EGHD Position Paper

The Evolving Role of the ATSEP Profession in the Digital European Sky

1 Introduction

This paper identifies principles and recommendations for the European Commission (EC) to ensure that the human dimension is appropriately considered in future industry developments. This is primarily concerned with the changing role of technical personnel within the Air Traffic Safety Electronics Personnel (ATSEP) profession.

The Expert Group on the Human Dimension (EGHD) of the Single European Sky (SES) recognises the urgent need within Europe for more capacity to address the ever-increasing demand. One action the SES is using to address this need is through SESAR by the introduction of new operational and technical concepts. The recent ambition to move to a SES based on a Digital European Sky will change the ATM landscape even further by introducing an open and competitive service orientated architecture. In order to successfully manage this new architecture and the service provision models ANSPs will rely on the technical competency of ATSEP.

Implementation of changes to service provision models must occur at a pan-European level to ensure the maximum benefit across safety, efficiency, security and resilience is realised. This will require the collaboration of all service providers at a scale not seen before in Aviation. At the same time, it provides challenges to ensure that ATSEP continue to have system wide situational awareness (including the aviation infrastructure) at the point of ATM/ANS service provision.

Additionally, there will be an increased reliance on suppliers from outside of the Aviation domain for services (e.g. the use of datacentres, cloud services and commodity IT hardware providers). In any case, the safety criticality of these functions, as well as the total system performance, must be retained and enhanced as new technology (including increased levels of tool advancement using artificial intelligence and machine learning) are introduced to the system. New methods and procedures must be devised in order to address the nature of increased levels of automation and the reliance on third party service providers. Examples such as self-learning algorithms implemented in technology will have to be treated differently in order to safely manage the restoration and, in the case of an incident investigation, attain correct incident reconstruction.

This paper reviews the responsibilities of technical personnel across the ATM/ANS system lifecycle in light of the future ATM/ANS service provision model. The aim is to ensure that any tasks that are defined to be directly contributing to the safe delivery of Air Traffic Services (ATS) are considered within this paper.

This paper explores a generic service provision model that is considered for the Digital European Sky and identifies recommendations that the ATSEP profession must consider so that the continued delivery of safe and efficient ATM/ANS services can be ensured. The topics covered include the scope

of the ATSEP profession, the competency framework, tools and working practices and the potential interactions between different service providers where new entrants may be providing services traditionally held within the primary ANSPs responsibility.

2 Current Environment for ATSEP

2.1 Scope of ATM/ANS Functional System

ATSEP are directly involved in all services within the ATM/ANS functional system. This includes services supplied directly in support of ATS and to the aircraft (i.e. Navigation). The key functions, covering site and field infrastructure equipment, are within the direct responsibility of ATSEP:

- Communication (COM),
- Navigation (NAV),
- Surveillance (SUR),
- System Monitoring and Control (SMC), and,
- Data processing and integration for Air Traffic Management (ATM).

Currently, the functions related to Building and Electrical services (such as Power Supply and Heating, Ventilation and Air Conditioning) are excluded from ATSEP responsibility under current EU regulation.

2.2 Scope of ATSEP Profession

According to ICAO Doc. 10057, the term ATSEP potentially covers all technical personnel working to provide, from specification to decommissioning, and support, the electronics and software which enable ATM/ANS systems to function. This encompasses engineers, technicians and computer hardware and software experts who are responsible for all functional systems.[1] This is not a definition but a description of ATSEP profession. Under ICAO Doc. 10057, each State is responsible for further defining the roles and responsibilities of ATSEP.

Commission Implementing Regulation (EU) 2017/373 defines ATSEP as any authorised personnel who are competent to operate, maintain, release from, and return into operations the equipment of the functional system.[2] EU terminology does not represent all technical activities that are conducted in the lifecycle of the technical system. For example, specification, design and installation of equipment, are excluded from scope of ATSEP duties.

Some European ANSPs include the staff who support the underlying infrastructure such as Building and Electrical services, specification and installation of equipment, and cybersecurity within the ATSEP duties, although this is beyond the current demands of the EU Regulation.

The scope of ATSEP varies from State-to-State with some ANSPs deploying different operating models. The ICAO and EU frameworks are captured in Figure 1. The orange arrow depicts the tasks

1 ICAO summary of possible ATSEP roles can be found in ICAO Doc. 10057 (here).

2 Regulation (EU) 2017/373 defines ATSEP in section ATSEP.OR.100 (here).

and staff accounted for in Commission Implementing Regulation (EC) 2017/373, with the ICAO term allowing for a broader definition of ATSEP roles based on individual ANSP requirements.

Further to this, the tasks shown in Figure 1 may merge and overlap in future service delivery models. Personnel within the 'safety chain' for these tasks may not currently be ATSEP, but in future these tasks could be completed by ATSEP. With that in mind, this paper **uses the term ATSEP to encompass all technical personnel who are involved in specification to decommissioning tasks.**

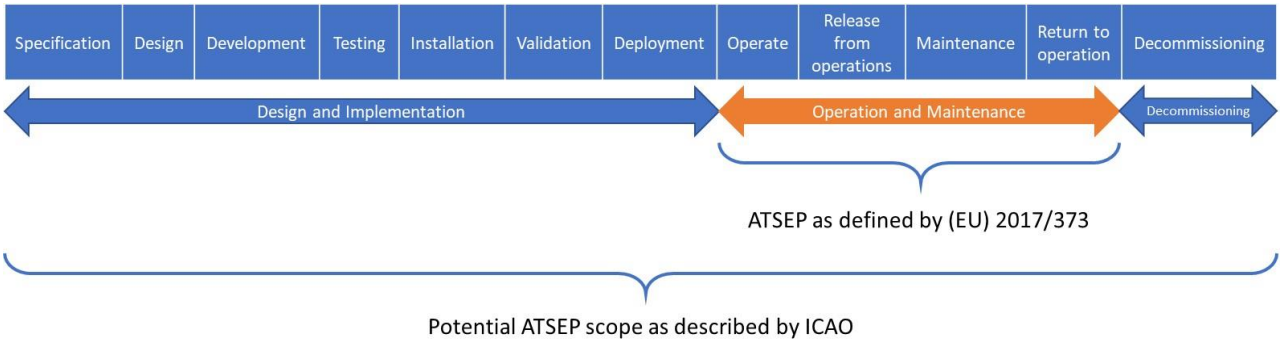

Figure 1: ATM/ANS Functional System Lifecycle

The broader view of this paper ensures that all tasks within the ATM/ANS lifecycle are considered. This may include tasks relating to the design and development of software (whether that is staff within an ANSP or within a manufacturer). This is an important example, as staff such as software engineers may become integral to the safety chain of the ATM/ANS system and therefore those staff must achieve a level of competency in certain skills.

2.3 Scope of ATSEP Competence

The traditional focus of ATSEP competence has been on the CNS/flight data processing for the ATM functions described above. These are described here as operational functions. Operational functions are those which have a direct impact on the provision of ATS such as CNS services or ATM data processing functionality. An example of this is identifying the cause of an erroneous flight plan depiction on an Air Traffic Controller (ATCO) workstation requires the ATSEP to understand how the information is sourced, processed and displayed.

In addition, ATSEP competence also covers awareness or maintaining critical equipment performance indicators such as accuracy, integrity, availability and continuity of service. These are described here as non-operational functions. The non-operational functions do not mean that they are not related to safety, security, efficiency or resilience of the system. They are tightly related and although they are performed offline do not directly impact on operational systems, through their implementation, they can impact the delivery of services and have direct impact on safety, efficiency and performance of the equipment in question.

For example, the calibration of critical parts of equipment when put into operation, are of high importance for the quality of service delivered to ATM/ANS or the aircraft. In general, ATSEP have an understanding of these non-operational functions, while some ATSEP may specialise in non-operational areas. Their contribution is vital to the optimum and safe operation of the ATM/ANS functional system. Potential examples of non-operational functions could include (but are not limited to) safety and security oversight (both physical and cybersecurity), quality oversight and control,

safety awareness, network and server maintenance, human factors and stress management and business to business communication modes.

2.3.1 Competence for System Monitoring and Control

Operational and non-operational functions require specific attention during the monitoring and control of the ATM/ANS functional system. The key operational function is to attain a **system wide situational awareness**, where the ATSEP creates an accurate and up-to-date picture of the health status of all services under their control including those supporting services provided by third parties. The status of upstream and downstream services of neighboring sites is also required as part of this awareness. An example of this is with adjacent FIRs, where staff should be aware of incidents up or downstream that require them to prepare for an increased level of traffic. For example, some states apply Separation minima procedures that rely on surveillance coverage from local and neighboring states. Be aware of the status of these services within the ANSP is extremely important. An additional example relates to the operational status of OLDI, which is used between two adjacent FIRs. The status of each operational OLDI link must be shared between the ANSPs.

The non-operational functions of the SMC ATSEP are the awareness of security, safety and resilience of the functional system. For example, in the event of a cyber-attack, it is expected that SMC ATSEP on duty will be part of the process to co-ordinate with the National Security Authorities (NSAs), the cybersecurity specialists and the ATCO Supervisor (as a minimum).

2.3.2 Common Scope of ATSEP Tasks

ATSEP tasks extend to other activities outside the scope of EU regulation. Examples of these tasks are described below.

ATSEP involvement in the drafting of the Technical Specifications transposing the Operational requirements drafted, quite often in the design and implementation stage of the equipment life cycle is essential. Requirements concerning interoperability, hardware and software, maintainability, monitoring & control are enabled and de-risking deployment when incorporating the operational views of ATSEP present during the specification and design phase of new equipment.

ATSEP involvement is also relevant in the installation and validation stage (provisional and final acceptance tests) as they will be responsible for ensuring the operation and maintenance of the equipment after deployment. Failing to do so will very likely result in a system that is difficult to maintain and mean it may lack the functionality to properly guarantee the continuity of delivery of service that is required. This buy in will be crucial with the introduction of higher levels of automation as it will enable an improved and more in depth understanding of the system that will be self-learning during its life cycle.

Equipment malfunctions that occur after deployment are solved by ATSEP and in many cases include numerous iterations with the manufacturer. Without a validated technical system support functionality, maintainability and monitoring & control, system degradation may take much longer to resolve with effects on the quality of service delivery.

3 ATN/ANS Service Provision

3.1 Technical Services Delivery Model

This section introduces a Technical Services Delivery Model to explain the environment which ATSEP operate in. The model is generic and represents an example that is used to provide commentary on both the current and future envisaged operational scenarios. The Technical Service Delivery Model considered by the group is shown in Figure 2.

Today, the majority of the ANSPs operate in a bundled way with most technical capabilities within the ATM/ANS functional system provided in-house through direct ownership, with only a handful of the required technical capabilities provided as a service by organisations that are external to the ANSP. These are referred to generically as external suppliers even though some external organisations may well be a certified aviation service provider. The ANSP is responsible for the integration of supplied data services within the ATM/ANS functional system.

All ATM/ANS technical functions (e.g. CNS) are generally co-located with the ATS provision or provided from field infrastructure such as ground stations. In some cases, the services are provided under SLAs over the border between providers (shown below as External ANS providers). Wide-area networking is generally provided through State providers under contract to the ANSP (shown as Technical Service providers (Non-Aviation)). In most cases, these providers are from outside the aviation industry. The equipment used by ANSPs is generally provided direct purchase from equipment manufacturers. This includes, in some cases, follow-on maintenance services. This type is shown as Hardware and Application providers.

ANSPs have different service models which reflect different proportions of services for each of the categories described above.

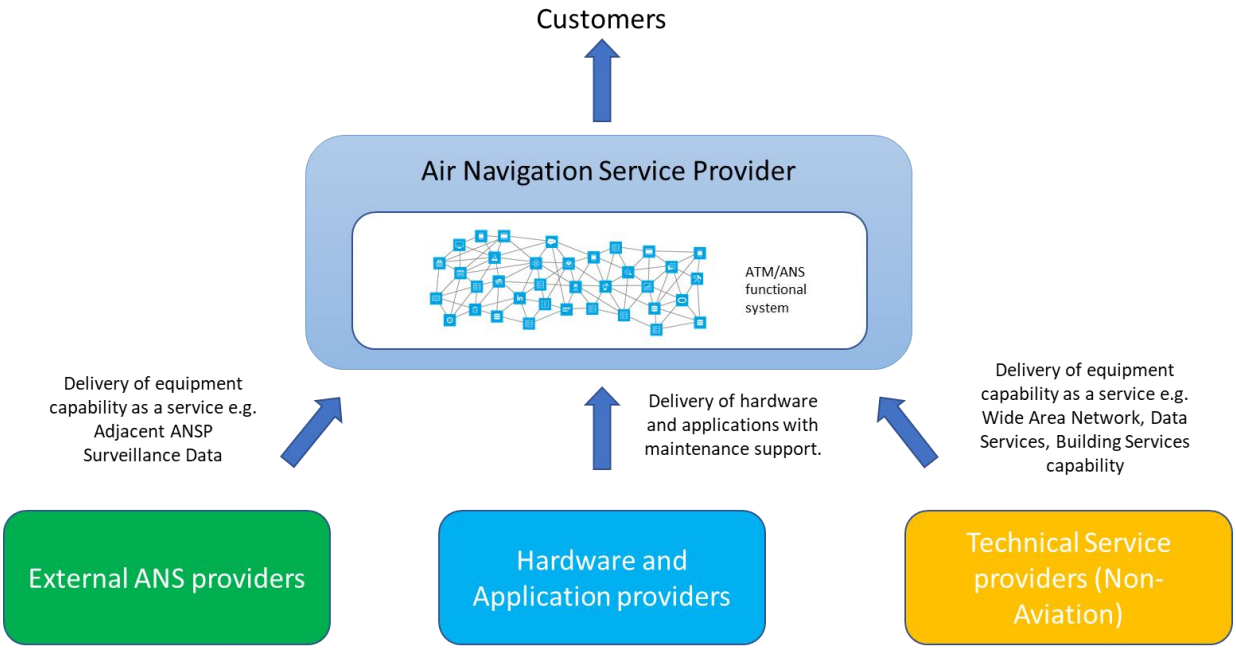

Figure 2: Technical Services Delivery Model

Looking to the future, some ANSPs are exploring different options for the provision of equipment capability; including from external parties or sharingequipment between them. This is seen as a way to reduce costs and also enable operational benefits such as contingency across ATS sites.

A relevant example with regards to CNS is where space-based navigation is gradually being integrated into the ATM/ANS ecosystem through a newly certified external ANSP. Used as an additional layer of service, this is providing promising results which mitigate the concerns on the availability of the service to the customer.

3.2 Technical Services Delivery Model in Digital European Sky

The expanded Technical Services Delivery Model, shown in Figure 3, represents a possible future service construct envisaged within the Digital European Sky. This is based on recommendations introduced by the Airspace Architecture Study. The key difference to the Technical Service Delivery Model shown above is that the integrated bundling of equipment within an ANSP is now represented by the grouping of capabilities around three service areas. The Building and Electrical Service is introduced to the model by the EGHD. This model is explained below to help provide the context for the scope and responsibilities of ATSEP in future.

The Model represents all third parties shown in the Technical Services Delivery Model, but with more clarity, showing different options of where they can support ANSPs in the future. The new ATM Data Service Provider (ADSP) category is also shown in the model.

The ADSP represents a category of service providers that produce and processes ATM and aeronautical data and provide these data services to ANSPs. This means that, increasingly, ANSPs can separate their core activity of providing ATS from the underpinning functions that are required to deliver those services. This is important should ANSPs wish to transition to new service delivery models for ATM data. This paper represents the ADSP as a standalone service. However, the ADSP could be an organisational function within an ANSP, a separate entity providing services within or outside the State that they are certified in.

The scope of ADSP services represents functions that an ANSP would traditionally deliver in-house. For example, the breakout of the currently integrated flight data processing functionality to separate sub-functions dealing only with ATM Data processing. In this example, the new ADSP could potentially provide data to multiple ATS providers. The scope of ATM data could include flight data processing functions like flight correlation, trajectory prediction, conflict detection and resolution, and arrival management planning. These services rely on underlying integration services for weather, surveillance and aeronautical information, which also appear in the scope for service delivery by ADSPs. It must be noted that a report on ADSPs assessing the legal, economic and technical feasibility will be released by the Commission in mid-2020. This report will enable a clearer understanding on how ATM data could be provided as a service.

It should be noted that any of the external service providers who provide data services, shown in Figure 3 below, may choose to certify as an ADSP as the means of delivering the service. i.e. the external party identifies technical or commercial advantage of changing the basis of how they provide a service.

It is likely that those certifying as an ADSP will already be an aviation service provider and it is likely that the knowledge to certify is already within these organisations. It is also noted that as the Technical Services providers (Non-Aviation) are external to the aviation industry, they may be less

willing and able to certify as either an ANSP or ADSP. Therefore, in this Service Delivery Model would not be audited or bound to European aviation regulation and instead the service provision is managed contractually by the ANSP as the consumer of those services.

The services still held within the ANSP in Figure 3 are summarized below.

1. Data and Application services deal with specific software applications and the management and distribution of data to support the Air Traffic Service provision. The applications, and associated data, cover all traditional functions that are currently within an ANSP e.g. Flight Data, Surveillance, Support Information, Safety Nets etc.

2. Infrastructure services will consist of the implementation and maintenance of the hardware and computer operating system software (e.g. LINUX, Windows etc) that are required to support the application and data services. This will include, but not be limited to, cybersecurity software, network hardware and operations. Elaborate network expertise and a thorough understanding of the internal and external interconnectivity of services and software are specific for this service layer ATSEP. Areas of expertise are on hardware (server) platforms, operating systems and virtualization.

3. Building and Electrical services include all power supplies, air conditioning of operational and server rooms, and cabling across sites. In principle, no ATM specific knowledge is needed in this service level. However, by the nature of the services, engineers at this level will have access to locations vital to the ATM service provision. A strong awareness and understanding of the functionalities and services provided by the equipment involved is essential.

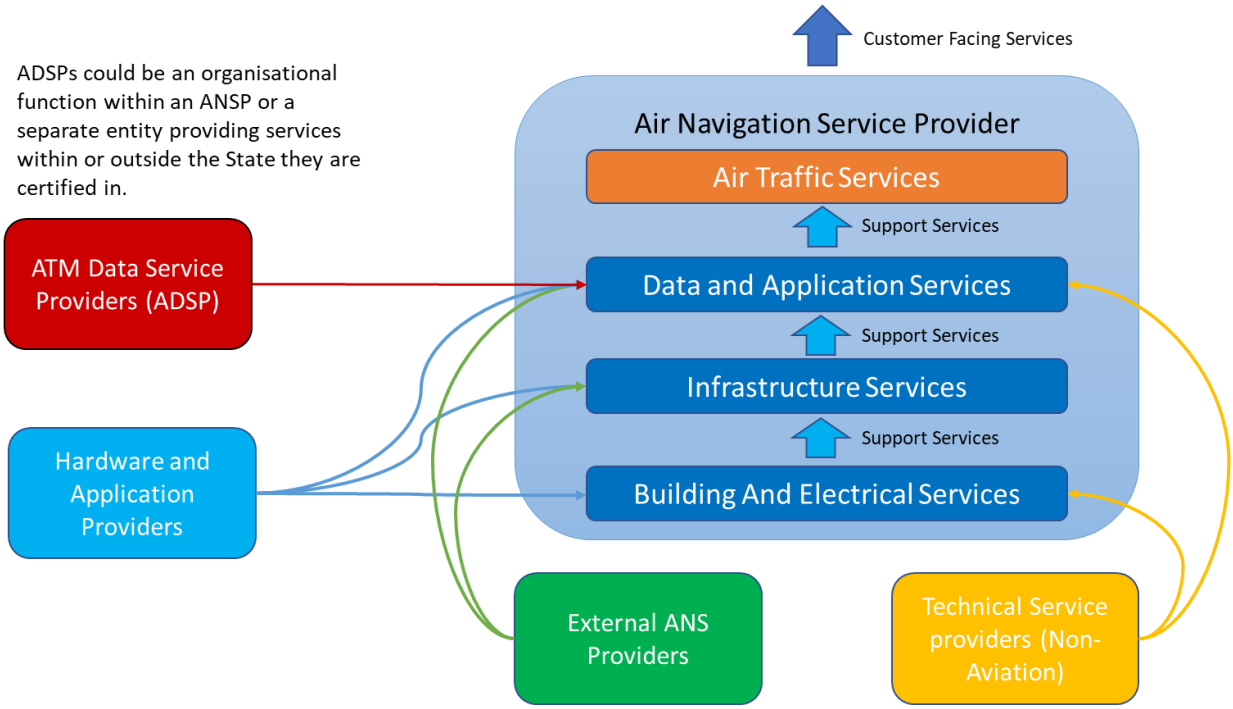

Figure 3: Expanded Technical Services Delivery Model

3.3 Technical Service Operational Concept

This section describes a technical service operational concept to help explain the relationships between the key activities performed by ATSEP based on the Technical Services Delivery Model described above. This is represented in Figure 4 below.

The figure represents the communication interactions required in the generic service delivery model shown. This helps to provide appropriate context when discussing how ATSEP may communicate in future, as well as the importance of information exchange between service providers to ensure system wide situational awareness. To ensure this process works smoothly, communication between each layer of support and to the customer is vital. These communication processes must be clarified prior to the commencement of any service provision, either internally or with third parties.

The operational concept recognises different user and customer groups that can request support or raise incidents. The request or incident is managed initially by the first layer of ATSEP activities. The request or incident may be resolved directly by the first layer, through the implementation of defined workflows or escalated to the second layer who specialise in the application to which the request or incident is related to. The second layer can be within the service provider or can be operated by an external provider. The roles and responsibilities of each layer of the support function in this example of a future Service Delivery Model are summarised in section 3.3.2. A short summary is provided directly below.

The first layer support function is supported by tools integrated at the ATSEP Working Position that provide system-wide situational awareness. These tools consolidate and correlate data across multiple equipment to show the impact the technical system has on service delivery. These tools provide current status plus also alert for future loss of service events and providing for control actions to restore system degradations or reconfigurations.

The second layer support function may be made up of a combination of ATSEP internal to the ANSP or from external providers. This layer is responsible for resolving incidents in a timely manner but must ensure status updates and service changes are communicated clearly to first layer support function or directly to users, customer or management as required. This communication may become more challenging due to the increasing number of interfaces to external customers, rather than just internal users.

3.3.1 Equipment Monitoring Tools

It is important to note that most ATM/ANS software applications in use today are bespoke, nationally focused, inter-ANSP and in most organisations this is unlikely to change for years to come. In an environment with multiple ATS units or one using a ‘virtual centre’ concept, it is unlikely that bespoke data processing services will be used. However, surveillance technology (e.g. radars) and other communications equipment will remain at a local level. This is highlighted by the need for back-up technology when using satellite-based navigation due to the numerous reports of GPS signals being interrupted across Europe.

These changes mean that any equipment monitoring tools used should be interoperable with new and old equipment and the ANSP must have a team of ATSEP who are competent to operate and maintain all necessary equipment. It is important to ensure that adding new and retaining older equipment does not lead to more fragmentation at national and the network level.

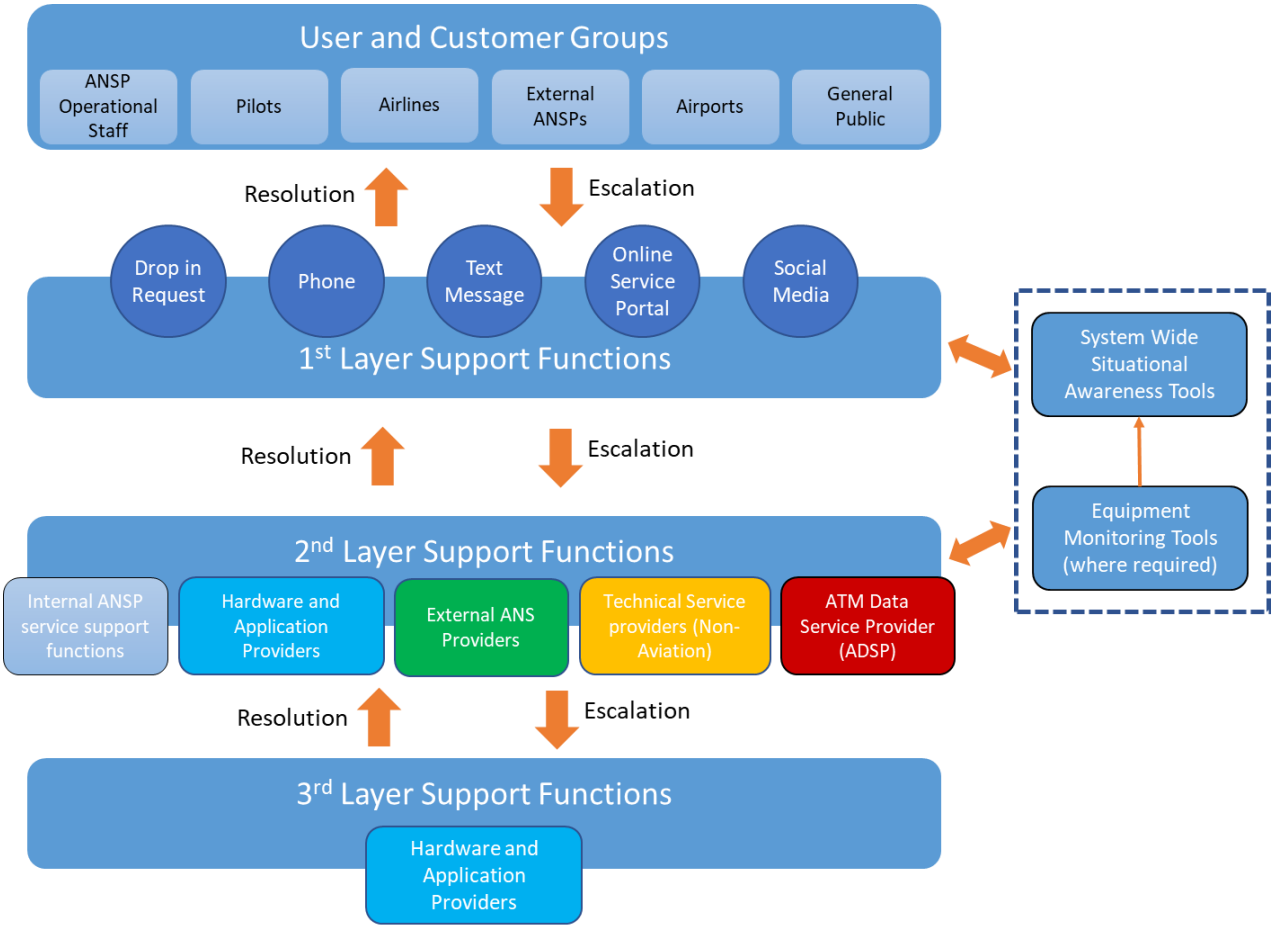

Figure 4: Technical Service Operations Concept

3.3.2 Summary of Roles and Responsibilities in Operational Concept

The responsibilities of 1st, 2nd, and 3rd layer support functions are summarised in the table below. These present potential tasks of ATSEP within the scope of this paper. The information shown is at a level suitable to provide context to under the Technical Services Operational Concept.

Layer of Support	Key Responsibilities
1st Layer	1. Provide users and customer groups with an image status of available services by monitoring and controlling the operational health status of all ATM/ANS services under their responsibility through the ATSEP Working Position and its tools. 2. Implements procedures for the safe, secure and resilient operation of the ATM/ANS equipment and systems and monitors the delivery of related ATM/ANS services. 3. Register, address, classify and undertake an immediate action to restore a failed service as quickly as possible and if the latter is not possible, escalates received incidents; 4. Report Service Requests and keep users informed about their Incidents' status at agreed intervals. Oversee access control to operational systems; local and remote.
2nd Layer	1. Act as the primary resolver for all escalated incidents. 2. Responsible for system administration, system integration and network administration. 3. Perform planned maintenance with close coordination of activities with users and customer groups and other stakeholders' input. 4. Perform calibration of systems and equipment. 5. If unable to provide solution, escalates the incident to the 3rd layer.
3rd Layer	1. Resolution of detailed incidents through analysis and identification of failure of causes of incidents and problems (Typically conducted by third-party suppliers who hold design authority accountability). 2. Perform offline system preventative maintenance and calibration. 3. Provide feedback aiming at amendment of corresponding system's manuals.

4 Principles for ATSEP in the Digital European Sky

The EGHD is committed to working collaboratively with the Commission and stakeholders to making the SES a success. From a human dimension perspective, the EGHD encourages the Commission to take note of the following principles and good practices that are critical to future evolution of the ATSEP profession:

1. The group recognises the importance of ATSEP in the future ATM environment, with the ATM/ANS functional system reliant on their competence to ensure they are operational and at high levels of availability. The group supports the **on-going contribution of expertise from Professional Staff Organisations and CANSO** in the development of new processes, methods and working arrangements considering the increasingly digitalised and automated nature of ATM. This is particularly key as the competency requirements of the ATSEP profession evolve over the coming 15 years.

2. The future European ATM/ANS system will be based on the Joint Human Machine System (JHMS) concept. The JHMS does not devalue the human to justify the machine, nor does it criticise the machine to rationalise the human – instead, it considers the human-machine system as a functional unit to amplify both. The group supports the continued **promotion of the JHMS** to foster optimised working practices for all ATSEP and encourages the continued input of EGHD in an attempt to ensure the automation design process is increasingly user-oriented through an **iterative and participative approach**.

3. The future scope of the ATSEP profession is to be underpinned by the **exploration and buy in from the IT and Engineering industry good practices for incorporation in the safety domain of ATM/ANS.** This can enable the introduction of optimal processes, methods and working arrangements to align with the evolving role of the ATSEP profession and the complex and specific needs of the ATM/ANS industry. The group is pleased to recognise that some European ANSPs (e.g. NATS, LVNL, skyguide and skeyes) are already in the process of adopting **and adapting** IT and Engineering industry good practices to support technical service provision. This is supported by the EGHD and should be encouraged amongst ANSPs to ensure harmonisation of good practices across Europe.

4. The group recognises that ATSEP will have a pivotal role in supporting ANSPs in the future delivery of ATM/ANS services. As more services and concepts are introduced, the role of the ATSEP will evolve within **the safety and (cyber)security chain**. As such, the group recognises the importance of **human interfaces between organisations which ensure the safe, efficient, secure and resilient delivery of services**. The group supports the use of tools, such as Service Level Agreements, and wider standardized/harmonized implementation of the ATSEP Working Position concept its capabilities, elaborated by EGHD, which enable effective human interfaces within ATM/ANS provision.

5. Specific recommendations

This section outlines, from a human dimension perspective, areas that will be important to consider in the future evolution of the ATSEP profession. This will ensure that ATSEP are continually supported in their day-to-day roles whilst new services and concepts are introduced into the ATM/ANS functional system. The EGHD's recommendations are described under the following topics:

1. Scope of ATSEP Profession
2. Competency Framework for ATSEP
3. Working Practices for ATSEP
4. Information Tools and Data Assurance for ATSEP
5. Working with User and Customer groups
6. Working with External Service Providers
7. Certification of Service Providers

5.1 Scope of ATSEP Profession

The existing ATSEP roles in the current Technical Service Delivery Model cover all CNS and ATM infrastructure, as well as data processing and integration for ATM information. As the role of the ATSEP evolves, it is likely that ATSEP will be required to cover more services. This may lead to some roles having certain expertise in new services such as security (physical and cybersecurity), networks, operating systems or building and electrical services. ATSEP will remain a key link in the safety chain, with key tasks of ATSEP ensuring the safety, security, continuity and resilience of service provision.

In Commission Implementing Regulation (EU) 2017/373, the definition of an ATSEP is as follows: "Any authorized personnel who are competent to operate, maintain, release from, and return into operations equipment of the functional system". While this is correct for existing operations, the definition should be re-considered in future taking into account how the example Technical Services Delivery Model, and the Technical System Lifecycle, has been applied to ANSPs. This is to ensure that all technical staff in the safety chain have appropriate competence to complete the tasks required of them.

Besides the operational tasks of maintaining equipment in use, involvement of technical personnel in the design and implementation phases of a system life cycle is key to ensuring maintainability and minimise the operational impact of introducing a new equipment or process. Personnel that have the competence to complete these tasks, which can be seen as key links in the safety chain, could in future be categorised as ATSEP. The incorporation of these tasks into regulation needs to be carefully considered and should not necessarily require the re-definition of ATSEP. The current regulation has a fixed scope and it is not flexible for change. For example, currently, new tasks or competencies cannot be added into the acceptable means of compliance for Regulation (EU) 2017/373.

Recommendation

The EC, with relevant authorities, should analyse the future service delivery models and determine whether changes to the scope of Regulation (EU) 2017/373 (Annex XIII), related to the ATSEP profession, are required.

Note: The review should consider the potential range of tasks (that support the safe and efficient delivery of services) to be performed by future ATSEP, the needs of service providers and the support required for the rapidly evolving ATM/ANS functional system.

5.2 Competency Framework for ATSEP

ATSEP are a key skilled resource to the ATM industry and a key part of the safety chain. The current competency requirements are published in Regulation (EU) 2017/373 which sets rigid requirements on training. This regulation also allows individual organisations to set the exact local training and competency requirements in order to meet their own needs.

To enable greater flexibility and harmonisation of competency requirements, a Competency Framework must be in place to manage and validate their abilities, with a focus on new non-operational functions of ATSEP. Developing an EU-wide Competency Framework would enable easier training of all ATSEP based on their specific responsibilities in terms of operational and non-operational functions. This Competency Framework could also allow the fostering of optimised working practices, ensuring ATM/ANS service provision is safe, secure and resilient.

The competencies within the Framework should be based on the following four categories:

- Technical work. This would include the need to understand operation maintenance procedures for the service, function or equipment under the control of each ATSEP. This includes normal and degraded operations.
- Business competence ensures all ATSEP have the correct approach to validating the quality, security, safety and resilience of all services being provided and would cover the non-operational functions of ATSEP. These non-operational functions could include, but not be limited to, security (physical and cyber), interoperability, operational ATS/ATM/ATC expertise, training and human factors (such as stress management during incidents).
- Process. This includes IT and engineering best practices, as well as enabling the clarification of communication routes between a primary ANSP and its external service providers.
- Behavioural competency and attitudes. This should include the fostering of a team working mentality, promoting cooperation between ATSEP, ATCOs and other ATM/ANS staff.

Note: There are non-safety related duties that ATSEP perform that would not be captured within a competency framework. These duties may include; providing training to new or existing employees, monitoring and reporting on team goals and metrics and communicating between different organisational departments.

When developing the Competency Framework, a number of considerations must be taken into account. Firstly, how continuation training can be completed by ATSEP, both within a ANSP and within external providers, must be considered. This is due to the limited opportunities to maintain currency on equipment-based competencies due to the separation of I.T. equipment from operational centres

and the high-reliability requirements placed upon that equipment. As is commonplace with ATCOs, simulation and/or offline environments should be developed and used to support the competency of ATSEP on all necessary equipment. Further to this, other tools enabling training on new non-operational functions must also be developed. Specific solutions to these challenges would not form part of the Competency Framework itself, but instead must be covered in subsequent local training plans, enabling flexibility in training topics and methods between each ANSP.

Further to this, equipment supporting the ATM/ANS functional system in current environment are bespoke, nationally focused, inter-ANSP systems and will remain in place for next 10 years at least. This means that ATSEP will have to be competent in this equipment in parallel to developing new competencies based on the service orientated environment described in the Technical Services Delivery Model. The Competency Framework must be flexible enough to handle this scenario.

Once a flexible Competency Framework has been developed, methods and procedures for the development, maintenance and verification of ATSEP competency should be developed. These new methods and procedures should focus on the specific competencies required of ATSEP and understand how competencies can be achieved through the implementation of a range of flexible training methods.

Recommendation

The EC, and relevant authorities, should revise Regulation (EU) 2017/373 (Annex XIII) to include a competency framework to apply to all future ATSEP to determine the competency requirements tailored to their specific roles and duties. The framework will facilitate the creation of appropriate initial and ongoing training and competency assessment programmes in a standardised manner across all service providers.

5.3 Working Practices for ATSEP

As new organisations enter the ATM domain, the standardisation of new practices, such as the terms used, and the implementation of IT and Engineering industry good practices, should be investigated. So far, some European ANSPs having already partially implemented these new methods, therefore good practices and lessons learned should be gained to enable a smoother transition for other ANSPs.

IT and Engineering industry good practices can provide solutions to challenges provided they are correctly applied and adapted to suit the complex, safety needs of the ATM industry, where they are deemed necessary and beneficial. These good practices can bring benefits to the ATM/ANS system oversight, monitoring and control and enhance resilience and system-wide situational awareness.

However, it must be noted that adaptions to processes must be made for them to suit the context of complex ATM/ANS provision. These processes can bring benefits, however any changes to working staff practices must involve consultation with staff.

Recommendation

The EC, with the relevant authorities, should develop guidance on the implementation of IT and Engineering industry good practice relating to technical staff working methods. IT and Engineering good practices should be evaluated to determine their applicability and how they can be adopted and adapted to suit the complex environment of ATM/ANS service provision.

5.4 Information Tools and Data Assurance for ATSEP

5.4.1 Information Tools for ATSEP

To enable ATSEP to correctly fulfil their roles, a suite of information display tools, embedded within the ATSEP Working Position, is required to ensure system-wide situational awareness. These can range from core service desk support tools, such as ticketing and incident management tools, to more complex functions (including artificial intelligence and machine learning algorithms) automating key support actions for ATSEP. These tools shall pro-actively look for potential issues, alerting ATSEP of the failure and if possible, stopping them occurring before the worst eventuality has occurred. Information tools should also provide the status of all services relevant to the area of ATS including upstream and downstream ATS services.

If a model based on the adaptation of IT practices to fit technical ATM service provision is followed, the first layer support function will require several tools and new functionalities to quickly manage the smaller incidents that occur using well defined workflows. One notable example of the use of information tools to support ATM staff has been in the case of trials within the IAA. Here, new functionalities were introduced for the management of alerts by using semantic alerts[3]. This trial focussed on ATCOs, however similar tools or technology could be assistance to ATSEP or other technical personnel in future.

In relation to maintaining a system wide situational awareness, any ANSP receiving data from an external provider will necessitate that ATSEP on both sides of the Service 'loop', consumer and provider, will share the status and quality indicators of the service provided. This will be a critical non-operational function for the safe deployment of a service orientated environment, without which the service provision loop will be open-ended without proper feedback.

Ultimately, the EGHD believes that organisations must adopt a human-centric approach in the design of the Joint Human-Machine System (JHMS). As such, when designing these support tools, the staff working positions (ATCO and ATSEP WP) must be designed using the key principles identified in the previous EGHD paper titled "*Optimising ATM staff working stations in the Joint Human-Machine System*", released in December 2018.

Recommendation

The EC, with the relevant authorities, should encourage the application of a human centric approach to the design of the Joint Human-Machine System in the implementation of any future automated monitoring tools or new functionalities for ATSEP in ANSPs.

Note: Principles and recommendations for implementing a human centric approach should be taken from the previous EGHD Position Paper entitled "Optimising ATM staff working stations in the Joint Human-Machine System".

3 *The Impact of Alerting designs on Air Traffic Controller's Eye Movement Patterns and Situation Awareness*. A research paper on audible semantic alerts

5.4.2 Data assurance in a service orientated environment

In the existing ATM/ANS system, data is assured as most data transfers occur from one ANSP to another or within ANSP ATM/ANS applications. As new data and ANS providers enter the market, as described in the Technical Services Delivery Model, a managed transition must be employed to ensure the data quality level (e.g. resilience, accuracy, integrity, security and availability) is maintained. No matter the benefits of outsourcing key functions to an external provider, assurance in all aspects of the service must be provided. This could be demonstrated by implementing a data assurance framework between the two organisations in question, looking at topics such as broad as safety culture within the third-party organisation and as detailed as good practice cybersecurity protocols.

The confidence in an external service provider affects the confidence with which ATSEP can perform their duties, and subsequently other ATM staff, to work safely, securely and efficiently. Therefore, assurance of services should be guaranteed, as far as practicable, by the ANSP (as shown in Figure 3) prior to any change in operating procedures.

Recommendation

The EC, with the relevant authorities, should investigate new methods, procedures and tools to enable the ATSEP to assure the quality of data exchanged (e.g. resilience, accuracy, integrity, security and availability) is maintained.

5.5 Working with User and Customer Groups

Communication methods between ATSEP and internal users and customers must remain as effective and efficient as possible. Whether an ATSEP is communicating with an internal user or customer the communication means is based on their field of expertise, which is not always clearly understood by their counterpart. This can lead to misunderstanding or misinterpretation and may trigger incorrect corrective actions. This is of note as the role of ATSEP and of ATM staff adapts to meet technological improvements, such as further digitalization and higher levels of new technology in ATM/ANS. As these topics change, it is vital the ATSEP can retain system-wide situational awareness of the ATM/ANS service.

One key process to be established within the new working environment is how failures can be reported by users and customers to the first layer support function, and then how resolution can be provided in the most suitable, safe and efficient manner. This is also applicable to any maintenance activities that are to be carried out by an ATSEP, or at an ATSEP working position without impacting the on-going service provision. The established procedures in any organisation should guarantee the resilience of the system.

To ensure a collaborative approach to solving ATS issues, such as incident reporting, it is important to locate ATSEP, specifically the first layer support functions, as close as possible to the ATS Operations room to be on hand in the event of any operational issues or events with technical relevance. This way, other ATM staff could understand the requirements on ATSEPs, with ATSEPs gaining an improved operational knowledge base in the process. Where this is not possible, the possibility of remote working should be considered. In order to do so however, it should be investigated how remote working can be effectively implemented for the first layer support ATSEP functions. New

collaborative decision-making approaches must also be investigated between ATSEP and internal users such as ATC.

Recommendation

The EC, and relevant authorities, should analyse future service delivery models and identify new methods, procedures and tools to facilitate effective communications and decision making between ATSEP and other ATM/ANS stakeholders within an ANSP or externally.

5.6 Working with External Service Providers

External service providers are commonplace in most European ANSPs and this will continue in the future as described in the Technical Service Delivery Model. While they may not directly provide ATM/ANS services, they still provide critical infrastructure that must be carefully managed. Recommendations by the Airspace Architecture Study present new opportunities for service providers at all levels of the Technical Service Delivery Model. To realise these opportunities, several new processes must be developed. These new processes are critical in effective human interaction between ANSPs and any external Service Providers.

New processes are always developing in any industry and the change management of these, whilst commonly carried out, can be complex. One way to simplify this is to standardise, where possible, the processes being implemented, allowing for easy interoperability between tools and processes within and outside individual organisations. When any new process or service provider is being introduced to a system it must be ensured that standard change management practices for are used, including; the input of all stakeholders is considered, such as Airspace Users, ANSPs, external Service Providers and all staff including ATSEP; the safety of aircraft has been clearly assessed from the start of the development, and; the aim of the process is clearly defined prior to the planning phase, enabling the efficient development and an easier process to adhere to for ATSEP.

In order to verify the working processes with external organisations a Contractual Framework must set out the working relationships. This Contractual Framework should use the Competency Framework, and the specific competency requirements, to express the requirements for competency of the technical staff within the external party.

In order to implement this, it should be investigated how the Contractual Framework operates in practice and how it effects the Competency Framework of ATSEP in new and existing service provision models and what processes and procedures may need developing to aid the transition to new working methods without compromising the safety of the ATM/ANS services.

Finally, for external organisations that are already of significant size and whose main customers are not the aviation industry (i.e. network providers), taking on board aspects of aviation culture may prove laborious, however some aspects, such as strong safety processes, must be present to ensure the safety of the aviation industry is not compromised. In order to understand what requirements must be placed on non-aviation service providers, there should be an investigation into what is deemed acceptable by ANSPs to ensure the working arrangements of ATSEP and the ANS services delivered are not compromised in relation to safety and efficiency.

A key clarification for external service providers is the implementation of Safety Management System (SMS) principles. Those providers that are certified as ANSPs, or potentially as ADSPs in the future,

will have specific requirements for SMS placed upon them. However, for non-certified organisations, the contracting ANSP must place their own requirements on the organisation as part of the contractual arrangements.

Recommendation

The EC, and relevant authorities, should analyse and identify mechanisms to ensure that operational procedures controlling the continuity of services (e.g. Change Management, Incident Management, Event Management etc) are fit for purpose in the context of the future service delivery models. This applies to those procedures performed either independently by suppliers or jointly between ANSP and suppliers.

5.7 Certification of Service Providers

The Technical Service Delivery Model described in this paper recognises three current categories of service provider (External ANSP, Hardware and Application and Technical Service provider) and a fourth new category, ADSPs, which are planned to be certified providers of ATM data services.

In 2019, Aireon, an organisation which provides global surveillance services using space-based ADS-B, has been certified as an **ANSP** for surveillance services by EASA in the absence of a legal framework for ATM data service providers. With this news it is expected that more organisations will follow suit, meaning clearer rules on the certification requirements must be provided. This should cover whether the ANSP or ADSP certification route is most appropriate for new data service providers that are setup as entities independent of the ANSP. However, EGHD note that the current regulatory framework does not suit the future Service Delivery Model, and this should continue to be investigated to determine how the regulatory framework must evolve to enable this model.

Specific attention on the competency requirement for ATSEP is required. The requirements for ATSEP in any future certified ADSPs must be aligned to the Competency Framework, as referred to in Recommendation 2. Any technical personnel working in a certified ADSP identified as ATSEP should undergo appropriate training to ensure they meet any necessary requirements that are set out within the Competency Framework described in the paper above.

Recommendation

The EC, with the relevant authorities, shall ensure that the future regulatory framework for ANSPs and ADSPs includes appropriate rules for ATSEP, and other technical personnel, based on the future scope of the ATSEP profession (Recommendation 1) and the competency requirements (Recommendation 2).

6. Principles

Principle 1	*The group recognises the importance of ATSEP in the future ATM environment, with the ATM/ANS functional system reliant on their competence to ensure they are operational and at high levels of availability. The group supports the on-going contribution of human factors expertise from Professional Staff Organisations and employees via CANSO in the development of new processes, methods and working arrangements considering the increasingly digitalised and automated nature of ATM. This is particularly key as the competency requirements of the ATSEP profession evolve over the coming 15 years.*
Principle 2	*The future European ATM/ANS system will be based on the Joint Human Machine System (JHMS) concept. The JHMS does not devalue the human to justify the machine, nor does it criticise the machine to rationalise the human – instead, it considers the human-machine system as a functional unit to amplify both. The group supports the continued promotion of the JHMS to foster optimised working practices for all ATSEP and encourages the continued input of EGHD in an attempt to ensure the automation design process is increasingly user-oriented through an iterative and participative approach.*
Principle 3	*The future scope of the ATSEP profession is to be underpinned by the exploration and buy in from the IT and Engineering industry good practices for incorporation in the safety domain of ATM/ANS. This can enable the introduction of optimal processes, methods and working arrangements to align with the evolving role of the ATSEP profession and the complex and specific needs of the ATM/ANS industry. The group is pleased to recognise that some European ANSPs (e.g. NATS, LVNL, skyguide and skeyes) are already in the process of adopting and adapting IT and Engineering industry good practices to support technical service provision. This is supported by the EGHD and should be encouraged amongst ANSPs to ensure harmonisation of good practices across Europe.*
Principle 4	*The group recognises that ATSEP will have a pivotal role in supporting ANSPs in the future delivery of ATM/ANS services. As more services and concepts are introduced, the role of the ATSEP will evolve within the safety and (cyber)security chain. As such, the group recognises the importance of human interfaces between organisations which ensure the safe, efficient, secure and resilient delivery of services. The group supports the use of tools, such as Service Level Agreements, and wider standardized/harmonized implementation of the ATSEP Working Position concept its capabilities, elaborated by EGHD, which enable effective human interfaces within ATM/ANS provision.*

7. Recommendations

Recommendation 1	*The EC, with relevant authorities, should analyse the future service delivery models and determine whether changes to the scope of Regulation (EU) 2017/373 (Annex XIII), related to the ATSEP profession, are required.* *Note: The review should consider the potential range of tasks (that support the safe and efficient delivery of services) to be performed by future ATSEP, the needs of service providers and the support required for the rapidly evolving ATM/ANS functional system.*
Recommendation 2	*The EC, and relevant authorities, should revise Regulation (EU) 2017/373 (Annex XIII) to include a competency framework to apply to all future ATSEP to determine the competency requirements tailored to their specific roles and duties. The framework will facilitate the creation of appropriate initial and ongoing training and competency assessment programmes in a standardised manner across all service providers.*
Recommendation 3	*The EC, with the relevant authorities, should develop guidance on the implementation of IT and Engineering industry good practice relating to technical staff working methods. IT and Engineering good practices should be evaluated to determine their applicability and how they can be adopted and adapted to suit the complex environment of ATM/ANS service provision.*
Recommendation 4	*The EC, with the relevant authorities, should encourage the application of a human centric approach to the design of the Joint Human-Machine System in the implementation of any future automated monitoring tools or new functionalities for ATSEP in ANSPs.* *Note: Principles and recommendations for implementing a human centric approach should be taken from the previous EGHD Position Paper entitled "Optimising ATM staff working stations in the Joint Human-Machine System".*
Recommendation 5	*The EC, with the relevant authorities, should investigate new methods, procedures and tools to enable the ATSEP to assure the quality of data exchanged (e.g. resilience, accuracy, integrity, security and availability) is maintained.*
Recommendation 6	*The EC, and relevant authorities, should analyse future service delivery models and identify new methods, procedures and tools to facilitate effective communications and decision making between ATSEP and other ATM/ANS stakeholders within an ANSP or externally.*
Recommendation 7	*The EC, and relevant authorities, should analyse and identify mechanisms to ensure that operational procedures controlling the continuity of services (e.g. Change Management, Incident Management, Event Management etc) are fit for purpose in the context of the future service delivery models. This applies to those procedures performed either independently by suppliers or jointly between ANSP and suppliers.*

Recommendation 8	*The EC, with the relevant authorities, shall ensure that the future regulatory framework for ANSPs and ADSPs includes appropriate rules for ATSEP, and other technical personnel, based on the future scope of the ATSEP profession (Recommendation 1) and the competency requirements (Recommendation 2).*