![EASA - European Union Aviation Safety Agency]

RESEARCH PROJECT EASA.2022.HVP.04

REPORT ON SAFETY AREAS AFFECTED BY SECURITY D-1.1

Impact of Security Measures on Safety

Research conducted by:

UK Civil Aviation Authority International   apave Aeroservices   CASRA

An Agency of the European Union

Disclaimer

APPROVED BY:	AUTHOR	REVIEWERS	MANAGING DEPARTMENT
CAAi	Dorota Broom	Apave - Ivan Volpoet	CAAi – Kevin Sawyer
		CASRA – Adam Troczynski	
		CAAi – Nina Smith	

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Contributed to Task 1.1
Dorota Broom - CAAi Technical Advisor Aviation Security (Technical Lead for Task 1.1)
Ivan Volpoet - Apave Lead SME on civil and military Airworthiness
Adam Troczynski - CASRA Technical Expert Aviation Security
Nina Smith - CAA Head of Training and Human Factors Aviation Security
Owen Healey - CAAi Technical Expert Aerodromes
Layla Bromley - CAA Cyber Security Policy Specialist
Ben Bamber - CAAi Flight Operations Training Inspector Senior Technical Adviser

CAA International Limited (CAAi) was established in April 2007 as a wholly owned subsidiary of the UK CAA. The UK Civil Aviation Authority (UK CAA) is the UK's specialist aviation regulator, directly reporting to the UK Government's Department for Transport (DfT). Through its skills and expertise, it is recognised as a world leader in its field. CAAi provides access to the UK CAA's wealth of expertise and experience within the five operating groups of the UK CAA (Safety & Airspace Regulation Group, Consumers and Markets Group, Security Group, Strategy and Policy Group and International Group). Its primary focus is providing advisory, training, examination and licencing services to agencies, fellow National Aviation Authorities and industry in over 140 countries. CAAi's work involves assessment and delivery of targeted safety, security and environmental improvements and offer unparalleled expertise stemming from insights into best practices defined by the CAA.

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 specialized 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 Center 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.

ABBREVIATIONS

ACRONYM	DESCRIPTION
ABP	Able-Bodied Passenger
AC	Advisory Circular
ACS	Area Control Surveillance
ADO	Aerodrome Design and Operations
ADV	Aerodrome Control and Visual Rating
ADI	Aerodrome Control Instrument Rating for Tower
AIC	Airport Identification Card
AMC	Acceptable Means of Compliance
Annex	ICAO Annex (referring to various safety and security annexes)
ATS	Air Traffic Services
ATM	Air Traffic Management
ATSP	Air Traffic Service Provider
AUI	Act of Unlawful Interference
BR	Basic Regulation
CCTV	Closed-Circuit Television
CAT	Commercial Air Transport
CBT	Computer Based Training
CC	Cabin Crew
CIC	Crew Identification Card
COG	Chemical Oxygen Generator
CRM	Crew Resource Management
CS	Certification Specifications
DGs	Dangerous Goods
DOC	Document
DSN	Design
EC	European Commission
EASA	European Union Aviation Safety Agency
EFB	Electronic Flight Bag
EU	European Union
FCC	Flight Crew Compartment
FC	Flight Crew
FDM	Flight Data Monitoring
GH	Ground Handling
GM	Guidance Material
HBS	Hold Baggage Screening
ICAO	International Civil Aviation Organization
ICT	Information and Communication Technology
ID	Identification

IED	Improvised Explosive Device
IUEIs	Intentional Unauthorised Electronic Interactions
LRBL	Least Risk Bomb Location
MEL	Minimum Equipment List
MSMs	More Stringent Measures
NAAs	National Appropriate Authorities
N/A	Not Applicable
NCASP	National Civil Aviation Security Program
OEMs	Original Equipment Manufacturers
SARPs	Standards and Recommended Practice
SEC	Security
SOP	Standard Operating Procedures
SRA	Security Restricted Area
TEM	Threat and Error Management
UA	Unmanned Aircraft
UAS	Unmanned Aircraft System
UTM	Unmanned Aircraft System Traffic management

1. Executive summary

Problem area

ICAO Annex 17 on Aviation Security, paragraph 2.1.1 states that "each Contracting State shall have as its primary objective the safety of passengers, crew, ground personnel and the general public in all matters related to safeguarding international civil aviation against acts of unlawful interference". Implicit within this overarching objective is the notion that the application of aviation security measures contributes to the overall safety of civil aviation.

There are clear examples in civil aviation where security and safety measures overlap or complement each other whilst in other areas the relationship between safety and security requirements may be less apparent. In order to understand how well these touchpoints (hereafter referred to as *interdependencies*) co-exist, it is first necessary to map out the interdependencies and areas of safety that may be affected by security measures both at a regulatory and operational perspective.

Having identified those areas where aviation safety is impacted by aviation security measures, we will then be able to consider the nature of that impact, be it positive or negative, direct or indirect. Whilst the implementation of aviation security measures has an unambiguous contribution to safety in the widest sense (the prevention of acts of unlawful inference), there will also likely be opportunities for greater collaboration and efficiency between the two domains particularly given the emergence of innovative technologies and operations within civil aviation which span the traditional boundaries between safety and security (e.g. cyber or unmanned aircraft systems).

The purpose of this research summary is to understand the nature and scope of the interdependencies between safety and security in order to identify the areas of safety affected by security measures and assess the impact that security measures have on safety (a systematic impact assessment will be undertaken in Task 2.3 of this research framework). This report outlines the areas of safety impacted by security measures considering security measures currently in place but also those that are likely to form part of future regulations or are likely to form part of a future response to specific threat scenarios. Future deliverables within this project will consider the specific job roles and responsibilities that are likely affected by the interdependencies (task 1.2).

Safety areas affected by security measures

These safety areas affected by security measures are categorised into eight primary sections that align with main safety regulatory framework. These main areas are:

- Aircraft and aircraft equipment (including design, certification and airworthiness)
- Unmanned Aircraft Systems
- Air Traffic Services and Management
- Aerodrome / airport operations
- Aerodrome / airport operations relating to security controls, screening and screening equipment[1]
- Air Operations
- Ground Operations
- Off-airport operations

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[1] The scope of this research study is confined to civil aviation, and the consideration of screening equipment in context other than aviation falls outside of the scope of this project.

Each primary area is subdivided into more specific areas of safety based on safety – security touchpoints identified:

- **Aircraft and aircraft equipment.** Entities who must comply with relevant safety standards and certification specification include aircraft manufacturers and maintenance organisations. Specific areas of safety affected by security measures include:

  - Aircraft design and certification
  - Aircraft systems and system security (cyber security) including information security
  - Air carrier emergency procedures and training (analysed in section related to Air Operations)
  - Aircraft maintenance in relation to maintenance organisations (MRO, CAMO)

- **Unmanned Aircraft Systems.** This area refers to the unmanned aircraft (drones) and their operators. Specific areas of safety affected by security measures include:

  - UAS operation
  - Aerodrome operational systems
  - Area of crisis management, contingency plans, emergency response primarily at the airports

- **Air Traffic Services and Air Traffic Management.** Area of air traffic control and air traffic management relevant to entities who apply relevant safety and security measures. Specific areas of safety affected by security measures include:

  - ATS systems and system security (cyber security)
  - Infrastructure
  - Staff recruitment and training
  - Organisational requirements
  - Emergency procedures and contingency planning
  - Operations
  - Management system

- **Aerodrome / airport operations.** Area of airport design, planning, airport operations relevant to entities designing and certifying aerodromes and entities managing airport operations. Specific areas of safety affected by security measures include:

  - Management system
  - Aerodrome design and certification
  - Aerodrome operations
  - Aerodrome systems (cyber security)
  - Contingency planning and emergency response
  - Staff recruitment and training

- **Area of aerodrome / airport operations relating to security controls, screening (safety area of Dangerous Goods).** This area is relevant to entities providing airport security controls and screening, (which in some cases may be delegated to third-party providers.) Measures relating to cargo and supplies screening were also examined in this section. Safety and security measures in relation to passengers and baggage screening, cargo and supplies screening were examined. Entities in scope include Regulated Agent, Regulated Supplier of In-Flight and Airport Supplies. Specific areas of safety affected by security measures include:

- o Certification of screeners
- o Dangerous Goods
- o Screeners training and recruitment
- o Organisational responsibility
- o Operations
- o Screening equipment

- **Air operations.** Area relevant to air carriers and operators including cargo operators. In this area measures related to air operations were examined. Specific areas of safety affected by security measures include:

  - o Operating procedures
  - o Staff recruitment and training
  - o Cyber security

- **Ground operations.** Area relevant specifically to Ground Handling operations. In the current regulatory environment, Ground Handling entities are not separately regulated. There is a DRAFT Commission Delegated Regulation laying down requirements and administrative procedures related to ground handling services. Looking ahead to the future regulatory landscape of ground handling operations, specific requirements for ground handling are listed separately withing this section. Specific areas of safety affected by security measures include:

  - o Ground Handling operating procedures
  - o Dangerous Goods

- **Off-airport operations.** This section pertains to off-airport operations conducted by entities such as Regulated Agents, Known Consignors, Regulated Suppliers, or hauliers. Within this domain, security measures concerning activities carried out beyond the boundaries of the airport perimeter were examined. Although these security measures may not currently exhibit a direct impact on the safety areas within the scope of safety regulations, they were subject to scrutiny for the purpose of this research due to the significant involvement of numerous entities in such operations.

  Specific areas of safety affected by security measures include:

  - o Transport of Dangerous Goods
  - o Training
  - o Organisational responsibility
  - o Safety Management

Identification of the safety areas impacted by security measures serves as an important primary step in this research project, providing a clear direction. A detailed analysis of the impact that these security measures have on safety will be systematically analysed in task 2. In task 2, the threat to aircraft safety will also be assessed enabling comparison of the areas of safety - security dependency and the areas of the most prominent threat. This process will facilitate the identification of additional safety areas which necessitate further investigation, thereby providing a comprehensive understanding of the interdependencies at play.

2. Methodology

In order to assess which areas of safety are impacted by security measures the research defines the entities in scope of both safety and security regulation. For the safety - security interdependency to occur, an entity must fall within scope of both safety and security regulations and have both safety and security responsibilities, as defined in legislation or internationally recognised standards (including industry standards). The initial stage of the research consisted of identifying and reviewing relevant security standards, regulations and guidance documents that detail security measures that civil aviation entities must comply with. These are listed in section 5, Introduction, Security regulations reviewed in this research. Entities in scope of security regulations were then identified in section 5, Introduction, Entities in scope of security regulations. The next stage entailed mapping safety regulations applicable to the relevant entities, which are listed in section 6, Mapping safety - security interdependencies. EASA Basic Regulation (EU) No 2018/1139 and its Implementing Rules provided a fundamental starting point to define areas of safety covered by the regulation and provides initial picture where safety – security dependencies may occur and areas that are further investigated in this task. To consider the complexity of civil aviation regulatory structure in both safety and security domains, and in order to comprehensively outline the safety areas influenced by security measures, it was essential to categorise the primary areas beforehand. The primary categories presented in this study pertain to the safety regulatory framework.

To identify specific safety areas, each primary area lists the security measures that relevant entities have to apply. EU and ICAO standards provided the list of security measures considered for the purpose of this research, including Regulation (EC) 300/2008 (Common Basic Standards), (EU) 2015/1998 (Implementing Regulation), ICAO Annex 17 and when applicable other security related standards (listed in section 5, Introduction).

Each primary area of safety includes a table where the first column denotes the security measure, followed by the corresponding regulatory reference (security – second column and safety – third column). The last column indicates the safety area affected by the respective security measure. The initial description is provided in the Initial description of the nature of the interdependency between safety and security section. This constitutes the initial description that will be further investigated during the framework of this research project (Task 2 and Task 3). Subsequently, the impact of the listed measures on safety areas will be assessed in task 2.

Summary of undertaken tasks:

- Listing applicable security standards and regulations
- Defining entities in scope of security standards and regulations
- Listing safety regulations applicable to entities in scope of security regulations
- Defining primary areas of safety affected by security measures
- Review security measures applicable to the entities in scope of primary areas of safety identified
- Describing the nature of each interdependency

3. Context

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 3 companies:
- CAA International
- Apave Aéroservices
- 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 aim to develop 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 security-safety 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

4. Objective of the document

Scope

This report represents deliverable 'D1.1' of the Impact of Security Measures on Safety (EASA.2022.HVP.04). The work presented here represents the output from 'Task 1' which includes identification of the safety areas affected (positively or negatively).

Place of the document in the overall project

This report is an entry for the deliverable D1.2, D1.3 and D2.2 which aims at providing an assessment of the impact of the security-safety interdependencies on safety. The results of task 1.1 are fundamental for the direction of the rest of the research project tasks 2, 3 and 4 have direct dependence on the outcomes presented in this report.
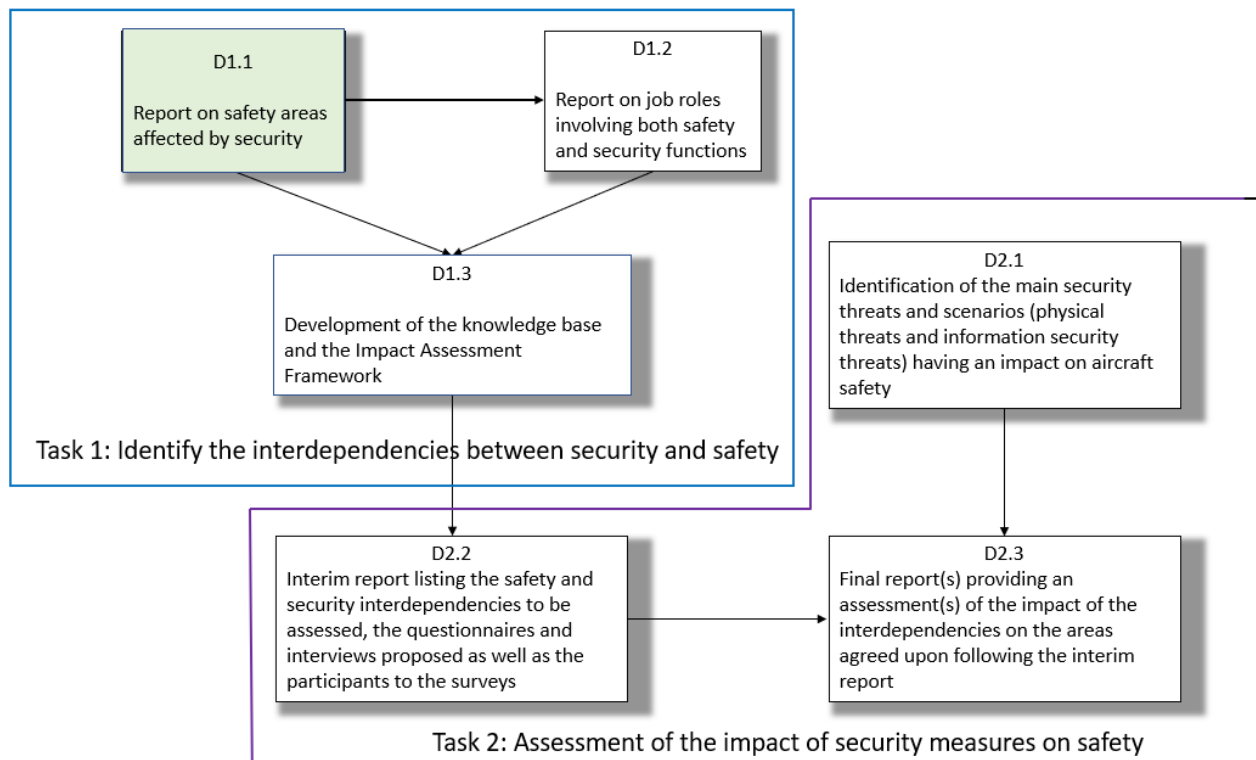
Figure 1. Place and dependencies of D1.1 report in the project

Out of scope of this research

Derogated flights. Flights which are derogated from common basic standards for aviation security, described in the regulation EU1254/2009 and the amendment EU2016/2096 and adopt alternative security measures fall out of scope of this research.

Derogated flights include:
- Aircrafts with a maximum take-off weight of less than 15 000 kilograms
- helicopters
- law enforcement flights
- fire suppression flights
- flights for medical services, emergency or rescue services
- research and development flights
- flights for aerial work
- humanitarian aid flights
- flights operated by air carriers, aircraft manufacturers or maintenance companies, transporting neither passengers and baggage, nor cargo and mail
- flights with aircraft with a maximum take-off weight of less than 45 500 kilograms, owned by a company for the carriage of own staff and non-fare-paying passengers and goods as an aid to the conduct of company business
- flights with aircraft with a maximum take-off weight of less than 45 500 kilograms, chartered or leased in its entirety by a company from an aircraft operator with which it has a written agreement for the carriage of own staff and non-fare-paying passengers and goods as an aid to the conduct of company business
- flights with aircraft with a maximum take-off weight of less than 45 500 kilograms, for the carriage of the owner of the aircraft and of non-fare-paying passengers and goods.

Third countries. Security measures only applicable to third countries are out of the scope of this research. Third countries are countries and territories to which, in accordance with Article 355 of the Treaty on the Functioning of the European Union, Title VI of Part Three of that Treaty does not apply.[2]

More Stringent Measures. As per Article 6 of EC300/2008 States may apply more stringent measures (MSM) than the common basic standards. MSMs are established on basis of national risk assessment and in compliance with Community law. MSMs are part of State NCASP and are not in scope of this research.

Impact of safety measures on security. Through the review of safety and security standards and regulations the impact of safety measures on security was included in this report when it was observed, however the full study of impact of safety measures on security would require a separate comprehensive study. This report does not provide the full map of those safety measures that may have an impact on aviation security.

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[2] COMMISSION IMPLEMENTING REGULATION (EU) 2015/1998 of 5 November 2015 laying down detailed measures for the implementation of the common basic standards on aviation security. Current consolidated version: 01/04/2023

5. Introduction

General considerations

Security measures, standards and regulations have historically been developed in reaction to identified threats or acts of unlawful interference. ICAO Annex 17 on Aviation Security, paragraph 2.1.1 states that "each Contracting State shall have as its primary objective the safety of passengers, crew, ground personnel and the general public in all matters related to safeguarding international civil aviation against acts of unlawful interference".

The regulation of aviation security has largely developed in reaction to successful or thwarted acts of unlawful interference with security measures being introduced to reduce the vulnerability of the system or reducing the risk of similar event from either being successful in the future or from happening again. At a macro level then, the impact of each security measure on safety is a positive one as security measures are increasing protection against acts of unlawful inference and therefore reducing the risk of harm. On a more granular level, there is the possibility that an individual security measure may impact aviation safety operations, systems, equipment or human factors by creating conditions where there is a potential for increased safety risk or reduction in the effectiveness of a mitigation. Equally, there is potential that an individual security measures may positively impact safety. The aim of this study is not to dispute the overarching necessity for implemented security measures but to look at interactions between safety and security, identifying and analysing areas of dependency (Fig.2).

The main purpose of introduced security measures is to prevent acts of unlawful interference, as such, at strategic level the impact of those measures remains positive.

Security measures may have an impact on aviation systems, processes, procedures and people, generating additional safety risk that may contribute to the development of unsafe conditions.
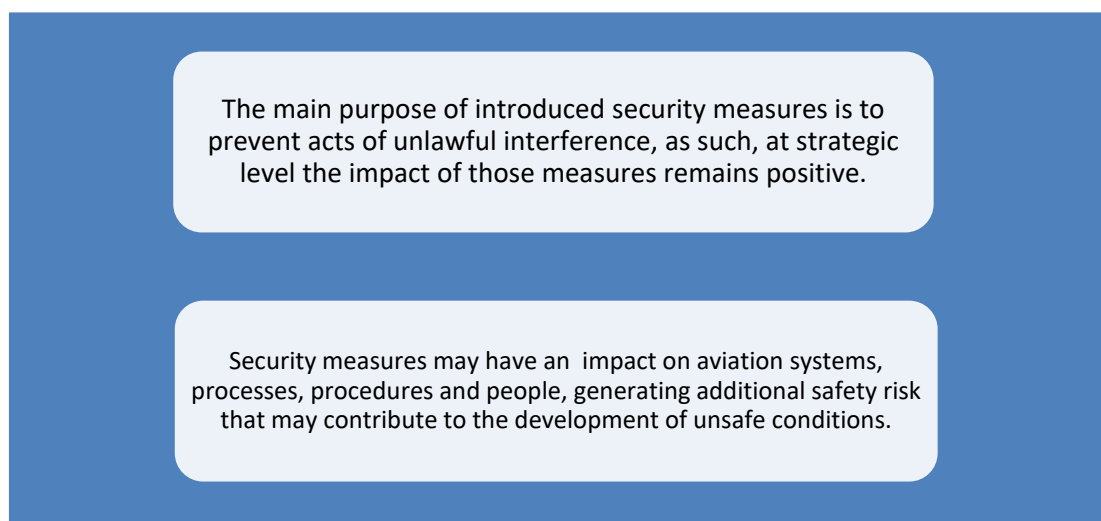
Figure 2. Impact of security measures on safety

Definition of aviation security

Article 3 of EC300/2008, Common Basic Standards in the field of civil aviation security, defines Aviation Security as "*the combination of measures and human and material resources intended to safeguard civil aviation against acts of unlawful interference that jeopardise the security of civil aviation*"[3]. ICAO Annex 17 defines Aviation Security as "*Safeguarding civil aviation against acts of unlawful interference. This objective is achieved by a combination of measures and human and material resources.*" Acts of unlawful interference are also defined in Annex 17 as "*acts or attempted acts such as to jeopardize the safety of civil aviation.*" Aviation security is therefore an essential element of the overall safety system, and it is composed of three main elements:

a) **Measures** include international, regional and national standards and recommended practices, including legally binding regulations, best practice, national rules, processes and individual SOPs

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[3] REGULATION(EC)No300/2008 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 11March2008 on common rules in the field of civil aviation security and repealing Regulation (EC)No2320/2002

established in order to protect civil aviation from acts of unlawful interference. Legal framework for aviation security constitutes a collection of security measures. When a new security measure is introduced, it may have an impact on safety, may duplicate existing safety regulation or contradict existing safety regulation.

b) **Human resources** include the human element of the security system. Recruitment, training, skills, knowledge, human factors, performance and actions. The human element is central to security systems and staff require specific cognitive abilities, skills, and knowledge to fulfil their assigned security functions. Several roles and functions within the aviation system include safety and security responsibilities. Where a safety - security interdependency exists, staff is likely to assess the risks and make trade-offs and need to be prepared to deal with potentially conflicting priorities. These tasks may have to be completed simultaneously in a fast-paced environment with some security related requirements having an impact on aviation safety, personal health and safety or human factors.

c) **Material resources** include equipment and facilities provided to safeguard civil aviation from acts of unlawful interference. There is a variety of equipment and material resources used solely in the security domain, for example screening equipment. Aircraft systems and equipment also provides additional resources to protect civil aviation against acts of unlawful interference. Systems and equipment installed on the aircraft for security purposes may impact other safety equipment installed on the aircraft, on aircraft operations or staff.

In the context of definition of aviation security, this study examines security requirements, processes, procedures, physical security as well as cyber security measures that may have an impact on safety.

Nature of potential interdependencies

a) **Regulatory overlap** – when a defined requirement is subject to safety and security regulations. These are more visible interdependencies where the requirement may be duplicated in both domains. It may be more challenging for the industry to comply with both safety and security measures if the measures are referred to in both sets of regulation, for example, perimeter fencing which has specific requirements from a security perspective and a separate function from a safety perspective.

1. **Challenges of regulatory overlap.** Entities having to comply with both safety and security regulations must identify two sources and establish processes and procedures that will satisfy both and keep track of potential updates of both. Possible issues when overlap occurs:

   i. Change to the regulation may result in conflicting rules or rules being established, changed or withdrawn in uncoordinated manner. With time, areas of duplication may develop, creating ambiguity and misunderstandings

   ii. Those drafting as well as those implementing safety rules may not have access and/or security vetting to access security detailed measures

   iii. Those drafting as well as those implementing security rules may not have skills or knowledge regarding safety rules and vice versa

   iv. Duplication of oversight – compliance monitoring activities conducted through safety and security oversight. Avoiding duplication of regulation would lead to more efficient use of NAA's resources and furthermore would increase efficiency for the industry regarding compliance monitoring activities

2. On some occasions, even with regulatory overlap the impact of one regulatory domain on the other is positive when the regulations are converging. This is the case when one source of regulation specifies the requirements, and the other source provides more detailed requirements or guidance. An example of this may be safety - security interdependency in case of security requirements for Carriage of potentially disruptive passengers. Security regulation require that the appropriate authority notifies an air carrier if it is intended to carry potentially disruptive passengers. This notification allows the air carrier staff to fully adhere to safety requirements in relation to seat allocation and enables the crew to implement Threat and Error Management strategies, allowing the crew to anticipate the issues and be better prepared for recovery should the situation arise. Similarly, in the area of Dangerous Goods carried as cargo, the security regulation states, "Assembled explosive and incendiary devices that are not carried

in accordance with the applicable safety rules shall be considered as prohibited" and the safety regulations describe in detail what these "safety rules" are.

b) **Interdependency with either positive, neutral or negative impact** – this is identified when specific security requirements included in security regulations are not directly referred to in safety regulations, however they may have an impact on safety operations or outcomes. A commonly cited example being the searching of external aircraft hatches and panels for security purposes. Whilst this is an effective means of ensuring no prohibited items are present in these areas, there is potential safety risk being created when these hatches and panels are not being properly closed and the security staff inspecting them are not appropriately trained (from a safety perspective).

c) **Missed opportunity** – occurs when there is no direct safety - security interdependency, however operational experience demonstrates that implementation of additional measures, guidance or considerations would positively impact safety. When observed these missed opportunities were listed in this study.

Initial mapping of interdependencies and their impact

In instances where an interdependency is identified, the impact will be systematically assessed during this research framework (task 2). It needs to be considered that entities applying security measures set up by their NCASP may conduct relevant risk assessments and as a result they may apply additional measures to counteract any negative impact on aviation safety. Therefore, some measures reducing the negative impact may have already been implemented by the industry, although this is not visible through the review of the standards and regulations alone. For example, wearing the airport ID in the visible place - if the lanyard ID is too long, it can pose an occupational safety hazard for baggage loaders if it gets tangled in the belt during baggage loading/unloading. To reduce the impact of this security measure simple solutions are already deployed for example in the form of the armbands used for ID cards for loaders. These solutions are not necessarily included in the regulatory framework but are an outcome of operational experience, risk assessments and considerations for health and safety. Further investigation undertaken in tasks 2 and 3 of this research and engagement with stakeholders will provide more clarity in those areas.

Security regulations reviewed in this research

The first task of this research was to establish the entities in scope and the security regulations. To establish this, following documents were reviewed:

- ICAO Annex 17 – Aviation Security. Safeguarding International Civil Aviation against Acts of Unlawful Interference. Twelfth Edition, July 2022. Annex 17 incorporates measures mandated on States by ICAO to prevent and suppress all acts of unlawful interference against civil aviation throughout the world. Annex 17 Standards and Recommended Practices (SARPs) shall be (unless differences are filed) incorporated into national legislation to be applicable to regulated entities.

  o ICAO Annex 17 supplies a list of relevant safety annexes and chapters where security standards are referred to. This goes some way to signposting the interdependencies and as such these sections were also examined for the purpose of this research.

- ICAO Doc 8973 – Restricted. Aviation Security Manual. Thirteenth Edition, 2022. Doc 8973 provides guidance to States on how to comply with Annex 17 SARPs. Doc 8973 applies to the same entities as Annex 17, predominantly to States and NAA's. Where applicable, provisions were referenced in this paper however it must be noted that Doc 8973 only provides guidance not regulatory requirements.

- ICAO Doc 9985 – Air Traffic Management Security Manual (restricted). First Edition, 2013. This manual complements the Aviation Security Manual (Doc 8973 – Restricted) and provides guidance on security issues specific to ATM in order to assist States and ATSPs in implementing appropriate security provisions to meet the published requirements of the NCASP.

- ICAO Doc 9811 - Manual on the Implementation of the Security Provisions of Annex 6. First Edition, 2002. The objective of Doc 9811 is to provide guidance on the implementation of the security Standards of Annex 6 and it addresses three major areas: the security of the flight crew area, aeroplane search procedures and the training programme for flight and cabin crew members.

- Commission Regulation (EC) No 300/2008 of the European Parliament and of the Council of 11 March 2008 on common rules in the field of civil aviation security and repealing Regulation (EC) No 2320/2002. Current consolidated version: 01/02/2010. Regulation (EC) No 300/2008 sets out common basic rules and standards for aviation security in order to protect persons and goods entering, leaving or within the European Union from acts of unlawful interference and provides common interpretation of ICAO Annex 17. Article 2 of EC300/2008 defines the scope of the regulation – which are all airports or parts of airports located in the territory of a Member State that are not exclusively used for military purposes, all operators, including air carriers, providing services at airports (not exclusively used for military purposes) and all entities applying aviation security standards listed in section Entities in scope of security regulations (below), that operate from premises located inside or outside airport premises and provide goods and/or services to or through airports.

- Commission Regulation (EC) No 272/2009 of 2 April 2009 supplementing the common basic standards on civil aviation security laid down in the Annex to Regulation (EC) No 300/2008 of the European Parliament and of the Council. Current consolidated version: 21/03/2013. Regulation (EC) No 272/2009 contains general measures designed to amend non-essential elements of the common basic standards on civil aviation security. Entities in scope of this regulation remain the same as those in scope of Regulation (EC) No 300/2008 and Implementing Regulation (EU) No 2015/1998.

- Commission Regulation (EU) No 1254/2009 of 18 December 2009 amended by the Commission Regulation (EU) 2016/2096 of 30 November 2016 setting criteria to allow Member States to derogate from the common basic standards on civil aviation security and to adopt alternative security measures. Current consolidated version: 21/12/2016. Regulation (EU) No 2016/2096 sets criteria to allow Member States to derogate from the common basic standards on civil aviation security and to adopt alternative security measures that provide adequate protection on basis of local risk assessment. Flights derogated from common basic standards were considered out of scope of this research.

- Commission Implementing Regulation (EU) 2015/1998 of 5 November 2015 laying down detailed measures for the implementation of the common basic standards on aviation security. Current consolidated version: 01/04/2023. The Implementing Regulation lays down detailed measures for the implementation of the common basic standards on aviation security. All entities in scope of regulation (EC) No 300/2008 are also in scope of the Implementing Regulation. The Implementing Regulation provides however, more detail in regard to entities involved in protection of the civil aviation against acts of unlawful interference and more detailed reference to specific job roles. The Implementing Regulation (EU) No 2015/1998 was essential to identify implemented security measures that may have an impact on safety.

- Commission Implementing Decision C(2015)/8005 lays down detailed measures and procedures for the implementation of the common basic standards on aviation security containing sensitive security information. This report does not make any specific references to non-public processes or procedures outlined in the Implementing Decision. All entities in scope of the Implementing Regulation (EU) No 2015/1998 are also in scope of the Implementing Decision.

- (ECAC) *Doc 30 Part II Policy statement in the field of civil aviation security* replicates EU common basic standards. Whilst not enforceable in the same way as the EU regulations, it nevertheless sets an agreed standard for the 44 ECAC member states which is the same as EU regulations.

Entities in scope of security regulations

The NCASP shall define responsibilities for the implementation of "common basic standards" (as per Annex 1 of the Regulation (EC) No 300/2008) which shall be reflected in the NCASP. These include:

- Airport security
- Demarcated areas of airports
- Aircraft security
- Passenger and cabin baggage
- Hold baggage
- Cargo and Mail
- Air carrier mail and air carrier materials
- In-flight supplies
- Airport supplies
- In-flight security measures
- Staff recruitment and training
- Security equipment
- Additional measures like cyber security or security culture which are not covered by a specific chapter in the regulation

It is left to the State Authority to assign entities with responsibilities to implement these basic standards and some of them may be different in different countries (depending on the NCASP arrangements). It can be concluded however the list of entities in the scope of regulations would typically cover:

- National Appropriate Authorities, Regulators and Compliance/Oversight bodies (where they form part of the governing structure)
- Entities (including their subcontractors e.g., MRO of air carriers or security service providers of an airport) as prescribed by the National Civil Aviation Security Program, including but not limited to:

  o Airports (typically responsible for access control and passenger/cabin baggage screening)
  o Air carriers (typically responsible for aircraft protection and aircraft search)
  o Regulated Agents (typically responsible for cargo screening)
  o Known Consignors (typically responsible for cargo security controls)
  o Regulated Suppliers of In-flight supplies
  o Known Suppliers of Airport Supplies
  o ATS/ATM

Some entities may fall within the scope of the regulations and have the scope increased because they are or decide to become vendor for the entity assigned with responsibilities through the NCASP.
This may be the case of e.g., aircraft cleaning company that may have increased security responsibility if it contracts aircraft search as a service for the aircraft operator.
Other entities may fall within the scope of regulation due to specific NCASP arrangements, e.g., some States may regulate directly through NCASP security training providers (e.g., ASTO – Aviation Security Training Organisations).

6. Mapping safety - security interdependencies

ICAO Annex 17 supplies a list of relevant safety Annexes and chapters where security standards are referred to. This effectively presents the list of safety - security interdependencies and as such these sections were also examined for the purpose of this research.

To identify interdependencies, the European Regulations Framework was examined including each specific regulation under the framework. The below chart indicates where interdependency may directly or indirectly occur. Where the specific regulations relate to one area of safety there were grouped like in case of aircrew and air operations. For additional clarity, the Implementing Rules of EASA Basic Regulation not in scope of this research were also listed in this chart.

Regulation	Area of safety	Possible safety – security dependency
Basic Regulation (EU) 2018/1139	Airworthiness	Aircraft design and maintenance specifications also include security related features
	Aircrew and Air operations	In scope of security standards and regulations
	Aerodromes	In scope of security standards and regulations
	ATM/ANS and air traffic controllers	In scope of security standards and regulations
	Unmanned aircraft	In scope of security recommended practices
Initial Airworthiness IR: (EU) No 748/2012 and Additional airworthiness specifications for operations IR: (EU) 2015/640	Aircraft airworthiness	Part 21 Initial Airworthiness include requirements relating to aircraft design specifications therefore they may be areas of interdependency
Continuing Airworthiness IR: (EU) No 1321/2014	Aircraft airworthiness	Maintenance organisations are not directly in scope of security regulations, however they may be responsible for implementation of security measures required by the air carrier, therefore they may be areas of interdependency
Aircrew IR: (EU) No 1178/2011 and Air Operations IR: (EU) No 965/2012	Air operations including aircrew	Air Carriers are also in scope of security regulations, therefore there will be areas of interdependency

Security training is required for aircrew, therefore there will be areas of interdependency in relation to training |

Regulation	Area of safety	Possible safety – security dependency
Balloons – Air Operations IR: (EU) 2018/395	Not in scope	Not in scope
Sailplanes – Air Operations IR: (EU) 2018/1976	Not in scope	Not in scope
Third country operators IR: (EU) No 452/2014	Not in scope	Not in scope
ATM/ANS provision of services – Air Traffic Management/Air Navigation Services IR: (EU) 2017/373 and Air Traffic Controllers IR: (EU) 2015/340	Air traffic services, air traffic management including air traffic control	ATM/ANS are also in scope of security standards and ICAO Doc 9985 therefore there may be areas of interdependency ATCOs training includes security elements therefore there may be areas of interdependency
Interoperability of the European ATM Network IR: (EU) 1079/2012 IR: (EU) 1207/2011 IR: (EU) 1206/2011 IR: (EU) 29/2009 IR: (EC) 262/2009 IR: (EC) 633/2007 IR: (EC) 1033/2006 IR: (EC) 1032/2006	Interoperability	Not in scope
Airspace usage requirements (ACAS II) IR: (EU) No 1332/2011	Airspace	Not in scope
Airspace usage requirements (PBN) IR: (EU) 2018/1048	Airspace	Not in scope
SERA IR: (EU) No 923/2012	Rules of the air	Not in scope
Aerodromes IR: (EU) No 139/2014	Aerodromes / airport operations	Airport operators are also in scope of security regulations therefore, there will be areas of interdependency
Unmanned Aircraft Systems (UAS) (Rules and procedures for the operation of unmanned aircraft) IR: (EU) 2019/947	Unmanned aircraft	UAS are not in scope of EU security regulations, however, are referred to in ICAO Doc 8973, therefore there may be areas of interdependency
UAS and third-country operators of unmanned aircraft systems) DR: (EU) 2019/945	UAS – third country operators	Not in scope

Regulation	Area of safety	Possible safety – security dependency
Regulatory framework for the U-space IR: (EU) 2021/664	U-space	Entities in scope of this regulation may also be in scope of security regulations therefore, there may be areas of interdependency
Information Security DA: (EU) 2022/1645 IR: (EU) 2023/203	All areas of safety	Entities in scope of this regulation are also in scope of security regulations therefore, there may be areas of interdependency
Other safety standards and regulations considered for the purpose of this research		
ICAO Annexes 6 – Operation of Aircraft, 8 – Airworthiness of Aircraft, 9 – Facilitation, 11 – Air Traffic Services, 14 – Aerodromes, 18 – Safe transport of Dangerous Goods, 19 – Safety Management	Aircraft operation, airworthiness, air traffic, dangerous goods, aerodromes, safety management	ICAO Standards and Recommended Practices also contain security related standards
ICAO Doc 9284-AN/905	Dangerous Goods	Some prohibited articles are also considered DGs, therefore there may be an area of interdependency
ICAO Doc 10147	Dangerous Goods	Some prohibited articles are also considered DGs, therefore there may be areas of interdependency
Occurrence Reporting IR: (EU) 376/2014	All areas of safety	Occurrence reporting includes reporting of security related incidents and security breaches therefore there may be areas of interdependency
Draft (EU)Ground Handling Regulation	Ground operations	GH staff have to comply with relevant security measures applicable to air carriers and airport operators, therefore there will be areas of interdependency
Certification Specifications for Large Aeroplanes (CS-25)	Aircraft safety	There are security related certification specifications therefore there will be areas of interdependency

Table 1. Mapping safety – security interdependency

Table 1 presents an initial outline of the safety areas that could potentially be impacted by security measures. These areas encompass airworthiness of the aircraft, unmanned aircraft, air operations, aerodromes, air traffic services, ground operations, dangerous goods. Entities in scope of these regulations include organisations responsible for the aircraft safety (both manufactures, operators and maintenance organisations), operators of the UASs, airport operators, entities responsible for screening (security screening and prevention of Dangerous Goods), air carriers and operators including cargo, as well as ground handling operators providing essential services at the airport.

National Appropriate Authorities have defined responsibilities within both safety and security domain, as such they are in scope of this research. The nature of activities undertaken by NAA's differs however, from other considered entities. Task 1 does not focus on those who regulates but on entities that are regulated and must apply security measures outlined in European Common Basic Standards, regulation (EC) No 300/2008, Implementing Regulation (EU) 2015/1998 and Implementing Decision (C)2015/8005.

Considering the complexity of safety and security regulatory systems, and safety and security measures given entities have to apply, it is proposed to group the areas of safety into primary categories first before looking into more detailed areas. Primary categories of safety areas affected by security are:

- Aircraft and aircraft equipment (including design, certification and airworthiness)
- Unmanned Aircraft Systems
- Air Traffic Services and Management
- Aerodrome (including screening and screening equipment)
- Air Operations
- Ground Operations

7. Safety areas affected by security measures

In order to comprehensively outline the safety areas influenced by security measures, it was essential to categorise the primary areas beforehand. The main categories presented in this chapter pertain to the regulatory framework and the principal regulatory domains. Within each of these categories, specific safety areas impacted by security measures are listed. To compile this list of areas, security measures are identified based on Regulation (EC) No 300/2008 (Common Basic Standards), Implementing Regulation (EU) No 2015/1998, ICAO Annex 17 and when required other security related standards. The first column denotes the security measure, followed by the corresponding regulatory reference (security – second column and safety – third column). The last column indicates the safety area affected by the respective security measure. The initial description is provided in the Initial analysis of the nature of the interdependency between safety and security section. This constitutes the initial analysis that will be further investigated during the framework of this research project (Task 2 and Task 3). Subsequently, the impact of the listed measures on safety areas will be assessed.

Primary categories of safety areas affected by security are:
- Aircraft and aircraft equipment (including design, certification and airworthiness)
- Unmanned Aircraft Systems
- Air Traffic Services and Management
- Aerodrome (including screening and screening equipment)
- Air Operations
- Ground Operations

7.1 Aircraft safety

This section examines the security measures associated with an aircraft safety including aircraft airworthiness, aiming to identify specific safety areas that could potentially be impacted by these measures.

Definition of airworthiness refers to the state of the aircraft, engine, propeller or part when it conforms to its approved design and is in a condition for safe operation[4]. SARPs of the ICAO Annex 8 are applicable to aircraft with a maximum certificated take-off mass greater than 5 700 kg and are intended for the carriage of passengers or cargo or mail in international air navigation. Aircraft not in scope of Annex 8 and CS-25 are out of the scope of this research.

Standards and Recommended Practices relating to security features of aircraft design and certification are contained in ICAO Annex 8 *Airworthiness of Aircraft*. In the EU, security related requirements specific to aircraft design are contained in Certification Standards for Large Aeroplanes CS-25.795. As per CS-25 an airworthy aircraft includes design features that are aimed to minimise the effect of an act of unlawful interference.

The areas that may be affected by these security measures are:
- Aircraft design and certification
- Aircraft systems and system security (cyber security) including information security
- Air carrier emergency procedures and training (analysed in section related to air carrier)
- Aircraft maintenance in relation to maintenance organisations (MRO, CAMO)

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[4] ICAO, Annex 8 Airworthiness of Aircraft, Thirteenth Edition, July 2022

Security measure that may have impact on safety	Security regulation	Relevant safety regulations	Area of safety
#1 Least Risk Bomb Location (LRBL)	Guidance: Doc 8973, 17.14.7 In-flight aircraft search procedures and Annex 2 to Appendix 44 Dealing with chemical/biological events during the flight	ICAO Annex 8, Part III A, Chapter 11.2 ICAO Annex 8, Part III B, Chapter 10.2 CS 25.795 Security considerations AMC 25.795(c)(1) Least risk bomb location AMC1 ORO.CC.125(c) Aircraft type specific training and operator conversion training AMC1 ORO.GEN.110(a) Operator responsibilities	Design and certification Air carrier emergency procedures and training (analysed in section related to air carrier)
#2 Features of Interior Design	N/A	ICAO Annex 8, Part III A, Chapter 11.4 ICAO Annex 8, Part III B, Chapter 10.4 CS 25.795 Security considerations AMC 25.795(c)(3) Interior design to facilitate searches	Design and certification
#3 Protection of Flight Crew Compartment (relating to aircraft design)	Guidance: Doc 8973, Aircraft Security	ICAO Annex 8, Part III A, Chapter 11.3 ICAO Annex 8, Part III B, Chapter 10.3 CS 25.795 Security considerations AMC 25.795(a)(1) Flightdeck intrusion resistance	Aircraft design and certification
#4 Other security considerations (relating to aircraft design)	N/A	CS 25.795 Security considerations	Aircraft design and certification
#5 Protection of aircraft equipment, systems and networks	EU2015/1998 1.7	ICAO Annex 8, Chapter 4, Continuing Airworthiness, 4.2.1.5 and 4.2.1.6 CS 25.1319 Equipment, systems and network information protection and H25.6 Information system security Instructions for Continued Airworthiness	Cyber security, Information security

Security measure that may have impact on safety	Security regulation	Relevant safety regulations	Area of safety
		General AMC for Airworthiness of Products, Parts and Appliances (AMC-20)	
#6 Security of parts, equipment and tools	N/A	ICAO Annex 8, chapter 6, Maintenance Organisation Approval	Aircraft maintenance

Table 2. Identification of safety areas affected by security measures in relation to aircraft safety

Initial description of the nature of the interdependency between safety and security

Security Measure	Safety Area
#1 Least Risk Bomb Location (LRBL)	**Design and certification**

Consideration shall be given during the design of the aeroplane to the provision of a least-risk bomb location so as to minimise the effects of an explosive device (IED) on the aeroplane and its occupants. CS 25.795 *Security considerations* refer to Federal Aviation Administration Advisory Circular (AC) 25.795-6, Least Risk Bomb Location, issue date 24 October 2008.

LRBL is specific to aircraft type, and it is designed to decrease the effects of explosion in passenger cabin. Its exact location should not be marked or disclosed to public. Aircraft manufacturers need to take into consideration aircraft systems and equipment in the vicinity of the LRBL. Additionally, operator emergency procedures should be developed to maximise positive safety outcomes including flight crew procedures to reduce cabin pressure and specific to aircraft type, methodology for building up the area. LRBL may therefore affect aircraft design features, safety and security training of aircrew and aircrew emergency procedures.

For Air Carrier procedures and training see: Section Air Operations, #7 Security training of Flight Crew and Cabin Crew.

Security measure	Safety area
#2 Features of Interior Design	**Design and certification**

Consideration shall be given to design features that will deter the easy concealment of weapons, explosives or other dangerous objects on board aircraft and that will facilitate search procedures for such objects. AMC 25.795(c)(3) *Interior design to facilitate searches*, refers to interior aircraft design to facilitate searches, issue date 24 October 2008.

Specific requirements regarding aircraft design standards are included in safety regulations. The level of complexity of the aircraft and number of stowages and hatches accessible to passengers may affect complexity of aircraft searches (detailed in Implementing Regulation (EU) No 2015/1998 and Commission Implementing Decision C2015/8005). This security requirement prevents easy concealment of prohibited articles on-board the aircraft and ensures aircraft security search or checks (if required) are facilitated. This results in less complex operational procedures if security check or search is required, also leading to reduced workload. This security feature impacts the air carrier SOP's and human factors.

Security measure	Safety area
#3 Protection of Flight Crew Compartment	**Design and certification**

The flight crew compartment bulkheads, floors and ceilings shall be designed to resist penetration by small arms fire and grenade shrapnel and to resist forcible intrusion, if these areas are accessible in flight to passengers and cabin crew. AMC 25.795(a)(1) *Flightdeck intrusion resistance* refers to Federal Aviation Administration Advisory Circular (AC) 25.795-1A, *Flightdeck Intrusion Resistance*, issue date 24 October 2008.

The features of the flight deck compartment described in the above FAA Advisory Circular (AC) 25.795-1A may have an adverse impact on safety in instances where quick access to the flight deck is required due to flight crew incapacitation or emergency landing. Flight deck doorknob shape and size is designed to prevent forced entry, although in some instances it may make entry difficult in normal circumstances potentially having an impact on emergency procedures.

Dead bolt feature of the flight deck door can be used in two modes. Key operable and key inoperable. Key inoperable position prevents entry to the flight crew compartment and there is no provision to override this. This is an essential protection measure in case of hijack when crew could be forced by the perpetrators to open the doors. However, in the case of flight crew deliberately locking the door, this system prevents crew from taking any further action.

Security measure	Safety area
#4 Other security considerations	**Design and certification**

Other security considerations of aircraft design include:
a) **Flight deck smoke protection.** This feature requires that an aircraft is designed to limit the entry of smoke, fumes, and noxious gases into the flightdeck in the event of detonation of an explosive or incendiary device on the aircraft. This security measure should also prevent smoke and fumes entering the flight deck compartment in the event of fire or smoke in the cabin enabling flight crew to operate the aircraft safely in an emergency.
b) **Passenger cabin smoke protection.** This security measure requires that an airplane is designed with means to prevent passengers from being incapacitated by smoke, fumes, and noxious gases that result from detonation of an explosive or incendiary device during flight. This feature may also have positive impact on passenger safety in the event of a fire/smoke in the cabin.
c) **Cargo compartment fire suppression.** The fire suppression system for the cargo compartment should be designed to withstand a sudden and extensive explosion and fire, such as could be caused by an explosive or incendiary device.
d) **Survivability of the systems.** This feature requires that redundant airplane systems necessary for continued safe flight and landing must be physically separated by certain minimum distances.
e) **Security of chemical oxygen generators.** This feature ensures the access to the COG is limited to prevent tampering and inadvertent activation which would create a risk to safety.

These security considerations of the aircraft design may have potential positive impact on safety not only against acts of unlawful interference but also during other emergencies.

Security measure	Safety area
#5 Protection of aircraft equipment, systems and networks	**Cyber security**

As outlined in CS 25.1319 aircraft *equipment, systems and networks, considered separately and in relation to other systems, must be protected from intentional unauthorised electronic interactions (IUEIs) that may result in adverse effects on the safety of the aeroplane.*

Additionally, ICAO Annex 8, chapter 4 on continuing airworthiness requires that sensitive aviation security information is not transmitted when distributing continuing airworthiness information. The sensitive information transmitted to the appropriate authority should be securely transmitted in accordance with the ICAO Annex 17. This shows that there is an interdependency between safety and security on the management of continuing airworthiness.

Security measure **#6 Security of parts, equipment and tools**	Safety area **Aircraft maintenance**

While security regulations primarily focus on areas other than maintenance organisations, ICAO Annex 8, Chapter 6 requires maintaining adequate storage security for parts, equipment, tools, and materials within maintenance organisations. Additionally, there are specific requirements regarding the security of records. Failing to ensure proper security measures for these aspects could elevate the risk of unlawful interference or sabotage, potentially leading to the use of unsafe aircraft parts. Therefore, it is evident that a relationship exists between safety and security in the realm of aircraft maintenance management.

7.2 Unmanned Aircraft Systems

This section examines the security measures associated with unmanned aircraft systems and their operators, aiming to identify specific safety areas that could potentially be impacted by these measures.

The 'unmanned aircraft system' (UAS) also referred to as 'drone' is defined by the Regulation (EU) 2019/947 as "*an unmanned aircraft and the equipment to control it remotely".* The 'unmanned aircraft system operator' (UAS operator) means "*any legal or natural person operating or intending to operate one or more UAS"*[5].

ICAO Doc 9873 contains guidance in relation to protection of civil aviation infrastructure against unmanned aircraft. It focuses on measures that might be taken by States to prevent, respond to, or mitigate the impact of acts of unlawful interference against civil aviation using UA. These recommendations include approach to regulation, counter UA technology, incident response and local contingency plans.

Typically, an Unmanned Aircraft System (UAS) comprises three essential components: the Unmanned Aircraft (UA) itself, the Control Unit (CU) responsible for managing and directing the UA, and a data link (C2 link) facilitating seamless communication and data transfer between the CU and the UA.
Unmanned aircraft (UA) may include remotely piloted aircraft (RPA), unmanned free balloons or model aircraft, all operating as part of a system (UAS).

The areas that may be affected by these security measures are:
- UAS operation
- Aerodrome operational systems
- Area of crisis management, contingency plans, emergency response primarily at the airports

Security measure that may have impact on safety	Security regulation	Relevant safety regulations	Area of safety
#1 Development of UAS regulations	Guidance: Doc 8973	(EU) 2019/947 & (EU) 2019/945) (EU) 2022/425	UAS operation

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[5] Easy Access Rules for Unmanned Aircraft Systems (Regulation (EU) 2019/947 and Regulation (EU) 2019/945)

Security measure that may have impact on safety	Security regulation	Relevant safety regulations	Area of safety
#2 Development of UAS traffic management	Guidance: Doc 8973	(EU) 2019/947, Annex D to AMC1 to Article 11	UAS operation
#3 Counter UAS technology	Guidance: Doc 8973	N/A	Aerodrome operational systems
#4 Preparedness and incident response	Guidance: Doc 8973	(EU) 2019/947, UAS.SPEC.050	Crisis management

Table 3. Identification of safety areas affected by security measures in relation to UAS

Initial description of the nature of the interdependency between safety and security

Security measure	Safety area
#1 Development of UAS regulations	**UAS operations**

Unmanned Aircraft Systems (UAS) are not directly encompassed within the scope of the existing security regulatory framework, and regulations pertaining to drone safety and security are still in their early stages of development. ICAO Doc 8973 offers guidance to States listing regulatory aspects that could be addressed on the national level. This guidance includes elements that hold relevance to both safety and security domains. While some of these elements are also integrated into safety regulations, certain aspects specifically pertaining to security remain unaddressed by the current regulatory framework.

Aspects of the UAS operations that contribute to aviation safety and are addressed in regulation (EU) 2019/947 & (EU) 2019/945 include:
- Operating limitations, for example exclusion (no-fly) zones near the airports, visual line-of-sight, geo-fencing
- Registration schemes
- Remote pilot competency and certification
- Remote identification / electronic identification

Regulation (EU) 2019/947 & (EU) 2019/945 refers to security requirements several times when describing responsibilities of UAS operators and responsibilities of remote pilots, however these security requirements are not clearly specified in the current security regulatory framework. For example, "*the UAS operator should develop procedures to ensure that the security requirements applicable to the area of operations are compiled during the intended operation[6]*" or, as outlined in Article 12(1)(c) - *Authorising operations in the 'specific' category, " the UAS operator has provided a statement confirming that the intended operation complies with any applicable Union and national rules relating to it, in particular, with regard to (…) security (…)".*

This research framework will delve deeper into UAS-related threats to aviation through a detailed assessment in Task 2.1.

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[6] Easy Access Rules for Unmanned Aircraft Systems, Cover Regulation to Implementing Regulation (EU) 2019/947, AMC4 Article 11 Rules for conducting an operational risk assessment.

Security measure	Safety area
#2 UAS traffic management	**UAS operations**

The operations and number of UAS operators are continuously increasing, and further developments in this area will lead to the sharing of airspace between unmanned and manned aircraft.

The aim of Unmanned Aircraft System Traffic Management (UTM) is to ensure the safe, orderly, and efficient management of UAS operations, collaborating with all parties and involving both airborne and ground-based functions. UTM is envisioned to be interoperable with existing Air Traffic Management (ATM) systems to facilitate seamless and scalable operations. Safety is paramount in integrating UAS with manned aircraft and existing aviation systems. Key principles include regulatory oversight, equitable access to airspace, qualifications of UAS operators and pilots, security and safety oversight, fostering a safety and security culture, and facilitating accident/incident reporting. When considering UTM operational approval, States must assess various factors related to safety security and operational requirements, airspace structure, spectrum availability, traffic density, automation capabilities, and more[7].

Currently in security context it is recognised that the development of UTM may assist authorities in identification and recognition of illegally operated unmanned aircraft or unmanned aircraft with malicious intent. UAS Implementing Regulation (EU) 2019/947 refers to UTM Surveillance Service, UTM Early Conflict Detection and Resolution Service and UTM Dynamic Geofencing, pointing out that these applications may not currently exist and these refer to possible future applications of automated traffic management systems for unmanned aircraft in an UTM/U-space environment.

Security measure	Safety area
#3 Counter-UAS technology	**Aerodrome operational systems**

Given the rapid advancement of unmanned aircraft systems (UAS) technology, it is crucial to establish suitable systems that safeguard civil aviation against both intentional and unintentional disruptions caused by UAS. While a wide range of counter UAS technologies exists, the field is still in its early stages without agreed-upon standards. The available solutions primarily focus on identifying and mitigating the risks posed by UAS (passive systems that aim to identify the UA), including techniques such as disabling or destroying the unmanned aircraft through various means like weaponry, capture or electromagnetic interference (active systems). However, it is essential to assess the potential implications these measures, both passive and active, may have on overall aviation safety. For instance, they may interfere with navigational systems, telecommunications, ground equipment and safety installations, or even pose a risk of bodily injury.

The guidance provided in ICAO Doc 8973 regarding counter-UAS solutions may be essential not only in security but also in the safety environment, particularly for those involved in development and procurement of such technologies. It is crucial to consider the effectiveness of these solutions, their suitability in various operational environments, which entities will be responsible for authorising their use, potential limitations and their future viability. Additionally, it is important to assess any potential negative impact associated with their utilisation, including considerations for related to the environment and aviation safety.

Security measure	Safety area
#4 Preparedness and incident response	**Crisis management**

ICAO Doc 8973 guidance provides recommendations for developing suitable crisis management plans and local contingency plans, with a specific focus on addressing the malicious use of UA, especially with the intention to cause disruption. Typically, such contingency plans are integrated into an airport contingency plan, which covers a broad spectrum of emergency situations encompassing both safety and security related emergencies.

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[7] ICAO, Unmanned Aircraft Systems Traffic Management (UTM) – A Common Framework with Core Principles for Global Harmonization, Edition 4.

Furthermore, the guidance also includes instructions on implementing UA sighting reporting mechanisms and outlines the decision-making process to be followed in the event of UA incursion and different threat scenarios.

The safety domain primarily addresses the non-malicious use of UAS and focuses on UAS operator, remote pilot skills and knowledge related to possible emergencies including incursions.

UAS.SPEC.050 requires the UAS operator to establish procedures and limitations adopted to the type of the intended operation and the risk involved, including procedures to ensure that security requirements applicable to the area of operations are complied with in the intended operation and measures are developed to protect against unlawful interference and unauthorised access.

7.3 Area of Air Traffic Services

This section examines the security measures associated with air traffic control and air traffic services, aiming to identify specific safety areas that could potentially be impacted by these measures.

ICAO Annex 17 standard 3.6 requires air traffic service providers operating in that state to establish and implement appropriate security provisions to meet the requirements of the national civil aviation security programme of that State. Additionally, security measures relevant to ATS/ATM are contained in ICAO Air Traffic Management Security Manual (Doc 9985 – Restricted). In the European context, standards pertaining to Air Traffic Management (ATM) security are integrated into ECAC doc 30 Part II. This document outlines the objectives, scope, application of these standards, as well as the responsibilities of Member States regarding ATM security.

It was identified that ATM security has a wider scope than other aviation security measures. There is a dual scope of security measures implemented by the ATM organisations. Firstly, they are responsible for protection of its own infrastructure and systems against acts of unlawful interference. Secondly their *operational* role involves supporting other partners engaged in civil aviation activities, predominantly aviation security, law enforcement and national security.

EU security regulation does not directly refer to ATS/ ATM in relation to the above requirements.

ATM security is defined in the ICAO Circular 330 as *the contribution of the ATM system to civil aviation security, national security and defence, and law enforcement; and the safeguarding of the ATM system from security threats and vulnerabilities[8].* ATM security contributes to aviation security by:
- protecting the ATM system against security threats – this is also referred to as *internal* function
- supporting organisations and authorities engaged in aviation security, national security, defence, and law enforcement – this is referred to as *operational* function

The areas that may be affected by these security measures are:
- ATS systems and system security (cyber security)
- Infrastructure
- Staff recruitment and training
- Organisational requirements
- Emergency procedures and contingency planning
- Operations
- Management system

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[8] ICAO Circular 330, Civil/Military Cooperation in Air Traffic Management, 2011

Security measure that may have impact on safety	Security regulation	Relevant safety regulation	Area of safety
#1 ICT system security	Guidance: Doc 9985 Appendix B, 3	EU2017/373 ATM/ANS.OR.D.010 Security management	Cyber security
#2 Protection of facilities	Guidance: Doc 9985 Guidance: Doc 8973 11.2.4.9 & 11.2.4.10	EU2017/373 ATM/ANS.OR.B.025 Facilities requirements	Infrastructure
#3 Personnel security	Guidance: Doc 9985 Guidance: Doc 8973	EU2017/373 ATM/ANS.OR.B.020 Personnel requirements	Staff recruitment & training
#4 Contingency planning	Guidance: Doc 9985 Guidance: Doc 8973 17.14.8.5 & 17.14.8.6 17.14.8.7	Annex 11 — Air Traffic Services, Attachment C 'Material relating to contingency planning' ATS.OR.135 Contingency arrangements	Organisational requirements Emergency procedures
#5 ATM contribution to safeguarding against AUI	Guidance: Doc 8973 4.4.1.7 & 10.4.4 &17.3.5 Guidance: Doc9985	Annex 10, 2.1 SSR Annex 11, 2.24 Service to aircraft in the event of an emergency & 5 Alerting service Annex 13 Aircraft accident and incident investigation	Operations
#6 Security management system	Guidance: Doc 9985 Guidance: Doc 8973	EU2017/373 ATM/ANS.OR.B.005 Management system ATM/ANS.OR.D.010 Security management	Management system

Table 4. Identification of safety areas affected by security measures in relation to air traffic services

Initial description of the nature of the interdependency between safety and security

Security measure **#1 ICT system security**	Safety area **Cyber security**

The main purpose of this measure is to protect internal systems against security threats and vulnerabilities. Guidance related to cyber security for ATM/ATS contained in ICAO Doc 9985 Air Traffic Management Security Manual is based on ICAO Doc 8973. These are minimum requirements that States should require from industry operators including ATSPs. ATM/ANS is reliant on secure transfer of data, aeronautical information and software. Cyber security provisions are part of safety regulation (EU) No 2017/373 and are included in following elements:

- Changes to a functional system
- Contingency plans

- Provision of aeronautical data
- Aeronautical data quality management
- Management system
- Change management procedures
- Personnel requirements
- Record-keeping
- Security management
- Aeronautical information management
- Tools and software
- Validation and verification
- Metadata
- Data error detection and authentication
- Safety assessment and assurance of changes to the functional system
- Verification
- Pre-flight information services
- Aeronautical data and information
- Technical and operational competence and capability

Compromising internal ATM systems have a potential to cause serious safety issues. Remote ATC towers, for example, depend entirely on adequate data transfer and system protection to operate safely and ensure service continuity.

Security measure	Safety area
#2 Protection of facilities	**Infrastructure**

As outlined in ATM/ANS.OR.B.025 *a service provider shall ensure that there are adequate and appropriate facilities to perform and manage all tasks and activities in accordance with the applicable requirements*. Guidance for ATM physical security is outlined in ICAO restricted documents, Doc 9985 and Doc 8973 and represents recommended best practice.

ATM/ANS organisations must protect internal infrastructure and systems against security threats. As such, at the high level it contributes to aviation security and ultimately safety. Adequate infrastructure security protects not only employees but also aviation critical assets and stored information.

The compromise of ATM infrastructure security would have a potential to seriously jeopardise the safety and security of passengers and staff. ATS facilities can be located both inside and outside of the airport perimeter, therefore security measures will differ depending on the location.

Security measure	Safety area
#3 Personnel security	**Recruitment and training**

ICAO Doc 8973 and Doc 9985 provide guidance relevant to personnel security and a description of personnel security programmes that the ATSP may follow. These guidance documents include risk categorisation, screening and vetting, personnel termination and transfer, access agreements, third-party personnel, sanctions, support and visitor control. Where the ATS facilities are located inside the airport perimeter, staff will also require an airport identification card (AIC) therefore relevant security processes and requirements will be followed to mitigate what is widely referred to as the insider risk. Safety regulation ATM/ANS.OR.B.020 also describes personnel requirements, however it is focused on the requirements for accountable manager and nominated post holders.

Although both safety and security domains refer to personnel requirements, they cover different aspects of requirements.

Security measure	Safety area
#4 Contingency planning	**Emergency procedures**

Contingency plans and arrangements shall extend across a wide variety of emergencies including both safety and security. Guidance contained in ICAO Doc 9985 & Doc 8973 refers to security elements of contingency planning, whilst safety regulation ATM/ANS.OR.A.070 requires that *a service provider shall have in place contingency plans **for all** the services it provides in the case of events which result in significant degradation or interruption of its operations.* Contingency plans are required in case of emergencies in the area of provided services but also in the area of the ATM own system infrastructure. Continuity of service should be enabled in the face of major outages, natural disasters, civil unrest or security threats. The main responsibility of ATS is to maintain flight safety even during unusual or emergency situations.

Security measure	Safety area
#5 ATM/ATS contribution to safeguarding against AUI	**Operations**

The ATM *operational* role consists of providing support to organisations and authorities engaged in aviation security, national security, defence, and law enforcement. ATM services for aviation security contribute to safeguarding civil aviation against unlawful interferences. Specific areas include monitoring and detecting possible cases of unlawful interference, responding to cases of unlawful interference and assistance during bomb threats scenarios. Coordination and communication with different aviation stakeholders enables maintaining safety for those directly affected by the AUI and other traffic in the area.

Air traffic controllers should be able to recognise and respond to overt and covert messages indicating the aircraft may be subject to unlawful interference. ATCO training includes the topic of unlawful interference and aircraft bomb threat training in Aerodrome Control and Visual Rating (ADV), Aerodrome Control Instrument Rating for Tower — ADI (TWR), Area Control Surveillance Rating (ACS) and Approach Control Procedural Rating.

Security measure	Safety area
#6 Security Management System (SeMS & SMS)	**Management system**

ATM/ANS.OR.B.005 outlines requirements for ATM/ANS management system which focuses on both safety and security. Security management system shall be integral to safety management system.

As outlined in section Aerodrome / Airport operations, #7, the integration of safety and security management system can result in safety benefits.

Management systems tend to be developed and implemented independently i.e., quality, environment, occupational health and safety, security and safety. From a security and safety perspective, without a mutual exchange of information, and taking into consideration third party arrangements, there could be a misunderstanding/breakdown in the system resulting in an unwanted safety or security event. Joint integrated management systems encourage coordination rather than independent systems with similar content i.e., accountability/responsibility, policies and procedures, sufficient numbers of trained/qualified personnel, security/safety manuals, compliance monitoring process etc. This also includes safety and security reporting systems, some of which may be integrated for safety - security occurrences.

7.4 Area of Aerodrome / Airport Operations

This section examines the security measures associated with aerodrome operations (excluding security screening), aiming to identify specific safety areas that could potentially be impacted by these measures.

According to Art. 2.1 (e) of Regulation (EU) 2018/1139, the applicability of the Basic Regulation (BR) in the domain of aerodromes is as follows:
The design, maintenance and operation of aerodromes, including the safety-related equipment used at those aerodromes, located in the territory to which the Treaties apply, which:

- are open to public use;
- serve commercial air transport; and
- have a paved instrument runway of 800 metres or more, or exclusively serve helicopters using instrument approach or departure procedures;

According to Art. 2.7 of the Basic Regulation, a Member State can decide to exempt the design, maintenance and operation of an aerodrome, and its safety-related equipment, where that aerodrome handles no more than 10,000 commercial air transport passengers per year and no more than 850 movements related to cargo operations per year. However, the Member State concerned must ensure that such exemption does not endanger compliance with the essential requirements for aerodromes that are detailed in the Annex VII of the Basic Regulation. These aerodromes should remain under the regulatory control of the Member States.

Aerodromes that are controlled and operated by the military, as well as air traffic management and air navigation services ('ATM/ANS') that are provided or made available by the military, should be excluded from the scope of this research.

Defining 'airport'. Both safety and security standards and regulations provide requirements that airport operators have to comply with. Whilst security requirements refer to 'airport security' and 'airport operations', safety regulations refer to 'aerodrome'. Aerodrome is defined in Basic Regulation (EU) No 2018/1139 as a "*defined area, on land or on water, on a fixed, fixed offshore or floating structure, including any buildings, installations and equipment thereon, intended to be used either wholly or in part for the arrival, departure and surface movement of aircraft*". Security regulation does not define the 'airport'. Whilst safety definition refers to physical structure, buildings, facilities and equipment and operational procedures, security standards and regulations apply to the entirety of entities operating within the aerodrome perimeter, also including security screening equipment.

All stakeholders operating within the airport environment are subject to safety - security interdependencies and should be considered when the airport operator is developing its Airport Security Programme. The stakeholders with specific safety function include ground handling which may contract de-icing and refuelling companies, independent aircraft servicing organizations, regulated agent. There are other stakeholders providing a service such as cleaning companies, known suppliers or regulated entities. Airport law enforcement entities include customs, border control and immigration authorities. Emergency response services like firefighting and rescue services, medical services, off-airport authorities responsible for law enforcement functions and other tenants on airport property.

Individuals responsible for a specific safety function or delivering a service to the airport on behalf of a regulated entity, fall into the scope of security Implementing Regulation (EU) No 2015/1998. Their security responsibilities include (but are not limited to): recognising suspicious behaviour and unauthorised access, reporting suspicious behaviour or unauthorised access, responding appropriately to security incidents.

These same individuals fall into the scope of safety requirements of ADR.OR.D.017 *Training and proficiency check programmes*, if they are allowed unescorted access to the movement area and other operational areas of the aerodrome. All personnel operating within the boundary of an aerodrome, operate within the area where safety and security responsibilities cross over.

The areas that may be affected by these security measures are:

- Management system
- Aerodrome design and certification
- Aerodrome operations
- Aerodrome systems (cyber security)
- Contingency planning and emergency response
- Recruitment and training

Security measure that may have impact on safety	Security regulation	Relevant safety standards and regulations	Area of safety
#1 Airport planning requirements	EC300/2008, 1.1 EU2015/1998 1.1	ICAO Annex 14 Vol 1, AMC1 ADR.AR.B.005(c) Management system	Management system
#2 Boundaries	EC300/2008, 1.1 EU2015/1998 1.1	ICAO Annex 14 Vol 1, EU 2018/1139 Definitions ADR.OR.B.015 Application for a certificate GM1 ADR.OR.B.015(b)(2) Application for a certificate	Certification
#3 Access control and security surveillance patrols	EC300/2008, 1.5 EU2015/1998 1.5	ADR.OPS.B.033 Control of pedestrians AMC1 ADR.OPS.B.033(a) Control of pedestrians AMC1 ADR.OPS.B.033(b) Control of pedestrians	Operations
#4 Fencing	EC300/2008, 1.1 EU2015/1998 1.1 Guidance: Doc 8973, 11.2.2 Airport perimeter protection	Annex 14 Vol 1, 1.10 CS ADR-DSN.T.920 Fencing GM1 ADR-DSN.T.920 Fencing	Certification
#5 Identification and protection of critical information, technology, systems and data	EU2015/1998 1.7	ADR.OR.D.007 (e) Management of aeronautical data and aeronautical information GM1 ADR.OR.D.007(b) Management of aeronautical data and aeronautical information ADR.OR.D.030 ADR.OR.D.035 ADR.OPS.A.010	Cyber security
#6 Demarcated areas	EC300/2008, 2 EU2016/2096	N/A	Design
#7 Management system	Guidance: Doc 8973 Chapter 9.3 Security Management System	ICAO Annex 19 and supporting guidance: Doc 9859, ADR.AR.B.005 Management system	Management System

Security measure that may have impact on safety	Security regulation	Relevant safety standards and regulations	Area of safety
#8 Aerodrome emergency response plan	EU2015/1998, 11 Guidance: Doc 8973 Definitions, Chapter 17	Annex 14, 9.1 ADR.OPS.B.005 Aerodrome emergency planning	Emergency procedures
#9 Training and vetting requirements	Annex 17 3.4 EC 300/2008, 11 Staff recruitment and training, EU 2015/1998, Chapter 11	ADR.OR.D.017 Training and proficiency check programmes	Recruitment and Training
#10 Isolated aircraft parking position	Guidance: Doc 8973, 17.8 Isolated aircraft parking position	Annex 14, 3.14 CS ADR-DSN.A.002 Definitions CS ADR-DSN.F.370 Isolated aircraft parking position GM3 ADR.OPS.B.005(a) Aerodrome emergency planning	Design
#11 Other measures implemented under airport operator responsibility	Annex 17 EC 300/2008 EU 2015/1998	EU139/2014	Operations

Table 5. Identification of safety areas affected by security measures in relation to aerodrome operations

Initial description of the nature of the interdependency between safety and security

Security measure	Safety area
#1 Airport planning requirements	**Management system**

Security regulations provide requirements for airport planning taking into consideration landside, airside, security restricted areas and the critical part of the security restricted area. Safety domain refers to manoeuvring area, movement area or apron. The area of interdependency relating to boundaries are further described in #2 Boundaries.

AMC1 ADR.AR.B.005(c) describes that coordination arrangements should be established between the Competent Authority and security agencies to ensure integration of security measures into the design and construction of an airport and optimisation of security measures. These safety provision allows for better integration of safety and security domains.

Security measure	Safety area
#2 Boundaries	**Certification**

In the safety domain, the aerodrome boundary should include, at least, runways, taxiways, aprons, associated strips, runway end safety areas, stopways, clearways, aerodrome visual aids, fixed aerodrome equipment, other aerodrome operational areas, and areas adjacent to the movement area.

The movement area is that part of an aerodrome to be used for the take-off, landing and taxiing of aircraft consisting of the manoeuvring area, the manoeuvring area is the part of an aerodrome to be used for the take-off, landing and taxiing of aircraft, excluding aprons. The manoeuvring and movement area must be protected as unauthorised access could increase safety risk. It is imperative that such areas are clearly defined, marked and maintained to differentiate areas of operation.

Security requirements also define areas of the airport: landside, airside, security restricted areas and critical parts of the security restricted areas and, if established, demarcated areas. Safety and security areas and boundaries do not have to correspond which may lead to operational challenges. Effectively, there are two layers of defined areas and boundaries within the airport/ aerodrome.

GM1 ADR.OR.B.015(b)(2) offers a precaution for those applying for aerodrome certification that the aerodrome boundary should not be confused with the boundaries established for other purposes, such as fences, the land ownership boundaries used by local planning authorities, or those used to designate security restricted areas.

Security measure	Safety area
#3 Access control and security surveillance patrols	**Operations**

Areas to be controlled consist of landside, terminal and airside (the movement area).

Security personnel and associated vehicles accessing the movement area must have appropriate authorisation and a vehicle pass. Additionally, knowledge and understanding of aerodrome operations, aircraft turnaround activities, safe practices and procedures, hazards/risks and related mitigation measures are also required. When undertaking security patrols and surveillance personnel will have to comply with safety rules regarding airside driving, entering different areas of the aerodrome, use of the radio and communication with air traffic control.

See: #9 training and vetting requirements

Security measure	Safety area
#4 Fencing	**Certification**

Fencing is required as part of aerodrome certification process.
Security Implementing Regulation (EU) No 2015/1998 point 1.1.1.2 defines that the boundary between landside and airside shall be a physical obstruction that is clearly visible to the general public, and which denies a person unauthorised access. State NCASP may define more specific requirements of the landside/airside boundary and fencing. In the safety domain the purpose of fencing is to prevent unauthorised persons and wildlife that could pose a safety risk to aircraft operations. Aerodrome fencing shall be a barrier that is suitable to adequately manage wildlife and/or prevent an unauthorised access. Safety regulation takes a wider approach when specifying the purpose of aerodrome fencing, covering both unauthorised access and animal control. Security regulation does not take wildlife control into consideration.

Entities designing the aerodrome boundaries and fencing need to comply with both requirements reaching to both sources of the regulation. GM1 ADR-DSN.T.920 provides additional guidance in relation to parameters of aerodrome fencing, additionally NCASP may contain additional specific requirements. In instances where security requirements do not account for safety requirements relating to wildlife, there may be a negative

impact on safety. This will be dependent on specific conditions and aerodrome location and will vary from one aerodrome to another. There may be impact of security regulation on safety and vice versa.

Security measure	Safety area
#5 Identification and protection of critical information	**Cyber security**

Security Implementing Regulation (EU) No 2015/1998 1.7 requires measures to be taken to protect critical information communication technology and systems and data without specifying exact measures to achieve this.
Aerodrome regulation includes cyber provisions in the following elements:

- Management of Aeronautical Data and Aeronautical Information
- Safety reporting system
- Record keeping
- Data Quality

Security measure	Safety area
#6 Demarcated areas	**Design**

The term 'demarcated area' is currently only referred to in the security domain with no reference to such an area in safety regulations. Where permitted by the Appropriate Authority an airport may establish a demarcated area, for flights which have been derogated from basic standards and apply alternative security measures. Not every airport will have a demarcated area, but where this in use, in particular at an airport which operates a permanent or critical part, it is important that all staff working at the airport have awareness of the alternative security measures which apply to the demarcated area, as well as the type of traffic which is permitted to operate from within this area. The type of traffic operating in this area may bring with it specific challenges, e.g., crews who may not always be familiar with the requirements applying to demarcated areas.

See: #2 Boundaries

Security measure	Safety area
#7 Management system	**Management system**

Management systems tend to be developed and implemented independently when they are developed by separate teams i.e., quality, environment, occupational health and safety, security and safety. From a security and safety perspective, without a mutual exchange of information, and taking into consideration third party arrangements, there could be a misunderstanding/breakdown in the system resulting in an unwanted safety - security event. Joint integrated management systems encourage coordination rather than independent systems with similar content i.e., accountability/responsibility, policies and procedures, sufficient numbers of trained/qualified personnel, security/safety manuals, compliance monitoring process etc. This also includes safety and security reporting systems, considering different approaches may be taken by different entities, some of which may be integrated for safety - security occurrences. Whilst this does not have a direct impact on safety, there may be opportunity for better integration of safety and security management systems.

Security measure	Safety area
#8 Aerodrome emergency response plan	**Emergency procedures**

Emergency planning is the process for preparing an airport to cope with an emergency occurring at the airport or in the immediate vicinity. The objective of emergency planning is to minimise the effects of an emergency, particularly in respect of saving lives and maintaining aircraft operations. The plan details the procedures for coordinating the response of different aerodrome agencies including Security and those agencies in the surrounding community that could be of assistance in responding to the emergency.

The plan takes into consideration aircraft accidents, emergencies, ground incidents, sabotage including bomb threats, unlawfully seized aircraft, dangerous goods occurrences etc.

Aerodrome security is an integral part of the emergency response plan and staff should be familiar with its procedures and participate in joint emergency exercises. There could be a potential impact on safety should this not be the case.

Knowledge of emergency response procedures is defined in the Implementing Regulation (EU) No 2015/1998, chapter 11 as a required competency for staff employed by the airport, with exception of those that only require basic security awareness training. Implementing Regulation, however, does not provide specific details of emergency response planning. This would typically be included in training designed to deliver the competencies. In security domain, Doc 8973 provides guidance relating to emergency response plan that may be adopted by States. Aerodrome emergency planning requirements are outlined more in detail in safety regulation.

Security measure	Safety area
#9 Training and vetting requirements	**Recruitment and training**

All personnel allowed unescorted access to movement area or any operational are of an aerodrome is required to be adequately trained and qualified for such access. Equally, all personnel allowed unescorted access to security restricted areas and critical parts should be adequately trained and aware of their security related responsibilities and be appropriately vetted to ensure suitability for the role undertaken. Training requirements are contained in different regulations, with separate syllabi, oversight and possibly during different sessions. Nevertheless, personnel operating within the boundaries of an aerodrome will have to observe safety and security requirements simultaneously. A set of competencies required to operate at the aerodrome includes both safety and security competencies. For example, being aware of the aircraft movements on the ground or applying procedures relating to the FOD but at the same time being vigilant and being able to recognise and report suspicious behaviour or unauthorised access.

When recruiting personnel allowed unescorted access to movement area the entity will have to comply with personnel requirements described in ADR.OR.D.015 *Personnel requirements,* but also with security requirements of the regulation (EC) No 300/2008 and Implementing Regulation (EU) No 2015/1998, chapter 11.

Training requirements and level of staff preparedness for dealing with safety - security interdependencies will be further investigated in Task 1.2 of this research framework.

Security measure	Safety area
#10 Isolated aircraft parking position	**Design**

According to the ICAO Annex 14, an aircraft that is known or believed to be the subject of unlawful interference shall be parked at the suitable, isolated area. Aerodrome regulation, CS ADR-DSN.A.002 defines 'isolated aircraft parking position'. This area may also be used for any aircraft that need to be isolated for other reasons. Doc 8973 provides additional guidance regarding safety considerations for such areas, including location of gas pipelines, refuelling hydrant pipes, electric power cables or prevailing wind direction. Since Doc 8973 is not a regulatory requirement, there may be potential for negative impact on safety if Doc 8973 guidance is not implemented.

Isolated aircraft parking position and emergency planning. As per GM3 ADR.OPS.B.005(a) aerodrome emergency planning document should include information on isolated aircraft parking position in regard to Section 6 — Sabotage including bomb threat (aircraft or structure) and Section 7 — Unlawful seizure of aircraft. When this guidance material is followed, this would allow for better cooperation and would increase performance during an emergency, resulting in positive impact on the overall safety.

See: #8 Aerodrome emergency response plan

Security measure **#11 Other measures implemented under** **airport operator responsibility**	Safety area **Operations**

Several other stakeholders providing services at the airport/aerodrome are subject to safety - security interdependencies. These stakeholders include, but are not limited to, entities providing refuelling, de-icing services, independent aircraft maintenance organisations, cleaning companies, airport suppliers and in-flight supplies (if they have access to restricted areas).

Individuals responsible for delivering a service on behalf of an airport operator fall into the scope of security Implementing Regulation (EU) No 2015/1998 if they are allowed unescorted access to the security restricted area. Their security responsibilities include (but may not be limited to): recognising suspicious behaviour and unauthorised access, reporting suspicious behaviour or unauthorised access, responding appropriately to security incidents.

Same entities fall into the scope of safety requirements of ADR.OR.D.017 *Training and proficiency check programmes*, if they are allowed unescorted access to the movement area and other operational areas of the aerodrome.

See: #9 training and vetting requirements

7.5 Area of Aerodrome / Airport Operations related to security controls and screening

This section examines the security measures associated with airport related security screening, aiming to identify specific safety areas that could potentially be impacted by these measures. These security measures may be implemented directly by the airport or by the contracted third party responsible for screening.

The purpose and methods of security screening are described in the Regulation (EC) 300/2008, Implementing Regulation (EU) 2015/1998 and non-public Commission Implementing Decision C2015/8005.
Airport operator or another entity assigned with such a responsibility via the NCASP including subcontractors that conduct screening activities are required to comply with the above regulatory requirements. The activities examined include screening of passengers and their carry-on baggage, screening of crew and their baggage and screening of hold baggage. There is no direct safety - security regulatory overlap at the EU legislative framework level related to screener job-role in this area in a sense that there are no regulatory safety provisions in relations to screeners. Nevertheless, there are several (EU) 2015/1998 provisions that relate to "safety" in screening processes and therefore impact screener functions. This would include:
- Attachment 4-C – open catalogue of prohibited articles including provision "without prejudice to applicable safety rules"
- point 4.4.2 and 5.4.2 - exemptions from bringing prohibited articles "provided safety rules are complied with"

Additionally, prohibited articles listed in the attachments 1-A, 4-C an 5-B of the Implementing Regulation (EU) 2015/1998 include articles that can be also considered Dangerous Goods.

Additionally, those responsible for screening passengers and crew, their carry-on baggage, screening cargo and mail are in scope of Dangerous Goods Regulations as specified in ICAO Doc 9284, part I, 4.1, Note 2.— *Security personnel who are involved with the screening of passengers and crew and their baggage and cargo or mail are required to be trained irrespective of whether the operator on which the passenger or cargo is to be transported carries dangerous goods as cargo.* Safety - security interdependency in the area of Dangerous Goods prevention will therefore need to be investigated within the framework of the project.

Consideration - Human Factors. Consideration for human factors is a mature concept in civil aviation safety domain. Investigating how human capabilities and limitations impact performance takes its roots from the 1979 NASA research study of accidents[9]. This was quickly adapted to civil aviation, initially for Flight Crew, and later extended to Cabin Crew, aircraft engineers and maintenance organisations[10]. In aircrew environment it is referred to as Crew Resource Management (CRM). Aircrew CRM training is highly regulated with significant training hours being dedicated to enable crew to understand their own limitations and how these affect their performance. Additionally human factors are also managed through application of Flight Time Limitations (FTL), Fatigue Risk Management System (FRMS). Human factors and performance requirements are also included in Initial and Continual Airworthiness regulations for maintenance organisations and their staff. ICAO Doc 10151 Manual on Human Performance (HP) for Regulators "*highlights the importance of integrating human performance (HP) considerations in the development of ICAO Standards and Recommended Practices (SARPs) and in States' associated regulatory activities. It supports regulators to make it easy for people in the aviation system to do the right thing and avoid negative safety consequences*".[11]

To enable security staff to significantly contribute to overall aviation safety and to further strengthen positive impact of security measures on safety, it is recommended to investigate the impact of human factors on screeners to establish what elements of human factors training may contribute to positive safety and security outcomes.

As with all other staff in aviation environment, security staff are equally exposed to stress, fatigue, errors, limitations of attention and perception as well as information processing. Despite this, no significant steps have been taken to increase the understanding of human factors for security staff until recently. The 41st ICAO Assembly provided a vital platform to discuss the importance of human factors, and this is now becoming a priority area for ICAO[12].

There is a potential to further improve safety with the introduction of human factors training for screeners. It must be noted that those providing screening of passengers and their baggage would be more exposed to human factors impact. However, general human factors awareness, for example fatigue awareness, limitations of attention etc. for Regulated Agents providing screening of cargo and mail would also be beneficial.

The list of interdependency areas below was developed based on the analysis of the regulatory framework conducted by subject-matter experts. It forms a basis for further investigation of the nature of interdependencies and as such may evolve.

The areas that may be affected by these security measures are:
- Screener certification
- Transport of Dangerous Goods
- Training
- Organisational responsibility
- Operations
- Aerodrome certification (related to equipment)

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[9] NASA (1980), Resource Management on the Flight Deck, California at:
extension://elhekieabhbkpmcefcoobjddigjcaadp/https://ntrs.nasa.gov/api/citations/19800013796/downloads/19800013796.pdf
[10] Kanki B.G., Anca J., Chidester T. R., (2019) Crew Resource Management, Third Edition, Elsevier
[11] ICAO Doc 10151 Manual on Human Performance (HP) for Regulators First Edition (Advance unedited), 2021
[12] ICAO Working Paper, HUMAN FACTORS IN THE AVIATION SECURITY DOMAIN, 41st Assembly Session, A41-WP\130

Security measure	Security regulation	Relevant safety regulation	Safety area
#1 Mutual recognition of screeners' certification	ICAO Annex 17 EU 2015/1998 11.7.1	Regulation 1139/2021 (art 67.1)	Certification of screeners
#2 Prohibited articles list	EU 2015/1998 1-A, 4-C and 5-B	Regulation 965/2012 Technical Instructions for safe transport of DG by air – ICAO Doc 9284 Part 2 Classification of DGs	Dangerous Goods, Training
#3 Prohibited items authorisation for carriage if "in line with safety rules"	EU 2015/1998 4.4.2 (c), 5.4.2. (b)	Regulation 965/2012, Technical Instructions for safe transport of DG by air	Training
#4 Liquids and gels restrictions	EU 2015/1998 4.1.3	Regulation 965/2012 Technical Instructions for safe transport of DG by air – ICAO Doc 9284 Part 2 Classification of DGs – Class 2 and 3 2.1.1	Dangerous Goods
#5 Separate screening of laptops and other large electrical devices	EU 2015/1998 4.1.2.1	Regulation 965/2012 Technical Instructions for safe transport of DG by air – ICAO Doc 9284 Table 8.1	Dangerous Goods
#6 Responsibility for passenger, cabin baggage and hold baggage screening	EU 300/2008 article 10.1	Regulation 965/2012 CAT.GEN.MPA.200 (c)	Dangerous Goods
#7 Screener training	EU 2015/1998 11.4.1	Regulation 965/2012 ORO.GEN.110 ICAO 10147	Screener training
#8 Refusal to enter CPSRA where an alarm cannot be resolved	EU 2015/1998 4.1.1.2	Regulation 965/2012 CAT.GEN.MPA.200 (c)	Dangerous Goods
#9 Exemption from screening	EU 2015/1998, ICAO Doc 8973 11.3.2	Regulation 965/2012	Operations
#10 Unpredictability/ randomisation	ICAO Annex 17 4.1.2	N/A	Operations
#11 Airport equipment approval	EU 2015/1998 Chapter 12	EU 139/2014 Subpart B – aerodrome operational	Aerodrome certification

Security measure	Security regulation	Relevant safety regulation	Safety area
		services, equipment and installations (ADR.OPS.B)	
#12 Airport equipment – new technologies	EU 2015/1998 4.1.2.5 – 4.1.2.12 5.1.1 (c)	N/A	Dangerous Goods

Table 6. Identification of safety areas affected by security measures in relation to screening

Initial description of the nature of the interdependency between safety and security

Security measure	Safety area
#1 Mutual recognition of screeners' certification	**Certification**

The certification is a term used by "security" and equally "safety" EU regulation. Both, "safety" (art 67.1 of the 1139/2021) and "security" regulations have provisions on mutual recognition, "safety" regulation is however much clearer compared to "security" regulation.

Further investigation within the framework of the project is needed to determine:
- if ambiguity of the "security" regulation has an impact on mutual recognition of screeners' certification, the availability of this workforce and the overall security and safety level at the airport will also be impacted. Airports can gain advantages from implementing a well-defined and organised system for the mutual recognition of competence and certification among screeners. Such an approach would facilitate the smooth transfer of staff and streamlined training procedures, particularly in situations with notable staff shortages that could otherwise hinder overall performance, potentially burdening the existing workforce with increased workload.
- if there's a need to further facilitate harmonisation of screeners' certification rules between EU States to facilitate mutual recognition of screeners' certificates. Although existing regulations contain provisions for mutual recognition of screener certification, their full utilisation is hindered by variations in deployed equipment and processes.

Security measure	Safety area
#2 Prohibited articles list	**Dangerous Goods, Training**

There is overlap between the prohibited articles list and dangerous goods as classified in Technical Instructions for safe transport of DG by air – ICAO Doc 9284, Table 8.1. There are several instances where prohibited articles defined in the security regulation overlap with articles classified as dangerous goods. This regulatory overlap may not only impact the "safety" level of airport operations and screeners' training processes but also impact the safety of aircraft.

Security measure	Safety area
#3 Prohibited items authorisation for carriage if "in line with safety rules"	**Training**

When exemptions to the carriage of prohibited articles are granted, conditions in the Implementing Regulation (EU) No 2015/1998 4.4.2 outline that the applicable safety rules must be complied with. It should be

investigated to what extent screeners need to be aware of safety precautions and which safety precautions they have to comply with.

Security measure	Safety area
#4 Liquids and gels restrictions	**Dangerous Goods**

Restricting certain LAGs reduced its total volume carried by passengers and therefore naturally decreased the safety hazard of some of these being DGs. With the emergence of new technologies and plans to withdraw these restrictions some DGs may not be identified, unless new technology has capability to detect DGs in passenger carry-on baggage.

Security measure	Safety area
#5 Separate screening of laptops and other large electrical devices	**Dangerous Goods**

Separate screening of electrical devices enabled screeners to physically see the device and could help in preventing damaged or counterfeit batteries being allowed into the cabin (safety fire hazard).
With the emergence of new technologies and plans to withdraw these restrictions, some hazardous devices may not be identified.

Security measure	Safety area
#6 Responsibility for passenger, cabin baggage and hold baggage screening	**Dangerous Goods**

Responsibility to perform screening is delegated by the EU Regulation to the National Civil Aviation Security Program level. Regulation 965/2012 clearly indicates the "operator" is responsible for preventing the transport of DGs. It needs therefore to be investigated within the framework of the project to what degree this distribution of responsibilities helps/prevents detection of DGs during passenger, cabin and hold baggage screening processes.

Security measure	Safety area
#7 Screener training	**Training**

Security regulation establishes the framework for x-ray image interpretation training and focuses on detection of prohibited articles. Safety regulation requires screeners to be trained (and complete competency assessment) for the identification of forbidden dangerous goods.
It needs to be investigated within the framework of the project to what degree these two training processes could/should/are aligned.

Current studies show that detection performance especially in 2D x-ray image interpretation depends mostly on the following factors: view difficulty, superposition and container (bag, cargo) complexity. Detection of items can be trained using CBT systems. Additionally, where new 3D screening technology is being introduced additional challenges in relation to staff training are visible, for example personal aptitudes and impact on human factors. Analysis is needed to see if potentially expanding the focus or screeners' attention beyond typical "prohibited articles" to cover DGs impacts their detection results for "prohibited articles".

Training requirements and level of staff preparedness for dealing with safety - security interdependencies will be further investigated in Task 1.2 of this research framework.

Security measure	Safety area
	Dangerous Goods

#8 Refusal to enter CPSRA where an alarm cannot be resolved

Provisions that allow screener to refuse entry to CPSRA for the item that cannot be cleared during screening may contribute to the prevention of "unknown" DGs.

Security measure	Safety area
#9 Exemptions from screening	**Operations**

Inspection activities in both the "security" and "safety" domains play a critical role in ensuring a high level of both safety and security. Immediate access is needed to conduct such inspections and sometimes to quickly detect a "safety" or "security" critical issue. According to ICAO Doc 8973 11.3.2 exemptions from screening should be granted only in case "*screening such persons would negatively impact the safe and secure operations of an airport*". It can be further investigated how screening exemptions are applied to "safety" and "security" inspectors and other staff requiring quick access to security restricted areas and to what degree it impacts their ability to perform their duties.

Security measure	Safety area
#10 Unpredictability/ randomisation	**Operations**

Part of the robust "safety" record of the aviation industry is because of the very high degree of predictability. Every operational activity is based on processes and procedures. Following procedures reassures that the high level of "safety" is maintained. It can be further investigated within the framework of this project if security "unpredictability" and "randomness" have a potential for impact on safety. Although conceptually security value of "unpredictability" and "randomness" is great, safety considerations should be taken into account to ensure e.g. random patrols or random screening activities, especially conducted within or near operationally critical areas (taxi-ways, runways, parking positions) do not create negative safety conditions (e.g. undercover patrol vehicle near the taxi way in the night period).

Security measure	Safety area
#11 Airport equipment approval	**Aerodrome certification**

Certification of screening equipment versus approval/certification of "aerodrome operational services equipment and installations". There is currently no link between the "security" and "safety" processes in the regulations. It needs to be further investigated to understand if this has an impact on airports certification.

Security measure	Safety area
#12 Airport equipment – new technologies	**Dangerous Goods**

Introduction of automation in cabin and hold baggage screening may have an impact on ability to detect Dangerous Goods. Conventional x-ray technology resulted in every image being reviewed and analysed by the screener. EDS technology may be used in a similar way, where all images are being reviewed but has also capability for automated decision making. Development of algorithms identifying both prohibited articles and dangerous goods can positively impact safety in the area of dangerous goods identification and prevention.

Gradual emergence of new technologies changed this process and introduced automation. APIDS (Automatic Prohibited Item Detection) in the context of Explosive Detection Systems (EDS) equipment is becoming available as a technology to allow automated decision making beyond the use of explosive detection algorithms. APIDs is already provided for in EU regulation and creates the opportunity to see concepts of operating in security checkpoint that do not show every image to the screener. This is similar to the concepts of operation already used in Hold Baggage Screening (HBS), where many images will be "cleared" in the automatic mode (which is a security/throughput trade off) resulting in images not being subject to human

(screener) interpretation anymore. It is therefore important to investigate within the framework of this study if Original Equipment Manufacturers (OEMs) considered/are considering prevention of DGs transport compared to solely "prohibited articles" detection. The impact of any "aids", e.g., algorithms need to be also investigated especially regarding screener detection rate.

See: HORIZON EUROPE PROJECT: DETECTION OF LITHIUM BATTERIES USING SECURITY SCREENING EQUIPMENT [EASA.2022.HVP.22]

7.6 Area of Air Operations

This section examines the security measures associated with air operations relevant to air carriers and operators, aiming to identify specific safety areas that could potentially be impacted by these measures.

The areas that may be affected by these security measures are:
- Operating procedures
- Training
- Cyber security

Security measure	Applicable security regulation	Relevant safety regulations	Area of safety
#1 Aircraft Security Search	EC 300/2008 EU 2015/1998, 3.1 272/2009 Part D C2015/8005	Annex 6, Part I CAT, 13.3 965/2012 – Part CAT AMC1 ORO.GEN.110(f)(h) Operator responsibilities	Operating procedures
#2 Aircraft Protection	EC 300/2008 EU 2015/1998, 3.2	N/A	Operating procedures
#3 Carriage of potentially disruptive passengers	EC 300/2008 Article 3, Definitions EU 2015/1998 4.3; 10; 11.2.3.1 (f); 11.2.3.5 (g); 11.2.3.11 (k) ICAO Annex 17, 4.7 ICAO Annex 9, Chapter 6, E	Air Operations 965/2012, Annex IV, Part – CAT, Operating Procedures CAT.OP.MPA.155 Carriage of special categories of passengers (SCPs) AMC3 ORO.MLR.100 Operations manual – general CAT.GEN.MPA.105 Responsibilities of the commander	Operating procedures

Security measure	Applicable security regulation	Relevant safety regulations	Area of safety
		AMC2 CAT.OP.MPA.165 Passenger seating CAT.GEN.MPA.160	
#4 Prohibited articles	EC 300/2008, 10 (point 3 & 4) EU 2015/1998 4.4; Attachment 1 – A, 4 - C, 5-B	CAT.GEN.MPA.155 GM1 CAT.GEN.MPA.155 Carriage of weapons and munitions of war	Operating procedures
#5 Baggage reconciliation	EC 300/2008 5.3 EU 2015/1998 5.3	Draft regulation GH.OPS.110 Baggage tagging AMC1 GH.OPS.110 Baggage tagging	Operating procedures
#6 Security of flight crew compartment	EC 300/2008, 10 EU 2015/1998, 10	ICAO Annex 6, Part I CAT, 13.2 (EU) No 965/2012 SUBPART SEC: SECURITY ORO.SEC.100 Flight crew compartment security – aeroplanes	Operating procedures
#7 Security training of Flight Crew and Cabin Crew	EC 300/2008, 11 EU 2015/1998, 11	AMC2 ORO.GEN.110(a)	Training
#8 Identification and protection of critical information, technology, systems and data	EU 2015/1998 1.7	EU 965/2012, AMC7 SPA.EFB.100(b)(3)	Cyber security

Table 7. Identification of safety areas affected by security measures in relation to air operations

Initial description of the nature of the interdependency between safety and security

Security measure	Safety area
#1 Aircraft Security Search	**Operating procedures**

An aircraft security search is defined by Regulation (EC) No 300/2008 as an inspection of the interior and accessible exterior of the aircraft to detect prohibited articles and unlawful interferences that jeopardise the security of the aircraft. This area of safety - security dependency occurs only when the aircraft is the subject of a security search specified in the Implementing Regulation (EU) 2015/1998, 3.1.1.

Typically, a security search is completed when the aircraft is on the ground before passenger boarding. In some instances, elements of the search may be completed before landing. Staff involved in a security search will also have safety responsibilities specified in AMC1 ORO.GEN.110(f)(h), Operator responsibilities. Safety and security related duties have to be conducted in the timeframe when the aircraft is on the ground. This may create an environment where the responsible staff prioritise either safety or security responsibility. Security search procedures may have an impact on safety, and equally, safety responsibilities may impact on the quality of a

security search. A number of staff may be involved in aircraft searches and the level of impact will depend on the specific job role and training of staff involved.

Similarly, when security search or some elements of it are completed before landing, it may result in conflicting safety-security priorities. This usually takes place when the aircraft is in preparation for landing. The priority for the crew is to secure the cabin for landing ensuring the safety of all passengers and crew. These duties include checking passengers are seated with seatbelts fastened, bags correctly stowed etc. Crew may need to prioritise safety related duties. With inexperienced crew this could result in a negative impact.

Staff training. There is separate security and safety training deriving from different syllabuses. Whilst safety training is regulated by the Air Crew Regulation (EU) 1178/2011 and Air Operations Regulation (EU) 965/2012, security training is regulated by the requirements of the Implementing Regulation (EU) 2015/1998 chapter 11, which specifies competencies of relevant staff in the area of security. There is no element of either safety or security training that would address dealing with conflicting priorities during actual line operation.

Equipment. When opening of panels and hatches is required to reasonably ensure that there are no prohibited articles concealed on board the aircraft, it may result in negative impact on safety. External panels and hatches as well as some internal stowage areas are not designed to be opened on a regular basis as this may result in increased wear and tear. The sealing of external aircraft panels outlined by the Implementing Regulation (EU) 2015/1998 provides a suitable countermeasure.

Security measure	Safety area
#2 Aircraft protection	**Operating procedures**

According to the Implementing Regulation (EU) 2015/1998 3.2.1.1 regardless of where an aircraft is parked at an airport, each of its external doors shall be protected against unauthorised access. This security measure is applicable to aircraft on the ground whilst the air carrier staff are on board or near the aircraft or the aircraft is left unattended. This security measure requires staff to operate aircraft doors, remove steps and challenge personnel near to and boarding the aircraft. As such there may be indirect safety-security dependency. A number of staff may be involved in an aircraft protection and the level of impact will depend on the specific job role and training of staff involved.

Challenging. As required by 3.2.1.1 (a) regardless of the specific job role it is a responsibility of staff at or near the aircraft to immediately challenge unauthorised access. To enable staff to detect unauthorised access, staff are required to monitor the aircraft doors that are open. Depending on the aircraft type, and the number of staff and operator SOPs, this may result in staff compromising other safety related duties, such as pre-departure equipment checks, or security check/search. This may have an impact on human factors (workload, distraction, awareness). Air carrier SOPs may already be established to counteract the possible negative impact of this measure. Additionally, for those roles with specific safety functions like flight crew (aircraft walkaround) or engineers working on a specific task on the aircraft parked in the security restricted area, their attention may be focused on the safety related task and security threats can be easily missed.

Aircraft unattended – closing doors. Staff responsible for closing the aircraft doors must receive appropriate training to ensure their safety and the safety of other staff and to ensure no damage to the aircraft door, door seals and aircraft equipment. Inappropriate door operation without adequate training may have an impact on safety. Staff must be adequately trained to ensure procedures are applied correctly and the risk to staff and the aircraft is minimised. CC, FC, engineers are trained although there is no regulatory reference to training of other staff. There is a potential for negative impact on safety if doors are operated by staff other than CC, FC or engineers.

Security measure	Safety area

#3 Carriage of potentially disruptive passengers   Operating procedures

Both safety and security regulations include rules relevant to carriage of Special Category Passengers (potentially disruptive passengers).

In the security domain 'potentially disruptive passenger' is defined in the regulation (EC) No 300/2008 as a passenger who is either a deportee, a person deemed to be inadmissible for immigration reasons or a person in lawful custody. ICAO Annex 17 defines only 'disruptive passenger', not 'potentially disruptive passenger', although Annex 17 establishes measures relating to 'special category of passengers' in standard 4.7. In the safety regulation CAT.OP.MPA.155 this category of passengers is also referred to as SCPs listed in point (a)(3) deportees, inadmissible passengers or prisoners in custody.

The competent authority is required to notify the air carrier, pre-flight, about the intention to board the 'potentially disruptive passenger'. This requirement is fundamental so the safety requirements in relation to seating requirements can be adhered to. It also has a positive impact on the CRM element of Threat and Error Management allowing staff to anticipate possible threats and make preparations should they encounter issues resulting from disruptive behaviour of such passengers.

If personnel escorting persons in custody are carrying firearms, safety requirements related to safe carriage of firearms apply.

See #4 Prohibited articles

Security measure   Safety area
#4 Prohibited articles   Operating procedures

Both safety and security regulations contain requirements regarding the carriage of weapons. Whilst security regulation provides the list of prohibited articles, and allows exemptions for carriage of firearms, safety regulation sets up safety requirements that have to be met when firearms are carried. Additionally, Dangerous Goods Regulations sets up requirements for the safe carriage of those prohibited articles that are also classified as DGs.

The provision of information to passengers is required by security (Implementing Regulation (EU) No 2015/1998 4.4.3) and DGs domains allowing passengers to identify which articles are prohibited and ensuring these items are not carried into SRAs and on-board the aircraft unintentionally.

Security measure   Safety area
#5 Baggage reconciliation   Operating procedures

Security regulations define the requirements for baggage identification and unaccompanied bags. Baggage reconciliation procedures defined in the Implementing Regulation (EU)2015/1998 5.3 may have an impact on air carrier SOPs. Typically, aircrew and ground handling staff will be involved in baggage reconciliation procedures ensuring security requirements are adhered to. This is completed during operations whilst the aircraft is on the ground and may affect other procedures related to this stage of the flight.

Occasionally when the bags are not properly tagged cabin crew will be involved in a process of baggage reconciliation. This requires all passengers to identify their own bags. Since the procedure may be lengthy and requires coordination with ground handling and effective passenger handling it adds additional workload not normally expected or planned for resulting in flight delays. This may have an impact on other human factors related issues and may lead to other safety related duties to be compromised.

Security measure   Safety area
#6 Security of flight crew compartment   Operating procedures

The rule ORO.SEC.100 falls under Section 10, *In-Flight Security Measures*, and is not directly referenced in either of the Commission Implementing Regulations as considered below.

There are a number of significant safety - security overlaps. These overlaps include the following:

AOC / Operator Procedures

a) Where a secure flight crew compartment door is provided, the requirement is for that operator to develop SOPs (standard operating procedures) for FCC (flight crew compartment) ingress and egress. These procedures must include compliance with ORO.SEC.100(c)(2) as follows:

"Means shall be provided for monitoring from either pilot's station the entire door area outside the flight crew compartment to identify persons that request to enter and to detect suspicious behaviour or potential threat".

It should be noted that the regulation does not refer to the use of CCTV cameras, yet it is difficult to understand how *monitoring from either pilot's station the entire door area outside the flight crew compartment* could otherwise be achieved.

1. Such SOPs also require secondary or 'fall-back' procedures for when CCTV systems become inoperable or unserviceable. These secondary procedures are designed – inter alia – to provide secure access for cabin crew to enter in the course of their duties. There is no current regulatory description of the secure process components or requirements such as password / ID details / methodology, nor of MEL (Minimum Equipment List) restrictions / requirements.

2. Such SOPs must also address the situation where emergency access is required to the FCC. One example might be where incapacitation of the flight crew has taken place, (perhaps due to hypoxia or similar). It is common for the door operating system to have an 'access request' function. Following operation of this request, the default methodology is for the Flight Crew to have a period of time (this differs from system to system) during which to allow or deny access. If neither selection is made, then after a variable period of time, the door security locks default to 'open' in order to permit entry. There is no current regulatory description of the application of such a default methodology, nor of MEL restrictions / requirements.

3. SOPs must also address a malfunction of the electronic locking system – which is normally automatic following activation of the flight deck door system. In the event this system is inoperative, a system of 'deadbolts' can be operated from within the FCC. When the deadbolts are in place, there is no emergency entry possible from the passenger compartment, short of destroying the door. Use of the deadbolt system therefore has a number of very significant issues:

    i. Potential single occupancy of the FCC during flight crew comfort breaks may result in the inability to re-enter the flight crew compartment, if the door is locked intentionally from the inside, like in case of the German Wings tragedy in 2015.

    ii. Potential flight crew incapacitation as in point 2 above.

    iii. The SOP requirement changes, during 'normal' operations causing a flight crew member to leave his/her seat in order to manually unlock the deadbolts to allow for ingress / egress.

    iv. The SOP requirement changes during 'normal' operations where CCTV malfunction may overlap use of the deadbolts as in C) above.

There is no current regulatory description of the application of such a default methodology, nor of MEL restrictions / requirements or MEL interactions with multiple FCC access systems malfunctions.

b) A secure flight deck compartment door is a complex technology, requiring a number of systems, including serviceability testing prior to flight. It seems reasonably common for a test to be conducted at least as part of the 'First Flight of the Day' checklist including the audio / visual signalling of a request for access from the passenger compartment. However, there is no regulatory requirement or guidance with reference to pre-flight testing of the emergency access process, nor of the deadbolt usage. From a Cabin Crew perspective, it is not clear how often the FCC access procedures are reviewed during the Cabin Crew briefing before the first flight of the day.

Security measure	Safety area
#7 Security training of Flight Crew and Cabin Crew	**Training**

AMC1 ORO.GEN.110(a) *Operator responsibilities*, AMC2 ORO.GEN.110(a) *Operator responsibilities*, the associated Guidance Material, GM1 ORO.GEN.110(a) and additionally the AMC Operator responsibilities AMC1 ORO.AOC.100(a) *Application for an air operator certificate* would fall under the Implementing Regulation (EU) No 2015/1998 Section 11 Staff Recruitment & Training. However, not all elements listed below, are reflected in the Implementing Regulation. This could potentially pose challenges for air carriers and operators who must align with both the security training requirements of Implementing regulation (EU) No 2015/1998 and security training programme requirements of AMC1 ORO.GEN.110(a).

There are a number of significant safety - security overlaps contained within the preceding Safety Regulatory References. These overlaps include issues as delineated in the following training reference requirements:

a) **Appropriate self-defence responses**
   1. There is a health and safety risk in training Flight / Cabin Crew personnel in any sort of self-defence technique, centred around personal safety.
   2. There is a health and safety risk in the application of self-defence techniques to travelling members of the public.

b) **Use of non-lethal protective devices assigned to crew members where use is authorised by the Member State**
   1. There is a health and safety risk in the use of non-lethal protective devices directly associated with the previously mentioned self-defence responses.
   2. These devices often also include the use of passenger restraint equipment; there is a health and safety risk in the use of such restraints, including:
      i.   Direct physical safety risk to the restrained person(s).
      ii. Safety implications regarding the procedures for the participation of restrained person(s) in a subsequent emergency situation, such as an evacuation.

c) **Understanding of behaviour of terrorists so as to facilitate the ability of crew members to cope with hijacker behaviour and passenger responses.** Depending upon the level / nature / content of the training associated with terrorist behaviours, there is a mental health safety risk to participant cabin crew when being presented with the nature of terrorist behaviours.

d) **In cases where cabin crew are required to attend live situational training exercises regarding various threat conditions.** The nature of such live situational training exercises may involve third party organisations (Police / specialist firearms officers / Military / Firefighters) and as such will contain a health and safety risk to Flight / Cabin Crew personnel.

e) **Flight crew compartment procedures to protect the aircraft**
   1. Depending upon the nature of any equipment used (for example) to block access to the flight deck door (galley cart / trolleys etc) there may be a safety risk involved in the non-standard and unapproved (by the manufacturer) usage of such equipment.
   2. The advice includes the use of able-bodied passengers to block access to the flight deck door. This may pose a safety risk to the ABPs, to the cabin crew in the event of a misunderstanding and also to any other passengers in the event of confusion on the part of the ABPs.

f) **Aircraft search procedures, in accordance with Regulation (EC) No 300/2008, including identification of prohibited articles.** Regulatory overlap in this area exists with possibility of conflicting information. Specific references to security training programme are contained in the Implementing Regulation (EU) No 2015/1998, whilst GM1 ORO.GEN.110(a) *Operator responsibilities* refers to ICAO Doc 9811 (restricted access) which also contains guidance on the development of training programmes.

g) **Guidance on the least risk bomb locations.** The guidance and training associated with LRBL (Least Risk Bomb Location) often includes the practice construction of such a thing against the relevant part of the aircraft, usually one of the rear doors. If training is conducted on the aircraft, rather than cabin trainer it could lead to damage or obstruction causing malfunction to the door in question.

h) **The CAT operator should establish and maintain a security training programme for ground personnel to acquaint appropriate employees with preventive measures and techniques in relation to passengers, baggage, cargo, mail, equipment, stores and supplies intended for carriage so that they contribute to the prevention of acts of sabotage or other forms of unlawful interference.**
   1. There are a number of safety / maintenance related issues applicable to the Ground Operations element of a CAT flight. These include:

i. Refuelling
ii. De-Icing
iii. Baggage handling / loading / unloading
iv. Aircraft Cleaning
v. Catering loading / unloading
vi. Line Maintenance Activities
vii. Passenger Handling – embarking / disembarking

All of the above activities have a primary safety function and a secondary security function in terms of access control, aircraft protection, aircraft search, detection of suspicious behaviour, access to major aircraft systems and aircraft replenishment – the list is not exhaustive. These training requirements remain the responsibility of the operator, even when the agent may not be a direct employee of the operator.

The Flight Operations regulatory requirement includes both safety and security, yet the training provision of 'second tier' services such as those listed above may not be well provided, monitored, conducted or audited by the operator.

The safety - security overlap is difficult to define without more granular information, although it seems clear that all of the safety functions could be affected by an overlapping security function. For example, there is a requirement for a refueller to be in contact with the flight deck for safety issues during the fuelling of a manned aircraft. The question might be posed as to the details of his responsibility to observe / report suspicious activity in the aircraft vicinity and the communication of such information to the flight / cabin crew.

Training requirements and the level of staff preparedness for dealing with safety - security interdependencies will be further investigated in Task 1.2 of this research framework.

Security measure	Safety area
#8 Identification and protection of critical information, technology, systems and data	**Cyber security**

Security Implementing Regulation (EU) No 2015/1998 1.7 requires measures to be taken to protect critical information communication technology and systems and data without specifying exact measures to achieve this. Following elements included in the Air Operations regulation include cyber provisions:

- Evidence Based Training Programme
- Portable Electronic Devices
- Electronic Flight Bags
- Use of electronic flight bags (EFBs) -Operational Approval
- Record Keeping
- Flight Data Monitoring
- Aeronautical databases
- Handling of flight recorder recordings: Preservation, production, protection and use
- Management of aeronautical databases
- Flight data monitoring (FDM) system
- Aircraft tracking system
- Documents, manuals and information to be carried
- Information to be retained on the ground
- Dangerous goods information and documentation

7.7 Area of Ground Operations

This section examines the security measures associated with ground operations, aiming to identify specific safety areas that could potentially be impacted by these measures. In the current regulatory environment, Ground Handling entities are not separately regulated. There is a DRAFT Commission Delegated Regulation (EU)

laying down requirements and administrative procedures related to ground handling services. Looking ahead to the future regulatory landscape of ground handling operations, specific requirements for ground handling are listed separately withing this section.

Listed security measures may be under the responsibility of the air carrier, however typically they are delegated to the Ground Handling organisations or other supply chain organisations.

The areas that may be affected by these security measures are:
- Ground Handling operating procedures
- Dangerous Goods

Security measure	Applicable security regulation	Relevant safety regulations	Area of safety
#1 Security search	EC 300/2008 EU 2015/1998, 3.1 272/2009 Part D C2015/8005		Operating procedures Dangerous Goods
#2 Aircraft protection	EC 300/2008 EU 2015/1998, 3.2	N/A	Operating procedures
#3 Baggage reconciliation	EC 300/2008 5.3 EU 2015/1998 5.3	Draft regulation GH.OPS.110 Baggage tagging AMC1 GH.OPS.110 Baggage tagging	Operating procedures
#4 Mail and materials	EC 300/2008, 7 EU 2015/1998, 7	AMC2 ORO.GEN.110(a) Operator responsibilities CAT.GEN.MPA.200 Transport of dangerous goods	Operating procedures, Dangerous Goods
#5 General security awareness requirements	EC 300/2008 EU2015/1998	ADR.OR.D.017 Training and proficiency check programmes	Operating procedures

Table 7. Identification of safety areas affected by security measures in relation to ground operations

Initial description of the nature of the interdependency between safety and security

Security measure	Safety area
#1 Security search	**Operating procedures**

An aircraft security search is defined by Regulation (EC) No 300/2008 as an inspection of the interior and accessible exterior of the aircraft to detect prohibited articles and unlawful interferences that jeopardise the security of the aircraft. This area of safety - security dependency occurs only when the aircraft is the subject of a security search specified in the Implementing Regulation (EU) 2015/1998, 3.1.1.

Although air carrier is legally responsible for security search of the aircraft (if applicable), ground handling staff may be responsible for certain elements of the required search like search of aircraft hold. This will be conducted simultaneously with other handling related duties like loading or unloading of aircraft or safety

related responsibilities like reporting observed dangerous goods spillages. Staff performing these duties will fall into safety – security interdependency area.

Security measure	Safety area
#2 Aircraft protection	**Operating procedures**

According to the Implementing Regulation (EU) 2015/1998 3.2.1.1 regardless of where an aircraft is parked at an airport, each of its external doors shall be protected against unauthorised access. This security measure is applicable to aircraft on the ground whilst the air carrier staff are on board or near the aircraft or the aircraft is left unattended. This security measure requires staff to operate aircraft doors, remove steps and challenge personnel near to and boarding the aircraft. As such there may be indirect safety-security dependency. A number of staff may be involved in an aircraft protection and the level of impact will depend on the specific job role and training of staff involved.

Challenging. As required by 3.2.1.1 (a) regardless of the specific job role it is a responsibility of staff at or near the aircraft to immediately challenge unauthorised access. To enable staff to detect unauthorised access, staff are required to monitor the aircraft doors that are open. Although this is typically responsibility of aircrew, GH staff is equally responsible for challenging unauthorised access which will be conducted simultaneously with other ground handling duties.

Aircraft unattended – closing doors, removing steps. Staff responsible for closing the aircraft doors must receive appropriate training to ensure their safety and the safety of other staff and to ensure no damage to the aircraft door, door seals and aircraft equipment. Inappropriate door operation without adequate training may have an impact on safety. Staff must be adequately trained to ensure procedures are applied correctly and the risk to staff and the aircraft is minimised. CC, FC, engineers are trained although there is no regulatory reference to training of other staff. There is a potential for negative impact on safety if doors are operated by staff other than CC, FC or engineers.

Security measure	Safety area
#3 Baggage reconciliation	**Operating procedures**

Security regulations define the requirements for baggage identification and unaccompanied bags. Baggage reconciliation procedures defined in the Implementing Regulation (EU) No 2015/1998 5.3 may have an impact on air carrier SOPs. Typically, aircrew and ground handling staff will be involved in baggage reconciliation procedures ensuring security requirements are adhered to. This is completed during operations whilst the aircraft is on the ground and may affect other aircrew and GH procedures related to this stage of the flight. The baggage reconciliation may be completed directly by the air carrier or may be delegated to ground handling (GH) entity.

GH is often responsible (on behalf of the air carrier) for correct bag reconciliation which involves bag tagging and ensuring all bags are accompanied. Currently there are no safety requirements in this area, although draft Ground Handlin regulation defines procedures for baggage identification like bag tagging. Locating unaccompanied bags may be part of air carrier SOPs role, although it is not a procedure with specifically allocated time, it may therefore create additional workload and have an impact on human factors leading to other safety related duties being compromised.

Security measure	Safety area
#4 Mail and materials	**Operating procedures**

Materials to be loaded onto an aircraft. There are no safety provisions specifically referring to mail and materials being loaded onto an aircraft, however AMC2 ORO.GEN.110(a) defines operator responsibilities

regarding security training programme for ground personnel, which include security provisions for mail and materials being loaded onto an aircraft.

Materials used for passengers and baggage processing. 'Clean desk' policies required by security regulation prevents unauthorised persons to get access to baggage and passenger processing materials like bag labels, boarding cards.

Security measure **#5** General security awareness requirements	Safety area **Operating procedures**

Entities responsible for a specific safety function, and entities delivering a service on behalf of an Air Carrier, fall into the scope of the Implementing Regulation (EU) No 2015/1998 if they are allowed unescorted access to the security restricted area. Their security responsibilities include (but may not be limited to): recognising suspicious behaviour and unauthorised access, reporting suspicious behaviour or unauthorised access and responding appropriately to security incidents.

Same entities fall into the scope of safety requirements of ADR.OR.D.017 *Training and proficiency check programmes* if they are allowed unescorted access to the movement area and other operational areas of the aerodrome.

Safety - security interdependencies relevant to these roles will be further investigated in Task 1.2 of this research framework.

7.8 Off-airport Operations

This section examines the security measures associated with off-airport operations, aiming to identify specific safety areas that could potentially be impacted by these measures. A number of entities falling into scope of security regulations engage in delivery of goods within the airport/aerodrome yet are situated beyond the boundaries of the airport. These include Regulated Agents responsible for cargo security measures or Regulated Supplier of In-flight supplies, hauliers or Known Consignors responsible for cargo security controls. It must be acknowledged that off-airport operations are not part of current safety regulatory remit, and the most significant area of interdependency exists between cargo/supplies screening and prevention of prohibited articles that may be also classified as dangerous goods. In some instances where the goods are being delivered and loaded directly to the aircraft by a Regulated Agent or a Regulated Supplier of in-flight supplies, additionally general airport safety and air carrier/operator safety can be affected.

Security measures applied by off-airport entities have are described in the Regulation (EC) 300/2008, Implementing Regulation (EU) 2015/1998 and non-public Commission Implementing Decision C2015/8005.
The activities examined include screening of cargo and mail, in-flight supplies and supplies and cargo protection. There is no direct safety - security regulatory overlap at the EU legislative framework level related to screener job-role in this area in a sense that there are no regulatory safety provisions in relations to screeners. Nevertheless, there are several (EU) 2015/1998 provisions that relate to "safety" in screening processes and therefore impact screener functions. This would include:

- point 6.0.2 - referring to "applicable safety rules" for cargo transportation

Additionally, those responsible for screening cargo and mail are in scope of Dangerous Goods Regulations as specified in ICAO Doc 9284, part I, 4.1, Note 2.— *Security personnel who are involved with the screening of passengers and crew and their baggage and cargo or mail are required to be trained irrespective of whether the operator on which the passenger or cargo is to be transported carries dangerous goods as cargo.* Safety - security interdependency in the area of Dangerous Goods prevention will therefore need to be investigated within the framework of the project.

All entities and individuals delivering goods that originate at off-airport premises may additionally contribute to the overall aviation safety when goods are being delivered directly to the aircraft.

The areas that may be affected by these security measures are:

- Transport of Dangerous Goods
- Training
- Organisational responsibility
- Safety Management

Security measure	Security regulation	Relevant safety regulation	Safety area
#1 Prohibited items authorisation for carriage if "in line with safety rules"	EU 2015/1998 6.0.2	Regulation 965/2012, Technical Instructions for safe transport of DG by air	Training
#2 Responsibility for cargo and in-flight supplies screening	EC 300/2008 art. 10.1 EU 1998/2015 6.1.1 EU 1998/2015 8	Regulation 965/2012 CAT.GEN.MPA.200 (c)	Organisational responsibility
#3 Screening of cargo and mail	EC 300/2008 art. 10.1 EU 1998/2015 6.2	Technical Instructions for safe transport of DG by air	Dangerous Goods
#4 Approval of Regulated Agents and Regulated Suppliers of in-flight supplies	EU 1998/2015 6.3 EU 1998/2015 8.1.3	N/A	Safety Management
#6 Protection of cargo and mail	EU 1998/2015 6.6	N/A	Safety Management
#7 Security controls in-flight supplies	EC 300/2008, 8 EU 2015/1998, 8.1	N/A	Operating procedures Dangerous Goods
#8 Protection of in-flight supplies	EC 300/2008, 8 EU 2015/1998, 8.2	N/A	Safety Management
#9 Screener training	EU 2015/1998 11.4.1	Regulation 965/2012 ORO.GEN.110 ICAO 10147	Training

Table 7. Identification of safety areas affected by security measures in relation to off-airport operations

Initial description of the nature of the interdependency between safety and security

Security measure	Safety area
#1 Prohibited items authorisation for carriage if "in line with safety rules"	**Training**

When exemptions to the carriage of prohibited articles are granted, conditions in the Implementing Regulation (EU) No 2015/1998 6.0.2 outline that the applicable safety rules must be complied with. It should be investigated to what extent screeners need to be aware of safety precautions and which safety precautions they have to comply with.

Security measure	Safety area
#2 Responsibility for cargo screening	**Organisational responsibility**

Regulation (EU) No 300/2008 states in 6.1.1 "An air carrier shall not accept cargo or mail for carriage on an aircraft unless it has applied such controls itself or their application has been confirmed and accounted for by a regulated agent, a known consignor or an account consignor". Although operationally the regulated agent is primarily responsible for screening (in some cases an air carrier may be a regulated agent) the ultimate accountability for accepting cargo which was screened (when necessary) rests with the aircraft operator. It is also worth noting cargo is transported under the airway bill (AWB) issued by an airline therefore regulated agents handling cargo before loading onto the aircraft are considered part of the cargo "supply chain" and acting as the aircraft operator subcontractors. At the same time the Regulation 965/2012 clearly indicates "operator" responsibility to prevent the transport of Dangerous Goods. It needs therefore, to be investigated within the framework of the project to what degree this alignment helps the detection of DGs during cargo screening processes especially compared to passenger and baggage screening processes.

Security measure	Safety area
#3 Screening of cargo and mail	**Dangerous Goods**

Screening of cargo is required to reasonably ensure there are no prohibited articles in the consignment. There is overlap between the prohibited articles list and dangerous goods as classified in Technical Instructions for safe transport of DG by air – ICAO Doc 9284, Table 8.1. There are several instances where prohibited articles defined in the security regulation overlap with articles classified as dangerous goods. This regulatory overlap may not only impact the "safety" level of airport operations and screeners' training processes but also impact the safety of aircraft.

Security measure	Safety area
#4 Approval of Regulated Agents and Regulated Suppliers of in-flight supplies	**Safety Management**

Any entity that applies security controls of cargo and mail outlined in Implementing regulation (EU) No 2015/1998, chapter 6, shall be approved as a regulated agent. Similarly, entity that applies security controls of in-flight supplies shall be approved as Regulated Supplier of in-flight supplies. This includes third party logistics providers responsible for integrated warehousing and transportation services, air carriers and handling agent. The scope of this approval typically includes verification of security programme and its compliance with the NCASP. Since Regulated Agents and Regulated Suppliers are delivering goods directly to the aircraft, staff involved in transportation and loading of goods operates within the areas of safety – security interdependency. It should be further investigated if the scope of approval of regulated agents should be extended to include safety considerations for example reporting system, Safety Management System (of both airports and air operators), verification of safety training of staff involved in delivery of goods.

Security measure	Safety area
#6 Protection of cargo and mail	**Safety Management**

Protection of cargo and mail entails ensuring security of goods throughout their transportation, handling, storage, and loading onto aircraft. The objective of protecting cargo and mail is to prevent unauthorised interference with items intended for aircraft loading, thereby falling under the realm of security concerns. However, the act of loading goods onto an aircraft introduces a dimension of potential impact on safety, encompassing risks such as inadvertent damage to the aircraft or its equipment, improper loading, or incidents that require reporting.

Personnel responsible for loading these goods must navigate the interplay between security and safety considerations. They bear the responsibility of adhering to security requirements whilst being aware of safety hazards. For example, any observed or induced damages occurring during the loading process must be duly reported, further underscoring the necessity for a comprehensive approach that addresses both security and safety imperatives.

Security measure	Safety area
#7 Security controls of In-flight supplies	**Dangerous Goods**

The air carrier is legally responsible for inflight supplies, although these activities are often contracted to a third-party provider who apply security measures required by the Implementing regulation (EU) No 2015/1998 chapter 8. Security controls applicable to inflight supplies are required to ensure there are no prohibited articles concealed within supplies. Some prohibited articles also fall into the category of dangerous goods.

Security measure	Safety area
#8 Protection of in-flight supplies	**Safety Management**

Protection of in-flight supplies entails ensuring security of goods throughout their transportation, handling, storage, and loading onto aircraft. The objective of protecting supplies is to prevent unauthorised interference with items intended for loading onto the aircraft, thereby falling under the realm of security concerns. However, the act of loading goods onto an aircraft introduces a dimension of potential impact on safety, encompassing risks such as inadvertent damage to the aircraft, its equipment, or incidents that require reporting.

Personnel responsible for loading these goods must navigate the interplay between security and safety considerations. They bear the responsibility of adhering to security requirements whilst being aware of safety hazards. For example, any observed or induced damages occurring during the loading process must be duly reported, further underscoring the necessity for a comprehensive approach that addresses both security and safety imperatives.

8. Conclusion

The objective of Task 1.1 was to identify and understand the areas of interdependency between safety and security, in other words, which security measures affect safety. Once identified, the nature of these interdependencies is then described and will subsequently be assessed in task 2. Task 1 is crucial in determining the direction of the project by identifying the specific safety - security touch points. Civil Aviation is multi-faceted and complex with many disciplines, some of which will have significant safety - security overlap and some which will have very little. The exploration phase was therefore all-encompassing and wide reaching to identify the full extent of the interdependencies between safety and security, not only in the current state but also scanning the horizon for future relationships between the two domains. The regulation of safety and security within civil aviation have largely developed independently of each other with limited and sometime fractious interaction between the two.

Civil aviation is a complex system, in which people, processes and equipment continuously interact and, in many instances, depend on each other. Aviation security is part of this wider aviation system but is also a complex system in its own right. One of the challenges observed during this stage of the project was to present identified interdependencies in a structured and systematic way which required a degree of simplification. It

must be noted that regulatory framework presented in this paper does not represent the entirety of civil aviation regulations. EASA Basic Regulation structure and its Implementing Rules were used to identify interdependencies including other specific safety regulations considered relevant for this project.

Interactions with aviation safety and security experts demonstrate that there is both a necessity and a desire to better integrate safety and security domains. There was a common agreement that even though regulations, and guidance material encourage safety and security entities cooperation and communication, often the implementation of this is not fully effective. It was also recognised that this entire project is fundamental to change the perception, the way experts think about safety and security and the way safety and security is approached. Without better integration and understanding of interdependencies on the national level, the industry and staff operating within the areas of interdependency may implement mechanisms and measures to address these that are not fully visible through compliance monitoring activities and may introduce additional safety risks.

The purpose of this research summary was to understand the nature and scope of the interdependencies between safety and security in order to identify the areas of safety affected by security measures to enable the assessment of the impact that security measures have on safety.

In conclusion, the safety areas impacted by security measures have been systematically categorised into eight primary sections, in large part, aligned with the main safety regulatory framework:

1. **Aircraft and Aircraft Equipment (including design, certification, and airworthiness):** This area encompasses compliance with safety standards and certification specifications for aircraft manufacturers and maintenance organisations. Specific safety areas impacted by security measures include aircraft design and certification, aircraft systems with an emphasis on cyber and information security, air carrier emergency procedures and training (discussed in the section related to Air Operations), and aircraft maintenance concerning maintenance organisations (MRO, CAMO).

2. **Unmanned Aircraft Systems:** This domain pertains to unmanned aircraft (drones) and their operators. Safety areas affected by security measures comprise UAS operations, aerodrome operational systems, and crisis management and emergency response primarily at airports. The examination of UAS operations within this section encompassed two distinct aspects. Firstly, it was recognised that even small, unmanned aircraft, if not adequately managed, can wield considerable influence on overall safety. Furthermore, the implementation of counter-drone systems at airports has the potential to impact various other operational systems within the airport environment. Secondly, a forward-looking perspective was taken into account, acknowledging the imminent potential for UAS to evolve and seamlessly integrate into the aviation landscape. As commercially operated UAS venture into shared airspace with manned aircraft, a significant transformation in aviation dynamics is anticipated. However, it's essential to note that the existing lack of stringent design and manufacturing requirements in the UAS domain might have a negative impact on safety outcomes in such scenarios.

3. **Air Traffic Services and Air Traffic Management:** Focusing on air traffic control and management, this area is pertinent to entities applying both safety and security measures. Specific safety areas influenced by security measures include ATS systems and their cyber security, infrastructure, staff recruitment and training, organisational requirements, emergency procedures, contingency planning, operations, and management systems.

4. **Aerodrome/Airport Operations:** Concerning airport design, planning, and operations, this section is relevant to entities designing and certifying aerodromes and managing their operations. Safety areas impacted by security measures encompass the management system, aerodrome design and certification, aerodrome operations, aerodrome systems' cyber security, contingency planning and emergency response, and staff recruitment and training.

5. **Aerodrome/Airport Operations related to security controls and screening:** This segment addresses safety aspects related to screening within the airport/aerodrome boundaries, particularly screening of

passengers, carry-on baggage and hold baggage. Specific safety areas influenced by security measures include handling of dangerous goods, screener training and recruitment, organisational responsibility, operations, and screening equipment. Although this area is not reflected in current regulatory safety landscape, it was considered important to include, to gain better understanding of the entire safety – security interdependencies in the aviation system.

6. **Air Operations:** Relevant to air carriers and operators, including cargo operators, this area focuses on air operation measures. Specific safety areas affected by security measures encompass operating procedures, staff recruitment and training, and cyber security.

7. **Ground Operations:** Specific to Ground Handling operations, this area acknowledges that in the present regulatory landscape, Ground Handling entities lack separate regulation. Nonetheless, with a potential future regulatory shift, specific requirements are listed separately within this section. Safety areas impacted by security measures comprise Ground Handling operating procedures and handling of dangerous goods.

8. **Off-airport Operations.** Relevant to Regulated Agents, Known Consignors, Regulated suppliers of in-flight supplies and hauliers. Ensuring the security of premises and infrastructure is imperative to avert the introduction of prohibited items into aircraft or airport facilities. Equally vital is the recognition and identification of Dangerous Goods and prohibited articles. Moreover, in instances where services or goods are directly delivered to aircraft, the actions of personnel involved can have an added contribution to overall safety, particularly when these individuals are trained in ramp safety or are equipped to promptly report any safety-related concerns.

The identification of safety areas influenced by security measures marks a pivotal initial stride in this research endeavour, offering a clear trajectory. A comprehensive analysis of the impact of security measures on safety will be systematically undertaken in Task 2. This phase will assess the threats to aircraft safety, enabling a comparative analysis of the safety - security interdependency areas and the most prominent threats. This analytical process will facilitate the recognition of additional safety areas necessitating more in-depth examination, thereby culminating in a comprehensive overview of the intricate interdependencies within the aviation realm.

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EASA

European Union Aviation Safety Agency

European Union Aviation Safety Agency

Konrad-Adenauer-Ufer 3
50668 Cologne
Germany

Mail   EASA.research@easa.europa.eu
Web   www.easa.europa.eu

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