2024

ATSEP SAFETY STUDY

An evaluation of the impact of ATSEP inclusion in ICAO Annex 1 and subsequent Licensing, to Safety and Performance of ANS

ATSEP:
"The Job and related functions are all qualified as safety-critical and therefore there might be a need to regulate some aspects of the job."
EU Study D7: Final Report, 2013

Delivered by :

International Federation of
Air Traffic Safety Electronic Associations
–IFATSEA-

2/10/2024

ECORYS & NLR Study
EU Study D7: Final Report, 2013

Based on the EUROCONTROL Accident Incident Model (AIM) an estimate can be made of contribution of the **ATSEP within several accident scenarios** if the ATSEP fails to perform his job properly.

According to AIM this contribution is significant in all accident scenarios **failure of the ATSEP may lead to an increase :**

of the mid-air collision probability of 17%,
of the runway incursion probability of 15%,
of the taxiway collision probability of 10% and
of the wake induced accident probability of 17%.

The ATSEP also plays a role in the barrier 'A/C Ground Proximity Warning'.

If this barrier fails, the **CFIT accident probability is 50 times higher** than when the barrier is intact.

Expression of acknowledgment and gratitude

17/10/2024

The development and production of this ATSEP Safety study could not be done only by one person but with the help of some significant contribution from highly valued colleagues.

For this reason, I would like to thank the following contributors:

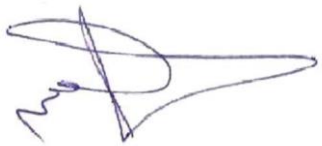
Thorsten Wehe, Goran Petrovic, Konstantinos Simaikis, Adeyinka Olumuyiwa Osunwusi, Costas Christoforou, Andreas Meyer, Nikola Cojic, and esteemed members of the IFATSEA Safety Subcommittee as well as the Executive board members,

This is to express my heartfelt gratitude for your remarkable support and invaluable contributions to the development of the ATSEP Safety Study. Your collective supporting efforts, irrespective of the extent, have helped me produce a foundational document that not only underscores the critical role of Air Traffic Safety Electronics Personnel (ATSEP) in aviation safety chain but also brings much-needed attention to the importance of standardized licensing and training for ATSEP professionals worldwide.

Thank you for offering your r expertise, insights, and collaborative spirit have been instrumental in driving this initiative forward. I hope that this study marks a significant step toward enhancing safety in air traffic management and serves as a testament to the dedication and professionalism of all involved. The comprehensive analysis, advocacy for regulatory recognition, and actionable recommendations within the study will undoubtedly contribute to the advancement of global aviation safety standards and practices.

Thank you once again for your unwavering commitment to this essential cause. Your work has set a new benchmark in aviation safety, and I look forward to seeing the continued impact of your efforts on the industry.

With deepest gratitude



Theodore Kiritsis
President
IFATSEA

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Executive summary

The present study is named **ATSEP Safety Study** and has been developed in response to the requirement set by the ICAO Assembly (2016) to investigate the **potential positive safety impact from the Inclusion of ATSEP in Annex 10 and their subsequent licensing.**

The *ATSEP Safety Study* document outlines the case for including Air Traffic Safety Electronics Personnel (ATSEP) in ICAO Annex 1, which governs personnel licensing. The study, developed by the International Federation of Air Traffic Safety Electronics Associations (IFATSEA), argues that ATSEP's responsibilities in managing and maintaining critical air navigation systems are essential for aviation safety, requiring standardized licensing. Key findings and arguments include:

1. **Safety Impact**: ATSEPs' roles are safety-critical, as their tasks impact accident probabilities in scenarios like mid-air collisions and runway incursions. Errors in these roles can lead to severe outcomes, such as higher Controlled Flight into Terrain (CFIT) risks.

2. **Regulatory Needs**: The study highlights a gap in ICAO Annex 1, which currently excludes ATSEP from formal licensing. Including ATSEP in Annex 1 would ensure consistent training and competency standards globally, enhancing safety and reducing operational risks.

3. **Professional and Economic Benefits**: Recognizing ATSEP as licensed professionals could improve job mobility, enhance career opportunities, and bring economic advantages by reducing incidents and improving system reliability.

4. **Cybersecurity and Technological Changes**: With increasing digitalization and automation in air navigation systems, ATSEP's role has expanded to include cybersecurity measures. The study argues that standardized qualifications will enable ATSEP to meet new technical challenges effectively.

5. **International Advocacy**: IFATSEA has worked with ICAO and other organizations to promote ATSEP licensing. This includes submitting working papers to ICAO assemblies, though progress has been slow due to differing views on safety and cost implications.

In conclusion, the document emphasizes that including ATSEP in ICAO Annex 1 aligns with global aviation's safety and efficiency goals, solidifying ATSEP's role as critical contributors to the aviation industry.

ICAO Annex I change are performed by ICAO regularly. The most recent took place in 2022 (Amendment 178) in order to introduces new provisions for the use of electronic pilot licenses, which are increasingly being used by ICAO Member States.
The **cycle for any change may also take as many as 8 years long**.
This means that **even if the decision to proceed with ATSEP licensing is taken this year it may be up to 2033 onwards that the whole process will be completed.**

The question is, can the aviation domain cope with the increasing complexity of Air Navigation systems, the hybrid environment of terrestrial and satellite-based Air navigation CNS and ATM enablers, while at the same time newcomers like UAVs (drones) are coming into the ecosystem?

Can the global aviation environment of networked ground and in-flight systems over SWIM afford to have different levels of ATSEP competence serving the same functionalities and services?

However, an EASA Study performed by ECORYS and NLR concluded that:

"ATSEPs play a crucial part in the ATM system and mistakes of the ATSEPs might lead to incorrect operation of systems, with a potential negative impact on safety.
Within the ATM system, the ATSEPs often contribute to the performance of the last safety barrier, according to the EUROCONTROL Accident Incident Model.

Outside the ATM/ANS system some barriers still remain, e.g. the pilot of the aircraft and TCAS systems. The job and related functions are all qualified as safety-critical and therefore there might be a need to regulate some aspects of the job".

The report also states that although some of the systems that ATSEP install and maintain are regulated by ICAO standards, only in EC 2011/1035 existed at the time a partial regulation concerning these Safety Critical Functions ATSEP perform.

Finally, the report concludes that **if regulation related to competence for ATSEP is adopted**, the following **positive** impacts can be expected:

- A **positive** safety impact stemming from improved qualifications of ATSEPs.
- An **overall** positive economic impact. Positive impacts from increased efficiency of the job and safety benefits are likely to outweigh the costs from implementing the regulation.
- A **positive** social impact stemming from increased qualifications of ATSEPs.
- A **positive** impact on regulatory harmonization stemming from the introduction of common rules regarding competence and training requirement for ATSEPs that apply throughout all EASA .

Introduction

The present study is named **ATSEP Safety Study** and has been developed in response to the requirement set by the ICAO Assembly (2016) to investigate the **potential positive safety impact from the Inclusion of ATSEP in Annex 10 and their subsequent licensing.**

This document aims to present the arguments related to the inclusion of Air Traffic Safety Electronics Personnel (ATSEP) in Annex 1 of the International Civil Aviation Organization's (ICAO) Personnel Licensing regulations.

ATSEP play a critical role in modern civil aviation, as their expertise is crucial for the effective management and operation of air traffic management systems.

This first section of this document explores the essential responsibilities and functions of ATSEP. These professionals are responsible for the maintenance, installation, and operation of the technological systems that underpin Air Traffic Management (ATM). By analyzing their vital role in ensuring safe and efficient air travel, it becomes evident that their expertise is integral to and impacts the the overall aviation ecosystem.

Furthermore, this document shows an overview of the legal, regulatory, and safety aspects that support the inclusion of ATSEP in Annex 1. It highlights the necessity of having standardized and unified requirements in ATSEP training to enhance their proficiency and ensure consistency among professionals worldwide. The safety implications of their role are also emphasized, underscoring the need for appropriate licensing and adherence to regulatory frameworks.

Moreover, the document highlights the commercial and economic benefits that arise from recognizing ATSEP as a crucial part of the aviation community. By including ATSEP in Annex 1, their value and expertise can be properly recognized and acknowledged, leading to improved job mobility and career growth opportunities. ATSEP professionals possess specialized skills and knowledge in managing air traffic systems, making them valuable assets in the ever-evolving aviation industry.

Additionally, the document focuses on the educational aspect, explaining how the inclusion of ATSEP in Annex 1 would open doors for specialized studies and advanced training programs tailored to their specific roles and responsibilities. This would further enhance their expertise and ensure they remain updated with the latest technological advancements in the field of air traffic management.

Notably, this document addresses the concerns and skepticism that may exist among aviation professionals regarding the pending inclusion of ATSEP in Annex 1. It provides a robust argument that demonstrates the criticality of their role and underscores the fact that their involvement would be a natural and necessary extension to the existing personnel licensing framework in aviation.

In conclusion, IFATSEA believes the inclusion of ATSEP in Annex 1 is not only vital but also aligns with the vision of ICAO to ensure the highest level of safety, efficiency, and standardization in global aviation. Recognizing the significance of their contributions and granting them formal recognition through personnel licensing would solidify their essential role in the aviation community, ultimately benefiting the industry as a whole.

Continuous development, introduction of technical innovations and new technologies, improvement of procedures, permanent training of personnel, led to the fact that safe, efficient and regular air traffic functions globally today. Despite being the youngest in terms of length of existence, air transport as a form of transport is also the safest. In order to reach that level, a long series of years of development had to pass, where technique and technology, on the one hand, were subject to

continuous review and improvement. On the other hand, competent personnel involved in air traffic were needed as key to the development of air navigation services (ANS).

When it comes to personnel who are key to the development of ANS, it is not possible to reduce everything to only air traffic controllers. The global air transport system is extremely dependent on the entire infrastructure required for the development of ANS, but also on the personnel who manage that infrastructure. A key part of that infrastructure is Communication, Navigation and Surveillance (CNS) systems as well as newer-generation CNS/ATM systems, which are managed by Air Traffic Safety Electronic Personnel (ATSEP), recognized by the International Labor Organization (ILO) as a separate profession under Unit 3155 in terms of their Performance, Continuity of Service, Accuracy and integrity of their critical parameters, most of which are listed in ICAO Annex 10 volumes I to V.

The key infrastructure for the development of ANS in the form of CNS (CNS/ATM) systems and equipment, but also more widely, require professional personnel, capable of achieving high performance objectives, whose training requires meeting the highest aviation standards, as is the case with licensed personnel recognized in ICAO Annex 1.

In recent decades, air traffic has recorded continuous growth. Among several factors responsible for this is improvements in Air Traffic Control Systems. The development of more advanced CNS (CNS/ATM) systems has allowed for more efficient management of airspace, reducing delays and increasing the capacity to handle more flights safely. These technological advances have helped accommodate the growth in air traffic without compromising safety.

According to the aforementioned facts about the CNS (CNS/ATM), the question inevitably arises,

"Who are the personnel whose scope of work includes the operation of the CNS (CNS/ATM) system?"

ATSEP do the following tasks among many others:

- ✓ are in charge of the Installation, Operation and maintenance of the (CNS/ATM) systems and services
- ✓ assure the Reliability and integrity of ANS Data, sharing data between interoperable ANS systems and enabling Cross border services?
- ✓ include Cybersecurity as **first responders** in Air Traffic Management
- ✓ Have the responsibility and jurisdiction for the Networking and Remote Towers

These are the ATSEP, as personnel responsible for ensuring the integrity and availability of the information used by both pilots and ATCO.

Many of the above tasks are safety critical and many more safety related. A thorough analysis has been done by the European Union and the FAA. Thus, ATSEP as safety critical personnel must be trained, qualified and capable of performing safety critical tasks in civil aviation and commensurate with ICAO requirements detailed in Annex 1.

Licensing ATSEP

Personnel licensing can be described as a system of standards, processes and procedures aimed to ensure that personnel undertaking safety related tasks in civil aviation (pilots, air traffic controllers, aircraft maintenance engineers, etc.) are competent to perform their tasks to the prescribed standard. ICAO Annex 1 clearly defines which personnel are covered by the licenses. Long ago these SARPs were based on the recommendations of the Personnel Licensing Department, which relate to the licensing of flight crew members, as well as key personnel responsible for the provision and maintenance of air navigation services.

However, ICAO, since its first edition of Annex 1 Personnel Licensing and after so many decades, has not included ATSEP in licensed personnel, regardless of belonging to the critical safety chain of personnel.

For the sake of safety, aircraft crews must communicate with ground services or with other aviation people, communication systems and devices. In order for the navigation of aircraft to take place safely, radio navigation systems are needed to facilitate this as well as take-off and landing operations themselves. Air traffic must also be adequately monitored via surveillance devices in order to separate aircraft safely from each other.

The CNS services proved to be one of the essential components of the air traffic system, and their development was supposed to be the main support in reducing human errors and enabling the aviation personnel to perform their duties as easily as possible.

Practical systems and devices of the CNS have served not only to further raise the level of safety in air navigation, but also to raise the number of operations, improving thus the overall Performance and Capacity of operations. Although most of these CNS systems and devices were already innovated a decades ago, this does not mean that the technology of operation has not advanced. It was also one of the elements of how to raise air traffic capacity in an economically acceptable way.

For the purposes of better understanding, more detailed structure, there was a need to further elaborate the SARPs from ICAO Annex 1, which was done through documents such as ICAO Doc 9868 PANS-TRG and ICAO Doc 10057.

ATSEP are included among other aviation personnel in the document where in 2015, the Next Generation of Aviation Professionals Task Force developed competency frameworks for air traffic controllers (ATCOs) and air traffic safety electronics personnel (ATSEP) to support the progressive implementation of competency-based training and assessment practices for air traffic management (ATM) personnel. Going even more in detail, ICAO has developed ICAO Doc 10057 for these needs as Additional guidance to the provision of the PANS-TRG customized for ATSEP. Thus, ICAO provided member states with documents of universal importance for ATSEP.

However, notwithstanding the above, ATSEP is not included in the licensed personnel according to ICAO Annex 1.

What is allowed according to ICAO Doc 9379 - Manual of Procedures for Establishment/ Management Personnel Licensing System is that ICAO member states can license certain categories of aviation professionals. In a certain number of ICAO member states, this has been done when it comes to ATSEP (Germany, France, Turkey, Czechia, Serbia, Greece, Bulgaria, ...) where exist national licenses. However, all this does not make such permits globally recognized. This still leaves differences between ATSEP in terms of competence acquisition.

How is this sustainable? In the era of ever-increasing growth in air traffic, the ever-increasing dependence of its development on the development of technical systems and devices, network connectivity, potential disruption from the domain of cybersecurity?

It is precisely this complexity of civil aviation that led to the need to create internationally recognized standards and recommended practices in the standardization of licensing of personnel involved in safety-critical activities. Keeping engineers and technicians (ATSEP) in charge of the operation of CNS devices and systems outside the category of personnel whose work requires a license according to ICAO Annex 1 is no longer sustainable.

Evidence for the above claim is abundant. Potential errors in the operation of ATSEP can be related to a series of safety-critical occurrences.

Take for example:

- Mid-air collision in Überlingen (2002),
- Runway incursion, Linate Milano (2001),
- Controlled Flight into Terrain (CFIT B762 Busan Korea CFIT (2002),
- failure of Technical Monitoring and Control System -TMCS of VCS at NATS Swanwick center (2013) and
- the failure occurred in the System Flight Server (SFS) at Swanwick Area Control (2014), etc.

Also, is it possible to maintain the entire concept of CNS or CNS/ATM and start new initiatives like FANS in the past with staff-experts in this field who do work without licenses?

How to implement initiatives like the European SESAR where experts from the ATSEP community have an important role and are not aviation licensed personnel themselves?

In addition, how will this ATSEP status affect air traffic in the long term, where this type of business will become less and less attractive?

Professional reasons

The reasons for the ATSEP license globally recognized as an ICAO license cannot only be reduced to safety and cybersecurity reasons. An ATSEP license in a professional sense would give additional credibility to the profession and thus also to the providers within which ATSEP perform their duties. With this, ATSEP additionally proved its competence in the work it deals with, its training and commitment to the profession it deals with.

The license should be proof of the protection of the public interest and the legality of the work that ATSEP is engaged in. In fact the ICAO license for ATSEP should indicate that all users of CNS services anywhere in the world can be assured that all international aviation standards in that area have been complied with.

Economic benefits

Is civil aviation losing out with globally recognized ATSEP Licenses?

Will this create a barrier to entry for new staff into the ATSEP profession and will it raise the cost of doing business?

Is this a form of protectionism and the creation of new bureaucratic inefficiency?

Judging by everything stated in the entire previous content of the text, it is hard to say that. It is primarily an initiative for the uniform application of aviation regulations (standards), the application of which is essential to protect public safety and welfare by ensuring that ATSEP practitioners meet certain standards of competence. Thus, licensing helps maintain quality and trust in the profession, preventing unqualified individuals from causing harm, because poor performance of ATSEP can cause serious economic damage to airline/airport operators. In addition, licensing can promote fair competition by establishing a level playing field where all ATSEP professionals must meet the same requirements, ultimately benefiting end users.

Also, is it possible to maintain the whole concept of CNS or CNS/ATM and start new initiatives like FANS in the past with personnel (experts) in this field who do work without licenses? How to implement initiatives like the European SESAR where experts from the ATSEP community have an important role and are not aviation licensed personnel themselves? In addition, how will this ATSEP status affect air traffic in the long term, where this type of business will become less and less attractive?

Although there are costs associated with licensing and certain administration, they are often outweighed by the benefits of higher quality services and greater protection of air traffic service users. In other words, costs associated with safety and training requirements for ATSEP personnel are already present. Costs have no place here as an excuse for not introducing ATSEP licenses. Finally, by licensing ATSEP all ICAO members would receive significant benefits in terms of safety and cost reduction, while in general the winner would be air traffic and thus civil aviation.

IFATSEA work with ICAO on ATSEP related issues

With the global deployment and operation of air navigation systems and the increasing digitalization, automation, virtualization and interoperability of these safety-critical systems, issues revolving around the training, competence, qualification and certification of the technical and engineering personnel involved in the installation, commissioning, maintenance and operation of these systems are becoming monumentally significant, thus requiring a comprehensive, standards-based and globally harmonized approach.

As the authoritative voice on the competence of air traffic safety electronics personnel (ATSEP) worldwide, the International Federation of Air Traffic Safety Electronics Associations (IFATSEA) has been championing this course by making interventions, either individually or in collaboration with Contracting States and other international entities, in an attempt to continue to improve air traffic safety performance and standards globally as well as continue to promote a global seamless airspace particularly given the multi-dimensional and paradigmatic nature of aviation safety.

IFATSEA's interventions have targeted quite a number of distinct areas, such as **training, competence and qualification** of ATSEPs:

- Addressing issues surrounding the dynamic changes in the ATSEP working environments occasioned by technological innovations and the increasing digitalization of communication, navigation and surveillance/air traffic management (CNS/ATM) systems. IFATSEA, for example, submitted **Working Paper A40-WP/105** – *Enabling Digital Aviation through the Cyber-Development of Air Traffic Safety Electronics Personnel (ATSEP)* - to the 40th ICAO Assembly on the introduction of a new ATSEP stream to enable the technical and managerial capability of ATSEPs to withstand cyber threats to CNS infrastructures.
- The **training, competence and qualification** of ATSEPs, including a standardized approach to competency-based training and the development of appropriate competency elements and competency units.
- The global standardization and harmonization of air traffic safety electronics practices through the inclusion of ATSEP in Annex 1 – *Personnel Licensing* - to the Convention on International Civil Aviation (otherwise known as the Chicago Convention).

The central focus over the years has been a **globally harmonized and standardized approach to the training, competence and certification** of personnel involved in the installation, maintenance, and operation of air navigation systems through the inclusion of ATSEP licence in Annex 1 to the Chicago Convention.

It will be recalled that as early as 2000 in the course of the 30th IFATSEA General Assembly in Montreal Canada, initial interactions among IFATSEA members, the ICAO (International Civil Aviation Organization) Secretariat and the ICAO Air Navigation Commission crystallized into a recognition of the fact that ATSEPs were trained to certain standards, thus creating the forum for a consideration of issues surrounding the competency of ATSEP and required standards for certifying these competencies. In furtherance of this recognition, the 11th Air Navigation Conference of ICAO, which held in Montreal Canada between 22 September and 3 October 2003, highlighted the overarching need to subject issues surrounding the training, competence, and qualification of ATSEP to further investigation.
The year 2004 witnessed two important developments as far as the competence and the certification of the competence and qualification of ATSEPs is concerned.

The first development was the approval, in principle, by the ICAO Secretary General, and the subsequent publication by ICAO of an advance version on 30 August 2009 of the ICAO Doc 7192 AN/857 (Part E-2) – *Air Traffic Safety Electronics Personnel Training Manual* - which actually set the stage for proposals targeting the inclusion of ATSEP in ICAO Annex 1.

The development of Doc 7192 was actually a culmination of efforts initiated by the European arm of IFATSEA in conjunction with EUROCONTROL, resulting in:

1) a draft document (the ESARR 5) outlining general safety requirements for all ATM personnel comprising ATSEPs and air traffic control officers (ATCOs) and
2) 2) the 2009 EUROCONTROL Specification for Air Traffic Safety Electronics Personnel Common Core Content Initial Training.

The second development was the development and acceptance of ICAO Doc 10057 (now V 2.0) titled Manual on Air Traffic Safety Electronics Personnel Competency-based Training and Assessment. According to this document, ATSEP are described as *"personnel proven to be competent in the installation, operation, and/or maintenance of a communications, navigation, surveillance/air traffic management (CNS/ATM) system".*

Further work is undergoing in the Air Navigation Commission of ICAO and the PTLP , Personnel Training and Licensing Panel(PTLP).
Work with ICAO is also ongoing in the ICAO Regions such as APAC where a document on ATSEP fatigue , the first of its kind is currently being finalized, and brings in a fresh and innovative perspective towards improving Performance and Safety in ANS and the ATSEP related areas.

IFATSEA interventions on the inclusion of ATSEP in ICAO Annex 1 vis-a-vis ICAO Technical commission decisions (since 2004)

IFATSEA has submitted a large number of Working papers at ICAO Assemblies on ATSEP competency but also on ANS technical issues and potential solutions.

Hereby follows a list of Working papers submitted with respect to ATSEP inclusion in ICAO Annex 1 and the respective ICAO Technical comission decisions since 2004.

A35:35th ICAO General Assembly (28 September-8 October 2004):

Submission of the Working Paper **A35-WP/198** – *Personnel Regulation as a Tool to Support Safety and Security in Air Traffic Services* – presented by the International Transport Workers' Federation (ITF) to the 35th ICAO General Assembly (28 September-8 October 2004) under Agenda Item 23 relating to "*Consolidated Statement of Continuing ICAO Policies and Practices Related to Communications, Navigation and Surveillance/Air Traffic Management (CNS/ATM) Systems*." The paper invited the Assembly, among other things, to develop requirements for the certification or licensing of ATSEP as well as the regulation of working time for ATSEPs and ATCOs.

> **In consideration of A35-WP/198**, the ICAO Technical Commission agreed that no further action by the Assembly was required on the issue of the licensing of ATSEPs, recalling that the issue had been addressed and concluded upon during ICAO 11th Air Navigation Conference in 2003. The Commission also expressed non-support for the ITF proposals regarding the development of working time regulation for ATCO and ATSEP and a study on restructuring and increasing fragmentation of air traffic services and maintenance operations as well as its impact on safety and security.

A36:36th Session of ICAO Assembly (18-28 September 2007):

Under Agenda Item 30 – *Other Safety Matters* – IFATSEA and ITF presented a joint working paper **A36-WP/210** – *Personnel Regulation as a Tool to Support Safety and Security in Air Traffic Services* - to the **36th Session of ICAO Assembly** (18-28 September 2007), inviting the Assembly to, *inter alia*, develop requirements for the licensing of ATSEP and certification of CNS/ATM systems.

> The ICAO Technical Commission, *having regard to the support of the majority of Assembly delegates* for the proposal on licensing standards for ATSEP, ***"agreed that the concept of establishing licensing requirements for ATSEP could be supported in principle but had to be referred to the ICAO Council for further consideration in view of its financial implications".***

However, several years later, ICAO has not yet considered or acted upon this. Moreover, the key questions arising from these minutes are as follows:

Some delegates did not believe that this inclusion would improve safety, and this view needs to be addressed. The ICAO Council needs to **further consider the financial implications** of this decision. These two unresolved issues are taken into account in the present study.

A37: 37th Session of the Assembly (28 September-8 October, 2010):

IFATSEA, in 2010, presented a Working Paper **A37-WP/160** – Competencies and licenses of Air Traffic Safety Electronics Personnel (ATSEP) – to the 37th Session of the Assembly (28 September-8 October) under Agenda Item 45 – Next Generation of Aviation Professionals – inviting the Assembly to, inter-alia, recognize the global context of ATM/ANS and endorse the concept of ATSEP licensing.

> In consideration of this paper, the ICAO Technical Commission expressed the view that licensing was not the only means of demonstrating ATSEP competencies and that new provisions developed by the NGAP Task Force should not overly impact developing States. The Commission added that transition measures be considered in the case of new requirements and that the scope of the NGAP Task Force be expanded in a timely manner to include the development of competencies for aerodrome professionals.

A38:38th Assembly (24 September-3 October,2013):

Under Agenda Item 38 – *Other issues to be considered by the Technical Commission* – Indonesia, in 2013, presented Working Paper **A38-WP/151** – *The Integration of Air Navigation Personnel into Annex 1* – to the 38th Assembly (24 September-3 October), inviting the Assembly to request the ICAO Council to update Annex 1 by developing requirements for air navigation personnel, comprising AIS personnel, ATSEPs and flight procedure designers.

> The Commission, in consideration of the paper, recalled that ICAO had developed competency frameworks for ATSEPs in cooperation with IFATSEA. While noting the absence of consensus on whether a sufficient safety case was available to justify the development of international licensing provisions for personnel outside of the scope of the existing disciplines covered under Annex 1, the Commission stated further:
>
> *"The Commission noted that the absence of international licensing provisions would not preclude States or regions from establishing their own national certification or licensing requirements.* ***The Commission agreed that, resources permitting, the ICAO Council be requested to identify the safety case*** *for the development of international licensing provisions beyond the current scope of disciplines covered under Annex 1."*

However, this has not been requested to be addressed yet by the Council.

A39: 39th ICAO Assembly (27 September-7 October, 2016)

The 39th ICAO Assembly (27 September-7 October, 2016) under Agenda Item 37 – *Other issues to be considered by the Technical Commission* – saw a confluence of three Working Papers proposing licensing requirements for ATSEPs to be developed for Annex 1. These were **A39-WP/129** presented by India, **A39-WP/298** – *The Inclusion of Air Traffic Safety Electronics Personnel into Annex 1* – presented by IFATSEA, and **A39-WP/368** Revision No. 1 presented by Ghana.

During the Assembly 39 proceedings, there was not much time to discuss the issue and the chair requested ***that only opposing statements be presented.*** From the very few opinions presented

against, Assembly 39 came to the same conclusion that reached in the previous assemblies. Reviewing the paper, the Commission, in its report, noted:

> "The Commission recalled that similar proposals for ATSEPs had been the subject of discussions during the 36th, 37th and 38th Sessions of the Assembly. The Commission had noted on those occasions that training provided the competency, while licensing was only one of the means to provide evidence of such competency. The Commission also recalled that ICAO has developed competency-based procedures for ATSEPs in the PNAS-TRG that would raise and harmonize the level of competencies while **allowing States to implement a flexible approach to competency-based training**. Introducing an ATSEP license would remove such flexibility and add to the administrative burden of States. In addition, the Commission recognized that such a development **could negatively impact the work of the air navigation services providers** (ANSPs) at a time when the **safety benefits accrued** from PANS-TRG competency-based training and assessment for ATSEPs had not yet been determined."

The Commission, while noting that there was no evidence that the lack of an ATSEP license impacted safety, declined to support the proposal to introduce Standards for ATSEPs into ICAO Annex 1.

However, IFATSEA is wondering how safety benefits will be or have been identified particularly in the absence of a structured study on safety and financial impacts. Additionally, there is concern regarding the basis for concluding that the implementation of a coordinated global ATSEP competence scheme, as mandated by ICAO Annex 1, could adversely affect the operations of ANSPs.

Moreover, while there is a study on **Safety criticality of ATSEP performed by the European Union** prior to the development of EU 373/2017 regulation, that clearly identifies ATSEP as a Safety critical profession and that the Regulation of the ATSEP profession can bring Positive safety benefits.

The study distinctly recognizes ATSEP as a safety-critical profession and indicates that regulating this profession can yield positive safety outcomes.
The findings of this unbiased study have consistently been cited in the references of IFATSEA working papers to the ICAO Assemblies.
Furthermore, a study by FAA also identifies ATSEP as a safety critical profession.

IFATSEA has been awaiting the initiation of these two tasks by ICAO for several years; however, limited progress has been observed regarding these items, which originated from two ICAO Assembly (Technical Commission) decisions.

During this period, ICAO and IFATSEA have engaged in active collaboration under the ICAO NGAP program, focusing on the development of documentation for ATSEP Training. The initial ATSEP ICAO Training manual, AN7192 A, created in 2003 through joint efforts, with IFATSEA contributing resources, has since been revised to align with a Competency Based Training (CBT) framework. This updated approach not only pertains to ATSEP but also encompasses the other two essential aviation professions: pilots and air traffic controllers (ATCOs).

Concerning the aforementioned task (a) related to the development of a safety study, it is essential to conduct a thorough examination of the following aspects:

- ✓ The ATSEP job safety criticality,
- ✓ Its potential contribution to safety and

- ✓ The Regulation of the Profession Roadmap through a Global Competency scheme for ATSEP
- ✓ Any potential financial implications

A comprehensive study must be conducted with impartiality, relying on robust evidence derived from historical incidents, accidents, or relevant research.

It is essential to consider the forthcoming transformative technological advancements stemming from initiatives such as SESAR, NEXTGEN, and CARATS, for which Air Traffic Safety Electronics Personnel (ATSEP) will be accountable for ensuring their safe implementation within traditional Air Navigation Service Providers (ANSPs) and beyond, including ATM Data Service Providers (ADSPs) and Virtual Centers and Remote Towers.

Recent initiatives by IFATSEA aimed at establishing a definitive roadmap for the inclusion of ATSEP in ICAO Annex 1 and their licensing in both ICAO and Europe have underscored the necessity of gathering pertinent materials and formulating a Safety Document supported by credible safety and financial data.

The Executive Board of IFATSEA has resolved to tackle this matter through the collection and integration of safety data, culminating in a document that addresses the critical safety role of ATSEP and the implications of their inclusion in ICAO Annex I (Licensing)

The IFATSEA Executive Board decided to tackle this matter by collecting and integrating safety data from previous related incidents and accidents to produce a document detailing the safety criticality of ATSEP and the impact of including ATSEP in ICAO Annex I (Licensing) on overall safety.

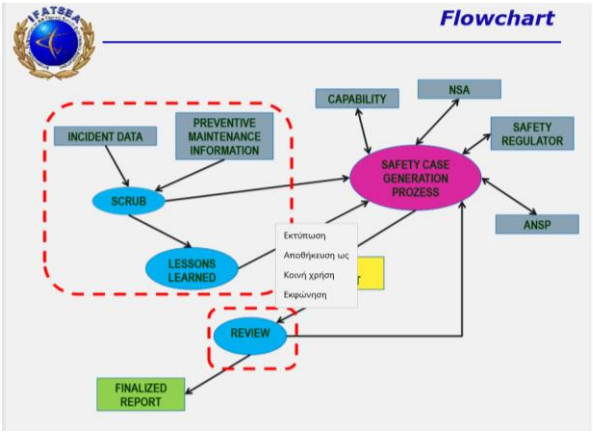
Methodology

The methodological framework employed for the Safety Study involved the aggregation of pre-existing data concerning the criticality of ATSEP Safety and the establishment of connections among these data points based on their impact on Safety and operational efficiency.

Since its inception in 1973, IFATSEA has advocated for the integration of the ATSEP profession into ICAO Annex I and the subsequent licensing of ATSEPs. Consequently, the strategy of gathering independent data has been deemed suitable to uphold a high degree of objectivity.

It is important to emphasize that IFATSEA, as a Professional Association, focuses exclusively on professional matters, leaving social issues to be addressed by other organizations at both national and international levels, such as ITF, ETF, and ATCEUC.

It must also be noted that since Safety has increased substantially in recent years, there is a lack of substantial information of incidents or accidents that are linked to ANS provision and CNS/ATM systems.



	B	C	D	E	F	G	H	I	J
3	AREA	HAZARD	PROBABILITY	SEVERITY	SAFETY RISK INDEX	SAFETY RISK TOLERABILITY	CONSECUENCES	ATSEP MITIGATION	OBSERVATIONS
4	Communications	Lightning destroyed low frequency splitters between RxTx and PCM, Transient voltage suppression diodes too. Place with weather conditions ok, plus with redunded communication system.	REMOTE	HAZARDOUS	3B	TOLERABLE	All TX were in keying state. Weak coverage of radiofrequencies below FL150.	Setting RxTx from other localities to somehow restore the RF coverage. ATSEPs repaired the damaged equipment themselves within 3 days (Soldering, measuring, changing RLC parts). Sending the equipment to supplier and waiting for repair would take more than 14 days.	New LF and HF surge protections and degradation procedures for all the RxTx localities.
5		Lightning destroyed low frequency splitters between RxTx and PCM, Transient voltage suppression diodes too. Place with usually bad weather conditions, plus with NO redunded communication system.	OCCASIONAL	CATASTROPHIC	4A	INTOLERABLE	No coverage of radiofrequencies at all. No communication between ATCO and PILOT.	Designing and implementing a redunded communication system with elctrical protections in order to use it when main communication system fails.	**Conclusion: Licensing through Training to improve safety.**
6									
								A switchover of FDA positions and/or FDPS did not improve the situation. A timeout parameter for the FPL associated with the message (automatic deletion from FPL	Issues within the FDPS/KDS software, i.e. queueing

Table 1 Picture 3: IFATSEA Incident and accident database

The ATSEP profession interacts with and is an integral part of the air navigation system. Through their job functions, ATSEPs ensure the optimum and safe operation of the Air Navigation systems, procedures, and services through the following means:

- **Preventive means**, among others, include the actions ATSEPs take and the preconditions they manage to minimize the probability of an incident or safety-related occurrence. It is the task of ATSEPs to uphold the highest safety standards, as an erroneous action performed on the CNS & ATM infrastructure could immediately compromise safety.
- **Corrective means** refer to safety-related occurrences that directly or indirectly impact the CNS & ATM infrastructure, where ATSEP's tasks and responsibilities are necessary to ensure safety.

For the collection of this data, a questionnaire was sent out by the IFATSEA Safety Subcomittee and data were collected.The form used can be found at the end of this Study .

This type of action refers to the situational awareness the ATSEP:

- ✓ maintains during occurrences,
- ✓ the implementation by ATSEP of troubleshooting strategies,
- ✓ the ATSEP expertise to take actions which resolve problems,
- ✓ and the ATSEP actions to restore CNS/ATM services and systems to their nominal situation.

IFATSEA has conducted incident and accident data collection over the years, as mentioned above.

For those incidents that were not public we had to:

- ➢ collect safety related data,
- ➢ **Anonymize**
- ➢ to scrub this data in order to ensure anonymity and fitness for purpose, and
- ➢ to deliver the processed data as evidence to support the arguments of the safety case.

Data collected by the IFATSEA Safety subcomittee are not public. (http://www.ifatsea.org/membership-resources/e-library/).
However, information on these can be provided upon request .

At this point, IFATSEA would like to emphasize that in order to ascertain objectivity to the highest possible extend, did not drive any conclusions without having respectfully addressed the particularities of each issue separately. **It has used direct references linked to the EASA-driven study** , accidents or serious incidents' data, or safety recommendations.

To understand the requirements derived from the ATSEP job today, it must be mentioned that although the aviation ecosystem is embarking on a paradigm shift towards Automation and Digitalization of Industrial Revolution 4.0, and above all through the networking over SWIM of all

ANSPs worldwide as the new concept of interoperability, *there is currently no globally harmonized scheme or tool that collects and evaluates technical incidents and the contribution of CNS/ATM systems/equipment failures* (from degraded mode to total loss) *to safety and performance KPIs of service providers, including the relevant economic cost.*

At the same time, the ICAO Annex 10 Volumes I-V **do not contain any specifications or requirements for ATM systems** that are about to be deployed (within the framework of ICAO Block Upgrades) nor for regional programs such as NextGen and SESAR with their interoperable systems.

This constitutes an oxymoron, as ICAO Annex 10 Volumes I to V include requirements for legacy CNS, but there is currently no technical description or requirement for future ATM systems, SWIM, and automation for the ground systems. *However, it is the duty of ATSEP to maintain the optimum and safe operation of these safety-critical modern digitalized systems and intervene on them while they are still operational in order to prevent or restore impacts to the services provided.*

Thus, the need for a new updated Annex Vol VI including ATM systmems and Automation is urgent and timely. Also an ICAO Annex specifically for Cybersecurity and ATM systems is urgently needed. For forthcoming CNS/ATM systems and potentially complex System of Systems, ATSEPs will ensure their optimum operation, service delivery, and system resilience by interacting with them when they are in full operation.

Moreover, the implementation of new space and ground-based hybrid concepts of service provision, together with potential cybersecurity issues, further elevates the requirements on ATSEPs to maintain the availability and continuity of CNS/ATM services.

Any under-performance of ATSEPs due to reasons such as lack of proper training, undeveloped new skills, or fatigue will have a direct impact on the safety and regularity of operations, services, and functions provided to ATCOs or directly to the pilots (e.g., PBN navigation AMHS, CPDLC).

Image 1 VOR-DME Calibration check

Although in ICAO Annex 11 there are specific requirements for airspace design in terms of Required Performance for Communication (RCP), Navigation (RNP) and Surveillance (RSP) in order to enable the airspace classification/organization, delivering safe and expeditious ANS service, which are enabled, maintained and secured by properly trained and competent ATSEP, this has not received the focus it deserves so far.

This document collates and presents already researched or listed data from various sources IFATSEA is confident that the information contained herein, as well as the data repository of related evidence in IFATSEA eLibrary, can constitute a solid basis signifying the contribution of the ATSEP Profession and the positive benefits that can come from the inclusion of ATSEP in Annex I and a Global Competency Licensing standard to be adopted by all ICAO States.

Who are the ATSEP globally?

The International Civil Aviation Organization (ICAO) defines Air Traffic Safety Electronics Personnel (ATSEP) in ICAO Doc 10057, titled Manual on Air Traffic Safety Electronics Personnel Competency-based Training and Assessment. According to this document, ATSEP are described as
"personnel proven to be competent in the installation, operation, and/or maintenance of a communications, navigation, surveillance/air traffic management (CNS/ATM) system

It is the responsibility of the ANSP to define the scope of ATSEP activities (Doc 9868, Procedures for Air Navigation Services — Training (PANS-TRG))

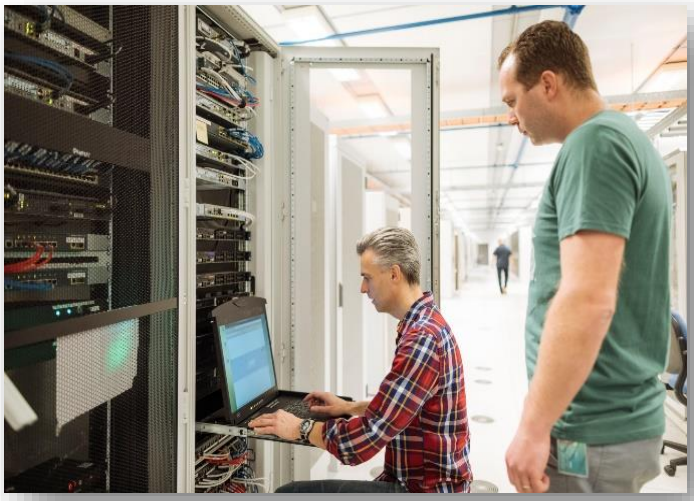


Image 2 ATSEP ON ATM Data processing

For Europe the EASA definition for ATSEP is :

'air traffic safety electronics personnel (ATSEP)' means any authorised personnel who are competent to operate, maintain, release from, and return into operations equipment of the functional system;" (Easy Access Rules for ATM-ANS (Regulation (EU) 2017/373).

The authorization is produced by the ANSP (or the Competent Authority in the case of national Licensing in some states). Only Authorized personnel (ATSEP) are allowed to deal with the CNS/ATM systems.

Air Traffic Safety Electronic Personnel (ATSEP) work on a wide range of Communication, Navigation, Surveillance, and Air Traffic Management (CNS/ATM) systems and equipment, which are ground-based Aeronautical and Airspace facilities and systems used by Air Navigation Service Providers as well as by Satellite CNS service providers.

EGNOS the European satellite service provider trains and certifies its ATSEP according to EASA Regulation (EU) 2017/373. All European ANSPs are subject to regular audits from their Competent Authorities (NSAs -National Supervisory authorities and EASA)

The work on these essential CNS/ATM systems requires specific specialized training to achieve specific skills that are increasingly required to be built on a sound scientific background that will eventually lead to operational competence.

ATSEP task and Job description

ATSEP are responsible for:

- The provision of required Communication, Navigation, and Surveillance performance, which are critical enablers to ensure safe and performant ANS e.g Performance-Based Navigation (PBN) in any given airspace, as stipulated by ICAO.

- High Availability, Accuracy, Continuity, Integrity, and Resilience of these services are very important factors in the aviation business and the associated supply chain as well as potential impacts on national economies.

Unreliable CNS services lead to a variety of consequences, from delays to severe incidents or accidents (see Uberlingen[1] accident report), and increase pilot and controller workload and occupational stress.

The availability and continuity of ATM/CNS services, in the "business as usual" concept, impacts efficiency, increases end-user costs and time waste, and consumes resources of the Service Provider as well as the airspace user (human manpower, work-hours), impacting economic annual balance, branding, and reputation.

Similarly, an ATM system/equipment failure can have major consequences. Traffic patterns of an entire flight information region can be affected with significant impact on flight schedules, route management, increased fuel burn, air & noise pollution and a more complex air traffic control environment.

ATSEP are also responsible for:

Ensuring the integrity and availability of the information used by both pilots and Air Traffic Controllers

Services performed by ATSEP on the legacy and existing operational systems/equipment worldwide have been proven throughout the years as critical to ensuring safety and efficiency in the civil aviation.

Technical systems for Low Visibility operations rely on the duty of ATSEPs (e.g. Instrument Landing System - ILS)

ATSEP are the key professionals responsible for safe and secure air navigation services.
The **need for proven competency, responsibility and accountability for ATSEP** is already stipulated and supported with a strong rational in ICAO Doc 10057 (Manual on Air Traffic Safety Electronics Personnel (ATSEP) Competency-Based Training and Assessment, which is former Doc

[1]

7192- PartE2-ICAO ATSEP Training Manual) as well as in Doc 9683 Human Factors Training Manual.

Personnel Licensing sets standards and recommended practices on licensing and ratings for pilots, flight crew members, ATCOs, and aircraft maintenance engineers, but it does not yet include ATSEP. Many states worldwide have developed **national requirements for licenses and ratings for ATSEP.** In Europe, ICAO state members like Germany, Greece, Turkey, Bulgaria, Croatia, Czech Republic, Serbia, North Macedonia have in place certain national legislation to ensure the professionalism of ATSEP employed in their service providers.
However, this state-based approach creates dissimilarities and fragmentation between states. ICAO Doc 10057 (formerly 7192-PartE2) includes certain provisions for ATSEP training, **but the implementation remains at each state's discretion.**

A solution to address this lack of harmonization is to include ATSEP licensing requirements in Annex 1, thus rendering such provisions imperative and binding to a common approach and holistic way of performing.

According to the aforementioned Documentation, ATSEP must achieve a minimum required level of operational competence that allows them to **"perform safety and other related tasks"** with the specific CNS/ATM equipment or systems they will be working with. These competencies apply to all ATSEPs, irrespective of the organization they work for, their location, or the composition of their functions.

Image 3 ATSEP AT WORK

According to the aforementioned Documentation, there are certain phases in ATSEP training. The Initial Training is the phase prior to S/E Rating Training. Therefore, the minimum training received during Initial Training will not be sufficient to permit operational competence, as it does not fully develop the acquired knowledge and newly obtained skills.

Also, by default, it is not ensuring experience and in-depth familiarization with the task at hand. It will however, be sufficient to prepare an ATSEP-Trainee to start the S/E Rating Training. Only this later phase will ensure professional competence and a high level of situational awareness.

In the ICAO Training material Doc 10057, **ATSEP are also to be trained to deal with security and Cybersecurity issues**. During Assembly 41 in 2022, following a WP submitted by IFATSEA it was decided that a revision of Doc 10057 on ATSEP Tasks related to Security and Cybersecurity will take place in the following months. This was also supported by CANSO.

In Europe, technical staff working for satellite-based CNS services provision at EGNOS are characterized and trained as ATSEPs, just like ANSPs providing terrestrial-based CNS/ATM services. This competence is finally achieved at the end of System and Equipment Rating (S/E) Training.

Therefore, the EC framework, being applied to the ATSEP and their duties, potentially oversees issues like latent hazards, vulnerability gap, hidden flaws or "bugs" in IT systems, latent failures, residual risk and their relevant control and mitigation measures and now with the networking of ANS over SWIM being implemented their security issues and especially Cybersecurity threats.

Moreover, in Europe, the Acceptable Means of Compliance (AMC) for the training of ATSEP addresses more specifically the issue of Cybersecurity for CNS Providers through its **Implementing Rule EU 2017/373** for state members.
More specifically in:

"*ANNEX VIII — PART-CNS, Specific Requirements for Providers of Communication Navigation and Surveillance Services Subpart A- Additional organisation requirements for CNS Providers and SECTION 1 — GENERAL REQUIREMENTS. (CNS.OR.100 Technical and operational competence and capability Regulation (EU) 2017/373) the new 'Common Requirements' Regulation for European ANSPs.*

> *(a) A communication, navigation or surveillance services provider shall ensure the availability, continuity, accuracy, and integrity of their services. (Ensured by ATSEP)*
>
> *(b) A communication, navigation or surveillance services provider shall confirm the quality level of the services they are providing and shall demonstrate that their equipment is regularly maintained and, where required, calibrated. (Ensured and performed by ATSEP)"*

In the same regulation we read the following requirement for all European states and their ANSPs:

"*ATSEP.OR.105 Training and competence assessment program Regulation (EU) 2017/343*

In accordance with point ATM/ANS.OR.B.005(a)(6), the **service provider employing ATSEP shall establish a training and competence assessment programme** to cover the duties and responsibilities to be performed by ATSEP."

Is the role of ATSEP Safety critical ?

The role of Air Traffic Safety Electronics Personnel (ATSEP) is considered safety-critical for several reasons:

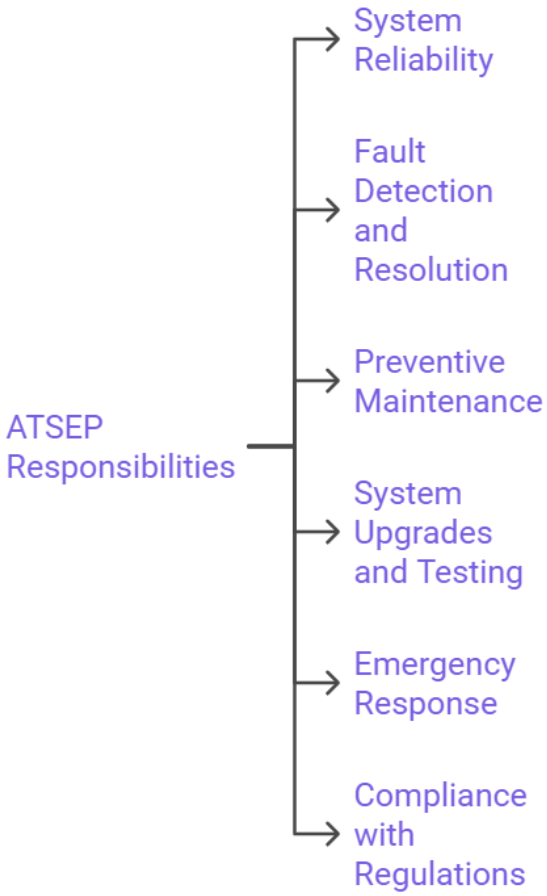
1. **System Reliability**: ATSEPs are responsible for maintaining and ensuring the reliability of electronic systems used in air traffic control. These systems include radar, communication, navigation, and surveillance equipment, which are essential for the safe and efficient management of air traffic.

2. **Fault Detection and Resolution**: They play a crucial role in detecting and resolving faults in these systems. Any malfunction or failure in these systems can lead to serious safety risks, including loss of communication with aircraft, inaccurate positioning data, and compromised navigation aids.

3. **Preventive Maintenance**: ATSEPs conduct regular preventive maintenance to ensure that all systems are functioning correctly and are up to date. This proactive approach helps prevent potential issues that could disrupt air traffic operations.

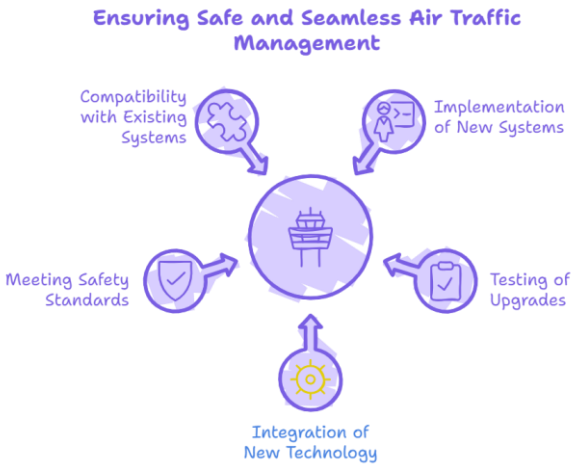
4. **System Upgrades and Testing**: They are involved in the implementation and testing of new systems and upgrades. This ensures that any new technology integrated into the air traffic management infrastructure meets safety standards and operates seamlessly with existing systems.

5. **Emergency Response**: In case of an emergency, ATSEPs are trained to respond quickly to restore system functionality. Their expertise is vital in minimizing downtime and ensuring that air traffic control can continue to operate safely.



6. **Compliance with Regulations**: They ensure that all electronic systems comply with national and international aviation safety regulations. This compliance is crucial for maintaining the overall safety and integrity of air traffic management.

The critical nature of their work means that any lapse in their duties can have significant implications for the safety of air traffic operations.



How do ATSEPs handle system failures during peak air traffic hours?

Handling system failures during peak air traffic hours is a critical task for Air Traffic Safety Electronics Personnel (ATSEPs). Here's how they manage such situations:

1. **Immediate Fault Detection**: ATSEPs use advanced monitoring tools to detect system anomalies or failures in real-time. These tools provide alerts that enable quick identification of issues.

2. **Rapid Response Protocols**: They follow established rapid response protocols to address the failure. This includes diagnosing the problem, determining its severity, and implementing immediate corrective actions.

3. **Redundancy Systems**: Air traffic control systems are designed with redundancy. ATSEPs switch to backup systems to ensure continuous operation while the primary system is being repaired.

4. **Coordination with ATCOs**: They work closely with Air Traffic Controllers (ATCOs) to manage the situation. ATCOs are informed about the failure and any potential impacts on air traffic operations, allowing them to adjust their procedures accordingly.

5. **Prioritization of Tasks**: During peak hours, ATSEPs prioritize tasks based on the criticality of the systems affected. Systems that directly impact safety and communication are addressed first.

6. **Emergency Maintenance Teams**: Dedicated emergency maintenance teams are on standby during peak hours to provide immediate support. These teams are equipped with the necessary tools and expertise to handle urgent repairs.

7. **Communication with Stakeholders**: They maintain clear communication with all relevant stakeholders, including airport authorities, airlines, and other air traffic management personnel, to keep them informed about the status of the system and any potential delays.

8. **Post-Failure Analysis**: After resolving the issue, ATSEPs conduct a thorough analysis to understand the root cause of the failure and implement measures to prevent future occurrences.

These steps ensure that air traffic operations remain safe and efficient, even during unexpected system failures

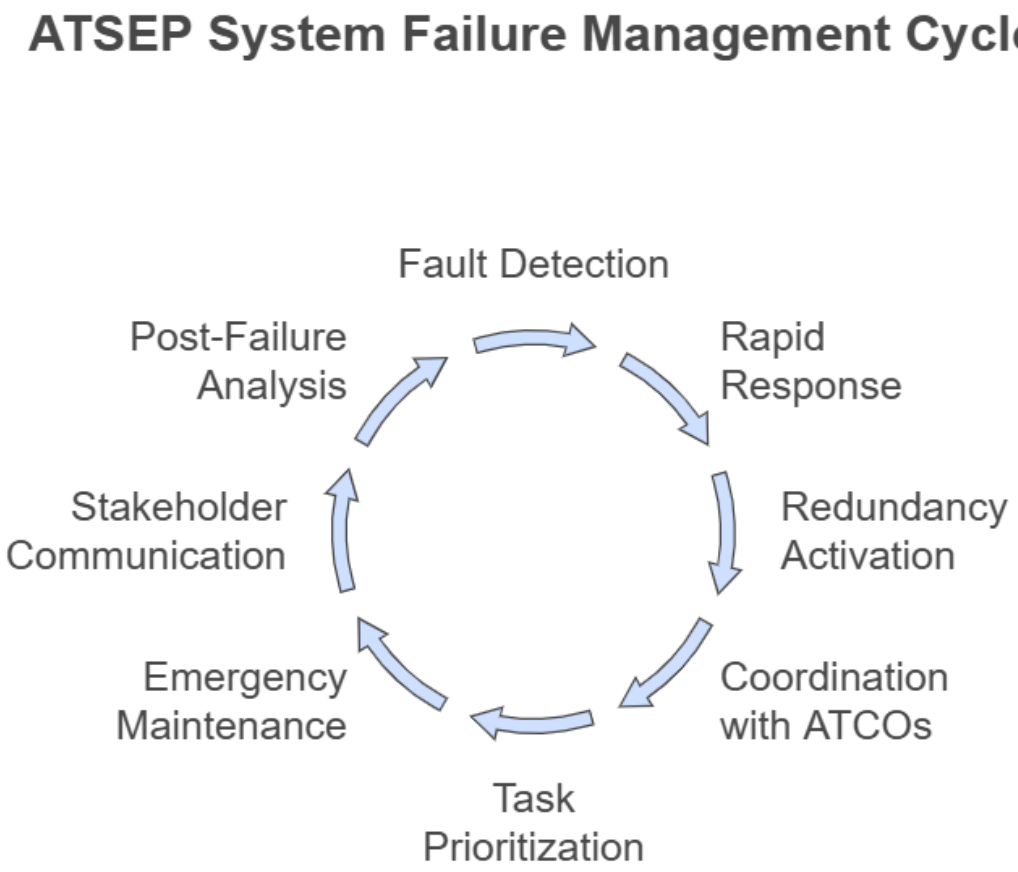


Image 4 ATSEP System Failure management cycle

Compelling Case for inclusion of ATSEP in Annex 1

Despite having a relatively short existence of just over 100 years, modern civil aviation has undergone significant development and transformation. Initially driven by the passion of enthusiasts, it has evolved into a crucial aspect of human life. The advancement of technology, personnel training, and safety measures have played a pivotal role in shaping the field of civil aviation into what it is today. As aviation expanded from a localized activity to a global phenomenon, the establishment of aviation organizations and international regulations became imperative.

Every technological innovation within civil aviation emerged as a response to specific needs and the ingenuity of individuals. These advancements have not only influenced the industry's growth but also had an impact on society at large. Regulatory measures in civil aviation have closely followed the progress in technology, adapting to its effects on aviation professionals and the general public. The International Civil Aviation Organization (ICAO) was established with the purpose of developing standardized regulations, primarily through technical Annexes to the Chicago Convention. These measures aim to facilitate safe, efficient, and regular air traffic worldwide.

Throughout the decades, the training and safe performance of aviation professionals have always been a central concern. It is essential to build trust in personnel and ensure that they are equipped with the necessary skills and knowledge to excel in their roles.

Legal perspective

Even though licenses for pilots and other aviation personnel were issued in the early years of civil aviation, a comprehensive solution was only introduced with the publication of Annex 1 in 1948. Over the decades, Annex 1 underwent significant changes to incorporate evolving categories of aviation professionals. However, not all categories have been included yet, highlighting an ongoing incomplete process. While pilots and flight crews remain a primary focus for ensuring safe aircraft operations, there is also a need for other ground personnel to support and contribute to the safety and efficiency of air traffic.

The issue of licensing for different categories of aviation professionals has been acknowledged and addressed through the inclusion in Annex 1. However, this process is not fully finalized. For instance, Annex 1 clearly defines the categories of personnel who require licenses, but additional provisions for air traffic safety electronics personnel (ATSEP) are outlined in ICAO Doc 9868 Procedures For Air Navigation Services (PANS) - Training. Thus, ATSEP, along with air traffic controllers, are included under the realm of air traffic management (ATM).

PANS Doc 9868 provides more detailed provisions for ATSEP training compared to Annex 1, as it does not contain standards. It serves as a framework for potential future standards related to ATSEP. However, the absence of standards in Annex 1 concerning ATSEP, despite their crucial role in managing CNS/ATM systems and devices, seems surprising given the technological advancements and expected developments in the aviation industry. ICAO has recognized the

significance of training ANS personnel, including air traffic controllers and ATSEP, resulting in the development of specialized manuals such as ICAO Doc 10056 and Doc 10057. In fact during the 2022 ICAO Assembly it was decided that due to the technological changes of digitalization and distributed architectures the content of Doc 10057 regarding ATSEP tasks linked with Cybersecurity be revised. This was also agreed during the PTLP sessions in late 2023.

In Europe, particularly among EU member states and signatories of the ECAA international agreement, the importance of training and competence for ATSEP staff is highly acknowledged. Key regulations in this regard include REGULATION (EU) 2018/1139, which establishes common rules for civil aviation and the European Union Aviation Safety Agency, and IMPLEMENTING COMMISSION REGULATION (EU) 2017/373, which sets common requirements for air traffic management/service providers and their supervision.

The importance of appropriately qualified and trained ATSEP, as well as their connection to safety, is emphasized in the preamble (invocations and opening statements) (17) of EU REGULATION 2018/1139. This significance is further recognized in COMMISSION IMPLEMENTING REGULATION (EU) 2017/373, which sets common requirements for air traffic management/service providers and their oversight.

The definition of ATSEP is clearly stated in Annex I of this regulation, and Annex XIII specifies the training requirements and competence assessment for ATSEP personnel (Part-PERS; SUBPART A). More specifically the ATSEP definition is quite clear that ‘Air traffic safety electronics personnel (ATSEP)’ means any **authorised personnel** who are competent to operate,maintain, release from, and return into operations equipment of the Functional* system ; wheras ‘*Functional system’ means a combination of procedures, human resources and equipment, including hardware and software, organised to perform a function within the context of ATM/ANS and other ATM network functions;

While several countries have acknowledged the need for ATSEP **licensing within their national frameworks**, as highlighted in ICAO Doc 9379 Manual of Procedures for Establishment and Management of a State's Personnel Licensing System, Chapter 4 (4.2 Non-ICAO Licences, I-4-3), **this approach does not fully address the issue**. It is commendable that these countries recognize the importance of ATSEP personnel and their qualifications, but it falls short of including ATSEP in ANNEX 1, which is still needed for a comprehensive globally harmonized solution.

International civil aviation is built on a high level of uniformity and trust that exists among nations. This high level of uniformity is reflected in the regulations (standards) that also refer to the training of personnel performing duties in civil aviation. If they are known to be groups of aviation professionals consisting of pilots, aircraft maintenance engineers/mechanics, air traffic controllers, cabin crew, then ATSEP personnel should certainly be among them. Looking at the broader ICAO initiative "No Country Left Behind in implementing ICAO Standards and Recommended Practices (SARPs)", the inclusion of ATSEP in Annex 1 would also be part of global harmonization. IFATSEA as an umbrella organization which represents the interests of national associations that include ATSEP membership across different countries, has consistently emphasized the importance of incorporating ATSEP in relevant ICAO forums. IFATSEA as well as many states have presented Working Proposals during ICAO assembly sessions to address ATSEP inclusion in the harmonized framework of ICAO Annex 1. In the 2000s, concrete steps were taken in cooperation with ICAO to focus on the training and competence of ATSEP.

As a result, ICAO Doc 7192 AN/857 E2 was developed, which later evolved into ICAO Doc 10057. These documents provided some solutions related to ATSEP training and competence. Notably, IFATSEA actively participated in the ICAO Air Navigation Conference, where the vital role and significance of ATSEP in maintaining the CNS/ATM infrastructure were recognized. This contributed to giving the training of ATSEP a universal importance.

Safety and Cybersecurity perspective

The role of pilots and air traffic controllers as key operational executors, is unimaginable without professionals who provide them with direct tactical technical support. In the case of the airborne site , they are mechanics/avionics/engineers who have long been recognized as such and are part of Annex 1.So technical staff the airborne equipment using ground signals are included in Annex 1, their counterparts responsible for the ground CNS information originating equipment are not (yet). Moreover, on the other hand, whereas we have air traffic controllers who are technically supported by ATSEP staff and where, unlike air traffic controllers, they are not part of Annex 1.

So, it's about that all the previously listed categories of aviation professionals belong to a part of the safety chain, but ATSEP is still the missing link.

At the time of the enormous growth of air traffic in all the past decades, the number of today's operations would be unimaginable without the help of the CNS/ATM system, which are precisely the systems and devices that are part of the responsibility of ATSEP. Over the years, ATSEP has slowly started to become part of the regulatory documents in terms of training requirements and meeting the requirements related to competence as well as the connection with safety in civil aviation. However, regardless of all these well-known facts, it seems that all this was not recognized enough for ATSEP to be included in ANNEX 1.

It should not be forgotten that ATSEP maintains not only the systems used by air traffic controllers but also the systems used by aircraft, i.e., pilots, such as Non-Directional Beacons (NDB), Instrument Landing Systems (ILS), and Satellites.

Considering that all ICAO annexes, except for two, are technical in nature, and Annex 10, which directly relates to the work of ATSEP staff, is the most extensive with its five volumes, the significance of ATSEP's work becomes evident. It is worth noting that ICAO Annex 10 Vol I already includes an accident fault tree due to CNS failures, further emphasizing the importance of their role. With this understanding, it raises the question of why there has been little progress in recognizing the status of ATSEP in Annex 1. It must also be noted that in all technical volumes of ICAO Annexes and especially in Annex 10 volumes, there is no reference or connection to the ATSEP for responsible for their optimum and within the performance envelope of their critical parameters like Availability-accuracy,Integrity and Continuity of service.

The licensing of ATSEP personnel within national frameworks of various ICAO member states indicates that this matter has not been universally resolved and different solutions exist.

ICAO's document, the Manual of Procedures for Establishment and Management of a State's Personnel Licensing System (ICAO 9379), allows for the licensing of certain aviation personnel

categories if there are justifiable reasons. However, since ATM systems and devices are interconnected, require consistency, reliability, and interoperability, and provide cross-border services, **a national solution alone cannot be satisfactory as mentioned above**. Providing such a service that has implications for international air traffic should not rely on differing national approaches among ICAO member states.

The field of air traffic control has undergone significant advancements over the years, moving from simple flag waving to a complex system of airspace organization and communication with aircraft. Today, regular communication with air traffic control is vital for safe and efficient air traffic management. In order for everything to operate smoothly and safely, a wide range of systems and devices must function flawlessly. This is where ATSEP plays a critical role.

ATSEP, responsible for the installation, maintenance, monitoring, and control of the entire CNS/ATM system, ensures the smooth operation of systems and devices used in air traffic management More specifically successful ATSEP performance ensures the Continuity of ANS services while minimizing recovery time that enhances operational performance and the greening of operations due to optimum trajectories flown. These systems and devices are directly linked to the safety and efficiency of flight operations, adhering to strict ICAO standards outlined in Annex 10. Despite meeting these standards and ATSEP personnel being trained and competent, they are not yet recognized as part of Annex 1.

ATSEP's role is critical in preventing potential safety-critical occurrences in air traffic operations. Various incidents, such as mid-air collisions, controlled flight into terrain, runway incursions, taxiway collisions, and wake-induced accidents, can be influenced by the performance of ATSEP.

Past incidents like :

- Mid-air collision in Überlingen (2002),
- Runway incursion, Linate Milano (2001),
- Controlled Flight into Terrain (CFIT B762 Busan Korea CFIT (2002),
- failure of Technical Monitoring and Control System -TMCS of VCS at NATS Swanwick center (2013) and
- the failure occurred in the System Flight Server (SFS) at Swanwick Area Control (2014), etc.serve as reminders of the impact of ATSEP-related errors **on air safety but also have a high cost for airlines and impact passenger experience.**

- In the realm of civil aviation, the introduction of new technologies, particularly in the air traffic management (ATM) sector, is generally considered to be a positive advancement. However, it is important to acknowledge that these advancements can also carry certain risks, which may not be immediately apparent but can manifest later in the form of undesired incidents. One specific area of concern is the growing reliance on software within ATM systems and devices. It becomes crucial to establish the appropriate standards to minimize the occurrence of software failures and to define the necessary competencies for personnel involved in software development. Instances of software failures within the ATM domain have been observed in recent years, as exemplified by the aforementioned cases in the ATC Center Swanwick.

- **These failures have resulted in significant delays, flight cancellations, and consequential financial repercussions.**The use of a huge amount of data in ATM, the increasing use of network protocols increases the danger that this data can be misused in some way. This area is certainly something that is the subject of interest and international terrorism. Intrusions into the radio frequencies of certain air traffic control are also known, as well as the giving of false instructions by hackers. Among other things, this is an effective way to do serious damage to public infrastructure in one fell swoop.

Cybersecurity for ATM/ANS is complex and attack scenarios can be network attacks combined with attack (e.g spoofing) on the Signal in Space (spoofing and/or jamming) in order to create service disruptions (e.g airports) or safety degradation combined with attacks on ground networks.

The ATSEP role in Cybersecurity events in ANSPs as first responder must (among other) distinguish whether any problem/degradation identified is a Technical failure or due to a Cyber event (space or Ground). Then, to respond to **tactically address** any Cybersecurity or associated technical issue so the intrusion does not reach the Air Traffic controller or the pilot.

ATSEP Supervisors to coordinate during the evolution of the cyberattack incident with the ATCO Supervisor locally or remotely in ATSUs of delegated airspace and National Authorities while at the same time mitigate any degradation so as to ensure CNS/ATM service continuity , speedy recovery and of course Safety, The evolution of the Communication, Navigation, Surveillance / Air Traffic Management (CNS/ATM) system, particularly through initiatives like the European SESAR Joint Undertaking (SESAR JU) and the implementation of centralized services, presents even more complex challenges in this sphere and increase cyber vulnerability. Additionally, the introduction of remote towers or virtual centers also introduces potential risks.

These networked systems can be susceptible to vulnerabilities, and it is the responsibility of ATSEP to identify and proactively prevent potential attacks or abuses directed towards this critical infrastructure. Geographically separated parts of ANSP data chain from Sensors to ATM Data processing , the ATCO working positions and even to the cockpit , potentially offering cross border services and operations will necessitate ATSEP to have the same level of qualifications on either site and also fulfill English language basic communication requirements, something not foreseen yet either.

Financial perspective and impact of ATSEP inclusion in Annex 1

The inclusion of personnel such as ATSEP into Annex 1, in economic terms, should not pose any significant issues. The proliferation of ICAO Doc 10057 globally and EU 2017/373 regulatory frameworks , have prepared the ground for ICAO Annex 1 at minimum administrative cost. It is also realized by IFATSEA on data collected , that most countries employ an ANSP controlled competency scheme in the form of Licensing or Certification or similar competency schemes as in IFATSEA.

The costs associated with security and training requirements for ATSEP personnel already exist within the aviation industry. Therefore, Air Navigation Service Providers (ANSPs) worldwide would not experience financial setbacks; in fact, the opposite is true. It is important to recognize that the inadequate performance of ATSEP can lead to substantial economic cost for airline operators.

Image 5 ILS calibration by ATSEP

For instance, the aforementioned incident at NATS Swanwick Operations Center in 2014, caused by a software error, resulted in disruptions to air traffic, leading to the cancellation of numerous take-offs and landings within the area of responsibility. Press reports reveal that this disruption affected over 230,000 passengers over a span of two days, thereby causing significant economic losses. However, several similar failures have been observed around the world e.g The Philippines ANC system failure that disrupted the flights over the high seas of the region with immense costs.

The implementation of licensing for ATSEP would enhance workforce mobility, thereby making their services more readily available and improving their overall quality. This would unlock notable benefits in terms of security and economy for all International Civil Aviation Organization (ICAO) member states. As a result, air traffic and the civil aviation sector as a whole would emerge as the ultimate beneficiaries from such measures.

Safety Relevance

Is the ATSEP Profession a safety critical one ?

Examples of the safety relevance **based on Accidents or serious incidents related to the ATSEP profession** (related to ATSEP tasks, duties and responsibilities) are found in:

- The ATSEP Profession has been recognized by EASA, through a Study by ECORYS in 2013, as Safety Critical alongside with ATCOs (ref.: **Study on safety-related and safety-critical functions and related jobs in ATM/ANS, D7: FinalReport ECORYS, 2013)**
-
- The Report of National Aerospace Laboratory NLR on "Aviation safety management in Switzerland" (NLR-CR-2003-316) proposed ATSEP licensing as a safety recommendation(Recommendation7-3). The actual text is *(Recommendation 7-3: **Licensing of Air Traffic Control technical personnel Skyguide is recommended** to investigate the practicalities and potential effectiveness of a licensing program for Technical Personnel. The eventual set-up of such a program shall be inagreement with Eurocontrol ESARR 5 requirements for Technical Personnel.)*

- ICAO State Letter AN7/5-01/52 on incidents caused by operational use of ILS signals radiated during testing and maintenance procedures by ATSEP after a NCFIT accident Guam Korean Air accident and related FAA advisory (NTSB/AAR-00/01)

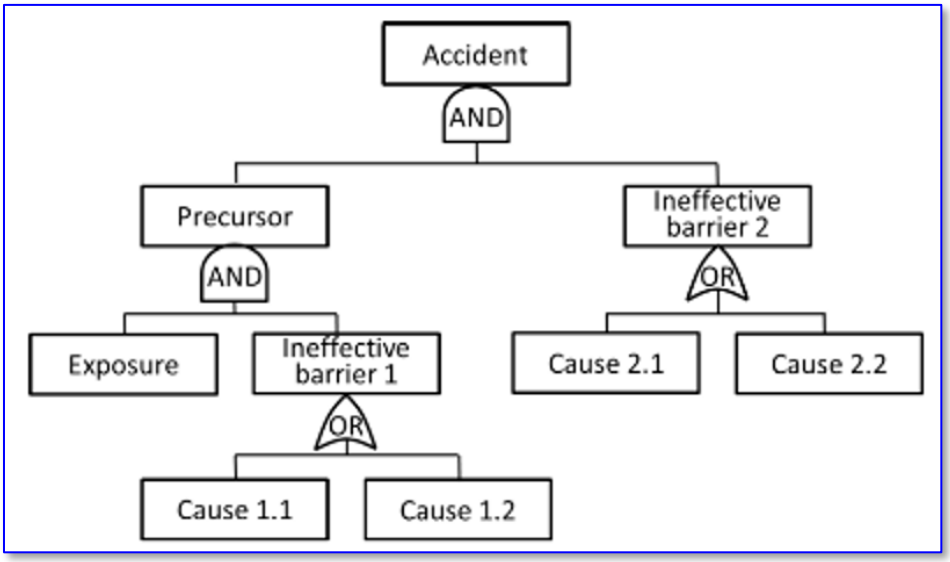


Image 6 Fault Tree in ICAO Annex 10

Image 7 UBERLINGEN, GERMANY

UEBERLINGEN, GERMANY - JULY 2: The tail wreckage of a Tupelov-154 Russian passenger airliner July 2, 2002 near the town of Ueberlingen, Germany. The aircraft collided with a DHL cargo plane during the night and at least 71 people, including 52 children and teenagers, are feared dead. (Photo by Sean Gallup/Getty Images)

IFATSEA has collected all above documents and uploaded them in the E-Library section at **https://ifatsea.box.com/v/icao-wp-annex1.**

In addition to the aforementioned aspects, it is essential to recognize the growing trend of incorporating satellite-based Communication, Navigation, and Surveillance (CNS) systems. These systems introduce unique technical considerations, such as the division of the overall system into ground-based stations and satellites in orbit, as well as spectrum allocation. Furthermore, legal airspace borders become significant concerns. However, besides these technical and legal aspects, there is also the imperative need to address potential threats to safety, performance, and Cybersecurity, including risks like spoofing and jamming. It becomes crucial for ATSEP personnel to monitor and effectively respond to these potential threats in real-time.

ATSEP working for European Satellite Service Providers involved in space-based CNS must undergo training and adhere to competency requirements that are comparable to those mandated for ANSPs providing traditional CNS services. This ensures that the same level of expertise and diligence is applied across all domains, thus safeguarding the integrity and security of satellite-based CNS systems.

In light of the rapid integration of high automation and artificial intelligence applications within the air traffic management (ATM) environment, it is evident that ATSEP personnel will soon face heightened and stringent entry qualification requirements. These requirements will encompass a solid scientific background as a prerequisite, along with a need for trustworthiness and capability to handle specialized fields like cybersecurity. Additionally, ATSEP personnel will be expected to possess various soft skills, including proficient decision-making abilities, to effectively address potential cascade failures. The interconnected and interoperable nature of these systems means that failures can extend beyond national borders and have impacts on multiple states.

Image 8 Radar Maintenance

ICAO AUDIT and ICAO Critical elements oversight

Today, **ATSEP as enablers and CNS/ATM systems as primary assets are not directly linked to the ICAO Critical Elements** and this constitutes a latent hazard for the systems as they oversee safety critical systems and safety critical processes* and procedures within the CNS/ATM environment (Ref. ECORYS classification). *(See picture Picture 6: List of Critical elements , (Source : ICAO GASP) below)*

The inclusion of the ATSEP Profession in ICAO Annex I alongside with the other two categories of staff included in NGAP, namely the Pilots and the ATCO and their inclusion to the ICAO Audit Scheme, would have a **positive impact** on the requirements for the so called Technical Personnel (ATSEP) and especially in relation to the Critical Elements (CE 1-7) .

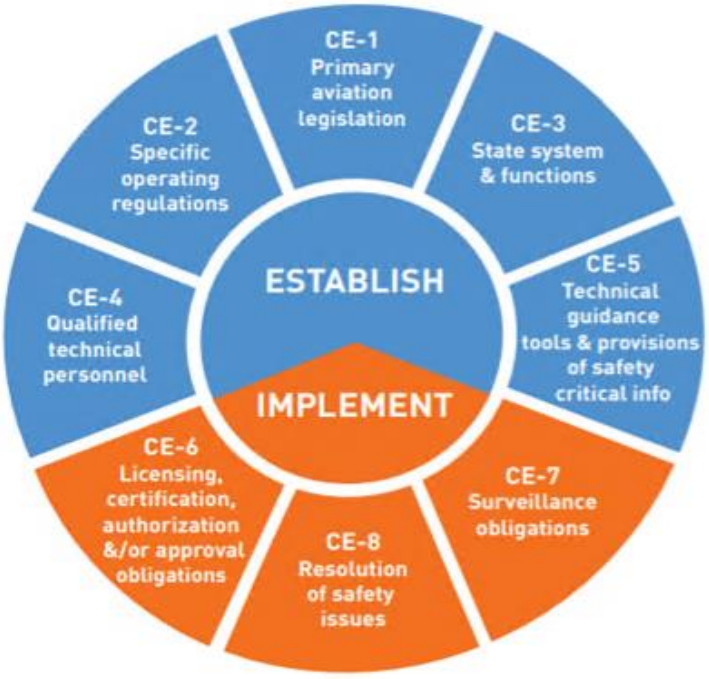


Image 9 List of Critical elements , (Source : ICAO GASP)

Also, ATSEP and their International Federation IFATSEA are an integral and active member of the ICAO NGAP program. Since 2011, as it can be seen from the extract of the relevant ICAO Council Report, a lot of progress has taken place. (ICAO, 1999)

ICAO has initiated and work is in progress to develop policies to ensure that enough competent personnel are available to manage, operate and maintain the global air transportation system of the future. As the aviation industry emerged from a difficult economic situation (COVID-19 Pandemic, international crisis, globalization), changing demographics and new technologies with far-reaching potential will intensify human resource challenges.

In this context and in partnership with all stakeholders of the industry, it becomes **urgent to**

consider the availability of competent human resources as a key strategic issue to implement the Global Aviation Safety Plan (GASP), to federate resources to attract and retain the next generation, to:

> "*establish a permanent coordinating mechanism to address training and education issues, and to review existing regulations and propose a new regulatory environment that will facilitate the recruitment, education, training and retention of the next generation of aviation professionals".(……)*

Two key points	Actions/Measures
2. to ensure that **enough competent personnel** are available to manage, operate and maintain the global air transportation system of the future	-**No actions taken yet**
1. to consider the issue of the **availability of competent human resources as a key strategic issue** to implement the Global Aviation Safety Plan (GASP)	-**Under consideration/ under discussion (?)**

The already ongoing NGAP and GASP projects at their frameworks necessitate the existence of Pilots, ATCOs and ATSEP as the three basic categories of personnel identified and included in their implementation.

Category of Ppersonnel	NGAP included	Training and competency	Inclusion in ANNEX I
PILOTS	**YES**	**YES**	**YES**
Air Traffic Controllers (ATCO)	**YES**	**YES**	**YES**
ATSEP	**YES**	**YES**	**NO**
Aircraft Mechanic & Avionics	**YES**	**YES**	**YES**

From the table above, it is clear that **the only safety critical profession that is not yet included in Annex I is ATSEP.**

It must be noted that IFATSEA together with Eurocontrol has identified a rising lack of ATSEP as young engineers do not choose the ATSEP job as not attractive, without job appreciation and clear career paths and demanding 24/7 rostering together with high responsibility and liability duties. A campaign was decided to be launched in the near future to attract future ATCOs and ATSEP to the aviation domain. Including the ATSEP profession in the Annex 1 alongside Pilots and avionics engineers and ATCO will make the job more attractive as an option for the younger generation of engineers and technicians with elevated qualifications due to the complexity of the forthcoming CNS/ATM systems.

A good assessment of the lack of ATSEP taking into account NGAP lessons and recommendations is available at **https://hermes.aero/wp-content/uploads/2023/12/R23-R.pdf**

As an evaluation of the current situation with regard to the inclusion of ANNEX I of ATSEP, in view of the decisions taken by the Technical Commission of ICAO it appears that a number of them have not progressed yet, despite that several years have passed.

ICAO Annex I changes are performed by ICAO regularly. The most recent took place in 2022 (Amendment 178) in order to introduces new provisions for the use of electronic pilot licenses, which are increasingly being used by ICAO Member States.
The **cycle for any change may also take as many as 8 years long**. This means that **even if the decision to proceed with ATSEP licensing is taken this year it may be up to 2033 onwards that the whole process will be completed.**

The question is, can the aviation domain cope with the increasing complexity of Air Navigation systems, the hybrid environment of terrestrial and satellite based Air navigation CNS and ATM enablers, while at the same time newcomers like UAVs (drones) are coming into the ecosystem? Can the global aviation environment of networked ground and in-flight systems over SWIM afford to have different levels of ATSEP competence serving the same functionalities and services?

Image 10 ATSEP Working position

ICAO Annex 1 on Personnel LICENSING

What are the requirements for Licensing a category of personnel?
Why?
What is the objective of Licensing a category of personnel?

Source*: ICAO DOC 9379 ON Licensing by states*

1.2 DEFINITION OF PERSONNEL LICENSING

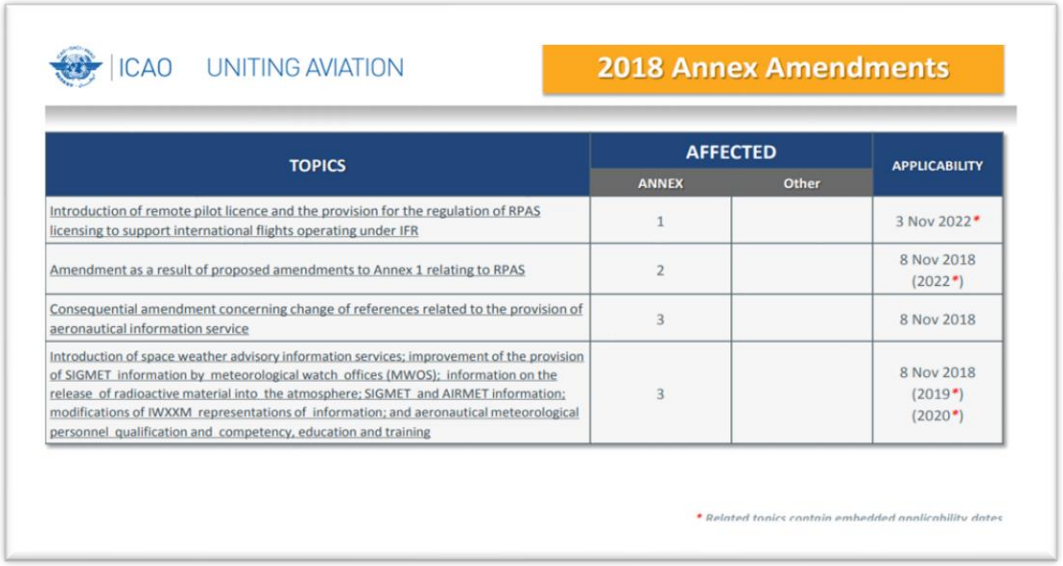
1.2.1 ICAO defines personnel licensing as follows: "A license is the means by which a State authorizes a license holder to **perform specific activities** which, ***unless performed properly, could jeopardize the safety of aviation***.
The license provides evidence that the issuing State is satisfied that the holder has demonstrated an **internationally** acceptable degree of competency."2

The **first** part of the definition indicates clearly that *personnel licenses cover only activities that are critical to the safety of aviation*. The **second** part of the definition indicates that the license *provides evidence of competency in that a license holder has demonstrated the required combination of skills, knowledge and attitudes*. However, the competency itself is the result of the selection and training and not of the license.

1.2.3 Annex 1 specifies SARPs covering both minimum and broad requirements for personnel licensing. The aim of Annex 1 is to standardize practices and procedures so that States can issue licenses based on a common standard.
By accepting and adopting the provisions of Annex 1, each Contracting State will contribute to the idea expressed in Article 37 of the Chicago Convention which states that:

"Each Contracting State undertakes to collaborate in securing the highest practicable degree of uniformity in regulations, standards, procedures and organization in relation to aircraft, personnel, airways and auxiliary services in all matters in which such uniformity will facilitate and improve air navigation."

1.2.4 In the sense in which it is used in Annex 1, licensing is the process of **giving official authorization** to a person to perform specific activities that are otherwise prohibited either by law or by custom and which, unless performed properly, could jeopardize the safety of international aviation. The license provides evidence that the issuing State is satisfied that the individual license holder has demonstrated an internationally acceptable degree of competency meeting the requirements of Annex 1 (except if otherwise endorsed). The action of licensing, therefore, consists in the granting of privileges to applicants who meet the prescribed requirements.
The term "license" is commonly used to describe the authorization given when the licensing processes have been completed. Those rights that the holder of a license enjoys, and which are denied to unlicensed individuals, are referred to in Annex 1 as "privileges". Depending on the type of license issued, these privileges may or may not have a time limitation imposed. They may or may not be limited with respect to the functions to be performed, and they may depend on certain conditions to be observed prior to the exercise of certain privileges.
Such conditions, if they exist, can be termed the "obligations of the person that has been authorized.



ICAO UNITING AVIATION

2018 Annex Amendments

TOPICS	AFFECTED		APPLICABILITY
	ANNEX	Other	
Introduction of remote pilot licence and the provision for the regulation of RPAS licensing to support international flights operating under IFR	1		3 Nov 2022*
Amendment as a result of proposed amendments to Annex 1 relating to RPAS	2		8 Nov 2018 (2022*)
Consequential amendment concerning change of references related to the provision of aeronautical information service	3		8 Nov 2018
Introduction of space weather advisory information services; improvement of the provision of SIGMET information by meteorological watch offices (MWOS); information on the release of radioactive material into the atmosphere; SIGMET and AIRMET information; modifications of IWXXM representations of information; and aeronautical meteorological personnel qualification and competency, education and training	3		8 Nov 2018 (2019*) (2020*)

* Related topics contain embedded applicability dates

Since 2018, ICAO has implemented three amendments to Annex 1 (Personnel Licensing):

1. **Amendment 175** (2018): This amendment introduced regulatory structures for licensing personnel involved with remotely piloted aircraft systems (RPAS), marking a significant step in accommodating emerging aviation technologies within international standards.

2. **Amendment 176** (2020): Focused on aligning personnel licensing standards with updated operational requirements and technological advancements. It included provisions for further integration of RPAS regulations and refined criteria for other aviation roles.

3. **Amendment 177** (2021): This amendment primarily dealt with aligning definitions and standards in Annex 1 with the changes introduced in Annex 10, specifically regarding radio frequency spectrum utilization and communication systems, which are essential for safe RPAS operations.

These amendments reflect ICAO's ongoing efforts to modernize personnel licensing standards, especially as aviation technology continues to evolve with increased automation and the growth of unmanned aircraft systems.

Sources:
- ICAO Implementation Support on Amendments and Manuals (2018, 2020, 2021).[2]

[2] Sources:
- ICAO Implementation Support on Amendments and Manuals (2018, 2020, 2021).

Global ATSEP Licensing & Certification Listing

IFATSEA Database

Region	Country	Licensing System	Certification	Other	Comments
AFRICA	Angola		Certification		
	Burkina Faso	License			
	Cameroon		Certification		
	DR Congo		Certification		
	Ethiopia		Certification		
	Gambia		Certification		
	Ghana	License			
	Kenya		Certification		
	Morocco		Certification		
	Niger		Certification		
	Nigeria	License	Certification		
	Senegal		Certification		
	South Africa		Certification		
	Sudan		Certification		
	Seychelles		Certification		
	Uganda	License			
	Tanzania		Certification		
	Tunisia		WIP		
	Zambia		Certification		

Region	Country	Licensing System	Certification	Other	Comments
AMERICAS	Jamaica			General competency	
	USA			Credentialed	
	Canada		Certification		
Asia Pacific	Japan	To be Completed	To be Completed	To be Completed	
	Sri Lanka	To be Completed	To be Completed	To be Completed	
	India	To be Completed	To be Completed	To be Completed	
	Nepal	License			
Europe	Croatia	License			
	Estonia				
	Finland				
	Germany	License			
	Netherlands				
	Spain				
	Ukraine				
	Albania				
	Bulgaria	License			
	France	License			
	Greece	License			
	Montenegro		Certification		
	Malta		Certification		

	Poland			**General competency**	
	Portugal			**General competency**	

….to be. with global data….

Image 11 ATSEP Working positions for Systems monitoring and Control

IS THE ATSEP PROFESSION SAFETY CRITICAL?

Independent studies on job safety relevance

PART A

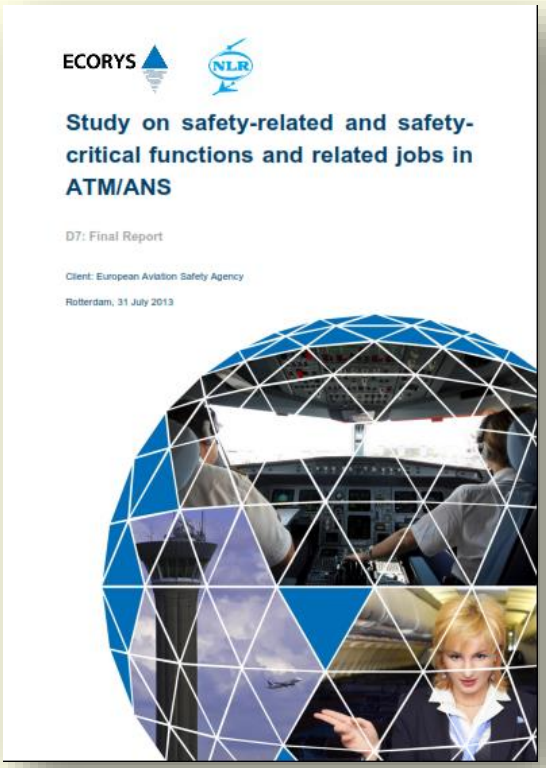
EASA Study performed by ECORYS and NLR for the identification of Safety critical professions

Source: EASA Study on safety-related and safety-critical functions and related jobs in ATM/ANS

D7: Final Report

Introduction and short Study Summary

In 2013, EASA awarded to the consortium of ECORYS and NLR a study concerning safety-related and safety-critical functions and related jobs in ATM/ANS. The outcome of this study was to be able to identify 143 independent functions, which are provided by 28 different jobs descriptions. The EUROCONTROL Accident Incident Model (AIM) was used to define which functions and jobs are the last barrier within the ATM system, before an accident occurs. Five different accident scenarios have been considered: mid-air collision, Controlled Flight Into Terrain (CFIT), runway incursion, taxiway collision and wake-induced risk.



ECORYS' study concluded that :

*"ATSEPs play a crucial part in the ATM system and **mistakes of the ATSEPs might lead to incorrect operation of systems, with a potential negative impact on safety**.*
*Within the ATM system, the **ATSEPs often contribute to the performance of the last safety barrier**, according to the EUROCONTROL Accident Incident Model.*

*Outside the ATM/ANS system some barriers still remains, e.g. the pilot of the aircraft and TCAS systems. **The job and related functions are all qualified as safety-critical and therefore there might be a need to regulate some aspects of the job".***

The report also states that although some of the systems that ATSEP install and maintain are regulated by ICAO standards, only in EC 2011/1035 exists a partial regulation concerning these Safety Critical Functions ATSEP perform.

Finally, the report concludes that **if regulation related to competence is adopted**, the following impacts can be expected:

A **positive** safety impact stemming from improved qualifications of ATSEPs.
An overall **positive economic impact**. Positive impacts from increased efficiency of the **job and safety benefits are likely to outweigh the costs from implementing the regulation.**
A **positive social impact** stemming from increased qualifications of ATSEPs.
A **positive impact on regulatory harmonization** stemming from the introduction of common rules regarding competence and training requirement for ATSEPs that apply throughout all EASA .

Table 1. Impacts from Regulation of the competence of ATSEP Profession according to the ECORYS/NLR Study			
Regulatory Action	**Impact**	**Justification-reason**	**Added Value**
SAFETY	A positive safety impact	Stemming from improved qualifications of ATSEPs	YES
Economic	Positive economic impact	from increased efficiency of the job and safety benefits are likely to outweigh the costs from implementing the regulation	YES
Social	Positive social impact	From increased qualifications of ATSEPs	YES
Regulatory harmonization	Positive impact on regulatory harmonization	from the introduction of common rules regarding competence and training requirement for ATSEPs	YES

The above table **clearly depicts the positive impact in all Areas from the Regulation of the ATSEP Profession**. It must be noted that **this information was public since 2013 and referenced in the IFATSEA WP/298 at ICAO's 39th General Assembly.**

Also, in the case where ATSEP are not competent to the required level or part of the Safety chain this can lead to the potential Risks as it is clearly stated in the EASA study .

Based on the EUROCONTROL Accident Incident Model (AIM) an estimate can be made of contribution of the ATSEP within several accident scenarios if the ATSEP fails to perform his job and duties properly and in a timely manner.

According to AIM this contribution is significant in all accident scenarios **as failure of the ATSEP efficiency and performance may lead to an increase**

- of the mid-air collision probability of 17%,
- of the runway incursion probability of 15%,
- of the taxiway collision probability of 10% and
- of the wake induced accident probability of 17%.

The ATSEP also plays a role in the barrier 'A/C Ground Proximity Warning'. If this barrier fails the CFIT accident probability is 50 times higher than when the barrier is intact.

PART B

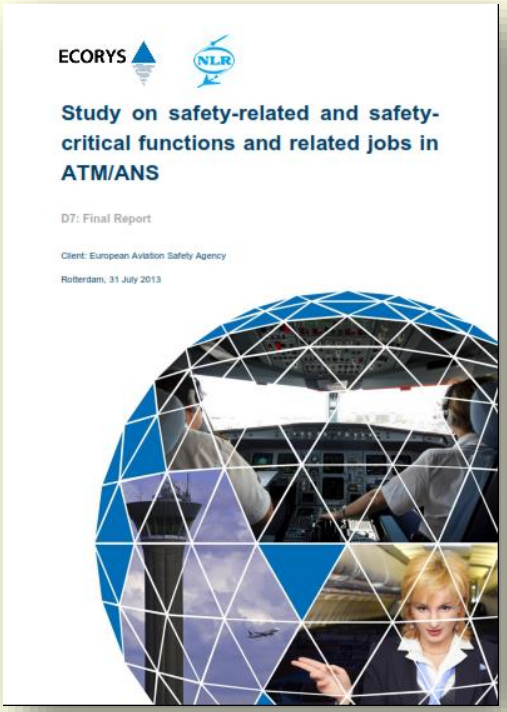
Technical input

Study of ECORYS and NLR for EASA,

Main points on definitions methodology and results

(EUROPE)

Introduction.



A study that had been awarded by EASA in 2013 to the consortium of ECORYS and NLR in response to EASA's relevant request, was aiming at definition and identification of categories of personnel whose human performance have a safety impact on the provision of ATM/ANS services as well as on the design, the manufacturing, installation and maintenance of ATM/ANS system and constituents.

The degree of safety impact was categorized as safety-related and safety-critical. For each safety-related and safety-critical function and related job, the study assessed whether EU legislation is currently in place or under development, and whether it is appropriate or not.

The jobs were derived from the available documentation (EU regulations, ICAO SARPS and EUROCONTROL documentation) and an analysis of current operational practice in European ATM/ANS Providers.

Disclaimer: In order to facilitate understanding of the Study of Safety related and critical functions and related Jobs, IFATSEA has developed a summary of the original report to the closest possible. In case of doubt please consult the original text that can be found in the IFATSEA website (www.ifatsea.org/).

Safety related and Safety Critical functions & Jobs

Following that framework of functions[3] and jobs[4], a definition of safety-related and safety-critical was proposed based on the application of the EUROCONTROL Accident Incident Model (AIM). "*A function is called safety-related if a failure of the function could impact the safety. A job is called safety-related in if the job involves performing at least one safety-related function*" (Πηγή, 1999).

A function is safety-critical if a failure of the function could impact the safety and there are no internal barriers within the ATM/ANS system or external barriers for the interoperability of the collaborating ATM/CNS systems, to prevent an accident following the failure of the function. A job is safety-critical if the job involves performing at least one safety-critical function.

Of the 143 safety-related functions, 28 of them have been identified as **safety-critical** and from the **nine (9) jobs associated to these functions**, five (5) of them (ATSEP-SMC, ATSEP-SUR, ATSEP-NAV, ATSEP-COM, ATSEP-DP) are ATSEP related. These jobs correspond to the basic duties performed by ATSEP 24X7, all year around, and are included in the Training Phases of the Common Core Content (CCC) of Eurocontrol.

Here it must be mentioned that other ATSEP duties like Safety Expert, Flight Inspector, OJT Instructor or Competence Assessor, are also included in the CCC and are considered as "carrier change specialities".

The ECORYS/NLR study prompts EASA to proceed to specific regulatory activities related to all safety critical jobs.

At the time of the study the regulatory framework, being in interest of ATSEP, was based on Regulation (EU) 1035/2011 which requires the ANS providers to ensure an adequate level of training and competency of staff involved in the provision of Air Navigation Services. This regulation also establishes safety provisions as regards the engineering and technical personnel involved in the provision of Air Traffic Services and Communication, Navigation and Surveillance services (insofar ATSEP) who undertakes operational safety-related tasks. **NOTE:** The

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[3] *A function is an activity performed either by humans or a system which transforms an input into an output on the basis of established procedures and objectives.*

2 *A job is all activities, intellectual and physical, performed by a person undertaking his/her prescribed duties. A job may be in charge of one or more functions identified for a service within the scope of this study.*

Regulation (EU) 1035/2011, was applied up to the end of 2019 and it was substituted by Regulation (EU) 2017/373.

Objectives of the ECORYS study

The objectives of the study were:

a) To unambiguously define 'safety-related' and 'safety-critical';
b) To determine safety-related and safety-critical functions in providing ATM/ANS and the design, the manufacturing, installation and maintenance of ATM/ANS systems and constituents, and provide a sound justification for such designation;
c) To derive from the safety-related and safety-critical functions related jobs;
d) To determine if regulations that are currently in force or under development are appropriate for the identified functions and jobs;
e) To propose justified regulatory options of the functions and jobs that are not appropriately covered by existing regulation.

Definition of safety-related and safety-critical

For the purpose of the study, the following definitions of safety-related and safety-critical were established:

- "A function is called safety-related if a failure of the function could impact the safety" , page X.
- "A job is called safety-related in if the job involves performing at least one safety-related function", page X.
- "A function is safety-critical if a failure of the function could impact the safety and there are no barriers within the ATM/ANS system to prevent an accident following the failure of the function", page X.
- "A job is safety-critical if the job involves performing at least one safety-critical function", page X.

Based on the definitions provided above the following 5 jobs (with 28 associated functions) could be qualified as safety-critical:

- the Air Traffic Controller (ATCO),
- **the ATSEP (five sub-types),**
- the AIS officer (AFISO),
- the navigation data provision officer, and
- the ATM/ANS technical system designer.

ATSEP jobs being judged, as safety critical.

Safety-critical jobs are those jobs that involve at least one safety-critical function as depicted in the following table where the ATSEP related jobs and functions are highlighted:

Safety-critical jobs	Associated safety-critical functions
ATCo	ATC.1, ATC.2, ATC.3
ATSEP-SMC	SUR.1a, SUR.1b, COM.2a, COM.2b, NAV.1a, NAV.1b, SUP.1q
ATSEP-SUR	SUP2l, SUP2m
ATSEP-NAV	SUP.2d, SUP.2j
ATSEP-COM	SUP.2b
ATSEP-DP	SUP.2o
AIS officer	AIS.3a, AIS.3b, AIS.3c
Navigation data provision officer	DAT.1a, DAT.1b, DAT.1c
ATM/ANS technical system designer	SUP.1d, SUP.1j, SUP1l, SUP1m, SUP.1b, SUP.1o

Regulatory framework for ATSEP (in EU).

According to ECORYS only the jobs of the Air traffic controllers and ATSEPs are currently regulated by EU legislation.

Commission Implementing Regulation (EU) No 1035/2011 established general safety provisions regarding engineering and technical personnel involved in the provision of Air Traffic Services and Communication, Navigation and Surveillance services who undertake operational safety-related tasks. However the Regulation (EU) 2017/373 which is in place as from 2nd January of 2020 includes detailed requirements related to ATSEP training and their competency assessment as well as syllabus of their training that the ANSP have to implement for them. At global level, the ICAO recommends to Member States to implement the training described in its Doc. 10057 “Manual on ATSEP Competency Based Training and Assessment” 1st edition, 2017, , as well as assessment procedures advocated by Doc 10057 and also by Doc 9868 “Procedures for Air Navigation Services – Training” 2nd edition, 2016, with the latest amendment No5 (dated 5/11/20) included.

EUROCONTROL uses the term Air Traffic Safety Electronics Personnel (ATSEP) to denote personnel monitoring and maintaining CNS and Data Processing systems (EUROCONTROL, 2009).

The ATSEP tasks are spread to the domains Communication, Navigation, Surveillance and Data Processing depending on the systems on which they perform monitoring, maintenance (preventive & corrective) and commissioning/decommissioning.

Additionally, EUROCONTROL has defined System Monitoring and Control (SMC) as an additional domain involving personnel that ensure that systems perform according to the defined performance requirements. In practice SMC ATSEP are not specialized for a particular type of system (Communication, Navigation, Surveillance and Data Processing), but monitor and control all operational systems in a holistic way, 24X7, all year around.

The same philosophy and structure is followed in Annex XIII to Regulation (EU) 2017/373, where detailed training syllabus for all the above mentioned CNS domains including SMC, is incorporated.

Furthermore, EUROCONTROL identifies three levels of maintenance tasks depending on the complexity of the maintenance (EUROCONTROL, 2009):

- Level A tasks: primarily associated with immediate service restoration or reconfiguration ("front-panel level").
- Level B tasks: involve in-depth fault analysis at the system/equipment level ("functional level").
- Level C tasks: involve the detailed diagnosis of a software problem, of a faulty Line Replacement Unit (LRU), Printed Circuit Board (PCB) or module ("component level").

For the purpose of the ECORYS / NLR study, this level of detail is not included, but, generally speaking, the ATSEPs are divided into the aforementioned domains, worldwide.

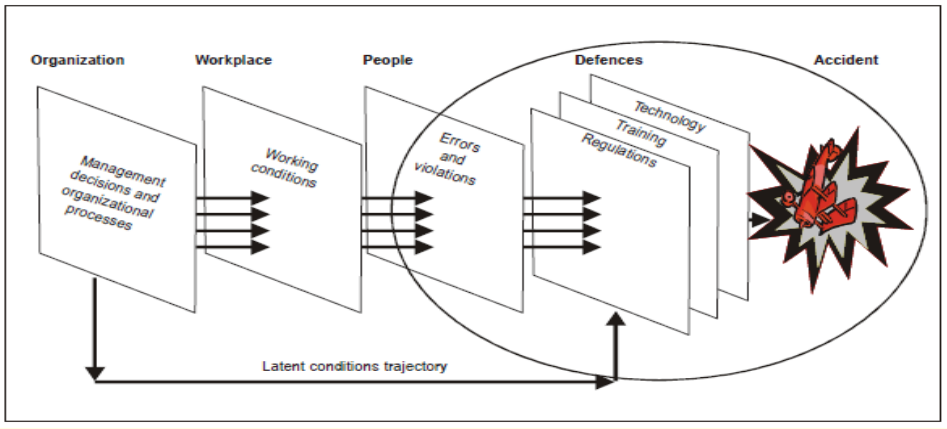
Personnel involved in the design and production of ATM/ANS systems and constituents are in the said study referred to as ATM/ANS technical system designers.

With respect to GNSS, the European Satellite Services Provider (ESSP) has been contracted by the European Commission to ensure the operation, maintenance and more generally the EGNOS Service Provision. For the purpose of the ECORYS study, the ESSP is regarded as a CNS provider that provides GNSS. Nevertheless, the technical personnel performing the installation and maintenance of GNSS are regarded as **ATSEP-NAV.**

System designer and ATSEP tasks.

According to ECORYS study, **performance failure of the ATM/ANS technical system designer will have a significant impact in different accident scenarios**.

Often the ATM/ANS technical system designer contributes to the **last barrier in the ATM system which is also related to ATSEP job as well as his/her competency** and skillfulness as depicted in the following figure:



NOTE: In the above picture the training of employees involved is also one of the last barriers which can abort a serious incident or an accident.

ATSEP Jobs & Safety criticality

The following table which has been excerpted from ECORYS study, illustrates the degree of impact that different jobs have on various domains of ATM/ANS.

Job	Option – Regulation regarding:	Safety	Environ-mental	Economic	Social	Regulatory
Navigation data provision officer	Competence Training	++	0	+	+	+
Air traffic controller	Human Factors	+	0	0	0	+
AIS Officer	Competence Training	++	0	+	+	+
ATM/ANS technical system designer	Competence Training	++	0	+	+	+
ATSEP	Competence	+	0	+	+	+

Please note that: Where: ++ means there is a very positive impact, + means there is a positive impact, 0 means there is no impact.

Also, according to the above table, **the impact on safety of ATCO and ATSEP job is judged as equal.**

According to ECORYS' study conclusion,

"*ATSEP play a crucial part in the ATM/ANS system and mistakes of the ATSEPs might lead to incorrect operation of systems, with a potential negative impact on safety.* ***Within the ATM/ANS system there is often no safety barrier or mitigation measure available once the ATSEP fails****.*

Outside the ATM/ANS system some barriers still remains, e.g. the pilot of the aircraft and TCAS systems. The job and related functions are all qualified as safety-critical and therefore ***there might be a need to regulate some aspects of the job"****.*

Based on the EUROCONTROL Accident Incident Model (AIM) an estimate can be made of contribution of the ATSEP within several accident scenarios if the ATSEP fails to perform his job properly. According to AIM this contribution is significant in all accident scenarios.
Failure of the ATSEP may lead to:

- ***increase of the mid-air collision probability of 17%,***
- ***the runway incursion probability of 15%,***
- ***the taxiway collision probability of 10% and***
- ***the wake induced accident probability of 17%***

The ATSEP also plays a role in the barrier 'A/C Ground Proximity Warning'. If this barrier fails the CFIT accident probability is 50 times higher than when the barrier is intact.

Please note that the estimated contribution, as mentioned above, is similar as for the ATM/ANS technical system designer due to the similar location in the Accident/incident model.

Furthermore, the said study identifies the various ATSEP jobs linking them with their importance in safety as illustrated further down.

Air traffic Safety Electronics Personnel – System Monitoring and Control (ATSEP-SMC)	
Job ID	**Job Description**
SUR.1a	Providing surveillance services
SUR.1b	Ensuring that the surveillance service performs according to the defined performance requirements
COM.2a	Providing the aeronautical mobile services (air-to-ground communication for the ATC purposes)
COM.2b	Ensuring that the aeronautical mobile services performs according to the defined performance requirements
NAV.1a	Providing aircraft with positioning and timing information
NAV.1b	Ensuring that the navigation services performs according to the defined performance requirements
SUP.1q	Ensuring that the Data Processing System performs according to the defined performance requirements
Air traffic Safety Electronics Personnel – Surveillance Systems (ATSEP-SUR)	
Job ID	**Job Description**
SUP.2l	Installing and maintaining the PSR
SUP.2m	Installing and maintaining the SSR
Air traffic Safety Electronics Personnel – Navigation systems (ATSEP-NAV)	
Job ID	**Job Description**
SUP.2d	Installing and maintaining the ILS
SUP.2j	Installing and maintaining the GNSS
Air traffic Safety Electronics Personnel – Communication systems (ATSEP-COM)	

Job ID	Job Description
SUP.2b	Installing and maintaining the Air-to-ground communication systems
Air traffic Safety Electronics Personnel – Data Processing Systems (ATSEP-DP)	
Job ID	**Job Description**
SUP.2o	Installing and maintaining the SMR
SUP.1p	Designing and producing Data Processing system
SUP.2p	Installing and maintaining Data Processing system

Serious incidents and ATSEP jobs

The tables bellow depict the risks, being closely related with ATSEP jobs, as they have been identified by the ECORYS/NLR study stressing *that, ATSEP contributes often to the last barrier in the ATM system.*

The following risks have been mentioned:

Mid-air collision.

Failure ID		Associated Functions	Associated jobs
S.T.C.A. Warning	Surveillance technical failure	SUR.1a, SUR.1b SUP1l, SUP2l, SUP1m, SUP2m	ATSEP-SMC ATSEP-SUR ATM/ANS technical system designer
	Ineffective STCA system (Degraded OPS)	SUP.1p, SUP.2p, SUP.1q	ATM/ANS technical system designer ATSEP-DP ATSEP-SMC
	PLOC – equipment/sSystems failure	COM.2a, COM.2b SUP.1b, SUP.2b	ATSEP-SMC ATSEP-COM ATM/ANS technical system designer

	PLOC: Prolonged Loss Of Communication		
	Failure ID	**Associated Functions**	**Associated jobs**
ATCOs Expedite	PLOC – equipment /systems failure	COM.2a, COM.2b SUP.1b, SUP.2b	ATSEP-SMC ATSEP-COM ATM/ANS technical system designer
	Failure ID	**Associated Functions**	**Associated jobs**
Tactical Conflict Management	Inadequate traffic picture	SUR.1a, SUR.1b SUP1l, SUP2l, SUP1m, SUP2m	ATSEP-SMC ATSEP-SUR ATM/ANS technical system designer
	No trajectory planning information	SUP.1p, SUP.2p, SUP.1q	ATSEP-DP, ATSEP-SMC, ATM/ANS technical system designer
	Incorrect trajectory planning data	SUP.1p, SUP.2p, SUP.1q	ATSEP-DP, ATSEP-SMC ATM/ANS technical system designer
	PLOC equipment /systems failure	COM.2a, COM.2b SUP.1b, SUP.2b	ATSEP-SMC ATSEP-COM ATM/ANS technical system designer
	Failure ID	**Associated Functions**	**Associated jobs**
ATC Induced Conflict	PLOC – equipment/systems failure	COM.2a, COM.2b SUP.1b, SUP.2b	ATSEP-SMC ATSEP-COM ATM/ANS technical system designer
	PLOC: Prolonged Loss Of Communication		

	Failure ID	Associated Functions	Associated jobs
Traffic Planning and Synchronisation	Inadequate Surv picture	SUR.1a, SUR.1b SUP1l,SUP2l, SUP1m, SUP2m	ATSEP-SMC ATSEP-SUR ATM/ANS technical system designer
	No planning information	SUP.1p,SUP.2p, SUP.1q	ATSEP-DP, ATSEP-SMC, ATM/ANS technical system designer
	Incorrect planning data	SUP.1p,SUP.2p, SUP.1q	ATSEP-DP, ATSEP-SMC ATM/ANS technical system designer

7.1.2.Controlled Flight Into Terrain

	Failure ID	Associated Functions	Associated jobs
A/C Ground Proximity warning	Ineffective Ground Proximity Warning	NAV.1a, NAV.1b, SUP.1d, SUP.2d, SUP.1j, SUP.2j, AIS.3a, AIS.3b, AIS.3c DAT.1a, DAT.1b, DAT.1c	ATSEP-SMC, ATSEP-NAV, ATM/ANS technical system designer, AIS officer, Nav data provision officer
	Failure ID	**Associated Functions**	**Associated jobs**
ATCo Warning	Inadequate traffic picture	SUR.1a, SUR.1b SUP1l, SUP2l, SUP1m, SUP2m	ATSEP-SMC ATSEP-SUR
	No planning information	SUP.1p, SUP.2p, SUP.1q	ATSEP-DP, ATSEP-SMC, ATM/ANS technical system designer
	Incorrect planning data	SUP.1p, SUP.2p, SUP.1q	ATSEP-DP, ATSEP-SMC ATM/ANS technical system designer

	Loss of communication	COM.2a, COM.2b SUP.1b, SUP.2b	ATSEP-SMC ATSEP-COM ATM/ANS technical system designer
	No MSAW coverage	SUP.1p, SUP.2p, SUP.1q	ATSEP-DP, ATSEP-SMC ATM/ANS technical system designer
	MSAW failure to give warning in time	SUP.1p, SUP.2p, SUP.1q	ATSEP-DP, ATSEP-SMC ATM/ANS technical system designer
	Loss of communications	COM.2a, COM.2b SUP.1b, SUP.2b	ATSEP-SMC ATSEP-COM ATM/ANS technical system designer
	Failure ID	**Associated Functions**	**Associated jobs**
FMS / RNAV /	GNSS error causes deviation	NAV.1a, NAV.1b SUP.1j, SUP.2j	ATSEP-SMC ATSEP-NAV ATM/ANS technical system designer

	ILS error causes deviation	NAV.1a, NAV.1b SUP.1d, SUP.2d	ATSEP-SMC ATSEP-NAV ATM/ANS technical system designer
	GBAS error causes deviation	NAV.1a, NAV.1b SUP.1j, SUP.2j	ATSEP-SMC ATSEP-NAV ATM/ANS technical system designer
	NAV aid error causes deviation	NAV.1a, NAV.1b SUP.1e, SUP.2e, SUP.1f, SUP.2f, SUP.1g, SUP.2g, SUP.1h, SUP.2h	ATSEP-SMC ATSEP-NAV ATM/ANS technical system designer
	SBAS error causes deviation	NAV.1a, NAV.1b SUP.1j, SUP.2j	ATSEP-SMC ATSEP-NAV ATM/ANS technical system designer
	Failure ID	**Associated Functions**	**Associated jobs**
ATC Flight	Inadequate traffic picture (radar)	SUR.1a, SUR.1b SUP1l, SUP2l, SUP1m, SUP2m	ATSEP-SMC ATSEP-SUR ATM/ANS technical system designer

	Inadequate communicatio n with crew	ATC.3 COM.2a, COM.2b SUP.1b, SUP.2b	ATCo, ATSEP-SMC ATSEP-COM ATM/ANS technical system designer

7.1.3 Runway incursion

	Failure ID	Associated Functions	Associated jobs
ATC Runway Collision	RIMCAS not in operatio nal use	SUP.1p, SUP.2p, SUP.1q	ATSEP-SMC, ATSEP-DP, ATM/ANS technical system designer
Runway Conflict Prevention	No system informs ATC of incursio n before impleme ntation of clearanc e	SUP.1p, SUP.2p, SUP.1q	ATSEP-DP, ATSEP-SMC, ATM/ANS technical system designer
Runway Monitoring	Ineffecti ve surveilla ce	SUR.1a, SUR.1b SUP1o, SUP2o	ATSEP-SMC ATSEP-SUR ATM/ANS technical system designer ATSEP-DP, ATSEP-SMC ATM/ANS technical system designer
	Failure ID	**Associated Functions**	**Associated jobs**

ATC Runway Management Entry	Inadequate information causes incursion	SUR.1a, SUR.1b SUP.1o, SUP, 2o, SUP.1p, SUP.2p, SUP.1q	ATSEP-DP, ATSEP-SMC, ATSEP-SUR ATM/ANS technical system designer
	Loss of communications	COM.2a, COM.2b SUP.1b, SUP.2b	ATSEP-SMC ATSEP-COM ATM/ANS technical system designer

	Failure ID	**Associated Functions**	**Associated jobs**
Landing Management	Loss of communications	COM.2a, COM.2b SUP.1b, SUP.2b	ATSEP-SMC ATSEP-COM ATM/ANS technical system designer
	Landing aids misleading	NAV.1a, NAV.1b SUP.1d, SUP.2d, SUP.1e, SUP.2e, SUP.1k, SUP.2k	ATSEP-SMC ATSEP-NAV ATM/ANS technical system designer
	Failure ID	**Associated Functions**	**Associated jobs**
Take-off Management	Loss of Communiations	COM.2a, COM.2b SUP.1b, SUP.2b	ATSEP-SMC ATSEP-COM ATM/ANS technical system designer

7.1.4 Taxiway collision

	Failure ID	Associated Functions	Associated jobs
ATC Taxiway Collision	ASMCGS failure to give warning in time	SUP.1o, SUP.2o, SUP.1p, SUP.2p, SUP.1q	ATSEP-DP, ATSEP-SMC, ATSEP-SUR, ATM/ANS technical system designer
	Failure ID	**Associated Functions**	**Associated jobs**
Taxiway Conflict	Loss of Communiatio ns	COM.2a, COM.2b SUP.1b, SUP.2b	ATSEP-SMC ATSEP-COM ATM/ANS technical system designer
	Failure ID	**Associated Functions**	**Associated jobs**
Tactical Taxiway	Loss of Communiatio ns	COM.2a, COM.2b SUP.1b, SUP.2b	ATSEP-SMC ATSEP-COM ATM/ANS technical system designer

7.1.5 Wake-induced accident

	Failure ID	Associated Functions	Associated jobs

Tactical Separati	No planning information	SUP.1p, SUP.2p, SUP.1q	ATSEP-DP, ATSEP-SMC, ATM/ANS technical system designer
Tactical Separation Managementt	Incorrect planning data	SUP.1p, SUP.2p, SUP.1q	ATSEP-DP, ATSEP-SMC ATM/ANS technical system designer
	PLOC-equipment/ systems failure	COM.2a, COM.2b SUP.1b, SUP.2b	ATSEP-SMC ATSEP-COM ATM/ANS technical system designer
	Failure ID	**Associated Functions**	**Associated jobs**
ATC-induced	PLOC-equipment/ systems failure	COM.2a, COM.2b SUP.1b, SUP.2b	ATSEP-SMC ATSEP-COM ATM/ANS technical system designer

Domains affected by ATSEP profession.

It is reiterated that the above tables have been copied (and pasted here) from ECORYS – NLR study. According to that study the ATSEP profession is strongly related to safety while other domains are also affected by it as depicted in the following table copied from the said study.

Safety	Environment	Economic	Social	Regulatory
YES	NO	YES	YES	YES

Table 2 Positive impact of ATSEP profession regulation

The ECORYS –NLR study points also out that with the new regulatory framework (the NPA 2013-08 which resulted to Regulation 2017/373 was launched when the study was about to finish) enhanced competency requirements are in place.

Because of that, it is stated in the study that with the new regulatory framework **the Safety "is likely to increase to some extent**.

ATSEPs will be required to dedicated a minimum of practical experience to the specialization they are trained for. This increases the maintenance of knowledge and skills, and thus the overall output of ATSEPs. This has a positive impact on safety. If the probability of failure can be reduced the probability of an accident will be reduced as well".

Also, while it does not foresee **impact on Environment,** the study expects that there will be an positive impact on the financial domain as the required experience and training of ATSEP will incur additional cost on the ANSPs.

However it concludes that, **"although a negative economic impact might occur, the safety will increase slightly**, because ATSEPs have more practical experience and are able to perform their jobs better. The implementation of this aspect in the competence scheme will support the increased quality of the service. **This can be beneficial for the efficiency of the service, with potential financial benefits for ATSEPs. In addition, the positive safety impact translates in a positive economic impact as well"**.

The study also underlines human factors which "can influence the performance of the job and the safety level. Especially fatigue and stress could impact the quality of the service performed by the ATSEPs, as for example deficiencies in system monitoring and control might affect safety negatively.

Therefore careful consideration to the impact of these human factors on the performance of ATSEPs should be given. The study did not address other human factors that may need to be regulated". From the social point of view, the increased qualification of ATSEP will definitely have positive social impact.

Finally from regulatory perspective, the “regulation related to the ATSEP will establish a high uniform level of safety in civil aviation. This will be in accordance with Article 2.1 of Regulation (EC) No. 216/2008” (article 1.1.of 2018/1139).

8. Conclusion.

According the above study ordered by EASA to ECORYS-NLR consortium, aiming at identification of safety-related and safety-critical functions and related jobs in ATM/ANS, ATSEP is a safety related profession and the ATSEP employee can affect positively (or the reverse) the ATM/ANS as a whole.
However the study considers that "performance failure of the ATSEP will have a significant impact in several accident scenarios". The ATSEP contributes often to the last barrier in the ATM system.

The following risks were identified:"

- ✓ Mid-air collision
- ✓ Controlled Flight Into Terrain
- ✓ Runway incursion
- ✓ Taxiway collision
- ✓ Wake-induced accident

as analyzed in the preceding tables where the corresponding functions and associated / involved ATSEP jobs are depicted.

The issue of the inclusion of Air Traffic Safety Electronic Personnel (ATSEP in ICAO Annex 1 (Personnel Licensing) their Licensing and Safety benefits

A detailed analysis[5]

1.Introduction

The existence and progress of modern aviation, which began over a century ago, would have been unimaginable in its early stages. The advancements in aviation technology have brought about unprecedented achievements, and fortunately, this progress continues today. We still acknowledge the significant impact it has on our lives. It is desirable that there be further technological advancements in the future, as this is inevitable. However, it is essential to consider the forms and dynamics in which these changes will occur. What we can confidently assert is that the future of aviation technology will be even more advanced.[6]

Knowing this, we must inquire who will be capable of managing such advanced technology in aviation and what requirements must be fulfilled. Is it feasible to entrust this highly sophisticated technology to inadequately trained management personnel lacking the necessary knowledge and skills for handling such complex air navigation systems? These concerns are not new, as they have been raised since the early days of aviation development. Over time, answers to these questions have been gradually provided through the establishment of regulations, guidelines, and procedures that address the expected level of competence required to perform tasks in aviation.

In light of these developments, the need for a systematic legislation addressing the qualifications and licensing of aviation personnel became apparent. Aviation professionals, including pilots and flight crew members, were the initial focus of this scrutiny. Following the conclusion of World War II, the renowned Convention on International Civil Aviation, commonly known as the Chicago Convention, played a significant role in shaping the discussions surrounding this topic. Specifically, Annex 1 to the Chicago Convention, established in 1948 pursuant to Article 37, can be regarded as the first comprehensive regulation addressing these matters.

2. Regulatory perspective

The term "License" used in Annex 1 Personnel Licensing carries the same meaning as the expressions "certificate of competency and license," "license or certificate," and simply "license" utilized in the Chicago Convention. While Annex 1 comprehensively regulates various aspects of personnel licensing (particularly in Chapters 2, 3, and 4), it does not encompass another

[5] Based on Goran Petrovice article in https://www.academia.edu/54207307/The_problem_of_licensing_the_Air_Traffic_Services_Electronic_Personnel_ATSEP_

[6] Some of the examples: Advanced Air Transportation Technologies (AATT) Project, The Next Genera-tion Air Transportation System (NextGen) in USA or SESAR in Europe

category of aviation personnel directly involved in air traffic management (ATM) and known as Air Traffic Safety Electronic Personnel (ATSEP).

Despite being recognized within the civil aviation industry, ATSEP has encountered challenges in obtaining a globally recognized license. This issue has been a subject of concern for many years, prompting discussions on ways to address it. This article aims to explore not only the legal implications but also the safety, professional, social, and health aspects related to this profession. It raises the question of whether it is still satisfactory for ATSEP to operate without a universally accepted license or with licenses that are valid only at the national level among ICAO member states.

Addressing the issue of ATSEP licenses requires a comprehensive approach that goes beyond the legal framework alone. It is crucial to understand this matter from various perspectives. It is also essential for global organizations like ICAO to review the facts and play a role in addressing this issue. Similarly, regional and national levels within each ICAO member state should be involved in finding solutions.

2.1 Legislation pertaining to ATSEP competence and Licenses

Legislation pertaining to ATSEP licenses or competency assessment frameworks or legislation can originate from regional, or national levels.

Taking **European countries** as an example, relevant regulations may include:

- ICAO Doc 9868, second edition 2016, PANS-Training + Amendment No.5 to the Procedures for Air Navigation Services
- ICAO Doc 10057, Training Manual on Air Traffic Safety Electronics Personnel Competency-based Training and Assessment Second Edition, 2017 (replacing ICAO Doc 7192, Training Manual, Part E-2 Air Traffic Safety Electronics Personnel - ATSEP)
- COMMISSION IMPLEMENTING REGULATION (EU) 2017/373[7] European Aviation Safety (replacing certain EU Regulations, including EU Regulation 1035/11)
- Acceptable Means of Compliance (AMC) and Guidance Material (GM) to Part-PERS Requirements for service providers concerning personnel training and competence assessment SUBPART A — AIR TRAFFIC SAFETY ELECTRONIC PERSONNEL
- EUROCONTROL Specification-132 for Air Traffic Safety Electronics Personnel Common Core Content Initial Training
- ILO – International Labour Organization (ISCO 08) ATSEP 3155

The previous regulations that have had a significant impact on ATSEP staff at the EU level include:

[7] https://skybrary.aero/articles/air-traffic-safety-electronics-personnel-atsep

- Eurocontrol ESARR 5 (European Safety Regulatory Requirements) which outlines the general safety regulatory requirements for all ATM services' personnel responsible for safety-related tasks across the ECAC area and was the first attempt to regulate/harmonize the ATSEP profession.
- Competence Assessment of ATM Staff other than ATCOs, which abides by the requirements specified in Commission (EC) No 2096/2005.
- EASA NPA 2013 (currently ongoing with extension reference 2013-08).
- EASA Opinion No 03/2014.

In terms of national legal frameworks, regulations can vary and differ from country to country. Factors such as legal tradition, inheritance, and other considerations play a role in shaping the specific regulations. For countries in Europe, particularly those with a codification law tradition, there is often a dedicated law that addresses the relevant matters. In the case of Serbia, when it comes to ATSEP, the regulations appear to include Air Transport Law, specifically Article 172 ("Official Gazette of the Republic of Serbia", No 73/10, 57/11, 93/12, 45/15, and 66/15) and Regulation on Licenses and Training Centers for ATC technical personnel ("Official Gazette of the Republic of Serbia", No 25/17).

2.2 Legal status and ATSEP licensing in some European countries

To properly approach ATSEP licensing matters, an overview of solutions used in various European countries, both members and non-members of the European Union, was conducted. A random sample of the eleven considered European countries reveals the existence of numerous ATSEP licenses required to perform professional duties, which may not be the case across all of Europe.

Different approaches to ATSEP licensing exist in many European countries, with varying requirements and standards are applied.

The lack of uniform solutions in ATSEP training and regulations has resulted in an unfavorable situation regarding licenses for the ATSEP profession. However, considering the crucial nature of ATSEP activities, it is imperative that efforts are made to initiate change in this domain. Since the early 2000s, progress has been observed. IFATSEA, a global professional organization uniting ATSEP personnel, has played a significant role in this regard. They have developed a separate document that has been used by ICAO in collaboration for the creation of ICAO Doc 7192 AN/857 E2, which provides solutions in ATSEP training. Mentioned involvement of IFATSEA and ICAO showcases the global recognition of the importance of cohesive training and regulations for ATSEP personnel.

Certain member states have incorporated the proposed solutions from ICAO Doc 7192 AN/857 E2 into their national legislation and have commenced ATSEP training accordingly. Subsequent developments have resulted in the creation of several documents that provide guidelines specifically related to ATSEP. One such document is Eurocontrol ESARR 5 or EAM/GUI 5. Additionally, ESARR 5 focuses on personnel not covered by licenses, specifically addressing the technical staff working in air traffic control. Another significant document from that period is

the Eurocontrol Specification for Air Traffic Safety Electronics Personnel Common Core Content Initial Training.

The latest documents in this field pertain to Commission Implementing Regulation (EU) 2017/373, which was enacted on 1st March 2017 and became fully applicable on 2nd January 2020. This regulation has integrated ATSEP Training and Competence into EU law. It replaced a series of regulations in the field of civil aviation in the EU that established common requirements for providers. Implementing Regulations (EU) No 1034/2011, (EU) No 1035/2011, and (EU) 2016/1377, along with the amending Regulation (EU) No 677/2011, contain the implementing rules for ATSEP training and competence assessment. These rules can be found in Annex XIII (page 101 of the regulation).

Recently, significant efforts have been made to restructure ICAO Doc 9868, which is an important training document for air traffic management (ATM) staff. This restructuring initiative was initiated under the ICAO stakeholders' program known as Next Generation Aviation Professional (NGAP). As part of this process, Chapter IV of the document, which focuses on Air Traffic Safety Electronics Personnel (ATSEP), was revised and updated on November 10, 2016. The revised chapter aimed to define security-related activities within the ATSEP role, thus ensuring the mobility of professionals while adhering to internationally recognized standards. This endeavor aimed to facilitate the smooth exchange of skilled personnel in the aviation industry.

Efforts have been made in recent years to achieve the international licensing of Air Traffic Safety Electronics Personnel (ATSEP) by proposing their inclusion in Annex 1 Personnel Licensing. However, these attempts have not been successful thus far.

During the 38th session of the ICAO Assembly, which took place from September 24 to October 4, 2013, a proposal (WP/151[8]), regarding ATSEP licensing and their inclusion in Annex 1 Personnel Licensing was put forward by Indonesia. Unfortunately, this proposal did not receive approval, as explained in point 38.12 of the Technical Commission's report[9] to the Assembly. It was stated that it was premature to include ATSEP in Annex 1 Personnel Licensing at that moment. In the subsequent General Assembly, similar proposals were made by Ghana, India, and IFATSEA, all with the aim of including ATSEP staff in Annex 1.

However, the Technical Commission did not reach a consensus on these proposals either. Nonetheless, it was acknowledged that ICAO's ongoing work would create conditions to harmonize this area at the international level by developing procedures related to the competence of ATSEP staff.

Hence, the necessary conditions for the inclusion of ATSEP licenses as Standard and Recommended Practice-SARPs in Annex 1 Personnel Licensing **have not been fulfilled yet**.

The proposed hierarchy of ICAO documents related to the licensing of ATSEP staff would have appeared as follows:

[8] A38-WP/151 TE/60 22/8/13 THE INTEGRATION OF AIR NAVIGATION PERSONNEL INTO ANNEX 1

[9] See: ICAO A38-WP/401 TE/178, ASSEMBLY — 38TH SESSION,TECHNICAL COMMISSION DRAFT TEXT FOR THE REPORT ON AGENDA ITEM 38

3. Safety aspect

3.1. General

In today's world, the aviation industry places significant emphasis on ensuring safety, recognizing its utmost importance. It is worth noting that air travel continues to maintain its position as the safest mode of transportation. In addition to notable advancements in safety systems over the past decade and a half, there has been considerable focus on creating safety-related documents which have gradually become more prominent in aeronautical regulations. This has given rise to various institutions and regulatory bodies dedicated to ensuring the safety of civil aviation, such as the European Union Aviation Safety Agency (EASA) in Europe.

In conjunction with these developments, new safety standards, regulations, manuals, recommendations, and contingency procedures have been introduced. Consequently, the industry has been able to establish fresh perspectives on safety matters, including the concept of aviation safety itself and the implementation of a safety management system (SMS) within aviation. It is important to note that the latest addition to the Chicago Convention, Annex 19[10], focuses specifically on Safety.

The concept of safety in aviation encompasses various perspectives, as evidenced by the range of definitions put forth by scholars and scientific institutions, as well as civil aviation organizations. While we won't delve into specific definitions or favor any particular one, each definition, whether broad or narrow, offers an understanding of aviation safety. However, regardless of the definition used, it is crucial to acknowledge that accidents and incidents can still occur in the aviation industry. As safety experts, the objective is to minimize the number of such incidents in the future.

It is important to acknowledge that the recommendations and requirements set forth by safety experts are not entirely independent. Various factors such as economics, law, and politics often influence the implementation of these measures. In practical terms, there can be situations where a security measure may be considered acceptable from a safety standpoint but may be economically unfeasible or unattainable. Therefore, the operational decisions within the aviation industry are influenced by multiple considerations. Additionally, it is worth mentioning that security is a crucial component in this context, although its evaluation and discussion are beyond the scope of this particular discussion.

Operational safety is an integral aspect of aviation safety, and it encompasses various factors, including the licensing of aviation personnel. Annex 1, titled Personnel Licensing, plays a significant role in regulating the licensing of aviation personnel. It comprises chapters 2, 3, and 4, which detail the categories of aviation personnel that require licenses. However, it is worth noting that Annex 1 does not presently include Air Traffic Safety Electronics Personnel (ATSEP) as one of the categories covered by licensing requirements.

In addition to Annex 1, ICAO Doc 9379 AN/916, the Manual of Procedures for Establishment and Management of a State's Personnel Licensing System, is a comprehensive document that provides guidance on licensing of aviation personnel. It is important to mention that this

[10] After 30 years ICAO issues the new Annex 19 which entered into force 14.11.2013

document does not mandate licenses for all aviation staff, particularly those working in ground operations.

The omission of ATSEP and the specific licensing requirements for ground staff highlight the need for further consideration and development in the field of personnel licensing to ensure a comprehensive approach to aviation safety.

Within compartment 4.2.2 of the mentioned document, there is a detailed explanation regarding the assessment of whether an activity requires a license. Two specific subsections, 4.2.2.4 and 4.2.2.5, are particularly relevant when considering the licensing of staff, including ATSEP.

Subsection 4.2.2.4 focuses on evaluating the criticality of a function to aviation safety. This assessment helps determine the level of impact a particular role or activity has on safety. Meanwhile, subsection 4.2.2.5 deals with the assessment of the need to demonstrate competency through a license.

To establish a connection between the safety of aviation and ATSEP personnel, it becomes imperative to evaluate their roles and responsibilities within the context of aviation safety. If their functions are deemed critical and their competency requires licensing to ensure safety standards, it would suggest the need to include ATSEP in the licensing requirements.

It is important to emphasize that this assessment and decision-making process should be conducted in a comprehensive and systematic manner, considering various factors, including the potential impact on aviation safety.

3.2. Safety cases (accidents with ATSEP involvement)

To provide concrete examples of the role ATSEP may play in aviation safety, let's consider some past incidents and accidents that occurred in Europe. It is important to note that these examples are not exhaustive, and similar incidents may have occurred worldwide.

The analysis included events which enjoy significant renown and attract diverse perspectives. It is treated with three significant accidents

i. (The Überlingen Mid-Air Collision in 2002,

ii. the Linate Runway Incursion in 2001 and the incident involving Korean Air Flight 801) as well as three accidental events

iii. (series of failures at the Swanwick ACC Center in 2013 and 2014. Additionally,

iv. the Zagreb incident in 2014 and the Brussels Power event in 2015).

The mid-air collision in Überlingen, Germany

In summary, **the mid-air collision in Überlingen, Germany**, occurred on 1 July 2002, involving a passenger plane from Bashkirian Airlines and a DHL cargo plane. The incident took place in the airspace between Germany and Switzerland, with Swiss ANSP Skyguide controlling the area based on a Letter of Agreement (LoA) with Germany. The collision was caused by various

factors, including air traffic controllers deviating from safety standards while handling the involved aircraft. It is possible that the air traffic controller responsible for the two aircraft was only aware of the collision less than a minute before it happened. Despite both aircraft being equipped with TCAS (Traffic Collision Avoidance System), they collided in the air. Additionally, the air traffic controller was unaware of the TCAS operation and issued conflicting instructions, leading to confusion. The pilot of the Bashkirian Airlines plane followed the air traffic controllers' instructions despite his TCAS[11] indicating otherwise, while the DHL pilot followed the TCAS instructions. Sadly, this resulted in the loss of 71 passengers' lives.

Following the accident, extensive investigations[12] and judicial proceedings were conducted in multiple states[13], with a focus on determining the responsibility of Swiss ANSP SkyGuide and its ATSEP employees in the CNS (Communication/Navigation/Surveillance) department as primary actors. A thorough investigation into the case has identified specific errors committed by the ATSEP employee.

In conclusion, one of the identified faults lies with the manager of the CNS Department, who was fined with 13,500 CHF despite not being present during the event. The manager was suspended for two years due to omissions made in coordinating the modifications to the Voice Communication System (VCS) at the Area Control Centre in Zurich with adjacent air traffic control units. This prevented the air traffic controller on duty, for which the ATSEP had direct responsibility, from effectively communicating with aircraft from a specific working position. Notably, among the four individuals released in this process, an ATSEP technician who was on duty at the time of the accident is included.

[11] According to Eurocontrol Review of the BFU Überlingen Accident Report after this case recommendation 18/2002 made to the ICAO on 1st October 2002 relates to changes in the requirements of Annex 2 and 6 and the PANS-OPS documentation to ensure that pilots follow TCAS advisories even in the face of conflicting information from ATM officers;see also:BFU Investigation Report,2004, page 112.

[12] The official investigation was conducted by German BFU according to ICAO Annex 13 and EU Directive 94/56 (European Council 1994)

[13] In Germany, Switzerland and Spain

Final Report:

Review of the BFU Überlingen Accident Report

(Version 1: 17/12/2004)

Contract C/1.369/HQ/SS/04

Assembed by Theodore Kiritsis

VP IFATSEA

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The BFU found that the following principles complied with the different requirements published by ICAO, Eurocontrol and the Bundesamt für Zivilluftfahrt (BAZL). They were also argued to go beyond those existing requirements at the time of the accident:

2. Principles:

2.1 The safety of Air Navigation will be given the highest priority. An explicit, pro-active approach to Safety
Management will ensure reasonable assurance of maintaining optimum levels of safety in the development,
implementation and continued function of the [...] operation.

2.2 All staff have an individual responsibility for their own actions whilst Managers are responsible for the
Safety Performance of their own divisions.

2.3 All staff members performing activities with safety related implications will be adequately trained, motivated and competent to undertake the tasks required of them, and properly licensed where appropriate.

3. Description:

3.1 Quantitative Safety Levels – meeting appropriate and agreed target levels of safety – will be derived for
all systems.

3.2 New systems and changes to existing systems, operations and procedures (including Engineering systems) will be regularly assessed for their safety significance and safety criticality. The results of these
safety assessments will be documented in an appropriate manner allied to the requirements of the established quality environment.

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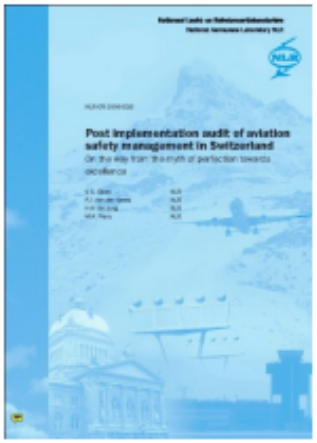
Observation 3-j: Proposals for the future shape of ATM service provision must consider both the benefits that techniques such as functional airspace blocks provide for degraded modes of operation. They must also consider the insecurities that these plans create for service providers that fear competition from ANSPs with lower investments in safety and hence lower costs.

NLR Post implementation



Recommendation 7-3: Licensing of Air Traffic Control technical personnel
Skyguide is recommended to investigate the practicalities and potential effectiveness of a licensing program for Technical Personnel. The eventual set-up of such a program shall be in agreement with Eurocontrol ESARR 5 requirements for Technical Personnel.

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It is concluded that, whereas the interviews have not clearly identified Skyguide's investigations regarding a licensing program for technical personnel, these investigations have not resulted in the immediate development of a licensing program. There does not seem to be full management support of this approach.

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Linate airport, Milan, Italy

Another equally well-known case occurred at Linate airport in Milan, Italy, on October 8th, 2001. It involved a collision between a Cessna Citation CJ2 (call sign: D-IEVX) and a McDonnell Douglas MD-87 operated by Scandinavian Airlines (call sign: SK 686), which was preparing for takeoff.

Instead of taxiing across the platform towards the designated taxiway, the pilot of the Cessna Citation CJ2 chose to taxi towards the main taxiway. This decision resulted in the tragic outcome of 114 fatalities from both aircraft. Additionally, during the subsequent prevention and rescue efforts, four employees lost their lives, and four others were injured in a fire.

On October 8, 2001, a significant collision took place at Linate Airport in Milan, Italy, where miscommunication and adverse weather conditions were contributing factors. The runway was enveloped in dense fog, severely limiting visibility to approximately 656 feet (200 meters). This reduced visibility, combined with high levels of air traffic, likely played a role in the tragic incident.

Image 12 Linate accident

A Cessna Citation CJ2 business jet received instructions to taxi towards its designated takeoff point, following a route that would ensure it avoided the main runway. However, due to a combination of inadequate radio communication, insufficient markings, and a lack of proper signage, the Cessna misinterpreted the message and turned in the incorrect direction, inadvertently crossing the main runway. This course of action resulted in it intersecting the path of Scandinavian Airlines Flight 686, a McDonnell Douglas MD-87 airliner.

The collision between the two planes occurred, with Scandinavian Airlines Flight 686 traveling at approximately 170 mph (270 kph). Upon impact, the Cessna immediately caught fire, while the right engine of the MD-87 was severely damaged. Despite the critical situation, the pilot of Flight 686, Joakim Gustafsson, skillfully attempted to regain control by utilizing the thrust reverser and brakes. However, despite his efforts, Gustafsson ultimately lost control of the aircraft, resulting in a catastrophic crash into a luggage hangar located at the end of the runway. Tragically, the accident claimed the lives of 118 individuals.

Indeed, it is unlikely that just one bad decision alone would lead to such a tragic outcome. Investigations and the final report[14] revealed significant deficiencies in the organization and equipment conditions at Linate airport. In particular, the CNS/ATM systems and facilities exhibited major shortcomings, including the lack of ground radar, issues with radio communication equipment, the absence of stop bars, and inadequate procedures. These systemic failures and deficiencies played a crucial role in creating an environment that contributed to the accident.

Indeed, the case highlighted the compounding factor of multiple unfavorable circumstances. Furthermore, considering the reported issues with the CNS equipment, the liability of the Italian ANSP ENAV was closely scrutinized. As a result of organizational deficiencies, inadequate planning, failure to implement appropriate measures, and the omission of certain procedures, the director of ENAV was sentenced to six and a half years in prison. In the same trial, seven junior managers were also convicted. Thus, a concrete set of omissions was identified in relation to the event. In other words, none of the ATSEP operators simply pressed

the "wrong button" or directly caused the accident. However, the responsibility of the ATSEP can be observed in the fact that the CNS management behaved in a manner where they knowingly or should have known that an unwanted event could occur, yet negligently chose to overlook the possibility. It is this negligence and failure to act that led to catastrophic consequences, even though they were not the sole culprits for the accident.

Korean Air flight 801

The tragic accident involving Korean Air flight 801 and a Boeing 747-3B5B (747-300) serves as an example that is relevant to ATSEP. This catastrophic incident occurred on August 30, 1997, at 01:42:26 local time during a flight from Seoul to A.B. Won Guam International Airport in Agana, Guam. While attempting to land at the destination airport, the aircraft tragically crashed, resulting in the loss of 228 passengers and crew members. Only 26 individuals survived the accident.

The fatal consequences of the accident were a result of crew members' non-compliance with prescribed procedures, inadequate crew restraint, and insufficient training. An important contributing factor was the intentional exclusion of the Minimum Safe Altitude Warning (MSAW) function on the flight control system, which deprived the flight control staff of accurate flight data and failed to provide timely warnings to the crew. The software changes intended to address false alarms from the MSAW system did not rectify the situation. As a result, the aircraft descended below the Minimum Descent Altitude (MDA) without detection by the flight control staff. The responsibility for this case primarily lies with the FAA due to inadequate system management, which directly falls under the responsibility of ATSEP personnel. These factors underscore the critical importance of proper operation by ATSEP personnel and the functioning of devices and systems for aviation safety.

If the above-mentioned tree cases transferred into the field of safety chain and the chain links as they lined: Continuing a streak is indeed logical. To clarify, just as mechanics/engineers are vital in aircraft maintenance and pilots are essential for safe operation, air traffic controllers (ATCs) and Air Traffic Safety Electronics Personnel (ATSEPs) play a crucial role in maintaining functioning radio navigation aids that are essential for safe air navigation. In other words, while irregularities in mechanics/engineers' maintenance of aircraft equipment pose a direct threat to

[14] Final Report, AGENZIA NAZIONALE PER LA SECUREZZA DEL VOLO

individual aircraft, improper operation by ATSEPs can potentially pose risks to multiple aircraft simultaneously.

Figure 8b. Closer view of the wreckage from Korean Air flight 801 and the NIMITZ VOR.

Image 13 view of the wreckage from Korean Air flight 801 and the NIMITZ VOR

Global failures and disruptions of CNS/ATM Systems and Services (2010-2024)

In recent years, there have been **several incidents of software failures in ATM systems**. As reliance on automation progressively increases, software failures present a wide range of repercussions. These range from temporary capacity issues to potential safety hazards, affecting the integrity of safe separation and the overall resilience of the Air Navigation Services (ANS) system.

The recent failure of the **FAA NOTAM system** that created a major disruption but also the CNS/ATM system failure in Philippines both in 2022 , alongside other major system failures, indicate the importance of the ATSEP profession for the whole aviation information and services chain.

As new Business Models come into the scene and aviation is moving towards a Service oriented approach, e.g. ATM Data Processing as a separate Service, Remote towers or Virtual centers (See SJU Airspace Architecture Study[15]) , it may lead to centralization of processing with potentially more widespread effect in the case of software or hardware failure or even worse a potential disabling (partial or total) of the system due to a purposeful cyber-attack.

There has been a large number of CNS/ATM systems outages world wid in recent years.. Below is a large list for reference. There is a trend that these incidents are on the rising side whearas ATSEP numbers and expenditure on CNS is falling .

IFATSEA is concerned about these outages their impact on Safety but also on the economic impact that is according to the press, in the range of hundreds of millions of Euros.

Here are some major air traffic control outages between 2010 and 2024 that occurred globally:. According to the web search results some of the major and minor ATC outages due to technical failures globally since 2010 are:

1)December 2010: A snowstorm in New York caused a power outage at the FAA's air traffic control center in Ronkonkoma, affecting flights at JFK, LaGuardia, and Newark airports1.

2)April 2011: A fire at the air traffic control tower in Memphis, Tennessee, forced the evacuation of controllers and the closure of the airport for several hours2.

3)May 2011: A software failure at the Eurocontrol's Central Flow Management Unit in Brussels disrupted the flight plans of thousands of flights across Europe3.

4)June 2012: A communication failure at the air traffic control center in Palmdale, California, affected flights in Southern California, Arizona, and Nevada4.

[15] https://www.sesarju.eu/sites/default/files/2019-05/AAS_FINAL_0.pdf

5)December 2014: A software glitch in the flight data processing system at the Swanwick control center in the UK caused widespread disruption to flights across the UK and parts of Europe5.

6)July 2015: A power failure at the Swanwick control center in the UK affected the radar displays and forced NATS to reduce the airspace capacity by 20%. The outage lasted for about 40 minutes and affected hundreds of flights.

7)August 2015: A router malfunction at the FAA's En Route Automation Modernization system in Leesburg, Virginia, caused delays and cancellations to flights along the East Coast of the US.

8)October 2015: A radar failure at the air traffic control center in Jakarta, Indonesia, disrupted flights at the Soekarno-Hatta International Airport.

9)January 2016: A power outage at the air traffic control center in Auckland, New Zealand, affected flights across the country and to Australia.

10)May 2016: A computer failure at the air traffic control center in Brussels, Belgium, caused the closure of the Belgian airspace for several hours.

11)June 2016: A radar failure at the air traffic control center in Manila, Philippines, affected flights at the Ninoy Aquino International Airport.

12)August 2016: A software failure at the air traffic control center in Swanwick, UK, caused delays and cancellations to flights across the UK and parts of Europe.

13)September 2016: A power outage at the air traffic control center in Sydney, Australia, affected flights at the Sydney Airport and other airports in the country.

14)October 2016: A radar failure at the air traffic control center in Lisbon, Portugal, caused delays and cancellations to flights at the Lisbon Airport and other airports in the country.

15)November 2016: A communication failure at the air traffic control center in Amsterdam, Netherlands, caused delays and cancellations to flights at the Schiphol Airport and other airports in the country.

16)December 2016: A software failure at the air traffic control center in Zurich, Switzerland, caused delays and cancellations to flights at the Zurich Airport and other airports in the country.

17)January 2017: A power outage at the air traffic control center in Istanbul, Turkey, affected flights at the Ataturk Airport and other airports in the country.

18)February 2017: A radar failure at the air traffic control center in Athens, Greece, caused delays and cancellations to flights at the Athens Airport and other airports in the country.

19)March 2017: A software failure at the air traffic control center in Karlsruhe, Germany, caused delays and cancellations to flights across Germany and parts of Europe.

20)April 2017: A communication failure at the air traffic control center in Marseille, France, caused delays and cancellations to flights across France and parts of Europe.

21)May 2017: A power outage at the air traffic control center in Stockholm, Sweden, caused delays and cancellations to flights across Sweden and parts of Europe.

22)June 2017: A radar failure at the air traffic control center in Rome, Italy, caused delays and cancellations to flights across Italy and parts of Europe.

23)July 2017: A software failure at the air traffic control center in Reykjavik, Iceland, caused delays and cancellations to flights across Iceland and parts of Europe.

24)August 2017: A communication failure at the air traffic control center in Salt Lake City, Utah, affected flights in Utah, Colorado, Wyoming, and Montana.

25)September 2017: A power outage at the air traffic control center in San Juan, Puerto Rico, affected flights in Puerto Rico and the Caribbean after Hurricane Maria.

26)October 2017: A radar failure at the air traffic control center in Dublin, Ireland, caused delays and cancellations to flights at the Dublin Airport and other airports in the country.

27)November 2017: A software failure at the air traffic control center in Brisbane, Australia, caused delays and cancellations to flights at the Brisbane Airport and other airports in the country.

28)December 2017: A communication failure at the air traffic control center in Atlanta, Georgia, affected flights at the Hartsfield-Jackson International Airport and other airports in the US.

29)January 2018: A power outage at the air traffic control center in Amsterdam, Netherlands, caused delays and cancellations to flights at the Schiphol Airport and other airports in the country.

30)February 2018: A radar failure at the air traffic control center in Mumbai, India, affected flights at the Chhatrapati Shivaji International Airport and other airports in the country.

31)March 2018: A software failure at the air traffic control center in Brussels, Belgium, caused the closure of the Belgian airspace for several hours.

32)April 2018: A communication failure at the air traffic control center in Frankfurt, Germany, caused delays and cancellations to flights at the Frankfurt Airport and other airports in the country.

33)May 2018: A power outage at the air traffic control center in Moscow, Russia, affected flights at the Sheremetyevo International Airport and other airports in the country.

34)June 2018: A radar failure at the air traffic control center in Warsaw, Poland, caused delays and cancellations to flights at the Warsaw Chopin Airport and other airports in the country.

35)July 2018: A software failure at the air traffic control center in London, UK, caused delays and cancellations to flights at the Heathrow Airport and other airports in the country.

36)August 2018: A communication failure at the air traffic control center in Washington, DC, affected flights at the Ronald Reagan National Airport and other airports in the US.

37)September 2018: A power outage at the air traffic control center in Copenhagen, Denmark, caused delays and cancellations to flights at the Copenhagen Airport and other airports in the country.

38)October 2018: A radar failure at the air traffic control center in Oslo, Norway, caused delays and cancellations to flights at the Oslo Airport and other airports in the country.

39)November 2018: A software failure at the air traffic control center in Paris, France, caused delays and cancellations to flights across France and parts of Europe.

40)December 2018: A drone sighting at the Gatwick Airport in the UK caused the closure of the airport for several days, affecting thousands of flights and passengers.

41)January 2019: A power outage at the air traffic control center in Bogota, Colombia, affected flights at the El Dorado International Airport and other airports in the country.

42)February 2019: A radar failure at the air traffic control center in Bangkok, Thailand, affected flights at the Suvarnabhumi Airport and other airports in the country.

43)March 2019: A software failure at the air traffic control center in Amsterdam, Netherlands, caused delays and cancellations to flights at the Schiphol Airport and other airports in the country.

44)April 2019: A communication failure at the air traffic control center in Chicago, Illinois, affected flights at the O'Hare International Airport and other airports in the US.

45)May 2019: A power outage at the air traffic control center in Johannesburg, South Africa, affected flights at the OR Tambo International Airport and other airports in the country.

46)June 2019: A radar failure at the air traffic control center in Helsinki, Finland, caused delays and cancellations to flights at the Helsinki Airport and other airports in the country.

47)July 2019: A software failure at the air traffic control center in London, UK, caused delays and cancellations to flights at the Heathrow Airport and other airports in the country.

48)August 2019: A communication failure at the air traffic control center in New York, New York, affected flights at the John F. Kennedy International Airport and other airports in the US.

49)September 2019: A power outage at the air traffic control center in Bucharest, Romania, caused delays and cancellations to flights at the Henri Coanda International Airport and other airports in the country.

50)October 2019: A radar failure at the air traffic control center in Madrid, Spain, caused delays and cancelations.

There is a trend that these incidents are on the rising side whereas ATSEP numbers and expenditure on CNS is falling .

IFATSEA is concerned about these outages their impact on Safety but also on the economic side that is according to the press, in the range of hundrends of millions of Euros according to

press reports. These outages also impact the environment as aircraft are forced to fly longer and less efficient routes which means higher CO2 emmissions. Correspondingly as ATSEP through their work contribute to ensuring the Availability and Continuity of CNS services and in the case of disruptions they minimize the downtimes , their work is , alongside Safety , highly contributory to the Performnace of air operations by the airspace users. For this reason IFATSEA in Europe has proposed to EASA, EUROCONTROL and IATA for the introduciton of a KPI that links CNS/ATM systems outages to the Performance scheme. This of course will necessitate that a data collection system will be developed accordingly, as very limeted data exists.

Fortunately, errors arising from the CNS/ATM domains and human factors related to ATSEPs have not always resulted in accidents or fatalities. However, these issues still require special attention due to their potential consequences. In recent years, there have been cases in Europe where such incidents, including emergencies, occurred. An example worth mentioning is the incident that took place at the ATC Center in Swanwick, UK.

On December 6/7th, 2013, an incident occurred involving the Technical Monitoring and Control System (TMCS) of the Voice Communications System (VCS) at the ATC Center in Swanwick, UK. The issue arose due to an update that caused the system to malfunction, resulting in the inability to smoothly transition from the nighttime configuration of 5 sectors to the daytime configuration of 15-20 sectors. This led to numerous flight reroutings and cancellations, causing both safety hazards and significant economic damages.

A similar incident occurred again at the ATC Center in Swanwick on December 12th, 2014, approximately a year later. At 14:44, a software error that had been latent since the 1990s[NATS System Failure 12 December 2014 – Final Report,”The fault lay in the software’s performance of a check on the maximum permitted number of Controller and Supervisor roles (known as Atomic

The disruption on flights and passenger discomfort was significant/

Power Supply problem, Belgocontrol, ACC Brussels

On May 27th, 2015, a power supply issue occurred at Belgocontrol, specifically at ACC Brussels. During a routine testing of emergency generator operations, there was an unexpected over-voltage when switching from the primary to the secondary power supply. This resulted in the shutdown of vital technical systems necessary for air traffic control operations at Brussels ACC.

However, in a fortunate turn of events, the emergency telecommunication transmitters remained active, providing an opportunity for Brussels ACC to implement contingency procedures. They gradually closed their airspace by transferring jurisdiction over the affected aircraft to adjacent ACCs. A crucial role was played by a military center in Semmerzake, which assisted in this operation.

ACC Zagreb water penetration

Another incident related to power supply occurred at ACC Zagreb, but with different causes compared to the one at Belgocontrol.

On July 30th, 2014, during a period of stormy weather accompanied by heavy precipitation, water penetrated the ACC Zagreb building, specifically in areas housing electrical power plants, between 14:50 and 15:22 local time. At the time, ACC Zagreb was responsible for controlling 42 aircraft.

The water damage caused a series of misjudgments and coordination failures, leading to incorrect decisions being made. The operating current of the UPS system was shut off, resulting in the uncontrolled shutdown of all essential ATM systems. This happened due to inaccurate information from the technical service, which had suggested that only the lighting would be affected while the devices and systems would continue to function normally.

With the key ATM system cancelled, the situation became alarming, considering the number of aircraft under the jurisdiction of ACC Zagreb and the potential conflicts that remained unresolved. This put a significant number of passengers and aircraft at potential risk. Fortunately, neighboring flight control centers (ACC Belgrade, ACC Padova, ACC Ljubljana) intervened by accepting the complete air traffic previously handled by ACC Zagreb. Their assistance played a vital role in resolving the situation and ensuring the safety of the affected flights.

This unfortunate event highlights the fact that, despite the enhanced features and increased redundancy of newer generation ATM systems and devices, they can still be compromised by poor handling and manipulation. In this case, the complete ATM system was affected due to inadequate power management, which could have had fatal consequences.

The incident can be attributed to factors such as poor organization of ATSEP staff work, incorrect assessments, and failure to comply with procedures. Additionally, the lack of developed security infrastructure, including security assessment plans, at the CROCONTROL provider was also a contributing factor to the incident.

Overall, this event underscores the importance of maintaining strict adherence to procedures, ensuring proper training and assessment of staff, and establishing robust security measures to mitigate potential risks in the ATM domain.

References (Websearch,) 6/24/2024

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4.. Philippines recovering from ATC power outage - AeroTime

5.. ATC outage in the UK causes flight disruptions - AeroTime

6. Thousands face delays after air traffic control fault - BBC

7.. Airlines call for compensation reform after ‘staggering’ air chaos ...

8. Link: Air Travel Chaos: Technical Glitch Grounds Flights, Strands Thousands - Labour Heartlands

9.(The collapse of air-traffic control that caused major flight chaos and .... https://www.independent.co.uk/travel/news-and-advice/flight-air-traffic-control-failure-nats-b2513127.html.

10. NATS report into air traffic control incident details root cause and .... https://www.nats.aero/news/nats-report-into-air-traffic-control-incident-details-root-cause-and-solution-implemented/.

11. Regulator publishes progress report on Independent Review into August .... https://www.caa.co.uk/newsroom/news/regulator-publishes-progress-report-on-independent-review-into-august-2023-nats-flight-planning-system-failure/.

12. How A Single French Bee Flight Plan Error Delayed 700,000 Passengers. https://simpleflying.com/french-bee-flight-plan-error-uk-airspace-meltdown/.

13. UK ATC system meltdown caused by two identical ATC waypoints ... - AeroTime. https://www.aerotime.aero/articles/uk-nats-failure-report.

14. These incidents highlight the critical importance of reliable air traffic control systems. If you need more details on any specific event, feel free to ask!

15. FAA outage: Graphics show number of flights impacted by system failure. https://www.usatoday.com/in-depth/graphics/2023/01/11/faa-outage-computer-failure-flight-delays/11030960002/.

16. Technical Outage Crippled Dutch Air Traffic for Hours, Authorities Say. https://www.usnews.com/news/world/articles/2024-04-16/technical-outage-crippled-dutch-air-traffic-for-hours-authorities-say.

17.Flight Delay Information - Air Traffic Control System Command Center. https://www.fly.faa.gov/flyfaa/usmap.jsp?legacy=true.

18.ATC Center in Swanwick, UK

19. https://skybrary.aero/articles/air-traffic-safety-electronics-personnel-atsep

4. Professional aspect

Considering ATSEP integration in Annex 1 Personnel Licensing solely from a safety perspective would be limited and inadequate.

Another important aspect to be taken into account is the professional aspect. It is widely acknowledged that the establishment of a profession is a lengthy process that involves meeting specific standards. The recognition of ATSEP as a an equally important profession extends not only within the aviation sector but also beyond, as evident from its inclusion in the International Standard Classification of Occupations by the International Labour Organization (ILO). In Volume 1 Structure, Correspondence Group Definitions and Tables of this classification, on page 193, Unit 3155 outlines the scope of activities performed by Air Traffic Safety Electronic Technicians (ATSEP). By considering this broader perspective, the integration of ATSEP in Annex 1 Personnel Licensing can be more comprehensive.

One crucial aspect of the aviation profession is training. This encompasses the quality of performance training and the desired outcomes expected from training, as well as the need for global standardization of training for aviation personnel to ensure recognition worldwide. Training issues have been a subject of frequent discussion among relevant bodies within ICAO, such as the Air Navigation Commission and General Secretariat, as well as the International Federation of Air Traffic Safety Electronics Associations (IFATSEA), which represents ATSEP professionals worldwide. Both organizations have recognized the challenges associated with ATSEP training, particularly the lack of a uniform standard for training ATSEP across different regions. Consequently, there has been significant variation in the administrative approaches to ATSEP training, with examples ranging from internal training programs within Air Navigation Service Providers (ANSPs) to state-issued certificates or licenses (commonly referred to as NON-ICAO licenses).

In the early 2000s, a shift began to occur in response to the growing demands of global CNS/ATM systems. This shift was driven by the recognition of perceived shortcomings in ATSEP training. Consequently, the relevant bodies within ICAO initiated cooperation with IFATSEA to establish regulations that would provide standardized training for ATSEP. This collaborative effort led to the development of ICAO Doc 7192, where recognition was given to the valuable contribution of IFATSEA in drafting the document. It was explicitly stated that the document was based on another independent document previously developed by IFATSEA.

As previously mentioned, ICAO Doc 7192 provides a comprehensive framework for ATSEP training. One noteworthy aspect of this document is the division of training principles for ATSEP into three main duties: maintenance, installation, and management/monitoring/control of CNS/ATM systems and equipment. This division ensures that training covers the specific responsibilities associated with each duty. Additionally, it is important to highlight the significance of training in the development, review, and modification of CNS/ATM systems, equipment, and maintenance procedures. This ensures that ATSEP are equipped with the necessary knowledge and skills to keep up with evolving technologies and standards within the aviation industry.

ICAO Doc 7192 gave the basis for standards in the field of training ATSEP. However, worldwide the same document was not accepted completely. The differences at the national level between the Member States of ICAO, when it comes to ATSEP still exist. 01/01/2017 ICAO Doc 10057 was issued as a replacement for ICAO Doc 7192. ICAO Doc 7192 has emerged as a crucial guideline for ATSEP personnel, outlining the necessary requirements and standards for their work. It is worth noting that its successor, Doc 10057, introduced a slightly different structure with six chapters. This revised document expanded the scope of competencies and expertise expected from ATSEP professionals. Additionally, t**he training process outlined in Doc 10057** consists of four distinct phases, providing a comprehensive framework for acquiring and maintaining the required level of proficiency in ATSEP roles. These changes signify the continuous development and refinement of industry standards to ensure the effectiveness and competence of ATSEP staff.

When the CNS/ATM systems become operational on a global scale and interconnected, it is not realistic to expect ATSEP to be trained in various standards, nor is it allowed or safe to do so. The national level regulatory recognition of ATSEP often differs, leading to discrepancies in training. In many countries involved in air traffic, ATSEP is not recognized as aviation personnel, but rather as auxiliary staff[16]. Although there may be possibilities for national-level certification or licensing, ATSEP is not uniformly regulated across countries. Regarding this matter, it is important to mention recital (17) of EU Regulation 1108/2009 (second extension of EASA), which emphasizes that Member States should retain the competence to establish or maintain certification or licensing requirements for professions not covered by the regulation. The focus should be on the acquisition and demonstration of competence rather than formal licenses issued by aviation authorities, as desired by the EU legislator.

When the global implementation and interconnection of CNS/ATM systems occur, expecting ATSEP to be trained in various standards is not realistic, nor is it allowed or safe. There are significant differences in training and regulatory recognition of ATSEP at the national level. Many countries engaged in air traffic do not acknowledge ATSEP as aviation personnel; instead, they are considered auxiliary staff, although there may exist provisions for certificates or licenses at a national level. In this regard, recital (17) of EU Regulation 1108/2009 (second extension of EASA) is important to mention. It states: "(17) With regard to the regulation of professions which are not covered by this Regulation, the competence of Member States should be retained to establish or maintain, at their own discretion, certification or licensing requirements of the personnel." Clearly, the emphasis of the EU legislator is on demonstrating competence rather than relying solely on formal licenses issued by aviation authorities.

With the rise in air traffic, aviation organizations such as ICAO and stakeholders have noticed a shortage of competent personnel in this technologically-driven era. To address this issue, the administration launched the Next Generation Aviation Professional (NGAP) initiative in 2009. As part of this initiative, proposals were made to restructure ICAO Doc 9868 PANS-TRG, which pertains to training in air traffic management (ATM). Under the proposed restructuring, both air traffic controllers (ATCOs) and air traffic system engineering personnel (ATSEP) are considered as ATM personnel.

[16] The case with ATSEP in Montenegro, see: http://www.sluzbenilist.me/PravniAktDetalji.aspx?tag=%7BC42FA975-10D6-4D49-ADB4-B645FC0C4E38%7D, page 30, article 104.

The anticipated decision in PART IV of the document includes three sections outlining principles and procedures for ATM personnel. Towards the end of the document[17], there is a table outlining the framework specifically for ATSEP. It is important to note that this document does not hold the same status as Standards and Recommended Practices (SARPs). Instead, it is stated in the document that PANS-TRG provides more detailed procedures for training organizations to follow when providing training for aeronautical personnel[18], compared to what is outlined in the SARPs.

To address the issue of non-standardized training for ATSEP at the national level, ICAO has developed documents such as ICAO Doc 9868 PANS TRG and ICAO Doc 10057. These documents aim to establish a uniform professional training framework that can provide a solution to the identified problems. However, it is important to note that member states of ICAO may still exercise some discretion in their training approaches.

At the regional level, parallel efforts have been made within the European Union (EU) to address the competence of ATSEP staff. The EU regulation 373/2017, which came into effect on 1st March 2017 and became applicable from 2nd February 2020, sets the framework for ATSEP in EU countries. This regulation replaces several previous regulations and includes provisions regarding the competence of ATSEP in ANNEX XIII, specifically in PART-PERS SUBPART A - AIR TRAFFIC SAFETY ELECTRONIC PERSONNEL.

To provide further clarity and guidance on the implementation of this regulation, a document has been created, known as the Acceptable Means of Compliance (AMC) and Guidance Material (GM) to Part-PERS Requirements for service providers in relation to staff training and competence assessment. This document, the Acceptable Means of Compliance (AMC) and Guidance Material (GM) to Part-PERS Requirements, provides additional information and guidance on how to apply and comply with the material outlined in the regulation. It particularly focuses on the training and competence assessment of ATSEP staff for service providers.

The aim of these regional documents and guidelines within the EU is to complement the global efforts made by ICAO and provide a more specific framework for ATSEP personnel in European countries. By implementing these regulations, the EU seeks to harmonize the training and competence assessment of ATSEP, ensuring a standardized approach within the member states.

Overall, the combination of global efforts by ICAO through documents like PANS TRG and regional regulations within the EU helps to address the issue of non-standardized training and establish a consistent framework for the competence of ATSEP personnel at both global and regional levels.

Certainly, the establishment of a training and competence system for ATSEP personnel, similar to that of aviation staff holding internationally recognized licenses, has paved the way for licensing requirements for ATSEP. These requirements have been met by implementing the provisions outlined in the relevant documents.

However, it should be noted that ATSEP personnel and other air personnel who have long been subject to licensing and are part of Annex 1 Personnel Licensing may require different solutions.

[17] See page 48

[18] Procedures for Air Navigation Services-Training, 2. Scope and purpose

It is not necessary to replicate solutions that have already been established for other air personnel.

The licensing and regulatory requirements for different categories of aviation personnel can vary based on their specific roles and responsibilities. While ATSEP personnel now have a framework for licensing based on the established training and competence system, other air personnel may have different licensing requirements that have been determined separately.

Therefore, it is important to consider the unique requirements and characteristics of each category of air personnel and ensure that appropriate and tailored solutions are applied, rather than blindly applying solutions that have been used for other personnel.

5.Social aspect

The social aspect for ATSEP is addressed very differently globally. Not many studies exist on this safety critical profession . Some studies that include a focus on the social side were performed over the years.

A. Study on Air Traffic Controller (ATCO) and Engineering Staff (ATSEP) social issues and working conditions[19]

B. ECORYS study

C. FAA Study

In the study that was performed in Europe under the name of Study on Air Traffic Controller (ATCO) and Engineering Staff (ATSEP) social issues and working conditions it focused on input from countries in center and northern parts of Europe. This study on Air Traffic Safety Electronics Personnel (ATSEP) social issues20, commissioned by the European Commission, provides an in-depth analysis of the challenges and working conditions faced by ATSEPs in the Air Traffic Management (ATM) industry. The detailed findings are summarized below:

1. Job Demands and Stress

- Increasing Workload: ATSEPs are experiencing higher job demands due to the continuous growth in air traffic and the integration of new technologies. This has resulted in increased stress levels and the need for ongoing skill development1.
- Technological Advancements: The shift towards digital technologies requires ATSEPs to manage both legacy systems and new digital infrastructures, adding to their workload and complexity of tasks1.

2. Staffing Issues

[19] https://publications.tno.nl/publication/34638403/dJAIVu/EC-2021-studysummary.pdf

[20] https://publications.tno.nl/publication/34638403/dJAIVu/EC-2021-studysummary.pdf

- Aging Workforce: Many ANSPs (Air Navigation Service Providers) are dealing with an aging workforce, which poses challenges for maintaining operational efficiency and knowledge transfer1.
- Recruitment Challenges: There are significant difficulties in recruiting new ATSEPs due to the specialized skills required and the competitive job market1.

3. Working Conditions

- Variability Across ANSPs: Working conditions for ATSEPs vary significantly across different ANSPs. Some have implemented measures such as flexible working hours and enhanced training programs to improve job satisfaction and reduce stress1.
- Health and Safety: The study highlights the importance of addressing health and safety concerns, including ergonomic work environments and mental health support1.

4. Social Dialogue

- Enhanced Communication: Improved social dialogue between management and ATSEPs is crucial for addressing social issues effectively. This includes involving ATSEPs in decision-making processes and ensuring transparent communication channels1.
- Stakeholder Engagement: Engaging various stakeholders, including unions and professional associations, is essential for developing and implementing effective strategies to address social issues1.

5. Future Scenarios and Recommendations

- Scenario Planning: The study outlines potential future scenarios to anticipate and mitigate social issues. These scenarios consider factors such as technological advancements, changes in air traffic volume, and regulatory developments1.
- Strategic Measures: Recommendations include enhancing training programs, improving recruitment strategies, and fostering a culture of continuous learning and adaptation1.

Conclusion

The study underscores the need for a comprehensive approach to address the social issues faced by ATSEPs. By implementing the recommended measures, ANSPs can ensure a sustainable and efficient workforce capable of meeting the evolving demands of the ATM industry1.

1: Study on Air Traffic Controller (ATCO) and Engineering Staff (ATSEP) social issues and working conditions

Considering the international nature of the ATSEP profession, it is becoming increasingly important to examine it from a sociological standpoint. However, it is worth questioning whether all ICAO member states recognize ATSEP as a an equally important profession at the national level. There are considerable differences between countries in this regard, influenced by factors such as the level of aviation development and other local considerations.

In many countries, there are professional associations specifically dedicated to ATSEP professionals[21]. These associations play a crucial role in representing and advocating for the interests of ATSEP personnel within their respective countries.

The establishment of ATSEP as a recognized and respected profession on a global scale requires a concerted effort and collaboration among ICAO member states. It involves acknowledging and addressing the discrepancies in recognition and status that currently exist among countries.

By recognizing ATSEP as a an equally important profession and implementing appropriate standards and regulations, countries can foster the professional growth and development of ATSEP personnel, ensuring a consistent and standardized approach to their roles and responsibilities in the aviation industry.

Professional associations for ATSEP are important for several reasons. One significant reason is that these associations enable the development of a code of professional ethics. A code of professional ethics is essential for a group of professionals to demonstrate their commitment to ethical conduct within a specific community or industry. In cases where there is no professional organization or if it functions poorly, it can be challenging to establish and uphold professional ethics, including a code of conduct.

The absence of a professional association or the limited development of such an organization within the ATSEP community would indicate a professional lag compared to other professions in the aviation industry. In contrast, the presence of a well-established professional association with a strong professional consciousness supports the achievement of professional ethics that are recognized and upheld within the community.

These professional associations can establish guidelines, standards, and principles that govern the behavior, responsibilities, and ethical conduct expected from ATSEP professionals. They play a crucial role in promoting professionalism, fostering trust within the industry, and ensuring the overall integrity of the ATSEP profession. Additionally, professional associations provide platforms for networking, knowledge sharing, and continuous professional development, further enhancing the competence and expertise of ATSEP professionals.

As previously mentioned, there are instances where the current status of ATSEP may be categorized as an occupation rather than a fully established profession. In such cases, the profession may have not yet achieved the level of autonomy and recognition necessary to hold a an equally important position within society, based on their expertise and exclusive knowledge in a specific field of activity. It is important for the development of ATSEP as a profession to occur at both national and international levels, considering the existing variations.

[21] For example, it has been achieved in Serbia a few years ago, see: http://tangosix.rs/2013/27/06/

osnovana-srbatsepa/

While professional associations play a significant role, their presence alone is not sufficient for the establishment of ATSEP as a full-fledged profession. Educational institutions also play a crucial role, particularly those specialized in providing training for ATSEP or organizations where ATSEP carry out their duties. Ultimately, it is essential for ATSEP to attain autonomy in relation to other related professions. The implementation of licensing for ATSEP can help facilitate this distinction and elevate their professional status.

It is crucial for non-members of a profession to recognize the role of state authorities in creating a conducive environment for professions to achieve their objectives. These factors are instrumental in promoting the development of professional ethics and taking appropriate actions, such as imposing sanctions or excluding individuals who fail to meet the standards of the profession. This process ultimately leads to the professionalization of a field.

Furthermore, upholding professional standards and achieving professionalization are imperative for establishing a professional identity. In addition to adhering to certain traditions, professionals must garner acceptance from recognized institutions and individuals who vouch for their competence and expertise. These factors contribute to the overall professional demeanor and reputation.

Provided that these requirements are fulfilled, and if the civil aviation authorities of certain countries acknowledge them, it becomes feasible to attain professional integrity. This can be exemplified by the inclusion of these standards in Annex 1 Personnel Licensing, which would lead to global recognition of licenses, specifically addressing the needs of Air Traffic Safety Electronics Personnel (ATSEP).

6. Commercial and Economic aspect

We acknowledge that the world we live in today has undergone significant changes compared to three decades ago. Several factors have contributed to this transformation, including globalization, economic liberalization, and advancements in information technology, particularly the internet. As a result, barriers to the movement of people, the provision of services, and the flow of goods between countries have been progressively eliminated over the past few decades. This ongoing process has directly influenced Civil Aviation, leading to its commercialization.

In this highly competitive environment, every economic actor, including Civil Aviation, is engaged in fierce competition to maximize their earnings and attract passengers or transport goods. The intensity of this competition has significantly heightened, with each player striving to secure even the smallest unit of profit or successfully transport a single passenger or kilogram of goods[22].

However, we must question whether competition and the pursuit of profit, as well as the commercialization of services, can be used as a justification for compromising security and professional standards within civil aviation. This is especially relevant when considering specific segments such as CNS/ATM, including the role of ATSEP. From a safety and professional standpoint, such compromises should never be acceptable.

Nevertheless, it is crucial to assess whether any given profession possesses the strength and influence required to resist these pressures. If the profession's goals are solely limited to the exchange of expertise and knowledge, it may lack the necessary power to combat external forces. However, if the profession is granted societal recognition and entrusted with the authority to utilize and apply its expertise, there is a greater potential for positive outcomes. In such cases, professions and their respective professional associations can play an active role in the development of their field and contribute to areas of societal interest.

These are the essential qualities and requirements for an ATSEP (Air Traffic Safety Electronics Personnel). Therefore, any aspects related to ATSEP and their professional responsibilities must be accompanied by appropriate public ATSEP associations. Despite the potential influence of commercialization, such as in CNS/ATM services, it should never serve as an excuse for compromising the standing of the profession, although regrettably, this can sometimes occur.

The pursuit of profit or the desire for the lowest cost of services in civil aviation should never take precedence over safety and professional standards. In fact, a crucial step in enhancing the ATSEP profession is the implementation of a unified training that includes licensing and thorough profiling of prospective members.

Striking a balance is crucial for ATSEP to effectively navigate the impact of commercialization. This recognition is reflected in the provision of services related to CNS/ATM, which should be built upon a unified training and licensing approach, fostering greater collaboration among

[22] Over a 40 year period, airlines have generated the lowest returns on invested capital out of a worldwide sample of almost 30 industries, THE CYCLICAL CRISIS IN COMMERCIAL AVIATION, Prof.Paul S Dempsey, McGill University

States/ANSPs. In the aviation industry, certain countries with advanced expertise have developed their own institutes or centers dedicated to CNS/ATM development. These services become accessible to a range of stakeholders and beneficiaries.

To better illustrate this approach within the realm of aviation technical personnel in air traffic control, one can examine the experiences of other countries that offer consulting[23] services and operate development centers. Additionally, professional services can be extended to the broader field of air traffic control or focused on specific segments like CNS. This may involve providing training for air traffic controllers from other nations or offering service of flight calibration for radio navigation aids.

The cost for ATSEP Basic Training may vary depending on the provider, the country, and the currency. According to the web search results that I found, the ATSEP Basic Course costs around € 9,900 - € 10,500 per participant in Europe. However, this price may not include other services such as selection, assessment, or continuation training. For more information, you can contact the training providers or the aviation authorities in your country.

6.1 Cost items and Process for ATSEP Training including Licensing

The stages for ATSEP training, comptetency and Licensing can be organized into the following phases according to the International Civil Aviation Organization (ICAO) and European Union Aviation Safety Agency (EASA)1:

1.Phase 0 - ATSEP Selection Process: This is where the air navigation service provider (ANSP) selects candidates according to its ATSEP profiles and activities1.

2.Phase 1 - Initial Training Phase: This phase includes basic training and qualification training1. The basic training is shared among all ATSEP, while the qualification training is specific to each ATSEP's role2.

3.Phase 2 - Unit/System/Equipment Rating Training: This phase involves specific training for the systems and equipment that the ATSEP will be working with3.

4.Phase 3 - On-the-Job Training (OJT): The applicant demonstrates satisfactory performance of maintenance, calibration, installation, management, monitoring, control, and modification (if applicable) for a period of not less than three (3) months at the unit and/or on the systems/equipment for which the License and rating is sought3.

5. Phase 4: Licensing together with Medical assesment . This process is implemented also in the form of Certification of ATSEP. In FAA , there is system of Credentials , in Europe by the Authorization of ATSEP and other countries in a Certification process tailored the state laws and implemented by the ANSP in most cases.

.Phase 4 - Continuation Training: This phase involves ongoing training to ensure that ATSEP maintain their skills and knowledge up-to-date2.

Please note that the exact process may vary depending on the country and the specific regulations of the aviation authority4.

6.2 Determination of Cost elements (based on websearch)

The cost for ATSEP Basic Training may vary depending on the provider, the country, and the currency. According to the web search results that I found, the ATSEP Basic Course costs around € 9,900 - € 10,500 per participant in Europe. However, this price may not include other services such as selection, assessment, or continuation training.

According to the DFS Training Catalogue, the ATSEP Basic Course costs € 9,900 per participant and lasts for 6 weeks. The ATSEP Qualification Courses vary in price and duration depending on the system or equipment. For example, the ATSEP Qualification - Communication Course costs € 9,900 per participant and lasts for 4 weeks.

According to Entry Point North, a global academy that provides ATSEP training, the ATSEP Basic Course costs € 10,500 per participant and lasts for 6 weeks2.

The ATSEP Qualification Courses also vary in price and duration depending on the system or equipment. For example, the ATSEP Qualification - Surveillance Course costs € 8,500 per participant and lasts for 3 weeks.

Entry Point North also offers other courses such as ATSEP Shared Course, ATSEP Development and Continuation Training Courses, and ATSEP On-the-Job Training Instructor Qualification and Refresher

Moreover, ANSP internal training can possibly be provided at a lower cost.

The ATSEP training cost is already addressed by all ANSPs either internally or through external Training providers , who are not needed to be Certified according to a standard. IFATSEA has cooperated with ICAO in assessing training institution but this is as far as it goes. Due to the lack of Training organization Certification, it is expected that the training depth and quality may differ between training entities. IFATSEA is aware of cases that minimal training was provide to ATSEP in order to minimize cost. This can be availed by the mandating of Doc 10057 for all ANSPs , as IFATSEA has requested.

Given the fact that the proliferation of ATSEP training according to ICAO Doc 10057 and the alignment of ANSPs with it , although it is mandatory, there is no significant direct extra cost as the issuance of Licenses will replace existing national Licenses or Certification procedures.

An extra cost could be the indroduction of Medical tests, however that may not be oblligatory as according to ICAO Annex 1 for aircraft engineers does not require a medical test.

There may be a small extra cost as anticipated by the ECORYS study that will be compensated by the increase in Safety and Performance.

In conclusion, **the financial burden of having a harmonized ATSEP Licensing program under ICAO Annex 1 , will be minimal** , but the recognition of ATSEP at ICAO level by this ANNEX 1 inclusion will make the ATSEP job more attractive and enable young engineers , to join the proffession which is currently facing a rising lack of ATSEP.

6.3 Safety Management for ATSEP Competency - The European Approach

These European safety requirements therefore introduce a safety management regime in respect of ATSEP which is similar in many respects to that of air traffic controllers. The service-provider has a legal responsibility to monitor and maintain the competence of all ATSEP staff involved in the service-provision, including training and in-service experience (to maintain recency of knowledge). In the cases of certain safety-related or safety-critical systems, such training and experience is a legal requirement before the ATSEP can carry out maintenance or other work on those equipments.

Furthermore, detailed records of the ATSEP work and training experience must be kept to provide evidence that the service-provider's safety management system is functioning satisfactorily in this respect. It also provides a basis for oversight by the appropriate safety regulatory body.

Achieving Competence

ATSEP are required to have a basic level of initial training in the electronics and engineering domains. There is a broad level of agreement in principle on the level of this basic training requirement, even though there are many hundreds of different routes to the acquisition of basic-level training. The system for achieving adequate levels of competence of ATSEP relies entirely upon the recording of qualifications and system/equipment ratings granted. In this context, the word qualification indicates the discipline in which ATSEP have been trained to provide the service. Four disciplines have been identified through the four corresponding qualifications - Communication, Navigation, Surveillance and Data Processing. A system of system/equipment rating is then added to provide for appropriate levels of knowledge and skills for recognised competency. Equipment/system-related training includes mentored training and on-site training and is the final stage for the acquisition of competence following basic and qualification training.

Recording of Competence

The recognition and proof of individual competence for ATSEP is usually achieved through the records of training and experience within the safety management systems of service-provider organisations. However, some countries have nevertheless decided that their ATSEP should hold individual documents - in some cases licences - to serve as individual records of competence and /or as evidence of appropriate professional qualification.

(USA) Airway Transportation Systems Specialists

In the U.S., the personnel responsible for installing, testing, troubleshooting, repairing and certifying radar, communications equipment, navigational aids, airport lighting, backup power, and other equipment are referred to as airway transportation systems specialists (electronic systems technicians) or ATSS.

According to the Federal Aviation Administration (FAA), these personnel work on environmental systems, radar, navigational aids, communications equipment, and automation-related systems.

"Everything air traffic controllers and pilots use for safe flight," according to FAA material. ATSS fall under FAA Technical Operations.

7.Health aspect (Medical checks)

Last but not least, the health aspect should be taken into account when considering the licensing of ATSEP. Certain factors directly result from the demanding nature of their job and the associated stress. Given the stress and challenges faced, it is essential to conduct specialized studies that dedicate adequate time to understanding the unique pressures experienced by various professions.

In the case of ATSEP, it is evident that throughout their career, which typically spans the entire duration, they work in shifts round the clock, resulting in significant levels of stress. The detrimental effects of shift work are widely recognized and well-documented, impacting various biological and physiological processes. These effects can include disruptions to the sleep-wake cycle, compromised physical health, psychological well-being, as well as issues with attention and performance.

The participation in social and family life is of utmost importance, often overlooked, particularly in the context of ATSEP. Working in shifts inherently disrupts sleep patterns, leading to sleep disturbances, insomnia, or daytime drowsiness, which can negatively impact both productivity and overall quality of life. It is worth questioning whether the work schedule of ATSEP aligns with their social life since significant discrepancies between the two can arise. As a consequence, individuals may experience lower productivity and a diminished quality of life, resulting in stress both at work and at home.

Moreover, stressful situations may arise within the functioning of the CNS system, where ATSEP members may encounter equipment failures or unexpected contingencies (e.g., the airspace closure of FIR Zagreb on 30.07.2014, or the London 2013 TMCS VCS incident), which require specific and careful consideration.

The division of ATSEP into different specialties is primarily based on the systems and devices they serve. These divisions entail distinct requirements for maintenance, installation, and utilization of such equipment or systems. Geographically, radio-navigation objectives can vary significantly in terms of distance and accessibility. Additionally, the climatic conditions prevailing at their specific locations, as well as the elevation and radiation emitted, can greatly differ.

These challenging working conditions pose additional difficulties for ATSEP and necessitate extra efforts to perform their required tasks. Addressing the harsh working conditions is crucial for improving the psycho-physical well-being of ATSEP. Specifically, fulfilling specialized medical criteria is essential to carry out these assignments successfully. The confirmation of meeting these medical criteria should be obtained from certified aviation medical centers. Hence, making the fulfillment of medical criteria essential requirement, closely tied to the future ATSEP license is imperative.

However, the indroduction of Medical tests, may not be oblligatory as according to ICAO Annex 1 for aircraft engineers does not require a medical test. This will have to be decided during the almost 8 year process for the indroduction of the Licensing formalities within ICAO.

8. Conclusion

The rapid development of international civil aviation can be attributed to various factors, including the establishment of regulations that have advanced alongside this growth. The dynamic nature of civil aviation, which surpasses international barriers, has necessitated the harmonization of crucial aspects in the international aviation domain. Notably, organizations like ICAO and its member states are better equipped to address these issues compared to other modes of transportation.

In terms of aviation personnel, licenses hold significant regulatory importance. Over the years, we have witnessed certain segments of the aviation community attaining globally recognized licenses, which play a pivotal role in performing their responsible duties. The focus has traditionally been directed towards pilots, flight crew members, mechanics, and air traffic controllers, which is understandable. However, it is important to note that the aviation community is not complete without acknowledgment of another crucial link - ATSEP. Some may argue that their exclusion is justified, but it can also be seen as unjustifiable.

As previously stated, technology and its development hold immense significance in the realm of modern civil aviation. Within this technological landscape, there exists a specific profession responsible for managing and working with the systems and technology associated with Air Traffic Management (ATM). This profession is known as ATSEP (Air Traffic Safety Electronics Personnel).

The association between the critical safety chain and ATSEP is no longer questionable nowadays. Previously considered accidents in civil aviation clearly indicate that safety standards must be met. Developing appropriate regulations in terms of uniqueness / distinctiveness training for ATM Personnel is something that was jointly launched by ICAO and IFATSEA and what is working on continuously. Removal of non-uniformity of standards of training ATSEP disappear and also the last reason for the absence of ATSEP being integrated in Annex 1 Personnel Licensing.

Moreover, it also **analyzed the various aspects of the ATSEP the same in favor of the needed integration in Annex 1 Personnel Licensing**.

The aspects considered in this study, spanning from a legal standpoint to health considerations, unequivocally indicate the need for certain actions.

One such action is the implementation of new standardized and unified requirements in ATSEP training, which would bring significant advantages in terms of dynamism, higher proficiency, and professional mobility. The importance of commercial considerations cannot be overlooked either.

From an educational perspective, the dissemination of ATSEP through specialized studies would present an opportunity for further growth and development in the field.

The benefits of making these changes are evident and the timing is opportune. ATSEP professionals are undoubtedly qualified to be included in Annex 1 of ICAO's Personnel Licensing regulations.

The described cases clearly indicate the potential hazards and actual damage that can occur due to the irregular work of ATSEPs, who are an integral part of the safety critical chain.

Therefore, it is essential to consider integrating ATSEPs into Annex 1 Personnel Licensing, as these examples unequivocally demonstrate the necessity from a safety standpoint.

Additionally, it is crucial to mention the growing importance and role of Cyber Security in the context of increasing integration and networking in ATM, such as in the case of the Single European Sky project (SES) and centralized services in Europe. The progress in Information and Communication Technology (ICT) inevitably impacts the field of aviation, with the use of wireless technologies and the implementation of remote tower systems.

However, it is important to acknowledge that these advancements also bring vulnerabilities to the system. While safety has traditionally received more attention in the aviation community, the significance of security, particularly in relation to cyber threats, cannot be ignored. With the availability of powerful software tools, it is possible to compromise communications in air traffic.

Considering these factors, the role of ATSEPs in ensuring both the safety and security of air traffic becomes increasingly important in the future. Their expertise and focus on maintaining the integrity of communication channels and safeguarding against cyber threats will be indispensable in the future.

Including ATSEP in ICAO Annex 1 for Personnel Licensing is a necessary step that the aviation community should undertake.

ICAO Annex I changes are performed by ICAO regularly. The most recent took place in 2022 (Amendment 178) in order to introduces new provisions for the use of electronic pilot licenses, which are increasingly being used by ICAO Member States.

The cycle for any change may also take as many as 8 years long.

This means that even if the decision to proceed with ATSEP licensing is taken this year it may be up to 2033 onwards that the whole process will be completed.

The question is, can the aviation domain cope with the increasing complexity of Air Navigation systems, the hybrid environment of terrestrial and satellite based Air navigation CNS and ATM

Concluding summary and recommendations:

The *ATSEP Safety Study* document, delivered by the International Federation of Air Traffic Safety Electronics Associations (IFATSEA), advocates for the inclusion of Air Traffic Safety Electronics Personnel (ATSEP) in ICAO Annex 1, which governs the licensing of aviation personnel.

This document presents comprehensive arguments emphasizing the safety-critical nature of ATSEP roles and the benefits of formalized licensing for these professionals. Here's an extended summary of the key points:

1. ATSEP's Role and Safety Impact**

- ATSEP professionals are responsible for installing, operating, and maintaining crucial air traffic management (ATM) systems, including Communication, Navigation, and Surveillance (CNS) infrastructure, which underpins safe and efficient air traffic operations.

- Their roles directly impact various safety scenarios, with potential effects on mid-air collision risk, runway incursions, and ground proximity incidents.

- The document references studies (such as those by EUROCONTROL and EASA) that highlight the significant safety risks associated with ATSEP errors. For instance, ATSEP failures have been linked to increased risks of CFIT (Controlled Flight Into Terrain), runway incursions, and mid-air collisions, underscoring the necessity of regulating their competencies.

2. ****Need for Regulatory Framework and Licensing**

- ICAO Annex 1, which traditionally licenses personnel like pilots and air traffic controllers, currently does not include ATSEP, despite the critical safety implications of their work.

- IFATSEA argues that including ATSEP in Annex 1 will ensure consistent standards for training and competence, harmonizing global practices. This is increasingly necessary given the interconnected nature of ATM systems across borders.

- ATSEP licensing would standardize qualification requirements globally, allowing personnel to operate seamlessly in various jurisdictions, similar to how pilots and controllers operate under internationally recognized licenses.

3. **Professional and Economic Advantages**

- Licensing would bring professional recognition to ATSEP roles, enhancing career mobility and development opportunities within the aviation industry.

- The document also suggests economic benefits: having licensed, highly skilled ATSEP personnel could reduce accidents, minimize service disruptions, and improve overall system efficiency, outweighing the costs associated with implementing a licensing program.

- ATSEP licensing could contribute to a more robust and reliable air navigation system, increasing the resilience of ATM infrastructure and ultimately benefiting airlines and airports financially through fewer disruptions and enhanced operational efficiency.

4. **Challenges of Technological Evolution and Cybersecurity**

- With advancements in ATM systems (e.g., increased automation, digitalization, and hybrid terrestrial-satellite navigation systems), ATSEP are now facing new challenges, including cybersecurity threats.

- The document points out that, as first responders to system issues, ATSEP must be able to address both traditional ATM responsibilities and emerging cybersecurity vulnerabilities.

- IFATSEA advocates for licensing that encompasses a broader range of technical skills to prepare ATSEP for the challenges of future aviation environments, including cybersecurity, remote operations, and data-sharing responsibilities.

5. **Historical Context and Advocacy Efforts**

- IFATSEA has been actively working to include ATSEP in ICAO Annex 1 since the early 2000s, submitting working papers to ICAO Assemblies and collaborating with other aviation bodies.

- Previous assembly discussions have acknowledged ATSEP's role but have raised concerns over the financial implications and whether licensing would meaningfully enhance safety. This study aims to address these concerns by presenting evidence of ATSEP’s safety-critical functions and the potential benefits of licensing.

- Despite some resistance, there is continued advocacy for regulatory changes to reflect the evolving responsibilities of ATSEP within the aviation industry.

6. **Case Studies and Evidence of ATSEP Safety Contributions**

- The document provides specific examples of incidents where ATSEP failures have had significant impacts, including the mid-air collision in Überlingen, Germany (2002) and the Linate Airport disaster in Milan, Italy (2001). These cases underscore how errors in ATSEP functions can contribute to catastrophic outcomes.

- It further references studies by EASA and ECORYS, which highlight ATSEP as a safety-critical profession, showing that licensing could provide safety benefits, regulatory harmonization, and social impact through improved qualifications.

7. **Conclusion and Recommendations**

- IFATSEA concludes that licensing ATSEP under ICAO Annex 1 is essential for maintaining high safety standards in modern aviation. Licensing would align with ICAO's vision for global aviation safety and standardization and offer benefits like improved job security, mobility, and recognition for ATSEP professionals.

- The report calls on ICAO and other stakeholders to support the licensing initiative, recognizing ATSEP's vital role and ensuring that they meet consistent global standards.

- The document also emphasizes that, as air navigation systems continue to grow in complexity, the role of ATSEP will only become more integral, making the need for standardized training and licensing more urgent.

In summary, the *ATSEP Safety Study* provides a thorough analysis of the safety, professional, and economic rationale for licensing ATSEP personnel. By standardizing qualifications globally, the study argues, ATSEP can continue to fulfill their essential roles more effectively, contributing to a safer and more resilient aviation system.

Appendix 1

IFATSEA Incident Reporting Sheet

International
Federation of
Air Traffic Safety
Electronics Associations

President:
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Germany

Executive Secretary:
Frank Kofi Apeagyei
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IFATSEA Incident Reporting Sheet

When? Date: Time: Duration:

Where? Country: City/Facility: Company:

Effected? System: Component:

ATSEP: yes/no ATCO: yes/no Aircraft: yes/no Other: yes/no

Effect/What happened?

Solution?

Conclusion/Lessons learned?

Attachment? (Documents, press release, presentation, internet address, etc.)

This sheet will be handled strictly confidential. No names or sources will be mentioned in reports or documents distributed by IFATSEA Safety Sub-Committee.

IFATSEA Safety Sub-Committee is allowed to contact me for further information: YES/NO

Send reporting sheet to postal address above or via e-mail to thomas.schuster@gdf.de

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