CIVIL AVIATION AND THE ENVIRONMENT

NOISE

Aviation generates noise emissions too. However, the number of people exposed, in relation to other transport carriers, is rather low.

Exceeding the emission limit value pursuant to LSV:

Transport Carrier	Exposed population over IGW [1]	
	Day	Night
Road	1’200’000	700’000
Railroad	70’000	140’000
Aviation	27’000	57’000

The noise-exposed area [2] around Zurich Airport has decreased over the last 20 years by two thirds, despite an increase in flight movements. At the same time, the population in the affected areas increased by 83%.

ENERGY / CO_2

Around 2% of worldwide fossil energy consumption is assignable to civil air transport. This results in a share of about 2% of man-made CO_2 output. [3] Air transport contributes with approximately 12% of worldwide CO_2 emissions within the entire transport industry. Considering transport carriers in Switzerland, around 24% of all consumed fuel is used for continental and intercontinental flights. [4] During an intercontinental flight a modern airliner consumes within a range of 100 km around 3 litres of fuel per passenger carried.

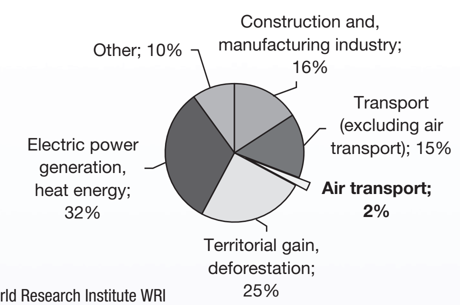
CLIMATE

According to the report „Aviation and the Worldwide Atmosphere“ of UNEP and WMO (IPCC 1999) [5], the worldwide air traffic contributes with 3.5% [6] to the man-made greenhouse effect. With increasing air traffic that share could grow up to 5% by 2050. The state of scientific research on the impact of nitric oxides and water vapour arising from aircraft engines on the greenhouse effect still shows significant uncertainties. In the long-run the climatic influence will be dominated by the CO_2 emission. The latest scientific studies assume that based on an assessment period of 100 years these materials strengthen the greenhouse effect of CO_2 by the factor 1.35 [7]. CO_2 emissions at cruise altitude have the same effect as ground-level emissions (e.g. road traffic, industry or heating). Approximately one third of the nitrogen oxide at cruising level originates from shipped ground-level emissions, from aircraft or has natural origins (thunderstorm).

1) IGW – imission limit value (aircraft noise: night-time > 50 dB(A) Leq) Principles: Zurich 2013, Geneva 2012
2) 60 dB(A) Leq day-time noise (IGW ES II)
3) Metz, B., Davidson, O. R., Bosch, P., Dave, R., & Meyer, L. 2007. *Climate change 2007: Mitigation of climate change. Working group III contribution to the fourth assessment report of the IPCC*
4) Overall energy statistics of the Federation
5) IPCC is the scientific body of UNEP (United Nations Environmental Program) and WMO (World Meteorological Organisation).
6) Besides the impact of CO2, further effects such as nitric oxides and condensation trails related to emissions released to date are included herein.
7) D.S. Lee et al. Transport impacts on atmosphere and climate/Aviation Atmospheric Environment 44 (2010) 4678–4734

CIVIL AVIATION AND THE ENVIRONMENT

Breakdown of CO_2 emissions by sector



Source: World Research Institute WRI

The global aviation industry is engaged to further mitigate greenhouse gas emissions.

This engagement is based on four pillars:

- **1st pillar: improved technology**
  (e.g. lower-emission engines, lighter aircraft equipment, alternative fuels from renewable resources)
- **2nd pillar: operational measures**
  (e.g. shorter and more direct air routes, fuel-saving start and landing procedures)
- **3rd pillar: more efficient infrastructure**
  (e.g. better use of airspace and airports)
- **4th pillar: economic measures**
  (e.g. voluntary CO_2-offset, emission trading)

EMISSION TRADING

In 2012, aviation became subject to the European Emissions Trading System (EU ETS). Airlines must thereby compensate their CO_2 emissions by acquiring CO_2 emission rights. According to the EU Directive, the EU ETS should initially apply to all flights to and from destinations in Europe. Due to international opposition against its extraterritorial legal effects, the EU ETS currently applies to flights within the EU only. The Federal Council intends including Swiss air transport when associating the Swiss emissions trading system with the EU ETS. A corresponding agreement was initialed early 2016. In autumn 2016, ICAO decided introducing the Carbon Offsetting and Reduction Schemes (CORSIA). This requires aviation to compensate for CO_2 emissions that exceed the level of 2020. To date, 68 countries (including Switzerland), being responsible for more than 85% of the CO_2 emissions from international civil aviation, have expressed their intention to participate in this system. The possible influence of CORSIA on the future design of emissions trading in Europe is currently not foreseeable yet. The aviation sector supports the introduction of CORSIA, however, rejects regional measures such as EU ETS. These would lead to competitive distortions and induce detour traffic via hubs outside Europe.

AEROSUISSE

LIST OF ITS 145 MEMBERS (as at 30th April 2017)

2assistu GmbH, Brugg
Aero-Club of Switzerland, Lucerne
Aéroport de Neuchâtel SA, Colombier
Aéroport de Sion, Sion
Aéroport Région Lausannoise La Blécherette SA, Lausanne
Aéroport Régional Les Eplatures SA, La Chaux-de-Fonds
AFS all-financial-solutions gmbh, Lupfig
Air-Espace Flight Academy, Colombier
Airline Assistance Switzerland AG, Zurich-Airport
Airport Altenrhein AG, Altenrhein
Airport Buochs AG, Buochs
Air Service Basel GmbH, Basel-Airport
Albinati Aeronautics, SA, Geneva-Airport
Alljets AG, Zurich-Airport
Altran AG, Lausanne
Amac Aerospace Switzerland AG, Basel
AOPA Switzerland, Zurich
Association Genevoise de l’aviation d’affaires AGAA, Geneva-Airport
Avex Aviation Experts AG, Wallisellen
Aviasuisse, Zurich
Aviation Experts Group, Eglisau
Aviation Media AG, Teufen
AviMall GmbH, Zurich
Avionix GmbH, Winterthur
AviSwiss GmbH, Zollikon
Belair Airlines AG, Glattbrugg
BGI Bertil Grimme AG Insurance Brokers, Zug
Breitling SA, Grenchen
BTEE SA Environnement & Sécurité/AIRTRACE, Geneva
Cargologic AG, Zurich-Airport
Cat Aviation AG, Zurich-Airport
Cessna Zurich Citation Service Center, Zurich-Airport
CGS Corporate Group Service AG, Zurich-Airport
Clemessy Switzerland AG, Basel
Clin d’Ailes, Musée de l’Aviation Militaire, Payerne
COREB Communauté régionale de la Broye, Payerne
Custodio AG, Zurich-Airport
Dasnair SA, Geneva-Airport
ddpConcepts GmbH, Ennetbürgen
Dnata Switzerland AG, Kloten
Dufry International AG, Basel
Easyjet Switzerland SA, Geneva-Airport
E-Aviation Swiss Sagl, Agno
Ecole de parachutisme de Château d’Oex, Le Vaud
EFOS Flight Charter AG, Kloten
Engadin Airport AG, Samedan
Ermini AG, Zurich
EuroAirport Basel-Mulhouse-Freiburg, Basel-Airport
European Business Aviation Association EBAA (Switzerland), Zollikon
ExecuJet Europe AG, Zurich-Airport
Fliegerschule Birrfeld AG, Birr-Lupfig
FLUBAG Flugbetriebs AG, Neudorf
Flughafen Bern AG, Belp
Flughafen Zürich AG, Zurich-Airport
Flugplatz Dübendorf, Dübendorf
Flugschule Basel AG, Basel-Airport
Flugschule Eichenberger AG, Buttwil
Franke Industrie AG, Aarburg
gategroup Holding AG, Zurich-Airport
gatesocial.com, Altendorf
General Aviation Genossenschaft Basel, Basel-Airport
Genève Aéroport, Geneva-Airport
Germania Flug AG, Glattbrugg
Glausen+Partner AG, Thun
Global Aerospace Underwriting Managers Ltd., Zurich
Great Circle Services AG, Hildisrieden
groWING of Switzerland GmbH, Hünenberg
Helvetic Airways AG, Zurich-Airport
Horizon Swiss Flight Academy Ltd., Kloten
Howald Kurt, Honory member, Muri b.Bern
Huber + Suhner AG, Pfäffikon
IBC Insurance Broking & Consulting Zurich AG, Zurich
IG AirCargo, Zurich-Airport
IG Berner Luftverkehr, Bern
IG Flughafen Zürich, Zurich-Airport
IG EUROAIRPORT, Basel
ISS Aviation AG, Zurich-Airport
Japat AG / Novartis International AG, Basel
Jet Aviation Management AG, Zurich-Airport
Ju-Air, Dübendorf
Kessler & Co. AG., Zurich
Lantal Textiles, Langenthal
Legendair Ltd., Beinwil am See
Lightwing Aircraft AG, Stans
Lufthansa Aviation Training Switzerland AG, Zurich-Airport
Lugano Airport, Agno
Malbuwit AG, Belp
Marenco Swisshelicopter AG, Pfäffikon
Mecaplex AG, Grenchen
Meyer Avocats, Geneva
Moreillon Dr. Pierre, Honory President, Lausanne
Mohler Burkhard Partner AG, Basel
Motorfluggruppe Thurgau, Lommis
Motorflug-Veteranen des AeCS, Grandcour
My Jet Switzerland SA, Lausanne
NOMAD Aviation AG, Kloten
The Nuance Group AG, Glattbrugg
Pilatus Aircraft Ltd., Stans
Pratt & Whitney Aero Engines International GmbH, Lucerne
Premium Jet AG, Zurich-Airport
proventavia LLC, Gross
Rabbit-Air, Bachenbülach
Rega Swiss Air Rescue, Zurich-Airport
Regionalflugplatz Jura-Grenchen AG, Grenchen
Renz & Partners, Bern
RUAG Schweiz AG, RUAG Aviation, Emmen
Schellenberg Wittmer SA, Geneva
Schweiz. Gletscherpiloten-Vereinigung SGPV, Hinwil
ShAir AG, Zurich
skyguide, swiss air navigation services ltd., Geneva
Sky Jet AG, Zurich-Airport
Sky Work Airlines AG, Belp
Slot Coordination Switzerland, Zurich-Airport
SPAS Seaplane Pilots Association Switzerland, Lutry
SR Technics Switzerland, Zurich-Airport
SSIG Swiss Space Industries Group, Zurich
Super Constellation Flyers Association, Basel
Swiss Aerodromes, Zurich
Swiss Aerospace Cluster, St. Gallen
Swiss Aircraft Maintenance Association SAMA, Basel
Swiss Air Force, Dübendorf
SWISS ASD The Aeronautics, Security and Defence Division of Swissmem, Zurich
Swiss Association of Aeronautical Sciences, Emmen
Swiss Federation of Civil Drones, Bern
Swiss Flight Services SA, Colombier
Swiss Hanggliding & Paragliding Association SHPA, Zurich
Swiss International Air Lines Ltd., Zurich-Airport
Swiss Helicopter Association, Bern
Swiss Jet Ltd., Zurich-Airport
Swiss Museum of Transport, Lucerne
Swiss Oil Association, Zurich
Swissport International Ltd., Zurich-Airport
Swiss PSA Pilot School Association, Meisterschwanden
Swiss Quality Broker Partner AG, Sargans
TAG Aviation SA, Geneva-Airport
TEKO Schweiz. Fachschule, Lucerne
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Wegier Andreas, Hünibach
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Zürich Versicherungs-Gesellschaft, Zurich

AEROSUISSE

Established in 1968, AEROSUISSE as umbrella association aims to maintain the interests of the Swiss aerospace sector and to ensure its means of existence. It takes influence on the formation of the legal framework in the domain of aviation and space. Today, AEROSUISSE represents 145 companies and organisations including scheduled and charter airlines, international and regional airports, airfields, fixed base operators, air traffic control, maintenance shops, aircraft and subcomponents manufacturers, Swiss Air Force, companies within the space industry, flight training schools as well as all influential aviation associations and other companies being related to aerospace in a broader sense.

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Managing Director: Philip Kristensen, Bern

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- Flughafen Zürich AG, Zurich-Airport
- IATA International Air Transport Association, Geneva
- IDT Institut für öffentliche Dienstleistungen und Tourismus, St.Gallen
- INFRAS, Zurich
- Marktforschungsinstitut GfK Switzerland
- Luftfahrtpolitischer Bericht des Bundesrates 2004
- Aviation Policy Report of Federal Council, 2016
- Rega Swiss Air Rescue, Zurich-Airport
- RUAG Schweiz AG, RUAG Space, Zurich
- Swiss Hanggliding & Paragliding Association SHPA, Zurich
- Switzerland Tourism, Zurich
- SIAA Swiss International Airports Association, Zurich
- skyguide, swiss air navigation services ltd., Geneva
- Swiss International Air Lines Ltd., Zurich-Airport
- Verband öffentlicher Verkehr, Bern

AEROSUISSE

VADEMECUM 2017

English Version

CIVIL AVIATION IS OF OUTSTANDING IMPORTANCE FOR SWITZERLAND1 [1]

VALUE ADDED AND LABOUR FORCE OF CIVIL AVIATION [1)2)]

Effects [3)]	**Value added** [4)] in billion CHF	**GDP** [4)] %	**Occupation** VTE [5)]
Direct [1)]	8.2		44'280
Indirect [1)]	3.9		22'670
Economic significance in a narrower sense [1)]	**12.1**	**1.8**	**66'950**
Induced [1)]	12.4		71'500
Economic significance in a broader sense [1)]	**24.5**	**3.8**	**138'450**
Catalytic [2)]	9.0		55'300
Sum of all effects [6)]	**33.5**	**5.6**	**190'000**

BREAKDOWN OF DIRECT EMPLOYMENT EFFECTS

	No. of employees
Zurich	26'800
Geneva	11'000
Basel	6'200
Bern	500
St. Gallen-Altenrhein	400
Lugano	300
Sion	200
Airports with airline movements [6/7)]	**45'400**
Regional airports without airline traffic	340
Airfields and miscellaneous (flying schools etc.)	550
Heliports	110
Airports without airline movements [2/7)]	**1'000**
Aviation industry (maintenance, fitting, sub-components) [1)]	**16'220**
Operation of a short- / medium-haul aircraft	40 – 120
Operation of a long-haul aircraft	210
Per million flight passengers [8)]	750 – 2'000

1) Aviation Policy Report of Federal Council, 2016
2) Economic significance of aviation in Switzerland, 1 June 2011, INFRAS
3) The sum of direct and indirect effect corresponds to the (causally narrow) economic significance of aviation in Switzerland (incl. exports of aviation industry). The induced and catalytic effect illustrates, which further, causally less narrow, economic linkages aviation exhibits with the rest of the economy.
4) Incl. exports of aviation industry
5) Full Time Equivalents
6) Head Count SIAA and Sion Airport
7) Including aviation industry
8) Direct and indirect effects

CIVIL AVIATION IN THE PUBLIC INTEREST

In its report dated 24 February 2016 considering Swiss aviation policy, the Federal Council particularly emphasizes the great significance of civil aviation in Switzerland as well as the optimal international air traffic connections.

The airline traffic is explicitly recognised as part of the public transport. [1)]

On a value basis, up to 40% of all exports is forwarded by air freight. [1)]

30–35% of foreign tourists visit Switzerland by air. [1)]

Per capita basis, Switzerland is one of the countries with the most condensed air navigation demand in the world.

THE CONFEDERATION'S CIVIL AVIATION EXPENDITURES IN COMPARISON (CHFM)

	2015	**2016**
Total expenditures federal government	65'243	66'261
whereof transport	8'322	9'104
whereof aviation [2)]	167	185

The confederation's expenditures in favour of civil aviation are with 0.26% in 2015 and 0.28% 2016 in relation to the overall expenditures extremely modest.

With few exceptions no federal funds flow into the aviation sector. [1)]

AIR TRAFFIC CONTROL

Skyguide, the Swiss incorporated limited company for civil and military air traffic control, coordinates and directs the air traffic of Switzerland and parts of neighbouring airspace. Skyguide is an enterprising and customer oriented private limited company owned by the federal government. Its running costs are covered by route and landing charges as well as statutory contributions of the federal government.

	2014	**2015**	**2016**
Revenue in CHFM	449	450	455
Employees (Full Time Equivalents)	1'397	1'412	1'426

Airports where Skyguide is in charge: Alpnach, Bern, Buochs, Dubendorf, Emmen, Geneva, Grenchen, Locarno, Lugano, Meiringen, Payerne, Sion, St. Gallen-Altenrhein und Zurich. On the regional airport Les Éplatures the local air navigation service is delegated to the airport operator.

1) Aviation Policy Report of Federal Council, 2016
2) Expenditures for international organisations of civil aviation, certain security tasks, supervision (FOCA), education, aircraft procurement, payments to Skyguide, contri- butions of mineral oil tax money

FIGURES ON SWISS CIVIL AVIATION

	2014	**2015**	**2016**
FLIGHT PASSENGERS (on SIAA airports) [1)]			
Zurich	25'477'622	26'281'228	27'666'428
Geneva	15'152'915	15'771'271	16'532'691
Basel	6'523'874	7'061'059	7'314'269
Bern	192'846	190'032	183'320
Lugano	145'521	165'984	176'688
St. Gallen-Altenrhein	94'070	101'092	108'413
Total	**47'586'848**	**49'570'666**	**51'981'809**
FLIGHT MOVEMENTS (on national and regional airports)			
Zurich	264'970	265'095	269'160
Geneva	187'596	188'829	189'840
Basel	89'474	94'359	95'542
Birrfeld	69'378	72'807	71'127
Grenchen	74'075	70'870	66'854
Bern	54'356	51'144	50'207
Lausanne-Blécherette	46'112	37'821	38'127
Sion	39'941	41'016	37'119
St. Gallen-Altenrhein	29'731	27'288	26'382
Lugano	20'263	21'275	19'577
Samedan	14'284	16'007	14'961
Écuvillens	15'391	15'201	14'842
Les Éplatures	11'943	11'941	12'015
Bressaucourt	8'311	8'095	8'072
Total	**925'825**	**921'748**	**913'825**
Transit flights within the Swiss airspace	684'372	703'037	716'159
Destination / countries [2)]	185/56	185/55	187/56
Airlift Rega by helicopter	10'802	11'186	11'055
Airlift Rega by jet aircraft	1'170	1'167	1'249
Freight and post (t)	410'633	404'632	431'141

1) SIAA Swiss International Airports Association
2) operated by Swiss domiciled airlines

FIGURES ON SWISS CIVIL AVIATION

	2014	**2015**	**2016**
AIRPORTS			
National airports	3	3	3
Regional airports	11	11	11
Airfields	48	48	48
Heliports	24	24	24
COMPANIES			
Airline operators	8	9	8
Commercial operators (non-airline)	68	66	62
Maintenance and repair shops	85	84	85
Flight schools	138	140	141
Hang-gliding schools with SHV label	67	67	65
other hang-gliding schools	57	60	67
Parachute schools	14	14	14
Manufacturers	19	18	18
Ground Handlers	4	4	4
DEVELOPMENT OF THE AIRCRAFT PORTFOLIO			
Airplanes (fixed wing)	1'880	1'850	1'823
Helicopter (rotor wing)	321	326	337
Engine-powered gliders	258	253	249
Gliders	720	696	658
Hang-gliders	15'452	15'281	15'780
Drones			10'280
Balloons	366	358	339
Airships	11	11	8

SWISS TRAFFIC NETWORK	**2016**
Line network of Swiss-domiciled airlines	439'780 km
Roadways (in Switzerland)	71'520 km
Railways (in Switzerland)	5'304 km

EXPOSED TERRAIN	Area	**2016** Area per capita
Land area of Switzerland	41'285 km²	4'904.00 m²
Airports [1)]	30 km²	3.65 m²
Sealed land area in respect of:		
Roadways	741 km²	90.36 m²
Railways	95 km²	11.58 m²
Airports [1)]	8 km²	0.97 m²

1) National and regional airports

FIGURES OF SWISS CIVIL AVIATION

TRAINING CENTRES IN SWITZERLAND

Airfields across the entire country offer various opportunities getting trained in aviation activities and practice aviation sports. This task is provided by 141 flight training schools, 132 hang-gliding flight schools and more than 400 clubs.

Many dynamic companies offering qualified employment and access to several vocational training are located at domestic airfields.

LICENCES

	2014	**2015**	**2016**
Private Pilot	4'904	4'872	4'777
Commercial Pilot	1'107	1'050	1'083
Airline Transport Pilot	2'478	2'571	2'492
Multi-Crew Pilot License (MPL/A)	94	87	70
Helicopter Pilot	1'025	1'043	1'068
Glider Pilot	1'729	1'715	1'766
Balloonist	278	255	247
Hang-Glider	36'700	37'755	38'661
Drone Pilot			145
Parachutist	1'590	1'664	1'669
Recognition of foreign permits	15	11	8
On-Board Engineer	3	2	3
On-Board Radio Operator	4	4	5
Aircraft Maintenance Mechanic	2'991	2'992	2'887

THE SWISS AVIATION INDUSTRY [1)]

The aviation industry is the basis of an efficient aviation sector. It comprises development, manufacturing and maintenance companies overall employing around 12'850 people. The aviation industry's value added (direct effect) amounts up to CHF 1.9 billion. Including suppliers (indirect effect) staff number is increasing to 18'200 generating a value added of over CHF 2.8 billion. The aviation industry also includes ground handling and catering companies.

The largest direct economic value is achieved by the 60 EASA Part 21 and EN9100 manufacturing companies, which generate well over CHF 1 billion. They all manufacture and supply extremely innovative and technically demanding aircraft as well as systems, subassemblies and aircraft components in order to prevail towards foreign competitors.

1) Aviation Policy Report of Federal Council, 2016

The Swiss manufacturing companies enjoy an excellent reputation and are largely growing in their niche markets in spite of the strong Swiss Franc. In the subcategories such as light aircraft as well as unmanned aircraft and alternative rotor wing concepts new companies have been established. In the maintenance business the competitive pressure due to high wage costs and the strong Swiss Franc remains.

The increasing regulatory density at European level confronts the entire aviation industry with new major challenges that can only be mastered through innovative products and process improvements.

SWISS SPACE INDUSTRY

As a founding member of the European Space Agency (ESA), Switzerland was able to contribute to the European space activities from the very beginning. The Swiss space industry is an important partner in many European space projects. In March 2017, ESA launched another satellite, Sentinel-2B, in a series of missions that form the core of the European Earth observation programme Copernicus. Copernicus' image data will be available for environmental protection, agriculture and forestry, spatial planning and disaster management. By 2021 a total of five different sentinel missions should have been launched.

To date, Switzerland is contributing to the ESA budget with ca. CHF 170 million per year. A large number of Swiss companies, universities and research institutes is engaged in ESA's earth observation programmes. The most important objectives from a Swiss perspective is the development of technological and industrial competencies in the field of sensor and instrument manufacturing as well as promotion of operational application of earth observation data.

The emphasis of the Swiss space industry lies on the development and manufacturing of subsystems that become applicable in space. The range of products is broad and extends from payload fairings and structures to optical, mechanical and electronic components as well as scientific instruments and ground equipment. The carbon fibre structures of the European carrier rockets Ariane 5 and Vega are also made in Switzerland.

Thanks to their extensive expertise and technologies, Swiss aerospace companies are successful in commercial space projects outside of European markets too. In the aggregate, the members of Swiss Space Industries Group (SSIG) achieve an annual turnover of ca. CHF 260 million. This corresponds to approximately 85% of revenues of the entire Swiss sector. Of the over 900 people being employed in space-related organisations, the majority has above-average qualifications. Around the half of all employed manpower in space has a university degree.