail infrastructure is unable to detect a crack in a wheel disc. During technical inspections of trains in operation, a fracture can only be detected if it is already sufficiently large, and only in the visible wheel area.
The initial results of the investigation as well as those of the metallurgical investigation showed a similarity to the wheel fractures that were the subject of the first JNS procedure 'Broken Wheels'.

Safety recommendation No 183, 22.09.2023
The STSB recommends that the Federal Office of Transport (FOT) initiate an extension of the measures defined in the first JNS Urgent Procedure in order to limit the risk to the wheelset of the BA 390 series during operation and maintenance.

Safety deficit
Wheelsets are interchangeable components that cannot be identified as belonging to a particular wagon. The wheelset of the BA 390 series is used by various wagon keepers in Europe.
It is not known how many BA 390 series axles are in operation nationally.
As the initial results of the investigation showed, the wheel disc fracture in the Gotthard Base Tunnel is similar to the wheel disc fractures that were the subject of the first JNS

procedure 'Broken Wheels'. There appears to be a systemic problem in the case of the various wheel disc fractures.

Safety recommendation No 184, 22.09.2023
The STSB recommends that the Federal Office of Transport (FOT) apply to the ERA to launch a JNS procedure.

5.4 Cableways

No safety recommendations were issued for cableways in 2023.

5.5 Buses

Fire on a new electric and battery-powered trolleybus in Givisiez (FR), 12.12.2021

On Sunday, 12 December 2021 at around 19:25, a fire broke out in trolleybus No 10, which was parked in the bus depot of the Fribourg transport company (TPF) in Givisiez. The trolleybus was connected to the power grid via two charging systems for 600V and 24V batteries at the time. There was considerable damage to the vehicle. The building was also damaged. No one was injured.

The fire on trolleybus No 10 was caused by an electrical malfunction in the 24V battery circuit, in one of the receivers or in a live power supply unit in the driver's cab.
The following contributed to the fire:

- The lack of insulation between the negative terminal of the 24V battery system and the chassis.
- The lack of protection for the power cables, which run over various metal parts with sharp edges.
- The fact that some cables in the secondary circuits were not suitable for containing the flames.

Safety deficit
The chassis and bodywork of trolleybuses consist of various interconnected metal parts. Some of these have sharp edges which, over time, due to the vibrations caused by the movement of the vehicle, damage the electrical wiring and lead to a faulty electrical connection, which may result in a fire.

Safety advice No 34, 04.04.2023
Target group: Companies that purchase new vehicles
The STSB recommends that the buyer, during the vehicle factory acceptance tests, should pay particular attention to the quality of the wiring and check whether all the necessary protection has been fitted to prevent the cable sheathing from becoming damaged by the sharp edges of a metal part of the chassis or bodywork.

5.6 Inland navigation

Grounding of the MS Diamant in Kehrsiten (LU), 07.12.2017

At 21:13 on 7 December 2017 the MS Diamant, which was operating a special service, collided with a rock near the shore, 400 m from the Kehrsiten-Bürgenstock landing stage. The hull was damaged laterally over a length of 23 m, causing water to enter three watertight compartments via a crack about 1.2 m long. The MS Diamant was subsequently able to reach the landing stage under its own power, with all passengers disembarking unharmed. The immediate and proportionate response by the crew (issuing an alert without delay and piloting towards the landing stage) and the appropriate measures taken by participating emergency services (pumping water from the ship, provisional sealing of leak by diving specialists) helped minimise the damage.

The reason the MS Diamant ran aground on 7 December 2017 on its special service near the Kehrsiten-Bürgenstock landing stage was because it manoeuvred into an unsafe position while approaching the landing stage at night and was consequently steered too close to the shore. Both shipmasters were too slow to notice the spatial disorientation created by the lack of visible reference points in the dark shore area, the bright lighting on the MS Waldstätter ahead and the illumination on the landing stage. The available aids (radar and GPS with heading lines and speed indicators) were insufficiently used, and the handover of command was unstructured. The requirements for approaching the landing stage – including keeping to the shipping lane and regulating speed – were not followed. The incident shows

that the error tolerance of the man-machine-environment system was insufficient under such circumstances.

The following contributed to the accident:
- The shipmasters' desire to meet their obligation to moor the ship on time.
- The shipmasters' insufficient awareness of the fact that, despite good visibility, they were vulnerable to optical illusions and spatial disorientation while piloting at night and should have consistently deployed the available aids. This issue was not sufficiently addressed in training on risk recognition and response.

The following weaknesses were identified during the investigation:
- Insufficient operational guidance and standard operating procedures (SOP) for piloting with radar at night and for handing over command.
- The shipmasters' insufficient training and consequent lack of awareness regarding human performance limitations, which resulted in a failure to develop appropriate human factor skills for piloting at night.

Safety deficit
The SGV course on shipmaster training describes the piloting procedures for approaching, departing and reversing. Other standard operating procedures are not described.
State requirements for operating regulations of shipping companies do not offer greater precision either qualitatively or in their content. The SGV operating regulations do not include a list of safety-relevant processes – such as piloting at night, handover of command, or the failure of a control system – which could be defined and trained using standard operating procedures.
Defining standard operating procedures helps to improve error resilience in the man-machine-environment system. Such standard operating procedures can apply to a range of conditions/situations/phases and each contains specific examples based on the principle of 'best-use-of-equipment'. It is quite possible for standard operating procedures to consist of criteria and rules that enable straightforward decision-making in a specific situation.

Safety recommendation No 180, 31.01.2023
The FOT should provide shipping companies with guidelines for their operating regulations. These should improve error resilience in the man-machine-environment system by ensuring the companies set down in writing, assess, develop, and provide training in standard operating procedures for a range of situations, based on a risk assessment.

Safety deficit
Neither shipmaster noticed their spatial disorientation and resultant loss of situational awareness. Neither of them had a sufficient basic awareness of the limits of human performance in darkness or the impact of this on the safe operation of the vessel.

Safety recommendation No 181, 31.01.2023
The FOT should issue a requirement or check with supervisors that the training officers educate their shipmasters sufficiently and at the appropriate level on relevant human factors in the man-machine-environment system, specifically in the area of situational awareness. Similarly, the FOT should request evidence from training officers of how shipmasters train for and assess these human factors competencies in practical situations.

5.7 Maritime navigation

No safety recommendations were issued for maritime navigation in 2023.

6 Time series

The following sections illustrate the trend over time in a range of data specific to the individual modes of transport. This was taken from the information that the STSB received or collected in connection with incident notifications and the associated preliminary enquiries. In each case, the figures cover the period between 2015, when the Ordinance of the Safety Investigation of Transportation Incidents (OSITI) came into force, and the reporting year. The time series data are presented in Annex 4.

6.1 Aviation

Figure 6.1.1 shows the incidents reported and investigations opened per year since 2015. In the years prior to 2015, the STSB received notification of approximately 1,036 aviation incidents per year. If this figure is taken as the baseline, the STSB had around 20% more notifications to process in the 2015 to 2017 period, and 51% more than the baseline in 2018 and 2019. There was a sharp drop in the number of reported incidents in 2020 (894) in connection with the impact of the COVID-19 crisis on commercial aviation. The number of incident notifications rose again significantly in 2021 (1,309). This increase is likely to be linked with developments in commercial aviation. The STSB received 1,803 incident notifications in the year under review. The trend seen since 2015 did not continue in 2023. Whether stabilisation is permanent remains to be seen. The number of notifications received levelled out at a high value, indicating that the new reporting ordinance that came into force in 2015 has taken effect.

A decision on whether or not to open an investigation is based on one key criterion: whether that investigation might help to prevent similar incidents or, in other words, whether the case holds any potential preventive value. As the trend in the number of investigations shows (Figure 6.1.1), there is no correlation between incidents reported and investigations opened. For example, just under half as many incidents were reported in 2020 (894) as in 2023 (1,803). In contrast, 63 investigations were opened in 2020, slightly more than twice as many as in 2023 (24).

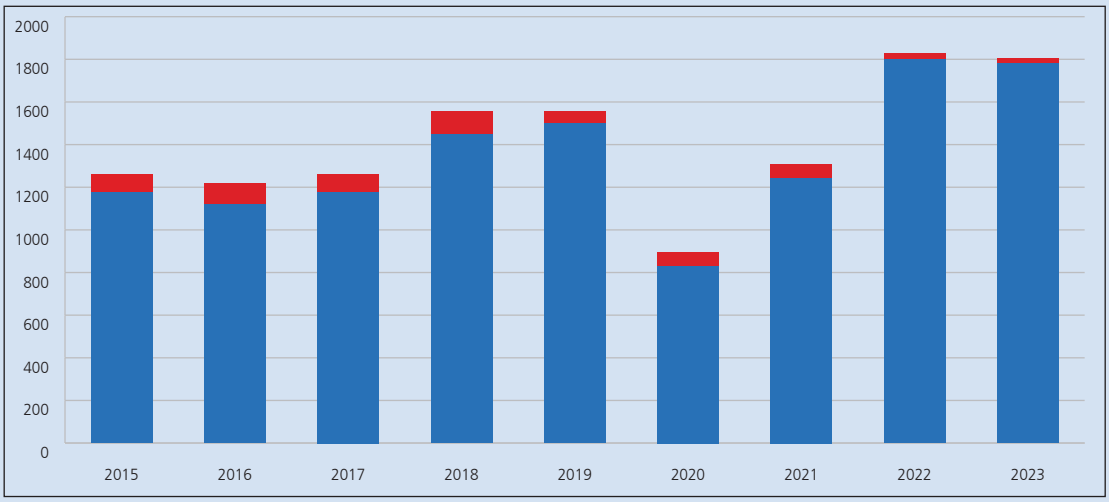


Figure 6.1.1: Number of incidents reported per year (red and blue) and investigations opened (red) since 2015.

Figure 6.1.2 tracks the quantitative trend in those incidents that satisfy the definitions of 'accidents' and 'serious incidents'.[2] It includes only those incidents which involved aircraft registered in Switzerland. The development in this subcategory differs from the time series for reported incidents overall.

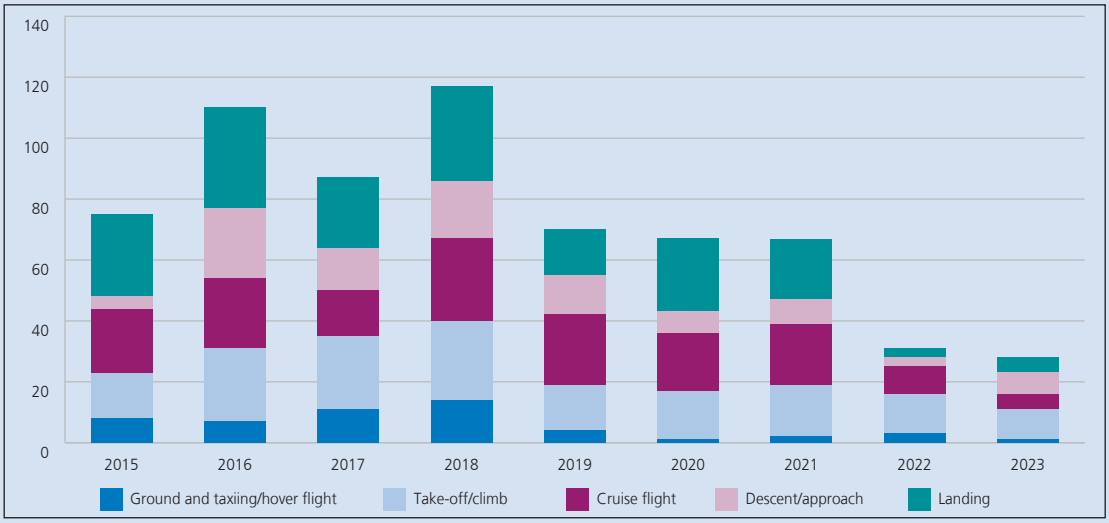


Figure 6.1.2: Total of accidents and serious incidents reported since 2015, broken down by flight phase. These figures cover events in Switzerland and abroad involving aircraft registered in Switzerland.

[2] As stated in Article 5 of the Ordinance on the Investigation of Transportation Incidents (OSITI; SR *742.161*), the term 'serious accident' corresponds to the definition for the identical term set out in Articles 2(1) and 16 of Regulation (EU) No 996/2010 of the European Parliament and of the Council of 20 October 2010 on the investigation and prevention of accidents and incidents in civil aviation.

Building on Figure 6.1.2, Figure 6.1.3 shows the changes over time in reported aviation accidents that resulted in a fatal or serious injury. This data reflects events that took place in Switzerland, irrespective of where the aircraft was registered, and events abroad involving an aircraft registered in Switzerland.

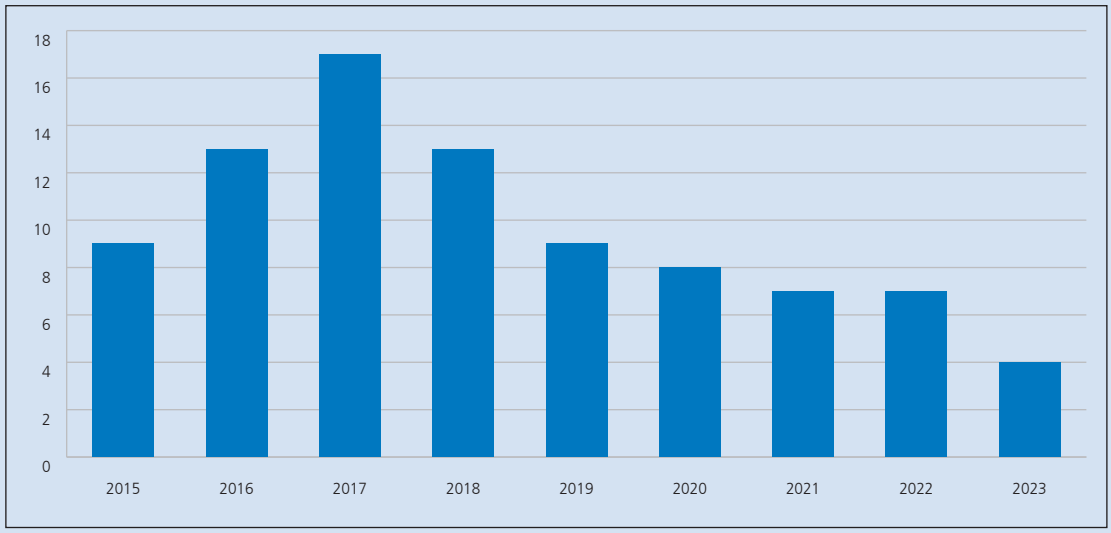


Figure 6.1.3: Development over time of aviation accidents that resulted in a fatal or serious injury.[3] The data covers accidents in Switzerland and abroad involving an aircraft registered in Switzerland, as well as accidents involving foreign-registered aircraft that occurred in Switzerland.

As described in Section 5.1, where an investigation reveals safety deficits, the STSB will issue safety recommendations and safety advices. Figure 6.1.4 below shows the number of such recommendations and advices published per year by the Aviation Division. Annex 4 contains additional tables giving an overview of which aspect of operations, whether technical, human, operational or organisational, was identified as the safety deficit on which the safety recommendation or advice was based.

[3] The terms 'fatal injury and 'serious injury' are defined in Article 2 paragraphs 5 and 17 respectively of Regulation (EU) No 996/2010 of the European Parliament and of the Council of 20 October 2010 on the investigation and prevention of accidents and incidents in civil aviation.

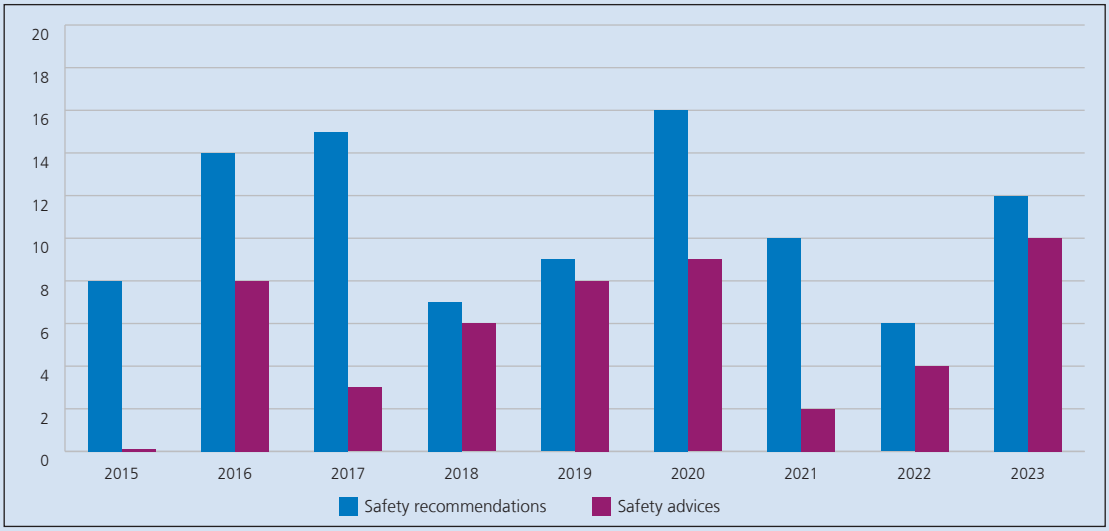


Figure 6.1.4: Number of safety recommendations and safety advices published since 2015 by the Aviation Division.

6.2 Railways, trams, cableways, buses, inland and maritime navigation

Figure 6.2.1 shows how the number of reported incidents and investigations opened has changed since 2015 for railways, trams, cableways, buses, and inland and maritime navigation. The figures for notifications vary between just under 300 and 400 per year, with increases and decreases over the years but no significant trend.

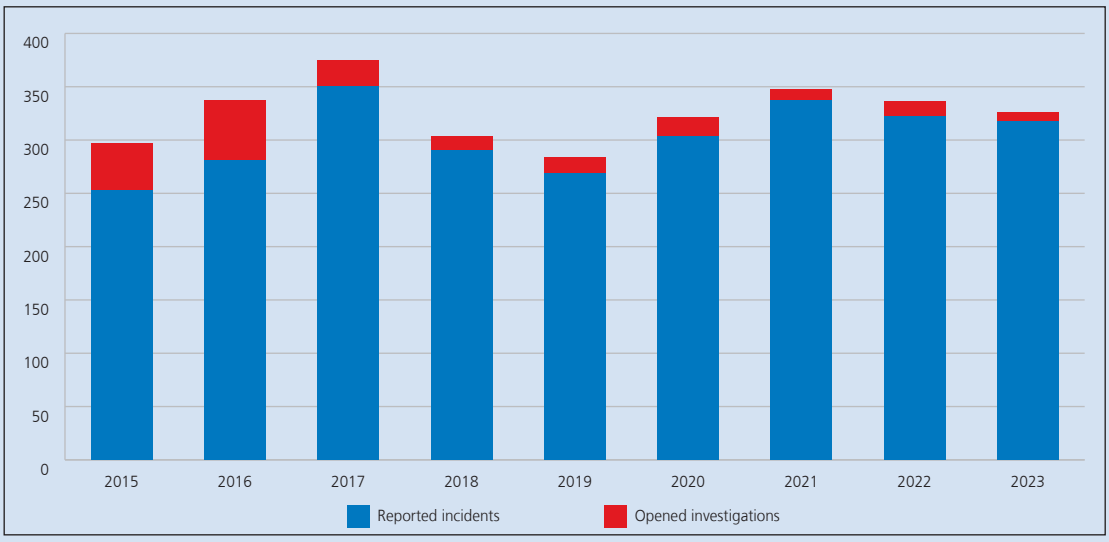


Figure 6.2.1: Number of incidents reported per year (blue and red) and investigations opened (red) for railways, trams, cableways, buses, and inland and maritime navigation.

The number of investigations opened each year since 2015 is shown in Figure 6.2.2, broken down according to the individual modes of transport. As expected, most investigations were opened into incidents on the railways, since they significantly exceed other modes of transport in terms of transport volume and service frequency. Since 2017 the decision on whether or not to open an investigation has been made consistently according to the potential preventive value of the case. This approach has reduced the number of investigations and thus resulted in a targeted and efficient use of resources.

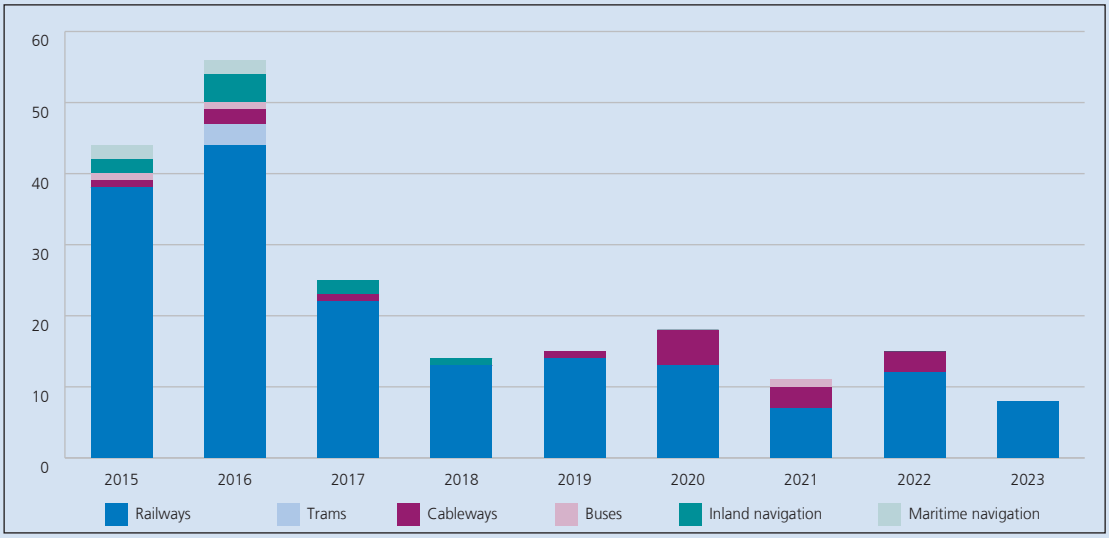


Figure 6.2.2: Number of investigations opened per year since 2015 concerning railways, trams, cableways, buses, inland and maritime navigation.

As is the case with the number of investigations opened, the majority of reported incidents also concern rail travel. Figure 6.2.3 illustrates what types of event led to notifications. In addition to near-accidents (15–25%), accidents involving persons (15–20%) are responsible for the most reports, followed by derailments and collisions (10–15% each).

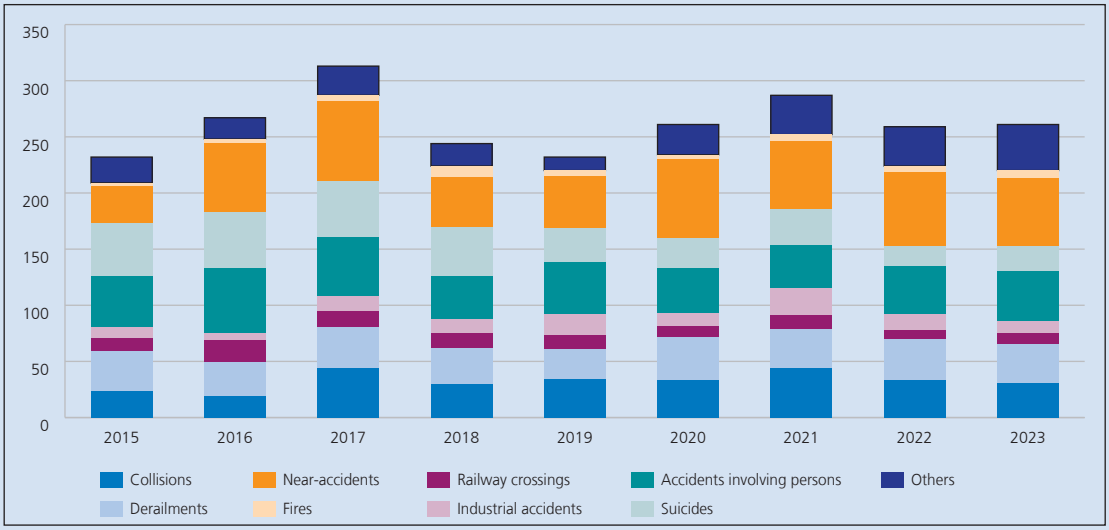


Figure 6.2.3: Number of incidents reported per year since 2015 for railways, broken down by type of event.

Depending on the outcome of its investigations, the STSB will publish safety recommendations or safety advices (see Section 5.1). The development over time of the number of recommendations and advices published is presented in Figure 6.2.4. Annex 4 contains additional tables giving an overview of which aspect of operations, whether technical, human, operational or organisational, was identified as the safety deficit on which the recommendation or advice was based.

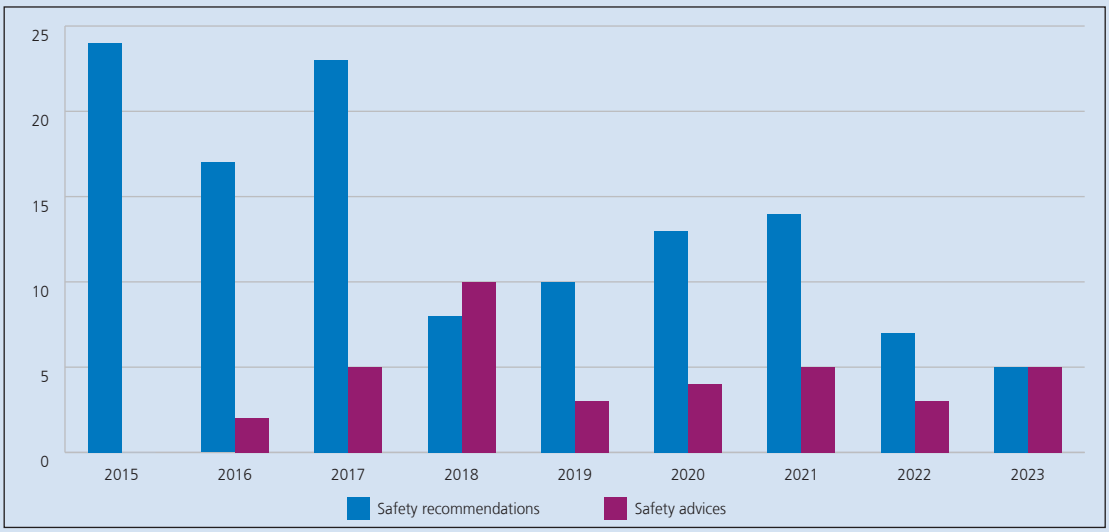


Figure 6.2.4: Number of safety recommendations and safety advices published per year since 2015.

Annexes

Annex 1: Lists of the number of notifications, as well as opened, ongoing and completed investigations and interim reports and studies published with regard to aviation

Annex 2: Lists of the number of notifications, as well as opened, ongoing and completed investigations and interim reports and studies published with regard to public transport and maritime navigation

Annex 3: Additional information on aviation and public transport incidents and investigations

Annex 4: Time series data (Chapter 6)

Annex 1

Lists of the number of notifications, as well as opened, ongoing and completed investigations and interim reports and studies published with regard to aviation

Notifications and opened, ongoing and completed investigations

Aviation						
Year	Number of notifications	Opened investigations	Completed investigations[4]			Ongoing investigations
			Total:	Extensive:	Summary:	
2023	1803	24	53	22	31	89
2022	1828	27	36	15	21	135
2021	1309	66	70	9	61	157
2020	894	59	40	9	31	164
2019	1566	64	76	14	62	162
2018	1556	119	83	22	53	156
2017	1259	86	93	30	48	111
2016	1219	92	58	27	31	142
2015	1260	86	33	33	n/a	n/a

Extensive investigations completed

Number	Registration	Date of incident	Location	Safety recommendation	Safety advise
2397	HB-ZOF	12.11.2022	Vorder Alp, Maienfeld		
2415	D-FLIC	30.03.2022	Grüehorn in the Säntis Massif		
2394	D-KDEU	17.10.2021	Dierdorf special airfield (EDRW), Germany	(581)*, 586	
2408	N559SG	18.09.2021	Reichenburg		
2400	HB-UVC	20.07.2021	Subingen		46
2399	HB-SGI	17.06.2021	Birrfeld aerodrome (LSZF)		
2393	9H-ILB / HB-SDV	18.12.2020	Sion airport (LSGS)	585	52, 54
2404	HB-3090	12.09.2020	Région col du Mollendruz		
2395	HB-CXV	12.06.2020	Lucerne-Beromünster aerodrome (LSZO)		48
2401	D-CNMB	18.12.2019	Geneva Airport (LSGG)	593, 594	47
2396	D-ETEG	11.10.2019	Zurich Airport (LSZH)		
2402	HB-KMJ	19.07.2019	Sitterdorf aerodrome (LSZV)		
2411	J-5236 / HB-DIH / J-5025	15.05.2019	Altendorf		50, 51
2390	SUI-9903	09.05.2019	Ob der Hueb, Kreis 6 (university area) in the city of Zurich	(553, 554)*, 587–591	44

* The figure in brackets means that the safety recommendation in question had already been published along with the interim report for the case or another final report.

[4] Figures prior to 2020 show the number of reports published, not the number of investigations completed.

Number	Registration	Date of incident	Location	Safety recommendation	Safety advise
2405	HB-ZCM	03.12.2018	Castione		55
2403	N561LC	24.03.2018	Arosa		
2361	HB-PTL	20.08.2017	Alp Tsanfleuron, Savièse		
2410	HB-ZTM	13.05.2017	Petersgrat		49
2398	HB-XFQ	07.02.2017	Ascona		
2362	EC-IBY	21.12.2016	Buochs aerodrome (LSZC)		
2331	D-MSON / D-MUHH	23.08.2015	Dittingen aerodrome (LSPD)	537–539	
2310	HB-MIP	05.10.2014	Lausanne La Blécherette Airport (LSGL)		

Summary investigations completed

Registration	Date of incident	Location	Type of incident
HB-2223 / HB-RCO	05.04.2023	St Gallen-Altenrhein Airport (LSZR)	Collision between two aircraft on the ground
HB-KFN	31.10.2022	Bex aerodrome (LSGB)	Collision with obstacles following runway overrun
C-408 / HB-1630	04.07.2022	1 km west of Fruthwilen	Near miss
HB-CHX	25.02.2022	Unknown	Uncontrolled ground contact
HB-SGD	25.02.2022	Bern Airport (LSZB)	Collapse of nose landing gear
HB-2033	06.01.2022	Obersee, 100 m west of Wangen-Lachen aerodrome (LSPV)	Emergency landing on water
F-HLLD	14.12.2021	Saanen aerodrome (LSGK)	Runway overrun
HB-SAP	24.10.2021	Sion airport (LSGS)	Loss of control upon landing
HB-KHO	25.08.2021	Bern Airport (LSZB)	Loss of control upon landing
HB-SDF	30.07.2021	Bad Ragaz aerodrome (LSZE)	Uncontrolled ground contact
HB-2314	09.07.2021	Locarno airport (LSZL)	Smoke
HB-2486	12.06.2021	Dittingen aerodrome (LSPD)	Collision with the terrain
HB-ZWJ / J-3044 / J-3094	18.03.2021	Thun region	Near miss
HB-SGD / N705TB	03.03.2021	Arbedo, 6 km north of Bellinzona	Near miss
HB-PRM / HB-SDM	24.01.2021	1 km north-east of Sursee	Near miss
HB-ZQH	18.01.2021	Rüedisbach	Serious incident during a rescue operation
D-IGGG	18.12.2020	Zurich Airport (LSZH)	Landing too long and commenced too late
HB-YLH	18.09.2020	Grenchen aerodrome (LSZG)	Loss of control after loss of power
HB-TCP / HB-ZNL	13.09.2020	Grenchen aerodrome (LSZG)	Near miss
HB-ZVM	09.09.2020	Zermatt	Collision with obstruction
HB-SCL	18.06.2020	Grenchen aerodrome (LSZG)	Veer-off
HB-ZWC	10.06.2020	Nods	Loss of control in the air
HB-ZTT	26.05.2020	Adelboden, Stiegelschwand	Loss of control in the air
HB-SGD	24.04.2020	Geneva Airport (LSGG)	Loss of power
G-ACGZ	30.08.2019	St Stephan aerodrome (LSTS)	Loss of control on ground

Registration	Date of incident	Location	Type of incident
HB-CIO / HB-UCT	24.11.2018	Sursee	Near miss
HB-JNB	23.06.2018	Zurich Airport (LSZH)	Airprox
HB-ZRW	05.05.2018	Basis Untervaz (LSXU)	Fire caused by short circuit
OE-XSP	29.03.2017	Mesocco	Loss of underload
HB-IYU	03.09.2016	Zurich Airport (LSZH)	Oil vapour in cockpit, use of oxygen masks
HB-JVG	08.06.2015	Zurich Airport (LSZH)	Engine failure

Discontinued investigations

Registration	Date of incident	Location	Type of incident
HB-KMG / HB-TEE	28.03.2017	St Gallen-Altenrhein (LSZR)	Airprox
HB-ZLV / HB-ZSE	12.01.2020	Saanen aerodrome (LSGK)	Airprox
HB-HMU / HB-TEE	19.05.2020	Wasen i. E.	Airprox
HB-ZNZ	16.06.2020	Vergeletto	Collision with an electrical cable
HB-YGS	06.08.2020	Lommis aerodrome (LSZT)	Aborted take-off and collision with obstruction
9H-FMJ / HB-FKH	22.08.2020	Mezzovico	Airprox
HB-DFN	28.05.2021	Locarno Airport (LSZL)	Landing on a closed runway
CS-TFO / HB-JXI	02.07.2021	Geneva Airport (LSGG)	Near-collision on the ground
CS-PHG / HB-HWE	20.10.2021	Seelisberg	Airprox
N985EK	06.05.2022	Speck-Fehraltorf aerodrome (LSZK)	Runway overrun

Annex 2

Lists of the number of notifications, as well as opened, ongoing and completed investigations and interim reports and studies published with regard to public transport and maritime navigation

Notifications and opened, ongoing and completed investigations

Public transport and maritime navigation						
Year	Number of notifications	Opened investigations	Completed investigations[5]			Ongoing investigations
			Total:	Extensive:	Summary:	
2023	325	8	9	7	2	19
2022	337	15	20	9	11	20
2021	346	11	17	11	6	24
2020	321	19	21	10	11	32
2019	283	15	15	8	7	35
2018	304	14	32	13	17	33
2017	376	25	38	27	12	50
2016	332	64	39	13	26	79
2015	296	87	31	18	13	n/a

Extensive investigations completed

Number	Mode of transport	Type of incident	Date	Location	Safety recommendation	Safety advice
2017120701	Inland navigation	Grounding	07.12.2017	Kehrsiten	180, 181	
2019041601	Railways	Collision – train-shunting	16.04.2019	Zurich marshalling yard	182	
2019110402	Railways	Train derailment	04.11.2019	Bonaduz		
2021121201	Buses	Fire	12.12.2021	Givisiez		34
2022062201	Railways	Train derailment	22.06.2022	Heimberg		
2022070601	Railways	Derailment during shunting	06.07.2022	Brig		35, 36, 37, 38
2022092101	Railways	Industrial accident	21.09.2022	Oberarth		

* The figure in brackets means that the safety recommendation in question had already been published along with the interim report for the case or another final report.

[5] Figures prior to 2020 show the number of reports published, not the number of investigations completed.

Interim reports published as part of ongoing investigations

Number	Mode of transport	Typoe of incident	Date	Location	Safety recom-mendation	Safety advice
2023081002	Railways	Train derailment	10.08.2023	Faido	183, 184	

Summary investigations completed

Number	Mode of transport	Type of incident	Date	Location
2022070701	Railways	Industrial accident	07.07.2022	Gossau
2023070401	Railways	Collision between shunting movement and obstruction	04.07.2023	Biel RB

Annex 3

Additional information on aviation incidents and investigations

Air accidents and serious incidents involving Swiss-registered aircraft

Year	Accidents with extensive investigation	Accidents with summary investigation	Total accidents	Serious incidents (incl. airproxes)	Airproxes investigated	Total accidents and serious incidents	Fatalities
2015	14	2	16	13	2	29	4
2016	22	17	39	48	16	87	5
2017	22	23	45	28	6	73	18
2018	14	16	30	64	25	94	38
2019	16	6	22	34	11	56	5
2020	14	16	30	32	9	62	10
2021	10	14	24	31	14	55	8
2022	8	1	9	15	6	24	3
2023	6	4	14	11	4	25	3

Air accidents and serious incidents involving Swiss-registered aircraft with up to 5,700 kg maximum take-off mass (MTOM)

Year	Accidents with extensive investigation	Accidents with summary investigation	Total accidents	Serious incidents (incl. airproxes)	Airproxes investigated	Total accidents and serious incidents	Fatalities
2015	14	2	16	5	1	21	4
2016	22	17	39	31	7	70	5
2017	22	23	45	23	4	68	18
2018	13	16	29	47	16	76	18
2019	16	6	22	26	8	48	5
2020	14	16	30	30	8	60	10
2021	9	14	23	28	12	51	8
2022	8	1	9	15	6	24	3
2023	6	4	14	7	4	21	3

Accidents and serious incidents with and without injuries involving Swiss-registered aircraft in Switzerland

		Total	2015	2016	2017	2018	2019	2020	2021	2022	2023
Aircraft up to 2,250 kg MTOM	with injury	30	5	1	7	3	3	3	5	2	1
	without injury	235	32	21	41	43	25	28	30	8	7
Aircraft 2,250–5,700 kg MTOM	with injury	0	0	0	0	0	0	0	0	0	0
	without injury	21	0	3	1	2	3	5	3	3	1
Aircraft exceeding 5,700 kg MTOM	with injury	1	0	0	0	1	0	0	0	0	0
	without injury	42	7	9	3	13	2	2	4	0	3
Helicopters	with injury	18	2	3	5	2	2	0	0	4	0
	without injury	81	10	14	6	14	10	8	9	5	5
Motor gliders and gliders	with injury	14	1	3	2	3	0	2	1	3	0
	without injury	41	6	8	5	7	2	8	3	2	0
Balloons and airships	with injury	1	0	0	0	0	0	0	0	0	1
	without injury	4	1	0	0	2	0	1	0	0	0
Ultralight aircraft	with injury	0	–	0	0	0	0	0	0	0	0
	without injury	2	–	2	0	0	0	0	0	0	0
Total[6]	with injury	64	8	7	14	9	5	5	5	9	2
	without injury	426	56	57	56	81	42	52	48	18	16

[6] The total number of accidents and serious incidents may differ from the sum of the individual categories. The reason for this is the allocation of events involving several aircraft of different categories. These are recorded in those individual categories, but are only counted as one event in the total.

Accidents and serious incidents with and without injuries involving foreign-registered aircraft in Switzerland

		Total	2015	2016	2017	2018	2019	2020	2021	2022	2023
Aircraft up to 2,250 kg MTOM	with injury	9	1	3	1	2	0	0	1	0	1
	without injury	24	3	6	4	0	4	1	3	1	2
Aircraft 2,250–5,700 kg MTOM	with injury	2	0	0	1	0	0	0	0	1	0
	without injury	3	0	0	0	1	0	1	1	0	0
Aircraft exceeding 5,700 kg MTOM	with injury	0	0	0	0	0	0	0	0	0	0
	without injury	32	5	8	3	4	6	2	2	1	1
Helicopters	with injury	2	0	1	0	1	0	0	0	0	0
	without injury	1	0	0	0	0	0	0	0	0	1
Motor gliders and gliders	with injury	4	2	0	0	0	1	0	1	0	0
	without injury	5	0	1	0	1	2	1	0	0	0
Balloons and airships	with injury	0	0	0	0	0	0	0	0	0	0
	without injury	1	0	0	0	0	1	0	0	0	0
Ultralight aircraft	with injury	0	–	0	0	0	0	0	0	0	0
	without injury	1	–	0	0	0	0	0	1	0	0
Total	with injury	17	3	4	2	3	1	0	2	1	1
	without injury	67	8	15	7	6	13	5	7	2	4

Accidents and serious incidents with and without injuries involving Swiss-registered aircraft abroad

		Total	2015	2016	2017	2018	2019	2020	2021	2022	2023
Aircraft up to 2,250 kg MTOM	with injury	8	2	0	1	1	2	1	0	0	1
	without injury	34	3	3	4	10	6	2	2	1	3
Aircraft 2,250–5,700 kg MTOM	with injury	1	0	0	0	0	0	1	0	0	0
	without injury	11	0	2	0	4	3	0	0	1	1
Aircraft exceeding 5,700 kg MTOM	with injury	0	0	0	0	0	0	0	0	0	0
	without injury	35	5	15	7	5	2	0	0	0	1
Helicopters	with injury	0	0	0	0	0	0	0	0	0	0
	without injury	2	0	0	0	0	0	0	2	0	0
Motor gliders and gliders	with injury	5	0	1	1	0	1	1	0	0	1
	without injury	6	0	1	0	3	1	0	0	1	0
Balloons and airships	with injury	0	0	0	0	0	0	0	0	0	0
	without injury	2	0	1	0	1	0	0	0	0	0
Ultralight aircraft	with injury	0		0	0	0	0	0	0	0	0
	without injury	1		0	0	1	0	0	0	0	0
Total	with injury	14	2	1	2	1	3	3	0	0	2
	without injury	91	8	22	11	24	12	2	4	3	5

Additional information on public transport incidents and investigations

Notifications and opened, ongoing and completed investigations – railways

Railways						
Year	Notifications	Opened investigations	Completed investigations			Ongoing investigations
			Total:	Extensive:	Summary:	
2015	232	38	28	17	11	69
2016	267	44	33	12	22	64
2017	313	22	34	24	10	46
2018	244	13	29	14	16	35
2019	232	14	16	9	8	28
2020	261	13	16	8	8	26
2021	286	7	11	8	5	18
2022	271	12	16	9	7	11
2023	261	8	7	5	2	12

Notifications and opened, ongoing and completed investigations – trams

Trams						
Year	Notifications	Opened investigations	Completed investigations			Ongoing investigations
			Total:	Extensive:	Summary:	
2015	33	0	0	0	0	2
2016	32	3	1	0	1	2
2017	30	0	1	0	1	1
2018	27	0	1	0	1	0
2019	24	0	0	0	0	0
2020	23	0	0	0	0	0
2021	21	0	0	0	0	0
2022	12	0	0	0	0	0
2023	28	0	0	0	0	0

Notifications and opened, ongoing and completed investigations – cableways

Cableways						
Year	Notifications	Opened investigations	Completed investigations			Ongoing investigations
			Total:	Extensive:	Summary:	
2015	10	1	1	1	0	2
2016	18	2	1	1	0	4
2017	10	1	3	2	1	4
2018	14	0	0	0	0	1
2019	12	1	0	0	0	2
2020	20	5	5	2	3	2
2021	20	3	4	4	1	1
2022	26	3	2	0	2	2
2023	15	0	0	0	0	2

Notifications and opened, ongoing and completed investigations – buses

Buses						
Year	Notifications	Opened investigations	Completed investigations			Ongoing investigations
			Total:	Extensive:	Summary:	
2015	18	1	0	0	0	3
2016	12	1	2	1	2	2
2017	18	0	1	1	0	0
2018	14	0	0	0	0	0
2019	9	0	0	0	0	0
2020	12	0	0	0	0	0
2021	8	1	0	0	0	1
2022	18	0	0	0	0	1
2023	12	0	1	1	0	0

Notifications and opened, ongoing and completed investigations – inland navigation

Inland navigation						
Year	Notifications	Opened investigations	Completed investigations			Ongoing investigations
			Total:	Extensive:	Summary:	
2015	2	2	2	0	2	1
2016	6	4	2	1	1	3
2017	3	2	1	0	1	4
2018	4	1	0	0	0	5
2019	4	0	1	0	1	5
2020	5	0	0	0	0	5
2021	10	0	2	2	0	2
2022	5	0	0	0	0	2
2023	8	0	1	1	0	1

Annex 4

Time series data (Chapter 6)

Aviation (Chapter 6.1)

Total number of accidents and serious incidents reported per year, broken down by flight phase (aircraft registered in Switzerland and abroad)

Year	Total	Ground and taxi-ing/hover flight	Take-off/climb	Cruise flight	Descent/ approach	Landing
2015	75	8	15	21	4	27
2016	110	7	24	23	23	33
2017	87	11	24	15	14	23
2018	117	14	26	27	19	31
2019	70	4	15	23	13	15
2020	67	1	16	19	7	24
2021	67	2	17	20	8	20
2022	31	3	13	9	3	3
2023	28	1	10	5	7	5

Development over time of air accidents resulting in injury, broken down by aircraft category (aircraft registered in Switzerland in Switzerland and abroad, as well as aircraft registered abroad in Switzerland)

Year	Motorised aircraft	Gliders	Helicopters	Total[7]
2015	7	0	2	9
2016	5	3	5	13
2017	1	4	3	17
2018	7	3	3	13
2019	5	2	2	9
2020	5	3	0	8
2021	6	2	0	7
2022	3	1	3	7
2023	3	1	0	4

[7] The total number of accidents and serious incidents may differ from the sum of the individual categories. The reason for this is the allocation of events involving several aircraft of different categories. These are recorded in those individual categories, but are only counted as one event in the total.

Number of safety recommendations and safety advices published per year

Year	Technical	Human	Operational	Organisational	Total
2015	2	0	4	2	8
2016	7	1	1	5	14
2017	7	0	2	6	15
2018	2	0	2	3	7
2019	6	0	2	1	9
2020	3	0	5	8	16
2021	5	0	2	3	10
2022	3	0	2	5	10
2023	8	2	7	5	22

Railways, trams, cableways, buses, inland and maritime navigation (Chapter 6.2)

Investigations opened per year, broken down by mode of transport

Year	Railways	Trams	Cableways	Buses	Inland navigation	Maritime navigation	Total
2015	38	0	1	1	2	2	44
2016	44	3	2	1	4	2	56
2017	22	0	1	0	2	0	25
2018	13	0	0	0	1	0	14
2019	14	0	1	0	0	0	15
2020	13	0	5	0	0	0	18
2021	7	0	3	1	0	0	11
2022	12	0	3	0	0	0	15
2023	8	0	0	0	0	0	8

Incidents reported per year, broken down by event type – railways

Year	Collisions	Derailments	Railway crossings	Industrial accidents	Accidents involving persons	Suicides	Near-accidents	Fires	Other	Total
2015	24	35	12	9	46	47	33	3	23	232
2016	19	30	20	6	58	50	61	4	19	267
2017	44	36	15	13	53	49	72	5	26	313
2018	30	32	13	13	38	43	45	10	20	244
2019	34	27	12	19	46	31	46	5	12	232
2020	33	39	9	12	40	27	70	4	27	261
2021	44	35	12	24	39	32	60	6	35	286
2022	33	37	8	14	43	17	66	6	35	271
2023	29	34	12	22	45	23	60	7	30	261

Number of safety recommendations and safety advices published per year

Year	Technical	Human	Operational	Organisational	Total
2015	6	4	1	13	24
2016	6	1	3	7	17
2017	9	1	7	6	23
2018	1	1	6	0	8
2019	4	2	1	3	10
2020	6	0	4	3	13
2021	7	2	2	3	14
2022	5	0	3	2	10
2023	4	1	4	1	10



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