

ANNUAL SAFETY REPORT 2023



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Summary

The Federal Office of Civil Aviation (FOCA) processed almost 10,000 incident reports in 2023. These contribute to the ongoing improvement of safety on the ground and in the air. Annual safety statistics are published in the Annual Safety Report. This year's report has just come out, and includes the positive news that there were no fatal accidents in commercial aviation in Switzerland in 2023.

A brief overview of the other statistics contained in the report: a 24% increase in the number of reported incidents in commercial and general aviation, 55% more GPS jamming, 10% more drone conflicts, more laser attacks and two general aviation accidents with a total of five fatalities. The number of incidents reported has been increasing since 2019, mainly because of an improved reporting culture, more large-scale GPS jamming on aircraft in conflict regions and the increased use of laser and drones.

The types of incidents reported to the FOCA are diverse and include aircraft damaged during ground handling, near collisions between aircraft mid-air and on the taxiway, bird strikes and cyber attacks. In the 2023 reporting year, the FOCA processed a total of 9,995 incidents.

From the reports received, the FOCA categorises, analyses and identifies the key causes of the incidents for five areas of risk – aerodromes, flight operations, flight technology, air traffic management and helicopter operations – 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 and should be used to increase airspace safety in the short and long term. The FOCA is working with the aviation industry to develop solutions.

The FOCA has also been running the [staysafe.aero](#) safety campaign for several years. The target group: recreational pilots and those involved in light aviation. It posts weekly about the latest safety-relevant topics – on social media, and now on its new [website](#).

Zusammenfassung

Knapp 10 000 Vorfälle bearbeitete das Bundesamt für Zivilluftfahrt (BAZL) 2023. Die Meldungen dienen dazu, die Sicherheit am Boden und in der Luft stetig weiterzuentwickeln. Publiziert wird die jährliche Sicherheitsstatistik im Annual Safety Report. Der neueste Bericht ist soeben erschienen. Die gute Nachricht: 2023 gab es in der Schweiz keinen Unfall mit Todesfolgen in der kommerziellen Luftfahrt.

24% mehr gemeldete Vorfälle in der kommerziellen und der Leichtaviatik, 55% mehr GPS-Störungen, 10% mehr Konflikte mit Drohnen, mehr Laserattacken, zwei Unfälle mit insgesamt fünf Todesopfern in der Freizeitfliegerei: So die Kurzfassung der Vorfalldaten 2023 in der Schweizer Aviatik. Seit 2019 nehmen die Vorfalldaten zu. Die Hauptursachen: eine bessere Meldekultur; in Konfliktregionen mehr grossflächig gestörte GPS-Signale auf Flugzeugen; und die vermehrte Nutzung von Lasern und Drohnen.

Ein bei der Abfertigung am Boden beschädigtes Flugzeug, ein Beinahe-Zusammenstoss zweier Flugzeuge in der Luft oder auf dem Rollweg, eine Kollision mit Vögeln, Cyberangriffe und, und, und: Im Berichtsjahr 2023 bearbeitete das BAZL insgesamt 9995 Vorfälle.

Kategorisieren, analysieren und daraus Massnahmen definieren: Aus den eingegangenen Meldungen identifiziert das BAZL für die fünf Risikobereiche 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. Eine zentrale Frage: Welche Dienste und Technologien können die Sicherheit im Luftraum erhöhen und sollen kurz- und langfristig im Einsatz stehen? Zusammen mit der Aviatik-Branche erarbeitet das BAZL Lösungen.

Und: Seit mehreren Jahren betreibt das BAZL die Sicherheitskampagne «Staysafe.aero». Die Zielgruppe: Pilotinnen und -piloten sowie Akteure der Leichtaviatik. Über das [Internet](#) – der Auftritt ist brandneu – und die sozialen Medien werden wöchentlich neue Beiträge zu aktuellen, sicherheitsrelevanten Themen veröffentlicht.

Synthèse

En 2023, l'Office fédéral de l'aviation civile (OFAC) a traité environ 10 000 comptes rendus d'incidents. Ceux-ci sont utiles pour améliorer continuellement la sécurité au sol et en vol. Les statistiques sur la sécurité font l'objet d'un rapport annuel, l'Annual Safety Report, dont la dernière édition vient de paraître. Bonne nouvelle : en 2023, l'aviation commerciale suisse n'a eu à déplorer aucun accident mortel.

En bref, la statistique des incidents 2023 dans l'aviation suisse peut se résumer comme suit : incidents signalés dans l'aviation commerciale et l'aviation générale : +24 %, cas de brouillage GPS : +55 %, conflits avec des drones : +10 % et davantage d'attaques au laser. On signale en outre deux accidents qui ont fait cinq morts au total dans l'aviation générale. Le nombre de comptes rendus est en augmentation depuis 2019. En cause, une meilleure culture de la notification, l'utilisation grandissante de drones et de laser, une recrudescence significative des brouillages des signaux GPS des aéronefs dans les zones en proie à des conflits.

Un aéronef endommagé lors des opérations d'assistance en escale, une quasi-collision en vol, une autre au sol, une collision avec des oiseaux, des cyberattaques : ce n'est qu'un échantillon des 9995 incidents traités par l'OFAC en 2023.

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'un des cinq thèmes de sécurité préétablis (Exploitation des aéroports, Gestion du trafic aérien, Exploitation des avions (hors hélicoptères), Exploitation des hélicoptères et Aspects techniques), en identifie les causes principales et les évalue en fonction de leur gravité.

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

La prévention du risque de collision est prioritaire. La question des services et technologies en mesure d'améliorer à court et à long terme la sécurité de l'espace aérien est à cet égard centrale. Les solutions sont élaborées par l'OFAC de concert avec le secteur de l'aviation.

Enfin, l'OFAC mène depuis plusieurs années une campagne de sensibilisation « Staysafe.aero » qui s'adresse aux pilotes de l'aviation générale et aux acteurs de l'aviation légère. Des contributions sur des thèmes d'actualité liés à la sécurité sont ainsi diffusées à un rythme hebdomadaire via un site [Internet](#) qui vient de faire peau neuve.

Sintesi

Nel 2023 l'Ufficio federale dell'aviazione civile (UFAC) ha trattato quasi 10 000 inconvenienti. Le notifiche permettono un ulteriore e costante miglioramento della sicurezza a terra e in volo. La statistica annuale sulla sicurezza viene pubblicata nell'Annual Safety Report. L'ultimo rapporto è appena stato pubblicato. C'è una buona notizia: nel 2023 non si sono verificati incidenti mortali nell'aviazione commerciale in Svizzera.

24% in più di inconvenienti segnalati nell'aviazione commerciale e generale, aumento di 55% delle perturbazioni dei segnali GPS (GPS jamming), crescita del 10% dei conflitti con i droni, aumento degli attacchi laser e due incidenti con un totale di cinque morti nell'aviazione generale: è questa in sintesi la statistica 2023 degli inconvenienti nell'aviazione svizzera. Le notifiche di inconvenienti sono in aumento dal 2019. Tale tendenza è da ricondurre principalmente a una migliore cultura di notifica, all'incremento di perturbazioni su larga scala dei segnali GPS sugli aeromobili nelle zone di conflitto e all'aumento dell'uso di laser e droni.

Tra gli eventi notificati, un velivolo danneggiato al suolo, una mancata collisione tra due velivoli in aria o sulla via di rullaggio, una collisione con volatili, attacchi informatici. Nell'anno in esame, l'UFAC ha trattato un totale di 9995 inconvenienti.

Classificare, analizzare e definire le misure necessarie: in base alle notifiche pervenute, per i cinque settori di rischio – aerodromi, servizi della navigazione aerea, operazioni di volo, tecnologia aeronautica ed elicotteri – l'UFAC individua le principali cause dei problemi di sicurezza e le valuta secondo la loro gravità.

La cultura della sicurezza dell'aviazione civile si sviluppa grazie all'esperienza di piloti, controllori del traffico aereo e personale di terra. Dalle notifiche di eventi rilevanti per la sicurezza l'UFAC deduce le misure di prevenzione necessarie ed elabora raccomandazioni.

La massima priorità è attribuita al settore «collisioni». La domanda centrale è la seguente: quali servizi e tecnologie possono aumentare la sicurezza in volo e quali dovrebbero essere utilizzati nel breve e nel lungo periodo? L'UFAC collabora con il settore dell'aviazione per sviluppare soluzioni.

Infine da diversi anni l'UFAC promuove la campagna sulla sicurezza «Staysafe.aero», rivolta principalmente a piloti e attori nell'aviazione leggera e generale. Ogni settimana su [Internet](#) (novità di quest'anno) e sui social media vengono pubblicati nuovi contributi riguardo a temi rilevanti per la sicurezza.

Introduction

The Annual Safety Report carefully examines any incidents that are relevant to the safety of Swiss civil aviation both on the ground and in the air.

Categorise, analyse and then define measures: 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](#). This national safety programme defines the most important tasks and actions. The FOCA, as the regulatory authority, has defined a series of safety indicators to monitor these. The indicators make it possible to monitor the development of individual risks in detail. If necessary, the FOCA carries out further analyses or risk assessments and specifies actions to be taken.

The data presented in the Annual Safety Report comes from commercial and non-commercial Swiss civil aviation. The 2023 report focuses on the current situation and highlights the development of incidents over the last five years. FOCA experts also clarify 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.

Various partners are active in the operation of an aerodrome. This includes ground handling companies. They are responsible for delivering baggage and cargo, loading aircraft and boarding and disembarking passengers.

Aerodromes often have extensive green areas where wild animals such as birds, badgers and deer are to be found. To ensure that flight operations run safely, the wildlife living on the aerodrome must be controlled.

In brief: The larger the aerodrome, the more complex the management.

Examples of incidents on aerodromes include: During ground handling, the passenger boarding bridge collides with the aircraft and damages it. An aircraft travels on the incorrect taxiway. Another suffers engine damage due to a duck strike. A tractor rolls in the wrong direction on push-back. An incorrectly loaded cargo space. These are all incidents that can occur at Swiss airports. What is most important in these cases is not where or when the incidents occur, but rather that they reach the correct [reporting point](#) in order for the correct lessons to be learned. The objective: to continuously improve aviation safety, both on the ground and in the air.



Aerodromes incidents: overview of top safety issues 2023

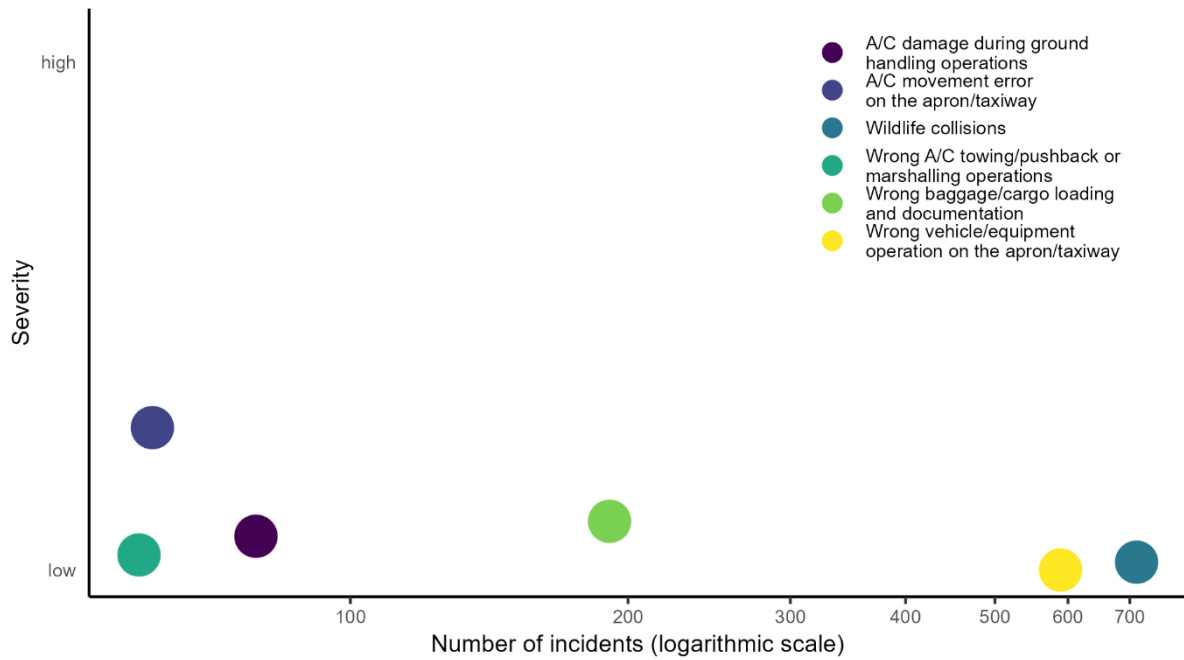


Figure 1: No. of incidents vs severity of top safety issues aerodromes 2023

Safety issues 2019-2023

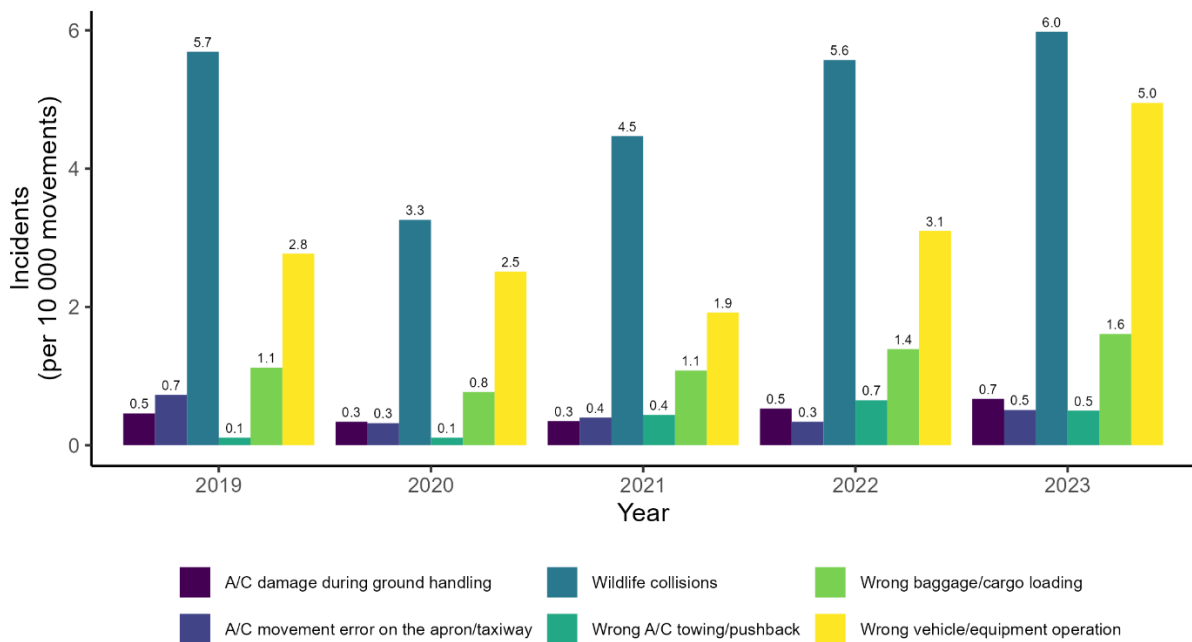


Figure 2: Top safety issues aerodromes 2019-2023



Aerodrome operations – 2023 incidents in detail:

In aerodrome operations, the most safety-relevant issues can be assigned to six categories:

1.1 Aircraft damage during ground handling

What this relates to: Collision with ground handling equipment (e.g. baggage conveyor belts or passenger stairs) or vehicles; improper handling, for example when opening the cargo hold doors, and so on. Damage during ground handling is inflicted on the stationary aircraft. The damage can impair the operating safety of the aircraft.

Example: An aircraft is proceeding on the apron. The ground crew approaches with the passenger boarding bridge to let the passengers disembark. An error occurs. The passenger boarding bridge collides with the aircraft and damages the fuselage. The aircraft must undergo maintenance before it can fly again.

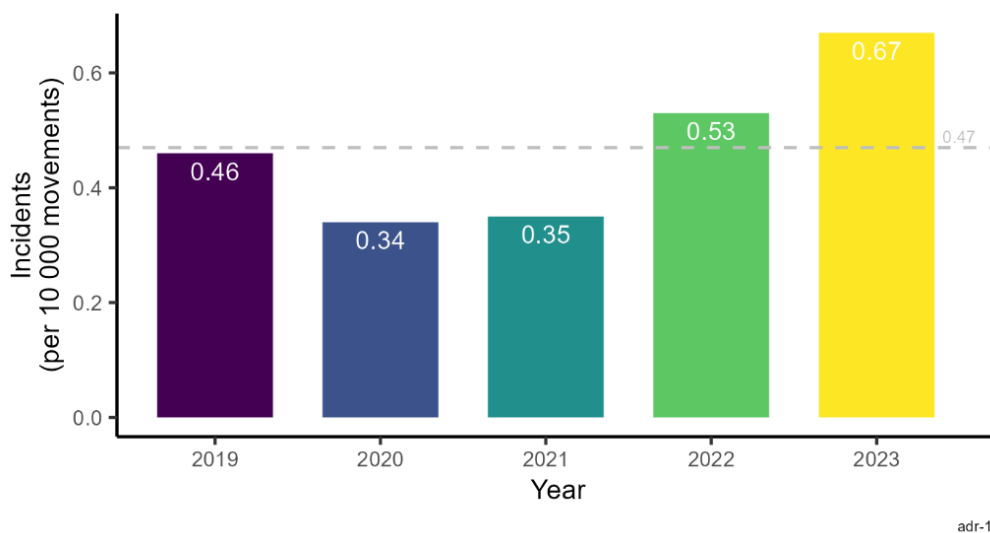


Figure 3: Aircraft damage during ground handling incidents 2019-2023 and average per 10 000 movements

Commentary on the 2023 figures: Reports increased by 27% in 2023 compared to the previous year, converted to incidents per 10,000 aircraft movements, the ratio rose from 0.5 (2022) to 0.7 (2023). Only 2% of the incidents were serious. The majority (66%) occurred at Swiss airports, while 34% of the incidents occurred abroad and were reported by Swiss operators.

Of reported incidents, 98% related to commercial air transport and only 2% related to general aviation. This large difference is due to the fact that most aircraft requiring ground handling services are commercially operated.

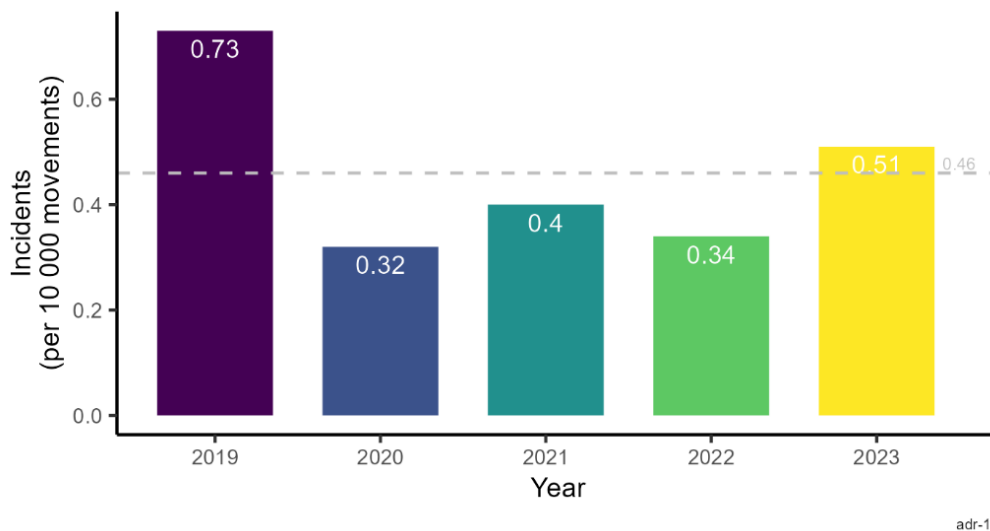
The incidents have a variety of causes, with narrow aircraft stands being the main one as the slightest lapse of concentration can quickly result in damage to parked aircraft. In most cases (80%), the damage occurred during container loading or during the docking phase of the passenger boarding bridge or passenger stairs. On the positive side, most damage is minor – a paint chip or a scratch – and nothing that would impinge on flight safety.



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

What this relates to: Errors occur on the apron or taxiway when the crew do not comply with taxiing rules, procedures or clearances. This can result in a near-collision or a collision with another aircraft, a vehicle or an obstacle on the ground.

Example: An aircraft accesses an incorrect taxiway. The taxiway is too small for the aircraft – and then the wingtip hits a lighting mast.



adr-12

Figure 4: Aircraft movement error on the apron/taxiway incidents 2019-2023 and average per 10 000 movements

Commentary on the 2023 figures: More than 90% of the cases occurred on Swiss aerodromes; the 10% that occurred abroad were reported by Swiss operators. 60% of the cases related to commercial aircraft; the remaining 40% had to do with general aviation.

Most of the reports (about 85%) related to a failure to observe the taxiing rules or navigation errors. Effects on safety: none or small. The most frequent causes: a misunderstanding about the granted clearance; a pilot loses his bearings on an airfield with a complicated apron and taxiway system. In a few cases (4%), severe weather conditions were the cause: the probability of navigation errors increases with reduced visibility.

An aircraft collided with another aircraft, a vehicle or another type of obstacle while taxiing in just 10% of the incidents. Unfortunately, in general aviation, such incidents are frequent. An aircraft taxis and comes close to a building or obstacle without there being any ground markings on the apron. If the pilot is not sufficiently observant, a collision can easily occur.

In 2023, 5% of incident reports related to navigation errors or deviations that led to incorrect manoeuvres on the apron or taxiway – both in commercial air transport and general aviation.

A total of 12% of the error reports on the apron or taxiway related to serious incidents.



1.3 Wildlife collisions

What this relates to: A bird strike or collision with an animal during takeoff or landing can cause damage to the aircraft. The damage can impair flight safety. Only if animal sightings or recovered animal carcasses can be unambiguously attributed to a collision is it recorded as a wildlife collision.

Example: An aircraft hits a bird during takeoff. The bird ends up in the engine. Shortly thereafter, the engine starts to vibrate in an unusual manner. The aircraft returns to the departure airport, where it is discovered that the turbine is damaged. The flight must be cancelled, but fortunately for the passengers they can be rebooked on another flight.

Commentary on the 2023 figures: Collisions with wild animals increased: from 5.6 incidents per 10,000 flight movements in 2022 to 6.0 in 2023. In figures: There were 734 incidents in 2019 (the current record) and 712 last year.

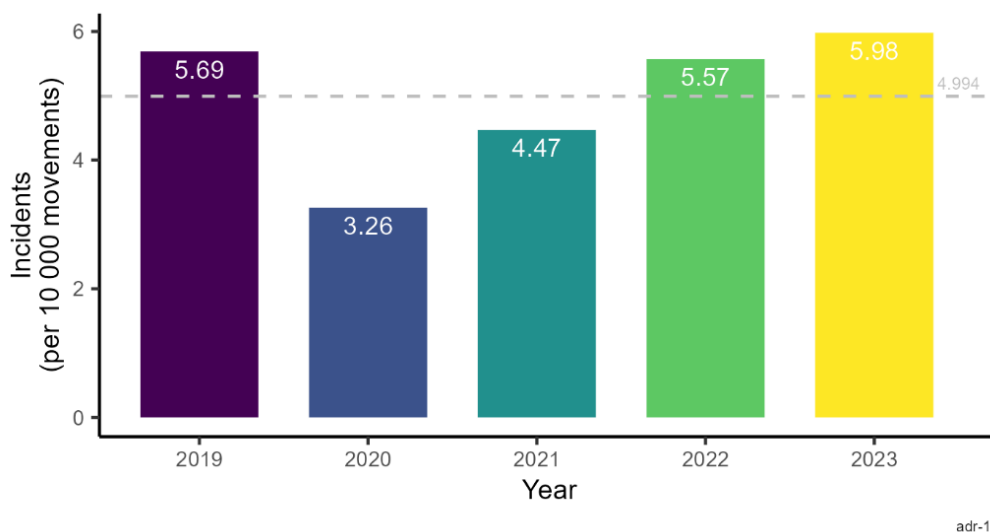


Figure 5: Wildlife collision incidents 2019-2023 and average per 10 000 movements

Only 50% of the collisions took place in Swiss airspace; the other half, reported by Swiss operators, occurred abroad. Most of the reports (95%) related to commercial air transport; only 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 diversionary action. Nevertheless, airspeed is not the sole factor that determines the severity of a collision. A large bird can have severe consequences for aircraft safety even if it is flying slowly. Luckily, most collisions in 2023 had negligible effects on aircraft. Collisions resulted in damage to the aircraft in less than 10% of the incidents; serious incidents accounted for less than 1% of the total.

Again in 2023, over 80% of collisions occurred within the perimeter of the aerodrome, i.e. during approach, landing or takeoff. The remaining 20% occurred during cruise flight or in some other unidentified flight phase. Birds were a factor in more than 99% of cases. Almost 70% of collisions occurred between May and October, with a maximum in July (128).



1.4 Incorrect towing/pushback or incorrect marshalling of an aircraft

What this relates to: A deviation from the towing or recovery procedures or clearances on the apron, incorrect marshalling, incorrect communication with the aircraft crew or incorrectly parked aircraft. Errors like this which occur on the ground can lead to an unintended near-collision or a collision with another aircraft, a vehicle or an obstacle.

Example: During pushback, the tractor pushes in the wrong direction. It steers the aircraft towards another aircraft which has already been parked. The tractor driver is fortunate that the ground handling team recognises the error and signals to the tractor driver to stop the manoeuvre. However, the distance between the two aircraft is very small; the outcome is a near-collision.

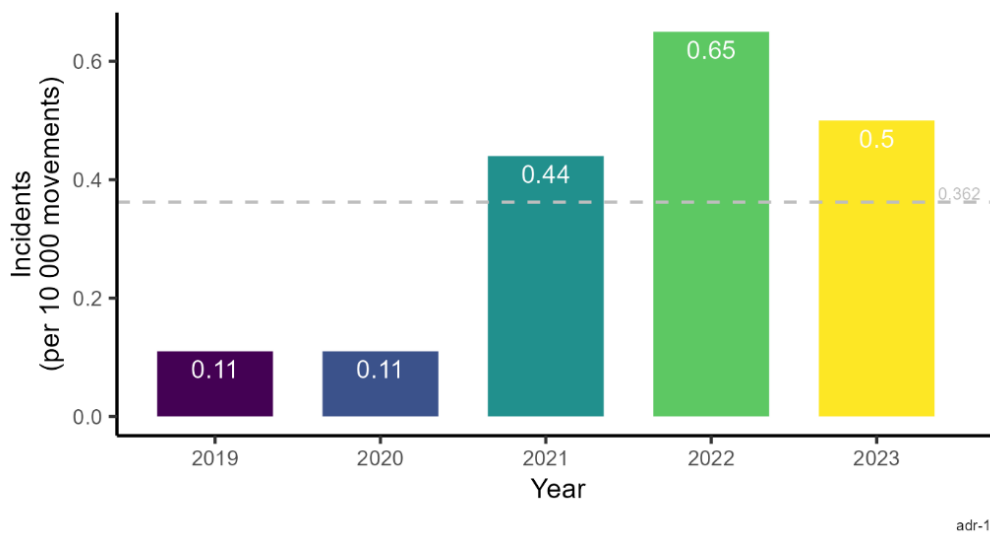


Figure 6: Towing/pushback or incorrect marshalling of an aircraft incidents 2019-2023 and average per 10 000 movements

Commentary on the 2023 figures: In 2023, the number of reports fell by almost 20% compared to the previous year. The number of incidents per 10,000 flight movements also fell, from 0.65 in 2022 to 0.50 in 2023. Only one case was serious.

Nearly all incidents (90%) related to commercial air transport, while only 10% related to general aviation. The main cause in commercial air transport was failure to comply with pushback/towing or briefing procedures. An incorrectly performed procedure can result in a collision with another aircraft or the infrastructure of the aerodrome. The consequence: personal injuries or serious property damage.

In general aviation, the cases were mainly unintentional errors during towing into or out of hangars, resulting in collisions with infrastructure or other aircraft and damage to the aircraft.



1.5 Incorrect baggage/cargo loading and documentation

What this relates to: An aircraft is incorrectly loaded. The loading plan may be deficient, contain errors in the takeoff weight, the calculation of the balance or the flight parameters. Errors can result in the load shifting during the flight. Loading errors can endanger operating safety during flying.

Example: An aircraft is fully loaded. Upon checking of the loading plan it becomes apparent that the load in the cargo compartment is not distributed in a manner that would ensure a safe flight. The aircraft must be loaded differently, which results in a considerable delay for the passengers.

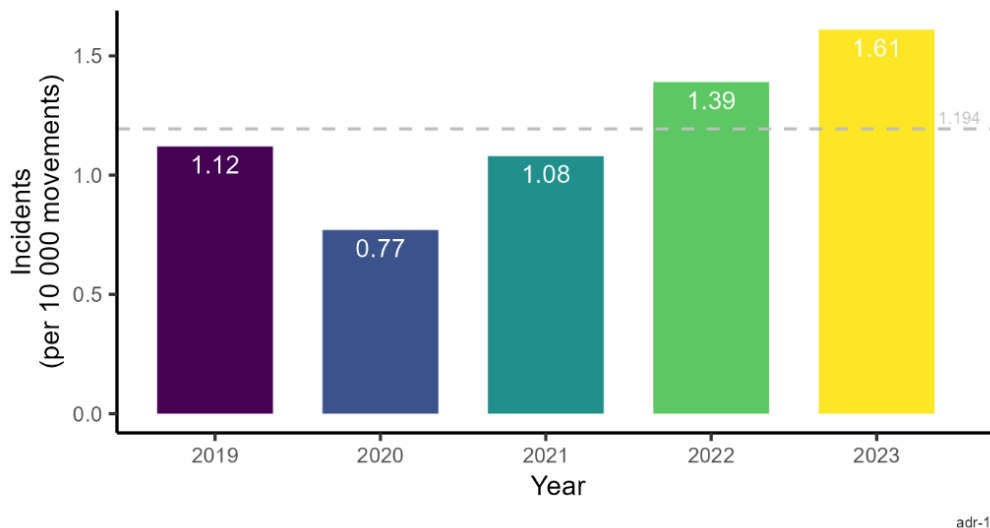


Figure 7: Baggage/cargo loading and documentation incidents 2019-2023 and average per 10 000 movements

Commentary on the 2023 figures: The number of reported loading errors increased by 15% in 2023 compared to the previous year. All incidents related to commercial air transport. Only just over 40% of the cases occurred at Swiss aerodromes, the rest, as reported by Swiss operators, took place abroad.

The causes and consequences were varied; approximately 30% had no operational or safety effects. These reports often related to baggage sent to the wrong destination or non-compliant loading procedures.

The remaining 70% related to incidents of baggage or cargo (including dangerous goods) being incorrectly loaded on the aircraft or errors in the loading plan. In most cases, these incidents had no significant effects on flight operations. In a few cases, the errors affected the weight and balance of the aircraft. The centre of gravity of the aircraft was no longer within the defined limits, which made control difficult.

The most important finding: in spite of the increase in incidents in 2023, less than 5% seriously affected flight operations.



1.6 Incorrect operation of a vehicle or ground handling equipment on the apron or taxiway

What this relates to: A vehicle fails to comply with the instructions or traffic rules on the apron or taxiway. This leads to an unintended collision near the ground or on the ground with an aircraft that is taxiing or being towed. It can also have to do with equipment or vehicles being incorrectly parked or located on the apron and obstruct a taxiing aircraft.

Example: A driver travels in his vehicle over the apron. An aircraft arrives on the taxiway to his right, but the driver infringes on the aircraft's right of way due to his uncertainty on how to proceed. The aircraft is forced to brake strongly to avoid a collision. Luckily, everybody on board the aircraft is seated at this point in time. The aircraft continues on its way to the gate where the passengers can disembark.

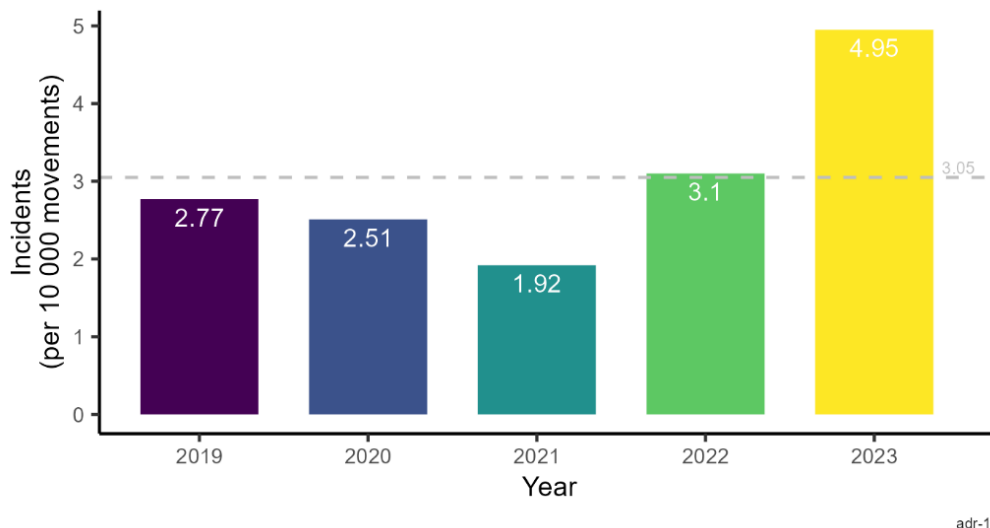


Figure 8: Operation of a vehicle or ground handling equipment on the apron or taxiway incidents 2019-2023 and average per 10 000 movements

Commentary on the 2023 figures: This category recorded 589 reports in 2023 – an increase of 66% compared to 2022. The number of incidents relative to the number of flight movements also increased: 5.0 incidents per 10,000 aircraft movements in 2023, compared to 3.1 in 2022. In spite of the increase, the number of serious incidents – abrupt evasive action by pilots – was less than 0.5% in 2023. And there were no collisions between a taxiing aircraft and incorrectly operated equipment or vehicles. Most evasive actions involve abrupt and hard braking. The danger: passengers who have undone their seatbelts or are standing can fall and injure themselves.

More than 99% of all reports in 2023 related to incidents at Swiss airports; 1% happened abroad and were reported by Swiss operators.

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. This is the reason why the severity of these incidents is very low. In contrast, if a vehicle violates the traffic rules forcing the pilot to take evasive action, the severity level is higher.



2 Air traffic management



An aircraft should be able to move safely and efficiently in its airspace in all operating phases: during takeoff, 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 air-space classes.



Air traffic management (ATM) incidents: overview of top safety issues 2023

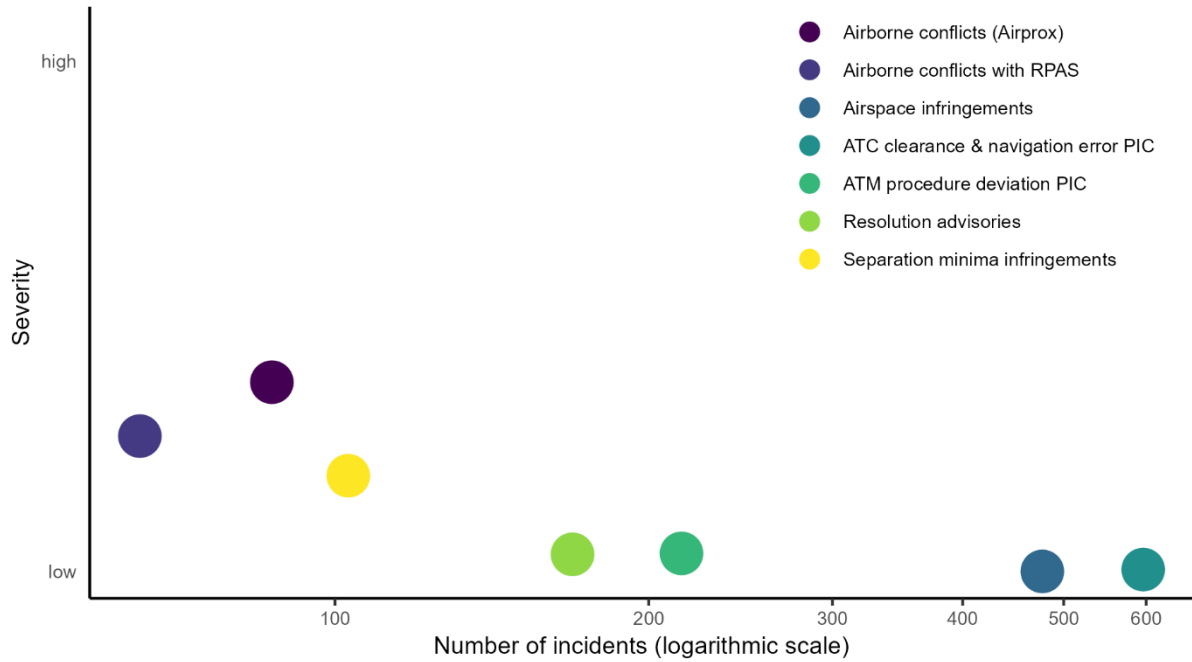


Figure 9: No. of incidents vs severity of top safety issues ATM 2023

Safety issues 2019-2023

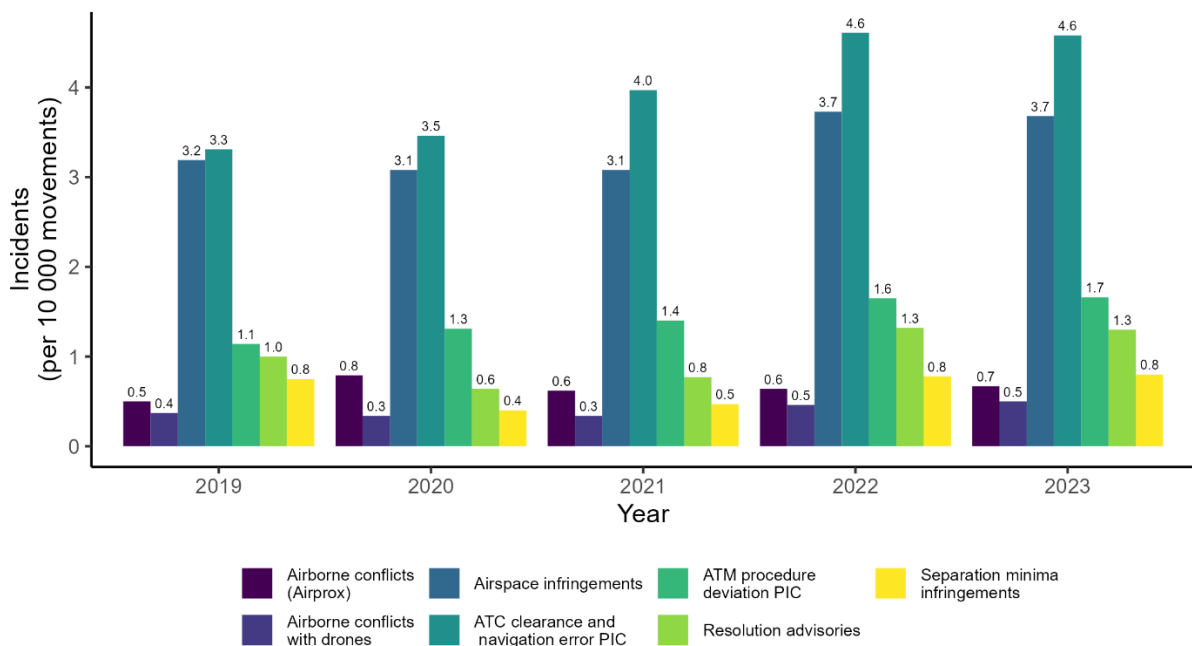


Figure 10: Top safety issues ATM 2019-2023



Air traffic management (ATM) incidents: 2023 cases in detail

In air traffic management, the issues most relevant to safety can be assigned to seven categories:

2.1 Airborne conflicts (Airprox)

What this relates to: The distance between aircraft, given their positions and speeds, is so small that their safety is 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.

Example: A pilot is transporting passengers around the Alps in a light aircraft. All of a sudden 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.

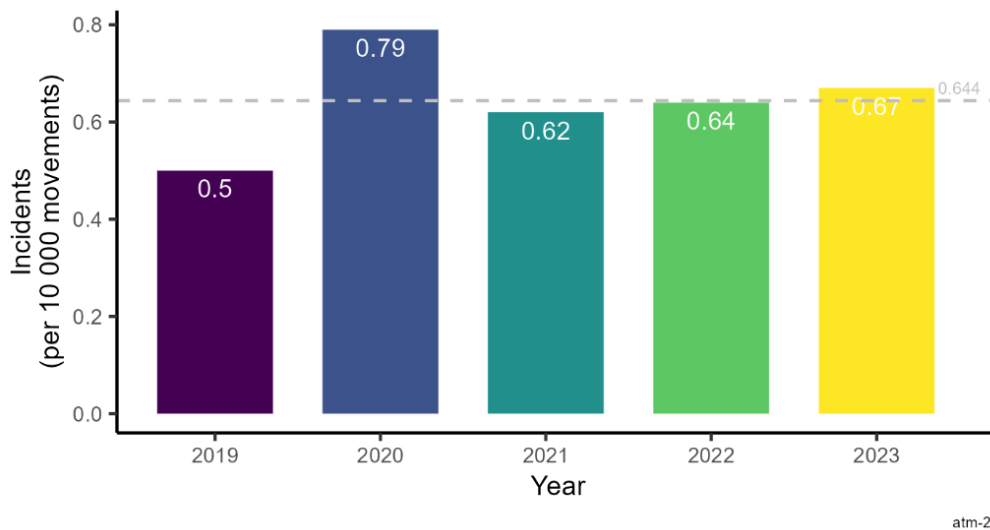


Figure 11: Airprox incidents 2019-2023 and average per 10 000 movements

Commentary on the 2023 figures: In 2023, pilots and air traffic control providers reported a total of 77 Airprox incidents. This is a slight increase on 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 and visual flight rules (IFR and VFR) have decreased by 11%; relative to IFR movements in Switzerland, they have reduced by 31%. Most of these conflicts occurred in mixed traffic in class Echo (E) airspace.



2.2 Separation minima infringements

What this relates to: To facilitate the safe navigation of aircraft in controlled airspace, national authorities specify vertical and horizontal distances, known as separation standards. The standards ensure safe separation of aircraft. Aviation terminology refers to undershooting of the separation standards as a separation minima infringement (SMI).

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.

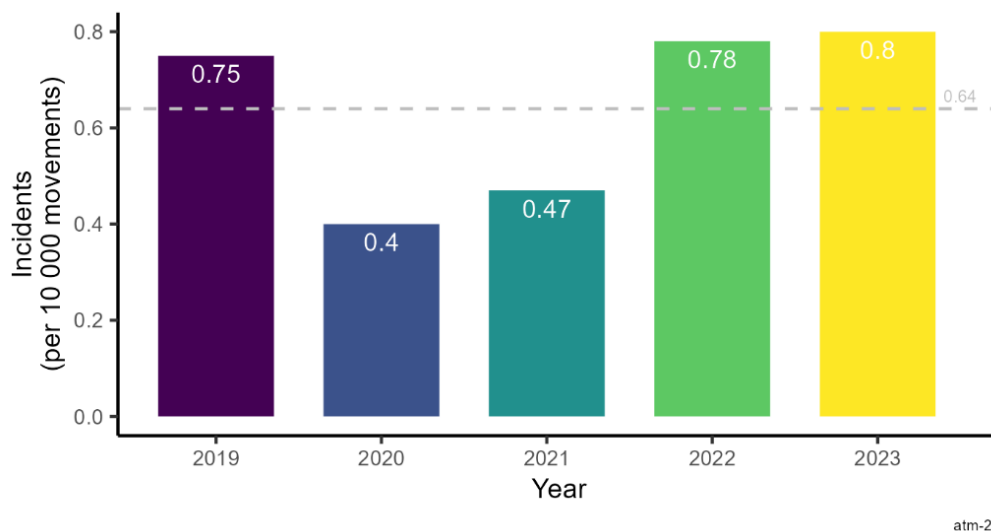


Figure 12: Separation minima infringement incidents 2019-2023 and average per 10 000 movements

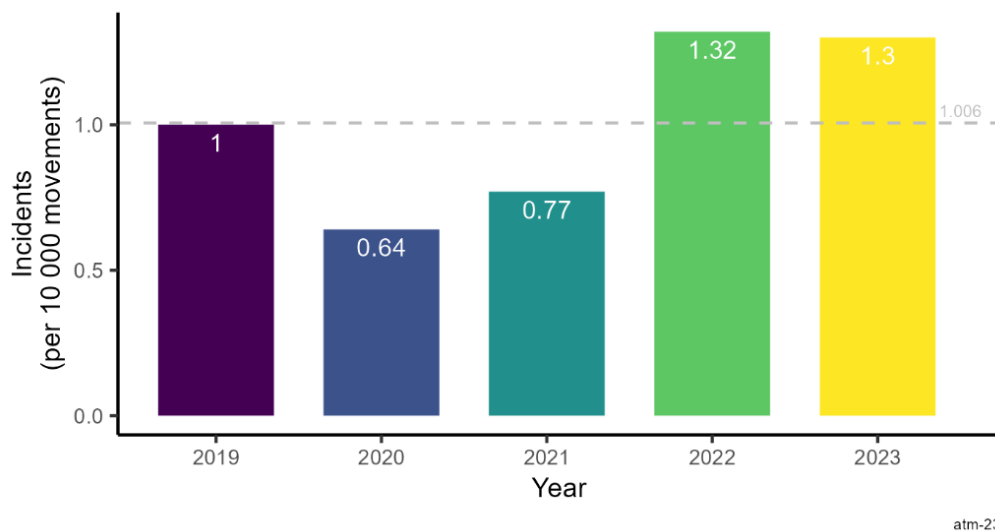
Commentary on the 2023 figures: Separation minima infringements (SMI) continued to increase in comparison with previous years; the number of reports was similar to 2019. Reports per 10,000 aircraft movements increased by 7% in 2023 relative to 2019. Similarly, the average severity level also increased over the last few years for a variety of reasons, such as the more concentrated and increasing volume of air traffic, human behaviour and weather conditions.



2.3 Resolution advisories

What this relates to: Near-misses or collisions of aircraft in the air: The Airborne Collision Avoidance System (ACAS) exists to reduce this risk. These devices supply 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, the 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.



atm-23

Figure 13: Resolution advisory incidents 2019-2023 and average per 10 000 movements

Commentary on the 2023 figures: The level of evasion instructions (TCAS RA) reported in Switzerland since 2022 has been higher than in previous years. There could be several, partially desirable, reasons for this increase. Two possible explanations:

- More transponders in use: The increased number of transponders in operation on aircraft makes it possible to detect and identify other nearby aircraft in the vicinity more precisely. Consequently, the system can react more sensitively to potential conflicts and issue 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:

- Infringements of foreign airspace by an aircraft registered in Switzerland.
- Delta or Charlie class airspace infringements by any aircraft in airspace under the responsibility of Skyguide (including delegated airspace in Germany, France, Italy and/or Austria).
- Infringements of prohibited areas (LS-Rxx) according to the same principles.

An example: A pilot undertakes a pleasure flight with friends. While flying, he decides to change 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.

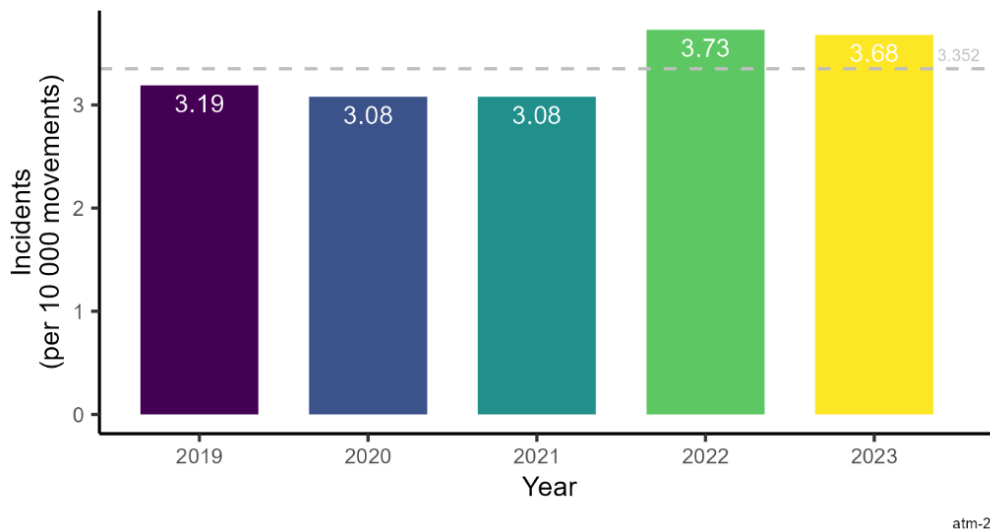


Figure 14: Airspace infringements incidents 2019-2023 and average per 10 000 movements

Commentary on the 2023 figures: 477 airspace infringements were recorded in 2023 - a similar number to that in 2022 (476). The long-term trend: a gentle increase. This is in spite of the fact that more and more navigation aids such as GPS and mobile apps are available for use in general aviation. It is possible that these navigation aids give pilots a false sense of security. They are tempted to fly as close as possible along airspace boundaries. And sometimes even - intentionally or not - to enter an airspace for a short distance or short period without authorisation. The majority of violations did not result in dangerous encounters. The effect on maintaining safety was minimal. But: Any unauthorised intrusion into an airspace reduces or nullifies the safety precautions. To be avoided under all circumstances.



2.5 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 takeoff of an aircraft to prevent a collision between drone and aircraft.

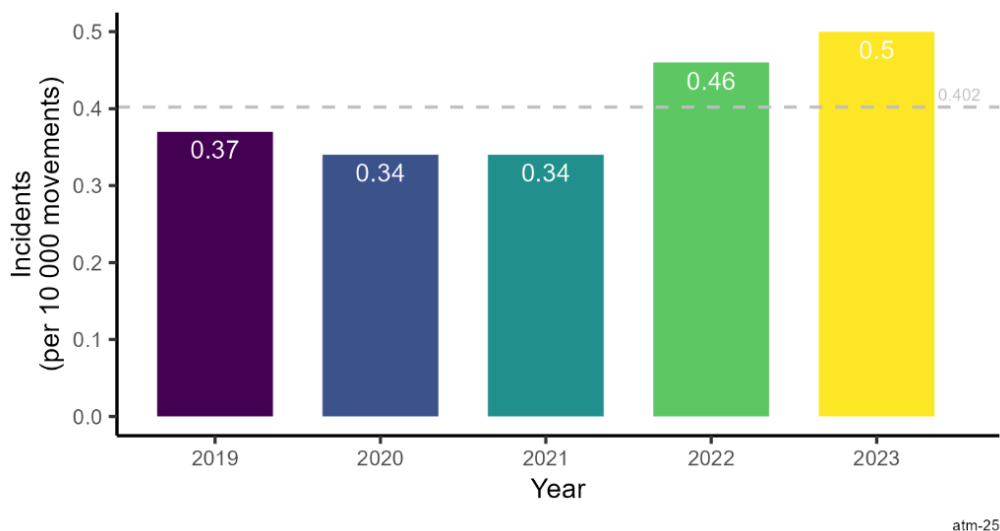


Figure 15: Airborne conflicts with drones incidents 2019-2023 and average per 10 000 movements

Commentary on the 2023 figures: In 2023, there were 65 conflict situations with one or more drones (+10% compared to 2022). Trend: increasing. Reason: increasing use of drones for both recreation and commercial purposes (measurements, goods transport, crop spraying, etc.). While most incidents have negligible consequences, a collision with a drone can have serious consequences. It is important that pilots, including private (hobby) pilots, know and comply with the [safety rules](#). In particular, the [flight restrictions](#).



2.6 Pilot errors in following air traffic control instructions or navigation

What this relates to: All incidents in which pilots do not act in accordance with the instructions, rules or standards of air traffic control (ATC) come within this category. These include incidents reported by Skyguide in Swiss and delegated airspace (Germany, France, Italy and/or Austria) and incidents involving an aircraft registered in Switzerland that was in contact with an air traffic control provider abroad.

Example: Air traffic control instructs a pilot to taxi to the holding point that marks the entrance to the runway and to enter the runway behind a landing aircraft. To identify the approaching aircraft, the pilot moves forward a little and crosses this line. The ATC stops him before he rolls onto the runway.

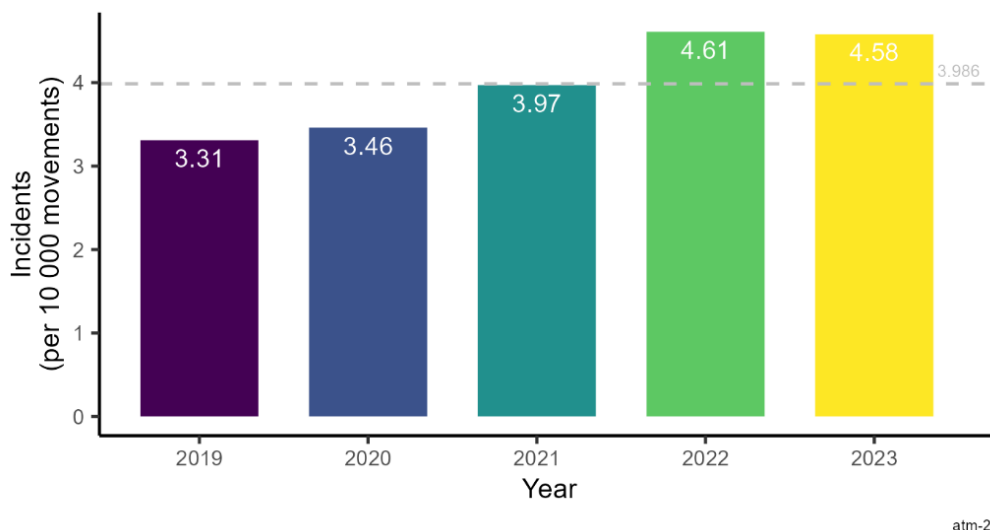


Figure 16: ATC clearance and navigation error PIC incidents 2019-2023 and average per 10 000 movements

Commentary on the 2023 figures: The number of reported incidents in 2023 (593) was very similar to that for 2022 (588). It remained at a high level.

The overwhelming majority: non-safety-related incorrect taxiing at controlled airports. Example: turning onto the wrong taxiway at a crossing.

Deviations from the permitted flight altitude (a level bust) remained the second most frequent type of incident in this category in 2023 (99 reported incidents). Compared with 2022, the number fell by 10%. However, compared with the last five years and the pre-Covid average 2017–2019 (+33%), the figure was still high. Luckily, air traffic control detects such deviations quickly in most cases. It instructs the crews to resume the authorised flight altitude.

Cases of non-compliance with course or route instructions during the flight (49) and unauthorised taxiing onto the runway (35) were less frequent.



2.7 Air traffic management (ATM) procedure deviation by pilots

What this relates to: There are incidents where pilots do not comply with international ATM standards and/or rules. This includes incidents in Switzerland or in delegated airspace (Germany, France, Italy and/or Austria) involving aircraft registered in Switzerland or abroad as well as incidents in foreign countries involving aircraft registered in Switzerland or operated by Swiss airlines.

Example: A pilot flying away from an international airport turns to the right too quickly, deviating from the standard instrument departure (SID) route.

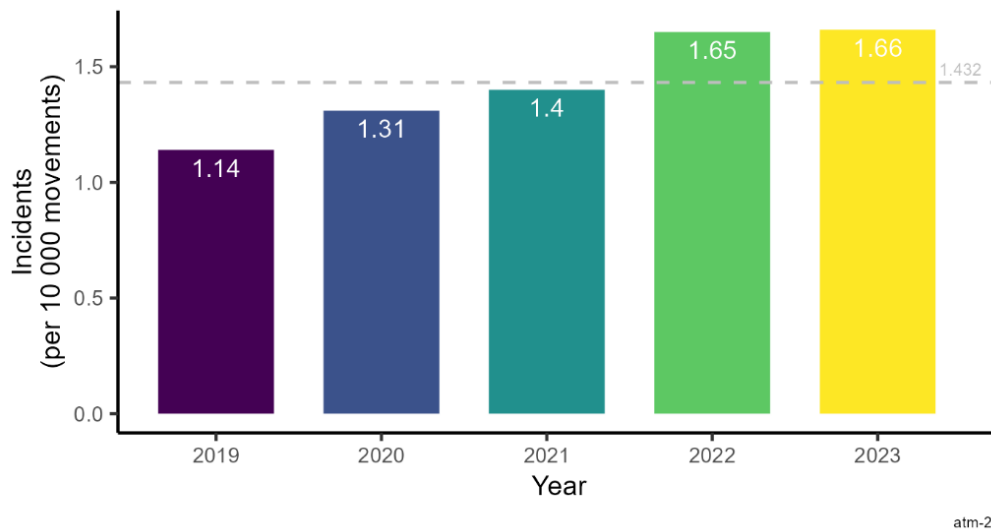


Figure 17: ATM procedure deviation by pilots incidents 2019-2023 and average per 10 000 movements

Commentary on the 2023 figures: With a value of 215, the number of incidents in 2023 was close to the number in 2022 (210). The number of these incidents remained above the pre-Covid average for 2017-2019 (+17%).

Most of the incidents related to deviations from standard instrument departure (SID) routes. With 60 cases, the level remains stable compared to 2022 (61 cases). Likewise, the number of cases is greater than the average for 2017–2019 (+15%).



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 determination of 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 air-space restrictions. A thorough pre-flight inspection is required prior to every flight in order to ensure that the aircraft is fit to fly. Before the passengers board the aircraft, the captain checks 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 - this also takes place 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 continuous contact with the air traffic controllers. The air traffic controllers issue instructions and clearances and ensure there is a safe separation distance 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.



Incidents during flight operations: overview of top safety issues 2023

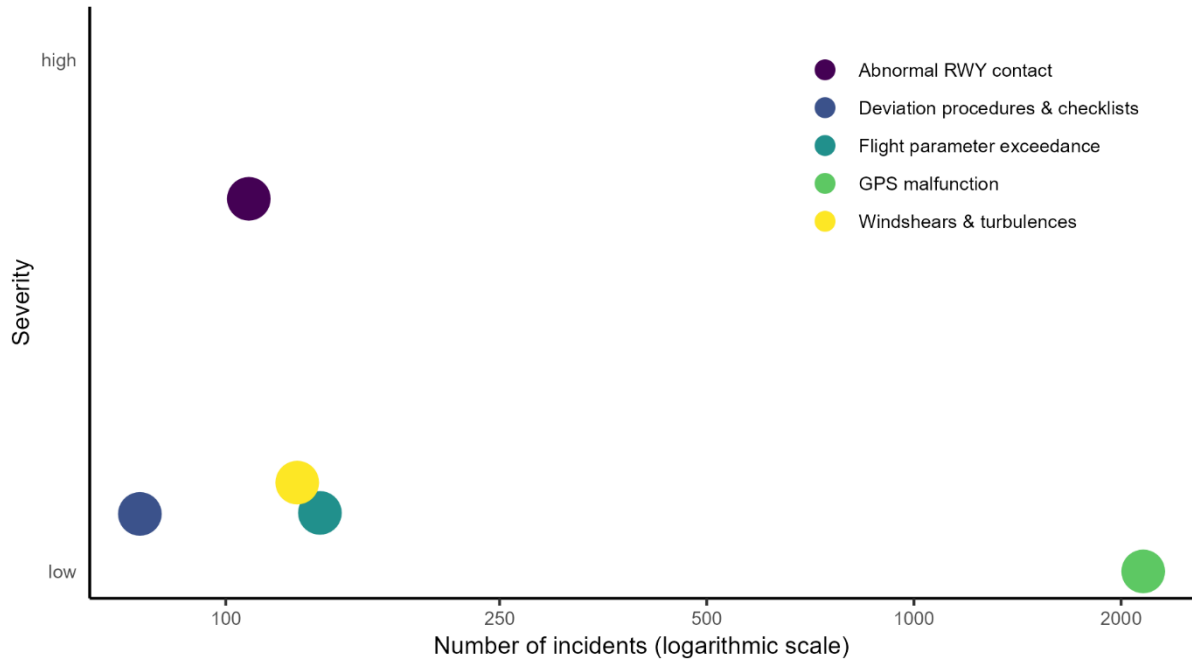


Figure 18: No. of incidents vs severity of top safety issues flight operations 2023

Safety issues 2019-2023

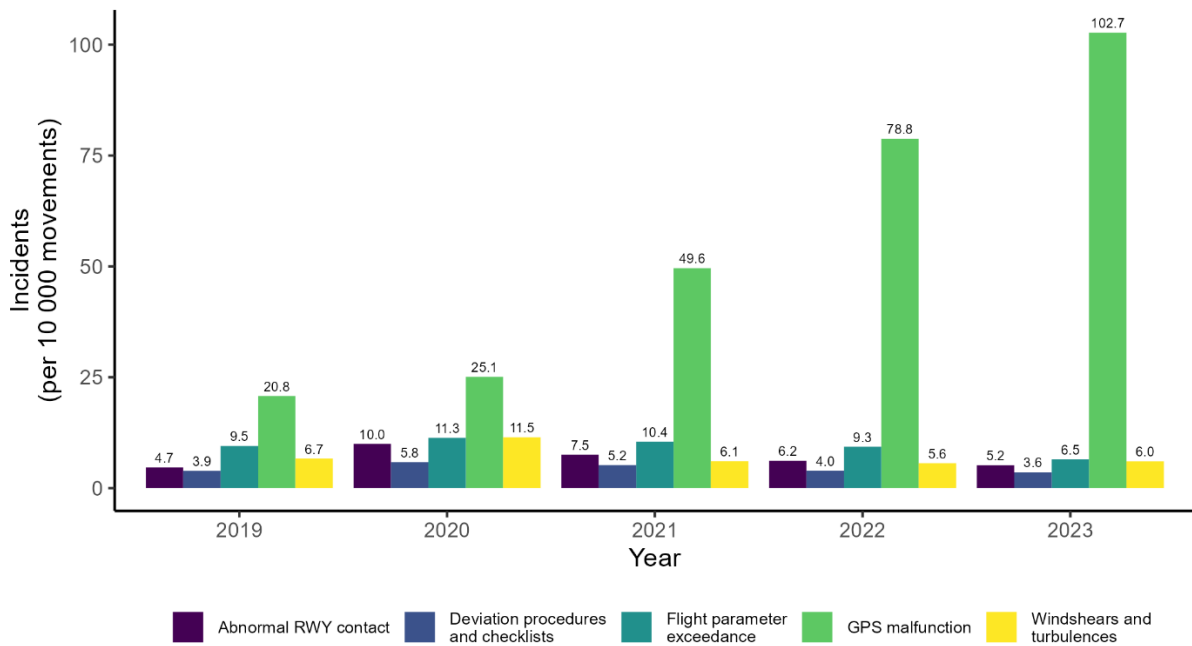


Figure 19: Top safety issues flight operations 2019-2023



Incidents during flight operations: 2023 cases in detail

For flight operations, the most safety-relevant topics can be assigned to five categories:

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 GPS 1 transmits an incorrect position. The crew decides to switch off GPS 1 and continue the flight with other radio navigation devices. After ten minutes, the GPS signal reconnects and the aircraft resumes normal navigation.

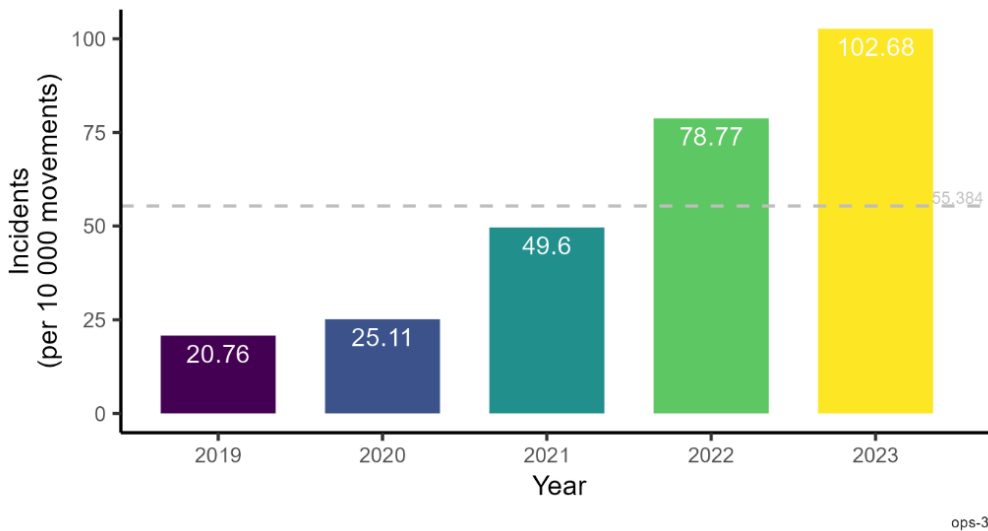


Figure 20: GPS malfunction incidents 2019-2023 and average per 10 000 movements

Commentary on the 2023 figures: In 2023, the Federal Office of Civil Aviation (FOCA) received a little over 2,100 reports of GPS malfunctions. Over the last few years, the number has increased steadily (2019–2023: +400%). This applies in particular to Europe and the Middle East (Turkey, Iraq and Iran) and political conflict zones. The problem is recognised at the international level, and conferences have been held to find solutions. The good news: a number of risk assessments confirm that GPS malfunctions do not significantly impair safety because aircraft normally carry multiple radio-navigation devices. In Switzerland, there have been isolated incidents relevant for helicopter operations. The Federal Office of Communications (OFCOM) investigates such cases.



3.2 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 via the elevator inputs. This is not sufficient. The alarm for excessive banking of the aircraft goes off. The pilot decides to abort the approach. The second approach is successful and the aircraft lands safely.

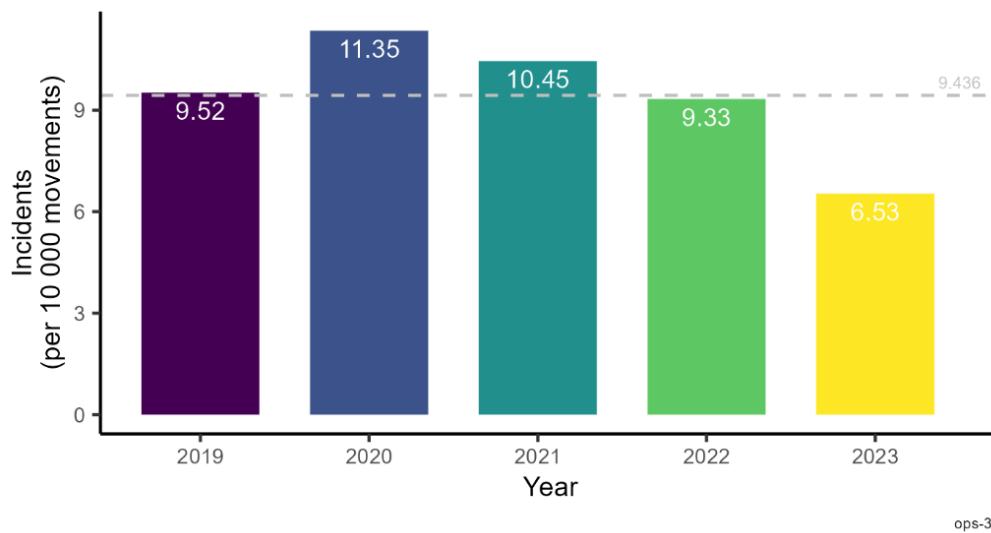


Figure 21: flight parameter exceedance incidents 2019-2023 and average per 10 000 movements

Commentary on the 2023 figures: The number of incidents per 10,000 aircraft movements has decreased slightly over the last two years: from 9 in 2022 to 7 in 2023. Almost always – 97% of the time – it is the flight crews in commercial air transport who report that flight parameters have been exceeded. 65% of the cases in which parameters were exceeded occurred during the approach or landing phase. Most frequent cause: severe weather conditions such as turbulence or wind shear. Exceeding of parameters includes overspeed or underspeed in all phases of flight (60%), exceeding the banking angle (15%) and aircraft pitch deviations (25%).



3.3 Wind shear and turbulence

What this relates to: Strong air movements can occur in the vicinity of high-altitude thunderstorms and jet streams. This type of wind shear and turbulence is challenging for the entire flight crew.

Example: While flying over the Alps, a passenger aircraft encounters severe turbulence. On board, a meal is just being served. A passenger is scalded when hot water spills on them.

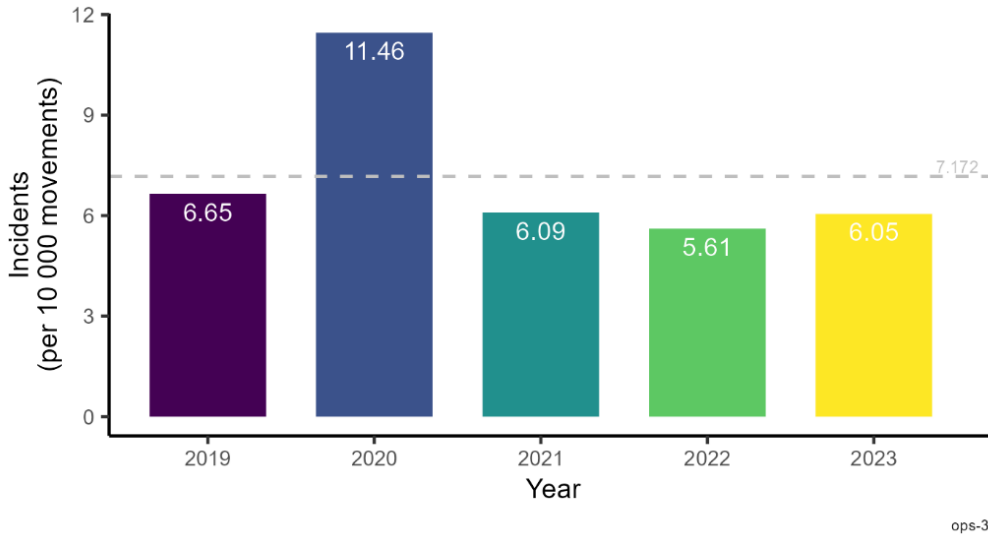


Figure 22: Wind shear and turbulences incidents 2019-2023 and average per 10 000 movements

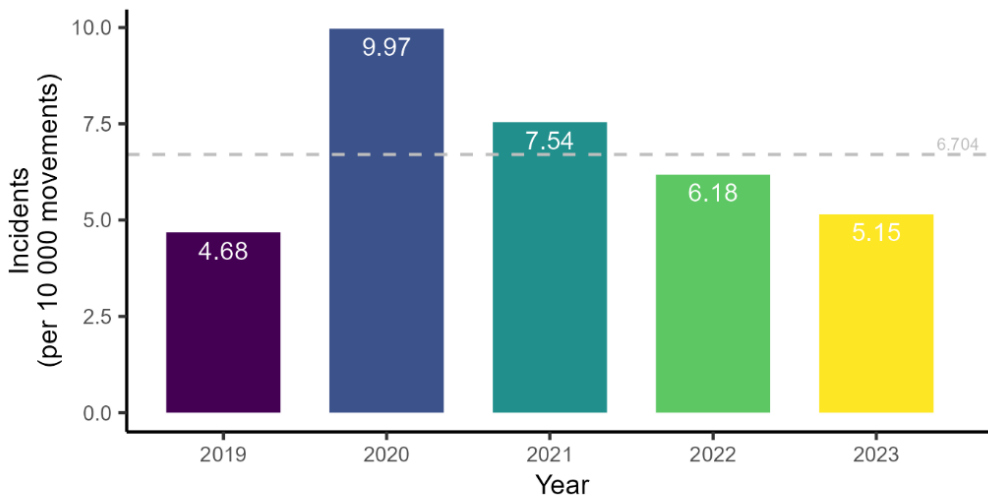
Commentary on the 2023 figures: In recent years, the number of incidents per 10,000 aircraft movements has remained constant: 6.1 in 2021, 5.6 in 2022 and 6 in 2023. General aviation reported 2% and commercial aviation 98% of incidents due to wind shear and turbulence. As in previous years, 65% of cases occurred during approach and landing, 5% during take-off and 31% while cruising. The good news: an electronic system detects dangerous wind shear during the approach. It urges pilots to take immediate action, for example to initiate the missed approach procedure (landing approach aborted for safety reasons). Turbulence is not critical for the aircraft structure – but things can look different for passengers who are not wearing their seatbelts. The recommendation: wear seatbelts throughout the flight.



3.4 Abnormal ground contact with the runway and exiting/overshooting of the runway

What this relates to: Wind shear and gusts, optical illusions, thermal updrafts or incorrect estimation of the rate of descent during the landing phase can lead to abnormal contact with the runway. If the aircraft descends too quickly, the landing gear may be damaged during touchdown. Excessive speed ends in a runway overshoot.

Example: While landing, an aircraft with a tail wheel is caught in a gust of wind. The wind pushes the left wing and the tail upwards. The pilot successfully takes corrective action. However, while the flight instructor (sitting in the front) tries to pull the control stick back to bring the tail down, the student (in the back seat) pushes the stick forwards. Combined with excessive braking, this leads to the aircraft flip over.



ops-34

Figure 23: Abnormal RWY contact incidents 2019-2023 and average per 10 000 movements

Commentary on the 2023 figures: General aviation recorded a somewhat higher number of unusual runway contacts last year (+24%), mainly caused by poor training and lack of flying skills among general aviation pilots. In total, there were five serious incidents; three ended with overshooting of the runway or damage to the wing tips or propellers. Luckily, there were no injuries and no fatalities.

There were no runway overshoots in commercial air transport. Here the main problems were hard (19%) or long landings (78%) in 70 cases. The main cause of these incidents was difficult weather conditions such as turbulence, wind shear and convective lift during landing.



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.

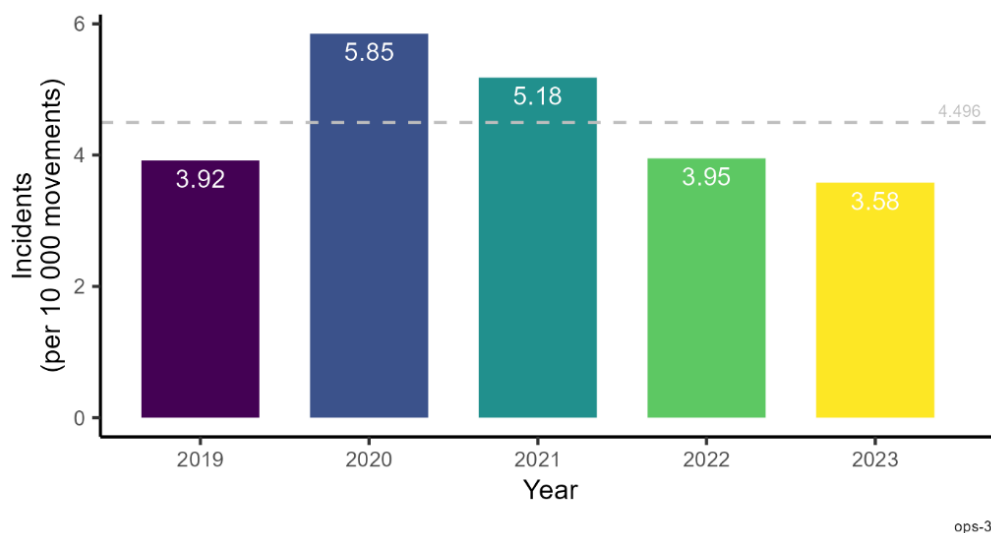


Figure 24: Deviation from procedures and checklists incidents 2019-2023 and average per 10 000 movements

Commentary on the 2023 figures: 90% of deviations from procedures and checklists occurred in commercial air transport. Only one incident was of high severity level (delayed aircraft rotation on take-off from the runway). Other findings from 2023: delayed configuration/adjustment of spoilers, flaps, altimeter, aircraft trim, unintentional activation of the emergency slide in the cabin or non-compliance with speed limits. Causes: pilots distracted in the cockpit due to communication, noise, navigation or weather, resulting in missing or delayed actions during the flight.



3.6 Dangerous goods

What this relates to: Radioactive material, flammable liquids, fireworks, rat poison and mercury all have one thing in common: they are on the list of dangerous goods of the International Civil Aviation Organization (ICAO). Dangerous goods are objects or substances that pose a risk to the health or safety of humans and the environment.

Example: A consignment of goods is being screened at the airport. The X-ray machine indicates suspicious objects, so the security officer takes the consignment to one side and opens it. The package contains several undeclared spray cans and a can of solvent. The officer sends the entire consignment back to the shipper.

Commentary on the 2023 figures: There were 260 reported dangerous goods cases in 2023, an increase of 13% over the previous year and a return to the pre-COVID level of 2019. More flight movements and, very likely, a better reporting culture contributed to the rise. Most reports related to undeclared dangerous goods (+30% compared to the previous year), loading and unloading (+178%, from 19 to 53 reports), damage to packaging (number unchanged) and incorrect or incomplete load sheets (-39%).



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 involves 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 2023

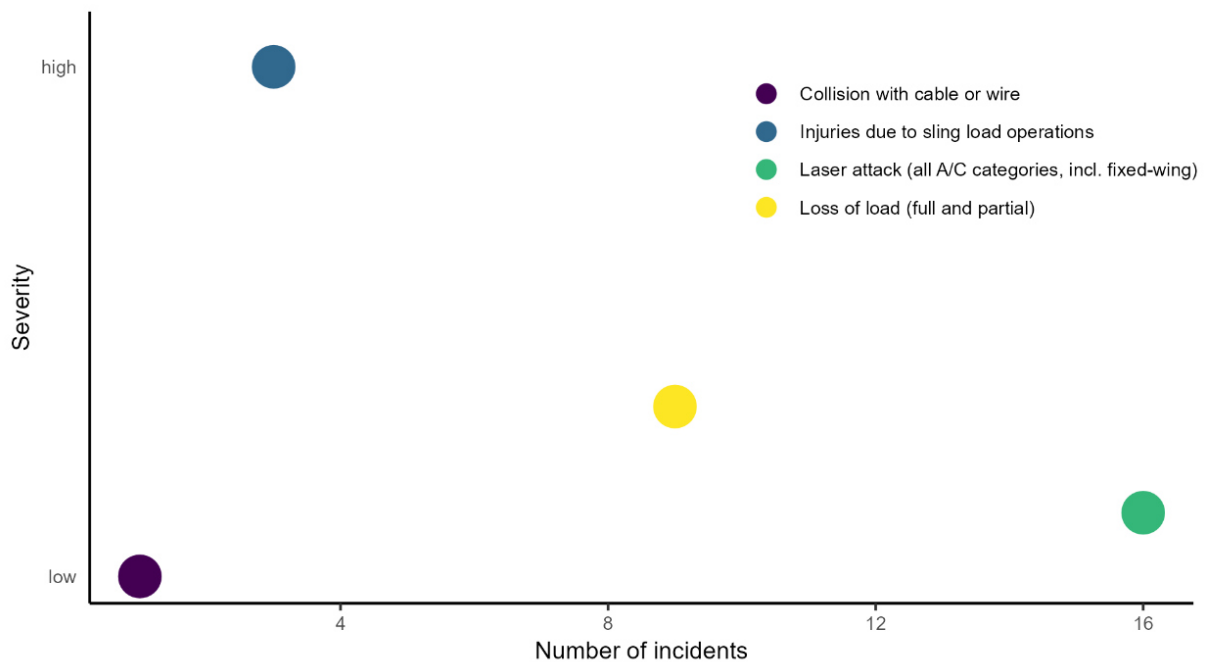


Figure 25: No. of incidents vs severity of top safety issues helicopter operations 2023



Safety issues 2019-2023

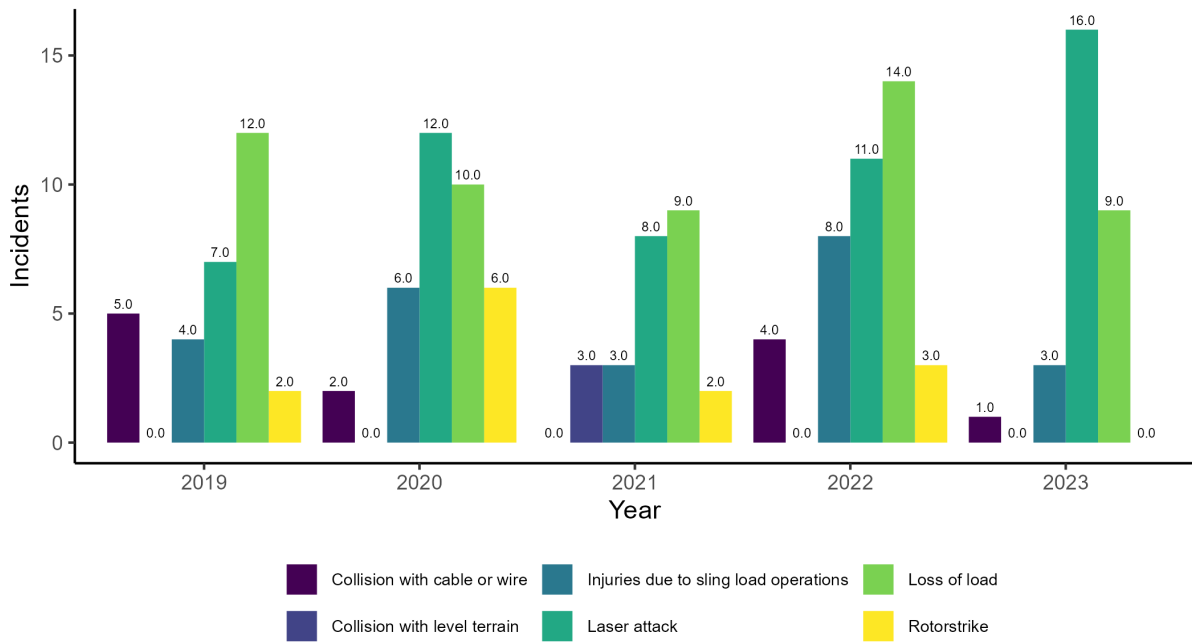


Figure 26: Top safety issues helicopter operations 2019-2023



Helicopters: 2023 cases in detail

For helicopter operations, the most safety-relevant issues can be assigned to six categories:

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.

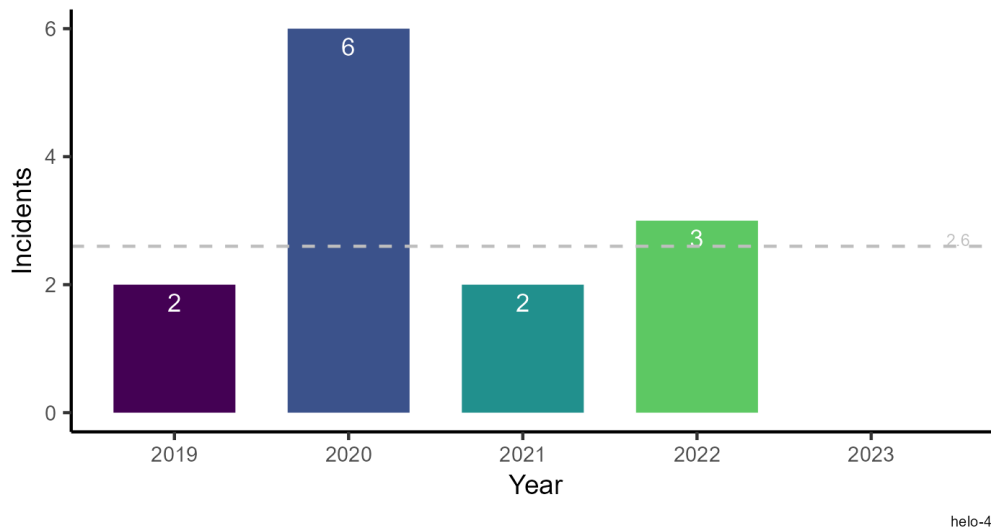


Figure 27: Rotor strike incidents 2019-2023 and average

Commentary on the 2023 figures: No reports of rotor strikes in 2023; two to seven rotor strikes per year from 2019 to 2022. This equates to 2.8 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.

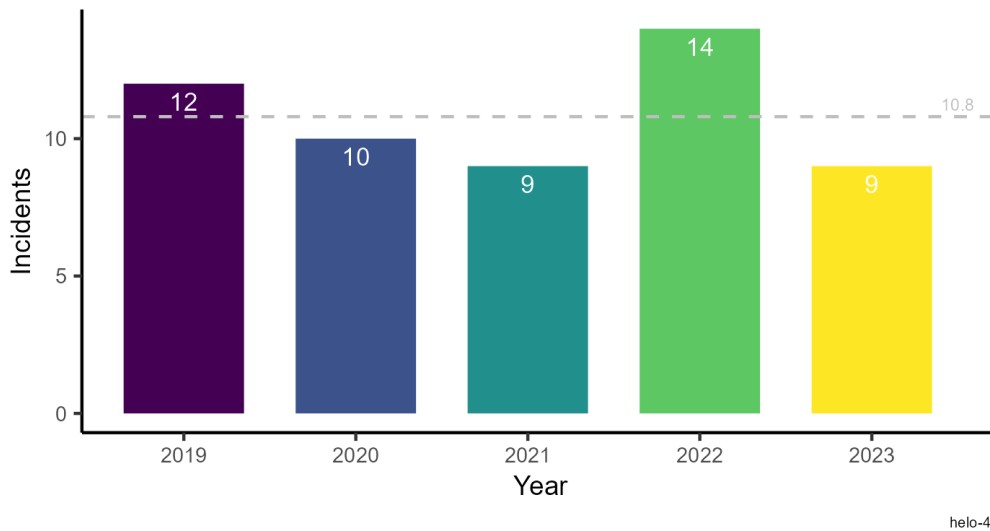


Figure 28: Loss of load incidents 2019-2023 and average

Commentary on the 2023 figures: Nine cases of loss of load in 2023. From 2019 to 2023, there were between 7 and 13 cases per year. The annual average for the last five years is 10.8; with nine load losses in 2023, it is slightly below average. Causes included inadequate preparation of the load and unexpected behaviour of an external load in the air.



4.3 Laser attack

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.

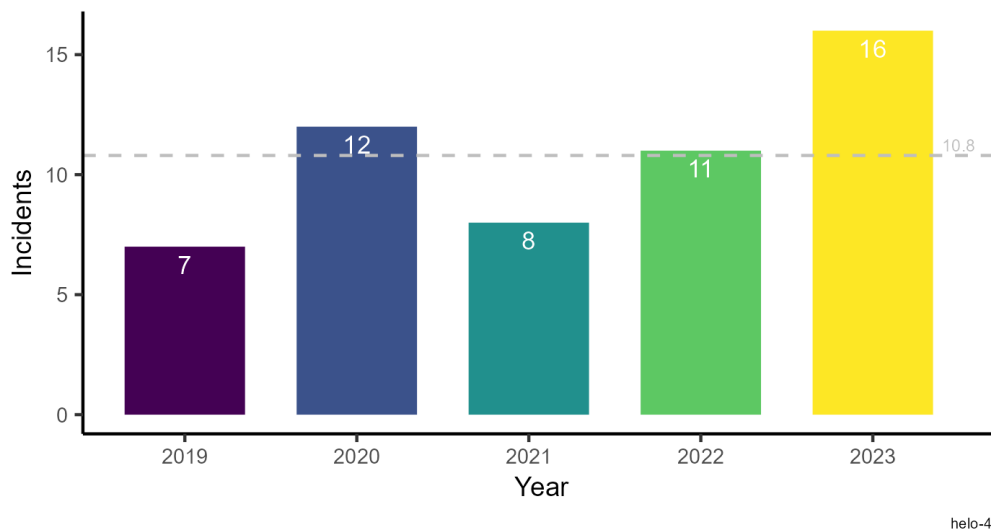


Figure 29: Laser attack incidents 2019-2023 and average

Commentary on the 2023 figures: In 2023, there were 16 reports of laser attacks on helicopter crews; the highest rate in the last five years. The average annual value for the last five years is 10.8 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 2023, there were 192 reports of laser attacks on aeroplanes, which also represented a new high for the last five years. The five-year average is 108.4 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.

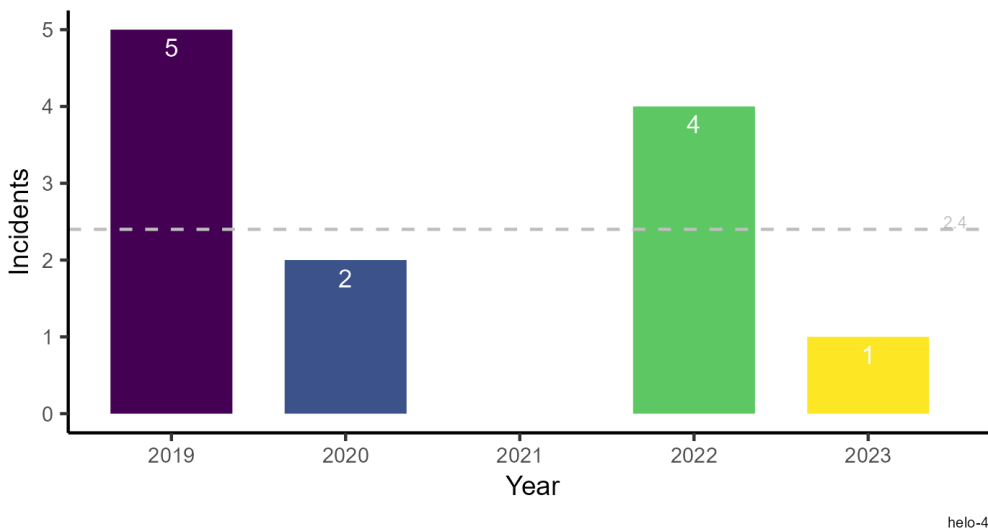


Figure 30: Collision with cables or wires incidents 2019-2023 and average

Commentary on the 2023 figures: There was one report in 2023; the severity of the incident was low. Nevertheless, such collisions can 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 travel 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

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.

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.

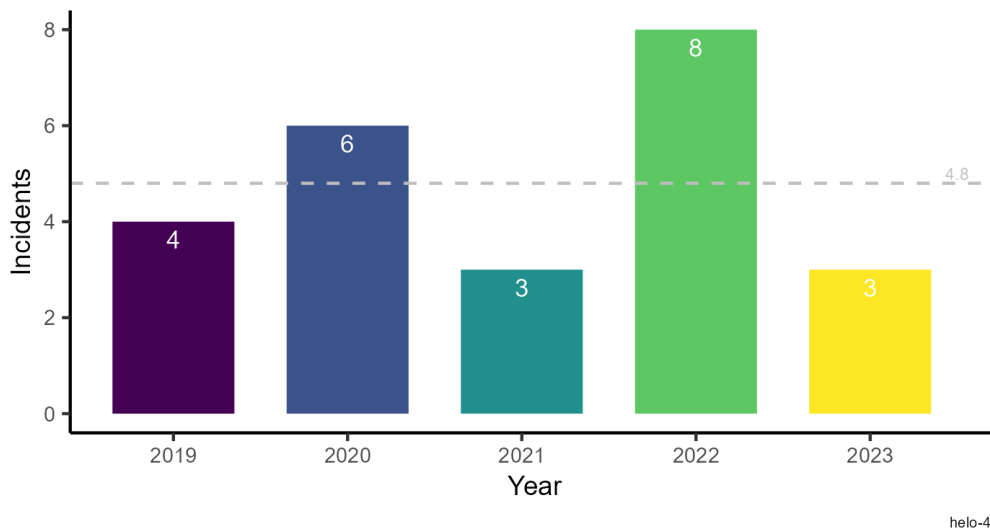


Figure 31: Injuries with external load operations incidents 2019-2023 and average

Commentary on the 2023 figures: Two people were reported injured during transport operations with sling loads in 2023, a decrease compared to previous years and compared to the five-year average of 4.2 per year. The hazard potential for people on the ground such as flight assistants and construction workers is relatively high. The risk is particularly high during assembly work and in rough terrain – even if everyone is wearing personal protective equipment, anybody not directly involved in the work 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 at which flight assistants swap information about the experiences they have encountered. Correct assessment and avoidance of hazard situations should receive special attention. Recommended value.



5 Aviation technology: 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.

Aviation technology incidents: overview of top safety issues 2023

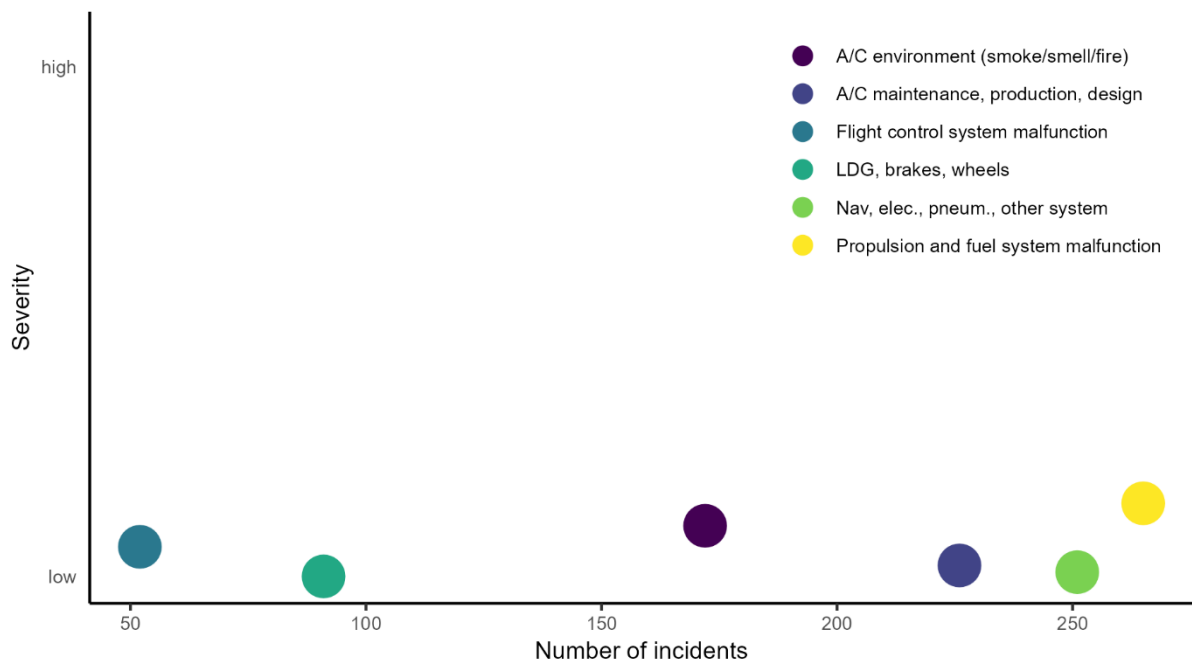


Figure 32: No. of incidents vs severity of top safety issues "technical" 2023



Safety issues 2019-2023

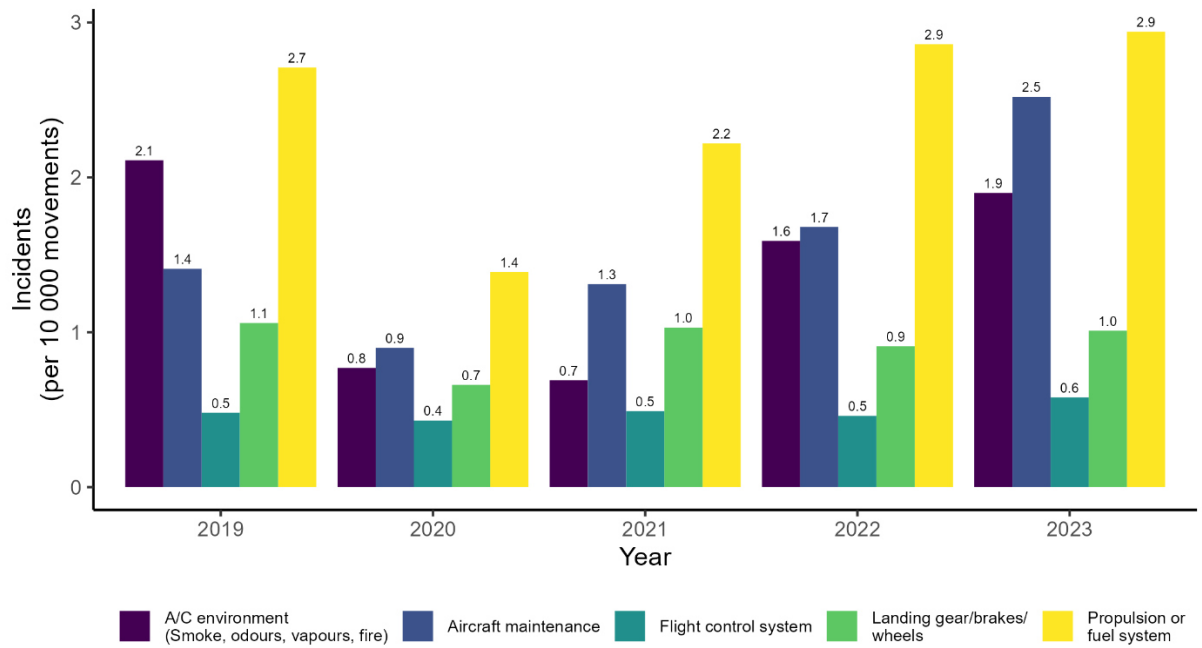


Figure 33: Top safety issues technical incidents 2019-2023



Aviation technology: 2023 cases in detail

In aviation technology, the most safety-relevant issues can be assigned to six categories:

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, bird strike, unfavourable weather conditions, lack of fuel or contaminated fuel.

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

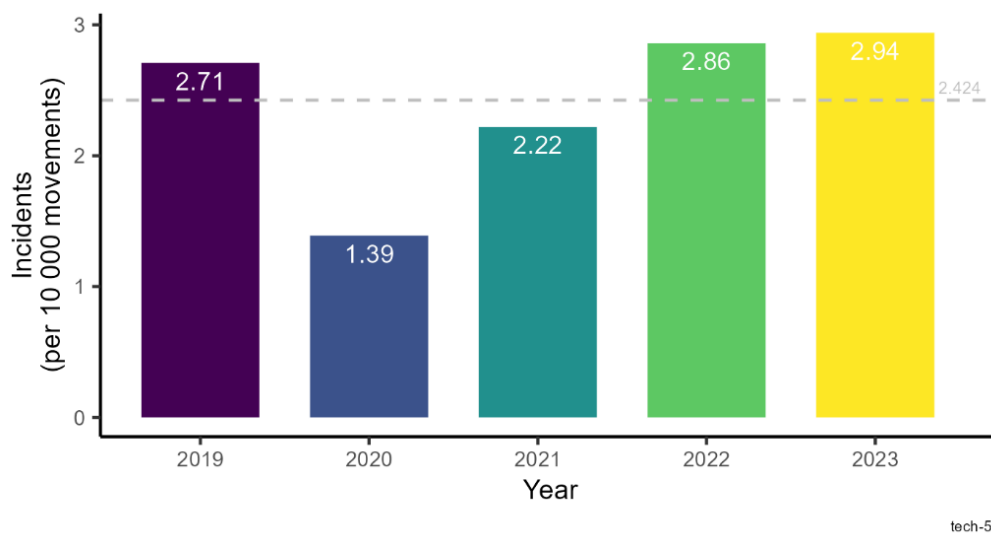


Figure 34: Propulsion and fuel system malfunction incidents 2019-2023 and average per 10 000 movements

Commentary on the 2023 figures: In 2023, the number of incidents per 10,000 movements related to propulsion and fuel systems was 2.9 incidents per 10,000 aircraft movements, roughly on a par with other non-COVID years (2019: 2.7; 2022: 2.9). The average severity level was lower than in previous years. The majority of engine-related incidents related to piston-engined aircraft. The European Aviation Safety Agency (EASA) is investigating possible causes of these incidents in cooperation with the Federal Office of Civil Aviation (FOCA) and other national authorities in Europe. Prerequisite for being able to recognise and investigate potential risks: consistent reporting of incidents with engines and other technical systems including the causes of the incidents.



5.2 Incidents due to smoke, odours, vapours, fire

What this relates to: Vapours or odours can arise in an aircraft for a variety of reasons. Depending on the source, concentration and chemical composition of the odor, 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.

Example: During the cruise phase of a flight, the cockpit crew of a passenger aircraft detects an unusual odour 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.

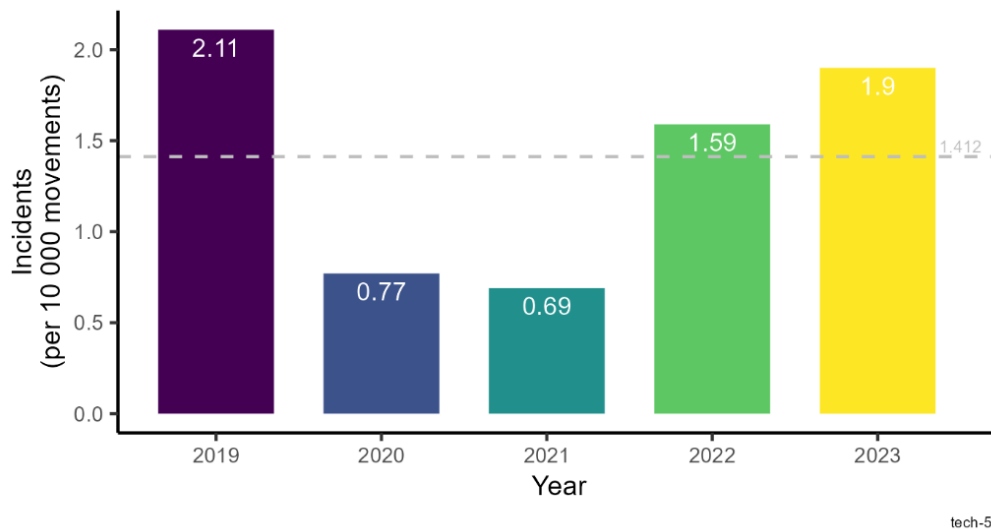


Figure 35: Smoke, odours, vapours, fire incidents 2019-2023 and average per 10 000 movements

Commentary on the 2023 figures: Incidents due to unusual odours in aircraft increased slightly in 2023 (1.9 incidents per 10,000 flight movements) compared to the previous year (1.6). Only a very small proportion had a high severity level (2.2%); this was roughly the same as the average over previous years. In about 19% of the incidents, the cause was found to be in the jet engines, piston engines or the auxiliary power unit (APU). At least half had no identifiable cause (non-reproducible individual cases, ambient influences). The remainder had various causes, such as cabin, electrical and air conditioning systems.



5.3 Flight control system malfunction

What this relates to: 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.

Example: An aircraft is making its landing approach with a flap position of 20 degrees. The crew selects a flap position of 30 degrees, but the flaps fail to move. The message MASTER CAUTION FLAPS FAIL comes on. The crew decides to abort the landing approach and apply the standard procedure for missed approaches. The procedure is performed, followed by a new approach and a trouble-free landing executed with a 20 degree flap position.

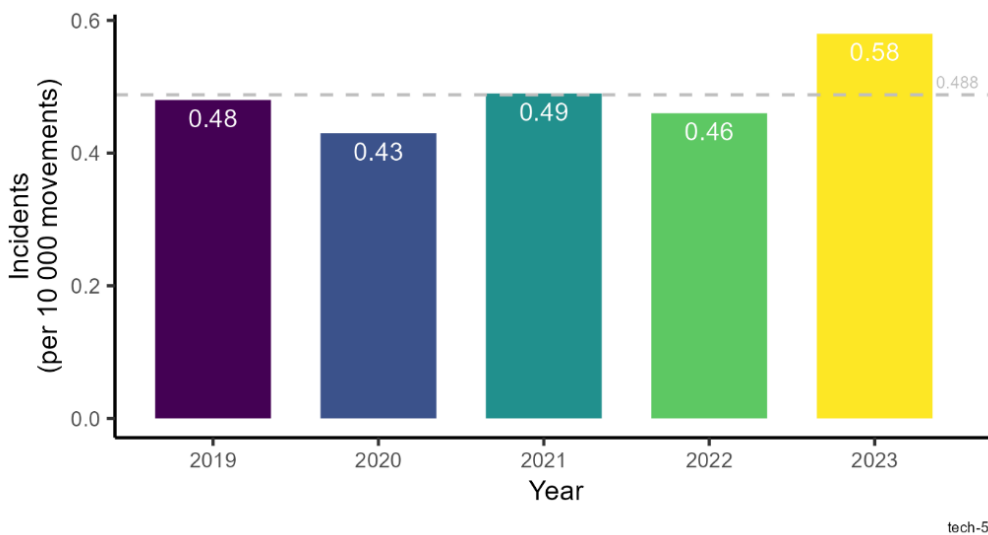


Figure 36: Flight control system malfunction incidents 2019-2023 and average per 10 000 movements

Commentary on the 2023 figures: The summary figures show no significant change relative to the previous years. The number of incidents was relatively low (0.6 incidents per 10,000 flight movements), while the average severity level has decreased. The main issues were problems extending and retracting the flaps.



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 takeoff, 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.

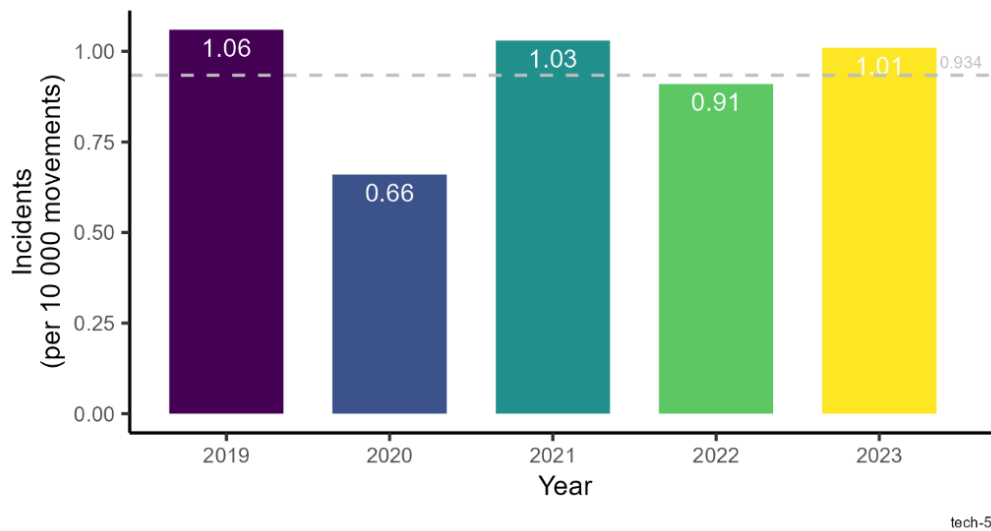


Figure 37: landing gear, brakes, wheels malfunction incidents 2019-2023 and average per 10 000 movements

Commentary on the 2023 figures: The number of incidents is on a par with previous years: 1 incident per 10,000 aircraft movements in 2021; 0.9 in 2022; and 1 in 2023. The majority of the reports related to wheels including tyres and brakes, followed by the undercarriage retraction and extension system. The average severity level (9.6) has decreased since its peak in 2020/2021 (2020: 49.5; 2021: 55.8).



5.5 Aircraft maintenance

What this relates to: Faulty or incomplete maintenance work; foreign objects 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 maintenance.

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

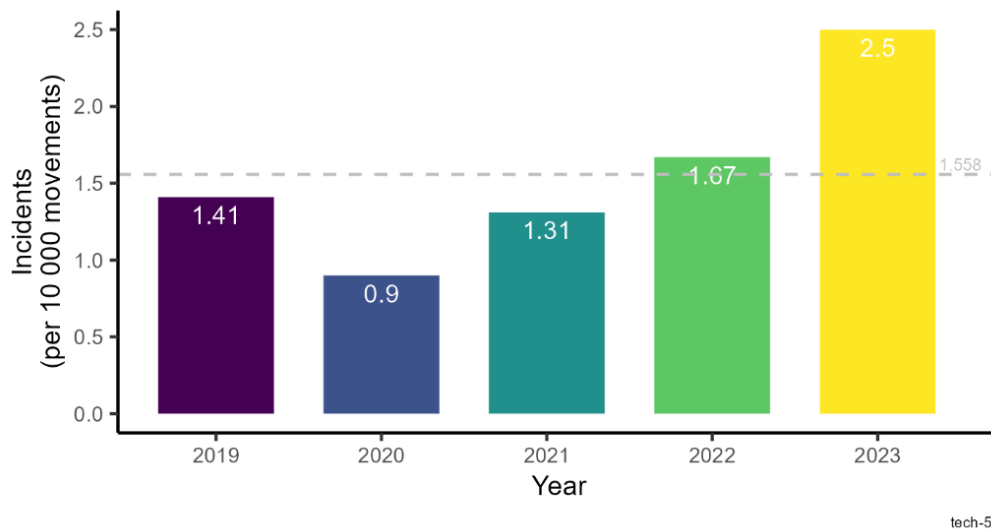


Figure 38: Aircraft maintenance incidents 2019-2023 and average per 10 000 movements

Commentary on the 2023 figures: The number of maintenance incidents increased relative to previous years (1.3 incidents per 10,000 aircraft movements in 2021; 1.7 in 2022; 2.5 in 2023). The average severity level dropped during this period (2021: 18.8; 2022: 15.4; 2023: 11.5). The reports were mainly related to incorrectly or incompletely installed components and systems. Mistakes were also reported in the planning and supervision of prescribed maintenance intervals, as well as exceeded maintenance intervals.

6 Conclusion

Data generates facts: based on the analysis of almost 10,000 incident reports from 2023, the FOCA has again been able to identify the safety issues and associated risks in the five main areas of aerodrome operations, air traffic management, flight operations, helicopter operations and flight technology. Analysing the data is central to ongoing risk assessment, which allows the FOCA to develop targeted measures to further enhance safety in the Swiss aviation system.

The findings from the data analysis help the FOCA to make decisions based on the existing risks and deploy resources in a targeted manner – and to implement projects such as [AVISTRAT-CH](#). The goal: to reorganise Swiss airspace as effectively as possible, taking account of the aviation infrastructure and thus further increasing safety. The incident reports are an important element in this and other projects.

The reports, data and information collected from commercial and non-commercial civil aviation indicate which safety issues are important in Switzerland. The priority is on collisions, whether in mid-air or on the ground.

Switzerland has operated its Airprox Analysis Board (AAB) since 2008 to reduce the risk of a mid-air collision (MAC) in Swiss airspace; other European countries have similar safety bodies. Since 2023, the FOCA has been running an internal project entitled Future Aviation Surveillance Services and Technologies (FASST-CH). The FOCA is in contact with representatives of Swiss aviation and the European Aviation Safety Agency (EASA) in connection with FASST-CH. Its task by the end of 2024 is to analyse and assess which services and technologies can and should be used to increase airspace safety in the short and long term. Our safety data also serves as a basis for FASST-CH.

A further priority: ground or mid-air collisions. The system at the largest Swiss airport is complex. A raft of larger-scale measures, such as runway extensions, would be needed to further reduce the risk of a collision. The incident data in the vicinity of the airport is used in assessing the probability of a risk occurring.

The work continues: incident analysis will remain a priority for the FOCA in future. Findings from audits and inspections, accident reports and developments in other countries are used to supplement the reports.

New issues are also relevant: drones, U-space and cyber security. In the future, the FOCA will collect even more data so that it is also able to correctly assess the risks in these areas.

Our overarching goal remains the same: to remain vigilant and sensitive to changes in the Swiss aviation system. To maintain an optimum overview of trends and risks and to act in an anticipatory manner. So that we avoid a risk becoming a reality.

We would like to say a big thank you to everyone in the aviation community who has [reported a safety-related event to the FOCA](#). It's the right thing to do, and it's an important contribution – to helping us learn from our mistakes and further improve aviation safety in a targeted and cooperative manner.

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