ANNUAL SAFETY REPORT 2024

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Summary

The Federal Office of Civil Aviation (FOCA) processed over 12,500 incident reports in 2024 – significantly more than in previous years. Incident reports contribute to the ongoing improvement of safety on the ground and in the air. Last year, there was one fatal accident in commercial aviation in Switzerland.

A brief overview of the other statistics contained in the 2024 report: an increase of approximately 20% in the number of reported incidents in commercial and general aviation, significantly more incidents involving verbally aggressive, intoxicated or violent passengers, 32% more runway incursions, 21% more aircraft damage during ground handling, 40% more GPS jamming, 13% more wildlife strikes, 8% more loading errors, 20% more near collisions between aircraft mid-air, the same number of drone conflicts, more laser attacks, one fatal accident in commercial aviation, three accidents with a total of six fatalities in general aviation, and a helicopter collision with a cable that resulted in the death of one pilot and serious injury to another.

The number of incidents reported has been increasing since 2019, mainly because of an improved reporting culture, the increase of commercial air traffic to pre-COVID levels and more conflict regions with more large-scale GPS jamming on aircraft.

The FOCA processed a total of 12,751 incident reports in 2024. From the reports received, the FOCA categorises, analyses and identifies the key causes of the incidents for five areas of risk – aerodromes, air traffic management, flight operations, helicopter operations and aviation technology – and assesses them according to their degree of severity.

The safety culture of civil aviation builds on the experience of pilots, air traffic controllers and ground staff. The FOCA derives preventive measures from the safety-relevant incidents reported and draws up recommendations.

Collisions are the safety aspect that takes the highest priority. It is crucial to determine which services and technologies can increase safety in airspace. Together with the aviation industry, the FOCA is developing solutions in the Future Aviation Surveillance Services and Technologies (FASST-CH) project.

For more than ten years, the FOCA has also been running the general aviation safety campaign staysafe.aero. The target group: pilots and stakeholders in light aviation. It posts weekly about the latest safety-relevant topics on the campaign website and on social media.

Zusammenfassung

Das Bundesamt für Zivilluftfahrt (BAZL) bearbeitete 2024 über 12’500 Meldungen zu Vorfällen – deutlich mehr als in früheren Jahren. Diese Meldungen dienen dazu, die Sicherheit am Boden und in der Luft stetig weiterzuentwickeln. Letztes Jahr gab es in der Schweiz einen Unfall mit Todesfolge in der kommerziellen Luftfahrt.

Rund 20% mehr gemeldete Vorfälle in der kommerziellen Luftfahrt und der Freizeitfliegerei, bedeutend mehr Vorfälle mit fluchenden, exzessiv trinkenden oder gewalttätigen Passagieren, 32% mehr Störungen auf der Start- oder Landebahn, 21% mehr Flugzeugbeschädigungen während der Bodenabfertigung, 40% mehr GPS-Störungen, 13% mehr Kollisionen mit Wildtieren, 8% mehr Verladefehler, 20% mehr Beinahezusammenstösse von Flugzeugen in der Luft, gleich viele Konflikte mit Drohnen, mehr Laserattacken, ein Unfall mit Todesfolge in der kommerziellen Luftfahrt, drei Unfälle mit insgesamt sechs Todesopfern in der Freizeitfliegerei, ein toter und ein schwer verletzter Helikopterpilot nach einer Kollision mit einem Kabel: So die Kürzestfassung der Vorfallstatistik 2024 in der Schweizer Zivilluftfahrt.

Seit 2019 nehmen die Vorfallmeldungen zu. Die Hauptursachen: Die bessere Meldekultur, die Zunahme des kommerziellen Luftverkehrs auf das Vor-COVID-Niveau sowie mehr Konfliktregionen mit mehr grossflächig gestörten GPS-Signalen auf Flugzeugen.

Im Berichtsjahr 2024 bearbeitete das BAZL insgesamt 12’751 Vorfälle. Kategorisieren, analysieren und daraus Massnahmen definieren: Aus den eingegangenen Meldungen identifiziert das BAZL für die fünf Bereiche Flugplätze, Flugsicherung, Flugbetrieb, Helikopter und Flugtechnik die wichtigsten Ursachen und beurteilt sie nach dem Schweregrad.

Die Sicherheitskultur der zivilen Luftfahrt baut auf Erfahrungen von Pilotinnen und Piloten, Fluglotsinnen und Fluglotsen sowie dem Bodenpersonal auf. Von den gemeldeten sicherheitsrelevanten Vorfällen leitet das BAZL Präventionsmassnahmen ab und erarbeitet Empfehlungen.

Der Sicherheitsbereich Kollisionen hat höchste Priorität. Zentral ist dabei die Frage, welche Dienste und Technologien die Sicherheit im Luftraum erhöhen können. Zusammen mit der Aviatik-Branche erarbeitet das BAZL im Projekt Future Aviation Surveillance Services and Technologies (FASST-CH) Lösungen.

Seit mehr als zehn Jahren betreibt das BAZL zudem die Sicherheitskampagne Staysafe.aero im Bereich Freizeitfliegerei. Die Zielgruppe: Pilotinnen und Piloten sowie Akteure der Leichtaviatik. Über das Internet und die sozialen Medien veröffentlicht das BAZL wöchentlich neue Beiträge zu aktuellen sicherheitsrelevanten Themen.

Sommaire

En 2024, l'Office fédéral de l'aviation civile (OFAC) a traité plus de 12 500 comptes rendus d'incidents, nettement plus que les années précédentes. Tout incident signalé est utile pour améliorer la sécurité au sol et en vol. L'année dernière, on a eu à déplorer un accident mortel dans l'aviation commerciale en Suisse.

Des comptes rendus d'incidents en augmentation de 20 % dans l'aviation commerciale et non commerciale, nettement davantage de cas de passagers agressifs, pris de boisson ou violents, des perturbations sur les pistes en hausse de 32 %, une hausse de 21 % des cas de dommage causé à un avion pendant la fourniture de services d'assistance en escale, une hausse de 40 % des perturbations du signal GPS, une hausse de 13 % des collisions avec des animaux, une hausse de 8 % des erreurs de chargement, une hausse de 20 % des quasi-collisions en vol, une évolution stable des conflits avec des drones, davantage de cas d'éblouissement par pointeur laser, un accident mortel dans l'aviation commerciale, trois accidents pour un total de six morts dans l'aviation de plaisance et un pilote d'hélicoptère mort et un grièvement blessé à la suite d'une collision avec un câble : tel est en résumé le bilan 2024 des incidents dans l'aviation civile suisse.

Le nombre de comptes rendus d'incidents est en augmentation depuis 2019. Ces chiffres s'expliquent essentiellement par une meilleure culture de compte rendu, la croissance du trafic aérien commercial qui retrouve son niveau antérieur à la pandémie de COVID-19 et la multiplication des zones de conflit dans le monde qui s'accompagne d'une recrudescence des perturbations des signaux GPS.

Durant l'année sous revue, l'OFAC a traité un total de 12 751 incidents. Catégoriser, analyser puis prendre les mesures qui s'imposent : à partir des comptes rendus qui lui sont adressés, l'OFAC attribue les incidents à l'une des cinq catégories Exploitation des aérodromes, Gestion du trafic aérien, Exploitation des aéronefs (hors hélicoptères), Exploitation des hélicoptères et Aspects techniques, en identifie les causes prépondérantes et les évalue en fonction de leur degré de gravité.

La culture de la sécurité dans l'aviation civile s'appuie sur les expériences des pilotes, des contrôleurs et contrôleuses de la circulation aérienne et du personnel au sol. Sur la base des incidents qui lui sont signalés, l'OFAC élabore des mesures de prévention et des recommandations.

La prévention des collisions est prioritaire, la question des services et technologies susceptibles d'améliorer la sécurité dans l'espace aérien étant à cet égard centrale. L'OFAC élabore des solutions cet effet de concert avec le secteur de l'aviation, dans le cadre du projet Future Aviation Surveillance Services and Technologies (FASST-CH).

L'OFAC mène par ailleurs depuis plus de dix ans une initiative de sensibilisation aux questions de sécurité, baptisée Staysafe.aero, qui s'adresse aux pilotes et acteurs de l'aviation légère. Des contributions sur des thèmes d'actualité liés à la sécurité sont ainsi diffusées à un rythme hebdomadaire via l'Internet et les médias sociaux.

Sintesi

Nel 2024 l'Ufficio federale dell'aviazione civile (UFAC) ha trattato oltre 12 500 segnalazioni di inconvenienti, un numero significativamente maggiore rispetto agli anni precedenti. Le segnalazioni permettono di continuare a migliorare la sicurezza a terra e in volo. L'anno scorso in Svizzera si è verificato un incidente mortale nell'aviazione commerciale.

Circa il 20 per cento in più di segnalazioni di inconvenienti nell'aviazione commerciale e da diporto, un numero significativamente maggiore di casi di passeggeri che imprecano, consumano troppo alcol o assumono atteggiamenti violenti, il 32 per cento in più di problemi sulla pista di decollo o di atterraggio, il 21 per cento in più di danni agli aeromobili durante le operazioni a terra, il 40 per cento in più di malfunzionamenti del GPS, il 13 per cento in più di collisioni con animali selvatici, l'8 per cento in più di errori di carico, il 20 per cento in più di quasi collisioni tra aeromobili in volo, lo stesso numero di conflitti con i droni, più attacchi con i laser, un incidente mortale nell'aviazione commerciale, tre incidenti con un totale di sei morti nell'aviazione da diporto, un pilota di elicottero morto e uno gravemente ferito in seguito a una collisione con un cavo: è questa in sintesi la statistica 2024 degli inconvenienti e degli incidenti verificatisi nell'aviazione civile svizzera.

Le segnalazioni di inconvenienti sono in aumento dal 2019. Tale tendenza è da ricondurre principalmente a una migliore cultura della segnalazione, al ritorno del volume del traffico aereo commerciale ai livelli pre-COVID e a un maggior numero di regioni interessate da guerre, che determinano maggiori aree in cui i segnali GPS sugli aerei sono disturbati.

Nel 2024 l'UFAC ha trattato un totale di 12 751 inconvenienti. Classificare, analizzare e definire le misure necessarie: in base alle segnalazioni pervenute l'UFAC individua per ciascuno dei cinque ambiti «aerodromi», «servizi della navigazione aerea», «operazioni di volo», «tecnologia aeronautica» ed «elicotteri» le principali cause e ne valuta la gravità.

La cultura della sicurezza dell'aviazione civile si sviluppa grazie all'esperienza di piloti, controllori del traffico aereo e personale di terra. Sulla base degli inconvenienti notificati rilevanti per la sicurezza l'UFAC individua le misure di prevenzione necessarie ed elabora raccomandazioni.

La massima priorità è attribuita al settore «collisioni». Qui la questione centrale è capire quali servizi e tecnologie possono aumentare la sicurezza nello spazio aereo. Insieme al settore aeronautico l'UFAC sta sviluppando soluzioni nell'ambito del progetto Future Aviation Surveillance Services and Technologies (FASST-CH).

Da oltre dieci anni inoltre l'UFAC gestisce anche la campagna di sicurezza Staysafe.aero nel settore dell'aviazione da diporto. Tale campagna è rivolta principalmente a piloti e attori dell'aviazione leggera. Ogni settimana l'UFAC pubblica in Internet e sui social media nuovi contributi riguardo a temi attuali concernenti la sicurezza.

Introduction

The Annual Safety Report (ASR) carefully examines all incidents that are known to the Federal Office of Civil Aviation (FOCA) and relevant to the safety of Swiss civil aviation, both on the ground and in the air.

Categorise, analyse and then define actions: FOCA experts categorise the reports received as high or low risk, depending on their severity and probability of occurrence. In the Annual Safety Report, the risks are allocated to the various areas of aerodrome operations, air traffic management, flight operations, helicopter operations and technical issues.

The International Civil Aviation Organization (ICAO) requires member states to have a State Safety Programme (SSP). Switzerland's SSP describes the country's regulatory environment and the activities and distribution of roles in the safety oversight of civil aviation. It shows how the targeted level of safety is achieved and how Switzerland fulfils its international and European obligations. The FOCA, as the regulatory authority, has defined a series of safety performance indicators which allow the development of individual risks to be monitored in detail. If necessary, the FOCA conducts further analyses or risk assessments and specifies actions to be taken. Such additional actions are then incorporated into the Swiss Aviation Safety Plan (SASP).

The data presented in the Annual Safety Report has been obtained from commercial and non-commercial Swiss civil aviation via the ECCAIRS reporting portal. The 2024 report focuses on the current situation and highlights the development of incidents over the last five years. FOCA experts also explain possible causes and trends.

1 Aerodromes: more than landing and taking off

The simplest definition of an aerodrome: a place where aeroplanes, helicopters and other aircraft land and take off. But an aerodrome needs more than just a runway to function safely. Thus, there is a movement area, called an apron, on which an aircraft is parked and where ground handling can take place. Taxiways are also required for aircraft access to the runway.

Proper and continuous operation of an aerodrome requires numerous partners. These can include air traffic control to guide aircraft, airlines to carry passengers, ground handling companies to deliver cargo and baggage and provide passenger assistance, airfield maintenance and many others.

The aerodrome is not simply paved surfaces – it often has extensive green areas where birds and other wildlife live. To ensure that flight operations run safely, the wildlife living on the aerodrome must be managed.

In conclusion: the larger the aerodrome, the more complex it is to ensure and manage the interoperability of services.

Examples of incidents on aerodromes include:

- Damage to aircraft resulting from collision with passenger boarding bridge during docking
- An aircraft taxies on the wrong taxiway
- Engine damage due to birdstrike
- A push-back in the wrong direction
- An incorrectly loaded cargo bay

These types of incidents can occur at Swiss airports. In such cases, the top priority is ensuring that they are accurately reported to the appropriate safety office and the Federal Office of Civil Aviation; where or when the incidents occur is less relevant. Proper reporting is essential, as it allows authorities to analyse the events, identify recurring patterns and implement corrective measures to enhance aviation safety. Only through thorough and timely reports can valuable lessons be learned, risks mitigated, and necessary improvements made to prevent future occurrences.

Aerodrome incidents: overview of top safety issues in 2024

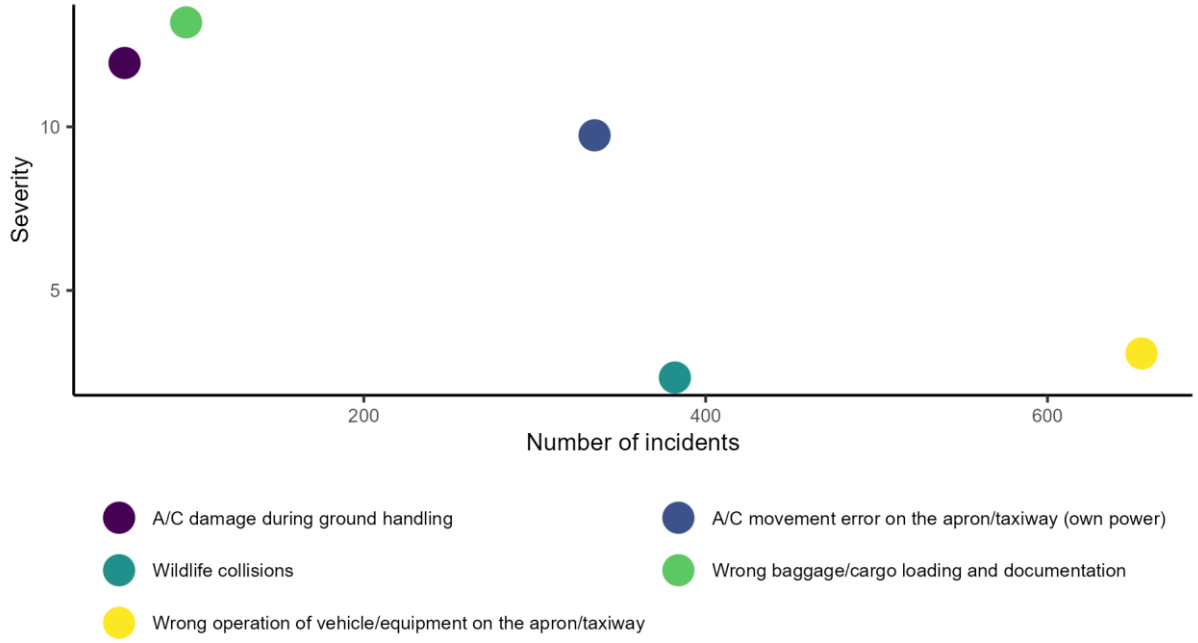

Figure 1: Number of incidents and severity of top safety issues aerodromes, 2024

Safety issues, 2020–2024
Number of incidents (per 10,000 movements)

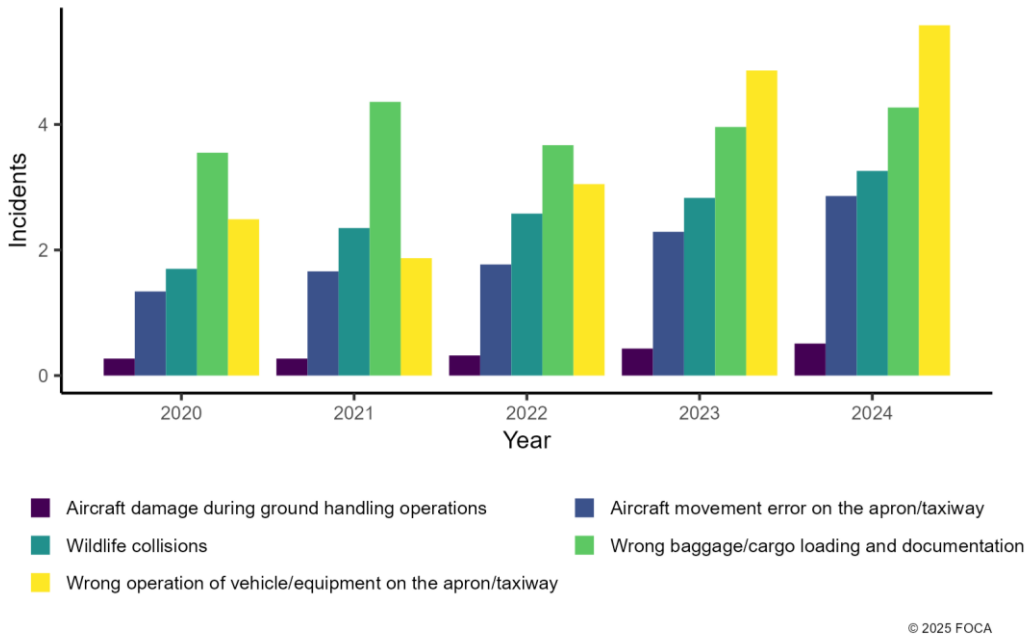

Figure 2: Top safety issues on aerodromes, 2020–2024 (per 10,000 movements)

1.1 Aircraft damage during ground handling

What this relates to: This concerns collisions with ground handling equipment (such as baggage conveyor belts, passenger stairs or vehicles), as well as improper handling (for example when opening cargo hold doors). Damage during ground operations occurs only on stationary aircraft and may compromise operational safety due to its possible impact on structural integrity.

Example: The ground crew approaches the parked aircraft with the passenger boarding bridge to dock. The passenger boarding bridge collides with the aircraft and damages the fuselage. The aircraft must undergo maintenance before it can fly again.

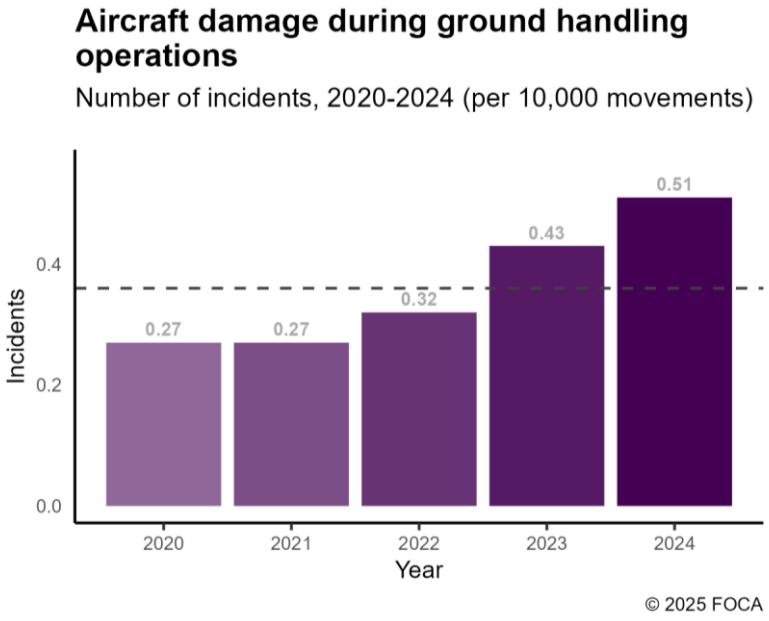

Figure 3: Incidents of aircraft damage during ground handling, 2020–2024 rates and five-year average (per 10,000 movements)

Remarks on the 2024 figures: Although the rate of incidents per 10,000 aircraft movements increased by 21%, the number of incidents in this domain remains very low. This is true for absolute numbers, with only 59 incidents recorded on Swiss aerodromes in 2024, as well as the ratio, with 0.5 incidents per 10,000 aircraft movements (compared with 0.43 in the previous year). Of the reported incidents, 93% were related to commercial air transport and the remaining 7% to general aviation. This large difference is due to the fact that most aircraft requiring ground handling services are operated commercially.

In commercial air transport, narrow aircraft stands are often the main cause of incidents as the slightest lapse of concentration can quickly result in damage to the parked aircraft. In the majority of cases (93%), the damage occurred during container loading or during the docking phase of the passenger boarding bridge or passenger stairs. In general aviation, damage is more likely to occur while hangaring aircraft.

Of all reported incidents in this category, 95% involve minor damage such as paint chips or scratches, which after technical assessment were found not to impact flight safety.

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

What this relates to: An aircraft crew taxiing on the apron or taxiway does not follow the taxi instructions, procedures or clearances. This can result in a near collision or collision with another aircraft, vehicle, infrastructure or obstacle.

Example: An aircraft takes the wrong taxiway. The taxiway is not suitable for this type of aircraft, resulting in a wingtip hitting a pole.

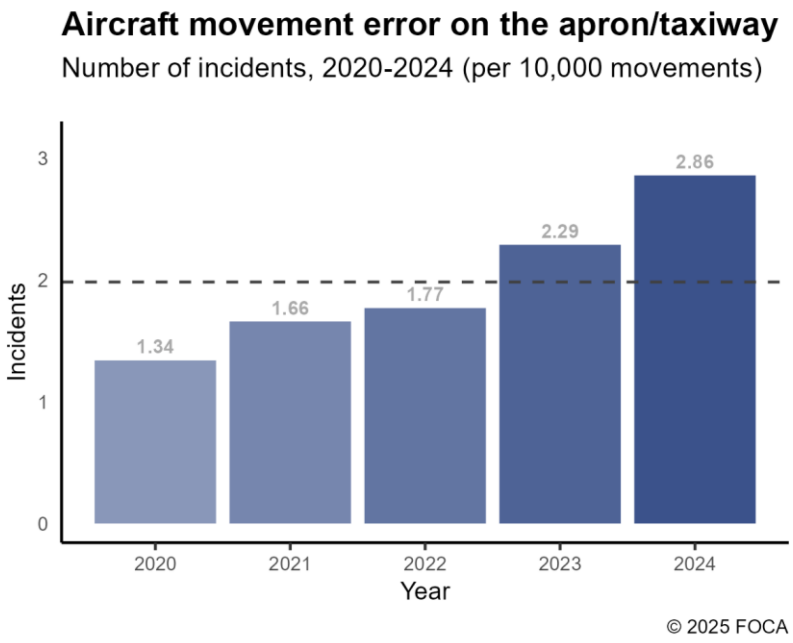

Figure 4: Incidents of aircraft movement error on the apron/taxiway, 2020–2024 rates and five-year average (per 10,000 movements)

Remarks on the 2024 figures: 335 incidents in this domain occurred on Swiss aerodromes during the reporting period. 80% of these cases are related to commercial aircraft, the remaining 20% concern general aviation.

About 90% of the reported incidents related to taxi clearance deviation or navigation errors with no impact or a small impact on safety. Most of the occurrences were caused by a misunderstanding about the issued clearance or a loss of orientation on an aerodrome with a complex apron and taxiway system. Navigation errors at large airports are also linked to their frequent maintenance works, which can lead to closing taxiways or changing procedures that confuse pilots. In only one case this year, adverse weather conditions were the cause of the navigation error due to reduced visibility.

Collisions involving two aircraft, an aircraft and a vehicle, or another type of obstacle during taxiing accounted for 4% of incidents. However, only 2% were classified as major incidents due to the extent of the damage caused. In commercial aviation transport, taxi clearance deviation or navigation errors are more frequent but with no impact or a small impact on safety. Because aircraft are under the supervision of the ATC or Apron Management, such deviations are generally identified promptly. Unfortunately, these collisions are more common in general aviation, as there is less guidance during taxiing. A collision can easily occur if the pilot is not sufficiently aware.

1.3 Wildlife collisions

What this relates to: A birdstrike or collision with an animal during take-off or landing can cause damage to the aircraft, impairing flight safety.

Example: During take-off, an aircraft strikes a bird, which gets ingested into the engine. The engine starts vibrating abnormally, forcing a return to the departure airport. Inspection reveals damaged fan blades, leading to flight cancellation and passenger rebooking.

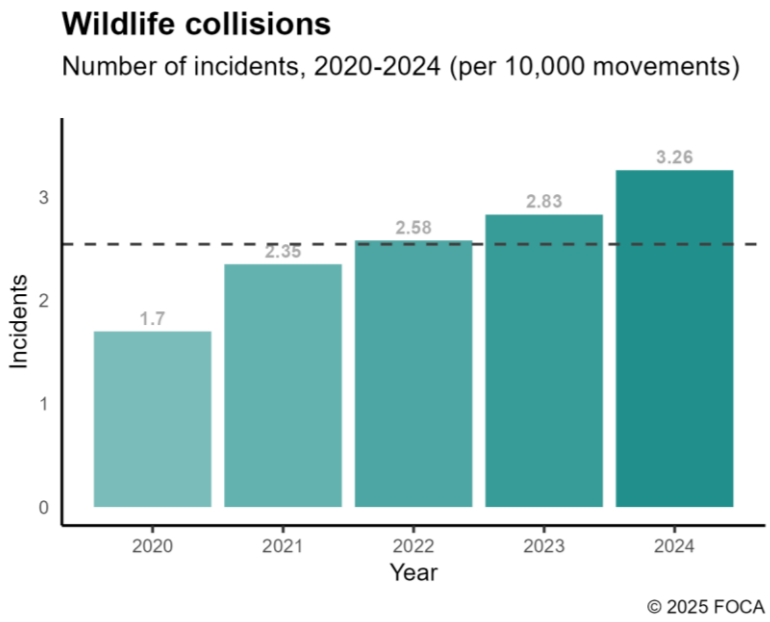

Figure 5: Incidents of wildlife collisions, 2020–2024 rates and five-year average (per 10,000 movements)

Remarks on the 2024 figures: The rate of wildlife collisions on Swiss aerodromes and in Swiss airspace increased from 2.83 incidents in 2023 to 3.26 in 2024 (per 10,000 flight movements). In absolute numbers, 388 incidents were recorded last year. The increase in these figures can be explained by the change in the behaviour of migratory birds, but some studies also mention the fact that new aircraft are bigger and less noisy, making it more difficult for wildlife to avoid them.

About 95% of the reported incidents related to commercial air transport, the remaining 5% to general aviation. As most propeller-driven aircraft travel relatively slowly, general aviation collisions tend to have a lower impact. According to studies, both pilots and birds have time to take evasive manoeuvre which is sometimes not the case with bigger commercial aircraft. Nevertheless, airspeed is not the sole factor that determines the severity of a collision – the size of the bird also plays a role. A large bird can cause severe damage even if the aircraft is flying slowly. In 2024, most collisions had at most negligible effects on aircraft: 5% of the collisions resulted in damage to the aircraft, with less than 1% classified as major.

Over 90% of collisions occurred within the perimeter of the aerodrome, i.e. during approach, landing or take-off. The remaining 10% occurred during cruise flight or in some other unknown flight phase. Birds were involved in more than 98% of cases, with the remaining 2% involving other wild animals. Almost 75% of collisions occurred in the second and third quarters of the year, hitting a peak of 66 in July.

1.4 Wrong baggage/cargo loading and documentation

What this relates to: Incorrect load sheets resulting in wrong aircraft loading or vice versa, errors in take-off weight or balance calculations, or flight parameters. Such mistakes may compromise operational safety.

Example: An aircraft is fully loaded, but a check of the load sheet reveals improper cargo distribution, making safe flight impossible. The aircraft must be reloaded, leading to significant passenger delays.

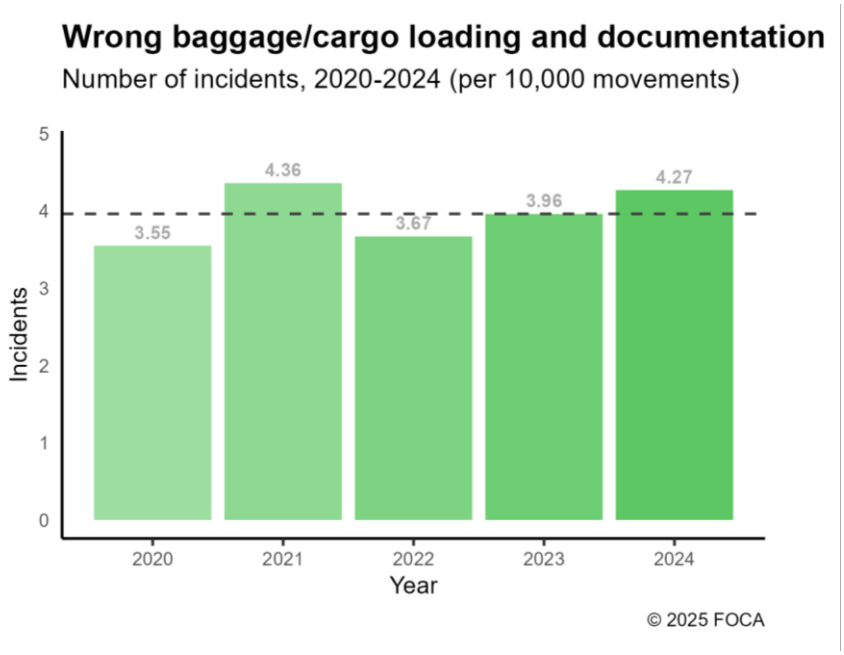

Figure 6: Incidents of wrong baggage/cargo loading and documentation, 2020–2024 rates and five-year average (per 10,000 movements); commercial air transport (CAT)

Remarks on the 2024 figures: Reported loading errors increased by 8% in absolute terms compared to the previous year. However, in relation to the number of movements it remained stable at an average of 4 incidents per 10,000 commercial air transport movements. All mentioned cases occurred at Swiss aerodromes and involved commercial operations.

Causes varied but were often linked to incorrect baggage or cargo loading, including dangerous goods, or errors in the loading plan. While most incidents had no significant impact on flight operations, some affected the aircraft's weight and balance. In a few cases, the centre of gravity shifted beyond safe limits, posing risks such as in-flight control difficulties or tail tipping during ground loading.

Despite the increase in incidents in 2024, less than 6% had a serious impact on flight operations.

1.5 Wrong operation of vehicles or ground handling equipment on the apron/taxiway

What this relates to: A vehicle fails to comply with instructions or traffic rules on the apron or taxiway. This can lead to a near collision with a moving aircraft. It can also happen with equipment or vehicles obstructing a taxiing aircraft.

Example: A vehicle driver crosses the apron as an aircraft approaches from the right on the taxiway. The driver fails to yield the right of way, forcing the aircraft to brake hard to avoid a collision. Fortunately, all passengers are seated at the time. The aircraft then continues to the gate, where passengers disembark safely.

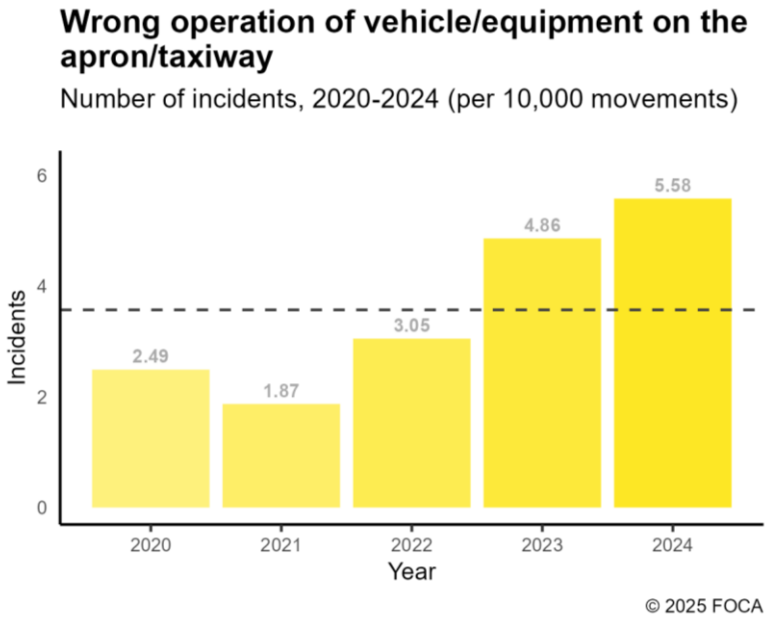

Figure 7: Incidents of wrong operation of a vehicle or ground handling equipment on the apron or taxiway, 2020–2024 rates and five-year average (per 10,000 movements)

Remarks on the 2024 figures: In 2024, 655 incidents of this type were reported on Swiss aerodromes, marking an increase in occurrence relative to flight movements (5.6 incidents per 10,000 aircraft movements, up from 4.9 in 2023). Most cases occurred on national and regional aerodromes. This trend is linked to the complexity of larger aerodromes and the high volume of vehicles and equipment operating on aprons and taxiways. The most frequent cause was the incorrect positioning of equipment or vehicles on the apron or taxiway, which forces the pilot to stop and wait until the way is clear to continue taxi. Therefore, the severity of these incidents tends to be very low. In contrast, the severity level is higher when a vehicle violates the traffic rules and forces a pilot to take evasive action. Wrong operation of vehicles or equipment can in some cases be linked to maintenance work, which may necessitate the closure of a taxiway or a change in procedures that can confuse drivers. Despite the increase, serious incidents – abrupt evasive action by pilots – accounted for less than 1% of the total in 2024. Furthermore, there were no collisions of taxiing aircraft and incorrectly operated equipment or vehicles. Most evasive actions involved abrupt and hard braking of the aircraft. The danger: passengers who have unfastened their seatbelts or are already standing can fall and injure themselves or other travellers.

2 Air traffic management

An aircraft should be able to move safely and efficiently in its airspace in all operating phases: during take-off, flying and landing. This task is the focus of air traffic management (ATM).

A light aircraft and a helicopter almost have a mid-air collision. A hobby pilot enters restricted airspace. A pilot misunderstands an air traffic controller and makes a mistake. Air traffic management (ATM) covers safety issues relating to air traffic control services and aircraft conflicts in flight in the various airspace classes.

Air traffic management (ATM) incidents: top safety issues in 2024

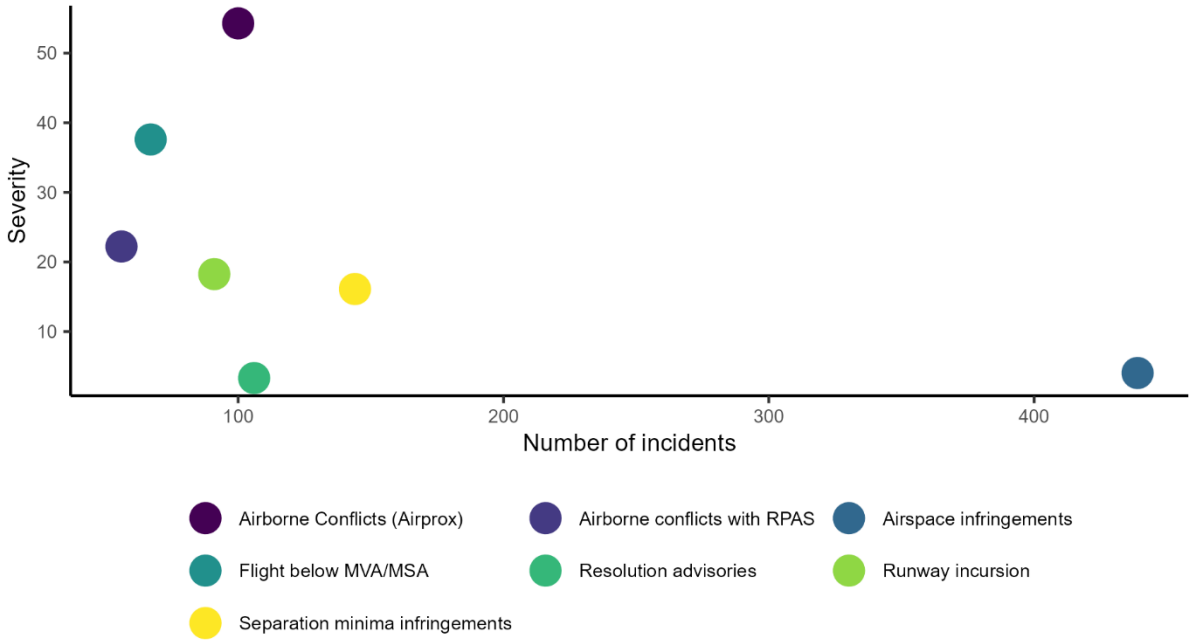

Figure 8: Number of incidents and severity of top safety issues in ATM, 2024

Air traffic management (ATM) incidents: safety issues, 2020–2024

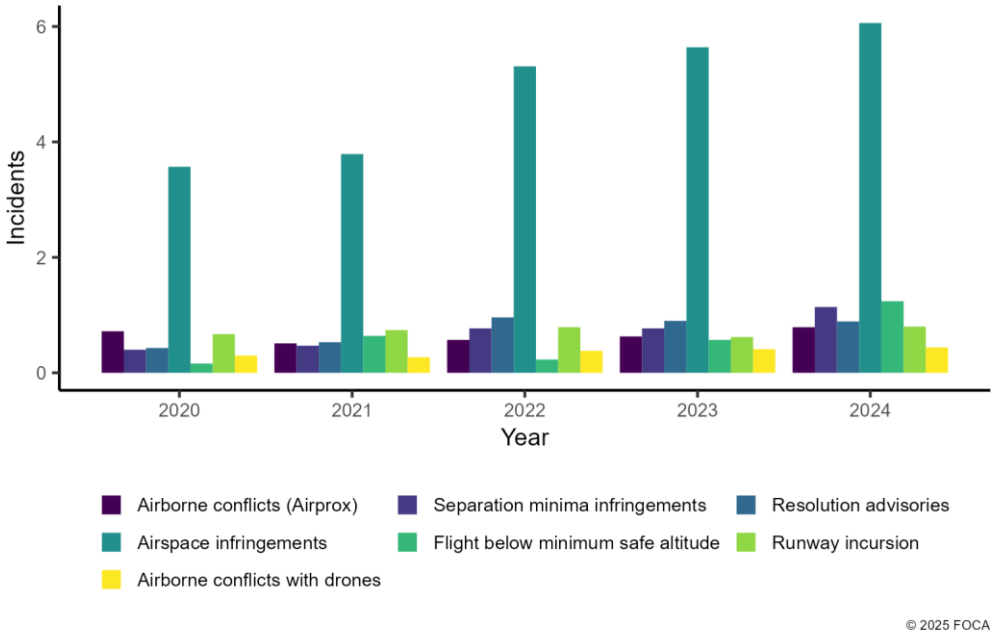

Figure 9: Top safety issues in Air traffic management, 2020–2024 (per 10,000 movements)

2.1 Airborne conflicts (Airprox)

What this relates to: The distance between aircraft, given their positions and velocity, is such that their safety is potentially threatened. When this situation occurs from the perspective of a pilot or air traffic controller, they refer to it as a near collision or Airprox. If the near collision cannot be anticipated and averted, a mid-air collision occurs.

Whether an airborne conflict is considered an Airprox or a separation minima infringement (SMI) depends on the type of airspace and the flight rules the two aircraft are subject to. The definitions of both, an Airprox and an SMI are not linked to the actual or perceived air conflict.

Example: A pilot is transporting passengers around the Alps in a light aircraft. Suddenly there is a helicopter flying directly towards her. The two pilots manage to avoid each other at the last second; they fly past each other with just 20 metres between them.

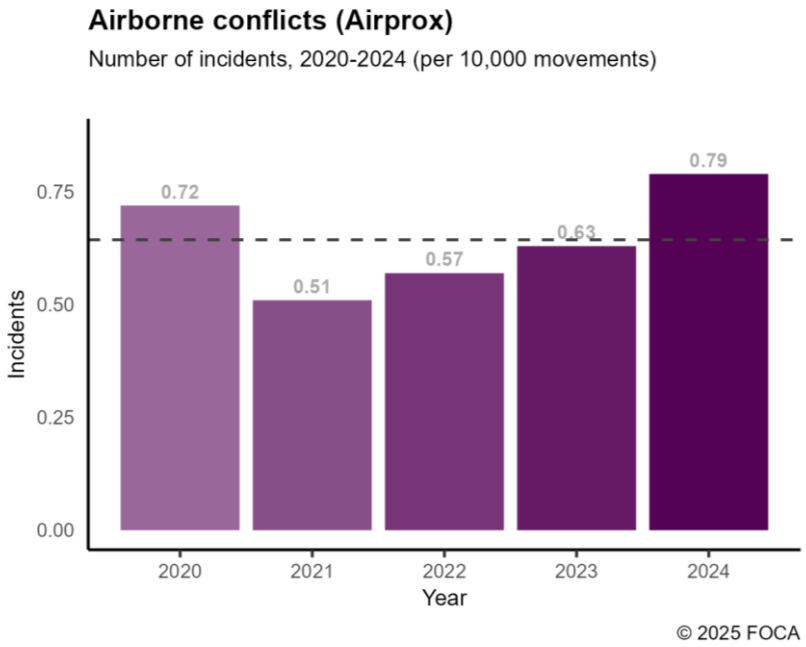

Figure 10: Airprox incidents, 2020–2024 rates and five-year average (per 10,000 movements)

Remarks on the 2024 figures: In 2024, pilots and air traffic control providers reported a total of 88 Airprox incidents, another increase in the number of reports compared to previous years. However, there were fewer incidents during which safety was not guaranteed or that involved a collision risk.

Conflicts between pilots flying under instrument flight rules (IFR) and visual flight rules (VFR) decreased by 8%; relative to IFR movements in Switzerland, they fell by a further 12%. As most of these conflicts occurred in mixed traffic in class Echo (E) airspace, the FOCA will launch an awareness campaign at the beginning of 2025 about the rules in ECHO airspace.

2.2 Separation minima infringements

What this relates to: To facilitate the safe navigation of aircraft in controlled airspace, authorities specify vertical and horizontal distances, known as separation standards. The standards ensure that aircraft are separated in a safe manner. If this minimum distance between two aircraft is not achieved, aviation terminology refers to as a separation minima infringement (SMI). This can happen if a pilot fails to follow air traffic control instructions or if air traffic control itself is unable to ensure the minimum separation.

Example: Two aircraft start one after the other from the same airport on the same route. The private jet is faster than the commercial aircraft in front of it and catches up to it. For a brief moment, they undershoot the separation standards. The air traffic controller instructs the private jet to correct its flight path, thereby ensuring that the separation of the two aircraft is safe again in accordance with the standard.

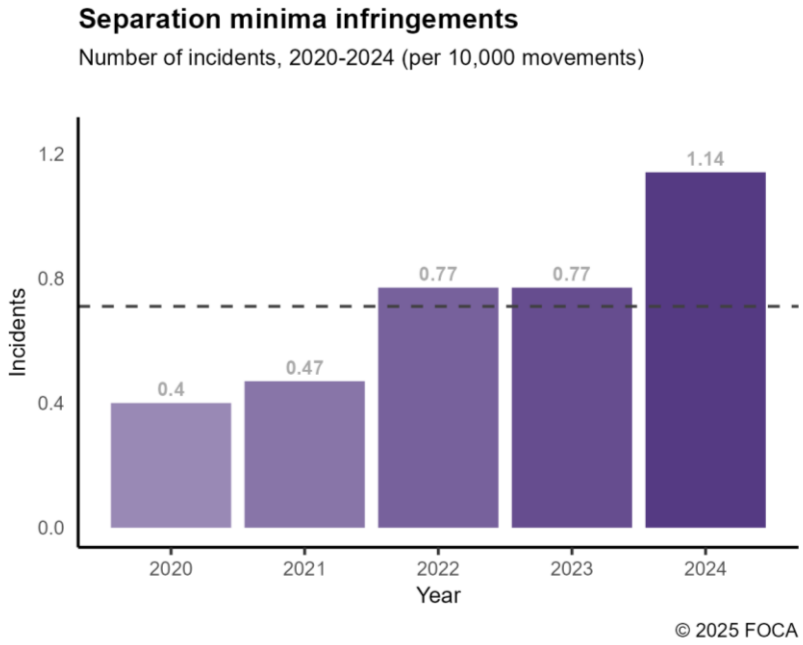

Figure 11: Incidents of separation minima infringement, 2020–2024 rates and five-year average (per 10,000 movements)

Remarks on the 2024 figures: In 2024, the FOCA again registered an increase in the number of separation minima infringements (SMI) in Swiss airspace and the airspace delegated to and managed by Skyguide. An in-depth analysis has shown that this increase can be explained by the growing number of reports from LSZH TWR/APP and is partly due to a new reporting category known as wake turbulence separation minima infringements.

Example: A small aircraft is approaching the airport directly behind an Airbus A380. Larger aircraft create air turbulence that can affect smaller aircraft. To ensure that the smaller aircraft is not endangered, a certain minimum distance must be maintained. If this minimum distance cannot be maintained, it is referred to as a wake turbulence separation minima infringement. However, the number of separation minima infringements also increased without this additional category. Compared to the previous year, reports in 2024 (per 10,000 aircraft flight movements) increased by 25%. On the other hand, the average severity level decreased again and is roughly back to the 2018–2022 average. This suggests that the increase in the average severity level in 2023 was an exception, but it will continue to be monitored.

2.3 Resolution advisories

What this relates to: Near-misses or collisions of aircraft in the air. The Airborne Collision Avoidance System (ACAS) is intended to reduce this risk by supplying pilots with evasion instructions. The pilots are obliged to observe all messages immediately, even if the messages contradict the clearances or instructions from air traffic control.

Example: On approach to the airport, a commercial aircraft receives an abort message with the order to climb immediately. The collision warning device has located a motorised aircraft performing aerobatics in the airspace beneath it.

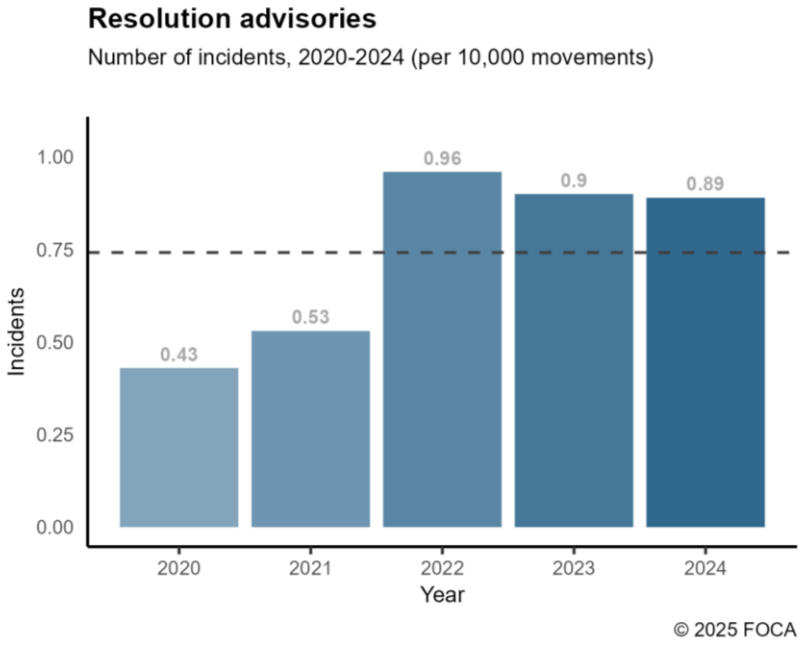

Figure 12: Incidents of resolution advisories, 2020–2024 rates and five-year average (per 10,000 movements)

Remarks on the 2024 figures: The frequency of evasion instructions (TCAS RA) reported in Switzerland since 2022 has been higher than in previous years but remains stable from 2022 to 2024. There could be several, partially desirable, reasons for this increase. Two possible explanations:

- More transponders in use. The increased number of transponders in operation enables more precise detection and identification of other aircraft in the vicinity. Consequently, the system is able to respond with greater sensitivity to potential conflicts and therefore issues evasion instructions more frequently.
- Transponder Mandatory Zone (TMZ) north-eastern Switzerland. The introduction of the TMZ has led to more aircraft operating in the defined airspace with switched-on transponders. This has increased the visibility of aircraft and the likelihood of evasion instructions being issued.

2.4 Infringements of controlled airspace

What this relates to: All infringements of controlled airspace fall within the category of airspace infringements. This includes:

- Delta or Charlie class airspace infringements by any manned aircraft in airspace under the responsibility of Skyguide (in Switzerland and in delegated airspace in Germany, France, Italy and/or Austria)
- Infringements of restricted or prohibited areas according to the same principle

Note: The rate is calculated with VFR movements, as this type of occurrences relates mainly to VFR flights.

Example: A pilot undertakes a pleasure flight with friends. While flying, he decides to change his flight path. Accidentally and without having previously asked for permission, he ends up in the Meiringen controlled airspace. He notices his mistake and calls the tower. The tower gives him permission to fly through the zone.

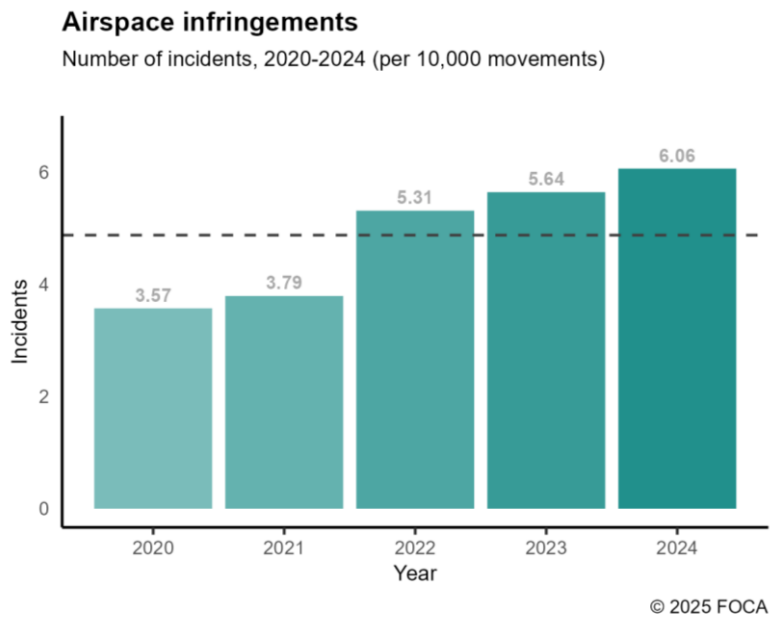

Figure 13: Airspace infringements incidents, 2020–2024 rates and five-year average (per 10,000 VFR movements)

Remarks on the 2024 figures: In 2024, 456 airspace infringements by manned aircraft were reported, 439 of which were reported in Switzerland or in airspace under the responsibility of Skyguide. This figure has remained in the same order of magnitude since 2022, roughly 10% above the pre-COVID average of 2017–2019. The rate of incidents per 10,000 movements has increased, however, due to the decreasing number of VFR flights.

Although infringements can occur in any controlled airspace, most of them are reported in terminal manoeuvring areas (TMAs) (226 in 2024; 150 in Zurich, 26 in Geneva and 15 in Bern) and control zones (CTRs) (146; 32 in Lugano, 24 in Grenchen, 20 in Zurich, 14 in Sion and 8 in Geneva). Most infringements were reported in Zurich airspace.

The complexity of the airspace is a contributing factor. A redesign of Zurich TMA has been performed and is expected to be implemented by March 2025. Although the new airspace will remain complex, the general aviation community was involved in the process in order to achieve the best possible and broadly supported solution.

There are various other contributing factors, such as delayed communication with ATC, distraction when performing other flight-related tasks, a lack of situational awareness and inadequate flight preparation.

Although the vast majority of airspace infringements had no consequences, any unauthorised intrusion into an airspace bears a risk of encounter or collision with other airspace users and must be avoided.

2.5 Flight below minimum safe altitude

What this relates to: Minimum altitudes are calculated in relation to the highest terrain or obstacle within a specified area, allowing a buffer for error. Flight below minimum safe altitude occurs when an instrument-flying aircraft infringes this buffer. This includes:

- Infringement of the buffer during departure, en route or approach phases in Switzerland or in foreign airspaces under the responsibility of Skyguide
- Flown approach path for Swiss aerodromes too low (below glide path)
- This safety performance indicator includes both flights below minimum safe altitude (MSA) and flights below minimum vectoring altitude (MVA). The generic term 'minimum safe altitude' is used for simplicity.

Note: The rate is calculated in relation to IFR movements as this type of occurrence only concerns IFR flights.

Example: Due to strong wind shears, an approaching aircraft descends faster than expected and finds itself for a short while below the standard glide slope. Alerts are triggered both on the air traffic control side and in the cockpit, and the pilot corrects the approach path.

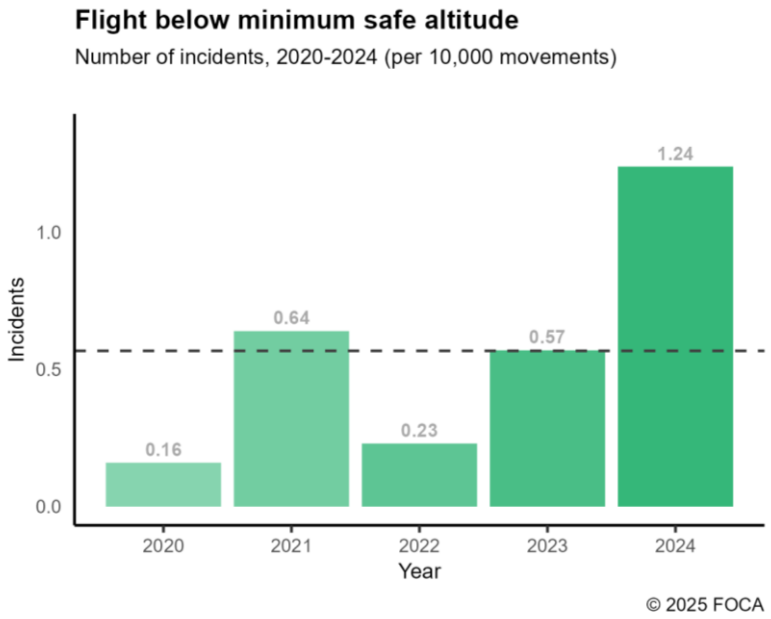

Figure 14: Incidents of flights below minimum safe altitude, 2020–2024 rates and five-year average (per 10,000 movements)

Remarks on the 2024 figures: As in past years, more detailed monitoring of the type of procedures and/or clearance deviations has been developed this year with the aim of showing more precisely where the main problems are. Due to some inconsistencies with past data, trends and comparisons with the past should be considered with caution.

There were 67 flights below minimum safe altitude reported in 2024, which shows a significant increase in comparison with the previous year (29). As mentioned above, however, this trend requires future confirmation. Most of the occurrences took place in the vicinity of the two largest aerodromes, which handle most of the IFR traffic in Switzerland. There were 31 incidents reported in the vicinity of Zurich Airport and 19 in the vicinity of Geneva Airport.

One approach below glide path on 20 April in Zurich is being investigated by the Swiss Transportation Safety Investigation Board (STSB).

The main contributing factor is aircraft deviating from their Standard Instrument Departure (SID) route, followed by level or route deviations during approach. Six occurred when the aircraft was on or intercepting the instrument landing system (ILS), which is usually noticed very quickly by pilots or by ATC.

2.6 Runway incursion

What this relates to: An occurrence at an aerodrome involving the incorrect presence of an aircraft, vehicle or person on a runway or its protected area. All Swiss aerodromes with civil traffic are considered.

Example: A pilot is cleared to taxi to the holding point of a runway and is informed that he can expect line up after the aircraft in approach has landed. He misunderstands the information as a clearance and lines up on the runway. The air traffic controller instructs the aircraft on final approach to abort the approach and climb to 7,000ft for a new approach circuit.

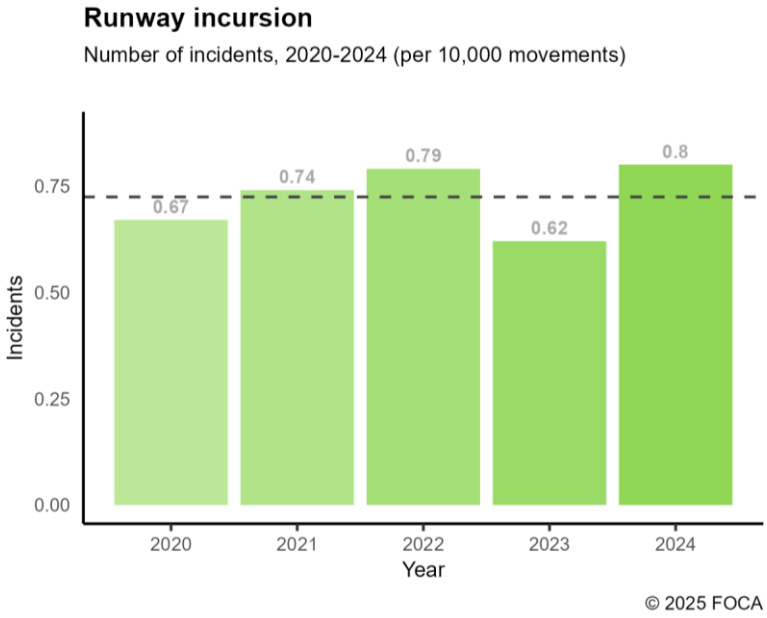

Figure 15: Runway incursion incidents, 2020–2024 rates and five-year average (per 10,000 movements)

Remarks on the 2024 figures: In 2024, 89 runway incursions were reported. This is higher than in 2023 (69) and above the pre-COVID average of 2017–2019 (69), but similar to 2022 (87). In comparison with the pre-COVID years, the rate in Switzerland was also higher in 2024 (0.80 incidents per 10,000 movements) than in 2017 to 2019 (0.57). There were 12 runway incursions reported in Zurich and 13 in Geneva. The remaining 64 occurred on regional aerodromes. The runway incursions in 2024 involved (an occurrence can involve more than one type of infringement):

- Aircraft: 60
- Vehicles: 17
- Persons: 14

There are numerous contributing factors that can differ significantly depending on the type of aerodrome and the traffic involved. At larger international airports, the most common contributing factor is misunderstandings – or misinterpretations – between ATC and pilots. Problems when vacating the runway are also a noteworthy contributing factor. On smaller or regional aerodromes, aerodrome design (fences, public roads crossing the aerodrome area, ‘tricky’ taxiways leading to the runway) and misunderstandings are frequent contributing factors.

2.7 Airborne conflicts with drones

What this relates to: Undesirable encounters between drones and aircraft in the air. Specifically:

- Collision between a drone and a flying aircraft
- Close encounters between a drone and a flying aircraft
- Presence of a flying drone in the vicinity of an aerodrome

Example: Aerial photographs of an aerodrome are cool! Two teenagers fly their drone over the aerodrome. Without authorisation. Air traffic control notices the drone. It delays the take-off of an aircraft to prevent a collision between drone and aircraft.

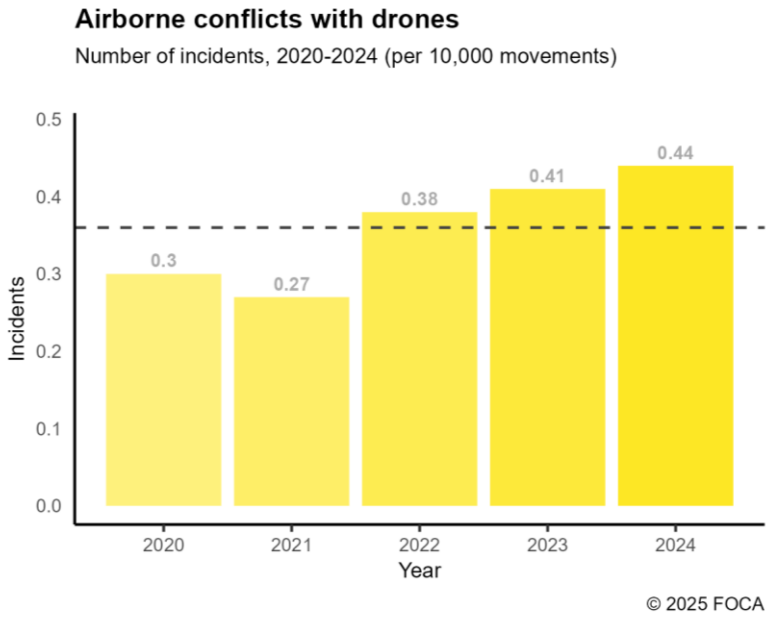

Figure 16: Incidents of airborne conflicts with drones, 2020–2024 rates and five-year average (per 10,000 movements)

Remarks on the 2024 figures: With 68 potential conflict situations reported to the FOCA (56 in Switzerland and/or foreign airspace controlled by Skyguide), 2024 remained in the same order of magnitude as the last two years and very close to the pre-COVID average of 2017–2019 (66.32 in total, 54 in Switzerland and foreign airspace controlled by Skyguide). The number of reported potential conflicts with helicopters (10 in 2024) has also remained in the same order of magnitude since 2022 and oscillates slightly above the pre-COVID average.

One collision between a leisure drone (< 250g) and a manned general aviation aircraft was reported, with minor damage to the plane. The drone was destroyed.

The number of registered pilots of drones and/or model aircraft increased from 67,838 at the end of 2023 to 94,403 in mid-December 2024. Although the number of *registered* pilots is not the same as the number of *active* pilots or the number of *flights* with drones, it is most likely that drone flights have been increasing over the years. In that context, the fact that the number of potential conflicts with manned aviation seems

to be stable is rather positive and could indicate growing awareness and knowledge among the general public of the rules when flying drones.

However, there are still reports of drones flying near helicopters, sometimes during rescue operations, which shows that at least some members of the public lack awareness of the very high risk that a collision can entail. This is particularly the case with helicopters, which are more vulnerable in the event of a collision (see guest article: Small drone, big danger – How a drone delays a Rega mission).

It is important to note that it is generally prohibited to operate drones in the open category beyond the visual line of sight (BVLOS). This type of flight is more dangerous, as the surroundings of the drone cannot be monitored adequately and is therefore subject to authorisation by the FOCA.

In conclusion, while most reported incidents had at most negligible consequences, a collision between a drone and a manned aircraft can have serious consequences. It is important that drone pilots know and comply with the relevant safety rules, in particular with the flight restrictions (refer to drone map), and that they continuously monitor the airspace surrounding their drone in order to stay well clear of any manned aircraft. General aviation pilots must remain aware that amongst other hazards, small drones fly below minimum VFR height above ground.

3 Flight operations: plan, inform, implement, monitor, report

Pilots, cabin crew, the airline's flight planning department, ground crew, engineers and air traffic controllers: many actors are involved in ensuring that a commercial flight is safe. From flight planning to implementation and monitoring, flight operations comprise activities and procedures that ensure safe and efficient operation of an aircraft.

Flight planning involves determining the ideal flight route, flight altitude and fuel requirements, while taking into account factors such as weather conditions, air traffic over the planned route and airspace restrictions. A thorough pre-flight inspection is required prior to every flight in order to ensure that the aircraft is fit to fly. Before passengers board the aircraft, the captain performs a visual check of the fuselage, landing gear, control surfaces, engines, avionics and navigation systems. The cockpit and cabin crew receive information about the flight route, fuel requirements, weather conditions, diversion airports, the number of passengers and cargo. These tasks and many others are all carried out during the planning phase.

During the flight, the pilots are responsible for monitoring the aircraft's systems, the navigation system and the weather conditions. They are in constant contact with air traffic controllers. The air traffic controllers issue instructions and clearances and ensure safe separation distances between aircraft, both on the ground and in the air.

After landing, the aircraft undergoes a post-flight inspection. The pilots inform the relevant authorities about any inconsistencies, incidents or deviations from the original flight plan.

The cabin crew is primarily responsible for the safety of passengers during a flight. They give safety instructions and demonstrations before the flight and do checks on all safety equipment, as well as ensuring that passengers have their seatbelts fastened, carry-on baggage is properly stowed and no safety hazards exist. Responding to potential security risks, such as unruly passengers or security violations, is also a task.

Incidents during flight operations: overview of top safety issues in 2024

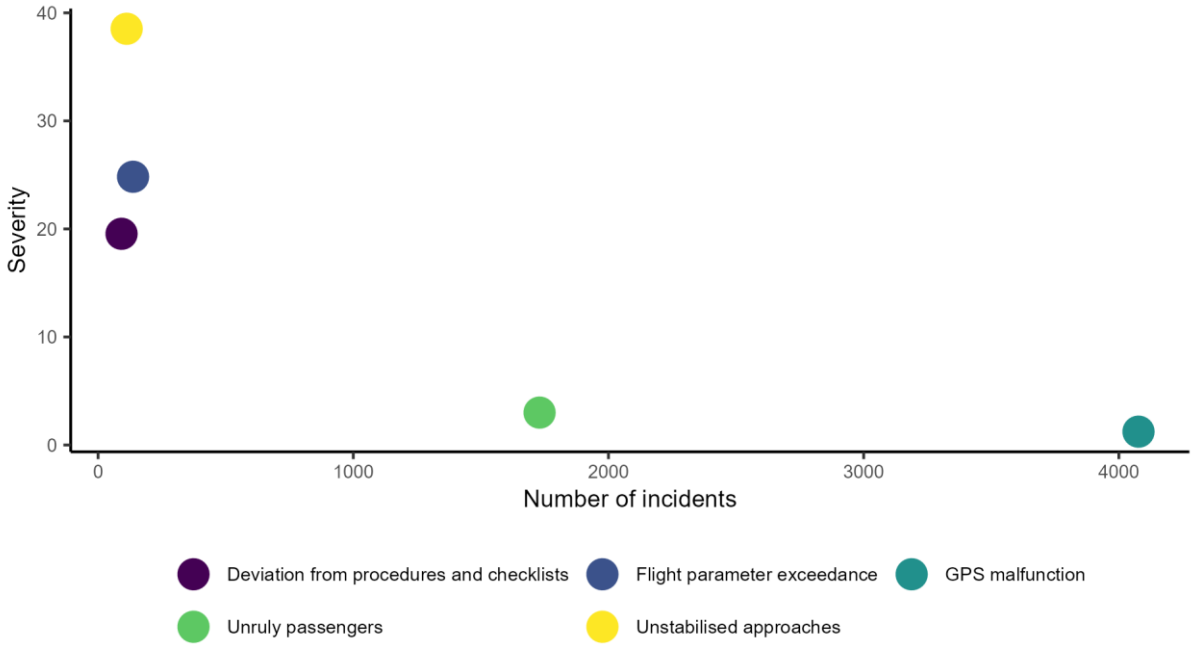

Figure 17: Number of incidents and severity of top safety issues in flight operations, 2024

Safety issues, 2020–2024

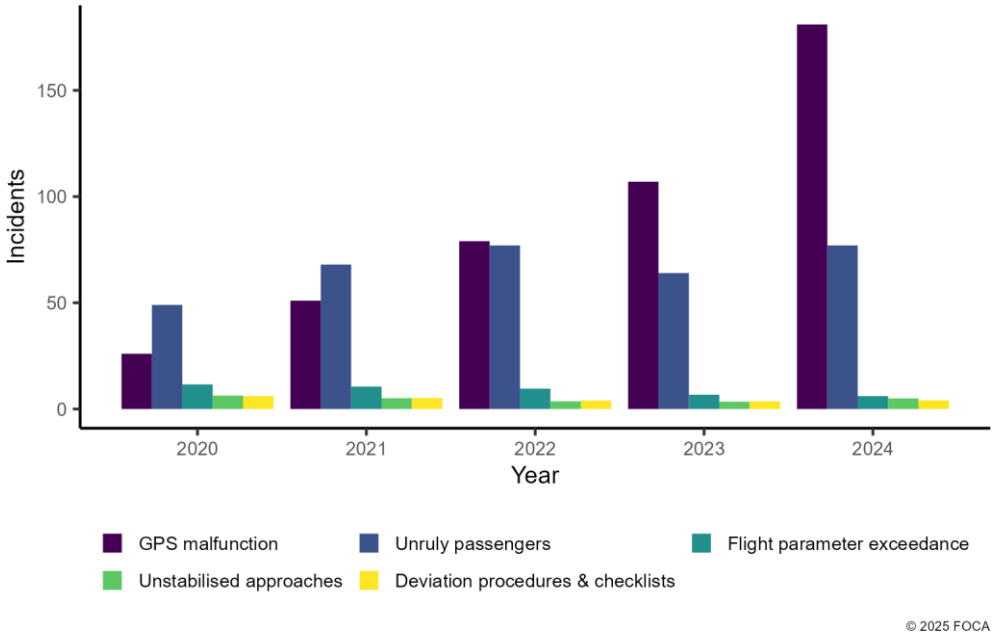

Figure 18: Top safety issues in flight operations, 2020–2024

3.1 GPS malfunction

What this relates to: Flight operations use GPS signals for navigation and positioning. The GPS receives signals from a satellite network in orbit around the Earth, enabling aircraft to determine their precise geographical position, height and speed. Frequency transmitters are used on the ground to block or jam these signals in the air for military purposes. GPS malfunctions primarily occur near geographical conflict zones, for example in Eastern Europe and the Middle East.

Example: A passenger aircraft is flying over the Middle East. Suddenly, the GPS transmits an incorrect position. The crew decides to switch off the GPS and continue the flight with other radio navigation devices. Since critical systems are designed to be redundant, this has no negative consequences for the safe continuation of the flight. After ten minutes, the GPS signal reconnects and the aircraft resumes normal navigation.

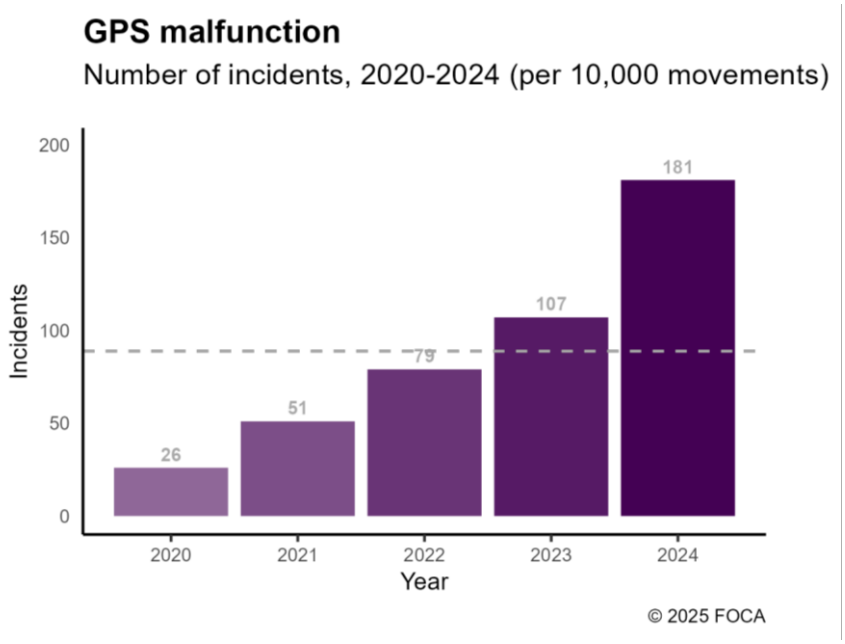

Figure 19: Incidents of GPS malfunction, 2020–2024 rates and five-year average (per 10,000 movements)

Remarks on the 2024 figures: In 2024, the Federal Office of Civil Aviation (FOCA) received around 4,000 reports of GPS interference, a figure that has been rising steadily in recent years and is globally recognised as a widespread problem (2020: 230 reports). About 80% of these events occurred in Southeastern Europe and the Middle East, affecting areas of military and political conflict.

GPS malfunctions do not have a significant impact on safety due to the presence of multiple on-board radio-navigation devices, but spoofing – the creation of false GPS signals – may impact the safety of flight operations. Spoofing, which became more common in 2024, has therefore become the focus of attention.

In Switzerland, there have been isolated incidents without serious consequences. The Federal Office of Communications (OFCOM) investigates such cases.

3.2 Unruly passengers

What this relates to: International aviation authorities such as the International Civil Aviation Organization (ICAO) and the International Air Transport Association (IATA) have strict regulations to address unruly passenger behaviour, and airlines follow a zero-tolerance policy.

Unruly passengers on board an aircraft engage in disruptive, violent or non-compliant behaviour that interferes with the safe and orderly operation of the flight. This can range from minor disturbances to serious threats that endanger the crew, passengers, and aircraft.

Examples include refusing to follow crew instructions (e.g. not wearing a seatbelt, ignoring the smoking ban), engaging in acts of verbal or physical aggression toward crew members or other passengers, becoming intoxicated and behaving disruptively and making real or hoax threats (including bomb threats or false claims of danger).

Possible consequences are fines and legal prosecution, financial liability for costs incurred due to delays or diversions, and permanent bans from airlines.

Example: A passenger is caught smoking a cigarette in the cabin or toilet. He is advised by the cabin crew that this is not allowed and is asked for his personal details and passport. He refuses to give his details and becomes very aggressive and violent. The pilots inform air traffic control that the police will be needed on arrival. After landing, the passenger is taken into custody by the police. The passenger can expect to be prosecuted and fined.

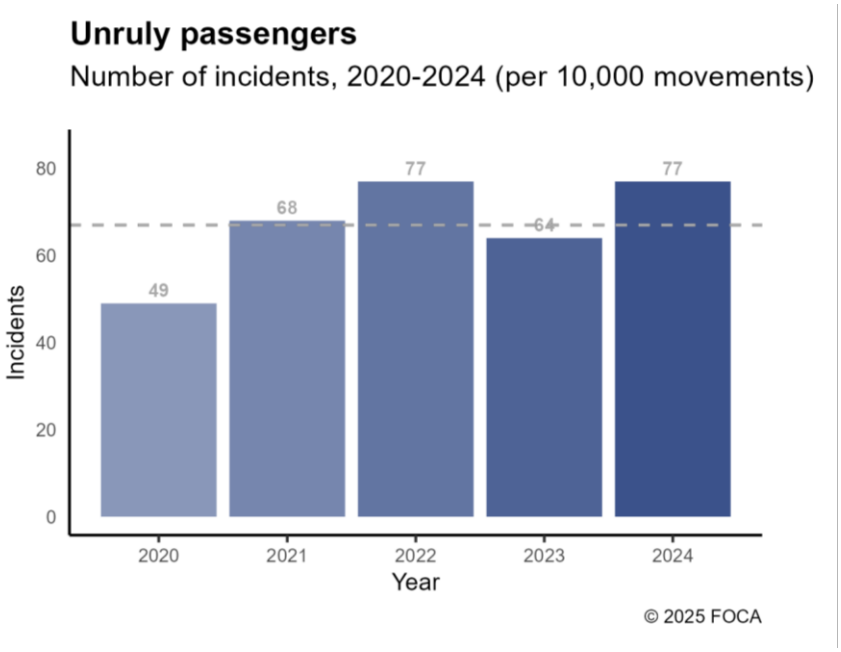

Figure 20: Incidents of unruly passengers, 2020–2024 rates and five-year average (per 10,000 movements)

Remarks on the 2024 figures: There were 1,730 incidents reported in 2024. In 432 cases, airlines such as Swiss, Edelweiss, easyJet Switzerland, Helvetic Airways and Chair reported passengers refusing to fasten their seatbelts or stow their luggage correctly, despite being asked to do so.

Other inappropriate behaviour included passengers' verbal disputes with crew members or other passengers (360 cases), ignoring the smoking ban (308 cases), excessive alcohol or drug consumption (201 cases) and unauthorised consumption of their own alcohol (136). In almost 100 cases, there was even violence against the flight crew or between passengers. Another 80 cases concerned violations of animal transportation requirements.

Last year, the FOCA imposed 142 fines on disruptive passengers. The fines usually range from CHF 400 to 1,000. However, enforcement is often not straightforward as many passengers are difficult to identify after their return abroad.

3.3 Exceeding of flight parameters

What this relates to: Pilots or external influences such as weather-induced turbulence or wind shear can cause the flight parameters to be exceeded. This includes excessively rapid changes in airspeed, direction or attitude, and exceeding the technical limits of aircraft systems.

Example: On approach to an airport, a passenger aircraft encounters severe turbulence. The pilot corrects for this using the elevator inputs. This is not sufficient. The alarm for excessive banking of the aircraft sounds. As a consequence, the pilot decides to abort the approach. The second approach is successful and the aircraft lands safely.

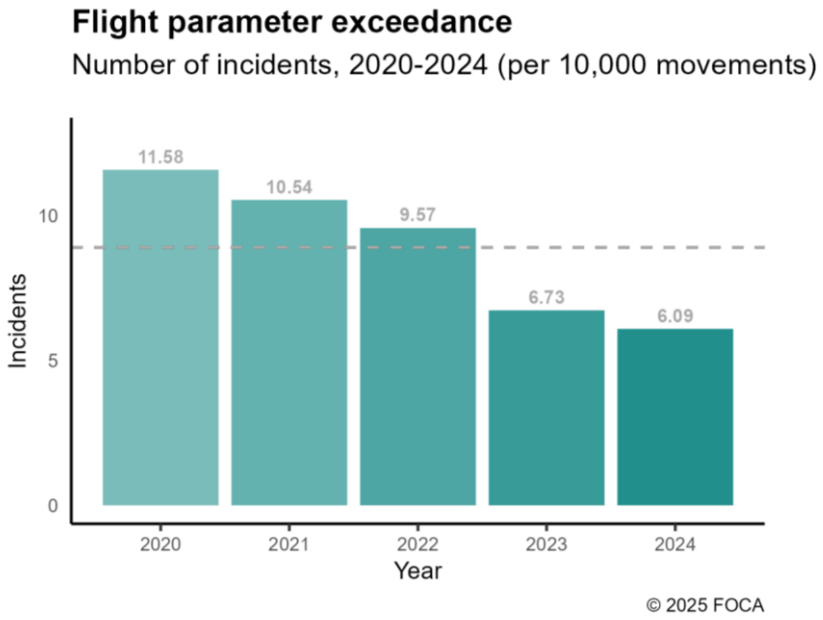

Figure 21: Incidents of flight parameter exceedance, 2020–2024 rates and five-year average (per 10,000 movements)

Remarks on the 2024 figures: The number of incidents per 10,000 aircraft movements has again decreased slightly over the last four years. 95% of reports were received from commercial air transport flight crews, who report flight parameter exceedances.

Of the cases in which parameters were exceeded, 58% occurred during the approach or landing phase, 35% en route and 7% during the take-off phase. Severe weather conditions such as turbulence or wind shears were the main causal factor for these deviations. Other factors were induced by the flight crews during configuration of flaps/slats right at the speed limits without any safety effect. Exceeding of parameters includes overspeed or underspeed (79%), exceeding the banking angle (16%) and small aircraft pitch deviations (5%) during landing.

3.4 Unstabilised approaches

What this relates to: An unstabilised approach in aviation refers to an approach to landing at the destination where the aircraft does not meet established safety criteria for a stable descent and approach to the runway, typically set by airlines or aviation authorities. These criteria include parameters like speed, altitude, descent rate, configuration, and alignment with the runway.

Example: At the airport of arrival, stormy weather conditions prevail, with severe turbulence and wind shear, as well as heavy rainfall. On the approach to the runway, the aircraft veers off the glide path and experiences strong turbulences. The pilots decide not to abort the approach and continue on to land with strong glidepath corrections. The aircraft makes a hard landing. After landing, the mechanics must check the landing gear for possible damage.

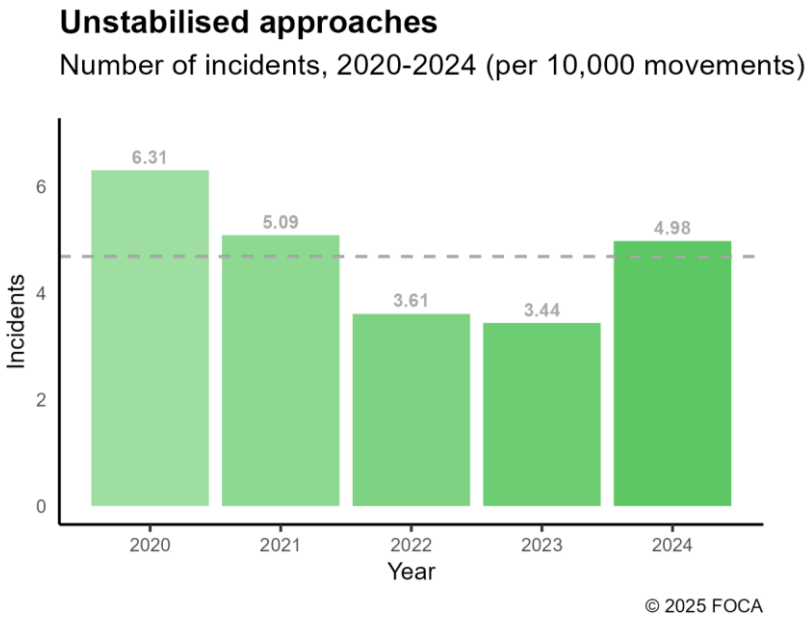

Figure 22: Incidents of unstabilised approaches, 2020–2024 rates and five-year average (per 10,000 movements)

Remarks on the 2024 figures: Unstabilised approaches were mainly reported in commercial air transport. This involved deviations from required stabilisation criteria such as altitude, rate of descent, speed and configuration with a correct flight path and alignment with the runway centreline on the approach to the runway. Such drifts from target values are often caused by abnormal weather situations including turbulence, wind shifts and changing head- or tailwind.

No accidents or serious incidents were registered in 2024, but one third of the destabilisations were corrected rather late. Such events are analysed in detail within the safety departments of the organisations concerned. This process is supported by flight data and discussed with affected flight crews for continuous improvement.

3.5 Deviation from procedures and checklists

What this relates to: The increasing complexity of technology and systems on an aircraft requires precisely defined procedures and checklists to minimise the error rate of aircraft operation. These tools specify how the pilots should fly and how they should use the technology correctly.

Example: The pilots are distracted by a call from the cabin crew. They forget to set the flaps while working through the checklists, so the flaps are still at zero degrees when the pilots press the button for the electronic configuration check. The alarm goes off. They acknowledge the alarm and set the flaps to the correct position. After the correction, the aircraft returns to normal operation.

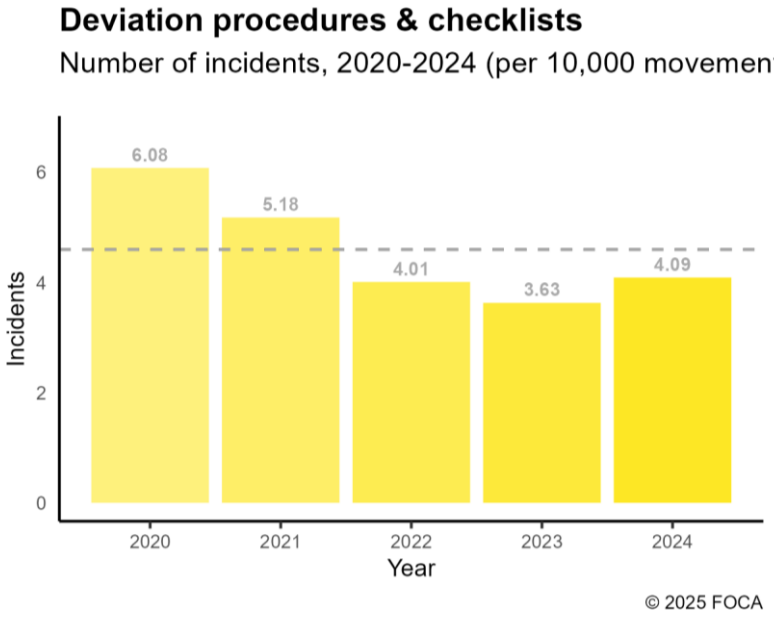

Figure 23: Incidents of deviation from procedures and checklists, 2020–2024 rates and five-year average (per 10,000 movements)

Remarks on the 2024 figures: Almost 95% of deviations from procedures and checklists occurred in commercial air transport, and the incident rate has remained stable over the last three years. In the area of recreational aviation, such deviations are reported much less frequently due to cultural factors, a reduced professional assessment of situations and a lack of awareness.

No accidents or serious incidents were recorded in 2024 in this area, which includes delayed configuration or adjustment of spoilers, flaps, altimeter and aircraft trim or non-compliance with speed limits. Deviations from procedures and checklists can be caused by pilots getting distracted in the cockpit due to communication, noise, navigation or weather, thus resulting in missing or delayed actions during the flight. Such incidents occurred generally in all phases of flight, with one third observed in the approach phase.

4 Helicopters: transporting, rescuing, surveillance

Transporting a cow with a broken leg from its alpine pasture down to the valley, extinguishing a forest fire, rescuing a lost hiker: helicopters are used in various private and public activities, with private sector activity largely comprising the transport of people and goods or emergency and rescue missions.

In comparison with other aircraft, helicopter operations involve one-of-a-kind challenges requiring unique skills. Whether air transport or surveillance, rescue operations or medical evacuations, helicopter operations require special training for both pilots and ground personnel.

It is important to bear in mind that the number of helicopter-related incidents reported each year varies significantly, but the overall numbers are low. Analysing the categories and identifying developments and trends is only possible to a limited extent.

Incidents with helicopters: overview of top safety issues in 2024

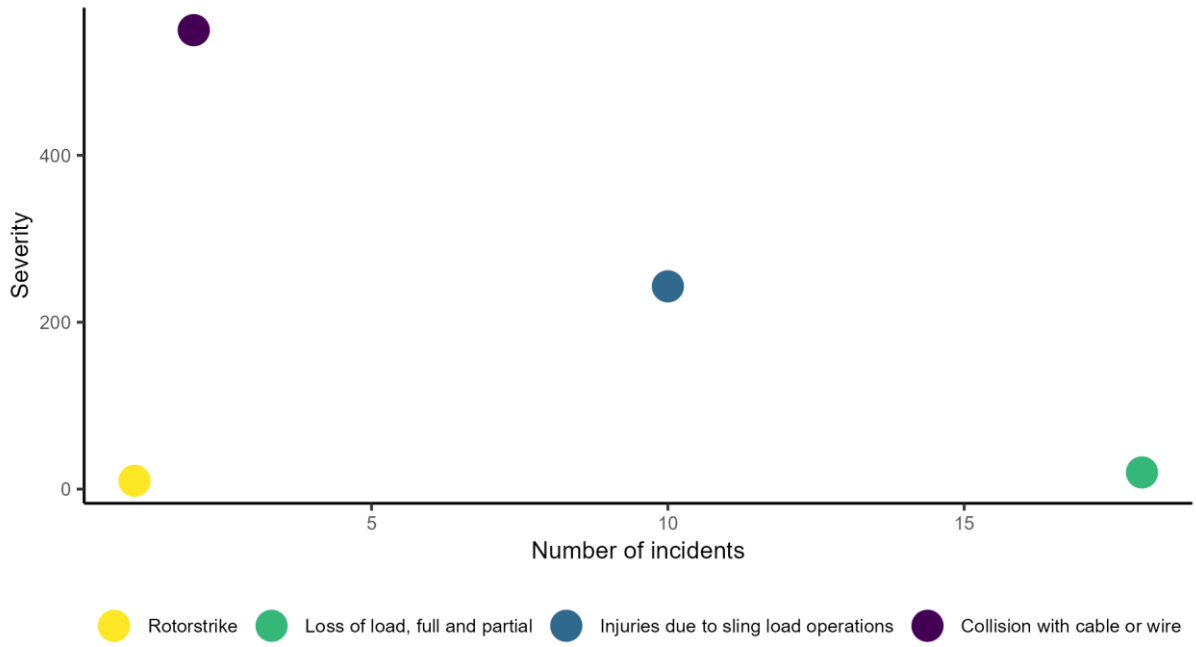

Figure 24: Number of incidents and severity of top safety issues in helicopter operations, 2024

Safety issues, 2020–2024

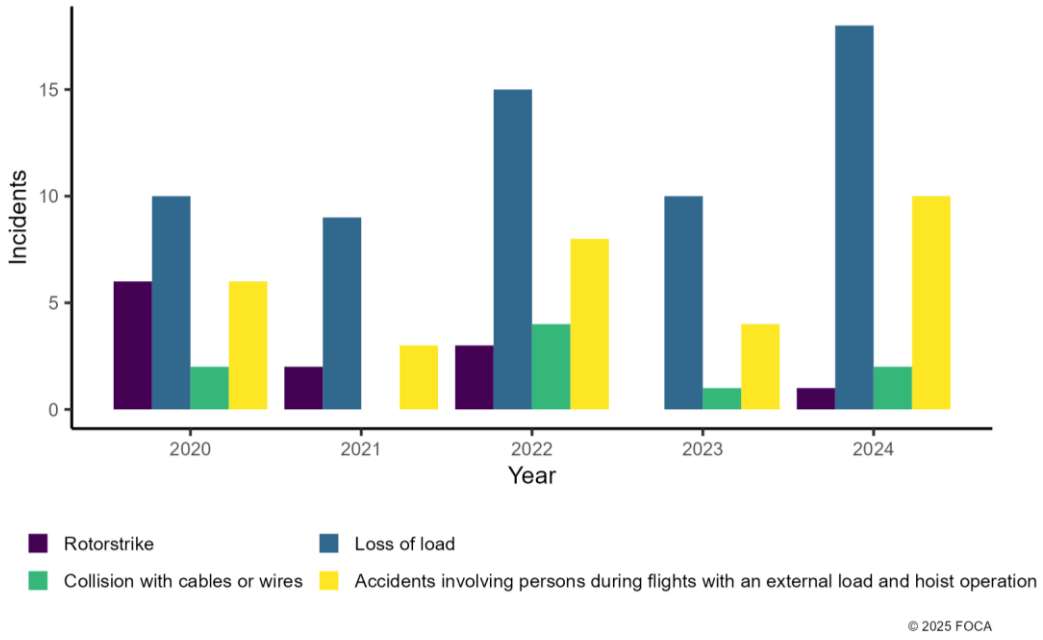

Figure 25: Top safety issues in helicopter operations, 2020–2024

4.1 Rotor strike

What this relates to: Cables or wires, trees, masts: the main or tail rotor blades collide with an obstacle on the ground during a helicopter operation and the helicopter is damaged.

Example: A helicopter disembarks a person at a farm. The terrain is too steep for a landing, so the pilot moves the helicopter a few metres to the left. He comes too close to a tree and the force of the downwash pushes a branch away. After landing, the downwash reduces. The branch snaps back so far that some twigs and leaves touch the end caps of the rotor blades. Green marks are visible on the leading edge of the end caps.

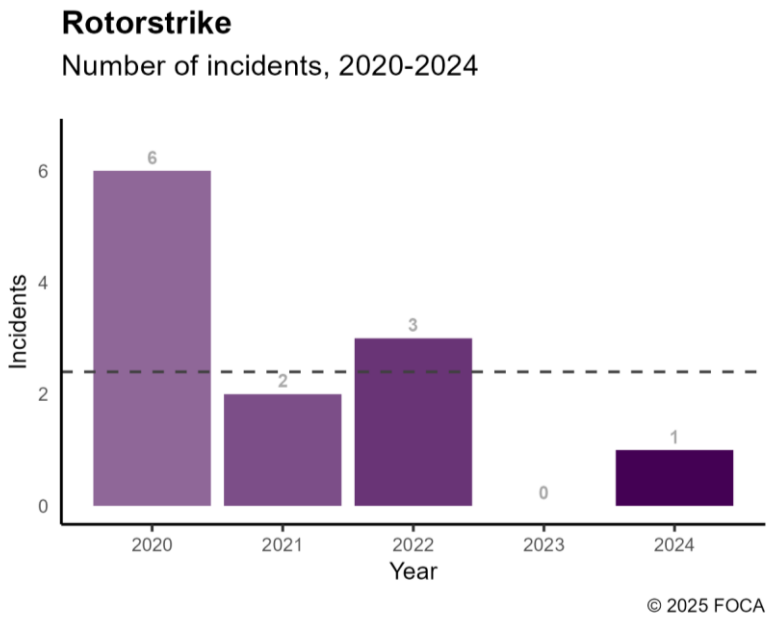

Figure 26: Rotor strike incidents, 2020–2024 rates and five-year average

Remarks on the 2024 figures: One report of rotor strike in 2024; up to six rotor strikes per year from 2020 to 2024. This equates to 2.4 reports per year on average over the last five years. The danger and the potential for personal injury or damage to helicopters are great. Therefore, the FOCA is monitoring further developments very closely.

4.2 Loss of load

What this relates to: Some or all of the external cargo can be lost during a transport flight.

Example: A customer has prepared a net for transport. There are two wooden posts at the bottom of the net, with two large sacks of material, a refrigerator and an emergency generator above them. This prevents the flight assistant from seeing the posts. The helicopter takes off – as it's flying away the load twists around and the wooden posts fall out of the net.

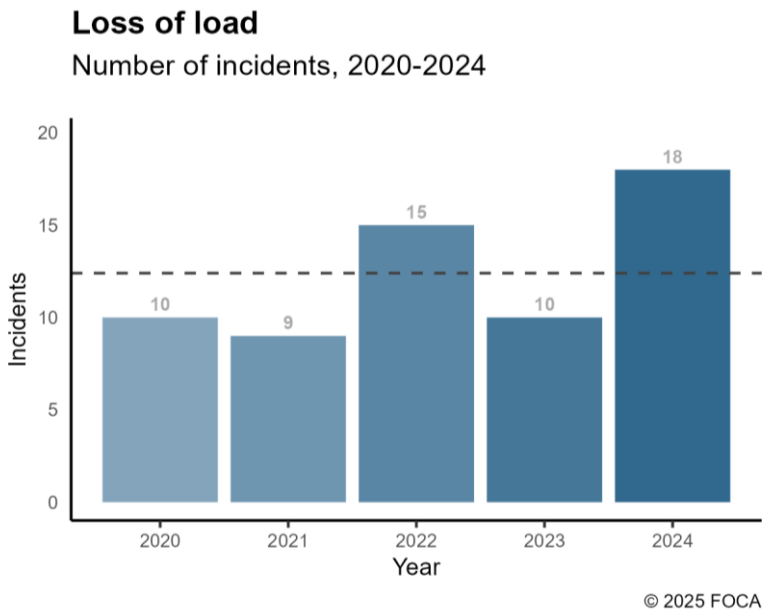

Figure 27: Loss of load incidents, 2020–2024 rates and five-year average

Remarks on the 2024 figures: There were 18 reported cases of loss of load in 2024. From 2020 to 2024, there were between 9 and 18 cases per year. The annual average for the last five years is 12.4; with 18 load losses in 2024, it is higher than average. It should be noted, however, that only absolute figures can be shown here at present. It is therefore not yet possible to determine whether more incidents have actually been reported in relation to the number of operations. Inadequate preparation of the load was the most frequent cause.

4.3 Laser attacks

What this relates to: A bright light. The light appears suddenly, blinding the pilots. 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, take-off or low-altitude flight, which require a pilot's full attention.

Example: A helicopter is flying to its base. Suddenly a laser beam is aimed at the crew, disrupting the approach. The pilot reacts quickly, and warns the crew of the beam coming into the cockpit. Nobody is injured. He briefly switches the positioning lights off, and the laser activity stops.

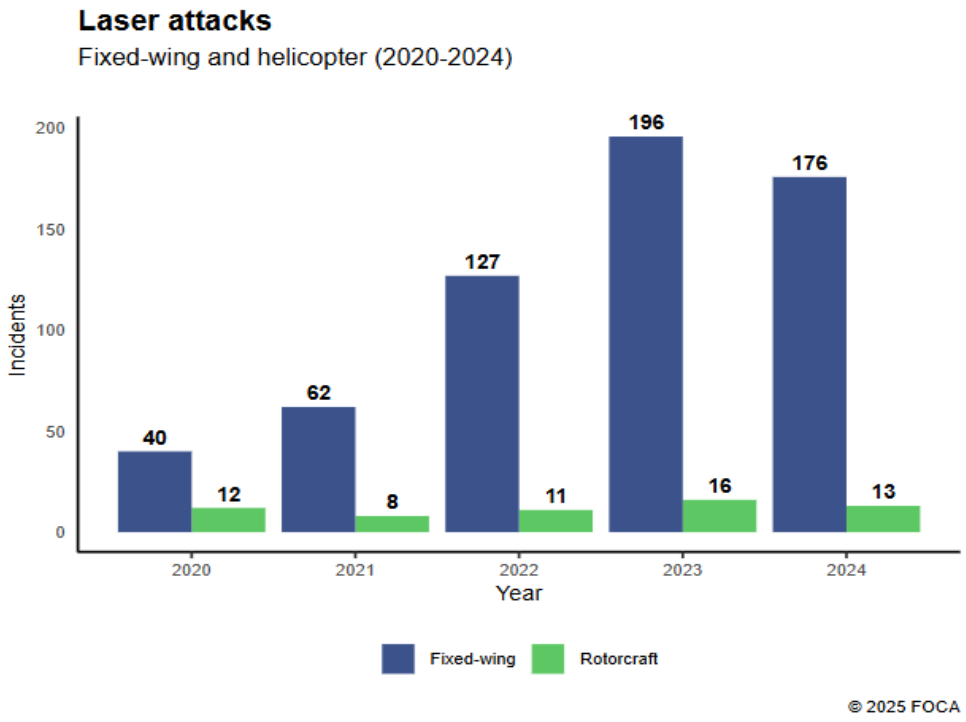

Figure 28: Laser attack incidents, 2020–2024 rates and five-year average

Remarks on the 2024 figures: In 2024, there were 13 reports of laser attacks on helicopter crews; three cases less than 2023. The average annual value for the last five years is 12 reports. The potential hazard is quite significant as most helicopters have a crew consisting of just one pilot. If dazzling occurs during a sensitive flight phase such as low-level flight, approach or departure – when flying to a hospital landing site in a densely populated area, for example – the pilot has little time to bring the situation back under control. In 2024, there were 177 reports of laser attacks on aeroplanes (−10% compared to 2023), which also represented a higher number than the five-year average of 120.2 reports per year. The number of reports went down during the COVID pandemic, with 40 reports in 2020 and 62 in 2021. Since 2022 the number of cases has increased markedly. In contrast to helicopter operations, the danger to a commercial aircraft and its occupants is somewhat lower as there are two pilots in the cockpit and the autopilot ensures safe flying in most cases. Despite the lesser danger for a commercial aircraft, laser attacks are still hazardous because they can result in lasting eye damage for crew members.

4.4 Collision with cables or wires

What this relates to: Transport cables in the mountains, high-voltage lines, wires: such obstacles are a serious hazard for helicopters.

Example: A helicopter is involved in flying materials from a mountain into a valley. When approaching the unloading site, the helicopter touches a cable and crashes.

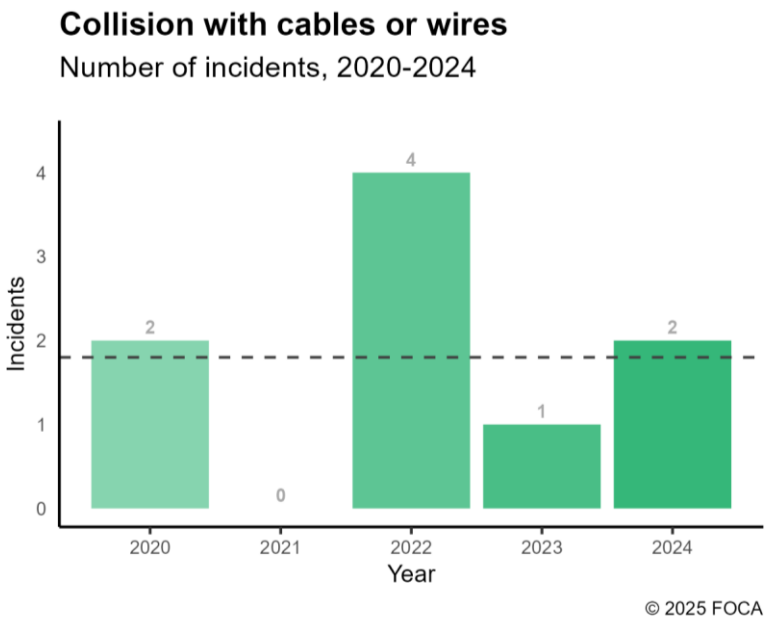

Figure 29: Incidents of collision with cables or wires, 2020–2024 rates and five-year average

Remarks on the 2024 figures: There were two reports in 2024; the severity of the incidents was high. In one case, the helicopter was able to land safely without any damage to people or the helicopter. In the second case, the pilot was seriously injured. This accident is being investigated by the Swiss Transportation Safety Investigation Board (STSB). Such collisions can rapidly have serious consequences. In 2022, a pilot lost his life in an accident while another was severely injured in a separate event.

Collisions with cables or wires is unfortunately a recurring issue. The FOCA carried out a detailed risk assessment in 2023 to obtain an accurate overall view. It took into consideration all available information in carrying out its risk assessment: the reporting process, entering of cables in the air navigation obstacle database, standard operating procedures (SOP), database-based warning systems onboard aircraft, the Rope Tracker project to map cables accurately, cable marking, etc. The FOCA concluded that although the risk is currently acceptable, it will continue to monitor the issue.

4.5 Accidents involving persons during flights with an external load and hoist operation

What this relates to: A load that is attached to the helicopter on a transport line is referred to as an external load. An accident occurs and the external load injures someone.

If a patient needs to be rescued in difficult terrain and the helicopter cannot land nearby for the evacuation, the rescue hoist is used.

Example: A helicopter is transporting cast iron pipes. The helicopter has already lifted the load by about one and a half metres, when all of a sudden, a pipe comes loose from the stack of pipes that are not being flown and hits a labourer on the head. Why? The labourer had previously been requested to secure the pipes on the stack, but he didn't do it.

A person is to be rescued using the rescue hoist. The helicopter crew and the rescue specialists discuss the risk of falling rocks and dry tree branches. The rescue specialists are flown to the patient. To reduce the effect of the downwash on the branches, a decision is made to extend the hoist cable. Despite the hoist cable extension, a finger-thick branch breaks off and injures one of the rescue specialists.

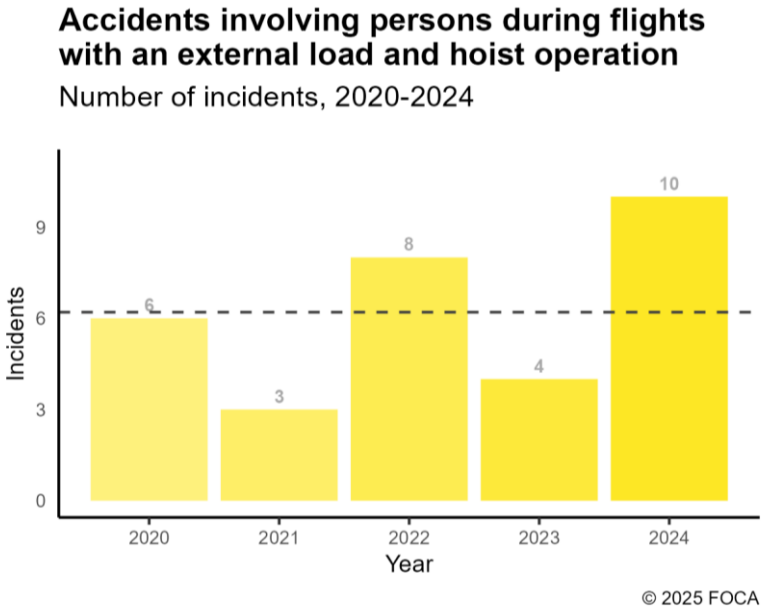

Figure 30: Incidents of injuries with external load operations, 2020–2024 rates and five-year average

Remarks on the 2024 figures: Ten people were reported injured during transport operations with sling loads or during hoist operations. This number is well above the five-year average of 6.2 per year. The hazard potential for people on the ground such as flight assistants, construction workers and medical crew members is relatively high. The risk is particularly high during assembly work and rescues in rough terrain – even if everyone is wearing personal protective equipment, anybody not directly involved in the work or rescue must be sent out of the hazard perimeter and all precautionary measures must be taken. Further training and awareness-raising are very important, for example at the annual meeting in late autumn where flight assistants discuss their experiences. Correct assessment and avoidance of hazard situations should receive special attention.

5 Airworthiness: developing, manufacturing, operating, maintaining

Technical systems are essential for the safe and reliable operation of aircraft. These include propulsion systems such as jet engines, piston engines or electrical flight control systems, navigation, communication and safety systems, etc.

A system can only operate correctly and safely when it has been developed, manufactured and maintained in accordance with the specified standards. The chapter on aviation technology covers not only incidents involving technical aircraft systems, but also the development, production and maintenance of aircraft and the related technology.

Please note that the remarks in this chapter are based on the number of reported occurrences for aircraft registered in Switzerland.

Airworthiness incidents: overview of top safety issues in 2024

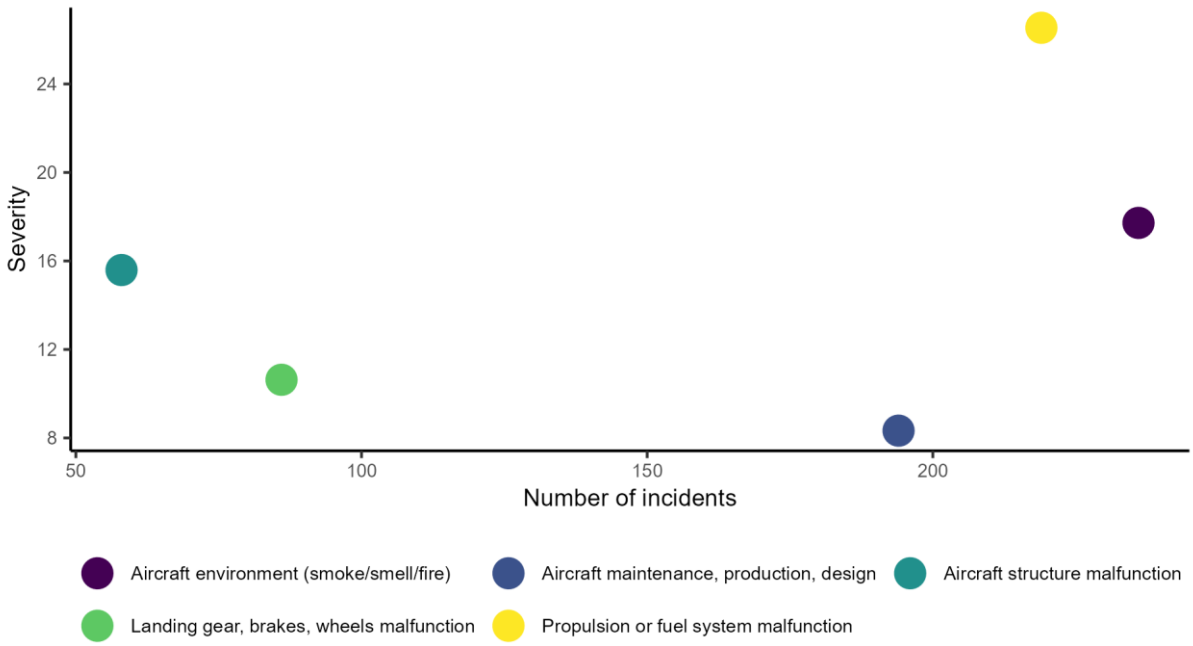

Figure 31: Number of incidents and severity of top safety issues regarding airworthiness, 2024

Safety issues, 2020–2024

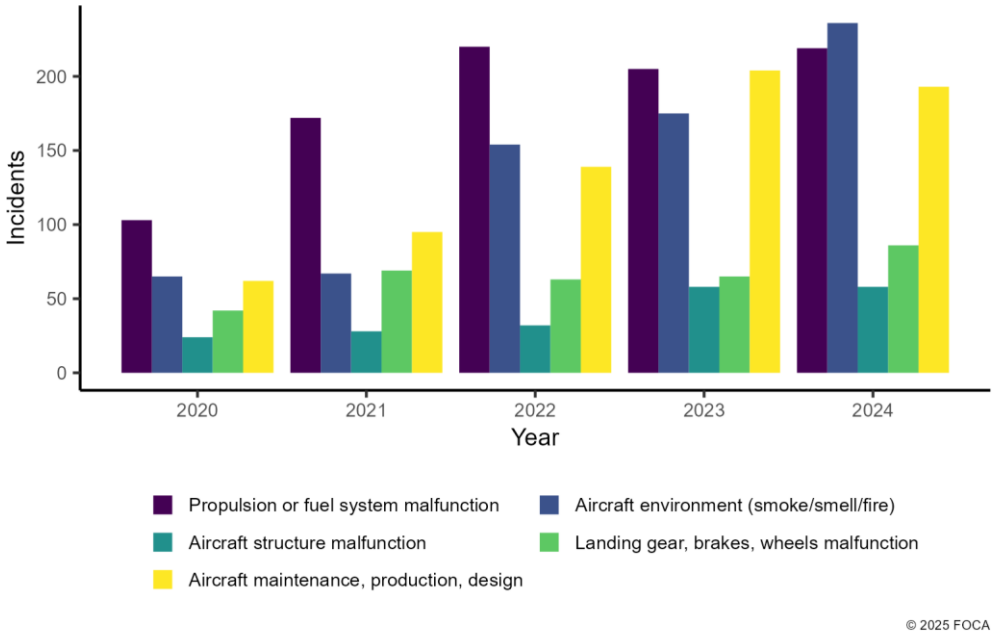

Figure 32: Airworthiness top safety issues, 2020–2024

5.1 Propulsion or fuel system malfunction

What this relates to: The engine/fuel system of an aircraft develops a fault, which can include a partial or complete loss of power.

Typical causes include technical defects in the propulsion systems (engine, propeller, gearbox and associated systems) or in the fuel system, user errors, maintenance errors, damage on the ground, birdstrike, unfavourable weather conditions, lack of fuel or contaminated fuel.

Example: Shortly after take-off, a single-engine aircraft with a piston engine begins to sputter and loses power. The pilot returns to the airport.

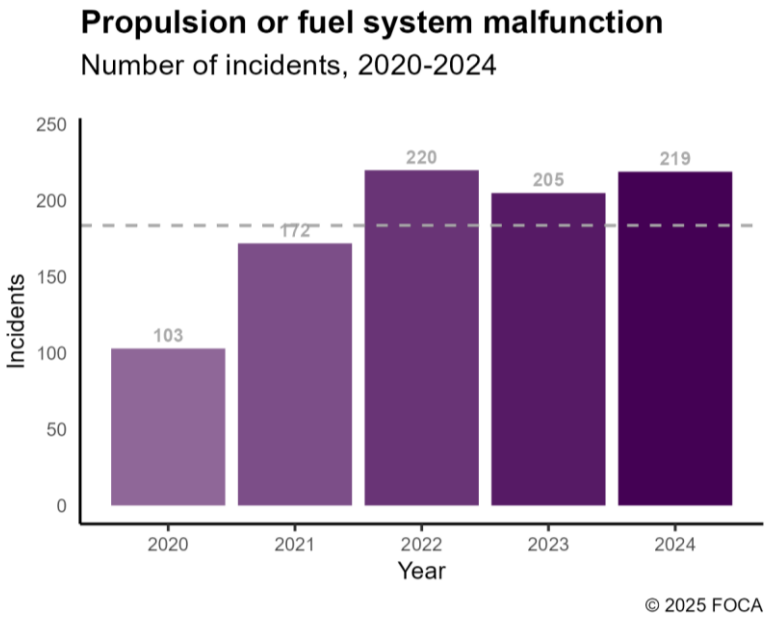

Figure 33: Incidents of propulsion and fuel system malfunction, 2020–2024 rates and five-year average (per 10,000 movements)

Remarks on the 2024 figures: In 2024, the number of reported incidents related to propulsion and fuel systems was roughly on a par with other non-COVID years and slightly higher than the previous year, following the recovery in traffic. As in the year before, the majority of engine-related incidents related to piston-engine aircraft. The investigation of possible causes for these incidents by the European Aviation Safety Agency (EASA) in cooperation with other national authorities in Europe and the Federal Office of Civil Aviation (FOCA) is ongoing.

There was an accident in commercial aviation due to problems with a turbine engine which led to smoke in the aircraft and an emergency landing. This was also the main driver for a small increase in the average severity level.

As in other categories, reported incidents decreased significantly as a result of the decline in traffic during the COVID pandemic and increased again during the post-COVID recovery in traffic.

5.2 Incidents due to smoke, smells, fumes, fire

What this relates to: Fumes or smells can arise in an aircraft for a variety of reasons. Depending on the source, concentration and chemical composition of the fume, the health or capabilities of the aircraft occupants may be endangered. To avoid potential risks, the crew may decide to land or use oxygen masks as a precaution. Airlines use established procedures to investigate such incidents and rectify 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. Fires can also lead to crew and passenger injuries. These incidents usually overlap with other areas. Known technical causes of smell events are therefore also listed in the relevant technical chapters of this report.

Example: During the cruise phase of a flight, the cockpit crew of a passenger aircraft detects an unusual smell and follows the relevant procedures for such a scenario. After landing the crew reports the observation to the maintenance organisation, and the latter determines the cause.

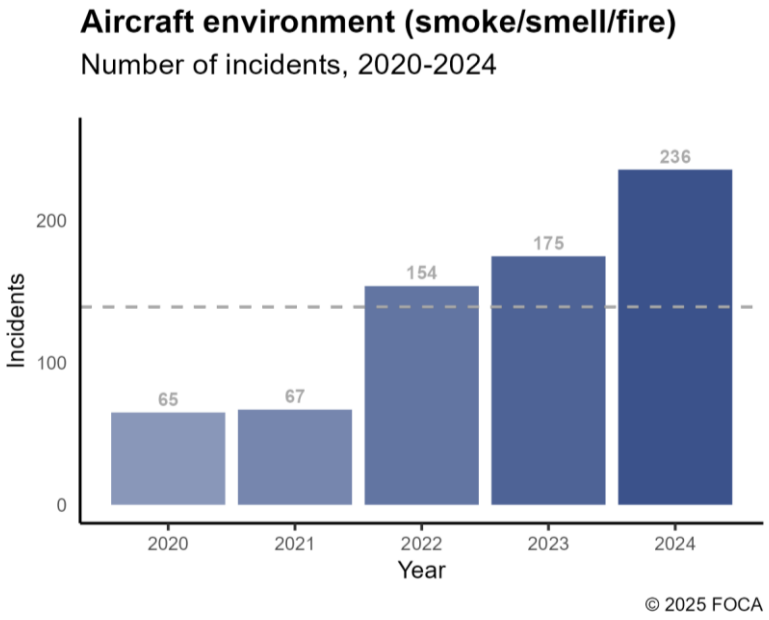

Figure 34: Incidents of smoke, smells, fumes and fire, 2020–2024 rates and five-year average (per 10,000 movements)

Remarks on the 2024 figures: The number of incidents of unusual smells in aircraft was higher in 2024 than in the previous year and is roughly at the same level as before the decline in traffic caused by COVID. Only a small proportion were of a higher severity level (3.4%). The increase compared to the previous year (2023: 2.1%) and the increase in average severity were mainly driven by the accident mentioned in chapter 5.1, Propulsion or fuel system malfunction. As in the preceding year, in about 19% of the incidents the cause was found to be in the jet engines, piston engines or the auxiliary power unit (APU). For about 57%, no identifiable cause (non-reproducible individual cases, ambient influences) could be established or the troubleshooting was still ongoing. The remainder had various causes, such as cabin, electrical and air conditioning systems.

5.3 Aircraft structure malfunction

What this relates to: The structural integrity of an aircraft is crucial for safe operation. This chapter looks at primary aircraft structures such as the wings, fuselage and empennage, as well as windshields, canopies, doors and structural elements within the aircraft.

Example: During a scheduled inspection the engineers detect cracks in a longeron of the aircraft fuselage structure. The affected part is removed and replaced.

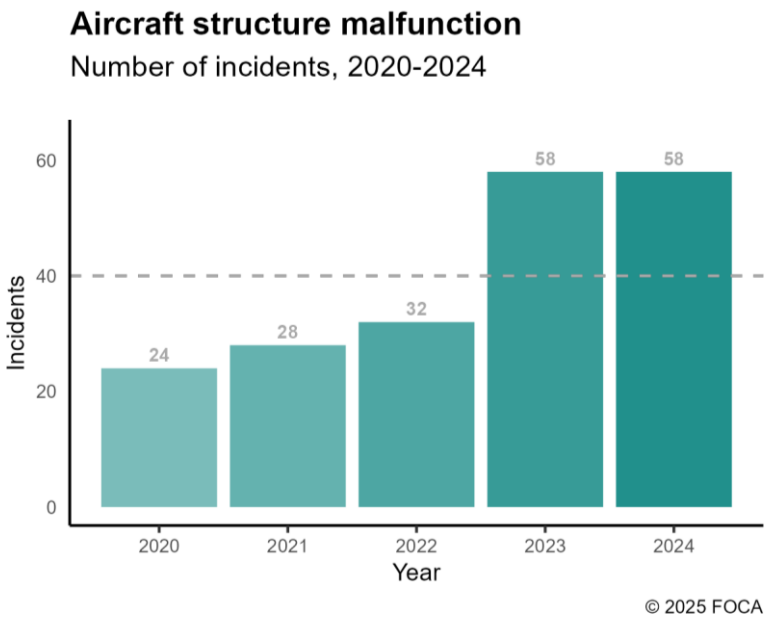

Figure 35: Aircraft structure malfunction incidents, 2020–2024 rates and five-year average (per 10,000 movements)

Remarks on the 2024 figures: The number of reported incidents remained unchanged from the previous year, while the average severity level decreased. 8.4% of the total of reported cases were classified as higher severity. The main problems concerned doors, followed by wing and fuselage structures and windshields.

5.4 Landing gear/brakes/wheels malfunction

What this relates to: Malfunctioning landing gear, a problem with the extension or retraction system, faulty brakes, a damaged tyre. Such malfunctions can lead to a variety of incidents: the aircraft might land with the landing gear retracted, the landing gear may collapse during landing or may not retract after take-off, or the aircraft may overshoot the runway.

Example: A single-engine aircraft is landing on the runway when a tyre bursts on the left side of the main undercarriage. Nevertheless, the aircraft is able to exit the runway via the taxiway.

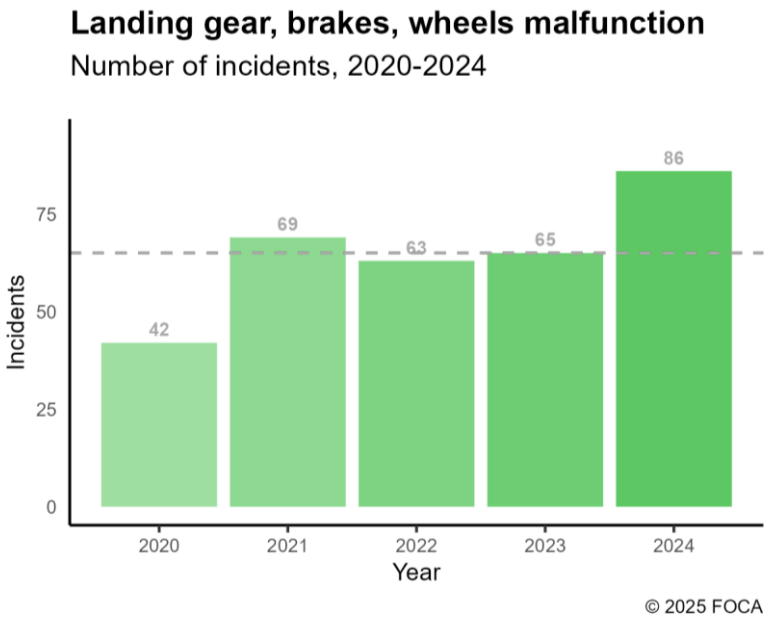

Figure 36: Incidents of malfunctioning landing gear, brakes or wheels, 2020–2024 rates and five-year average (per 10,000 movements)

Remarks on the 2024 figures: The number of incidents shows a similar development in relation to traffic as in the other categories. The majority of the reports related to wheels (including tyres and brakes), followed by the undercarriage retraction and extension system. The average severity level stayed roughly equal to the previous year, with only a small number of events of higher severity (2.3%).

5.5 Aircraft maintenance

What this relates to: Faulty or incomplete maintenance work; foreign objects such as tools or material left in the aircraft after maintenance; problems in planning and monitoring of maintenance activities, use of documentation and compliance with procedures; or production and known design problems. These are reportable incidents that can occur during aircraft or component maintenance, production or design.

Example: During maintenance, the aircraft technician finds loose terminals. The manufacturer did not tighten them to the prescribed torque.

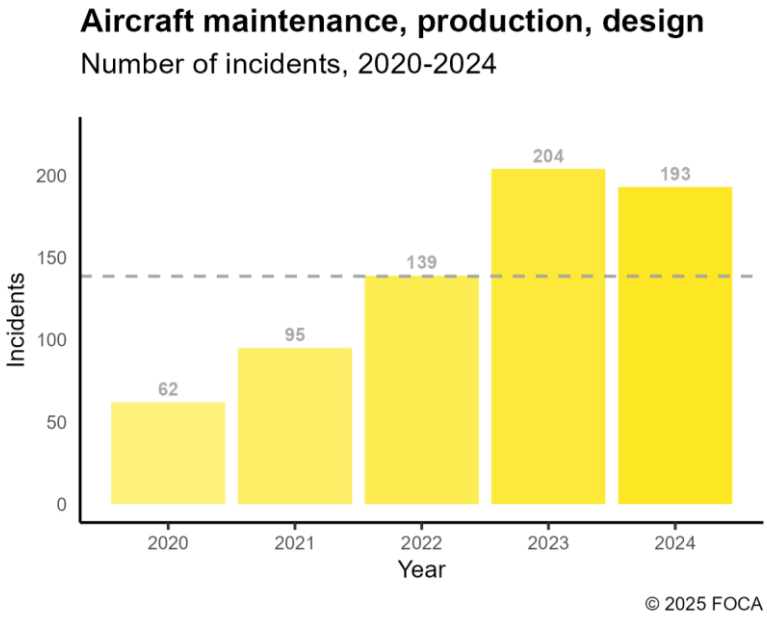

Figure 37: Aircraft maintenance incidents, 2020–2024 rates and five-year average (per 10,000 movements)

Remarks on the 2024 figures: There was a slight decrease in the number of reported maintenance incidents compared to the previous year. The average severity level dropped and about 2% of the cases were classified as higher severity.

The reports mainly referred to incorrectly or incompletely installed components and systems, followed by problems in planning and monitoring the required maintenance intervals, which in some cases led to the maintenance intervals being exceeded. Other reports related to faulty inspections and servicing and to regulatory issues.

6 Conclusion and acknowledgements

Facts emerge from data: Based on the analysis of over 12,500 incident reports from 2024, the Swiss Federal Office of Civil Aviation (FOCA) has once again been able to identify key safety issues and associated risks in five main areas: aerodrome operations, air traffic management, flight operations, helicopter operations and airworthiness. Systematic data analysis remains central to ongoing risk assessment, enabling the FOCA to implement targeted measures that further enhance aviation safety in Switzerland.

The insights gained from this data-driven approach allow the FOCA to make risk-based decisions and allocate resources effectively. This methodology supports key initiatives such as AVISTRAT-CH, which aims to optimise Swiss airspace management by considering aviation infrastructure requirements and improving overall safety. Incident reports play a crucial role in these and other projects, including FASST-CH. Additionally, findings from the ASR2024 report are directly linked to the Swiss Aviation Safety Plan (SASP), which will be revised following this publication. The SASP will integrate the latest topics to address evolving challenges.

Comprehensive data from both commercial and non-commercial civil aviation provide critical insights into Switzerland's primary safety concerns, with a particular focus on preventing collisions, both mid-air and on the ground. Since 2008, Switzerland has operated the Airprox Analysis Board (AAB) to mitigate the risk of mid-air collisions (MAC) in Swiss airspace, in alignment with similar safety bodies across Europe. In parallel, the FOCA has been conducting the Future Aviation Surveillance Services and Technologies (FASST-CH) project since 2023. Working closely with Swiss aviation stakeholders and the European Union Aviation Safety Agency (EASA), FASST-CH aims to evaluate and implement advanced surveillance services and technologies to enhance airspace safety in both the short and long term. The findings from the FOCA's safety data analysis will serve as a critical foundation for these assessments, with conclusions expected by autumn 2025.

A further priority is addressing ground and mid-air collision risks at Zurich Airport, Switzerland’s busiest aviation hub. Due to the complexity of its operational environment, a range of significant measures—including runway extensions, modifications to airport layout, and updated flight procedures—would be required to further reduce collision risks. Incident data collected from the airport vicinity is instrumental in assessing risk probability. The implementation of the redesign of the TMA Zurich has introduced additional safety buffers for departure and approach paths. However, projected traffic growth and increasing delays will continue to put pressure on the system. Notably, 2024 has seen a rise in incidents involving separation minima infringements (SMIs) and flights below the minimum safety altitude. The FOCA is closely monitoring these developments and will address them in relevant management board meetings.

Furthermore, global challenges such as GPS spoofing/jamming incidents and the number of unruly passenger cases have increased significantly in 2024. While these are not Swiss-specific issues, they warrant continuous monitoring due to their potential impact on aviation safety. Similarly, the growing number of reported smell/fume-related incidents requires careful observation.

The FOCA remains committed to continuous safety enhancement, with incident analysis remaining a key priority. Findings from audits, inspections, accident reports, and international aviation safety developments will continue to inform Swiss aviation policies and risk-mitigation strategies.

Our overarching objective remains unchanged: to maintain vigilance and adaptability within the Swiss aviation system, ensuring a comprehensive understanding of emerging risks and working proactively to prevent them from materialising.

We would like to express our sincere gratitude to the entire aviation community for reporting safety-related incidents. Such contributions are invaluable, enabling us to learn from past experiences and collaboratively advance aviation safety in a precise and effective manner.

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