EUROPEAN AVIATION SAFETY AGENCY
AGENCE EUROPÉENNE DE LA SÉCURITÉ AÉRIENNE
EUROPÄISCHE AGENTUR FÜR FLUGSICHERHEIT

Turning Policy into Reality: Human Performance and Safety Management Systems

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SMS for Maintenance: Regulatory Developments

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Plan

- Contribution of Maintenance to accidents
- Management Systems as a solution
- Management Systems in Maintenance
  Rulemaking Task MDM.055
- How much is missing?
  Focus on Safety Culture
- The EHFAG and its Maintenance and Engineering Sub Group

Maintenance-related accident example

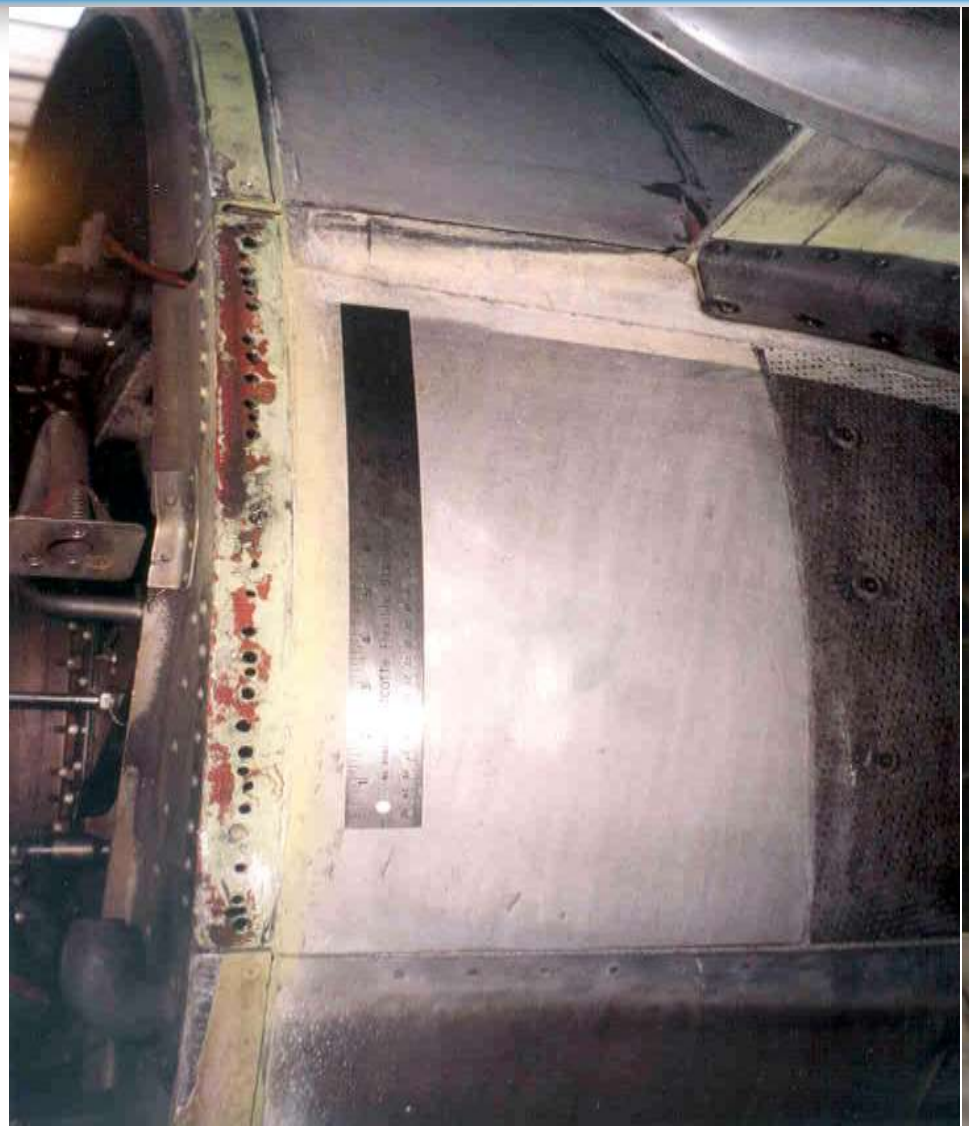
Concorde F-BTSC accident, 25 July 2000, CDG, France

- Source: final investigation report accessible at http://www.bea.aero/docspa/2000/f-sc000725a/htm/f-sc000725a.html

The French BEA concluded in 2002 that a wear strip of metal fell off a DC-10 that took off 4 minutes earlier had punctured a tire of the Concorde, sending shards of rubber into the fuel tanks, leading to flames pouring from its undercarriage and sending the plane crashing into a hotel.

- The strip was attached with rivets close to other previous existing holes and was improperly attached (deviation from the approved repair procedure and standard practices).

DC10 reverse as found: How it should be:



Concorde crash: tyre and wear strip

Maintenance-related accident example

- No trouble shooting was performed in order to understand why the strip separated two times within the 6 week period prior to the accident.
- Several signals should have alerted the MRO such as the high level of engine vibrations. As a response, the MRO decided to disconnect the vibration indicator.
- On Dec. 2010, the sheet metal worker was declared guilty of negligence and serious misconduct by the French Court of Justice.
- The negligence of the mechanic who released to service the aircraft was established (for restoring to service an aircraft by carelessly validating the replacement of the wear strip carried out by the sheet metal worker).
- The MRO was charged for not monitoring enough the maintenance and for not investigating the repetitive discrepancies.

Maintenance contribution in numbers

Many studies and investigation reports draw the same conclusions:

1) Maintenance is identified as a causal factor in incidents/accidents:

Airplanes above 5.7T: between 6 and 12%

- Has increased during the last 20 years
- Also due to a better occurrence reporting system

Helicopters: 19-24% of the accidents/ incidents

2) By far the large number of errors occurs at the installation stage (44%)

Maintenance contribution in numbers

3) Main contributors to human error:

33% skill or probably skill (slips and lapses)

52% deviation from SOPs (rules, procedures, maintenance data, standard practices)

Only 4% knowledge

10% unclassified

4) ATA chapters most concerned:

Equipment and furnishings

Power plants and associated systems

Landing

Flight controls

Maintenance contribution in numbers

Recent study published in September 2011:

- 52% of managers believe that their front-line workforce engaged in non-compliant behavior;
- 16% knowingly condoned non-compliant behavior within their front-line workforce;
- 16% intentionally pressured their employees not to follow procedures;
- 10% condoned employees not following procedures.

Source:
www.bainessimmons.com/thoughtleadership.php?dm_i=73J,JWAH,1HY7UT,1M85S,1

Conclusion and way forward

Deviations from SOPs are quoted in 50% of the cases

Even managers and front-line workforce «tolerate» deviations

Experience (having engineering judgment or several TRTs endorsed) or time pressure is no reason for breaking the rules and professional standards!

It is not a matter of skill or technical knowledge:

- Several studies clearly mention that **maintenance occurrences are due to inadequate attitude/behavior**
- Competence is made of **skill, knowledge** and **attitude**
- **Safety culture must be enhanced!**

Conclusion and way forward

Culture must change from:

"Can do" to "Can do safely"

SMS is a systematic solution

Builds on existing regulatory provisions (e.g. Part 145)

SMS: Regulatory framework

(ICAO Annex 8)

"States shall require, as part of their State Safety Programme (SSP), that a service provider implement a SMS acceptable to the State."

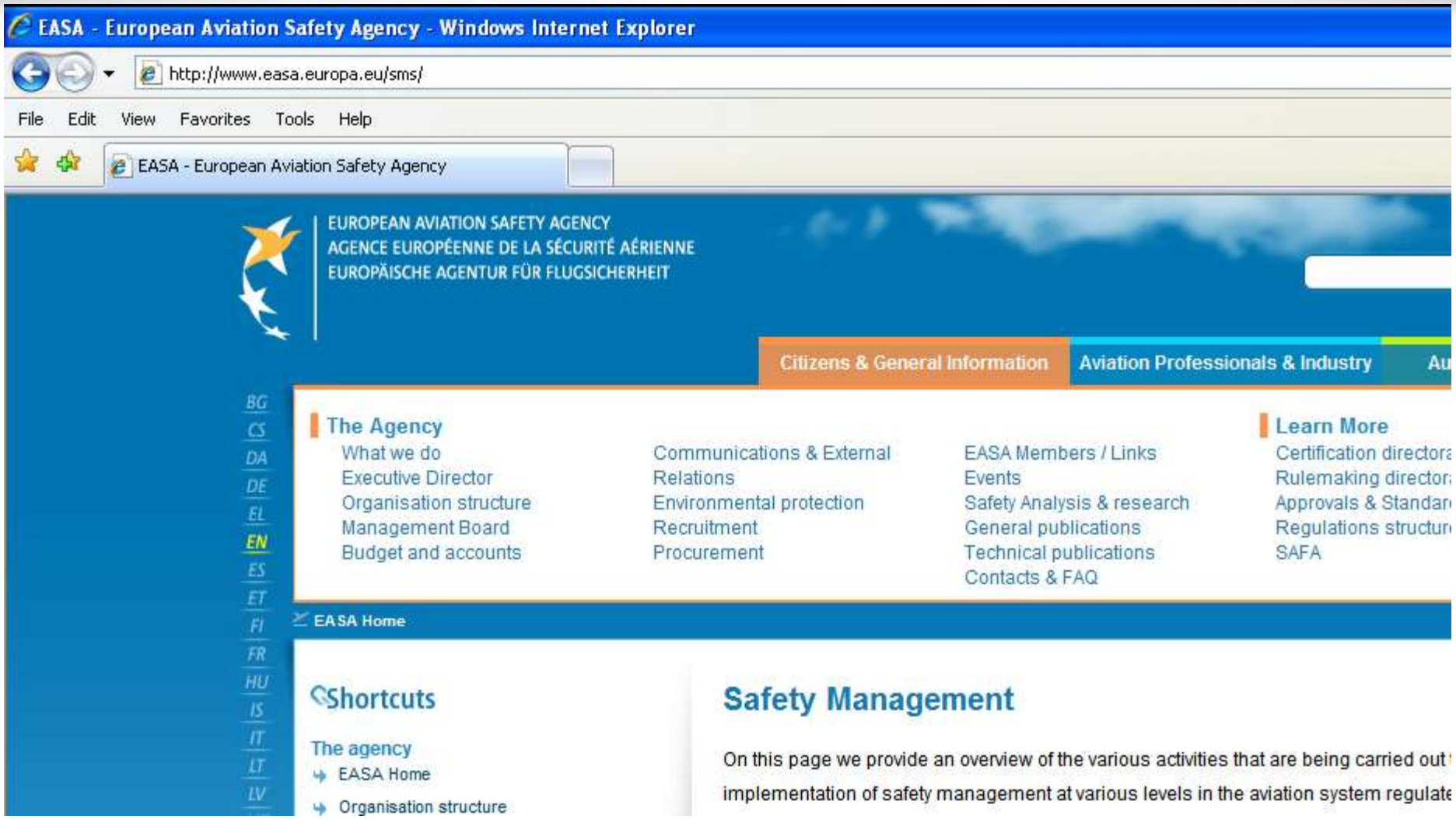
Applicability 1 January 2009

The Agency is in the process of giving a European legal framework to this SARP.

The European Aviation Safety Plan (EASp)

- The European Aviation Safety Programme (EASP) complements the State Safety Programmes (SSPs)
- Strategy (developed by the EC)
  - Policies and objectives
- Programme: (developed by the EC)
  - Means for States to implement SSP (by the EC)
- Plan: the EASp (developed by EASA)
  - European-wide priority actions (by EASA)
  - 1st edition 2011-2014, now being revised

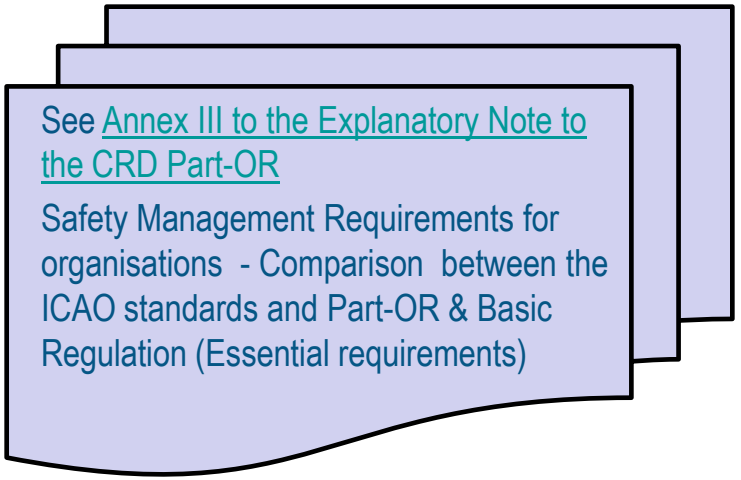
EASA SMS webpage



Organisation Requirements & Management Systems

- ORs do not explicitly refer to SMS. Section 2 of Part-OR Subpart GEN deals with “Management System”.

- ORX.GEN.200 and related AMCs/GM set out what is needed in terms of management system. These, together with the relevant provisions of the Basic Regulation, fully cover the relevant ICAO SARPS on SMS.



Organisation Requirements & SMS

Who will be required to implement a Management System i.a.w. ORX.GEN.200?

- ***First extension (Air Crew and Air Operations)***
  - *Air Operators: commercial and non-commercial if operating complex motor-powered aircraft (CMPA)*
  - *Approved Training Organisations (Pilots)*
  - *Holders of an FSTD qualification certificate*
  - *Aero-medical Centres*

- ***In a second stage (Airworthiness – RM tasks MDM.060 and MDM.055)***
  - *Design organisations and Production organisations (Part-21)*
  - *Maintenance organisations (Part-M Subpart F and Part-145)*
  - *Continuing Airworthiness Management Organisations (Part-M Subpart G)*
  - *Maintenance Training Organisations (Part-147)*

OR.GEN.200

An organisation shall establish, implement and maintain a Management System that includes:

(1) clearly defined lines of responsibility and accountability throughout the organisation, including a direct safety accountability of the accountable manager;

(2) a description of the overall philosophies and principles of the organisation with regard to safety, referred to as the safety policy;

(3) the identification of aviation safety hazards entailed by the activities of the organisation, their evaluation and the management of associated risks, including taking effective actions to mitigate the risk;

(4) maintaining personnel trained and competent to perform their tasks;

(5) documentation of all management system key processes, including a process for making personnel aware of their responsibilities, and its amendment procedure;

(6) a function to monitor compliance of the organisation with the relevant requirements. Compliance monitoring shall include a feedback system of findings to the accountable manager to ensure effective implementation of corrective actions as necessary.

Where are we today?

- **OPS and SMS**
  - Addressed by Opinion 03/2011 dated 19April 2011 – Authority Requirements and organisation requirements
  - Will enter into force 08 April 2012 with transition periods

- **Maintenance & Engineering and SMS**
  - Regulation EC n°2042/2003
  - Is addressed by rulemaking task MDM.055 (ToR already published) – next slide
    - Start 3Q/2011 – Opinion to deliver in 2013
  - Will be aligned with Opinion 03/2011

ToR of rulemaking task MDM.055

- **Identify the element of EC n°2042/2003 that already comply with the SMS**
  - See next slide (gap analysis)
  - Must be practical and applicable for the day to day duties
  - Will focus on managerial factors
    - Ex. Fatigue Risk Management

- **Address the inconsistency between Part-M, Part-145, Part-147 and Part-66 regarding HF**
  - Ex: HF will be extended to Part-M (CAMOs)

ToR of rulemaking task MDM.055

- **Identify the requirements of EC n°2042/2003 that already comply with SMS:**
  - Occurrence reporting addressed by M.A.202 and 145.A.60
  - Competence of maintenance staff addressed by 145.A.30(e)
  - Competence of certifying staff in145.A.35(a)
  - Man-hour planning and availability of personnel addressed in 145.A.30(d)
  - Production planning in 145.A.47
  - Safety and quality policy, quality system in 145.A.65 covering:
    - Capture and rectification of maintenance errors
    - Procedures taking into account the human performance
    - Identification of critical tasks (including the simplest ones)
    - Feedback reporting system
    - Training
    - Oversight

ToR of rulemaking task MDM.055

- **SMS will build upon existing elements**
- **Emphasis should be on Safety Culture**
  - Professional attitude everyday and everywhere
  - Re-think the practices at all levels of the organisation, including middle and top management
  - Understand underlying organisational factors contributing to errors and address them;
  - "No risk taking!" (proper mitigations in place)
  - Safety element in every decision and action!
- **Training and (continuous?) competence assessment**
- **Introduction of Threat and Error Management**

An example

The organisation has to carry out a maintenance task during the night (one man inspection and replacement of parts). According to the maintenance document, the task will last 8 hours and is due today.

- **A risky approach:**

  The shift manager assigns the task to an experienced certifying staff and puts pressure:

  "The aircraft has to be ready to fly at 06:00 next morning."

  "I have selected you because I know that you are one of the best mechanics in the company"

  " Just report in case of any difficulties"

Context:

- Operation and production costs are the main drivers.
- Middle management instructs the shift manager to complete the task on time.
- Senior management does not monitor the production constraints.

The same example with an SMS approach

- **The task is analysed before hand so to identify hazards and assess risks. Critical steps are identified.**
- All documentation is prepared and a job card is issued.
- All spare parts are prepared.
- The aircraft will be brought to the hangar (all resources available).
- An experienced mechanic is chosen and is seconded.
- The mechanic doesn't suffer fatigue from previous tasks (FRMS)
- All critical aspects of the task are double checked.
- The Shift Manager monitors progress of the task and assesses likelihood of on time completion.
- The Shift Manager participates to the final check (testing).
- Events (if any) are noted and will be analysed
- And the organisation has a "Plan B", just in case….

The European Human Factors Advisory Group (EHFAG)

- EHFAG = **European Human Factor Advisory Group**
  - Created at the JAA times
  - Now hosted by EASA

- http://easa.europa.eu/safety-and-research/european-human-factors-advisory-group-EHFAG.php

- https://europa.eu/sinapse/sinapse/
  - Assist EASA and European NAAs in integrating HF into the Agency's activities
  - EHFAG ToR under progress
  - **Sub-group Maintenance and Engineering** provides advice, including on MDM.055

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Thank you for your attention

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AMCs and GM to ORX.GEN.200

Reference	Applies to	Subject
AMC1-ORX.GEN.200(a)(1)(2)(3)(5)	non-complex	- Responsibility and accountability - Safety policy - Hazard identification, risk management - Documentation of management system key processes - Safety manager - Emergency response plan
AMC1-ORX.GEN.200(a)(1)	complex	Organisation and accountabilities: - Safety manager - Safety review board (SRB)
GM1-ORX.GEN.200(a)(1)	complex	Safety action group (to assist the SRB)
AMC1-ORX.GEN.200(a)(2)	complex	Safety policy and management commitment
GM1-ORX.GEN.200(a)(2)	all	Definition of safety policy
AMC1-ORX.GEN.200(a)(3)	complex	Safety risk management: - Risk management system - Management of change - Continuous improvement - Emergency response plan

AMCs and GM to ORX.GEN.200

Reference	Applies to	Subject
GM1-ORX.GEN.200(a)(3)	all	Internal occurrence reporting scheme
AMC1 -ORX.GEN.200(a)(4)	all	Training and communication on safety
AMC1-ORX.GEN.200(a)(5)	all	Organisation management system documentation
GM1-ORX.GEN.200(a)(5)	all	Organisation management system documentation
AMC1-ORX.GEN.200(a)(5)	complex	Organisation management system documentation – Safety management manual (SMM)
AMC1-ORX.GEN.200(a)(6)	all	Compliance monitoring - general -Designation of a compliance monitoring manager -Compliance monitoring documentation -Training
AMC1-ORX.GEN.200(b)	all	Size, nature and complexity of the activity

Alternate Means of Compliance

Organisations may use means alternative to those established in the AMC issued by the Agency:

Alternative Means of Compliance

Organisations need to apply to their competent authority and demonstrate that an equivalent level of safety can be reached.

They may use such alternative means of compliance following approval by their competent authority.

NOTE: Authorities will notify the Agency of the alternative means they have approved.

What is Safety Culture?

Is the set of enduring values and attitudes regarding safety issues, shared by every member of every level of an organization.

- Refers to the extent to which every individual and every group of the organisation is aware of the risks and unknown hazards induced by their activities;
  - *is continuously behaving so as to preserve and enhance safety;*
  - *is willing and able to adapt itself when facing safety issues*
  - *is willing to communicate safety issues; and consistently evaluates safety related behavior.*

Is an integral part of Safety Management

- A strong Safety Culture is generally considered as a vital condition to a well functioning SMS.
- It is sometimes said that is it is well possible to have a good Safety Culture without a formal SMS, but is not possible to have an effective SMS without a good Safety Culture.
- Should be interpreted as a common language, a strong belief, a day to day effort (holistic approach rather that a regulated one)

The EHFAG (ToR dated 8 June 2011):

- To respond to EASA, NAA's and industry requests for HF expertise
- To provide Human Factors expertise for the development and implementation of the European Aviation Safety Plan.
- To co-ordinate with the European Strategic Safety Initiative (ESSI) and the European Aviation Research Partnership Group (EARPG).
- To facilitate the conversion of academic research into practical applications
- To consider and share industry best practice and lessons learnt
- To propose or review existing and proposed changes to the regulatory framework
- To propose or review compliance material and develop or review guidance material
- To promote harmonisation between NAA's, including the FAA, and co-operate where possible with international bodies

Sub-Group "Maintenance and Engineering" of EHFAG

- **5 priority areas**
  - 2 in a specific area:
    - Creating Part M Subparts G and I HF requirements (final)
    - Introducing Fatigue Risk Management System Requirement
  - 3 generic areas:
    - Developing the means to measure the effectiveness of the existing HF requirements
    - Improving the effectiveness of the oversight of HF by the NAAs
    - Addressing Organisational Factors which are currently not adequately addressed (e.g. Just culture policy)