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A SYSTEMATIC REVIEW OF SAFETY MANAGEMENT SYSTEM (SMS) IN AVIATION WITH A FOCUS ON THE SAFETY LEVEL

Summary. Safety is generally characterised as the state of being "safe", the condition of being protected from harm or other non-desirable consequences. One effective way of achieving it is to implement a safety management system (SMS). SMS should be seen as an aggregate strategic aspect of standard business management, understanding its high priority to safety. This article describes and illustrates SMS in aviation, focusing on the similarities and differences in the system approaches adopted by selected Civil Aviation Authorities (CAAs) with the primary focus on the safety level. The main goal is to provide a structural comparison of the system framework within individual CAAs and its explanation in safety-related documents. This article also dealt with the chosen safety approach (reactive, proactive and predictive) and safety performance indicators (SPIs), forming a quality and effective safety system that maintains an acceptable safety level. Finally, this article is mainly based on datasets publicly available through the International Civil Aviation Organisation, Transport Canada, Civil Aviation Safety Authority Australia, Federal Aviation Administration, UK Civil Aviation

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Authority, Civil Aviation Administration of China and Civil Aviation Authority of
New Zealand websites and documentation related to safety.
Keywords: safety management system, SMS framework, SMS approach

1. INTRODUCTION

Many authors characterised safety as the state in which the chance of harm to persons or
property damage is decreased and maintained at or under an acceptable (adequate) level within
continuing hazard identification and risk management [18, 25-27, 40]. Air safety and its
improvement have constantly been the highest priority for the airline industry, and achieving
an adequate air safety record is essential to an airline's success [23]. Safety Management System
(SMS) presents a framework of methodologies, specifications, and mechanisms that help
organisations understand safety principles, create and customise a management framework
ideal for accomplishing each organisation's required safety outcomes. Even though safety
management was a preferred mechanism to improve occupational health and safety, it has
developed into a much more complete system including psychological, organisational, social,
and technological approaches to safety and systems thinking [231]. A safety system is created
to continuously improve safety by identifying hazards, managing and examining data and
continually evaluate safety risks. The SMS attempts to proactively check or mitigate threats
before they appear in aviation accidents and incidents. It is a system that is comparable to the
organisation's regulatory obligations and safety goals [17]. The International Civil Aviation
Organisation (ICAO) characterised SMS as a "systematic approach to managing safety,
including the necessary organisational structures, accountabilities, policies and procedures"
[15]. This definition also represents a conventional interpretation of the term "safety
management system" and is reflected in almost every other description. Aviation is becoming
a regulatory requirement. Civil Aviation Authorities (CAAs) need to find methods to manage
safety management activities to achieve means to show compliance with actual regulations
[239]. The International Civil Aviation Organisation (ICAO), Transport Canada (TC), Civil
Aviation Safety Authority Australia (CASA), Federal Aviation Administration (FAA), the UK
Civil Aviation Authority (UK CAA), Civil Aviation Administration of China (CAAC), CAA
New Zealand (CAA NZ) have made significant progress in the development, implementation,
and refinement of SMS. Selected aviation authorities also provide a clear and accurate picture
of the system in place and its features.

2. CIVIL AVIATION AUTHORITIES (CAAS)

INTERNATIONAL CIVIL AVIATION ORGANISATION (ICAO)
The International Civil Aviation Organisation (ICAO) was founded in 1947 and it is a
specific agency of the United Nations. To ensure safe and organised development, it modifies
the principles and techniques of international air navigation and promotes international air
transport planning and development. The ICAO Council adopts guidelines and recommended
practices for international civil aviation in air traffic, facilities, flight inspection, unlawful
intrusion prevention, and border-crossing procedures [20]. The Safety Management Manual
(Doc 9859), which was published in 2006, is intended to assist ICAO Contracting States in
fulfilling the specifications of Annexes 6, 11 and 14 regarding introducing SMS by operators
and service providers. In the guidance manual, ICAO suggests individual and proper steps for

combining the different elements into a unified SMS as a beginning and operating an effective process for safety management [19]. The manual's primary objectives are to help States transition to a performance-based safety approach; put in place safety-related information-protection tools, and achieve the goals set out in the Global Aviation Safety Plan (GASP). The latest edition of the Safety Management Manual (SMM) is its fourth and is complemented by a unique website (www.icao.int/smi). The website contains some examples and resources from the third edition of the SMM and additional practical examples, tools, and instructional materials that are compiled, revised and updated regularly [15, 21]. SMS is the topic of Annex 19, which was first published in July 2013 (and became effective in November 2013) [6]. Annex 19 presents standards for implementing and maintaining a State Safety Programme (SSP) by States and providing a SMS by relevant service providers included in the various services and industries in aviation [5]. Annex 19 applies to safety management functions that are directly connected to or facilitate aircraft's safe operation. It lays out a broad collection of specifications that are not specific to any aviation role, service provider, or organisation. Per ICAO Annex 19, Edition 2, Chapter 4, the Safety Management System of a service provider shall be established following the framework elements and be proportional to the service provider's size and the complexity of its aviation products and services [6].

TRANSPORT CANADA (TC)

The Department of Transport was formed in 1935 by Canada's government to understand Canada's changing transportation environment. Transport Canada is the department in the Government of Canada that is accountable for developing regulations, policies and services of all transportation types in Canada. It merges transportation departments: road, rail, marine, aviation and transportation security in general. It is a federal institution responsible for transportation policies, systems and programmes. They support secure, safe, effective and environmentally responsible transportation. Transport Canada is responsible for licensing pilots and other aviation professionals and registering and inspecting aircraft. Additionally, it is in charge of safety certification and constant safety oversight of most commercial operations. Transport Canada's Civil Aviation (TCCA) Directorate is Canada's civil aviation authority [37]. Since the 2000s, Canada's Commercial and Aircraft Maintenance and Manufacturing Branch have published corrections to the Canadian Aviation Regulations (CAR) requiring SMS establishment in certain operations types [19]. In 2001, the first material related to SMS was published as Introduction to SMS (TP13739 E) [34]. The guidance material Safety Management Systems for flight operations and aircraft maintenance organisation (TP13881 E) was published in 2002 to explain the recommended regulatory requirements' purpose and use [35]. The practical guide to the implementation of Safety Management Systems for small aviation operations (TP14135 E) was published in 2004 to explain SMS in simple operations [36]. These materials are designed as operational guidelines for defining, developing and implementing an SMS within the flight, maintenance operations and small aviation operations. In 2008, Advisory Circular (AC) No. 107-001 - Guidance on Safety Management Systems Development was published as guidance on SMS's ways to be implemented in large, complex organisations. This guidance material interprets the application of the SMS regulatory requirements. It contains valuable examples and models of how the elements that make up an SMS might be achieved and gives an evaluation tool for understanding whether an organisation reaches the minor regulatory requirements [38]. In 2016, Advisory Circular (AC) No. 107-002 – Safety Management System Development Guide for Smaller Aviation Organisations was published to help small-sized aviation organisations implement an SMS. It has the same content as a guide for large organisations but related to small ones [3].

CIVIL AVIATION SAFETY AUTHORITY AUSTRALIA (CASA)

The Civil Aviation Safety Authority (CASA) is the national authority for civil aviation regulation in Australia. It was founded in 1995 when the air safety functions of the former Civil Aviation Authority of Australia were separated from the air traffic control's other regulatory role. CASA is accountable for controlling and monitoring civil air operations in Australia, issuing proper licences, enforcing and implementing safety requirements, and preserving the environment from aircraft use impacts. Its mission is to develop a positive and collaborative safety culture within a good, effective and efficient aviation safety regulatory system, supporting and helping the aviation community. CASA is a government organisation that manages aviation safety and the operation in Australia and aircraft overseas. CASA licence pilots, list and register aircraft, manage safety and increase safety awareness in aviation. Furthermore, It is responsible for ensuring that its airspace is controlled and used safely [10]. Because of the importance of SMS, CASA published a draft AC119-165 in 2002 to help establish course criteria for the preparation and training of safety managers as required to implementing and managing the SMS. In 2005, an AC 172-01(0) was published to provide general principles and practical guidance to illustrate SMS requirements compliance. In addition, CASA issued two guidance materials that described, more specifically, the work of CEOs in the implementation of SMS [19]. Recently, CASA published the Civil Aviation Advisory Publication (CAAP) as guidance material of Safety Management Systems for Regular Public Transport Operations CAAP SMS-01 v1.1 [8].

FEDERAL AVIATION ADMINISTRATION (FAA)

The Federal Aviation Administration (FAA) is the biggest improved transportation agency and governmental organisation that manages every aspect of civil aviation in the United States and over its neighbouring international waters. It was founded in 1958 and its capabilities cover the development and operation of airports, air traffic control, the certification of pilots, other professionals and aircraft, and the protection of assets during the launch or re-entry of commercial space vehicles [39]. In 2006, FAA published Advisory Circular AC120-92 - Introduction to Safety Management Systems for Air Operators to introduce the SMS concept for the first time to airlines and other air transport operators and guide SMS improvement by aviation service providers. FAA indicates that a circular is not obligatory and does not create a regulation; for example, SMS implementation is optional [19]. This circular described SMS as an organisation-wide comprehensive and preventive method for managing and achieving safety. An SMS also ensures the overall safety performance of the organisation [38]. SMS presents an evolutionary method in operation safety and safety management. It is a structured method that forces organisations to maintain safety with the corresponding preference that other core business processes are handled. This applies to internal (FAA) and external aviation industry organisations (Operator and Product Service Provider) [16]. In 2020, FAA published ORDER 8000.369C - Safety Management System, which establishes policy and requirements. The requirements included within this order are meant to assist organisations in incorporating SMS into their organisations [28].

UK CIVIL AVIATION AUTHORITY (CAA)

The UK Civil Aviation Authority (UK CAA) is a government corporation of the Department for Transport that was founded in 1972. The UK CAA is the legal corporation that directly or indirectly oversees, regulates and manages all civil aviation aspects in the United Kingdom. As the UK's aviation regulator, CAA works to meet the highest safety standards in the aviation industry, protect all customers when they fly and manage security risks effectively. Most

aviation regulation and policy are arranged worldwide to guarantee consistent safety and consumer protection levels [38]. The United Kingdom National Air Traffic Services (NATS) started introducing standard SMS in 1991, primarily because of the growing attention on safety concerns and airspace capacity from outside groups as the public, media and the UK Parliament. In 2002, the UK Civil Aviation Authority's Safety Regulation Group (SRG) published one of the first introductory Civil Aviation Publication (CAP) 712 – Safety Management Systems for Commercial Air Transport Operations as a guidebook. An SMS was described as an exact component of the corporate management responsibility, which sets out a company's safety policy and determines how it intends to manage safety as an integral part of its overall business [19]. In 2015 was published the Safety Management System (SMS) guidance for organisations – CAP 795. This document aims to guide the implementation of SMS. It has been developed to understand the SMS concept and develop management methods and processes to implement, manage and achieve a good SMS. It applies and implements to air operators, airworthiness management organisations and maintenance organisations, air navigation service providers, aerodromes and accredited training organisations. This guidance material meets the ICAO Annex 19 requirements and is a UK CAA alternative to compliance with the European Union Aviation Safety Agency (EASA) management system requirements regarding safety management. SMS continues beyond compliance with prescriptive directions to a systematic approach where potential and possible safety risks are identified and controlled to an acceptable level. SMS uses a business-like approach to safety, safety plans, safety performance indicators(SPIs) and targets, and constant monitoring of its safety performance. It allows efficient risk-based decision-making processes over the business [8].

CIVIL AVIATION ADMINISTRATION OF CHINA (CAAC)

The Civil Aviation Administration of China (CAAC) is the aviation authority under the Ministry of Transport of the People's Republic of China. It was formed in 1949 to manage all non-military aviation in the country and provide general and commercial flight service. As a national civil authority, it oversees civil aviation and investigates aviation accidents and incidents. Its principal functions are to ensure the development of long-term plans and strategies for the civil aviation industry; formulate rules and regulations; implement particular suggestions linked to the whole system of transport; regulate the responsibility of flight and ground safety and ensure the safety of civil aviation [32]. CAAC began SMS development and trial in 2005. From 2013 to 2014, CAAC reviewed the national safety programme linking and drafted the official Rules of Civil Aviation Safety Management following Annex 19 and Doc 9859 for improved safety performance management. To implement the ICAO Safety Management Concept, help the efficient implementation of SMS in China, and guarantee the integrity and uniformity of safety management standards, CAAC published the first complete Civil Aviation Safety Management Regulation Safety Regulation. Verification of SMS requirements mandated by CAAC is given in Requirements on Safety Management Systems of Air Operators (AC-121/135), Regulation of Airport Operation Safety and Management (CCAR-140), Rules on Safety Management of Air Traffic Control Units (CCAR-83), Safety Management Systems of Maintenance Organisations (AC-145-15), additional laws or regulating documents. Today, airlines, airports, ATS providers and maintenance organisations in China have implemented SMS following the ICAO rules and standardised ICAO SMS framework. In addition, CAAC supports the implementation of SMS in companies responsible for designing or manufacturing aerospace products. Due to the rapid increase in air traffic, CAAC has been investigating and innovating safety oversight procedures and is prepared to promote civil aviation authorities worldwide. Further, CAAC has introduced a specific strategy to the direction of airline

operators. In 2018, the Guidelines on Differentiated Supervision of the Safety of Certified Operators and the Implementation Procedures for Differentiated Supervision of the Safety of Certified Operators were issued. Both regulations define the complex importance of air traffic assessment, current safety assessment and the current safety oversight classification [22]. It is necessary to point out that it is difficult to get documents that directly refer to the SMS and its framework as these documents are in Chinese. Based on the information found, it will be assumed that the SMS structure under CAAC is the same as the standard ICAO structure.

CIVIL AVIATION AUTHORITY OF NEW ZEALAND (CAA NZ)

The Civil Aviation Authority of New Zealand (CAA New Zealand) was founded in 1992 as the "most recent" of this article's aviation authorities. It is the state agency charged with developing civil aviation safety and security standards and approaches in New Zealand. CAA further controls the implementation and usage of standards and is accountable for enforcement proceedings. It provides accident and incident investigations, certification, inspection, auditing and other activities and collates industry-wide safety picture. The Civil Aviation Authority is a top entity accountable to the Minister of Transport. Civil aviation in New Zealand works within a system founded and managed by the Civil Aviation Act 1990 [12]. CAA New Zealand issued Advisory circular Ac 00-4 Safety Management Systems in December 2012 to give complete guidance material to support Part 119, 139, 145 and 172 organisations implement an SMS. Additionally, its released series of four booklets makes part of the "resource kit". The kit contains valuable advice and information about improving current systems and describes and illustrates the moves that can be taken to successfully, regularly, and proactively manage safety. The first booklet includes advice to organisations about enhancing safety systems and supplement mechanisms and methods to perform the best safety outcomes. The second booklet presents an enhancement guide that helps from Quality Management Systems (QMS) to Safety Management systems (SMS). The third booklet supports implementing SMS as guidelines for small aviation organisations, and the last one is the introduction to aviation risk management [13].

3. COMPARISON: SIMILARITIES AND DIFFERENCES IN SMS FRAMEWORK

Modern SMS can be defined as a collection of activities considered necessary actions to fulfil responsibilities under the new age of self-regulation delegated responsibility [33]. The definitions of SMS in air transport differ depending on the system's approach and perception of CAAs (Tab. 1.
).

Tab. 1.

Definition of SMS

ICAO	**systematic approach to managing safety, including the necessary organisational structures, accountabilities, policies, and procedures** [19]
TC	explicit, comprehensive, and proactive process for managing risks that integrates operations and technical systems with financial and human resource management for all activities [2]
CASA	**systematic approach to managing safety, including organisational structures, accountabilities, policies, and procedures** [8]

FAA	the formal, top-down, organisation-wide approach to managing safety risk and assuring the effectiveness of safety risk controls [388]
UK CAA	a systematic and proactive approach to managing safety risks [8]
CAAC	**systematic approach to managing safety, including the necessary organisational structures, accountabilities, policies, and procedures** [19, 22]
CAA NZ	**a systematic approach to managing safety, including the necessary organisational structures, accountabilities, policies and procedures** [13]

It can be observed that SMS definitions in some point of view differ significantly from each other, although the whole system's meaning and essence do not conflict. The definitions of ICAO, CASA, CAAC, CAA New Zealand (NZ), which are marked "**bold**" (Tab. 1.

), are the most consistent and characterised SMS in the same way as a systematic approach to managing safety. The UK CAA describes this system directly related to the risk management contained in it and emphasises a proactive approach to risk management. TC and FAA define the system differently, which is reflected in the components and elements of this system. On the other hand, these definitions also highlight proactivity and risk management, effective and explicit. The SMS structure is mainly based on the ICAO SMS guidance [8].

The ICAO-specified system (

Fig. 1) for implementing and maintaining an SMS has a safety policy, safety risk management, safety assurance, safety promotion plus, a minimum of twelve elements that are an integral part of each component, and each element is further sub-divided to help the organisation and CAA evaluate the system. This standard structure has been divided into two fundamental units for this article, ensuring system management and an acceptable level of safety.
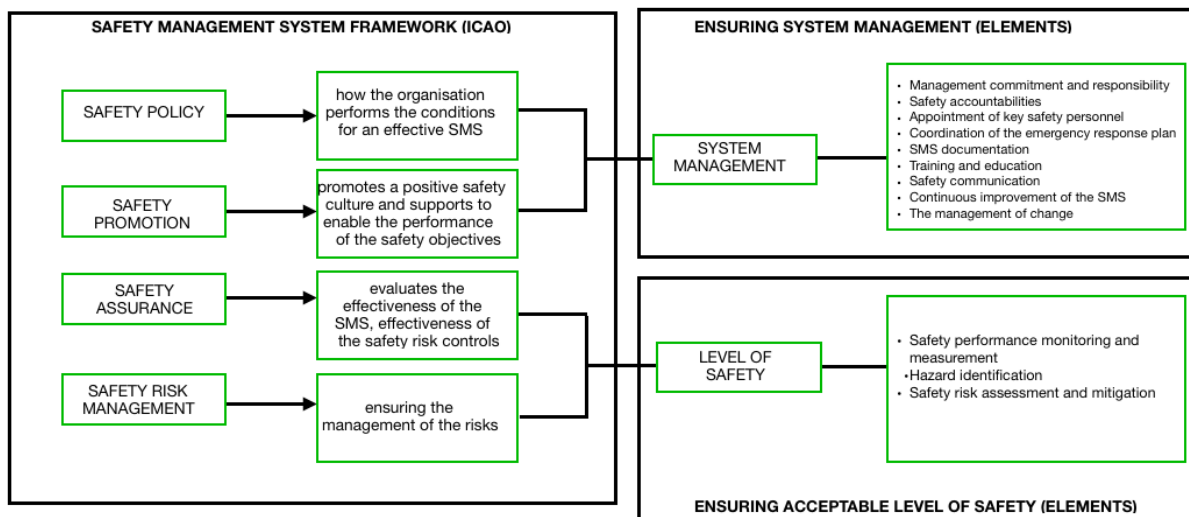

Fig. 1. Standard ICAO framework and its divisions

The system can be tailored to each organisation's company's complexity and nature [6, 30]. Every Civil Aviation Authority (CAA) explains the safety outcomes and the key components and elements of an SMS.

Summarily, results (Tab. 2.) in similarities and differences present comparable SMS components based on various documents published by CAAs and organisations. A significant difference in the SMS components is shown by Transport Canada (TC), as it has a different structure than the classic ICAO framework and, at the same time, complements it with the safety management plan, documentation, safety overview, training, quality assurance and emergency response plan. Although the individual components have different names, they essentially reflect the primary structure and goals to be achieved.

Tab. 2.

Similarities and differences in SMS components

	ICAO	TC	CASA	FAA	UK CAA	CAAC	CAA NZ
Safety policy	✓	NO	✓	✓	✓	✓	✓
Safety risk management	✓	NO	✓	✓	✓	✓	✓
Safety assurance	✓	NO	✓	✓	✓	✓	✓
Safety promotion	✓	NO	✓	✓	✓	✓	✓
Safety management plan	NO	✓	NO	NO	NO	NO	NO
Documentation	NO	✓	NO	NO	NO	NO	NO
Safety overview	NO	✓	NO	NO	NO	NO	NO
Training	NO	✓	NO	NO	NO	NO	NO
Quality assurance	NO	✓	NO	NO	NO	NO	NO
Emergency response plan	NO	✓	NO	NO	NO	NO	NO

Furthermore, it is possible to see changes in the individual elements (Tab. 3.), which differs and complements the SMS depending on the country's perception of safety and SMS definition. The most significant difference can be observed in TC, where the structure of the elements differs significantly.

Tab. 3.

Similarities and differences in SMS elements

	ICAO	TC	CASA	FAA	UK CAA	CAAC	CAA NZ
Management commitment and responsibility	✓	NO	✓	✓	✓	✓	NO
Safety accountabilities	✓	NO	✓	✓	✓	✓	✓
Appointment of key safety personnel	✓	✓	✓	✓	✓	✓	NO
Coordination of an emergency response plan	✓	✓	✓	NO	✓	✓	✓
SMS documentation	✓	NO	✓	✓	✓	✓	✓
Hazard identification	✓	NO	✓	✓	✓	✓	✓

Safety risk assessment and mitigation	✓	✓	✓	✓	✓	✓	NO
Safety performance monitoring and measurement	✓	✓	✓	NO	✓	✓	✓
Management of change	✓	NO	✓	NO	✓	✓	✓
Continuous improvement of SMS	✓	NO	✓	NO	✓	✓	✓
Audit	NO	NO	NO	NO	NO	✓	✓
Training and education	✓	✓	✓	✓	✓	✓	✓
Safety communication	✓	✓	✓	✓	✓	✓	✓
SMS implementation plan	NO	NO	✓	NO	NO	NO	NO
Third party investigation	NO	NO	✓	NO	NO	NO	NO
Internal safety investigations	NO	NO	✓	NO	✓	NO	NO
Safety policy	NO	NO	NO	✓	NO	NO	NO
Non-punitive safety reporting policy	NO	✓	NO	✓	NO	NO	NO
Roles, responsibilities and employee involvement	NO	✓	NO	✓	NO	NO	NO
Safety objectives, planning and goals	NO	✓	NO	✓	NO	NO	NO
Management review	NO	✓	NO	NO	NO	NO	✓
Identification and maintenance of applicable regulations	NO	✓	NO	NO	NO	NO	NO
Records management	NO	✓	NO	NO	NO	NO	NO
Reactive processes	NO	✓	NO	NO	NO	NO	NO
Proactive processes	NO	✓	NO	NO	NO	NO	NO
Investigation and analysis	NO	✓	NO	NO	NO	NO	✓
Operational QA	NO	✓	NO	NO	NO	NO	NO
Risk management	NO	NO	NO	NO	NO	NO	✓

4. LEVEL OF SAFETY

ICAO describes safety as the state in which the likelihood of harm to a person or property damage is decreased to and maintained at or under an acceptable level through ongoing hazard identification and safety risk management. The definition includes the word risk, characterised as a combination of likelihood and severity of harm. The definition also refers to acceptable levels of risk, proposing the presence of a threshold that distinguishes between safe and unsafe states [14]. Total safety is usually an unachievable and costly goal. Thus, the idea of acceptable safety has been used in risk-bearing industries, including aviation. The unambiguous ICAO definition for an acceptable level of safety expresses the safety goals of an oversight authority, an operator, or a services provider. The relationship between oversight authorities and

operators/services providers provides the minimum safety objective(s) acceptable to the oversight authority, achieved by the operators/services providers while conducting their core business functions [4]. Typically, in aviation, safety regulation are been carried out. The regulator outlines the standards to be followed and uses audit and inspection to check compliance with them.

Safety management is a systematic activity and, in this way, helps to achieve safety goals systematically.

The SMS risk management pillar ensures identifying, assessing, and controlling risk proactively as the purpose of an SMS. Risk management is characterised as a coordinated activity to direct or manage an organisation about risk. It allows an organisation to ensure that risk remains at an acceptable level through a consistent and proactive framework.

The SMS safety assurance pillar directs the monitoring of safety indicators and the evaluation of safety performance. The concept of an acceptable level of safety is represented by two specific metrics, namely:
- safety performance targets and
- SPIs.

Safety performance targets support to assure the achievement of the principle safety objective, includes one or more SPIs, mutually with wanted results displayed in those indicators. The wanted safety target (outcome) may be presented either in absolute or relative terms. For instance: a desired safety outcome, expressed in absolute terms, is: less than one fatal accident per 1 000 000 operating hours.

SPIs help measure and demonstrate that the achieved level of safety meets the targets. They are directly linked to safety performance targets. In general, SPIs are presented in terms of the frequency of harmful event(s). For instance: the number of severe aircraft incidents per 100 000 flight hours. SPIs are categorised as "lagging" or "leading".

Leading indicators are circumstances that lead to an unwanted event (accident, incident, undesirable safety state) and have value in predicting the arrival of the event.

Lagging indicators are measures of a system that are taken following events, which measure consequences and incidents. It suggests that leading indicators are seen as inputs while lagging indicators are viewed as outputs from a safety viewpoint. Consequently, all indicators might be characterised as both leading and lagging depending on their place in the process [14].

The relationship between an acceptable level of safety, safety performance targets and SPIs, and safety requirements is as follows [15]:
- Acceptable level of safety is the overall concept.
- Safety performance targets are the quantified goals related to the acceptable level of safety.
- Safety performance indicators are the measures (metrics) applied to determine if the acceptable level of safety has been achieved.

The whole system is therefore interconnected and continuous.

5. RESULTS

This article aimed to provide a systematic review of the SMS approach adopted by selected Civil Aviation Authorities (CAAs) with the primary focus on the safety level. Many aviation organisations and CAAs have made efforts to develop SMS and make it an official requirement.

In this article, all significant CAAs globally, such as ICAO, TC, CASA, FAA, UK CAA, CAAC, CAA NZ were selected and compared in components and elements in the SMS framework. The summary of the results is shown in Tab. 4..

Summary of results

CAA	Components	Elements	Document
ICAO	4	12	Doc. 9859
TC	**6**	**17**	(AC) 107-00
CASA	4	**15**	CAAPSMS-01
FAA	4	-	Or.8000_369C
UK CAA	4	12	CAP 795
CAAC	4	12	AC-121/135
CAA NZ	4	**13**	AC 00-4

These further results show (Tab. 4.) that the SMS structure is mainly based on the ICAO SMS guidance, consisting of four major components: safety policy, safety risk management, safety assurance and safety promotion. It is possible to see a notable difference in the Transport Canada components, supplemented by other features. In principle, however, the structure of SMS in Canada is the same, only the components are named differently. The universally held SMS framework includes components and key elements describing SMS requirement – especially elements varying depending on the CAA strategy. Although there are noticeable differences, especially in the number of elements, it can be stated that all the main topics are incorporated in each of the described documents, though not in the same place and not in separate elements. Increased consideration needs to be given to the requirements to ensure the system's efficiency and focus on improving safety (safety level). SMS becomes effective by incorporating all components. According to [7], the core of an efficient SMS is Safety Risk Management (SRM). It deals with hazard identification, risk evaluation and risk mitigation. SMS also illustrates three management approaches: reactive, proactive and predictive. These are precisely linked to SRM and safety assurance (the third component, which includes safety monitoring and measurements). SMS requires data to provide possible results, and methodologies are an SMS mechanism that obtains the necessary safety data.

• The reactive approach collects safety data from accidents and incidents that have already happened and learns from their consequences. As mandatory reports are drawn up after the event, necessary occurrence reporting can be classified as a reactive safety data collection methodology.

• The proactive approach uses safety reporting systems and SPIs to collect safety data to discover and mitigate possible threats and hazards that could trigger accidents or incidents.

• The predictive approach is not well organised. It intends to identify viable and potential risks based on predictive analyses (or forecasts) that obtain information from historical and current safety data and predict trends and behaviour patterns of emerging hazards.

Each of the three approaches is specific to safety management, that is, depending on SMS development in a particular organisation. Each method has its advantages and disadvantages; the recommendation is to proceed from reactive through proactive to the predictive approach.

Therefore, the last part of this article deals with which approach (reactive, proactive or predictive) was chosen, respectively, what approach is recommended and adopted by selected CAAs. Based on the information obtained, it was possible to see the results (Tab. 5.), which showed that even though most have a reactive and proactive approach, only CASA and CAA NZ actively apply a predictive approach. The literature [23] describes SPIs as "lagging" or "leading". As was mentioned, leading indicators present situations that lead to unwanted circumstances and can predict the arrival of an event, and lagging indicators are measures to measuring results and circumstances. Furthermore, almost every CAA recommended establishing SPIs in safety-related documents. ICAO, CAAC and CAA NZ deal with these indicators in more detail, specifying the use of individual indicators, and TC and FAA do not widely deal with them in their documents.

Tab. 5.

Approach and safety performance indicators

	ICAO	TC	CASA	FAA	UK CAA	CAAC	CAA NZ
Safety performance indicators (SPIs)							
should be established	✓		✓		✓	✓	✓
Lagging	✓					✓	✓
Leading	✓					✓	✓
Risk management approach							
reactive	✓	✓	✓	✓	✓	✓	✓
proactive	✓	✓	✓	✓	✓	✓	✓
predictive			✓				✓

6. CONCLUSION

It can be concluded that the whole system, regardless of where it is used and applied, represents a unique improvement direction for ensuring safety. SMS focuses on maximising opportunities to improve the aviation system's overall safety continuously. The whole approach builds on current procedures, integrate with other management frameworks and shows good corporate practice by tailoring a compliant regulatory environment to the enterprise. This article analysed the basic structure of the SMS of selected CAAs. CAAs were chosen based on prior knowledge of each country and the assumption that there is a high level of safety awareness. The primary safety-related documents were searched and the standard SMS structure was compared among individual CAAs, and the results were summarised in tables. The standard SMS structure does not differ significantly in most countries, although interpretation may vary. The individual components and elements are essentially interdependent and function as one complete system. At the same time, the results indicated that the standard ICAO structure represents a generic model, which is implemented and supplemented depending on the overall perception of safety in the country. The next part of the article dealt with the level of safety and how to reach its acceptable level. For this purpose, the standard SMS structure was also divided into two units, dealing with system management and level of safety. It is necessary to deal with the system's structure, the safety performance targets and SPIs that help assess and ensure an

acceptable level of safety. A system is primarily reactive, proactive and predictive; however, the reactive and proactive system is applied more often than the predictive. Safety performance targets and safety performance indicators help to improve and enhance the whole SMS. Although the results show that this area is more of a recommendation or suggestion, not every CAA gives priority to it. Implementation of SMS describes a fundamental change in the way all organisations do business. Based on the results, it can be stated that all selected aviation authorities have a well-developed system that meets the requirement to implement the system. Furthermore, it is also possible to tell that although the standard structure of SMS does not change and is applied, less emphasis is placed on safety performance targets and safety performance indicators, which support the quality and efficiency of the system. Although, it should be highlighted that most aviation authorities depart from the primary system established by ICAO, not least because all countries (Canada, Australia, the USA, the United Kingdom, China and New Zealand) are member states.

In conclusion, safety becomes an essential part of the organisation's operations. However, for SMS to be successful, every CAA must establish a disciplinary and enforcement policy that promotes and rewards behaviours for achieving it. The most positive benefit of SMS is its improvement of the current levels of aviation safety in the knowledge of the industry's continuing growth.

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