ANNUAL SAFETY REPORT 2018

Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
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Swiss Confederation

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

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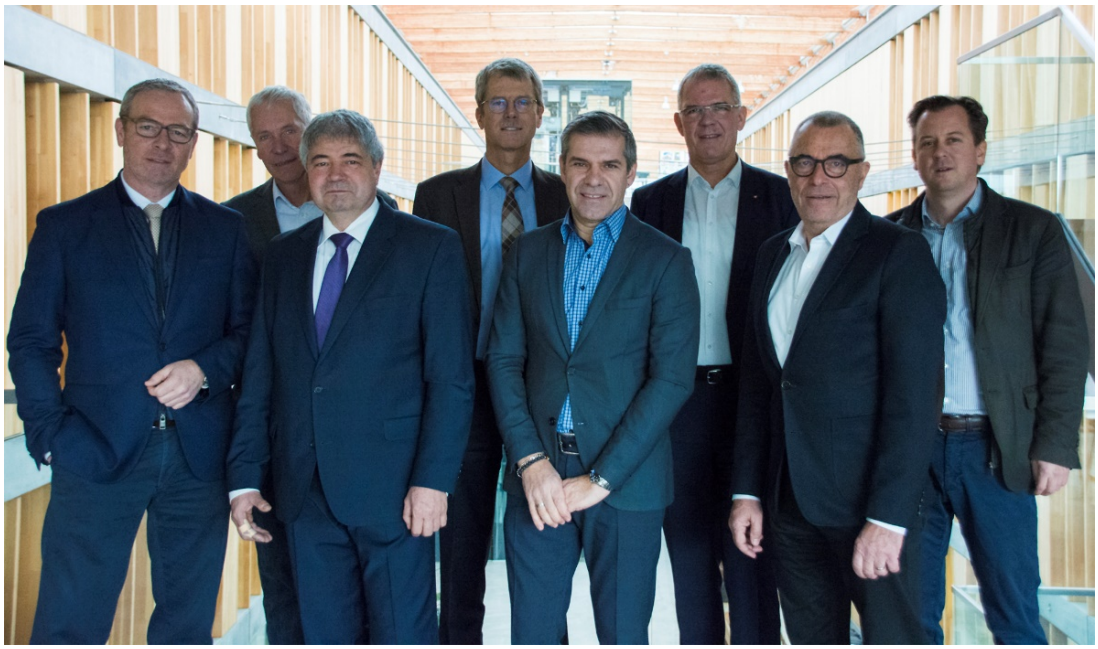
1 FOREWORD BY THE MANAGEMENT BOARD

Swiss civil aviation experienced a mixed year in 2018. The crash of a Ju-52, which claimed 20 lives, was the most serious accident in commercial aviation in Switzerland for many years. The number of non-commercial accidents in Switzerland and involving Swiss aircraft abroad fell from 39 (2017) to 16 (2018). Chapter 4 gives an overview of the number of incidents in 2018.

On the one hand, the accidents and incidents recorded in this report concern occurrences that have already taken place, but on the other hand, as the relevant federal authority, we want to simultaneously process the data into information that will help us prevent accidents in the future. By implementing suitable and practicable safety measures, we want to reduce the risks to a level that ensures a high degree of safety. The available accident and incident data are an important prerequisite for targeted, risk-related and performance-based supervisory activities. In this respect, it is critical that the companies and the supervisory authority have enough information in the form of incident data and safety information to be able to gain a complete picture of the situation. In 2018, criminal trials and their verdicts triggered discussions that call into question the open and proactive culture of reporting security-related incidents that has existed to date. Various seminars have dealt with the important question of whether such criminal proceedings and convictions of aviation personnel for negligent disruption of public transport will have a lasting adverse impact on the high level of safety in aviation. This will be revealed by the developments that subsequently occur in 2019.

Drawing conclusions from occurrences and exchanging findings with other authorities and industry representatives help us achieve our defined safety objectives. It is one of the FOCA's core competencies to consolidate safety-related topics in the areas of flight operations, infrastructure and technology on the basis of available data, and to analyse these in detail and subsequently orient its supervisory activities on the identified hotspots – to the benefit of Swiss citizens and air travellers at home and abroad. The Management Board's main focus is on holding risk-based discussions and deriving decisions from these. In 2018, various decisions were taken by the Management Board against the background of risk considerations. This allows the Board's resources to be deployed in the right place with the right priority. The Management Board hopes this report will provide you with a good overview of safety performance in 2018 and of the most important safety projects.



Federal Office of Civil Aviation, Management Board, 1 March 2019

2 INTRODUCTION

This Annual Safety Report (ASR2018) deals with incidents that occurred during 2018 in the Swiss civil aviation categories cited below, and describes how appropriate measures were implemented and which measures are planned for the future. It primarily addresses players in the aviation sector, but is also accessible to the general public. The structure of its chapters and incident categories is based on the European Plan for Aviation Safety (EPAS). The four main purposes of the 2018 report are as follows:

1 Provision of data and information as indicators for Swiss civil aviation

2 Measurement of the key safety data / achievement of safety objectives in accordance with the mandate from the Federal Department of the Environment, Transport, Energy and Communications (DETEC)

3 Assessment of risks in selected areas and description of negative trends

4 Description of measures based on incident data and obtained findings

The ASR2018 report focuses on the FOCA's direct areas of responsibility as supervisory authority (Swiss airspace, Swiss airports and airfields, HB-registered aircraft, Swiss-certified air transport operators). Against this backdrop and based on the SASP (Swiss Aviation Safety Plan) and EPAS, it distinguishes between the following categories: Commercial Air Transport (CAT), Non-Commercial Air Transport (NON-CAT) and Special Operations (SPO). In 2018, as in previous years, the focus was on analysing data relating to the following accident categories: Mid-Air Collision (MAC), Runway Excursion (RE), Runway Incursion (RI), Collision on Ground (COG) and Loss of Control (LOC). Category CFIT (Controlled Flight into Terrain) has not been included in this report, but the data will be analysed as of 2019 and presented in next year's report.

Following the first two chapters (Foreword by the Management Board and Introduction), chapter 3 contains a brief description of the most important FOCA projects during 2018. Chapter 4 deals with current safety performance in Switzerland and the rest of the world. Chapter 5 deals with the system-related topics of safe-ty promotion and reporting culture. The central component of this report is chapter 6, which provides an overview of all relevant operational incident categories and their statistics for 2018. Chapter 7 contains cur-rent data relating to drones, U-space and cyber security. Chapters 8 and 9 focus on activities relating to the SAFA (Safety Assessment of Foreign Aircraft) programme and EASA and ICAO compliance management. And chapter 10 contains an evaluation of the results, draws conclusions from them and presents an outlook of the forthcoming activities.

3 2018 FOCA SAFETY-RELATED PROJECTS

3.1 Instrument flight rules without air traffic control (Grenchen Airport)

In 2018, as part of a pilot project, Grenchen Airport continued to offer instrument flight rules (IFR) without air traffic control (ATC), i.e. during off-peak periods and at midday (IFR without ATC): from 5 p.m. to 9 a.m. and from 12.15 p.m. to 1.45 p.m. From the end of March to the beginning of April, an aerodrome flight service (AFIS) was additionally offered at certain times over a total of four days. At the request of Grenchen (security concerns), the AFIS project was then terminated by the FOCA. Since the end of 2018, ATC is now provided continuously between 9 a.m. and 5 p.m.; IFR flights without ATC are still possible from 5 p.m. to 9 a.m. At the beginning of December 2018, the FOCA decided to phase out the IFR without ATC pilot project in its current form as of 28 March 2019. The Radio Mandatory Zone introduced in the pilot project is to be continued during off-peak periods when skyguide does not provide air traffic control. This requires pilots within the zone to report via radio, which will improve safety during visual flight. This gives Flugplatz Grenchen AG more time to solve the conflict regarding IFR take-offs without ATC, allowing permanent instrument flight rules without air traffic control to be introduced.

3.2 Low Flight Network (LFN)

Given the LFN project's growing complexity (increase in the number of approaches and take-offs via PinS, greater demands on network availability (e.g. at night)) and the associated inefficiencies in communication between the four main stakeholders (REGA, Swiss Air Force, skyguide, FOCA), the FOCA called for central management of the project. As a result, the current LFN project was launched in mid-2018. The LFN project's four objectives are:

1 To address all open material questions regarding the development, costs and operation of the LFN and of approach and take-off procedures (via PinS)

2 To further develop the LFN's architecture and operation, taking into consideration the currently foreseeable approach and take-off procedures (civil and military), so that they meet the needs of current users

3 To set binding processes for adapting the LFN and introducing approach and take-off procedures (via PinS)

4 To establish an organisational structure to handle applications

Work on the current project began after it was approved at the end of August 2018 and is progressing as planned. The target date for completion of the LFN project is December 2019. The project is being closely monitored by the FOCA, and in December 2018 a FOCA employee took part in various LFN operations at REGA.

3.3 AVISTRAT

In 2018, the FOCA carried out and completed a survey of user needs. For this purpose, it held workshops with the stakeholders. The FOCA now has a complete overview of users' needs, which it will take as the basis for developing a vision for Switzerland's future airspace and aviation infrastructure. It will then draw up a strategy for the best way to realise the formulated vision. After the strategy phase has been concluded and a realisation plan has been defined, the actual implementation will be initiated in 2020. Within the scope of this project and its findings, safety recommendations of the Swiss Transport Safety Board (STSB) are to be reassessed and incorporated into the discussions.

3.4 Update on Zurich airspace (PCP2024)

At the end of 2017, the Zurich Airport Coordination and Management Committee initiated a new project to take account of the following aspects and findings:

1 Implementation Regulation (EU) No. 716/2014 – Pilot Common Project

2 Changed use of Dübendorf for civil aviation

3 Implementation Regulation (EU) on Airspace Design, including Instrument Flight Procedure Design and Airspace Process (entry into force scheduled for January 2020; implementation by January 2022)

4 Document entitled ‘‘Airspace Design Principles’’ (including safety buffers), which is currently being prepared by the Airspace Regulation Team headed by the FOCA and will be ready for implementation in 2018

5 Relevant safety recommendations of the STSB – to be specified by the project team

6 Airspace and (flight) procedures at Emmen airfield and (flight) procedures of Friedrichshafen / Altenrhein (ARFA) skyguide sector, because they interact with Zurich

7 Initiation of talks with the German regulator and German air traffic control – DFS (a part of TMA Zurich is above Germany)

This new project applies a risk-based approach similar to that of AVISTRAT and the Grenchen and Samedan projects. As a first step, new Instrument Flight Procedures (IFPs) are to be developed for Zurich Airport based on Implementation Regulation (EU) No. 716/2014 (first part of the take-off segment and last part of the approach segment – other parts of the procedure have to be designed more flexibly). With respect to coordination with the stakeholders and the overview of the project status, as well as the necessary decision-making powers, the FOCA will assume responsibility for the management of the project concerning the restructuring of airspace around Zurich Airport and the associated processes and procedures. In addition, all the already ongoing projects aimed at increasing the safety margin at Zurich Airport will be managed and monitored by the Zurich Airport Coordination and Management Committee. Three meetings with the core team were held in 2018.

3.5 Historic aircraft

On 4 August 2018, a Ju-52 crashed in the Swiss mountains, killing 20 people. This prompted a discussion about the level of safety in the operation of historic aircraft in connection with the carriage of passengers.

The indications are accumulating that the use of historic aircraft or aircraft without a type certificate (TC) holder (“orphan”) entails increased risks. On the one hand, the aircraft’s fuselage, wing structures and systems were not designed for indefinite use and should therefore only continue to be operated in compliance with an ageing aircraft programme. On the other hand, aircraft without a TC holder lack an essential function for maintaining airworthiness.

The FOCA is therefore examining whether to implement measures to ensure flight safety in the absence of a TC holder.

Possible security measures could include:

- Limiting the number of passengers carried
- Restricting flyovers of populated areas or critical infrastructure
- Requiring maintenance to be carried out in an approved maintenance organisation similar to Part-145
- Introducing a continuous maintenance management system based on CAMO
- Integrating a safety management system for maintenance
- Developing and implementing the necessary engineering competencies
- Integrating a quality inspection system for manufacturing activities
- Introducing an ageing aircraft programme

The exact form of these measures and their mutual dependencies (mitigation measures) will be defined using standardised hazard analysis. The complexity of these programmes will increase according to the type of aircraft and operation. For example, the requirements and possible measures for a larger aircraft that can also carry passengers are much more demanding than those for a light aircraft with one or two seats.

4 SAFETY LEVEL

4.1 Global safety level

The figures published by the IATA (International Air Transport Association) for 2018[1] indicate a slight decline in the global safety level compared with 2017. The all accident rate increased from 1.11 accidents per million flights in 2017 to 1.35 per million in 2018. The hull losses rate also showed a marginal increase between 2017 and 2018 for aircraft with jet engines, from 0.12 to 0.19 per million flights. Nevertheless, both the all accident rate and the hull losses rate remain below the 5-year average (2013 to 2017).

4.2 Safety level in Switzerland

A total of 23 accidents were recorded in 2018. Compared to the previous year, the absolute number of all accidents fell by 45 percent (cf. 2017: 42 accidents), while the number of fatal accidents remained at the previous year's level: in both 2017 and 2018, 9 fatal accidents were recorded. While a total of 19 people were fatally injured in 2017, the 2018 total was 36. The number of non-fatal accidents fell from 31 to 14, more than halving compared with the previous year. In summary, over 90 percent of accidents still take place in the non-CAT segment.

In commercial air transport (CAT), 2 accidents occurred last year. One of these accidents resulted in no fatalities, while the crash of a Ju-52 killed 20 people.

With regard to helicopters, a total of 5 accidents were recorded in 2018 in CAT and work flights (SPO), one of which resulted in death.

[1] https: //www.iata.org/pressroom/pr/Pages/2019-02-21-01.aspx

5 SYSTEMIC ISSUES

5.1 Safety Promotion

The FOCA continued to use various channels in 2018 to disseminate safety-relevant information to the Swiss aviation industry. For example, FOCA representatives were actively involved in various safety seminars and industry events (e.g. organised by AOPA, skyguide, Swiss Helicopter Association, Alp Aviation). The FOCA also hosted various events at which stakeholders were given information about projects and new developments (Safety Oversight Committee, Swiss Aviation Days, airport manager meetings, etc.). The attention of the general aviation sector was drawn in particular to a wide variety of safety-related topics, with the issue of drones featuring prominently in 2018. The FOCA awareness campaign included publication of a flyer, a video and a quiz, as well as updating of the drone section on the FOCA website.

5.2 Reporting culture

In 2018, 5,717 incidents (2017: 5231, 2016: 5,370; 2015: 4,896) were reported. A total of 8,586 reports were processed. The difference is due to reports being received from different parties involved, follow-ups and final reports.

There was little change in the number of reported incidents at airfields and specialised operations compared with the previous year. The number of incidents reported by air traffic control also remained constant. We will be unable to deduce any potential impact on the reporting culture of civil law charges brought against air traffic controllers until the next annual report at the earliest. It should be noted that the incident reports from air traffic control highlight two different areas: a conclusion can be drawn about the quality of air traffic con-trol itself, while incidents reported by airspace users can be fed into skyguide's reporting system. The num-ber of incidents reported under Commercial Air Transport (CAT) increased by almost 20 percent, which is explained by a significant increase in the number of reports relating to dangerous goods (see earlier chapter on dangerous goods). In the case of maintenance providers, there has been a marked decrease of almost 40 percent in the number of incidents reported, which is largely explained by the decline in the number of reports relating to outsourcing. Individuals have been reporting more incidents every year since Regulation (EU) No. 376/2014 came into force on 1 April 2016, which fortunately indicates that the number of unreport-ed incidents continues to decrease.

6 OPERATIONAL ISSUES

6.1 Mid-air collisions (MAC)

An AIRPROX is described in the fundamental principles as follows: “A situation in which, in the opinion of a pilot or air traffic services personnel, the distance between aircraft as well as their relative positions and speed have been such that the safety of the aircraft involved may have been compromised.” These incident reports are combined with aircraft collisions, separation minima infringements (SMI) and resolution advisories from the collision avoidance system (TCAS RA) in the mid-air collisions (MAC) category, and the severity is assessed on the basis of the information available.

In 2018 there were two mid-air collisions involving Swiss aircraft. The first accident occurred in Oberhausen-Rheinhausen (D) on 23 January 2018 between a Piper P28A and an Airbus helicopter EC135, in which all four passengers lost their lives. Another accident happened on 8 May 2018 in Lochenstein (D) between two gliders – in this collision, both pilots landed and were unhurt. The German Federal Bureau of Aircraft Accident Investigation (BFU) has started an investigation into both collisions.

In Swiss airspace, a total of 219 incidents were recorded in the MAC category in 2018. On top of these came a further 128 reported incidents in delegated airspace managed by Switzerland, resulting in a total of 347 reported incidents.

Once again, of the 98 AIRPROX incidents reported, more commercially operated aircraft were involved than in the previous year. Of these, 17 were classified as serious incidents by the FOCA’s Safety Risk Management unit. The number of resolution advisories issued by the collision avoidance system (TCAS RA) remained the same for all airspace categories compared with the previous year.

Since the ICAO airspace categories have to be defined according to the type of air transport (composition for commercial or private transport, operation under visual flight rules or instrument flight rules, manoeuvrability of the aircraft, etc.), and in order to ensure a sufficient distance between aircraft, on the basis of requirements and regulations, the typical dangers, risks and potential measures are also differentiated according to these airspace categories.

6.1.1 Airspace category Charlie (C), controlled airspace, terminal manoeuvring areas, air routes and upper airspace primarily used for IFR flights

ATC-relevant reports concerning violations, procedural errors and conflicts in 2018: 435

With 158 reported incidents, the number of airspace violations remained unchanged compared to the previous year. Fortunately, at 98 incidents, fewer separation minima infringements (SMI) were recorded.

In 2018, there were only 5 reported AIRPROX incidents in this airspace category.

6.1.2 Airspace category Delta (D), controlled airspace, control zones of intercontinental and regional airports, mixed use for VFR and IFR flights

ATC-relevant reports concerning violations, procedural errors and conflicts in 2018: 414

Here, too, at 200 and 48 percent of all reports, the number of airspace violations by pilots operating flights under visual flight rules in the general aviation segment represented the largest category of precursors to other potential conflicts. In 2018, there were a total of 16 reported AIRPROX incidents in category D air-space. This resulted in 4 separation minima infringements (SMI) between commercial aircraft and aircraft operating under instrument flight rules and 4 incidents with inadequate separation

between VFR and IFR aircraft. The remaining reported incidents took place between aircraft under visual flight rules.

6.1.3 Airspace category Echo (E), controlled airspace for IFR flights at lower altitudes at regional airports, though primarily used for VFR flights in the general aviation segment

ATC-relevant reports concerning violations, procedural errors and conflicts in 2018: 82

The 13 airspace violations contained in the ATC-relevant reports relate exclusively to violations of restricted areas. The total number of incidents is low compared to airspace categories C and D, but most of the re-ported conflicts during a flight in airspace E were serious, so it is no surprise that 50 of these incidents were reported as AIRPROX. IFR aircraft were involved in 17 incidents, 75 percent of which were being operated commercially.

6.1.4 Airspace category Golf (G), uncontrolled airspace for IFR flights taking place on a test basis at Grenchen regional airport, though primarily used for VFR flights in the general aviation segment

ATC-relevant reports concerning violations, procedural errors and conflicts in 2018: 16

The air traffic control incidents in airspace category Golf were all due to test operations at Grenchen region-al airport. These were reported by air traffic control in connection with deviations from the prescribed procedures, which also necessitated the report of a serious AIRPROX. In 2018, there were a total of 24 reported AIRPROX incidents in this airspace category. It is noticeable that many of these incidents were only reported by one of the parties involved. To achieve the most reliable analysis possible, the FOCA relies on reports by all parties involved.

6.2 Loss of Control Inflight – LOC-I

Throughout European airspace, loss of control of an aircraft is now one of the most common causes of ac-cidents. Here, a distinction is made between loss of control due to insufficient engine power, damage to the aircraft structure, system defects and human performance and limitations in daily operations. In addition, the influence of weather conditions (storms, lightning strikes, hail, etc.) has been identified as a possible cause of air accidents due to loss of control.

The above figures refer to reported incidents which, if the situation had developed adversely, could have led to a deviation from the intended flight attitude and ultimately to loss of control. Only a very small proportion of these actually led to such a deviation.

The majority of reports came from commercial aviation, which can be explained by differences in the re-porting culture, as well as in the type and scope of operations and aircraft complexity.

We list below three categories which can lead to loss of control in flight.

6.2.1 Engine power

This category concerns the loss of control in flight due to loss or reduction of engine power. This may be caused by technical defects, faulty manipulation, maintenance errors, damage incurred on the ground, bird strike, weather conditions, lack of fuel or contaminated fuel. A loss of power or even the failure of an engine does not always lead to an emergency. Modern passenger aircraft can be controlled, even after an engine failure, and crews receive ongoing training for such cases.

If necessary, the pilots can also shut down engines or operate them with reduced power to prevent damage. This can be the case, for example, with engine vibrations, an overly high EGT (exhaust gas temperature) or an overly low oil level or oil pressure.

In 2018, 169 technical incidents were reported, roughly the same level as in the previous year. The number of reported incidents relating to maintenance decreased to 25. There were no engine failures due to fire re-ported in the year under review. 65 percent of incidents concerned commercial aviation.

A total of 26 bird strikes against engines or propellers were reported to the FOCA, most of them in commer-cial flight operations. A small number of these bird strikes resulted in engine damage, but did not cause a loss of engine power.

The following scenarios were observed in this accident category:

Loss or reduction of engine power

In a few cases, engine problems and reports of these gave rise to precautionary landings at alternative airports or to aircraft returning to the airport of departure or aborting take-off. These are standard pro-cedures carried out to avoid a potential compromise of safety.

In the general aviation segment, three emergency landings had to be made due to engine or propeller defects.

The following main potential causes were identified:

- In the majority of cases, the loss of engine power was attributable to technical defects in the engines and their systems, while technical defects in the fuel system accounted for a smaller number of engine power losses.

- Two engines in commercial aviation failed due to technical defects and in five cases the engines were switched off as a precautionary measure due to warning signals.

6.2.2 Human / aircraft performance and limitations

The incidents analysed in this category mainly concern human causes relating to crew or ground handling, as well as technical defects compromising flight control, navigation, air conditioning or cabin pressure.

The following scenarios in particular were observed in this accident category:

Malfunction of instruments, flight control, systems or automation

With regard to aircraft technology, this category concerns incidents involving systems for automatic and manual flight control, navigation, displays, cabin pressure and de-icing. This also includes hydraulics, pneumatics and electrical components.

In passenger aircraft, the important systems are usually designed redundantly; if one system fails, others take over some or all of its functions and the aircraft remains controllable. Failures and problems are displayed to the pilots, according to their severity, as indicators or warnings, in order to enable appropriate measures to be taken. In addition, the crews receive periodic training for potential failures of the various systems.

In 2018, 408 incidents were reported relating to technical topics, including the odour build-up or smoke incidents described below, of which 91 percent relate to commercial aviation. This is a slight increase versus the previous year. In contrast, the number of reported incidents relating to maintenance decreased to 30.

In 2018, 6 cases of a minor deviation from the planned flight status or speed were reported in this incident category in the commercial aviation segment.

The main potential causes identified were as follows:

- Failure of navigation systems
- Autopilot errors
- Hydraulic or electronic defects in the flight control system
- Electrical systems

Impedance of crew due to loss of cabin pressure, contaminated cabin air, smoke or fire

Odours in aircraft can arise for a variety of reasons and do not necessarily have an adverse impact on safety or health. However, depending on the concentration and chemical composition, health may be adversely affected. In a few cases, to prevent potential risks, odour or smoke in the cockpit led to a precautionary landing or to the use of oxygen masks by the crew.

Airlines follow established processes to investigate such incidents and remove their causes.

In general, the following causes in particular can lead to odour forming in aircraft:

- Traces of oil from an engine or auxiliary power unit that penetrate the air-conditioning system
- Defective electrical / electronic components
- Odour development in the galley due to defects or soiled ovens or coffee machines
- Defects in the cabin pressure and air-conditioning system
- External odour sources on the ground (e.g. de-icing, ambient air)
- Luggage, cargo, passengers

Deviations from flight parameters due to human performance and limitations

Flight speed and horizontal and vertical flight attitude are controlled by flight control automation (autopilot) or directly by the pilot. The engine power required for take-off is also calculated on the basis of the air temperature and take-off weight and configured accordingly via the on-board computer. If the deviation is too large, these vital parameters can lead to loss of control of the aircraft.

The number of reports in this area has not changed in the last three years, and is low (210 reports). Taking into account the general increase in the number of reports in recent years due to the improved reporting culture (+12 percent), it can be deduced that there was a slight decrease overall. Fewer than 7 percent of the reports derive from leisure-time aviation, while the remaining incidents occurred in commercial aviation.

The severity of these incidents depends, among other things, on the flight phases of the aircraft. While critical incidents are more likely to occur during take-off and landing, the high altitudes of cruise flights make them less critical and provide a greater safety reserve. The incidents were distributed among the various flight phases as follows: 7 percent during take-off, 32 percent during cruise and 61 percent during approach and landing. Similar figures were also observed over the past three years.

Of the different types of deviations, 55 percent related to drifting at the required airspeed, 30 percent to deviations from the horizontal flight attitude and 15 percent to deviations from the aircraft's banking position or rolling motion.

Main causes of flight path deviations

Due to the information contained in the reports received, it is not always possible to determine exactly what caused the deviations. In 70 percent of the reports, weather conditions, such as rapid changes in wind direction (wind shear) and strong turbulence, were the main cause. In 20 percent of the deviations, distractions in the cockpit, late reactions of the pilots or inadequate application of defined procedures were responsible for breaches of individual parameters (e.g. flight speed).

As a rule, flight path deviations were quickly detected and corrected by pilots. Special technical warning devices also helped to draw the pilots' attention to any deviation from regular flight parameters, enabling an immediate adjustment to be made to the lateral or vertical deviation or the airspeed. Last but not least, situations also arose, for example, where landing manoeuvres were aborted and a new, stabilised approach initiated. Occasionally, due to unstabilised approaches, aircraft made hard landings or landed late on the runway – which in extreme cases can lead to the aircraft leaving the runway inadvertently.

More than 93 percent of all deviations of the above mentioned parameters had a minor influence on flight safety, which corresponds to a further reduction of 3 percent compared to the previous year.

In the helicopter segment, 13 reports of deviations from flight parameters were received in 2018, the same number as in the previous year. This figure is slightly above the 4-year average. In most cases, the deviations concerned too high or too low engine and rotor speeds, and were largely operational in nature or attributable to inattention.

Laser attacks

In 2018, 77 laser attacks of aircraft crews over Swiss territory were reported to the FOCA, a 16 percent increase versus 2017 and 12 less than the 4-year average of 89 reports. Over 9 percent of the reports received in 2018 indicated a higher risk potential because at least one crew member was hit directly by the beam and suffered temporary sight impairment or eye pain. A cluster of laser attacks was observed at Zurich and Geneva airports, although there was a decrease in the number of incidents at Zurich compared with the previous year. This is understandable, however, in that laser attacks are mainly possible at low flight altitudes, i.e. during landing and take-off (distance from, and visibility of, aircraft).

Six helicopter crews were blinded by laser pointers in 2018, which is more than 50 percent less than the year-earlier figure (15). Once again, no geographic cluster of laser attacks against helicopters was identified in 2018. The potential threat of laser attacks is slightly higher in helicopters because, unlike passenger aircraft, they generally only have one pilot. If the pilot's sight is seriously impaired, there is no co-pilot to take over the controls. In view of this, it is especially important to protect helicopter crews against laser attacks.

Dangerous goods

In the carriage of dangerous goods segment, two and a half times more reports were registered in 2018 than in the previous year. A closer analysis of the incidents shows that this significant increase in incident reports is mainly due to the reporting culture of a few flight operators. For example, the number of reports relating to undeclared dangerous goods rose from around 150 in 2017 to just under 500 in the year under review. This cluster of reports in 2018 is probably attributable to the fact that regular checks were carried out on Transitpost this year, particularly by one stakeholder. On the other hand, some flight operators have also started to report dangerous goods detected at check-in, such as e-cigarettes and laptops. A similar trend was observed in other countries last year.

6.2.3 Structure

This category concerns the loss of control during flight due to failure or deterioration of the aircraft structure. This may be caused by technical defects, ageing, corrosion, faulty manipulation, maintenance errors, dam-age incurred on the ground, bird strike or the transport of dangerous goods.

The number of reported technical incidents for this topic fell to 26 in 2018. The main reason for the decrease was a fall in the number of damaged aircraft doors and fuselage. 77 percent of incidents derived from commercial aviation and 8 of these cases resulted from maintenance errors.

In commercial flight operations, over 300 bird strikes affecting the aircraft structure were reported to the FOCA in 2018. Only a small proportion of these bird strikes resulted in damage, none of which led to impairment or even failure of the aircraft structure.

In 2018, 75 incidents were recorded in which commercially operated aircraft were damaged by faulty manipulation of handling equipment or vehicles in Switzerland and abroad. None of these incidents were classified as serious, particularly as the majority of the damage was duly reported by ground personnel and appropriate measures were taken. In 16 cases, damage of unknown origin was found following a flight. However, the flight behaviour was not impaired in these cases either.

The following scenarios were observed in this accident category:

6.2.4 Failure or impairment of the aircraft structure

The following potential causes were identified, among others:

- Cracks in structural parts and casing. In most cases, these cracks were identified during maintenance inspections
- A small aircraft lost a cargo door during flight due to improper maintenance

6.2.5 Fire outside the pressurised cabin

In the cargo hold of a helicopter, a fire with smoke was caused by defective insulation on electrical cables. EASA then published an AD (Airworthiness Directive) on checking and modifying the affected components.

6.3 Runway Excursion (RE)

EASA statistics show that between 2007 and 2017, most aviation accidents occurred during landing. This usually involved the aircraft unintentionally leaving the runway to the side or at the end. The causes of such incidents were usually environmental conditions (strong tail wind, slippery runways), technical defects or human error.

6.3.1 Overshooting the runway

In 2018, the same number of runway overshoots occurred as in 2017. In commercial aviation, no incidents were recorded in this area; 5 incidents occurred in total, and only in general aviation. While there were no injuries in 4 cases, 1 accident unfortunately resulted in 2 fatalities.

One reason for overshooting the runway is unstabilised approaches, which often lead to this result when there is a tailwind and there is no decision to take off. Technical difficulties with brakes or thrust reversal can also lead to aircraft overshooting the runway.

The third cause of overshooting the runway is engine problems; such an incident can be caused when take-off power is weak or absent and the pilot fails to take the decision to abort take-off or takes the decision too late to abort in time.

6.3.2 Runway side excursion

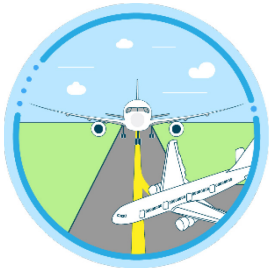
A runway side excursion is frequently also due to a non-stabilised approach and is mainly seen in general aviation. The reason for this is often insufficient flying experience in bad weather conditions; turbulence and wind shear due to weather fronts are an additional challenge for pilots in this flight phase. And in general aviation, many aircraft are still equipped with stern or tail wheels, which are much more difficult to land, especially in crosswinds, than more modern light aircraft with nose wheel control. Other reasons for runway departures in 2018 were technical defects in the aircraft.

While there were as many as 24 cases in 2016, the number had fallen to 9 the following year. In 2018, there was another increase to 17, which corresponds to the average for 2016 and 2017.

In commercial air transport, only one incident occurred – involving a business jet but with no injuries.

All other incidents occurred in general aviation at small airfields and here, too, there were no injuries and only the occasional material damage.

6.4 Runway Incursion (RI)



Runway incursion is the term used if the runways at airports and airfields are accessed or used by people, vehicles or aircraft without authorisation.

A distinction is made here between the runway itself and the protected area adjoining it. Any cases of unauthorised access or use of the protected area by people, vehicles or aircraft must be reported to the FOCA.

A distinction is also made as to whether an airport or airfield is controlled and supervised by an air traffic control authority (e.g. tower control, ground control, apron control) or whether it is an uncontrolled airfield.

In 2018, 76 runway incursions were reported to the FOCA.

Of these, 37 runway incursion reports concerned aircraft, 18 concerned vehicles and 23 concerned the unauthorised presence of people on runways. There was therefore a slight increase in all three categories in the number of incidents compared with the previous year.

Runway incursions mostly occur at regional airports or airfields that are not as thoroughly protected by fencing, barriers and markings as intercontinental airports. Thus, at regional airfields, the proportion of people and vehicles that do not belong to the airfield but nonetheless intentionally or unintentionally access a runway or its protected area is high.

In most cases, pilots who enter the protected area or runway with their aircraft without authorisation (stop bar crossing deviations) do so because they have overlooked the corresponding markings or lights (inadequate awareness of the situation), or have had a communication problem with air traffic control. These incidents resulted in a few aborted landings being ordered by air traffic control or autonomously initiated by the pilot of an approaching aircraft.

Communication problems rarely result in an aircraft entering or taking off from a runway that has not been allocated by ATC.

6.5 Collision on Ground – COG

This category concerns a collision between a taxiing aircraft and another aircraft, vehicle, person, animal or other obstacle in its path. It does not apply to collisions on the runway.

In 2018, 11 collisions between a taxiing aircraft and another aircraft, vehicle or airfield infrastructure were registered in this category. As in previous years, these collisions resulted in damage to property, but there were no injuries. In addition, a total of 242 incidents were reported that had the potential to result in a colli-sion. The majority of the reported cases occurred in the CAT segment, while a few cases concerned the general aviation segment. On the basis of the reported information, the following main scenarios and causes were determined:

6.5.1 Aircraft moving on taxiway or apron without clearance from ATC

In 2018, 51 incidents occurred (just under half of which were at Swiss airports) in which an aircraft began to move on a taxiway or apron without clearance from ATC, although none of these required classification as serious. However, the number of such incidents was higher than in the previous year. In most cases, the identified causes were as follows:

- The crew understood the instructions of ATC correctly, but overlooked relevant signals / markings and subsequently deviated from the ATC instructions (wrong TWY, exceeding the clearance limit, etc.). The crew did not understand the instructions of ATC correctly and erroneously believed they had been given the go-ahead for this TWY / aircraft stand
- Apron / Air Traffic Control gave inappropriate or incomplete instructions

6.5.2 Failure to maintain a safe distance from other aircraft or objects

In this category, 19 incidents at Swiss or foreign airports or airfields were reported in which a commercially or non-commercially operated aircraft failed to maintain a safe distance from other aircraft, vehicles or objects while taxiing or parking. The number of such incidents was stable compared with the previous year. Three incidents were classified as serious. The following causes were identified:

- The aircraft was not correctly guided by the escort vehicle or the operator; communication between the cockpit and the ground crew was misleading
- The crew lost their awareness of the situation (for example, due to distraction in the cockpit) and deviated from the specified taxiway or oversaw relevant markings
- Pilot error in the cockpit led to an unplanned aircraft movement

6.5.3 Taxiing aircraft impeded by a person, vehicle or object

A total of 172 incidents (the majority at Swiss airports or airfields) were reported in which a safe distance was not maintained between a vehicle or a person and a taxiing aircraft. On average, a slight increase in such incidents has become apparent over the past four years. In most cases, the identified causes were as follows:

- Failure to observe right of way of a taxiing or reversing aircraft due to lack of awareness of the situation by the vehicle operator (due to distraction or focus on other activities)
- Due to time pressure and lack of space, ground handling personnel placed equipment outside the designated storage area

6.6 Helicopter operations

This chapter deals with helicopter operations that cannot be allocated to any other incident category (including work flights with underload).

A slight increase in the number of reports was recorded in this area in 2018. Over the last few years, the number of reported incidents has been stable, with only small fluctuations. Due to the low number of reported incidents, it is not possible to draw any clear conclusions. It is therefore difficult to identify a trend here.

In the reporting period, the number of load losses recorded was half that in the previous year. However, the number of injured flight assistants or construction workers on the ground increased. In none of the cases was an investigation by the Swiss Transport Safety Board (STSB) necessary.

An analysis of the reports did not reveal any other noticeable trends in helicopter operations.

7 EMERGING ISSUES

7.1 Drones and U-space

In the 2018 reporting year, there was a collision between a drone and a helicopter in Ticino; there were no reports of accidents involving injuries caused by drones. The FOCA strongly urges players in Switzerland's civil aviation sector to report all incidents involving drones so that it can obtain as complete and objective a picture as possible. Some time will be required before it is possible to assess the influence of an improved reporting culture.

Sales of drones (especially in the hobby sector) have increased sharply in the past few years. It is now estimated that more than 100,000 drones have been sold in Switzerland, although exact figures on how many of these aircraft are actually in use in Switzerland are not available. The number of reported incidents involving drones, most of which concern sightings by aircraft crews, remained stable in 2018. The FOCA received 84 reports from pilots or skyguide air traffic controllers concerning drone sightings. Of these, 41 came from passenger aircraft and 21 concerned incidents at foreign airports. The FOCA received 43 reports last year from the general aviation and airforce segments. 28 reports have been recorded for the Swiss airspace. In 2018, the STSB initiated several investigations concerning incidents in which drones came into dangerously close proximity to passenger aircraft and helicopters. Almost all the reported significant incidents occurred at locations where a drone should not have been flown without a permit from the FOCA or the airfield concerned or skyguide (within a radius of five kilometres around an airport). In this regard, a first collision of a helicopter with a drone occurred in the vicinity of the aerodrome of Locarno on the 25th May 2018. In this context a detailed risk assessment was carried out in the first quarter of 2018 which revealed the degree of probability of occurrence of a collision between a drone (with a maximum weight of 2 kilo-grams) and an aircraft (airliner, business jet, light aircraft, helicopter) in Switzerland.

The FOCA regards the risk situation as stable, but is aware that increased attentiveness and communication efforts will be required in the future to ensure that the ever increasing number of drones designed for use by the general public are employed responsibly. In recent years, the Federal Council has also recognised the need for action to remotely identify drones in order to enforce the applicable legislation. For this reason, the FOCA's Innovation Management Office supported the development of a U-space. This is a system for introducing automated traffic management for drones. If drones are subject to automated traffic management, their identification, monitoring in airspace and coordination with other airspace users, and the protection of particularly sensitive areas, can be secured. Since it will incorporate all the necessary elements for the enforcement of the applicable legal provisions, U-space is to become the central instrument for ensuring the safe, controlled operation of drones and serve as a basis throughout Europe.

The possibility of electronic registration and identification of drones will soon be technically available, which will also significantly improve law enforcement. It will enable sensitive areas to be reliably protected and of-fending drone pilots to be identified, or face a fine if their device is not properly registered. But U-space will bring even more advantages in the next few years for the benefit of manned aviation. It will be a few years before the link between manned and unmanned aviation is established on a comprehensive, fully automated basis. Although U-space is developing at a very high pace – thanks, not least, to the industry's appetite for innovation – it takes time to fulfil aviation safety standards and create, as required, the basics for certification and standardization. In this development at tearing pace, Switzerland is at the very forefront with scalable and future-oriented legal foundations. A civil aviation authority with competence in the relevant areas and an outstanding research and development environment plays an important role in this. As the FOCA sees change as an opportunity, it is determined to continue strengthening these factors.

7.2 Cyber Security

In the area of cyber security, in 2018 the FOCA repeated its call for proportional and harmonised procedures and measures. Activities within the European Civil Aviation Conference (ECAC), the ICAO and the relevant EU and EASA bodies were closely coordinated and actively supported. The FOCA also participated in the activities aimed at developing the second Swiss national strategy to protect against cyber risks (NCS 2.0).

The recommendations of the ECAC regarding cyber security in the civil aviation sector, which were revised in 2017, will be incorporated in the National Aviation Security Programme (NASP) in 2018.

The supervisory activities that were initiated several years ago were continued in 2018.

8 SAFA[2] / ACAM[3]

8.1 Swiss aircraft operators in the EU Ramp Inspection Programme (SAFA / SACA[4])

The ratio that is calculated within the framework of the EU Ramp Inspection Programme is based on the number of categorised and weighted findings divided by the number of inspections.

In 2018, the number of inspections carried out by foreign authorities (EU Ramp Inspection Programme members) of aircraft registered in Switzerland decreased slightly versus the previous year The total number of inspections depends on the individual planning of the individual EASA member states and is also limited by EASA within the framework of a coordination programme (SWC System Wide Coordination Pro-gramme / Risk & Performance based).

In general, we found that the safety performance of Swiss aviation is good by international standards. Com-pared to the previous year, the number of complaints has decreased, as a result of which the overall ratio for Swiss operators has also improved.

Of the air carriers registered in Switzerland that were audited in 2018, 68 percent have a ratio below that of ECAC (European Civil Aviation Conference) states and the global average. This is a slight improvement on the previous year.

The majority of the addressed findings did not directly give rise to a safety deficit, though in some cases (CAT 3 findings) the safety margin was reduced.

[2] SAFA = Safety Assessment of Foreign Aircraft (checked against ICAO standards)

[3] ACAM = Aircraft Continuing Airworthiness Monitoring

[4] SACA = Safety Assessment of Community Aircraft (checked against ICAO standards)

9 COMPLIANCE MANAGEMENT

9.1 EASA

9.1.1 Survey period

All results of the analyses of the findings refer to the 2015 to 2018 inspection period. The results of the inspections carried out and the legislative activities of the EU / EASA refer to 2018.

9.1.2 Number of inspections

In 2018, EASA conducted a comprehensive inspection of airworthiness. The planned comprehensive inspection in the new area of SYS (Systemic Enablers for Safety Management) was postponed to 2019 in Switzerland at the express wish of another member state.

9.1.3 FOCA'S Performance

Based on all findings in the areas AIR, OPS, FCL, MED, FSTD and ANS, 63 percent belonged to the "Critical Element 6" (licensing, certification, authorisation and approval obligations) and "Critical Element 7" (supervision obligations) categories. In the area of OPS, it is noticeable that, in addition to CE-6 and CE-7 mentioned above, Critical Element 3 (State Civil Aviation System and Safety Oversight Functions) also has an above-average number of findings. In addition, 59 percent of all findings in the ANS area are solely assigned to CE-6, while the remaining findings are distributed among the other critical elements at significantly lower percentages.

9.1.4 Status of the findings

The FCL, MED and FSTD areas are not included in subsequent assessments due to the relatively low number of findings collected.

In the area of AIR, delayed corrections of errors in 27 percent of C findings and 40 percent of D findings gave rise to temporary overdue classifications. In the area of OPS, however, delayed corrective measures gave rise to a temporary overdue status in all findings (7 C and 4 D findings). The ANS area recorded delayed corrective measures in 22 percent of C findings and in 25 percent for D findings. The higher the percentage of delays, the greater the adverse effect on the EASA standardisation rating. This can result in an increase in the frequency of EASA audits.

It is also noted that the proportion of D findings in the areas of ANS (47 percent) and OPS (36 percent) is above average compared to the AIR area, at 16 percent. D findings have a certain degree of safety relevance if they are not remedied within a short period of time. All D findings in the ANS area have now been closed. In the area of OPS, 2 D findings are still open – within the framework of the ordinary Corrective Actions Plans.

9.1.5 EASA Rulemaking/EASA Opinions

The scope of EASA's new Basic Regulation (EU) 2018/1139 was extended to include cyber security, drones and ground handling as part of its "total system approach to aviation". In addition, the new basic regulation creates the possibility of using scarce resources in a more targeted way, e.g. by making it possible to set up a pool of inspectors at European level or to transfer competences in the areas of supervision, certification and enforcement to EASA or to other EASA member countries. Furthermore, the publication of Commission Regulation (EU) 2018/1042 provides for the testing of flight crews and flight attendants for alcohol. EASA published only three opinions in 2018. These include Opinion

01/2018, which was published on the operation of unmanned aircraft systems (UAS) in the ‘‘open’’ and ‘‘specific’’ categories.

9.2 ICAO

9.2.1 Universal Safety Oversight Audit Programme (USOAP)

The ICAO did not carry out any audit activities in 2018. The results (effective implementation) of the audit modules have not changed versus 2017. Most of the findings (19, last audit carried out in 2010) are included in Critical Element 4 (technical personnel qualification and training); 17 of these concern the area of ANS, though most of these were already remedied.

9.2.2 Implementation status – comparison between Switzerland and EU countries

For half the critical elements, the effective implementation rate is close to 100 percent. For all critical elements and the majority of audit modules (exception: ANS), Switzerland’s effective implementation rate is above the EASA average. There are no findings in the ORG and PEL (personnel licensing) modules (100 percent effective implementation).

9.2.3 Compliance with standards and recommended practices (SARPs)

As of the end of 2018, Switzerland had reported 676 category (less protective or partially implemented or not implemented) differences to the ICAO annexes. This corresponds to a deviation of 6 percent from the total of 11,690 SARPs.

9.2.4 ICAO Rulemaking

In 2018, many amendments to the ICAO Annexes entered into force; these concerned Annexes 1, 2, 3, 4, 6, 8, 10, 11, 13, 14, 15 and 17. The review of these amendments resulted in additional personnel costs for the FOCA.

10 ASSESSMENT AND OUTLOOK

In terms of civil aviation safety, 2018 was not a pleasing year in either Switzerland or the rest of the world. In the commercial segment, there was one accident with 20 fatalities. The number of accidents and incidents in the non-commercial segment was within the average range of the previous years. In the area of incident reporting, Swiss civil aviation now has good data quality. The implementation of EU Regulation 376/2014, which entered into effect in 2016 and in particular imposes an obligation on pilots in the general aviation segment to report safety-relevant incidents to the applicable authority, played a part in this outcome. Criminal investigations launched against aviation personnel in 2018 could have an impact on a positive reporting culture in the future.

The most important topics to be addressed from a safety perspective are known – thanks to data and in-formation from industry. In future, this review will be consistent with the risk assessment forecasts. In addition, management decisions will increasingly be risk- and performance-based and prioritised in accordance with predefined criteria. Data obtained from incidents can be used as a decision-making basis alongside other factors, for example in the framework of the AVISTRAT project. In view of the European risk portfolio and its findings, mid-air collisions (MACs) and loss of control (LOC) are right at the top of the list of priorities. The Airprox Analysis Board (AAB) was reformed in 2018 and given the required importance through a new mandate and terms of reference. In addition, this Safety Report examines the same topics under Systemic Issues, Operational Issues and Emerging Issues as in the European Plan for Aviation Safety (EPAS) and the SASP (Swiss Aviation Safety Plan), which was published in Switzerland in February 2019. The SASP lists the main safety topics and shows which actions must be initiated by the FOCA's safety divisions and by when they are to be completed. The FOCA, in turn, examines the status of implementation and the effectiveness of the measures implemented. The results of the STSB investigations help to find out which safety barriers failed to function in a given incident. These findings, too, together with the resulting recommendations, largely correspond to the figures presented in this Annual Safety Report. In comparison with other European countries regarding safety levels, Switzerland is among the leaders; this is underscored by the SAFA / ACAM results and the findings of the ICAO and EASA audits.

This Annual Safety Report provides industry partners with a retrospective overview of the reports and incidents in the Swiss civil aviation sector in 2018. Internally, alongside other variables, these data can be used to specify the appropriate priorities within the scope of forward-looking supervisory activities. For industry, the added value consists of gaining a nationwide overview of incidents and observing the trends in safety performance in comparison with previous years. While this big picture is no substitute for topic-specific analyses, it nonetheless provides a good starting point for further discussion and future activities.

With respect to the topics of drones, U-space, LFN and IFR without ATC, it will be necessary to collect a lot more data to obtain findings from these and from any incidents that should occur. Alongside proactive risk assessment, the reactive approach within the framework of incident analyses must be retained in the future, in line with the motto "If you can't measure it, you can't manage it". The FOCA aims to derive additional and more precise information from incident reports in the future with reasonable effort and expense. Its long-term objective is to draw the right conclusions from big data and focus on the critical and relevant topics.