AVISTRAT-CH

Total System Approach

A skyguide Proposal

"Aviation is a cornerstone of the Swiss economy and our country's ability to compete on the international market. In the time after COVID, this will become even more important, and it is therefore vital that we prepare our outdated airspace and associated (infra) structures for a sustainable future with the successful implementation of AVISTRAT."

(A. Bristol, CEO skyguide)

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TABLE OF CONTENT

TABLE OF FIGURES

1 About the document

1.1 Background

The AVISTRAT-CH programme delivered its Vision 2035 at the end of 2019. Skyguide has been designated as one of the internal architects to support the elaboration of the AVISTRAT-CH strategy.

1.2 Scope

The scope of this document is the AVISTRAT-CH programme covering all the domains of the Swiss aviation value chain.

1.3 Purpose

The purpose of this document is to propose strategic orientations that should be undertaken in order to guarantee a safe, efficient and sustainable Swiss aviation system.

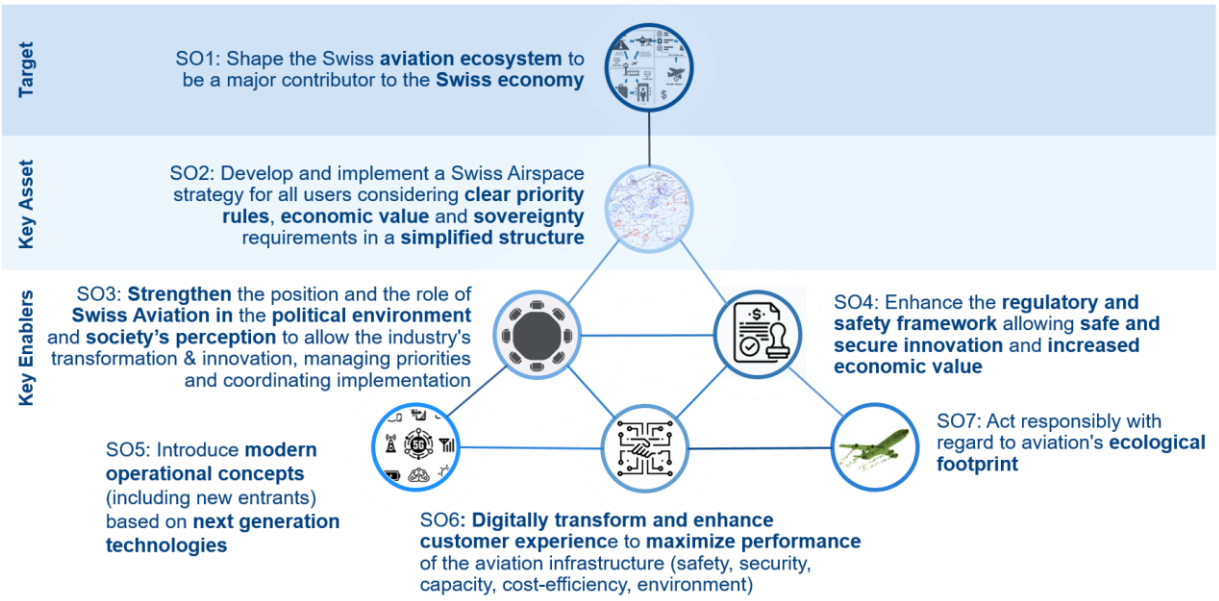
1.4 References

- Aviation Policy Report (Bericht über die Luftfahrtpolitik der Schweiz 2016)
- AVISTRAT-CH Vision 2035
- Skyguide Vision 2035
- Skyguide Strategy for Success 2020
- Skyguide OPS strategy
- An aviation strategy for Europe DEC 2015
- European Master Plan 2020
- European Drones outlook Study SESAR JU
- The European Green Deal 2019
- IATA Air Transport Competitiveness Index Report 2019 edition
- Monitoring der Wettbewerbsfähigkeit des Schweizer Luftverkehrs 2018
- Network Strategy Plan 2020-2029
- Commission Implementing Regulation (EU) No 716/2014 of 27 June 2014 Pilot Common Project
- Commission Implementing Regulation (EU) No 2019/123 ATM
- Eurocontrol Challenges of Growth 2018
- ICAO Technical Assembly WP Improving Just Culture 2016
- Advanced FUA Concept EUROCONTROL July 2015
- ICAO Seminar_ Aviation in Transition Session 5 Physical and Environmental Constraints Dr P Rochat March 2003
- The Swiss Aviation Ecosystem flying blind after 2030 BCG-Swiss American Chamber of Commerce-Oct 2018
- EU Better Regulation: Why and how?
- Airspace Usage Priorities (HLAPB-AMG document V2.0)
- Riga declaration on remotely piloted aircraft (drones) "framing the future of aviation" Riga - 6 March 2015
- NASA UAM Airspace Integrations Concepts and Considerations 2018
- Aviation Round Table Report on the recovery of European Aviation Nov 2020
- IATA Future of airlines industry 2035- 2018 edition
- SESAR Airspace Architecture Study

1.5 Document Change Record

Version	Date	Reason for changes	Author of changes
V1.0	21.12.2020	Released version	JH Rousseau

Skyguide Strategic Proposals Overview



2 Introduction

2.1 Setting the Scene

2.1.1 Economic Growth

The growth of the aviation industry is closely linked with economic growth.

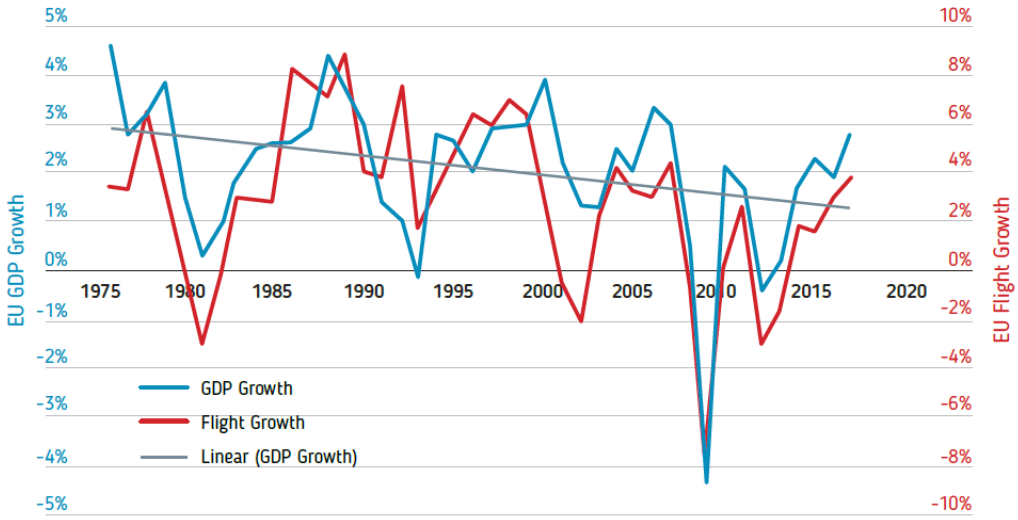


Figure 1: Correlation between Traffic and GDP in Europe[1]

The figure below show the GDP forecast for the next 20 years. This forecast was released before the COVID-19 pandemic.

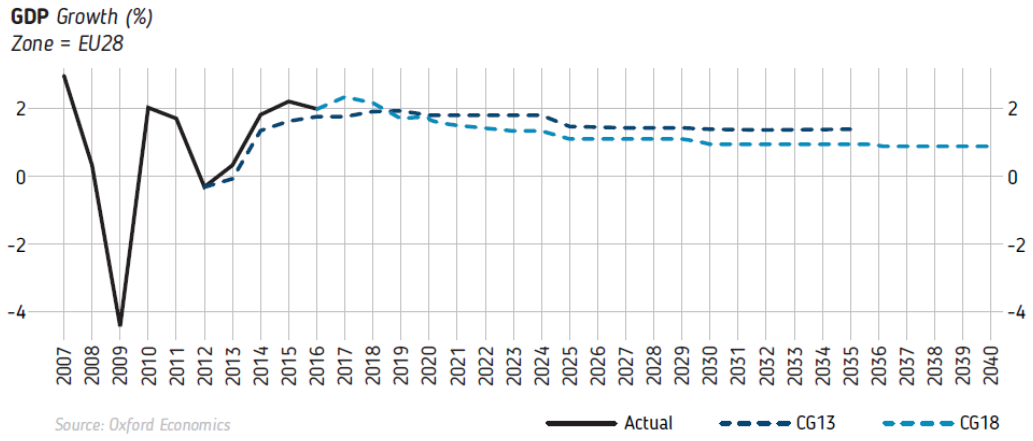


Figure 11 / *GDP growth forecast for EU28 has been revised downwards compared to CG13.*

Figure 2: GDP Forecast 2040[2]

[1] Eurocontrol Challenges of Growth 2018

[2] Eurocontrol Challenges of Growth 2018

2.1.2 Traffic Forecast

In its most likely scenario Eurocontrol forecasts an average annual growth rate of 1.4% for Switzerland (which is below the European AAGR of 1.9%). With a rate of 1.4% growth per annum, it is expected that there will be almost 1200 additional IFR flights per day.

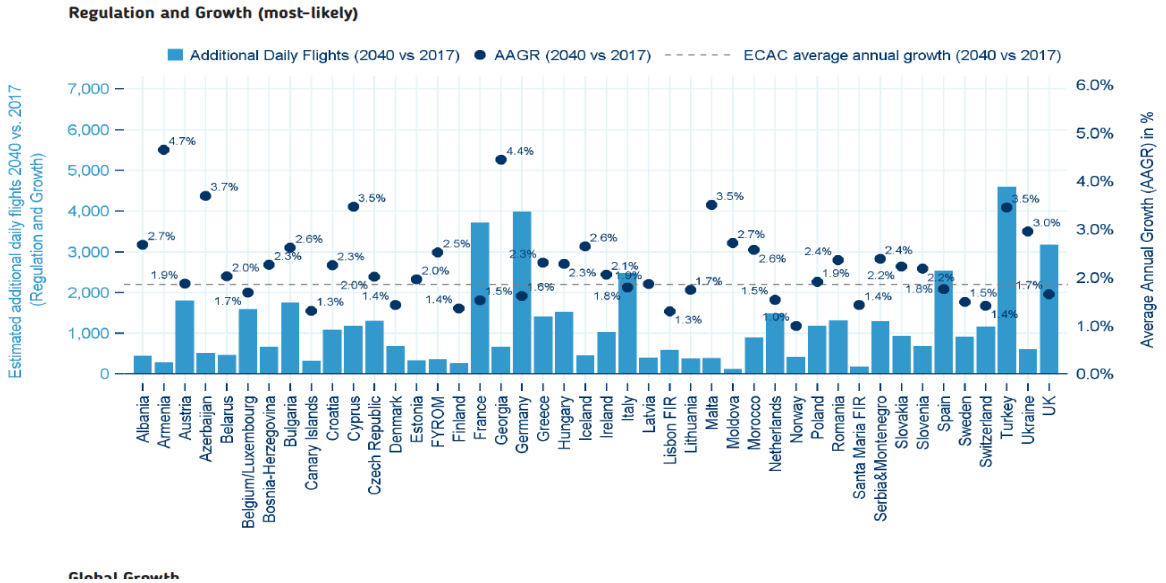


Figure 3: Traffic Growth Forecast 2040[3]

The challenges of such growth pushed the European Commission to elaborate and deliver an aviation strategy for Europe. Its main purposes are to identify and tackle the challenges undermining the industry's performance, while questioning the business models that have been adopted, and the regulatory framework that has been put in place.

The traffic growth forecast as depicted in the figure above has to be put in the current (COVID-19) context. The most recent 5-year forecast shows that in the most optimistic scenario traffic recovery will take place in 2024 (see below), whilst a lot of uncertainties remain on how traffic demand will grow.

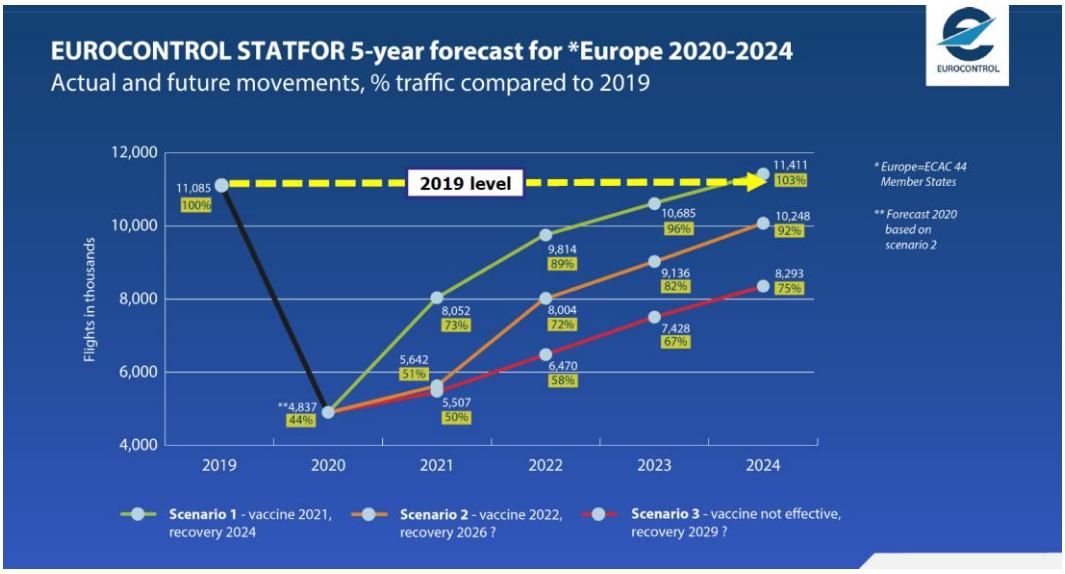


Figure 4: EUROCONTROL 5 years forecast Nov 2020

[3] Eurocontrol Challenges of Growth 2018

2.1.3 Climate neutral aviation

In order to reduce the risks and impacts of climate change, in 2016 the Federal Council signed the Paris Agreement's long-term temperature goal, limiting the increase in global average temperature to 1.5 °C above pre-industrial levels. In 2019, the Federal Council decided to set an even more ambitious target: for Switzerland to reduce its net carbon emissions to zero by 2050.

To achieve climate neutrality the European Green Deal sets out the need to reduce transport emissions by 90% by 2050 compared to 1990-levels. The aviation sector will have to contribute to the reduction.

Unfortunately, transport is the only sector in which emissions have grown since 1990. International aviation had the highest growth in energy consumption among the principal modes of transport between 1990 and 2017, rising by 106.8 %. All improvements deployed by aviation were offset by traffic growth.

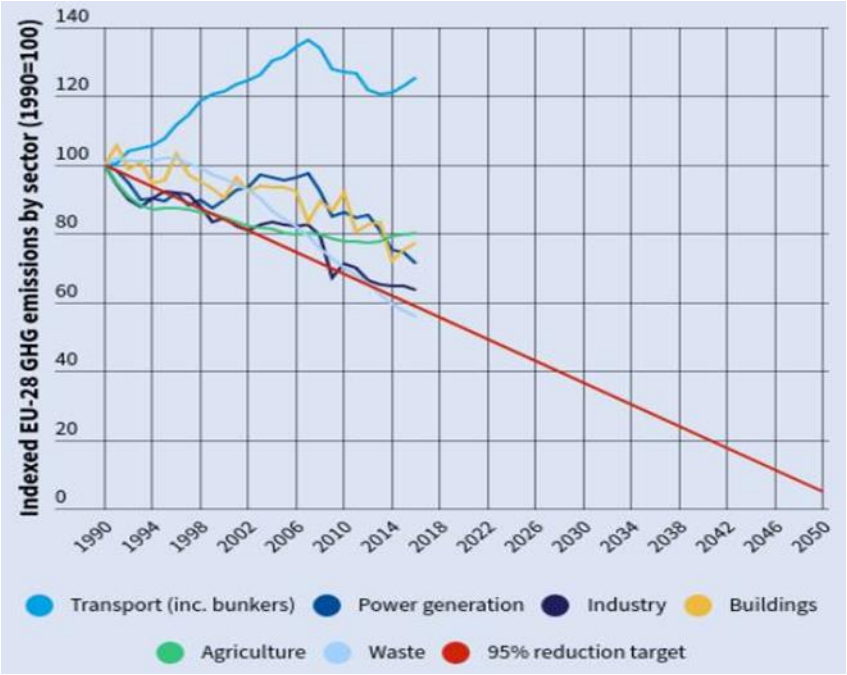


Figure 5 : Indexed evolutions of EU GHG emissions per sector (EU)[4]

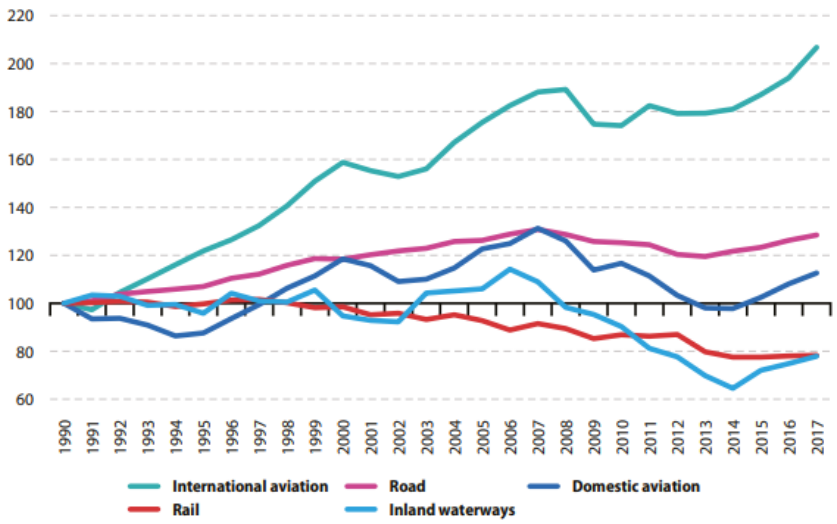


Figure 6 : Energy consumption by transport mode (EU)[5]

[4] Transport & Environment : CO2 emissions report

[5] Eurostat : Energy, transport and environment statistics

2.2 AVISTRAT-CH an opportunity

Switzerland is at the core of the European aviation network. The performance of its aviation industry is a key enabler of economic activity in Switzerland, supporting 207,000 jobs and contributing CHF 26.8 billion to the Swiss economy, which is equivalent to 4.1% of Swiss GDP[6]. IATA reports that Switzerland has the 10th highest level of air connectivity in Europe (measured by IATA Air Connectivity Index1). Air connectivity grew by 30% between 2013 and 2018. In 2017, 27.9 million passengers departed from Switzerland's airports. There were 54.9 million terminal passengers.

Since March 2020, the aviation industry is facing its most profound and unexpected crisis since the Second World War. The current pandemic crisis situation has put a halt to the continuous growth of air traffic the aviation industry has been facing over the last 10 years. When the AVISTRAT-CH initiative was launched, the challenges it planned to tackle were well known but now, with the COVID 19 crisis, even though these remain virtually the same, the priorities of the different stakeholders may be different. Some of them, end 2019, were talking about exponential growth and now, end 2020, are talking about survival. Even though the expectations are that commercial traffic will recover by 2024, the aviation industry may be somewhat different to what is now known in terms of market sharing, types of aircraft and the technological environment. It is worth mentioning that traffic recovery will happen in the European Green Deal context, meaning that the regulatory framework will evolve to ensure that aviation takes its share in the efforts of the States to reach Paris agreement's targets.

In its "Aviation Policy Report 2016", the Swiss Federal state stated that "*Civil aviation is of the utmost importance both for the population and for the economy. It is the duty of the federal government to create the necessary conditions for maintaining efficient and reliable international connections for Switzerland and ensuring a high level of safety and security. In its 2016 report, the Federal Council explains how the civil aviation environment has changed over the years and how it aims to ensure that the Swiss civil aviation sector can remain competitive. Here, for example, one of the policy measures envisaged by the Federal Council concerns the elimination of the existing capacity bottlenecks at the national airports in cooperation with the involved cantons. Furthermore, the report clearly identifies that "Swiss airspace should in principle be open to all users. However, since airspace is restricted, criteria, processes and priorities must be defined for its design and use within the framework of an airspace strategy. Simplification of the airspace structure must be strived for flexible airspace management and new technical tools can help to take the needs of all users into account. However, scheduled air traffic is a top priority, especially in the local control areas of national airports*"[7].

The AVISTRAT-CH initiative should prepare the Swiss Aviation system assuming that the aviation industry will recover. It is therefore expected that the trend of growing demand would regain momentum in the near future and will again face the pre-COVID 19 performance challenges.

Over the next fifteen years, the traditionally manned aviation transport of passengers and goods continues to exist next to the rapid development of unmanned aviation. The same applies to the technologies and operational concepts. Additionally, any development of the aviation system, at whatever level, is required to adequately address the environmental challenges.

AVISTRAT-CH is expected to support the development of the Swiss aviation system by putting in place the appropriate framework and playing field meeting the various stakeholders' requirements whilst supporting the sustainability and profitability of the aviation industry. It is also expected that the implementation of such a framework will likely need trade-offs to be made at political level.

[6] Source: IATA Switzerland Competitiveness Index Report 2019

[7] Extract from "Bericht der Luftfahrtpolitik der Schweiz 2016 (Lupo)

2.3 Methodology

Skyguide management already reflected on the future of the aviation industry.
In close cooperation with the DETEC, different strategic orientations were adopted accordingly.
Taking these into account and having a good understanding of the various needs and requirements of the different Swiss stakeholders, the elaboration of this document has been made by:

- Asking ourselves the following framing questions:
  - What are the drivers of change within the Swiss aviation system?
  - What could be the post COVID-19 options?
- Using the following methodology:

2.4 Challenges

The following challenges have been identified:

- Aviation is a global industry
- Single European Sky (SES) Performance and Charging Scheme framework
- Complexity of the airspace (due to different factors e.g. airspace dimensions, locations of international airports, numerous and various airspace users' needs, etc.)
- Multiple stakeholders with numerous and heterogeneous requirements
- Complex regulatory framework
- Digitalisation of the aviation industry
- Intelligent automation and Human Machine Collaboration
- Competitiveness of the Swiss aviation industry
- Managing uncertainty in a complex environment
- Climate change prompting new environmental trends
- Interdependencies among the different Key Performance areas of the Performance scheme
- Maintain safety and security trends in a complex, digital and automated environment
- Fair sharing of responsibilities and accountabilities among the different stakeholders in order to guarantee a safe, performing, sustainable and cost-efficient aviation industry whilst taking into account international regulations e.g. ICAO, EASA, European Commission, etc.
- On time delivery of required technologies
- Rulemaking falling radically behind technical developments
- Depletion of ATM/aviation expertise, resulting in huge inefficiency in rule making, concept developments and almost every facet of aviation business. Ultimately, this slows down the evolution and makes it more costly than what it would have been if supported timely and correctly with adequate expertise
- Business pressures, combined with the above-mentioned depletion are introducing safety risks already at the design and conceptual level

2.5 Assumptions

The following assumptions are made in order to develop the strategic orientation:

- Air Traffic will recover as forecast although one may expect that the type of air traffic distribution may be different (Short/Medium/Long haul flights, business flights, UAS, UAM, Cargo, etc.), and that 2024 may be optimistic with regard to new constraining environmental regulations as well as long-lasting economic uncertainties impacting both offer and demand.
- The aviation industry business models (Low Cost, Legacy, Hybrid, States ownership, etc.) will be similar to what is known in 2020.
- Role allocation among the different types of transport (Train, High Speed Trains, UAS, UAM, etc.) will be shifting (EC Green Deal, CH mobility sectorial plan 2050).
- Thanks to the development of the high speed train network, competition among airports will be increasing.
- Environmental challenges are higher than ever (Lobby groups pushing policy makers to take decisions which will require major transformation within the aviation industry).
- Digitalisation and automation is being rolled out and have led to:
    - increased leisure flights and volatile air traffic demand to access the airspace
    - less human intervention
    - increased availability of data (Big Data)
    - an updated regulatory framework
    - new requirements with regard to new cyber security concepts, framework, etc.
- Mobility will be constrained by environmental regulations, requirements, etc. (Taxation, etc.).
- Business models of airlines are being adapted (Point-to-point business model v/s Hub & Spoke)
- Increased requests to access the airspace from new customers (Drones, VLJs, Air Taxis, Low Flying Network, etc.), requiring a new approach to airspace management.
- Changing/evolving requests from legacy customers (Airlines, Military, Leisure flights, etc.).
- Switzerland continues to adopt and comply with international regulations.
- Growing requests in terms of "transparency" (Financial, Investment strategies, etc.) from the stakeholders.
- Fleet modernisation across Europe allowing implementation of up-to-date technologies.
- Trade-offs are made in the most sustainable way i.e. decisions are made taking into account all relevant aspects (safety, environmental/economic/financial impacts, performance, etc.).
- Price of oil remains at an "acceptable" level.

3 Context in 2035

2035 may seem a long way away but in fact it is closer that one might think. Fifteen years to bring major transformation in the aviation industry is very short given the highly regulated, and global environment it has to evolve in. Technology and new types of "flying objects" are pushing the industry to change at a faster pace. While the "legacy stakeholders" (Commercial airlines, Military aircraft , GAT flights, leisure flights, etc.) will try to guarantee their operations, profitability and sustainability, new types of stakeholders (Amazon, Alibaba, Google, Cargo Drones, Unmanned vehicles, Individual very light aircraft, air taxis, etc.) require major adaptation of the aviation industry legal, regulatory and "operational" environment. The aviation industry will have to be agile to cope with changing demands, more flexible to adapt to a complex and volatile environment, and sustainable in order to cope with the climate change challenges (while maintaining highest safety levels).

3.1 Trends impacting mobility and socio-political requirements

Environment	Social	Technology	Political	Economy
Climate change	Increasing demand for access to airspace	Digitalisation	More stringent regulatory requirements	Infectious disease and Pandemics
Environmental activism	Tailored services to meet user requirements	Automation	Privatisation of infrastructure	Price of oil
More stringent environmental targets	Terrorism	Cyber Security	Liberalisation of EU markets	Congestion at international airports
	Fear of travelling	New types of flying vehicles	Open data and transparency	Global recession
	Reduction of revenues (recession)	Alternative modes of transport	Decrease support for aviation industry in general but still strong support for systemically relevant/critical national infrastructure	Reduced demand (business and leisure travel)
	Business travels socially less accepted		Health issues rank higher on political agenda	Reduced offer (reduced fleet, load factor and connecting time)
	"Slow-travel and "Staycation"		Increased pressure on aviation to go greener	Green Taxes on flights
	Rejection of mass tourism			

Table 1: Identified drivers of change

1. Climate change: With the growing concerns about environment, one of the major trends that will shape our mobility needs is climate change, and the need to develop more sustainable means of transportation. With the adoption of the "Green Deal" at EU level, it is evident that a "greener" aviation is a prerequisite for traffic restart.
2. "Flygskam" (Flight shame): Flight shame has been a trend over the last years. Will it continue to grow or is it "fashion" therefore disappearing in the near future? Will it stay "regional" or will it grow globally? The flight shame movement needs to be monitored as it may impact demand, or redefine the need for greener means of transportation. (In 2035, young people who were in the streets in the late 2010's asking for more actions against climate change will have accessed decision-making positions).
3. Technology, digitalisation, automation will play a growing role in all the fields of society. With the advent of cutting edge technologies, one could imagine a more integrated approach to mobility.
4. While the pace of development of technology and innovation is growing together with increased pressure for more transparency, the challenges of maintaining a high level of security (especially cyber-security) and safety are also evolving accordingly.
5. Increasing demand to access the same Airspace at the same time may sometimes be contradictory and therefore impeding performance. This challenge has to be addressed when developing an Airspace Strategy at Swiss level especially in terms of Priority Rules (as define in the HLAPB-AMG Document Airspace Usage Priorities V2.0).
6. The increasing variety of services that have to be delivered (air policing, commercial aviation, unmanned systems, cargo drones, search and rescue, hospital flights, leisure, training, etc.) lead to a more complex environment.
7. Increasing and more stringent regulatory requirements will be required to manage the new technologies being made available, automation development and digitalisation/virtualisation. The regulatory framework will have to evolve to meet new requirements of stakeholders, and support the transformation of the aviation industry within the required implementation timeframe.
8. Terrorism, warfare: has severely impacted the aviation industry since the beginning of the century. Each time it took several years to recover from these dramatic events. It is considered that this threat will remain and the associated risk will remain high over the next fifteen years.
9. Liberalisation of internal EU markets: the European Commission "Aviation Strategy for Europe" clearly identifies that "*EU's liberalisation of the internal market for air services and the substantial growth of demand in air transport within the EU and worldwide, have resulted in the significant development of the European aviation sector*[8]" and states that "*the goal of this Aviation Strategy is to strengthen the competitiveness and sustainability of the entire EU air transport value network*." The liberalisation of the EU market brings more competition and will be faced with new competitors (coming from outside of EU).
10. Growing competition among states, airports, airlines, high speed trains, etc.
11. Infectious disease and pandemics. In the past, pandemics had local or regional impacts on the aviation industry. COVID-19 showed that it can also be global. The probability to be faced with another COVID type pandemic is not yet known but we have to be prepared as the risk is now identified.
12. Congestion at international airports and meeting demand during peak hours.

[8] Reference. EC An Aviation Strategy for Europe 2015

3.2 Trends Impact Assessment

Trend Impact assessment				
Trend	**Risk (Severity of impact)**	**Probability**	**Possible Impact**	**Remark**
1. Climate change	Medium	High	Environmental aspects driving the aviation industry. May severely impact profitability	Here we are considering the required adaptation to climate change. Resilience of the system will be key
2. "Flygskam" development	High	High	The movement will remain local/regional but may lead to other types of movements that could be more radical	Will require a change in Aviation communication strategy. Consider how this impact performance?
3. Development of technology, digitalisation and automation driving the transformation of the aviation industry	Medium	High	New technologies will require major transformation of the aviation industry	Aviation industry will be more data and technology driven
4. Security requirements	High	High	With the development of new technologies supported by opened architectures. Security aspects will be at the core of the aviation industry	Air-policing, sovereignty aspects, data exchange
5. Increasing demand to access Swiss airspace	High	High	Requirement to review conditions to access Swiss airspace for the users	Reviewed airspace classifications, airspace management, priority rules, etc.
6. Increasing variety of services to be managed	High	High	Increase in complexity impairing performance of the system	Different levels of service per area of airspace and capability-based segmentation
7. Increasing regulatory requirements	High	High	Risk to lead to over regulation impairing system performance and driving cost of oversight	Speed to adapt to change may suffer, innovation cannot be deployed to full benefit due to lack of/or too stringent regulatory requirements
8. War, Terrorism	High	High	Aviation being a global industry any war or terrorist attack will severely impact the aviation industry	Resilience, adaptability, service and business continuity, air policing and air defence
9. Liberalisation of EU markets	High	High	Growing competition from inside and outside Europe. Endangering sustainability of Swiss aviation industry	Number of service providers may increase and necessity for State's oversight

Trend	Risk (Severity of impact)	Probability	Possible Impact	Remark
10. Growing competition among airports, airlines, etc.	Medium	High	Switzerland has one of the highest level of airport and passenger charges and taxes in Europe (6th most expensive in 2019[9])	Increase connectivity to the Swiss international airports locally but also regionally (cross-border). This would require improved cooperation among neighbouring countries.
11. Pandemics	High	High	COVID-19 showed that such global pandemics may transform severely the whole aviation value chain globally	Lessons learnt and develop resilient strategies
12. Airport Capacity	High	High	Zurich and Geneva airports are reaching their capacity limits. If measures are not taken, around 6% of demand will be left unaccommodated[10]	Measures to decrease complexity and increase capacity have to be put in place especially during peak hours (E.g. a possible measure could be to have differential airport charges during peak hours in order to flatten demand over day). Airport regulation schemes should be adapted to support the airports' system performance while balancing the environmental impact.

Table 2: Trends Impact assessment

[9] IATA Air Transport Regulatory Competitiveness Indicators 2019 Edition

[10] EUROCONTROL Challenges for Growth 2018 edition

4 The Swiss aviation ecosystem

"Aviation is a cornerstone of the Swiss economy and our country's ability to compete on the international market. In the time after COVID, this will become even more important, and it is therefore vital that we prepare our outdated airspace and associated (infra) structures for a sustainable future with the successful implementation of AVISTRAT." (A. Bristol CEO Skyguide)

A business ecosystem is the network of organizations—including suppliers, distributors, customers, competitors, government agencies, and so on—involved in the delivery of a specific product or service through both competition and cooperation. The idea is that each entity in the ecosystem affects and is affected by the others, creating a constantly evolving relationship in which each entity must be flexible and adaptable in order to survive as in a biological ecosystem (Ref Investopedia).

As already mentioned in Section 2, Switzerland has the 10th highest level of air connectivity in Europe. The air connectivity grew by 30% between 2013 and 2018. In 2017, 27.9 million passengers departed from Switzerland's airports. There were 54.9 million terminal passengers.

The aviation industry is a key enabler to the Swiss economic activity. It supports 207,000 jobs and contributes CHF 26.8 billion to the Swiss economy[11].

"*The mounting demand for air transport combined with a looming capacity shortage in Switzerland's national airports have created an urgent need for action. Operating improvements are required immediately in order to sustain functionality. These include investments in the infrastructure at all airports as well as potential relocation of some general aviation from national airports to regional (and other) airports. In addition, it is imperative that work begin on a long-term strategy for Swiss aviation—built on reconfirmation of the importance of the aviation ecosystem to Switzerland's economy and location attractiveness. The formulation of a national aviation strategy has long been obstructed by political deadlock and lack of clarity on the federal government's responsibility for defining a sustainable long-term view.*[12]"

It is assumed that the traffic level will reach pre-COVID level within 5 years. It is crucial to ensure that planned strategic investments are performed and not delayed. Any delay in those investments may put the Swiss Aviation industry competitiveness at risk. Moreover, setting the appropriate financial and regulatory frameworks will be key to a successful AVISTRAT-CH implementation. The adoption of innovative financial instruments will support a balanced approach to securing the benefits of aviation and contribute to long-term economic growth, thus benefiting the global Swiss economy.

In short, the proper financing of its infrastructure is paramount to safeguard its performance while addressing the social-political needs.

In order to accommodate the future growth of traffic, the new entrants, the required technological leap and the impact of climate change, it is important that the Swiss State develop a state-of-the-art and resilient aviation infrastructure.

To be able to achieve such goals it is important to:

- Adapt the current financial framework (mainly driven at European level through the SES Financial Scheme) so that it:
  - allows key stakeholders to have access to financial support that is available at EU level or, if not possible, establish financial arrangements at Swiss level (currently it is difficult for Swiss aviation stakeholders to get funding from the EU to support implementation of Next Gen technologies which leads to a "competition bias"),
  - enables the implementation of Next Gen technologies, Digital transformation (Advanced Automation supported by AI), location independent, cloud-based, auxiliary services,
  - supports innovation and R&D (e.g. SESAR),
  - allows to implement innovative financial instruments such as User Pay Principle, Best-Equipped-Best Served, Differential Pricing, Subsidies, etc.),
  - addresses the trade-offs that are to be made (Economic, Environment, Socio-political needs, etc.),
  - adopt best practices from partnerships and benchmarks.
- Develop a Swiss strategy addressing the financing of the aviation infrastructure and services (with its associated roadmap)
- Establish an aviation steering body to manage priorities and roadmap
- Develop aviation knowledge and competences across the Swiss educational system

[11] IATA Air Transport Regulatory Competitiveness Indicators Report 2019

[12] BCG The Swiss Aviation Ecosystem Flying Blind after 2030

5 Safety and Security

5.1 Introduction

Safety in the aviation industry is paramount. Any failure in the safety chain will impact all the benefits that can be derived directly, and indirectly, from the industry. It is therefore extremely important that all stakeholders involved in the value chain, tackle the safety aspects at all levels with the appropriate priority and seriousness. Delivering a safe aviation system should be top priority, and should be shared amongst all.

In order to maintain the highest level of safety, whilst embracing all the changes and challenges ahead, the following is proposed:

- Safety aspects should be dealt with at the level of the entire aviation system. The process should involve all the relevant stakeholders in order to integrate the results of the respective safety activities.
- Clear accountabilities and responsibilities (of all the actors) should be defined. The FOCA has to play a leading role in establishing risk-sharing mechanisms (e.g. total system approach to Safety as modelled at Schiphol airport). This will support the development of effective safety processes that can be applied by all stakeholders.
- A target level of Safety for the entire aviation system shall be defined. This means that a holistic approach to safety should be developed and implemented taking into account all the Key Performance Indicators of the aviation value chain. As such, if trade-offs have to be made, the Swiss state has to play a leading role, especially in its policy-making role.
- The digitalization and the development of Artificial Intelligence will impact our approach to safety, as the current safety system is human centred. It is important to tackle this aspect in the future developments of safety processes and concepts (e.g. shared database for all aviation stakeholders).

Moreover a healthy safety culture goes hand in hand with Just Culture. Just Culture is "a culture, in which front-line operators or other persons, are not punished for actions, omissions or decisions taken by them that are commensurate with their experience and training, but in which gross negligence, wilful violations and destructive acts are not tolerated."

Just Culture means openly reporting and discussing safety issues and mistakes, without punitive response, while also accepting and consistently enforcing the principle that individuals must be held to account for malicious actions. A Just Culture recognizes that an employee's intent is critical to properly evaluating safety performance. All staff are responsible for acting safely and in a manner which is commensurate with their training, experience, and the professional standards expected in their job. They adhere to written procedures unless, in the clear interest of safety, it is necessary to deviate from these procedures. Where such deviation is required, staff will be given full and fair opportunity to account for their actions[13].

It is therefore important that aviation organisations adopt Just Culture policies that would maintain high safety standards and culture across the whole aviation system.

Maintaining the highest level of security is key for the aviation industry. Any failure in security will severely impact its performance, and recovery is always difficult and uncertain as it is clearly link with trust into the system.

Therefore, it is crucial to develop a security plan at national level incorporating the aviation industry requirements in terms of data security, air policing, cyber security, etc. while taking into account the sovereignty and performance aspects of the whole aviation system. And given the global nature of aviation, it is also important to engage at International and European levels to ensure alignment with global standards.

[13] ICAO Technical Assembly WP_Improving Just Culture_2016

5.2 Proposals

The following proposals are made:

- Implement Safety Targets for the whole aviation system
  - Total System Approach to Safety: Safety aspects should be dealt with at the level of the entire aviation system. In order to integrate the results of the respective safety activities, the process should involve all the relevant stakeholders to avoid gaps between the different safety systems currently in place, and align the stakeholders involved in the safety chain.
  - A Swiss safety plan must be developed at system level in order to foster the overall consistency amongst all stakeholders.
  - The Target Safety levels should be agreed by all stakeholders.
  - Clear Accountabilities and Responsibilities have to be defined.
  - FOCA has to play a leading role to establish risk-sharing mechanisms.
  - Just Culture should be included in the Total System Approach.
- Total system approach to security
  - Develop a national security plan involving major aviation stakeholders.
  - Set target levels that are realistic and transparent considering local/regional constraints, interdependencies and socio-political requirements through appropriate CDM process.
  - Develop a set of guidelines and procedures that could be easily implemented in case of security breaches. (Considering development of new technologies, new aerial vehicles, automation, A.I. etc.).
  - Address sovereignty aspects (e.g. air policing), conditions to access data, level of transparency (at users level only or down to public level?).

6 Aviation System Performance

6.1 Key Elements of the aviation infrastructure

6.1.1 Airspace

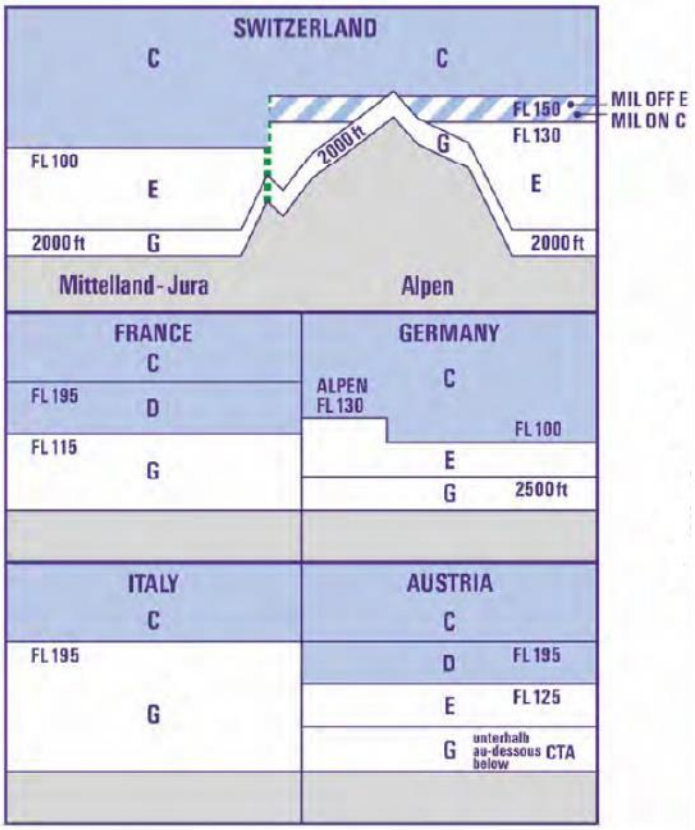


Figure 7: Swiss Airspace Vertical Cut vs neighbouring countries

AVISTRAT-CH should address the following main challenges:

- Complexity and fragmentation of the airspace
- Accessibility to the airspace (application of the A-FUA principles)
- Inclusion of U-Space and the opening of service provision to competition
- Inclusion of Low Flight Network, IFR flights at hospitals and military facilities
- Cross-border airspace (especially around international airports)
- Provision of ATS services to cope with multiple and heterogeneous Airspace Users (AUs) requirements (MIL, UAS; Leisure flights, manned/autonomous drones, etc.)
- Integration of concepts like self-separation, 4D trajectory, tailored service delivery, free route, PBN, etc.
- Priority setting among the increasing amount of AUs
- Changes in ground infrastructure (Drone ports, Heliports, etc.)
- Shifting from reactive to proactive airspace management
- International airports capacity challenges

Taking into account the above mentioned challenges, it is recommended to:

- Develop a strong HLAPB acting according EU regulations and HALPB Switzerland mandate (e.g. Priority Setting, Inclusion of new airspace users' requirements, etc.)
- Further develop and establish the Airspace Management Cell in terms of scope, accountabilities and responsibilities in terms of Airspace Management (e.g. collaborative decision making etc.) as the executive body of the HLAPB
- Simplify and "modernise" the airspace structure by:
  - Reviewing the airspace classification in use (e.g. segregation of the various activities, clear rules and responsibilities associated to the different segregated areas if implemented)
  - Adapting airspace design to the AUs requirements
  - Introducing new concepts like dynamic sectorisation, VPAs (Variable Profile Areas), etc.
  - Establishing close collaboration with neighbouring states to address cross-border aspects
  - Establishing close collaboration with FABEC states and MUAC
  - Establishing airspace configurations that would support A-FUA. Airspace Configurations are aimed at responding to and balancing performance driven strategic objectives (capacity, flexibility, flight efficiency, mission effectiveness, environmental) at all levels, network, sub-regional and local. In specific, the Airspace Configurations will be supported by:
    - Extensive use of Free Route Airspace in significant parts of the airspace, dynamically defined, where flights are not constrained by any route structure,
    - Provisions for dynamic and pro-active sector management, based on multi-sector planning of sector families, not limited to a local ATS unit,
    - Dynamic sectorisation will support the accommodation of short-term changes, help ensure the network-FRA/sectors consistency, and provide a mechanism to alleviate critical ACC sectors when and where necessary.
  - Introduction of mechanisms allowing the definition and use of flexible, ad hoc, reserved/segregated airspace structures within a given Airspace Configuration, based on the concept of Variable Profile Areas (VPAs) as described in the SESAR Step 1 documents and possibly on dynamic mobile areas in the longer term[14]
- Implement Enhanced Airspace Management by:
  - Establishing Swiss-wide Collaborative Decision Making (CDM) process (all ASM levels) with all relevant stakeholders involved. Implementation of an enhanced collaboration process at international, and national levels, with airports, airlines, regulators, the Swiss Air Force and the broader network (Total System Approach) focused on optimising capacity in the controlled airspace (e.g. with Network Manager, ANSPs, AOs and CFSPs)
  - Implementing Advanced FUA through Dynamic ASM and real time exchange ASM, dynamic sectorisation, development of local and sub-regional ASM tools
  - Refine (and implement) existing Airspace Usage Priority rules to access the airspace structure
  - Develop and implement airspace booking systems that can be made visible to all the airspace users
  - Implementing, at least, Interoperable Systems or eventually, fully integrated systems
  - Adapting Regulatory requirements to support the implementation of new concepts (e.g. Virtual Centres, Self-separation, Air Traffic Managers instead of Air Traffic Controllers, etc.) and tools (Automation, Advanced Conflict Detection tools, etc.)
  - Addressing cross-border aspects of airspace management
- Consider using secondary and tertiary airports to address capacity and environmental constraints at International airports. These could be a good solution whenever hubs are close to saturation or whenever business models of airlines may require such development (new intermodal connections)

[14] Advanced FUA Concept EUROCONTROL July 2015

6.1.2 Airports and Aerodromes

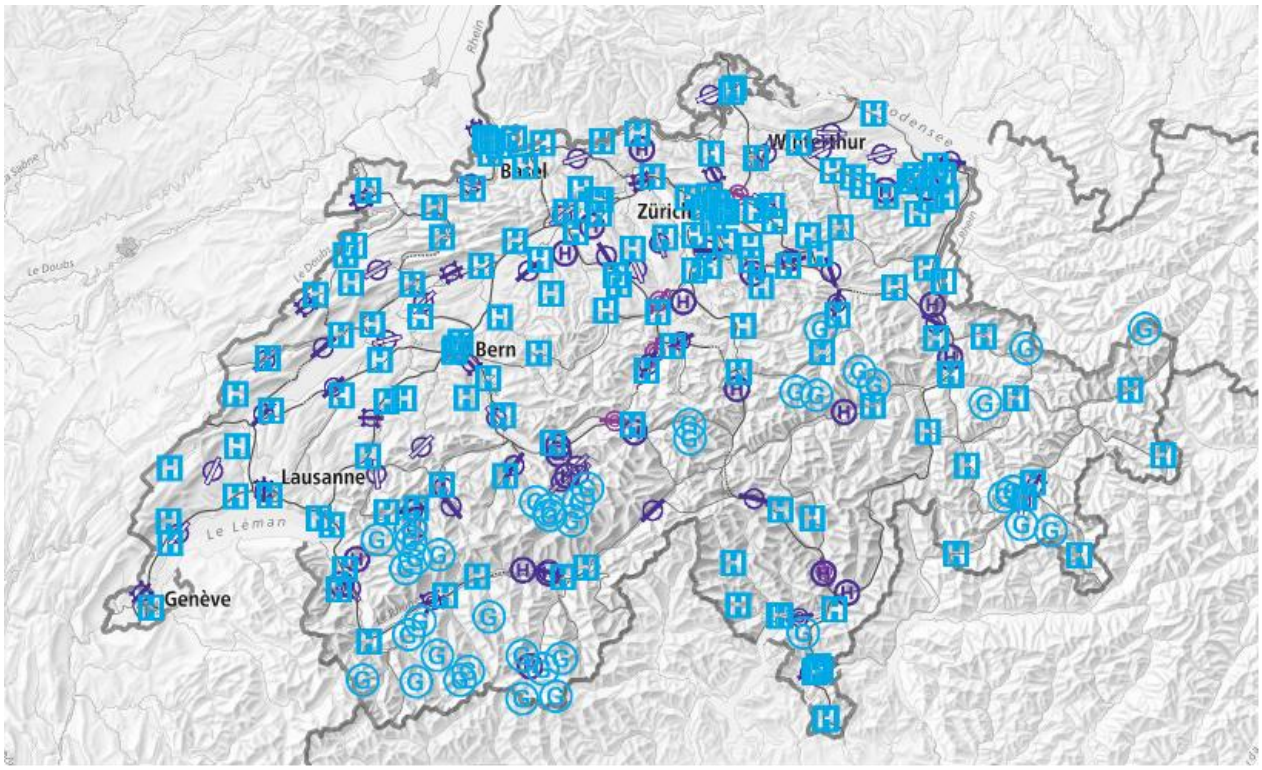


Figure 8: Switzerland Airports, Aerodromes, Heliports, etc.

The figure above depicts all the ground infrastructure already available to the Swiss Airspace Users. Given the variety of services that have to be provided, the operations involved, the challenges that are at stake, it is important to differentiate between:

- International airports
- Regional aerodromes
- Heliports, Mountain landing sites, Hospital landing sites, etc.

6.1.2.1 International Airports

International airports are key to the Swiss economy and important in terms of mobility[15]. This means that, from an operational viewpoint, their ability to deliver the optimum capacity at all times (especially during peak hours and during adverse weather conditions) is crucial. Additionally, it is as important to address the political and environmental constraints around the international airports.

It is crucial to:

- Guarantee political support to address the cross-border and environmental aspects impacting the international airports' performance
- Establish a platform to institutionalize dialogue among the politicians, the local community representatives and citizen organizations leading to broadening the dialogue and to covering simultaneously the three pillars of sustainability (environmental constraints, economic benefits and social progress) so that airport neighbours do not only experience the negative but also the positive elements of living close to an airport[16]
- Define financial mechanisms that would address capacity gaps during peak hours (e.g. differential airports charges to flatten demand)
- Maintain and strengthen CDM platforms, including all major stakeholders involved at airport level, to develop operational measures improving airport performance and resilience (e.g. specific measures for adverse weather conditions, low visibility procedures, business continuity procedures, etc.)

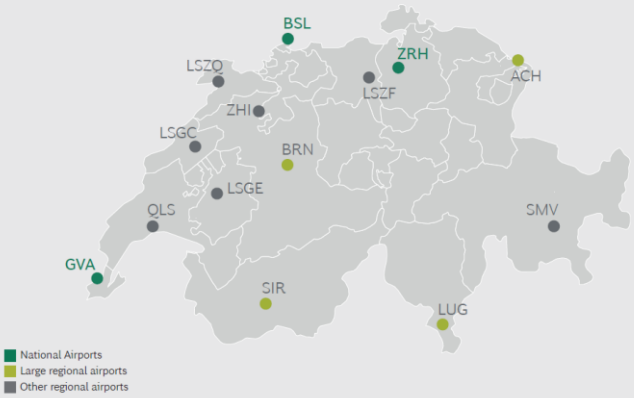
[15] "Bericht der Luftfahrtpolitik der Schweiz 2016 (Lupo)

[16] ICAO Seminar_ Aviation in Transition_Session 5_Physical and Environmental Constraints_Dr P Rochat_March 2003

- Improve the airspace design structure around Geneva and Zürich, in close cooperation with the major stakeholders (cross-border constraints, flows' segregation, optimised runway configurations, airspace classification, SID and STAR of the TMAs have been optimised in a manner to reduce ATCO intervention, visual pollution, noise and fuel consumption, etc.)
- Implement new concepts and technologies contributing to enhanced airport performance (e.g. PBN, AMAN, XMAN, DMAN, A-SMGCS, digital towers, reduced separation to allow higher capacity, etc.) while reducing the environmental impact
- Develop and implement concepts that will bring more resilience into the system (e.g. AOP/APOC, dynamic conditional routings in case of bad weather)
- Address challenges linked with UAM developments

6.1.2.2 Regional Airports, Aerodromes, Heliports, etc.

EXHIBIT 2 | The Swiss Air Transportation System Contains Three National Airports and Eleven Regional Airports



National airports	Passengers (millions)	Total (%)	Freight (kilotons)	Total (%)	Number of Destinations	Movements[1] (thousands)
BSL: Basel (BS)	7.9	14.3	112	16.2	85	96
GVA: Geneva (GE)	17.4	31.5	89	12.9	158	191
ZRH: Zurich (ZH)	29.4	53.2	491	70.9	189	270

Large regional airports	Passengers (thousands)					
ACH: St. Gallen–Altenrhein (SG)	125	0.2	NA	NA	3	29
BRN: Bern Belp (BE)	183	0.3	NA	NA	22	48
LUG: Lugano (TI)	144	0.3	NA	NA	8	19
SIR: Sion (VS)	32	0.1	NA	NA	11	42

Other regional airports	Passengers (thousands)					
LSGC: Les Eplatures (NE)	6	0.0	NA	NA	NA	11
LSGE: Ecuvillens (FR)	11	0.0	NA	NA	NA	15
LSZF: Birrfeld (AG)	14	0.0	NA	NA	NA	66
LSZQ: Bressaucourt (JU)	6	0.0	NA	NA	NA	8
QLS: Lausanne Blécherette (VD)	3	0.0	NA	NA	NA	39
SMV: Samedan (GR)	11	0.0	NA	NA	NA	16
ZHI: Grenchen (SO)	59	0.1	NA	NA	NA	69

Sources: Aerosuisse, Vademecum, 2018; OAG Analyzer; EuroAirport press release, January 18, 2018; annual reports from the Sion Airport, Lugano Airport, Bern Airport, and St. Gallen–Altenrhein Airport.
Note: Information on national airports is current as of 2017; information on regional airports is current as of 2014. Any apparent discrepancies in calculations are due to rounding.
[1]Movements are the number of takeoffs and landings.
NA = not available.

Figure 9: The Swiss Aviation Eco System[17]

(Note: Not all regional airports listed above are managed by skyguide.
LSGE, LSZF, LSZQ, QLS: all have no ANS services and are therefore not under skyguide managerial control.
LSZC (Buochs) is missing. But this is a regional airport as well.
Categories of airports: CAT I airports = ZRH & GVA, CAT II airports (regional airports with ANS) are LSZB, LSZG, LSZC, LSZA, LSZR, LSGC, LSGS and LSMV (not skyguide) but all of these CAT II airports receive state subsidy (BV87). All other regional airports, which are uncontrolled, meaning having no ANS services at all, are a separate category of airports (CAT 0) and not under skyguide managerial control.

[17] BCG The Swiss Aviation Ecosystem Flying blind after 2030

The above picture indicates that from a national perspective, in regard to the economic perspective, the role played by the regional airports is low. However, from a regional perspective this may be different given that in the above picture, General Aviation (GA) is not part of the figures.

The contribution of GA to the Swiss Aviation industry is an important element for the regional airports as, not only is it an important source of income, they provide direct access to key Swiss industries, they contribute to support the development of local communities (e.g. leisure flights, high-end tourism), they provide up to date facilities for training of future pilots, etc. However, most of them face the challenge of economic and environmental sustainability.

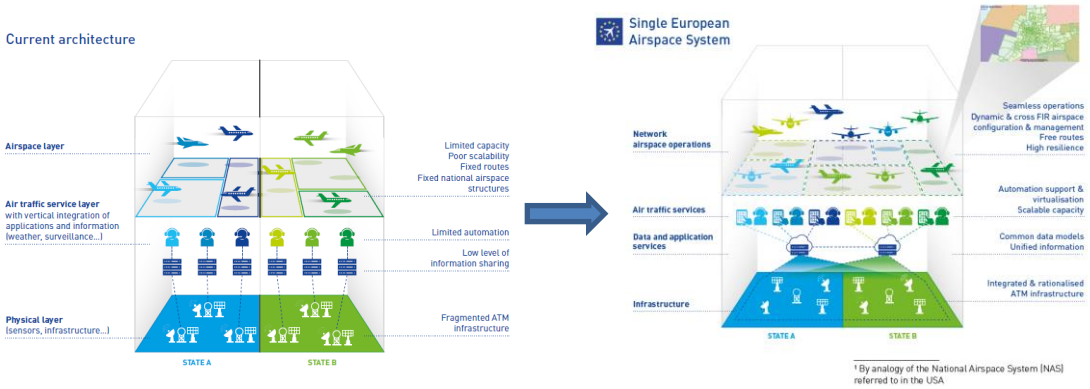
It is expected that regional aerodromes (or any other landings sites as depicted in the figure above) will deliver more and more different types of services, to different types of airspace users. This means the access to these facilities, and to the relevant airspace to support their operations, is crucial. However, the growing multiplicity of airspace users, and their associated heterogeneous needs, makes it even more complex and challenging to deliver safe performing, and cost-efficient services.

Given the already highly developed regional airfields infrastructure, it is important to:

- Make best use of the available regional airports infrastructure, while identifying possible synergies to make economies of scale
- Address which airports have to deliver ATS services, and which not, based on objective criteria defined and agreed at State level (FOCA)
- Develop and implement a lower airspace concept supporting the development of GAT, Drones, etc. while delivering tailored services to the regional airports airspace users
- Define a sustainable solution for the future financing of Switzerland’s regional airports. The FOCA should define the Swiss Confederation’s interests in the country’s regional airports. (Grimsel Workshop)
- Outsource technical installations to the regional airports, along with the introduction of new lower-cost technologies in the network and radar fields
- Removal certain navigation facilities to further reduce costs
- Implement tailor-made services at specific aerodromes
- Continue to lower the costs, through the appropriate CDM process, wherever possible and where it makes sense by:
  - getting rid of ground based NAV infrastructure and transition to PBN
  - eliminating seldom used IFP's and keep only what is really necessary
  - improving airspace design in a way to only protect what is really necessary
  - reviewing airspace classification usage in accordance to users' requirements

6.1.3 SESAR Airspace Architecture Study

The future developments of the Swiss airspace should take into account the proposals made in the SESAR Airspace Architecture study.



A key enabler for the proposed target architecture is the optimisation of the airspace organisation across the network supported by operational harmonisation where important quick wins can be achieved. Furthermore, in order to ensure that in the longer term capacity can keep up with demand it is necessary to decouple airspace from service provision to enable new collaborative approaches for the provision of ATM

The Proposal

The proposed Single European Airspace System:

- Is an evolution of the European airspace architecture that leverages modern technologies to decouple the service provision from the local infrastructure.
- Increases progressively the level of collaboration and automation support through a data rich and cyber-secured connected ecosystem.
- Respects the sovereignty of Member States in relation to their airspace.
- Optimises airspace configuration and design from a European network point of view, connecting airports and taking due consideration of major traffic flows across Europe.
- Supports trusted users of data feed advanced air traffic control tools, allowing operational harmonisation and bringing the level of performance of each control centre to that of today's top 10% -20% performers.

Characteristics of the proposal:

The airspace architecture study proposes a progressive transition strategy towards the Single European Airspace System in three 5 year-periods:

- By 2025, in addition to the already planned roll-out of first SESAR results, new programmes on airspace re-configuration and operational excellence have delivered quick wins. Regulation has evolved to support the transition ahead;
- By 2030, the implementation of the next generation of SESAR technologies should be completed with the roll-out of virtualisation techniques and dynamic airspace configuration, supported by the gradual introduction of higher levels of automation support. The new architecture should enable resources (including data) to be shared across the network supporting a flexible and seamless civil/military coordination allowing for more scalable and resilient service delivery to all airspace users;
- By 2035, the network should operate at its optimum capability having fully evolved from a system based on punctuality to a system based on predictability across a network that can safely and effectively accommodate 16 million flights (+50% compared to 2017).

6.1.4 Proposed future operational concept

Taking the above into account, the proposed operational concept is visualised in Figure 10 below, based on 10 key elements. The graphic illustrates a concept that is reliant on automation as well as harmonisation of key ATM system components at both a national and international level.

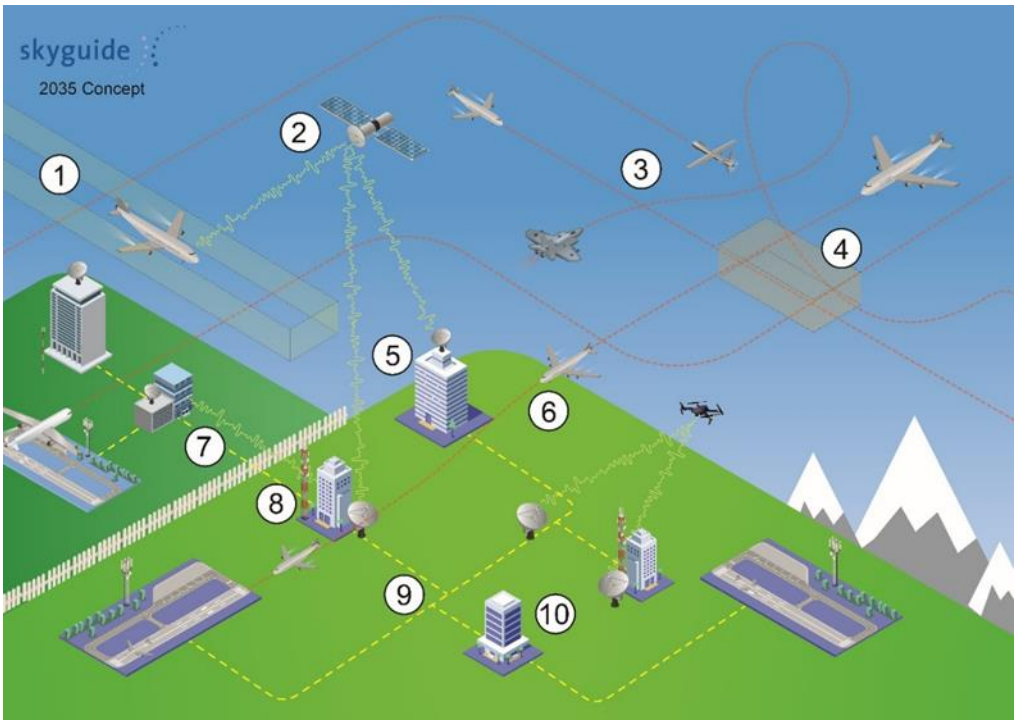


Figure 10: Proposed operational concept

1 Differential services tailored to customer demands (best equipped – best served)
2 Real-time data capture achieved through satellite-based technologies and advanced aircraft surveillance equipment
3 Advanced Flexible Use of Airspace implemented to enable seamless integration of the civil and military airspaces as well as unmanned aircraft
4 Trajectory de-confliction is automated using AI based technologies, maximising the efficiency of airspace capacity
5 Data centres in place to store and distribute aviation data as well as develop future automation technologies
6 Automated separation management in place
7 Relationships forged with neighbouring ANSPs to enable data exchange and better airspace management
8 Virtual centres implemented to enable location-independent control of airspace under skyguide control
9 ATM infrastructure interconnected with diverse network connections to enable a total system approach (one sky by one system)
10 Advanced technologies (such as digital tower technologies) implemented for ATM service delivery

6.1.5 Technical infrastructure (Communication, Navigation and Surveillance)

The technical infrastructure should evolve to support the development and implementation of new concepts (location independence, PBN, U-Space, L-Space, etc.), new technologies (drones, GBAS, Data and application services, etc.) and digitalisation (moving from physical assets to delivery of services) while addressing aspects such as, amongst others, costs, safety, cyber-security and required changes to the regulatory framework.

It is necessary to develop a CNS strategy at Swiss level that will:

- Be a performance based CNS approach (allows the evolution from a system/technology based operations towards the delivery of performance-based services). "*This approach enables airspace users to rationalise airborne systems by customising the required airborne equipage to their aircraft, taking into account their operation models"*[18]*.*
- Make use of the infrastructure in an integrated way i.e. combining satellite, airborne and ground-based CNS.
- Identify synergies to optimise the network (e.g. CIV/MIL infrastructure).
- Deploy and implement Airspace Management Systems, locally developed and ensure their interoperability with NM systems.
- Contribute to a safe, secure and resilient CNS infrastructure.

[18] EATM master Plan 2020

6.1.6 U-Space, Drones, and UAM

Given the growing importance of drones (and associated spin-offs), it rightfully needs a dedicated section, as their development will impact the aviation system performance, and will induce a major transformation of the aviation landscape.

The overall concept of transport, not only air transport, is changing. Since its beginning aviation was not only about transport; with the 4th and looming 5th technological revolution, the variety of usage, type of operations, locations of operations, speeds, performances, sizes of users are reaching a level of diversity and complexity beyond what was even imaginable a decade ago. They are major disruptors requiring a new holistic approach to managing and regulating the whole aviation system.

The Swiss UTM ecosystem is depicted as follows:

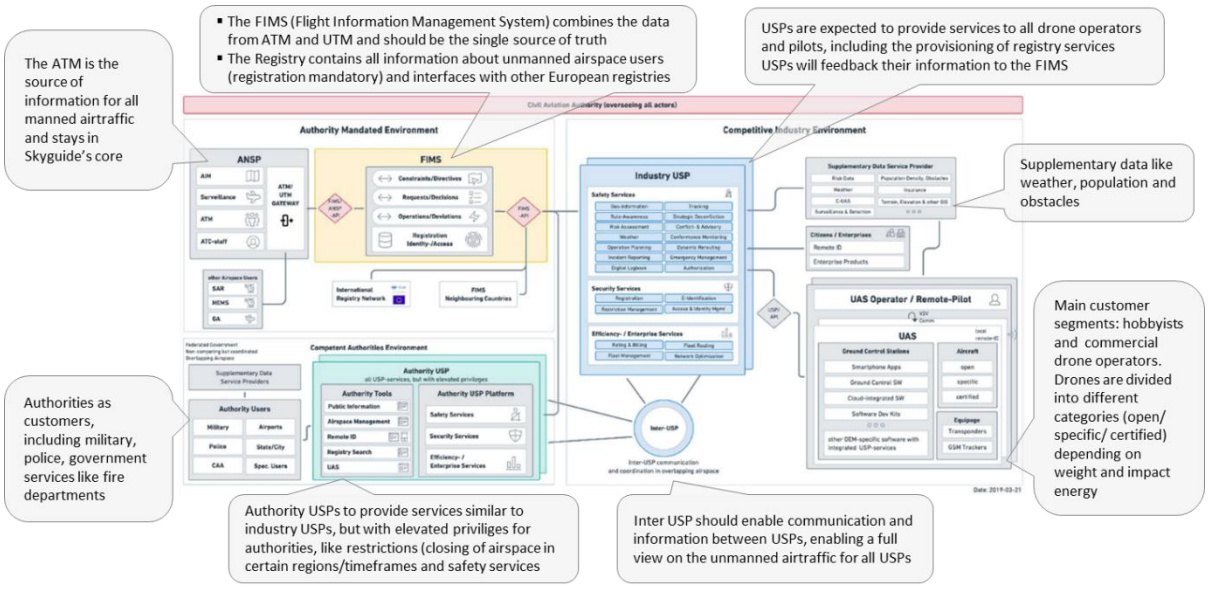


Figure 11: Swiss UTM Ecosystem

The figure above shows the complexity of the system. On one side a monopolistic environment, and on the other side a competitive environment. It also shows the numerous actors involved which brings even more complexity, and questions the safety, security and environmental aspects of the aviation system.

U-Space is at its core a "traffic management" framework for drone operations that is separate but complementary to the traditional Air Traffic Management (ATM) system. It will be defined as a set of functions enabling the safe and secure integration of drones in the airspace, without limit of airspace class, altitude or type of operations.

The Riga Declaration 2015 states the following:

- Drones need to be treated as new types of aircraft with proportionate rules based on the risk of each operation
- Technologies and standards need to be developed for the full integration of drones in the European airspace
- The operator of a drone is responsible for its use
- EU rules for the safe provision of drone services need to be developed
- Public acceptance is key to the growth of drone services

The future of aviation will require:

- Provision of drone services must not be less safe than is accepted from civil aviation in general
- That rules should be simple and performance based
- To develop a risk-based regulation
- That higher risk operations would be gradually subject to more stringent regulations or operational limitations
- Safety rules, including on remote pilot and operator qualifications, should be developed by EASA
- Harmonisation of essential requirements at global level
- That, when a drone service is delivered in prohibited airspace, in an unsafe manner, or for illegal purposes, the authorities should be able to act and hold the operator accountable
- Drone incidents reporting should be integrated into the overall incident reporting requirements. Systematic and coherent incident reporting will improve safety and will be instrumental for insurance companies in their risk analysis on which third party liability insurance premiums are based

Additionally Urban Air Mobility (UAM) brings another challenge into play.

Urban air mobility refers to urban transportation systems that move people by air. These transportation systems developed in response to traffic congestion.

Future UAM operations will probably include carrying passengers, delivery of cargo, survey works of all sorts, event and media coverage, recreational and sporting activities, and some other purposes that is beyond what one can yet expect. They will operate in close proximity to the ground, and in the most sensitive blocks of airspace i.e., in Switzerland, close to major airports and big cities/agglomerations.

It is anticipated that they will be very similar to (if not the same as) current VFR operations.

A set of principles for UAM airspace integration (including barriers, benefits, and competing considerations), will need to be taken into account and balanced when developing UAM airspace integration concepts.

UAM integration will require a safe, efficient, and predictable, approach with minimal impact on existing airspace operations, and will necessitate that the full breadth of aircraft and operations must be supported equitably.

Development of UAM airspace integration concepts, technologies, and procedures will be governed by the following set of guiding principles:

- *UAM should require minimal additional ATC infrastructure (e.g., radar systems, controller positions) and minimal changes to automation systems used for ATC.*
- *UAM should impose minimal additional workload on controllers beyond their current duties for existing airspace users.*
- *UAM should impose minimal additional requirements or burdens on existing airspace users beyond equitable access to airspace resources.*
- *UAM will meet the regulatory requirements for vehicle-level and system-level safety and security, such as timely and assured data exchange and the elimination of single points of failure and common failure triggers.*
- *UAM will be resilient to a wide range of disruptions, from weather and localized sub-system failures (e.g., a single vehicle or software tool) to widespread disruptions (e.g., GPS failure).*
- *UAM will economically scale to high-demand operations with minimal fixed costs.*
- *UAM will support user flexibility and decision making to the greatest extent possible and enforce airspace structure and prescriptive procedures only as necessary to meet the above principles*[19]

One must also bear in mind that their operations will raise public concerns about their environmental impact (noise, nuisance, privacy, etc.).

Taking the above into account, the U-Space, the drones and UAM development cannot be performed in isolation. There should be an integrated approach to the whole aviation system in order to have the right balance between airspace users' needs and requirements, the system performance (including safety and security performance) and the socio-political needs.

[19] NASA Document UAM Airspace Integration Concepts and Considerations 2018

6.1.7 Human Factors

The aviation industry is evolving quite rapidly, together with the demand for talent from pilots, air traffic controllers to ground operations. Then what does the future demand for talent look like, and is the Swiss Aviation industry prepared for the upcoming challenges?

In its "Switzerland Air Transport Regulatory Competitiveness Indicators" report (Figure 11 below), IATA forecasts a jobs' growth of around 10% (trend before COVID). It is therefore crucial for the Swiss aviation industry to create an environment where jobs' attractiveness are high, where people can develop themselves and find high quality jobs.

Given that aviation is vastly dependent on high-skilled and specialised workers (aeronautical engineers, pilots, air traffic controllers, safety specialists, etc.), the elaboration of effective education and training programs is crucial to guarantee the next generation of workers will be able to cope with the technology and values shifts.

This means that in the short term the aviation industry should invest in:

- Skills and competences that would support the industry's rapid changing environment,
- Structures (training facilities) that would educate and train the Next Gen aviation workers,
- Communication activities to make the aviation industry highly attractive for the Next Gen aviation workers.

Chart 3. Forecast for passenger traffic, GDP and jobs growth

		Passengers	EUR GDP	Jobs
2017		27.9 m	€ 24,6 bn CHF 26.8 bn	206,723
2037	Current trends	38.0 m	€ 33.5bn CHF 36.5bn	223,073
	Upside	41.2 m	€ 36.3 bn CHF 39.6 bn	242,317
	Downside	33.0 m	€ 29.1 bn CHF 31.7 bn	193,778

* Passengers are counted as departures, including connections. The passenger forecasts are based on the IATA 20-year passenger forecast (October 2018). Data on GDP and jobs are from Oxford Economics. GDP and jobs forecasts are from IATA Economics.

Figure 12: IATA Forecast for passenger traffic, GDP and Jobs growth[20]

In the longer term, there is a need to understand how technology, automation, A.I, (relative to work and evolution of values) will impact the aviation industry's workforce and, therefore, how education should evolve to attract young job-seekers and to keep them within the industry. Keeping highly skilled workers within the aviation industry will be an even greater challenge as competition will increase for such skilled workers.

Moreover, with increased automation, human intervention within the system is expected to decrease, together with the amount of workforce needed. This transition will need to be reflected in the training programs (e.g. moving from air traffic controllers to air traffic managers), not to mention the social aspects of such a major change.

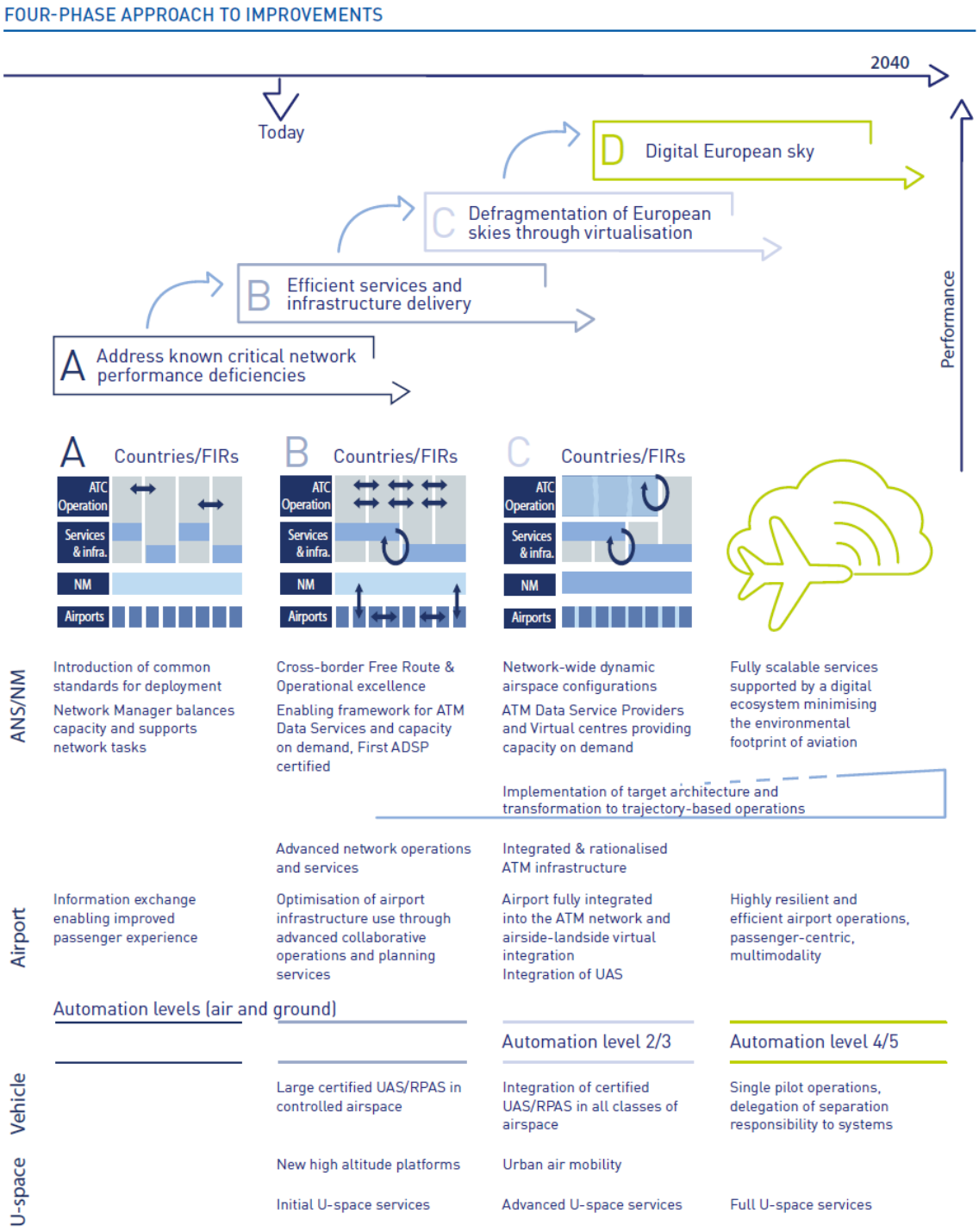
[20] IATA Switzerland Air Transport Regulatory Competitiveness Indicators report 2018

6.1.8 Proposals

Taking into account the above, the following proposals are made:

- Develop and implement a Swiss Airspace Strategy that will take into account the following:
  - reduce complexity and increase the overall performance of the Swiss Airspace
  - consider concepts like Virtual Centre, location independence, etc.
  - elaborate and implement an airspace concept supporting the development of International airports taking into account the airspace users' needs, and tackling their associated challenges (MIL requirements, airport capacity, airport infrastructure, cross-border constraints, dynamic sectorisation, contingency/continuity, PBN, Noise-abatement procedures, etc.) utilising a network perspective (connecting with neighbouring countries and complying with network requirements)
  - develop a lower airspace concept that will address the challenges of:
    - airports and regional aerodromes (sustainability, business model, consultation process, etc.)
    - airspace users' needs (delivery of air traffic services (privatisation), U-Space, L-Space, segregated areas, VPAs, revision of the airspace classes to simplify the airspace structure, etc.)
  - apply the already existing airspace management concepts to its full extent, i.e. by developing further the roles and responsibilities of the HLAPB, the Airspace Management Cell, agree and implement Priority Rules, develop interoperable tools, make airspace data available to all involved stakeholders, etc.
  - be performance driven
  - developments of Drones, U-Space and UAM and associated challenges
- Develop a CNS strategy at Swiss level that will:
  - be a performance based CNS approach (allows the evolution from a system/technology based operations towards the delivery of performance-based services)
  - make use of the infrastructure in an integrated way, i.e. combining satellite, airborne and ground-based CNS
  - identify synergies to optimise the network (e.g. CIV/MIL infrastructure, interoperable ASM systems, partnerships with neighbouring countries, etc.)
  - contribute to a safe, secure and resilient CNS infrastructure
- Develop a plan to educate and train the aviation Next Gen work force by:
  - establishing an agreed multidisciplinary educational basic programme
  - supporting the development of training platforms (e.g. airfields where pilots can be trained, training simulators, etc.)
  - establishing privileged partnerships with universities and industrial partners
- Establish the appropriate funding mechanism to support the training programme
- Put in place measures to monitor system performance and share the information with the aviation industry stakeholders and the public

7 Technology and Innovation



[21]Figure 13: European ATM Master Plan

Note: U Space airspace will be defined as a set of functions enabling the safe and secure integration of drones into the airspace, without limit of airspace class, altitude or type of operations.

[21] European ATM Master Plan 2020

7.1 Digitalisation

7.1.1 From "owning assets" to "service orientation"

Technology is one of the main drivers of the aviation industry. Implementing new technologies should be performed in such a way that they serve the purpose, address the stakeholders' requirements, are adaptive to the changing environment, meet the safety and security standards and are cost efficient.

There is a shift in terms of "owning assets" towards a more "service-based", "cloud-based" concept. More and more, the industry is moving from owning assets, as it hinders its ability to adapt to the market requirements, in a flexible and cost-effective manner.

Taking the above into account, the technological strategic orientations of AVISTRAT-CH should support the development of the following types of services:

- *Location independent Services* – Through virtualisation, services required to support the industry could be performed independently from its location. This will require the identification and assessment what services and/or assets have to remain within "Swiss ownership" and what are those that could be performed outside the Swiss boundaries.
- *Cloud based Data Services* – Data services are currently performed within each stakeholder data centre, but will progressively be transferred to the cloud using a "Data Service Provider" concept. Using cloud-based services provides additional flexibility and scalability allowing stakeholders to access relevant aviation related data whenever required.
- *Auxiliary Services* – The EU policy requires auxiliary services to be progressively outsourced or operated by regional partnerships. Auxiliary services include communications, navigation and surveillance services, aeronautical information services and meteorological services. This again means that there is a need to review and rationalise auxiliary services taking into account the specificity of their provision in Switzerland. This will help in finding solutions that allows the industry to concentrate on core service provisions whilst ensuring that Swiss aviation industry is addressing its stakeholders' requirements and guaranteeing the protection of Switzerland's sovereignty.
  The above services are key elements of skyguide Virtual Centre concept and skyguide Vision 2035 which are compliant with the SESAR Airspace Architecture study

The above services are key elements of skyguide virtual centre concept and Vision 2035 which are compliant with the SESAR Airspace Architecture study.

The early adoption of the virtual centre concept will place Switzerland in a unique position both to steer these developments towards more efficiency and effectiveness and where appropriate to seize the commercial opportunities that the new approach is designed to provide. The advantages of the virtual centre approach include:

- Lower service provision costs due to the potential outsourcing of data services and rationalisation of auxiliary services;
- Improved flexibility for the Network Manager to balance demand across centres (potentially leading to lower traffic risk);
- Simpler technical arrangements for cross-border services, including the ability to provide contingency services to other European states.

7.1.2 Advanced Automation and Artificial Intelligence

To support the total system approach and maximise performance of the aviation infrastructure, the aviation industry has to embark in the digitalisation journey (also referred as the 4.0 revolution), as already accomplished by many other industries. This digital transformation of traditional technical solutions has to be accomplished by significant technological modernisation (virtualisation, cloud infrastructure, seamless connectivity, network-centric approach, etc.) which will at the same time set the foundation to implement advanced automation capabilities.

This advanced automation objective is the key to preserve and improve the efficiency of the workforce employed by Swiss companies in a national context of higher cost levels than neighbours. Focus should be put on increasing the automation level of the low-added value tasks, while preserving the expensive workforce contributions for the high-added value tasks. It is expected that automation will then support, and enhance, the delivery of continuous safer, more secure and more cost-efficient operations in an increasingly demanding and complex environment.

One major new technological contributor to the progress in automation is the rapidly developing domain of Artificial Intelligence. First initial usages are already being experimented with in the aviation domain, but far from the potential that these types of technology could bring in the future. The regulatory and legal framework (e.g. certification) will also have to evolve to support the corresponding technological development as it questions foundations of the traditional regulations.

This will of course be dictated mainly from what the European context establishes in this area, but Switzerland has an important voice in promoting such moves and supporting the whole community with its view on the future concepts required by these innovations.

Innovative concepts and projects in increasing automation will be crucial in supporting the Swiss aviation industry to play a leading role at European level. Supporting the development of next-generation technologies, and the accompanying financial, legal and regulatory frameworks means supporting the competitiveness of the Swiss aviation industry, and integrating the numerous varieties of the "*highly automated vehicles" (single-pilot operations, urban air mobility aircraft, cargo drones, etc.) that are creating new markets and business opportunities*[22].

7.1.3 Aviation Big Data

Figure 14: Role of Big Data in Aviation Industry

Data acquisition and analysis (data crunching) is crucial in taking the aviation industry to the next level of automation. A large amount of data is available and currently not shared across the industry for several reasons. Making aviation data accessible for the industry's stakeholders will support real time data capture, the development of an AI powered environment, automation, predictive analyses, aircraft maintenance, passenger experience, improved resilience of the system, etc. Above all, aviation big data will be key to decision-making.

Any endeavour to implement Big Data analytics infrastructure (investment in storage solutions, servers intended for big data, etc.) should be supported and financially incentivised.

7.2 "Smart" Investments

In terms of investments, it is important to set the right priorities. In order to ensure that investments contribute to improve the performance of the aviation system, it is important to demonstrate the following:

- the return on investment (in financial/economic terms)
- their contribution to the operational sustainability of the industry
- their alignment to the Swiss aviation industry's strategy
- their compliance with ICAO, European and other National strategies
- their compliance with the International and Swiss regulatory framework
- their feasibility in an agreed time frame and the capability to deliver
- their contribution to the aviation safety system
- the reduction of complexity of the Swiss aviation system

[22] European ATM Master plan 2020

Taking the above into account, is therefore required to:

- Design an agreed process that will deliver the above
- Define clear accountabilities and responsibilities of each stakeholder within that agreed process
- Establish a consultation process involving each stakeholder (thus ensuring the required transparency)

7.3 Prerequisites

The implementation of location independent/cloud based/auxiliary services will offer the required flexibility and adaptability that the aviation industry needs. However, they will also be required to answer the following questions:

- What are the accountabilities and responsibilities of each stakeholder (especially in a partially or fully automated environment?
- What are the core businesses, what can be sub-contracted and what are the conditions?
- What are the National interests and thus must be kept Swiss-based? The National interests are to be clarified (taking into account sovereignty aspects, the aviation industry sustainability from economic point of view, Business Continuity aspects, etc.).

7.4 Proposals

Taking the previous paragraphs into account, the following is proposed:

- Develop a "smart investments" strategy. The implementation of next-gen technologies should undergo systemic Cost Benefit Analyses (CBAs) that would demonstrate their benefits not only from an economic or financial viewpoint, but also in terms of environmental impact and the industry's operational performance.
- Follow developments at EU level and invest in selected R&D programmes such as SESAR in order to identify emerging technologies and be early adopters. Specifically programmes bringing more flexibility and resilience into the system, together with implementation of responsive and more efficient processes, cloud based data services, etc.
- Identify and develop strategic partnerships where relevant.
- Identify the regulatory requirements' adaptations, changes or establishment that would support the implementation of new concepts, technologies, financial support, etc.
- Support the Next Gen technologies by:
  - establishing the appropriate financial mechanisms targeting digitalisation initiatives of the aviation industry
  - developing the legal and institutional frameworks allowing the implementation of those technologies
- Support the development and implementation of the Virtual Centre and associated concepts
- Develop and implement a data/information strategy favouring the establishment of Swiss ADSPs whenever the criticality of data/information requires it.

8 Environment

8.1 Climate Change Mitigation

Climate change is a growing concern across the world and will remain a challenge over the next 15 years. At the end of 2019, the European Commission launched "The European Green Deal" in order to respond to the climate change challenges and setting the ambition to be climate neutral by 2050. Switzerland has the ambition to follow that path and to support States to achieve their "net zero emissions" targets.

Unfortunately, the environmental performance of Switzerland as measured by ICAO (based on fuel loaded in Switzerland) and the European Commission (based on the horizontal flight efficiency) shows poor results.

Inefficiencies in Swiss airspace reflects given operational constraints. New expectations regarding environmental performance should allow challenging old constraints.

Air Traffic Management is already quite efficient and room for improvement is limited. CO2 emissions reduction until 2050 will mainly come from improved aircraft and engine technology, sustainable aviation fuel and market-based measures (see Figure 14).

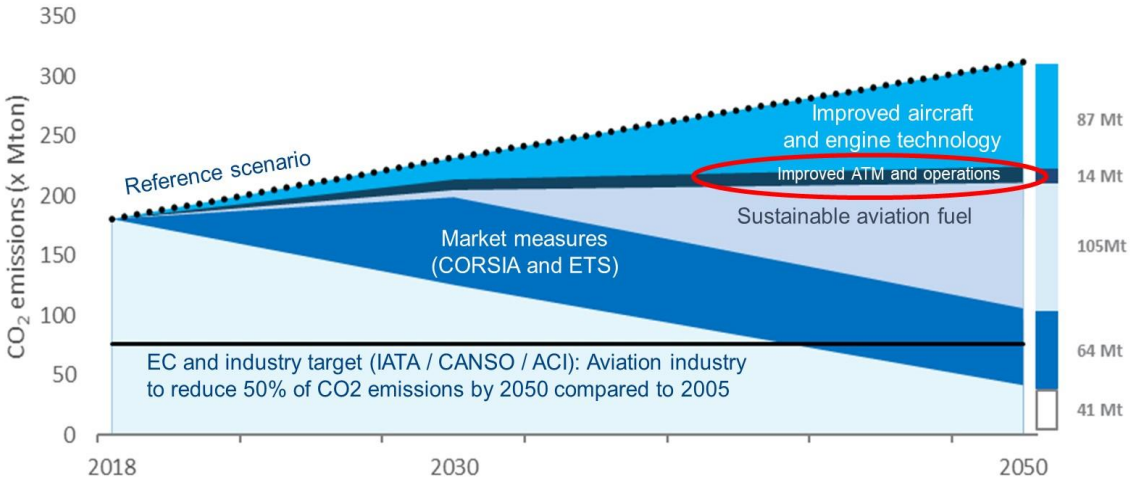


Figure 15: Stakeholders' contribution to aviation's reduction of CO2 emissions

Factors influencing aviation's CO2 emissions reduction are interdependent, and involves sharing of responsibilities. Part of the inefficiencies cannot be recovered due to operational constraints linked to aspects such as safety, capacity, weather and noise. Environmental performance is influenced by each and every operational stakeholder having their own constraints (see Figure 15).

It needs to be noted that the understanding of the impact of aviation on climate change is not yet fully mature. For example, latest research and development results indicate that contrails have a stronger impact than CO2 emissions. To that extent, flights should, in the future, avoid the airspace where contrails are formed and therefore fly longer routes and/or at sub-optimum flight level for a higher environmental performance.

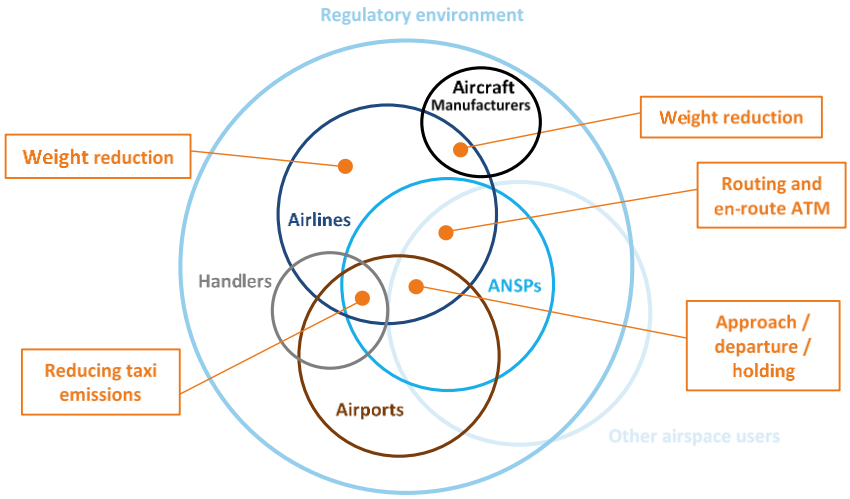


Figure 16: Various Stakeholders influence ENV performance

Even if small compared to the impact of air navigation services on aircraft CO2 emissions, the carbon footprint of the ground infrastructure needs to be considered and addressed. For example, skyguide, as a heavy energy consumer, receives energy efficiency targets from the Swiss State and participates to the federal 'exemplary in energy programme'. A catalogue of good practices (Federal Action Plan) in the fields of buildings, renewable energy, mobility and Green IT is being implemented.

8.2 Adaptation to Climate Change

Aviation has an environmental impact like other industries, but aviation on the other hand, is also impacted by climate change.
Main issues for Switzerland are summarized in the table below:

Climate change	Changes effects	Aviation impacts
Temperatures	Higher mean temperatures Higher, colder tropopause Fewer days of snow/frost Forecast of precipitation type less predictable	Traffic patterns (geographical + seasonal) Aircraft performance (cruise altitude, noise impact) Airspace Design Flow management Snow clearance and de-icing
Precipitation	Increased precipitations in winter Increased freezing rains Decreased precipitations in summer More Intense events Increased risk of flooding	Airport availability (capacity/delay) Demand re-distribution
Wind Patterns (Jet Stream)	Movement pole-ward and upward Weather disruption (change in storm tracks, En-Route turbulences)	Quality of Service decreased performance (punctuality, horizontal & vertical flight efficiency) Flow management and Airspace Design Additional fuel burnt from decreased wind assistance Noise distribution
Convective Weather	Increased intensity of precipitation events, lightning, hail and thunderstorms	Decreased capacity Quality of Service decreased performance (punctuality, horizontal & vertical flight efficiency) Damage to infrastructure
Visibility	Decrease in winter days affected by fog	Capacity improvements at Airports

Table 3: Climate Change Challenges CH

If long term impacts are difficult to predict, short to mid-term ones are well identified. Changes in routes and procedures to match aircraft performance will be necessary. Customer demands will change (seasonal activity change: less ski charters and more traffic during summer time) and more disruptive events will be experienced at airports (flooding, wind phenomena (local and jet stream), thunderstorms, birds) impacting capacity and delays.

Airports which already see the impact of climate change on their operations (e.g.: Locarno, Sion, Payerne, Zürich) will need to adapt their infrastructures (e.g.: buildings cooling, runway length e.g.: ZRH 10/28, water harvesting and catchment area).

8.3 Proposals

The figures above show that addressing environmental challenges is the concern of all and should be addressed in a holistic way. The Total System Approach fits perfectly in that context. All stakeholders involved in the aviation value chain should cooperate to:

- Implement concepts, procedures and technologies reducing the carbon footprint of Swiss aviation (e.g. Improved flight efficiency, improved airport infrastructure reducing taxi time, "time-based spacing system, use of "more silent modern aircraft", "track concentration or track dispersion" concepts, reduced thrust take-offs, displaced landing thresholds, etc.), that would require cross-stakeholder support. This includes re-assessing operational constraints that are set.
- Set realistic environmental targets for the whole aviation system, while understanding the constraints of all the stakeholders (interdependencies!).
- Develop a "marketing, branding and communication plan" to make the politicians and citizens more aware of the achievements and "positive contribution" of Swiss aviation to the environmental targets.
- Establish proper consultation processes with communities around airports (especially where cross-border operations are involved).
- Have a better understanding of climate change and its impacts on aviation and adapt procedures and infrastructure accordingly.

To conclude when addressing environmental issues some compromises have to be made. For example, the aviation industry and local governments must choose between track dispersion or track concentration and it may have economic (less capacity at airport) or political (overflight of populated areas or overflight of less populated but recreational areas) collateral impacts. This is a difficult and delicate balancing exercise.

9 Regulatory Framework

9.1 Introduction

Aviation has historically been a highly regulated industry, given the associated risk to the nature of operations involved. Over the years, the regulatory system has developed to adapt to the requirements of the aviation industry. With the multiplication of systems, business models, safety and security requirements, etc. it seems that too many regulations negatively impact the industry's performance. As such the EU launched the "Better Regulation" initiative with the objective to ensure:

- *decision-making is open and transparent*
- *citizens and stakeholders can contribute throughout the policy and law-making process*
- *EU actions are based on evidence and understanding of the impacts*
- *regulatory burdens on businesses, citizens or public administrations are kept to a minimum*[23]

9.2 Challenges of the Regulatory Framework

The following challenges have been identified:

- too many layers of regulation (International (ICAO), European (SES), National) inducing, in some cases, conflicting (in timelines) and/or contradictory requirements (in terms of content)
- adaptability of regulatory framework to the rapid pace of changes at aviation system level (e.g ICAO vs EC/EASA/National)
- regulatory burden (too many, workload involved, time consuming, inflexible, etc.)
- compliance requirements unclear
- cross-border aspects
- monitoring impacts across the aviation system (holistic view)

9.3 Proposals

In the light of the above the following is proposed:

- Regulate only when the necessity to regulate is demonstrated and this should be proportionate to the problems identified, so that the costs of compliance are minimized by pursuing the most cost-effective solution.
- Develop a balanced consultation approach to regulation by establishing a transparent, objective and the involvement of relevant stakeholders, through an appropriate consultation process.
- Develop partnerships with key aviation stakeholders to develop key policies.
- Review regulations to ensure consistency with existing (and planned) rules and practices so that there are no overlaps and contradictions (nationally or internationally).
- Regulations
  - Have to be "foreseeable" and applied with clear oversight responsibility and accountability,
  - Should have specific and well-defined objectives that directly respond to the problems identified, giving appropriate flexibility to those being regulated to meet defined objectives,
  - Regulations should be applied fairly and not create discriminatory burdens on any groups in particular,
  - Have to be pro-active and adaptive in order to be responsive and risk based (according to Riga declaration).
- Process Principles
  - There should be an assessment of the impacts from the regulation,
  - The drafting of the regulation should involve those who are potentially affected; the decision making process should be transparent and objective,
  - The process of developing the regulation should focus on reducing the compliance burden and allow for regular and systematic review (and subsequent modification, if needed) to ensure that the regulation is still appropriate.

[23] EU Better Regulation: Why and how?

10 Swiss Aviation Steering Body

In order to monitor, guide and steer the AVISTRAT-CH strategy implementation, there is a need to establish an aviation body at system level in order to support that Total System Approach and thus maximising performance at system level.

The main objectives should include the following:

- Establish a collaborative alignment platform including relevant stakeholders to address key topics, agree on priorities, agree on trade-offs to be made and implementation of roadmaps.
- Act as sparring partner to "owners" and political bodies to create awareness and support decision making.
- Ensure stakeholder alignment and be recognised as the centre of excellence to elaborate stronger positioning of the aviation system and to act as one strong industry.
- Ensure the appropriate interactions with the different stakeholders to maximise the performance of the aviation ecosystem.
- Be a platform supporting interaction among the different forms of mobility, to ensure a comprehensive approach.
- Promote innovative ideas to support the Swiss aviation industry transformation.
- Develop strategic advice based on a collaborative process involving the main stakeholders.
- Monitor trends impacting directly, and/or indirectly, the Swiss aviation industry, develop guidance material etc. (such as European aviation trends).
- Establish a process for regular consultation at industry/system level.

The establishment of such a strategic body will require political support and has to comprise the major of aviation industry stakeholders.

11 Strategic Orientations Proposals

AVISTRAT-CH Strategic Orientations and Roadmap

Strategic Pillars	Strategic Orientations Proposals	Description and proposed Specific Measures	Key Enablers	Timeline
Financial Framework	**SO1**: **Shape the Swiss aviation ecosystem to be a major contributor to the Swiss economy** SR: 1, 2, 12, 13, 14, 15, 16, 21, 22, 23	**Description:** 1. Create a sustainable financial framework, lean governance and ensure access to national and international funding to secure the competitiveness of the Swiss aviation industry. 2. Promote sustainable business models in the entire aviation value chain to cover investment and operating cost based on economic value and the 'user-pays' principle. 3. Enable new commercial "target" operating models to offer choice and increase quality and competitiveness while providing mandated services to protect Swiss sovereignty and to comply with ICAO requirements. 4. Enable efficient, effective and environmentally sustainable connectivity of people and goods to support Switzerland's economic attractiveness in a global market. 5. Invest into critical national infrastructure and services to cover the demand for current and next generation aviation services. 6. Shape and use international regulations and industry trends to benefit from global connectivity and developments. 7. Provide a lean and flexible regulatory environment to adapt to changing conditions and to open opportunities for new users. 8. Involve those players of the aviation system Switzerland which keep it well balanced and	• Availability of needs of the stakeholders, transparent and open discussion, and agreement on priorities • Political back-up (trade-offs to be made) and support in the European context • Smart Investments processes	2022-2030

		successful, to promote the key capabilities and to maximize the economic benefits whilst maintaining Switzerland's sovereignty over its airspace. 9. Provide a clear and focused aviation R&D with Switzerland's universities and schools. 10. Educate, train and get access to skilled workforces to keep and improve all aviation services.		
		Proposed Specific Implementation Measures • Develop a sustainable Swiss aviation strategy, financial framework, and road map to finance aviation infrastructure and services. • Establish strategic partnerships and adopt best practices. • Participate in rule and policy making European bodies. • Decide which services are mandated – based on the requirements of the above-mentioned strategy and not based on existing regulations. • Decide which services can be or must be commercialized. • Establish financial mechanisms (e.g. user pay principle, pricing according to economic value, financial support, level playing field with EU players, etc.). • Establish a high-level aviation steering body to manage priorities and road map. • Maintain and develop aviation competence in the Swiss educational system and economy (including drones).		

Strategic Pillars	Strategic Orientations Proposals	Description and proposed Specific Measures	Key Enablers	Timeline
Airspace	**SO2**: **Develop and implement a Swiss Airspace strategy for all users considering clear priority rules, economic value and sovereignty requirements in a simplified structure** SR: 1, 2, 4, 5, 7, 8, 9, 10, 11, 17, 18, 21, 23, 25, 26	**Description** 1. Design the Swiss airspace based on future requirements regarding safety, efficiency and economic value based on the principle of "simplification before automation". 2. Provide airspace management and air navigation services according to airspace users' needs, clear and agreed priority rules, regulations to ensure that the full cost of development and operation are covered and economic value for the overall system is maximized. 3. Have an airspace design that is independent of any external constraints created by ground infrastructure, historical or political considerations. 4. Maximize performance while increasing capacity, resilience, efficiency, safety and environmental sustainability to meet market demand and increase competitiveness. 5. Controlled airspace should exist only where absolutely needed based on safety considerations. 6. Apply "managed airspace" principles to all airspace (including today's uncontrolled airspace). 7. Apply ICAO airspace classifications properly and avoid "Swiss specific" solutions. 8. Design and manage airspace as a Swiss asset in order to maximize its efficiency and usability as a part of the European network. 9. Integrate the airport/aerodrome landscape needs into the airspace design, reflecting and prioritized by economic value for the Switzerland, and accepting that the optimal solution can never please all parties. 10. Link the international gateways to the global aviation network to ensure seamless and efficient connectivity.	• Use the European Airspace Architecture Study, the new Master Plan and the SESAR initiatives to drive an aligned development of Swiss aviation and, where needed for Switzerland, the development of the international network. • Provider of services in development or operating of the air space have to be compensated by the user or the owner of the procedure or the service. • Swiss-side Collaborative Decision Making platform, Strong HLAPB (High Level Airspace Policy Body). • Advanced-Flexible Use of Airspace, Realistic Performance Framework, Cross-Border/Network Collaboration, Interoperable systems, Advanced Automation.	2022-2027

		11. Simplify airspace structures to increase safety and to make the procedures more user friendly and more consistent at system level. 12. Adapt airspace and technical infrastructure in line with international regulations and latest research and development to enable automation wherever possible. Operate integrated processes among the stakeholders at international airports in line with best practice to maximize safety and capacity and to enable automation (the integrated airport)		
Airspace		**Proposed specific implementation measures** • Develop and implement a Swiss Airspace Strategy • Set safety targets at the Swiss aviation system level • Adopt Performance targets at system level • Provide cost efficient ATM services according to the user needs and capability to pay • Introduce concepts and procedures optimizing airspace usage (e.g. IFR services in airspace Golf, Variable Profile Areas, Advanced Flexible Use of Airspace, etc.)		

Stakeholder Management	**SO3**: **Strengthen the position and the role of Swiss Aviation in the political environment and society's perception to allow the industry's transformation & innovation, managing priorities and coordinating implementation** SR: 3, 8, 9, 12, 13, 26	**Description** 1. Establish a collaborative, high-level alignment platform including relevant stakeholders to address key topics, define – agree – and enforce priorities, trade-offs to be made and implementation roadmaps. 2. Act as sparring partner to "owners" and political bodies to create awareness and support decision making. 3. Ensure stakeholder alignment and be recognised as centre of excellence to position the aviation value chain and act as one strong industry. 4. Ensure the appropriate interactions with the different stakeholders to maximise the performance of the aviation ecosystem. 5. Be a platform supporting interaction among the different forms of mobility to ensure a comprehensive approach. 6. Promote innovative ideas to support the Swiss aviation industry transformation. **Proposed Specific Implementation Measures** • Establish a Swiss Aviation Steering Body • Agree where and how to position this platform to maximise impact	• Own independent strategies and governance processes of the members of the aviation ecosystem. • Political buy-in. • Swiss Aviation Industry stakeholders' support.	2022-2035

Strategic Pillars	Strategic Orientations Proposals	Description and proposed Specific Measures	Key Enablers	Timeline
Regulatory	**SO4**: **Enhance the regulatory and safety framework allowing safe and secure innovation and increased economic value** SR: 9, 19, 20, 21, 22, 23, 24	**Description** 1. Design Airspace, Systems and Procedures based on a systemic and systematic risk basis, where the solution is commensurate with the risks. All elements of the system as well as the sum of all elements should be tolerably safe. 2. Develop a holistic System Approach to regulation to create balanced solutions that can be applied system wide. 3. Actively contribute to international rule making activities to improve regulations and procedures to develop and protect the Swiss aviation system. 4. Strengthen and develop the competent authority and regulations processes to address over-regulation, to reduce cost of compliance, enable safe innovation and create efficiency gains. 5. Support quickly and effectively emerging customer demands, new technologies and changing procedures (e.g. Artificial Intelligence, Automation, U-Space, Low Flight Network, Single Person Operation, system licensing, etc.) to channel development activities and to provide clear and reasonable guidelines (including financing of the associated activities). 6. Operate according to just culture principles in aviation, and ensure that this is reflected in national legislation. **Proposed specific implementation measures** • "Balanced approach" to regulation. • Adaptation of the roles and responsibilities of the regulatory authority. • Delineation of roles and responsibilities between Military Aviation Authority and Civil Aviation Authority. • Definition of allocated State regulatory requirements. • Develop a consultation process at system level (transparent, objective and involving relevant stakeholders).	• Political buy-In • Adequate resources • Decision making transparent and objective. • Partnerships with key aviation stakeholders	2022-2035

Strategic Pillars	Strategic Orientations Proposals	Description and proposed Specific Measures	Key Enablers	Timeline
Technology and Innovation	**SO5**: **Introduce modern operational concepts (including new entrants) based on next generation technologies** SR: 3, 4, 12, 13, 14, 16, 21, 25	**Description** 1. Offer technology and procedures to serve new market entrants and demands (e.g. U-Space, L-Space, Performance Based Navigation, Ground Based Augmentation System, etc.). 2. Harmonize technology system-wide to benefit from scaling effects. 3. Introduce and use new technologies to be ready for automation and the transformation of the aviation industry (e.g. live data availability and accessibility, Artificial Intelligence, from Air Traffic Control to Air Traffic Management, etc.). 4. Make Air Navigation & Data Services location independent based on interconnected and open systems (e.g. skyguide's Virtual Center). 5. Provide frequency spectrums which allow optimal utilization of Swiss airspace with all participants, secure and with the required performance. 6. Ensure funding for research and development activities to get a competitive advantage (e.g. automation) or serve new market requirements (e.g. UTM, LFN, etc.). **Proposed Specific Implementation Measures** • Implement the Virtual Center concept as soon as possible, and promote its use elsewhere. • Support the move from voice to data links. • Move from location-dependent services to location-independent where feasible. • Identify and split between critical national infrastructure and international services (ATM & Data). • Strengthen the “System Switzerland” concept with the Armed Forces/Luftwaffe. • Set up a Swiss R&D concept to fund effectively innovative solutions	• Adaptation of the regulatory framework. • Total System Approach to Security. • Financial Framework (e.g. best equipped, best served, financial incentives, etc.). • Decision of what to be Swiss-based and what not. • Acceptance that some non-critical data can be processed outside Switzerland.	2022-2030

Strategic Pillars	Strategic Orientations Proposals	Description and proposed Specific Measures	Key Enablers	Timeline
Technology and Innovation	**SO6: Digitally transform and enhance customer experience to maximize performance (safety, capacity, cost-efficiency, environment)** SR: 3, 4, 10, 12, 13, 14, 15, 16, 17, 18, 25	**Description** 1. Build secure ground-ground, air-air, and air-ground connectivity. 2. Provide data instead of assets to become more responsive and effective. 3. Use inter-connected information to create value in the Swiss aviation system. 4. Increase level of automation for low-end tasks to preserve the expensive Swiss workforce contributions for high-end (value-adding) tasks. 5. Evolve products and services according to the new opportunities to become more effective and adaptive to changing environment **Proposed specific implementation measures** • Implementation of location independent/cloud base data/auxiliary services. • Digital applications making visible airspace usage to Airspace Users dynamically • "Smart" investments approach. • Invest in Big Data analytics infrastructure. • Educate and provide the appropriate workforce to ensure a successful transformation.	• Adaptation of the Financial, Institutional and Regulatory Frameworks • Total System Approach to Safety and Security • Industrial and Universities Partnerships • Common understanding of "critical data" • Conditions of access to data/live data • Sovereignty aspects considerations • Availability of next Gen Workforce	2022-2035

Strategic Pillars	Strategic Orientations Proposals	Description and proposed Specific Measures	Key Enablers	Timeline
Environment	**SO7**: **Act responsibly with regard to Aviation's ecological footprint** SR: 2, 5, 6, 7	**Description** • Aim for "net zero emissions" targets to reduce the aviation industry's footprint. • Reduce track miles and optimise procedures to reduce emissions. • Promote greener technologies as a driver for innovation in all areas of aviation activities. • Agree on a Swiss-wide approach to environmental responsibility to create balanced solutions that can be applied system wide and which are politically acceptable. • Follow and contribute to international research and development activities to adopt new technologies and procedures. • Set ambitious targets and agree on concepts reducing aviation's carbon footprint. • Develop an environmental communication plan to create awareness and ensure buy-in **Proposed specific implementation measures** • Contribute to the development and implementation of an environmental strategy at Swiss system level. • Develop and establish realistic environmental targets. • Establish a Swiss Aviation Environmental group (develop communication plans, identify constraints, interdependencies and trade-offs to be made)	• Buy-in from politicians and citizens • Agreed consultation process at Swiss level, to get buy-in for the implementation of greener concepts • Level of acceptance of new types of "flying vehicles", (e.g. drones, UAM, etc.) • Consultation processes with communities around airports (cross-border)	2022-2035

12 Annexes

Annex A: Table of Compliance with System Requirements

Strategic Orientation	System Requirement	Reference
SO1	1, 2, 12, 13, 14, 15, 16, 21, 22, 23	Sections 3, 4, 8,10
SO2	1, 2, 4, 5, 7, 8, 9, 10, 11, 17, 18, 21, 23, 25, 26	Sections 5, 6, 7
SO3	3, 8, 9, 12, 13, 26	Section 10
SO4	9, 19, 20, 21, 22, 23, 24	Section 5, 9
SO5	3, 4, 12, 13, 14, 16, 21, 25	Sections 6.1.3, 6.2, 7
SO6	3, 4, 10, 12, 13, 14, 15, 16, 17, 18, 25	Section 7
SO7	2, 5, 6, 7	Section 8

Annex B: Acronyms and Abbreviations

AAGR	Average Annual Growth Rate
A-CDM	Airport CDM
ACI	Airport Council International
ADSP	ATM Data Service Provider
A.I.	Artificial Intelligence
A-FUA	Advanced FUA
AMC	Airspace Management Cell
AO	Aircraft Operators
ASM	Airspace Management
ATCO	Air Traffic Controller
ATM	Air Traffic Management
ATMO	Air Traffic Management Officer
ATS	Air Traffic Services
AU	Airspace User
CAA	Civil Aviation Authority
CBA	Cost Benefit Analysis
CDM	Collaborative Decision making
CIV	Civilian
CFSP	Computerised Flight planning Service Provider
CNS	Communication Navigation Surveillance
DETEC	Federal Department of Environment, Transport, Energy and Communications
EC	European Commission
EASA	European Union Aviation Safety Agency
ENAC	Ecole Nationale de l'Aviation Civile
ENV	Environment
EU	European Union
FOCA	Federal Office Civil Aviation
FUA	Flexible Use of Airspace
GA	General Aviation
GAT	General Air Traffic
GBAS	Ground Based Augmentation System
GDP	Gross Domestic Product
HLAPB	High Level Airspace Policy Body
IATA	International Air Transport Association
ICAO	International Civil Aviation Organisation
IFP	Instrument Flight Procedure
IFR	Instrument Flight Rule
KPI	Key Performance Indicator
LFN	Low Flight Network
MAA	Military Aviation Authority
MIL	Military
Next Gen	Next Generation
NM	Network Manager
OLM	OPS Leadership Meeting
OPS	Operations
PBN	Performance Based Navigation
R&D	Research and Development
SAF	Safety
SEC	Security
SES	Single European Sky
SESAR	SES ATM Research
SID	Standard Instrument Departure route
SJU	SESAT Joint Undertaking
SO	Strategic Orientation
SPO	Single Person Operation
SR	System Requirements

STAR	STandard instrument Arrival Route
UAS	Unmanned Aerial system
UAM	Urban Air Mobility
UTM	Unmanned Traffic Management
VC	Virtual Centre
VFR	Visual Flight Rule
VLJ	Very Light Jet
VPA	Variable Profile Area
WS	Workshop