UNIVERSIDADE DA BEIRA INTERIOR
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Feasibility Study on the implementation of a Safety Management System at euroAtlantic airways under EASA Part M

(versão final após defesa)

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Dissertação para obtenção do Grau de Mestre em
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Inscription

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Resumo

Nas últimas décadas tem-se verificado um crescimento exponencial na aviação comercial, sendo que existem previsões de que a frota global de jatos comerciais duplicará em número nos próximos vinte anos. De modo a evitar que o número de acidentes siga a mesma tendência, é necessário assegurar o nível de segurança operacional pretendido de acordo com os standards da industria.

Neste contexto, considerando as melhorias sentidas pela implementação de um Sistema de Gestão de Segurança Operacional noutras vertentes do setor aeronáutico e dado o crescimento na complexidade da tecnologia das aeronaves, assim como dos requisitos de aeronavegabilidade continuada associados, a European Union Aviation Safety Agency considera necessário que as organizações que realizem atividades de gestão de aeronavegabilidade continuada[1] procedam também à implementação de um Sistema de Gestão de Segurança Operacional[2].

Esta dissertação consiste assim num estudo de viabilidade de adaptação do Sistema de Gestão de Segurança Operacional da euroAtlantic para que a sua implementação incorpore as atividades realizadas no âmbito da Parte-M[3].

Foi realizada uma pesquisa bibliográfica sobre sistemas de gestão de segurança operacional e sistemas de gestão de risco que serviu de auxílio no entendimento dos processos implementados previamente pela empresa. Posteriormente, foi efetuada uma análise ao parecer No 06/2016[4] emitido pela European Union Aviation Safety Agency que propõe a integração de um novo anexo VC ("Part-CAMO") no regulamento No 1321/2014[5] (no qual constam os requisitos de Parte-M).

Seguidamente é realizado um questionário individual a cada um dos funcionários dos departamentos de engenharia e do planeamento e controlo operacional com o intuito de

[1] Todos os processos para garantir que, em qualquer altura durante a sua vida operacional, a aeronave cumpre com os requisitos de aeronavegabilidade em vigor e se encontra em condições para a sua operação segura (EASA, 2014 - A).

[2] Uma abordagem sistemática para a gestão da segurança operacional na aviação que inclui as estruturas, responsabilidades, políticas e procedimentos organizacionais necessários e que inclui qualquer sistema de gestão que independentemente ou de foma integrada com outros sistemas de gestão da organização, abordam a gestão de segurança operacional (EASA, 2014 - B).

[3] Anexo do Regulamento No 1321/2014, estabelecendo requisitos aplicáveis à aeronavegabilidade, aprovados de acordo com o regulamento No 216/2008 (EASA, 2014 - A).

[4] Esboço de regulamentação proposta pela European Union of Aviation Safety Agency à Comissão Europeia introduzindo a incorporação de requisitos de sistema de gestão de Segurança Operacional no regulamento 1321/2014 – Sistemas de Gestão de Segurança Operacional na Parte-M (EASA, 2019 - A).

[5] É a regulamentação da European Union Aviation Safety Agency relativa à aeronavegabilidade de aeronaves, produtos aeronáuticos, componentes e suas aplicações, assim como à aprovação de organizações e funcionários envolvidos nessas tarefas (EASA, 2014 - A).

perceber qual a sua perceção em relação à organização em termos de segurança operacional e o que a mesma espera deles neste âmbito.

Após o processo de pesquisa inicial identificaram-se aspetos que deveriam ser melhorados nas tarefas de gestão de aeronavegabilidade para que estejam de acordo com os standards de Segurança Operacional pretendidos pela empresa de acordo com os regulamentos que lhe serão impostos; neste sentido efetuou-se uma proposta de medidas a tomar para atingir esta melhoria.

Num estágio final de modo a medir a performance de Segurança Operacional da euroAtlantic no que diz respeito à efetividade das medidas propostas e do cumprimento dos requisitos da Parte-CAMO considerados relevantes durante esta dissertação, propõem-se, Indicadores de Segurança Operacional a serem avaliados no futuro, assim como a métrica segundo a qual os dados devem ser medidos e o método para a informação a ser recolhida.

Palavras-chave

Segurança Operacional, Sistema de Gestão de Segurança Operacional, euroAtlantic airways, Aeronavegabilidade Continuada, Indicadores de Performance de Segurança Operacional

Resumo Alargado

Introdução

Este resumo alargado pretende expôr de uma forma concisa o enquadramento desta dissertação e os objetivos que se pretendem atingir com a realização da mesma. São também referidos os aspetos mais relevantes do caso de estudo, as principais conclusões retiradas durante o seu desenvolvimento e as perspetivas de trabalhos futuros.

Enquadramento da dissertação

A segurança operacional na aviação é dinâmica, o que significa que surgem continuamente novos perigos e riscos que tem de ser mitigados. Num mundo ideal, todos os problemas associados à segurança operacional seriam eliminados, no entanto tal não é possível, e como tal o objetivo é que os perigos e riscos conhecidos sejam reduzidos até o nível mais baixo possível dentro do que é considerado razoável.

A euroAtlantic airways, atualmente é detentora do certificado de Operador Aéreo (PT-01/99/78) em conformidade com o Regulamento No 965/2012[6], e tem a aeronavegabilidade das suas aeronaves geridas pela sua CAMO, detentora do certificado PT.MG.017 (ANAC, 2019 - A) em conformidade com a Sub-parte G[7] do Regulamento No 1321/2014.

A aprovação de acordo com a Sub-parte G não inclui requisitos de gestão de risco nas atividades de gestão de aeronavegabilidade que devem agora ser introduzidos. Em 2016 a European Union Aviation Safety Agency publicou um parecer com o intuito de introduzir requisitos para integração de um Sistema de Gestão de Segurança Operacional nas organizações aprovadas para efetuar a gestão da aeronavegabilidade continuada de aeronaves com uma massa máxima à descolagem superior a 5700 kg.

A euroAtlantic, tem atualmente um Sistema de Gestão de Segurança Operacional implementado na empresa, dimensionado de acordo com o que é requerido pelo Regulamento No 965/2012 e como tal o sistema atualmente existente compreende:

- Hierarquias de responsabilidade de segurança operacional bem definidas;

[6] Regulamento da European Union Aviation Safety Agency que estabelece requisitos técnicos e procedimentos administrativos relacionados com operações aéreas (EASA, 2012).

[7] Sub-parte do Anexo I do Regulamento No 1321/2014, estabelecendo requisitos aplicáveis às organizações aprovadas para realizar a gestão de aeronavegabilidade de aeronaves (EASA, 2014 - A).

- Uma política com a descrição dos standards de segurança operacional pretendidos pela empresa;
- Processos para identificação de perigos;
- Processos para gestão dos riscos resultantes dos perigos idetificados;
- Processos para que sejam tomadas ações de mitigação em caso de necessidade;
- Processos para identificar a efetividade dessas ações;
- Um sistema de reporte de ocorrências;
- Um programa de treino no Sistema de Gestão de Segurança Operacional da empresa.

No entanto, o Sistema de Gestão de Segurança Operacional implementado na euroAtlantic, assim como os seus processos, foram idealizados para contabilizar principalmente o setor das operações e o pessoal navegante. Como tal, apesar de parte dos processos implementados serem transmissíveis ao setor da Part-M, existem aspetos que carecem de um processo de adaptação.

Objetivo

O objetivo desta dissertação é assim, o de estudar a viabilidade de alargar os processos resultantes da implementação do Sistema de Gestão de Segurança Operacional na empresa também às atividades de gestão da aeronavegabilidade das aeronaves da euroAtlantic, de modo a garantir que os perigos e riscos que advém destas atividades são devidamente controlados.

Em particular, este trabalho tem por base os novos requisitos que a European Union Aviation Safety Agency propôs em 2016 e que irá impor no futuro a todas as organizações que realizem atividades de gestão de aeronavegabilidade continuada de aeronaves a integração de um sistema de gestão de segurança operacional.

Deste modo, este estudo tem como objetivo a análise dos procedimentos internos da companhia, assim como dos processos associados neste campo e dos requisitos que lhe serão impostos pela European Union Aviation Safety Agency, com o intuito de propôr alterações ao sistema atualmente implementado para que este seja mais abrangente e inclua as atividades de gestão de aeronavegabilidade.

Caso de estudo

Numa fase inicial, foi realizada uma pesquisa bibliográfica sobre sistemas de gestão de Segurança Operacional e de Gestão de Risco que serviu de auxílio no entendimento dos processos implementados previamente pela empresa.

Posteriormente, foi efetuada uma análise ao parecer No 06/2016 emitido pela European Union Aviation Safety Agency que propõe a integração de um novo anexo VC ("Part-CAMO") no regulamento No 1321/2014 (no qual constam os requisitos de Parte-M). A proposta deste anexo é que este substitua a Sub-parte G dos requisitos de Parte-M. Deste modo é também efetuado um estudo dos requisitos da Parte-M, com particular ênfase na Sub-parte G, e das alterações que iriam resultar da substituição mencionada anteriormente.

Foi também necessário desenvolver um estudo sobre a organização interna da empresa, com especial foco nos Departamentos de Segurança Operacional, Planeamento e Controlo Operacional e de Engenharia. Para tal são consultados o Manual da Organização, o Manual de Gestão de Segurança Operacional, o Manual de Gestão da Continuidade da Aeronavegabilidade e as normas funcionais aplicáveis.

Após este estudo é realizado um mapeamento dos novos requisitos, fazendo comparação com os requisitos de Parte-M (já implementados pela euroAtlantic airways) e também com os requisitos da "Parte-ORO Subparte GEN"[8] do regulamento 965/2012 (aplicável às operações de ar).

Estes últimos, já incluíam requisitos de Sistemas de Gestão de Segurança Operacional incorporados pela euroAtlantic noutros departamentos que revelaram interesse na integração de parte dos processos implementados para cumprimento desses requisitos nos departamentos da CAMO como por exemplo, os processos utilizados para gestão de riscos identificados. Assim estes requisitos serviram de modelo para a abordagem dos processos a serem propostos para as atividades de gestão de aeronavegabilidade ainda por implementar.

Com o intuito de complementar a análise realizada sobre os procedimentos da companhia e perceber qual a perceção dos principais intervenientes nas atividades de aeronavegabilidade continuada na euroAtlantic, e proceder à avaliação das suas culturas de Segurança Operacional e de Reporte, é realizado um questionário nos departamentos de engenharia e de planeamento e controlo operacional.

Após o processo de pesquisa inicial foram identificados diferentes aspetos que necessitam de ser melhorados nas tarefas de gestão de aeronavegabilidade para que estejam

[8] Sub-parte da Parte-ORO do Anexo III do regulamento 965/2012 com requisitos gerais para operações aéreas (EASA, 2012).

de acordo com os standards de Segurança Operacional pretendidos pela empresa de acordo com os regulamentos que lhe serão impostos:

- Discussão de assuntos de Segurança Operacional dentro dos departamentos;
- Consciência da importância da Segurança Operacional;
- Importância de reportar aspetos de Segurança Operacional no IQSMS, em vez de somente os identificar;
- Comunicação interna aquando do processo de gestão de mudança;
- Qualificações do departamento de Segurança Operacional, no que diz respeito ao âmbito de trabalho da Parte-M;
- Avaliação atempada da informação reportada; e também
- Método e disponibilização de recursos para despacho das Hold Item Lists[9].

Com o intuito de melhorar estas condições foram propostas medidas que serão descritas com maior detalhe no capítulo 4, nomeadamente:

- Presença reforçada do Gestor de Segurança Operacional;
- Comunicação aos funcionários do motivo da alteração aos procedimentos que eles usam como guia, além da descrição da alteração;
- Melhorias ao treino do Gestor de Segurança Operacional no que toca ao âmbito de trabalho da Part-M;
- Comunicação interna aquando do processo de gestão de mudança;
- Qualificações do departamento de Segurança Operacional, no que diz respeito ao âmbito de trabalho da Parte-M;
- Criação de um substituto para o Gestor de Segurança Operacional, para o apoiar na Gestão da Segurança Operacional nas atividades realizadas pela Organização Gestora da Aeronavegabilidade Continuada;
- Aconselhamento para a submissão de reportes dentro de 72h;
- Avaliações mensais das necessidades de treino;
- Disponibilização de recursos para avaliação das Hold Item Lists abertas.

De modo a medir a performance de Segurança Operacional da euroAtlantic no que diz respeito à efetividade das medidas mencionadas em cima e do cumprimento de alguns dos requisitos da Parte-CAMO considerados relevantes durante esta dissertação, o aluno propõe

[9] São documentos nos quais são descritos defeitos que podem ser diferidos de acordo com as disposições da lista de equipamentos mínimos ou com as disposições dos manuais e outros documentos do fabricante (EAA, 2019 - A).

Indicadores de Segurança Operacional a serem avaliados no futuro, assim como a métrica segundo a qual os dados devem ser medidos e como devem ser recolhidos.

Os resultados obtidos foram validados a nível interno na EAA pelo Gestor de Segurança Operacional e pelo Diretor de Manutenção e Engenharia.

Do desenvolvimento desta dissertação surge a proposta a integração de 3 *Safety Performance Indicators* (SPIs) para o departamento de segurança operacional, 5 para o departamento de treino da Parte M e 1 para o departamento da engenharia.

Relativamente aos SPIs propostos para o departamento de Segurança Operacional como descrito na tabela 7, refere-se que foram criados com o intuito de:

- Medir o volume de reportes submetidos pelos departamentos que realizam tarefas de aeronavegabilidade continuada - SPI número 5;
- Medir a qualidade da informação aquando do primeiro envio do reporte - SPI número 6;
- Medir se foi cumprido o período de tempo recomendado entre o envio do reporte e a identificação do assunto que o motivou – SPI número 7.

A inclusão do SPI 5 permitirá avaliar a cultura de reporte dos departamentos da Parte-M da euroAtlantic, que se traduzirá na efetividade de identificação de aspetos de Segurança Operacional cuja obtenção não possa ser feita de forma automatizada.

O SPI número 6 permitirá que seja avaliada a confiança que os funcionários tem no sistema de reporte, em particular nos processos utilizados para o tratamento da informação que é reportada e medir se foi alcançada melhoria do nível de detalhe fornecido aquando do reporte de ocorrências.

A proposta do SPI número 7 é feita com o intuito de potenciar o reporte de ocorrências no período de tempo mais curto possível, e para assegurar que o conteúdo reportado não é perdido com o passar do tempo.

Os SPIs propostos para o departamento do treino descritos na tabela 11 foram propostos com o intuito de assegurar a avaliação mensal do planeamento do treino necessário para os departamentos da engenharia e do planeamento e controlo operacional, de modo a diminuir o risco de perda de competências durante o desempenho das suas funções.

Por último o SPI número 4 da tabela 12 é proposto com o intuito de medir se o número de reportes relativamente a HILs que contenham defeitos aumenta. Ao introduzir este processo no sistema de Segurança Operacional da euroAtlantic, está-se a fomentar o hábito de reporte de ocorrências que constam na lista de reportes obrigatórios, e como tal a melhorar a cultura de segurança operacional existente na empresa.

Conclusões

A presente dissertação levou à conclusão que o Sistema de Gestão de Segurança Operacional atualmente implementado na empresa é passível de ser melhorado.

Este estudo em particular realçou uma cultura que necessita de ser melhorada, na medida em que os reportes nos quais são identificados perigos, condições de componentes que não eram expectáveis dado o período de vida associado, e condições com potencial para comprometer a segurança das atividades da companhia, são a principal fonte de informação do sistema, e assim conclui-se particularmente que seria um dos aspetos que ao ser melhorado, teria um impacto positivo no sistema utilizado atualmente.

A realização deste estudo realça a importância em melhorar a cultura de segurança operacional que atualmente caracteriza os departamentos que realizam as atividades de gestão de aeronavegabilidade continuada, na medida em que estes colaboradores tendem a considerar defeitos encontrados (que não eram expectáveis) com uma postura reativa.

Esta postura reflete uma ótica técnica como algo que tem de ser corrigido aquando da sua identificação sem que sejam tidas as considerações de segurança operacional necessárias para o avaliar, identificar a raiz do problema, e implementar ações de mitigação e, desse modo, evitar ocorrências semelhantes no futuro.

Prespetivas de investigação futuras

Um sistema de gestão de segurança operacional, é um sistema constantemente passível de ser melhorado, pelo que após conclusão desta dissertação considera-se relevante que seja feito um estudo:

- dos parâmetros a avaliar durante uma análise de risco quando se verifique uma rotação considerável do pessoal encarregue da execução de tarefas de gestão de aeronavegabilidade continuada, ou aquando da subcontratação de uma nova empresa para que esta realize atividades no âmbito da aeronavegabilidade continuada.

- sobre a efetividade das medidas de mitigação implementadas para os perigos e riscos já identificados, e perceber se os valores selecionados como objetivo são adequados ou necessitam de ser revistos, assim como se os indicadores proposto neste estudo foram bem definidos ou necessitam de alterações.

Abstract

In the last decades, it has been verified an exponential growth in commercial aviation, and there are predictions that the global fleet jets will duplicate in number over the next twenty years. In order to prevent the number of accidents from following the trend, it is necessary to ensure the safety level intended in accordance with industry standards.

In this context, considering the improvements verified by the implementation of a Safety Management System in other aspects of the aeronautical sector and given the growing complexity of aircraft technology, as to the related continuing airworthiness requirements, the European Aviation Safety Agency considers a need that Continuing Airworthiness[10] Management Organisations proceed with the implementation of a Safety Management System[11].

This dissertation thus consists of a feasibility study on the adaptation of euroAtlantic's Safety Management System so that its implementation incorporates the activities carried out under Part-M[12].

It was carried out bibliographic research on safety management systems and management risk systems which helped to understand the processes previously implemented by the company. Subsequently, it was performed an analysis of Opinion 06/2016[13] issued by European Union Aviation Safety Agency that proposes the integration of a new Annex VC (Part-CAMO) into Regulation 1321/2014[14] (which contains Part-M requirements).

Then it is conducted an individual questionnaire with each of the engineering and planning and operational control staff in order to understand their understanding regarding the companys safety and what it expects from them within that scope.

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[10] All of the processes ensuring that, at any time in its operating life, the aircraft complies with the airworthiness requirements in force and is in a condition for safe operation (EASA, 2014 - A).

[11] A systematic approach to managing aviation safety including the necessary organisational structures, accountabilities, policies and procedures, and includes any management system that, independently or integrated with other management systems of the organisation, addresses the management of safety (EASA, 2014 - B).

[12] Annex of Commission Regulation (EU) No 1321/2014 of 26 November 2014, establishing permanent applicable airworthiness requirements, approved in accordance with Regulation (EC) No 216/2008 (EASA, 2014 - A).

[13] Draft regulation proposed by EASA to the European Commission introducing the embodiment of safety management system (SMS) requirements into Comission Regulation (EU) No 1321/2014 – SMS in Part-M. (EASA, 2019 - A).

[14] It is the EASA regulation on the continuing airworthiness of aircraft and aeronautical products, parts and appliances, and on the approval of organisations and personnel involved in these tasks (EASA, 2014 - A).

After the initial investigation process, the present research identified different aspects that should be improved in management of airworthiness tasks in order for them to agree with the Safety standards intended by the company in accordance with the regulations that will be imposed; with that in view it proposed measures to achieve that improvement.

At a final stage, with the intent of measuring the Safety performance of euroAtlantic respecting the effectiveness of the measures proposed and compliance with the Part-CAMO requirements considered relevant during this dissertation, the present research proposes to the Safety department and the DME, Safety Indicators to be evaluated in the future, as the metric that should be used to measure them and the method to collect the information.

Keywords

Safety, Safety Management System, euroAtlantic airways, Continuing Airworthiness, Safety Performance Indicators

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List of Acronyms

ACARS	Aircraft Communications Addressing and Reporting System
AD	Airworthiness Directive
ALARP	As Low As Reasonably Practicable
AM	Accountable Manager
AMO	Approved Maintenance Organisation
AMP	Aircraft Maintenance Programme
ANAC	Agência Nacional de Aviação Civil
AOC	Air Operator's Certificate
ASQS	Advanced Safety and Quality Solutions
CAME	Continuing Airworthiness Maintenance Exposition
CAMO	Continuing Airworthiness Maintenance Organisation
CMPA	Complex Motor Powered Aircraft
DCM	Compliance and Monitoring Department
DME	Maintenance and Engineering Director
DME/ENG	Engineering Department
DME/PCO	Planning and Operational Control Department
DOV	Flight Operations Director
EAA	euroAtlantic airways – Transportes Aéreos S.A.
EASA	European Aviation Safety Agency
EC	European Comision
EO	Engineering Order
ETOPS	Extended Twin Engine Operations
EU	European Union
FC	Flight Cycle
FDA	Flight Data Analysis
FDM	Flight Data Monitoring
GPIAAF	Gabinete de Prevenção e Investigação de Acidentes com Aeronaves e de Acidentes Ferroviários
HIL	Hold Item list
IATA	International Air Transport Association
ICAO	International Civil Aviation Organization
INAC	Instituto Nacional de Aviação Civil
IOSA	IATA Operational Safety Audit
IQSMS	Integrated Quality and Safety Management System
LLP	Life Limited Part
MEL	Minimum Equipment List
MGCA	Manual de Gestão da Continuidade da Aeronavegabilidade
MMEL	Master Minimum Equipment List
NC	Nonconformities
OEM	Original Equipment Manufacturer
ORO	Organisational Requirements for Air Operations
RVSM	Reduced Vertical Separation Minima
SAF	Safety Department
SB	Service Bulletin

SM	Safety Manager
SMICG	Safety Management International Collaboration Group
SMM	Safety Management Manual
SMS	Safety Management System
SPI	Safety Performance Indicator
SPT	Safety Performance Target
SRB	Safety Review Board
SRM	Safety Risk Management
SSP	State Safety Plan

Concepts

Aircraft (EASA, 2014 - B): means any machine that can derive support in the atmosphere from the reactions of the air other than the reactions of the air against the earth's surface.

Part M (EASA, 2014 - A): Annex of Commission Regulation (EU) No 1321/2014 of 26 November 2014, establishing permanent applicable airworthiness requirements, approved in accordance with Regulation (EC) No 216/2008.

Continuing Airworthiness (EASA, 2014 - A): all of the processes ensuring that, at any time in its operating life, the aircraft complies with the airworthiness requirements in force and is in a condition for safe operation.

Reporter (EASA, 2014 - B): means a natural person who reports an occurrence or other safety-related information pursuant to this Regulation.

Safety Management System (EASA, 2014 - B): a systematic approach to managing aviation safety including the necessary organisational structures, accountabilities, policies and procedures, and includes any management system that, independently or integrated with other management systems of the organisation, addresses the management of safety.

Occurrence (EASA, 2014 - B)**:** means any safety-related event which endangers or which, if not corrected or addressed, could endanger an aircraft, its occupants or any other person and includes, in particular, an accident or serious incident.

Chapter 1 - Introduction

1.1 Motivation

In the past, aviation safety improvement was characterized by a fly-crash-fix-fly approach, meaning the improvements usually emerged as the result of reactive posture and connected to a specific occurrence, in which the root causes would be identified and actions taken in order to avoid similar situations. Today it is understood that it is much more productive to engineer a system in which, to the extent possible, causes of failure have been designed out (J.Stolzer, Carl D.Halford, & John J.Goglia, 2008).

Aviation safety is dynamic and that means that new safety hazards and risks continuously emerge and must be mitigated. For that reason, from the beginning of the 21st century, competent authorities and service providers have been focusing on ensuring the continuous improvement of safety performance.

In the European Union (EU), the European Aviation Safety Agency (EASA) is the entity responsible for elaborating regulations, approving companies that design, manufacture and maintain aeronautical products and for providing safety oversight and support to the EU countries (European Union, 2019). On the other hand, Autoridade Nacional de Aviação Civil (ANAC) is the competent aeronautical authority in the Portuguese territory responsible for regulating aviation activities (ANAC, 2019 - B).

After the introduction of Safety Management System (SMS) in other industries (J.Stolzer, Carl D.Halford, & John J.Goglia, 2008), ICAO introduced it in Annex 6[15] (ICAO, 2010 - A). In 2009, the Portuguese competent aeronautical authority issues an aeronautical information document acknowledging the content of Annex 6, writing that at the national level, airlines and national companies associated with the field shall implement SMS (INAC, 2009).

However, the decision to require its approval by the competent authority was postponed until 2014, as that is the date EASA defines for the mandatory implementation of SMS for air operators after providing further guidance on how to proceed to effective implementation. At the time it is decided not to require the implementation of SMS by CAMOs (EASA, 2014 - C).

An SMS as the name indicates is a system that ensures the safe operation of aircraft through effective management of safety risks. This type of system is designed to continuously improve safety by identifying hazards, collecting and analysing data and continuously assessing safety

[15] Annex to the Convention on International Civil Aviation, entitled “Operation of Aircraft” to assist the authorities in the management of aviation safety risks and the operation of aircraft.

risks. In addition to that, SMS seeks to proactively contain or mitigate risks before they result in aviation accidents and incidents.

After verifying the benefits resulting from requiring SMS in other sectors like air operations, EASA (hereinafter referred to as 'the Agency'), considers relevant the embodiment of SMS requirements in continuing airworthiness management and issues the Opinion No 06/2016[16].

Following the issuance of the Opinion aforementioned, two months after initiation of this study, EASA issues Commission Implementing Regulation (EU) 2019/1383 regarding safety management systems in continuing airworthiness management organisations, which becomes the principal motivation of this study.

1.2 Objective

To study the feasibility of extending the EAA's Safety Management System processes to the management of aircraft continuous airworthiness activities in view of complying with the applicable regulations from the competent aeronautical authorities.

1.3 Methodology

The methodology used for this study is based on bibliographic research about safety management systems, the analysis of the EASA existing and expected regulations regarding SMS in Part-M activities, the analysis of the internal procedures and rules of EAA as a CAMO and the Hazard Identification Log of the company.

After that initial analysis, it is performed an identification of the elements of the Part-M that could be integrated into the EAA's SMS in order to improve the safety of EAA as a CAMO.

1.4 Work limits

The biggest limitation of this work is the lack of information as a result of the lack of reports identifying safety issues.

[16] Draft regulation proposed by EASA to the European Commission introducing the embodiment of safety management system (SMS) requirements into Comission Regulation (EU) No 1321/2014 – SMS in Part-M. (EASA, 2019 - A).

The reporting culture of the two departments performing management of continuing airworthiness in EAA is limited as the mentality “fix-fly” without the safety considerations associated in order to avoid future occurrences is still deep-rooted.

Due to the fact that EAA is still preparing for the process of approval to hold Subpart I privileges, the requirements imposed by that Subpart are not going to be considered in this study.

1.5 Structure

This dissertation is divided in five chapters organised as follow:

The first chapter presents the motivation, objective, methodology, work limits and structure.

The second has a brief presentation of euroAtlantic Airways in terms of history, fleet information, the variation of the number of employees and the structure and organisation of euroAtlantic in terms of safety and management of continuing airworthiness activities.

The third chapter focuses on the state of art of the subjects in which knowledge is considered relevant to the development of this thesis. It introduces the safety aviation developments achieved in the last decades and it introduces concepts as safety culture, an exposition of EAA’s reporting system and a brief explanation of what is the Part-M process.

The fourth describes the procedure followed during this study. This is the chapter where it is described the methodology used to decide the changes that are to be done in EAA to improve its current SMS in order to improve safety performance as a CAMO.

Primarily it is analysed the EASA existing and expected regulations, and then it is analysed the internal procedures and rules of EAA as a CAMO. Pior to the identification of the elements of Part-M to be integrated into EAA’s SMS, it is done a survey to the departments performing Part-M tasks to evaluate its current safety culture. After the processes before mentioned, and the identification of risks that are not being properly managed, mitigation actions are proposed as to Safety Performance Indicators in order to improve EAA’s SMS and to measure its effectiveness.

In the last chapter, the fifth, the conclusion of the work is presented, as well as the recommendations driven from the results achieved and the indication of future work that will enable to deepen relevant aspects.

Chapter 2 - euroAtlantic airways

2.1 Brief history

On August 25th, 1993, EAA's chairman and largest shareholder until November 2019, Tomaz Metello, founded Air Zarco. During its first years of operation until 1997, Air Zarco operated as a broker[17]. In that year the company bought its first aircraft, a Lockheed L-1011 Tristar (Figure 1), starting operations with its own AOC.

The company operated under the trade name of Air Madeira between 1997 and 1999, and due to bureaucratic issues the name Air Zarco was reused until May 17th, 2000, the date that marks the adoption of the current name euroAtlantic airways – Transportes Aéreos S.A. (euroAtlantic, 2019). On November 15th, 2019 EAA is bought by I-Jet Aviation PT-SGPS, Lda.

Figure 1: Air Zarco Lockheed L-1011-385-3 TriStar 500.
*Source: (EAA, 2019 - B).

[17] A company which arranges transactions between a buyer and a seller with the purpose of receiving a commission when it is verified the execution of the deal (William J.Stanton, 1978).

EAA is a regular and non-regular International Airline with Portuguese registry, specialised in the provision of Charter Services[18], ACMI[19], long term Dry-Lease[20] and Ad Hoc flights[21] worldwide and, in addition to that, also offers maintenance, consulting and design services. Its operational base is located in Portela Airport and the headquarters in Sintra.

2.2 Aircraft fleet

EAA's fleet has been evolving since the acquisition of its first aircraft back in 1997 and an illustration of that evolution can be observed in Annex A. On this date, EAA operates one Boeing 737-800NG (Figure 2), six Boeing 767-300ER (Figure 3) and one Boeing 777-200ER (Figure 4).

Figure 2: euroAtlantic airways Boeing 737-800 NG.

*Source: (EAA, 2019 - B).

[18] A contractual arrangement between an air carrier and an entity hiring or leasing its aircraft encompassing a no scheduled operation (ICAO, 2009).

[19] Wet lease contract is an agreement between operators that includes the aircraft, lessors exclusive technical and cabin crew and all maintenance and ensurance needed for the aircraft (ANAC, 2015).

[20] Dry lease contract is an agreement with the purpose of leasing aircraft without any crew, being the operation performed under the lessors AOC (ANAC, 2015).

[21] Lease agreement not exceeding five or fourteen consecutive days for wing fixed aircraft and helycopters (INAC, 2003).

Figure 3: euroAtlantic airways Boeing 767-300ER.

*Source: (EAA, 2019 - B).

Figure 4: euroAtlantic airways Boeing 777-200FM.

*Source: (EAA, 2019 - B).

2.3 Variation of the number of employees

Considering the kind of services provided by EAA, it is recognised the number of flown hours fluctuates throughout the year, due to the fact that the client's requirements are not constant as it can be perceived by analysis of Figure 5.

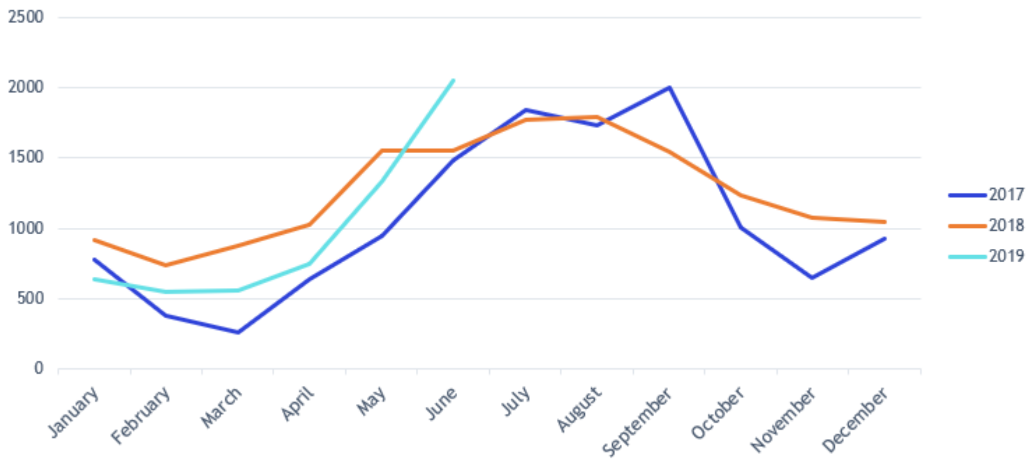

Figure 5: Number of hours flown by EAA's fleet.

*Source: (AIMS International, 2019).

Given that fact, it is understandable that the number of employees also oscillates, majorly because of the lack of constancy in the flying personnel contracted. That being mentioned, a brief description of the personnel employed in August 2019 is provided in Table 1 below.

Table 1: Description of the number of persons employed by EAA in August 2019.

Board of Directors	4
Support to the Board of Directors	5
Commercial Department	7
Maintenance & Engineering Department	70
Compliance Monitoring Department	7
Flight Operations Department	24
Corporate Image Department & Public Relations	2
Legal Department	2
Human Resources Department	3
IT Department	4
Finance and Accounting Department	17
Planning and Control Department	2
Ground Operations Department	9
Security Department / ERP	2
Safety Department	2
Training Department	5
Regular Flights	3
Cockpit Crew	78
Cabin Crew	175
Total *	421

Source – euroAtlantic's Human Resources department /20 August 2019.

Due to the intent of the table represented above, which is the number of EAA employees description by each department, the accumulation of positions is not considered. That fact means that there are departments with more employees than the aforementioned.

2.4 EAA's organisation and structure

EAA has reached a dimension that requires a complex structure in order to coordinate the work actions among the different departments efficiently. The following Figure 6, shows the general organisation chart.

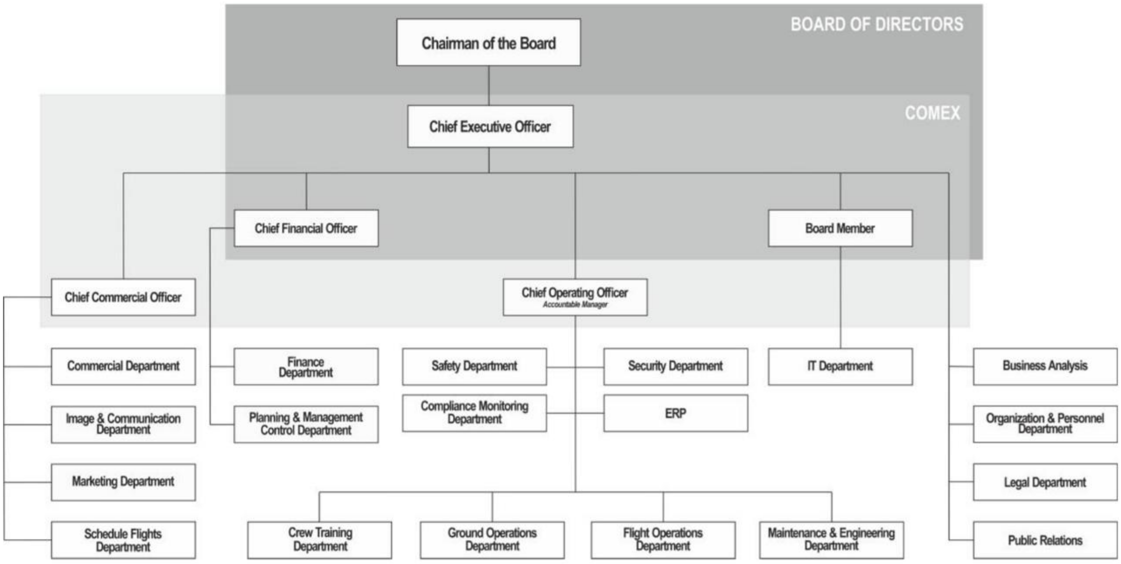

Figure 6: euroAtlantic airways general chart.

*Source: (EAA, 2019 - B).

2.4.1 Accountable Manager

The Accountable Manager (AM), as the name implies, assumes great responsibility in the management of different departments of EAA. He is responsible and has corporate authority for ensuring that all operations can be financed and carried out to the standard required by the competent authority. Due to his hierarchical status, he must ensure that all the requirements imposed by the supervising authority (ANAC) comply while performing the maintenance required by the fleet and that the required financial resources are timely available.

In particular (EAA, 2019 - C):

- "The accountable manager has the authority to ensure the allocation of resources necessary to manage safety risks";

- He has overall responsibility and is accountable for ensuring operations are conducted in accordance with conditions and restrictions of the AOC (PT-01/99/78), and in compliance with National and International authorities or other applicable regulations and standards of euroAtlantic airways.

2.4.2 Safety department

EAA has a safety department in charge of implementation and monitoring of safety, ensuring ongoing conformity with all regulatory requirements, euroAtlantic airways standards, and local procedures.

EAA standards are registered in the company's safety management manual (SMM) that has been developed taking into consideration several items, such as, Annex 19 of the Chicago Convention, guidance from ICAO Doc.9859, industry standards, European Regulations (EU) No 376/2014[22], (EU) No 996/2010[23], (EU) No 965/2012[24], Implementing Regulation (EU) 2015/2018[25], Portuguese DL318/99[26] and DL 218/2005[27] and applicable requirements of Portuguese Civil Aviation Authority (ANAC) (EAA, 2019 - C).

Figure 7: euroAtlantic airways - SAF flow chart.

*Source: (EAA, 2019 - C).

22 It is based on the EASA regulation on the reporting and follow-up of occurrences in civil aviation, amending Regulation (EU) No 996/2010 (EASA, 2014 - B).

23 It is based on the EASA regulation on the investigation and prevention of accidents in civil aviation (EASA, 2010).

24 It is based on the EASA regulation laying down technical requirements and administrative procedures related to air operations (EASA, 2012).

25 It is based on the EASA implementing regulation laying down a list of classifying occurrences in civil aviation to be mandatorily reported according to Regulation (EU) No 376/2014 (EASA, 2018).

26 National Regulation establishing regulatory principles for the investigation of aircraft accidents and incidents, and announcing the creation of an entity to prevent and investigate those accidents/incidents (Assembleia da República, 1999)

27 National Regulation concerning occurrences communication in civil aviation (Assembleia da República, 2005).

The Safety department chart is represented in Figure 7 shown above.

A brief explanation of the Accountable and Safety Manager's responsibilities inside the safety department is given, as they are key elements that must be considered in order to achieve an effective SMS and when proposing alterations to it.

2.4.2.1 **Accountable Manager responsibilities in the safety department**

EAA's AM must provide overall responsibility and accountability on behalf of euroAtlantic airways for the implementation and maintenance of the Safety Management System throughout the organisation (EAA, 2019 - C).

The Accountable Manager has the authority and responsibility to (EAA, 2019 - C):

- "Define and approve the SMS policies and objectives";
- "Communicate to the organisation the importance of an SMS";
- "Provide the resources (personnel, funding, and support) necessary to fulfill SMS requirements";
- "Foster a strong safety culture within the organisation";
- "Facilitate implementation of the SMS across the organisation";
- "Promote awareness of safety requirements throughout the organisation";

2.4.2.2 **Safety Manager**

The Safety Manager is the individual responsible for the oversight of the euroAtlantic's safety performance. He is the focal point for the development, implementation and day-to-day administration and maintenance of the SMS on behalf of the Accountable Manager, and he reports directly to him on all safety matters. This way safety reports and recommendations can be assured of the proper level of study, assessment, and implementation (EAA, 2019 - C).

2.4.2.3 **Safety representatives**

As aforementioned, it is conceived that Safety comprises all EAA's work operational areas, and that way it is considered of greater importance to appoint a safety representative to each of them in order to create the level of connectitude desired between the safety and the other departments.

The main tasks of the department safety representatives are (EAA, 2019 - C):

- “when required, support the investigation procedures for all the occurrence reports related to their functional area, providing the safety department with all the necessary elements to the investigation process closure”;
- “promote the volunteer safety reporting among their department and team members, raise awareness to the importance of the volunteer safety reporting”;
- “cooperate with the Safety Department promotion activities”;
- “actively participate in the Safety Review Board[28] and Safety Action Group[29]”;
- provide the Safety Department with all relevant information and recommendations to improve operational safety;
- “relay urgent and routine safety-related information within their department”;
- “identify and analyse safety hazards within their department aiming at its' elimination or risk mitigation”;
- “collect and manage the data for safety performance indicators”;

2.4.3 Maintenance and engineering department

The maintenance and engineering department is responsible for performing all maintenance in accordance with the maintenance programme of EAA’s aircraft and the policies and procedures included in the continuing airworthiness management manual. It is its responsibility to ensure that maintenance operations are conducted in accordance with the conditions and restrictions of the Air Operator Certificate (EAA, 2018).

The maintenance and engineering department chart is displayed in Figure 8.

[28] A high level meeting, which occurs as a minimum of twice a year which is chaired by the Accountable Manager with the intent of monitoring safety performance against the safety policy and the organization’s Safety management processes effectiveness (EAA, 2019 - C).

[29] A meeting that takes place after the Safety Review Board (SRB) chaired by the Safety Manager as strategy to assist and support the Safety Management department by resolving identified risks and ensuring that the safety actions are implemented within agreed timescales, among others (EAA, 2019 - C).

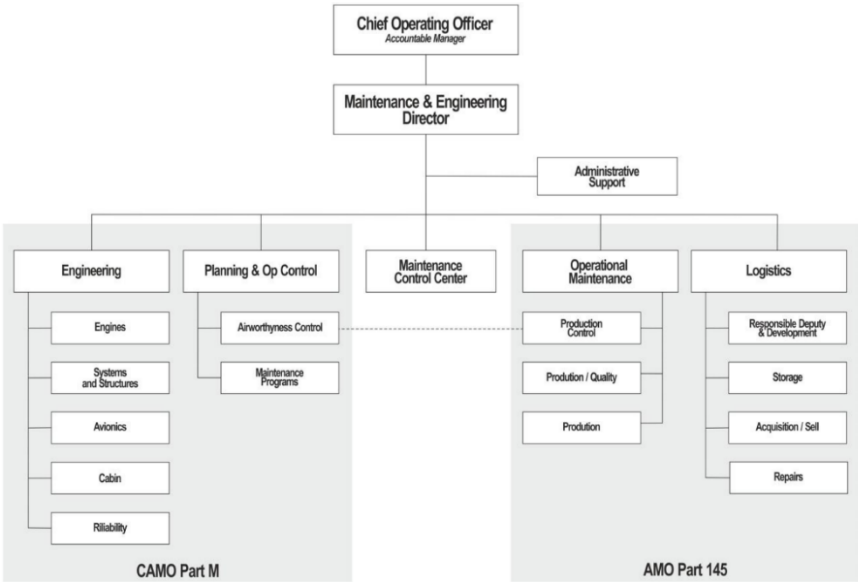

Figure 8: euroAtlantic airways - Maintenance and Engineering flow chart.
*Source: (EAA, 2018).

2.4.3.1 euroAtlantic as Part M

Tasks related to continuing airworthiness management are performed by euroAtlantic, as an Approved Part M subpart G Organisation, certificate PT.MG.017 (ANAC, 2019 - A).

EuroAtlantic Continuing Airworthiness Management Organisation (CAMO) Part M Subpart G grants continuing airworthiness management in accordance with Commission Regulation (EU) No 1321/2014[30]. No airplane can be released to operation with a pending task, namely approved Aircraft Maintenance Programme (AMP) tasks, Airworthiness Directives[31] (ADs) and Life Limited Parts (LLPs) and all defects corrected or deferred.

The certifying staff has the responsibility to decide the action before the flight when a defect threatens operational safety. Data used must be in accordance with M.A. 401[32] (EAA, 2018).

2.4.3.2 Accountable Manager responsibilities in euroAtlantic's Part M

The Accountable Manager ensures the existence of necessary facilities, workspace, equipment, and support services, as well as the work environment to ensure that maintenance is performed in accordance with the Maintenance Programme. He is the person, approved by ANAC,

[30] It is the EASA regulation on the continuing airworthiness of aircraft and aeronautical products, parts and appliances, and on the approval of organisations and personnel involved in these tasks (EASA, 2014 - A).

[31] Airworthiness directives are documents of mandatory compliance released by aviation authorities holder type certificate, with the intent to perform the inspection, modification or replacement of products, parts or aeronautical equipment of the aircraft or establishing, or to establish limits for its use (ANAC, 2015).

[32] Content of Annex I - Subpart D to Commission Regulation (EU) No 1321/2014 of 26 November 2014 related to the Maintenance data (EASA, 2014 - A).

responsible for ensuring EAA's compliance with the requirements set forth in Part M Subpart G. Furthermore he delegates to the Head of Compliance Monitoring the responsibility for managing the Quality system, integrated in the Compliance Monitoring System of the Company, in particular, the Quality of Continuing Airworthiness Management activities (EAA, 2018).

The above delegations do not exempt the Accountable Manager from the overall management and assessment of the CAMO (EAA, 2018).

2.4.3.3 **Director of the maintenance and engineering**

The Head of Continuing Airworthiness Management is the person, approved by ANAC, as the Director of the maintenance and engineering departments. He is responsible for ensuring that all maintenance is performed in a timely manner in accordance with approved standards.

He is the person who ensures the coordination with the Flight Operations Department in order to ensure that both departments are mutually aware of each other requirements. The Director of the maintenance and engineering department reports directly to the Accountable Manager (EAA, 2018).

2.4.3.4 **Head of engineering**

The Head of Engineering is the person in charge of coordinating the Engineering Department actions, as such, he/she is responsible, under the delegation of DME, for the review and release of ADs, Service Bulletins[33] (SBs), and similar documentation from manufacturers and from the aeronautical authorities with respect to euroAtlantic's fleet.

As previously mentioned, ADs implicate mandatory compliance, which means that their release has to be approved by the Accountable Manager, on the other hand, SBs and similar documentation from manufacturers allow flexibility on their integration. For that reason, the head of engineering has the responsibility, based on the criticality of the document, to propose decisions to the Accountable Manager on their adoption, exclusion, or alternative measures to be implemented.

The Accountable Manager, may then decide how to proceed based in his senior experience as an engineer with working knowledge of the current regulation.

It must be ensured that scheduled and unscheduled maintenance and modification programmes suffer appropriate adjustments in order to comply with the manufacturer's manuals and

[33] It is a technical publication issued by the manufacturer informing on actions to be taken in order to improve its "product/documentation". Those recommended actions may range from alterations to documentation, inspections or modifications (EAA, 2019 - D).

specifications as well as with the applicable regulations, and that way, he/she is responsible for granting the monitorisation of aircraft operations, engines and parts thereof.

He/she is in charge of ensuring the preparation and update of the euroAtlantic manuals, namely Reduced Vertical Separation Minima (RVSM), CAT II[34], CAT III[35], and other technical documentation. When Hold Item Lists[36] (HILs) are opened, he must analyse them, verify their correct categorisation and release over the repetitive actions, their deadlines (when not specified) and all technical issues relevant for its treatment.

Besides that he/she must analyse occurrences relevant for safety, incidents, and accidents, ensuring liaison with regulatory authorities, Original Equipment Manufacturers (OEM) and other operationally relevant external entities, including providing information in accordance with procedure NF 01-04[37] (EAA, 2018).

2.4.3.5 **Head of operational planning and control**

It is the person with the responsibility of preparing charts for planning aircraft immobilization in coordination with the commercial department for optimizing fleet operations, taking into account the maintenance programme. Due to that fact, he has certain responsibilities adjacent to his status, for example (EAA, 2018):

- Ensuring compliance with approved maintenance programmes and protocols, as well as the update thereof based on reliability data and on other data collected from experience, from manufacturer's recommendations and in accordance with requirements from aeronautical authorities;
- Preparing and reviewing, in coordination with Engineering, the AMP's and preparing Work Packages to be carried out by Approved Maintenance Organisations (AMOs);
- Checking the accomplishment of the works defined and performed on the aircraft in coordination with operational maintenance;
- Plan the necessary maintenance actions to control and close the HILs in accordance with DME/ENG[38] dispatches.

[34]It is a precision instrument approach and landing with decision height lower than 60m (200ft) but not less than 30m (100ft), and a runway visual range not less than 350m (1200ft) (ICAO, 2010 - B).

[35]It is a precision approach at lower height than CAT II minima, and is divided in three sub-categories: CAT III A, CAT III B, and CAT III C, associated with three minima levels (CAT III A is associated with highest minima, and CAT III C with lowest minima) (ICAO, 2010 - B).

[36]They Are documents in which are described malfunctions that may be deferred according to the provisions of the minimum equipment list (MEL), or provisions of the manufacturer's manuals and other documents (EAA, 2019 - A).

[37] EAA's functional rule on the occurrences notification in maintenance environment.

[38] EAA's engineering department.

Chapter 3 - State of Art of SMS

3.1 Safety management fundamentals

Aviation safety is dynamic and that means that new safety hazards and risks continuously emerge and must be mitigated. In an ideal world, all the safety issues found would be eliminated, but unfortunately, that is not possible.

Within the context of aviation, safety is “the state in which risks associated with aviation activities, related to, or in direct support of the operation of aircraft, are reduced and controlled to an acceptable level” (ICAO, 2018). The progress of aviation as we know it today is usually divided into four main eras as represented in Figure 9.

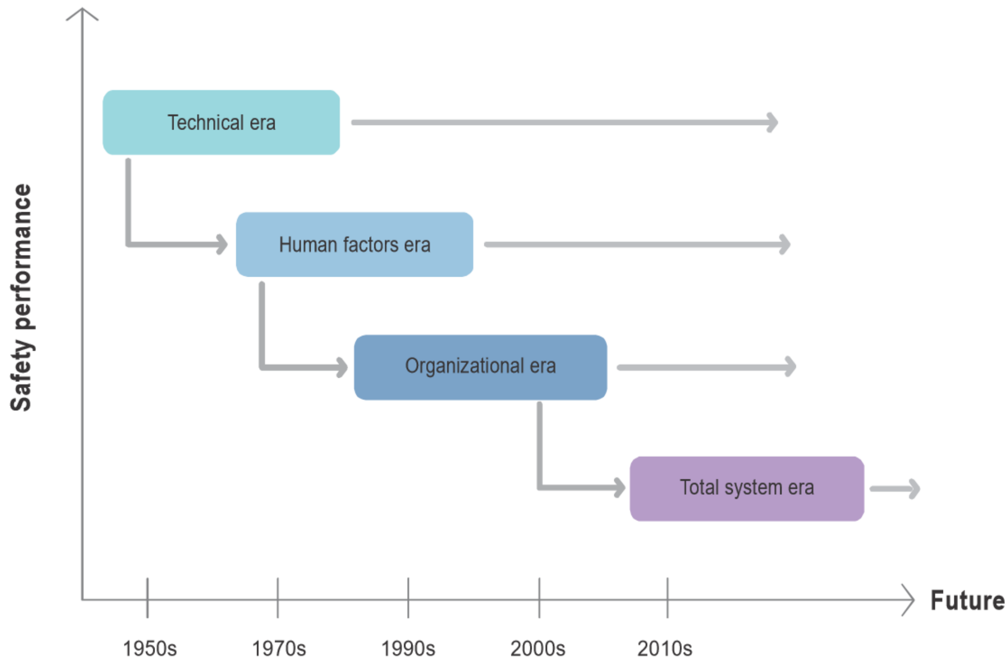

Figure 9: The evolution of safety.

*Source: (ICAO, 2018).

The first years of aviation developments are recognised as the time when safety problems are majorly caused by technical factors and technological failures. Due to the fast growth of aviation in the Technical era, the need to investigate and improve operations emerges, and by the 1950s, the number of accidents starts to decline.

By the early 1970s, major technological advances and enhancements to safety regulations stand out, as the frequency of aviation accidents declines significantly. That achievement highlights the importance of human factors, and with it arises the era associated with the investment of resources in error mitigation, and the developments on the knowledge related to the "man/machine interface". Despite the wherewithal allocation, human factors continue to be cited as a recurring factor in accidents.

Given the continuity of human-factor problems identified in air operations, safety reaches a turning point during the mid-1990s and starts to include organisational factors as well as human and technical factors. This marks the beginning of the organisational era, which considers the impact of organisational culture and policy on the effectiveness of safety risk controls. Additionally, routine safety data collection and analysis using reactive and proactive methodologies enabled organisations to monitor known safety risks and detect emerging safety trends.

From the beginning of the 21st century, competent authorities and service providers have started to implement State Safety Plans (SSPs) or SMSs and, although safety systems to this date have focused largely on individual safety performance and local control, growing recognition of the complexity of the aviation system has been felt. That way, the Total system era arises as a time in which bigger importance is given to the interfaces between organisations that play a part in aviation safety.

3.1.1 The Human Contribution

Human error can be defined as the failure of planned actions to achieve their desired ends—without the intervention of some unforeseeable event (Reason, 1990).

It is frequent to hear statements claiming that human error is implicated in 80 to 90 percent of all major accidents, and although that may be accurate, it does not consider that people behave differently with hazardous systems than in their day-to-day tasks, as most of the procedures they have to perform are regulated and controlled by a certified entity.

These administrative regulations and controls form a major part of any hazardous system defences and are of two main kinds (P.Johnson & J.Gill, 1993):

External controls made up of rules, regulations, and procedures that closely prescribe what actions may be performed and how they should be carried out. Such paper-based controls embody the system's collective wisdom on how the work should be done.

Internal controls derived from the knowledge and principles acquired through training and experience.

3.1.2 Shell Model

It is generally acknowledged that the aviation industry is highly complex, which makes the hazard control process vexing. Given the difficulty to consider all the complex interactions between the elements acting in the system with the potential to be hazardous, several models were created to assist in the assessment process.

The SHELL model is usually used to explain the importance of considering human factors as an integrated part of the safety risk mitigation (SRM) process, as humans interact with the remaining components of the system. Figure 10 illustrates the relationship between the human (at the centre of the model) and workplace components, those being, Software (S), Hardware (H), Environment (E), and Liveware (L).

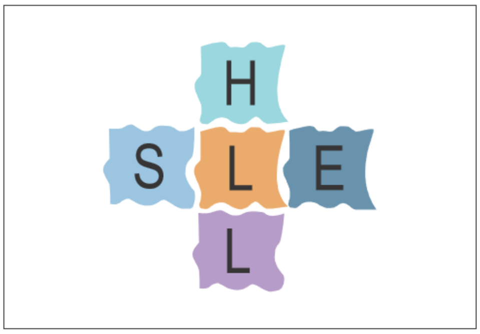

Figure 10: Shell Model.

*Source: (ICAO, 2018).

Particular emphasis is given to the Liveware which is represented in the centre, as aforementioned, due to the fact that this is the least regular of the components. It is noticeable that the boxes are designed with irregular shapes, and that comes as a remark that people do not interface perfectly with other elements of the system, including with itself. They are more susceptible to the effects of internal (hunger, fatigue, motivation, etc.) and external (temperature, light, noise, etc.) influences.

This model is useful to visualise the interfaces between the various components of the aviation system (ICAO, 2018):

a) Liveware-Hardware (L-H). The L-H interface refers to the relationship between the human and the physical attributes of equipment, machines, and facilities;

b) Liveware-Software (L-S). The L-S interface is the relationship between the human and the supporting systems found in the workplace, e.g. regulations, manuals, checklists, publications, processes and procedures, and computer software;

c) Liveware-Liveware (L-L). The L-L interface is the relationship and interaction between people in their work environment. Some of these interactions are within the organisation (colleagues, supervisors, managers), many are among individuals from different organisations with different roles (air traffic controllers with pilots, pilots with engineers, etc.);

d) Liveware-Environment (L-E). This interface involves the relationship between the human and the physical environment.

3.1.3 Accident Causation

Accidents occur when external disturbances and dysfunctional interactions between system components create a situation that gets out of control (Leveson, 2004).

According to Boeing, the air travel market is projected to be 2.5 times larger in 20 years and it also predicts the global commercial jet fleet will grow to accommodate doubling in size by 2038 (Boeing, 2019 - A). With such prospects, arises the need to increase the safety level in air operations in order to ensure the number of accidents will not follow the growth trend expected to the field. However, that mission is hampered because safety is not a property of static parts but the outcome of complex processes.

3.1.3.1 Swiss cheese metaphor

The description of how processes, functions or tasks fail requires a model. The model determines what information needs to be collected to provide an explanation for the failure.

The ‘Swiss cheese’ metaphor, so well-known in the aviation industry, has a great graphical representation power. The model developed by Professor James Reason is based on the fact that no defensive layer is impenetrable and it illustrates that although such a complex system as aviation is extremely well defended by successive defence layers, those barriers present breaches.

Those breaches appear due to the existence of latent conditions or active failures, which are represented by the holes in Figure 11 below. To better understanding of this graphical representation, the holes should be seen as moving points that under certain local triggers could align through the successive defences, allowing hazards to come into damaging contact with people and assets, and cause an organisational accident.

The Reason Model proposes that all accidents include a combination of both active failures and latent conditions (ICAO, 2018):

Active failures are actions or inactions, including errors and rule-breaking, that have an immediate adverse effect. They are viewed, with the benefit of hindsight, as unsafe acts.

Latent conditions can exist in the system well before a damaging outcome. The consequences of latent conditions may remain dormant for a long time. Initially, these latent conditions are not perceived as harmful, but under certain conditions may become clear when the operational level defences are breached.

Importantly, it should be recognised that latent conditions, when created, had good intentions. Organisational decision-makers are often balancing finite resources, and potentially conflicting priorities and costs, which could lead to their involuntary creation.

This model can be used to evaluate which of the organisation's defences are the effective ones, and where the system could benefit from additions. In practice, the event will breach the defences in the direction of the arrow as displayed in the rendering of Figure 11 and by logic, the situation assessment will be conducted in the opposite direction.

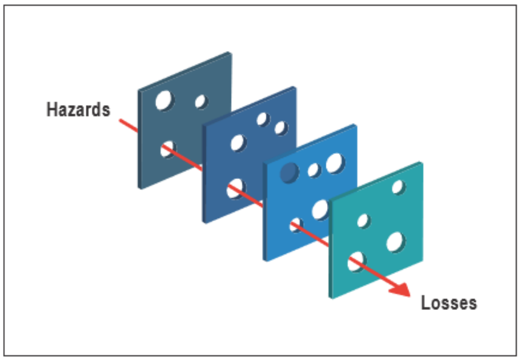

Figure 11: Concept of accident causation.

*Source: (ICAO, 2018).

3.1.3.2 Management dilemma

It is noticeable that any organisation that provides the delivery of services is frequently forced to balance production/profitability and safety risks, once they are linked. Implementing safety risk controls comes at a price, whether it is money, time, or resources. The aim of safety risk controls is usually to improve safety performance, and not production performance; however, some investments in "protection" can also improve "production" by reducing accidents and incidents and thereby their associated costs (Dijkstra, 2006).

Although it is imperative to balance the two elements previously mentioned, it must be considered that the excessive allocation of resources to safety risk controls may jeopardize the profitability of the organisation and that the excessive allocation of resources to production, by reducing safety controls, can lead to an accident.

The safety space metaphor comes as the safety boundary that any company should define in order to maintain the viability of its operation, which can be achieved by implementing early warnings to the unbalanced allocation of resources.

An illustration of this metaphor can be seen in Figure 12 shown below.

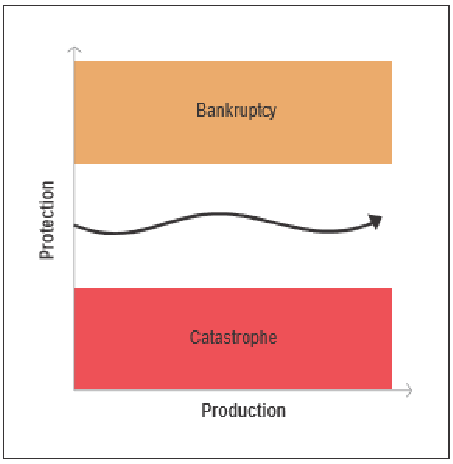

Figure 12: Concept of safety space.

*Source: (ICAO, 2018).

3.2 SMS at euroAtlantic airways

ICAO defines SMS as a systematic approach to managing safety, including the necessary organisational structures, accountability, responsibilities, policies, and procedures (ICAO, 2018).

After the SMS introduction in other domains, ANAC introduced its implementation at the national level for airlines (for air operations) and national companies associated with the field, by issuing CIA 06/2009 (ANAC, 2019 - C); however, the mandatory implementation only became applicable in 2014 by the EASA requirement.

The requirement by the Agency came by the issuance of Commission Regulation (EU) No 965/2012[39], containing *Annex III Part ORO (Organisational Requirements for Air Operations)* where it states that the operator shall establish, implement and maintain a management system introducing the mandatory requirements to comply in order to achieve it (EASA, 2012).

[39] Commission Regulation (EU) No 965/2012 of October 2012 laying down technical requirements and administrative procedures related to air operations pursuant to Regulation (EC) No 216/2008 of the European Parliament and of the Council.

According to ANAC, euroAtlantic has its own SMS implemented since 25th October of 2014 (Jupiter - euroAtlantic, 2019). EAA's SMS is an organised, proactive and integrated approach to manage safety, including the necessary organisational structures, accountabilities, policies, and procedures. Such a system was conceptualised considering EAA's size as a company and the nature and complexity of its activities. That being mentioned, the hazards and associated risks inherent to those activities were also mandatorily considered.

EAA's SMS is designed and implemented to (EAA, 2019 - C):

- "Identify safety hazards in operations";
- "Ensure that remedial action is implemented to control safety risks";
- "Provide for on-going monitoring and assessment of safety performance";
- "Make a continual improvement to the level of safety in operations".

The EAA's SMM contains all the contents related to the safety management system, where are highlighted its four operational "pillars":

- Safety Policy;
- Safety Risk Management;
- Safety Assurance; and
- Safety Promotion.

3.2.1 Safety policy at EAA

The safety policy is the formal documented commitment from euroAtlantic, communicated throughout the organisation, to improve, when practicable, the safety levels in all its activities. The EAA's safety policy ensures that the company has established as objective, the achievement of the industry safety standards and best practices in order to reduce its contribution to aircraft accident risks.

The Safety Policy includes a commitment (EAA, 2019 - C):

- to improve towards the highest safety standards;
- to comply with all applicable legislation, and meet all applicable standards and consider best practices;
- to provide appropriate resources;
- to enforce safety as a primary responsibility of all managers; and
- not to blame someone for reporting something which would not have been otherwise detected in an environment of a "Just Culture".

In order to achieve the high safety standards desired it is important that all the company staff recognise that safety is involved in their day-to-day tasks and that it entails safety responsibilities. That kind of commitment and ideology must be really deep-rooted inside the company, so the EAA top management makes an effort to turn them into the company's safety culture.

3.2.1.1 Safety culture

Safety culture is the natural consequence of having humans in the aviation system. Safety culture has been described as how people behave in relation to safety and risk when no one is watching (ICAO, 2018).

This element is arguably the single most important influence on the management of safety. It is important that the organisation's staff feel that the achievement of the safety objectives is a shared responsibility and that it is only possible if a positive safety culture exists.

It is usually accepted that culture is an organisation characteristic other than just something that it has. In order to reach that satisfactory state, it is peremptory that senior management demonstrates the commitment to safety in all its decisions, which includes directing resources to address safety concerns, as that will reflect the effectiveness of its SMS.

When leadership actively endorses safe practices, the staff feels encouraged to evolve and develop trust in sharing information about their experiences, and the reporting errors and mistakes with their colleagues and managers. This evolution process ultimately leads to a shared awareness of the hazards and risks faced by the organisation and its activities, as to the need to manage risks.

Considering this, the SMS policies in the EAA's SMM have been designed to promote a positive safety culture that comes as the achievement of the five cultures undermentioned:

1. **Informed culture**. Personnel is provided with the necessary knowledge, skills and job experience to work safely, and they are encouraged to identify the threats to their safety and to seek the changes necessary to overcome them (EAA, 2019 - C).

2. **Learning culture**. People are encouraged to develop and apply their own skills and knowledge to enhance organisational safety. Staff is updated on safety issues by management, and safety reports are fed back to staff so that everyone can learn the pertinent safety lessons (EAA, 2019 - C).

3. **Reporting culture.** Personnel is able to report hazards or safety concerns as they become aware of them, without fear of sanction or embarrassment (EAA, 2019 - C).

Any safety information system depends crucially on the willing participation of the workforce, the people in direct contact with the hazards, and that way it is important that personnel understand that management acts upon information, and trust the information will not be used for any purpose other than safety management, like the punishment of the reporter colleagues.

Without such trust, the report will be selective and will probably gloss over pivotal human factors information. In the worst case—that in which potential reporters have no trust in the safety organisation—there may be no report at all (O'Leary & Chappell SL., 1996). An important part of a reporting culture is the ease of making the report and provision of feedback to the reporter.

4. **Flexible Culture.** EAA and its employees are capable of adapting effectively to changing demands (EAA, 2019 - C).

A flexible culture takes a number of forms, but in many cases, it involves shifting from the conventional hierarchical model to a flatter professional structure, where control passes to task experts on the spot and then reverts back to the traditional bureaucratic model once the emergency has passed (Reason, 2016).

Although this kind of behaviour could dictate the survival of a company when exposed to a critical situation it is necessary to ensure that staff would know how to act without guidance.

Weick (1987) argues that you first have to centralise so that people are socialised to use similar decision premises and assumptions so that when they operate their own units, these decentralised operations are equivalent and coordinated.This is precisely what culture does. It creates a homogeneous set of assumptions and decision premises which, when they are invoked on a local and decentralised basis, preserve coordination and centralisation.

5. **Just culture.** While a non-punitive environment is fundamental for a good reporting culture, all EAA employees must know what is acceptable and what is unacceptable behaviour (EAA, 2019 - C).

It would be quite unacceptable to punish all errors and unsafe acts regardless of their origins and circumstances; however, it would be equally unacceptable to give total immunity from sanctions to the actions that could or did contribute to organisational accidents.

Johntson (1995) proposes a *substitution test* in order to decide what cases should require sanctions. He recommends that the person who is seconded to do that decision should substitute the individual concerned for someone else coming from the same domain of activity and possessing comparable qualifications and experience and then ask the following question:

'In the light of how events unfolded and were perceived by those involved in real-time, is it likely that this new individual would have behaved any differently?' If the answer is 'no', then the organisation have to consider whether there were any system-induced deficiencies in the person's training, selection or experience. If such latent conditions are not identified, then the possibility of a negligent error must be considered.

3.2.2 Safety Risk Management in EAA

The achievement of proper safety risk management implicates good comprehension of hazard and risk definitions. According to (ANAC, 2015), these key elements can be defined as follows:

Hazard – A situation or an object with the potential to cause death or people injuries, damage structures or equipment, lead to material losses or to the reduction of a person's capability to perform a certain role.

Risk – Combination of the predicted probability and frequency of a harmful effect induced by a hazardous situation and the severity of that effect.

The purpose of SRM is to evaluate the risk associated with an identified hazard in order to understand if it is tolerable or if it is necessary to go beyond and implement mitigation measures to reduce it.

Having a detailed system description that defines the system and its interfaces help. Safety risk assessments and safety risk mitigations need to be continuously reviewed to ensure they remain effective. ICAO provides guidance for the overview of the hazard identification and safety risk management processes which are illustrated in Figure 13.

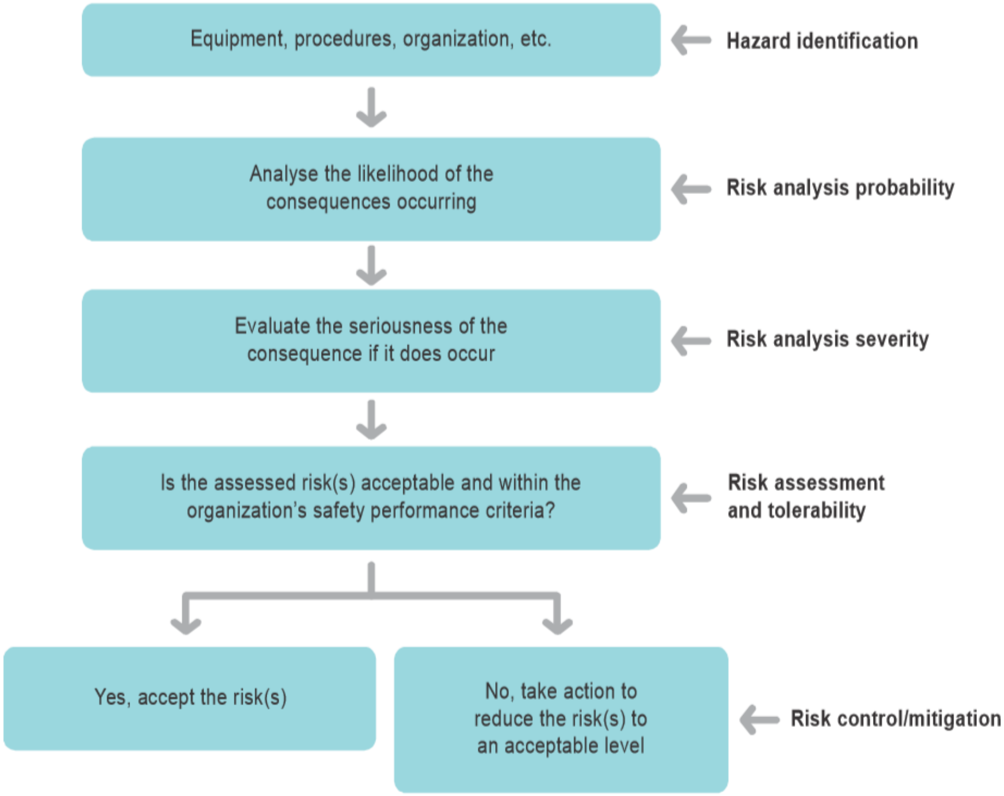

Figure 13: Hazard identification and risk management process.

*Source: (ICAO, 2018).

3.2.2.1 Hazard Identification

Hazards are an inevitable part of aviation activities and exist at all levels in an organisation. It is possible to ensure a safe coexistence of aviation activities and associated hazards, as long as hazards are controlled. The first step in order to control them is proper identification, and for that reason, safety risk management initiates with effective hazard identification.

Their detectability is possible through many sources including reporting systems, normal operations monitoring, inspections, audits, feedback from training, Flight Data Monitoring (FDM), brainstorming sessions, etc., and expert judgement.

The goal is to proactively identify hazards before they lead to accidents, incidents or other safety-related occurrences. Lately, organisations have been alerted by the competent authorities like the Agency to the importance of considering hazards that may exist as a result of the SMS interfaces with external organisations.

(ICAO, 2018) distinguish two main methodologies for identifying hazards:

a) Reactive. This methodology involves the analysis of past outcomes or events. Hazards are identified through the investigation of safety occurrences. Incidents and accidents are an indication of system deficiencies and therefore can be used to determine which hazard(s) contributed to the event;

b) Proactive. This methodology involves collecting safety data of lower consequence events or process performance and analysing the safety information or frequency of occurrence to determine if a hazard could lead to an accident or incident. The safety information for proactive hazard identification primarily comes from flight data analysis (FDA) programmes, safety reporting systems, and the safety assurance function.

EAA goes beyond that and considers a third methodology for hazard Identification (EAA, 2019 - C):

c) Predictive. Through data gathering in order to identify possible negative future outcomes or events. Analysing system processes and the environment to identify potential future hazards and initiating mitigating actions.

3.2.2.2 Sources for hazard identification

There are a variety of sources for hazard identification, that can be internal or external to the organisation and Table 2 illustrated below represents the sources used by EAA to the effect.

Table 2: Internal and external sources used by EAA to hazard identification.
*Source: (EAA, 2019 - C).

Internal Sources	External Sources
Reactive	
EAA Reporting System	Accident and incident reports
Occurrence Investigation	
Flight Data Monitoring	
Proactive	
Annual and quarterly Safety Reports	Accident and incident reports
EAA Reporting System	Technical publications from manufacturers
Flight Data Monitoring	Safety Publications
Safety Performance Indicators	Case studies/Industries occurrences
Audits	
Management of Change	
Predictive	
Flight Data Monitoring	Incident Statistics
Incident Statistics	
Normal Operations Monitoring	

3.2.2.3 Safety Risk Assessment and Mitigation

EAA's Safety Risk Management System encompasses the assessment and mitigation of safety risks (EAA, 2019 - C).

The safety risk assessment process is divided into two phases, first is the evaluation of the safety risk probability and the second is the evaluation of the safety risk severity based on the tables that can be seen in Annex B. During this evaluation, it is important to use whatever safety data and safety information that is available at the moment.

Safety risk probability is the likelihood that a safety consequence or outcome will occur and that way an occurrence is considered foreseeable if any reasonable person could have expected the kind of occurrence to have happened under the same circumstances. Identification of every conceivable or theoretically possible hazard is not possible. Therefore, good judgement is required to determine an appropriate level of detail in hazard identification (ICAO, 2018).

Once the probability assessment has been completed, the next step is to assess the severity, taking into account the potential consequences related to the hazard. The severity assessment should consider all possible consequences related to a hazard, taking into account the worst foreseeable situation (ICAO, 2018).

Sometimes, due to the unavailability of data, emerges the need to use qualitative information, implicating the use of expert judgement; however, in order to express the safety risk(s) associated with an identified hazard in a quantitive format, it is possible to use the safety risk matrix Table 3, which is obtained by conjugation of the two tables aforementioned.

The safety risk assessment matrix is used to determine safety risk tolerability.

Table 3: Safety risk assessment matrix.

*Source: (EAA, 2019 - C).

RISK PROBABILITY	RISK SEVERITY				
	NEGLIGIBLE (A)	MINOR (B)	MAJOR (C)	HAZARDOUS (D)	CATASTROPHIC (E)
FREQUENT (5)	5 A	5 B	5 C	5 D	5 E
OCCASIONAL (4)	4 A	4 B	4 C	4 D	4 E
REMOTE (3)	3 A	3 B	3 C	3 D	3 E
IMPROBABLE (2)	2 A	2 B	2 C	2 D	2 E
EXTREMELY IMPROBABLE (1)	1 A	1 B	1 C	1 D	1 E

The safety risk matrix intends to separate each safety risk identified into one of three possible categories, with those being: acceptable, represented by the green colour; tolerable, after mitigation measures are adopted represented by the yellow colour; and unacceptable which is the category represented in red.

Once safety risks have been assessed, the EAA will engage in a data-driven decision-making process to determine what safety risk controls are needed. The safety risk tolerability illustrated below in Table 4, provides common criteria for that process.

Table 4: Safety risk tolerability.

Risk Index	Tolerability	Action required
3D; 3E; 4C; 4D; 4E; 5B; 5C; 5D; 5E	**Intolerable**	Unacceptable under the existing circumstances. Do not permit any operation until sufficient control measures have been implemented to reduce the risk to an acceptable level. Top management approval required.
2D; 2E; 3C; 4B; 5A	**Tolerable**	Acceptable based on risk mitigation. Required Departmental approval of risk assessment.
1A; 1B; 1C; 1D;1E; 2A; 2B; 2C; 3A; 3B	**Acceptable**	Acceptable. Distributed to managers of departments involved.

*Source: (EAA, 2019 - C).

An important concept in order to define proper risk mitigation also defined as risk control actions is ALARP which means that a risk has been mitigated to the extent that is "as low as reasonably practicable". It is important to understand that the intent is not to achieve the lowest possible risk but to obtain the lowest level that can be derived, using those resources reasonably available to the operator (J.Stolzer, Carl D.Halford, & John J.Goglia, 2008).

The level of safety risk can be lowered by reducing the severity of the potential consequences, reducing the likelihood of occurrence or by reducing exposure to that safety risk. It is easier and more common to reduce the likelihood than to reduce the severity (ICAO, 2018).

It is important to consider that the full range of possible control measures to find an optimal solution implicates that each of the safety risk mitigation alternatives proposed should be evaluated considering its effectiveness, cost/benefit, practicality, unintended consequences, like residual safety risks, etc.

3.2.3 Safety assurance at EAA

The effect of the ICAO and FAA safety definition is that much focus is put on risk management. Then a quality management approach should be applied to the control of risk and this is what the FAA introduces as 'safety assurance' (Dijkstra, 2006).

Safety Assurance consists of the processes and activities undertaken to determine whether the SMS is operating according to expectations and requirements. The safety department continually monitors internal processes as well as the operating environment to detect in advance changes or deviations that may introduce emerging safety risks or degradation of existing risk controls.

3.2.3.1 Safety performance monitoring and measurement

Safety performance reflects the EAA's ability to manage risks effectively. That ability is proved recurring to Safety Performance Indicators[40] (SPIs) when they indicate the achievement of the Safety Performance Targets[41] (SPTs) previously stipulated. The Safety Performance Monitoring as suggested refers to the monitoring of the expected values, in order to validate the effectiveness of the safety risk controls.

The process for determining quantitative safety performance indicators and targets for a given period consists of (EAA, 2019 - C):

- Measuring the baseline against which safety improvements are to be assessed;
- Fixing reasonable, yet ambitious targets; and
- Monitoring target achievement over time and reviewing targets as necessary.

In accordance with the existing data on record, the directors and managers of the departments will determine as Safety Performance Indicators the events which, by its Severity/Frequency and/or Risk Level, are considered critical to the operation with approval of the Safety Manager and the Accountable Manager (EAA, 2019 - C).

3.2.3.2 Safety audits

Safety auditing is a proactive safety management activity that provides means for identifying and validating potential hazards before they have an impact on safety (EAA, 2019 - C).

The intent of the audit realisation is to ensure that there are not nonconformities (NCs) related to Safety, and when that is not the case, distribute them to the Safety department so the problem can be adequately solved.

Every department is internally audited at least once a year, and it is an EAA's compliance department duty to every month send a list, to the Safety Department, of all issued NCs in the previous month with the results of the risk analysis performed for each NC issued.

[40] Data-based parameter used for monitoring and assessing safety performance (ICAO, 2016).

[41] The state or service provider's planned or intended target for a safety performance indicator over a given period that aligns with the safety objectives (ICAO, 2016).

3.2.3.3 The management of change

Change brings risk, whereas managing change reduces the risk. Whether it is the introduction of a new aircraft type, a new maintenance procedure, or a move to new premises, an SMS needs to cover the identification of any changes that may pose a risk to aviation safety (SMICG, 2015).

Change may affect the effectiveness of existing safety risk controls. In addition, new hazards and related safety risks may be inadvertently introduced into operation when change occurs. Hazards should be identified and the related safety risks assessed and controlled as defined in the organisation's existing SRM procedures.

That being referred, EAA has defined that the department managers have the responsibility to identify the need for management of change in its department and proceed with the notification to the Safety department.

3.2.3.4 Continuous improvement of the SMS

EuroAtlantic airways continuously seek to improve its safety performance through (EAA, 2019 - C):

a) "Identification of the cause(s) of substandard performance of the SMS";

b) "Elimination or mitigation of such cause(s) of substandard performance";

c) "Evaluations of facilities, equipment, documentation, and procedures through audits";

d) "Evaluation in order to verify the effectiveness of the system for control and mitigation of risk".

Measures that can improve the SMS include improved (EAA, 2019 - C):

a) Hazards identification and risk assessment processes and improved awareness of the risks;

b) Reporting and analysis tools;

c) Safety reviews, periodic reports, studies, and audits;

d) Communication processes, including feedback from the personnel;

e) Relations with the subcontractors, suppliers, and customers regarding safety.

3.2.4 Safety Promotion in EAA

Safety Promotion is the process aimed at promoting a culture of safety by ensuring that all personnel in the organisation is aware that, at their level and in their day-to-day activity, they are key players in safety and that everyone, therefore, contributes to an effective SMS.

Managers are important actors of the Company's Safety Management System. In all the activities they manage, they demonstrate a commitment to safety and take care of safety aspects. They lead by example and have an essential role to play for safety promotion (EAA, 2019 - C).

3.2.4.1 SMS training programme

The longer and more intensive an individual's training, the less likely it is for that person to be governed by rigid feedforward controls, and conversely (Reason, 2016).

Training is a direct mode of ensuring that personnel understand and embrace safety behaviour, as it roots the compliance of the EAA's safety requirements. The safety training programme represents the commitment of the company to ensure that it will provide efficient, effective and appropriate training to all employees according to its responsibility and role in the EAA's SMS.

Quality and effectiveness are the founding principles of the programme as it is imperative to guarantee that all employees are competent to perform their tasks being alerted to the performance shortcomings whenever they are identified.

To meet this training need, the SMS training programme of euroAtlantic will ensure (EAA, 2019 - C):

- A systematic analysis, to identify the training needs of each occupation;
- The establishment of training schemes to meet the identified needs; and
- The training is assessed and is effective, in that each training session has been understood and the training program is relevant.

3.2.4.2 Safety communication

An important matter to achieve continuous improvement of safety performance is to have an effective communication system regarding the dissemination of current operational safety issues, especially related to assessed risks and analysed hazards.

In order to oppose resistance from the staff, EAA distributes the SMS manual and the safety procedures within the organisation, explaining the reason for its introduction or change. Communication also reinforces the commitment of everyone to report hazards and occurrences and provides feedback to the reporters (EAA, 2019 - C).

3.2.4.3 Dealing with contractors and other organisations

As aforementioned (subchapter 3.2.2.2) there are a variety of sources for hazard identification, that can be internal or external to the organisation, and under that line of thought, there may be external sources of hazards that have the potential to compromise its SMS, like services or products provided by contracted and subcontracted organisations.

ICAO (2018) recommends that organisations identify hazards related to their safety management interfaces. The Agency issued on 4th September 2019 the Commission Implementing Regulation (EU) No 2019/1383[42] where it mandates on requirement CAMO.A.205, that when an organisation contracts maintenance or subcontracts any part of its continuing airworthiness management activities, considers any aviation safety hazards associated with such contracting or subcontracting as part of the organisation's management system.

Beyond this requirement, it must also be ensured that the competent authority is provided access to the subcontracted organisation in order to determine continued compliance with the applicable requirements.

3.2.5 Reporting system at EAA

It is of great importance to learn from previous occurrences, and such is only possible if there is a system properly outlined to gather relevant information related to safety deficiencies, those already occurred or likely to occur (when adverse trends are identified). That learning process is only possible if there is a good reporting culture, due to the fact that the company is majorly dependent on its staff reports to have access to knowledge related to relevant incidents and accidents.

EAA has an occurrence reporting system to enable the collation and assessment of relevant incident and accident reports in order to identify hazards (EAA, 2019 - C). As the purpose of this system is to use the reported information with the aim of improving safety, reporting occurrences is strongly encouraged, with the premise that blame and consequent punishment will not be attributed unless it is verified gross negligence, reckless conduct, wilful deviation, and unacceptable operational behaviour.

The objectives of the occurrence reporting system are to (EAA, 2019 - C):

- Enable an assessment of the safety implications of each occurrence to be made, including previous similar occurrences, so that any necessary action can be initiated.

[42] Commission Implementing Regulation (EU) 2019/1383 of 8 July 2019 amending and correcting Regulation (EU) No 1321/2014 as regards safety management systems in continuing airworthiness management organisations and alleviations for general aviation aircraft concerning maintenance and continuing airmowrthiness management.

The assessment will determine how and why the occurrence has taken place and what might prevent a similar occurrence in the future;

- Ensure, through safety promotion actions, the dissemination of occurrence info related data, so that other persons and operators may learn from the knowledge of relevant incidents and accidents.

This occurrence reporting system provides a way for staff to submit reports, encouraging the submission of voluntary reports raising safety concerns and identifying safety hazards. However, mandatory reports are also contemplated by the system respecting to the compliance of the applicable regulations mentioned below.

The scope of this system includes three types of reports – mandatory, voluntary and confidential reports.

3.2.5.1 Mandatory occurrence reporting

EAA reports to the Portuguese National Authority directly from the Integrated Quality and Safety Management System (IQSMS)[43] all occurrences defined in EU Regulation 376/2014 and EU Regulation 2015/1018. The occurrences categorised as serious incidents or accidents (EU Regulation 996/2010) are sent by euroAtlantic directly from IQSMS to ANAC and GPIAAF (Gabinete de Prevenção e Investigação de Acidentes com Aeronaves e de Acidentes Ferroviários), (EAA, 2019 - C).

3.2.5.2 Hazard (voluntary) reporting

Voluntary reports are a working tool available to all the staff allowing the report to the Safety Department of any condition, object, situation or process with the potential to directly or indirectly result or contribute to significant degradation of operational safety and/or cause damage to equipment and/or injury to personnel as soon as they become aware of them.

Hazard voluntary reporting can be completed using IQSMS – Hazard Report, or a hazard report form in paper format (EAA, 2019 - C).

By ensuring a non-punitive system EAA encourages reporting of hazards. The reporting system will also allow for receiving reports of hazards associated with the activities of any contracting organisation where there may be a safety impact (EAA, 2019 - C).

[43] (see subchapter 3.3 IQSMS) – web-based program accorded between ANAC and EAA used by EAA as Safety, Quality and Risk Management System tool based and in compliance with ICAO Doc. 9589, ICAO Annex 19, EASA and IATA Operational Safety Audit (IOSA) requirements (EAA, 2019 - C), (EAA, 2019 - E).

3.2.5.3 Confidential reporting system

There are certain situations in which the person or persons who witnessed the event or condition passable of reporting do not feel comfortable exposing their identity in order to proceed. Although that fact represents a lack of trust in the company's safety culture, EAA considers primordial that the report is submitted.

To avoid that problem, EAA implemented a confidential safety reporting system that encourages and facilitates the reporting of events, hazards and/or concerns resulting from or associated with human performance in operations, including fatigue. Due to the fact that confidential reports are usually connected to fear of sanction, this category of reports is only accessible to the Safety Manager (EAA, 2019 - C).

Confidential Safety Reporting can be completed using (EAA, 2019 - C)

- IQSMS – Confidential Report;
- Confidential and Human Factors Incident Report.

3.3 IQSMS

The IQSMS is the web-based programme created by *Advanced Safety and Quality Solutions* (ASQS) used by the Safety Department and the Compliance Monitoring department as a tool for the reporting system and the management of audits respectively, in compliance with ICAO DOC.9859, ICAO Annex 19, the Agency and enhanced IOSA requirements. Although this system is mainly used by these two departments, access is granted to all EAA employees so they can easily report to safety and reply to audit-related findings.

The system contemplates 4 modules (EAA, 2019 - B):

- Reporting Module;
- Quality Management Module;
- Flight Risk Module; and
- Risk Management Module.

The reporting module, considers nine categories of reports as illustrated in Figure 14, and as the name indicates, is used to report occurrences being that IQSMS has the capability to store, and posteriorly displayed them as statistic data by events, aircraft system type, descriptor, among others. Those data are then analysed to identify trends and proactively define recommendations to correct possible deviations and avoid accidents and incidents.

Figure 14: List of the report categories available in IQSMS.

*Source: (ASQS, 2019).

Every occurrence identified through mandatory occurrence reports, voluntary reports, confidential reports or other sources provide the opportunity to draw safety lessons (EAA, 2019 - C).

During a safety investigation, upon direct request by the Safety Department or through the Department Safety Representative, it is a primary responsibility of any company employee to properly and effectively assist the department into the gathering of all safety-related information aiming at the identification of causal factors and implementation of adequate mitigation measures. The IQSMS is also a crucial tool enabling an easier communication process with the Safety Department.

When the occurrence reported requires sending to ANAC and GPIAAF, that can be done recurring to the IQSMS, taking into account that the period from the occurrence identification to the submission of the form cannot exceed 72 hours. The information sent to the authority is described in the system by the automatic submission icon as seen in Figure 15 shown below.

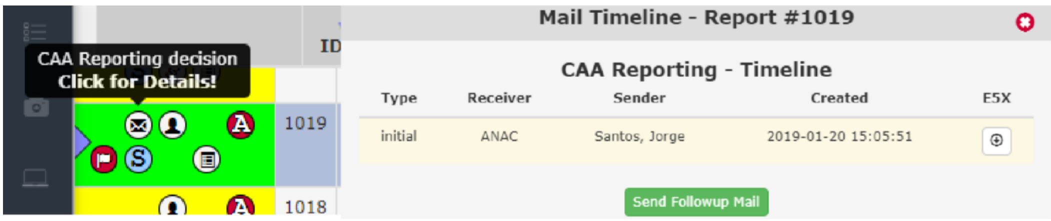

Figure 15: Confirmation of the report submitted to ANAC in IQSMS.

*Source: (ASQS, 2019).

3.4 Introduction to Part-M

In 2002, the Agency created European Commission Regulation (EC) No. 2042/2003 which together with several amendments provided the EASA Part M of this regulation specifying airworthiness requirements for EU based carriers and owners of private aircraft in regard to the obligation to manage continuing airworthiness. That regulation was further consolidated in 2014 with the introduction of the updated regulation 1321/2014 which together with further amendments is the regulation currently in force.

The conduct of this study involves understanding the purpose of Part M and its scope in EAA. Part M is presented in two sections. Section A (called "Technical Requirements" that is applicable to industry) and Section B ("Procedure for Competent Authorities" that is applicable to the Regulator – Competent authority).

Section A, the one applicable to airlines, is subdivided into the following subparts:

Subpart A - General
Subpart B – Accountability
Subpart C – Continuing Airworthiness
Subpart D – Maintenance Standards
Subpart E – Components
Subpart F – Maintenance Organisation
Subpart G – Continuing Airworthiness Management
Subpart H – Certificate of Release to Service – CRS
Subpart I – Airworthiness Review Certificate

The requirement M.A.101 of Subpart A establishes the measures to be taken in order to ensure the airworthiness of aircraft, including its maintenance. It also specifies the conditions to be met by the persons or organisations involved in such activities. Each of the Subparts is associated with a series (raging from 100s corresponding to Subpart A to 900s corresponding to Subpart I) in order to distinguish the requirements of each subpart. That way, as an example, a requirement numbered inside the spectrum of 200 series like M.A.201 can be easily identified as a requirement of Subpart B.

According to its Approval Certificate, as mentioned in subchapter 2.4.3.1, EAA is approved as a CAMO in compliance with Section A Subpart G of Annex I (Part-M) to Regulation (EU) Nº1321/2014, meaning that it is approved to manage the continuing airworthiness of the aforementioned aircraft (subchapter 2.2), and to carry out limited continuing airworthiness tasks with any contracted organisation, working under its quality system.

That approval implies that EAA has to comply with a great part of the requirements of Subparts A to E; however, compliance with Subparts F, H, is not mandatory for EAA as those items are ensured under the approval of its license as Part-145[44], or by such contracted companies.

EAA is currently preparing for the process of approval to hold Subpart I privileges; for that reason, the requirements imposed by that Subpart are not going to be considered in this study.

In order to understand what are the responsibilities of EAA, as a holder of a Part-M Subpart G approval, a brief exposition of part of the requirements that it has to comply will be presented, once its understanding is essential to perceive the elements to use in order to implement a successful SMS in this Part.

The requirement M.A.201 imposes to the owner of the aircraft the responsibility to ensure that no flight takes place unless all of the following requirements are met (EASA, 2014 - A):

(1) “the aircraft is maintained in an airworthy condition”;

(2) “any operational and emergency equipment fitted is correctly installed and serviceable or clearly identified as unserviceable”;

(3) “the airworthiness certificate is valid”;

(4) “the maintenance of the aircraft is performed in accordance with the approved AMP”.

The same requirement establishes that the owner/operator shall ensure that any person authorised by the competent authority is granted access to any of its facilities, aircraft or documents related to its activities, including any subcontracted activities, to determine compliance with Part M.

Subpart G establishes that for aircraft used by licensed air carriers in accordance with Regulation (EC) No 1008/2008[45], (similarly to EAA) the organisation shall establish and control the competence of personnel involved in the continuing airworthiness management, airworthiness review and/or quality audits in accordance with a procedure and to a standard agreed by the competent authority.

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44 Annex of Commission Regulation (EU) No 1321/2014, establishing requirements related to the approval of maintenance organisations (ANAC, 2015).

45 Regulation on common rules for the operation of air services in the European Community (EASA, 2008 - A).

It is of great importance that the continuing airworthiness and the serviceability of operational and emergency equipment are ensured, and in order to achieve it, the requirement M.A.301[46] includes continuing airworthiness tasks.

These tasks involve the rectification of any defect and damage affecting safe operations in accordance with any requirement, procedure, standard or information issued by the competent authority or by the Agency, as to any applicable airworthiness directive and any applicable instructions for continuing airworthiness issued by the type certificate[47] or supplementary type certificate[48] holder.

While performing rectifications, it must be ensured that the minimum equipment list[49] (MEL) (elaborated by the operator based on the master minimum equipment list[50] (MMEL)) and any configuration deviation list (when existent) are taken into account (EASA, 2008 - B).

It is also established that the accomplishment of all maintenance must be achieved in accordance with the aircraft maintenance programme (AMP), a document that shall be approved by the competent authority, or when the continuing airworthiness of aircraft is managed by a CAMO may be approved through an indirect approval procedure. The AMP is a formal document that contains all maintenance to be carried out, including frequency and any specific tasks linked to the type and specificity of operations (EASA, 2014 - A).

Once an airline is approved to manage the continuing airworthiness of its fleet it is fundamental to have the knowledge of how to process any identified aircraft defect, and in order clarify how to treat such identified conditions, the Agency specifically created the requirement M.A.403 "Aircraft defects" defining that (EASA, 2014 - A):

- "Any aircraft defect that hazards seriously the flight safety shall be rectified before further flight";
- "Any aircraft defect that would not hazard seriously the flight safety shall be rectified as soon as practicable, after the date the aircraft defect was first identified and within any limits specified in the maintenance data or the MEL";

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[46] Content of Annex I - Subpart C to Commission Regulation (EU) No 1321/2014 of 26 November 2014 related to the continuing airworthiness tasks (EASA, 2014 - A).

[47] It is a document issued by the competent aeronautical authority certifying a product's project compliance with the applicable airworthiness requirements (ANAC, 2015).

[48] It is a document issued by the competente aeronautical authority certifying an alteration to the already certified product's project in order to ensure compliance with the applicable airworthiness requirements (ANAC, 2015).

[49] It is a list prepared by the operator and approved by the competent aeronautical authority, in compliance or more restrictive than MMEL establishing the conditions under which a certain type of aircraft can be operated, even though the defined components listed on it are inoperative (ANAC, 2015).

[50] It is a list elaborated by the manufacturer of a certain type of aircraft approved by the aeronautical authority of the project's state, that defines the equipment that can be inoperative at the begging of a flight (ANAC, 2015).

- “Any defect not rectified before flight shall be recorded in the aircraft continuing airworthiness record system or, if applicable in the aircraft technical log system”.

The requirement M.A.708 “continuing airworthiness management” establishes that in order to manage the continuing airworthiness of its aircraft, the approved CAMO shall:

1. “develop and control a maintenance programme for the aircraft managed including any applicable reliability programme”;
2. present the aircraft maintenance programme and its amendments to the competent authority for approval unless covered by an indirect approval procedure;
3. “manage the approval of modification and repairs”;
4. ensure that all maintenance is carried out in accordance with the approved maintenance programme;
5. “ensure that all applicable airworthiness directives are applied”;
6. “ensure that all defects discovered during scheduled maintenance or reported are corrected by an appropriately approved maintenance organisation”;
7. “ensure that the aircraft is taken to an appropriately approved maintenance organisation whenever necessary”;
8. “coordinate scheduled maintenance, the application of airworthiness directives, the replacement of service life-limited parts, and component inspection to ensure the work is carried out properly”;
9. “manage and archive all continuing airworthiness records and/or operator's technical log[51]”;
10. “ensure that the mass and balance statement reflects the current status of the aircraft”.

To ensure that the approved CAMO continues to meet the requirements of Subpart G, it shall establish a quality system and designate a quality manager to monitor compliance with, and the adequacy of, procedures required to ensure airworthy aircraft. Compliance monitoring shall include a feedback system to the accountable manager to ensure corrective action as necessary (M.A.712[52]).

As mentioned in Sub-chapter 3.2.5 the learning process is only possible if there is a good reporting culture, as the identification of any condition of an aircraft or component which

[51] The Aircraft Technical Log is a document used to record flight times and cycles, as well as all the discrepancies and malfunctions detected during operation (except discrepancies related with passenger commodity and services), and also to record all maintenance actions accomplished in the aircraft during operation until new scheduled maintenance action (EAA, 2019 - F).

[52] Content of Annex I - Subpart G to Commission Regulation (EU) No 1321/2014 related to the quality system (EASA, 2014 - A).

endangers flight safety is majorly dependent on its report. That way, requirement M.A.202[53] defines that when such conditions are identified by the organisation, it should report them to:

- the competent authority designated by the Member State of registry of the aircraft, and, when different to the Member State of registry, to the competent authority designated by the Member State of the operator;
- to the organisation responsible for the type design or supplemental type design.

[53] Content of Annex I - Subpart B to Commission Regulation (EU) No 1321/2014 related to the occurrence reporting (EASA, 2014 - A).

Chapter 4 - Case Study

4.1 Introduction

As mentioned in 1.1 this study was motivated by the issuance of EASA document Opinion No 06/2016 that proposed the introduction of Safety Management in Continuing Airworthiness Management through the creation of a new Annex Vc 'Part-CAMO' to Commission Regulation (EU) 1321/2014.

The Opinion was developed in line with Regulation (EC) 216/2008[54] (hereinafter referred to as the 'Basic Regulation') and the Rulemaking Procedure[55] and led to the supersedence proposal of the current Subpart G of Annex I (Part-M) by the new annex.

The Opinion as the name indicates is not of mandatory compliance, but a draft regulation addressed to the European Commission that may use it as a technical basis to prepare a legislative procedure. This alteration proposal emerges with the intent of aligning current requirements with the general requirements adopted in other domains (Aircrew, Air Operations, Aerodromes, Air Traffic Management/Air Navigation Services) and:

- "increase the level of safety in continuing airworthiness management and maintenance of aircraft operated by license air carriers and of Complex Motor Powered Aircraft (CMPA)"; and
- "facilitate the implementation of a single management system by multiple-approved organisations and streamline the related oversight".

The management system requirements proposed combine safety management and compliance monitoring provisions into a single set of requirements and this study is intended to recognise what is to be done in relation to safety, in particular to the system used to manage it. Part of the requirements focuses on what is essential for safety management by proposing the organisation to:

(a) clearly define responsibilities and accountabilities for safety;

[54] Regulation (EC) No 216/2008 of the European Parliament and of the Council on common rules in the field of civil aviation and establishing a European Aviation Safety Agency (EASA, 2008 - B) that was repealed in 2018 by Regulation (EU) 2018/1139 published as replacement to that regulation having the same name.

[55] The Agency is bound to follow a structured rulemaking process as required by Article 52(1) of the Basic Regulation. Such process has been adopted by the Agency's Management Board and is referred to as the 'Rulemaking Procedure' (EASA, 2019 - A).

(b) establish a safety policy;

(c) ensure the identification of aviation safety hazards entailed by its activities, including through an internal safety reporting scheme;

(d) ensure the evaluation of aviation safety hazards and the management of associated risks;

(e) take actions to mitigate the risks and verify the actions' effectiveness;

(f) maintain personnel trained, competent, and informed about significant safety issues;

(g) document all management system key processes; and

(h) effectively manage risks in contracted and subcontracted activities.

As mentioned in Sub-chapter 3.2 EAA already has an SMS implemented, which means that the adaptation of the current system to encompass Part-CAMO and the consequent positive safety impact on continuing airworthiness management would have limited economic impact, as a major part of the safety management policies, processes, and systems are already in place. However, it would still be necessary to update its manuals and adapt to meet the additional 'requirements' of the proposed Part.

"If safety management is not implemented by CAMOs managing aircraft used by licensed air carriers and/or managing CMPA, the overall level of safety may be adversely affected, in particular with regard to the increasing complexity of aircraft technology and related continuing airworthiness requirements and the evolution in business models with more and more operators applying second and even third-tier outsourcing of maintenance" (EASA, 2019 - A).

4.2 Alterations to the current regulation

As mentioned in Sub-chapter 2.1, EAA holds an air operator certificate ('AOC') (PT-01/99/78) pursuant to Regulation (EU) No 965/2012, meaning that at present it has a management system in place that includes the Continuing Airworthiness Management of its aircraft by a CAMO approved in accordance with Subpart-G of Regulation (EU) No 1321/2014, certificate PT.MG.017 (ANAC, 2019 - A).

"However, Subpart G of Annex I does not currently contain any requirements for safety risk management within the CAMO. Therefore, a management system of CAMOs, including safety risk management for organisations that manage the continuing airworthiness of aircraft used by AOC holders, should be introduced. That management system should apply to all CAMOs that manage the continuing airworthiness (EASA, 2019 - B)".

Two months after this study was initiated, as mentioned in (3.2.4.3), the Agency issued the Commission Implementing Regulation (EU) 2019/1383 amending Regulation 1321/2014 and introducing SMS requirements to continuing airworthiness activities by imposing the implementation of Part-CAMO until 24th September 2021 (EASA, 2019 - B).

The new Part-CAMO table of contents is presented in Table 5. For the 100 and 200 series of the Section A requirements, as well as for all Section B requirements, the rule titles and last three digits of the rule reference are aligned with those in the corresponding Authority Requirements/Organisation Requirements in the Aircrew and Air Operations Regulations. The 300 series is new and related to specific requirements to Part-CAMO.

Table 5: Table of contents of the new Part-CAMO.
*Source: (EASA, 2019 - A).

Annex Vc (Part-CAMO) to Commission Regulation (EU) No 1321/2014	
SECTION A — ORGANISATION REQUIREMENTS	**SECTION B — AUTHORITY REQUIREMENTS**
CAMO.001 General	
General requirements	**General requirements**
CAMO.A.005 Scope	CAMO.B.005 Scope
CAMO.A.105 Competent authority	CAMO.B.115 Oversight documentation
CAMO.A.115 Application for an organisation certificate	CAMO.B.120 Means of compliance
CAMO.A.120 Means of compliance	CAMO.B.125 Information to the Agency
CAMO.A.125 Terms of approval and privileges	CAMO.B.135 Immediate reaction to a safety problem
CAMO.A.130 Changes to the organisation	
CAMO.A.135 Continued validity	
CAMO.A.140 Access	
CAMO.A.150 Findings	
CAMO.A.155 Immediate reaction to a safety problem	
CAMO.A.160 Occurrence reporting	
Management	**Management**
CAMO.A.200 Management system	CAMO.B.200 Management system
CAMO.A.202 Internal safety reporting scheme	CAMO.B.205 Allocation of tasks to qualified entities
CAMO.A.205 Contracting and subcontracting	CAMO.B.210 Changes in the management system
CAMO.A.215 Facilities	CAMO.B.220 Record-keeping
CAMO.A.220 Record-keeping	
CAMO specific requirements	**Oversight**
CAMO.A.300 Continuing airworthiness management exposition	CAMO.B.300 Oversight principles
CAMO.A.305 Personnel requirements	CAMO.B.305 Oversight programme
CAMO.A.310 Qualification of airworthiness review staff	CAMO.B.310 Initial certification procedure
CAMO.A.315 Continuing airworthiness management	CAMO.B.330 Changes
CAMO.A.320 Airworthiness review	CAMO.B.350 Findings and corrective actions
CAMO.A.325 Continuing airworthiness management data	CAMO.B.355 Suspension, limitation and revocation

4.3 Changes to be implemented

This study is focused on section A[56] of the new Part-CAMO requirements as it is the section having direct implications on the current procedures existent in EAA. The first step is to define

[56] Section of the Annex VC (Part-CAMO) to Commission Regulation (EU) No 1321/2014 with the requirements applicable to CAMOs.

what needs to be done to ensure future compliance, and for that reason, it was created a detailed cross-reference table between the new requirements of Part-CAMO and the current Part-M and Part-ORO[57] Subpart GEN[58]. The referred table is available in Annex C.

In the initial phase, all Part-CAMO requirements are considered in the process, as it is also intended to set the work methodology for the approach to the safety non-related requirements by the other departments in the future.

In order to list the changes that will be necessary to implement the table from Annex C is complemented considering the audits done to the requirements suffering alterations with the introduction of the Part-CAMO requirements. In that process, the quality module of IQSMS is used to obtain the compliance lists of Part-M of Regulation (EU) 1321/2014 and Part-ORO Subpart GEN of Regulation (EU) 965/2012, that contain the audits done to the pretended requirements.

The first compliance list is selected to consider the audits performed between January 2018 and August 2019, as insurance that all requirements from Part-M are at least audited once. The second compliance list, for the same reason, is selected to consider the audits performed between January 2019 and August 2019 as that period was sufficient to encompass all the requirements in that period.

Those lists are used as a guide to all of the requirements, and the latest audits are checked to evaluate compliance with the current regulations and understand if there are new amendments in force that were not considered.

After the cross-reference is completed, the safety department verifies the requirements identified as safety-related where the present research work considers them separately in order to proceed with the documentation and implementation processes. Table 6 represented below highlights in green the requirements with direct impact in the safety department, and in yellow the requirements in which only part of the subheadings have implications to safety. This study results in the creation of SPIs with the intent of measuring the effectiveness of safety consideration in the compliance of part of the requirements identified below.

[57] Annex III to Regulation (EU) No 965/2012 containing the organisation requirements for air operations (EASA, 2012).

[58] Subpart of Part-ORO with the general requirements for air operators (EASA, 2012).

Table 6: List of Part-CAMO's safety-related requirements.
*Source: (EASA, 2019 - A).

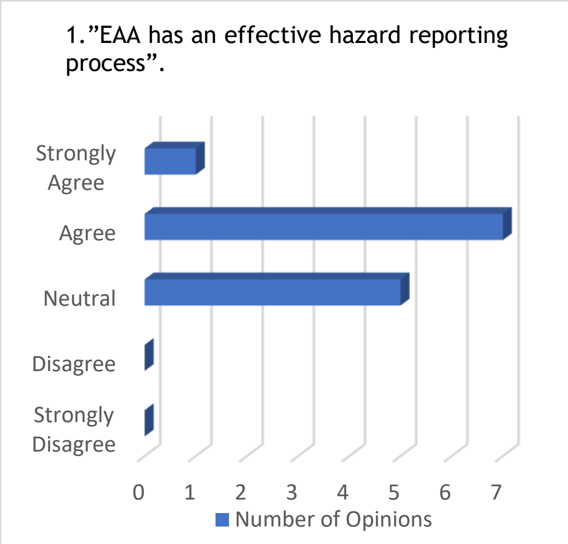
SECTION A — ORGANISATION REQUIREMENTS
CAMO.001 General
General requirements
CAMO.A.005 Scope
CAMO.A.105 Competent authority
CAMO.A.115 Application for an organisation certificate
CAMO.A.120 Means of compliance
CAMO.A.125 Terms of approval and privileges
CAMO.A.130 Changes to the organisation
CAMO.A.135 Continued validity
CAMO.A.140 Access
CAMO.A.150 Findings
CAMO.A.155 Immediate reaction to a safety problem
CAMO.A.160 Occurrence reporting
Management
CAMO.A.200 Management system
CAMO.A.202 Internal safety reporting scheme
CAMO.A.205 Contracting and subcontracting
CAMO.A.215 Facilities
CAMO.A.220 Record-keeping
CAMO specific requirements
CAMO.A.300 Continuing airworthiness management exposition
CAMO.A.305 Personnel requirements
CAMO.A.310 Qualification of airworthiness review staff
CAMO.A.315 Continuing airworthiness management
CAMO.A.320 Airworthiness review
CAMO.A.325 Continuing airworthiness management data

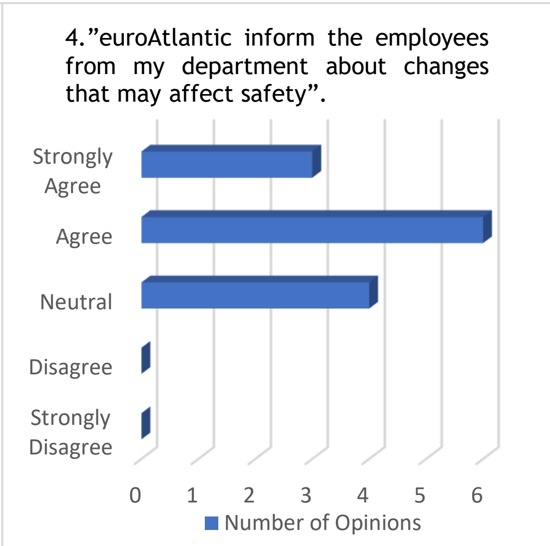
4.4 SMS - Survey Part-M

In order to assess the safety and reporting cultures of engineering and operational planning and control departments, and consult them regarding their experience with the existent SMS, as those are the prime intervenients in EAA's Continuing Airworthiness Management activities, the present research work proposes to the safety department the survey available in Annex D. After evaluation of the safety department, it decides to approve and conduct the survey in the departments aforementioned.

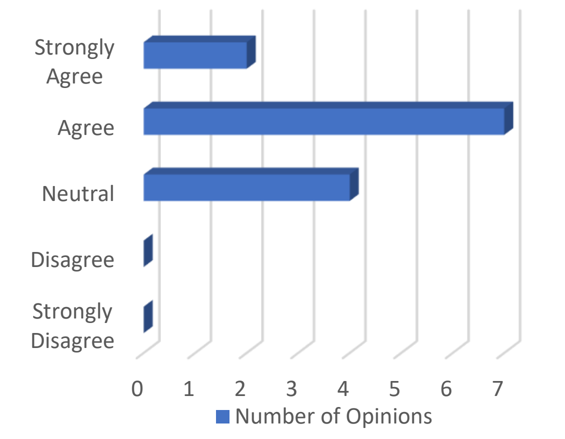
The survey consists of 18 assertions about the subject and its evaluation from 1 to 5, with one being "Strongly Disagree", two "Disagree", three "Neutral", four "Agree" and five "Strongly Agree" with exception of the last one that respects to the number of reports submitted in the last six months.

The referred document is filled by the maintenance and engineering director, the 7 seven engineers from the engineering department and the 5 engineers of the operational planning and control department. Although it is a reduced number of answers, it represents the entire population being studied and considers everyone's experience and perception in their day-to-day tasks. The results of the survey are described below as to the conclusions that were taken from it.

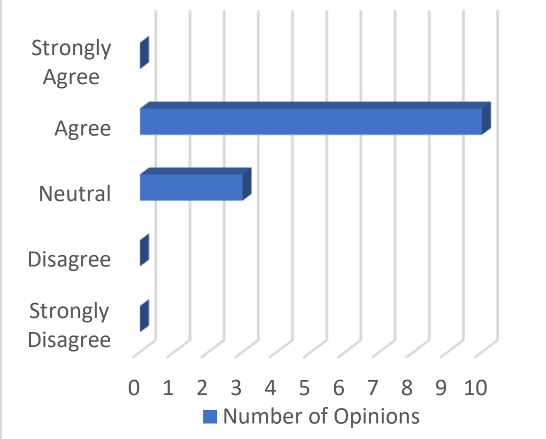




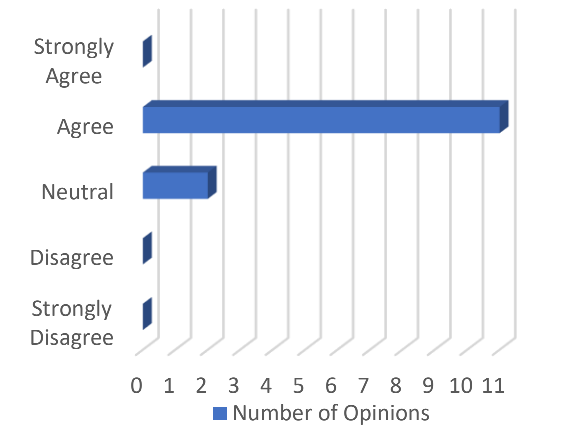
5."EAA management provide good feedback regarding company's safety performance".



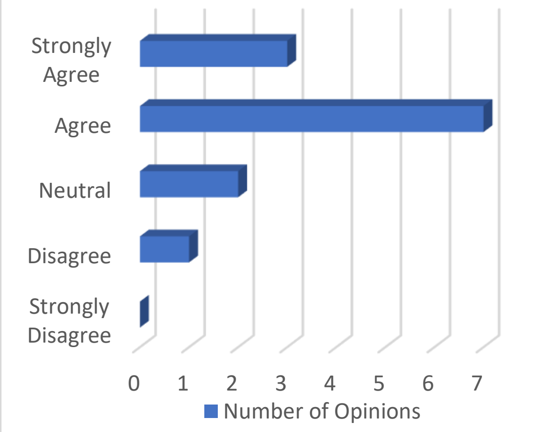
6."The training I receive in order to complete my tasks is enough and appropriate".



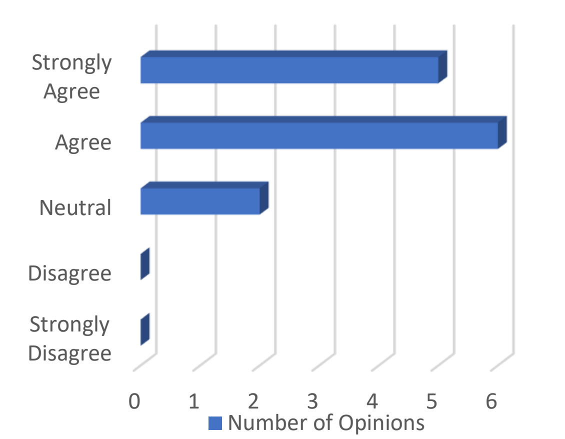
7."My training on the purpose and goals of EAA's SMS is sufficient and appropriate".



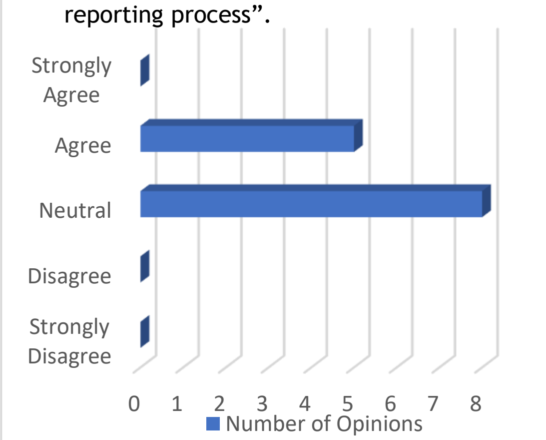
8."Managers are aware of the main safety problems I deal with in my department and performing my tasks".

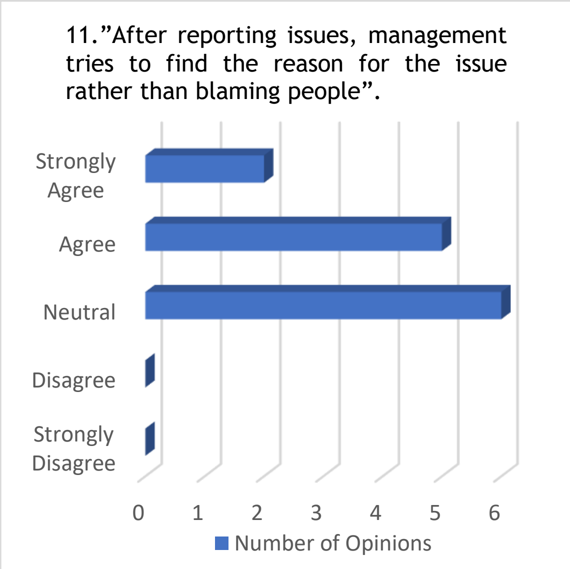


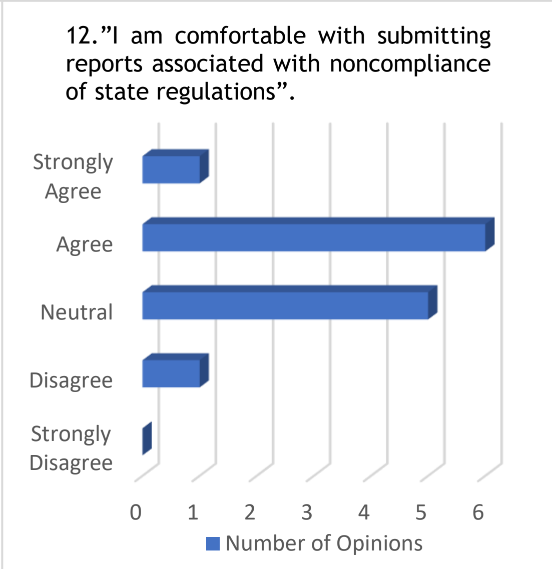
9."I consider that reporting safety issues from my department could improve the safety of EAA's operations".

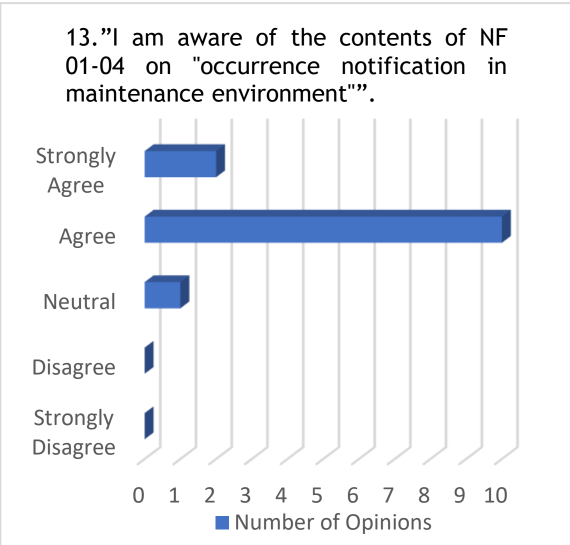


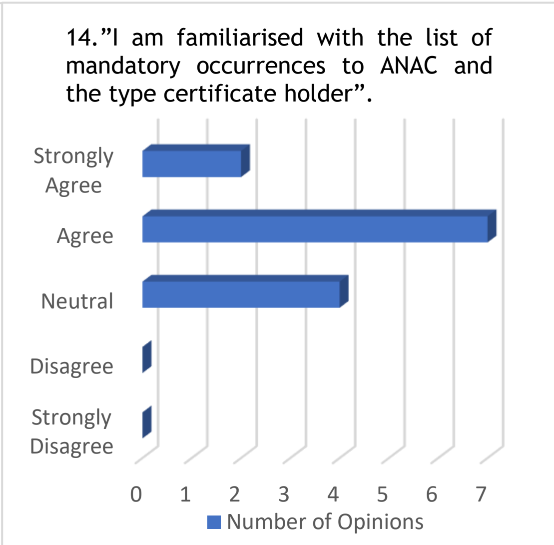
10."The employees from my department feel confortable reporting issues with the existent hazard reporting process".

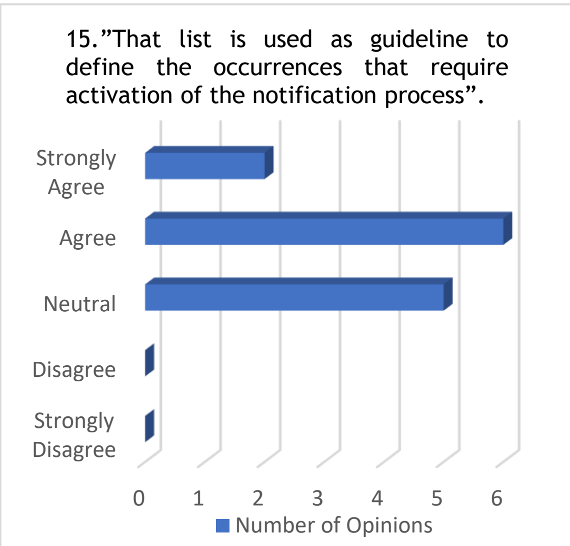


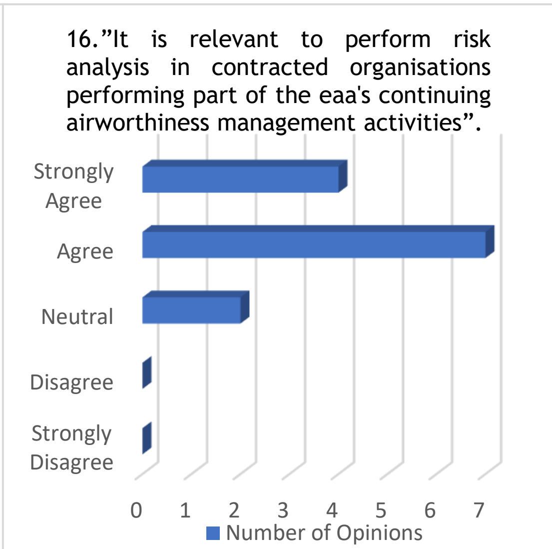

11."After reporting issues, management tries to find the reason for the issue rather than blaming people".
Strongly Agree
Agree
Neutral
Disagree
Strongly Disagree
0 1 2 3 4 5 6
Number of Opinions

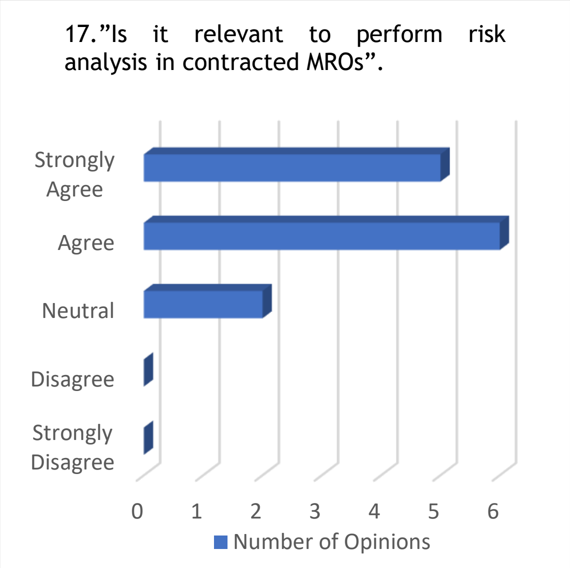

12."I am comfortable with submitting reports associated with noncompliance of state regulations".
Strongly Agree
Agree
Neutral
Disagree
Strongly Disagree
0 1 2 3 4 5 6
Number of Opinions

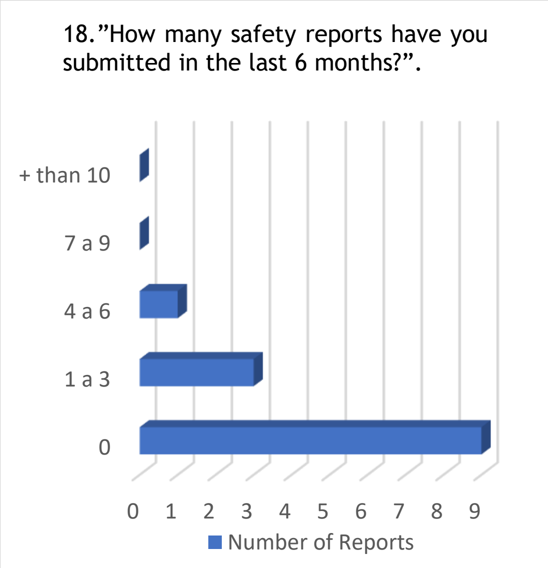

13."I am aware of the contents of NF 01-04 on "occurrence notification in maintenance environment"".
Strongly Agree
Agree
Neutral
Disagree
Strongly Disagree
0 1 2 3 4 5 6 7 8 9 10
Number of Opinions


14."I am familiarised with the list of mandatory occurrences to ANAC and the type certificate holder".
Strongly Agree
Agree
Neutral
Disagree
Strongly Disagree
0 1 2 3 4 5 6 7
Number of Opinions


15."That list is used as guideline to define the occurrences that require activation of the notification process".
Strongly Agree
Agree
Neutral
Disagree
Strongly Disagree
0 1 2 3 4 5 6
Number of Opinions


16."It is relevant to perform risk analysis in contracted organisations performing part of the eaa's continuing airworthiness management activities".
Strongly Agree
Agree
Neutral
Disagree
Strongly Disagree
0 1 2 3 4 5 6 7
Number of Opinions





In general terms, the number of "Neutral" responses is considered high which could be explained considering that from the 13 universe personnel that participated in the survey, 4 of them (at the time the survey took place) were working in the organisation for less than six months.

The results of this survey showed a major part of the considered population acknowledge EAA provides defined and effective procedures as to the necessary means to report occurrences, hazards and safety issues, admitting that reporting safety from their department could improve the safety of EAA's operations.

However, it is highlighted the need to improve safety communication and training as an attempt to reduce neutral answers regarding the internal processes and procedures of EAA.

Internally, after proposal of the present research work, the Safety Manager defines his presence within the CAMO's scope of work should be reinforced by ensuring weekly visits to gain a better perception of what is done inside the DME/ENG and DME/PCO[59] in order to be able to understand how to improve their safety culture and in particular, their confidence in providing information about safety issues.

In particular, safety awareness should be improved while providing safety training to its employees. EAA as an organisation should reinforce/emphasize the description of the processes and system used for reporting safety issues.

In addition to the training given by EAA, it should be improved the continued communication about changes that may affect safety, to show the company that EAA has established as

[59] EAA's Planing and Operational Control department.

objective the achievement of the industry safety standards and that it includes keeping its personnel alerted to the issues when they emerge and include them in the management process.

By keeping its employees informed regarding the management of change process (when affecting the procedures used to perform their tasks), managers would also raise awareness of the main safety problems they have identified, and potentiate the help of its employees in the identification of additional safety problems that may emerge.

The answers to the survey aforementioned, describe a lack of reports (not caused by a shortage of resources), as the majority of the employees did not submit any report in the previous 6 months from the filling of the survey and a substantial part of the population does not feel comfortable reporting issues with the existent hazard reporting process. The answers to question 18 led to the creation of an SPI to the Safety department as described in Table 7 regarding the reports issued by the departments considered.

The development of this study is conducted in view of resolving the conditions identified above and results in the proposal of measures to improve them. The validation of the proposals described during this study will be decided on the next SRB.

4.5 Implementation process

The main purpose of having an SMS in Part-M is to ensure an acceptable level of risk in continuing airworthiness processes and in its implications to the airline operations.

After analysis of the regulations regarding the management of airworthiness, the internal procedures and rules of EAA to comply with them, the answers of the survey and the Hazard Identification Log[60], the present research work identifies aspects considered relevant to improve EAA's SMS regarding the activities performed by the departments in charge of Part-M activities. The aspects considered relevant to be improved are related to:

- Discussion of safety issues;
- Awareness of the importance of safety;
- Importance of reporting safety issues in IQSMS, other than just identifying them;
- Internal communication in the management of change process;
- Qualifications of the Safety Department regarding Part-M scope of work;
- Timely evaluation of the Information reported;

[60] It is as a registry that includes each identified hazard, the associated risks, the initial risk assessment, the mitigation measures that can be applied and the re-assessment of the risk once the mitigation actions have been implemented (CAA, 2013).

- Method and allocation of resources regarding the release of HILs.

Following the identification of the CAMO's elements that could be used by EAA's SMS in order to be improved (given the resources available), it is necessary to implement measures to actually improve it. With that need, the next step of performing this study is to propose to the safety department and the DME alterations to the existent procedures. For that matter, in accordance with what is described later in detail in this chapter, the present research work proposes:

- A greater presence of the Safety Manager in the CAMO's departments;
- That in the management of change process the employees are provided with information regarding the motive of the change to the procedures they use as guidance;
- Improvements in the training of the Safety Manager regarding the scope of work of Part-M;
- Creation of a new position as deputy of the Safety Manager, to assist him in the management of safety in CAMO's activities;
- Promotion on the issuance of the reports within 72h;
- Monthly evaluation of the training needs;
- Procedure to evaluate the HILs opened;
- Timely allocation of resources to evaluate the HILs opened.

The introduction of measures to improve certain aspects, however, does not ensure that the results intended will be obtained, and for that matter, it is necessary to assure its effectiveness.

In order to measure EAA's Part M safety performance regarding the measures described SPIs are also proposed to the DME and the safety department as a method to measure and assure the adequacy of the measures aforementioned. The SPIs currently implemented in EAA are measured monthly and exposed in SRBs to make sure that high management is aware of the safety performance of the company.

4.5.1 SAF – Safety Department

There are various requirements with aspects that must be considered by continuing airworthiness management organisations in order to develop a management system in accordance with Part-CAMO.

The requirement CAMO.A.200 a)(3) is intended to ensure the identification of hazards, the evaluation, and management of the risks accruing from them and to ensure mitigation actions to minimise its impact. In order to ensure an effective safety management system, it is necessary to also consider all the safety issues identified and for that reason the requirement CAMO.A.202 (a) covers similar processes for occurrences like errors and near misses.

These requirements emerge as the need to create a safety culture in organisations managing the continuing airworthiness of aircraft. It is necessary to manage and evaluate all the safety issues identified and verify if risks are maintained at a level as low as reasonably practicable. An important part of this process is to ensure the SMS receives the appropriate information by the people who have direct contact with the deficiencies.

Faced with this reality, considering the internal acknowledgement that EAA already has implemented a structure and procedures to manage and assess risks that emerge, one of the objectives of this dissertation is to propose measures to improve the current reporting culture in these two EAA departments, as a complement to the automated process of collecting information contained in the Tech Logs (sent by Airplanning (EAA, 2019 - G) and measured by aircraft systems (sent via Aircraft Communications Addressing and Reporting System (ACARS)).

4.5.1.1 Improvement of the reporting culture in the CAMO departments

As mentioned in (3.2.1.1) any safety information system depends crucially on the willing participation of the people in direct contact with the hazards. The Survey exposed above shows personnel recognises the improvements that could result from reporting safety issues of their department on the safety of EAA's operations.

It also evidences that although they claim to be aware of the improvements, the number of reports submitted as to the number of reporters in the DME/ENG and DME/PCO is inferior to what is desired according to EAA’s safety policy and objectives.

In accordance with 3.2.4 managers are important actors of the Company’s SMS. For that reason, it is important that in the activities they manage, they demonstrate a commitment to safety.

In view to achieving that visible commitment, and following the analysis of the answers to the Survey, the Safety Manager and the Maintenance and Engineering Director considered relevant to raise awareness of the Heads of the Engineering and the Planning and Operational Control concerning the importance they have in the safety performance of their personnel.

Considering the short number of EAA’s employees performing Part-M tasks it is easier for its management to keep up to date the tasks being performed. So as a measure to enhance the continued improvement of the learning culture of the two departments, it is considered practicable by the SM and DME to attribute to their managers the responsibility of ensuring the list of occurrences that implicate mandatory sending to ANAC is used when applicable.

Ideally, the improvement of the learning culture results in a better reporting culture, as submitting mandatory reports is important to create the habit of reporting, mandatorily and voluntarily.

However, that could not be the case, and for that reason, it is still necessary to measure EAA's safety performance as Part-M/future Part-CAMO organisation regarding its reporting culture, which led to the proposal of the SPI described in 4.5.1.3.

In view of increasing the awareness that all the employees performing airworthiness activities are key players in safety, the present research work proposes the implementation of a procedure as part of the management of change process regarding alterations to internal procedures.

The proposal consists of the inclusion on the "Reason of Revision" of the EAA's internal procedures (regarding the procedures of airworthiness management activities), the motivation of the change, apart from describing the changes implemented.

4.5.1.2 Reports issued by CAMO departments.

It is mentioned in (3.2.1) that in order to achieve the industry safety standards desired it is important that all company staff recognise safety is involved in their day-to-day tasks and that it entails safety responsibilities.

One of those responsibilities is to contribute to an effective communication system regarding the dissemination of current operational safety issues, by using IQSMS to fill reports containing a detailed description of all the facts related to an occurrence (when identified) as to any additional information or pertinent recommendation to clarify the situation.

The overall purpose of the internal safety reporting scheme is to collect information reported by the organisation's personnel and to use reported information to improve the level of the safety performance of the organisation. This improvement resorting to the information reported depends on two factors, one being that the information provided is not filtered (the report contains all the relevant information), and two being that the information arrives in time.

When a report is submitted in IQSMS it is a safety department's responsibility to evaluate, approve and if necessary send it to ANAC. For that matter, when (after the evaluation process) the safety department realises that the content of the report is not sufficient to have a general overview of the occurrence and draw any conclusion in relation to the effectiveness of the mitigation action, it can request further investigation through an Engineering Report made by the engineering department.

In order to ensure an acceptable level of effectiveness during the evaluation of the reports received in IQSMS, as mitigation action, the present research work proposes to increase the training requirements for the employees analysing reports related to continuing airworthiness management, with those being the Safety Manager and the new position that is proposed to create “CAMO’s Safety Officer” as illustrated in the proposal for the new EAA’s Maintenance and Engineering flow chart (see Annex E).

The Safety Manager as the unique focal point for the development, administration, and maintenance of the EAA’s safety management processes, and the CAMO’s Safety Officer as his deputy in safety matters related to airworthiness management, have the responsibility to facilitate hazard identification, risk assessment and management, and the monitorisation of actions taken to mitigate risks in EAA’s airworthiness activities.

In order to ensure that the persons in the positions aforementioned are competent and that their responsibilities are not compromised, in particular considering the actual Safety Manager is a captain and does not have training in the *Manual de Gestão da Continuidade da Aeronavegabilidade* (MGCA) nor Part-M, the present research work proposes in a taskforce[61] additional training apart from the implicated by their positions in terms of safety, human factors and accident investigation.

The proposal (considered relevant by the Safety Manager and the DME) includes familiarisation with EAA’s continuing airworthiness manual as to EAA’s associated procedures, regulations Part-M and Part-CAMO and familiarisation with at least one type of aircraft operated by the company.

4.5.1.3 SPI proposed to SAF – Safety (Reporting Culture)

After proposing improvements in the commitment to the safety of EAA as CAMO like the improvement of the proximity of the Safety Manager with the CAMO’s departments, the increments on the training provided to him/her and to the CAMO’s Safety Officer regarding continuing airworthiness procedures and regulations, and the inclusion of explanation of the motivations involved in the management of change process concerning alterations to the internal procedures to the employees is necessary to measure its effectiveness.

In order to measure the aspects considered relevant related to the evolution of the learning and reporting culture of the company, it is proposed the creation of additional SPIs to the ones being monitored by the safety department (SPIs one to four described in Table 7).

[61] Weekly meeting among representatives of the different departments of EAA regarding important subjects of the company’s activities.

The new SPIs proposed are in Table 7 and are highlighted in green to be distinguished from the ones already implemented. SPI number 5 is created to evaluate if the pretended improvement of the reporting culture is verified. For that matter, it is important to define an efficient metric to evaluate the performance of the reporting culture.

The number of reports itself does not allow the safety department to draw any conclusion regarding that performance. For example, year (A) during which is verified an increment of reports (1.2 X reports) in comparison to year (B) (X reports) can convey a false impression of improvement if the parameters with potential to cause it, are not considered. A significant increase in the number of flights potentiates a bigger volume of occurrences and for that reason a bigger number of reports.

Thus, if in the year A the company performed 3000 flight cycles (FCs) and in year B 1500 FCs this represents a decrease in the level of reporting culture, on the other hand, the contrary, if in year A the company perform 1500 FCs, and in year B the 3000, it would indicate a significant improvement.

Under that line of thought, in order to identify the current status of EAA, it is consulted the number of FCs performed by EAA's fleet in 2019 (Figure 16) and the number of reports submitted by EAA's Part-M in that year (Figure 17) as it is relevant for the effect.

Actual Aircraft Utilization

01/01/2019-31/12/2019

	HOURS			AVRG UTILIZATION		AVRG SECTOR LENGTH	
REGISTRATION	BLOCK	FLIGHT	CYCL	BLOCK	FLIGHT	BLOCK	FLIGHT
ACMI1	0:00	0:00	0	0:00	0:00	0:00	0:00
ACMI2	0:00	0:00	0	0:00	0:00	0:00	0:00
TOTALS :	0:00	0:00	0	0:00	0:00	0:00	0:00
CS-TFM	311:15	285:21	54	0:51	0:47	5:46	5:17
TOTALS :	311:15	285:21	54	0:51	0:47	5:46	5:17
CS-TKR	2720:05	2460:33	586	7:27	6:44	4:39	4:12
CS-TKS	3241:11	2951:59	661	8:53	8:05	4:54	4:28
CS-TKT	1469:10	1330:01	332	4:02	3:39	4:26	4:00
CS-TST	1803:50	1537:01	550	4:57	4:13	3:17	2:48
CS-TSU	2493:45	2270:13	546	6:50	6:13	4:34	4:09
CS-TSV	1656:50	1497:33	382	4:32	4:06	4:20	3:55
TOTALS :	13384:51	12047:20	3057	6:07	5:30	4:23	3:56
CS-TQU	2971:50	2525:15	1296	8:09	6:55	2:18	1:57
TOTALS :	2971:50	2525:15	1296	8:09	6:55	2:18	1:57
PERIOD :	16667:56	14857:56	4407	3:16	2:54	3:47	3:22

Figure 16: Flight cycles performed by EAA's fleet in 2019.

*Source: (AIMS International, 2019).

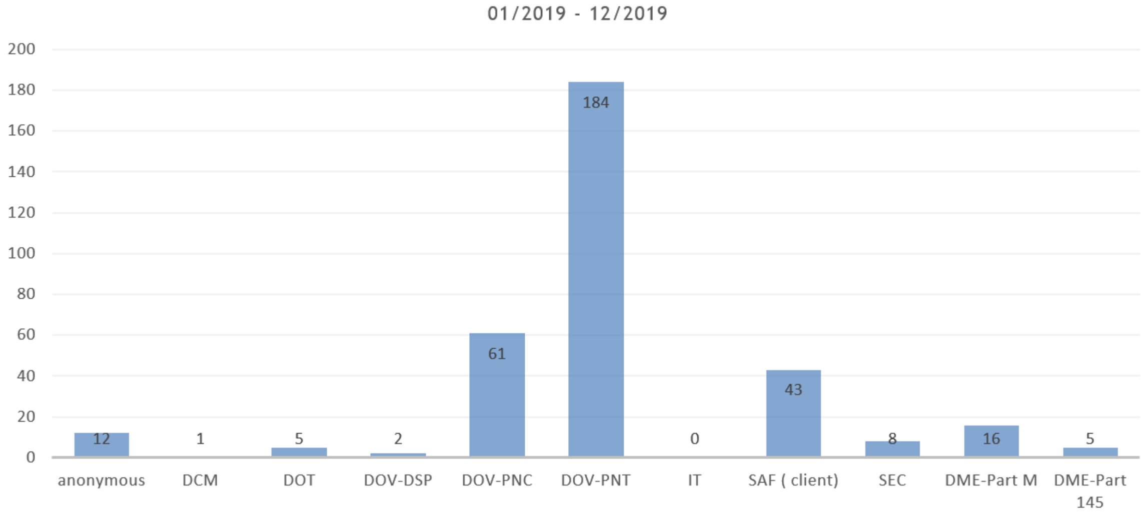


Figure 17: Number of reports submitted in IQSMS by each EAA department in 2019.
*Source: (ASQS, 2019).

Considering the information analysed, regarding the 2019 results, the two departments representing EAA's CAMO submitted 16 reports in 4407 FCs performed. This can be expressed as a ratio of approximately 0,36 reports submitted per each 100 FCs.

EAA considers achievable and important to increase this value by 20 percent by the end of 2020 and for that reason, it is defined as the target a ratio of 0,44. In order to be warned when that rate is decreasing to a value close to the target and in order to avoid reaching it or a value inferior to the goal is defined for the warning the ratio of 0,49.

Table 7: SPIs of the safety department.

Safety Performance Indicator	SPI #	Warning	Target
Mandatory reports (based on FDM) not filled by the flight crew.	1	40%	50%
Not Preformed vs Requested (Airport Risk analysis).	2	15%	20%
FDM collected vs Flight performed.	3	94%	93%
Employees without SMS training.	4	5%	10%
Reports issued by CAMO departments (reports/100FC).	5	0,49	0,44
Reports containing all the relevant information by all the departments involved on the first submission.	6	/	/
Reports submitted within 72 hours from the issue identification in the last 6 months	7	65%	57%

*FC meaning flight cycles.

As mentioned in 3.3, IQSMS has the capability to store the occurrences' reports and posteriorly display them as statistic data. For that reason with the proposal of SPI number 5 of Table 7, comes the joint utilisation of IQSMS to collect the reports issued by the CAMO departments, and the AIMS[62] to account for each 100 flight cycles.

4.5.1.4 **SPI proposed to SAF – Safety (Content of the Report)**

SPI number 6 of Table 7 is proposed in order to create the monitorisation of the reports that are filled with all the relevant information on its first sending and that way understand if in general, it does not represent a problem or if exists a significative tendency to avoid reporting sensible information by the fear of sanctions to the reporter or to a third as mentioned.

As this monitorisation has not been done yet, it is not defined values for the target nor the warning. It is however proposed to measure from the universe of all the reports received and evaluated by the safety department, the percentage of the ones which information was considered insufficient by the safety department and motivated the request for better details.

In accordance to the mentioned in 4.5.1.2, the safety department is responsible for evaluating the content of the report and for that reason, in order to measure SPI number 6 of Table 7, the safety department would be in charge of accounting the reports that did not require further actions and feed that information into an Excel document.

4.5.1.5 **SPI proposed to SAF – Safety (Timing of the Report submission)**

The Agency defined in requirement CAMO.A.160 (d) that reports should be made as soon as possible but in any case within 72 hours of the organisation identifying the condition to which the report relates. During this study, it is realised that although EAA has implemented this rule in NF 01-04 for the reports that require sending to ANAC, the monitorisation of the reports submitted on time is not being done, and there is not an advised period to submit voluntary reports.

This study led to the proposal of defining an advised period (also 72h) for the voluntary reports, as it is considered important in terms of the detail of the report to avoid loss of information over time. To ensure the measurement of the performance regarding the compliance of that period it is also proposed the creation of SPI 7 (Table 7).

Ideally, in order to define the targets, it would be analysed all the reports (mandatories and voluntaries) issued by EAA as a CAMO, and from those, verify the percentage of reports sent in the 72h strongly advised by the Agency for the voluntaries and required for the ones that are mandatory. Unfortunately, the lack of information regarding the due times of the voluntary

[62] The system used by EAA for the management of its information as an airline.

reports' submission and the shortage of EAA's reports as a CAMO would not allow relevant conclusions.

For that reason, in order to understand what would be a reasonable value for the target and warning for SPI 7, it is performed that exercise with all the mandatory reports that EAA sent to ANAC, due to the fact that, the 72h period was required, and it could reflect more precisely what is currently achieved.

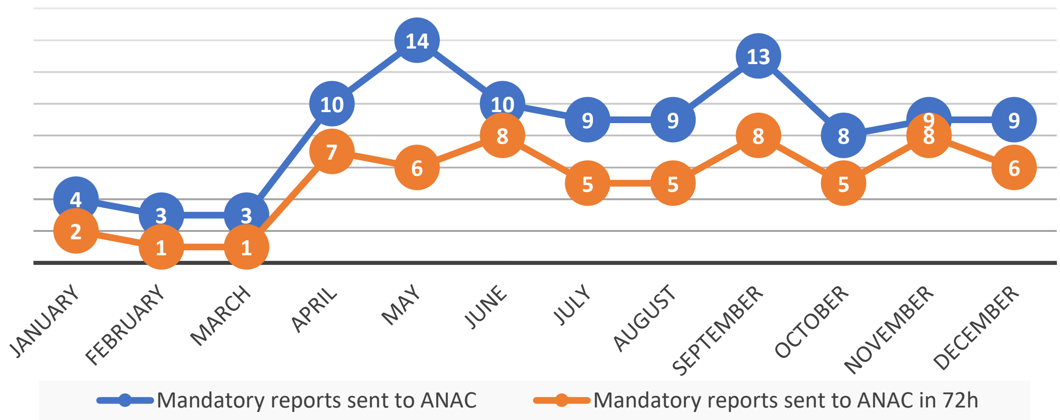


Figure 18: Comparison of the number of reports sent to ANAC and sent in 72h in each month of 2018.

*Source: Courtesy of the EAA's safety department.

At an initial stage, is analysed the data from 2018 shown above in Figure 18 (in 2019 there was a technical error with IQSMS that led to problems in sending reports to ANAC).

By observing each month singularly it is difficult to set a reasonable value for the percentage aforementioned, due to the existence of considerable oscillations. In order to solve that problem and obtain more reliable results, it is decided to manage information about six-month periods as illustrated in Table 8.

Table 8: Reports sent to ANAC covering six-month periods of 2018.

*Source: Courtesy of the EAA's safety department.

2018	Reports sent to ANAC.	Reports sent to ANAC within 72h.	Reports sent to ANAC within 72h [%]
January to June	44	25	≈56,8
February to July	49	28	≈57,1
March to August	55	32	≈58,1
April to September	65	39	≈60,0
May to October	63	37	≈58,7
June to November	58	39	≈67,3
July to December	57	37	≈64,9

By analysing the results of the third column of Table 8 it is seen that the percentage of reports sent to ANAC in the time required varies between approximately 56,8 and 67,3 being that it is verified a more pronounced trend to high 50's. For that reason, at an initial stage, before it is collected information to define a target it is decided to initiate the target as 57%, the warning as 65% and after its first exposition decide if it is necessary to change them.

In similarity to what was done to obtain Figure 18, IQSMS is the source of information to be used by the safety department to consult if the reports submitted by the Part-M departments occurred within 72 hours from the issue identification. Considering the IQSMS does not allow to calculate the intended percentage, that data must be transposed to an Excel document in order to do it, and then the Excel document used to measure SPI number 7 of Table 7.

4.5.2 DME – Training

The requirement CAMO.A.200 (a) 4) orders that the organisations approved under Part CAMO shall establish, implement, and maintain a management system that includes maintaining personnel trained and competent to perform their tasks. EAA's hazard identification log identified the hazard "ORG-02-04" related to maintaining skills of personnel as forgetting to plan current training could lead to the risk of loss of competence.

This risk was object of the safety risk management system mentioned in 3.2.2, evaluated in terms of probability by the safety department and classified as remote (Value 3 – unlikely to occur) in accordance with the safety risk probability table (see Table 13 - Annex B). After the probability assessment was completed, the next step was to assess the severity of the risk in accordance with the safety risk severity table (see Table 14 - Annex B), and its severity of occurrence was classified as major (Value C).

In order to express the safety risk(s) associated with the identified hazard, the safety risk matrix (Table 3) was used, and by conjugating the probability and severity risk classifications aforementioned, the risk of loss of qualification or competence (classified as 3C) was considered tolerable. In order to mitigate the risk, it was created a file for follow up qualification and refresher courses for staff with associated alarms that are provided by the AIMS which is the system used by EAA for the management of its information as an airline.

However, the hazard evaluation aforementioned was restricted to the flying staff, and this study led to the evaluation of the same risk considering the engineering and the planning and operational control employees' training. In order to ensure proper evaluation of the risk of loss of competence by those department's personnel, it is subjected to the EAA's safety risk management system.

First, it is evaluated its probability, and for that, the human resources department is consulted to obtain information on the subject, including the current status of the two departments' mandatory training established in NF 09-01[63]. The safety department is given access to Table 9[64] and Table 10[65] represented below, each line corresponding to one of the department's employees whose identity is omitted.

Table 9: Training records of DME-ENG.

*Information provided by courtesy of the Human Resources department.

CURSO MANDATÓRIOS - ENG											
Regulamentação Aeronáutica	Sistema da Qualidade	Fatores Humanos	MPM - ENG	Operações Especiais	FTS 1+2	EWIS 4+5	MGCA	MOM	SMS	Gen Fam	AVALIAÇÃO DE COMPETÊNCIAS
28-03-21	23-05-21	17-05-19	22-05-21	11-07-21	08-02-21	18-05-19	ONE TIME	ONE TIME	01-03-21	CHECK	09-02-19
23-05-21	23-05-21	30-04-21	22-05-21	11-07-21	11-02-21	29-01-20	ONE TIME	ONE TIME	06-11-20	CHECK	19-12-19
11-07-20	17-10-21	08-01-21	13-02-20	29-03-21	07-01-21	11-07-20	ONE TIME	ONE TIME	29-03-21	CHECK	09-02-18
28-03-21	21-03-21	22-04-21	22-05-21	23-01-20	21-04-20	21-04-20	ONE TIME	ONE TIME	21-01-21	CHECK	28-03-20
23-05-21	23-05-21	08-07-21	22-05-21	10-05-21			21-05-21	21-05-21		18-06-19	FALTA
20-08-21	20-08-21			22-08-21			20-08-21	20-08-21	28-08-21	FALTA	FALTA
18-09-21	16-09-21								28-08-21	FALTA	FALTA

Table 10: Training records of DME-PCO.

* Information provided by courtesy of the Human Resources department.

CURSO MANDATÓRIOS - PCO												
Regulamentação Aeronáutica	Sistema da Qualidade	Fatores Humanos	MPM - PCO	Operações Especiais	FTS 1+2	EWIS 4+5	MGCA	MOM	Gen Fam	SMS	PMA	AVALIAÇÃO DE COMPETÊNCIAS
28-03-21	23-05-21	02-08-20	18-02-21	10-05-21	17-01-20	01-08-20	ONE TIME	ONE TIME	CHECK	06-04-20	18-02-21	28-03-20
21-06-21	16-09-21	17-01-20	21-12-19	12-12-20	16-01-21	24-05-20	ONE TIME	ONE TIME	CHECK	12-11-20	08-02-20	20-12-20
28-03-21	23-05-21	29-01-21	21-12-19	22-08-21	09-04-20	17-07-21	ONE TIME	ONE TIME	CHECK	28-11-19	08-02-20	20-12-20
12-07-20	21-03-21	15-01-21	18-02-21	26-03-21	24-04-21	24-04-21	ONE TIME	ONE TIME	CHECK	19-12-20	18-02-21	28-03-19
30-07-21	20-08-21	08-07-21	28-06-21	11-07-21	FALTA	FALTA	20-08-21	20-08-21	FALTA	FALTA	FALTA	FALTA

The boxes colored in red, (at the time this information was provided) represent training expired or that was still missing and the ones in yellow represent the training that was about to expire, with the exception of the ones saying "ONE TIME", as those correspond to nonrecurrent training.

It is mentioned in subchapter 3.4 that EAA as an approved CAMO, shall ensure that all applicable ADs are applied and coordinate scheduled maintenance when necessary. The engineering department is in charge of analysing the ADs, perform its release and produce the engineering order[66](EO) in order to comply with the AD and the planning and operational control department

[63] EAA's functional rule on the training of DME and DCM personnel.

[64] Table in Portuguese due to the fact that it was provided by the human resources as an image.

[65] Table in Portuguese due to the fact that it was provided by the human resources as an image.

[66] Internal document produced by EAA with the necessary actions to embody a certain task (inspection/modification) (EAA, 2019 - D).

has the responsibility to keep up to date a document with the ADs status and send the EOs to the Part-145 (NF 06-04[67]).

With assistance from the Head of Engineering department, it is identified that expired or missing training of Part-M employees could result in a lack of knowledge concerning the methods, techniques, standards, and instructions currently in force to perform maintenance and airworthiness activities. Therefore, it could lead to EOs containing procedures, techniques and methods no longer approved.

As an example, EAA has an internal rule procedure on the control of parts related to Extended Twin Engine Operations (ETOPS) approved by ANAC where it is mentioned that although legal, swapping components between ETOPS significant systems on the same aircraft for trouble-shooting purposes must be avoided as in those rare cases where similar components are swapped it is required verification of system integrity (EAA, 2019 - H).

Considering the constant alterations that regulations regarding the procedures applicable to airworthiness suffer, in case the "swap" procedure becomes illegal, not having this type of training updated could result in the preparation of an EO with a procedure containing errors.

By analysing Table 9 and Table 10, considering the experience of the human resources regarding the problems in the update of the training (as the staff in charge of controlling the training of EAA's employees), and of Head of the engineering department, the risk associated to the loss of competence by employees of these two departments leading to EOs with defects containing not approved procedures is classified as remote (Value 3 – "unlikely to occur, but possible") in accordance with Table 13.

After the probability assessment is done, it is necessary to assess the severity of the risk. Considering the example given, and the consequent reduction of aircraft system's redundancy, this risk could lead to serious material damage and injuries and for that reason it was classified as major (Value C –see Table 14 - Annex B).

In similarity to the process referred for the flying staff, in order to express the safety risk(s) associated with the identified hazard the safety risk matrix (Table 3) is used, and by conjugating the probability and severity risk classifications aforementioned the risk is classified as 3C.

4.5.2.1 **SPIs proposed to DME - Training**

For that reason, it is decided to create SPIs for the training department in order to measure and control the provision of training in due time.

[67] EAA's functional rule on the AD's circulation and control process.

Table 11: SPIs defined to the training department.

Safety Performance Indicator	SPI #	Warning	Target
DME/ENG or DME/PCO employees with missing training	1	25%	< 34 %
Nº of mandatory training subjects expiring in less than 1 month per DME/ENG employee.	2	1	2 or less
Nº of mandatory training subjects expired in less than 1 month per DME/PCO employee.	3	1	2 or less
Nº of mandatory training subjects expiring in less than 3 months per DME/ENG employee.	4	2	4 or less
Nº of mandatory training subjects expiring in less than 3 months per DME/PCO employee.	5	2	4 or less

Although it is desirable that all employees have their training updated (apart from the mandatory by regulations, whose status has to be constantly updated), prolonged times abroad to support work maintenance on aircraft realised by contracted maintenance can difficult training planning, and for that reason, the SPIs shown above are created according to what is considered achievable until next year.

The percentual value for the target of SPI 1, is defined as the intent of not having more than 4 people with missing training by the end of 2020 and in order to avoid that, it is created a warning when 3 of the employees are missing training. The SPIs 2 to 5 are created in order to avoid when missing training, no more than 2 subjects led to that condition.

The monthly measuring of the SPIs of Table 11 should be done resorting to the Excel document used by the training department to plan the training programmes as shown in Table 9 Table 10.

4.5.3 DME – Engineering

The requirement CAMO.A.160 a) mandates that in order to be in compliance with Part CAMO, EAA's occurrence reporting system shall meet the requirements defined in Regulation (EU) No 376/2014 and Implementing Regulation (EU) 2015/1018 (EASA, 2019 - B).

As mentioned in subchapter 3.2.5.1, EAA compromises to report to ANAC directly from the IQSMS all occurrences defined in those regulations. During this study, it is reviewed the Annex II to Implementing Regulation (EU) 2015/1018 which contains the list of occurrences related to technical conditions, maintenance and repair of the aircraft requiring the mandatory report to the competent aeronautical authority, in particular, point 3 ("maintenance and continuing airworthiness management").

It is noticed that subheading 8 requires communication when it is identified the wrong assessment of a serious defect or serious non-compliance with MEL procedures.

DME/ENG is the department responsible to analyse and release all HILs (documents that are necessary to fill when releasing an aircraft by MEL), checking in advance its correct opening and verifying between others, the correct reference to manuals and its correct category classification according to MEL (when applicable) (EAA, 2019 - A).

By consultation of the Head of the Engineering department's judgement it is evidenced the need to evaluate the effectiveness of EAA's process to communicate this type of occurrence to ANAC.

In April 2019 HILs' release started being done resorting to an automated system instead of using paper format (EAA, 2019 - G). By having compiled all the information related to the compliance of the timeframe for defects' correction in accordance with what is stipulated in MEL, and related to the correct categorisation of the HIL, it is easier to identify serious defects or serious non-compliance with MEL procedures and ensure the required report to the competent aeronautical authority.

Therefore, it is extracted from the automated system currently in use (Airplanning[68] "Sistema de Fiabilidade"), a list of the HILs opened from May until November, (April was considered the test period) in order to evaluate HILs closed in time and analyse its classification. In the considered period 403 HILs were opened and from those, 397 had been released by the engineering department, and for that reason, the number of HILs reviewed during this study is the last mentioned.

As mentioned in subchapter 3.4 the MMEL includes items related to airworthiness, air operations, airspace requirements, and other items the Agency considers that may be inoperative and yet maintain an acceptable level of safety by appropriate conditions and limitations. In order to maintain an acceptable level of safety, the MMEL establishes limitations on the duration and conditions for operation with inoperative items (Boeing, 2019 - B).

Depending on what component is inoperative, and the category to which it corresponds (from the four mentioned below) the MMEL establishes intervals for rectification by the following letter designators (Boeing, 2019 - B):

> "Category A: No standard interval is specified; however, items in this category shall be rectified in accordance with the conditions stated in the MMEL".
>
> > 1) "Where a time period is specified in days, the interval excludes the day of discovery".

[68] The internal software used by EAA to compile the information contained in the Tech Logs of its aircraft.

2) “Where a time period is specified other than in days, it shall start at the point when the defect is deferred in accordance with the operator’s approved MEL”.

“Category B: Items in this category shall be rectified within three (3) calendar days, excluding the day of discovery”.

“Category C: Items in this category shall be rectified within ten (10) calendar days, excluding the day of discovery”.

“Category D: Items in this category shall be rectified within one hundred and twenty (120) calendar days, excluding the day of discovery”.

“The operator may be permitted, by their competent authority, a one-time extension of the applicable rectification intervals B, C or D for the same duration as that specified in their MEL where indicated in this MMEL” (Boeing, 2019 - B).

In order to verify if there were wrong assessment of defects or non-compliance with MEL procedures implicating mandatory report to the competent aeronautical authority, it is created the flowchart shown in Figure 19. It is worthy of mention that the numbers on the flowchart are merely representative and are going to help in the analysis exposition of the HILs considered relevant to the point they led to the creation of an engineering SPI.

This flowchart is built and used as a guideline with the purpose of identifying the aspects that lead loss of airworthiness/safety standards of the aircraft, such as:

a) the wrong assessment of a defect (inoperative component) and its classification with a category establishing bigger rectification intervals than the ones attributed to the category it corresponds;
b) having an aircraft flying with a HIL that has not been closed nor extended after its due time;
c) having an aircraft flying after the period to which the extension was approved before the extended HIL is properly closed.

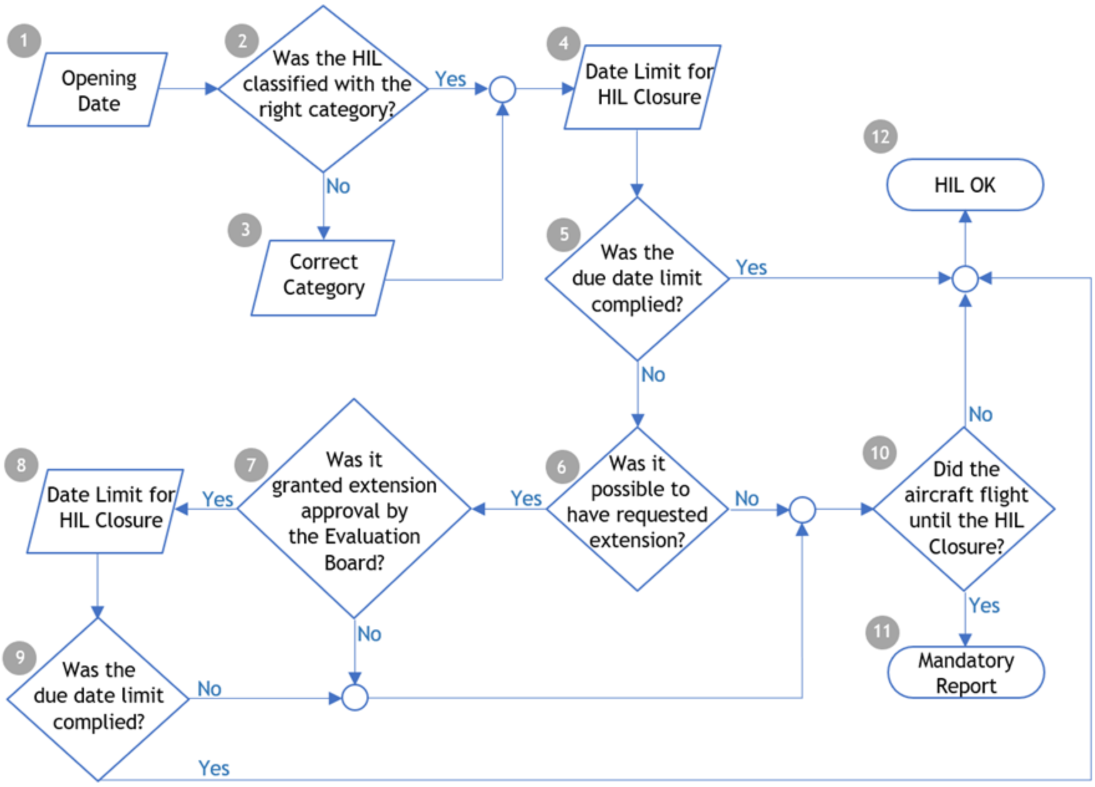


Figure 19: Flowchart with the process used to evaluate the HILs opened.

*EAA's Evaluation Board[69] is the members with authorisation to approve the extension of HILs.

After individual analysis of the 397 HILs following the steps determined in the Figure aforementioned, three of them have stood out possible lack of rigorous investigation or miss of mandatory report to ANAC.

4.5.3.1 First HIL

The first of them is related to the report of a component's "bad condition" using a HIL opened and classified with the category "Not applicable" (N/A), which means there is not a defined period to perform the rectifications needed. In these cases, EAA defined as an internal procedure that the period to perform the rectifications is 120 days, equally to category D.

However, after evaluation by the engineering department (represented by one of its employees), it considers the component inoperative and that considering the item in question the HIL should have been classified as category A.

While analysing the HIL during this study the Head of Engineering highlighted the term "bad condition" used, lacks in its specificity as only with a detailed description of the item by the

[69] Consists of the Flight Operations Director (DOV) or his deputies, Maintenance and Engineering Director (DME) or his deputies, Chief Pilot, Fleet Managers, and the Safety Manager or his deputy.

technician who filled the HIL or posterior investigation of the engineer who evaluated it would allow understanding if this is a condition to be reported on the Tech Log and not to open a HIL.

Consulting the conditions stated in the MEL, it is noticed that the inoperative condition of that type of component may be kept for a maximum of five flight days provided the additional conditions stipulated in the MEL are ensured.

By analysis of EAA's flight chart in the relevant dates, it is seen that four days after the opening of the HIL the aircraft performed the five flights permitted (assuming the additional conditions stipulated in the MEL are complied). Figure 20 is given as an example of how the information is consulted.

For that matter, given this example and the short period to fix or replace the component associated (considering it was, in fact, inoperative), it is necessary to ensure that in the future, in the presence of a similar situation where the wrong classification of the HIL could implicate significant time reductions to fix the defect, the employees are aware that a rigorous investigation must occur in order to ascertain the deadlines to meet.

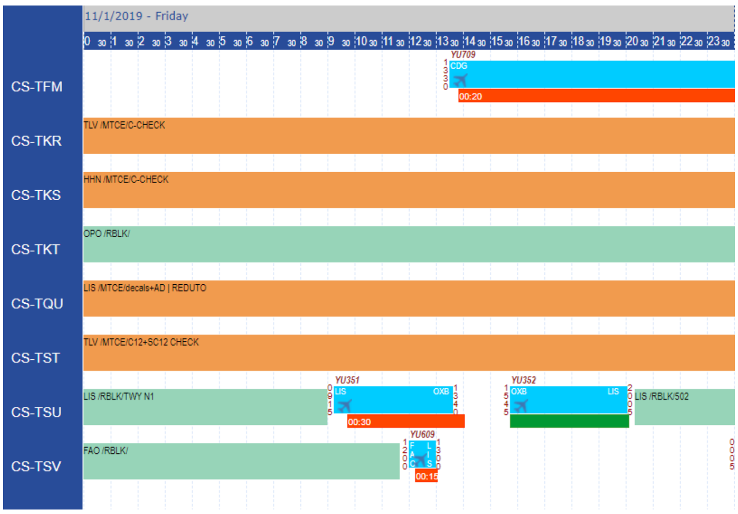


Figure 20: EAA's Flight Chart from November 1st 2019.

*Source: (AIMS International, 2019)

Following the steps illustrated in Figure 19, this HIL follows the sequence (1-2-3-4-5-6-10-11).

4.5.3.2 Second HIL

The second HIL in similarity to the case aforementioned is discovered to be wrongly classified after evaluation of the engineering department, as it should be of classification C with maintenance procedures before each flight instead of classification N/A. Due to the fact of this discrepancy being found five days after the opening of the HIL, it is possible to ask for a HIL extension and obtain the approval for it in order to have time to proceed with the necessary rectification actions.

However, it is only possible to proceed with the closure of the extended HIL 23 days after the day of its opening, meaning that it was only closed 3 days after the period approved by the extension. Assuming that the closure is concluded before any flight takes place on the third day, the EAA's flight chart is checked in order to understand if the aircraft has flown in the two days interval between the end of the period approved by the extension and the date of closure.

It is verified that in that two days period the aircraft is released to flight 4 times without the HIL being closed, despite the defect being corrected. Following the steps illustrated in Figure 19, this HIL follows the sequence (1-2-3-4-5-6-7-8-9-10-11).

4.5.3.3 Third HIL

The third HIL is related to a release by MEL correctly classified as category C. After its analysis, it is verified that the HIL was only closed 2 days after the period approved to release the aircraft to flight. In similarity to the assumption done when analysing the second HIL regarding the moment in which the closure of the HIL is done, it is checked the flight chart, and it is verified that the aircraft performed 4 flights in the day previous to the date of closure.

As mentioned in 4.5.3, the MMEL comprehends a one-time extension of the applicable rectification intervals for category C (which means an additional 10 days to the initial deadline).

The extension of HILs comprehends a safety and reliability risk analysis, that takes into consideration the operation the aircraft is going to perform. That analysis must be approved by the Evaluation Board 2 days previous to the expiration date and signed by the Flight Operations Director (DOV) and the Maintenance and Engineering Director (DME) when filling the fields shown in Figure 21 on the EAA's form ("MEL extension authorisation") (EAA, 2019 - A).

Although the extension is granted by the Evaluation Board and although ANAC allows EAA to extend deadlines for HILs closure as long as it complies with the MEL impositions, ANAC approved an EAA procedure where it is mentioned that when extending due times for HILs closure, ANAC must be notified within 24 hours following the granting of the extension, which did not happen.

AUTHORIZED BY	DATE	SIGNATURE
DIRECTOR OF AIRCRAFT MAINTENANCE & ENGINEERING		
FLIGHT OPERATIONS MANAGER		
After analysis, it is our understanding that this MEL extension will not affect the airworthiness / safety standard of the aircraft, in accordance with EAA procedures and ANAC/EASA regulation, and aircraft is authorized to fly under the limitations above described		

Figure 21: Fields of the MEL extension authorisation form to be signed by the DOV and DME.

*Source: (EAA, 2019 - A)

4.5.3.4 SPIs proposed to DME - Engineering

Once it is identified the risk of wrong evaluation of a defect in compliance with the requirements imposed by MEL, it is considered relevant to analyse it resorting to the safety risk management system mentioned in (3.2.2).

Therefore it is necessary to evaluate the probability associated with this risk in accordance with the safety risk probability table (see Table 13 - Annex B), and based on the data analysed and exposed above, it is classified as occasional (Value 4 – likely to occur sometimes).

The next step is to assess the severity of the risk in accordance with the safety risk severity table (see Table 14 - Annex B). Considering the fact that in the three cases analysed, there were inconsistencies in the utilisation of the HILs extensions or lack of investigation of a wrong assessment classification, and the fact that it is verified a noncompliance with a regulation of the Agency (by the lack of report to ANAC) it is evaluated as a major occurrence (Value C).

In order to express the safety risk associated with the identified hazard, the safety risk matrix (Table 3) is used, and by conjugating the probability and severity risk classifications aforementioned, the risk of wrong evaluation of a defect in compliance with the requirements imposed by MEL (classified as 4C) is considered intolerable.

As a measure to mitigate the risk, it is proposed that the Head of the Engineering department provides more manpower to analyse HILs in a shorter period. To evaluate the effectiveness of the mitigation action proposed it is created an additional SPI (4) highlighted in green in Table 12 for the engineering department (in addition to the three already existent), to continually evaluate the conditions aforementioned in 4.5.3.

Table 12: SPIs of the engineering department.

*FC meaning flight cycles

Safety Performance Indicator	SPI #	Warning	Target
Reliability reports (minutes/meetings) in due time	1	80%	75%
HIL release < 7 days per HIL opened	2	80%	75%
Fleet Repair Map/Mods/STCs status Updates < 1 month	3	80%	75%
HIL containing defects that led to the occurrence report to ANAC	4	0,0523 p/100FC	0,067 p/100FC

In order to ensure that the values fixed for the warning and the target are reasonably defined, it is measured what would be the current performance of the new SPI, by using the data collected between May and November. To assist in this process the AIMS is used to collect the number of FCs performed by EAA's fleet in that period as shown in Figure 22.

Actual Aircraft Utilization

01/05/2019-30/11/2019

	HOURS			AVRG UTILIZATION		AVRG SECTOR LENGTH	
REGISTRATION	BLOCK	FLIGHT	CYCL	BLOCK	FLIGHT	BLOCK	FLIGHT
CS-TFM	310:00	284:32	53	1:27	1:20	5:51	5:22
TOTALS :	310:00	284:32	53	1:27	1:20	5:51	5:22
CS-TKR	2394:55	2160:57	527	11:11	10:06	4:33	4:06
CS-TKS	1941:56	1732:33	483	9:04	8:06	4:01	3:35
CS-TKT	1347:55	1220:51	299	6:18	5:42	4:30	4:05
CS-TST	1803:50	1537:01	550	8:26	7:11	3:17	2:48
CS-TSU	2022:40	1852:18	412	9:27	8:39	4:55	4:30
CS-TSV	1448:05	1306:56	340	6:46	6:06	4:16	3:51
TOTALS :	10959:21	9810:36	2611	8:32	7:38	4:12	3:45
CS-TQU	1996:50	1748:53	734	9:20	8:10	2:43	2:23
TOTALS :	1996:50	1748:53	734	9:20	8:10	2:43	2:23
PERIOD :	13266:11	11844:01	3398	7:45	6:55	3:54	3:29

Figure 22: Registry of the flying cycles of EAA's fleet from May 2019 to November 2019.

*Source: (AIMS International, 2019)

It is verified that in the considered period, EAA's fleet performed 3398 FCs, and considering there are 2 times that the release of the aircraft by MEL contains anomalies and 1 time that is uncertain, these results can be expressed as a rate of nearly 0,09 reports per each 100 FCs. Due to the seriousness of such occurrences, it is pretended to reduce that rate by 25% by the end of 2020 which led to the selection of the target shown above for SPI 4.

The SPI number 4 of Table 12 can be measured by the engineering department as the department with the responsibility to do the release of the HILs, using AIMS to collect the number of the FCs in similarity to what is shown in Figure 22 and posteriorly calculate the rate on an Excel document.

Chapter 5 - Conclusion and future work

This last chapter ends the dissertation, exposing the conclusions, main difficulties, challenges and proposals to improve and complement what was done during this study.

5.1 Conclusion

In the past decades, accidents and serious incidents were to a large extent the result of some common causes. Common cause hazards are the ones that are most effectively addressed through prescriptive requirements. Although it cannot be assumed that all common cause hazards have been or even can be ultimately addressed, fewer accidents will be related to broadly distributed exposure factors.

In order to assist in the process of addressing these random causes, the Agency created SMS requirements for CAMOs managing aircraft used by licensed air carriers and/or managing CMPA in addition to the ones already existent for air operations. These new requirements complement the traditional approach to managing safety by promoting a more proactive approach that will rely on the organisations' capability to effectively manage risks, stemming both from common cause hazards or hazards having more random, context and organisation-specific causal factors.

One of the biggest challenges of this study was to understand how to keep improving the reporting culture due to the fact that most of the employees performing continued airworthiness activities have adopted a reactive posture (instead of proactive) tending to look at defects as something merely technical that needs to be fixed without spending the appropriate amount of time with safety considerations.

For that reason, during this study, the present research work researches changes that will have to be considered in EAA's SMS in order to apply for approval as a CAMO with an SMS implemented.

With this dissertation, the present research work raises awareness inside the EAA as a CAMO that the changes imposed by the Agency require improvements in safety communication, in particular, CAMO.A.200 (a) 3) and CAMO.A.202 (a). He also highlights that the SMS already existent could be improved as the addressing process is largely dependent on critical thinking of the personnel in contact with the new and repetitive hazards emerging while performing their tasks.

The acknowledgement of the dependence and shortage of reports mentioned in 4.5.1.1, led the present research work to propose three safety performance indicators to be implemented by the safety department in order to measure the volume of reports issued by the departments performing Part-M activities, the quality of the information reported, as to the period comprehended between the issuance of the report and the identification of the issue that motivated it.

Requirement CAMO.A.200 (a) 4) regarding the need of a management system to include maintaining personnel trained and competent to perform their tasks and posterior consultation EAA's hazard identification log, made the present research work identify the risk of not maintaining personnel's skills leading to EOs with defects.

In order to reduce the probability of that risk, the present research work proposes 5 SPIs for the training department to promote monthly evaluation of the training programme for the engineering and the planning and operational control departments.

The last SPI the present research work proposes to implement in order to improve EAA's SMS is motivated by the requirement CAMO.A.160 a) regarding the mandatory report of the occurrences defined in Regulation (EU) No 376/2014 and Implementing Regulation (EU) 2015/1018.

It is identified the risk of wrong evaluation of a defect in compliance with the requirements imposed by MEL and the consequent non-report of DME/ENG as the department responsible for analysing the HILs.

As an attempt to increase the culture of reporting in accordance with the regulations aforementioned the present research work proposed to the Head of the Engineering department the provision of more manpower to analyse HILs on a timely basis.

To evaluate if the mitigation action proposed is efficient or needs to be rethought it is proposed SPI number 4 of Table 12 to evaluate if the number of reports regarding HILs containing defects increases, and creates the habit of reporting other occurrences.

Apart from the proposal of the SPIs created the present research work, also proposed the metric to be used in each of them, and what the tools to be used in order to ensure the information is available and for that reason, it will be possible to measure the safety performance achieved in the future.

Not spending resources to find the root causes of the errors or near misses, safety issues and hazards, and not performing assessment and management of risks potentiate similar happenings in the future. For that reason, it was considered relevant to improve training and create greater proximity to the safety department in order to promote guidance in the adoption of safety behaviours.

In addition to the aspects that could compromise safety inside EAA, the increasing complexity of aircraft technology, the related continuing airworthiness requirements and the evolution in business models with more operators applying second and even third-tier outsourcing of maintenance, great importance was given to the interfaces between organisations contracted by EAA.

During this study, it was defined by the safety department and documented in EAA's SMM (after proposal by the present research work), the procedure for contracted maintenance organisations to submit reports, and it was improved the procedure to notify the type certificate holder of any defect, for example, data that is ambiguous, incorrect or conflicting, that could result in a Service Bulletin for other operators operating the same components.

5.2 Future work

The implementation of the Part-CAMO management system framework requires the continued development of capabilities to identify aviation safety hazards, to assess the associated risks, and to effectively mitigate their consequences. Given what was achieved with this work it is proposed that EAA continue improving its SMS and consider in the near future to:

- Perform risk analysis when verified significant changes in personnel (high turn-hover);
- Perform hazard identification and risk management when adding a new organisation to the list of subcontractors that can perform management of continued airworthiness activities in EAA's aircraft;
- Initiate the creation of checklists containing relevant parameters to consider while performing the two processes aforementioned;
- Evaluate the effectiveness of the mitigation actions currently implemented;
- Evaluate the results obtained in the new SPIs proposed in order to define if the targets were well defined and based in that define the SPTs until 2022;
- Define a procedure to share the lessons learnt by EAA to the employees in general, explaining why particular actions are taken and why safety procedures are introduced or changed.

Bibliography

AIMS International. (2019, October 08). euroAtlantic airways - Airline Information Management System. Dubai.

ANAC. (2015). *Glossário da Aviação Civil*. Lisbon.

ANAC. (2019 - A). *Lista de Organizações Part M Subpart G*.

ANAC. (2019 - B, 12 20). *Missão, Visão e Valores*. Retrieved from anac.pt: https://www.anac.pt/vPT/Generico/ANAC/QuemSomos/Missao/Paginas/MissaoValores.aspx

ANAC. (2019 - C, 09 25). *Circulares de informação aeronáutica*. Retrieved from anac.pt: https://www.anac.pt/vPT/Generico/InformacaoAeronautica/CircularesInformacaoAeronautica/Paginas/CircularesdeInformacaoAeronautica.aspx

ASQS. (2019, August 28). Retrieved from https://eaa.asqs.net/core/main/iqmenue.php

Assembleia da República. (1999). Decreto-Lei nº.318/99. *Diário da República N.º 186*.

Assembleia da República. (2005). Decreto - Lei nº.218/2005. *Diário da República*.

Boeing. (2019 - A, 09 14). *Boeing's Market Outlook*. Retrieved from boeing.com: http://www.boeing.com/commercial/market/commercial-market-outlook

Boeing. (2019 - B). *767 Master Minimum Equipment List*. Seatle Washington: EASA.

CAA. (2013). *CAP 1059 - Safety Management Systems: Guidance for small, non-complex organizations*.

Dijkstra, A. (2006). Resilience Engineering and Safety Management Systems in aviation. *KLM Royal Dutch Airlines / TU Delft Netherlands*.

EAA. (2018). *Continuing Airworthiness Management Manual*.

EAA. (2019 - A). Norma Funcional 06 - 27 - Abertura, Fecho, Extensão e Controlo de HILs. In *Manual de Procedimentos de Manutenção*.

EAA. (2019 - B, April 30). Manual da Organização da euroAtlantic airways. Sintra.

EAA. (2019 - C). *Safety Management Manual, Rev 10, 3rd Edition*.

EAA. (2019 - D). Norma Funcional 06-13 - Controlo e Despacho de SBs. In *Manual de Procedimentos de Manutenção*.

EAA. (2019 - E, 01 23). NF 01-04 "Occurrences notification in maintenance environment". In EAA, *Manual de Procedimentos de Manutenção*.

EAA. (2019 - F). NF 06-01 "Utilization and distribution of aircraft technical log". In *Manual de Procedimentos de Manutenção*.

EAA. (2019 - G, 12 3). *jupiter system - airplanning*. Retrieved from jupiter.euroatlantic: jupiter.euroatlantic.pt/manutencao/reqwork_EVENT_.asp

EAA. (2019 - H). NF 08-08 "ETOPS PARTS CONTROL". In EAA, *Manual de Procedimentos de Manutenção*.

EASA. (2008 - A). Regulation (EC) No 1008/2008 of the European Parliament and of the council of 24 September 2008 on common rules for the operation of air services in the Community. *Official Journal of the European Union*.

EASA. (2008 - B). Regulation (EC) No 216/2008 of 20 February 2008 on common rules in the field of civil aviation and establishing a European Aviation Safety Agency. *Official Journal of the European Union, OJ L 79/1*.

EASA. (2010). Regulation (EU) No 996/2010 of the European Parliament and of the Council on the investigation and prevention of accidents and incidents in civil aviation. *Official Journal of the European Union, OJ L 295/35*.

EASA. (2012). Commission Regulation (EU) No 965/2012 of October 2012 laying down technical requirements and administrative procedures related to air operations pursuant to Regulation (EC) No 216/2008 of the European Parliament and of the Council. *Official Journal of the European Union, OJ L 296/1*.

EASA. (2014 - A). COMMISSION REGULATION (EU) No 1321/2014 of 26 November 2014 on the continuing airworthiness of aircraft and aeronautical products, parts and appliances, and on the approval of organisations and personnel involved in these tasks. *Official Journal of the European Union, OJ L 362/1*, 17-18.

EASA. (2014 - B). Regulation (EU) 376/2014 of the European Parliament and of the Council of 3 April on the reporting, analysis and follow-up of occurrences in civil aviation, amending Regulation (EU) No 996/2010 of the European Parliament and of the Council. *Official Journal of the European Union, OJ L 122/18*.

EASA. (2014 - C). Commission Regulation (EU) No 71/2014 of 27 January 2014 amending Regulation (EU) 965/2012 laying down technical requirements and administrative procedures related to Air Operations pursuant to Regulation (EC) No 216/2008 of the European Partliament and o. *Official Journal of the European Union*.

EASA. (2018). Commission Implementing Regulation (EU) 2015/1018 on 29 June 2015 laying down a list of classifying occurrences in civil aviation to be mandatorily reported according to Regulation (EU) 378/2014 of the European Parliament of the Council.

EASA. (2019 - A, 08 20). *European Union Aviation Safety Agency*. Retrieved from easa.europa.eu: https://www.easa.europa.eu/document-library/opinions/opinion-062016

EASA. (2019 - B). Commission Implementing Regulation (EU) 2019/1383 of 8 July 2019 amending and correcting Regulation (EU) No 1321/2014 as regards safety management systems in continuing airworthiness management organisations and alleviations for general aviation aircraft. *Official Journal of the European Union, OJ L 228/1*.

euroAtlantic. (2019, 08 04). Retrieved from euroatlantic.pt: https://www.euroatlantic.pt/sobre-nos/quem-somos/

European Union. (2019, 12 20). Retrieved from europa.eu: https://europa.eu/european-union/about-eu/agencies/easa_en

ICAO. (2009). *Review of the classification and definitions used for civil aviation activities*. Montreal.

ICAO. (2010 - A). Annex 6 to the Convention on International Civil Aviation - Operation of Aircraft. In *International Standards and Recommended Practices*.

ICAO. (2010 - B). *Operation of Aircraft, Ninth Edition*. International Civil Aviation Organization.

ICAO. (2016, July). *Annex 19 to the Convention on International Civil Aviation*.

ICAO. (2018). *Safety Management Manual - Fourth Edition*. Robert-Bourassa Boulevard, Montréal, Quebec, Canada .

INAC. (2003). Regulamento nº32/2003. *Diário da República*, 11488.

INAC. (2009, 02 06). *Safety Management System*.

J.Stolzer, A., Carl D.Halford, & John J.Goglia. (2008). *Safety Management Systems in Aviation*. Croft Road Aldershot Hampshire, England: Ashgate Publishing Limited.

Johnston, N. (1995). Do blame and punishment have a role in organizational risk management? *Flight Deck*.

Jupiter - euroAtlantic. (2019, August 17). Retrieved from Jupiter.euroAtlantic: https://jupiter.euroatlantic.pt/FILES/lbl/blb_8537_9278/lidia%20-%20jupiter.pdf

Leveson, N. (2004). New Accident Model for Engineering Safer Systems, Vol 42 No 4. *Safety Science*.

O'Leary, M., & Chappell SL. (1996). Confidential incident reporting systems create vital awareness of safety problems. *ICAO Journal, 51*.

P.Johnson, & J.Gill. (1993). *Management Control and Organizational Behaviour*. London: Paul Chapman.

Reason, J. (1990). Human Error - models and management. *Cambridge University Press*.

Reason, J. (2016). *Managing the Risks of Organizational Accidents*. Aldershot, England, United Kingdom: Ashgate Publishing Limited.

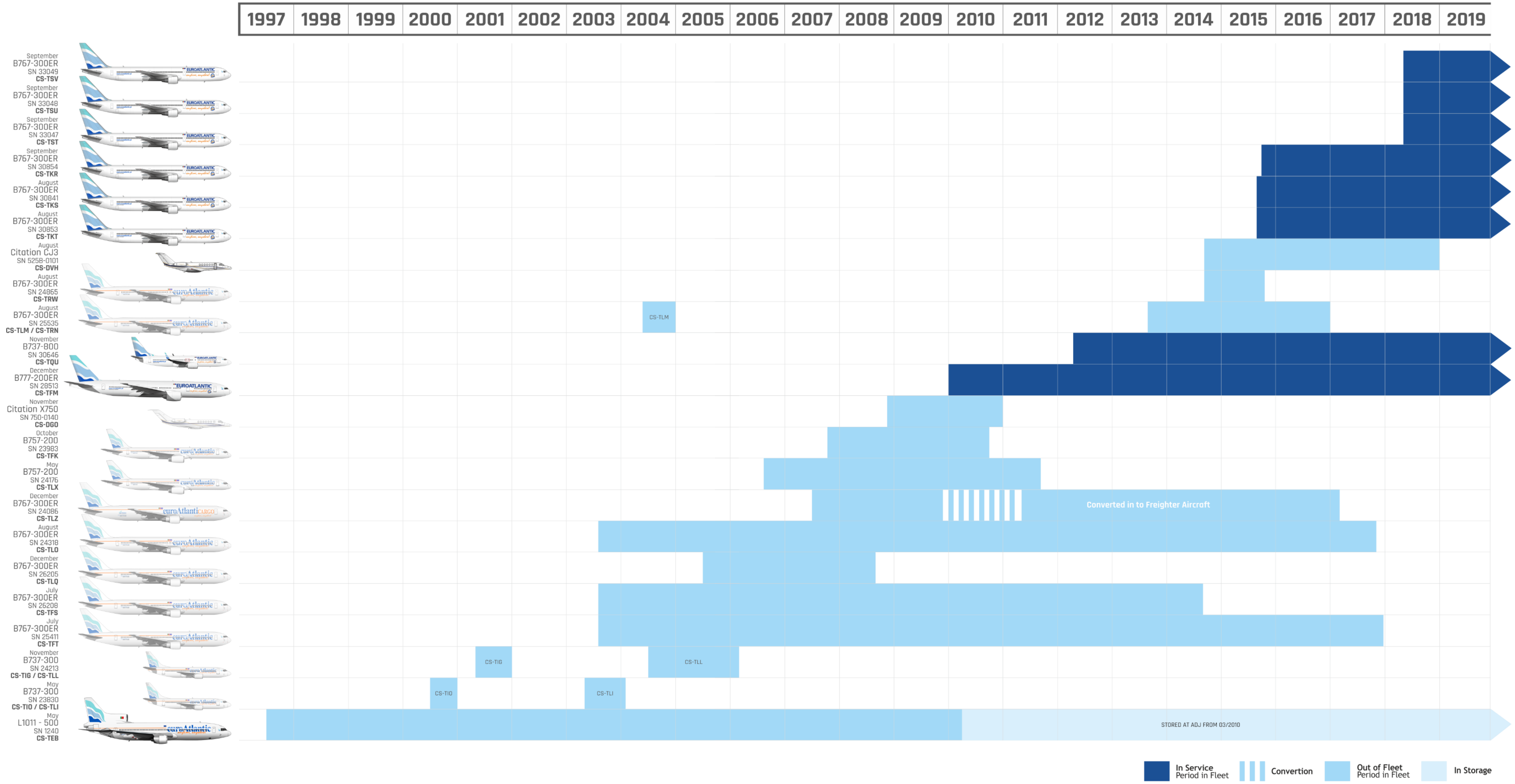
SMICG. (2015). *SMS for Small Organizations*.

Weick, K. E. (1987). Organizational Culture as a Source of High Reliability. *California Review Management*.

William J.Stanton, R. H. (1978). *Management of the Sales Force*. R. D. Irwin.

Annexes

Annex A - Fleet evolution of EAA throughout the time



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September B767-300ER SN 33047 CS-TST
September B767-300ER SN 30854 CS-TKR
August B767-300ER SN 30841 CS-TKS
August B767-300ER SN 30853 CS-TKT
August Citation CJ3 SN 525B-0101 CS-DVH
August B767-300ER SN 24865 CS-TRW
August B767-300ER SN 25535 CS-TLM / CS-TRN
November B737-800 SN 30646 CS-TQU
December B777-200ER SN 28513 CS-TFM
November Citation X750 SN 750-0140 CS-DGO
October B757-200 SN 23983 CS-TFK
May B757-200 SN 24176 CS-TLX
December B767-300ER SN 24086 CS-TLZ
August B767-300ER SN 24318 CS-TLO
December B767-300ER SN 26205 CS-TLQ
July B767-300ER SN 26208 CS-TFS
July B767-300ER SN 25411 CS-TFT
November B737-300 SN 24213 CS-TIG / CS-TLL
May B737-300 SN 23830 CS-TIO / CS-TLI
May L1011 - 500 SN 1240 CS-TEB
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Converted in to Freighter Aircraft
CS-TIG
CS-TLL
CS-TIO
CS-TLI
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Out of Fleet Period in Fleet
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Annex B – EAA’s safety risk probability and severity tables

Table 13: EAA's safety risk probability table.

*Source: (EAA, 2019 - C).

SAFETY RISK PROBABILITY TABLE		
RISK PROBABILITY	**MEANING**	**VALUE**
FREQUENT	**Likely to occur many times** (has already occurred in the company (Freq. > 3 x year). Has occurred frequently in the history of the aviation industry)	**5**
OCCASIONAL	**Likely to occur sometimes** (has already occurred in the company (Freq. < 3 x year). Has occurred infrequently in the history of the aviation industry)	**4**
REMOTE	**Unlikely to occur, but possible** (has already occurred in the company at least once. Has regularly occured in the history of the aviation industry)	**3**
IMPROBABLE	**Very unlikely to occur** (not known to have occurred in the company but has already occurred at least once in the history of the aviation industry)	**2**
EXTREMELY IMPROBABLE	**Almost inconceivable that the event will occur** (it has never occurred in the history of the aviation industry)	**1**

Table 14: EAA's safety risk severity table.

*Source: (EAA, 2019 - C).

SAFETY RISK SEVERITY TABLE					
SEVERITY OF OCCURRENCE	**MEANING**				**VALUE**
	PERSONNEL	**ENVIRONMENT**	**MATERIAL**	**IMAGE**	
CATASTROPHIC	Multiple fatalities	Massive effects (pollution, destruction, etc.)	Damage> 1 M€	International impact	**E**
HAZARDOUS	Fatality	Effects difficult to repair	Damage< 1 M€	National impact	**D**
MAJOR	Serious injuries	Noteworthy local effects	Damage< 250K€	Considerable impact	**C**
MINOR	Slight injuries	Little impact	Damage< 50K€	Limited impact	**B**
NEGLIGIBLE	Superficial or no injuries	Negligible or no effects	Damage < 10K€	Light or no impact	**A**

Annex C – Cross-reference list between requirements from Part-CAMO and from the current Part-M Subpart G and Part-ORO Subpart GEN

COMMISSION IMPLEMENTING REGULATION (EU) 2019/1383 of 8 July 2019

amending and correcting Regulation (EU) No 1321/2014 as regards safety management systems in continuing airworthiness management organisations and alleviations for general aviation aircraft concerning maintenance and continuing airworthiness management

v-green e-red

Requirement Part-CAMO	Corresponding Part-M	Is the Camo requirement related to SMS?	AUDIT																		Other requirements	Internal procedure		Implementation State of the correspondence
			CAMO 02/17 v#337	CAMO 1 v#358	CAMO 2 e#477	LOG * e#504	DOC TEC e#506	QUAL PART M v#411	ARC e#489	OPS SPC v#509	CONT v#450	TRN * #421	DOV v#464	SAF v#518	DSP e#528	MOP v#567	CGO v#520	DOV v#472	DOT v#519	PMA v#508		Internal manual	Internal procedures	
			DME 11-01-2018	ENG 23-03-2018	PCO 26-03-2019	LOG 24-05-2019	DQU/ DOC 24-05-2019	DQU 25-09-2018	DQU 15-05-2019	ENG 30-07-2019	DCM, PCO, MOP 28-12-2018	TRN 06-11-2018	DOV/ ORG 08-02-2019	SAF 15-04-2019	DSP 30-05-2019	DME/MOP 11-07-2019	DOT 30-07-2019	ENG/ OPS 19-02-2019	DOT 30-07-2019	PCO 27-06-2019				
CAMO.A.005 Scope																								
CAMO.A.005	M.A.701	No						x														MGCA - CAME (37) 0.1 Aval Financeiro		Documented/Implemented- manual
CAMO.A.105 Competent authority																								
CAMO.A.105 a)	M.1	No																				MCM 1.7		Documented/Implemented- manual
CAMO.A.105 b)	M.1	No																				MCM 1.7		Documented/Implemented- manual
CAMO.A.105 c)	M.1	No																				MCM 1.7		Documented/Implemented- manual
CAMO.A.115 Application for an organisation certificate																								
CAMO.A.115 a) ***	M.A.702	No	x					x														MGCA 0.5 - CAME (34) 0.5		Documented/Implemented- manual
CAMO.A.115 a)	ORO.GEN.115 a)	No																x				OM Part A 3º Ed, Rev 4 of date 5/2/19 OM (D) 2º Ed, Rev 00 TR 20-24 Ef Date 11/2/19 SOPS 737/767/777 Ed 2 - Rev 4 TR 15 - 18 Ef date 11/2/19		
CAMO.A.115 b) ***	M.A.702	No	x					x														MGCA 0.5 - CAME (34) 0.5		Documented/Implemented- manual
CAMO.A.115 b) (1)		No																x						
CAMO.A.115 b) (2)	ORO.GEN.115 b)	No																x						
CAMO.A.120 Means of compliance																								
CAMO.A.120 a)	ORO.GEN.120 a)	No											x									OM A (3rd edition rev 04) all		Documented/Implemented
CAMO.A.120 b)	ORO.GEN.120 b)	No											x											
CAMO.A.125 Terms of approval and privileges																								
CAMO.A.125 a)	M.A.703 (a)	No	x					x														MGCA - CAME (34) MGCA		Documented/Implemented- manual
CAMO.A.125 b)	M.A.703 (b)	No	x					x																Documented/Implemented- manual
CAMO.A.125 c)	M.A.703 (c)	No	x					x														MGCA - CAME (34) 0.2.0		Documented/Implemented- manual
CAMO.A.125 d)	M.A.711 (a)	No							x													MGCA - CAME (41) 0.2.3, MGCA - CAME (41) 4.6.3		Point two and four documented/implemented-manual
CAMO.A.125 e)	M.A.711 (b)	No	x						x													MGCA - CAME (34) secção 4		Documented/Implemented- manual
CAMO.A.125 f)	M.A.711 (c)	No	NOT APPLICABLE "...be approved to issue a permit to fly..."																					
CAMO.A.130 Changes to the organisation																								
CAMO.A.130 a) ***	M.A.713	No	x					x														MGCA - CAME(34) 0.5		Documented/Implemented - manual
CAMO.A.130 a) ***	ORO.GEN.130 a)	No											x									OM A (3rd edition rev 04) 2.4 ORO.GEN.130, OM A (3rd edition rev 04) 1.3.10		
CAMO.A.130 b) ***	M.A.713	No	x					x														MGCA - CAME(34) 0.5		Documented/Implemented - manual
CAMO.A.130 b)	ORO.GEN.130 b)	No											x									OM A (3rd edition rev 04) 2.4 b)		Documented/Implemented - manual

Requirement Part-CAMO	Corresponding Part-M	Is the Camo requirement related to SMS?	AUDIT																		Other requirements	Internal procedure		Implementation State of the correspondence
			CAMO 02/17 v#337	CAMO 1 v#358	CAMO 2 e#477	LOG * e#504	DOC TEC e#506	QUAL PART M v#411	ARC e#489	OPS SPC v#509	CONT v#450	TRN * #421	DOV v#464	SAF v#518	DSP e#528	MOP v#567	CGO v#520	DOV v#472	DOT v#519	PMA v#508		Internal manual	Internal procedures	
			DME 11-01-2018	ENG 23-03-2018	PCO 26-03-2019	LOG 24-05-2019	DQU/ DOC 24-05-2019	DQU 25-09-2018	DQU 15-05-2019	ENG 30-07-2019	DCM, PCO, MOP 28-12-2018	TRN 06-11-2018	DOV/ ORG 08-02-2019	SAF 15-04-2019	DSP 30-05-2019	DME/MOP 11-07-2019	DOT 30-07-2019	ENG/ OPS 19-02-2019	DOT 30-07-2019	PCO 27-06-2019				
CAMO.A.130 c) ***	M.A.713	No	x					x														MGCA - CAME(34) 0.5		Documented/Implemented - manual
CAMO.A.130 c)	ORO.GEN.130 c)	No											x									OM A (3rd edition rev 04) 2.4 c)		Documented/Implemented - manual
CAMO.A.135 Continued validity																								
CAMO.A.135 a)	M.A.715 (a)	No						x														MGCA - CAME (37) 0.1		Documented/Implemented - manual
CAMO.A.135 b)	n/c	No																						
CAMO.A.135 c)	M.A.715 (b)	No						x														MGCA - CAME (37) 0.1		Documented/Implemented - manual
CAMO.A.140 Access																								
CAMO.A.140 a)	ORO.GEN.140 a) (1)	No											x									OM A (3rd edition rev 04) 0.7.1, OM A (3rd edition rev 04) 2.4 ultimo parágrafo, OM A (3rd edition rev 04) 1.3, OM A (3rd edition rev 04) 2.4		
CAMO.A.140 b)	ORO.GEN.140 a) (2)	No											x									OM A (3rd edition rev 04) 0.7.1, OM A (3rd edition rev 04) 2.4 ultimo parágrafo, OM A (3rd edition rev 04) 1.3, OM A (3rd edition rev 04) 2.4		
CAMO.A.150 Findings																								
CAMO.A.150 a) ***	M.A.716 c)	No						x														MCM (Revisio 5) 3.12		Documented/Not Implemented
CAMO.A.150 a)	ORO.GEN.150 a)	No											x									OM A (3rd edition rev 04) 2.4		Documented/Implemented
CAMO.A.150 a)	ORO.GEN.150 b)	No											x									OM A (3rd edition rev 04) 2.4		Documented/Implemented
CAMO.A.150 a)	ORO.GEN.150 c)	No											x									OM A (3rd edition rev 04) 2.4		Documented/Implemented
CAMO.A.150 b)	ORO.GEN.150 c)	No											x									OM A (3rd edition rev 04) 2.4		Documented/Implemented
CAMO.A.155 Immediate reaction to a safety problem																								
CAMO.A.155 a)	M.A.301 (5)(iv)	Yes								x												MGCA - CAME (42) 1.4.3, MGCA - CAME (42) 1.4.4		Domumented/Impimented - manual
CAMO.A.155 a)	ORO.GEN.155 a)	Yes											x									OM A (3rd edition rev 04) 0.7.1 2nd paragraph		Documented/Implemented
CAMO.A.155 b)	ORO.GEN.155 b)	Yes											x									OM A (3rd edition rev 04) 0.7.1 2nd paragraph		Documented/Implemented
CAMO.A.160 Occurrence reporting																								
CAMO.A.160 a)	ORO.GEN.160 a)	Yes												x								SMM (3rd Ed. Rev. 08) 3.5.1 via IQSMS		CAMO.160 a) Documented/Implemented
CAMO.A.160 b)	M.A.202 a)	Yes			x																	MGCA - CAME (38) 1.8 MPM (26)	NF 01-04	Noot applicable to CAMOs (according to Opinio 06/2016)
CAMO.A.160 b)	ORO.GEN.160 b)	Yes												x								SMM (3rd Ed. Rev. 08) 3.5.1 MGCA - CAME (38) 1.8	NF 01-04	Not complitely Domumented nor Implmented - manual

Requirement Part-CAMO	Corresponding Part-M	Is the Camo requirement related to SMS?	AUDIT																		Other requirements	Internal procedure		Implementation State of the correspondence
			CAMO 02/17 v#337	CAMO 1 v#358	CAMO 2 e#477	LOG * e#504	DOC TEC e#506	QUAL PART M v#411	ARC e#489	OPS SPC v#509	CONT v#450	TRN * #421	DOV v#464	SAF v#518	DSP e#528	MOP v#567	CGO v#520	DOY v#472	DOT v#519	PMA v#508		Internal manual	Internal procedures	
			DME 11-01-2018	ENG 23-03-2018	PCO 26-03-2019	LOG 24-05-2019	DQU/ DOC 24-05-2019	DQU 25-09-2018	DQU 15-05-2019	ENG 30-07-2019	DCM, PCO, MOP 28-12-2018	TRN 06-11-2018	DOV/ ORG 08-02-2019	SAF 15-04-2019	DSP 30-05-2019	DME/MOP 11-07-2019	DOT 30-07-2019	ENG/ OPS 19-02-2019	DOT 30-07-2019	PCO 27-06-2019				
CAMO.A.160 c)	M.A.202 b)	Yes			x																	MGCA - CAME (38) 1.8.1 MPM (26)	NF 01-04	Noot applicable to CAMOs
CAMO.A.160 c)	ORO.GEN.160 c)	Yes												x								SMM (3rd Ed. Rev. 08) 3.5.1 MGCA - CAME (38) 1.8		Not complitely Domumented nor Implmented - manual
CAMO.A.160 d)	M.A.202 d)	Yes			x																	MPM (26)	NF 01-04	Noot applicable to CAMOs
CAMO.A.160 d)	ORO.GEN.160 d)	Yes												x								SMM (3rd Ed. Rev. 08) 5.3.1	NF 01-04 - Pag 6	Domumented/Implmented - manual
CAMO.A.160 e)	M.A.202 e) n/c ia	Yes																						Noot applicable to CAMOs
CAMO.A.160 e)	ORO.GEN.160 e)	Yes												x								SMM (3rd Ed. Rev. 08) 3.5.4 SMM (3rd Ed. Rev. 08) 5.7		Domumented/Implmented - manual
CAMO.A.200 Management system																								
CAMO.A.200 a) (1)	ORO.GEN.200 a)(1)	Yes																	x			AHM (12) 0.5 SMM 3rd Ed, Rev9 (2.2)		Documented/Implemented
CAMO.A.200 a) (2)	ORO.GEN.200 a)(2)	Yes																	x			MOEAA 1.9 SMM 3rd Ed, Rev9 (0.6)		Documented/Implemented
CAMO.A.200 a) (3)	ORO.GEN.200 a)(3)	Yes																	x			Verificada a "Hazard Identification Log", Rev 01 de 160419 - vide anexo. Disponivel no "JUPITER".		Documented/Implemented
CAMO.A.200 a) (4)	ORO.GEN.200 a)(4)	Yes																	x			DGR Cat.10 da NP-DOT-001		Currently Documented Currently Implemented
CAMO.A.200 a) (5)	ORO.GEN.200 a)(5)	Yes																	x			AHM (12) 0.7, AHM (12) 0.10.2 SMM 3rd Ed, Rev9 (0.10) SMM 3rd Ed, Rev9 (3.1.2)		Documented/Implemented
CAMO.A.200 a) (6)	ORO.GEN.200 a)(6)	No													x							OM A (3rd edition rev 04) 3.4.2		Documented/Implemented

Requirement Part-CAMO	Corresponding Part-M	Is the Camo requirement related to SMS?	AUDIT																		Other requirements	Internal procedure		Implementation State of the correspondence
			CAMO 02/17 v#337 DME 11-01-2018	CAMO 1 v#358 ENG 23-03-2018	CAMO 2 e#477 PCO 26-03-2019	LOG * e#504 LOG 24-05-2019	DOC TEC e#506 DQU/ DOC 24-05-2019	QUAL PART M v#411 DQU 25-09-2018	ARC e#489 DQU 15-05-2019	OPS SPC v#509 ENG 30-07-2019	CONT v#450 DCM, PCO, MOP 28-12-2018	TRN * #421 TRN 06-11-2018	DOV v#464 DOV/ ORG 08-02-2019	SAF v#518 SAF 15-04-2019	DSP e#528 DSP 30-05-2019	MOP v#567 DME/MOP 11-07-2019	CGO v#520 DOT 30-07-2019	DOV v#472 ENG/ OPS 19-02-2019	DOT v#519 DOT 30-07-2019	PMA v#508 PCO 27-06-2019		Internal manual	Internal procedures	
CAMO.A.200 a)(6)	M.A.712 a) ***	No			X																	MGCA - CAME (38) Section 2		Domumented/Implmented
CAMO.A.200 a)(7)	ORO.GEN.200 a)(7)	No																						
CAMO.A.200 b)	ORO.GEN.200 b)	Yes																	X			AHM (12) 0.5, other (?) 'Hazard Identification Log' + 'SPIs' SMM 3rd Ed, Rev9 (0.6)		Documented/Implemented
CAMO.A.200 c)	n/c	Yes																						
CAMO.A.200 d)	n/c	Yes																						
CAMO.A.202 Internal safety reporting scheme																								
CAMO.A.202 a)	145.A.60 b)	Yes														X						Internal reports produced by IQSMS (Safety Department) NF-01-04		Documented/Implemented
CAMO.A.202 b)	n/c	Yes																				Internal reports produced by IQSMS (Safety Department)		
CAMO.A.202 c) (1)	n/c	Yes																						
CAMO.A.202 c) (2)	n/c	Yes																						
CAMO.A.202 d)	n/c	Yes																						
CAMO.A.202 e)	n/c	Yes																						
CAMO.A.205 Contracting and subcontracting																								
CAMO.A.205 a) (1)	ORO.GEN.205 a)	No															X					COM - Cargo Operations Manual (05) 0.5		Documented/Implemented
CAMO.A.205 a) (2)	n/c	Yes																						
CAMO.A.205 b)	ORO.GEN.205 b)	No															X					COM - Cargo Operations Manual (05) 0.5		Documented/Implemented
CAMO.A.215 Facilities																								

Requirement Part-CAMO	Corresponding Part-M	Is the Camo requirement related to SMS?	AUDIT																		Other requirements	Internal procedure		Implementation State of the correspondence
			CAMO 01/17 v#337 DME 11-01-2018	CAMO 1 v#358 ENG 23-03-2018	CAMO 2 e#477 PCO 26-03-2019	LOG * e#504 LOG 24-05-2019	DOC TEC e#506 DQU/ DOC 24-05-2019	QUAL PART M v#411 DQU 25-09-2018	ARC e#489 DQU 15-05-2019	OPS SPC v#509 ENG 30-07-2019	CONT v#450 DCM, PCO, MOP 28-12-2018	TRN * #421 TRN 06-11-2018	DOV v#464 DOV/ ORG 08-02-2019	SAF v#518 SAF 15-04-2019	DSP e#528 DSP 30-05-2019	MOP v#567 DME/MOP 11-07-2019	CQO v#520 DOT 30-07-2019	DOV v#472 ENG/ OPS 19-02-2019	DOT v#519 DOT 30-07-2019	PMA v#508 PCO 27-06-2019		Internal manual	Internal procedures	
CAMO.A.215	M.A.705	No				x		x														MGCA 0.2.1 MGCA 0.3.1 MOM - MOE (31) 1.8.3 (b), MOM - MOE (31) 1.8.2 (lado do ar), MOM - MOE (31) 1.8.3 (c)		Documented/Implemented - Manual #504
CAMO.A.220 Record-keeping																								
CAMO.A.220 a) (1) e (2)		No					x															MGCA - CAME (41) 1.3.2, MGCA - CAME (41) 1.3.3		
CAMO.A.220 a) (3)	M.A.714 a) M.A.714 b)	No							x															Documented/Implemented - manual
CAMO.A.220 a) (4)	M.A.714 c)	No				x				x														
CAMO.A.220 a) (5)	M.A.714 d)	No	x			x																MGCA - CAME (34) 4.7.2		Documented/Implemented - manual
CAMO.A.220 a) (5)	M.A.714 g)	No					x															MGCA - CAME (41) 1.3.4		Documented/Implemented - manual
CAMO.A.220 a) (6)	M.A.714 h)	No					x															MGCA - CAME (41) 1.3.4		Documented/Implemented - manual
CAMO.A.220 b) (i)	n/c	Yes																						
CAMO.A.220 b) (ii)	n/c	No																						
CAMO.A.220 c) (1) i)	n/c	Yes																						
CAMO.A.220 c) (1) ii)	n/c	No																						
CAMO.A.220 c) (2)	M.A.707 e)	No							x															Documented/Not Implemented #489 (Perdemos o privilégio da Subpart I)
CAMO.A.220 c) (3)	M.A.707 e)	Yes							x													Registo de ARIs e Documentos dos ARI's estão disponíveis no Globalshares-QualityAvaliação de aeronavegabilidade. MGCA - os capítulos referentes a ARI foram retirados do MGCA por já não termos este privilégio		Documented/Not Implemented #489 (Perdemos o privilégio da Subpart I)
CAMO.A.220 d)	ORO.GEN.220 a)	No													x							OM-B SOPS FLT Dispatch (18) 14		
CAMO.A.220 e)	ORO.GEN.220 b)	No													x							OM-B SOPS FLT Dispatch (18) 14		
CAMO.A.220 f)	M.A.714 e)	No					x															MGCA - CAME 1.3.3		Documented/Implemented - manual
CAMO.A.300 Continuing airworthiness management exposition																								
CAMO.A.300 a) (1)***	M.A.704 a)(1)	No	x					x														MGCA - CAME (34) 0.1		Documented/Implemented - Manual

Requirement Part-CAMO	Corresponding Part-M	Is the Camo requirement related to SMS?	AUDIT																		Other requirements	Internal procedure		Implementation State of the correspondence
			CAMO 02/17 v#337 DME 11-01-2018	CAMO 1 v#358 ENG 23-03-2018	CAMO 2 a#477 PCO 26-03-2019	LOG * a#504 LOG 24-05-2019	DOC TEC a#506 DQU/ DOC 24-05-2019	QUAL PART M v#411 DQU 25-09-2018	ARC a#489 DQU 15-05-2019	OPS SPC v#509 ENG 30-07-2019	CONT v#450 DCM, PCO, MOP 28-12-2018	TRN * #421 TRN 06-11-2018	DOV v#464 DOV/ ORG 08-02-2019	SAF v#518 SAF 15-04-2019	DSP a#528 DSP 30-05-2019	MOP v#567 DME/MOP 11-07-2019	CGO v#520 DOT 30-07-2019	DOV v#472 ENG/ OPS 19-02-2019	DOT v#519 DOT 30-07-2019	PMA v#508 PCO 27-06-2019		Internal manual	Internal procedures	
CAMO.A.300 a) (2)	n/c	Yes																						
CAMO.A.300 a) (3)	M.A.704 a)(2)	No	x																			MGCA - CAME (34) 0.2.0		Documented/Implemented - Manual
CAMO.A.300 a) (4)	n/c	No																						
CAMO.A.300 a) (5) related to CAMO.A.305 a) (5)	M.A.704 a) (3)	Yes (due to 305 (a)(5))	x																			MGCA - CAME (34) 0.3		Documented/Implemented - Manual
CAMO.A.300 a) (5) related to CAMO.A.305 a) (3), a)(4), b) (2) e (f)	M.A.704 a) (3)	No																				MGCA - CAME (34) 0.3		Documented/Implemented - Manual
CAMO.A.300 a) (6)	n/c	Yes (due to 305 (a)(5))																						
CAMO.A.300 a) (7)	M.A.704 a) (4)	Yes (due to 305 (a)(5))	x																			MGCA - CAME (34) 0.4.2		Documented/Implemented - Manual
CAMO.A.300 a) (8)	M.A.704 a) (5)	No	x																			MGCA - CAME (34) apendice 2		Documented/Implemented - Manual
CAMO.A.300 a) (9)	M.A.704 a) (6)	No	x																			MGCA - CAME (34) 0.2.1		Documented/Implemented - Manual
CAMO.A.300 a) (10)	n/c	Yes																						
CAMO.A.300 a) (11)(i)	M.A.704 a) (8)	Yes	x																			MGCA - CAME (34) secção 1		Documented/Implemented - Manual
CAMO.A.300 a) (11)(ii) a (v)	M.A.704 a) (8)	No	x																			MGCA - CAME (34) secção 1		Documented/Implemented - Manual
CAMO.A.300 a) (12)	M.A.704 a) (9)	No	x																			MGCA - CAME (34) 0.7		Documented/Implemented - Manual
CAMO.A.300 a) (13)	n/c	No																						
CAMO.A.300 a) (14)	n/c	No																						
CAMO.A.300 b) ***	M.A.704 b)	No	x					x														MGCA - CAME (34) 0.6		Documented/Implemented - Manual
CAMO.A.300 c) ***	M.A.704 c)	No	x					x														MGCA - CAME (34) 0.6	NF 01-12	Documented/Implemented - Manual
CAMO.A.305 Personnel requirements																								
CAMO.A.305 a) (1)***	M.A.706 a) e b)	No			x																	MGCA -CAME (38) 0.3.1		Documented/Implemented - Manual
CAMO.A.305 a) (2)	n/c	Yes																						

Requirement Part-CAMO	Corresponding Part-M	Is the Camo requirement related to SMS?	AUDIT																		Other requirements	Internal procedure		Implementation State of the correspondence
			CAMO 02/17 v#337 DME 11-01-2018	CAMO 1 v#358 ENG 23-03-2018	CAMO 2 e#477 PCO 26-03-2019	LOG * e#504 LOG 24-05-2019	DOC TEC e#506 DQU/ DOC 24-05-2019	QUAL PART M v#411 DQU 25-09-2018	ARC e#489 DQU 15-05-2019	OPS SPC v#509 ENG 30-07-2019	CONT v#450 DCM, PCO, MOP 28-12-2018	TRN * #421 TRN 06-11-2018	DOV v#464 DOV/ ORG 08-02-2019	SAF v#518 SAF 15-04-2019	DSP e#528 DSP 30-05-2019	MOP v#567 DME/MOP 11-07-2019	CGO v#520 DOT 30-07-2019	DOV v#472 ENG/ OPS 19-02-2019	DOT v#519 DOT 30-07-2019	PMA v#508 PCO 27-06-2019		Internal manual	Internal procedures	
CAMO.A.305 a) (3)***	M.A.706 c) e d)	No			x																			
CAMO.A.305 a) (4)	M.A.712 or n/c?	No			x																			
CAMO.A.305 a) (5)	n/c	Yes																						
CAMO.A.305 a) (6)	M.A.706 e)	Yes			x																			
CAMO.A.305 a) (7)	n/c	No																						
CAMO.A.305 b)(1)	n/c	Yes			x																	MGCA - CAME (38) 0.3.2		Documented/Implemented - Manual
CAMO.A.305 b)(2)	M.A.706 d) e e)	No			x																	MGCA - CAME (38) 0.3.2		Documented/Implemented - Manual
CAMO.A.305 c)	M.A.706 c)	Yes			x																	MGCA - CAME (38) 0.3.1, MGCA - CAME (38) 0.3.2, MGCA - CAME (38) 0.3.3	NF Nr. 09-05 (5.1.1)	Documented/Implemented -Manual
CAMO.A.305 c)	M.A.706 g)	Yes			x																	MGCA - CAME (38) 0.3.5.1, NO-PES-001 (04) Função A03 e A07	Ver Doc 4 do Eng. Paulo Castro	Documented/Implemented -Manual
CAMO.A.305 d)	M.A.706 f)	No								x												MGCA - CAME (42) Secção 5, Apêndice 8	NF 01-13 NF 02-04 NF 09-01	Documented/Implemented - Manual
CAMO.A.305 e)	n/c	No																						
CAMO.A.305 f)	M.A.706 i)	No							x													MGCA -CAME (41) 5.2		Documented/Implemented - Manual? E-vermelho
CAMO.A.305(g) ***	M.A. 706 k)	Yes				x																		Currently Documented and Currently not Implemented
CAMO.A.310 Airworthiness review staff qualifications																								
CAMO.A.310 a)	M.A.707 a)	No							X															Documented/Not Implemented #489 (Perdemos o privilégio da Subpart I)
CAMO.A.310 b)	M.A.707 a) (1) (e)	No							X															Documented/Not Implemented #489 (Perdemos o privilégio da Subpart I)
CAMO.A.310 c) ***	M.A.707 b)	No							X															Documented/Not Implemented #489 (Perdemos o privilégio da Subpart I)

Requirement Part-CAMO	Corresponding Part-M	Is the Camo requirement related to SMS?	AUDIT																		Other requirements	Internal procedure		Implementation State of the correspondence
			CAMO 02/17 v#337	CAMO 1 v#358	CAMO 2 e#477	LOG * e#504	DOC TEC e#506	QUAL PART M v#411	ARC e#489	OPS SPC v#509	CONT v#450	TRN * #421	DOV v#464	SAF v#518	DSP e#528	MOP v#567	CGO v#520	DOV v#472	DOT v#519	PMA v#508		Internal manual	Internal procedures	
			DME 11-01-2018	ENG 23-03-2018	PCO 26-03-2019	LOG 24-05-2019	DQU/ DOC 24-05-2019	DQU 25-09-2018	DQU 15-05-2019	ENG 30-07-2019	DCM, PCO, MOP 28-12-2018	TRN 06-11-2018	DOV/ ORG 08-02-2019	SAF 15-04-2019	DSP 30-05-2019	DME/MOP 11-07-2019	DOT 30-07-2019	ENG/ OPS 19-02-2019	DOT 30-07-2019	PCO 27-06-2019				
CAMO.A.310 d)	M.A.707 c)	No							X															Documented/Not Implemented #489 (Perdemos o privilégio da Subpart I)
CAMO.A.315 Continuing airworthiness management																								
CAMO.A.315 a)	M.A.708 a)	No																		X		MGCA - CAME (42) 1.0		Documented/Implemented #508
CAMO.A.315 b)	M.A.708 b) ***	No																		X		MGCA - CAME (42) 1.2.2 + 1.5 (1), MGCA - CAME (42) 1.2.3.4 (2), MGCA - CAME (42) 1.6 + 1.7 (3), MGCA - CAME (42) 1.0 (4), MGCA - CAME (42) 1.4 (5), MGCA - CAME (42) 1.0 (6), MGCA - CAME (42) 3.1 (7), MGCA - CAME (42) 1.0 (8), MGCA - CAME (42) 1.3 (9), PMA B777 (Rev 8) 0.5 (10)		Documented/Implemented
CAMO.A.315 c)	M.A.708 c)	No									X											MGCA - CAME (38) Secção 1		Documented/Implemented
CAMO.A.315 d)	M.A.708 d)	No									X											MGCA - CAME (38) Secção 1		Documented/Implemented
CAMO.A.315 e)	n/c	No																						
CAMO.A.320 Airworthiness review																								
CAMO.A.320	M.A.710 a)	No							X															Implemented
CAMO.A.320	M.A.710 b)	No							X															privilégio da Subpart I)
CAMO.A.320	M.A.710 c)	No							X															vermelho
CAMO.A.320	M.A.710 d)	No							X															Implemented
CAMO.A.320	M.A.710 e)	No							X															privilégio da Subpart I)
CAMO.A.320	M.A.710 f)	No							X													MGCA - CAME (41) 4.6.3 parágrafo f)		Documented/Implemented - manual
CAMO.A.320	M.A.710 g)	No								X														Not Applicable
CAMO.A.320	M.A.710 h)	No							X															privilégio da Subpart I)
CAMO.A.325 Continuing airworthiness management data																								
CAMO.A.325	M.A.709 a)	No					X																	Not Applicable E-vermelho

*** the point is more descriptive than its correspondence

n/c	there is no correspondence
Not included in Subpart G	
N/c ia	Not contained in any auditory
Wating for approval	
X	Wrong auditory was listed in compliance list

Annex D – SMS Survey Part-M

SAFETY DEPARTMENT	SMS SURVEY-Part M	euro Atlantic airways

This is a survey to assess the EAA's CAMO safety performance and the procedures currently implemented related to SMS. Please assess the following matters from 1 to 5 according to the following classification:

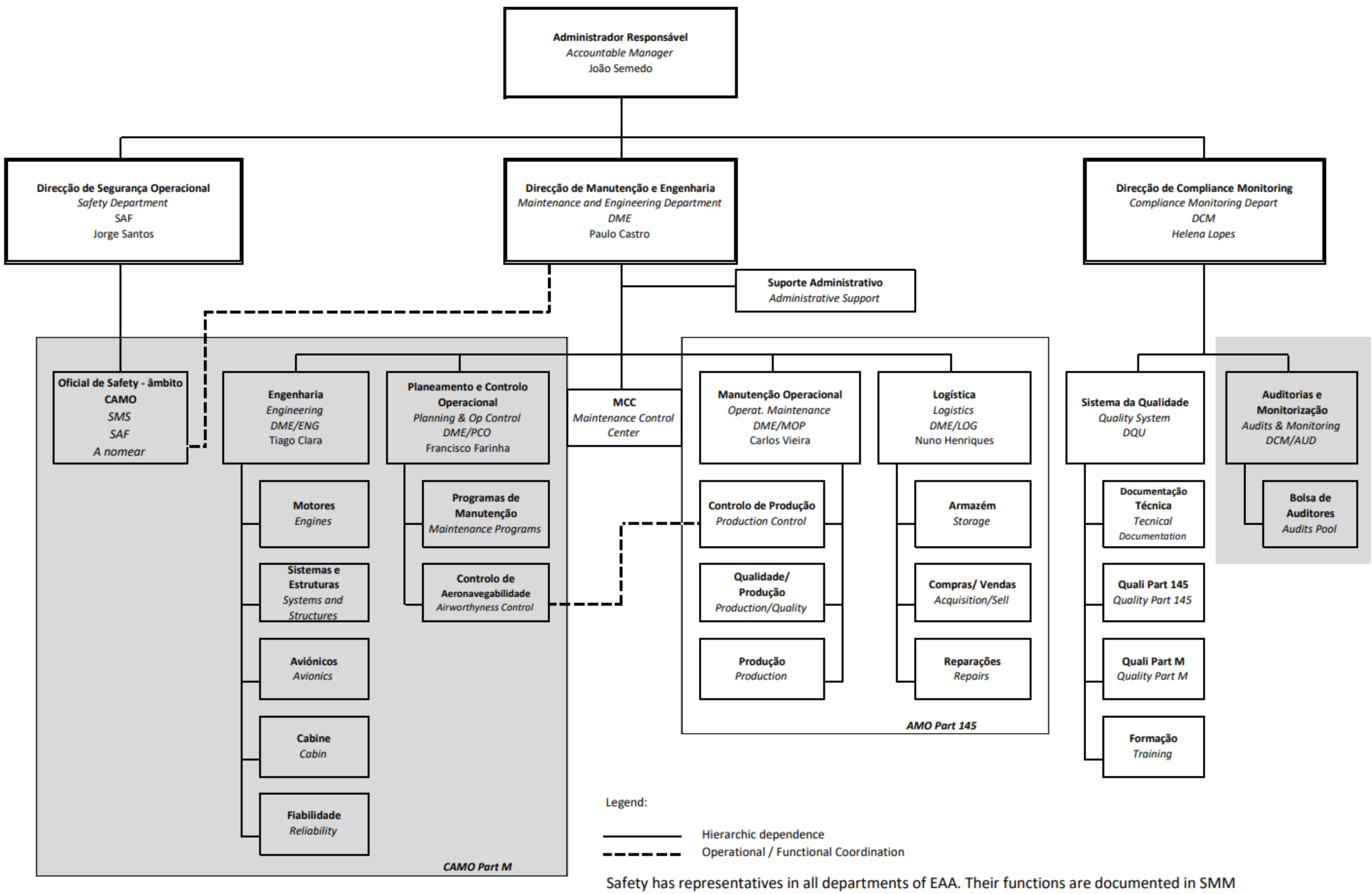
1. Strongly Disagree
2. Disagree
3. Neutral
4. Agree
5. Strongly Agree

	1	2	3	4	5
1. EAA has an effective hazard reporting process.					
2. The company's hazard/issue reporting system is easy to use.					
3. The Safety Manager often discuss safety issues with me and with employees from my department.					
4. euroAtlantic inform the employees from my department about changes that may affect safety.					
5. EAA management provide good feedback regarding company's safety performance.					
6. The training I receive in order to complete my tasks is enough and appropriate.					
7. My training on the purpose and goals of EAA's SMS is sufficient and appropriate.					
8. Managers are aware of the main safety problems I deal with in my department and performing my tasks					
9. I consider that reporting safety issues from my department could improve the safety of EAA's operations.					
10. The employees from my department feel comfortable reporting issues with the existent hazard reporting process.					
11. After reporting issues, management tries to find the reason for the issue rather than blaming people.					
12. I am comfortable with submitting reports associated with noncompliance of state regulations.					
13. I am aware of the contents of NF 01-04 on "occurrence notification in maintenance environment".					
14. I am familiarised with the list of mandatory occurrences to ANAC and the type certificate holder.					
15. That list is used as guideline to define the occurrences that require activation of the notification process.					
16. It is relevant to perform risk analysis in contracted organisations performing part of the eaa's continuing airworthiness management activities.					
17. It is relevant to perform risk analysis in contracted MROs.					

	0	1-3	4-6	7-9	10+
How many safety reports have you submitted in the last 6 months?					

Thanks for your collaboration - Safety department

Annex E – Proposal for the new EAA's Maintenance and Engineering flow chart



Safety has representatives in all departments of EAA. Their functions are documented in SMM