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REPORT ON CURRENT SECURITY CERTIFICATION PROCESSES WITH DIRECT AND INDIRECT IMPACT ON SAFETY

D-3.3.1

Impact of Security Measures on Safety

Research conducted by:

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Apave's core business is to help companies and government services managing their technical, environmental and human risks in the areas of Oil & Gas / Nuclear / Industry / Transportation. In aviation, Apave is committed to offering a range of civil and military aviation safety services, covering oversight authority tasks, audits, technical control, training and consulting services, through specialised and dedicated entities. Apave's staff in aviation enjoy extensive knowledge of the International and European regulatory framework, with a focus on Airworthiness, Flight Operations and Safety Management Systems In 2022 Apave has strengthened its portfolio through the acquisition of Oppida a cyber-security specialist in many highly regulated domains and safety and security exposed businesses. Apave has organised its civil and military aviation risk management consulting services around a unique value proposition with a dedicated entity: Apave Aeroservices (hereafter referred to as ''Apave") has been designated in 2009 as the Group centre of excellence to provide risk management solutions to the Aviation community, including aviation authorities, Air Operators, Industry, Maintenance Organisations (MROs - Maintenance, Repair & Overhaul) and Training Organisations.

APSS Software & Services Ltd is part of the Centre for Adaptive Security Research and Applications (CASRA), which was founded in 2008. CASRA emerged from the Visual Cognition Research Group of the University of Zurich, which was founded by Adrian Schwaninger in 1999. Today, CASRA APSS has a workforce of around 35 people, comprising of psychologists, economists, computer scientists, imaging specialists, software developers, aviation security experts, and more, most of which have an academic degree. The main objective of CASRA is to increase security and facilitation at airports and other environments involving people and technology. Through their studies and research on human – machine interaction, it was identified that visual abilities and training determine largely screeners' performance. As such CASRA has been working with a number of aviation security authorities and airports on selection, training and competency assessment processes providing advisory and research as well as their solutions globally.

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ABBREVIATIONS

ACRONYM	DESCRIPTION
AA	Appropriate Authority
ANS	Air Navigation Services
APIDS	Automated Prohibited Items Detections Software
ATM	Air Traffic Management
CA	Competent Authority
CAA	Civil Aviation Authority
CASRA	Centre for Adaptive Security Research and Applications
DG	Dangerous Goods
EASA	European Union Aviation Safety Agency
EC	European Commission
EDD	Explosive Detection Dogs
EDS	Explosive Detection Systems
EEA	European Economic Area
EPAS	European Plan for Aviation Safety
ETD	Explosive Trace Detection
EU	European Union
EVD	Explosive Vapour Detector
HRCM	High Risk Cargo and Mail
ICAO	International Civil Aviation Organisation
LAGs	Liquids, Aerosol and Gels
LEDS	Liquid Explosive Detection Systems
MD	Metal Detector
NCASP	National Civil Aviation Security Program
SDT	Self Determination Theory
SIA	Safety Impact Assessment
STAC	Service Technique de l'Aviation Civile
STEB	Security Tamper-Evident Bag
WTMD	Walk Through Metal Detector

1. Executive summary

Problem area

The general objective of the project *Impact of security measures on safety* is to understand the nature and extent of interdependencies between safety and security. Through the research within this project, an attempt is made to produce the comprehensive knowledge base describing these interdependencies.

Task 3 focuses on the analysis of certification standards with subtask 3.3 assessing security certification processes and their impact on safety.

Executive Summary

The present report is the deliverable D-3.3.1 of task 3: "*Report on current security certification processes with direct and indirect impact on safety*". During previous phases of the project, multiple interdependencies between security and safety were identified, shaping the directions for further developments. In this report, the research team investigated which processes are subject to security certification under the EU Regulations and Member States' national frameworks. The report specifically provides insight into the practices of individual Appropriate Authorities appointed in accordance with ICAO Annex 17 provisions, which lead on aviation security matters.

The findings highlight the existence of a general baseline for security certification, primarily related to specific groups of personnel tasked with aviation security responsibilities. However, an analysis of individual EU Member States revealed that security certification practices often extend beyond this baseline, with considerable variation in scope and application. These practices range from specific security certification for airport operators and air carriers to entities within the cargo security supply chain and suppliers of goods.

The input from stakeholders helped identify the main drivers for implementing aviation security certification beyond the EU aviation security framework. These include the following:

- Risk management
- Standardisation
- Compliance
- Quality assurance
- Competency development
- Business continuity

Security certification mandated by the Appropriate Authority typically reflects the following circumstances:

- Specific objectives – Security certification is implemented to address specific and priority threats and vulnerabilities related to aviation security
- Competency and jurisdiction of authorities – Security certification is typically conducted by the dedicated entity[1]
- Separate regulatory frameworks – The regulatory structures governing security and safety are distinct, although previous analysis showed areas of overlap or touchpoints

[1] Organisational unit assigned with security certification within the Competent Authority structure or a separate government entity appointed as Appropriate Authority responsible for aviation security (separate from the Competent Authority)

- Single-purpose focus to maintain clarity - The single-purpose orientation of security certification ensures clarity and precision in its implementation

The interdependence between safety and security identified is more pronounced for entities which are subject to both, safety and security certification. The research identified a limited but notable impact of security certification on safety, particularly in relation to the following areas:

- Reinforcement of safety compliance
- Support of safety processes
- Helping in preventing safety hazard
- Increase of overall compliance awareness

Moreover, stakeholders' feedback indicated some positive impact of security certification on safety. The research considered this input valuable even if the feedback lacked sufficient quantifiable evidences. To supplement stakeholders' expert opinion the research independently identified several examples of such an impact.

Finally, the research investigated and summarised existing literature. Analysis revealed several theories supporting the thesis that cross-domain expertise expansion is a well-documented phenomenon in literature. Various psychological, educational, and interdisciplinary theories support a thesis that the regulated process of security certification, which build corporate and individual expertise, can indirectly foster greater interest and engagement with the safety regulatory framework. Consequently, this could drive a positive impact on safety by increasing safety awareness, improving safety performance and encouraging a more consistent and coordinated management of safety and security which in turn balances priorities of either domain.

The content of this report could be helpful in building the overall understanding of safety and security correlations in relation to certification. As well as potentially foster a holistic and comprehensive analysis of positive or detrimental impacts that security measures could have on the overall safety. It may also encourage further investigations in specific technical domains and thereby enable identification of opportunities for improvement.

2. Introduction

This chapter first provides the context and background of the project (Section 2.1) and then objectives of the document are presented (Section 2.2).

2.1. Context and background

The European Union Aviation Safety Agency (hereinafter "EASA") is an agency of the European Union, which has been given specific regulatory and executive tasks in the field of aviation safety. The Agency constitutes a key part of the European Union's strategy to establish and maintain a high uniform standard of safety and environmental protection in civil aviation at European level.

As part of the Horizon Europe Work Programme 2021-2022 on Cluster 5 Climate, Energy and Mobility, the European Commission has entrusted EASA with the management of one specific research action entitled "Impact of security measures on safety".

As a result, EASA has awarded a public contract to a consortium of three companies:

- CAA International
- Apave Aeroservices
- CASRA

The contract details the four main tasks which are specified in order to achieve the expected outcome which is to understand the nature and extent of the interdependencies between safety and security in order to assess the impact of security measures on safety. In doing so, the research project should identify which processes and job roles are affected by safety–security interdependencies and which certification requirements and licensing activities are affected. In the medium term, safety risk management techniques that can be applied to security will produce harmonised risk assessment methods and support integrated policy and decision-making processes at national and EU level.

The project aims at developing a comprehensive knowledge base for the evaluation of the potential impact of security measures on the safety performances of aviation systems, personnel and operations, including the leading indicators for measuring such an impact (positive or negative) as well as the main factors playing a role in such safety–security dependencies.

The four main tasks are:

- Task 1: Identify the interdependencies between security and safety
- Task 2: Assessment of the impact of security measures on safety
- Task 3: Analysis of certification standards
- Task 4: Integrated risk management

The intention of this activity is to provide a basis for better understanding of where security threats have safety consequences in a more granular way than is currently understood.

2.2. Objectives of the document

The present report is an output of task 3. Task 3 covers the analysis of certification standards in the context of safety-security interdependencies and the assessment of the impact security arrangements have on safety in this context. Subtask 3.3 focuses on the assessment of security certification processes and their impact on safety.

The present report is the deliverable D-3.3.1 of task 3: "*Report on current security certification processes with direct and indirect impact on safety*". The objective of this document is to examine and describe existing security certification regulatory frameworks and assess whether these processes have any bearing on aviation safety (equally called further safety).

During previous phases of the project several interdependencies between security and safety were identified, shaping the directions of further developments. For this report, the research team identified which processes are subject to security certification in accordance with the EU Member States national framework to investigate if and to what extend they may have a direct or indirect impact on safety. This part of the research focused on comprehension of the EU and national framework of security certification. In this context researchers attempted to gain a thorough understanding of how various implementation models and approaches to security certification could support addressing safety issues.

The research allowed an opportunity to identify and discuss technical specifications governing the certification processes, focusing specifically on the methodologies and standards used, including any potential intersections between safety and security.

Analysis conducted within this part of the research aimed at providing a clearer delineation between the security and safety domains, ensuring that future policies, procedures, and certification practices avoid confusion or ambiguity between these two critical areas.

Overall, this part of the research had the objective of fostering enhanced coordination between security and safety domains in the aviation sector. By investigating prerogatives and priorities of national authorities, we seek to uncover opportunities for synergy, where security and safety complement each other's goals, and support the development of a more interconnected approach.

Ultimately, this collaborative effort would help create a more robust and resilient aviation sector where both security and safety objectives are mutually reinforcing, contributing to a safer and more secure operating environment for all.

3. Methodology

This chapter outlines the process of work conducted for the creation of this report.

Figure 1 shows the working process in order to achieve this task.

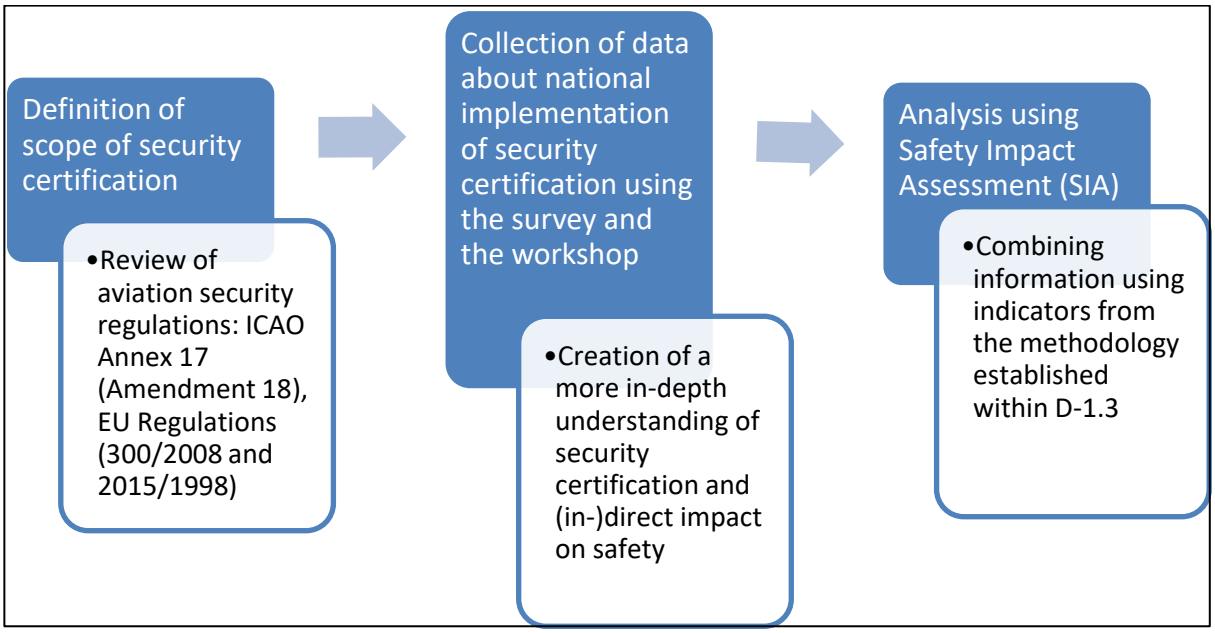

Figure 1 – Process of work

To capture the potential impact of security measures in a systematic manner, the analysis was based on elements of D-1.3 ("*Methodology to assess the impact of security measures on safety*") where a framework was established to evaluate the impact of security measures on safety and where indicators have been identified to determine their scope and significance (see Appendix Figure 4). For this particular research, indicators from the methodology (Figure 4, step four) were used to evaluate the impact of security certification (understood in this specific case as a type of *security measure*).

As an initial step, a review of aviation security regulations: ICAO Annex 17 (Amendment 18) and EU Regulations (300/2008 and 2015/1998) was conducted in order to define the scope of security certification. As a second step, the survey with different stakeholders (appropriate authorities, airport operators) was conducted in order to develop a basic understanding of their comprehension and implementation of security certification (see Section 3.1 for more details). Participants were able to leave their contact details at the end of the survey, if they decided they would be available to share more insight on the topic. Based on this feedback, a workshop was scheduled and conducted. The workshop was tailored to a more detailed discussion and to follow-up on the survey for those who agreed to it (see Section 3.2 for more details). This allowed researchers to gather additional information on how the security certification is conducted in different EU countries. The results are listed in Chapter 4.

The combined results of the regulation review, survey and workshop allowed researchers to identify if and how security certification processes intersect with the safety domain. These relationships are discussed in Chapter 5.

Chapter 6 concludes the report.

3.1. Stakeholder survey

The analysis conducted within the previous report D-3.2.1 ("*Assessment report on the existing safety and security certification requirements"*) together with the analysis of the aviation security regulatory framework were used as a baseline to draw up an online survey to assess the actual current practices of states.

The report D.3.2.1 identified that while the actual scope of security certification is very limited, the aviation security EU regulatory framework has a very broad and detailed regulatory scope. The survey was aimed to validate these findings, and at the same time attempted to investigate if there are any additional practices of stakeholders in the scope of security certification.

The survey was shared with stakeholders in November 2024. Table 1 shows the main survey question which was multiple choice. Results of the survey are presented in Chapter 4.2.

Table 1: Survey structure

	Which of below are subject to the process defined specifically as security certification according to your National Civil Aviation Security Program? Select all applicable:
1	Air operators
2	Airports
3	Regulated agents
4	Known consignors
5	Hauliers
6	Suppliers of in-flight supplies
7	Suppliers of airport supplies
8	Organizations authorized to conduct trainings in aviation security
9	Aviation security instructors
10	National auditors / inspectors (from or on behalf of the appropriate authority)
11	Internal auditors / inspectors (internal compliance of entities)
12	Heads of security
13	Security managers
14	Screeners
15	Security personnel performing vehicle examination
16	Security personnel performing access control
17	Other

3.2. Stakeholder workshop

In the next step, after receiving answers to the survey, interested participants were invited to the workshop. The goal of the workshop was to collaboratively examine further the existing regulatory national frameworks (National Civil Aviation Security Programmes) and assess whether security certification processes are related to safety, or whether they remain distinct and therefore with no, or only very limited impact on safety outcomes.

Key areas for exploration included:

- Elements assessed in certification: What is evaluated through national-level certification methods?
- Safety intersections: Do any of these certification methods or assessments have touchpoints with the safety domain requirements or objectives?
- Relevance to safety objectives: Are any of the elements assessed related to safety objectives?

The workshop aimed at obtaining input from Member States on the implementation of these processes and exploring how they could potentially contribute to overall operational safety. In connection with this, discussions during the workshop contributed to addressing underlying safety issues identified in the European Plan for Aviation Safety (EPAS 2023-2025) which the research intended to consult with security domain.

Nine stakeholders were present for the workshop that took place on the 10th of January 2025.

The stakeholders' input and discussion during the workshop enabled to identify:

- National-level security certification scope and methods
- Touchpoints with the safety domain requirements or objectives

During the workshop, participants were asked to complete the below Table 2 which stems directly from D-1.3 and includes a set of indicators (positive / negative / neutral) to identify relevant elements that suggest the impact on safety.

Table 2: Set of indicators to identify relevant elements that suggest the impact on safety.

Positive safety indicators for security certification		Negative safety indicators for security certification		Neutral safety indicators for security certification	
Facilitate compliance with safety rules	☐	Forces safety non-compliance, contradicting safety rules	☐	Does not affect compliance with safety procedures (implementation of safety rules)	☐
Increases implementation of safety rules	☐	Decreases implementation of safety rules by making compliance more difficult	☐		
Increases safety awareness	☐	Decreases safety awareness	☐	Does not affect safety awareness	☐
Offers opportunity for safety improvement or leads to actual safety improvement	☐	Develops latent conditions whereby safety can be compromised	☐	Does not contribute to tangible safety enhancements nor diminishes safety	☐
Increases efficiency of systems and equipment (aircraft, air traffic, aerodrome)	☐	Causes deterioration of system and/or equipment (aircraft, air traffic, aerodrome)	☐	Does not affect efficiency of systems and equipment (aircraft, air traffic, aerodrome)	☐
Reduces aircraft maintenance requirements	☐	Decreases efficiency of systems and equipment (aircraft, air traffic, aerodrome)	☐	Does not affect maintenance requirements (aircraft, air traffic, aerodrome)	☐
Improves staff performance in terms of human factors	☐	Negative impact on staff performance in terms of human factors causing decline in safety performance	☐	Does not affect staff performance in terms of human factors	☐
Increases operational efficiency	☐	Decreases operational efficiency	☐	Does not affect operational efficiency	☐
Reduces maintenance requirements (aircraft, air traffic, aerodrome)	☐	Increases maintenance requirements (aircraft, air traffic, aerodrome)	☐		☐
Reduces operational complexity	☐	Increases operational complexity	☐	Does not affect operational complexity	☐
Reduces complexity of required safety training	☐	Increases complexity of required training (safety or security)	☐	Does not affect complexity of required training (safety, security)	☐
Increases efficiency of emergency operations/ procedures (aircraft, air traffic, aerodrome)	☐	Decreases efficiency of emergency operations/ procedures	☐	Does not affect efficiency of emergency operations/ procedures (aircraft, air traffic, aerodrome)	☐
Increases efficiency of standard operating procedures (aircraft, air traffic, aerodrome)	☐	Decreases efficiency of standard operating procedures	☐	Does not affect efficiency of standard operating procedures (aircraft, air traffic, aerodrome)	☐
Provides additional safety benefits	☐			Does not offer additional safety benefits	☐
Improves safety management	☐	Introduces additional challenges in safety management	☐	Has no impact on safety management	☐
Allow for reduction of safety hazard	☐	Introduces safety hazard	☐	Does not reduce or increase safety hazard	☐
Enables increased data collection	☐	Reduces or impacts on safety data collection	☐	Has no impact on data collection	☐
Improves emergency management	☐	Introduces additional challenges in management of emergency situations	☐	Does not affect emergency management	☐
Decreases the possibility of conflicting safety – security priorities	☐	Creates actual decrease of safety standards	☐	Does not introduce conflicting safety – security priorities	☐

Additional comments:

4. Results

This chapter shows the results for the:
- Review of aviation security regulations (Section 4.1)
- Assessment of stakeholder feedback (Section 4.2)

4.1. Review of aviation security regulations

This section provides a synthetic overview of the **definition of certification** as described in the ICAO Annex 17 and the EU aviation security framework.[2]

4.1.1. ICAO Annex 17

ICAO Annex 17 (Amendment 18) defines certification as a "*formal evaluation and confirmation by or on behalf of the appropriate authority for aviation security that **a person** possesses the necessary competencies to perform assigned functions to an acceptable level as defined by the appropriate authority*." Based on further review of Annex 17 (Amendment 18) it has been confirmed that that individuals involved in aviation security who undertake two roles require certification: **instructors** (Standard 3.4.3) and **screeners** (Standard 3.4.4).

4.1.2. EU Regulation 300/2008

The Regulation 300/2008 defines certification as "*a formal evaluation and confirmation by or on behalf of the appropriate authority that **a person** possesses the necessary competencies to perform **the functions of an auditor** to an acceptable level as defined by the appropriate authority*[3]". Analysis of the Regulation also revealed the following:

- Uses term **certification or equivalent approval for auditors** performing functions on behalf of the Appropriate Authority (Point 15.1 of the Annex II)
- Requires specific types of persons to be **certified, where appropriate**, depending on their duties (Point 11.1 of the Annex I)
- Requires the equipment used for screening, access control and other security controls **to comply with the defined specifications** (Point 12 of the Annex I) **and refers to implementing legislation** for technical specifications and **procedures for approval and use of security equipment** (Article 4.3 (l)) however it does not specifically mention *certification*

4.1.3. EU Regulation 1998/2015

The Regulation 1998/2015 defines certification as "*a formal evaluation and confirmation by or on behalf of the appropriate authority indicating that **the person** has successfully completed the relevant training and that the person possesses the necessary competencies to perform assigned functions to an acceptable level (limited to Chapter 11 – Staff recruitment and Training only)*". Analysis of this Regulation also revealed the following:

[2] See also D-3.2.1, Assessment Report on existing safety and security certification requirements, Section 7

[3] Annex II of the Regulation 300/2008 – Common specifications for the National Quality Control Programme

- Uses the term **certified or approved** for "an entity" in the cargo domain **(e.g. third-party contractors of hauliers)** (Point 6.3.1.1 (c) of the Annex[4])
- Uses the term **approved** for authorisation of entities, persons or equipment and applies to regulated agents, known consignors (also RA3, KC3 and ACC3[5]), hauliers, training courses (unless content is specified), EU validators, security equipment, and Explosive Detection Dogs (EDD)
- Requires persons performing specific tasks to be subject to certification or approval (see Table 3)

Table 3: Job roles requiring certification in line with the EU aviation security regulations.

Job role (tasks)	Initial requirement	Recurrent requirement	Reference (Annex to the Regulation 2015/1998)
Staff, passengers, cabin and hold baggage screener	Certification or approval	Recertification (only for x-ray or EDS)	Point 11.3.1 Point 11.2.3.1
Cargo and mail screener	Certification or approval	Recertification (only for x-ray or EDS)	Point 11.3.1 Point 11.2.3.2
Air carrier mail and materials, in-flight and airport supplies screener	Certification or approval *)	Recertification (only for x-ray or EDS) *)	Point 11.3.1 Point 11.2.3.3
Vehicle examinator	Certification or approval	Recertification or reapproval	Point 11.3.1 Point 11.2.3.4
Access control, surveillance and patrols staff	Certification or approval	Recertification or reapproval	Point 11.3.1 Point 11.2.3.5
Instructors	Certification (only for specific training)	Recertification	Point 11.5.1 Points 11.2.3.1 – 11.2.3.5 Point 11.2.4 Point 11.2.5

**) may be exempted if authorised to implement visual checks and/or hand searches*

The regulatory framework analysis shows that **security certification is limited to persons / individuals** and therefore focused on the evaluation and confirmation of staff competences. This aspect was investigated at the next stage of the research where the research team looked into processes related to the effectiveness of the security certification process (D-3.3.2).

4.1.4. EU Regulation 2018/1139

Regulation 2018/1139 defines certification as: "***any form of recognition*** *in accordance with this Regulation,* ***based on an appropriate assessment****, that a* ***legal or natural person****,* ***product****,* ***part****,* ***non-installed equipment****, equipment to control unmanned aircraft remotely, aerodrome,* ***safety-related aerodrome equipment****, ATM/ANS system, ATM/ANS constituent or flight simulation training device* ***complies with the applicable requirements*** *of this Regulation and of the delegated and implementing acts adopted on the basis thereof,* ***through the issuance of a certificate attesting such compliance***."

[4] as per the ICAO Annex 17 Standard 4.6.5, an 'entity' approved for application of screening or security controls for cargo

[5] 'RA' meaning the regulated agent; 'KC' meaning the known consignor; 'ACC3' meaning the Air Cargo or Mail Carrier operating into the Union from a Third Country Airport'

In summary, the definition of certification in the safety domain is evidently broader in scope[6]. As mentioned in the report D-3.2.1 conceptually, approval and certification are related but distinct concepts. *Certification* is a formal process by which the authority assesses and verifies that a particular entity meets established standards and regulations. *Approval* is more focused on the authorisation of a specific operation, procedure or use of equipment. Certification and approval processes can however overlap. For example, an organisation might need certification to operate in general, but specific operations or equipment might require separate approvals. Certification might also be a prerequisite for obtaining certain approvals.

The term approval is very often used in safety and security but is not defined in a standalone manner within the EU regulation itself.

4.2. Assessment of stakeholders' feedback

Figure 2 shows the coverage of European countries participating in the initial survey (17 stakeholder replies). Figure 3 shows the absolute number of responses for each security certification process existing in States which replied to the survey. The assessment of any potential impact on the safety of these processes was analysed and further discussed with stakeholders during the workshop.

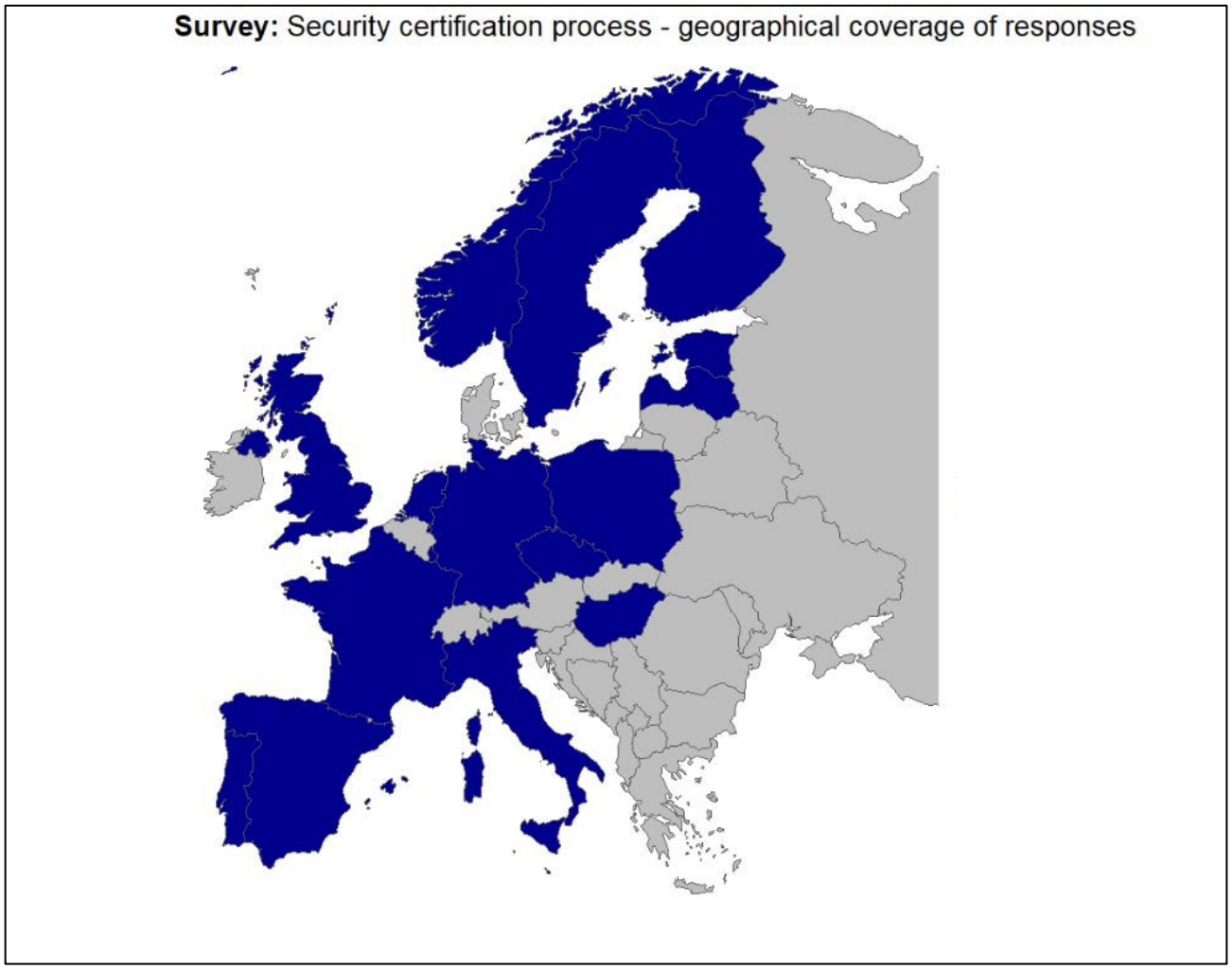

Figure 2 – Coverage of European countries participating in the survey

[6] Differences in certification in safety and security domains are also described in the report D-3.2.1 section 4.5.

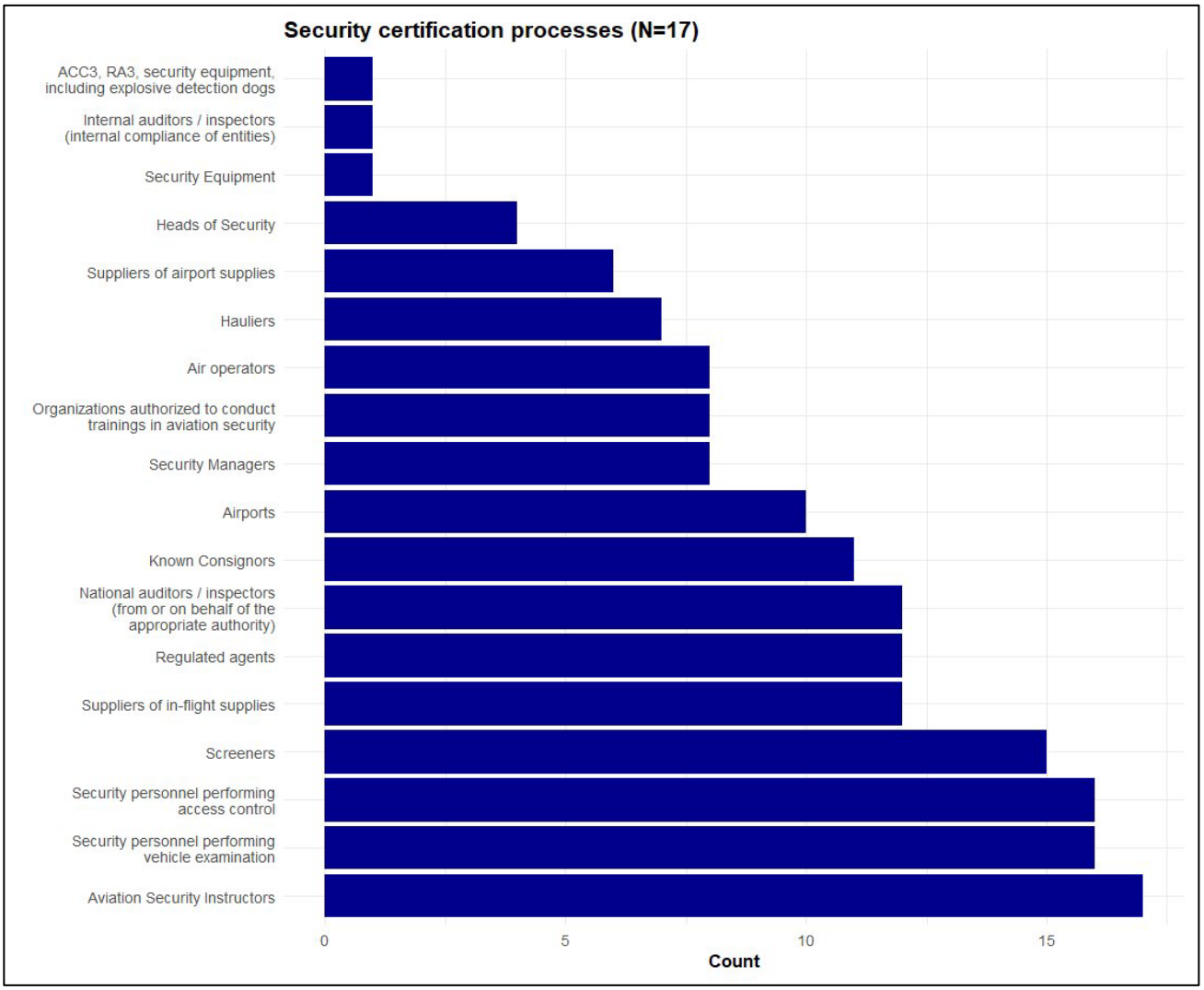

Figure 3 – Elements subject to security certification processes mentioned

Table 4 below presents stakeholder responses received from entities participating in the follow-up analysis during the workshop. This analysis applied indicators from the D-1.3 methodology. Stakeholders were provided with these indicators and asked to use them to specify the impact of security certification processes applicable in their jurisdiction on safety.

Table 4: Replies of stakeholders with regards to the impact on safety (the number in the brackets shows the count of replies).

Positive impact
Facilitates compliance with safety rules (1)
Increases implementation of safety rules (1)
Offers opportunity for safety improvement or leads to actual safety improvement (3)
Increases safety awareness (3)
Improves staff performance in terms of human factor (2)
Increases operational efficiency (1)
Increases efficiency of emergency operations / procedures (1)
Provides additional safety benefits (2)
Improves safety management (2)
Allow for reduction of safety hazard (4)
Enables increased data collection (3)
Improves emergency management (3)
Decreases the possibility of conflicting safety – security priorities (2)

Neutral impact
Does not affect compliance with safety procedures (implementation of safety rules) (3)
Does not affect safety awareness (2)
Does not contribute to tangible safety enhancements nor diminishes safety (2)
Does not affect efficiency of systems and equipment (4)
Does not affect maintenance requirements (4)
Does not affect staff performance in terms of human factors (3)
Does not affect operational efficiency (3)
Does not affect operational complexity (1)
Does not affect complexity of required training (2)
Does not affect efficiency of emergency operations / procedures (3)
Does not affect efficiency of standard operating procedures (3)
Does not offer additional safety benefits (2)
Has no impact on safety management (2)
Does not reduce or increase safety hazard (1)
Has no impact on data collection (2)
Does not affect emergency management (1)
Does not introduce conflicting safety – security priorities (3)

Negative impact
Decreases efficiency of systems and equipment (1)
Decreases operational efficiency (1)
Increases operational complexity (4)
Increases complexity of required training (3)
Introduces additional challenges in safety management (1)
Introduces additional challenges in management of emergency situations (1)

Results of the stakeholders' replies indicated a rather **neutral perception** of the impact security certification has towards safety with little to no effect or touchpoints with the safety domain requirements or objectives.

Interestingly, responses indicated instances of a positive impact. This was especially with regards to the following:

- offering opportunities for improvement or leading to actual safety improvements and
- allowing to reduce safety hazards

This could be coupled with another indicator selected – increased safety awareness.

Very few answers indicated a negative impact. The only one which was standing out was increased operational complexity. This is understandable given the certification is a formal process which has to be conducted to have an entity allowed to perform operational activity.

The research remained mindful that although indicators were selected by subject matter experts responsible for these security certification processes, no specific examples were provided to support the selection of these indicators.

5. Discussion

This chapter discusses the results of the literature analysis and stakeholder feedback in the scope of:
- National security certification rationale (Section 5.1)
- Analysis of impact (Section 5.2)
- Security equipment (Section 5.3)
- Literature analysis: Expansion from one domain into another (Section 5.4)

Based on the feedback provided by participating stakeholders the research was able to confirm that the certification processes at the national level are expanded compared to the EU regulatory framework. These processes are reflected in the National Civil Aviation Security Program (NCASP), which is the basis of the aviation security system in each State.

Security certification, as a regulatory process, is implemented based on a predefined set of specifications. These specifications are usually outlined in a State's NCASP and, for of EU Member States, are based on common overarching standards, such as EU regulations on aviation security. Security certification when established by the Appropriate Authority (assigned with the responsibility for aviation security), is highly specialised and purpose driven. Its scope is narrowly focused on ensuring compliance with security-related requirements designed to protect civil aviation against unlawful acts (such as terrorism, sabotage, and other security threats).

5.1. National security certification rationale

The research aimed to understand the reasons behind expanding the certification scope in the aviation security domain beyond the EU baseline, particularly concerning entities that are already regulated by the aviation security framework, such as the following:

- Airport operators
- Aircraft operators
- Regulated agents[7]

[7] 'regulated agent' means an air carrier, agent, freight forwarder or any other entity who ensures security controls in respect of cargo or mail

- Known consignors[8]
- Hauliers[9]
- Suppliers of in-flight supplies[10]
- Suppliers of airport supplies[11]

Several reasons were found to be most important for the authorities that implemented certification of these entities. Stakeholders listed the following:

- Risk management – Appropriate authorities in security are responsible for the oversight of many different types of entities with most of them mandated to establish their own aviation security processes and procedures described in their respective security programs. While each entity is accountable for their own security posture the ultimate responsibility for overall level of security in the State rests with the authority. States are therefore responsible for conducting their own risk assessments in aviation security[12]. This risk assessment is the main driver of adjustments as regards the NCASP. This process is used by appropriate authorities to conduct the analysis and prioritise entities with the higher vulnerability profile and subsequently apply certification towards them. In this context the certification is a risk management tool to implement the strategy aimed at reducing the risk by implementing additional safeguards or barriers.
- Standardisation – In this context the certification relates to verification. Verification would typically be conducted in the form of an assessment. For the assessment to be valid it needs to be standardised to make sure the assessment is conducted in a fair and repeatable manner. This way, through standardisation of certification assessment, the standardisation of processes, procedures and practices is also encouraged or enforced ensuring enhanced consistency.
- Compliance – The certification is a formal endorsement and a confirmation of compliance. It demonstrates that the entity operates within the legal requirements or mandated specifications.
- Quality assurance – Certification typically involves processes of preparation, assessment, validation and conclusions and therefore triggers more rigorous processes within the entity subject to certification (due to the exposure to appropriate authority assessment activities). It also increases confidence in the reliability and durability (understood as the ability of processes and procedures to remain effective, relevant, and functional over time) in the security posture in the certified entity.
- Business continuity – Certification provides enhanced protection for entities by confirming adherence to regulatory requirements. In case of accidents and serious incidents certification may be helpful in mitigating liability risks.
- Competence development – Certification enforces increasing standards and the organisational ability to manage the scope subject to certification. It can typically bolster the qualification level of work force responsible for processes and procedures subject to assessment and validation. Ongoing skill

[8] 'known consignor' means a consignor who originates cargo or mail for its own account and whose procedures meet common security rules and standards sufficient to allow carriage of cargo or mail on any aircraft;

[9] 'haulier' means an entity that ensures, on behalf of a regulated agent or known consignor, the surface transport and protection of air cargo and mail consignments to which security controls have previously been applied and whose procedures meet common security rules and standards sufficient to maintain the integrity of the consignments.

[10] 'regulated supplier of in-flight supplies' means a supplier whose procedures meet common security rules and standards sufficient to allow delivery of in-flight supplies directly to aircraft

'known supplier of in-flight supplies' means a supplier whose procedures meet common security rules and standards sufficient to allow delivery of in-flight supplies to an air carrier or regulated supplier, but not directly to aircraft

[11] 'known supplier of airport supplies' means a supplier whose procedures meet common security rules and standards sufficient to allow delivery of airport supplies to security restricted areas

[12] Standard 3.1.3 of Annex 17 (Amendment 18)

development is encouraged by the introduction of this method which involves external verification and regulatory enforcement (serious deficiencies may lead to withdrawal or suspension of the certificate).

These reasons were equally considered important for security certification of personnel, including these job roles which are not covered by EU certification requirements, i.e. internal auditors, and heads of security or security managers.

Having in mind the reasons listed above the introduced security certification would be expected to deliver an output serving the aviation security mission and would typically not expand to the safety domain.

In the next step the research focused on increasing the understanding of the specifications used in conducting security certification. As previously outlined, these specifications are typically derived from and grounded in the NCASP of individual States. The NCASP serves as foundational documents that outline preventive and protective measures designed to safeguard civil aviation against unlawful acts together with assigned responsibilities in the State.

However, due to the sensitive nature of their content, it is not in the interest of the security mission to make these documents publicly accessible. This confidentiality is further reinforced by Article 10(3) of EU Regulation 300/2008, which explicitly mandates that the appropriate authority must restrict access to the NCASP content. According to this provision, only individuals or organisations with a "legitimate interest" may be granted access to specific parts of an NCASP, and even then, access is strictly limited to what is necessary on a "need-to-know" basis. This ensures that sensitive security measures are protected from exposure that could compromise their effectiveness or reveal vulnerabilities.

The research could not directly evaluate or analyse the specifications within NCASPs due to their restricted nature. Instead, it relied on using the common aviation security standards established by the European Union as a point of reference. These standards, which are publicly available through EU regulations, provide a framework of guidelines and requirements applicable across Member States, ensuring a degree of uniformity in aviation security practices.

The analysis used relevant sections of the EU regulations to identify specifications that could be applicable to specific entities or personnel subject to certification. By doing so, the research maintained alignment with established EU security principles while respecting the confidentiality of NCASPs. This way, EU regulations were not used as a direct substitute for NCASP specifications but rather served as a reference to ensure the applicability of the specifications in the security certification process is accurately captured. Consequently, the following sections of EU regulations are defined as minimum specifications used for security certification of:

- Airport operator – The following sections of the Annex to the EU Regulation 2015/1998:
    - Section 1 Airport security – 1.0 – General provisions, 1.1 – Airport planning requirements, 1.2 – Access control, 1.3 – Screening of persons other than passengers and items carried, 1.4 – Examination of vehicles, 1.5 – Surveillance, patrols and other physical controls, 1.6 – Prohibited articles, 1.7 – Identification and protection of civil aviation critical information and communication technology systems and data from cyber threats
    - Section 2 Demarcated areas of airports
    - Section 4 Passenger and cabin baggage – 4.0 General provisions, 4.1 – Screening of passengers and cabin baggage, 4.2 – Protection of passengers and cabin baggage, 4.4 – Prohibited articles
    - Section 5 Hold baggage – 5.0 – General provisions, 5.1 – Screening of hold baggage, 5.2 – Protection of hold baggage, 5.4 – Prohibited articles
    - Section 9 Airport supplies – 9.0 – General provisions, 9.1 – Security controls, 9.2 – Protection of airport supplies, 9.3 – Additional security provisions for supplies of LAGs and STEBs

- Section 11 Staff recruitment and training – 11.0 – General provisions, 11.1 – Recruitment, 11.2 – Training, 11.3 – Certification or Approval, 11.4 – Recurrent Training, 11.5 – Qualification of Instructors
- Section 12 Security equipment

- Air operator (air carrier) – The following sections of the Annex to the EU Regulation 2015/1998:
  - Section 1 Airport security – 1.2 – Access control, 1.7 – Identification and protection of civil aviation critical information and communication technology systems and data from cyber threats
  - Section 4 Passenger and cabin baggage – 4.0 – General provisions, 4.1 – Screening of passengers and cabin baggage, 4.2 – Protection of passengers and cabin baggage, 4.4 – Prohibited articles
  - Section 5 Hold baggage – 5.0 – General provisions, 5.1 – Screening of hold baggage, 5.2 – Protection of hold baggage, 5.4 – Prohibited articles
  - Section 6 Cargo and mail – 6.0 – General provisions, 6.1 – Security controls – general provisions, 6.2 – Screening, 6.3 – Regulated agents, 6.6 – Protection of cargo and Mail, 6.7 – High Risk Cargo and Mail (HRCM), 6.8 – Security procedures for cargo and mail carried into the Union from third countries
  - Section 7 Air carrier mail and Air carrier materials – 7.0 – General provisions, 7.1 – Air carrier mail and air carrier materials to be loaded onto an aircraft, 7.2 – Air carrier materials used for passenger and baggage processing
  - Section 8 – In-flight supplies – 8.0 – General provisions, 8.1 – Security controls, 8.2 – Protection of in-flight supplies, 8.3 – Additional provisions for in-flight supplies and LAGs and STEBs
  - Section 11 Staff recruitment and training – 11.0 – General provisions, 11.1 – Recruitment, 11.2 – Training, 11.3 – Certification or Approval, 11.4 – Recurrent Training, 11.5 – Qualification of Instructors

- Regulated agent – The following sections of the Annex to the EU Regulation 2015/1998:
  - Section 1 Airport security – 1.7 – Identification and protection of civil aviation critical information and communication technology systems and data from cyber threats
  - Section 6 Cargo and mail – 6.0 – General provisions, 6.1 – Security controls – general provisions, 6.2 – Screening, 6.3 – Regulated agents, 6.6 – Protection of cargo and Mail, 6.7 – High Risk Cargo and Mail (HRCM), 6.8 – Security procedures for cargo and mail carried into the Union from third countries
  - Section 11 Staff recruitment and training – 11.0 – General provisions, 11.1 – Recruitment, 11.2 – Training, 11.3 – Certification or Approval, 11.4 – Recurrent Training, 11.5 – Qualification of Instructors

- Known consignor – The following sections of the Annex to the EU Regulation 2015/1998:
  - Section 1 Airport security – 1.7 – Identification and protection of civil aviation critical information and communication technology systems and data from cyber threats
  - Section 6 Cargo and mail – 6.4 – Known consignors, 6.6 – Protection of cargo and Mail, 6.7 – High Risk Cargo and Mail (HRCM), 6.8 – Security procedures for cargo and mail carried into the Union from third countries
  - Section 11 Staff recruitment and training – 11.0 – General provisions, 11.1 – Recruitment, 11.2 – Training, 11.3 – Certification or Approval, 11.4 – Recurrent Training, 11.5 – Qualification of Instructors

- Haulier – The following sections of the Annex to the EU Regulation 2015/1998:

- Section 1 Airport security – 1.7 – Identification and protection of civil aviation critical information and communication technology systems and data from cyber threats
- Section 6 Cargo and mail – 6.5 – Approved hauliers
- Section 11 Staff recruitment and training – 11.0 – General provisions, 11.1 – Recruitment, 11.2 – Training, 11.3 – Certification or Approval, 11.4 – Recurrent Training, 11.5 – Qualification of Instructors

- Supplier of in-flight supplies – The following sections of the Annex to the EU Regulation 2015/1998
  - Section 1 Airport security – 1.7 – Identification and protection of civil aviation critical information and communication technology systems and data from cyber threats
  - Section 8 – In-flight supplies – 8.0 – General provisions, 8.1 – Security controls
  - Section 11 Staff recruitment and training – 11.0 – General provisions, 11.1 – Recruitment, 11.2 – Training, 11.3 – Certification or Approval, 11.4 – Recurrent Training, 11.5 – Qualification of Instructors
- Supplier of airport supplies – The following sections of the Annex to the EU Regulation 2015/1998:
  - Section 1 Airport security – 1.7 – Identification and protection of civil aviation critical information and communication technology systems and data from cyber threats
  - Section 9 Airport supplies – 9.0 – General provisions, 9.1 – Security controls, 9.2 – Protection of airport supplies, 9.3 – Additional security provisions for supplies of LAGs and STEBs
  - Section 11 Staff recruitment and training – 11.0 – General provisions, 11.1 – Recruitment, 11.2 – Training, 11.3 – Certification or Approval, 11.4 – Recurrent Training, 11.5 – Qualification of Instructors
- Organization authorized to conduct trainings in aviation security – The following sections of the Annex to the EU Regulation 2015/1998
  - Section 1 Airport security – 1.7 – Identification and protection of civil aviation critical information and communication technology systems and data from cyber threats
  - Section 11 Staff recruitment and training – 11.0 – General provisions, 11.1 – Recruitment, 11.2 – Training, 11.3 – Certification or Approval, 11.4 – Recurrent Training, 11.5 – Qualification of Instructors
- National auditor / inspector (from or on behalf of the appropriate authority) – The following sections of the Annex to the EU Regulation 300/2008:
  - Section 15 – Qualifications criteria for auditors
- Aviation security instructor – The following sections of the Annex to the EU Regulation 2015/1998:
  - Section 11 – Staff recruitment and training – 11.0 – General provisions, 11.1 – Recruitment, 11.2 – Training, 11.3 – Certification or Approval, 11.4 – Recurrent Training, 11.5 – Qualification of Instructors
- Screener, security personnel performing vehicle examination and/or access control – The following sections of the Annex to the EU Regulation 2015/1998
  - Section 11 – Staff recruitment and training – 11.0 – General provisions, 11.1 – Recruitment, 11.2 – Training, 11.3 – Certification or Approval, 11.4 – Recurrent Training, 11.5 – Qualification of Instructors
- Head of security / security manager – The following sections of the Annex to the EU Regulation 2015/1998
  - Section 11 – Staff recruitment and training – 11.0 – General provisions, 11.1 – Recruitment, 11.2 – Training, 11.4 – Recurrent Training

The EU Regulation does not contain specifications for internal auditors.

5.2. Analysis of impact

The research did not identify quantifiable evidence of direct impact of security certification on safety. This has been confirmed when consulting stakeholders which mostly indicated a neutral effect of security certification on safety.

The positive impact of security certification on safety indicated by stakeholders, not supported however by specific examples or evidence has been considered by the research team as informed yet subjective opinion of approached experts. Nevertheless, the research determined, that even if at high level, due to general certification benefits outlined earlier, the positive value of security certification for the overall confidence in the system and safety of aviation should be recognised. The positive impact was identified especially with regards to: *offering opportunities for improvement or leading to actual safety improvements* and *allowing to reduce safety hazards*. This could be coupled with another indicator *increased safety awareness*.

Reasons for the identification of this positive impact might be related to the fact that certification builds a certain degree of assurance over aviation security and the effect of it may be twofold:

- Enhanced attention to aviation security requirements and related compliance
- Compliance with security requirements reduces the risk of creating additional safety hazard exposure

The former could happen when an entity or person subject to security certification improves their awareness of a different regulatory framework and comprehension of the certification purpose in general. This in parallel increases the awareness of the role of State's oversight and enforcement role. Ultimately, this may potentially lead to recognition of other regulatory requirements. The latter is a result of the assumption that aviation security regulation is coordinated with other applicable requirements – including aviation safety. In this context, security certification assures that the entity or a person follows an agreed and recognised implementation method which consequently warrants no knock-on effect on safety. In the absence of security certification, implementation could be done intuitively and lead to potential safety hazards.

Having in mind that stakeholders did not provide any examples, the research developed several of them to present how implementation of security specifications results in positive (direct or indirect) impact. Consequently, if security requirements would not be implemented, not regulated or not included in the security certification this could result in an increased safety hazard if:

- **Example 1**: In aviation security access control, vehicle pass is coupled with the operational need. This means a vehicle pass is only issued if such a need is established. This requirement is included in one of the sections related to security certification specifications and it not only prevents malicious access but improves the overall aerodrome area management ensuring operations are conducted with only necessary number of vehicles involved in the turnaround operations of the aircraft. In this context this specific requirement supports implementation of safety certification requirement ADR.OPS.B.026 – Authorisation of vehicles.
- **Example 2**: Knowledge of reporting procedures and reporting of cases of unauthorised persons is part of the training requirements in aviation security framework. This implies existence of the security occurrences reporting[13]. .When security certification includes security occurrences reporting it will

[13] The concept supported and encouraged also by the ICAO Guidance material *Reporting of Aviation Security Occurrences and Incidents*, ICAO, June 2022 - https://www.icao.int/Security/SFP/Pages/Incident-Reporting-Guidance-and-Taxonomy.aspx

have a positive impact on overall ability of the aerodrome (airport) operator to implement security occurrence reporting, which in consequence supports implementation of safety certification requirement ADR.OR.C.030 and ADR.OR.D.030 through an increased data collection.[14]

- **Example 3**: Critical information and communication technology systems and data shall be identified and protected from cyber threats in accordance with aviation security framework.[15] This requirement improves the overall aerodrome operator ability to implement data quality requirements of ADR.OPS.A.010.
- **Example 4**: Persons responsible for screening undergo extensive training related to detection of prohibited articles in the screening process. As some of these articles could be also dangerous goods (DG) the implementation of training and screening positively contributes to the aircraft operators' ability to implement safety specification requirements related to the transport of dangerous goods in line with CAT.GEN.MPA.200.

5.3. Security equipment

In the course of the research around certification an element related to security equipment has been noted. This mechanisms of authorising use of security equipment have been created on the basis of Regulation 300/2008 and specifically provisions of its section 12 of the Annex I which states "*equipment used for screening, access control and other security controls shall comply with the defined specifications and be capable of performing the security controls concerned*."

The research noted an initiative from 2016 when a proposal for establishing an EU certification system for aviation security screening equipment was tabled. This proposal originated from the Security Industrial Policy Action Plan for an innovative and competitive Security Industry document which announced legislative proposal for an "EU-wide harmonised certification system for airport screening (detection) equipment". Although the initiative was driven more by economical needs and in the context of the development of internal market, several elements of the impact assessment were considered worth noting for this research.

To reiterate earlier observations, the certification process incorporates elements of assessment and validation. The document describing arrangements for security screening equipment clearly indicated the following:

- Technical specifications and performance requirements exist and are classified
- There is no legally binding EU-wide conformity assessment scheme

In the context of safety and security interdependencies the research identified one of the options discussed at that time was the so called "centralised approach" which considered "aviation screening equipment certification could be done by the European Aviation Safety Agency (EASA)." This option was related to the fact, EASA has been in charge of multiple certification processes already. Further, this option proposal reads "*If EASA would become responsible for the certification of aviation screening equipment as well, the agency would set the rules that would apply for the certification of the equipment and establish a certification programme in order to test compliance with the criteria. The agency would test the equipment and verify if the products concerned meet the regulatory requirements. Aviation screening equipment which fulfils the criteria would*

[14] In particular since the EU Regulation 376/2014 includes types of occurrences in Article 4 *Mandatory reporting* which could be submitted within the security reporting procedure e.g. "occurrences related to injury, emergencies and other critical situations".

[15] Section 1.7 of the Annex to the EU Regulation 2015/1998

receive a certificate of compliance, issued by EASA." Several other options were discussed in this document and served as a basis for formulating the legislative proposal by the European Commission[16].

This legislative proposal aimed at establishing a legally binding EU certification system and described the obligations of the different bodies involved in that certification mechanism. The option of engaging EASA mentioned above however has not been considered as the preferred one.

In line with the mechanism described in this proposal, the certificate would be valid throughout the EU and based on the principle of mutual recognition by all Member States. According to article 6 of the proposal, each Member State would designate, and notify to the Commission, an approval authority competent for all aspects of the approval of equipment, as well as for issuing, amending or withdrawing EU type-approval certificates. According to article 5, manufacturers would issue a certificate to accompany each piece of equipment manufactured in conformity with the type and configuration covered by an EU type-approval certificate. By issuing the certificate of conformity, the manufacturer would assume responsibility for the compliance with the approved type and configuration. Regarding applications for EU type-approval certificate, the manufacturer would submit to an approval authority only one application in respect of any given type and configuration of equipment and in only one Member State (article 7). The approval authority would be required, within 20 working days from issuance of the type-approval certificate, to send to the other approval authorities and the Commission, a copy of the EU type-approval certificate (article 11)[17].

The further consultation process revealed substantial differences in opinions of stakeholders. The European Economic and Social Committee in its opinion expresses concerns about its added value and regrets that the proposal does not introduce a single EU approval authority with an integrated technical service, which seemed to be an approach considered more efficient.[18] The legislative proposal was ultimately withdrawn.

Current legislation and provisions of Regulation 2015/1998 do not constitute formal certification of screening equipment however they bring an additional value by endorsement of certain equipment and therefore build a solid baseline for EU Member States especially in the absence of State's internal capability to perform equipment testing.

On this basis, the implementation rules have been introduced to EU Regulation 2015/1998 to limit the deployment of security equipment and software installed after the 1st of October 2020 to such that has been granted the "EU Stamp" marking.

These rules apply to:

- Walk-through metal detection (WTMD) equipment
- Explosive detection systems (EDS) equipment
- Explosive trace detection (ETD) equipment
- Liquid explosive detection systems (LEDS) equipment
- Metal detection (MD) equipment
- Security scanners

[16] SWD(2016) 261 final, Commission Staff Working Document, Impact Assessment accompanying the document Proposal for the Regulation of the European Parliament and of the Council establishing a Union certification system for aviation security screening equipment, Brussels 7 September 2016

[17] Proposal for a Regulation of the European Parliament and of the Council establishing a Union certification system for aviation security screening equipment, COM(2016) 491 final, 2016/0236 (COD), 7 September 2016

[18] Briefing, EU Legislation in Progress, EU certification of aviation security screening equipment, 7 July 2019, https://www.europarl.europa.eu/RegData/etudes/BRIE/2017/599358/EPRS_BRI(2017)599358_EN.pdf and https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CONSIL:ST_5715_2017_INIT

- Shoe scanner equipment
- Explosive vapour detection (EVD) equipment
- Automated prohibited items detections software (APIDS)

The research noted only very limited number of States having the capability of conducting tests and actually certifying security equipment. An example of such an EU Member State is France, which requires security equipment to be certified by the Direction du Service Technique de l'Aviation Civile (STAC). According to the French regulatory framework security equipment must be equipped with valid type certificate or individual certificate. Additionally, list of certified security equipment is available on the STAC website.[19]

The impact on safety related to the security certification of screening equipment, is more direct when related to detection capabilities of this equipment in relation to prohibited articles that are also Dangerous Goods.[20]

5.4. Expansion from one domain into another: A literature analysis

In the attempt to further understand potential positive impact of security certification on safety, and to deepen the understanding of positive indicators highlighted by stakeholders the researched turned (in the absence of quantifiable evidence) into the further science research. Researchers conducted a literature analysis to check if any concepts exist that suggest a relationship between gaining expertise or awareness in one domain (i.e. security certification) and developing the curiosity or motivation to explore other domains (i.e. safety certification). The research question was:

> *"What psychological, educational, or interdisciplinary theories suggest that expertise or proficiency in one domain can inspire curiosity, motivation, or application in another domain? In this case: how might organizations involved in security certifications expand their focus to explore or integrate safety certifications?"*

The literature showed that the expansion of expertise from one domain into another is a well-documented phenomenon, supported by various psychological, educational, and interdisciplinary theories:

- Transfer of learning theory
- Curiosity-driven learning theory (intrinsic motivation)
- Epistemic curiosity theory
- Interdisciplinary learning theory
- Self-determination theory (SDT)
- System thinking

The following sections explore (some of these) theories in more detail (see Table 5 for a summary).

Transfer of learning theory

This theory posits that knowledge and skills acquired in one domain can transfer to another domain, therefore enabling individuals to apply their learning in new contexts - particularly when there are overlapping principles or shared methodologies. This transfer may encourage exploration of related fields. This alignment encourages organisations to leverage their existing expertise to address new challenges effectively.

Example: A person gaining expertise in computer science might become curious about cybersecurity, artificial intelligence, or even the ethical implications of technology, leading them to explore philosophy or law.

Curiosity-driven learning (intrinsic motivation)

[19] https://www.stac.aviation-civile.gouv.fr/en/surete/certification-security-equipments

[20] Topic analysed in more details in the report D-3.1.2 "Assessment report on the relevance of the existing detection requirements for screening equipment to mitigate threats to aircraft structure".

This theory posits that expertise in one domain enhances confidence and curiosity, which drives individuals to explore adjacent areas. This theory aligns with the SDT (see below).

Example: A biologist specializing in genetics might develop an interest in bioinformatics or data science as a means of analysing genetic data more effectively.

Epistemic curiosity theory

This theory posits individuals have the desire to acquire knowledge and reduce uncertainty. Proficiency in one domain often generates awareness of gaps or unanswered questions in related fields.

Example: A historian studying the industrial revolution might grow curious about the technological advances of the era, leading them to explore mechanical engineering or economic theory.

Interdisciplinary learning

This theory posits that understanding the connections between fields fosters broader intellectual growth. When individuals master one area, they often realise that real-world problems require knowledge from multiple domains, prompting them to explore others.

Example: A psychologist researching human behaviour may study neuroscience or sociology to gain a more comprehensive understanding of their field.

Self-determination theory (SDT)

This theory posits that people have three basic psychological needs: competence, autonomy, and relatedness. As they grow more competent in one domain, they may feel empowered to explore other areas that align with their interests or are connected to their initial expertise.

Example: A teacher becoming proficient in educational technology might start exploring curriculum design or cognitive science to improve student outcomes.

System thinking

Systems thinking highlights the interconnectedness of domains, where improvements in one area often require attention to others. Organisations addressing industrial security might recognise that safety certifications are crucial for ensuring the resilience of interconnected systems, prompting them to adopt a broader perspective.

Example: A company focused on IT security for critical infrastructure might explore physical safety certifications, recognizing that securing systems alone is insufficient without ensuring the safety of personnel and equipment.

Table 5: Similarities and differences among theories

Theory	Focus	Shared principles	Unique aspects
Transfer of Learning	Knowledge transfer between domains	Application of existing knowledge	Emphasis on overlapping methodologies
Curiosity-Driven Learning	Exploration driven by intrinsic motivation	Confidence fuels exploration	Connection to intrinsic psychological growth
Epistemic Curiosity Theory	Desire to reduce uncertainty and answer new questions	Awareness of gaps leads to exploration	Emphasis on knowledge acquisition
Interdisciplinary Learning	Connections between fields foster intellectual growth	Recognising the interconnectedness of fields	Focus on addressing complex real-world problems
Self-Determination Theory	Competence, autonomy, and relatedness motivate exploration	Growth from confidence and relatedness	Psychological emphasis on autonomy and personal growth

Theory	Focus	Shared principles	Unique aspects
Systems Thinking	Interconnectedness of domains and holistic problem-solving	Recognising dependencies between fields	Emphasis on systemic resilience and integration

In summary, these theories collectively suggest that expertise in one domain can fuel curiosity and the desire to explore others. This is often driven by the awareness of interdisciplinary connections and thinking, and the recognition of gaps in knowledge that other domains could fill. In this case, these theories suggest that entities operating in security certifications may naturally explore an adjacent domain like safety certifications.

6. Conclusion

Overall, based on collected data and conducted analysis, security certification impacts safety only to a certain, limited degree. Its impact is related mainly to following areas:

- Reinforcement of safety compliance
- Support of safety processes
- Helping in preventing safety hazard
- Increase of overall compliance awareness

In case of entities which are subject to both: safety and security certification, direct impact or dependence of security and safety could be easier determined especially in terms of overlapping management processes and especially in air operator organisation (e.g. impact of security occurrence reporting on overall ability to develop and maintain a comprehensive reporting system). This is aligned with replies provided by stakeholders via the survey conducted as part of D-3.2.2 report. In this survey about safety and security certification requirements, stakeholders indicated that serious findings in security may impact the process of safety certification of air operators.[21] In this context security certification would have a direct impact on safety as security serious findings would prevent completion of the Air Operator Certificate process and the entity could not engage in the commercial air transport operations.

For entities that are not covered by safety certification there is however no such specific direct dependency in terms of regulatory-related impact or outcome.

Based on the research in this scope security certification is related to the State risk assessment and is reflective of the following circumstances:

- Specific security certification objectives – Security certification is implemented to address specific and priority threats and vulnerabilities related to aviation security. It involves evaluating systems, procedures, and infrastructure to ensure they meet strict requirements for safeguarding against security risks. This narrow focus ensures that resources and expertise are directed toward security conformity. Including safety requirements within a security certification would dilute its purpose and risk overcomplicating the certification process.
- Competency and jurisdiction of authorities – Security certification is typically conducted by the organisational unit within the Appropriate Authority responsible for aviation security (or an authority responsible for aviation security separate from the Competent Authority). These authorities possess specialised knowledge and expertise in implementing and enforcing aviation security measures but are not authorised to assess or validate safety-related aspects. Safety falls under the jurisdiction of a different regulatory framework, often managed by a separate organisational unit or authority with relevant expertise. This separation of competencies ensures that both domains—security and safety—

[21] See section 4.1.5 of the D-3.2.2 report "Assessment report on the verification of security related requirements during the certification process".

are addressed thoroughly and effectively by the respective experts. Attempting to combine the two could affect the depth and focus of each assessment.

- Separate regulatory frameworks – The regulatory structures governing security and safety are distinct (although previous analysis showed areas of overlap or touchpoints)
- Single-purpose focus to maintain clarity - The single-purpose orientation of security certification ensures clarity and precision in its implementation. Trying to incorporate safety-related requirements into a security certification process could lead to confusion, and potential conflicts in priorities. Keeping security certification narrowly focused ensures thoroughness and avoid any compromise in addressing the unique challenges of this domain.

APPENDIX

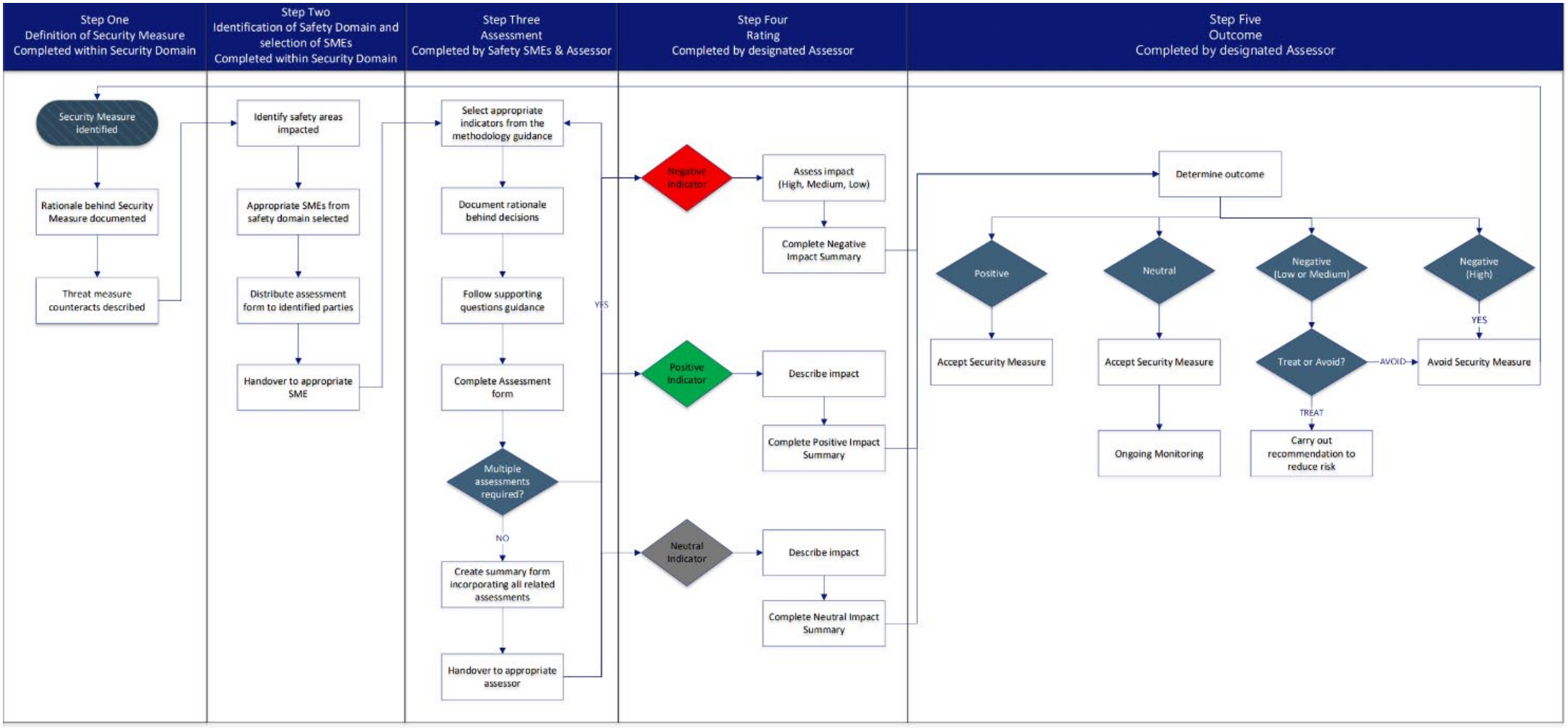

Figure 4 – Safety Impact Assessment methodology – process map (from D-1.3)

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