

Air Freight Logistics Study Switzerland 2020


Facts – Requirements – Trends

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Air Freight Logistics Study

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Air freight in focus



In mid-March, the Swiss government quickly reacted to the spread of the corona virus with the lockdown. Thousands of Swiss citizens around the world were blocked and had to be brought back. In addition, medical material in particular had to be transported. The corona crisis clearly showed why Switzerland needs an efficient aviation infrastructure, not only to carry out repatriation flights when borders are closed, but also be able to safeguard the supply of urgently needed goods.

Ten years after the first air freight logistics study was conducted by the University of St. Gallen, a new study is now available in this publication, which shows the extraordinary importance of air freight, especially for the Swiss export industry.

In 2019, Swiss industry exported goods with a total value of 312 billion Swiss francs. Of this, goods to the value of 157 billion were cleared through Swiss airports and transported by air freight. With an export share of around 50 %, air freight (measured by the value of consignments) is the most important means of transport for Switzerland. Freight transport by air is only used selectively, mainly for valuable consignments such as watches and precious metals, urgent deliveries, e.g. spare parts, perishable products, high-quality pharmaceuticals, or foodstuffs (predominantly imported).

Aviation and air freight are therefore important competitiveness factors for Switzerland and make a significant contribution to securing development and prosperity in our country.

From a climate change perspective, air traffic, and consequently air freight as well, is increasingly being criticised. It should be noted that air freight is usually used when other means of transport cannot meet the transport requirements.

I am convinced that you will better understand the importance of air freight for our country after reviewing this information booklet with scientifically compiled facts and practical insights. Smoothly functioning infrastructure is important, with sufficient capacity and advantageous general conditions.

Guy Parmelin
Federal Councillor

A vote for air freight



Our interest group was founded in 2010 with 25 founding companies with the aim of increasing acceptance of this often underestimated transport mode and to offer support to the players involved in the handling of air freight shipments. In the meantime, practically the entire Swiss air freight industry is united under one roof and a healthy mix of over 100 companies (airlines, forwarders, insurance companies, ground handlers, road hauliers, consulting firms, IT providers, general sales agents etc.) ensures the necessary diversity and versatility.

Our vision is the development of a professional, modern and united community for the benefit of air freight in Switzerland in order to be able to achieve the following goals:

Strengthening air freight through lobbying, communication and PR activities

Actively seeking joint solutions and implementing innovative projects for efficient processes

Promoting development through communication and regular exchange of information

The most important cornerstones for the successful further development of air freight in Switzerland are:

- High-performance, expandable and high quality infrastructure
- Global route network with sufficient freight capacity
- Competitive cost structures

- Effective security with adequate general conditions
- Digitalisation for optimized and seamless data exchange

Air freight during the Covid-19 crisis in spring 2020

Who would have ever thought that air freight would be more important than passenger transport at Zurich Airport or Swiss International Airlines, for example? It was only for a short time, but with a high impact. Thanks to the flexibility and commitment of all those involved, air bridges for (relief) goods transports could be carried out at short notice. The collapse in earnings for many of the companies involved is dramatic, but everyone is confident that they will succeed in finding a way out of this crisis and into a successful future

Together for air freight

With the implementation of this study, carried out by the Institute for Supply Management at the University of St. Gallen by Ludwig Häberle, under the direction of Prof. Dr. Wolfgang Stölzle, we are proud to have made an important contribution to understanding the economic significance of air freight for our country

I would like to take this opportunity to express my sincere thanks for the conceptual and financial contribution and support of various authorities, companies and individuals

IG AirCargo Switzerland
Peter Somaglia
President

Air freight market

50 %

of total exports with a goods value of CHF 157 billion were exported from Switzerland by air freight in 2019 (including precious metals).

47 %, the value of chemical-pharmaceutical products, which are thus the

most important category of goods

for air freight exports from Switzerland (excluding precious metals).

CHF 1,413

is the average value of an air freight shipment per kilo in Swiss exports. This is a factor of about 150 higher than road freight transport.

25,000

jobs in logistics, industry and commerce are directly or indirectly related to air freight.

200

Logistics clerks are trained annually and receive a federal vocational qualification.

In 2019

638,505 t

air freight was handled at the three major Swiss airports. This corresponds to almost 1/3 of the air freight turnover at Frankfurt Airport.

1/3

of the air freight volume in terms of value and 1/5 of the tonnage are destined for the USA – the most important single market for the Swiss export industry (excluding precious metals).

29 %

the share of secondary air freight traffic (delivery or collection by truck from/to European hubs) of the total air freight volume in Switzerland.

82 %

is the value of air freight exports as a proportion of total Swiss overseas exports.

Digitalisation

73 % in Basel, 68 % in Geneva and 56 % in Zurich is the

e-AWB penetration

in Switzerland.

Switzerland ranks

20th

among 135 countries, in the "IATA E-Freight-Friendliness Index" (EFFI).

Customer requirements

64 %

of freight forwarders expect an increase in air freight handling via Swiss airports as a result of the lifting of the ban on night/weekend traffic.

77 % in the case of Zurich, 75 % for Basel and 46 % for Geneva, is the

satisfaction rate

of export freight forwarders and 73 % in the case of Basel, 56 % for Zurich and 68 % for Geneva in the import business.

Climate and environment

50 % reduction of net CO₂ emissions

by 2050

compared to 2005, is the declared goal of IATA for the aviation industry.

10 %

the share of national and international air traffic of Switzerland's greenhouse gas emissions in accordance with the marketing principle.

69 %

of forwarders consider paperless handling processes as being important to very important.

13th place for Switzerland in the World Bank's Logistics Performance on the

"logistical affinity"

of individual countries (rank 6 in 2007)

61 %

of the forwarders handle export shipments mainly via Swiss airports. Frankfurt is an important transit airport in Europe for 67 % of forwarders.

2.4% of global CO₂ emissions are caused by commercial aviation. With a share of 19%, air freight contributes just

0.5 %

to global CO₂ emissions.

311 airports

in 71 countries on all continents participate in the Airport Carbon Accreditation Initiative to reduce emissions and represent 45 % of global air traffic.

Management Summary

The study Swiss Air Cargo Logistics 2020 examines the relevance of air cargo logistics for the Swiss economy and highlights the performance of the players in air cargo logistics from various perspectives. Taking the customer perspective into account, the performance profile of Swiss air freight logistics is presented in a European comparison, focusing on the main topics of digitalisation, climate and environmental protection as well as regulatory framework conditions. This leads to the following key findings.

Air cargo market & trends

Air cargo opens up global markets for Switzerland, and as a business location Switzerland benefits significantly from good air transport connections. With the increasing importance of the overseas markets of Asia and North America, air cargo is of systemic significance for Switzerland's economic development and makes a decisive contribution to securing prosperity and jobs.

By value, 50% of all exports (CHF 157 billion) left Switzerland by air in 2019. The value share of 82% in total intercontinental exports underlines the high relevance of air cargo as a mode of transport for opening up intercontinental markets. The high value density of CHF 1,413 per kilo in exports in 2019 is regarded as a central characteristic of the transport mode air cargo in Switzerland. At less than 1%, the tonnage share of air cargo is very low for both exports and imports. With air cargo volumes at Swiss airports remaining nearly constant over the last ten years, the value of exports (+43%) and imports (+57%) carried by air has increased. Among industrial goods, the relevance of chemical-pharmaceutical goods has continued to increase in recent years, accounting for 47% of all air cargo exports. Machinery, medical products and watches are further important export goods of the Swiss air cargo industry. A special feature of Switzerland as an air cargo location is the high proportion (70%) of freight on passenger

flights. While the export industry benefits from a dense network of flights due to the combination of freight and passenger services, airlines with a departure/destination at Swiss airports depend on air cargo in the lower deck of passenger flights.

Customer perspective

Air cargo transports are organised jointly by shippers, forwarders, airlines and ground handling agents and are closely linked with customs, security and other authorities. Due to the complexity of process chains in air cargo logistics, specialised forwarders usually organise and handle the processes on behalf of shippers. This means that the perspective of freight forwarders in particular must be considered in the context of customer requirements. Short transport times over long distances, high security standards for the freight as well as a pronounced reliability through precisely planned transport processes are decisive criteria for the use of air cargo as a means of transport from the customer's perspective. Although the majority (over 75%) of air cargo is handled by Swiss freight forwarders via Swiss airports, relevant airports are also located outside of Switzerland due to the international nature of the transport mode, meaning that Swiss air cargo is in direct competition with airports in the surrounding European region.

By international comparison, the three Swiss national airports are valued for their speed, reliability and for their high security standards. Due to the high-quality products in Swiss air cargo, adequate infrastructure for special goods such as valuable cargo, temperature-controlled and perishable goods is a key success factor for the air cargo location. One challenge arises from Switzerland's high cost level, especially for labour-intensive operations. As a result, the competitiveness of Swiss air cargo logistics suffers compared to other European airports. Due to the high wage level, Switzerland can differentiate itself from other European countries, particularly in terms of quality. The digitalisation of

air cargo logistics plays a decisive strategic role here. In view of the complex process chains, the use of integrated platforms with common standards offers the potential for paperless shipment processing and seamless monitoring.

Digitalisation

Concerning digitalisation, increased transparency and a higher degree of automation in shipment processing are central approaches in air cargo logistics, whereby technological trends such as artificial intelligence and block chain have the potential to cause major structural changes in a short time. Manual, paper-based processes currently entail considerable additional administrative work and limit resource planning and data quality for all stakeholders. Paperless handling processes are rated as important or very important by 69% of the carriers surveyed. In a fragmented market without dominant market participants, the enforcement of industry-wide standards is challenging. With the ONE Record initiative, IATA is shifting from document-centered to data and process-centered air cargo logistics, thus promoting end-to-end electronic data exchange. Compared to stand-alone solutions, the overarching integration of all parties involved offers efficiency advantages in the overall logistical view. The modest number of actors and the resulting small Swiss market offer good opportunities to implement the digitalisation potential throughout the industry and to build integrated platforms for the inclusion of all actors.

Climate and environmental protection

In 2018, commercial aviation accounted for 2.4% of global CO₂ emissions from the combustion of fossil fuels. About 19% of these emissions can be attributed to air cargo. With 5.35 million tonnes of CO₂ equivalents emitted, air traffic emissions in 2017 accounted for around 10% of Switzerland's total CO₂ emissions. Due to the increasing share of air traffic in global CO₂ emissions and the forecast further increase, the industry is of particular importance in achieving international climate protection goals. CO₂ has the strongest climate impact of all aviation emissions, as it not only causes the highest proportion of emissions from the combustion of kerosene but also remains in the atmosphere for many decades. In addition to CO₂ emissions, the climate impact of "non-CO₂ emissions" such as nitrogen oxide, sulphur dioxide, hydrocarbons and soot particles must be considered as well. IATA's four-pillar climate protection strategy offers effective long-term

approaches to reducing air traffic emissions, with technological innovations promising the greatest impact. The political promotion of sustainable fuels is a starting point for Switzerland to contribute to the ecologically sustainable development of aviation.

The IATA four-pillar climate protection strategy offers long-term effective approaches to the reduction of air pollution emissions, whereby technological innovations promise the greatest effect. The political promotion of alternative fuels is a good starting point for Switzerland to contribute to the ecologically sustainable development of aviation.

Compared with all other modes of transport, air transport causes by far the most CO₂ emissions per kilometre. Since the transport of air cargo shipments is inseparably connected with upstream and downstream road transport, the ecological footprint of an air cargo shipment must be viewed holistically and cannot be reduced to air transport between two airports alone.

Regulatory framework conditions

Due to the air traffic agreement with the EU, Swiss air cargo logistics benefits from extensive air traffic rights, which means that Switzerland has a very high level of air traffic connections for its size by international comparison. Restricted operating times and the limited accessibility of Swiss airports due to the ban on night and weekend driving of trucks and the ban on night flights represent a challenge for the competitiveness of Swiss air cargo, particularly in terms of international competition with other European airports.

As a reaction to the COVID-19 crisis in 2020, the study has been expanded to include an excursus on the focus topic of air freight in times of crisis in order to record the relevant effects on air freight logistics and make statements on how the industry is dealing with the crisis.

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Ludwig Häberle

Prof. Dr. Wolfgang Stölzle

Air freight market and trends

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of total exports with a goods value of CHF 157 billion were exported from Switzerland by air freight in 2019 (including precious metals).

82%

is the value of air freight exports as a proportion of total Swiss overseas exports.

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E-Commerce

Air cargo market & developments

Economic importance of air cargo as a mode of transport¹

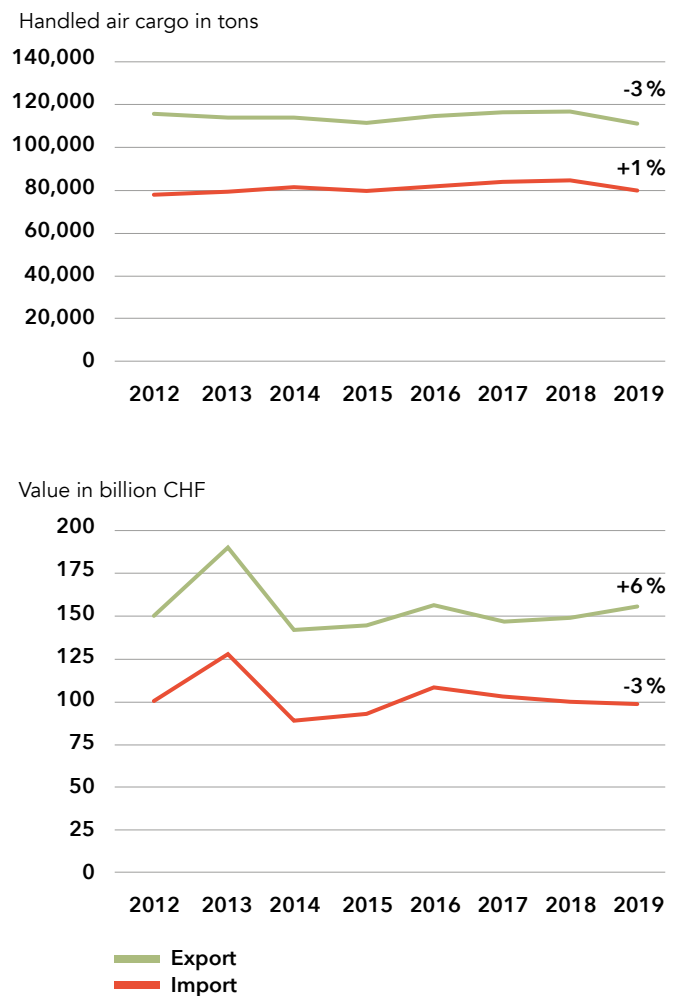
About a third of the worldwide cross-border trade is carried out by air cargo, based on the value of the goods. Air cargo is thus regarded as a driving force of the development of world trade. Switzerland has one of the highest foreign trade ratios of all OECD countries, which makes exports and imports of goods essential for the Swiss economy. The use of air cargo ensures that the Swiss economy is integrated into global supply chains and opens up both sales and procurement markets. As a mode of transport air cargo ensures that high quality, perishable and timecritical goods are transported quickly and safely over long distances around the world.

In 2019, goods with a total value of CHF 157 billion were exported from Switzerland by air cargo. As a mode of transport air cargo thus accounts for 50 % of total exports valued at CHF 312 billion. Among imports, air cargo accounts for about 35 % of all imports to Switzerland (CHF 98 billion). 111,357 tonnes of handled air cargo in exports in 2019 correspond to a share of 0.56 % of all Swiss exports, respectively 0.16 % in imports. With a value of CHF 1,413 per kilo, air cargo demonstrates a particularly high value of goods compared with other modes of transport. The comparatively low tonnage volumes and the high value per kilo thus make evident that companies only use air transport selectively for specific categories of goods.

Developments in export and import

While the total tonnage of exports and imports remained nearly constant, the value of air cargo, excluding precious metals, shows a steady increase from 2012 to 2019: In exports from just under CHF 74 billion to over CHF 102 billion, and in imports from about CHF 27 billion to over CHF 43 billion. With an increase in value of 57 % since 2012, the increase in the value of air cargo imports is even higher than that of exports.

Development of Swiss air cargo exports and imports by weight and value from 2012 to 2019

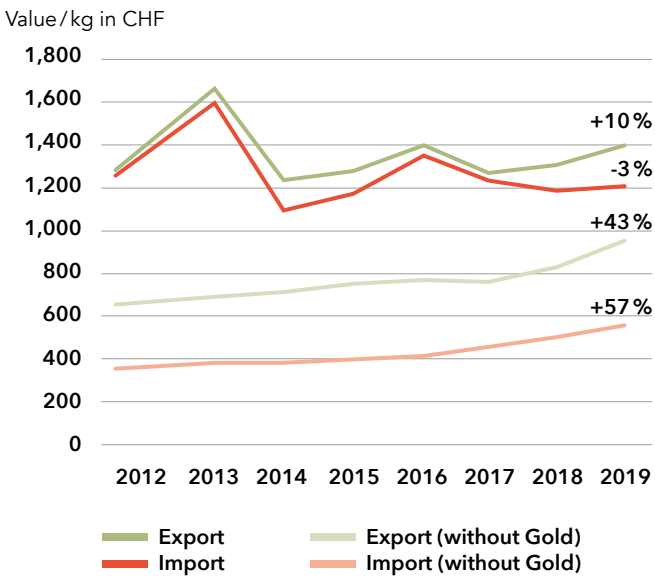


¹Petroleum products (e.g. kerosene) are excluded from all statistics and figures as not commercially relevant (FCA commodity group 07.02)

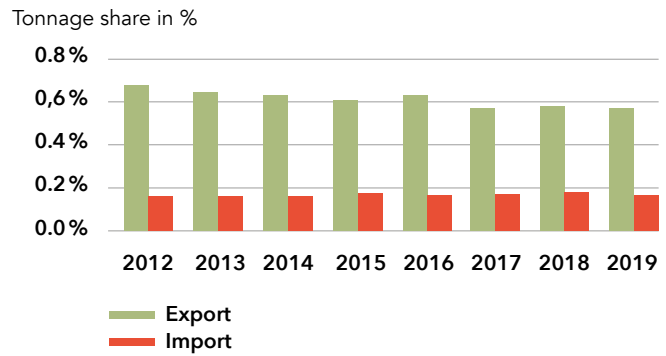
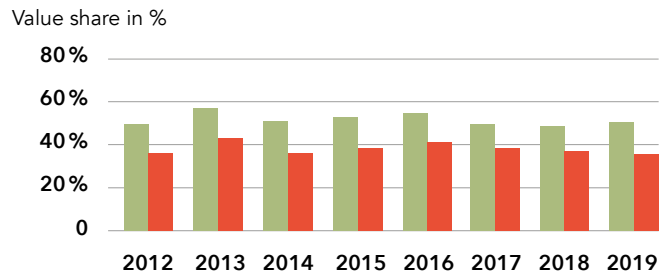
Influence of the commodity group precious metals

Precious metals are an important component of Swiss air cargo. Although the tonnage share of gold and other precious metals (Federal Customs Administration (FCA) commodity group 10.02) is low overall, its high value per kilo and the volatility of the gold price have a significant impact on the value share of air cargo in foreign trade². The exclusion of commodity group 10.02 from the statistics reduces the value share of air cargo in total foreign trade from 50% to 40% in exports and from 35% to 20% in imports. For reasons of transparency, it is indicated whether statistics are shown with or without "gold factor"³.

Development of Swiss air cargo exports and imports by weight and value from 2012 to 2019



Development of the value and tonnage share of air freight in % of all exports / imports of Switzerland



Excursus: Value added and jobs in the aviation industry

Taking into account not only the direct (revenues at airports) and indirect (revenues of suppliers) effects, but also the economic effects in the broader sense (e.g. expenditures in tourism), air traffic secures around 200,000 jobs in Switzerland^{4/5}. Direct employment at Swiss airports, including non-aviation services, secures 67,000 jobs. In addition, a good 49,000 indirect jobs are created by suppliers in the supply chain. Furthermore, the multiplier effects of the direct and indirect effects—including consumer spending by employees and spending in tourism and business travel as induced or catalytic effects—can secure an estimated 90,000 additional jobs in Switzerland. Air freight directly or indirectly provides about 25,000 jobs in logistics, industry and trade. With a value added of more than CHF 30 billion, the aviation industry contributes around 4% to Switzerland's gross domestic product and thus generates considerable economic value.

²Price for one kilo of gold on 24/04/2020: CHF 54,115

³In general, statistics are given including precious metals (FCA commodity category 10.02). In case of exclusion, this will be indicated in individual cases by a footnote.

⁴Air Transport Action Group (ATAG). (2018). Aviation benefits beyond borders

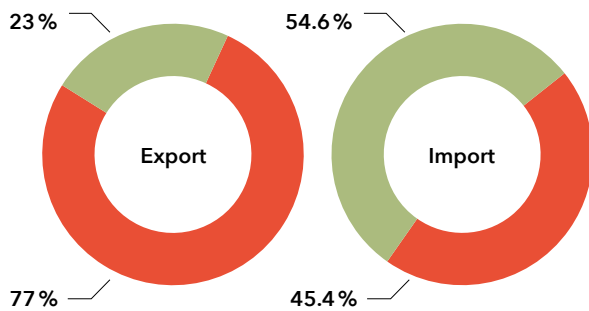
⁵Boston Consulting Group (2018). The Swiss Aviation Ecosystem

Intercontinental transport

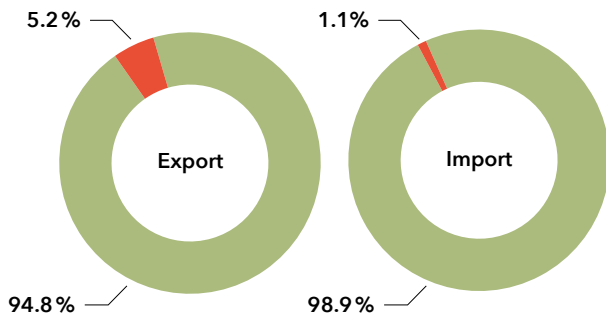
By value, at least 81.6% of all intercontinental exports from Switzerland (totalling over CHF 121 billion) were shipped by air freight in 2019. While transport by sea freight takes several weeks, transports of several thousand kilometres by air can be handled in a few hours. This makes air freight the fastest mode of long-haul transport in intercontinental trade and indispensable for many companies.

Value and tonnage shares in intercontinental transport by mode of transport in 2019 (without Gold⁶)

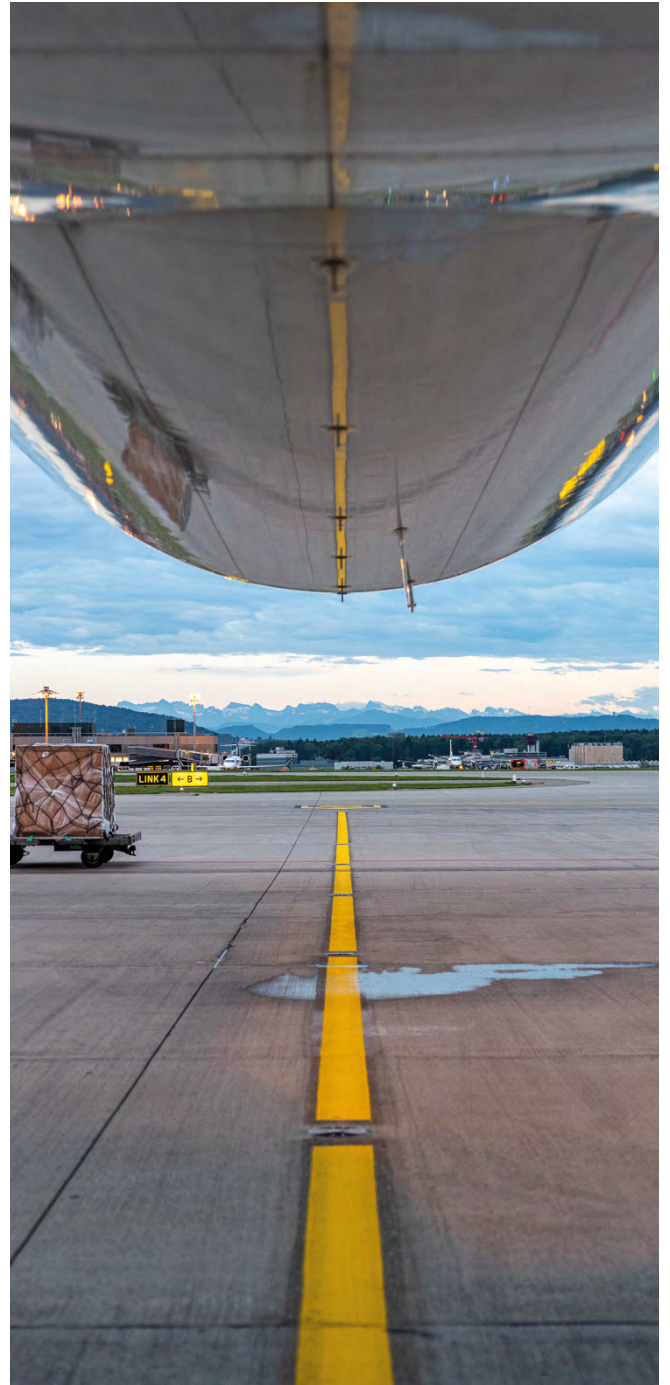
Value shares



Tonnage share



■ Air freight
■ Sea freight



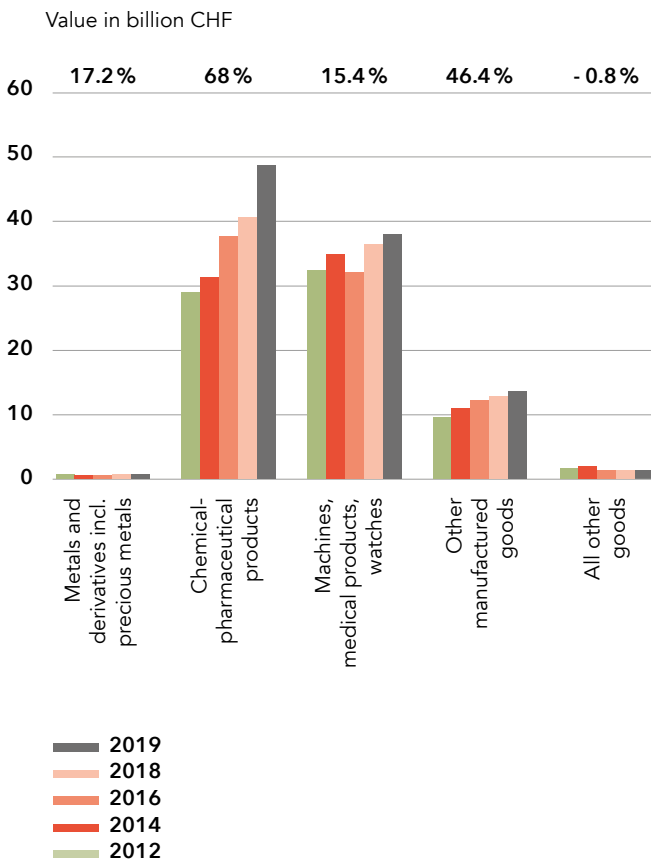
⁶Gold and other precious metals excluded (FCA category 10.02)

Overview of industrial goods

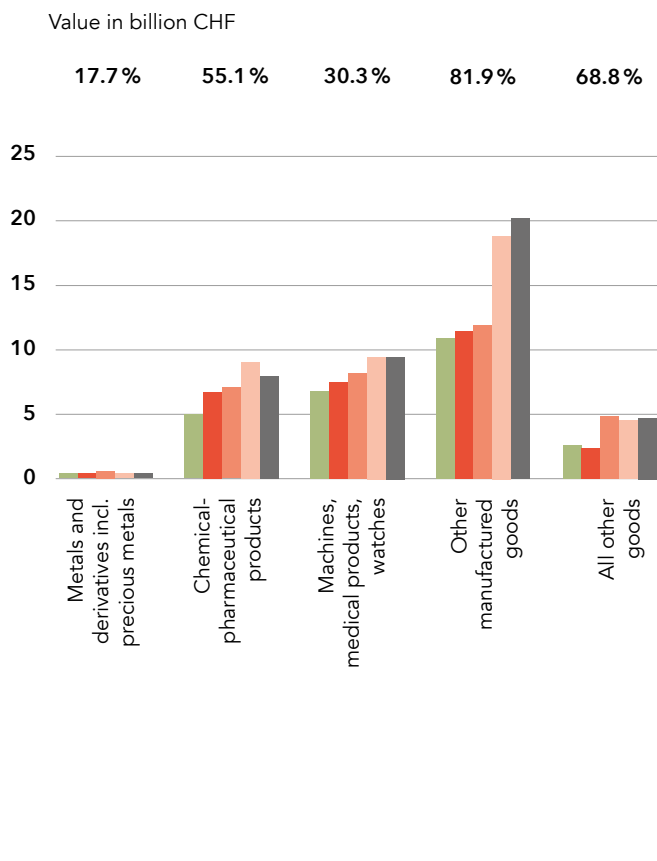
Modes of transport meet different requirements in terms of user needs. Air cargo has a strong traffic affinity especially for high-value, time-critical and perishable goods. In contrast, the high transport costs of air cargo can rarely be justified for cheap bulk goods. The use of air cargo is only attractive for specific commodity groups. In the export sector, pharmaceutical products, machinery, watches and other high-quality products of Swiss industry are transported by air. Chemical-pharmaceutical products represent the largest category of goods in terms of value for export. Since 2012, their value share has increased by 68% to almost 48 billion Swiss francs in 2019. Imports include other urgent commodity groups such as peris-

hable goods and consumer goods including high-tech products, which should reach their destination as fast as possible. With an 80% increase in value since 2012, the importance of “other manufactured goods” —including jewellery, sports equipment and toys—as the most important category of imported goods continued to grow.

Development of the value of air cargo exports to Switzerland by commodity group, from 2012 to 2019 (without Gold⁶)

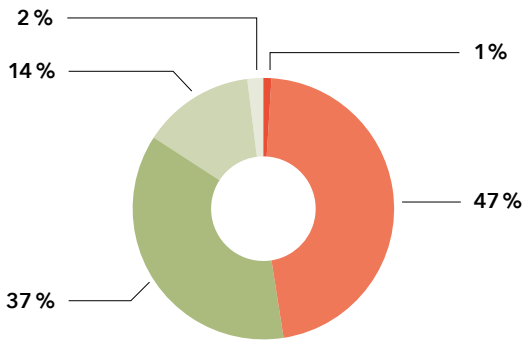


Development of the value of air cargo imports from Switzerland by commodity group, from 2012 to 2019 (without Gold⁶)



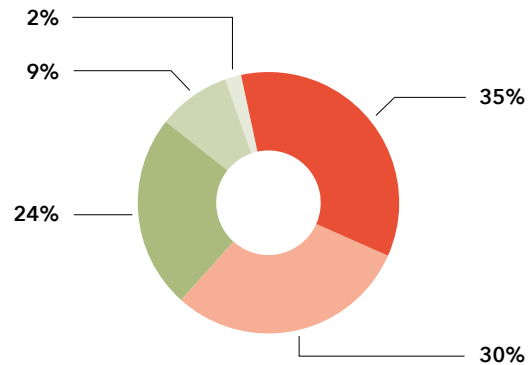
⁶Gold and other precious metals excluded (FCA category 10.02)

Air cargo exports from Switzerland 2019 by commodity group (without Gold⁶)



- Metals and derivatives incl. precious metals
- Chemical-pharmaceutical products
- Machines, medical products, watches

Air cargo exports from Switzerland 2019 by commodity group (with Gold)



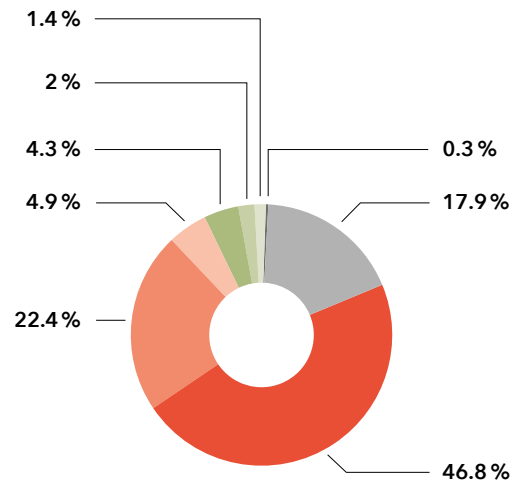
- Other manufactured goods
- All other goods

Air cargo food imports

A lot of fresh food originates not or only to a limited extent from domestic production but is imported from abroad. For climatic reasons, a part of the food imports reaches Switzerland from overseas regions. Air cargo plays an important role in supplying Switzerland with food from overseas. Typical air cargo goods in this segment are fresh, perishable and temperature-sensitive foodstuffs, which should be transported to the end consumer as fast as possible. These include fish, meat, fruits and vegetables.

In 2019, a total of 7,100 tons of food were imported via Swiss airports. This corresponds to a considerable tonnage share of 9% of the total air freight imports into Switzerland, whereas the value share of food imports is very low at 0.2% (CHF 27.-/kilogram). Meat and fish products are the two most important categories of goods. Fruit and vegetables are considerably less common among air cargo imports at Swiss airports.

Air cargo food imports to Switzerland 2019



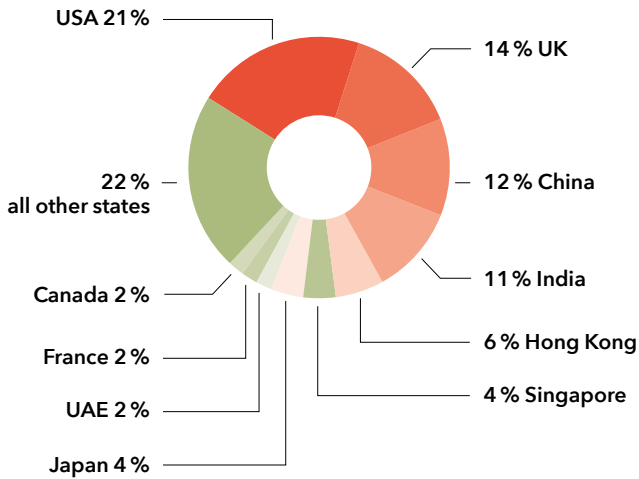
- Meat and meat products
- Fish and fish products
- Grain mill and starch products; animal feed
- Fruit and vegetables
- Beverages
- Animal and vegetable oils and fats
- Dairy products; ice cream
- Other food products (incl. Tobacco)

⁶Gold and other precious metals excluded (FCA category 10.02)

Traffic flows of Swiss air cargo

Asia and North America are the main markets for air cargo transports to and from Switzerland. Based on the value of goods, the ten most important markets account for a cumulative three quarters of the total Swiss air cargo tonnage in exports and almost two thirds in imports. In terms of industrial goods, the USA and China are the most important single markets for the Swiss air cargo industry. While the tonnage volume (see Appendix) is decisive for assessing the relevance of individual markets from the perspective of individual stakeholders in air cargo logistics, the value flows must be considered from an economic perspective.

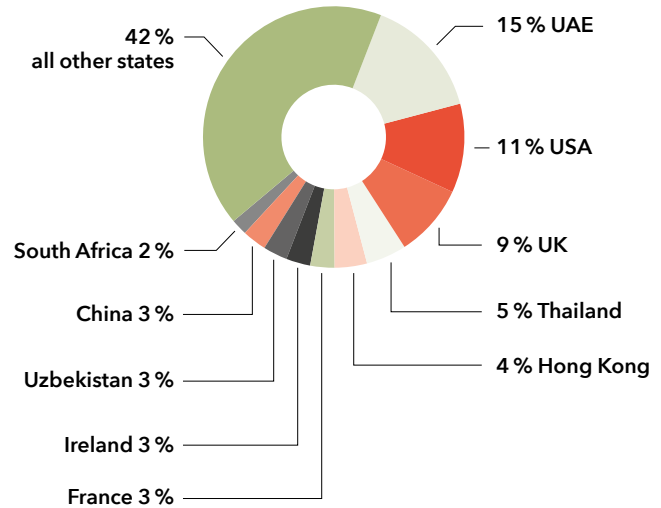
Top 10 markets for Swiss air cargo exports by value (with Gold⁷)



If one adds precious metals to this analysis, in some cases significant shifts in value can be seen in single markets, due to the high value of the commodity category per kilo. For example, gold and other precious metals account for a large proportion of air cargo exports to the United Kingdom. Excluding this commodity group, the value of air cargo exports to this region will fall from CHF 21 billion to just over CHF 3 billion in 2019.

In the FCA foreign trade statistics, exports are recorded as the first destination after leaving Switzerland, and imports as the immediate destination of origin before entering Switzerland. In the case of trade relations between Switzerland and other countries, however, the flow of goods does not necessarily have to be a direct one between both countries. Since individual countries

Top 10 markets for Swiss air cargo imports by value (with Gold⁷)



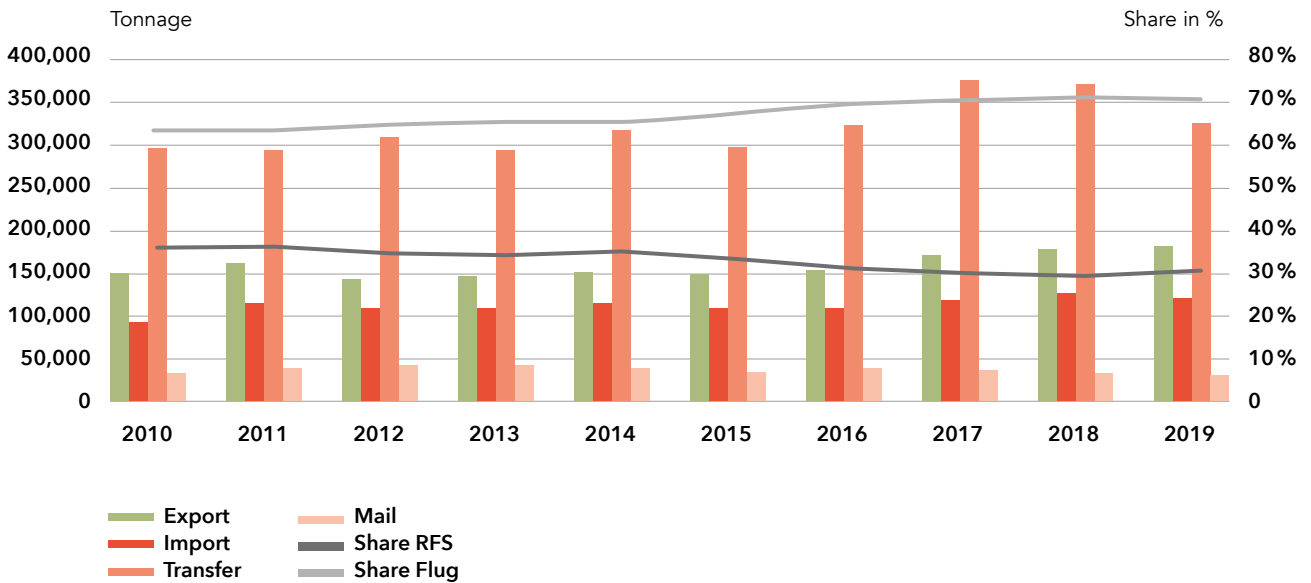
are also used as transit countries for the movement of goods, the final destinations and the original origin may differ. For example, the high share of the United Arab Emirates (UAE) illustrates the function of the Middle East for goods handling on the route between Asia and Europe. European countries are also significant for the transfer traffic of Swiss air freight, as many shipments are handled via air cargo hubs in neighbouring countries such as Germany, France etc.

Air cargo traffic at Swiss airports

In 2019, 638,000 tonnes of air cargo were handled at Swiss airports. With a share of over 70%, Zurich airport accounts for the largest share. The high level of intercontinental freight on offer in Zurich means that the proportion of transfer cargo is much higher than in Geneva and Basel (see statistics in the appendix). Thanks to its international hub function, Zurich Airport also attracts freight from other airports which arrives as transfer freight. The development of air cargo volumes in Switzerland, especially in Zurich, is closely linked to international market developments. While in 2017 and 2018 the air freight tonnage increased strongly globally as well as in Switzerland, the dependence on the European market resulted in a decrease of 8.7% in the freight volume at Swiss airports. European freight airports also recorded substantial tonnage declines in 2019.

⁷Gold and other precious metals (FCA category 10.02)

Development of air cargo volume at Swiss airports from 2010 to 2019

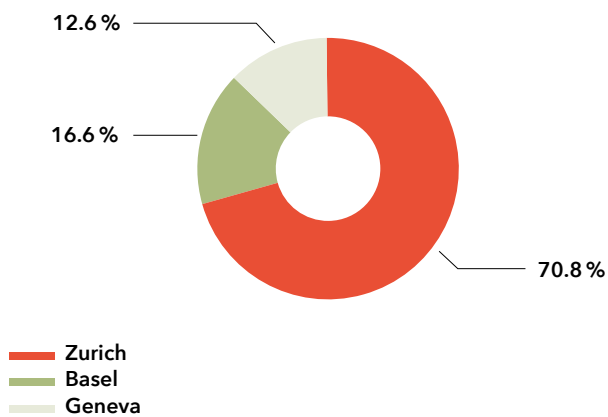


In Frankfurt, freight handling fell by 4%, in Amsterdam by as much as 9%. The effects of the COVID-19-crisis in global aviation affected Switzerland as from March 2020. The loss of belly capacities during the grounding of passenger aircraft will reduce air cargo capacities, particularly at the airports of Zurich and Geneva. As a result, cargo handling in 2020 will suffer primarily at airports with high belly freight capacity, while the expansion of freighter flight connections will absorb part of it.

Cargo and passenger transport are mutually dependent

Even though the development of passenger traffic is generally driven by passenger demand and the freight volume by freight demand, airlines consider these two business areas to be complementary. The lower deck of passenger aircraft offers space for the transport of so-called belly freight, which makes it possible for airlines to combine cargo and passenger operations. Even at full capacity with passengers and baggage, long-haul aircraft such as the Boeing 777 can carry up to 28 tons of additional belly freight. Apart from most low-cost carriers, airlines therefore combine cargo and passenger operations.

Market shares of Swiss airports in Swiss air cargo tonnage in 2019



Passenger traffic is considered the driving force in airline network management, but cargo operations also makes a substantial contribution to an airline's revenues, accounting for 10–15% of SWISS's total revenues. Without these additional revenues, the large intercontinental flight offerings of SWISS and other airlines in Swiss passenger air transport could not be operated profitably.

Especially on long-haul routes, airlines consider cargo to be a very important factor in establishing and maintaining flight connections. Worldwide, more than half of the air cargo tonnage is carried on passenger aircraft, the remain share is carried on full-freighter aircraft. In Switzerland, on contrast, air cargo is mainly transported on passenger

For detailed figures for 2020 see www.igaircargo.ch

flights, a consequence of the excellent air transport connections in the passenger sector. However, there are differences between individual airports. While in Geneva and Zurich air cargo is mainly loaded on passenger aircraft, at Basel airport cargo is transported primarily on full-freighter aircraft in scheduled operations.

If forecasts of further growth in the passenger fleets of aircraft manufacturers Airbus and Boeing should be confirmed in the coming decades, belly capacities will continue to increase. Globally, the volume of air cargo would continue to shift from cargo to passenger aircraft.

Road feeder service:

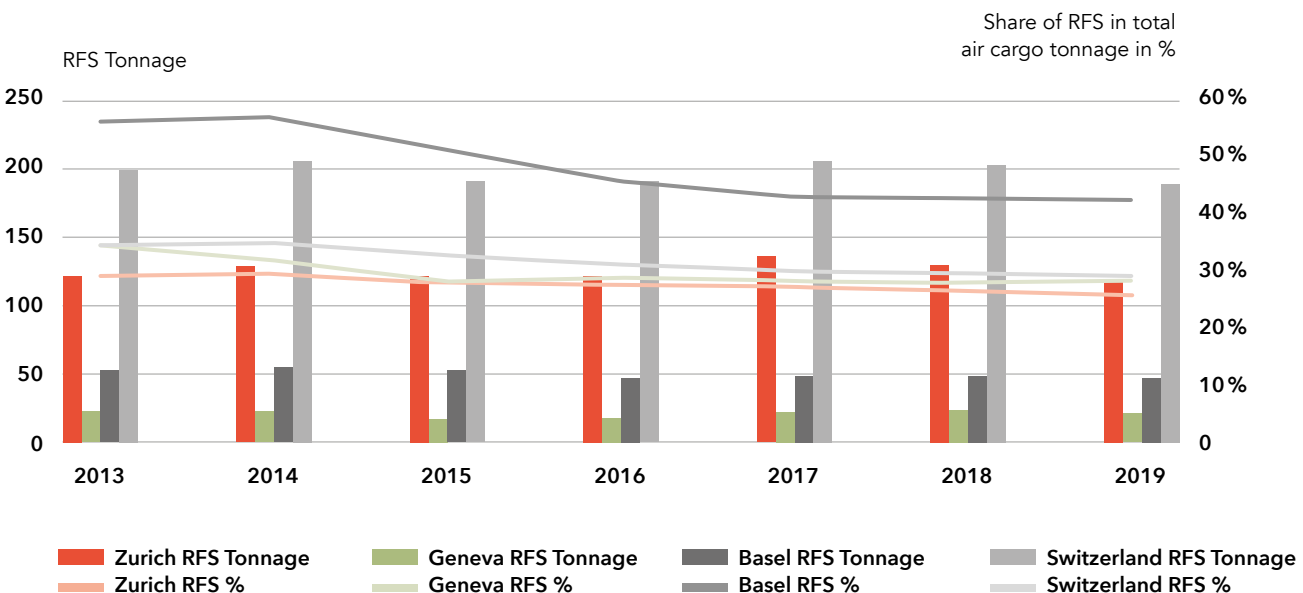
When air cargo is transported on the road

Air cargo is not always transported only by aircraft. A considerable share of air cargo is transported by truck on the road to link individual airports within specific regions. These transports are referred to as Road Feeder Services (RFS).

RFS are primarily used as feeder/defeeder services due to space or price reasons or when direct flights from individual airports are not available. This allows airports such as Basel or Geneva to be connected to the international freight network via Zurich or another European airport. At Swiss airports, the share of RFS for 2019 was 30%, while 70% of air cargo was flown. With a share of 45%, Basel airport has the highest RFS share among Swiss airports.

In contrast to normal road freight transport, a shipment is transported by RFS on an air waybill and handled at an airport. Outside Switzerland, RFS are not subject to the ban on night-time driving. This means that air cargo can also be delivered to and collected from airports at night. According to the sector, this is unfortunately not the case in Switzerland. Through the sale of goods "ex works" (Incoterms EXW), further road transport is added, whose volume cannot be precisely quantified. According to industry estimates, around 20–30% of Swiss air cargo tonnage is shipped directly to airports in other European countries without first being handled at a Swiss airport.

Development of RFS volumes at Swiss airports from 2013 to 2019



Decoupling of freight and passenger demand since the financial crisis

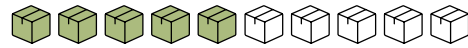
Looking back, it can be seen that since the financial crisis in 2008, global passenger traffic has grown significantly faster than freight volumes. While the freight tonne-kilometres flown have increased globally by a good third in the last 10 years, the passenger volume has almost doubled from 2.5 to 4.5 billion passengers in this period. Not only in Switzerland is the growing touristic air traffic considered to be a major driver of this development over the last years. Due to the resulting increasing demand in the passenger sector, the development is also reflected in the load factor. As the passenger kilometres flown in 2019 increased by 4.2%, which was higher than the passenger kilometres offered, the passenger load factor continued to rise worldwide (+0.6% compared to 2018). Over the past 15 years, the passenger load factor across all airlines has risen by a good 10 percentage points to a value of 82.6% in 2019.

Load Factor

82.6 % Passenger Load Factor

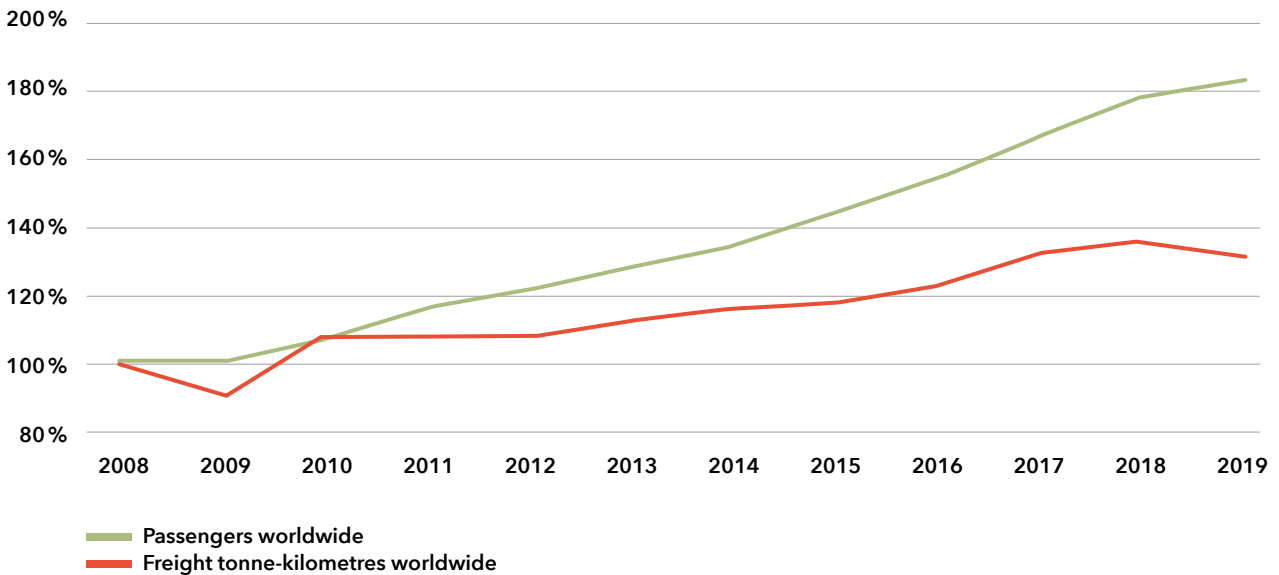


46.7 % Cargo Load Factor



The situation is different for air cargo: Due to the strong expansion of belly capacities in recent years, freight demand is not keeping up with the increase in air cargo supply. While globally offered freight tonne-kilometres (FTKs) increased by 2.2% in 2019, flown FTKs decreased by 3.2%. This reduced the load factor by 2.6% to 46.7%. The increase in belly capacity in passenger aircraft due to fleet expansion not only leads to a stagnation or decrease in the load factor, but the excess capacity arising on the market also exerts pressure on the airlines' freight rates.

Development of air cargo and passenger volumes worldwide between 2008 and 2019⁸



⁸IATA (2019). World Air Transport Statistics.

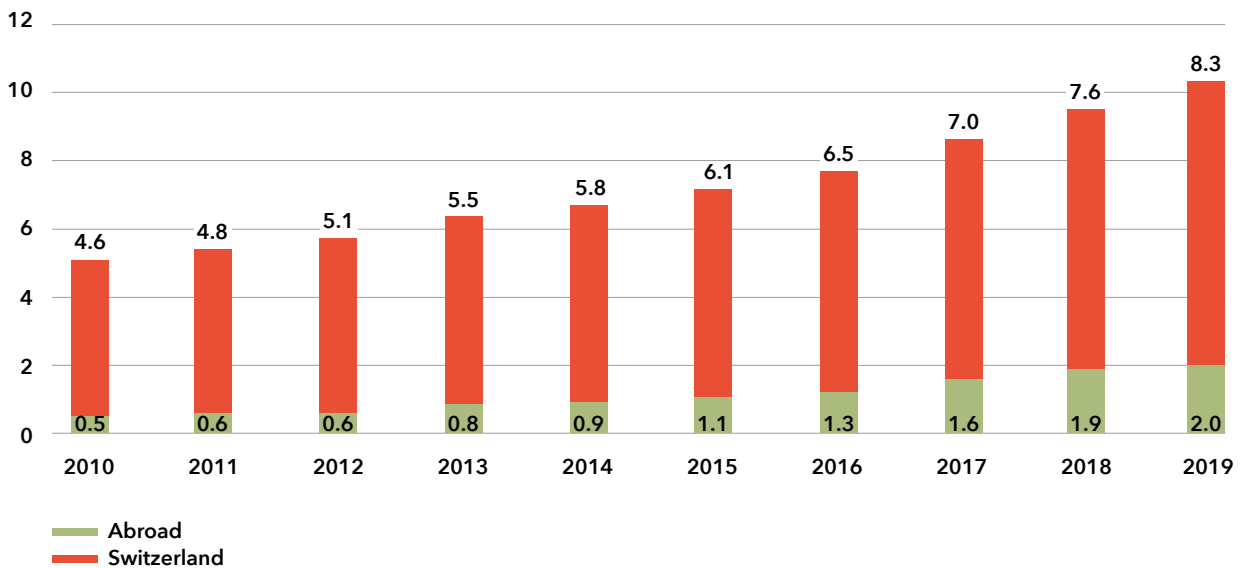
E-Commerce

E-commerce offers consumers the freedom to order goods from any retailer anywhere in the world. In 2019, online trade accounts for 9.1% of total Swiss retail trade. This includes purchases outside Switzerland as well. In 2019, these cross-border purchases, which are among the growth drivers of air cargo, amounted to CHF 2 billion in online retail. Over 20 million small consignments from Asia reach Switzerland every year⁹. According to estimates by the Swiss Association of Mail Order Businesses (VSV), around a third of these are transported by air. The contribution of e-commerce to air cargo growth is difficult to quantify, as air cargo shipments are not specifically labelled as e-commerce.

Swiss online retailers grow faster than foreign competitors in 2019

In the past few years, cross-border online purchases have always grown faster than domestic purchases, with a trend reversal in 2019. At 5.2%, e-commerce purchases abroad grew at a slower rate than domestic purchases. In previous years, the growth rates were just under 20%. The revision of the value-added tax law is likely to play a significant role in this development. The "Lex Amazon" led to the de facto abolition of the tax exemption for small consignments and goods of low value for foreign mail order companies in 2019. Due to an existing tax gap, they previously were not registered for value-added tax, which gave them a competitive advantage over domestic retailers with a profit margin advantage of 7.7% and 2.5% respectively.

Development of Swiss e-commerce in billion CHF between 2010 and 2019¹⁰



⁹Swiss postal service (2020). Annual report 2019.

¹⁰GfK (2020). Focus survey VSV members.

Trade with China offers opportunities for economy and society

Due to its size and affinity for e-commerce, China is considered one of the most attractive markets for export-oriented Swiss companies. The growing prosperity in China offers Swiss companies the opportunity to meet the growing demand for high-quality products in the areas of healthcare, food and luxury goods. With “Your Gate-way to China”, the Swiss postal service has initiated a project to support small and medium-sized companies in opening up the Chinese market and to exploit the potential of cross-border online trading.

Shifting distribution centres from the Far East to Europe

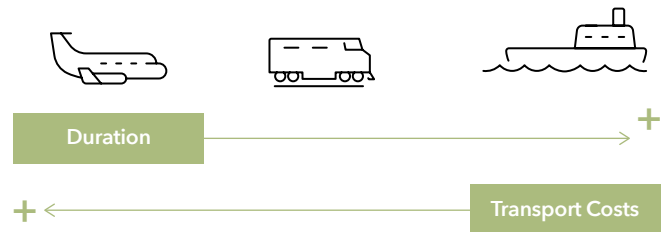
Delivery time is a critical success factor in e-commerce. To gain a foothold in Europe, Chinese retailers are relocating distribution centres to Europe. In the Belgian city of Liège, the logistics subsidiary of Alibaba is building a distribution centre as a European hub, which will be operational in 2021. The strategic location at Liège Cargo Airport offers good flight connections and short distances to the seaports of Antwerp and Rotterdam. It can be assumed that part of the current air cargo volume will be shifted to sea freight. For “fast-moving” items, which are kept in stock due to the high sales volume, the main run to Europe will probably be handled by sea freight for cost reasons. For fast Europe-wide distribution to end customers, CEP service providers are particularly in demand.

Does air cargo face competition on the New Silk Road?

With the expansion of the New Silk Road as part of China's One Belt One Road Initiative, rail transport is increasingly offering an alternative to air and sea freight for goods traffic between Europe and Asia. Regular train connections between China and Europe run from several locations. There are already 40 weekly connections from Duisburg Port to Chinese destinations. Shippers from Switzerland also use the train connection as well. In terms of transit times and transport costs, the train connection positions itself between air and sea freight. With a transit time of 14 to 18 days faster than sea freight and transport

costs lower than those of air cargo, the train connection is an option when air cargo is too expensive and sea freight is too slow.

Position of rail freight transport between air and sea freight



In the future, rail transport will expand its market share and increase its relevance on this trade route. It is questionable how the market shares will shift. The system-specific advantages of air and sea freight differ greatly. While air cargo has a strong transport affinity for time-sensitive, high-value goods, the advantages of sea freight include low transport costs and high performance for bulk goods. Even if air freight-affine goods, for example high-value electronics, are occasionally transported in consolidated containers, air and sea freight are only rarely to be seen as substitutes. Containers are transported both by rail and by ship. The high performance of these two modes of transport for bulk goods argues in favour of shifting transport from sea freight to rail. As air freight is valued for particularly time-critical and high-value goods, a shift to rail will only occur in exceptional cases. For a substantial shift, the transit times of rail transport would have to be shortened considerably.

Customer requirements

77 % in the case of Zurich, 75 % for Basel and 46 % for Geneva, is the

satisfaction rate

of export freight forwarders and 73 % in the case of Basel, 56 % for Zurich and 68 % for Geneva in the import business.

13th place

for Switzerland in the World Bank's Logistics Performance on the "logistical affinity" of individual countries (rank 6 in 2007)

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Customer perspective:
air freight requirements

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The customer is and remains king
for Swiss WorldCargo

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airports

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Potential for improvement

Customer perspective: air freight requirements

What do shippers need air freight for?

Air freight is able to build complex global supply chains and is therefore an important enabler of world trade. However, due to the higher consignment-related transport costs compared to other modes of transport, air freight is only used for a limited number of goods categories. Air freight-related goods are characterized by the fact that they are time-critical and have a high value in relation to the weight of the consignment. Short transport times on long-haul routes, high safety standards for the freight and exceptional reliability through precisely planned transport processes are the decisive criteria for Swiss shippers when using air freight as a means of transport. For individual shippers, the reasons for using air freight can vary depending on the industry and type of goods. Two case studies illustrate the essential importance of air freight as a mode of transport:

Case study 1:

Customer-specific contract manufacturing makes air freight the standard mode of transport

The Swiss Endress+Hauser group of companies, based in Reinach near Basel, is a leading global supplier of measurement and automation technology for process and laboratory applications. More than 95% of the orders are customer-specific products. Due to the very high product diversity with more than 20 million variants, products must be manufactured in an application-specific way for business customers. The protection of intellectual property rights plays an important role in the company. In order to protect the company's own know-how, for example in the field of sensor technology, the production of core components takes place predominantly in Europe. One of the largest plants is located in Switzerland. In order to meet the requirements of customers for short-term and rapid delivery, air freight is used as the standard mode of transport worldwide.

Case study 2:

When sea freight is no longer an option

In intercontinental transport, air freight is sometimes unavoidable as a mode of transport. When transporting gaseous goods classified as dangerous goods class 2.1, under temperature-controlled conditions, a Swiss tool manufacturer cannot use sea freight, which is actually the preferred mode of transport, as this category of goods may not be transported by sea in refrigerated containers for safety reasons. Cargo aircraft are therefore a suitable means of delivering the goods to customers overseas.

Use of air freight to reduce capital commitment costs

The average value of goods in Swiss air freight of CHF 1,413 per kilo in exports underlines the enormous value density of Swiss air freight compared with other modes of transport. In 2019, the value per kilo in road freight was around CHF 9.–, and CHF 15.– in sea freight. According to Swiss air freight forwarders, financial considerations play an important role as a criterion for the selection of transport modes. Although Switzerland has the lowest key interest rate level among central banks in the world at -0.75%, a survey of Swiss companies by the University of St. Gallen showed that the weighted average cost of capital (WACC) in 2018 was 6.5%¹. Even in times of low interest rates, capital is not available to companies free of charge. As an example, the automotive industry shows that the average cost of capital varies widely within an industry, from below 3 to 5% for OEMs to over 10% for suppliers. Therefore, the reduction in committed capital has a high significance and becomes all the more important the higher the value of the goods transported. Transportation by air freight can reduce the capital commitment with short transit times of only a few days compared to sea freight.

¹Hofmann & Wetzel (2018). Working Capital Management Study 2018—Supply Chain Finance Introduction.

Weighted average capital costs of Daimler and selected suppliers in 2018

	Company	WACC
OEM	Daimler	3.48%
Supplier	Magna International Inc	9.96%
	Continental Ltd.	8.97%
	China Motor Corp	8.40%
	ZF Friedrichshafen Ltd.	6.10%
	Lear Corp	8.82%
	Kuka Ltd.	11.61%

Source: Wetzel, Hofmann & Köpplé (2020). Supply Chain Financing in the automotive industry

Case study Apple iPhone:

Due to their high value density, smartphones are considered to be air freight-related goods. The sales price of the current flagship model iPhone 11 Pro in Switzerland is around CHF 1,300. In view of the fact that the Apple iPhone has a market share of over 40% (Moneyland, 2019) of the 3 million smartphones sold in Switzerland (Statista, 2020), the value of goods transported by Apple for the Swiss market alone is in the billions². For the transport of an iPhone shipment from China to Europe, a transit time of 5 days by air freight and 45 days by sea freight is supposed. Assuming a WACC of 6.5%, the capital tied up in one item amounts to CHF 10.56* by sea freight and CHF 1.17* by air freight. (*Note: the values for the tied up capital are calculated by multiplying the sales price by the WACC, multiplied by the term in days, divided by 360). With a weight of about 400 grams including accessories and packaging, an air freight rate of CHF 3.– per kilo for an iPhone will result in transport costs of CHF 1.50 per unit, including pre and onward-carriage. For high-tech products such as the iPhone, weighing up transport costs and capital commitment therefore often leads to the choice of air freight as the favoured transport mode.

Forwarding agents handle air freight transports wholly on behalf of shippers...

Shippers almost always commission forwarding agents to take over the complete handling of air freight transports on their behalf, starting with collection from the factory or

logistics centre and ending with delivery to the recipient, including customs clearance. By handing over the responsibility to the forwarder, the forwarder acts as 'shipper' to an airline for booking capacities for air freight shipments from customers. Shippers usually seek an end-to-end solution to the consignee. Air transport is only one part of the process chain, which is why forwarders are usually also contracted for the pre and onward-carriage to provide a one-stop service.

...and choose the airport

The unanimous view of shippers and forwarders is that the choice of airport for handling air freight consignments is primarily the responsibility of the forwarder. Although 51% of the freight forwarders surveyed agreed or somewhat agreed with the statement that shippers actively influence the choice of the airport used for handling air freight shipments. However, this influence is only exerted in individual cases, for example when the customers of the shippers issue instructions. Shippers usually leave the decision on the use of the mode of transport to the logistics service provider they have engaged.

Swiss forwarders primarily use Swiss airports

A survey of Swiss air freight forwarders shows that more than three-quarters of the Swiss forwarders surveyed use Swiss airports for air freight handling in export and import. However, they are not limited to using Swiss airports alone. Numerous large European airports can be reached from Switzerland in a few hours by truck, so that freight forwarders can use an easily accessible airport network in Europe as an alternative to Swiss airports.

Air freight relevant airports are also located outside Switzerland

Figures show that, in addition to the three national airports of Zurich, Basel and Geneva, Swiss freight forwarders also regularly use nearby airports in Europe. The most important of these are the airports of Frankfurt, Amsterdam and Luxembourg. With 893,000 tonnes of air freight handled in 2019 and only 4.4 million passengers, Luxembourg is positioning itself as a cargo airport. With over 70 million passengers each in 2019, Frankfurt and Amsterdam are characterised by dense and high-frequency flight networks. 507,520 aircraft movements in Frankfurt mean there are almost twice as many take-offs and landings compared to 275,329 at Zurich Airport.

²Statista (2020). Number of sold smartphones and tablets in Switzerland between 2013 and 2019 with projection for 2020.

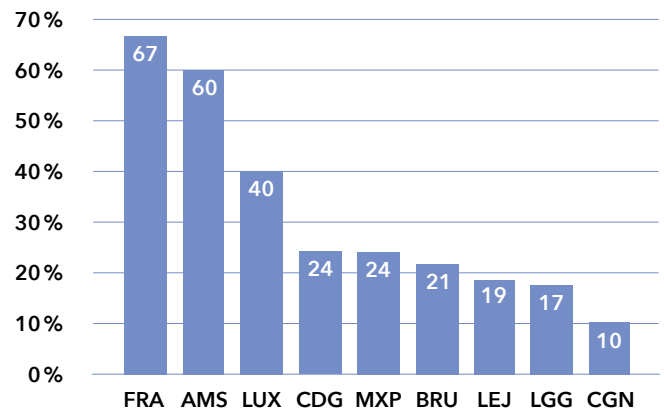
Criteria for airport selection

The question of the relevance of individual criteria for the selection of an airport reflects the criteria that are generally decisive for shippers when choosing air freight as a mode of transport — where speed, safety and reliability are the focus. Within the scope of the survey, 24 criteria were evaluated with regard to their relevance for the choice of airport for the handling of air freight shipments. The results speak for a high-quality and firmly plannable transit time over the entire transport, which can be guaranteed to customers. The reduction of disruptive factors which potentially delay the planned transit time has high priority. The following list chronologically lists the TOP 10 criteria for airport selection.

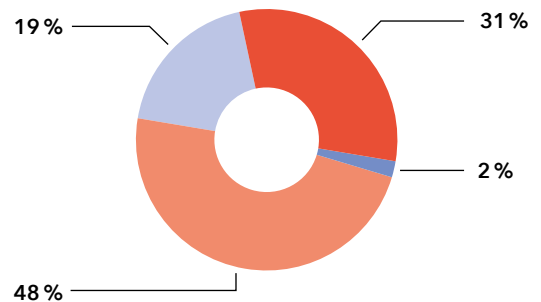
The TOP 10 criteria

1. Reliability of the players in the air freight chain (quality)
2. Efficiency of the clearance processes
3. Speed of processing for handling agents for export shipments
4. Security standards for air cargo shipments
5. Availability of standard handling capacity at the airport
6. Frequency of departures
7. Planning security through regular flight connections
8. Planning security through a flight plan with advance notice
9. Rapid access to import shipments
10. Accessibility of the airport by road

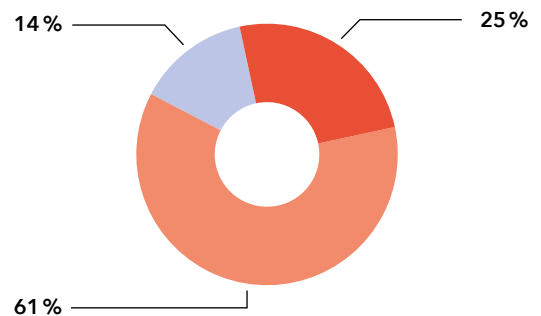
Airports in the European region regularly used for air freight shipments



Handling of air freight imports (by Swiss forwarders) per region



Handling of air freight exports (by Swiss forwarders) per region



- Switzerland only
- mainly Switzerland
- European neighbours only
- Mainly European neighbours

Source: Survey of Swiss air freight forwarders, N=45

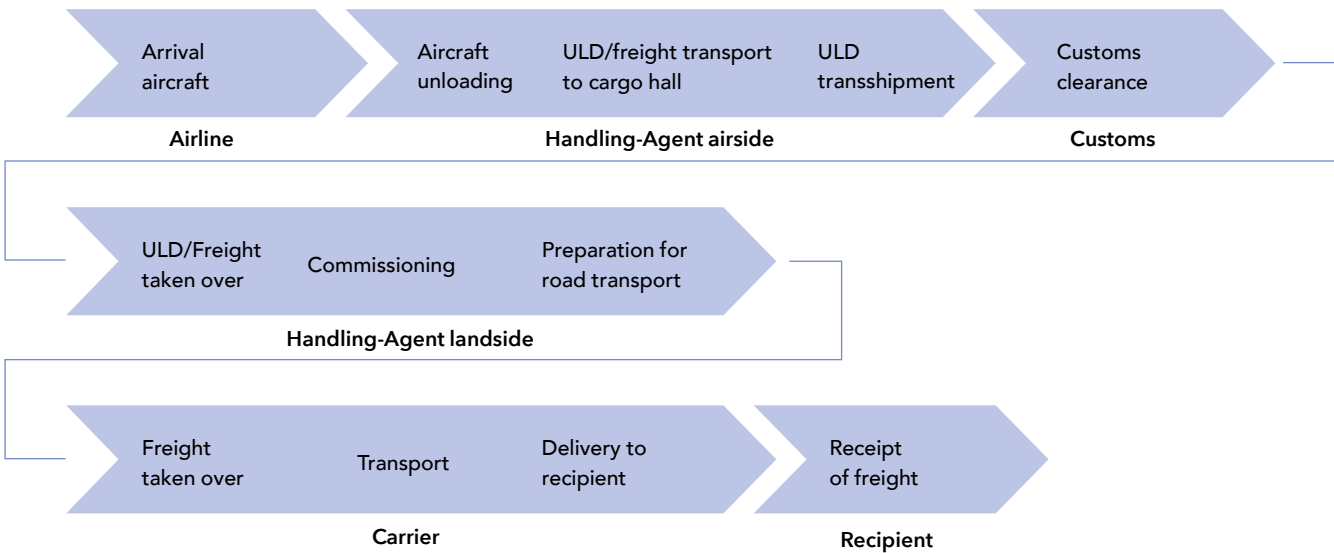
Physical handling process of an air freight shipment in export and import

The handling of traditional air freight is an interaction of several companies with their specific tasks. The big challenge for a smooth transport process is the continuous coordination and communication between the parties.

Export



Import



For Swiss WorldCargo the customer is and continues to be King

Since IG AirCargo's last "Luftfracht" study of the Swiss air freight sector in 2009, both the air cargo industry and Swiss WorldCargo have changed. 10 years ago the economy was in the midst of a global financial crisis, and since then many developments in the wider world have shaped our industry. Amidst a constantly evolving marketplace, our company has continued to distinguish itself from the competition while still staying true to what we stand for.

In the last ten years, our primary focus has been on providing the consistent high standard quality services, which our customers, and the industry, expect from SWISS and Swiss WorldCargo. This entails the shipping of care-intensive, niche and high-value goods, such as in the pharmaceutical and valuables domains. We build on excellent partnerships, on the ground and in the sky. Our hub in Zurich remains one of our core USPs, due to its quick handling and processing times. Our strong partnership with ground handler Cargologic and ramp handler Swissport in Zurich have set the tone for myriad successful partnerships throughout the world. It is of our utmost interest to walk the extra mile for our customers' needs and enable a global good and quick flow of goods.

However, beginning March 2020, we have had to deal with the worst crisis to ever hit the entire aviation sector. It is no secret that COVID-19 and the Coronavirus crisis has had devastating effects on the global economy, and has been absolutely tumultuous for various industries. It has required us to be flexible, agile and forward-looking; to think of innovative new solutions and to continue finding new ways to service our customers in spite of these global challenges.

It has also forced us to adapt many of our processes and quickly change our core ways of doing business. At the onset of the crisis, amidst quickly changing border restrictions, our passenger travel slumped and we began flying with a cargo-only fleet of aircraft. In the next few weeks, this rapidly expanded, and by the end of June,

we had carried out nearly 600 cargo-only flights. That's quite something different, considering we have historically been a belly carrier. We also launched our "belly charter" option. With this offer, customers could book part or all of one of our aircraft for their shipment needs. Quickly, orders began filling up for these cargo-only flights. Originally, many were from Asia and bound for Switzerland, but over the weeks, this expanded to flights between Switzerland and all continents.

With imports coming in from countries all around the world, we focused on providing PPE (personal protective equipment), meaning that we were shipping tonnes of goggles, surgical gowns, gloves and face masks for medical personnel in Switzerland every day. We also continued our regular operations of supporting global supply chains, importing and exporting vital and critical goods from Switzerland.

So what's next? It's impossible to predict. One thing is clear, however: A customer-centric approach remains central to our Swiss WorldCargo strategy. We will continue to focus on an area where we are proud to have made a name for ourselves: the transportation of high-value, care-intensive goods for import and export. We will continue to seek ways to optimize our efficiencies, while focusing on further development of our sustainability and digitalisation offering.

If this crisis has taught us anything, it's that the air cargo industry is resilient and quickly able to adapt to the most challenging circumstances. And ultimately, that our services are both necessary and needed and will continue to be: we provide the foundation for much of the global economy, and will continue to play an important role in providing global connection and ensuring the continued flow of goods globally.

Ashwin Bhat
Head of Cargo Swiss International Air Lines

Assessment of Swiss air freight

Infrastructure and Service

Short distances between the freight infrastructure and the runway generally facilitate fast freight handling at airports. A characteristic of Swiss air freight is its manageable size compared to cargo airports. While Frankfurt and Paris handle more than 2 million tonnes of air freight annually, all Swiss airports together handle only around a third of this. For time-critical intercontinental transport, freight forwarders value Zurich Airport in comparison with other European hubs for its fast handling and short transit times at the airport. For delivery by truck, the waiting time for the handling agent is a maximum of 20 minutes. The proximity of the cargo to the apron ensures very short distances at all Swiss airports, which enables efficient handling of air freight. For example, a consignment can be delivered in Zurich up to 90 minutes before departure, while a transfer to another flight guarantees reloading in 90 minutes. Long distances between freight buildings and runway as well as a significantly higher freight volume at larger airports mean longer processing times for air freight. A transfer flight via Zurich can therefore sometimes be faster than a direct flight from another European airport. On the other hand, a very high volume of freight at the airport enables the company to position itself as a cost leader by achieving economies of scale, if processes are standardized meaning that economies of scale can be realized. In this respect, Swiss airports are at a disadvantage compared to Frankfurt or Paris.

The strategic focus of Swiss airports on particularly high-value and sensitive goods is reflected in the well-developed infrastructure. At Basel Airport, 92% of forwarders are satisfied with the availability of temperature-controlled handling capacities. Zurich has the highest satisfaction values for theft-proof and dangerous goods-compliant handling capacities, important criteria for handling special products such as valuable and dangerous goods. Geneva Airport is rated in all categories

Satisfaction rate of freight forwarders with the range of services offered at Swiss airports

Airports	Zurich	Geneva	Basel
Export	77 %	46 %	75 %
Import	56 %	68 %	73 %

Remarks. The percentage given is of forwarders who are satisfied with the export/import service at the respective airport.

ries in the medium satisfaction range. In the opinion of the airport's Cargo Department, this is a retrospective assessment of the airport's highly developed infrastructure in recent years. Freight forwarders who use Geneva in particular for air cargo handling rate the airport much better than the average. The current lower cargo volume compared to 2017 and 2018 eases the burden on the air freight infrastructure at Zurich and Geneva airports. In these years, the record high volume of air freight at Geneva and Zurich airports showed capacity bottlenecks in cargo handling, which led to waiting times in the receiving area and delays in handling.

Zurich Airport is considering the construction of a new cargo hangar in order to adjust cargo capacities for the forecast further growth. The Freight West building is also to be modernized to increase the quality of the infrastructure. Due to limited space on the airport site, planning considerations suggest that the cargo buildings should be relocated to the Rächtenwisen site on the eastern edge of the airport. One challenge is to maintain fast air freight handling, as the structural changes would require undesired extended transport routes to the runway system. In view of the competitive situation with other hub airports, a restriction of process efficiency through longer distances should be avoided.

Regulations

60% of the freight forwarders surveyed are satisfied with the regulatory framework. Strikes, like those in other European countries, are not to be expected; political stability is seen as an argument for the reliability of Swiss air freight. Nevertheless, there are challenges. 62% of the forwarders see the ban on night/weekend traffic as a restriction on the efficient handling of air freight. If the ban on night/weekend traffic were to be lifted, 64% of those surveyed believe that more air freight could be handled via Swiss airports. The assessment of Switzerland as an air freight location therefore shows a mixed picture. More than half of the freight forwarders see a locational disadvantage for Swiss airports in an international context due to the regulatory framework. An extension of customs opening hours at the airports would be desirable for freight forwarders and airlines, as freight operations at the airport also take place at night.

More than half of the freight forwarders see a locational disadvantage for Swiss airports in an international context due to the regulatory framework.



Swiss national airports in a European comparison

Swiss air freight logistics is characterised by speed, high quality and safety standards, and thus covers the most important reasons from the shippers' perspective for using air freight. Across the three national airports, the strengths of Switzerland as an air freight location are shown in four comparative categories

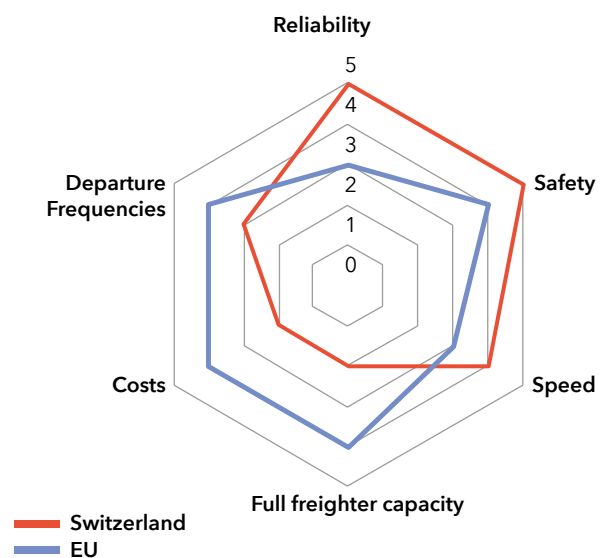
- **Safety standards** for air freight shipments to Swiss airports are rated significantly better than at European airports in the surrounding area: 57 % of freight forwarders rate the safety standards for Zurich as much better (Geneva 43 %; Basel 54 %).
- **Reliability**: almost two thirds of the forwarders rate the reliability of the players in the air freight chain at Zurich Airport as better or much better. Basel also scores above average.
- **Fast processing by handling agents for export shipments**: three-quarters of all forwarders across the three airports rate the processing speed for export shipments as at least equal to or faster than that of the surrounding European region.
- **Fast access to import shipments**: more than 75 % consider Switzerland's national airports to be at least on a par with other European airports. For Geneva, Basel and Zurich, more than 25 % of forwarders see advantages at Swiss airports.

Swissness: quality has its price

The survey reveals that the level of charges for use of services and infrastructure is perceived by freight forwarders and shippers as a central weakness of Switzerland as an air freight location compared with the surrounding European countries. While 67 % of freight forwarders in Zurich gave a lower rating for the level of charges, the figure is 50 % in Basel and 42 % in Geneva. First and foremost, this refers to labour-intensive services

at the airports: handling costs in Switzerland are considerably higher due to the Swiss wages level. To add to this, there are higher costs for road transport. In addition to the personnel costs in transport, the LSVA levy, which is many times higher than the comparable truck toll systems in neighbouring countries, also has an impact. A relative classification of Swiss air freight in comparison to its European neighbours shows strengths and weaknesses.

Relative positioning of Swiss airports in comparison to their European neighbours based on selected criteria



While Swiss air freight competes with other European airports on the aspects of reliability, safety and speed as sales arguments, European airports position themselves with relative advantages in terms of costs. The higher the share of transport costs in the total costs of a product, the more relevant their reduction becomes. If shippers are primarily concerned with low costs, airports in France, Germany or Italy become more attractive. Consequently, the higher the share of transport costs in the sales price

For Switzerland as a business location, a differentiation strategy geared to special products with high quality requirements for air freight is appropriate.

of a product, the greater the probability that products will leave Switzerland by truck, bypassing Swiss air freight logistics. For Switzerland as a business location, a differentiation strategy geared to special products with high quality requirements for air freight is appropriate.

Reasons for the outflow of air freight to European neighbours

Industry representatives estimate that up to a quarter of Swiss air freight tonnage leaves Switzerland without being declared and handled as air freight. In addition to the cost advantages of personnel-intensive processes, geographical or customs considerations can also make airports in the EU attractive: customs procedures in Switzerland are considered comparatively simple, which provides Swiss exporters with good connections to the European market. The advantage of being able to export goods from Switzerland quickly and easily also means that Swiss air freight will face stronger competition from neighbouring airports in Frankfurt, Luxembourg, Paris or Milan.

Safety regulations for some dangerous goods prohibit their transport on passenger flights

The international regulations of IATA (IATA DGR) and the International Civil Aviation Organization ICAO (ICAO TI) apply to the transport of dangerous goods by air. For safety reasons, a change in the IATA DGR in April 2016 led to a ban on UN3480 lithium-ion batteries, labelled as dangerous goods as cargo on passenger aircraft. This product category must be labelled "Cargo Aircraft only". As only Basel Airport offers full-freighter capacities in Switzerland, air connections from Switzerland can only partially meet the demand for air freight in this and other categories of dangerous goods. In addition to strategic reasons at a company level, regulatory requirements in the area of security may therefore also be a reason for handling air freight consignments using airports outside Switzerland.

Relocation of logistics centres to the EU

Due to the high level of wages in Switzerland, some Swiss companies are relocating logistics sites to other countries. By outsourcing to logistics service providers, considerable cost savings in logistics are sought in comparison to a location in Switzerland. An Eastern Swiss pharmaceutical company works with a logistics service provider in Germany: the processes are designed in such a way that goods from production in Switzerland are collected directly from the factory by truck and transported to the central logistics centre in the greater Frankfurt area for storage. Due to the proximity to Frankfurt Airport, air freight shipments are largely handled through this airport.

Duty-free in the EU as a trade barrier for Switzerland as an air freight location

In addition to financial considerations, Switzerland's limited access to the EU internal market at the regulatory level creates trade barriers that limit its attractiveness as an air freight location for European shippers and forwarders. Due to the fact that there are no customs duties in the EU, the necessary customs procedures when crossing the border into Switzerland mean that European logistics networks are spatially sealed off, so that despite the geographical proximity of neighbouring regions such as southern Germany, very little air freight destined for export flows into Switzerland from its European neighbours.

Potential for improvement

End-to-end transparency in air freight logistics: e-commerce as a driver of changing requirements

End-to-end transparency is becoming increasingly important for air cargo customers. With goods worth millions or billions to be transported, shippers are increasingly demanding seamless shipment tracking, ideally in real time, regardless of industry. The possibility of self-monitoring of shipments is desired, whereby e-commerce is to be seen as a driver of changing requirements. The experience gained in the B2C sector thus reaches the B2B market. From the point of view of forwarders and shippers, it is primarily a matter of proactive information management in the event of deviations from the planned standard process. Instead of providing maps with shipment overviews, real-time warnings are intended to alert shippers to event-related incidents. Since regulatory requirements mean that shipment information may not always be passed on in real time, the principle of closest possible to real time applies to the passing on of shipment data. The one-stop service means that integrators are currently perceived by shippers as role models in Track and Trace, as they enable shipment tracking without media discontinuity, which is difficult for freight forwarders due to the large number of players involved in classic air freight.

In the event of disruptions in air freight logistics, the shippers must be able to react quickly

In the event of incidents in air freight logistics, the shippers must be able to react quickly. Although air freight is rated better than sea freight in terms of reliability and transparency - individual shippers experience sea freight as a Blackbox, since the transport over several weeks is subject to time variance and therefore customers cannot be given reliable information about the exact delivery date. However, air freight is not free from criticism either. Some shippers have had the experience that information about delays or theft of goods is given much too late or not at all. Instead of being informed by the forwarder, customers sometimes complain directly to

The lack of standards for tracking and tracing ties shippers to individual service providers

A Swiss manufacturer of precision measuring instruments is currently experiencing a dilemma in tracking and tracing: being faced with the choice of either systemically tying itself to a service provider by setting up an interface to the latter or being confronted with a lack of shipment information without a system connection. The creation of an interface for the purpose of automated transmission of shipment data from the freight forwarder to the company's own TMS can represent a considerable organizational and/or financial outlay. As a result, the company only has interfaces to individual service providers, which from the shipper's point of view represents a system link to the service provider. The company sees the integrator UPS as a strategic partner for parcel shipments, which justifies the creation of an interface. In order not to be dependent on individual players when choosing a forwarder, the establishment of an industry-wide standard for the transmission of shipment data is desirable in order to achieve complete, real-time shipment tracking even without a system connection.

the shipper about missing deliveries. Shippers want early status air freight updates, if possible in real time, in order to be able to react to deviations from the planned process. By receiving information early, shippers hope to find a solution more quickly in a joint dialogue with their customers. As a means of information, tracking and tracing is becoming a critical requirement in the field of air freight logistics. The manager of a manufacturer of high-quality electrical engineering in Eastern Switzerland, responsible for the global supply chain, states that "tracking and tracing has become a decisive criterion for or against the selection of a service provider".



CARD'S
HANDLING
CONTROL

Digitalisation

Switzerland ranks

20th

among 135 countries, in the
"IATA E-Freight-Friendliness
Index" (EFFI).

69%

of forwarders consider paperless
handling processes as being
important to very important.

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demand in the future?

Digitalisation potential for air freight logistics

Air freight logistics is characterised by the involvement of a large number of market participants. The lack of dominant players in a fragmented market makes it difficult to enforce standards such as those being pushed forward by tech companies such as Google or Amazon.

Unlike other regions of the world, the European market, including Switzerland, is dominated by SMEs. Individual players in air freight logistics, for example, optimise their own sub-processes in particular, without coordination through cross-sector standards. The resulting inefficiencies are particularly evident at the interfaces between players. For 82 % of the freight forwarders surveyed, efficient handling processes are very important when choosing an airport for handling air freight shipments, along with the reliability of the participants. The reality at airports provides considerable potential for improvement: for example, when goods are delivered to the airport, ground handlers often do not know in advance when and how many shipments a freight forwarder will deliver. Shipment information in air freight follows the physical flow of goods, processes remain uncoordinated, and preparatory measures are only possible to a limited extent. Paperless handling processes are important or very important for as many as 69 % of forwarders. This is because manual, paper-based processes entail considerable additional administrative work and limit resource planning and data quality for all parties involved. At the technological and process level, the opportunities offered by digitalisation offer the chance to coordinate processes in air freight logistics and make them more efficient — while at the same time increasing transparency and data quality.

IATA Digitization Initiatives

As the umbrella organisation of the airlines, IATA takes on the challenges of paper-based and therefore comparatively intransparent processes. In the passenger sector, the IATA initiative Simplifying the Business (StB) pursued the goal of enhancing the passenger experience between 2004 and 2017. In line with this goal, StB Cargo also aims to transform air freight processes in order to increase the efficiency and service quality of air freight. The IATA guideline for future air freight is “easier, smarter and faster”.

e-freight and e-AWB

If an electronic data exchange contains all the information relevant to the shipment, the physical transport of documents becomes superfluous. According to this principle, the development of EDI standards by IATA provided a basis for the digital air freight process. With e-freight, IATA is aiming for a consistently paperless transport process in the freight sector.

The introduction of the electronic air waybill (e-AWB) in 2010 is regarded as a central lever of the initiative. Since the introduction of the e-AWB, the penetration rate at airports worldwide has increased continuously. In December 2019, the e-AWB penetration rate across all IATA airlines was 67.5 %. Swiss airports show similar figures.

e-AWB-Quota at Swiss airports (data for 03/2020)

Airport	Basel	Geneva	Zurich
e-AWB-Quota	73.4 %	67.9 %	55.8 %

According to industry representatives, many more air freight shipments are still accompanied by paper than the IATA figures suggest. The “digital failure” of a single player in complex air freight logistics is already sufficient to prevent the continuous electronic exchange of shipment information. In some cases, the use of the e-AWB fails due to regulatory conditions, as customs authorities in some countries do not fully accept the e-AWB as a document. Smaller forwarding companies or carriers do not always have the technical requirements and would first have to invest in new systems. De facto, the process flow remains the same, and shipment information continues to follow physical shipments. The lack of trust between the players in air freight logistics means that paper is often carried along with the e-AWB.

Bilateral data exchange between two parties can be effectively carried out using bilateral EDI without any loss of information. However, as soon as several parties are involved, all parties would have to be informed about changes, a weak point in bilateral communication. This is because the transfer of information along the logistics chain sometimes requires an adjustment of data, which then requires more than one party to be informed. In the status quo, therefore, there is often a lack of transparency about data and its origin, so that it is unclear whether it has been adapted or is incorrect.

The process perspective is crucial

The basic approach of e-freight is to drive the digitization of existing processes and documents. This often ignores an overarching process perspective, detached from the status quo. Findings from business process reengineering show that comprehensive process efficiencies are often only achieved through a complete process reorganization. Digitization basically offers the potential to redesign processes. The lack of a process perspective is therefore a fundamental criticism of the e-AWB initiative. IATA is self-critical in stating that the e-AWB initiative alone is not sufficient to achieve the goals originally set: the air freight industry is still not ready to fully digitalise the handling of an air freight shipment. Based on the analysis, the ONE record project was initiated in 2017, for which the prerequisite is the full implementation of e-freight at the level of individual players.

A data-centric instead of a document-centric system as a basic principle of efficient air freight processes

Within the framework of ONE record, IATA is currently working on solutions for “end-to-end” digital air freight logistics, which promotes the electronic exchange of data in a simple and cross-party manner. This is intended to overcome the bilateral messaging standard. ONE record represents an approach to data sharing that does not focus on individual documents such as air waybills, customs data or proof of security.

ONE record goals

→ Permanent data availability
→ Transparency and relevance
→ Use of modern technologies
→ Creation of an integrated platform network
→ Close cooperation with authorities

IATA as the industry enabler

Many air cargo documents such as the AWB are basically composed of information from several players and therefore require the integration of information from shippers, forwarders, ground handlers and airlines. In order to increase transparency and data quality, all affected players should, at any time, be able to see who has provided which data and when it was entered or updated. IATA is playing the role of enabler in the project to develop the standard in cooperation with air cargo stakeholders. In 2021, concrete solutions are to be implemented from the perspective of individual players in the current pilot project.

ONE record Roadmap

2017	Brainstorming
2018	Definition of objectives and establishment of a task force to develop first high level standards
2019	Initiation of pilot project with, currently, 25 companies: Detailing of standards
2020	Continuation of pilot project with interim evaluation in the first half of the year
2021	Planned Go-Live of first solutions

From the point of view of Swiss air freight logistics, the clarity of the market in comparison to neighbouring countries such as Germany or France offers a good position for quickly implementing standards for cross-player air freight logistics. With the “e-freight Switzerland” project, an initiative of IG AirCargo, together with the associations SPEDLOGSWISS, Swiss Shippers Council and VNL, was launched in 2012 to enable the digital processing and monitoring of air freight transports via a central interface.

Efreight Switzerland as an independent and integrated air freight network

As a hub, a communicative platform can bundle all information relevant to the shipment and allow players to access the required data. An independent, integrating interface between the players involved in air freight logistics reduces media gaps, which still occur in many areas in air freight logistics today.

The figure illustrates the overall informative handling process of an air freight shipment in export from the shipper to the recipient. The process provides information about the fact that data must be exchanged between several parties at several points in the

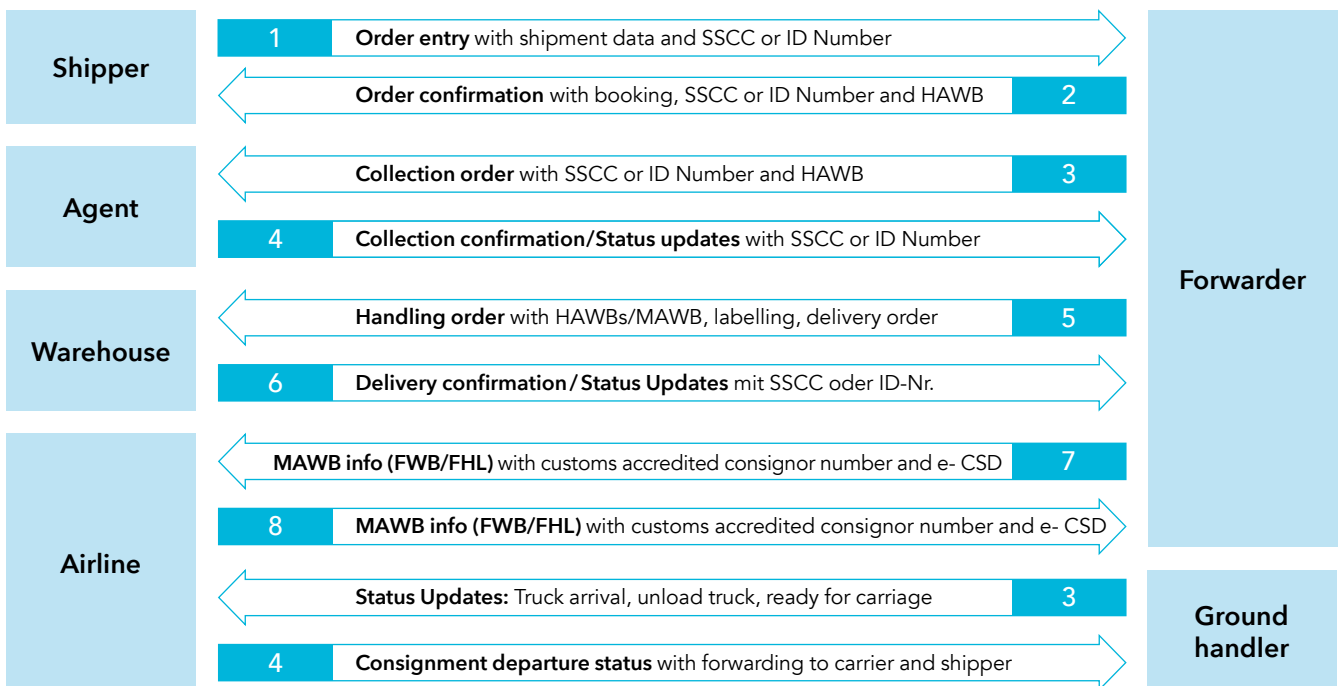
process—information does not flow one-dimensionally in just one direction. To implement the process in a completely digital way across all parties, several requirements must be fulfilled:

- Digitalisation of all documents relevant to the shipment
- Electronic customs clearance
- Traceability of individual process steps for the participants
- Uniform consignment numbering

Targeted improvement potential through e-freight Switzerland

- Increase in data transparency for shippers and consignees
- Cross-participant integration instead of the insular individual player solutions
- Reduction of media gaps that restrict the efficient electronic flow of information
- Reduction of manual effort by using a single communicative interface

Representation of the handling process of an air freight shipment in export from receipt of the order by the shipper.



At present, many shippers are trying to establish interfaces with individual players, for example to enable an automated track & trace system with carriers. From the shipper's point of view, the disadvantages lie in the system connection to individual service providers, as the financial outlay for setting up an interface is high and therefore only suitable for central service providers. With an independent cloud-based platform, E-freight aims for an immediate transition to the digital e-freight process of IATA. As an integrating network, this is the only interface for data transfer, making insular solutions between two parties superfluous.

Excursus CMR: The international waybill

The Agreement on the Contract for the International Carriage of Goods by Road (CMR; from the French Convention relative au contrat de transport international de marchandises par route), initiated by the United Nations in 1956, is a contract for international road transport by land. In the member states (mainly Europe and the Near and Middle East), the CMR is mandatory between the consignor and the carrier and supersedes national transport law in international land transport

According to various players in the air freight chain, the electronic connection of road transports by freight carriers or forwarding agents is a problem in many cases, since freight documents have not been transmitted digitally up to now. The extension of the CMR contract by the e-CMR protocol in 2008 enables the use of digital waybills for pre- and post-carriage by truck. Already ensured in the air by the introduction of the e-AWB,

With an independent cloud-based platform, E-freight aims for an immediate transition to the digital e-freight process of IATA.

the gap of uniform consignment numbering can now be closed by the electronic connection of the carrier with an app solution from TransFollow. In addition to Switzerland, 23 other countries have already ratified the e-CMR protocol, the prerequisite for the digital consignment note on the road. Germany is expected to ratify it in 2020.

e-freight addresses the hurdle of customs simplification by using the web-based platform TransitNet of the goods inspection company SGS to digitally record and check shipping declarations. This procedure offers two central advantages:

- Digital, fast, cost-effective and cross-national customs declaration using a single system
- SGS guarantee to secure the transit procedures

This creates the conditions for a continuous electronic flow of information in the air freight process. Shippers can initiate this process themselves using the e-freight platform and enable all the players to be linked.

Representation of the functional principle of the e-freight process using the independent, cloud-based platform as the central interface between the participants



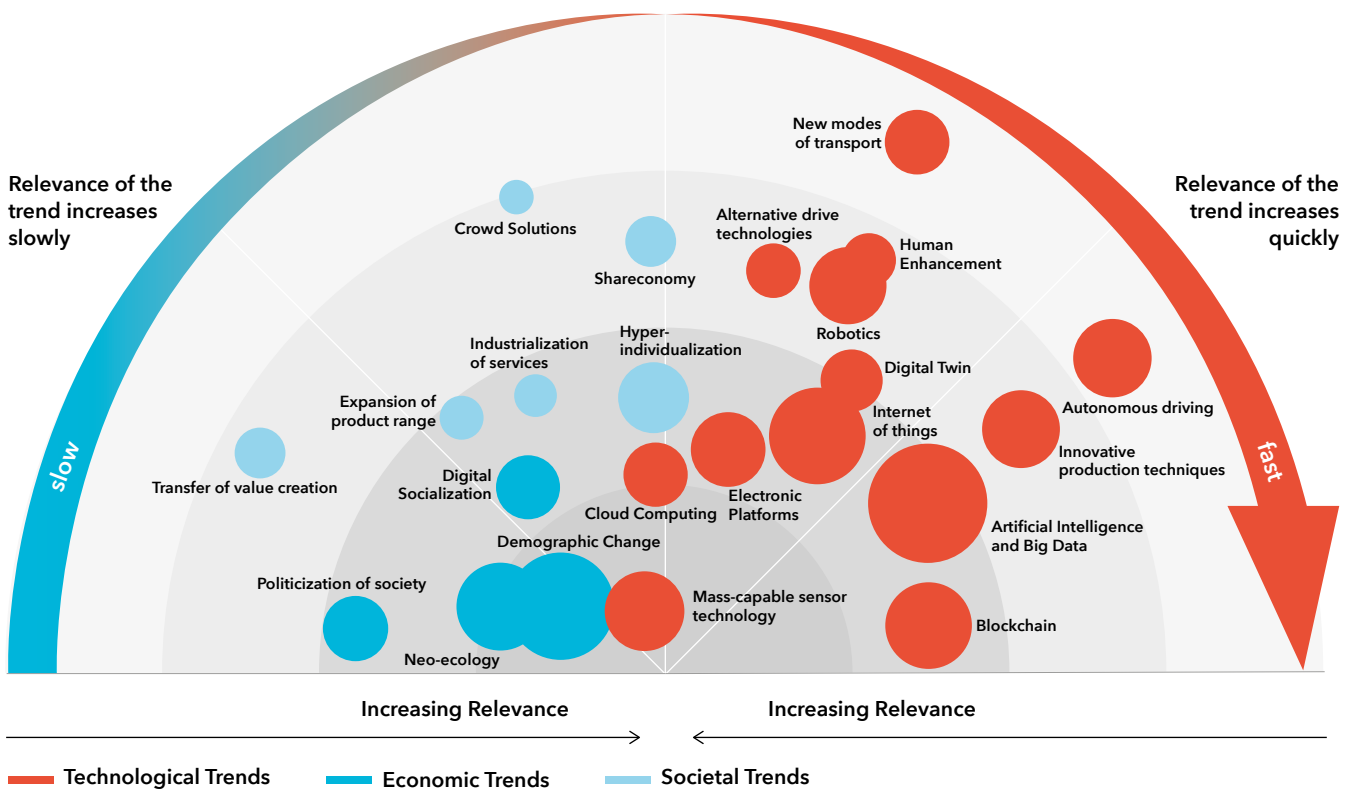
Influence of technological trends on air freight

The availability of large amounts of data and the orientation towards processes that are as standardised as possible offer numerous starting points for technological and structural changes in logistics. The air freight industry itself sees increased transparency and a higher degree of automation as essential cross-player levers.

The Trend Radar of the Future Study of the Swiss Logistics Market lists trends in logistics at various levels. On the one hand, a distinction must be made between technological, economic and social trends. With artificial intelligence (AI), block chain, innovative production

techniques and autonomous driving, technological trends in particular have the potential to bring about major changes in logistics in a short space of time. For some of the trends, concrete applications and potentials in air freight logistics can be identified. In the following sections, different effects of the technological trends on air freight logistics will be illustrated by means of concrete case studies. To this end, we will draw on practically implemented technological trends from the Future Study Logistics Market Switzerland 2019. Due to their potentially major impact and rapidly increasing relevance, these trends can also be described as game changers, as they (radically) change the industry. While

Trend radar: Trends in Logistics and Supply Chain Management



Source: Future Study Logistics Market Switzerland, 2019

the potential of 3D printing technology through its use in manufacturing suggests a shift in the flow of goods, IOT applications to facilitate seamless communication between objects or the use of AI for optimized ground processes promise concrete process improvements in air freight. The Swiss start-ups nexxiot and Assaia show that technological trends are often transferred to air freight by IT-related players from outside the industry.

What is the digital maturity level of Swiss air freight logistics?

In order to compare Switzerland's digital maturity level internationally, the IATA E-Freight Friendliness Index (EFFI) can be used to assess the penetration of electronic transactions and documents in air freight shipments. It consists of a weighted score of the e-AWB penetration rate, the implementation of the IATA e-freight initiative and the acceptance and processing of electronic customs data. The EFFI ranks Switzerland 20th out of 135 countries worldwide¹.

Cross-player data transparency through cloud-based IOT solution

The ETH spin-off nexxiot uses an IOT solution to create transparency when tracking ULD containers. As an "asset-focused" solution, GPS data and sensors provide almost real-time information on the position, shock impact, temperature and humidity of the ULDs. From the perspective of ULD leasing companies, central administration offers the opportunity to optimize fleet management, for example to avoid losses, increase utilization or initiate maintenance in the event of shock impacts. The data can be released to airlines, who make it available to shippers as value-added services. Above all, the added value of the application lies in the cloud-based software that enables all players to access the data centrally. Nexxiot thus picks up on the trend of providing solutions from a single source for all players in air freight logistics.

Case: AI-supported aircraft handling

The Swiss start-up Assaia uses the principle of the learning algorithm to apply historical data for predictive analysis. Assaia uses an AI to address transparency in the process of aircraft handling at airports.

The focus is on the generation of structured data to make airside operations safer and more efficient when handling aircraft. Proactive information management enables better control of handling processes at the airport, real-time alerts allow timely intervention in ongoing turnarounds.

Principle of operation and added value

The machine learning-algorithm used takes existing ramp surveillance cameras and converts their video material into structured data in real time, e.g. in the form of time stamps for individual operations during a handling process. The AI also uses alerts to communicate dangerous situations or deviations and provides predictions about important process milestones, such as the status that an aircraft is ready to be pushed back from the gate (pushback readiness).

Airlines, airports and ground handlers use the new emerging opportunity to intervene in ongoing handling processes, optimize ground processes and prevent accidents. Airlines can use the information from the records for analysis purposes; for example, to identify causes of delays that can be avoided in the future through optimized planning. In addition to faster handling in the future, the AI solution primarily offers the possibility of stabilizing turnaround times. In view of the current high variance in the time an aircraft stays on the ground between landing and take-off, this will allow better planning and better utilization of aircraft.

¹ IATA Economics (2019). The importance of air transport to Switzerland.



Airlines, airports and ground handlers use the new emerging opportunity to intervene in ongoing handling processes, optimize ground processes and prevent accidents.

For air cargo logistics, the use of AI offers the following operational efficiency potential:

- Timely delivery of cargo to the aircraft
- Reduction of waiting times
- Better scheduling of the vehicles
- Trip optimisation
- Combining outward and return journeys

Classification of the players

Airlines, airports and ground handlers take on different roles as stakeholders during implementation:

- Enabler Airport
- User Ground Handler
- Beneficiary Airline & Ground Handler

Why does the solution target aviation?

In view of the growth forecasts for global air traffic, capacity bottlenecks at airports will increase in the future. Any expansion of the infrastructure at many airports is often not possible for a variety of reasons, whether politically motivated or due to a lack of available space in the surrounding area. Large airports such as London Heathrow show that it is hardly possible to reduce delays built up when slot capacities are exhausted.

More efficient handling management can increase the scope for action at airports with capacity bottlenecks, as resources such as slots, ground support equipment and aircraft are better utilized.

Overview Artificial Intelligence

AI describes the ability of machines to interpret problems themselves and to independently develop solutions for them. Instead of static algorithms, dynamic regression models are used, so that decisions are subsequently verified by AI and a well-founded wealth of experience is built up. As the amount of data increases, an AI can develop better and better solutions that enable experience-based predictions.

Will additive manufacturing processes influence global air freight demand in the future?

3D printing has been the focus of attention for many companies in the manufacturing industry in recent years, and the processes known as additive manufacturing promise a wide range of potential and applications. Air freight is also looking at possible effects on the global flow of goods. Will the air freight industry lose part of its air freight volume in the future?

Distinction between classic and additive manufacturing processes

3D printing stands for a variety of technologies in which material in the form of liquids or powder is applied layer by layer in an additive manner. A 3D model serves as a template for the "print". While solids are the starting material in classical manufacturing, liquids or powder are the starting point for 3D printing. The conceptual differentiation in additive versus "separating" manufacturing processes shows the essential difference in the process: in 3D printing, the starting material is applied in layers. Conversely, in the classical process, the removal of material results in the volume of the manufactured part being smaller than its starting material.

Application areas of the technology

3D printing has its origins in rapid prototyping to accelerate the product development process. Depending on industry requirements, different characteristics of 3D printing technology are at the forefront. In the case of medical products such as dental prostheses, the focus is on the production of customized one-off products, while in aircraft construction, lightweight construction can be the main focus for aircraft parts to reduce fuel consumption. Basically the application purposes can be divided into two areas:

- Process Improvement: 3D printing as a supplement to the use of classical processes
- Series Application: 3D printing replaces classical processes as a manufacturing technology

Potential for air freight logistics

From the perspective of the air cargo industry, the question arises as to how 3D printing will lead to changing global supply chains and whether it will make some of today's air cargo transportation redundant. The ability to capture production-relevant information in a 3D model means that this information can be digitally exchanged, making production more locally independent. Instead of being supplied from a central spare parts warehouse, a workshop with a 3D printer and a database of various digital 3D models could print components on site at short notice as required. Companies with a considerable volume of spare parts hope that this will enable them to relocate production to local customers, and also in order to make transport unnecessary.

Instead of being supplied from a central spare parts warehouse, a workshop with a 3D printer and a database of various digital 3D models could print components on site at short notice as required.

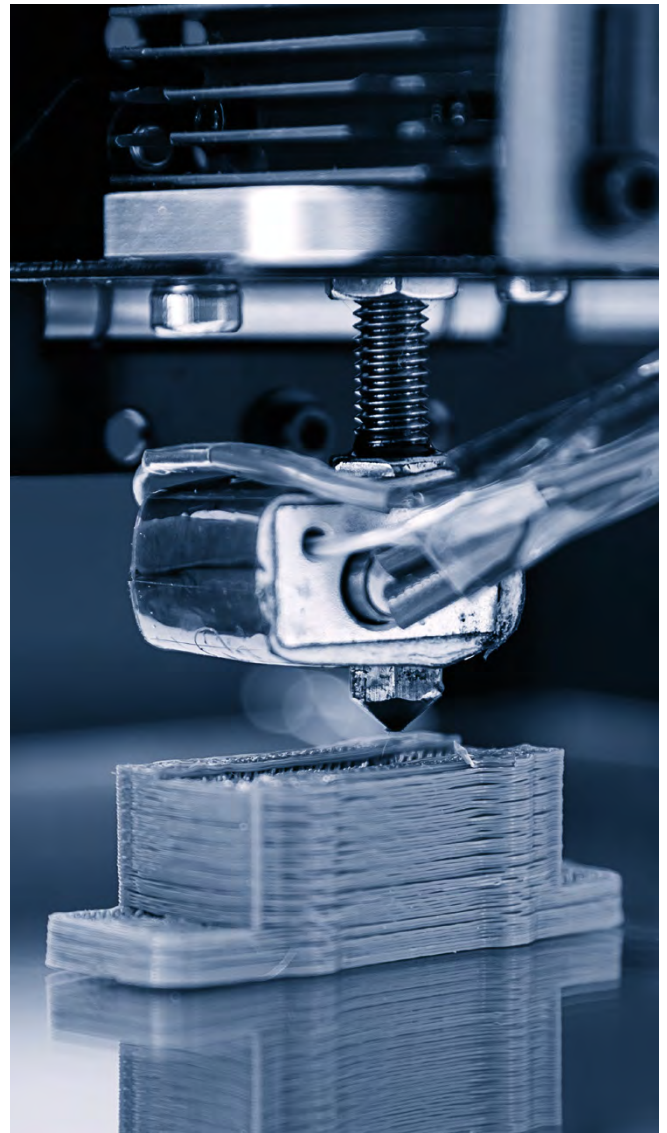
Challenges for 3D printing

If 3D printing is to be considered for serial application, current challenges that limit the use of the technology must be solved:

- Quality: Parts manufactured additively differ in their material properties from milled pieces. Ensuring a consistently high component quality is central to series production in automotive or aircraft construction.
- Speed is a critical factor in mass production. The production speed of 3D printing is limited in comparison to classical processes due to the lack of economies of scale, therefore further technological innovations are required.
- Costs: Manual processing is often necessary due to surface quality defects or to remove production-relevant support structures. Labour is therefore the most cost-intensive factor in most 3D printing processes.

What does this mean for air freight?

In the area of spare parts or special tools, 3D printing technology certainly offers the potential to reduce some of the air freight volume in the future. Jiang, Kleer and Piller (2017) present the scenario for the year 2030, in which in the case of custom-made products and sustainably demand production, production will increasingly be local, while mass products will continue to be produced globally². However, it should be borne in mind that different challenges exist depending on the application. Therefore, the technology is not expected to have a disruptive potential at present, so that air freight will only be substituted in the short to medium term on a selective basis.



²Jiang, R., Kleer, R., & Piller, F. T. (2017). Predicting the future of additive manufacturing: A Delphi study on economic and societal implications of 3D printing for 2030.

Climate & Environmental Protection

2.4 % of global CO₂ emissions are caused by commercial aviation. With a share of 19 %, air freight contributes just

0.5 %

to global CO₂ emissions.

311
airports

in 71 countries on all continents participate in the Airport Carbon Accreditation Initiative to reduce emissions and represent 45 % of global air traffic.

Page 43
Climate impact of air freight

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Strategies and instruments for climate protection

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4-pillar aviation strategy

The impact of aviation on climate change

In a globally networked world, aviation is one of the most important means of transport. Due to the global nature of supply chains and tourism, the demand for air transport is particularly high over long distances. As strong growth is forecast for the industry on the passenger side as well as in air freight over the next 20 years, the need to promote the ecologically and socially sustainable development of aviation is increasing worldwide. The Swiss parliament is preparing a total revision of the CO₂ law, but regardless of political measures, the industry itself has committed itself to climate protection.

This is why the Lufthansa Group has defined climate protection as the most important responsibility of the Group, along with digitisation and innovation¹. The Climate & Environmental Protection section shows how air traffic emissions from passengers and freight can be recorded and which factors need to be considered. On the one hand, the ecological footprint of aviation as a mode of transport should be classified quantitatively. On the other hand, the focus is on the presentation and evaluation of concrete climate protection instruments and initiatives in order to show and evaluate on several levels how the industry actually contributes to climate protection.

Basic information on emissions and climate impacts in aviation

The combustion of kerosene mainly produces carbon dioxide and water vapour; 0.4 litres releases one kilo of CO₂. Other climate-relevant emissions are also released. These include the emission of gases that do not directly affect the climate, such as nitrogen oxide, sulphur dioxide, hydrocarbons and sooty particles, which are also classified as “non-CO₂ emissions”. The chart (see next page) gives an overview of the climate-relevant emissions

from aviation, using the combustion of one kilogram of kerosene as an example. Due to their varying time duration spans, the different emission types have a different climate impact. Since CO₂ remains in the atmosphere for a particularly long time (50 to 100 years) and accounts for the largest share of emissions, the focus in climate policy debates is often on reducing these emissions in particular. In addition to pollutant emissions, aircraft also cause local noise emissions and toxic particulate matter, which can affect health locally in the vicinity of airports.

Measuring parameters of the CO₂ pollution of an air freight shipment

Various approaches are possible to assess the climate friendliness of a transport mode. As a combustion product of fossil fuels, CO₂ emissions have been the focus of political debates on climate protection at least since the United Nations Conference on Environment and Development in Rio de Janeiro in 1992.

The CO₂ pollution caused by the combustion of fossil fuels is regarded as a central driver of global warming, which is why its measurement has become established as a relevant parameter not only in aviation. CO₂, methane and other greenhouse gases differ in terms of their greenhouse effect and the duration of their action in the atmosphere. Reporting emissions in CO₂ equivalents makes it possible to compare emissions of different greenhouse gases using a standard scale. Various approaches are possible to show specific emission values for an air freight shipment. Based on fuel consumption, emission values can be given per shipment. CO₂ emissions can also be given in relation to the distance (e.g. kilograms/tonne-kilometre). Both approaches make it possible to compare air freight transport with other modes of transport.

¹ Lufthansa Group (2019). Sustainability Report.

Overview of climate-relevant air traffic emissions and their effect during the combustion of one kilogram of kerosene (according to LTO cycle, in line with the Federal Office for the Environment)

			Impac	Duration	Effect
<p>Greenhouse gases</p> <p>other climate-relevant emissions</p>	3.150 g	Carbon dioxide CO ₂	Long term, strongest Driver of climate influence	many decades	★ ★ ★
	1.240 g	Steam H ₂ O	Intensifier of global warming	minutes to hours	★ ★ ★
	0.35 g	Methane CH ₄	Efficiency 25 times higher than CO ₂	12 years	★ ★ ★
	0.12 g	Nitrous oxide N ₂ O	Efficiency 300 times higher than CO ₂	120 years	★ ★ ★
	6-16 g	Nitric oxide NO _x	Greenhouse gas ozone produced	months	★ ★ ★
			Reduces greenhouse gas methane	12 years	★ ★ ★
	0.42 g	Sulphur dioxide SO ₂	In combination with H ₂ O formation of vapour trails & cirrus clouds	weeks to months	Depending on climatic & geogra- phical conditions
	0.1-0.7 g	Hydrocarbons HC	> Reflection of solar radiation with simul- taneous prevention of radiation		★ ★ ★ to
	0.04 g	Sooty particles C			★ ★ ★

Explanation of scale:
 ★ ★ ★ = light cooling effect
 ★ ★ ★ = strong warming effect

Factors influencing the specific emissions of an air freight shipment

The proportionate fuel consumption of a shipment transported by air freight serves as the basis for determining its ecological footprint. Emissions can be reported on the basis of fuel consumption. In order to make quantitative statements about the specific emissions of an air freight shipment in individual cases, a number of factors must be considered which have a strong impact on the emission values. The most important factors influencing fuel consumption are listed below:

- Length of flight route: since fuel consumption during take-off is many times higher than in cruising flight, short-haul flights have a considerably higher fuel consumption per km than long-haul flights. The average fuel consumption per kilometre decreases with increasing distance.
- Flight altitude: due to the lower air resistance at high altitude, fuel consumption decreases with increasing altitude.

- Degree of utilisation: as the utilisation rate of an aircraft increases, the specific fuel consumption per kilo transported decreases.
- Type of aircraft: newer aircraft types consume less fuel than older aircraft types due to improved engines and aerodynamics as well as reduced-weight materials.
- Type of transport: due to the more effective use of cargo space in full-freighters, the specific fuel consumption per kilo of cargo in full-freighters is lower compared to belly freight on passenger aircraft (assuming identical load factors).
- Classification of means of transport: if pre-carriage and onward carriage to and from airports (e.g. by truck) are added to air freight transport, the consignment-specific emissions increase accordingly by this value.

CarbonCare - Online CO₂ calculator for logistics

Transparency of emissions caused along the entire logistics chain for internal and external services enables companies to take targeted measures to reduce greenhouse gases caused by their logistics and supply chains. In this way, industry, trade and logistics service providers are supported by the CarbonCare emissions calculator. The calculation of emission values on www.carbon-care.org is carried out in accordance with the recognised European standard EN 16258, which includes various methods and describes standardised procedures for the measurement of CO₂ emissions for the different transport modes. With Tank-to-Wheel and Well-to-Wheel, CarbonCare's calculation methodology covers direct and indirect emission values and determines both CO₂ equivalents (CO₂e) and pure CO₂. The Swiss climate protection foundation myclimate has validated the calculator and certifies that CarbonCare's calculations for the various transport sectors are in compliance with EN 16258.

Emissions comparison between full-freighter and belly freight

Due to better space utilization and a higher payload of cargo aircraft, these can carry a higher tonnage compared to passenger aircraft, thus reducing emissions per kilogram. In terms of passengers (one passenger including baggage is statistically rated at 100 kg), Lufthansa Cargo's freighter fleet consumed 1.83 litres of kerosene per 100 kilometres in 2018 at an average payload factor of 65.9% (Lufthansa Group, 2019). At SWISS, consumption per passenger was significantly higher at 3.11 litres of kerosene per 100 kilometres, even though Swiss is the most fuel-efficient airline within the Lufthansa Group. Across the Lufthansa Group the fleet is divided roughly equally between cargo and passenger aircraft. When considering the Lufthansa Group's cumulative air freight transports in freighters and passenger aircraft, fuel consumption in 2018 was 2.66 litres per 100 kilometres (Note: the calculation is based on EN Standard 16258. In a comparison between a belly aircraft and a full-freighter, CarbonCare shows 44% lower values in favour of the full-freighter. This is due to the higher efficiency, as the full-freighter transports higher masses and also has higher certificated take-off weights than comparable aircraft types.

Environmental impact of aviation in figures

Since 2000, global CO₂ emissions from the combustion of fossil fuels have increased by more than 50% to 37.9 gigatonnes in 2018². With a share of one quarter

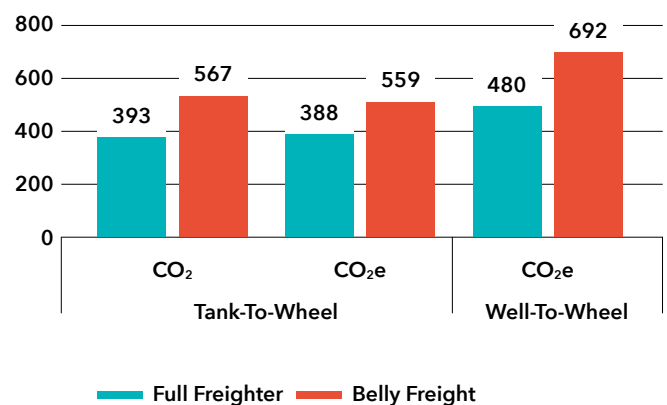
of global CO₂ emissions, transport is one of the main sources, along with the electricity and heating sectors, and industry. At 74%, road traffic is responsible for the largest quantities of all CO₂ emissions from transport, while aviation is responsible for around 12%. Despite strong absolute increases, the relative shares of the individual polluters in CO₂ emissions from the combustion of fossil fuels have not changed significantly since 2000. The International Council on Clean Transportation (ICCT) calculated that global CO₂ emissions from aviation would amount to 918 million tonnes of CO₂ in 2018, an increase of 32% within 5 years³. Measured against global CO₂ emissions of 37.9 gigatonnes, commercial aviation is thus responsible for 2.4% of global CO₂ emissions from the combustion of fossil fuels in 2018. According to the ICCT, passenger transport was responsible for 747 million tonnes of CO₂ emissions in 2018, while air freight was responsible for 171 million tonnes. Air freight thus accounts for 19% of the total CO₂ emissions of aviation.

Consignment comparison using the CarbonCare emissions calculator

- Route: flight from Zurich to Hong Kong
- Distance: 9,280 km
- Shipment weight: 100 kg

Comparison Full Freighter vs. Belly Cargo

Emissions in kg



²Crippa et al. (2019). Fossil CO₂ and GHG emissions of all world countries.

³Graver, Zhang & Rutherford (2019). CO₂ emissions from commercial aviation.

What factors need to be considered in the country-specific assessment of aviation emissions?

When recording the climate impact of aviation in individual countries, the question of territorial boundaries in principle arises. Should the aviation emissions of a flight from Geneva to Dubai be assigned to Switzerland or the United Arab Emirates? In relation to a country such as Switzerland, it is necessary to define to what point a cross-border flight is allocated to Switzerland in terms of emissions. A fundamental distinction can be made between two methodological principles:

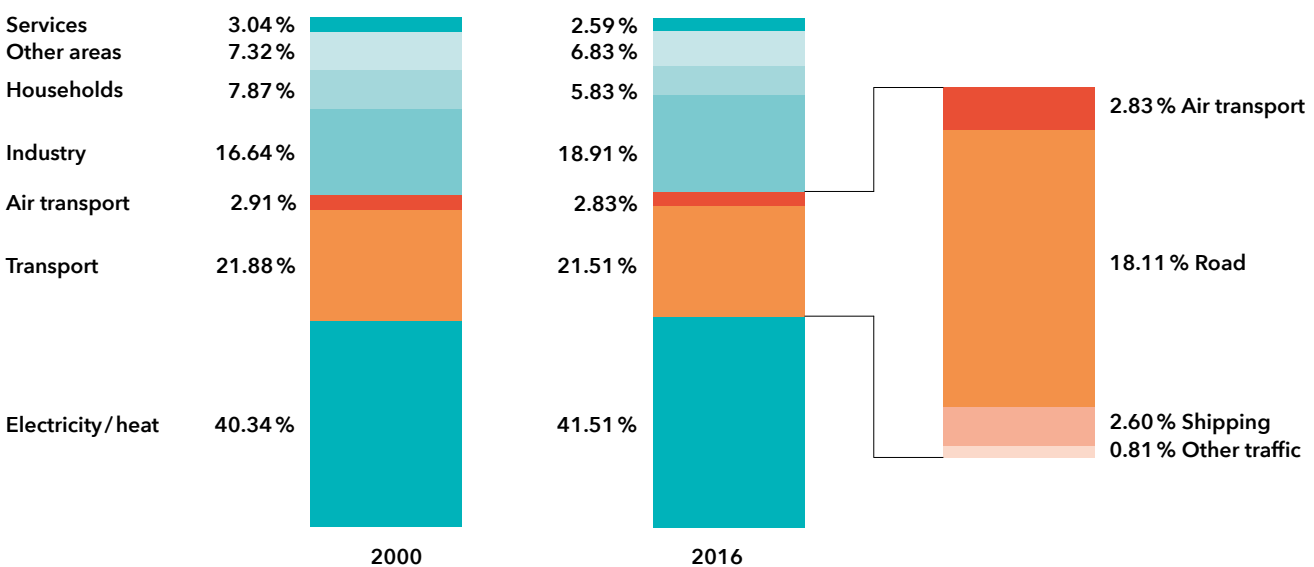
1. The **territorial principle** covers emissions within Swiss territory. This includes emissions from overflights without landing or take-off in Switzerland.
2. The **distribution principle** covers emissions based on the total amount of fuel consumed in Switzerland. This includes both domestic and international traffic. Short flight distances over Swiss territory are offset by large quantities of fuel, especially on long-haul flights. Therefore, the application of the distribution principle results in higher consumption and therefore also the emission values compared to the territorial principle. If the distribution principle is applied, the half-haul principle can be used, i.e. half of the route of all flights

is allocated to Switzerland from take-off in Switzerland and half of the route of all flights on take-off or landing in Switzerland.

Emissions: Figures on Swiss civil aviation

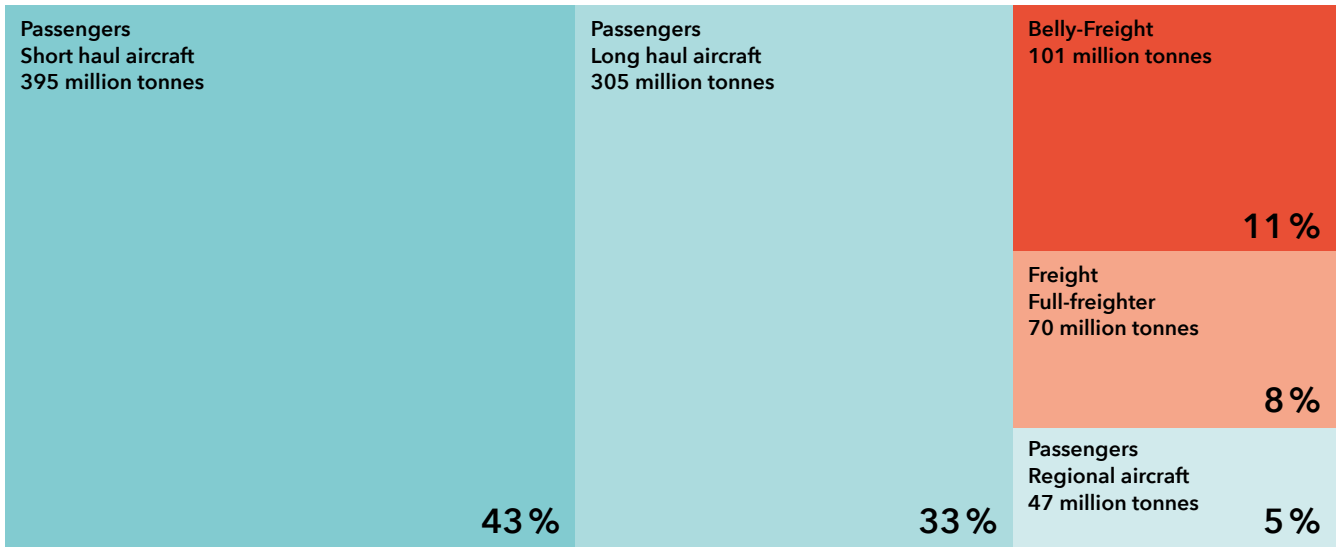
- The Federal Office of Civil Aviation reports the following values for the fuel consumption of Swiss civil aviation in 2015:
 - Following the territorial principle: 556,077 tonnes
 - Following the distribution principle: 1,602,319 tonnes
- The BFU's greenhouse gas inventory documents 47.24 million tonnes of greenhouse gas emissions in Switzerland in 2017 CO₂ equivalents. Measured against this, the 5.35 million tonnes of CO₂ equivalents from national and international air traffic, following the sales principle, account for around 10% of Switzerland's total CO₂ emissions.
- According to evaluations by FOCA, Swiss's CO₂ emissions per passenger in 2017 was less than 90 g CO₂ per passenger kilometre. By way of comparison, the target value set by the EU for the average fleet consumption of newly registered cars from 2020 is 95 grams per kilometre.

Development of global CO₂ emissions measured by the combustion of fossil fuels in the period from 2000 to 2016 (according to the International Energy Agency, 2019)



Source: International Energy Agency (IEA) 2019, data for 2016

Overview of global CO₂ emissions from aviation by type of use and aircraft in 2018



Source: Graver, Zhang & Rutherford (2019). CO₂ emissions from commercial aviation

– 431,841 tonnes or 25 % of the total 1,695,779 tonnes of fuel consumed by the Swiss fleet are allocated to the air transport sector, with the remainder used for passenger transport⁴. This means that about a quarter of Swiss’s air traffic emissions can be allocated to air freight.

Effective climate protection requires a comprehensive approach to emissions

Due to the long duration of CO₂ in the atmosphere, the climate impact of CO₂ emitted today will contribute to the greenhouse effect over decades. Today, climate protection measures are primarily aimed at reducing CO₂. In addition to direct CO₂ emissions, the climate impact of “non-CO₂ emissions” such as nitrogen oxide, sulphur dioxide, hydrocarbons and sooty particles must also be taken into account. The types of emissions mentioned influence the atmospheric concentrations of carbon dioxide, ozone, methane, water and also aerosols. How much these warm or cool the earth depends on many factors. Some of these non-CO₂ effects of air traffic have a radiation-enhancing effect, meaning that they contribute to the warming of the atmosphere, while others have a radiation-reducing effect. There is a broad consensus in science that the non-CO₂ effects (see note on radiation propulsion) have an overall radiation-enhancing effect and thus contribute to global warming⁵.

Conflicting goals: technical optimizations on engines to convert fuel into thrust more efficiently and thus emit less climate-impacting CO₂ lead to improvements in one area, but to deteriorations in another. This causes the following conflicts of objectives, among others:

- Balancing the emission of nitrogen oxide against the reduction of CO₂ emissions. The progressive development of low-CO₂ turbofan engines has led to increased temperatures and pressure in the combustion chamber of modern aircraft engines. Nitrogen oxides result from the reaction of nitrogen and oxygen at high combustion temperatures, especially when the fuel is burned in a highly efficient, clean and residue-free manner.
- According to current understanding, vapour trails have an overall warming effect. Therefore, at first sight it seems reasonable to prevent the formation of these as far as possible. However, it has been shown that more fuel-efficient engines that emit less climate-changing CO₂ tend to form more vapour trails.

⁴ Lufthansa Group (2019). Sustainability Report.

⁵ Lee (2018). The current state of scientific understanding of the non-CO₂ effects of aviation on climate.

To ensure that fresh cut flowers reach the end customer as quickly as possible, air freight is usually used.

What does this mean for climate protection measures? On the one hand, it must be ensured that climate protection measures address climate impacts in a comprehensive manner and provide the right incentives through regulatory influences. On the other hand, not all emissions can be reduced at the same time (e.g. nitrogen oxide and CO₂ reduction). It makes sense to prioritise the reduction of CO₂, as it accounts for the largest share and effects are achieved most quickly.

Note: Radiative Forcing

The term radiative forcing was introduced by the Intergovernmental Panel on Climate Change (IPCC) to describe the influence of external (anthropogenic) factors on the Earth's radiation balance. Radiative forcing expresses the change since 1750 in the effect of radiation from space on the energy balance in the Earth's atmosphere. The radiation balance is measured at the upper limit of the troposphere in terms of w/m². Positive values lead to a warming of the Earth's surface and thus contribute to global warming. To determine the climate effect of aviation based on CO₂, the CO₂ emissions must be multiplied by the Radiative Forcing Index. The IPCC assumes a factor significantly greater than 1, and a value of 2 is often used⁶. However, discussions in recent years also show that this value, which was originally 5.0, has fallen steadily. Above all, the complexity of such a calculation is enormous and even today not all of its mechanisms are fully understood in the overall context.

So, the RFI is not free of criticism: scientists criticise the RFI factor as a backward-looking measure and propose other metrics⁷. For example, CarbonCare, in consultation with FOCA, is using an RFI of 1.0 until a different value can be established.

⁶ Jungbluth & Meili (2018). Recommendations for calculation of the global warming potential of aviation including the radiative forcing index.

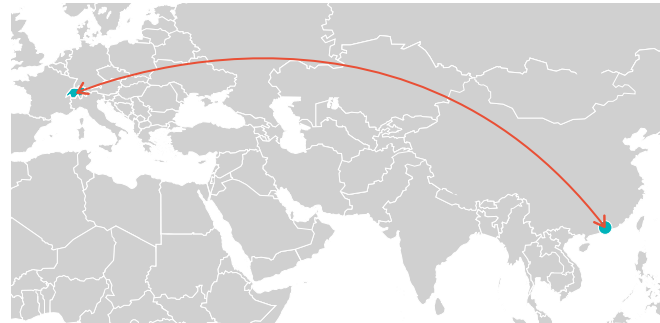
⁷ Fuglestad et al. (2010). Transport impacts on atmosphere and climate: Metrics Lund et al. (2017). Emission metrics for quantifying regional climate impacts of aviation.

Ecological footprint in a comparison of modes of transport: air freight compared to sea freight

Using the example of a 100 kg shipment from St. Gallen to Hong Kong, the carbon footprint of an air freight shipment compared to sea freight looks as follows. It is assumed that the destination of the shipment is near Hong Kong airport and therefore the onward carriage can be omitted. The route is an example of the transport of a shipment from Switzerland to the Far East, whereby in principle both air freight and sea freight can be used. For the transport from St. Gallen to Hong Kong, the comparison for the air freight shipment results in a carbon footprint that is 60 times higher than the emitted CO₂ equivalents by sea freight.

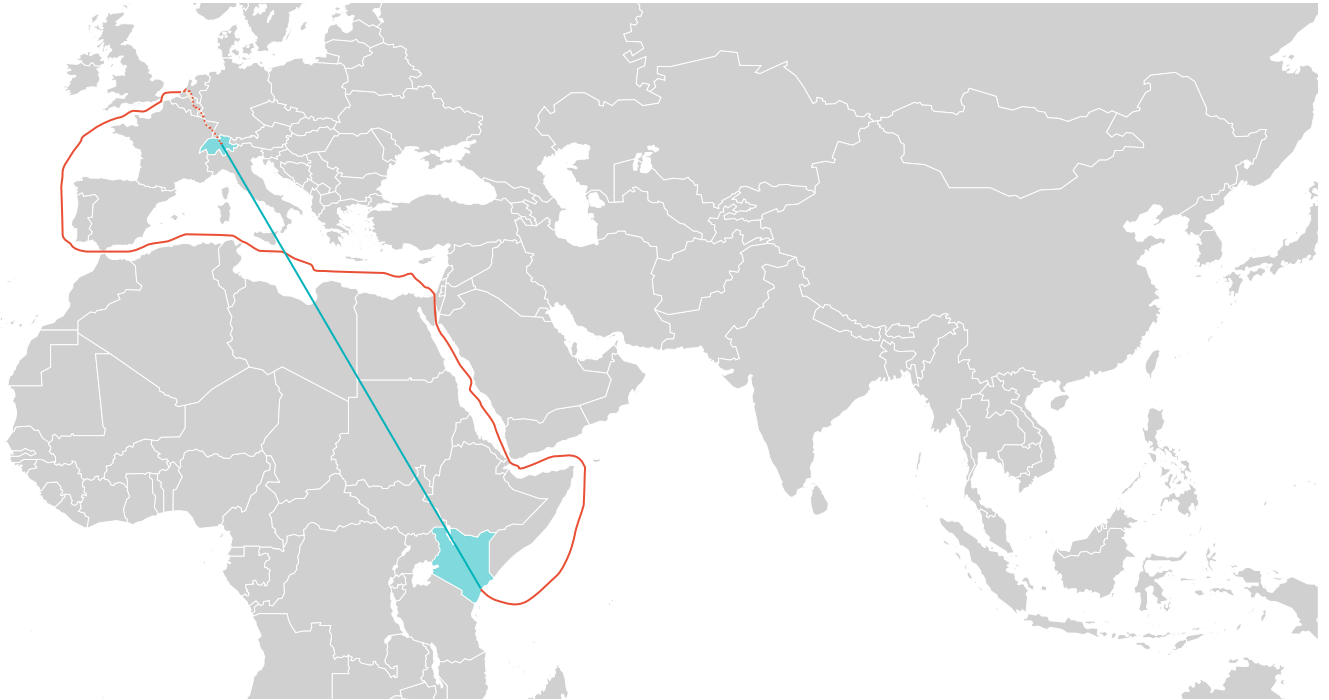
Since the system-specific infrastructures of ports and airports always require pre-carriage and onward carriage by road, transport by air or sea alone must not be compared. Air and sea freight are not possible without these transports. The measurement of the carbon footprint must therefore always be carried out end-to-end, including pre-carriage and onward carriage.

Air freight shipment compared to sea freight



	Air freight	Sea freight
Route	St. Gallen – Hongkong (via Zurich airport)	Zurich – Hongkong (via Hamburg dock)
Pre-carriage	St. Gallen – Zürich 62 km per truck: 40 tonnes, load 80% 0.32 kg CO ₂ e (TTW)	St. Gallen – Hamburg 683 km per truck: 40 tonnes, load 80% 3.52 kg CO ₂ e (TTW)
Main leg	Zurich – Hongkong (as belly-freight) 9,280 km 566.90 kg CO ₂ e (TTW)	Hamburg – Hongkong (ship) 18,456 km: CCWG-data, load 74% 6.00 kg CO ₂ e (TTW)
Total	567.22 kg CO₂e (TTW)	9.52 kg CO₂e (TTW)

Life cycle assessment of the transport of roses



→ 3 weeks by sea freight

→ 2-4 days by air freight

Environmental Life Cycle Assessment Case: roses from Kenya and the Netherlands in comparison

On birthdays or Valentine's Day, few people want to do without flowers for their loved ones. Very often flowers reach Switzerland from all over the world after having already travelled several thousand kilometres. After the Netherlands, Kenya is considered the second most important country for European rose imports. To ensure that fresh cut flowers reach the end customer as quickly as possible, air freight is usually used for this purpose. What is the climate impact of a rose? In order to be able to make product-specific statements about the carbon footprint, the principle of lifecycle assessment is suitable for the systematic analysis of the environmental effects over the entire life cycle of a product. A lifecycle assessment of roses from different countries of origin commissioned by Migros compares roses from Kenya with those from the Netherlands and Ecuador⁸. The results show that the total emissions of a Kenyan rose, including transport

by air, are four to six times lower than roses by truck from a greenhouse in the Netherlands. This means that the life cycle assessment of these roses is much better despite air freight. The reasons for this are mainly due to the natural conditions in Kenya, as heating is not necessary there. Air freight, with its transport-specific advantage of fast transport over long distances, makes it possible to take advantage of these climatic differences, which means that the life cycle assessment of roses can be improved compared to "local" European production. Thus, an isolated view just of transport would not adequately represent the life cycle assessment of a rose.

⁸ Alig & Frischknecht (2018). Life Cycle Assessment of Cut Rose Production in the Netherlands and Kenya.

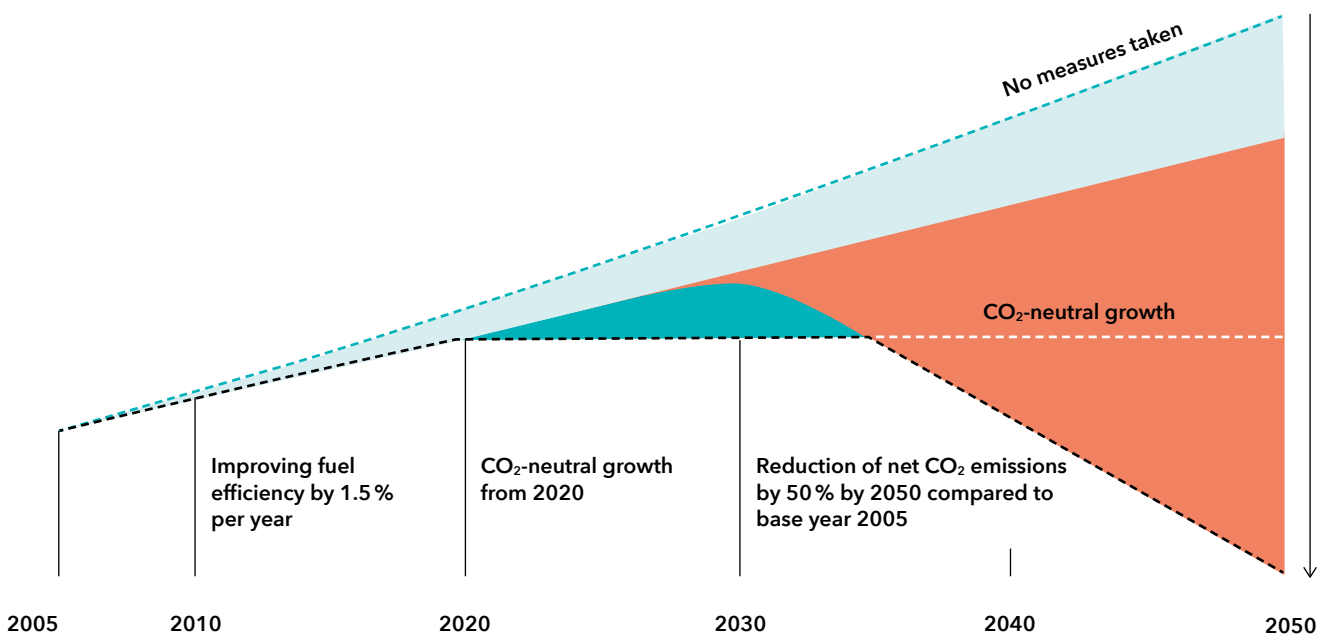
Strategies and instruments for climate protection

Climate protection strategy of the aviation industry

In view of the growing global demand for air transport in the passenger and cargo sectors and the resulting further increase in ecological responsibility, the industry agreed on a joint global climate protection strategy as

early as 2009. Airlines, aircraft manufacturers, air traffic control authorities and airports have set themselves three central goals for the coming decades in order to keep the ecological impact as low as possible.

Schematic representation of the roadmap for emission reduction in the aviation industry



- Increase fuel efficiency by 1.5 percent per year
- CO₂-neutral growth from air traffic from 2020
- 50 percent reduction of net CO₂ emissions by 2050 compared to 2005

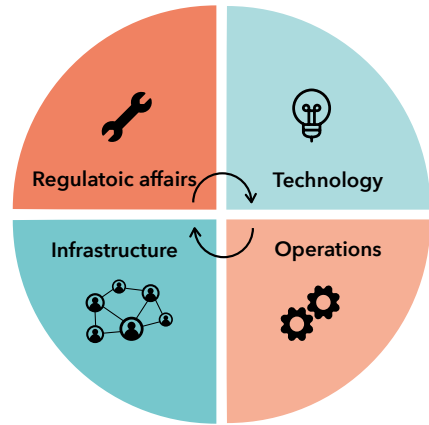
Three basic principles are used to achieve these goals:

1. Avoidance
2. Reduction
3. Compensation

Since in principle not all emissions can be avoided, they should be reduced wherever possible through concrete initiatives. Particularly in the short to medium term, the principle of offsetting makes sense as a transitional solution until more environmentally friendly technologies with greater leverage become available in the longer term.

4-pillar aviation strategy

The industry plans to achieve the defined goals with regard to fuel efficiency and the reduction of air traffic emissions by combining various measures. These can be classified under the four-pillar climate protection strategy adopted by IATA in 2007.



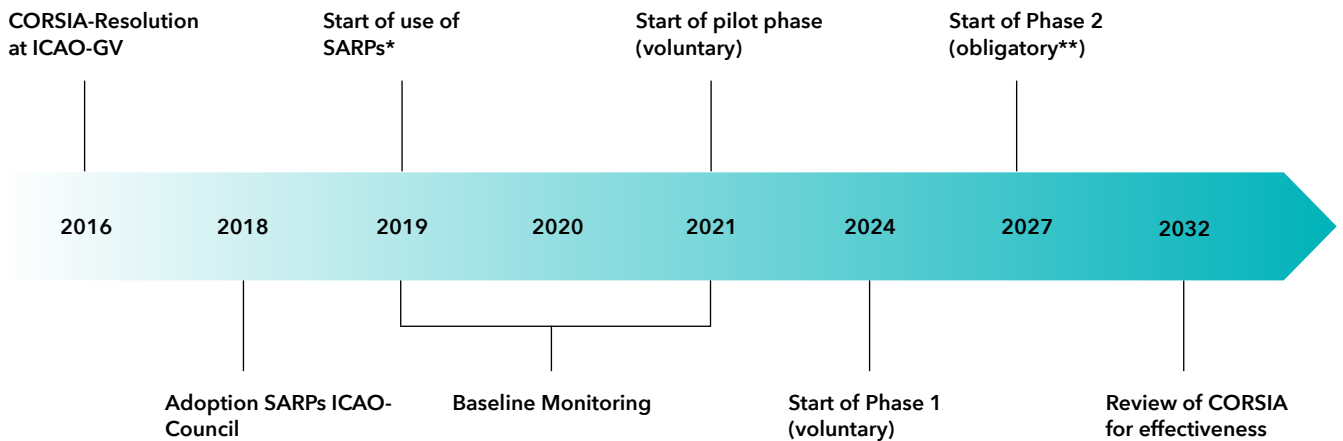
1. Regulatory affairs

CORSIA

In 2016 the ICAO Assembly decided to adopt a global compensation scheme for international aviation. From 2020, air traffic is to grow in a CO₂-neutral way. To achieve this goal, airlines will have to buy certificates for the additional carbon dioxide emitted, which will be used to finance certified climate protection projects that save the

corresponding amount of CO₂ elsewhere. The system set up by ICAO is a global compensation mechanism called CORSIA (Carbon Offsetting and Reduction Scheme for International Aviation). CORSIA is intended to help counteract an annual increase in the total CO₂ emissions of international civil aviation beyond 2020 levels. It is regarded as an essential tool to achieve IATA's goal of reducing global aviation emissions by 50% by 2050 compared to 2005 levels.

Implementation of CORSIA in phase overview



* Standards and Recommended Practices
 ** Participation obligatory for all countries that accounted for more than 0.5% of global air traffic in 2018

2. Infrastructure

Airport Carbon Accreditation

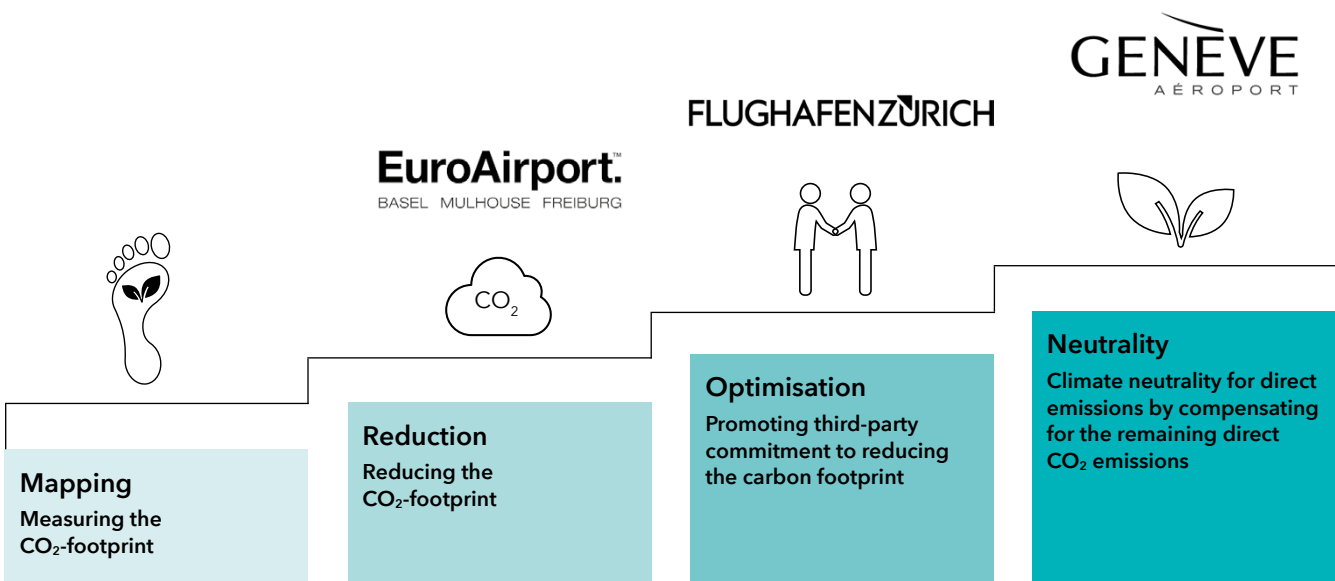
To support airports in their commitment to climate protection, the European airport association Airport Council International Europe launched the Airport Carbon Accreditation (ACA) Initiative in 2009. ACA offers airports a way of taking further steps to reduce their carbon footprint in order to achieve a neutralization of direct emissions at the airport. In March 2020, ACA comprised 301 airports in 72 countries on all continents, which together handle more than 44% of global passenger traffic⁹. The airports participate in this initiative voluntarily and are ranked according to their commitment to climate protection. Participation in Airport Carbon Accreditation requires annual verification and audits every three years by recognised auditors. The figure below lists the four stages of accreditation. The third stage means that the other companies involved in the airport processes are also included. This means that Scope 2 and 3 emissions are integrated, which go beyond the airport's direct

Scope 1 emissions. The highest level of accreditation is CO₂ neutrality, which is achieved by purchasing compensation certificates for all remaining emissions based on the previous levels. Geneva Airport was the first national airport in Switzerland to be accredited at level 3+.

Note

More than 90% of CO₂ emissions at airports come from aircraft movements, a smaller proportion from transport with vehicles by RFS and delivery services. Viewed across the entire aviation industry, the direct impact of CO₂-neutral airports as a climate protection instrument is rather low. Due to the local quasi-monopolistic position of airports, however, individual airports can set incentives for other players and use their intermediary function; therein lies the special environmental responsibility of airports. With the introduction of pollutant-based emissions charges (1997 in Zurich, 1998 in Geneva, 2003 in Basel), Swiss airports are among the pioneers in this area. In order to assess the sustainability of airports, such factors should be included in the assessment, or instruments such as the ACA should be expanded.

Overview of the four-stage accreditation process and location of Swiss national airports



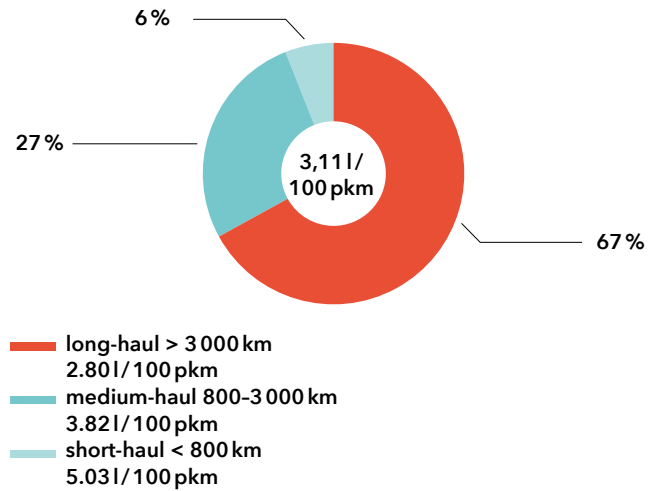
⁹ Airport Council Europe (2020). Airport Carbon Accreditation.

3. Technology

Industry focuses on new engines and aircraft

The roadmap focuses on environmentally friendly aircraft technology. The continuous improvement of aircraft fuel efficiency plays a crucial role in achieving the goal of carbon reduction by 2050. Innovations in lightweight aircraft construction, higher engine performance and aerodynamic improvements have already significantly reduced fuel consumption per passenger of airlines worldwide over the past decades. Swiss has been able to reduce fuel consumption per passenger kilometre by 29% since 2003. In 2018, the fuel consumption per passenger kilometre was 3.11 litres of kerosene. This also improves fuel efficiency in the cargo sector.

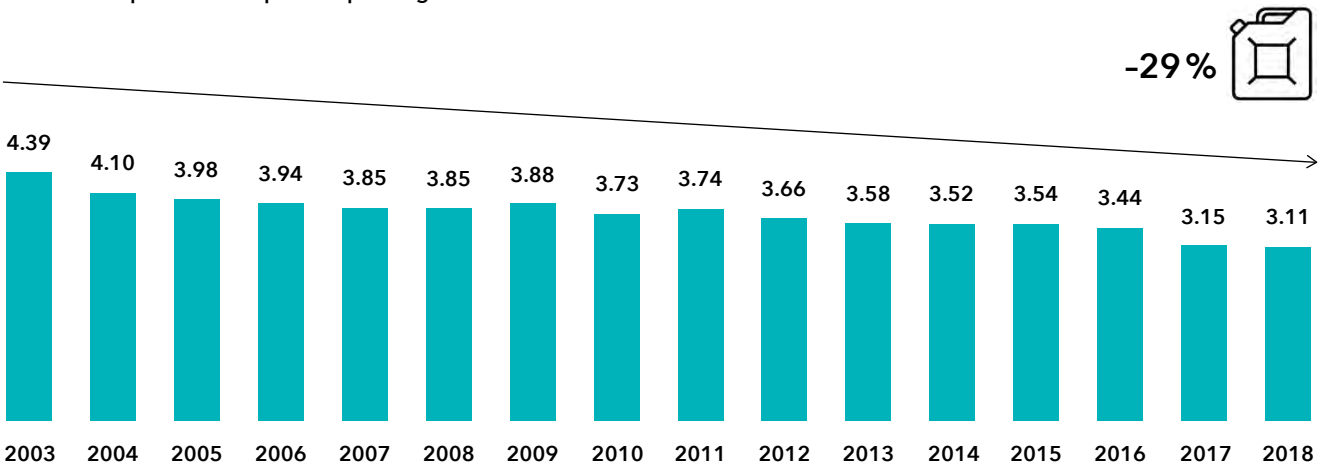
Fuel consumption of the SWISS aircraft fleet in 2018 by flight distance



ACA offers airports a way of taking further steps to reduce their carbon footprint in order to achieve a neutralization of direct emissions at the airport.

Development of fuel consumption of the SWISS aircraft fleet from 2003 to 2018

Fuel consumption in litres per 100 passengers kilometres





New aircraft concept

In addition to the continuous improvements in engines (e.g. further increase of the bypass ratio) and materials (e.g. weight reduction through aircraft parts from 3D printers), the introduction of new aircraft concepts represents a breakthrough in technology. The established tube and wing concept will diversify in the coming decades as different aircraft concepts move from current research or pilot status to series production. These concepts are combined by a focus on fuel efficiency through improved aerodynamics and more efficient engines. A possible market launch is not expected for decades.

The blended wing body concept combines the tube-and-wing concept with a wings-only concept. The aerodynamic shape enables improved lift throughout the entire aircraft.

Sustainable Aviation Fuels (SAF)

Sustainable aviation fuels generate up to 80% less CO₂ emissions on a life cycle basis than fossil aircraft fuel¹⁰.

As of today, there are two main obstacles to this:

- On the one hand, the SAFs currently available cannot be produced at a competitive cost compared to

conventional aircraft fuel. This represents a major barrier, as fuel is the largest cost factor for an airline, accounting for up to 40% of the total. In addition, current regulations permit the inclusion of only 50% SAF.

- Furthermore, the available quantities of SAF will remain limited in the coming years: according to EASA, the EU's estimated production capacity for all types of SAF in 2025 is 3.5 million tonnes per year. This could cover about one third of the fuel consumption of the Lufthansa Group fleet in 2018.

Since the use of biomass (bio-fuel) for the production of SAF for aviation will remain limited due to competition with the food industry and other bio-fuels, the future potential for SAF lies in the use of non-biogenic fuels. With Power-to-Liquid (PtL) and Sun-to-Liquid (StL), these two processes offer the possibility of producing synthetic fuel from raw materials that are available in unlimited quantities. Following the closed-loop principle, the combustion of these synthetic fuels releases only as much CO₂ as was previously removed from the cycle. PtL and StL are therefore considered CO₂-neutral. These fuels have the most significant potential and are free of

¹⁰EASA (2019). European Aviation Environmental Report 2019.

sulphur and aromatic compounds. So far, however, there are only a few research projects on electric fuels, as the production costs are currently three to six times higher than for conventional kerosene and will remain high in the long term¹¹.

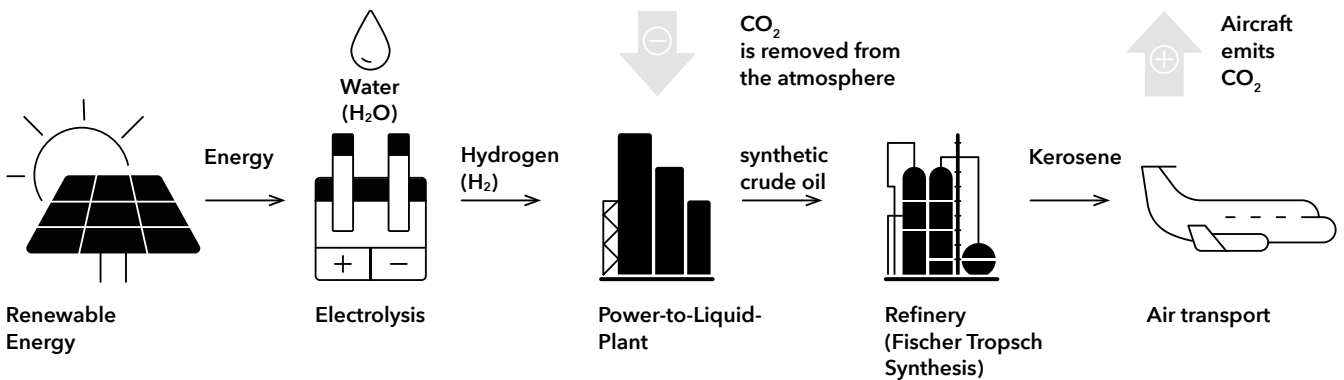
Power-to-Liquid

PtL converts (sustainably produced) electrical energy and CO₂ together with hydrogen into synthetic fuel. The emissions of PtL fuels are mainly determined by the emission intensity of the power supply and the CO₂ source. This is why PtL produces almost no CO₂ emissions—depending on the electricity generated (Environment Federal Office, 2016).

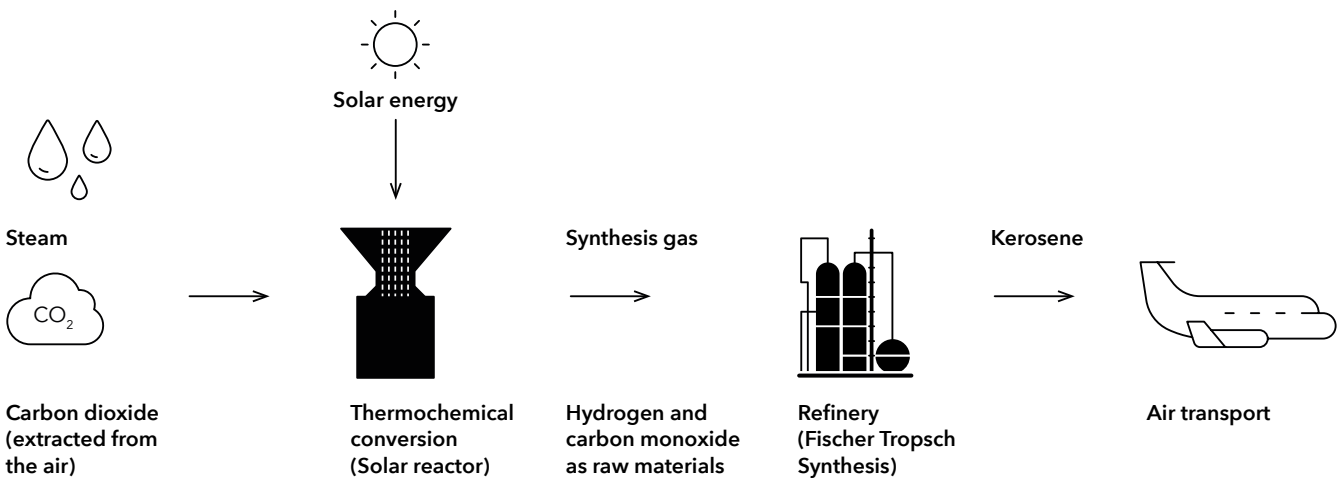
Sun-to-Liquid

With StL, the solar radiation is directed onto a reactor with a mirror field. This generates high temperatures (1500 degrees Celsius) to convert water and CO₂ from the air into synthesis gas, which is then liquefied into kerosene using proven processes (Fischer-Tropsch). A mini-refinery on the roof of the ETH Zurich's machine laboratory in Zurich proves that the technologies for the production and use of synthetic fuels work. However, the costs are still immense, and the efficiency of production is too low for it to be commercialized.

Power-to-Liquid operating principle



Sun-to-Liquid operating principle



¹¹ Müller-Langer et al. (2018). Research and Demonstration Project on the Use of Renewable Jet fuel at Airport Leipzig/Halle.

4. Operations

From the beginning, SWISS has introduced a wide range of operational measures with a department dedicated to systematically reducing the fuel consumption of its fleet. These primarily involve weight reductions, improved aerodynamic steps, actions to optimise engines or entirely optimised measures in flight operations.

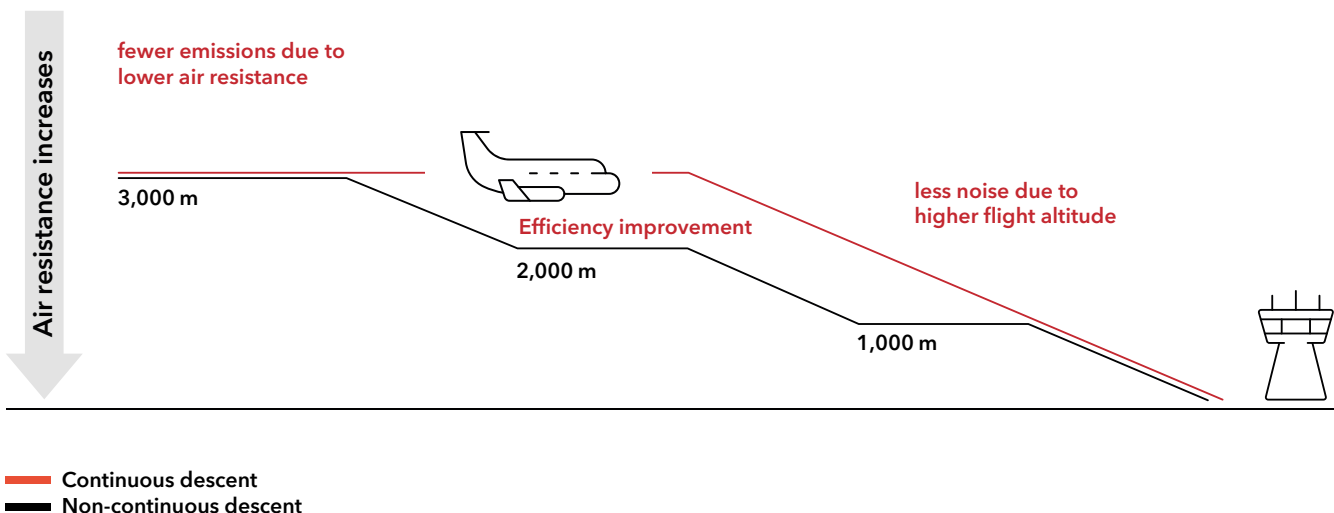
Continuous descent flight

One measure in flight operations, for example, is the implementation of a continuous descent approach (CDO). This prevents more fuel-intensive, horizontal intermediate segments. In this way, the engines remain at idle, which also reduces noise emissions. A study by the European Organisation for the Safety of Air Navigation EUROCONTROL¹² concluded that only 24% of flights in the European control area land entirely in this way. For flights currently not using CDO flights, the average time in horizontal flight was 217 seconds. The savings per flight are estimated at 46 kg fuel and 145 kg CO₂. The potential savings from optimised approach procedures in Europe amount to over 300,000 tonnes of kerosene per year.

Single European Sky

As passenger planes in Europe have to fly detours, they consume more kerosene due to longer flight distances. With a single sky, up to ten percent of greenhouse gas emissions from air traffic could be saved. Plans of the EU Commission and the wishes of the airlines call for the Europe-wide integration of air traffic control and airspace into a Single European Sky. (SES) should enable more direct flight routes, the choice of the most efficient flight altitudes and fewer delays. If no detours have to be flown, SWISS estimates that the route from Zurich to London could be shortened by almost 300 km. The SES should therefore also be seen as an important climate protection measure at a political level.

Schematic representation of the efficiency gain through an optimized approach procedure using continuous descent flight.



¹² Eurocontrol (2019). Continuous climb and descent operations.

Overall view of climate changes and climate protection

Air freight consignments are inseparably linked to upstream and downstream road transport due to the airport infrastructure available at specific points. The significant share of air freight feeder traffic in the tonnage handled at Swiss airports also underscores the fact that road freight as a mode of transport plays an important role in the main air freight route, not only in the pre- and post-carriage. The ecological footprint of an air freight shipment cannot therefore be reduced to transport by air between two airports alone. For the ecologically sustainable development of air freight, measures to improve fuel efficiency and the use of alternative fuels and drive systems for air freight transport by road should therefore also be promoted in order to integrate air freight logistics fully into the climate protection strategy.

It is irrelevant to the climate impact whether a tonne of freight or a tonne of "human cargo" is transported. Consequently, the climate protection goals and measures of the international aviation industry address freight and passenger traffic in equal measure. In view of the long-term forecast growth in demand for air transport worldwide, the long-term goals of the aviation industry can

be regarded as ambitious. The greatest long-term levers of the four pillars of the international climate protection strategy lie in the area of technological developments. The use of sustainable fuels and the renewal of aircraft fleets promise to make the greatest long-term contribution to achieving the climate protection goals. In general, the current initiatives can be assessed as long-term oriented in terms of reducing CO₂ emissions. In the short to medium term, there is potential for efficiency gains in the areas of operations, regulation and infrastructure in order to reduce the industry's CO₂ emissions. Potential for improvement lies in the comprehensive inclusion of climate-relevant "non-CO₂ emissions", which are currently not sufficiently addressed. In the short term, it must be ensured at a political level that the right incentives are in place to avoid or reduce all climate-relevant emissions in the first place. The compensation of emissions is to be assessed as a temporary mechanism, the use of which makes sense until technological innovations can be implemented.

In the short term, it must be ensured at a political level that the right incentives are in place to avoid or reduce all climate-relevant emissions in the first place.

We would like to thank Dr. Peter Wild, Lecturer Aviation and Sustainability at ETH Zurich, for his valuable support in the Climate & Environmental Protection section

Infrastructure

64%

of freight forwarders expect an increase in air freight handling via Swiss airports as a result of the lifting of the ban on night/weekend traffic.

In 2019

638,505 t

air freight was handled at the three major Swiss airports. This corresponds to almost $\frac{1}{3}$ of the air freight turnover at Frankfurt Airport.

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Air freight handling at Zurich airport

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The strategic importance of Geneva airport for air freight

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The EuroAirport for the region

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The border veterinary service at Zurich and Geneva airports

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Swiss Federal Plant Protection Service

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Easier, faster and safer with DaziT

Air freight at Zurich airport

The following numbers and values refer to and serve as a basis for future infrastructure planning. The corona crisis has also hit Zurich Airport hard, as practically all transfer traffic and around 2/3 of Swiss export and import freight was lost in the two months of March and April 2020.

Zurich Airport is the largest Swiss national airport and it handles 70% of the Swiss air freight market. From an air freight perspective, the hub function for the home carrier is in the forefront. Swiss World Cargo is the most important customer with a market share of about 65%. Most of the air freight is loaded in passenger aircraft. At 70%, the share of transfer freight at Zurich Airport is high. Every day, over 1,200 tonnes of air freight are handled by around 1,400 employees. Cargo handling is carried out by the two handling companies Cargologic and Dnata. Around 120 forwarding companies are represented in the area surrounding the airport. Zurich Airport offers handling facilities for every kind of commodity that can be transported by air freight. Complete facilities and special infrastructure are available. All relevant offices required for handling are on site.

The further development of the infrastructure is extremely complex due to the limited space available. Major infrastructural adjustments will be made over the next ten years. At the eastern end of the airport, a new 9,000 m² cargo hall is to be built to meet the individual needs of Dnata. At the same time, detailed planning and development of the new Cargo West will begin. The current building has been in operation since 1960 and urgently needs to be adapted to today's quality requirements. In the future, the handling facilities for special goods such as fresh products, pharmaceuticals, valuable goods and mail are to be set up there in line with the latest market requirements. At the same time, Flughafen Zürich AG is also supporting other innovative projects. For example, a landside connection to the new tunnel system of "Cargo sous terrain" is being tested.

We are forecasting moderate growth in air freight tonnages for the next few years. The trend in Zurich will be increasingly towards goods with special infrastructure requirements. We will probably not be able to profit from the boom in express freight generated by e-commerce, primarily due to our short opening hours. This special freight needs the night flights. Also, in the long term, the ban on night-time driving for trucks transporting air freight between European airports will become an ever greater problem. This ban on night driving restricts the function of the Cargo Hub, especially on Sundays and holidays.

Of course, the issue of sustainability also plays a major role for us. Over the last twenty years, Flughafen Zürich AG has halved its CO₂ emissions despite doubling its building space. It has set itself challenging targets to achieve net zero emissions by 2050. As the airport operator, it provides airlines that park their aircraft at one of the three finger docks with a central aircraft energy supply. The airlines are obliged to use these. Flughafen Zürich AG also tries to motivate the airport partners to focus on electric mobility when using special vehicles etc.

The biggest challenge for us in the next few years will be to overcome the consequences of the Corona crisis and, as soon as the situation returns to "normal", to modernise the existing infrastructure, which is flexible, close to the needs of the market and affordable for our customers. We are looking forward to it!

Michael Sack
Head Cargo Logistics

The strategic importance of Geneva airport for air freight

Geneva airport is a hub of regional and national importance for the economy. Trade in goods between Geneva airport and the rest of the world has grown steadily over the last ten years, rising from 45,909 tonnes in 2009 to 80,572 tonnes in 2019*. Geneva airport is characterised by its geographical location between Switzerland and France and by the transport of high valued products, such as chemical products or watches.

Efficient intercontinental air transport network

Geneva Airport's extensive network to some 140 destinations provides easy access to the most important international destinations for the general public, companies in French-speaking Switzerland, diplomatic circles and non-governmental organisations active in the humanitarian field. Between 2001 and today, the number of intercontinental routes offered has increased from 3 to 12, with a seven-fold increase in weekly frequencies (from 10 to 69). Some routes are served by airlines which are not present at any Swiss airport other than Geneva.

Good conditions for the transport of goods.

There is no doubt that the availability of transport planes is a major advantage, as their capacity ensures the transport of goods for exporters and the import of goods necessary for economic development and daily use. The revenues which the airlines generate with air freight secure the existence of several intercontinental connections in the long term.

Geneva Airport works closely with all the representatives of the logistics chain to create the necessary conditions for their activities. The cargo terminal offers the best possible environment in terms of security, speed and punctuality in the handling of goods.

Future challenges

Air freight logistics is becoming increasingly important for young people in training. In addition, more and more standards have to be observed, and which are constantly being updated. This represents a major challenge for the future of the industry, an important pillar of the Swiss export economy.

On the other hand, the resources available to the players in the air freight chain must be constantly improved in terms of both material and technological resources in order to guarantee the high level of service expected from freight forwarders.

Solutions are needed for an unhindered flow of goods between national airports and logistics centres, so that the air freight sector in Switzerland can continue to face the future with optimism.

Geneva Airport
Samer Jrab
Network development & cargo manager

*without postal freight



The EuroAirport for the Region

USP's

In the general cargo sector, we were able to bring the new Cargo Terminal into operation in 2015, which guarantees us sufficient capacity for the coming years for handling temperature-sensitive goods in particular. Infrastructural modifications such as the interface, which enables the transfer of aircraft pallets from the inside of the building to the freighter within 2 minutes, or the planned cross dock for the handling of pharmaceutical goods at 5 degrees Celsius, will allow the handling of other needs at EuroAirport.

By moving to the new Cargo Terminal, it was possible to meet the space requirements for the integrators in the new Express Terminal over the last 3 years. Together with investments on the part of the integrators, the location at the EuroAirport has been strengthened, e.g. through more efficient processes for the handling of express shipments.

Outlook for the coming years

COVID-19 will have an impact on the development of aviation and thus also on air freight. All the more reason for us to further expand the attractiveness of the location with the aim of being able to offer more full-freighter flights on the one hand, and to implement new ideas and customer needs with our infrastructure and service potential on the other.

In the digital sector, we want to continue to implement projects together with our stakeholders. The aim is to achieve greater transparency in the supply chain as well as an increase in efficiency; this should lead to cost optimisation on the one hand and have a positive impact on the environment on the other (e.g. better planning, better capacity utilisation, etc.).

With regard to sustainability in particular, we want to set the course for the coming years. For example, one of the EuroAirport goals is to achieve CO₂ neutrality for the entire platform by 2030.

Gian Carlo Alessi
Basel-Mulhouse Airport



EUROAirport™
BASEL-MULHOUSE-FREIBURG

TAXI

The border veterinary service at Zurich and Geneva airports

In the service of animal health, food safety and species protection

As a department of the Federal Office for Food Safety and Veterinary Affairs, we control the import of live animals and goods of animal origin from other countries, and we carry out species protection checks on protected species imported from all over the world. Annually there are about 11,000 consignments checked by our border veterinarians. The controls are based on Swiss import legislation and the bilateral agricultural agreement with the EU.

The objectives of the controls are to prevent the introduction of animal diseases into Switzerland or the EU, to protect consumers against the import of unhygienically produced food and to contribute to the conservation and sustainable use of endangered animal species.

From mid-2020, our controls will be extended to goods of non-animal origin where there is a high risk of chemical and toxic residues.

Dr. med. vet. Catherine Paine Kuhn
Head of border veterinary services

Federal Plant Protection Service

The SPPS is a joint service of the Federal Office for Agriculture FOAG and the Federal Office for the Environment FOEN.

Duties/Goals

Plant diseases and pests can be spread through the global movement of goods and people. Economic, social and ecological damage can be the result. The prevention of the introduction of dangerous plant diseases and pests is a major task of the SPPS.

Import regulations

Live plant material from non-EU countries must be declared at import (Traces NT) and must be accompanied by a plant-health certificate from the exporting country.

Air freight statistics

11,000 import consignments with around 100,000 notifiable batches of goods from non-EU countries are checked by the SPPS every year

Checks at the first point of entry (Switzerland-EU)

Switzerland and the EU mutually recognise the plant protection import controls. The goods therefore only have to be declared to the plant protection service at the first point of entry (CH or EU) for inspection. In Switzerland, the airports of Geneva and Zurich are considered to be plant protection entry points.

Outlook for e-freight

Currently, the use of electronic plant-health certificates for the handling of consignments to other countries is in a pilot phase.

Hanspeter Diem
Head of Federal Plant Protection Service SPPS

Easier, faster and safer with DaziT



The Swiss Federal Customs Administration (FCA) with its DaziT transformation programme, is striving consistently to simplify and digitize Swiss customs and control processes. This will enable companies to bring goods across the border both with less bureaucracy and faster. At the same time, security is increased thanks to optimized risk analysis.

Digital registration and automatic activation

In future, goods can be declared to Swiss customs fully digitally. Both goods and the means of transport will be listed. In air traffic, the AirWayBill number could be used for this. The goods declaration is only legally binding when the goods actually arrive in Switzerland. The goods declaration is then activated automatically. Existing technologies in the respective transport industries should be used for this.

Improving risk analysis in air transport

The European project ICS2 will extend the security process for air freight. A new feature is the so-called

“Preloading”: even before loading at the point of departure, a risk analysis is carried out on the basis of a reduced advance notification in order to block dangerous goods (e.g. explosives). The processes “Pre-Arrival” and “Arrival” largely correspond to the procedures already tried and tested today in eDec-SA. The introduction of ICS2 is planned for March 1, 2023.

Acceleration and easing

Digital goods declarations, automatic activation and optimised risk analysis make a significant contribution to speeding up border crossings and increasing air traffic safety. This is because goods movements are only stopped when a check is necessary. On the other hand, goods that are not to be checked can be released more quickly. This eases the infrastructure and personnel costs at the airport.

Nicolas Rion
Communication Programme DaziT,
Federal Customs Administration FCA

Further information: www.dazit.admin.ch

Regulatory and political

25,000

jobs in logistics, industry and commerce are directly or indirectly related to air freight.

13th place for Switzerland in the World Bank's Logistics Performance on the

**“logistical
affinity”**

of individual countries (rank 6 in 2007)

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Regulatory framework for Swiss aviation

The global networking of the Swiss economy, as the basis for economic growth, is a central prerequisite for securing Switzerland's prosperity. Only a few economies are as internationally oriented as Switzerland. Favoured by a limited domestic market compared to neighbouring countries, the Swiss economy is strongly focused on foreign trade.

According to data from the State Secretariat for Economic Affairs (SECO), the foreign trade ratio has continued to rise in the last ten years and now stands at over 120%¹. This means that with countries such as the USA, China, India, Hong Kong and Japan, five of the ten most important export markets are outside Europe.

As a prerequisite for the flow of goods in import and export as well as for the efficient processing of foreign trade, air freight is therefore of central relevance to the Swiss economy. A globally networked air traffic connection ensures the link to the world economy and strengthens Switzerland in international competition for business locations.

The nine freedoms of the air govern air traffic rights between states

International air traffic between states is regulated by the International Civil Aviation Organisation (ICAO). The freedoms can be divided into nine different situations and must be mutually complied with by states.

Overview of the nine aviation freedoms

1		Overflight of foreign countries
2		Non-commercial stopovers in foreign countries
3		Direct outward flights from home country to foreign countries
4		Direct return flights from foreign countries to home country
5		Boarding and deboarding during stopovers in a foreign country
6		Connection between foreign countries with stopover in home country
7		Connection of foreign countries without a stopover
8		Connections in foreign countries with start or destination in home country
9		Connections in foreign countries without any contact with other countries

■ Home country
 ■ Foreign country A
 ■ Foreign country B

¹ Swiss Federal Council (06.12.2019). Federal Council for Switzerland Management Report.

The air traffic agreement with the EU ensures Switzerland comprehensive air traffic rights in Europe

Within the EU, European airspace is considered to be liberalized through the granting of all nine freedoms. The conclusion of the Air Transport Agreement, as part of Bilateral Agreements¹, represented an important step for Switzerland towards entry into the liberalized European air transport market. Since the adoption of the Air Transport Agreement in 2002, whereby Switzerland and the EU have granted each other the first seven freedoms, Swiss airlines have been able to operate in the European airspace of the EU. The European Council of Ministers of Civil Aviation has agreed on the essential freedoms of the air in European airspace. The resulting approval of traffic rights and the ban on discrimination put Swiss airlines on an equal footing with European airlines.

Challenges for the competitiveness of Switzerland as an air freight location

Despite the current generally high quality of Switzerland's air transport services in international comparison, there are challenges at various levels for the industry, which will affect the future development of Switzerland as a location for aviation.

On the one hand, internationally restrictive operating times at airports limit the accessibility of Switzerland for cargo traffic from a regulatory point of view. Compared to other European hub airports, Zurich Airport with its operating time of 6 a.m. to 11 p.m. has very restrictive conditions. Due to the global networking of the industry the flight networks of airlines are therefore globally oriented. Long-haul routes rely on transfer connections to the hub with short- and medium-haul connections to ensure the highest possible seat load factor. Should flights take off earlier in the evening due to reduced operating times, the connection for transfer passengers on short-haul routes would be endangered. Without transfer passengers, many destinations would not be profitable to operate. A further reduction in operating times would endanger direct long-haul connections to distant destinations in South America, South Africa or Asia, in particular. In view of the global connectivity of the Swiss air transport network, extended night flight restrictions would affect the attractiveness of Switzerland as a location for aviation.

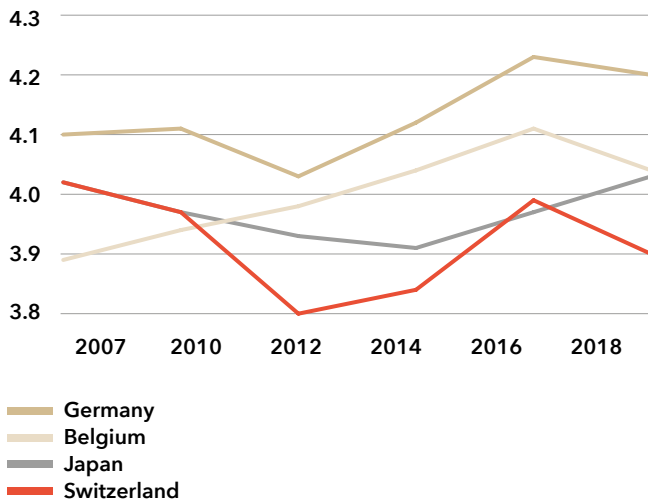
The accessibility of Switzerland for cargo traffic suffers on the regulatory side due to internationally restrictive airport operating hours and ban on night and holiday traffic. The 30-minute flexibility period after 11 p.m. is central to reducing delays for airlines in Zurich. A reduction in operating times would jeopardize long-haul connections, especially to distant destinations in South America, South Africa and Asia.

The ban on night and weekend traffic for road freight traffic represents a further challenge for air freight in Switzerland. Due to the limited accessibility of the airports by road at night, transports from Switzerland partly flow into neighbouring countries, which can be reached more easily and flexibly. This circumstance also contributes to the fact that Switzerland as an air freight location is rather unattractive for transports from neighbouring regions such as southern Germany despite its geographical proximity. In some cases, other European countries provide the same exemptions for substitute air freight transport as for perishable goods. A corresponding relaxation of the current rules in Switzerland for origin and destination traffic at the three Swiss national airports would significantly increase accessibility for air freight shipments.

The general logistical conditions for air freight are deteriorating in an international comparison

As a benchmark instrument, the World Bank's Logistics Performance Index (LPI) provides information on the "logistics friendliness" of a country. The sub-areas considered in LPI include hard and soft factors: infrastructure, customs clearance, price competitiveness of goods deliveries, quality of logistics services, punctuality and shipment tracking. First surveyed in 2007, the current survey was conducted in 2018, making it the sixth. The comparison shows that the "logistics friendliness" of the top group has improved in recent years compared with Switzerland. In the current ranking, which is led by Germany, Switzerland only occupies 13th place, whereas in 2007 it was still in 6th place. While the index value for Switzerland is tending to trend downwards, the top group has been able to improve its position over the last ten years.

Logistics Performance Index of individual countries in comparison



Aviation hubs, as locations, are in international competition with each other

Like Frankfurt, Paris or Amsterdam, Zurich Airport is one of the international aviation hubs in Europe. For Swiss, Zurich Airport is the hub, while Lufthansa, as a multi-hub carrier, considers internal hubs within the Group, which include Frankfurt and Munich for Lufthansa and Vienna for Austrian Airlines, to be in competition with each other. In recent years, the expansion of the Gulf airlines in Europe has brought more competitors onto the playing field. In recent decades, the competition for airport locations has intensified due to the trend towards the airline hub and spoke networks. It is therefore questionable whether airports can continue to be regarded as natural monopolies². This requirement is no longer met, especially for international airports with a hub function. Airports must therefore increasingly face up to the international competition for locations.

Capacity bottlenecks at Swiss airports endanger the future development of Swiss aviation to meet demand

Global networking in aviation leads to wave systems of aircraft movements at hub airports, which are a central feature of airports such as London Heathrow, Frankfurt or even Zurich. The wave-shaped flight plan at hubs is designed to handle passenger flows with the shortest

possible transit times. Due to its hub function, Zurich is already encountering capacity bottlenecks, especially at at either end of the day and at lunchtime.

From this perspective, the crucial factor for the evaluation of capacities is the maximum number of aircraft movements per hour. At peak times, the maximum 80 slots for take-off and landing times in normal operation are already in short supply. To be able to cope in the future with the growing passenger volume³ forecast up to 2030, Switzerland should press ahead with the demand-driven, cost-efficient expansion of Zurich and Geneva airports in order to meet the demand for air transport in the long term. Since air freight generally depends on the shortest possible, fast transport routes, a reduction in flight connections at the three national airports would also restrict the competitiveness of the Swiss air freight industry.

LUPO 2016 sets the course for the sustainable development of Swiss aviation

In 2016 the Federal Council adopted a new aviation policy report (Lupo). The initiative came against the background of growing passenger numbers at Swiss airports, increasing competition among airlines and technological advances in the industry. The comprehensive assessment of the situation in the Lupo report addresses key starting points at the infrastructure level and from a climate policy perspective, in order to pave the way for the sustainable development of Swiss aviation and to achieve the objectives set by the Commission itself in aviation policy.

Infrastructure

With regard to infrastructure, in the longer term, construction measures should be considered in order to meet the needs of the market. Without political commitment, this scenario carries the threat that future capacity bottlenecks will be caused by the additional flight capacity that will be added as part of the expansion plans, e.g. Vienna and Milan will be absorbed by other European airports. This shows that in the absence of a strategy for increasing capacity at national airports, the need for action is urgent.

Environmental protection

²Linden, Feltscher & Wittmer (2017). A model for measuring Airport competitiveness.

³Intraplan (2015). Development of air traffic in Switzerland until 2030.

The Swiss Federal Council believes that aviation has a duty to make an appropriate contribution to climate protection and thus recognises the climate impact of aviation, both locally and globally. The aviation industry should itself become active and, in addition, be guided by politically effective instruments. In particular, the focus should be on measures to reduce fuel consumption and pollutant emissions from air traffic and their effects on the climate. To achieve these goals, global approaches promise the highest degree of effectiveness, which is why Switzerland should support global climate protection instruments at supranational level in addition to national initiatives. A central component of the global climate protection strategy for aviation is the introduction of the global market-based climate protection measure CORSIA, which is to ensure climate-neutral growth in the sector from 2020.

CORSIA is considered a model for a sector-wide global and competition-neutral climate protection instrument

CORSIA is regarded as the first global, market-based measure that was created as an industry-wide, self-imposed commitment by an industry. In the short term, the principle of compensation is at the centre of climate protection activities, so that growth-related CO₂ emissions in international aviation will be offset with climate protection projects. The development of the programme through global consensus between governments, industry and international organisations ensures the global acceptance of the instrument: the voluntary pilot phase from 2021 to 2026 already involves 79 countries, which together are responsible for more than three-quarters of global air traffic. The unification of national regulatory efforts in a superordinate instrument offers a competition-neutral way to reduce emissions from international air traffic.

National ticket levies do not have a competition-neutral effect on the air transport market

The political and social discourse in Switzerland in the climate debate is dominated by demands for a climate levy on airline tickets. From the point of view of competition law, there is a danger that Switzerland's attractiveness as a location for air traffic will be impaired. A purely nationally introduced tax favours undesirable avoidance traffic at border crossings near airports in other countries. From an ecological perspective, no progress in climate protection would be achieved if passengers were to

switch to Munich or Milan as a result. Due to the dependence of Swiss air freight on belly capacities, a shift of passenger traffic to the European hinterland would also affect the handling of Swiss air freight shipments in both export and import.

Promotion of technologies as an effective contribution to climate protection in aviation

The EU research project SUN to LIQUID has shown considerable potential for reducing the climate impact of alternative fuels. A mini-refinery on the roof of the ETH machine-laboratory demonstrates the technical feasibility of producing CO₂-neutral fuel from air and sunlight. In order to protect the climate effectively, the promotion of sustainable alternative fuels and other technologies offers a great deal of leverage for the reduction of emissions. The sun-to-liquid process is particularly suitable for this purpose as a Made in Switzerland innovation. By using 49% of the taxpayers' money within the framework of the climate fund for a specific purpose, the marketability of alternative fuels can be actively promoted.

The "Single European Sky" vision

An effective and at the same time—in theory—rapidly implemented measure for climate protection in Europe is promised by the unification of European airspace, a project which the EU Commission has been working on since the 1990s within the framework of the "Single European Sky". Airlines in Europe today have to fly long detours or have to wait in holding patterns because national authorities operate their flight security in narrow, fragmented blocks of airspace. Harmonised processes within a single European airspace enable optimised routing, which can save around 10 percent CO₂ on intra-European routes. According to SWISS, the route from Zurich to London could be shortened by some 300 km, which is almost a third of the route. So far, further efforts have failed primarily because of national interests.

Role and tasks of the Federal Office for Civil Aviation

The Federal Office for Civil Aviation (FOCA) is responsible for aviation development and the supervision of civil aviation in Switzerland. FOCA is part of the Federal Department of the Environment, Transport, Energy and Communications (DETEC) and is responsible for ensuring that civil aviation has a high level of safety in Switzerland and pursues sustainable development.

FOCA's supervisory activities cover all areas of civil aviation: flight personnel, infrastructure, air traffic operations and aircraft. FOCA is also responsible for shaping the aviation policy conditions.

Switzerland is extremely dependent on a functioning trading system with foreign partners. It is of great importance for the Swiss economy that goods can be delivered to and from Switzerland at the right time, in the right place and in the desired quality.

Air freight opens and secures sales and procurement markets for the economy, creates jobs and added value. Competitive general conditions are central to the air freight industry.

A reliable freight infrastructure is a core element of economic connections to foreign countries. Furthermore, a large proportion of passenger flights would not be able to cover their costs without cargo. In the Federal Council's 2016 Aviation Policy Report, air freight is therefore treated as an important component of the Swiss aviation system.

The national airports provide a reliable and efficient freight infrastructure for the transport and provision of air freight services. In the SAIP object sheets, the airports were therefore obliged to provide the corresponding infrastructure.

The handling of air freight on the ground and in the air throughout the logistics centres is largely regulated by international standards. FOCA is involved in international aviation organisations to ensure that Switzerland's national interests are adequately taken into consideration.

FOCA is participating in the new version of the freight study in order to update its knowledge about the design of the Swiss air freight system and to expand. Through which airports is the air freight transported? What is imported into Switzerland, what is exported and how, and by whom? Is the infrastructure sufficient for this kind of revenue? Changes in the volume and value of Swiss air freight are also of interest.

In order to meet the sustainable development goals for aviation, the Confederation has introduced various measures and systems to reduce emissions in the civil aviation sector. It is therefore also interesting to see what efforts the aviation industry is making to further reduce greenhouse gas emissions.

Christian Hegner
Director



Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra
Swiss Confederation

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

Air freight – a competitiveness factor for the Swiss economy

The air freight services to and from Zurich strengthen the competitiveness of the Swiss economy. As a by-product of passenger traffic, air freight plays a major role in ensuring that Zurich remains attractive as an intercontinental hub for service providers. And it is an important element in supplying our country with vital goods in times of crisis.

The importance of air freight for the Swiss economy is underestimated. It is “the” mode of transport for time-critical, process-relevant or valuable goods. Air freight is indispensable as a service for the biotech, high-tech and pharmaceutical industries, or for the chemical, medtech and watch-making industries. It will retain its strategic relevance for the Swiss economy, even in the age of the “Internet of Things”. Air freight is an integral part of complex value chains. For many companies it is even the basic prerequisite for the provision of services.

Air freight not only creates the conditions for the efficient and safe transport of time-sensitive, high-value goods. It also strengthens the competitiveness of service companies, tourism, science and research.

The most important air freight hub in Switzerland is Zurich Airport. The restrictive ban on night flights and the politically influenced, disadvantageous operating concept in the aviation industry, as well as bottlenecks in the area of infrastructure, have a negative impact on the “air freight” business at Zurich Airport.

Competitive disadvantages in air freight affect not only freight but also passenger traffic. Air freight to and from Zurich is mainly transported in the belly of passenger aircraft. Many long-haul destinations could no longer be served profitably without the income from air freight. As a result, the intercontinental network for passenger traffic is being reduced.

Conclusion: Companies that are exposed to global competition need excellent transport connections for goods and passengers. Air freight not only creates the prerequisites for the efficient and safe transport of time-sensitive, high-quality goods. It also strengthens the competitiveness of service companies, tourism, science and research. The demand-driven development of the air freight infrastructure in Zurich thus supports the international accessibility of Switzerland as a whole. Restrictive operating hours, a politicized arrival and departure regime or the toleration of capacity bottlenecks are, on the other hand, damaging to the Swiss economy.

Dr. Thomas O. Koller
Vice president /Managing director

komitee
weltoffenes zürich

The committee for a Zurich open to the world was founded in 1968. It supports general public approval of strategic transport infrastructures, in particular Zurich Airport. In this way, the committee promotes demand-oriented transport links between Switzerland and global markets. Members are businesses, business leaders and personalities who know and can judge the importance of Switzerland’s international accessibility from their own experience.

www.weltoffenes-zuerich.ch

Political scenarios and visions for the future

Air freight is important for Switzerland as an exporting country, for the logistics industry, airlines, Swiss airports and for the security of supply in our country. AEROSUISSE is committed to ensuring that politicians do not sweep this issue under the carpet in the discussion on climate policy and revision of the CO₂ law.

As an exporting country, it is vital for Switzerland that the aviation industry provides efficient connections and the necessary capacities for long-haul flights—air freight also benefits from this. Such capacities could also be made available abroad. However, this would have consequences: increasingly, Swiss goods would have to be transported to Frankfurt, Amsterdam or Paris to be flown from there. Costs and delivery times for shipping from Switzerland are likely to rise. Air freight is a lifeline for our company that we must not stifle—the COVID-19 pandemic has made this clear to us. AEROSUISSE emphasises that the capacity bottlenecks that already exist today at national airports are reducing the punctuality of air traffic and hampering the development of long-haul connections. This has corresponding effects on the connectivity of our business location and poses enormous operational challenges for companies and their customers.

In addition to the introduction of incentive levies for aviation, we expect the federal government to present a strategy for Switzerland as an aviation location. The Federal Council for its part holds fast to the 2016 Aviation Policy Report: “Air freight contributes to Switzerland's link to the global flow of goods and is dependent on competitive general conditions”. It is time for the Federal Council to improve the general conditions for the use of airport infrastructure—including for air freight.

We expect the federal government to present a strategy for Switzerland as a location for aviation in addition to the introduction of incentive taxes on aviation.

This is important, as in parliament's deliberations on the total revision of the CO₂ law with the introduction of an air ticket levy, Switzerland's optimal air transport connections will come under further pressure. The earmarking of revenue from the air ticket levy for climate-neutral aviation fuel is not sufficient to strengthen the competitiveness of Swiss aviation in the long term. The neighbouring airports in Milan and Munich and foreign airlines are becoming more attractive in comparison to Switzerland because we are not in a position to use modern technologies for our aviation—be it on the ground or in the air. In addition, we need security, customs and tax procedures for air freight that make Switzerland an attractive location and do not make it more expensive than its European neighbours.

Thomas Hurter
Member of the Swiss National Council
President Aerosuisse

A E R O  S U I S S E

Education in the digital age

There is no doubt that the change towards “Economy 4.0” is taking place. This is demonstrated by new business models, innovations in products and services, and also by the large number of new jobs that are being created as a result of digitalisation. However, it is not only new jobs that are being created, but also the reform of job profiles that have been tried and tested for decades that is necessary in order to meet the requirements of the future.

This is currently being demonstrated by the “Independent Retailers 2022” project, which has been running since 2018. In this project, in which SPEDLOGSWISS is also actively involved as an industry representative, basic commercial training is being made fit for the working world of tomorrow. In the process, our job description “International Freight Forwarding Logistics Management Assistant” will be analysed and reformed so that the young generation will be able to survive in the job market from 2022 onwards with new technical, manual and social skills.

The same requirement also applies to further education. SPEDLOGSWISS is constantly reviewing its range of further training courses. For example, our ongoing specialist seminars help to put acquired knowledge directly into practice. The new “Know-How Course Air Cargo Compact”, for example, was designed in cooperation with IG AirCargo. The course covers the topic of air cargo and the associated daily tasks.

SPEDLOGSWISS is constantly reviewing its range of further education courses. Specialist seminars contribute to putting acquired knowledge directly into practice.

The core of the SPEDLOGSWISS further education programme is and will remain the courses leading to a federal degree. Whether as a customs agent or as a specialist in international freight forwarding and logistics, both are excellent building blocks for advancing your own career. Our further education programme is aimed at professionals who, in addition to practical skills, would like to acquire competencies such as networked thinking and working.

Thomas Schwarzenbach
Director

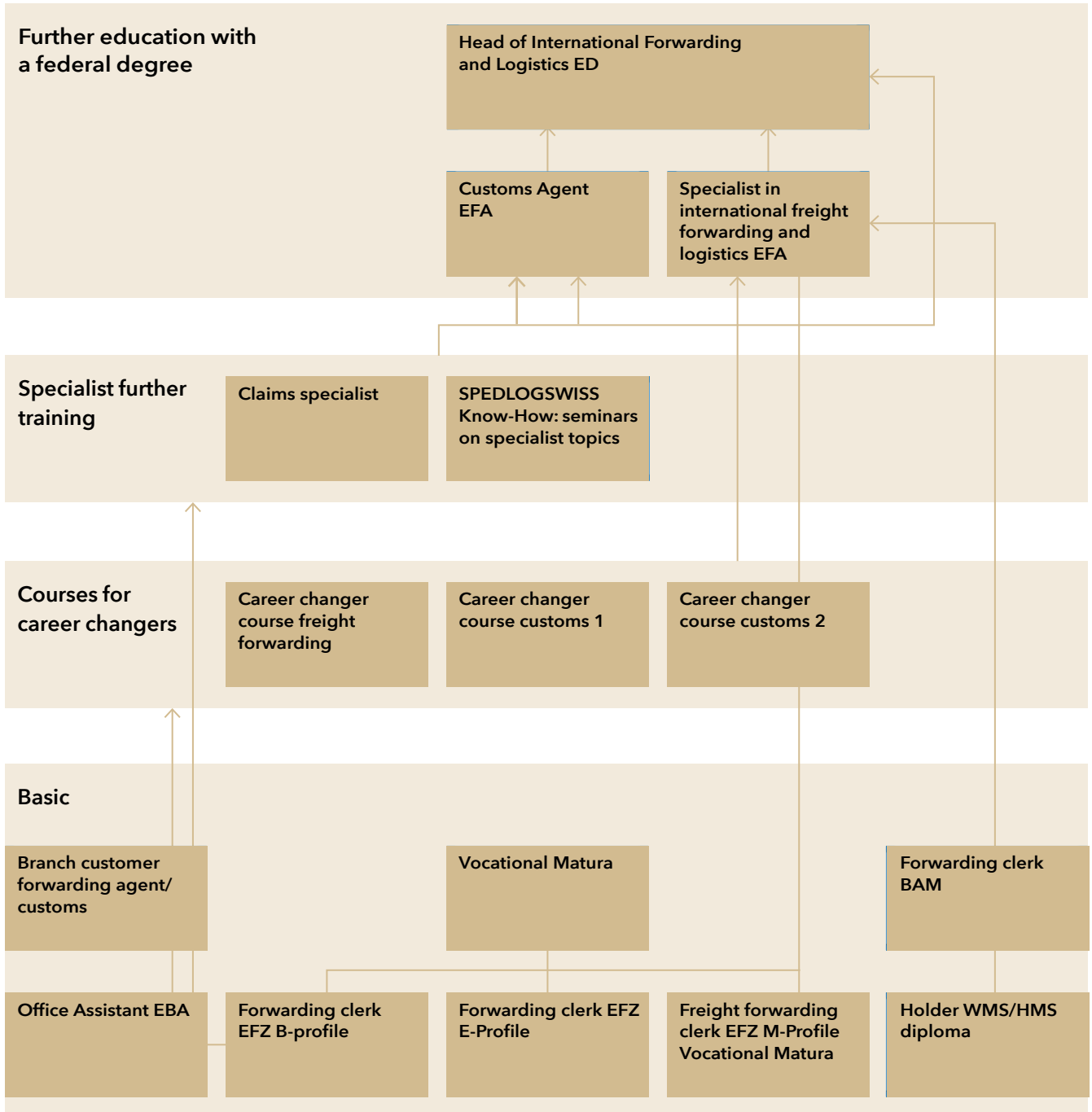
SPEDLOGSWISS

SPEDLOGSWISS, the Swiss Freight Forwarding and Logistics Association, is a training and examination institution recognised by the Swiss Confederation. It trains around 600 young forwarding agents throughout Switzerland as part of the 3-year basic commercial training programme, thus ensuring the next generation of professionals in the industry. The association thereby supports the dual vocational training system in Switzerland. SPEDLOGSWISS has the examination certification recognised by the Swiss Confederation for further training courses with a federal certificate.

SPEDLOGSWISS

Basic and advanced vocational training

International freight forwarding logistics



EBA = Swiss Federal Professional Certificate
 EFZ = Federal Certificate of Competence
 BAM = Sector diploma for secondary school leavers

HMS = Commercial College
 EFA = Federal Certificate of Competence
 ED = Swiss Federal Diploma

WMS = Business school

COVID-19: Air freight in times of crisis

Global slump in aviation in April 2020¹:

-94 % passengers -28 % air freight

Shortly before publication, the COVID-19 pandemic impacted the study at a critical moment and presented it with new questions. How are companies reacting in the crisis? What insights does crisis management provide? It was therefore logical to react promptly to the current developments with a further survey of experts in May/June 2020 and to gauge the relevant effects on air freight logistics. The focus was on how the industry was dealing with the crisis situation in order to be able to make statements about the resilience of air freight logistics and crisis management extending beyond the measures in connection with COVID-19.

Restricted and urgently needed: maintenance of air freight networks as a major challenge

Due to the worldwide spread of the COVID-19 pandemic, politicians have massively restricted passenger air traffic. According to IATA data, the extensive grounding of passenger fleets in April 2020 led to a virtual standstill of international passenger traffic. This month, the Lufthansa Group recorded a 97% year-on-year decline in passenger volume. In Switzerland, the slump from the beginning of March 2020 onwards is evident from the number of daily aircraft movements. At the start, after flights to and from China were discontinued, the declaration of the "extraordinary situation" by the Swiss Federal Council

accelerated the decline in aircraft movements in calendar week 12. More than 90% of aircraft movements collapsed suddenly and unexpectedly, which also affected the operations of many companies at the airports.

Since more than half of the world's air freight is transported as belly capacity on passenger aircraft, there is a direct link between the grounding of passenger fleets and the maintenance of air freight operations. The abrupt loss of cargo capacity on passenger flights posed a particular challenge for air freight operators. Air freight is in crisis!

System-critical mode of transport in times of crisis

In general, aviation as a mode of transport is regarded as indispensable for the maintenance of global supply chains for urgent transports. With the activation of political measures in connection with the so-called corona crisis, air freight has also moved into the focus of public attention as an important mode of transport and partner for the supply of urgently needed goods.

The sharp rise in demand for protective materials such as breathing masks underlines the high relevance of air freight as a mode of transport for urgent consignments over long distances.

¹IATA Economics (2020). Monthly Statistics April 2020. Figures in comparison to same month in previous year.

Capacity bottlenecks lead to price explosions and shifting markets

The decline in available cargo space led to a supply bottleneck in the market, which resulted in a multiple increase in air freight rates. At peak times, freight forwarders report spot market prices that are 10 times or more higher than the usual freight rates.

The month of April has so far been considered the peak of the crisis. While 32% less air freight was transported in Switzerland this month compared to the previous year, there has been a change among the carriers. As a result of passenger fleet grounding, SWISS lost over 83% of its cargo tonnage in April. The loss of belly freight capacity was thus barely compensated for. In contrast, cargo carriers such as Lufthansa Cargo and Cargolux were able to transport more freight to Frankfurt and Luxembourg by deploying additional RFS.

- 32%

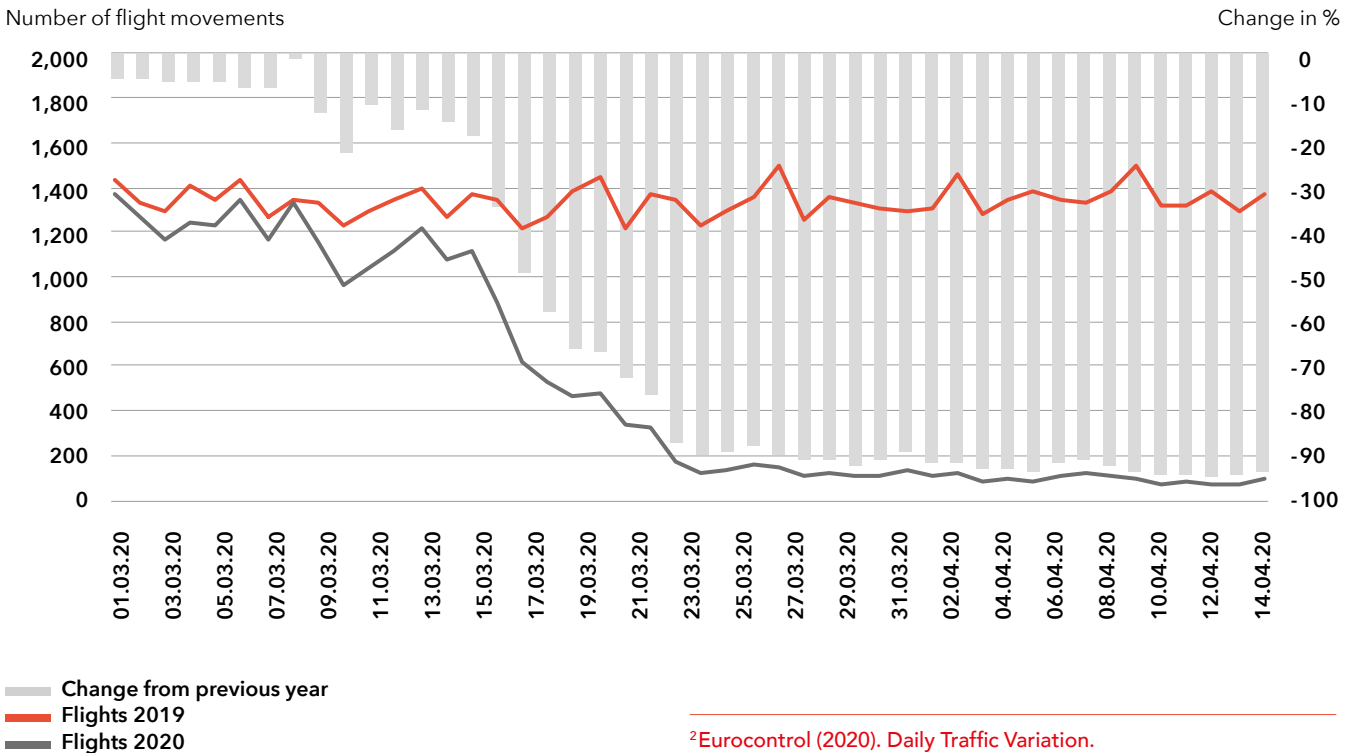
decrease in air freight tonnage in Switzerland in April 2020 compared to the previous year

Key challenges in the crisis

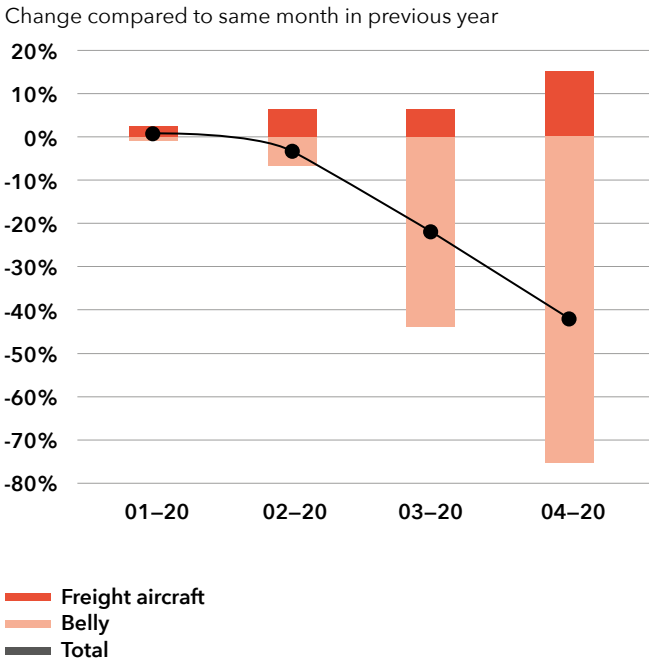
Overnight the collapse of operational business activities due to the cuts in the passenger sector put the players into crisis mode. The companies are confronted with two major challenges:

- Maintaining operational activities in compliance with hygiene regulations
- Securing liquidity in order to ensure the continued existence of the company

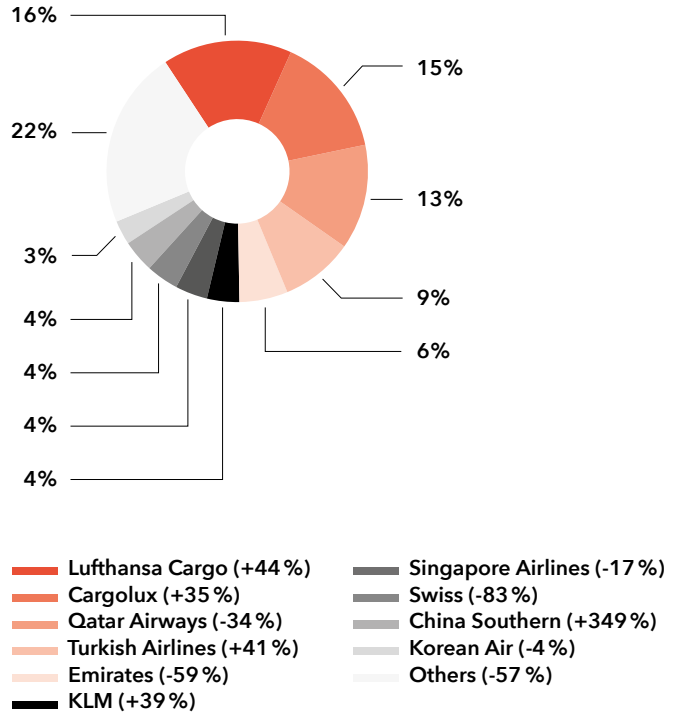
Development of the number of daily aircraft movements in Switzerland – take-offs and landings²



Development of available global freight tonne-kilometres for airlines compared to the previous year³



Market shares of individual airlines in the tonnage volume of Swiss air freight exports in April 2020⁴



Passenger freighter as response to lack of belly capacity

In order to be able to react quickly to developments in the course of the pandemic and to shorten decision-making processes in an unbureaucratic manner, many companies set up Corona-support task forces. In this exceptional situation, the main concern of all those involved in air freight logistics is to ensure that they are fully operational. For operations with a local presence, protective measures similar to those in other sectors are being implemented for employees.

In view of the situation threatening their existence due to the high fixed costs, airlines are opting for unconventional measures. Instead of carrying passengers,

a number of airlines have used their passenger planes on long-haul routes to transport urgently needed medical equipment. A special permit issued by the Federal Office for Civil Aviation allows the transport of special medical and humanitarian goods on economy class seats. The introduction of the "SWISS Belly Charter" and the establishment of a network of scheduled flights has enabled the company to meet the demand for cargo transport and to consolidate its global supply chain for Switzerland, where it has been relying on the expansion of its economy seating capacity to three Boeing 777s to transport an additional 12 tonnes per flight until further notice.

³IATA Economics (2020). Air Cargo Monthly Statistics.

⁴On the basis of chargeable weight: change compared with the same month last year in brackets. IATA (2020) CASS data.

Requirements for crisis management: responsive, flexible, cooperative

While the aviation industry is crisis-tested, the scale of the political measures of the COVID-19 pandemic presents a new dimension. Across the air freight logistics industry, companies agree that they and others have been particularly responsive during the crisis.

The experts agree that the speed of reaction of all players in air freight logistics was a key factor in maintaining the flow of goods in air freight immediately following the lockdown. According to their own estimates and those of others, all players mastered the transition to crisis mode from within one day to a maximum of one week. The close cooperation between authorities and companies is seen as a success factor for the stable maintenance of the supply chains. Administrative easing made a valuable contribution. On the other hand, there is criticism of lacking or insufficient contingency plans for crises that are not geared to the dimension of political pandemic-related measures.

Success factors for successful crisis management:

→ **Task-Forces:** central competence centre with regular communication exchanges, often several times a day at the beginning of the crisis. The elimination of coordination loops and approval processes accelerated decision-making and increased the speed of action

→ **Internal communication platforms:** information events at management level, e.g. virtual town halls in the form of a webinar, and the promotion of exchange among employees reduce uncertainty

→ **Short-time working:** contribution to securing short-term liquidity and maintaining efficiency through flexibility in operational processes and long-term safeguarding of specialist knowledge in companies

→ **Reducing bureaucracy:** administrative easing for the smooth movement of goods

“How to” for incident management⁵

The COVID-19 pandemic has highlighted the vulnerability of global value creation networks. Lack of information about and the limited controllability of events of

individual players are central risk factors. Incidents that originate from one player or event can lead to domino effects and impair the process flows of all those involved in a supply chain. There are two common strategies for handling incidents in supply chains. Firstly, a risk management process can help to proactively counteract potential incidents with carefully-developed emergency plans. Secondly, an incident management process can be applied to respond to disruptions that have occurred in air freight logistics. The interaction of both strategies represents an integrative approach to dealing with risks and incidents.

Business Continuity-Plan

Based on the incident management process, action plans for dealing with incidents such as a pandemic can be developed in the form of business continuity plans. These should address three levels:

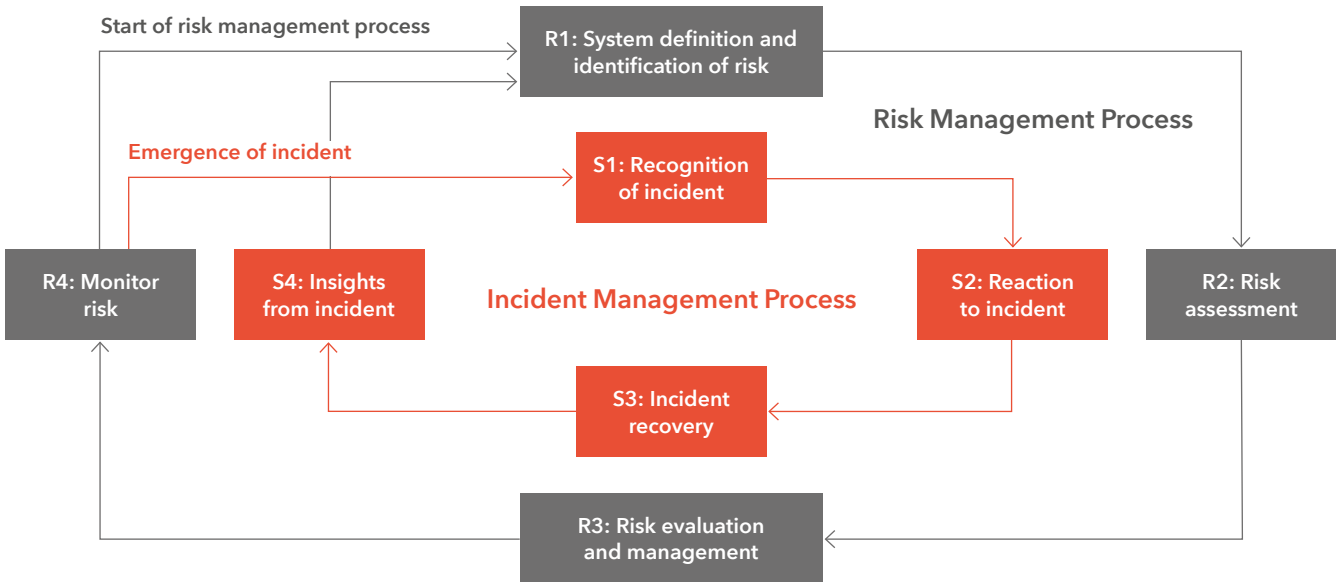
1. Company level: what could affect an individual company?
2. Network level: what precautions can the players in air freight logistics take jointly?
3. Government level: what can national economies or regulating governmental authorities do?

Preventive measures for handling incidents in air freight logistics

- Development of redundant modes of transport
- KPI-Cockpits
- Prior discussion on bottlenecks
- Checks on the availability of the employees
- Flexible production planning
- Avoiding single sourcing
- Supplier ranking
- Supplier background checks
- Establishment of a continuous improvement process

⁵Wütz, S., & Stözl, W. (2014). Disruptions in Supply Chains: An Analysis of Contemporary Challenges and Reactions.

Risk Management and Incident Management Process⁶



Operational sequence of the risk management process

R1: in order to define a system, its exact description and delimitations are crucial. Critical goals and performance indicators are used for this purpose. Events that influence the performance of a logistics process chain present risks.

R2: two questions are asked when quantifying risks: what is the probability of an event occurring and what is the expected impact of the incident?

R3: a "Level of Unacceptance" for individual incidents is defined. Measures are developed for these incidents.

R4: in order to take account of the dynamic development of risks and to permanently assess the risk profile of a system and individual risks, continuous feedback processes are established. If an incident is identified, incident management is applied.

Operational sequence of the incident management process

S1: fast detection of incidents is a prerequisite for an effective response, limitation of effects and rapid system recovery

S2: the planning of measures is carried out using specially developed emergency checklists. The selection of individual measures is based on the criteria of feasibility and priority.

S3: in the event of incidents, measures to restore the stability of operational processes come to the fore. Fast, effective crisis management helps to strengthen customer confidence.

S4: in order to prepare for similar incidents in the future, strategies resulting from incidents are implemented. Due to the lack of preparation by many players for the political measures to be taken in the COVID-19 pandemic, the highest priority is given to gathering knowledge and making concrete preparations.

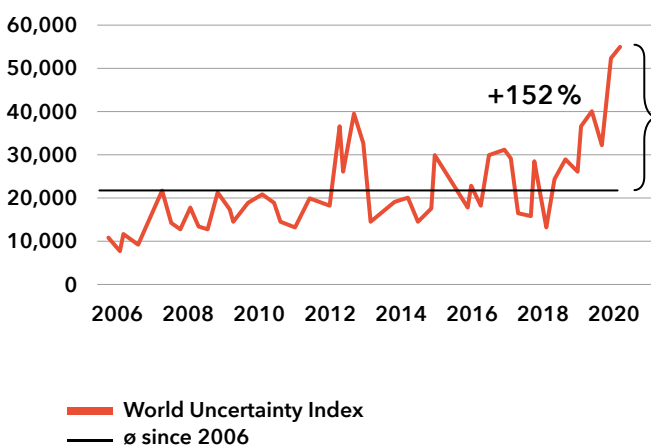
⁶Behdani (2013). Handling disruptions in supply chains: an integrated framework and an agent-based model.

Use of established tools in crisis management

In expert interviews, the usage patterns, and the relevance of individual tools for crisis management were examined. The analysis shows no major changes in the course of the crisis with regard to the players involved. Financial management is generally regarded as a critical and therefore particularly relevant function in companies. For the time being, the principle of “liquidity before profitability” comes to the fore. The onset of the crisis has highlighted the added value of business intelligence as a basis for forecasts of sales development or for personnel planning, in order to make decisions on a quantitative basis. The most important category is communication tools, which are decisive for the personal exchange of information between employees in the home office. In this connection, use was made of sophisticated solutions already available on the market.

Companies with a global network of suppliers and production facilities use business continuity plans to check the stability of their supply chains. The Stanford University’s World Uncertainty Index can be used for this purpose. This quarterly index has been compiled since 1996 for 143 countries and is a global index. It represents a measure of global uncertainty using frequency counts of the term “uncertainty” (and its variations) from the quarterly country reports of the Economist Intelligence Unit. In the first quarter of 2020, the Index reached a new record high of 152%, well above the 2006 to 2020 average. In addition to increased economic and political uncertainty, the index is also associated with stock market volatility, increased risk and lower GDP growth. In the

Stanford University World Uncertainty Index



future, the index is to be used by individual companies to assess regional uncertainties as a stress test for the robustness of supply chains

Vulnerability and resistance to crises

The capacity bottlenecks that have occurred during the lockdown reveal a vulnerability in air freight logistics. Due to the high global belly freight share of over 50%, air freight is strongly dependent on passenger flight connections being maintained in the short term. As a result of the increase in cargo capacity on passenger flights since the financial crisis, the air freight offer has shifted in favour of belly freight. Many airlines have reduced their full-freighter offers in recent years, which makes the capacity bottlenecks in the crisis all the more apparent. The loss of flight connections affects not only airlines but also handling companies. They are considered an irreplaceable link in maintaining the flow of goods. Their loss would be equivalent to the discontinuation of an air connection. From the point of view of increased resistance to crises, a long-term increase in the proportion of full-freighters would therefore be conducive to operating the carrier independently of passenger transport.

Air freight forwarders operate air freight networks that do not stop at national borders. Thanks to its geographical location, Switzerland benefits from its proximity to other European freight airports, which can be reached by truck in just a few hours. The loss of direct flight connections out of Switzerland has consequently led to an increase in air freight traffic at airports with higher freight capacities such as Frankfurt and Luxembourg. Border closures in almost all European countries led to considerable congestion and delays in the movement of goods by road immediately after the introduction of border controls, due to checks on people crossing the border. The introduction of Green Lanes at border crossings has helped to stabilize road freight traffic and therefore air freight replacement traffic.

With the exception of the weaknesses revealed in the crisis, the industry's handling of the crisis is universally regarded as positive and air freight as a crisis-proof mode of transport. The flexibility of all players and the rapid response to political developments have contributed significantly to this.

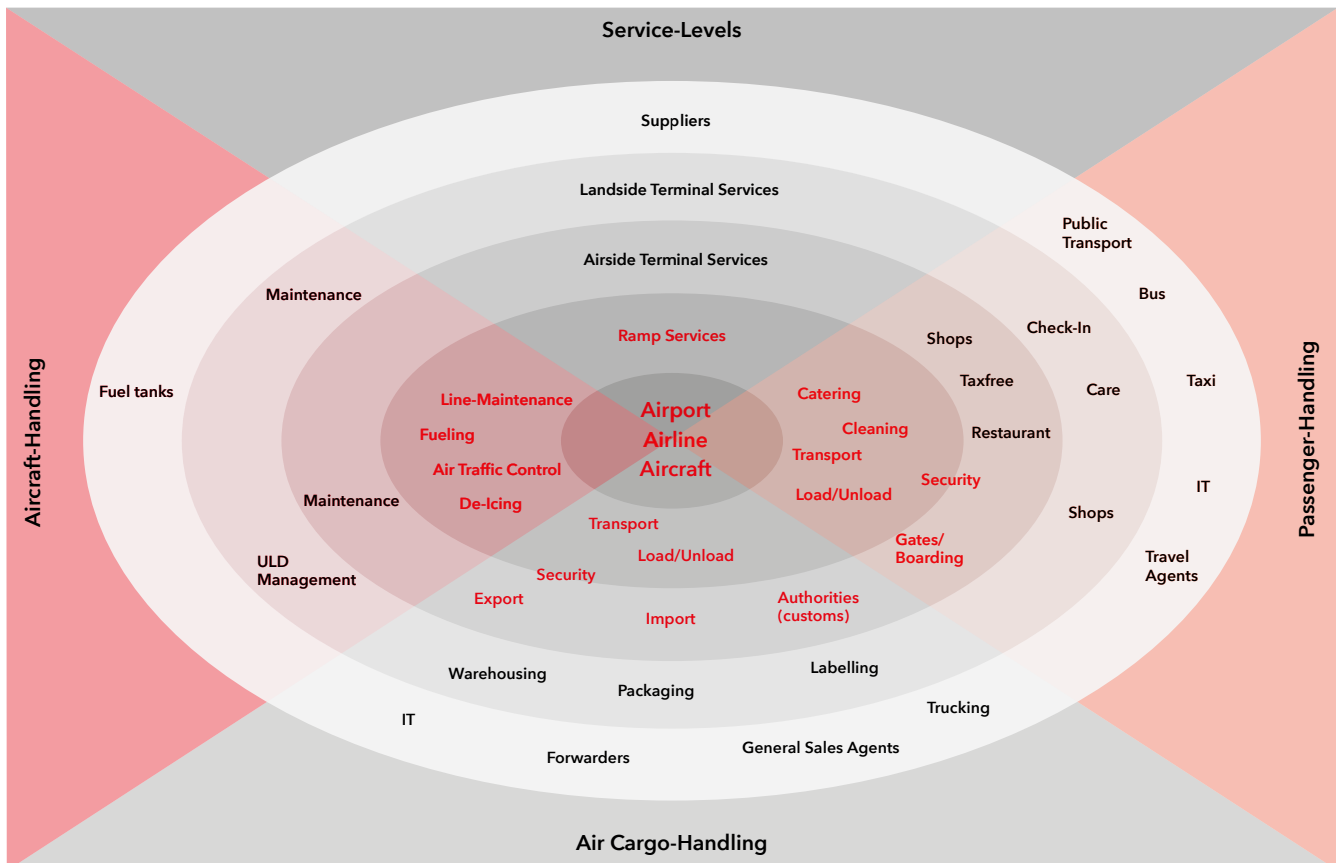
Economically critical services in the Swiss aviation system

Air freight, as part of the logistics sector, was classified by politicians as systemically relevant, which meant that it was not directly restricted by the lockdown. In the wake of possible financial state aid in order to secure the flow of goods, the question of which companies should be rescued from an economic point of view is being raised in Switzerland, as in other countries. A generally accepted definition of system-relevant enterprises is not (yet) available, however.

In order to be able to act independently of individual interests in the economy, politics and society, services are considered in isolation and their relevance is assessed. All services that are necessary for a commercial aircraft

to take off and land with freight, passengers and baggage in accordance with the legal regulations are classified as "system-relevant". The following representation of the Swiss aviation system is based on this. The diagram makes it clear that the efficient maintenance of the system requires not only airlines but also services and infrastructures from other players. System relevant services are marked below:

Aviation System Switzerland with all relevant services



Development trends relevant to air freight

The crisis has made many shippers more aware of the risk of dependence on individual modes of transport in view of endangered supply chains. Two trends are coming to the fore for improved risk management:

Sourcing-Strategies: shippers critically examine the resilience of their supply chains and put their sourcing strategy to the test. With an integrated cost approach, the default risk of global supply chains must also be assessed, making the issue of reshoring more relevant. Shippers are particularly interested in nearshoring, the relocation of production facilities and services to nearby foreign countries in order to increase stability. In the long term, this tendency can take the air freight consignments out of the equation.

New Silk Road: a few shippers have considered rail as an alternative for transport between Europe and Asia during the crisis. Transport capacities that were previously limited have prevented the shift to rail. Future expansion of capacity and shorter transit times on the New Silk Road will make rail increasingly attractive as an alternative to air and sea freight on this route.

Links to current air freight relevant COVID-19 updates using the following QR codes:



IATA



Eurocontrol



ICAO



BAZL

- IATA:** <https://www.iata.org>
- Eurocontrol:** <https://www.eurocontrol.int/covid19>
- ICAO:** <https://www.icao.int>
- BAZL:** <https://www.bazl.admin.ch>

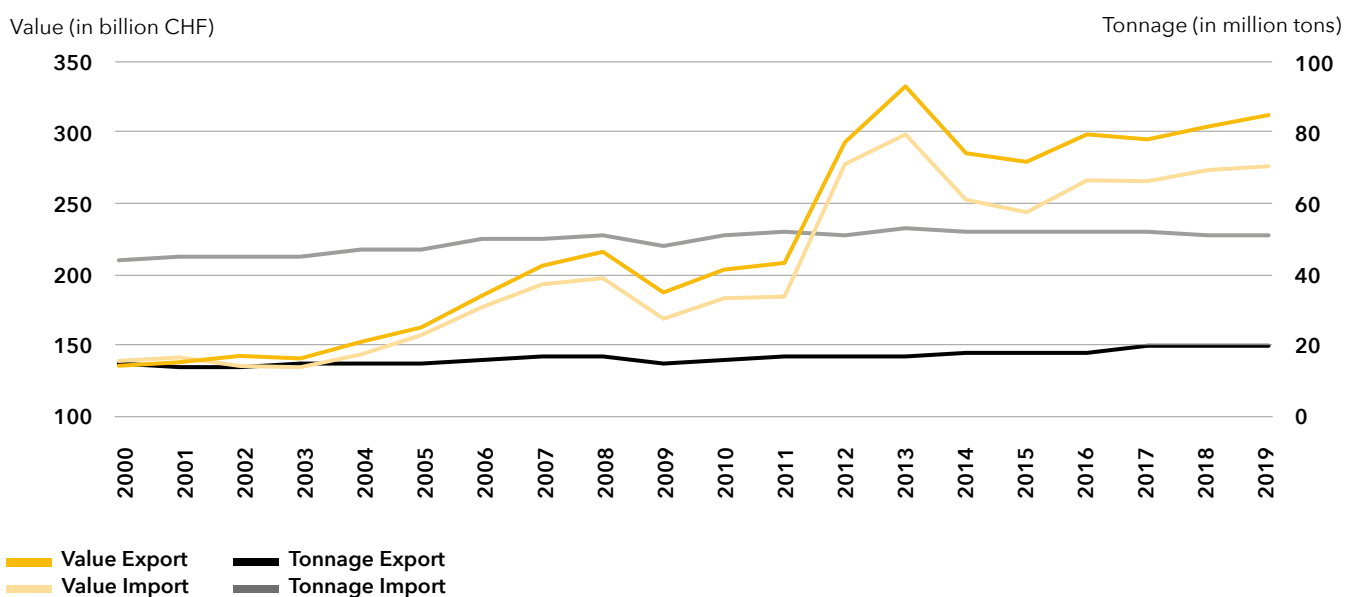
Statistics

The following are statistics* from Swiss airports and the Swiss Federal Customs Administration concerning Swiss air freight. The descriptions complement the findings and representations in the study and are intended to present in detail relevant developments in Swiss air freight in recent years.

*Source: Foreign trade statistics, Swiss Federal Customs Administration; further statistics at www.igaircargo.ch

Exports and imports of the Swiss economy

Development of Swiss imports and exports between 2000 and 2019 by value and tonnage



Development of Swiss exports between 2012 and 2019

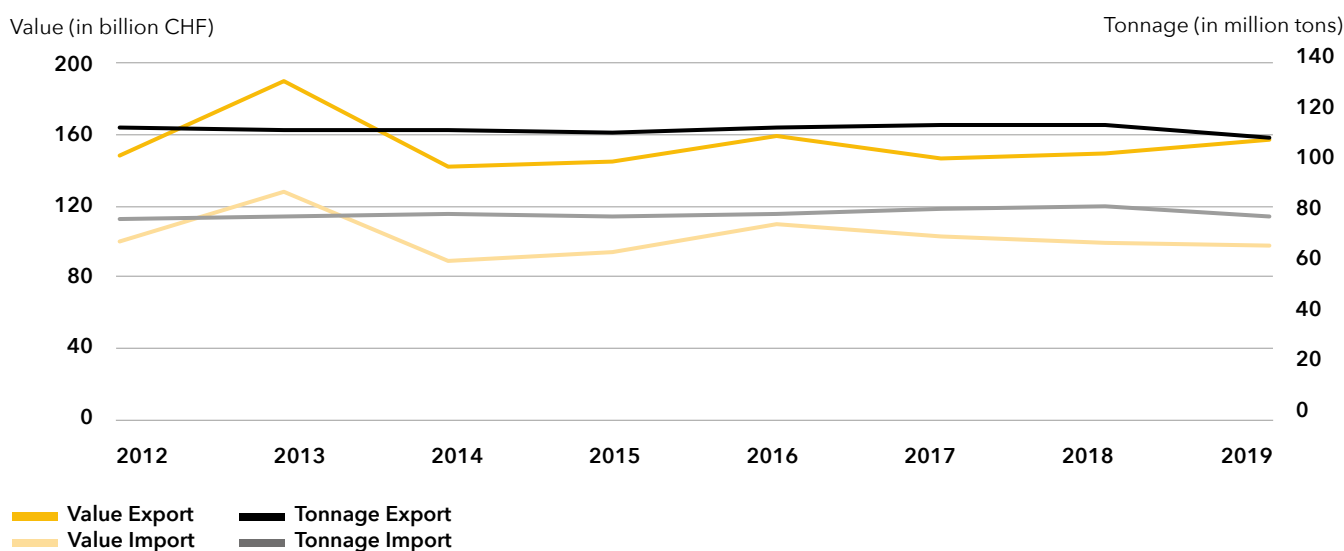
Year	Tonnage	+/- prev. y.	Value in CHF/bn.	+/- prev. y.	CHF/kg	+/- prev. y.
2012	16,874,631		292.96		17.36	
2013	17,421,033	3.2%	332.14	13.4%	19.07	9.8%
2014	18,205,939	4.5%	285.18	-14.1%	15.66	-17.8%
2015	18,357,479	0.8%	279.15	-2.1%	15.21	-2.9%
2016	18,199,839	-0.9%	298.41	6.9%	16.40	7.8%
2017	20,365,770	11.9%	294.89	-1.2%	14.48	-11.7%
2018	20,288,277	11.5%	303.89	1.8%	14.98	3.4%
2019	20,034,377	-1.9%	311.98	5.8%	15.57	7.5%

Development of Swiss imports between 2012 and 2019

Year	Tonnage	+/- prev. y.	Value in CHF/bn.	+/- prev. y.	CHF/kg	+/- prev. y.
2012	50,890,160		277.54		5.45	
2013	52,714,604	3.6%	298.39	7.5%	5.66	3.8%
2014	51,999,314	-1.4%	252.50	-15.4%	4.86	-14.2%
2015	51,959,089	-0.1%	243.77	-3.5%	4.69	-3.4%
2016	52,314,633	0.7%	266.14	9.2%	5.09	8.4%
2017	52,324,090	0.0%	265.57	-0.2%	5.08	-0.2%
2018	50,729,230	-3.0%	273.39	2.9%	5.39	6.2%
2019	50,822,087	0.2%	276.06	1.0%	5.43	0.8%

Air cargo: exports and imports²

Development of Swiss air cargo imports and exports between 2012 and 2019 by value and tonnage



Development of Swiss air cargo exports from 2012 to 2019

Year	Tonnage	+/- prev. y.	Value in CHF /bn.	+/- prev. y.	CHF /kg	+/- prev. y.
2012	115,246		148.47		1,288.31	
2013	114,209	-0.9%	190.28	28.2%	1,666.05	29.3%
2014	114,158	0.0%	142.24	-25.2%	1,246.00	-25.2%
2015	112,509	-1.4%	145.10	2.0%	1,289.65	3.5%
2016	114,589	1.8%	159.46	9.9%	1,391.58	7.9%
2017	116,249	1.4%	146.84	-7.9%	1,263.19	-9.2%
2018	116,486	0.2%	149.66	1.9%	1,284.75	1.7%
2019	111,358	-4.4%	157.37	5.2%	1,413.23	10.0%

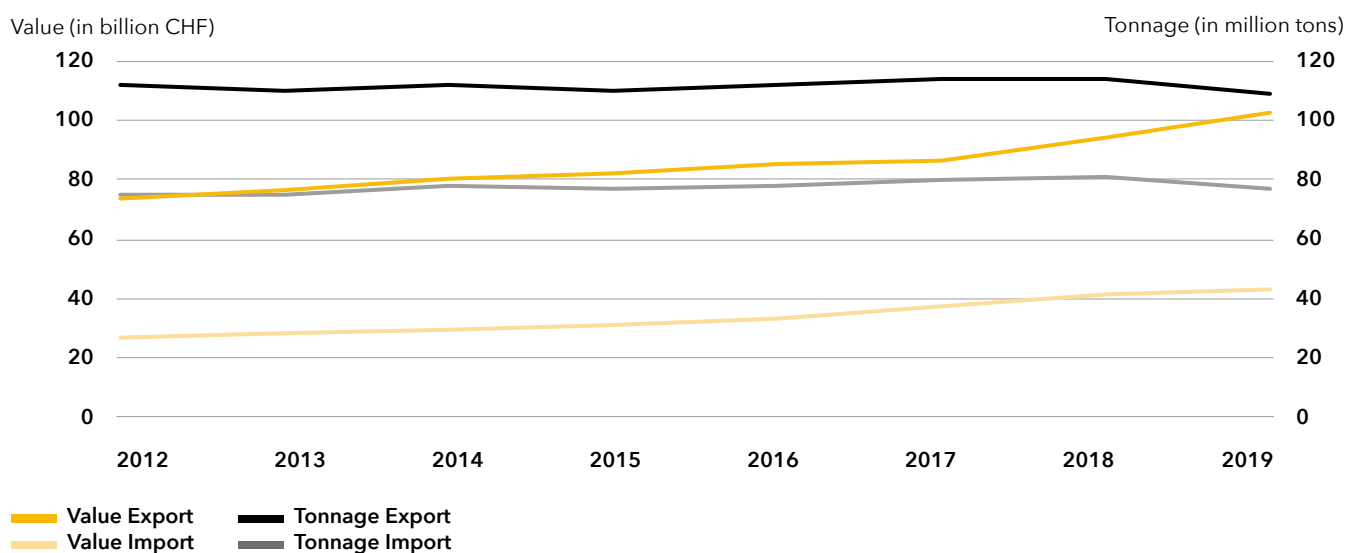
Development of Swiss air cargo imports from 2012 to 2019

Year	Tonnage	+/- prev. y.	Value in CHF /bn.	+/- prev. y.	CHF /kg	+/- prev. y.
2012	78,965		100.24		1,269.43	
2013	79,956	1.3%	128.15	27.8%	1,602.79	26.3%
2014	81,372	1.8%	89.32	-30.3%	1,097.69	-31.5%
2015	80,269	-1.4%	94.27	5.5%	1,174.40	7.0%
2016	81,371	1.4%	109.96	16.7%	1,351.40	15.1%
2017	83,306	2.4%	103.07	-6.3%	1,237.20	-8.5%
2018	83,868	0.7%	99.47	-3.5%	1,186.03	-4.1%
2019	79,578	-5.1%	97.92	-1.6%	1,230.51	3.8%

²Mineral oil products are excluded from the statistics as not commercially relevant (FCA commodity category 07.02).

Air cargo: exports and imports without gold²

Development of Swiss air cargo exports and imports from 2012 to 2019 by value and tonnage (without Gold³)



Development of Swiss air cargo exports from 2012 to 2019 (without Gold³)

Year	Tonnage	+/-prev. y.	Value in CHF/bn.	+/-prev. y.	CHF/kg	+/-prev. y.
2012	111,621		73.71		660.40	
2013	110,465	-1.0%	76.56	3.9%	693.10	5.0%
2014	111,643	1.1%	80.40	5.0%	720.14	3.9%
2015	109,613	-1.8%	82.21	2.2%	749.98	4.1%
2016	111,671	1.9%	85.35	3.8%	764.30	1.9%
2017	113,761	1.9%	86.48	1.3%	760.16	-0.5%
2018	113,930	0.1%	94.25	9.0%	827.30	8.8%
2019	108,712	-4.6%	102.64	8.9%	944.11	14.1%

Development of Swiss air cargo imports from 2012 to 2019 (without Gold³)

Year	Tonnage	+/-prev. y.	Value in CHF/bn.	+/-prev. y.	CHF/kg	+/-prev. y.
2012	74,881		26.87		358.80	
2013	75,403	0.7%	28.37	5.6%	376.29	4.9%
2014	78,015	3.5%	29.52	4.0%	378.35	0.5%
2015	77,118	-1.2%	31.12	5.4%	403.58	6.7%
2016	77,929	1.1%	33.26	6.9%	426.84	5.8%
2017	80,068	2.7%	37.42	12.5%	467.40	9.5%
2018	80,885	1.0%	41.42	10.7%	512.11	9.6%
2019	76,579	-5.3%	43.13	4.1%	563.18	10.0%

²Mineral oil products are excluded from the statistics as not commercially relevant (FCA commodity category 07.02).

³Gold and other precious metals excluded (FCA commodity category 10.02).

Commodity groups air cargo Switzerland²

Development of Swiss air cargo exports by commodity groups from 2012 to 2019

Year	Metals and derivatives incl. precious metals		Chemical-pharmaceutical products		Machines, medical products, watches		Other manufactured goods		All other goods		Total
	Value in CHF/bn.	Share	Value in CHF/bn.	Share	Value in CHF/bn.	Share	Value in CHF/bn.	Share	Value in CHF/bn.	Share	Value in CHF/bn.
2012	75.50	50.9%	28.45	19.2%	32.65	22%	9.47	6.4%	2.40	1.6%	148.47
2014	62.66	44%	31.00	21.8%	34.93	24.6%	10.90	7.7%	2.76	1.9%	142.24
2016	74.89	47%	36.83	23.1%	32.71	20.5%	12.66	7.9%	2.38	1.5%	159.46
2018	56.29	37.6%	41.02	27.4%	36.62	24.5%	13.22	8.8%	2.50	1.7%	149.66
2019	55.61	35.3%	47.80	30.4%	37.71	24%	13.88	8.8%	2.38	1.5%	157.37

Development of Swiss air cargo exports by commodity groups from 2012 to 2019 (without Gold³)

2012	0.74	1.0%	28.45	38.6%	32.65	44.3%	9.47	16.1%	2.40	3.3%	73.71
2014	0.81	1.0%	31.00	38.6%	34.93	43.4%	10.90	17.0%	2.76	3.4%	80.40
2016	0.78	0.9%	36.83	43.1%	32.71	38.3%	12.66	17.6%	2.38	2.8%	85.35
2018	0.89	0.9%	41.02	43.5%	36.62	38.9%	13.22	14.0%	2.50	2.7%	94.25
2019	0.87	0.8%	47.80	46.6%	37.71	36.7%	13.88	13.5%	2.38	2.3%	102.64

Development of Swiss air cargo imports by commodity groups from 2012 to 2019

Year	Metals and derivatives incl. precious metals		Chemical-pharmaceutical products		Machines, medical products, watches		Other manufactured goods		All other goods		Total
	Value in CHF/bn.	Share	Value in CHF/bn.	Share	Value in CHF/bn.	Share	Value in CHF/bn.	Share	Value in CHF/bn.	Share	Value in CHF/bn.
2012	73.76	73.6%	5.30	5.3%	7.26	7.2%	11.17	11.1%	2.76	2.8%	100.24
2014	60.20	67.4%	7.09	7.9%	7.86	8.8%	11.53	12.9%	2.64	3.0%	89.32
2016	77.21	70.2%	7.41	6.7%	8.38	7.6%	12.10	11.0%	4.87	4.4%	109.96
2018	58.52	58.8%	8.96	9.0%	9.46	9.5%	18.32	18.4%	4.21	4.2%	99.47
2019	55.25	56.4%	8.23	8.4%	9.45	9.7%	20.33	20.8%	4.66	4.8%	97.92

Development of Swiss air cargo imports by commodity groups from 2012 to 2019 (without Gold³)

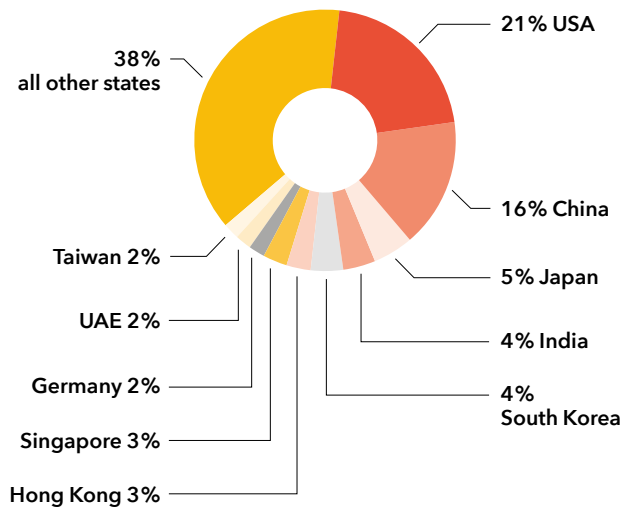
2012	0.38	1.4%	5.30	19.7%	7.26	27.0%	11.17	41.6%	2.76	10.3%	26.87
2014	0.39	1.3%	7.09	24.0%	7.86	26.6%	11.53	39.1%	2.64	9.0%	29.52
2016	0.51	1.5%	7.41	22.3%	8.38	25.2%	12.10	36.4%	4.87	14.6%	33.26
2018	0.47	1.1%	8.96	21.6%	9.46	22.8%	18.32	44.2%	4.21	10.2%	41.42
2019	0.45	1.0%	8.23	19.1%	9.45	21.9%	20.33	47.1%	4.66	10.8%	43.13

Value per kilo of Swiss exports and imports in a transport mode comparison (2019)

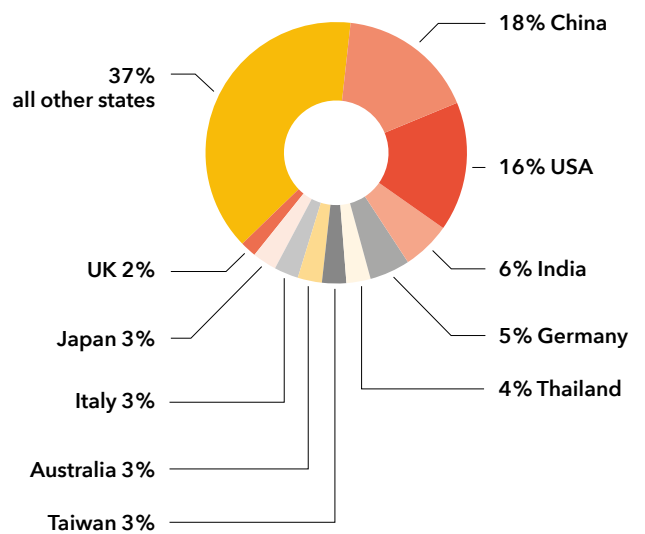
Transport mode	Value CHF/kg Export	Value CHF/kg Import
Air ²	1,413.20	1,230.50
Air ² (without Gold ³)	944.40	562.80
Road	9.50	5.00
Rail	2.80	1.40
Sea	15.40	6.20

Traffic flows of Swiss air cargo²

Tonnage share of the top 10 markets for Swiss air cargo exports



Tonnage share of the top 10 markets for Swiss air cargo imports



²Mineral oil products are excluded from the statistics as not commercially relevant (FCA commodity category 07.02).

³Gold and other precious metals excluded (FCA commodity category 10.02).

Air cargo volume at Swiss airports⁴

Development of tonnage handled at Swiss airports from 2010 to 2019

Switzerland	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Export	150,536	158,779	145,344	148,204	151,976	150,002	153,264	170,136	175,397	176,404
Import	95,160	110,214	105,989	108,947	112,028	110,029	112,304	118,928	123,658	118,907
Transfer	297,653	295,501	308,111	295,559	313,324	298,861	319,042	374,369	369,489	320,664
Total	578,444	586,032	580,727	575,423	600,568	577,941	604,192	687,581	694,008	638,505
Share RFS	210,581	212,571	203,719	198,687	208,360	190,708	186,366	206,347	203,212	189,650
Share Flown	367,863	373,461	377,008	376,737	392,208	387,233	417,826	481,234	490,796	448,855
Mail	34,350	39,838	42,776	44,181	40,832	32,652	36,515	34,888	30,954	31,346

Development of tonnage handled at Zurich Airport from 2010 to 2019

Zurich	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Share CH	71.1%	70.8%	72.1%	71.8%	71.6%	71.2%	71.8%	71.3%	71.1%	70.8%
Export	73,968	77,374	70,873	74,494	73,383	70,932	72,938	80,290	87,421	90,649
Import	65,998	65,942	60,900	63,034	62,168	57,934	59,509	62,559	61,479	60,169
Transfer	271,112	271,674	286,968	275,577	294,278	282,910	301,122	347,596	344,323	301,008
Total	411,078	414,990	418,742	413,104	429,829	411,776	433,569	490,445	493,223	451,826
Share RFS	125,088	129,092	127,359	122,428	129,355	119,685	120,473	134,249	130,474	117,166
Share Flown	285,990	285,898	291,384	290,676	300,474	292,091	313,096	356,196	362,749	334,660
Mail	28,072	32,936	35,606	37,061	34,343	27,216	30,947	30,690	26,213	27,008

Development of tonnage handled at Basel Airport from 2010 to 2019

Basel	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Share CH	18.6%	17.6%	16.3%	16.3%	16.3%	17.5%	16.8%	16.3%	15.9%	16.6%
Export	60,643	62,593	58,063	57,832	60,059	61,336	61,565	68,903	64,687	63,348
Import	30,264	31,377	31,433	31,792	33,295	34,723	35,293	37,253	39,071	39,043
Transfer	16,707	9,417	4,885	4,316	4,821	4,992	4,424	6,147	6,433	3,717
Total	107,614	103,387	94,382	93,940	98,175	101,051	101,282	112,303	110,191	106,108
Share RFS	63,954	61,941	55,077	53,546	55,765	52,030	46,357	48,003	47,320	49,954
Share Flown	43,659	41,446	39,304	40,394	42,409	49,021	54,925	64,300	62,871	56,154
Mail	118	40	35	175	96	36	30	27	18	12

⁴Source: Swiss airports.

Development of tonnage handled at Geneva Airport from 2010 to 2019

Geneva	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Share CH	10.3%	11.5%	11.6%	11.9%	12.1%	11.3%	11.5%	12.3%	13.0%	12.6%
Export*	15,926	18,812	16,408	15,878	18,534	17,734	18,761	20,943	23,289	22,407
Import*	12,454	12,895	13,656	14,121	16,564	17,372	17,502	19,116	23,108	19,695
Transfer*	9,834	14,410	16,257	15,667	14,226	10,959	13,496	20,626	18,733	15,939
Total	59,752	67,654	67,604	68,379	72,564	65,058	69,295	84,780	90,548	80,571
Share RFS	21,538	21,538	21,283	22,713	23,239	18,993	19,536	24,095	25,418	22,530
Share Flown	38,214	4,116	46,321	45,666	49,325	46,065	49,759	60,685	65,130	58,041
Mail	6,160	6,862	7,135	6,945	6,393	5,400	5,538	4,171	4,723	4,326

* Figures for export, import and transfer are reported excluding RFS

Swiss quality throughout the world

Swiss WorldCargo is the air freight division of Swiss International Air Lines (SWISS) and responsible for transporting cargo throughout the world. Swiss WorldCargo has a long-standing reputation in the industry as focused on complex, high-value and care-intensive consignments. The extensive Swiss WorldCargo network of air freight services is supplemented by daily truck connections between key business centres and partnerships with innovative service providers worldwide. As part of the Lufthansa Group, Swiss WorldCargo is consistently committed to delivering Swiss quality to its air freight customers, and makes a substantial contribution to SWISS's overall profitability.



Local responsibility embedded in an international network

As the leading Swiss provider of air freight handling services, Cargologic has been working for airlines and forwarders at various airports for over 65 years. With a reputation for innovative logistics, Cargologic has since 2002 been part of the international Rhenus Group, which operates from 750 locations around the world with a workforce of some 33,000 employees. To ensure that its business develops sustainably and successfully for customers, employees and investors alike, Cargologic emphasises three key elements: leadership, professionalism and innovation. While applying its corporate values of quality, efficiency and innovation, Cargologic ensures on a daily basis that it meets even the most demanding requirements flexibly and professionally.



Quality, Experience and Passion

dnata Switzerland AG is a service company at Zurich and Geneva airports and is part of the world-renowned Emirates Group. It offers a comprehensive range of airline and cargo handling services and serves over 35,000 flights annually for more than 100 airlines from all over the world. It thus takes care of over 7 million passengers and almost 85,000 tonnes of freight per year. With many years of experience in the air freight business, dnata Switzerland has established itself in the market and developed precisely-tailored handling competencies, supported by a reliable cargo management system. It handles every type of freight both carefully and professionally. The aim is to meet and, ideally, exceed the expectations of the customer. For this reason, in the future, dnata Switzerland plans to invest for its customers - with well-defined plans for the expansion of a new, state-of-the-art cargo warehouse, which will be supplemented in the near future with the introduction of a new "one Cargo" freight handling software system.



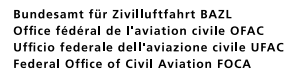
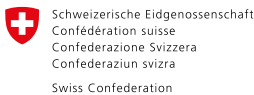
Sensitive goods in safe hands

When it comes to handling sensitive and valuable freight, Swissport offers tailor-made solutions for airlines, forwarders and shippers. At Geneva Airport, Swissport specialises in the handling of particularly valuable goods. The services include customised processes and a highly secure infrastructure. Swissport customers in Geneva also have access to "Rapid Channel" services. Thanks to particularly fast processes, deliveries can be made up to 50 minutes before departure, while import consignments are ready for collection just 50 minutes after arrival of the aircraft. In Basel, Swissport attaches particular importance to handling sensitive consignments from the pharmaceutical industry. The Swissport Pharma Centre offers 7,500 m² of temperature controlled area with temperatures ranging from +15°C to +25°C. There are also special refrigeration units that guarantee a temperature between +2°C and +8°C and a unit for goods for which a constant temperature of -20°C is required. In May 2018, the International Air Transport Association (IATA) awarded Swissport Basel the CEIV Logistics Certificate for sensitive pharmaceutical goods.



Many thanks

We would like to thank all sponsors for their active cooperation and valuable support. Such an extensive study can only be realized with the committed participation of many organizations and we have therefore greatly appreciated their cooperation.



Glossary

Aircraft movements	Take-offs and landings at airports.
Air freight	Air freight is used for all products with a shipment weight of single units of more than 31.5 kg. Due to the mixture of shipments of any type, weight class, size etc., air freight is very heterogeneous in terms of characteristics and requirements of the freight products. In contrast to the business model of the integrators, the service is provided with involvement of various players.
Belly-Cargo	Carriage of cargo on passenger flights (in the lower deck of the aircraft).
Bulk Unitization Program (BUP)	Pre-built transport units in air freight, which are already built for carriers at the landside handling agent. For the delivery of a BUP, customers receive lower freight rates (BUP rate) compared to a loose delivery of the unit.
Center for Aviation Competence (CFAC)	Interdisciplinary institute at the University of St.Gallen with a research focus on the aviation industry. The Institute of Supply Chain Management is a partner of the CFAC focusing on air freight.
EN16258	The European Norm EN 16258 includes various methods for measuring CO ₂ emissions for modes of transport. Among other things, the norm contains standardised procedures for calculating emissions from the transport of single consignments and part loads. When stating CO ₂ equivalents (CO ₂ -e), both direct and indirect emissions can be taken into account. The calculation methods of Carboncare include TTW and WTW and calculate both CO ₂ : equivalents (according to EN 16258) and pure CO ₂ for the emission values.
Foreign trade ratio	Share of exports and imports in GDP.
General Cargo	Cargo without hazardous or dangerous characteristics, which does not require special precautionary measures for air transport.
Home Carrier	Airlines with their main location at the considered airport, e.g. SWISS in Zurich.
Hub (airport)	Important air traffic hub in international traffic
Integrator (CEP service provider)	Integrators are specialized in the fully integrated coordination of transport services from door to door (end-to-end). They are specialized in the transport products courier, express and parcel. In processing letters, documents and parcels, the relatively light, homogeneous consignments enable a high level of automation. By "orchestrating" all services, customers are offered a bundled service from one single source.
Low-Cost-Carrier (LCC)	Airlines in the LCC segment focus on minimizing their cost structure. By reducing services and keeping operating costs to a minimum (e.g. use of smaller, peripherally located airports with low fees), LCC can offer lower fares than other airlines. Additional optional services such as baggage check-in or on-board catering are charged separately. In contrast to other airlines (e.g. SWISS), LCCs generally do not transport air cargo.
LTO-cycle	The landing and take-off cycle (LTO cycle) is a procedure standardised by the ICAO for the determination of engine emissions, which is used for the certification of aircrafts. The cycle comprises the phases taxiing, take-off, ascent and descent.

Multimodal transport	Combination of two or more transport modes for the carriage of passengers or goods. Air freight shipments are always multimodal transport chains, as they represent “broken traffic” in terms of infrastructure. The combination of two modes of transport (e.g. truck and plane) is called bimodal transport.
National airport	Airport with mainly international traffic (CH: Zurich, Geneva, Basel).
Road Feeder Service (RFS)	Collection and distribution of cleared air freight on the road (customs cleared and consolidated at another airport), usually in regular traffic operations published in the flight schedule.
Shipper	Consignors of products and users of goods transport services of all kinds (air, rail, sea and road).
Tank-to-Wheel	“Tank-to-wheel” emission figures include direct emissions from the consumption of energy during transport.
Temperature controlled cargo	Cargo which must not exceed or fall below a defined temperature range.
Transfer traffic	Transfer cargo, unlike transit cargo, is handled at a transfer airport during a stopover. The airport infrastructure is used there. Transfer cargo is counted twice in the air transport statistics, for each transfer operation, when unloading and reloading.
Transit traffic	Cargo remaining in a landed aircraft without cargo handling until the aircraft is reboarded. In contrast to transfer traffic, cargo handling facilities are not used. Transit traffic is generally counted once in air transport statistics.
Unit Load Device (ULD)	Pallets and containers used for loading baggage, freight and mail on aircraft. They make it possible to bundle large quantities of cargo in large units. By using them, fewer units have to be loaded which saves ground handling agents staff, time and effort.
Well to Wheel	“Source-to-wheel” emission data are more comprehensive than the TTW data and include production, transport and distribution of fuel, including final consumption of energy during a transport.

Methodology

The Air Cargo Logistics Study Switzerland was conducted between October 2019 and June 2020 by the Institute for Supply Chain Management, member of the Centre for Aviation Competence at the University of St. Gallen, in cooperation with IG AirCargo Switzerland. Leading Swiss players from business and the public sector supported the preparation of the consortium study.

Procedure: The research design of the study aims to provide a comprehensive survey of the performance profile of Swiss air freight logistics in an international comparison, considering various perspectives, as well as highlighting challenges and development trends. The research design combines qualitative and quantitative approaches. Initially, in the period October to December 2019, an overview of current literature sources and secondary statistical data on the topics of air freight and air freight logistics was compiled focusing on the Swiss market. In addition, three workshops were held during this period to identify relevant key issues in air freight logistics from the perspective of industry representatives. At the beginning of January 2020, the research design based on this was validated together with the consortium partners. The empirical investigation took place in the months January to March 2020.

Expert interviews and case studies: 30 qualitative interviews were conducted with experts from business, politics and research for all study areas. By covering different stakeholder groups, different perspectives were incorporated into the study. With the survey of shippers, forwarders, airports, airlines and ground handling agents, the key players are represented across the entire air freight logistics sector. The interviews were conducted as semi-standardised interviews based on the guidelines. This ensures that detailed information is collected and that the personal views of individual interview partners are included.

For the validation of the results, individual assessments of industry experts were reflected in the interviews. The survey of individual case studies with players in the air freight industry enabled an in-depth and comprehensive investigation of opportunities, challenges and concrete solution approaches in relation to the study focus areas investigated.

Online survey: an online survey among air freight forwarders from Switzerland was conducted in parallel to the interviews in February 2020, thus providing a quantitative as well as qualitative assessment of the perspective of forwarders on Swiss air freight logistics, with particular reference to the three Swiss national airports. Through the associations IG AirCargo Switzerland and Spedlog-swiss, air freight forwarders were interviewed directly with a total of 45 companies participating in the survey. After answering the first questionnaire, the participants were able to select from a list of airports to be evaluated individually. In the specific evaluation of the performance profile of air freight handling at individual airports, Zurich Airport was rated 39, Geneva Airport 26 and Basel Airport 24 by forwarders.

In order to respond to current developments in the course of the COVID-19 pandemic, 12 additional guideline-based, qualitative expert interviews were conducted in May and June 2020 and a literature analysis focusing on crisis management and resilience was initiated. The insights gained from this analysis into the effects and the handling of crises within supply chains are incorporated into the study as an excursus.

A study by the University of St. Gallen Institute for Supply Chain Management on behalf of IG AirCargo Switzerland

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ISCM – Institute for Supply Chain Management

The Institute for Supply Chain Management (ISCM-HSG) at the University of St. Gallen sees itself as an international platform for dialogue between science and practice in the field of supply chain management, especially purchasing, logistics and transport. The ISCM-HSG researches complex problems of global value-added networks in the form of concepts, methods and instruments, thereby building a bridge between research and applied solutions. This way the further development of supply chain management in industry, trade, services and the public sector is promoted. In addition, the comprehensive range of training and further education is aimed at managers, young scientists and students.

CFAC – Center for Aviation Competence

The Center for Aviation Competence (CFAC-HSG) is an independent institution of the University of St. Gallen, which was founded in 2005 and is supported by a total of six HSG institutes. CFAC offers services as well as training and further education courses in aviation and mobility and carries out projects such as consulting, market research and studies. Its aim is to support aviation through research, services, seminars and conferences on a scientific basis. CFAC focuses on the fields of business administration, economic policy, air traffic law, labour law, logistics and corporate governance.

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