SMS takeaways

(Derived from the AIR OPS SMS workshop held on 12/13 February 2019)

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Introduction

These SMS takeaways stem from the EASA workshop that took place on 12/13 February 2019 about the oversight of the Management Systems implemented by air operators:

- They refer mainly to ORO.GEN.200 and ARO.GEN.300/305/350 of Regulation (EU) 965/2012 accessible at https://www.easa.europa.eu/regulations (consolidated version with AMC/GM here);
- All workshop presentations are posted at https://www.easa.europa.eu/newsroom-and-events/events/air-ops-sms-workshop.

The document has been complemented by the experience of the EASA air Ops Inspectors during their standardisation visits of EU Member States.

The main targeted population is the NAA Inspectors responsible for the oversight of the air operators' Management Systems. The document not only serves for safety promotion or training purposes, but can also be used by the air operators to improve the implementation of their management systems.

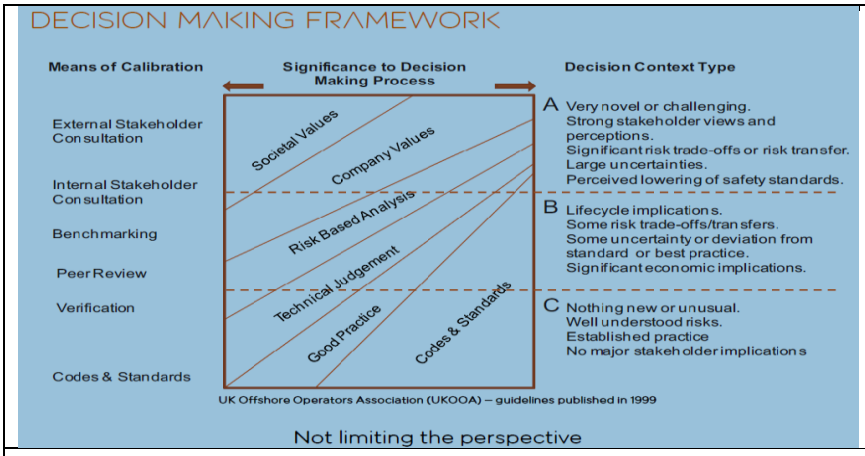
A number of key messages may also apply to other domains besides air operations.

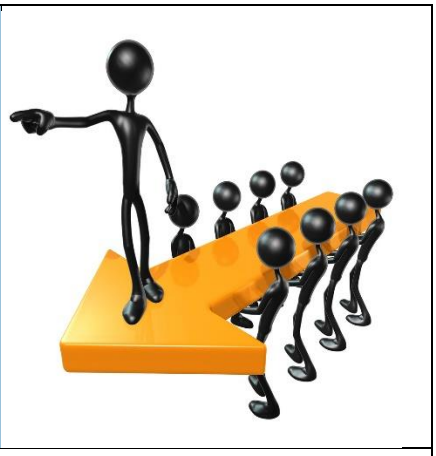
A bibliography is available at the end of the document. By clicking on the pictures you can directly access the documents.

The document will be up-dated based on experience gained and feedback over time. Comments and suggestions should be addressed to safety.management@easa.europa.eu.

Note: The document uses the terms "Management System" (MS) in accordance with ORO.GEN.200 and "Safety Management System" (SMS) in line with the elements of ICAO Annex 19.

Senior management buy-in





Speaker's key messages

Risk prevention, recovery and survivability is paramount to the business.

The importance of safety leadership and risk-awareness. "Sets the safety tone."

Different level of involvement for technical decision compared to strategic decision-makers

- Not all technical information has to be discussed at Safety Review Board (SRB) level.

Importance of nominated persons involved in the management of safety.

- Everyone has a safety role, including responsibilities.
- The role of the Accountable Manager (AM) is to make it clear to everyone and assume final accountability.

Importance of:

- Quantifying the risk consistently.
- Developing effective and practicable solutions.
- Communicating risk and options, not forgetting subcontractors.

Additional EASA considerations

Ensure that the SRB minutes do not contain too much technical information, so as to assist the AM in providing the appropriate level of risk awareness.

- Feeding the SRB with too many technical details may deter from transferring the importance and wider risk picture to the AM.

Understanding, support and participation of the nominated person to the overall process is paramount in order to have an effective management system.

Ensure that the AM is aware of his/her role, so that everyone understand their safety responsibilities:

Ensure that the AM accepts the risk options.

Ensure that the risk picture is common and visible across the organisation, including subcontractor activities [ORO.GEN.205].

The risk appetite of the operator should be considered when evaluating the effectiveness of the management system.

Further SM ICG reading on the role of the senior managers or AM is available here.

Causes and consequences of operational errors are not linear in their magnitude

Speaker’s key messages

How much do we know and how much do we understand?

How much does the risk assessment reflect who we are?

Bow tie helps visualising the top event associated to the hazard, threats and consequences; however it may require additional elements to get the full risk analysis picture, such as the process to calculate the score based on the chosen matrix

Risk assessment looks very well but there is often no data to support them.

Risk assessment process is by definition data-driven.

- Risk assessment is not just an opinion; therefore it cannot rely only on expert judgement.

A risk assessment should be a collaborative approach, involving frontline people.

There is a need for more engagement and understanding in the risk assessment process.

“Reverse engineering” should not be used to manipulate the risk analysis (see section of “Reviewing Risk Assessment and Hazard Logs”)

Importance of discussing and accepting the outcome of the risk assessment during the SRB.

Additional EASA considerations

The quality of the risk assessment relies on the data used to run the process.

- Check how the data is validated;
- The importance of challenging the risk assessment outcome is driven by the fact that a quantitative assessment is key to the process;
- Ensure customisation of the likelihood and severity tables are based on values, which are meaningful for the nature of the operations;
- the likelihood and severity tables need to be regularly reviewed and updated in order to reflect the tolerability of risks and operational experience;
- Data is often available from past-operations or from industry statistics.

The importance of the line managers' and nominated person's support in developing the risk assessment.

- Competence of the key staff involved in the risk assessment process is essential.
- Training should reflect the organisation's needs and methodologies.

Consideration for small organisations.

- The risk assessment process should benefit from available, public data and safety information such as domain risk portfolios; EASA Annual Safety Review; manufacturer or international association data; or any other public databases etc.

Importance of NAAs in terms of SMS support by actively involving the AM and the Nominated Person during audits.

Importance of effective communication about risk assessment's outcome.

- "What matters is what people understand."
- Role of the senior management to highlight the highest risks and the direction to take.

SMS software is only a tool to support:

- The SMS should not be adapted to the SMS software but the other way round.
- Ensure that the software is customized to the SMS needs of the organisation.

Hazards:

- For every hazard, there could be more than one consequence; each consequence needs to be risk-assessed.
- The number of hazards does not necessarily indicate the maturity of the SMS; what matters is the description of the identified hazards and the assessment of the associated consequences.

Customization of the risk assessment matrix

Occurence	Meaning	Value
Frequent	Likely to occur many times (has occurred frequently)	5
Occasional	Likely to occur sometimes (has occurred infrequently)	4
Remote	Unlikely to occur, but possible (has occurred rarely)	3
Improbable	Very unlikely to occur (not know to have occurred)	2
Extremely Improbable	Almost inconceivable that the event will occur	1

Figure 1: ICAO standard proposal for likelihood

Probability LEVEL	Occurrences in XYZ			One out of ___ flights	Probability	Description
	Upper Boundary	Mean	Lower Boundary			
P5	Always	10 per day	6,5 per day	140	7,3E-03	**Probability:** Almost certain, very high **History:** Significant past history, has occurred many times and is considered most likely to happen in these circumstances **Context:** Has occurred innumerable times at XYZ
P4	6,5 per day	Once per day	2,9 per week	1.100	9,0E-04	**Probability:** Likely, high **History:** Past history and will probably occur in most circumstances **Context:** Has occurred many times at XYZ
P3	2,9 per week	Once per week	1,3 per month	10.000	1,0E-04	**Probability:** Possible, medium **History:** Some past history, has occurred occasional and is considered quite likely to happen in these circumstances **Context:** Has occurred several times at XYZ
P2	1,3 per month	Every two months	2,2 per year	100.000	1,0E-05	**Probability:** Low, possible under certain circumstances **History:** Some past history and considered possible in these circumstances **Context:** Has occurred at XYZ
P1	2,2 per year	Every year	Every 3,2 years	500.000	2,0E-06	**Probability:** Very low, unlikely **History:** Has occurred rarely, has happened, but a credible statistic frequency is hard to establish **Context:** Has occurred sporadic at XYZ
P0	Every 3,2 years	Every 10 years	Every 32 years	5.000.000	2,0E-07	**Probability:** Quite unlikely, rare **History:** In most circumstances no past history, but possible in exceptional circumstances **Context:** Has occurred in the aviation industry
P6	Every 32 years	Every 100 years	Every 320 years	50.000.000	2,0E-08	**Probability:** Extremely unlikely, mishap basically impossible **History:** No past history and considered very unlikely to occur **Context:** Not yet heard of in the aviation industry

Figure 2: Example of customized table

Speaker's key messages

Importance to customize the risk matrix:

- Severity and likelihood should reflect the operational needs.

The decision making framework should not only consider the technical judgement but also the risk-based analysis; the societal values; the company values; the company reputation; assets, environment and benchmarking etc.

Although customisation may be complex, adaption may be nevertheless necessary, as explained in section "Senior management buy-in".

Additional EASA considerations

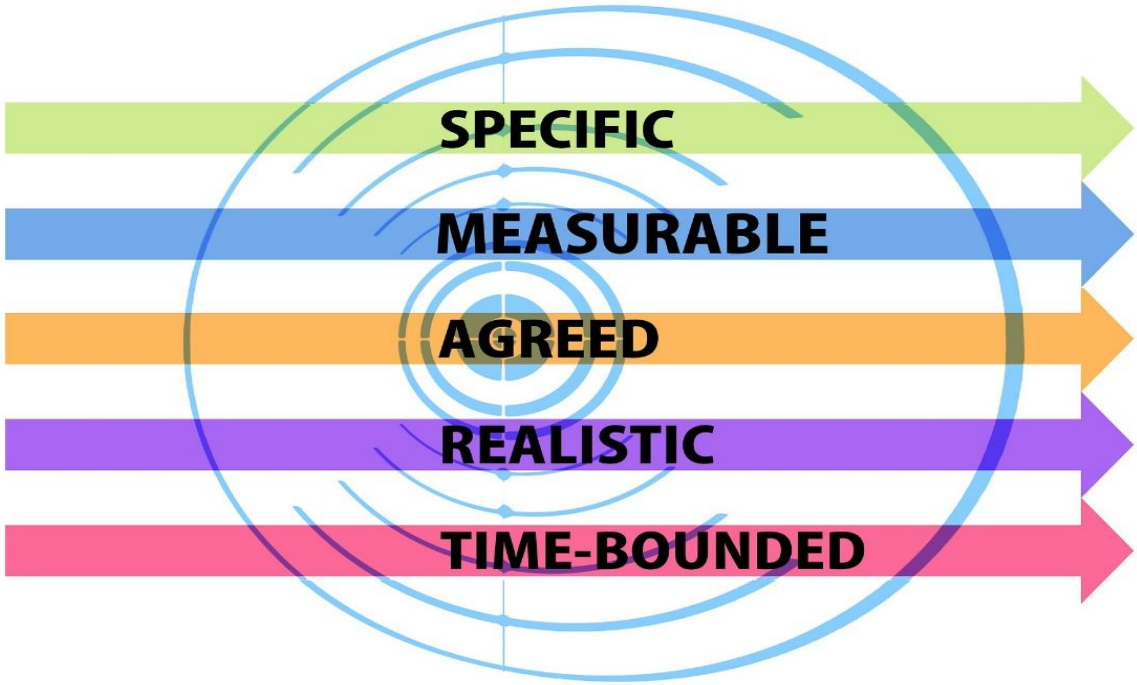
The use of the ICAO standard risk matrix does not allow to determine an accurate risk picture that reflects actual peculiarities of the operator.

When analysing likelihood, the inspectors have to pay attention to what and how it is measured:

- Missing this can easily lead to significant mistakes when entering the risk assessment matrix;
- "Is it a dice with 6, 12 or 24 faces?"

Having too subjective definitions of "likelihood" and "severity" (e.g. for "frequent, "probable", "severe", "extreme" etc.) does not help to convey a common understandable, coherent use of the risk matrix.

Risk tolerability criteria have to be sufficiently clear to let NAANAA inspectors understand within which timelines the actions have to be taken by the operators.



Speaker's key messages

The mitigation actions are defined based on the SMART concept, as depicted above.

The responsibility and ownership to implement the agreed mitigation measures have to be clearly defined within the organisation:

- Mitigation measures have to be discussed and agreed at the SRB;
- Effectiveness of the mitigation measures has to be continually monitored;
- Compliance and/or safety manager monitors the implementation;
- Software can help in tracking the due dates and guarantee that the agreed actions are addressed.

Sources available to identify and assess the robustness of barriers and controls should be considered such as:

- Appropriate actions stemming from the European Plan for Aviation Safety (EPAS), when applicable;
- Safety Information Bulletins (SIBs);
- International association documents such as "Annual safety reports";
- EOFDM;
- Etc.

Additional EASA considerations

AMC2 ARO.GEN.300(a);(b);(c): "as part of its continuing oversight, the competent authority should also remain satisfied as to the **effectiveness** of the safety risk assessments."

Risk assessment as such does not reduce the risk:

- Efficient mitigations measures are necessary;
- Operator is responsible to implement and monitor the agreed mitigation;
- Inspectors have to verify the effective implementation of these mitigation measures.

Mitigation measures could follow the SMART concept:

- "Specific" in order to address the identified issue(s);
- "Measurable" in order to evaluate the effectiveness;
- "Achievable / agreed" in order to ensure that the actions can be implemented;
- "Realistic" in terms of resources;
- "Time constrained" in terms of "timeframe versus risk exposure."

Assessing the credibility of risk assessment and mitigation:

- Verification
- Validation
- Input data validity (in line with recognised available data)
- Result robustness
- Use of history
- People qualification

NAAs have to verify who is in charge of the implementation and management of mitigation measures.

Importance of tracking actions by the operator / owner, using safety assurance processes:

- A feedback loop is required for the compliance monitoring function in order to ensure effective implementation.

A mitigation data collection process is necessary to continually monitor the effectiveness and ensure that the risks are not shifted elsewhere.

For "small organisations", SMICG reading provide some useful good SMS practices.

Safety Performance Indicators and Targets (SPIs / SPTs)

Speaker's key messages

Power of SPIs and SPTs to benchmark:

- It is required to move to "performance" and compare.

Normal operations usually give more information than "event" Information

- "Operation" is a major source of information;
- Chase many potential events.

Ensure that the right sources of information are available and compatible to set up relevant SPIs and SPTs:

- Blending compatible data sources with associated SPIs/SPTs will make the management system more powerful (e.g. number of hours flown versus level of fatigue versus level of unstable approaches versus weather data etc.);
- Integrate your data sources.

Positive trends are as important as negative ones.

Additional EASA considerations

SPIs should be:

- Related to the safety objectives they aim to indicate or monitor
- Selected or developed based on available data and reliable measurements
- Appropriately specific and quantifiable;
- Realistic by taking into account the possibilities and constraints of the organisation.

(Source: ICAO Safety Management Manual).

Usually safety metrics tend to focus on serious incidents and accidents since these are easy to measure or often receive more attention:

- In terms of safety management, the focus on such negative events should be considered with some caution because it does not help operators to identify their daily operational risks and the effectiveness of the management system.
- The very low number of worldwide accidents can give a false sense of a high level of safety; this does not mean that risks do not need to be continuously and effectively mitigated.
- The focus should be more on precursors stemming from normal operations rather than accident and incident data.

SMICG provides some guidelines about "measuring safety performance".
For "small organisations", SMICG reading provide some further useful good SMS practices, when the volume of data is low.

Meeting with the Accountable Manager and attendance to the SRB

Speaker's key messages

"The aim of the Accountable Manager Meeting (AMM) is to ensure that the NAA and the Accountable Manager (AM) have the same broad perspective on the major risks and safety performance across the entity":

- Encourage two-way dialogue about business context, safety risks and desired outcomes.
- Promote trust between the NAA and AM to ensure that risks are openly discussed.

Additional EASA considerations

A common risk picture of the organisation is the outcome of an effective SRB. Nominated person and AM should have a common understanding of their specific risks.
The provisions of the NAA's sector risk picture for comparison is good practise.

The AM meeting outside the audits should be organised and led by the responsible oversight inspector who is familiar with the overseen organisation. It should be an open two-way discussion between the responsible inspector and the AM. In order to have an effective and constructive meeting, it is important that the responsible inspector adapt his/her interview technics and attitude to establish trust and confidence.

The AM meeting is a good opportunity to:

- remind the AM of his/her safety accountability;
- Ensure the AM understands the regulatory environment.

The meeting should be recorded and its outcome acknowledged by the AM.

It is noted that the AM is not always familiar with operational safety risks and the added value of an effective "management system", resulting in a lack of engagement/buy-in from the AM. It is the Authority's responsibility to convey the right factual messages to the top management, notably encouraging full support to the effectiveness of the MS.

NAA participation at the SRB is recommended when appropriate:

- What cannot be seen during audits is live discussions and decision making;
- SRB is a good opportunity to gain the picture of risk awareness and see the system at work;
- Inform the operator about the willingness to participate to SRB as observer by clearly defining attendance's objectives and protocol.
- Access to safety critical information during such meeting should not be used to raise findings against the organisation.

Reviewing Risk Assessment and Hazard Logs

Speakers' messages

- Risk assessments should not be conducted singly; wider group consultation is recommended.
- Ensure that all risk mitigations measures are included in the assessment.
- Ensure that risk mitigations promised but not carried out are discussed and challenged
- Risk assessments filed away and not updated / revisited
- Hazard register –does such a process exist?
- If so, is the hazard register relevant to the organisation?

Additional EASA considerations

The inspector needs to change his/her mind-set to challenge risk assessments and the hazard log.
In doing so, he/she needs to be aware that :

- Sometimes performed risk assessments are reversed engineered to try to demonstrate that what the organisation has in place is acceptable without providing evidence of appropriate analysis.
- One hazard can have several consequences, each of them should be assessed.
- Bow-tie is good to summarise the result of a risk assessment but does not allow to understand the severity and likelihood used to perform the analysis.
- The main objective of event risk classification (ERC) is to act as the first screening of all events. Therefore it should be used to prioritise and decide what needs to be risk assessed.
- Risk assessment scope has to be clearly defined and all relevant information should be appropriately included.
- The hazard log / risk register is a live document to be regularly updated and not only to add new hazards, but also to ensure that listed barriers and consequences still remain relevant.[AMC2 ARO.GEN.300(a);(b);(c)].

The effectiveness of the hazard identification process and therefore of the MS is not necessarily measured by the number of identified hazards (i.e. 20 hazards identified and duly managed is probably better than 100 hazards identified but not duly managed).

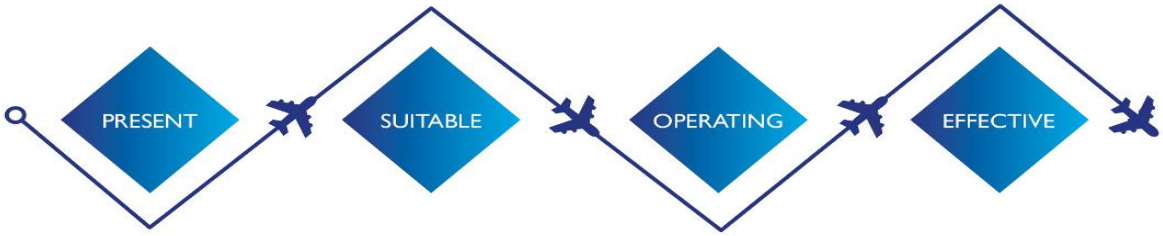
Speakers' key messages

Inspector should be trained and competent to carry out management system assessments.

- "Management system assessment" differs from "Compliance monitoring": there is a need to consider additional inspector competences" where necessary.
- When evaluating the effectiveness of the SMS and the safety performance of the organisation, the "new generation of inspectors" will need to: **understand; challenge; and decide**.
- There is no black or white, nor simple scoring criteria when assessing an Operator's MS; "critical thinking" is key for conducting risk and performance-based oversight.

The NAA should provide technical guidance and tools to effectively assess the management system of air operator so as to evolve from traditional compliance-based to risk-/performance-based oversight:

- Here EASA provides a tool using the "PSOE" model: "present", "suitable", "operational" and "effective"



Additional EASA considerations

There is a need to assess the MS both initially and continuously during the oversight cycle.

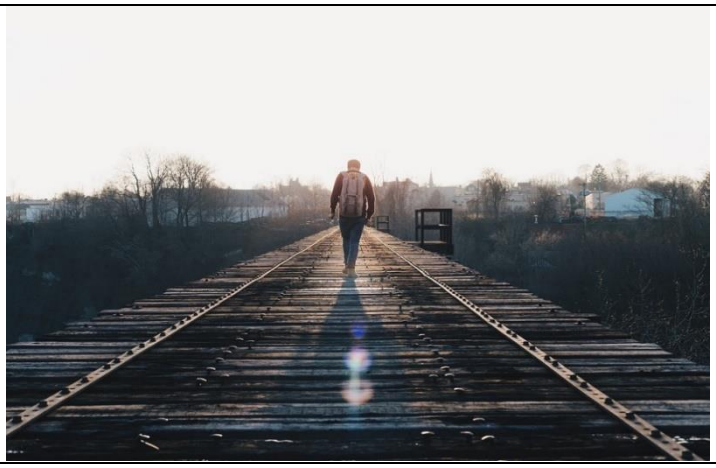
In accordance with ARO.GEN 305, the outcome of the assessment shall feed into the determination of the oversight planning cycle.

Consideration should be given to the size, nature and complexity of an organisation to assess whether the individual feature of the management system is “present”, “suitable”, “operational” and “effective”.

Good preparation of the assessment of an operator’s Management System is essential:

- Identify the scope of the assessment (e.g. select one hazard);
- Collect documents and evidences before the assessment (e.g. operator’s risk assessment documentation; operator’s risk profile and benchmarking);
- Be ready how to conduct the assessment and who to interview;
- Have a cross domain perspective as an SMS may not be fully “operating” and/or “effective” due to the interfaces that are not sufficiently addressed;
- Know how and what to report in a positive manner, according to “present”, “suitable”, “operational” and “effective” criteria, recognizing what “is well done” and “what could be better done”.

"The Safety Manager" as a lonely bird



Speaker's key messages

- The organisation, including the nominated person and the operational managers, often does not support enough the safety management processes.
- The safety manager is often left alone in the organisation.
- The safety manager is often seen as the only one responsible for managing safety throughout the organisation.
- The organisation should clearly define its own competence and qualification criteria to fulfil the role of the safety manager.

Additional EASA considerations

- Do we need a Form 4 for the safety manager? What matters most is to have the organisation's support.
    - Authority's responsibility is to support the safety manager's role during standard oversight activities;
    - Qualification matters, but it is insufficient without organisation's support [e.g. Accountable Manager, nominated persons];
    - Authorities need to verify the nominated person's knowledge and understanding of risk management concept.
- The safety manager and other key personnel involved in the process should receive training customized to the organisation specific needs [i.e. a training off-the-shelf may not be sufficient];
- The inspectors should verify the effectiveness of the training of the safety manager as well as the nominated persons by challenging the process. EASA standardisation feedback shows that:
    - Too often the competences of key personnel involved in the SMS activities are not at the expected level;
    - The SMS training received is not always appropriate to meet the desired level of competence.
- The NAA inspectors should ensure that the organisation's safety department:
    - Has a supportive role, ensuring that the risk assessment is done by the subject matter expert (SME) or the operational department;
    - Ensures consistency across the organisation;
    - Ensures that "risk assessment" is engrained within the organisation;
    - Ensures that the risk is managed by the right department;
    - Checks that complacency is not the mind-set instilled;
    - Challenges, inspires and encourages.

How and when to raise SMS findings

EASA considerations

Raising findings in a performance-based environment differs from the compliance environment:

- Substantiating the finding with enough evidence is necessary;
- The "PSOE" grading system may not be necessarily suitable for "levels 1 or 2" findings in accordance with ARO.GEN.350:
  - For the initial evaluation or as part of a transition to new SMS requirements, all the processes should be '*Present*' and '*Suitable*'. If not then the approval or certificate should not be granted or transition accepted. Once an SMS is functioning and transition periods expired, during the evaluation if a process is found not to be '*Operating*', a finding should be issued;
  - Where a feature is found not to be '*Effective*' the inspectors may consider issuing an observation to give rise to suggested improvements. However, findings should not be issued if the process is '*Operating*' but not '*Effective*'.
- The process aims at assessing the effectiveness of the SMS and the performance of the organisation.
- Raising a finding is the last step of the decision-making process based on the evidences and evaluation performed by the inspector on site.
- Wherever possible, rather than just relying on expert judgment, the decision making should be made by consensus of a team of experts.
- The timeframe to close findings may require more than the standard, initial three-month timeframe as indicated in ARO.GEN.350.
- Since the details are listed in the AMCs, it is not always easy to link the nature of the finding to an implementing rule.
- It is acceptable for the competent authority to raise findings against organisation's internal policies and procedures.
- Inspector's training on writing findings need to be further developed.

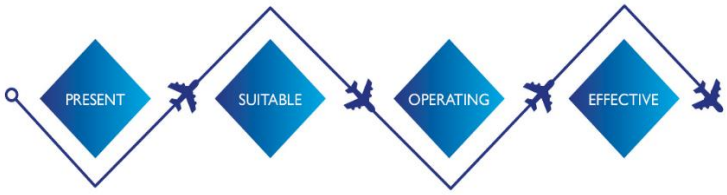
EASA has published "risk-based oversight practices" here.

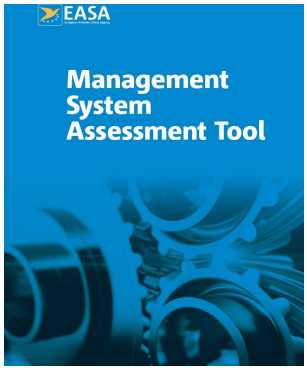
Recommended bibliography

All **presentations of the Air Ops SMS workshop** held on 12/13 February 2019 can be accessed here.

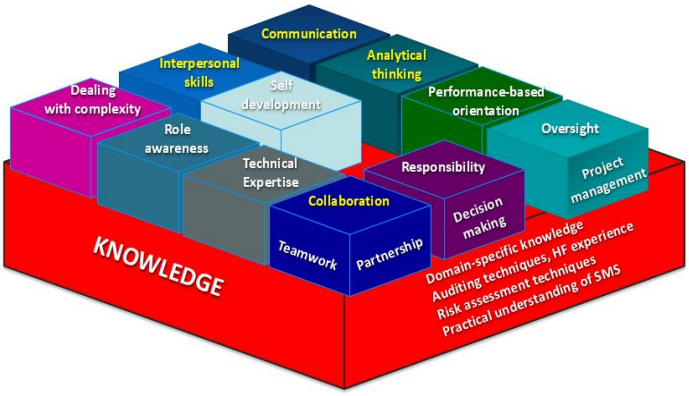
The **EASA Management System assessment tool** can be downloaded here.

An editable version can be requested at safety.management@easa.europa.eu.

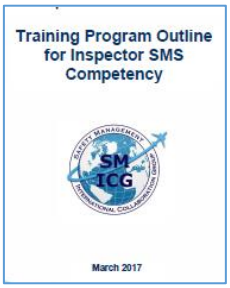




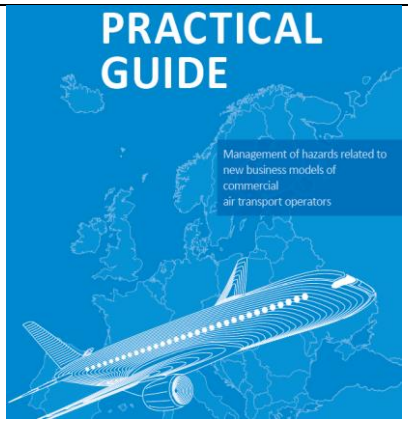
The EASA aviation **Inspector Competencies** can be downloaded here.



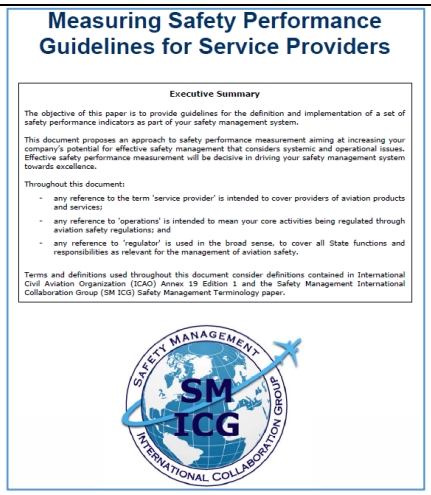
The SM-ICG has also developed a "Safety management System Inspector Competency guide" and a training program outline for inspector SMS competency.



EASA "Practices for risk-based oversight" can be downloaded here

The European Operators **Flight Data Monitoring** - EOFDM - forum is a voluntary partnership between European Operators and the EASA in order to: • Facilitate the implementation of Flight Data Monitoring (FDM) by Operators; • Help operators draw the maximum safety benefits from an FDM program. A number of documents address the precursors to LOC-I, CFIT, MAC etc. NAAs have developed guidance and good practices to enhance their FDM oversight capabilities, including the monitoring of KPIs, through the European Authorities Coordination group on Flight Data Monitoring (EAFDM)	
The EASA Practical Guide on '**Management of hazards related to new business models of commercial air transport operators'** includes a number of easy to use and practical examples for SMS managers for hazard identification and management in the following five areas: • Outsourcing of safety critical services, • Leasing agreements, • Interoperability, where several airlines belong to the same parent company or holding, • Different employment models within the airline, • Increased mobility & turnover of pilots.	
ICAO Annex 19 "Safety Management" as well as **Document 9859 "Safety Management Manual"** (SMM) [for sale on the ICAO store] An Ebook version of the SMM can be consulted here. Chapter 9 further explains SMS, notably the management commitment, the role of the Safety Manager etc.	
The ICAO website and its **Safety Management Implementation portal** (SMI) This website complements the 4th edition of the ICAO Safety Management Manual (SMM) and provides **examples, tools and supporting educational material** to address the diverse needs of the aviation community.	
The SM-ICG products contain material such as: "The frontline manager's role in SMS"; "A systems approach to measuring safety performance – the Regulator perspective and the Service Provider's perspective"; "Risk-based decision making principles"; "SMS for small organisations"; "Training program outline for inspector SMS competency". *Note 1:* The Safety Management International Collaboration Group (SM ICG) is a joint cooperation between many regulatory authorities for the purpose of **promoting a common understanding of safety management and Safety Management System (SMS)/State Safety Program (SSP)**	

principles and requirements, facilitating their implementation across the international aviation community. **Some editable versions are available**.
Note 2: To receive notification when new SM ICG content is published, contact smicg.share@gmail.com.
Note 3: To obtain editable versions of these documents, contact visit https://www.caa.co.uk/sms, which also published "bowtie risk assessment models", further guidance and templates, SMS for non-complex org. etc.



More **EASA material** is available here.

The EASA Annual Safety Reviews provide with the safety risk portfolios for risk sector profiles. The European Plan for Aviation Safety (EPAS) provides with systemic, operational and emerging issues, including the key risk areas as well as causal contributory factors that lead to these key risk areas.

Additional publication or videos (for information only)

- Search with Youtube: "SMS explained" "Bowtie explained"– many videos available such as here or here or here
- EHEST MARIA Risk Assessment Toolkit
- EHEST safety Management Toolkit for non-complex operators and a SM toolkit for complex operators
- The ARMS methodology for operational Risk Assessment in aviation Organisations
- STAMP/STPA (handbook) developed by Nancy Leveson and John Thomas
- Improving the risk matrix (i.e. "customization) - Prof. Nancy Leveson, MIT Department of Aeronautics and Astronautics
- ISO 31000:2009
- NASA – Risk Informed Decision Making Handbook
- L. Ostrom – Risk Assessment
- R. Stephans – System Safety for 21st Century
- J. Reason – Managing the risk of organizational accidents

Refer also to the EASA SMS safety promotion website.