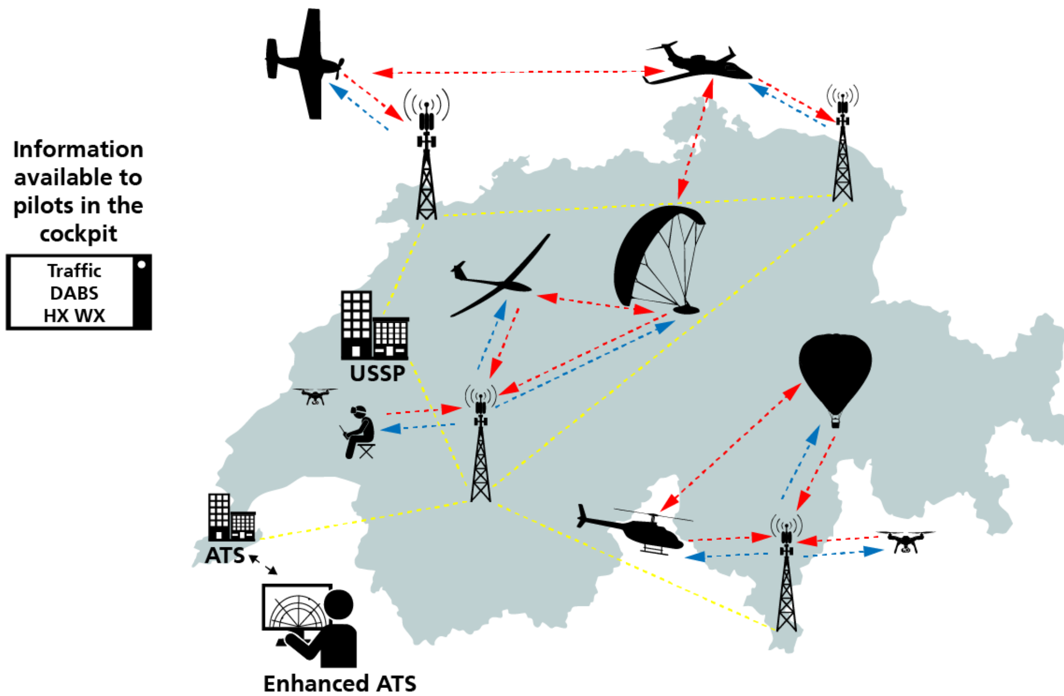

AVISTRAT FASST-CH Ecosystem - White Paper

Edition 1.0

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Executive Summary

In 2024, the FASST-CH initiative focused on:

1. Means to improve the current safety, in answer to the SUST recommendations and the reported occurrences
2. establishing the ideal connectivity and services to enable traffic information to the users of the Swiss airspace, in line with the AVISTRAT initiatives.

Two workshops held in summer 2024 with external stakeholders contributed in developing the FASST-CH[1] roadmap, replying to the points above, aligned with EASA and, most important, meeting the needs of the users and finding their consensus.

In particular, the outcomes of the stakeholder workshops and internal research uncovered key findings:

- The e-Conspicuity market is mature and already established in Switzerland with many general aviation aircraft equipped with systems such as PowerFLARM.
- The Swiss aviation community has demonstrated a proactive approach to implementing e-Conspicuity, through “do-it-yourself” ground-based infrastructure of receive antennas.
- There is an opportunity to promote the achievement of becoming a 100% conspicuous State.

The research also showed that a full conspicuous, interconnected airspace will open up a range of possibilities aligned with AVISTRAT strategy, such as providing real-time traffic information to unmanned aircraft, enhancing FIS to protect IFR traffic, and optimizing the airspace design through better insights into actual airspace usage patterns to be combined with the Collision Risk Model (as done for TMA ZRH redesign).

FASST-CH proposes the establishment of an i-Conspicuity ecosystem in Switzerland that fosters full conspicuity among all aircrafts and allows for real-time information sharing, thereby improving flight safety and facilitating the access to the airspace. The study conducted together with industry and external stakeholders concluded that the adoption of e-Conspicuity and creation of an i-Conspicuity ecosystem tackles the current challenges and future needs for the Swiss airspace, building a solid foundation towards a future digitalized and optimized airspace.

i-Conspicuity is based on the principle of interoperability as a means to ensure the communication across diverse systems. While the transponder mandate alone will only benefit commercial IFR flights by informing them about VFR traffic, implementing i-Conspicuity will provide enhanced situational awareness for all users, improving safety outcomes in mixed-traffic airspaces. The deployment of ground infrastructure plays a pivotal role in this process, offering the opportunity to gather traffic data, elaborating and broadcasting it further, up to even extending traffic visibility over greater distances and mitigating obstructions like mountainous terrain.

FASST-CH strongly believes in this way forward and recommends engaging in the adoption of e-Conspicuity technologies to establish an i-Conspicuity ecosystem (including ground infrastructure).

The concrete actions of FASST-CH in a nutshell are:

a. In class E airspace, the transponder mandate will be extended to a conspicuity mandate initially containing Mode-S transponders equipped with ADS-B Out for new installations.
b. Additional technologies, such as ADS-L will be incorporated to the mandate upon validation through a set of dedicated testing and validation (with users and industry).
c. A set of e-Conspicuity devices will be *recommended* by the FOCA, fostering its adoption by general aviation and with the aim of achieving full conspicuity in both class E and G airspaces.

[1] FASST: Future Aviation Surveillance Services and Technologies; see also www.bazl.admin.ch/FASST-CH

d. The establishment of a ground infrastructure ensuring the seamless exchange[2] of traffic information, and providing future uplink capabilities for the broadcast of digital aeronautical data to the cockpit will be enabled.

A project plan has been developed to implement these actions over the next three years, to validate the anticipated benefits, feasibility, and community acceptance.

FASST-CH sets the basis for fostering a collaborative environment where both certified and non-certified equipment can interact harmoniously, promoting what, currently, seem to be essential for a self-managed airspace, which is the end of goal of the AVISTRAT strategic focus area 2.

All these developments will continue being conducted in collaboration with industry stakeholders, EASA, and Eurocontrol and under continuous benchmarking with other States in order to ensure harmonized flights across Europe.

[2] The technical solution will be open source and the data under an open data governance, compliant with the national laws on the use of electronic means to carry out the authorities' tasks

1 Safety Analysis and Technological Environment

The need for airspace users to be electronically visible has been highlighted in the last years in a number of projects and initiatives:

- The AVISTRAT Strategy published in 2022 fosters strategic initiatives like self-managed airspace and access to airspace using equipment,
- A number of reports and recommendations from the Swiss Transportation Safety Investigation Board (STSB) foster being electronically visible as a means to ensure safety,
- The U-Space regulation requires all manned flights to be electronically visible and introduces a low-end open standards solution (ADS-L) to support this, and
- The EASA i-Conspicuity initiative builds on electronic visibility to reduce the risk of mid-air collisions by enhancing the pilot's situational awareness to assist in avoidance of collisions and/or mitigation of other airborne hazards.

The FASST-CH project, which stands for Future Aviation Surveillance Services and Technologies in Switzerland, has emerged as an initiative to address these challenges and build a roadmap towards future needs in reply to the AVISTRAT objectives through the adoption of advanced e-Conspicuity technologies.

In recent years, there has been a growing recognition of the need for enhanced visibility among various types of aircraft operating within airspace classes G and E. Currently, many airspace users, particularly those operating under Visual Flight Rules (VFR), experience limited electronic traffic visibility. This limitation is exacerbated by the diversity of non-interoperable systems in use, which not only hinders effective communication between aircraft but also heightens the risk of mid-air collisions. To mitigate these risks, FASST-CH aims to integrate state-of-the-art surveillance technologies in Swiss airspace, fostering a more connected and cohesive environment. The project aligns with the overarching objectives of the AVISTRAT-CH Strategy, which envisions a future where all airspace users, including unmanned aircraft systems (UAS), can operate safely and efficiently within a seamlessly integrated airspace ecosystem.

1.1 Current Safety Situation

Switzerland has a significant general aviation community and a unique topography ideal for the practice of multitude types of flights. At lowest altitudes, within airspace class G and E, the country enjoys a wide variety of aircraft activity such as helicopters, gliders, paragliders, motorized general aviation, balloons, unmanned aircraft, parajumpers and wingsuit flights. This dense and diverse activities interact with commercial air traffic flights in airspace class E.

As stated in the “Normenkonzept zur Teilrevision der VRV-L” that was sent for stakeholder consultation mid-January 2025:

“Aircraft without transponders are invisible to skyguide's secondary radar systems and to the TCAS (Traffic Collision Avoidance Systems) used by other users, so that ground and airborne safety systems are unable to prevent dangerous approaches between aircraft (AIRPROX). Particularly in Class E airspace, which is open to VFR and IFR traffic as well as Air Force aircraft, and in the vicinity of Swiss aerodromes, there has been an increase in dangerous approaches, with gliders frequently involved.

A switched-on transponder is an important safety net. In its accident reports, the Swiss Safety Investigation Service (SESE) has repeatedly pointed out that dangerous close encounters could probably have been avoided if a transponder had been used. Several dangerous incidents between airliners and gliders or balloons prompted the SESE to issue several safety recommendations concerning transponders (SE no. 466 and 518). As a result, the authority considered making the use of a transponder compulsory during glider and balloon flights as part of the total revision of the ORA in 2014 and returned to the issue in 2019/2020. On both occasions, this measure was ultimately not introduced. In 2019/2020, it was decided instead to introduce mandatory transponder zones (TMZs) in high-risk areas (hotspots), where they provide a gain in terms of safety. The FOCA has thus created a zone of this type (TMZ Northeast [TMZ NE]) in spring 2022 in the vicinity of St. Gallen-Altenrhein (LSZR) and Friedrichshafen (EDNY) aerodromes.

However, in the course of implementing the TMZ and in the light of current incident monitoring, it became apparent that the risk zones were not limited to the airspace around certain aerodromes, but concerned the whole of Class E controlled airspace where VFR and IFR traffic converge. The safety benefits of delimiting TMZ here and there according to hotspots would be meagre. Not to mention the fact that a Swiss sky dotted with TMZs with sometimes disparate rules would be all the more complex and would generate new risks."

In reply to the safety situation described in the paragraphs above, the additional challenge to safely integrate unmanned aircraft into the airspace and considering the future needs in reply to AVISTRAT objectives, this document outlines and summarizes the findings and recommended roadmap concluded by the FASST-CH group.

1.2 Technological Landscape

In the current technological landscape, state-of-the-art surveillance technologies are being adopted by airspace users due to their reduced costs compared to traditional systems and the additional tools and services that provide to pilots. Notably, ADS-L and ADS-L mobile are emerging as cost-effective solutions for enhancing system visibility among general aviation VFR traffic on top of the existing see-and-avoid principle. These technologies offer low entry barriers and, combined with advances in data fusion, enable the creation of a comprehensive traffic picture. As already successfully implemented in other countries such as TIS-B and FIS-B in the United States, ground stations consisting of transceiver antennas play a crucial role in data collection and dissemination, overcoming challenges such as terrain obstructions and providing extended coverage.

In Switzerland, the current e-Conspicuity landscape reveals significant gaps in traffic visibility, particularly in Class G and E airspace. The diversity of systems used for e-Conspicuity, many of which lack interoperability, exacerbates these gaps and thus do not improve the risk of mid-air collisions. The FASST-CH project addresses this by promoting the adoption of standardized e-Conspicuity devices and integrating them into a cohesive system. This approach aims to enhance situational awareness amongst VFR pilots, between IFR and IFR traffic, improve airspace management, allow the integration of unmanned aircraft, embed the improved air picture in the ATM/ANS landscape and ultimately mitigate the risk of a mid-air collision.

1.3 e-Conspicuity and i-Conspicuity

e-Conspicuity stands for electronic conspicuity and is an umbrella term for a range of technologies that help airspace users to be more aware of other aircraft in the same airspace.

At the most basic level, aircraft equipped with an e-Conspicuity device effectively signal their presence to other airspace users (is made conspicuous). In a nutshell, e-Conspicuity transforms the see and avoid concept into "sense, see and avoid". Nevertheless, many e-Conspicuity devices also receive signals from others, alerting pilots to the presence of other aircraft which may assist the pilot in being able to visually acquire the aircraft and take avoiding action as necessary.

On the other hand, i-Conspicuity, which stands for interoperable conspicuity, refers to the capability of different e-Conspicuity systems to seamlessly communicate with one another, allowing all aircraft equipped with such systems to be electronically visible to each other regardless of the specific technology they use. The goal is to overcome technical differences and fragmentation among e-Conspicuity devices, so that aircraft operating in the same airspace can share real-time traffic data regardless of their equipment.

The key components of i-Conspicuity are:

1. **Standardized Communication Protocols**: Interoperability requires the use of common or compatible data formats and communication protocols. For example, different e-Conspicuity systems such as ADS-B, FLARM, and newer technologies like ADS-L (Automatic Dependent Surveillance-Light) must be able to exchange and interpret each other's signals. These systems use various transmission frequencies (e.g., 1090 MHz, SRD860) and protocols, and without standardization, devices from different manufacturers may not communicate effectively.
2. **Multilink Devices and Networks**: Interoperable conspicuity involves using multilink devices that can receive and transmit signals across multiple frequencies and data channels. For instance, an aircraft might be equipped with a device capable of receiving traffic data from both 1090 MHz ADS-B broadcasts and SRD860 transmissions. These multilink systems also rely on ground-based traffic networks that aggregate data from various transmission paths, ensuring that aircraft using different systems remain visible to one another.
3. **Seamless Air-to-Air and Air-to-Ground Communication**: For true interoperability, conspicuity systems must support both air-to-air and air-to-ground communication (with ground stations or networks). For example, a small aircraft using ADS-B should be able to detect another aircraft using ADS-L or a system like FLARM, and this information should be relayed back to ground stations for further processing and sharing.

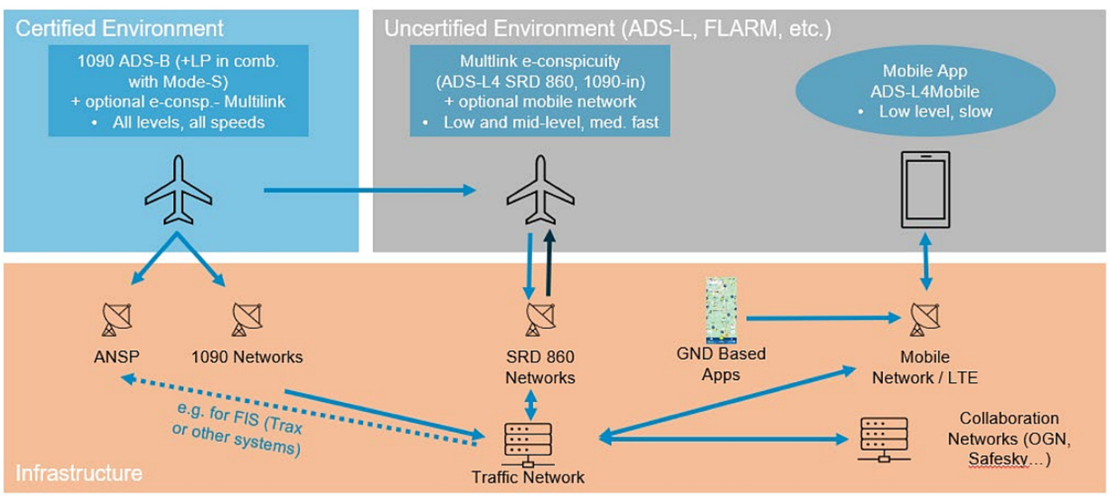

Figure 1. i-Conspicuity interoperable environment[3]

For illustrative purposes, we can imagine a scenario where a glider pilot using FLARM, a small aircraft equipped with ADS-B, and a drone using a mobile-based e-Conspicuity system are all flying in the same airspace. Without interoperability, each pilot might only see a limited subset of the traffic data, which does not contribute to lower the risk of collision. However, with an interoperable conspicuity system, these aircraft would exchange position data in real time, either directly or through a shared ground-based traffic network, giving each pilot a clear and unified picture of the surrounding air traffic.

In summary, i-Conspicuity is about creating a unified system of communication between different types of e-Conspicuity devices, allowing aircraft to be visible to one another regardless of the specific technology they use, enhancing safety especially in mix traffic airspaces.

[3] Source: EASA D-5.4: final report for stakeholders' consultations and dissemination events

2 Safety Analysis and proposed mitigations

2.1 Safety Analysis

In the current aviation landscape different aviation stakeholders operate using preferred technologies (e.g., OGN, FLARM, traffic awareness phone/table applications) that are often incompatible with each other, thereby making it impossible to achieve a complete air-space picture. As airspace usage increases with both traditional and new stakeholders, the limitations of "see and avoid" due to human perception become more evident.

Furthermore, due to Switzerland's topography, the current communications, navigation and surveil-lance infrastructure does not provide full coverage at low level. Therefore, it is without doubt that for general aviation and commercial air transport "sense and avoid" technologies are necessary to im-prove situational awareness and enhance flight safety, as well as for new entrants such as unmanned aircraft, which can't always rely on see and avoid, to integrate in the airspace.

In the current scenario, the different stakeholders in Swiss airspace have learned to co-exist as best they can. For almost all airspace users it is important to maintain a sufficient amount of uncontrolled airspace (Class G and E), while simultaneously reducing unwanted potential airborne conflicts. This becomes specially challenging for unmanned aircraft, which for Beyond Visual Line of Sight (BVLOS) flights, must rely solely on technical assistance to avoid collisions, requiring robust technology sup-porting traffic detection.

When assessing the larger picture beyond the protection of commercial air transport, improving the position information exchange between airspace users (air-to-air) is essential for enhanced situational awareness and issuing proximity warnings when necessary. Furthermore, this information should also be accessible on the ground (air-to-ground) for use by air traffic service providers and unmanned aircraft systems.

In today's environment, moving invisibly through airspace is increasingly questionable for safety reasons. Enhancing the visibility of airspace users to each other and to air traffic control is expected to significantly increase safety in Swiss airspace and allow the integration of new forms of mobility and unmanned aircraft.

2.2 Mitigations to the current safety concerns and answer to future needs

The research conducted by the FASST team, which included reviewing several conspicuity technologies and benchmarking against EASA and other countries, concluded that interoperable electronic conspicuity (i-Conspicuity) devices could improve the level of safety while unlocking new possibilities to ensure the safety of airspace users, as well as offering additional services and benefits to them. This outcome is in line with EASA's recent research project.

The FASST team particularly concluded that while a TMZ only offers the possibility to inform IFR traffic about VFR traffic (excluding hang gliders and unmanned aircraft), has limited to none added value for VFR traffic (as in most cases they are not equipped with TAS or TCAS), whilst the use of i-Conspicuity has the potential to offer enhanced traffic awareness to VFR traffic as well as opening the door to offering new safety enhancing services in the cockpit.

With some i-Conspicuity solutions offering mobile or radio uplink, there is the possibility to deliver not only the benefits of a traffic conspicuity and awareness device, but also weather information or airspace status information in real time to the cockpit. This is aligned with the goal of current and future FOCA projects such as HX concept and FUA CH (Flexible Use of Airspace in Switzerland), of providing a more efficient and fair airspace allocation, A variant of this traffic and information concept is already in place today in the US with great success, namely TIS-B and FIS-B.

2.3 e-Conspicuity and i-Conspicuity – in Switzerland

Research shows that e-Conspicuity (and i-Conspicuity) market is mature enough, with several devices already proven in operational environments. In Switzerland the adoption of these technologies is widespread, with aviation stakeholders benefiting from low-cost, high-service conspicuity systems. Particularly in Switzerland, the interest in e-Conspicuity is evident, with many general aviation aircraft equipped with PowerFLARM, ADS-B, and other traffic awareness systems. Those pilots frequently use portable devices to see other traffic on electronic flight bags (EFBs) or mobile devices. The EFB solutions in general aviation usually include visual and auditory proximity warnings (e.g., “traffic, 2 o’clock, same altitude”). On the other hand, gliders often use FLARM, and paragliders are adopting FANET+. This was further evidenced by the research conducted by the FASST-CH group, including a countrywide survey with more than 1400 participating pilots.

On the ground, receive-only antennas supporting a conspicuity network have been deployed all over Switzerland. The sailplane/paraglider community built the Open Glider Network (OGN), Involi, a privately held company, built a network with a focused service for drones, and private aviation enthusiasts have installed ADS-B receivers to fed information into flight tracking websites. This conspicuity should be further enhanced by establishing a network of ground stations across the country to gather, aggregate and relay traffic data to both ATS, manned aircraft and unmanned aircraft.

The ambition, as detailed in section 3 is to achieve 100% conspicuity rate among airspace users through interoperable technologies, with exemptions for some military and for state flights, as well as parajumers, model rockets, and other crafts that, due to its nature, can’t comply with the currently established rules of the air.

Based on a thorough analysis of e-Conspicuity technologies and devices in the market, the recommended technologies, which enable full transmit and receive capabilities in the cockpit are ADS-B Out/In and ADS-L for manned aviation, while other technologies might be accepted. The conspicuity of unmanned aircraft has not been analyzed in detail in this report, and further assessment is necessary to ensure its conspicuity in the Swiss airspace.

This proposed conspicuous, digitalized and interoperable environment aligns with EASA’s roadmap for i-Conspicuity in Europe and presents an opportunity for the FOCA to enhance flight safety and airspace efficiency by making Switzerland a leader in the adoption and implementation of this technologies.

3 i-Conspicuity Roadmap

By the end of 2027, all manned flights[4] within the Swiss territory will be electronically visible using a mix of suitable and interoperable e-Conspicuity technologies.

In class E airspace, the transponder mandate will be extended to a conspicuity mandate, applicable from January 1st, 2027, initially containing Mode-S transponders equipped with ADS-B Out as an acceptable conspicuity technology. Upon validation of alternative e-conspicuity technologies through a set of dedicated activities, additional technologies such as ADS-L will be incorporated to this mandate.

Additionally, the establishment of a nationwide ground infrastructure, ensuring the reception and broadcasting of real-time traffic information to and from the i-Conspicuous cockpits, as well as to unmanned aircraft systems on the ground may enable ATM/ANS provider to develop a so-called Enhanced FIS/ATC service, where all e-conspicuous aircraft are visible.

The aim is that industry builds and establishes an ecosystem that enhances safety through electronic traffic visibility, provides ground-to-air traffic information to pilots and air traffic service units, supports the integration of unmanned aircraft into Class G airspace and allows the validation of future uplink of aeronautical flight data.

This aims at:

1. Enhancing safety of VFR and IFR non-CAT flights in airspace class G and E, by providing to pilots a comprehensive electronic view of the surrounding traffic through air-to-air e-Conspicuity, complemented by ground-to-air traffic information uplink.
2. Enhancing safety of IFR CAT flights in airspace class E, by:
    a. Making IFR CAT flights electronically visible to VFR and non-CAT IFR flights equipped with traffic awareness systems, either through air-to-air or ground-to-air e-Conspicuity.
    b. Providing e-Conspicuity traffic data to ATS units, in order to provide an improved service (Enhanced FIS/ATC)
3. Enabling the integration of unmanned aircraft in class G, by achieving full manned aircraft e-Conspicuity, and making live traffic data available to unmanned aircraft operators.
4. Validating the concept of providing aeronautical flight data, other than traffic data, via up-link into the cockpit for manned aviation, as well as providing this data to unmanned aircraft on the ground.
5. Establishing means for FOCA to periodically gather traffic data to improve data-backed assessments and analysis such as Collision Risk Modelling.

The above goals are consistent with the EASA i-Conspicuity roadmap and are based on a set of assumptions that will be verified in the project.

[4] A set of possible exemptions is considered applying for example to military and state aircraft, as well as parajumpers, model rockets and other crafts that, due to their nature, can't comply with rules of the air.

4 Opportunities of i-Conspicuity in Switzerland

The following subchapters describe the new opportunities by the establishment of an i-Conspicuity ecosystem in class G and E in Switzerland.

4.1 For the FOCA

A fully conspicuous airspace and its traffic picture gathered by ground infrastructure opens new possibilities for data driven analysis at FOCA.

4.1.1 Traffic data for SRM risk assessments

Currently, FOCA risk assessments are in some areas based solely on expert judgement. The lack of traffic data leads to assumptions being made, which may be inherently imprecise. With a known traffic environment, data can be analysed for traffic flow and density. Specific situations can be analysed, such as traffic density in certain weather conditions, increased risks due to seasonality changes, and the evolution of hotspots and effectiveness of mitigations can be traced.

4.1.2 Strategic mid-air-collision mitigation: Improved routing

Comprehensive and complete traffic data could be used to reduce mid-air-collision risk. This would be achieved by identifying high risk areas in the density heat maps and amending the VFR or IFR traffic flow if deemed necessary. As an example, it might be the case that some IFR routings in airspace E lead exactly through areas with optimal thermals for soaring. Based on occurrence reports and traffic heat maps, SRM might realize that a lateral IFR routing (airway, SID or STAR) change of 5nm would reduce MAC risk. If route changes are not possible, alternative mitigations based on the data could be proposed, such as specific warnings about high traffic densities during certain months or daytimes. Route changes or specific traffic warnings on visual approach charts for VFR traffic are similarly possible.

4.1.3 Integration of unmanned aircraft

This traffic data would enable data-backed risk assessments for unmanned aircraft operational approval (specific operation risk assessment (SORA)) and unmanned aircraft route planning. As MAC probability is a function of traffic density, effective mitigations can be achieved when traffic hotspots are avoided based on historic flight data. Additionally, tactical mitigations based on real time traffic data could be used by drone operators, either gathered directly using own ground infrastructure, or with the support of Supplemental Data Service Providers gathering and aggregating traffic data, facilitating the assessment of air risk during the SORA process. This paradigm shift is essential for the large-scale development of BVLOS drone operations.

4.1.4 Search and rescue (SAR)

In the event of search and rescue, the FOCA is already using data from the Open Glider Network (OGN) to locate accident aircraft. In the current situation, operators of OGN ground receivers, usually sailplane or paraglider clubs, often turn off their station when they are inactive, making the use of this data not always possible. By having access to air traffic information based on a robust network of ground stations, the availability of this data could be guaranteed to the FOCA's SAR team.

4.1.5 Smart obstacle lighting

Obstacle lighting, for example for wind turbines, can cause considerable light emissions. For example, in Germany, wind turbines are equipped with smart obstacle lighting, which will only activate with traffic in the vicinity. This traffic needs to be electronically conspicuous for the system to operate. With the objectives of the UVEK towards more sustainable energies, this is a use case for Switzerland as well. By achieving full conspicuity in the Swiss airspace, the implementation of such systems by the FOCA would become a reality.

4.1.6 Data-backed airspace design and optimization

Achieving traffic conspicuity across Swiss airspace would provide airspace experts with invaluable real-time and historical traffic data. By having comprehensive insights into all aircraft movements, from commercial flights to general aviation and unmanned aircraft operations, experts could identify traffic bottlenecks, inefficiencies, and high-risk areas with greater precision. This data-driven approach would enable more informed decisions on airspace restructuring and optimizing flight routes. Additionally, full conspicuity would allow for the dynamic allocation of airspace resources, ensuring better integration of emerging technologies like BVLOS unmanned aircraft operations while maintaining high safety standards.

4.2 Opportunities for airspace users

By adopting e-Conspicuity technologies supported by a ground network of transceivers, the uplink of data from ground to the cockpit opens multiple opportunities for airspace users. In particular, such an uplink data service provides enhanced situational awareness, specifically with traffic data, real-time information about weather, NOTAM and airspace information.

4.2.1 Enhanced situational awareness: Traffic

For manned aviation, situational awareness of traffic is currently based on the pilot’s ability to visually detect other traffic and the mental capacity of translating VHF messages into a traffic picture. Due to the varying workload of pilots during a flight, this mental capacity can be insufficient during some phases of flight (e.g. traffic information received while listening to ATIS). This, and the inherent inaccuracy of VHF position reports, are reasons why pilots are already using traffic awareness systems.

Some e-Conspicuity devices allow pilots to see traffic on a graphical display well ahead, as well as receive traffic visual and aural alerts. This does not only help pilots acquire the position of targets easily but also help adjusting speed or heading to avoid any traffic conflict early on. Additionally, when traffic data on the cockpit does not rely solely on air-to-air communication (radio line of sight), but also relayed through grounds stations, pilots can identify well upfront traffic hotspots or dense areas, and adjust course or altitude to avoid those areas altogether.

For unmanned aircraft, traffic situational awareness represents a paradigm shift to improve safety of visual line of sight flights (VLOS) and enabling beyond visual line of sight (BVLOS). Currently, although unmanned aircraft operators obtain ADS-B and FLARM data to support their operations, they can’t rely on obtaining a full airspace picture, as not all traffic is conspicuous. The residual risk is in some cases unacceptable, as the percentage of non-conspicuous traffic could be deemed too high for a positive risk assessment. With the proposed i-Conspicuity strategy, not only unmanned aircraft benefit from a fully conspicuous airspace, but are also able to see distant traffic well ahead through a network of ground stations and even make themselves visible to manned aircraft.

4.2.2 Enhanced Air Traffic Service (ATS)

The new i-Conspicuity paradigm could be used to complement situational awareness of ATS units, and provide enhanced services to airspace users. In this context, the use of conspicuity data acquired could be used to issue traffic information well beyond the secondary surveillance radar (SSR) detected aircraft, and traffic warnings via VHF by flight information.

This is already a reality in the United Kingdom, where some control towers are using i-Conspicuity traffic displays and we intend to establish a close exchange and visiting these realities in order to assess if this could be a use case for Switzerland, e.g., for control towers without radar or airports with circuit altitudes below radar coverage.

Additionally, such data could further enhance the safety of flights within the Low Flight Network (LFN), by enabling traffic coverage and thus traffic information below the radar altitudes.

4.2.3 Enhanced situational awareness: Weather, Flight Information Service Broadcast

In the current situation, the pilot is briefed on weather information during flight planning. In the air, weather reports are limited to VHF weather updates such as ATIS, VOLMET or via flight information service. With the establishment of a ground infrastructure able to transmit data in the cockpit, e-Conspicuity equipped aircraft could receive real-time weather with a visual presentation of precipitation, lightning strikes and other data. While there are some niche products, such as ADL from Golze Engineering (weather via Iridium satellites), these devices are currently almost exclusively found in owner-pilot IFR aircraft and not yet in the broad GA community.

A mobile data up-link, as envisioned by EASA's planned ADS-L mobile specification, or a satellite to mobile link are viable solutions to bring in-flight weather to the masses. However, further collaboration with BAKOM would be required to enable aerial use of mobile and satellite telecommunications.

As a matter of fact, in the United States, UAT FIS-B includes weather information such as precipitation, AIRMET, SIGMET, METAR, TAF, PIREP or winds and temperatures aloft. Aircraft with UAT 978 MHz FIS-B (Flight Information Service – Broadcast) capabilities are also able to receive special use airspace status (areas with status of prohibited, restricted, warning, military operations, alert, controlled firing), and NOTAMs. This technology is widely available due to the USA's use of UAT. Due to the lack of UAT broadcasts in Europe, this is not foreseen to be available within the next 7 to 10 years. The ADS-L FIS-B uplink might solve this problem and enable FIS-B like services in the short term in Switzerland.

4.2.4 Enhanced situational awareness: NOTAM and airspace status

After flight planning, manned aircraft pilots currently rely on the data acquired during the briefing for the entire flight without further updates. If a NOTAM becomes active during a flight, this is not known by the pilot (e.g., NOTAM published due to *Gefahr im Verzug* situation). Similarly, the status of e.g., HX airspace (dynamically activated controlled airspace) can only be verified by contacting ATC/FIS, ATIS or with a phone call. The FOCA, paragliding community and military have been looking for alternative solutions, which could be offered by the uplink or broadcast of this data from the established i-Conspicuity ground infrastructure.

4.3 For the Industry

The adoption of i-Conspicuity presents significant opportunities for the industry, in particular avionics manufacturers as well as ATM/ANS5 and USSPs (U-Space Service Providers) and Supplemental Data Service Providers capitalizing on new market opportunities.

With the ability to provide data downlink and uplink, the hardware and software industry has a unique opportunity to continue developing innovative services and pilot support tools. Other opportunities for the industry include traffic data aggregation and processing, with the possibility to process data in order to offer tailored traffic and aeronautical data to specific aviation sectors, generating a competitive landscape that is beneficial for both airspace users and industry.

Additionally, i-Conspicuity also offers numerous opportunities for Air Traffic Management (ATM), particularly by improving ATS situational awareness, earlier detection of (possible) airspace infringements and reducing airborne collision risks.

As mentioned above, ATM can benefit from enhanced traffic information through the integration of e-Conspicuity data into ATM systems allowing for better tracking and monitoring of general aviation, providing more complete air traffic information, even in lower altitudes or in areas typically difficult to monitor. This helps addressing existing gaps in surveillance at a lower cost compared to traditional systems.

By harmonizing multiple e-Conspicuity systems, including ADS-B, ADS-L, and others, ATM systems can benefit from more consistent and interoperable data, facilitating more accurate and efficient air traffic control, particularly in congested or shared airspaces.

Finally, i-Conspicuity enables cost-effective monitoring. ATS services, including Flight Information Services (FIS) and Search and Rescue (SAR), can leverage i-Conspicuity data to enhance their operations without the need for costly ground-based radar or surveillance infrastructure.

5 FASST-CH proposed Action Plan

In order to achieve the goals as described in section 3, the FASST-CH team has developed a multi-year project plan with the main activities defined below.

It should be noted that the presented roadmap is in line with the i-Conspicuity roadmap developed and presented by EASA, and that activities and proof of concept like those proposed in the project plan are expected to be conducted either by EASA or other Member States in the following years. It is therefore of utmost importance that, upon definition of further steps and granular activities planned by FOCA, a continued benchmarking with EASA and other Member States is performed, to make use of synergies in research, testing or simulations that might take place in parallel to FOCA’s activities.

5.1 Implementation of conspicuity mandate in class E

This step aims to implement a conspicuity mandate in class E airspace. Initially, Mode-S transponders equipped with ADS-B Out will be the accepted conspicuity technology. Other technologies, like ADS-L, will be evaluated and added once proven effective.

The normative concept for a partial evolution of the “Verordnung über die Verkehrsregeln für Luftfahrzeuge (VRV-L)” was shared for stakeholder review in January 2025. It includes the proposed revision of article 29 on the obligation to carry and operate a transponder. It is planned that the new article 29 would be adapted to include the e-conspicuity solutions proposed by FASST-CH and would be published throughout 2027 for entry into force one year after its publication.

The propose updated article 29 of VRV-L covers motorized aircraft, helicopters, gliders and balloons while hang gliders and paragliders could be covered through an evolution of the “Verordnung des BAZL über die Kennzeichen der Luftfahrzeuge (VKZ)” complementing the obligation to have the identification on the wing with e-conspicuity solutions.

5.2 i-Conspicuity ConOps and Proof of Concept

The aim of this step is to develop an i-conspicuity concept of operations, together with industry and external stakeholder followed by a proof of concept exploring and validation together with stakeholders the different possible use cases and supporting services/technologies.

5.3 e-Conspicuity equipage

The goal of this step is to foster the equipage of all airspace users with e-Conspicuity technologies and monitor the equipage rate. This has been done by publishing an e-conspicuity recommendation on the FOCA website, with the list of recommended technologies for different airspace user categories to become e-conspicuous.