ANNUAL SAFETY REPORT 2022

Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Swiss Confederation

Bundesamt für Zivilluftfahrt BAZL
Office fédéral de l'aviation civile OFAC
Ufficio federale dell'aviazione civile UFAC
Federal Office of Civil Aviation FOCA

Executive summary

In the 2022 reporting year, the FOCA registered 8052 incidents, consolidated from 11 840 incident reports. In order to achieve better comparability, the number of incident reports is increasingly normalised, i.e. set in relation to flight movements. Unfortunately, this is not possible in the helicopter sector due to a lack of data.

From the reports received, the most important safety problems were identified for each risk area and assessed according to severity. In the area of air traffic management, the increasing number of incidents concerning mixed IFR and VFR traffic since 2019 is notable. Collisions with cables or wires are recorded regularly. In the years 2018 to 2022, an average of slightly more than one cable collision was recorded per year. In the year under review, two accidents were registered with one person suffering fatal injuries.

Both, incidents involving drones and sightings by aircraft crews declined in 2022. In order to obtain an overall picture, an open reporting culture and data over a longer period of time are required.

In order to reach the target groups even better, the "Safety Promotion" working group was reorganised within the FOCA. Current, safety-relevant topics are addressed to the GA community via social media.

Looking to the near future, the safety risk areas "airborne collision" and "aircraft upset" are given the highest priority.

Zusammenfassung

Im Berichtsjahr 2022 registrierte das BAZL 8052 Vorfälle, konsolidiert aus 11 840 Vorfallmeldungen. Um eine bessere Vergleichbarkeit zu erzielen, wird die Anzahl der Vorfallmeldungen vermehrt normalisiert, d. h. in Relation zu den Flugbewegungen gesetzt. Im Bereich Helikopter ist dies aufgrund fehlender Daten leider nicht möglich.

Aus den eingegangenen Meldungen wurden für jeden Risikobereich die wichtigsten Probleme identifiziert und nach Schweregrad beurteilt. Auffällig im Bereich *Air Traffic Management* ist die seit 2019 steigende Anzahl von Vorfällen betreffend *IFR* und *VFR* Mischverkehr. Im Berichtsjahr gab es zwei Unfälle im Zusammenhang mit Kabeln. In den Jahren 2018-2022 wurde durchschnittlich mehr als ein Unfall mit einem Kabel konstatiert.

Sowohl Vorfälle mit Drohnen sowie Sichtungen durch Flugzeugbesatzungen waren im Jahr 2022 auf tiefem Niveau. Um ein gesamtheitliches Bild zu erhalten, bedarf es einer offenen Meldekultur und Daten über einen längeren Zeitraum.

Um die Zielgruppen noch besser erreichen zu können, wurde innerhalb des BAZL die Arbeitsgruppe zur Förderung der Sicherheit (*Safety Promotion*) neu aufgestellt. Über soziale Medien werden aktuelle, sicherheitsrelevante Themen an die *GA Community* gerichtet.

In die nahe Zukunft blickend, wird den Sicherheitsbereichen (*Safety risk areas*) «Airborne collision» und «Aircraft upset» höchste Priorität eingeräumt.

Résumé

Pour l'année sous revue, l'OFAC a enregistré 8052 incidents, chiffre basé sur plus de 11 840 comptes rendus d'évènements. Afin de permettre une meilleure comparaison, le nombre de comptes rendus d'incidents est de plus en plus normalisé, ce qui signifie qu'il est mis en relation avec le nombre de mouvements d'aéronefs. Malheureusement, par manque de données, la normalisation n'est pas possible dans le cas des opérations d'hélicoptères.

Les principaux problèmes de sécurité ont été identifiés et leur degré de gravité évalué pour chaque type de risque à partir des comptes rendus reçus. Dans le domaine *Air Traffic Management* (gestion du trafic aérien), on remarque une augmentation du nombre d'incidents liés au trafic mixte *IFR* et *VFR* depuis 2019. Des collisions avec des câbles sont régulièrement signalées, durant l'année sous revue, deux accidents ont été enregistrés qui ont fait un mort. Sur la période 2018-2022, on dénombre un peu plus d'une collision avec des câbles en moyenne annuelle.

Tant les incidents impliquant des drones que les observations de drones par les équipages de conduite ont diminué en 2022. Une bonne vue d'ensemble de la situation suppose de s'appuyer sur une culture de compte rendu transparente et sur une série de données suffisamment longue.

Désirant mieux toucher ses différents groupes cibles, l'OFAC a mis en place un nouveau groupe de travail chargé de promouvoir la sécurité (*Safety Promotion*). Des contributions sur des thèmes d'actualité liés à la sécurité sont ainsi diffusées via les médias sociaux afin de sensibiliser les pilotes de l'aviation générale.

Dans l'immédiat, la plus haute priorité sera accordée aux domaines de sécurité « *Airborne collision* » (collision en vol) et « *Aircraft upset* » (décrochage de l'aéronef).

Sintesi

Nell'anno in esame 2022, l'UFAC ha registrato 8052 eventi, a fronte di oltre 11 840 notifiche. Ai fini di una migliore comparabilità, il numero di notifiche viene sempre più normalizzato, cioè messo in relazione al numero di movimenti di volo. Purtroppo, per mancanza di dati, ciò non è possibile per il settore degli elicotteri.

Sulla base delle notifiche pervenute, per ogni settore di rischio i principali problemi di sicurezza sono stati individuati e classificati secondo la gravità. Nel settore Air Traffic Management continua a risaltare il numero di eventi riguardanti IFR e VFR (traffico misto), in aumento dal 2019. Inoltre si registrano regolarmente collisioni con cavi o fili. Nell'anno in esame, sono stati registrati due incidenti e una persona con lesioni mortali. Tra il 2018 e il 2022, il numero medio annuo di collisioni con cavi è stato leggermente superiore a uno.

Nel 2022 sia gli eventi riguardanti droni che gli avvistamenti di droni da parte di equipaggi di aeromobili sono diminuiti. Per disporre di un quadro globale sono necessari una cultura di notifica aperta e un rilevamento di dati effettuato su un periodo di tempo più lungo.

Per raggiungere ancora meglio i gruppi target, in seno all'UFAC è stato riorganizzato il gruppo di lavoro di promozione della sicurezza (Safety Promotion). Attraverso i social media, la «GA Community» viene informata su temi attuali rilevanti per la sicurezza.

Guardando al prossimo futuro, i settori rilevanti per la sicurezza «Airborne Collision» e «Aircraft Upset» assumeranno massima priorità.

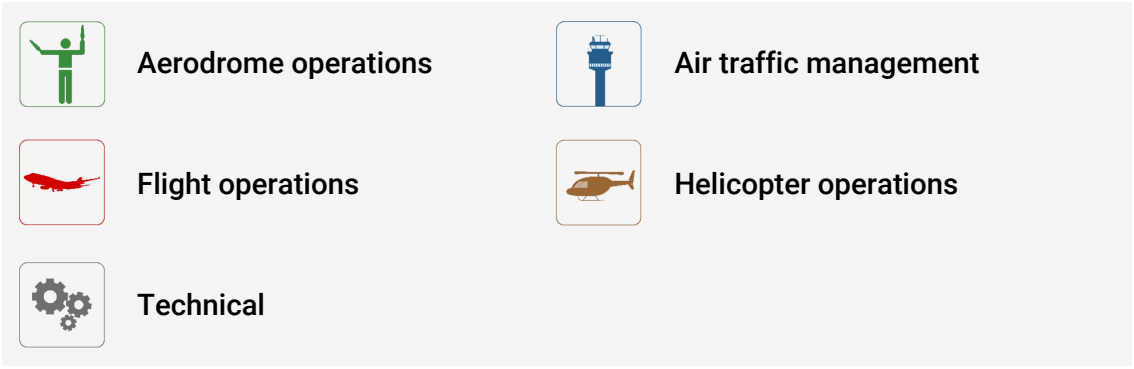
Introduction

The Annual Safety Report (ASR) 2022 takes a closer look at the operational issues that are currently of most relevance to Swiss civil aviation in safety terms. These extend throughout the safety risk areas defined for civil aviation, and may have an impact on the safety of flight operations.

As part of its data analyses, and with due regard to the numbers of occurrences reported and the severity classifications thereof, the FOCA identified safety-relevant issues in various operational areas in 2022 which were subjected to extensive analysis since they could lead to accidents in the safety risk areas mentioned in the Swiss Aviation Safety Plan (SASP).

To monitor these safety risk areas, the FOCA has developed a number of safety indicators that enable it to continuously track their general development and also conduct any more extensive analyses or risk assessments which may be required. The data studied derive from both commercial and non-commercial aviation and also from specialized operations.

These safety issues have been assigned to the following operational categories, each of which is individually elaborated on in the subchapters below:



Structure of sub-chapters

The most relevant safety issues for each operational category are presented in chart form according to the number of occurrences assignable to them in 2022 and with due regard to the average severity thereof. A multi-year comparison showing the occurrence trends over the past five years is provided as well. Each subchapter includes a brief discussion of the current situation and trends for each safety issue, whenever possible together with comments on their potential causes.

Aerodrome operations

Overview of safety issues in aerodrome operations

Number and severity of occurrences

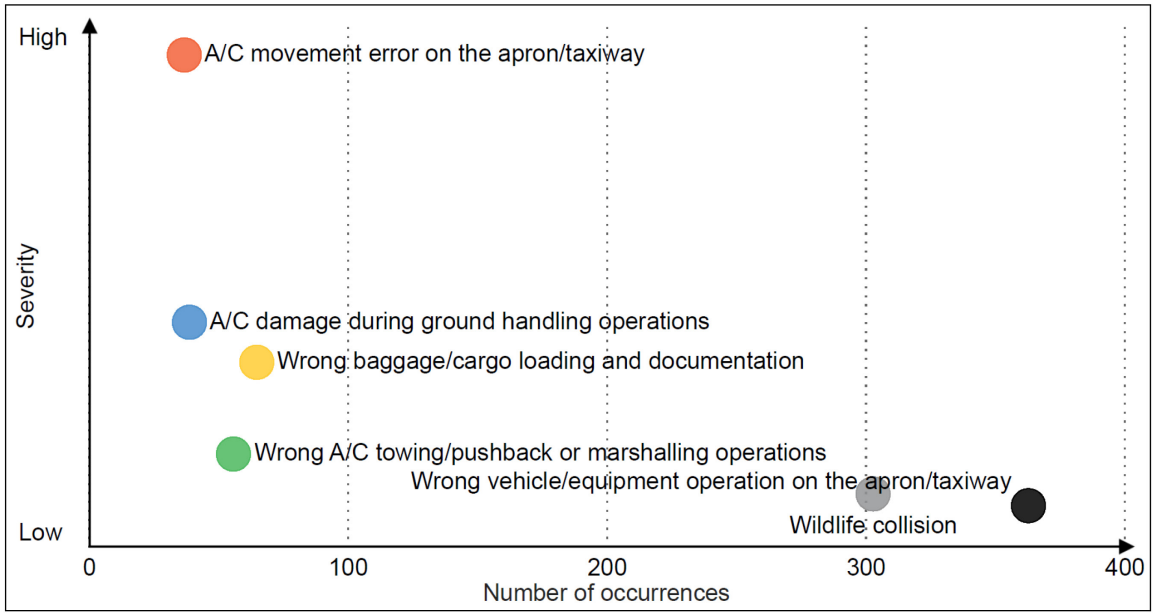


Figure 1: absolute number and severity of occurrences in ADR operations in 2022

Number of occurrences in the last five years

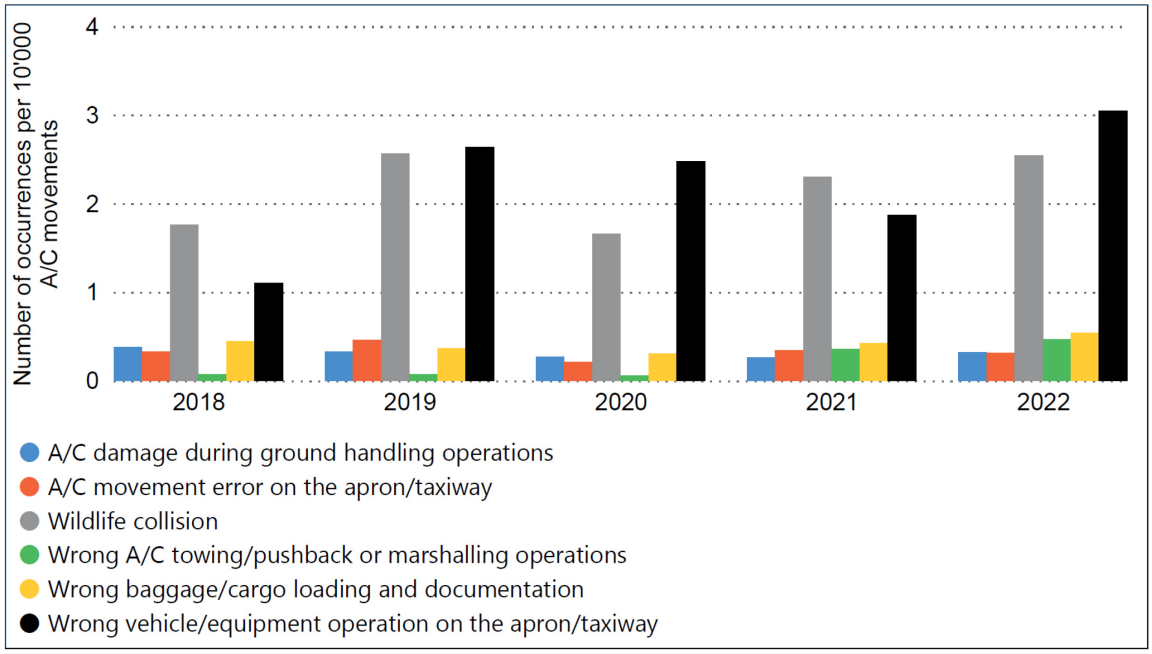


Figure 2: No of occurrences 2018-2022 in ADR operations (normalised)

Data analysis of aerodrome operations safety issues

Aircraft damage during ground handling operation

Definition: A stationary aircraft is damaged during ground handling: collision with equipment/vehicle, incorrect manipulation (e.g. incorrect opening of cargo hold doors). The damage may compromise operational safety in flight. This does not include damage caused by foreign object debris (FOD).

In 2022, 39 occurrences were reported in which aircraft were damaged at Swiss aerodromes owing to the incorrect handling of equipment or vehicles. Commercially operated aircraft were involved in over half of the incidents reported, with the others involving non-commercial traffic. In comparison to last year, only 10% of the occurrences reported were classified as serious, in view of the structural damage caused to the aircraft and/or its operational consequences which represents a decrease of 20%. But in total and in relation to 10 000 aircraft movement, the incident rate increased a bit with 0.31 compared to 2021 with 0.27 incident. In most cases, collisions between equipment and a parked aircraft can be attributed to the limited space at the stand or to time pressure and/or the possible resulting lack of attention by ground handling staff.

Aircraft movement error on the apron/taxiway (own power)

Definition: The crew deviates from the taxiing rules, procedures and/or clearances when taxiing on the apron, which results in an unintentional near-ground collision or a ground collision with another aircraft, a vehicle or an obstacle. This does not include movement errors or collisions on the runway.

A total of 37 occurrences were reported in Switzerland in 2022 of an own-powered aircraft movement error on the apron or taxiway. Almost all the occurrences reported involved taxi clearance deviations or navigation errors. Occurrences in which a non-commercially or commercially operated aircraft failed to maintain a safe distance from other aircraft, vehicles or objects while taxiing or parking, resulting in a collision where material damage was incurred, represent 11% of the total, with only four such occurrences classified as high-severity incidents. In total and in relation to the aircraft movement, the incident rate decreases slightly with 0.31 per 10 000 movements (2021: 0.35)

Wildlife collision

Definition: Bird strike or collision with an animal during approach or takeoff. The collision may cause damage and/or compromise flight safety. Animal sightings and carcass finds that cannot be clearly attributed to a collision are not included.

A noticeable increase in the number of wildlife collisions reported in absolute number and in proportion to the number of air traffic movements was registered for the year 2022 compared to 2021. In absolute terms, 303 wildlife collisions were reported in Swiss airspace. In this year also, and for more than 85% of these cases, the collision occurred within the airport perimeter, i.e. during the approach, landing or takeoff phase, while the remaining 15% occurred en-route. In 99% of the cases birds were involved. Fewer than 2% (five incidents in absolute numbers) of all the cases reported were classified as serious. Nearly 75% of the collisions reported occurred between May and October.

Wrong aircraft towing/pushback or marshalling operation

Definition: A deviation from the towing/pushback procedures and/or clearances on the apron or incorrect marshalling signs to or communication with crew, which results in an unintentional near-ground collision or a ground collision with another aircraft, a vehicle or an obstacle. This also includes aircraft parking procedures and issues (not suitable owing to size etc.) which could lead to a collision.

Some 55 incidents in this category were reported to the FOCA in 2022. More than three quarters of these involved commercial operations, while the rest related to non-commercial aviation. In commercial aviation, most such incidents are due to non-compliance with pushback/towing or marshalling procedures. In non-commercial aviation, the cases reported were mainly a matter of inadvertent errors during towing into or out of hangars, resulting in collisions with infrastructure or other aircraft and damage to the aircraft. In comparison to last year and even if the number increased in absolute number and in relation to the aircraft movement compared to 2021, no occurrence was classified as serious this year.

Wrong baggage/cargo loading and documentation

Definition: An aircraft is not loaded by the ground handling staff in accordance with the instructions, or is loaded based on incorrect rules. The loading plan may be incorrect (wrong takeoff weight, balance calculation, flight parameters); or the aircraft may be loaded incorrectly, so that cargo may shift in flight. Loading errors can compromise operational safety in flight.

Some 69 reports of occurrences involving loading errors were received in 2022. Most of these related to the incorrect loading of commercially operated aircraft. The other half were mainly a matter of loadsheet errors or misrouted baggage. Nearly 10% of these occurrences were classified as high-severity incidents, in view of their impact on flight operations which represents a decrease regarding to 2021. But in general, this type of incident is still increasing since 2020, in proportion to total air traffic movements for the years concerned.

Wrong vehicle/equipment operation on the apron/taxiway

Definition: A vehicle deviates from the instructions/traffic rules on the apron or taxiway, which results in an unintentional near-ground collision or a ground collision with a taxiing or towed aircraft. Equipment or vehicles are parked incorrectly on the apron and obstruct a taxiing aircraft. This does not include movement errors on the runway or a collision between a vehicle/equipment and another object/vehicle.

In this category, some 363 reports were received of incidents at airports in Switzerland in 2022. No collision between taxiing aircraft and equipment or vehicles was recorded this year. Fewer than 1% of the incidents reported here were classified as serious because of the abrupt maneuvers made by the pilots to avoid the collision. The number of such incidents in proportion to annual movement volumes has been decreasing since 2019 and is now increasing strongly regarding to the last years with 3.05 incident per 10 000 aircraft movement in 2022 compared to 1.87 in 2021. The commonest cause of such reports is an apron or taxiway incursion resulting from the incorrect positioning of equipment or vehicles in these areas.

Air traffic management

Overview of safety issues in air traffic management

Number and severity of occurrences

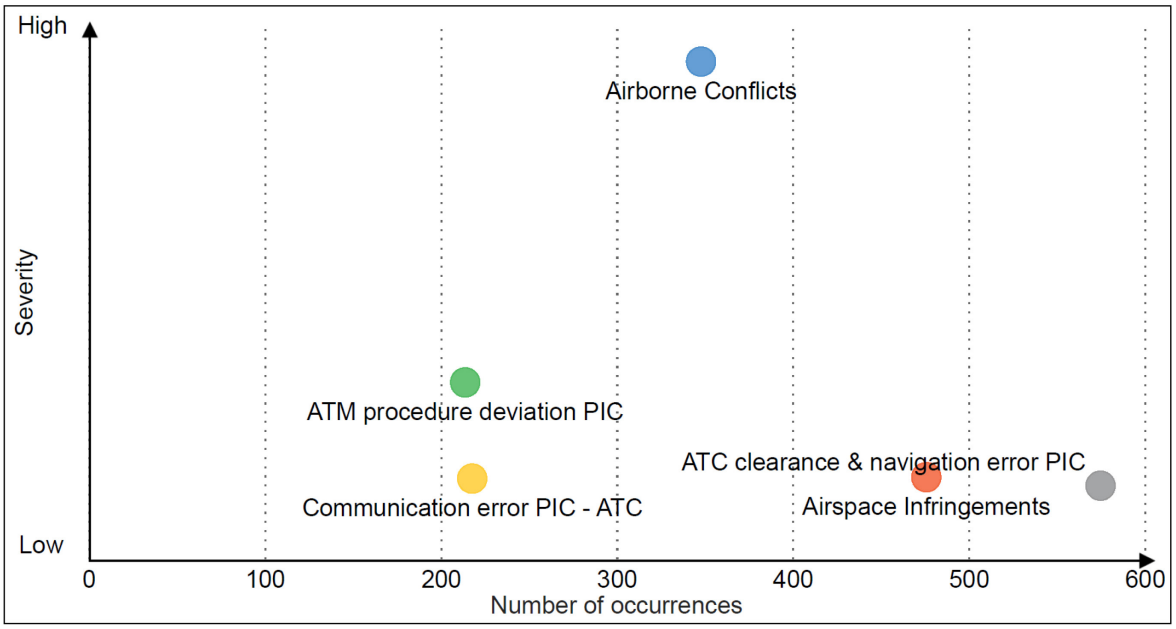


Figure 3: absolute number and severity of occurrences in ATM in 2022

Number of occurrences in the last five years

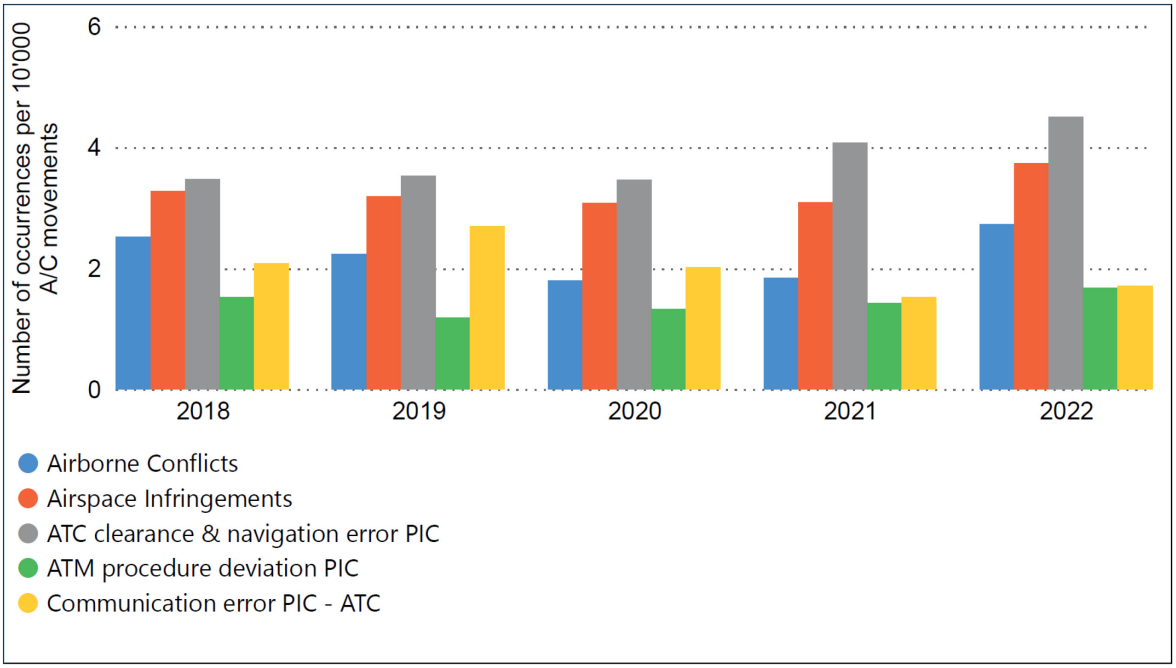


Figure 4: No of occurrences 2018-2022 in ATM (normalised)

Data analysis of air traffic management safety issues

Airborne conflicts

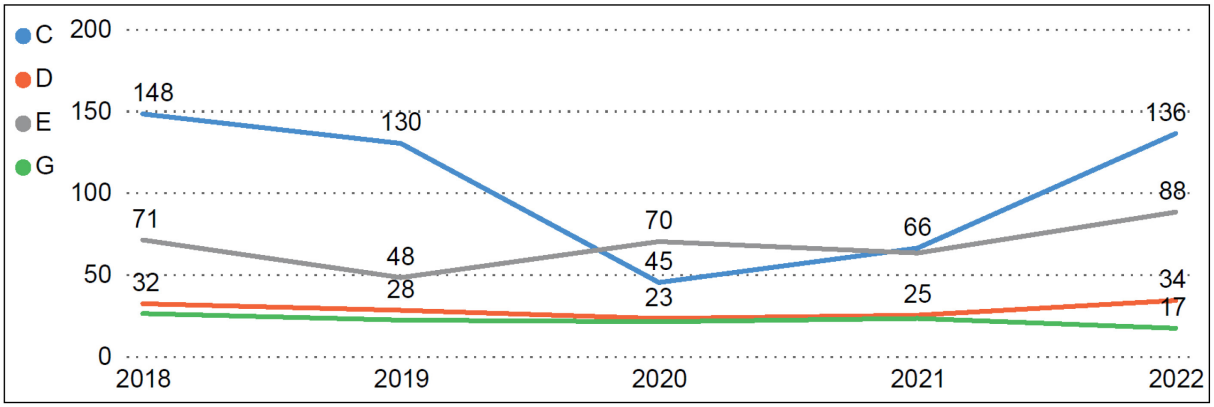
Definition: This includes collisions, airproxes and occurrences that can lead to an airborne collision, as well as resolution advisories from collision warning systems.

Throughout Swiss airspace, the number of reported airborne conflicts rose continuously in absolute terms and relative to the number of movements. A total of 236 airborne conflicts in Swiss airspace were reported in 2022. To these must be added a further 53 such occurrences registered in the delegated foreign airspace managed by Swiss air navigation service provider Skyguide. The increase in conflicts in mixed IFR/VFR traffic is still increasing (2022: 90).

In the new TMZ Northeastern Switzerland with voluntary listening squawk 17 Airborne Conflicts were reported. It can be assumed that the previously unrecognized conflicts were made visible by the additionally operated transponders and that ATC was able to act accordingly in the conflict resolution.

The mid-air collision recorded in 2022 at the Junior Gliding World Championship in Tabor (CZ) was fortunately without serious consequences for both pilots.

Airborne conflicts by airspace class



C	Airspace Class Charlie (C): controlled airspace, terminal manoeuvring areas surrounding major airports, air routes and upper airspace primarily used for IFR flights. There are clear separation criteria for air traffic in these airspaces, which must be applied by air traffic control.
D	Airspace Class Delta (D): controlled airspace, control zones and terminal manoeuvring areas of airports, regional aerodromes and military airfields for mixed use by VFR and IFR air traffic. Requires high discipline from pilots in mandatory radio contact with air traffic control.
E	Airspace Class Echo (E): controlled airspace for IFR flights at lower altitudes and from/to uncontrolled regional aerodromes and airfields, but mainly used by light aircraft operations for sightseeing flights and by the air force for VFR training flights. No permanent radio link with air traffic control authorities required for VFR flights.
G	Airspace Class Golf (G): uncontrolled airspace for IFR flights; only used in Grenchen and Samedan. One single maxim applies: see and avoid.

Figure 5: absolute number of airborne conflicts by airspace class 2018-2022

Airspace infringements

Definition: All reported (confirmed and suspected) airspace infringements are recorded in this category. This includes airspace infringements caused by Swiss-registered aircraft abroad, as well as infringements of controlled airspace (Delta and Charlie airspace classes) by any aircraft within Skyguide's area of responsibility (i.e. including delegated airspace in Germany, France, Italy and/or Austria). This category also includes infringements of restricted areas (LS-Rxx in Switzerland, restricted areas abroad).

The number of airspace violations reported by Skyguide (330) increased by 25% in 2022 compared with the previous year and reached nearly the amount of the worst reported yearly figures so far (2015). The vast majority of such incidents only slightly violated airspace boundaries vertically or horizontally, and were mainly classified as having low safety relevance. They can probably be attributed to the growing practice in general aviation of navigating with mobile navigation aids and apps, which deceive pilots into believing that they are flying as close to the airspace boundaries as possible, either intentionally or unintentionally, in the belief that they are not violating the boundary in this way.

Airspace infringements by airspace class

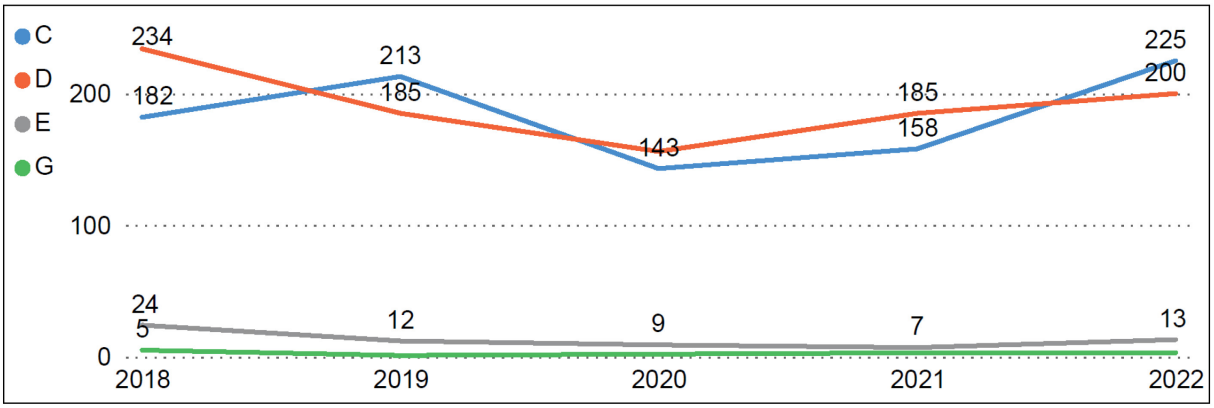


Figure 6: absolute number of airspace infringements by airspace class 2018-2022

Communication error between pilot and ATC

Definition: This includes all occurrences that are mainly (or at least initially) due to missing, defective or misunderstood communication between pilots and air traffic control authorities (or vice versa).

Despite a further substantial increase in traffic volumes in 2022, the number and severity of communication problems remains more or less constant in a normalized comparison. But in particular, the number of PLOCs (prolonged loss of communication) in the commercial aviation sector doubled to 71 cases in 2022 compared with the absolute figures for the previous year.

ATC clearance or navigation error by pilot

Definition: Occurrences where pilots fail to act in accordance with the rules/clearance of air traffic control (ATC) or where pilots have not followed prescribed standard ATC procedures. This includes all occurrences reported by Skyguide involving all aircraft under its responsibility (controlled Swiss airspace plus delegated airspace), as well as occurrences by Swiss-registered aircraft abroad in connection with air traffic control issues (usually reported by crews, safety offices or foreign supervisory authorities).

This category shows again a significant increase in reports with normalized values, but on the other hand a decrease in the weighting of the severity concerned. Such incidents consisted mainly of errors during taxiing at major airports where incorrect taxiways or intersections were taken, which were classified as no safety impact in the vast majority of cases. There was a tremendous increase in the number of reported level bust incidents of 463% compared to 2021 – a level bust means non-adherence to the altitudes assigned by air traffic control. Such deviations are usually detected quickly by the air traffic control units responsible, and the crews involved are immediately requested to make the appropriate corrections.

ATM procedure deviation by pilot

Definition: Occurrences where pilots do not operate according to internationally agreed and valid ATM rules and procedures. This includes all occurrences reported by Swiss airports or airfields, as well as occurrences reported by Swiss air traffic control service providers involving Swiss and foreign registered aircraft in Switzerland (including delegated airspace). This also includes occurrences involving Swiss cockpit crews and/or Swiss certified flight operators (mainly reported by their safety offices) in Switzerland and abroad that have violated ATM procedures and regulations

In absolute figures the number of SID deviations increased by about 20% compared with 2021. As well the number of occurrences concerning deviations from procedures concerning Joining or Leaving flights raised significantly.

Only one incident, an abandoned take-off of a glider train, due to an opposite approach of a third aircraft, was classified as a high-risk occurrence (7 high risk occurrences were reported in 2021).

Flight operations

Overview of safety issues in flight operations

Number and severity of occurrences

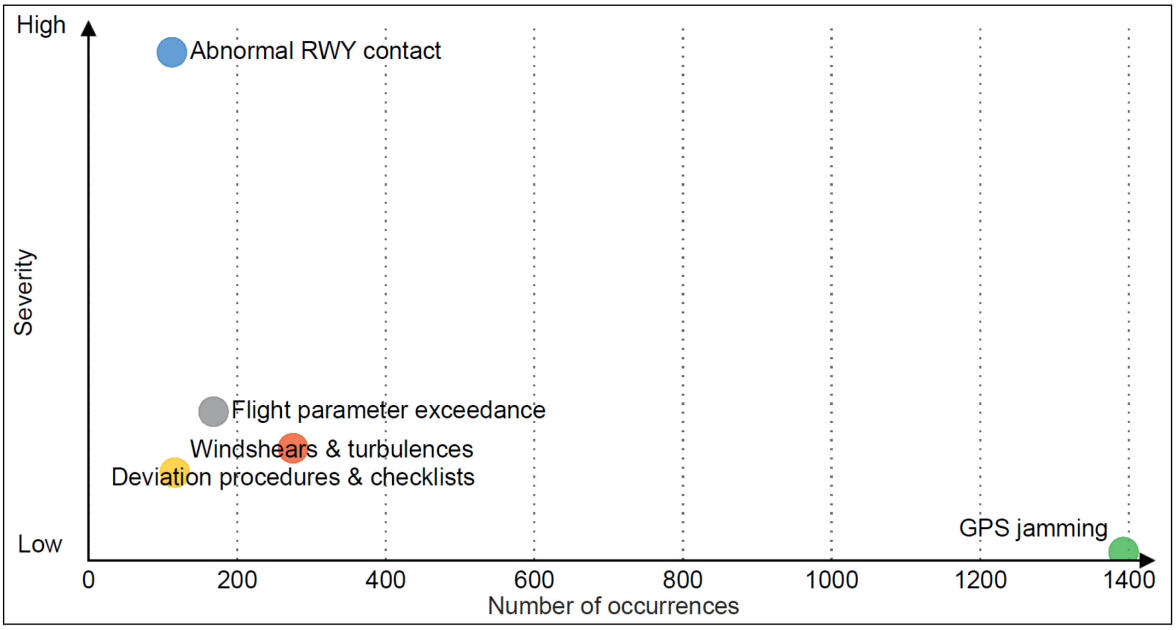


Figure 7: absolute number and severity of occurrences in flight operations in 2022

Number of occurrences in the last five years

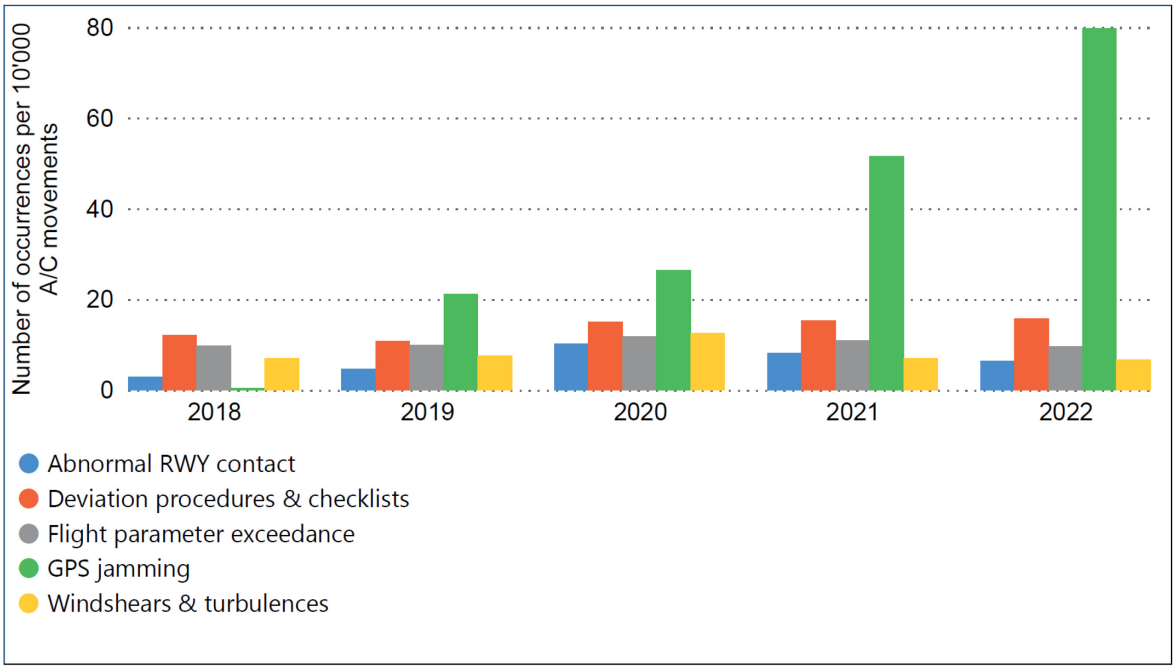


Figure 8: No of occurrences 2018-2022 in flight operations (normalised)

Data analysis of flight operations safety issues

Global positioning system (GPS) interference

Definition: GPS jamming is the process of using a frequency transmitting device on ground to block or interfere with radio communication signals mainly for military purposes in the air.

An increasing number of GPS interferences were reported by the industry over the past years mainly in the eastern part of Europe. These interferences, have intensified in geographical areas surrounding political conflict zones. Pilots are fully aware about such possible interferences and are prepared to revert to conventional navigation procedures. There was no event reported having a high severity.

Flight parameter exceedances

Definition: Flight parameters exceedances are usually caused by pilots or external influences, such as turbulences or wind shears. Such deviations generally include a rapid change in airspeed, flight direction, horizontal/vertical flight attitude or technical limits of aircraft systems.

Exceedances of flight parameters are mainly reported by commercial air transport flight crews. 70% of the deviations were observed during the approach or landing phases (as in the year 2021), often caused by turbulences or wind shifts. Flight parameter deviations, including overspeed or underspeed (58%) in all flight phases, excess of an aircraft lateral bank (8%) or pitch deviations (38%). The overall rate has remained stable over the last years.

Wind shear and turbulence

Definition: Wind shears and turbulences are caused by air movements associated with convective activities, especially within or near thunderstorms or near jet streams at high altitudes.

The rate of wind shear and turbulence events variated only slightly in the past years. Only 4% were reported from the general aviation domain and 96% from commercial air transport. There were 53% occurrences in the approach and landing phase, 14% during the take-off phase and 30% enroute, as in the previous reporting periods. Wind shears are mainly encountered during the approach phase where a electronic detection system informs the pilots for immediate action (i.e. initiating the missed approach procedure). Turbulences are not critical for the aircraft structure but for the occupants in the aircraft if they are not wearing seat belts.

Abnormal runway contact and runway excursion

Definition: During landing and taxiing, influences such as wind shears, thermal convections, optical illusions or an incorrect assessment of the rate of descent can lead to abnormal runway contacts, like hard- or long landings, runway overshoots or veer-offs.

A rather high amount of abnormal runway contacts and excursions were observed in non-commercial air transport during the past years (27%). The main contributing factor is lack of training and airmanship. Only one serious incident without injuries is investigated by the AIB (hard landing, nose gear collapse). A total of 13 runway excursions events were reported.

Deviation from procedures and checklists

Definition: The increasing complexity of technology and systems on an aircraft requires precisely defined procedures and checklists to minimize the error rate of aircraft operation. Such procedures and checklists tell the pilots how they should fly in specific flight phases and the correct use of technical systems in order to ensure passengers are transported as safely as possible.

Causal factors for deviations are lack or delayed actions inflight, influenced by distractions from the cockpit environment (communication, noise, navigation, weather, etc.). Such distractions can lead to level busts, deviations from vital flight parameters, runway incursions, navigational errors, deviations from ATM procedures, etc. A total of 85% of the events occurred in commercial air transport.

Dangerous goods

The number of dangerous goods incidents reported increased by almost 42% from 153 in 2021 to 217 in 2022, owing probably to the year-on-year increase in aircraft movements. Most of these cases involved undeclared goods, followed by damaged goods or shipments not recorded.

Helicopter operations[1]

Overview of safety issues in helicopter operations

Number and severity of occurrences

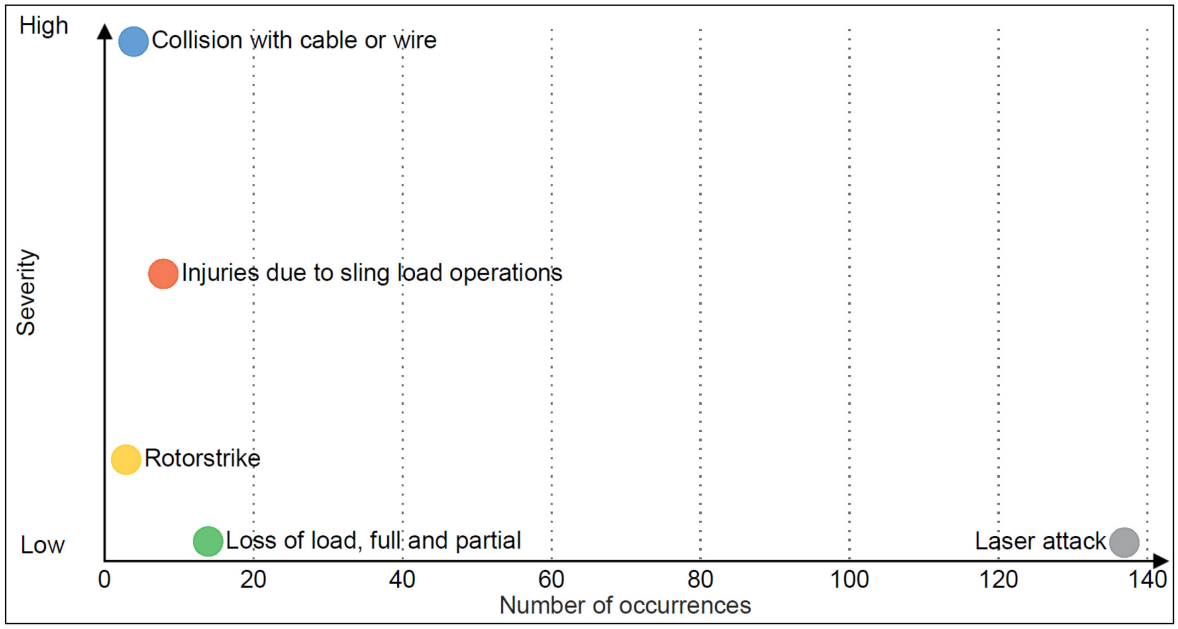


Figure 9: absolute number and severity of occurrences in helicopter operations in 2022

Number of occurrences in the last five years

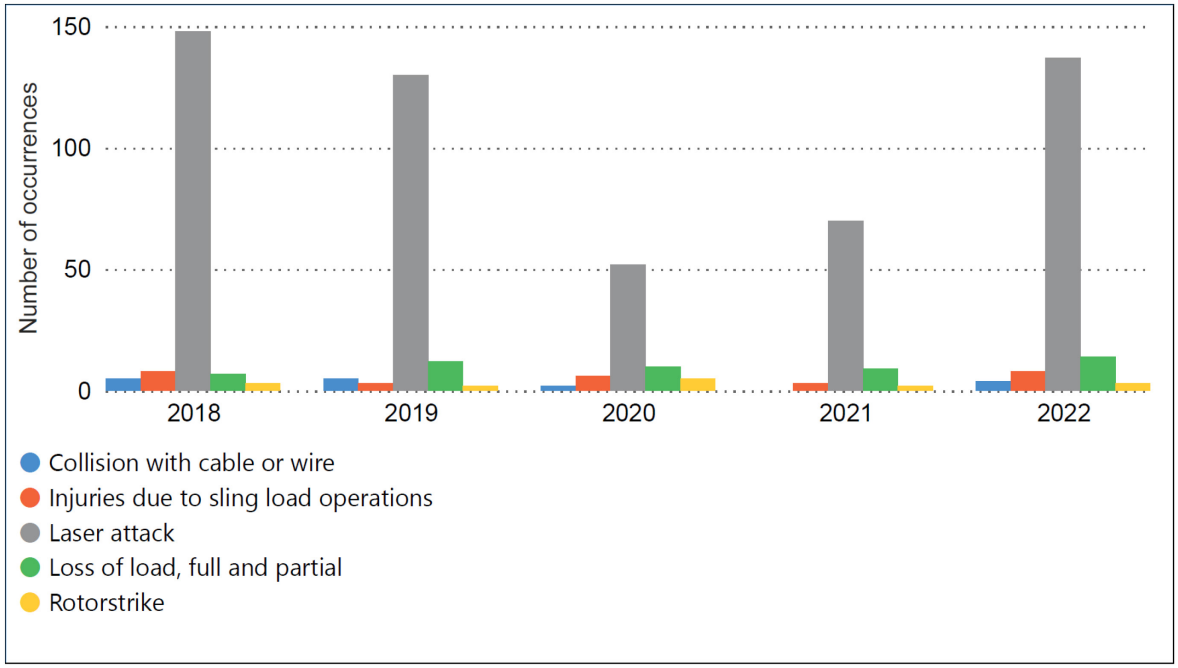


Figure 10: No of occurrences 2018-2022 in helicopter operations (not normalised)

Data analysis of helicopter operations safety issues

Rotor strikes

Definition: A rotor strike is an event involving damage to the aircraft because its main or tail rotor blades collide with an obstacle on the ground (cable/wires, vegetation, poles etc.).

The number of reports in this category remains stable for this reporting period. Whilst seven rotor strikes had been reported in 2021, only two respectively three such reports were submitted to the FOCA during 2021 and 2022 (see also "Collision with cable or wire" below.)

Total or partial loss of load

Definition: A total or partial loss of load occurs if, during transport, all or part of the external load is lost.

Following an increase in 2019, the number of reported load losses declined in 2020 and 2021. In 2022, the number of reported incidents increased again (2021: 9, 2022: 14). The small number of reported incidents should be noted.

Laser attack

Definition: The sudden appearance of a strong light source that exposes a pilot to glare can have varying impacts, depending on its intensity. The possible consequences range from brief distraction to temporary blindness or even permanent eye damage. Exposing crews to glare is illegal and can have fatal consequences, especially in the crucial phases of approach, takeoff or low-altitude flight, which require a pilot's full attention.

In recent years, we have seen an increase in the outdoor use of lasers for legitimate purposes, such as laser shows and commercial testing. Similarly, there has been an increase in the use by private individuals of hand-held laser pointers for the intentional (and illegal) illumination of airplanes and helicopters. Disruptions of this nature are very dangerous for pilots in critical flight phases such as takeoff and approach/landing, especially for helicopter pilots in single pilot operation.

After a significant decrease in the total number of reports of laser glare in 2020 by nearly 60%, the number of such reports rose again in the two last reporting periods (2020: 52; 2021: 70; 2022: 137). The number of laser incidents reported in 2022 is the same as the number of cases before the Corona crisis. The numbers of helicopter crews affected by laser glare remained stable in this reporting period. Helicopters were affected in ~7% of all such reports (compared to 11% in 2021).

Collision with cable or wire

Definition: An event involving an aircraft collision with power line conductor, cable or wire.

In the year under review, 2 accidents were registered with one person suffering fatal injuries. Collisions with cables or wires are recorded regularly. In the years 2018 to 2022, an average of slightly more than one cable collision was recorded per year. Further developments in this area will continue to be closely monitored.

Injuries due to sling load operation

Definition: This category covers incidents in which injuries are sustained by persons while they are part of a sling load operation.

The FOCA received eight reports in 2022 of injuries to flight assistants or workers on the ground during sling load operation. The numbers here vary from year to year, and no trend can be identified, not least because the figures are too small. In contrast to the year before, no fatal injuries were recorded in this area.

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[1] *Important note:* It must be noted that the numbers here are consistently too small for clear conclusions to be drawn about possible trends. This small number of reports spread over a relatively wide band of operations makes it virtually impossible to conduct any meaningful analyses.

Unlike with the other areas, incident data in helicopter operations cannot be normalized. The figures available to the FOCA, especially in the SPO field, do not allow the number of incidents to be set in relation to the number of rotations, for example. The figures provided by the organizations involved do not permit a reliable comparison.

Technical

Overview of technical safety issues

Number and severity of occurrences

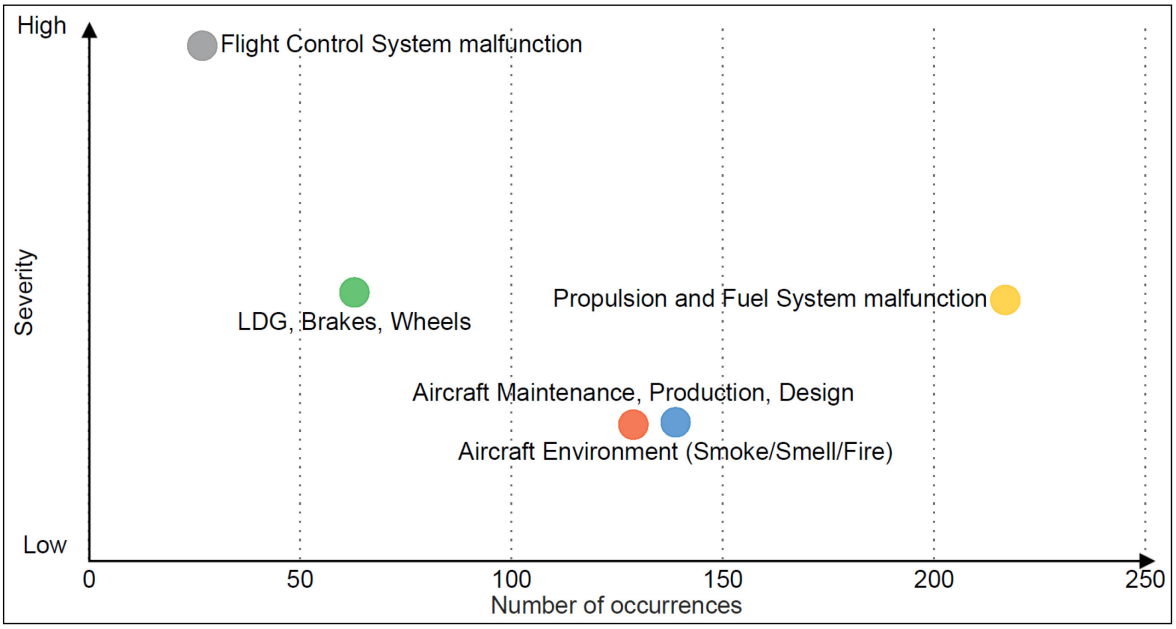

Figure 11: absolute number and severity of technical occurrences in 2022

Number of occurrences in the last five years

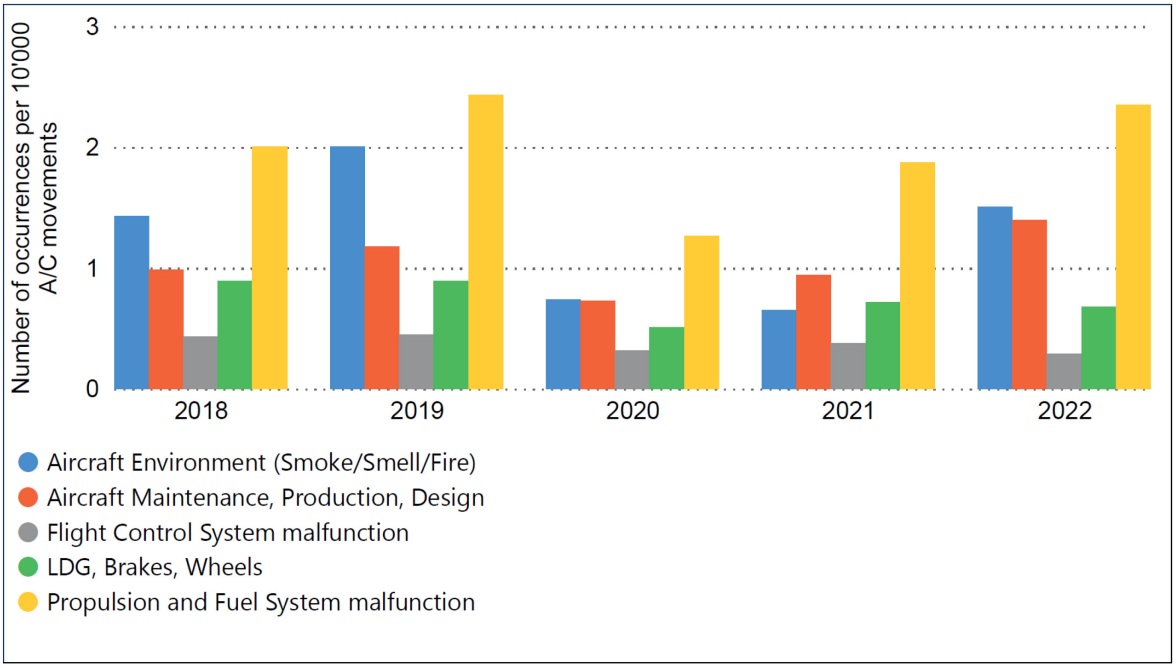

Figure 12: Number of technical occurrences 2018-2022 (normalised)

Data analysis of technical safety issues

Propulsion or fuel system malfunction

Definition: Engine and/or fuel system malfunction, including partial or complete loss of power. Possible causes are technical defects in the propulsion systems (engine, propeller, transmission and associated systems) or the fuel system, faulty manipulation, maintenance errors, damage incurred on the ground, bird strike, weather conditions, fuel shortage or contaminated fuel.

The overall aggregate severity of reported engine and fuel system incidents decreased in 2022 in comparison to the previous year, while an increase was seen in the number of such incidents per 10 000 movements again. The main contributors here were two accidents in non-commercial aviation due to power loss of reciprocating engines.

In commercial aviation, there was a slight increase in the rate while the severity of incidents remained at a similar level to previous years.

Aircraft environment (smoke, smell, fumes, fire)

Definition: Fumes/smells can arise in an aircraft for a variety of reasons. Depending on the source, concentration and chemical composition of the odor, the health or performance of the aircraft occupants may be affected. To avoid potential risks due to odor or smoke in the cockpit, the crew may decide to land or use oxygen masks as a precaution. Airlines use established procedures to investigate such incidents and eliminate their causes.

An uncontrolled fire in an aircraft is one of the hazards with the greatest potential impact and can result in loss of control due to damage to the structure and/or control systems and/or injury to the crew.

The number of incidents in this category per 10 000 aircraft movements increased, while the overall severity of incidents in 2022 decreased from the previous year. The rate increase was driven primarily by commercial aviation.

In commercial aviation, most identifiable causes of cabin or cockpit odors came from engines, followed by an almost equal number of incidents caused by cabin/galley equipment, avionics, or electrical and hydraulic systems. About half of these were one-off incidents with no attributable cause.

Flight control system malfunction

Definition: The flight control system is used to control the aircraft about its three axes and includes the various control surfaces and their control mechanisms; for helicopters, these are primarily the main and tail rotor controls.

There was a slight decrease in 2022 in the number of reported incidents in this category per 10 000 movements contrary to an increase in their aggregate severity compared to 2021. The accident involving a motor glider, which was found to have flight control problems, contributed to this increase; however, the investigation is still ongoing and the cause has not yet been determined. Overall, the number of incidents remained at a low level.

Landing gear/brakes/wheels malfunction

Definition: A malfunction of the landing gear including its extension/retraction system, the brakes or a tire failure can result in a wheels-up landing, the collapse of the landing gear during landing, a failure to retract the gear after takeoff or a runway excursion.

Compared to the previous year, there was a slight decrease in the rate of reported incidents in this category as well as a decrease in their aggregate severity.

In non-commercial aviation, a landing gear collapse during landing led to an accident.

Aircraft maintenance

Definition: Maintenance issues include, but are not limited to, incorrectly or incompletely performed maintenance tasks, foreign objects left in aircraft after maintenance, the planning and monitoring of maintenance actions, the use of maintenance documentation and the adherence to maintenance procedures. In addition, this chapter also includes production and known design problems.

The number of reported incidents in this category per 10 000 aircraft movements increased in 2022 compared to 2021 while the overall severity decreased.

The main causes were errors in planning or monitoring of scheduled maintenance tasks, closely followed by incorrect or incomplete execution of repairs or installations.

General remark: the charts in this chapter show the figures and rates for the whole of Swiss aviation. Where necessary, differences between the individual categories of aviation are mentioned in the text.

Assessment and outlook

The safety priorities for Swiss civil aviation are well known, thanks to the data and the further information provided by the air transport industry and the private aviation sector. Analyzing occurrences is a key element in the risk assessment analyses which the FOCA conducts in connection with safety-relevant activities. More and more management decisions are being taken on the basis of risk and performance considerations and predefined criteria. The information from occurrences is serving, for instance, as a key decision-making foundation (among others) in the AVISTRAT project and on the issue of transponder mandatory zones (TMZs).

The safety risk area of 'Airborne collision' is at the top of the priority list in Switzerland, too, also in view of the European risk portfolio and the findings thereof. The Airprox Analysis Board (AAB) was further developed in 2022 with a new mandate and terms of reference to give it the requisite weighting. Some major decisions lie ahead here, on issues such as TMZs, which are being discussed with various specialists in the field to determine whether the creation of such zones could reduce the risk of future airborne collisions.

This Annual Safety Report should provide our industry partners with a review of the reports and occurrences in Swiss civil aviation in 2022. Our special thanks here go to our industry for its constantly improving reporting culture. The present safety report has taken a closer look at systemic, operational and other emerging issues. Drawing on our data analyses of 11 840 occurrence reports, we have been able to identify safety issues in various categories.

These focuses help the FOCA to make more targeted use of its resources, both in supervisory terms and in defining the actions required to steadily further enhance safety performance. Our analyses of these occurrence data provide a vital foundation, too, for our further discussions and work. And on the issues of drones, U-Space and cybersecurity in particular, we need to collect even more data in future to draw our lessons from such information and from any occurrences in these fields.

In addition to proactively identifying opportunities and risks in Swiss civil aviation, the FOCA will continue to put a strong emphasis on analyzing occurrence data (with due and full regard, too, to further information sources such as the findings from audits and inspections, accident reports, developments outside Switzerland and more to maintain an optimum overview in all the areas concerned, in order to draw the right conclusions and remain as alert and sensitive as possible to further changes and developments in the aviation system.

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