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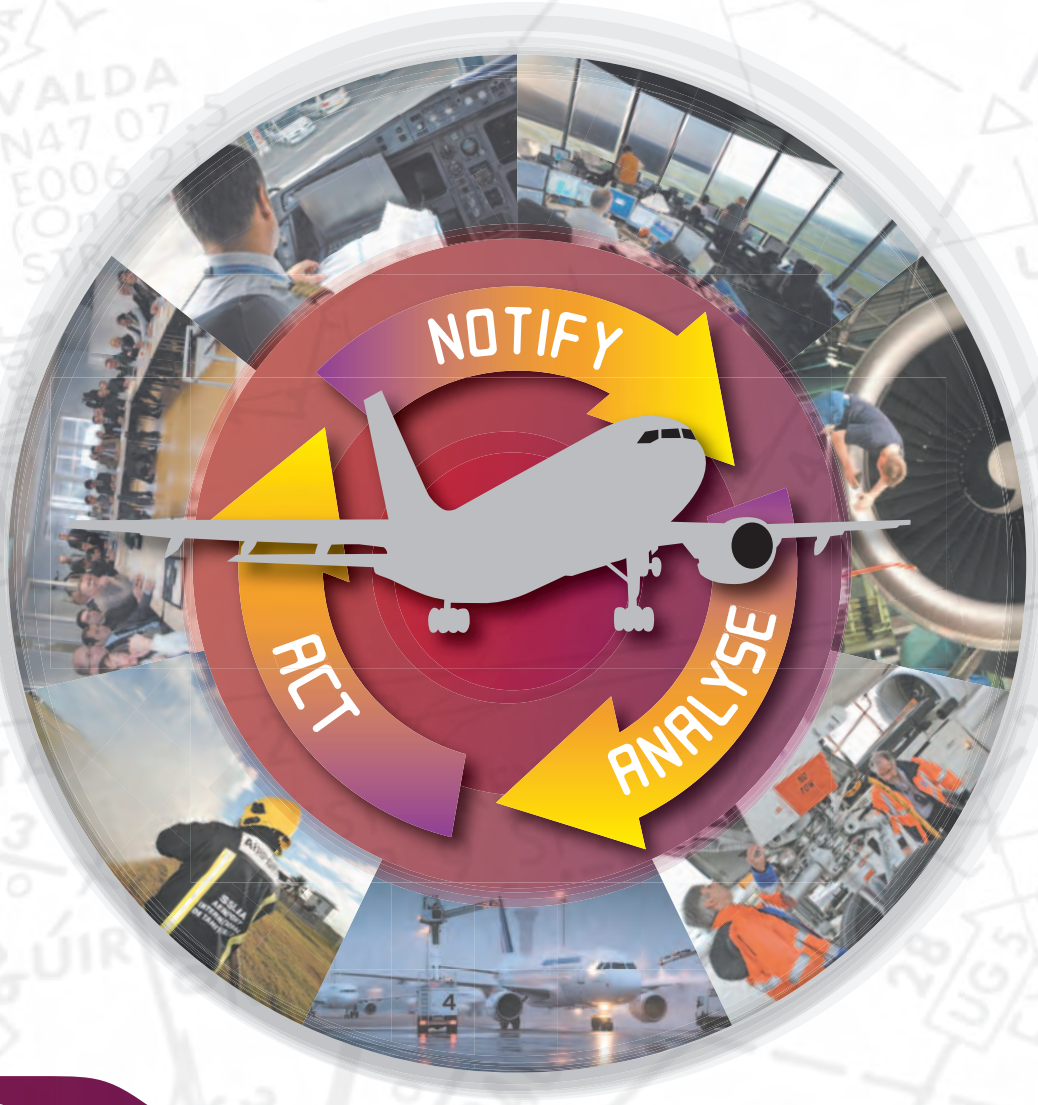
The symposiums

THURSDAY 24 NOVEMBER 2011

FROM OCCURRENCE PROCESSING TO RISK MANAGEMENT

Summary and best practices



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Foreword

The deployment of safety management systems (SMS)[1] is one of the flagship measures recommended by the International Civil Aviation Organisation (ICAO) to improve safety in civil aviation. This recommendation has been included in many national and international regulations and, a few years hence, SMS will be mandatory for most players in civil aviation.

What is really new about SMSs, is that they formally define risk management in an organisation. This results in a whole new paradigm: the safety of operations is no longer achieved simply by applying rules, procedures and best practices. It is now the very risk itself that is identified, assessed and mitigated.
This formal definition is useful for a number of reasons:

- it engages company management in the process to improve safety
- it involves all the actors, including those who are not directly involved in air operations
- it requires the operator to consider the risks induced by its operations, and the potential consequences of these risks.

The formalisation of the processing of safety occurrences is an essential part of risk management.

Monitoring the SMSs of all types of air operators is one of the missions of the civil aviation safety directorate (DSAC). In the discharge of these duties, the DSAC has itself adopted a similar approach as part of the French Air Safety Programme, in order to develop a globally coherent system. In view of the difficulties experienced by certain operators with the implementation of their SMS, the DSAC is taking a series of actions to support and promote safety by clarifying the regulatory requirements and highlighting the gains in operational safety resulting from the deployment of this type of system. The 2011 symposium, on the theme of risk management through the processing of safety occurrences, is one of these.

Preparations for the symposium started in 2011. They allowed us to identify the problems experienced by the different types of operators when it comes to processing safety occurrences, whether they have already deployed their SMS or not. These exchanges were highly instructive and helped us to identify difficulties, be they specific to a given area or common to several areas, and to define best practices.

This document presents the results of this work, by following the sequence of safety occurrence processing operations: the notification, sorting and analysis of occurrences, monitoring of safety actions and control of their effectiveness. The last two chapters cover aspects related to the organisation of risk management and the exchanges between players in the aeronautical sector on questions of safety.

(1) Safety Management Systems (SMS)

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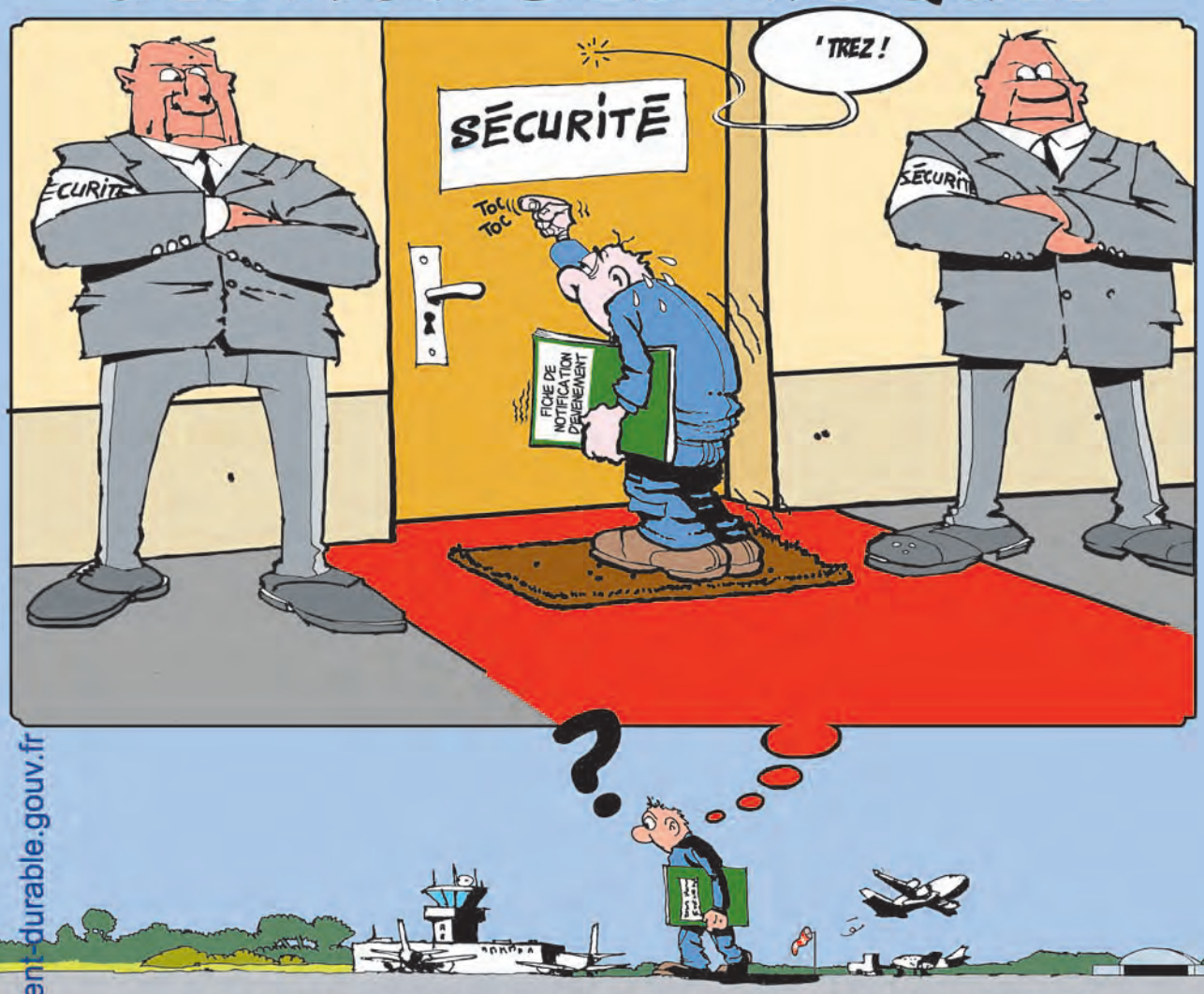
DU TRAITEMENT DES ÉVÉNEMENTS À LA GESTION DES RISQUES



LA NOTIFICATION DES ÉVÉNEMENTS AU SGS REPOSE SUR UNE RELATION DE CONFIANCE.*

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Deymo

* NOTIFICATION OF EVENTS TO THE SMS IS BASED ON A RELATIONSHIP OF TRUST.

Notification of safety occurrences

In the notification[2] process, agents, who are aware of a safety occurrence, inform the organisation to which they belong. There are several types of notification circuits. But knowledge of the occurrence and the information used to identify it (date, location, persons or entities involved, etc.) must ultimately reach the department responsible for analysing it through the SMS.

Occurrence notification is an essential part of the operator's risk management. For many operators who are currently designing or deploying their SMS, occurrence notification is a problem in itself.

Just culture and social pressure

Difficulties

The main obstacle to notification faced by operators is the reticence of their agents to inform their management of incidents they are aware of, and for which they are sometimes partly responsible. While most front-line players in air operations (pilots, controllers) have been used to giving notice of safety occurrences for many years, this is not the case for most of the other agents, who are not used to working in an SMS.

Just culture

Players in civil aviation have adopted the concept of a "just culture" (see insert) in an effort to overcome these problems. But employees may still be reticent, even if management offers guarantees that occurrence notification will not result in any punitive measures. In most professions, an employee's career development, or even job security, is determined on the basis of performance and efficiency. Particular attention is paid to mistakes made by the employee that are costly for the company. If this type of working conditions existed until recently in the company, it is difficult to progress from atmosphere of suspicion to relationships founded on trust.

On the other hand, the just culture cannot be used to justify the deliberate infringement of company procedures or repeated negligence.

Just culture:

a culture in which front-line operators are not punished for actions or decisions that are taken within the scope of their experience and training, but also a culture in which deliberate breaches and infringements committed by front-line agents, or other agents, are not tolerated.

Confidentiality

Respect for confidentiality is another difficulty. If employees know that they can give notice of an occurrence in which they are involved, without their colleagues (or even their management, if the company procedures so permit) being informed, then they will be more likely to respect the notification process. But this confidentiality is difficult to respect in small companies, or even in small teams in a large company.

(2) Unless stipulated otherwise, from here on, "notification" shall refer to the act of reporting an occurrence to the operator's internal safety management system, and not to the "notification" or "declaration" of an occurrence to the civil aviation authority.

Even if company management takes the "just culture" seriously, the sense of betrayal associated with occurrence notification and the social pressure on employees, can represent serious obstacles to the escalation of information.

Respect for confidentiality is also essential within the organisation itself. Even if the knowledge of incidents is accepted as being essential for the improvement of safety, such occurrences often give a negative image of the corresponding operators.

It is important that safety information, which is of use to everyone, can be distributed in a suitable manner. The information can be filtered to avoid damaging the company, but it must not be overly "censored", if it is to remain relevant and specific.

Legal aspects

Another concern frequently expressed by employees who are in a position to give notice of occurrences, is their fear of prosecution by the legal authorities, and in particular of the use of occurrence reports as proof of "reckless endangerment". This concern appears to be unfounded: At the time of writing, not a single occurrence spontaneously notified by an aviation operative in France has resulted in legal proceedings against them[3].

On the contrary, legal inquiries into air accidents attempt to find out whether the persons under cross-examination showed any signs of "negligence" in the processing of the preceding occurrences and in the actions taken to avoid them. The non-notification of serious and known occurrences, or the failure to respond to these occurrences, are definitely both liable to be subsequently judged as forms of "negligence".

Information and best practices

Promoting the just culture

At the very least, company management must clearly apply, across the board, the principles of just culture that underpin the processing of safety occurrences, and include them in the company's safety policy. These principles must be applied without fail, otherwise there is a real danger that the relationship based on trust will collapse, especially when the process undergoing implementation. The diagram opposite can help to define these principles, while achieving the right balance between the non-punitive nature of occurrence notification and the intolerance of any deliberate and repeated breach of safety procedures or negligence.

But trust, like the safety culture, cannot be created by decree through. The leading operators that already have a mature SMS, all state that they spent several years building relationships based on trust and demonstrating the benefits of feedback.

The best means of overcoming fears due to social pressure and the sense of denouncement probably consist in showing that the organisation itself is capable of analysing its own malfunctions and deciding on systemic actions that stretch beyond the front-line operators. A survey of the safety culture in the company, based on questionnaires and/or discussion groups, is one way of detecting any reticence.

(3) Accidents are processed differently, since they involve real damage. In any case, it is impossible to keep them "under wraps".

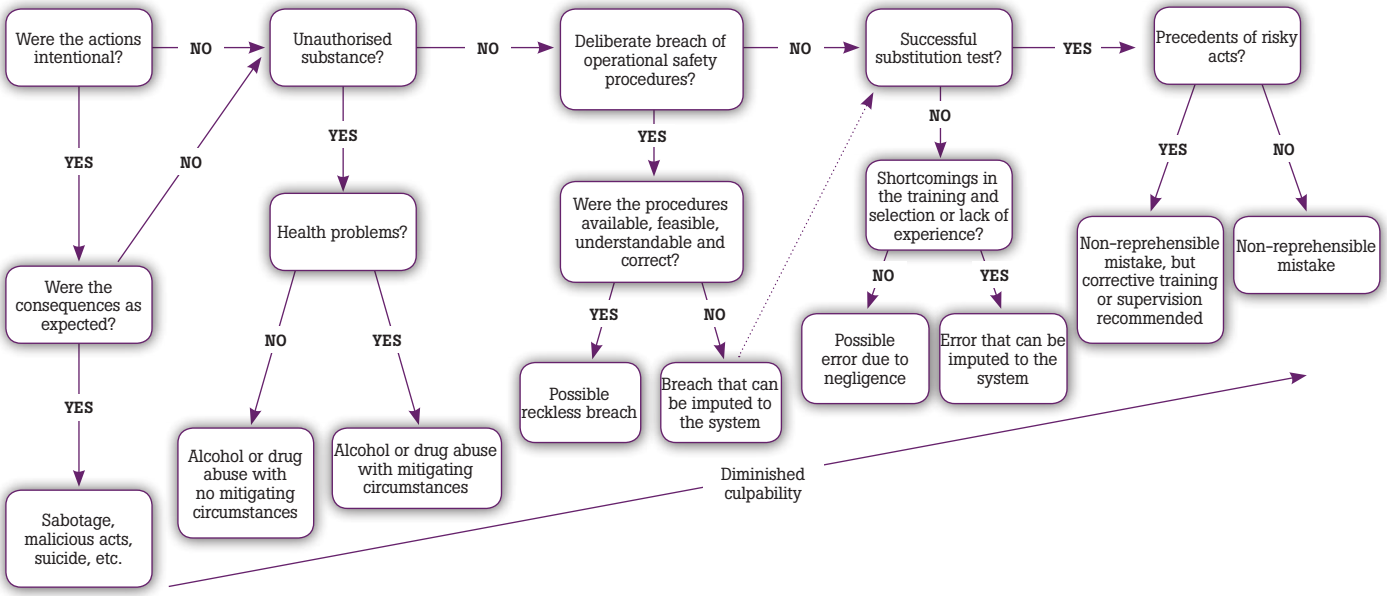

Figure 3. Taken from Reason (1997) *A decision tree for determining the culpability of unsafe acts.* p. 209

Role of the SMS manager

The SMS Manager plays a cross-functional role that is extremely important in terms of communication and staff awareness. He must frequently remind employees of the scope and purpose of the SMS and of the just culture, which is part of the safety policy of the Accountable Executive. The SMS Manager can organise specific information meetings for employees, or give reminders in institutional meetings. He must stay in close contact with the operational managers.

The SMS Manager also assesses the performance of the notification process. Performance can be measured in comparison with the performance in other similar organisations or by using indicators, such as the number of notifications versus the level of activity (traffic, number of operations, etc.).

The success of the notification process depends to a great extent on the energy, commitment and persuasive powers of the SMS Manager. The SMS Manager must not be perceived as a person who simply collects information and fills in spreadsheets!

Compensation of notifying employees

Ultimately, operatives will be prepared to give notice of safety occurrences, if they believe that it is a useful thing to do. When these operatives feel concerned by the improvement of safety, they expect feedback from the SMS on the analysis, on the identified causes and on the corrective actions that have been taken. They could even take part in the assessment of the impact of these corrective measures, a step that would further reinforce their commitment to the processing of safety occurrences.

When high numbers of occurrences occur, it is not always possible to provide individual feedback on every single notification. But the SMS must continue to demonstrate the benefits of notification and of the processing of safety occurrences, for example as part of actions to promote safety, or in feedback meetings with the employees.

In stark contrast to the punitive culture, some companies have opted to promote the SMS by remunerating employees that give notice of occurrences. This compensation is not systematic and is arbitrated by

the committee in charge of occurrence analysis to avoid any excesses or inequalities, by assessing the safety gains achieved through the notification and analysis of a given occurrence.

Another method consists in emphasizing the non-punitive nature of the notification of an occurrence resulting from a mistake made by an employee, but in punishing the mistake if the employee fails to inform the SMS of the occurrence, or does not follow the notification procedure. This method is more efficient and a better incentive that a simple declaration of good intent. But, if sanctions are taken without careful aforethought, its coercive dimension can result in a crisis of confidence that is incompatible with the just culture.

Formalisation

Formalisation is one of the main features of an SMS. It guarantees the traceability of notifications, analyses, identified causes and corrective actions. But it can also form an obstacle to notification by certain agents. However, adapted solutions do exist.

The formalisation is not suited to the circumstances or is too complex

SMS regulations allow operators considerable scope in the definition of the manner in which the organisation is notified of occurrences. And in particular:

- the medium (forms, log book, electronic notification, etc.) may vary, according to the operator's usual practices. Media that existed before the advent of the SMS stand a better chance of being accepted,
- the fields to be completed must be adapted to the type of activity,
- the number of fields can be limited to reduce the employee's workload.

The SMS Manager in a small company revealed that a lot of safety information was retrieved in personal e-mails[4] or "during coffee breaks".

These alternative channels must be maintained to encourage the sharing of information. The occurrence can then later be formalized in the SMS.

*** SAFETY MANAGEMENT SYSTEMS: AN OVER-FORMALISED OR POORLY ADPATED SYSTEM IS PERCEIVED AS JUST ANOTHER ADMINISTRATIVE CHORE**

Employees are not used to writing

This difficulty is often encountered in certain ground handling or maintenance companies. But the feedback from employees who are in the field and involved in operations is often valuable when it comes to improving safety, and the SMS needs to make the most of this information. Training and formal procedures can help to make the most of these skills.

(4) Creating a confidential e-mail address may also be useful.

Other processes have already been formalised (quality, H&S, etc.)

In this case, the SMS can be perceived as yet another administrative chore. If this is the case, the SMS, which requires a voluntary and proactive attitude, will remain ineffective. This trap can be avoided by emphasising the expected benefits of the SMS, which can stretch beyond the realm of air safety to include the prevention of accidents and the protection of persons (H&S) or the protection of the company by improving quality and profitability, etc. Properly adjusted formal procedures can reduce the additional administrative workload significantly, if the SMS is part of an integrated management system (IMS) *(see "Organisational aspects of risk management").*

Notification by subcontractors

In certain fields, the SMS regulations require the notification of safety occurrences by subcontractors to be formally defined in the contract with their customer. But notification must be based on a trusting relationship and free of any punitive measures. This relationship may be hard to establish, due to the contractual context and financial considerations. And there may also be issues of liability.

Example: an aircraft comes into collision with a parking block when it is being pushed back. The internal inquiry reveals that the procedures of the company's subcontractor in charge of pushback operations do not include this type of aircraft. In addition to the question of safety and the improvement of existing procedures, the issue of the subcontractor's liability for the accident is also raised, as is the identification of the insurance company that will cover the repairs.

When the subcontractor has an SMS, it must communicate with the customer's SMS, but this type of relationship is difficult to formally define in a contract. The principle of just culture can be applied to this type of relation, while achieving a fair balance, since it allows a certain tolerance of mistakes that are notified (even if they cost money), but does not exclude the right to apply sanctions in the occurrence of repeated faults or incidents resulting from proven negligence. Even if legal proceedings are sometimes necessary, solutions based on dialogue that allow the responsibilities and the costs incurred to be shared, must always be preferred, in order to protect the trustful relations.

Systematic collection

The spontaneous notification of occurrences is useful in determining the risk of operational failure, but cannot be easily used for statistical purposes. The number of notified occurrences depends on both the number of actual occurrences and the performance of the notification system, which is difficult to quantify.
For these reasons, several operators have opted to use additional tools that systematically detect and record certain occurrences. These tools are based on the automatic detection of, for example:

- air or ground losses of separation (safety net alerts),
- occurrences related to flight operations or the failure of onboard equipment (based on the flight data recorder).

These tools can be used to enter non-notified occurrences in the SMS and to quantify the risks associated with certain occurrences in terms of frequency and severity with greater precision. They also encourage employees to give notice of similar occurrences of which they are aware, since they know that such occurrences will systematically be detected by the automated tools. They can then provide the information required for a more detailed analysis.
But these systems do not replace spontaneous notification, which remains essential, because they are unable to identify occurrences with characteristics that cannot be quantified according to precise criteria.

*** FLIGHT SAFETY – FLIGHT = SAFETY**

**** THE ONLY PEOPLE WHO HAVE NOTHING TO NOTIFY ARE THOSE WHO DO NOTHING AT ALL.**

Sorting of safety occurrences

There are several means of sorting safety occurrences. First, the SMS team needs to distinguish air safety occurrences from occurrences that are part of other processes (quality, safety of persons, the environment) or of no process at all (for example, a personal complaint about another employee that has no impact on the activity).

But for major operators, sorting takes on a quite different dimension. In general, the available resources are insufficient to analyse all the occurrences in detail. Therefore, it is necessary to try and identify occurrences that appear to possess the greatest potential to improve air safety as early as possible.

Identifying safety occurrences

What is a safety occurrence?

The question of identifying safety occurrences may appear trivial to operatives who take part in the flight itself. But it is far less trivial for the employees who support this activity.

Once the occurrence has been notified, it is essential that the SMS be capable of determining whether the occurrence is a safety occurrence or not. A number of criteria can be defined to decide whether the incident should be registered in the SMS or not. But these criteria may differ, depending on the activity in question.

The main criteria used to identify a safety occurrence are:

- damage to the structure of an aircraft, or cases of passenger injury or death (in the occurrence of an accident),
- the structure of an aircraft could have been damaged,
- the crew lost, or could have lost, control of the aircraft,
- the lives of the occupants of an aircraft were endangered or could have been endangered,
- the lives of third parties were endangered or could have been endangered.

The scenarios used to determine the potential consequences of an occurrence must be based on realistic and reasonable hypotheses.

These main criteria may be supplemented by others that help to determine the need for an in-depth analysis of the occurrence, depending on the activity in question. The following examples are not comprehensive, but provide some ideas about the determination of these criteria:

- By way of example, a maintenance workshop will not include all the failures observed on aircraft in its SMS, since solving these failures constitutes its core business. But it may include a serious equipment malfunction that may have jeopardised the safety of a flight[5], or recurrent failures of the same item of equipment, which may be indicative of unsuitable maintenance procedures or an airworthiness problem.
- Training centres must include in-flight problems that are indicative of problems with crew training in their SMS.
- An aerodrome operator's SMS must include any occurrences related to the presence of potential dangers for aircraft (FOD, presence of containers or vehicles in unauthorized places, etc.), even if no aircraft are manoeuvring when the occurrence is observed.

(5) By way of example, a failure impacting the primary flight controls, engines, thrust inverters, propellers or landing gear.

- In the field of air navigation, occurrences such as near-misses between aircraft or between aircraft and an obstacle, or the loss of the CNS/ATM service covered by the SMS. However, certain occurrences can be considered as both quality indicators and precursors of safety problems. By way of example, this is true when capacity is exceeded.

The lists of typical occurrences are useful when it comes to identifying the safety occurrences that are specific to each field of activity. Nevertheless, it is important not to remain restricted to these lists and, above all, to avoid the systematic dismissal of occurrences that are "not part of my activity". By way of example, an incorrect approach may be caused by poor flight management by the crew. But if several cases occur in the same place, they may reveal paths of improvement to be explored in air traffic control methods or problems in the definition of air traffic procedures. Therefore, it will be useful for an air traffic control service provider to include this kind of occurrence in its SMS.

*** SAFETY OCCURRENCE?**

Separating the SMS from the other processes

There are several similarities between a safety management system and the other processes implemented by air operators, such as quality, health and safety or environment[6].
But they are different, inasmuch as simply abiding by the regulatory requirements or meeting the standards is no guarantee of safety. The improvement of safety requires the implementation of the means of adapting, of self-training and of sharing a culture of safety.

While the members of the SMS team (or the members of the IMS team, if there is one) need to understand and master this distinction, it may not be necessary to inform all the employees. Since other employees are not always capable of making the distinction between air safety occurrences and occurrences belonging to other processes, they may be reluctant to notify them. Consequently, the SMS team may prefer to collect all the occurrences indifferently and to then sort them, according to the process to which the occurrences belong.
On the other hand, in certain organisations with a mature SMS or experienced agents, the agents can be trained to identify the safety occurrences and to notify them accordingly.

(6) Note that an occurrence of the type "collision on the ground between an aircraft and a catering vehicle" can be assigned to several processes: quality, occupational safety and flight safety.

High numbers of safety occurrences

When the resources of the organisation are insufficient to analyse all the safety occurrences, it is necessary to determine which occurrences must undergo in-depth investigation[7]. There are several approaches, but they all share the same goal: **to process occurrences having the greatest potential in terms of safety benefits, or in other words, the occurrences that can be used to determine specific actions that will reduce the probability of an accident.**

The risk map

Previous occurrences or other factors affecting the safety of operations can also help to map out the risks, by listing the most important safety issues that require particularly close attention. New occurrences are then investigated in comparison with this map and are analysed to see whether they belong to one of the listed topics. By adopting this approach, it is possible to step back from the occurrence itself and to compare it with the known risks.

By identifying the risk map, it is possible to decide on safety actions that will reduce a given risk in a global manner, rather than on individual actions that will only address the problems raised by a single occurrence.

A number of precautions must be taken when drawing up the risk map:

- The map must "live" and change over time. New occurrences may identify new risks, which must be included in the map.
- The inclusion of too many risks may make the map difficult to use. In this case, priority must be given to the most important safety issues in terms of severity.
- On the other hand, a map that is too simple will not give a true reflection of the risks. But it can represent an initial and proactive approach to risk management for small organisations.

Another problem for small organisations is to have knowledge of outside occurrences, given the low number of occurrences in their own activity.

(7) Note that all safety occurrences must be taken into consideration by the SMS. On the other hand, after the initial investigation, deciding not to analyse an occurrence that does not represent a significant risk is compatible with the existing SMS regulations, provided that the selection criteria have been established beforehand.

Risk definition and assessment

The risk associated with an occurrence is usually defined by a combination of its frequency and its severity. But sometimes, it can be difficult to assess these two parameters:

- since no two occurrences are identical, their frequency is always open to interpretation (e.g. are runway incursions in general the same as runway incursions with an approaching aircraft, or runway incursions from a taxiway, etc.?). Moreover, when these occurrences are not systematically recorded, it is difficult to assess their frequency,
- the severity also depends on the selected feared occurrence (e.g., is the consequence of a runway incursion a collision, or simply a loss of separation?).

So even when working in a team, the assessment of the risk associated with an occurrence can be very subjective and can vary significantly over time. These are the reasons why objective means of assessing frequency and severity have been developed. The "Risk Analysis Tool" (RAT) used by European air navigation service providers is one example. The tool asks the operator a number of questions. The operator replies with figures or simply "yes" or "no". On the basis of these answers, the tool assesses the severity and the probability of further occurrences associated with the risk, and situates the occurrence in a risk matrix. The tool also assesses the levels of malfunction in the ATS.
While the criteria used to determine severity and frequency are open to discussion and can always be improved, this tool is capable of processing every occurrence in an objective and consistent manner.

Some operators prefer to think in terms of failures (of procedures, equipment, etc.) and remaining barriers of defence:

- Which procedures did not work? Was this circumstantial or a case that had not been foreseen?
- Which dangers has this occurrence revealed?
- How many barriers of defence (procedures, equipment) were there between me and the accident?

Finally, other operators have broken their activity down into "safety functions" that must be fulfilled according to certain principles in order to guarantee the safety of operations. By way of example, the "Perform a maintenance action" function may demand that the following safety functions be fulfilled:

- the maintenance technician must read and correctly apply the check list,
- a supervisor must check the quality of the maintenance action, etc.

Each of these principles is associated with a level of confidence, which varies depending on whether the action is taken automatically, by a human operator or by applying a procedure, etc. Depending on this level of confidence, preventive or corrective actions may also be taken. This approach is proactive, since it systematically examines all the principles to check whether they have been properly applied or are exposed to failure. The feedback is important in order to pass on failure modes that have not been foreseen.

Quality of reports

The information in the initial occurrence report (e.g. in an occurrence notification form) reflects the view of the employee who notified the occurrence. All too frequently:

- the occurrence report is incomplete or focuses on certain considerations that are not directly related to the causes of the occurrence,
- the report is biased or contains mistakes, reflecting the subjective point of view of a person faced with an unexpected situation,
- it contains interpretations or analyses that can only be confirmed or invalidated after a full investigation of the occurrence.

Consequently, it is often necessary to collect more information before deciding whether a safety occurrence needs to be analysed or not. This information often consists of:

- further questioning the agent who notified the occurrence or other witnesses involved,
- objective input: radio and radar recordings, flight data, etc.

This phase is not always possible and it must be as simple as possible. The purpose is to assess the actual risk or the potential consequences of an occurrence in order to decide whether it needs to be analysed, and not to start the analysis itself. Even if this phase creates additional work, it helps to optimise the sorting of occurrences. It also helps to improve knowledge of the types of occurrences for statistical purposes.

The SMS team can also take awareness actions in order to improve the quality of the information contained in the initial reports. Since the levels of awareness of risks is not uniform, it may be useful to adapt the information actions or guides to the different personnel categories.

Expert knowledge of personnel tasked with selecting occurrences

The agents tasked with processing occurrences must possess sufficient operational knowledge to be capable of identifying the risks. But since the awareness and knowledge of agents is highly varied and dependent on their experience, it is often preferable to involve several people with a range of different skills (operations, workings of the SMS, etc.). The combination of their experience will help to converge towards an accurate identification of the risks associated with an occurrence.
While team work is always useful, the members of the team must be aware of several possible forms of bias:

- the group dynamics must always allow every member to express their individual assessment of the risk,
- two similar occurrences do not necessarily have the same causes and are not always the result of the same failings (but it is difficult to know this before analysing the occurrence!), ;
- the hypotheses used to analyse the potential consequences of an occurrence must remain reasonable,
- at this stage, the goal consists in selecting the occurrences. Therefore, it is necessary to keep the resources required to analyse them in mind.

While the expert knowledge of the agents remains essential, only a thorough methodology can guarantee that the occurrences are processed consistently, and that the subjectivity in the assessment of the seriousness of an occurrence is kept as low as possible. It is important for organisations that process high numbers of safety occurrences to develop training courses, procedures and guides that allow the agents tasked with sorting to proceed with the utmost thoroughness.

Decision time

A number of decisions may be taken after the sorting phase:

- register the occurrence for statistical purposes, after having identified just a few key characteristics (e.g. type of occurrence, location, electronic data, etc.),
- describe only the circumstances of the occurrence in detail. This may be useful if occurrences of the same type have already been analysed, or if safety actions have already been taken on the same subject. The internal distribution of these circumstances may help to keep up risk awareness inside the company,
- analyse the occurrence in detail in order to reproduce the causes and systemic factors and to decide on corrective actions,
- make changes to the safety model, in other words the organisation's perception of its own strengths and weaknesses.

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* COORDINATION = SAFETY

Internal inquiries and safety occurrence analysis

Internal analyses are the sum total of all the activities designed to learn as much as possible from an occurrence and to prevent similar occurrences from arising, in particular further incidents or accidents. They include the collection of facts and their analysis.

In a safety management system, the primary purpose of internal inquiries is to prevent an occurrence with identical risk factors from recurring. But after a particularly serious occurrence, the internal analysis also plays an essential role in restoring management's and the employees' faith in procedures, equipment and the organisation itself.

"To analyse is to rebuild a story from the facts on the basis of an explanatory causal model. The stories allow us to identify the shortcomings in the explanations and to identify the points where inferences may be necessary" (Cohen et al, 1996).

An analysis is also a complex human process, the fruit of a confrontation between knowledge, experience, hypotheses and facts. An analysis is a difficult exercise, ridden with traps, the first of which is that it seems to be easy and simple[8].

Allocation of resources

An enquiry that results in a detailed analysis is a process requiring substantial resources and that may last several weeks.

Right from the start of the inquiry, it may be useful to identify the necessary resources and, once the enquiry is over, to take stock of the resources that were actually used. This review will enable the SMS Manager to:

- draw up better estimates of the resources required for the following inquiries,
- effectively select the safety occurrences, in order to adapt the number of occurrences to be analysed in detail to the available resources,
- where appropriate, inform the relevant manager of the need to allocate additional resources to occurrence processing, if certain regulatory requirements cannot be met, or if they significantly improve the safety of operations.

Even the suitable use of resources will probably only result in the detailed analysis of a limited number of occurrences. But this strategy is far better than an approach that consists in partially analysing all the occurrences, since this will not allow the right corrective measures to be identified.

Collecting the facts

At the start of the process, the team tasked with analysing the occurrence only has a limited number of facts at its disposal. These facts are usually contained on the notification form, although they may be supplemented by other input that was used to make the selection. But in any case, once the decision has been taken to analyse an occurrence in detail, it is imperative to collect as much data on the occurrence as possible.
This information includes all the recordings (radar, radio communications, flight data, etc.), but much more too. Since the purpose of the analysis is to reconstruct the occurrence as experienced by the agents, their input is essential.

(8) Much of the content in this section is taken from the CARTES manual (Consolidation of the Retrospective Analysis and the Taxonomy of Safety Occurrences) written by the DSNA and the laboratory of applied anthropology at Paris V university. This manual, which is available on the Symposium's web site, presents the analysis process and its difficulties, and offers advice on the best way to conduct interviews in the course of an inquiry.

Their feedback will provide a clear view of:

- the perception and awareness of the situation from the standpoint of those who experienced the event,
- their thinking at the time,
- the actions they took.

If their account of the occurrence can be taken down in writing, then the ideal solution consists in interviewing the people involved.

Collecting the facts is often an iterative process. After a first round of data collection, the questions raised in the analysis phase may lead to the collection of more information.

The analysis

The goals of the analysis

The analysis is the heart of the inquiry. The purpose of the analysis is to reconstruct the **circumstances** of a safety occurrence and to determine its **causes** and **contributing factors.** The accurate identification of the causes is essential in order to decide on the risk-reduction measures that will reduce the threat revealed by an occurrence.

Circumstances: facts describing the sequence of events leading to the accident or the incident.

Causes: the acts, omissions, events, conditions or any combination thereof that led to the accident or the incident. The establishment of the causes does not necessary involve the identification of fault or administrative, civil or criminal responsibility *(source EU regulation n°996/2010).*

Contributing factors: the acts, omissions, events, conditions or any combination thereof that contributed to the occurrence of the accident or the incident, but without any direct causal link.

The team in charge of the analysis must understand the purpose of their task. It is not a matter of completely reconstructing the occurrence and the motivations of each agent involved, which are determined by their own individual story. The reconstruction of reality is impossible and would involve the consumption of endless resources, for a result that offers limited benefits in terms of safety.

In order to meet the needs of the SMS and for risk management purposes, the analysis must aim to identify the risks associated with a system, the dangers, existing means of protection the level of confidence in them, in an effort to determine realistic and applicable measures to reduce the risk. This is the criterion that determines whether an analysis is useful, and at which point it should be stopped.

Bias in the analysis

The analysis process may appear to be simple, because it is something that we all do everyday. Our understanding of the world and the way it works is based on the collection of facts and our own perception and experience. But we rarely have to completely reconstruct a logical chain of thought. For greater efficiency, we tend to introduce forms of bias that are well suited to most everyday situations.
But this bias can be harmful to the analytical process, since it results in inaccurate reasoning and the incorrect determination of the causes of the occurrence. Therefore, it is necessary to recognise these forms of bias and to avoid the associated pitfalls.

There are several forms of bias:

Shortcuts

Shortcuts explain an occurrence by comparing it with previous situations and information that easily comes to mind. One variant is selective bias, which consists in selecting the collected information in an unrepresentative manner in order to confirm a pre-established explanation of the situation.
These forms of bias may come from experts, whose explanations can contain elements of intuition and refer to known or past situations. In a given organisational context, one can also ignore facts that highlight deep-seated systemic factors, since we consider them to be self-evident.

Example: the following occurrence occurs at an airline. In the course of a go-around, after climbing, the aircraft quickly descends and loses more than 1,000 feet. The analysis by management concludes that the go-around altitude was not properly selected. But the precise analysis of the recorded data reveals a complex phenomena related to the pilot's perception, the ergonomics of the instruments and the coordination of the crew's actions.

Retrospective bias

This mistake consists in considering the facts before an occurrence in the light of our knowledge that the occurrence happened. This leads us to believe that facts are always logical and that the consequences were inevitable, and, therefore, that the failure was foreseeable.

Bias of causal attribution

This bias consists in explaining a phenomenon according to causes that depend on our personal involvement. It results in the attribution of the causes or of the "responsibility" for an occurrence to other people or to other groups of people.

It is difficult to avoid these forms of bias, even if we are aware of them. They can be limited by:
- making the effort to identify bias in others and in oneself,
- adopting the most objective and impartial approach as possible,
- showing caution when collecting the data,
- reconstructing the thought processes of those involved and the meaning of their actions,
- diversifying the accounts and cross-referencing the data,
- making the analysts aware of these forms of bias and correcting statements accordingly,
- conducting joint analyses with people from different backgrounds.

The analysis team

Most operators call on teams rather than individuals to conduct their analyses.
This strategy offers a number of advantages:
- it allows high numbers of facts to be processed and compared,
- it provides the expert input required by the analysis: the general expertise in safety of the SMS team and specialist expert knowledge (pilots, ATOS, maintenance operatives, etc.);

- it reinforces the "company" approach, rather than an approach by domain,
- it limits the interference of the bias described in the preceding paragraph.

Nevertheless, the leader of the analysis must remain aware of the difficulties related to group dynamics:

- The group may be dominated by one or more "wise men". In this case, the other participants will be reluctant to speak out.
- Each member of the group may tend to consider that the responsibility for the work is shared and to refuse to accept ownership of the work. A faulty analysis will be considered as being the responsibility "of the group".

So the leader has to make sure that everyone is able to express themselves, irrespective of their socio-cultural background, their position in the company or each individual's ability to speak out, and must collect everyone's opinion on the results of the analysis.

Analysis methods

Operators use different analysis methods, which are suited to their own needs and the available resources (see insert).

Even if these methods are different from one another in their very conception, they all follow a number of common principles.

Safety occurrences have multiple causes

These methods consider that every occurrence is the result of several causes and contributing factors.

Determination of errors

All the analysis methods look for the causes and contributing factors beyond the errors made by the front-line operatives. It is quite common for one or more human errors to trigger an incident or an accident. But these errors are inherent in all human activity and cannot be considered as the sole causes of an occurrence.

As far as possible, an error must be analysed in order to try and determine the measures that will improve safety. Examples:

- Was the error caused by the improper interpretation of a procedure? The procedure can be improved.
- Was the error caused by ignorance of a procedure? Additional training may be necessary.
- Did it happen because the employee was disturbed when on duty? The working environment may have to be reviewed.

The same mistake can have consequences that differ considerably in terms of their nature and severity, depending on the system and the circumstances in which it is made. Therefore, it is very important to make the distinction between the mistake and the consequences of the mistake.

Example: a mechanic forgets to push back the engine ignition or the probe de-icer C/B. While the mistake is the same – forgetting to set the C/B – the consequences are radically different.

In certain special cases, corrective measures can almost totally prevent certain mistakes from recurring (example: installation of a foolproof device on a connector). But very often, corrective measures can only reduce the number of times the mistake is made or limit its consequences, until the situation is deemed to be acceptable.

When no suitable measures can be found, the analysis process must investigate the system's resistance to the error. A system in which a single mistake is likely to cause an accident is unacceptable. Means of defence must be provided or strengthened.

Determination of systemic factors

The analysis methods will also require the team members to systematically ask questions about factors other than those that are directly apparent in the accounts of the occurrence, and in particular about systemic factors. There are different types of systemic factors:

- the characteristics of the working environment (day, night, noise, lighting, etc.),
- the characteristics of the procedures,
- characteristics related to training,
- characteristics related to the management of the activity (allocation of resources, funding of the activities),
- characteristics related to the performance of the equipment, their user-friendliness and their interface, etc.

The capacity of an organisation to identify systemic risks and take suitable measures to reduce them is the main indicator of the maturity of its safety management system.

Taboos

The cohesion or the smooth operation of a company or an organisation is based on the extent to which its members adhere to common values and principles. While certain principles, like procedures or the company's general policy, are explicitly described in documents, others are not so clear and subconscious. Examples include:

- the personnel's opinion on the company's objectives and the degree to which they are adopted,
- the personnel's perception of their immediate and superior managers, and vice versa,
- labour relations in the company,
- social inequality and socio-cultural differences,
- the way in which investment decisions are taken and the investment options, etc.

Therefore, several groups of people coexist in the same company with a common vision of these principles, on which the group's cohesion is founded. Consequently, questioning these principles, further to the analysis of a safety occurrence, constitutes a "threat" to the cohesion of the group or the organisation. In this case, these risk factors are, more or less consciously, excluded from the investigation of the causes of occurrences and the corresponding corrective actions.

There is no simple method to avoid these difficulties, because the risk of destroying cohesion and trust is very real. In extreme cases, inappropriate communications about an occurrence can result in the total rejection of the analysis, thereby destroying any possibility of improving safety.
The first step always consists in identifying and taking account of any taboos. Action can then be taken to gradually raise the awareness of the risk incurred by the overly strict application of certain principles and the need to make changes to them.

Some existing analysis methods

The Ishikawa diagram is a structured representation of all the causes leading to a situation. It is represented by a herringbone graph. It allows the members of a group to share a precise vision of the possible causes of a situation. According to this representation, causal factors generally fall into one of the 7Ms categories: material, machine, milieu, method, manpower, money, management. This representation can also be produced using the rule of the 5Ms: material, machine, milieu, method, manpower.

The SHELL model was developed for aviation. It depicts the individual in the centre of a system made up of procedures (Software), equipment (Hardware), the milieu (Environment) and other individuals (Liveware). This representation lists the interfaces between the individual and each of these components that can potentially diminish his performance. Like the Ishikawa diagram, this model considers that the individual is rarely the sole cause of an accident.

The CARTES method (Consolidation of the Retrospective Analysis and the Taxonomy of Safety Occurrences), developed by the DSNA, is also based on the use of causal trees. It pays particularly close attention to the information collection phase that precedes the analysis and provides the means of keeping bias under better control.

*IF YOU HAD ASKED ME, I WOULD HAVE TOLD YOU THAT IT WOULDN'T WORK.
** SAFETY: NEVER WORK ON YOUR OWN...

Safety actions

Events are processed in order to improve safety. The analysis of an occurrence must identify the failings of the existing system, the defences that work well and those that can be improved. The chosen safety actions must solve any identified problems.

But selecting these actions is no mean feat. The organisation must guarantee that they are effective, adapted to the problem in question and that they can be implemented. Furthermore, other considerations, such as the safety benefits and the cost (human and financial), also come into play.

Selecting the safety actions

Logically, the safety actions are selected on the basis of the results of the analysis. Thought must be given to every danger and the defences involved in the occurrence, and the following questions need to be asked:

- Can any measures be taken to prevent this occurrence from recurring, or so that it at least occurs less often?
- This defence did not work under the circumstances of the occurrence. Why? Is it useful? Do we need to change our safety model?
- If we cannot improve the existing defence, can we add another one?
- Can the risk be transferred?

*** ONE SPOON FOR THE SMS?**

These discussions are often more creative than the analysis, but they do have a number of points in common:

- it is always preferable to form a group of people from different backgrounds, and in particular from the entities that will potentially be impacted by the safety actions,
- the group must make sure that there is a causal link between the safety action and the problem in hand,
- all the entities involved must voice an opinion on the timeliness of the actions taken, on their expected effectiveness and on the human, operation and financial impacts of the actions.

In general, safety actions will be more readily accepted if they are consistent with the reality in the field, compatible with operational constraints and discussed with the people who will have to take them (a measure which will also demonstrate the benefits of the SMS). Employees must have a clear picture of the link between the action and the safety problem that needs to be solved.

Very often, several actions of differing types are decided on to solve a single safety problem. It may also be opportune to decide on actions at several levels: front-line operatives and management, regional and national entities, etc.

Finally, as part of a more open and proactive approach, it may be useful to consult other organisations that have been faced with similar problems to see which actions they took *(see "Joint risk management").*

The nature of safety actions

Safety actions can be very different in nature:
- feedback to internal operatives,
- exchanges with other companies,
- improvements to equipment,
- training or information campaigns (presentations, web, films, etc.),
- creation or modification of instructions/procedures, improvement of working methods,
- surveys, think tanks, creation of working groups for identified issues, which can result in the development of more general action plans, etc.

Every safety action must be accompanied by:
- a clear description of the action that unambiguously determines the moment at which the action stops,
- an expected deadline,
- a person or entity that owns the action,
- the means of measuring the effectiveness of the action taken,
- and, for future reference, the safety problem that the action is supposed to solve.

The priority of safety actions

In addition to being a human tragedy, aircraft crashes have a huge media and economic impact on the operators, which can even put them out of business. This is why we often hear that "safety is priceless" in justification of the investments needed to improve safety, which are often less costly than an aircraft crash.

But these considerations that make safety a top priority must not conceal the fact that air operators work on a restricted and competitive market and that the human, material and financial means at their disposal are always limited. Furthermore, a certain antagonism may develop between the company shareholders, who want to cut costs and increase productivity, and the operatives in the field, who demand the resources and an environment that allow them to work in safety. So the selection of safety actions must be an acceptable compromise between the priority given to safety and the economic reality of the company.

All safety actions always come at a given cost in terms of human resources. And since these resources are limited, they must be determined rationally. This issue is especially critical for the major operators, who are usually faced with high numbers of safety occurrences. They are faced with the problem of prioritising the numerous possible safety actions. Some operators prioritise their actions according to criteria of scale and complexity. But it is never easy to assess the potential safety gains of a safety action. If the identified safety issue is likely to result in an accident, then corrective actions must obviously be taken quickly. But when the safety gains are more difficult to quantify and the planned action is costly in terms of resources, the selection of actions is often more arbitrary. In this case, it is important for the operator to clearly state its safety policy, by indicating the safety issues that take top priority. This strategy, and the associated priorities, can change over time. Moreover, certain safety actions cost a lot of money (the cost of a feasibility study, research and development, the acquisition of new equipment, the construction of new infrastructures, etc.). Similarly, the expected safety gains must be compared with the costs incurred[9] and the selection of safety actions must remain coherent with the operator's investment plans.

(9) This task is far from easy, since safety gains are difficult to quantify. Whenever possible, it may be useful to compare the risk (probability) and to calculate the cost of the consequences of the worst-case scenarios with and without the safety action.

Measuring the impact of safety actions

Even if the safety action is carefully prepared well in advance, only measurements taken after its implementation can make sure that:

- it is effectively applied by the operatives or the entities concerned,
- it is adapted to the safety problem that it is supposed to solve,
- it effectively reduces the risk levels.

It is also important to make sure that the action does not give rise to other risks that were not initially identified, both for others and for oneself.

Example: the operator of an aircraft exposed to the risk of tail contact runs an awareness and surveillance campaign by analysing the aircraft's attitude on landing. This action appears to be effective until an occasion when one of its aircraft lands on a contaminated runway and is unable to stop before the end of the runway. At this point, it emerges that the recommended rounding-up technique resulted in a long landing, a fact that contributed to the runway excursion.

For all these reasons, and as soon as the action is taken, it is important to plan the operations to check the impact of the action, by deciding on:

- the date of the check, which will determine the initial period during which the action will be taken,
- the person in charge of the checks,
- the method to be used.

Measuring the effectiveness may involve a number of actions that are all designed to achieve the same goal.

*** CHECK THAT YOUR SAFETY ACTIONS ARE SUITABLE.**

➔ Monitoring new safety occurrences is the primary verification method. If the number of similar occurrences does not drop, then the action is probably ineffective.

➔ If the risk can be easily quantified and easily assessed on the basis of recordings (e.g., the number of runway incursions or reverse TCAS corrections), then the use of indicators may be a good solution. The time between when the action is taken and the verification must be long enough (usually several months) for the indicator to be meaningful.

➔ In other cases, feedback on the implementation of the actions may be preferred. The information collected, in particular from front-line operatives, must be used to check:

- that the training and awareness actions were effective,
- that the employees are aware of the changes to the procedures,
- that these procedures are applicable,
- that a new equipment is actually used (simple problems of ease of use can result in rejection),
- the positive or negative impact that the action may have had on operational activity,
- that the action has not produced any new and unexpected problems (in this case, the action is usually rejected by the employees and is never actually taken),
- that the employees have understood the purpose of the safety action and the associated safety problem.

It is often necessary to make changes to an action, or to take another action, after analysing the feedback.

Example: an airport operator replaces a runway deicing vehicle because its chassis is corroded. During the winter, the operator realises that the products are less effective than previously. During the analysis of the occurrences, it emerges that the chassis of the new vehicle is higher than that of the older vehicle, resulting in the excessive dispersion of the product. The selected safety action consists in reducing the speed of the new vehicle, so that the distribution of the product is improved.
In the course of the following winter, despite working at a lower speed, the performance of the de-icing product drops again! Further investigations reveal that, this time, the problem is due to the granularity of the runway surface, which traps the snow and humidity. The runway was resurfaced in the summer, and the granularity of the surface increased significantly. New actions are now necessary to effectively de-ice the runway…Despite these unforeseeable problems, the repeated action of the operator's SMS allowed not to stop after the first operation did not come to an end with the first safety action, by checking its effectiveness several times.

The efficiency of safety actions

Since most safety actions involve human error, actions are often taken or recommended to raise the operatives' awareness of a given safety issue. Awareness actions are often used when no other satisfactory safety actions can be identified, for example:

- because the problem is complex and occurs in a variable manner, and it is not possible to define a simple procedure,
- because the cost of the equipment that would solve the problem is deemed to be too high for the activity in question,
- because, for media-related or political reasons, it is essential to provide a solution to a given problem, etc.

But awareness actions have their limits:

- To be really effective, awareness actions require a lot of resources. They take the form of a multitude of actions: meetings, feedback, technical bulletins, training, discussions with the employees, etc.
- The employee must be aware of the action. What is the point of just another technical bulletin, when the employee already receives dozens of documents? Do they see the poster, even if it is perfectly "visible"? Is the employee's culture compatible with the campaign's methods?
- Any single person can only be made aware of a limited number of problems. Each new awareness campaign diminishes the effect of the preceding ones.

Example: A manufacturer sends a service letter to the technical and operational departments of its operators. It describes a malfunction of the secondary system to prevent the beta range from being selected in flight. The manufacturer proposes to send a service bulletin to solve the technical problem and gives warning of the operational consequences, pending the application of the technical solution, but without emphasising the impact of this phenomenon on safety. Several years later, an accident happens involving the scenario described by the manufacturer in its technical memo. The inquiry reveals that, even if the information reached the right people, it was not interpreted or distributed by the operator in order to underline the risks of an accident related to this technical problem. This example highlights the importance of sending the right information to the right person at the right time in safety management.

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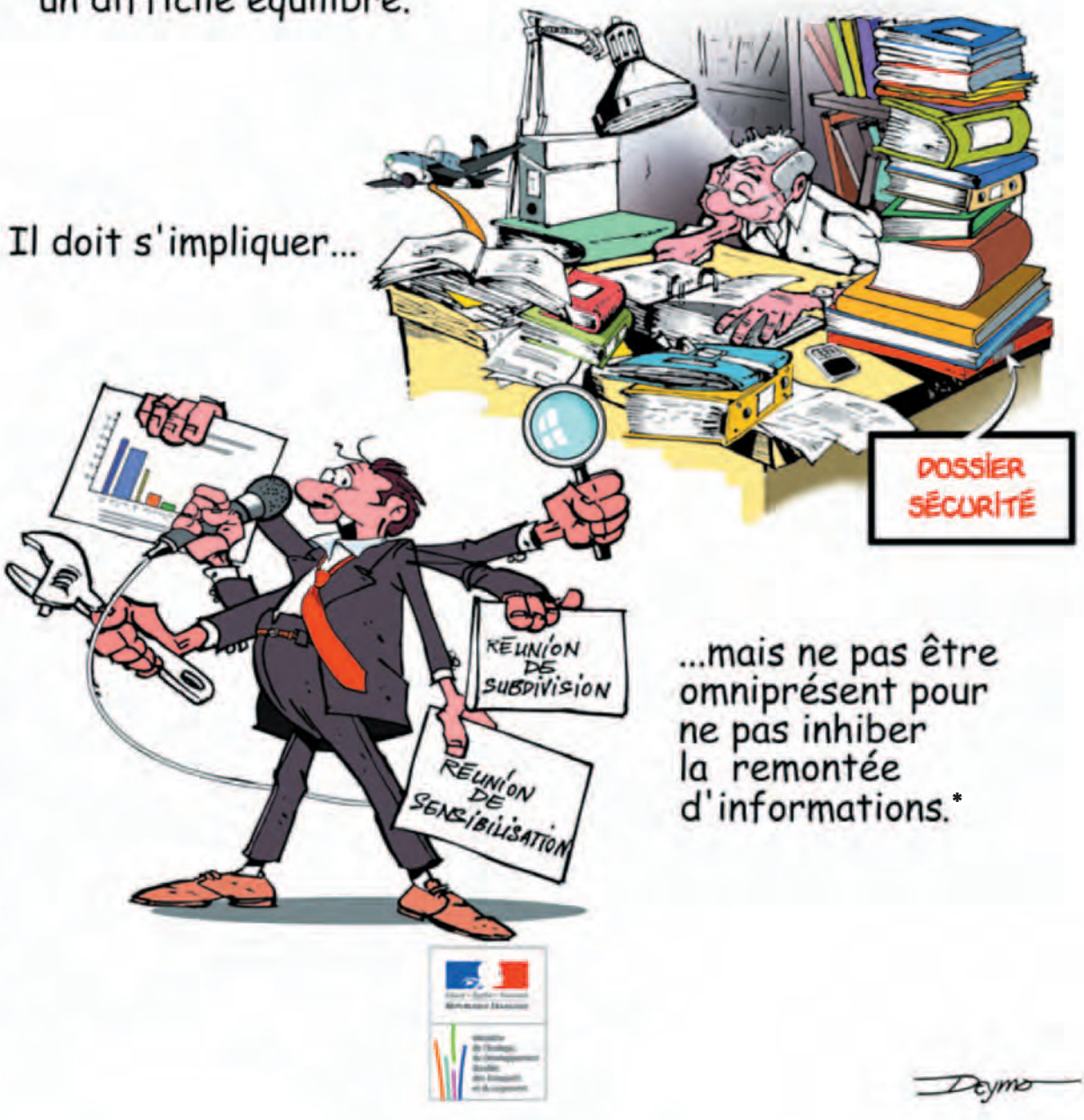

...mais ne pas être omniprésent pour ne pas inhiber la remontée d'informations.*

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*ACCOUNTABLE EXECUTIVE: A KEY ROLE FOR SAFETY AND A DIFFICULT BALANCE TO STRIKE.
THEY MUST BE INVOLVED...
... BUT MUST NOT BE INVOLVED IN EVERYTHING, OR THEY WILL IMPEDE THE ESCALATION OF INFORMATION.

Organisational aspects of risk management

Risk management involves much more than just the internal processing of safety occurrences. This process, often qualified as "reactive", must be supplemented by "proactive" initiatives as part of the safety management system: establishment of a safety culture in the company, safety analyses for change management, internal and external exchanges on aspects of safety, etc.
But these ambitious safety targets exist alongside the operator's other demands: efficiency and results, quality and customer satisfaction, protection of the personnel and the environment, etc. Aviation companies have to show some creativity if their SMS is not to be perceived, in particular by the operatives, as "just another administrative chore", but as an initiative that naturally forms an integral part of the company's activities.

Integrated management systems (IMS)

Companies that have to implement an SMS often have, at the very least, a quality process and a health and safety commission. This is why most of them decide to implement an integrated management system (IMS) that manages and coordinates all the demands applicable in different domains. IMSs can cut administrative workload and share procedures and resources, a fact that offers a number of advantages, in particular in the organisation of the notification process or internal audits. They also facilitate exchanges between the domains, which feed one another with information. By way of example:

- the quality system can assess the workings of the SMS according to quality criteria,
- the SMS can identify dangerous or inapplicable standards and procedures, and allow them to be changed,
- as mentioned earlier, the protection of the personnel may also be one of the concerns of aeronautical safety.

But the SMS stands out from the other processes inasmuch as simply respecting the formal demands that apply to the system[10] is far from being enough to guarantee that it operates properly. The real effectiveness of an SMS is measured in terms of the employees' awareness of its purpose and objectives, and of its real capacity to bring about changes, sometimes deep-seated, in the company's procedures and operations. An aircraft accident often calls into questions the strategy, the organisation and the modus operandi of the company involved. An efficient SMS must be capable of bringing about such changes, for safety's sake, before the accident happens.

(10) Safety policy signed by the Accountable Executive, formalisation of feedback, nomination of an SMS manager who does not occupy an operational position, etc.

Role of the Accountable Executive

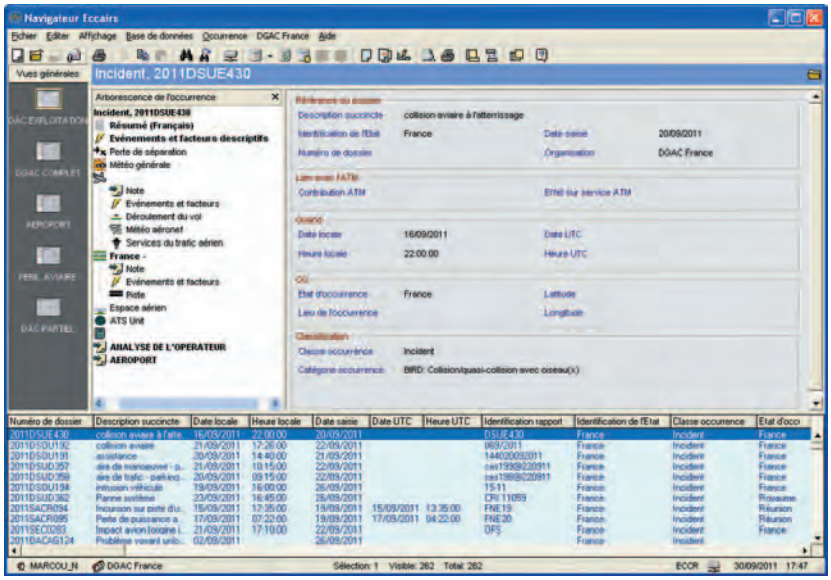
The Accountable Executive defines the company's safety policy. But, beyond this duty, Accountable Executives promote a culture of safety in the organisation through their commitment to and their interest in the improvement of safety. Frequently, The Accountable Executive does not have the time to promote the safety-oriented culture himself. In this case, their main role consists in making sure that the SMS and the operational entities are well coordinated and that all the identified safety issues are taken into consideration in routine operations.
Accountable Executives were also in charge of strategy, and in particular of preparing and defending requests for budgets and investments. They must take all the actions resulting from the choices that are made. By listening to the SMS manager and taking the right decisions to improve safety, the Accountable Executive proves to the personnel that the improvement of safety is at the heart of the company's concerns. The SMS is one of the Accountable Executive's management tools, which helps them to take decisions based on the identification of risks.

But the involvement of the Accountable Executive, and of management in general, in safety initiatives must remain measured. The presence of supervisors can have an inhibiting effect on other company employees. Therefore, they should not take part in all the safety meetings and the staff interviews conducted when collecting facts, so that employees feel free to express themselves.

Risk management tools

Operators can use a number of methodological or computerised tools to manage risks at every point of the occurrence processing chain. Operators tend to spontaneously opt for tools that are best suited to the type and the complexity of their operations, and there is little point in defining any general best practices that can be applied to the choice of tools. A number of questions may be asked before taking a decision:

- Will the tool be used by a small group or by a lot of people? If the tool will be used by a lot of people, then the training effort will be significant and the complexity of the interface must be suitable.
- Do the size and the complexity of the operations require a lot of data to be input for the SMS to operate in a nominal manner? If the answer is yes, then the operator will prefer professional, off-the-shelf tools to extract and process high volumes of data. If the answer is no, a simple spreadsheet may suffice.
- If a communication tool is required, what are the expected characteristics in terms of accessibility of information, ease of use and possible upgrades? What are the characteristics of the population to which the information will be sent: numbers, location and spread, socio-cultural background, etc.?



Risk management support tools differ significantly in nature:

- Occurrence notification: paper documents are increasingly being replaced by electronic notification forms.
- Occurrences collection: from spreadsheets to professional databases, such as Eccairs[11].
- Occurrences analysis support: CARTES, the 5M method, etc.
- Risk analysis support: the RAT risk assessment tool. Certain tools already contain significant quality features and can be adapted to the IMS (AQD, Q-Pulse). Other tools are capable of more refined management of the organisation's risks, dangers and defences (SafetyDesk).
- Measurement of the maturity of the SMS: Eurocontrol has developed the "SMS maturity survey" questionnaire.
- Indicators (see insert).
- Communication tools: safety information bulletins for employees, guides to best practices, multimedia material, safety meetings, internet or extranet sites for the feedback and safety information, etc. These same tools can be used by third parties and subcontractors.

The indicators set up further to an occurrence for which a safety action has been chosen can aim to check:

1. that the action is effectively taken,

2. the impact of the action on safety.

By way of example, repeated reports of FOD (Foreign Object Debris) on the taxiways may result in additional inspections. The aerodrome operator may then decide to keep track of the number of inspections of the taxiways in order to make sure that the extra inspections are really carried out. The operator may also decide to keep track of the amount of FOD found on the taxiways during and between inspections, in order to judge whether the action has been effective.

(11) ECCAIRS is a database used to keep detailed records of information on the circumstances, causes and contributing factors of air accidents or incidents, and to process this information using queries. Developed by the Joint Research Centre (JRC), ECCAIRS is used by most civil aviation authorities and European accident investigation offices, and by several major operators.

* I MAY NOT BE AN EXPERT IN PLANES BUT I'D BETTER TALK TO SOMEBODY ABOUT THIS...
** SAFETY: IT'S EVERYONE'S BUSINESS.

Cross-functional risk management

Local risk management through the processing of occurrences is essential, but has a number of limits that must be made known to the SMS entities:

- *local occurrences may not reveal all of the risks related to the operations. This is the case when only few occurrences occur,*
- *the ignorance of certain risks may also lead to the failure to recognise the safety occurrences that reveal the existence of these risks,*
- *it may be particularly difficult to see the consequences of one's own actions on the safety of others, whose activity is little known.*

These are the reasons why risk management must be cross-functional and include the collection of safety information outside the strict scope of operations of a given operator.

Local cross-functional risk management

SMS regulations require the organisation of exchanges with third parties working with the operator on questions of safety (for example, in the form of safety committees). These exchanges allow all the operators to understand how their actions can impact the operational safety of other entities, and to take joint action to reduce a given risk.

One of the first types of exchange is the transmission of a given safety occurrence to all the entities concerned by the said occurrence. The organisation that was informed of the occurrence in its SMS should be the one that transmits the occurrence, whether it is concerned by the occurrence or not.

Example: the protocols between the SMSs of aerodrome operators and the SMSs of air navigation service providers (DSNA, AFIS) formalise these exchanges on a given platform.

For subcontractors, in addition to the initial notification *(see "Notification by subcontractors")*, it is important that the customer that owns the SMS makes the subcontractors aware of the safety aspects of its activity, in particular by providing feedback on the occurrences concerning the subcontractors.

Local Runway Safety Teams (LRST) are set up on larger aerodromes, bringing together the aerodrome operator, the ATC services and the airlines that use the aerodrome. These committees investigate and solve safety questions related to the runways, such as runway incursions, inspections of the runway surface, neighbouring obstacles, beacons, etc.

These safety questions can also be included in the meetings with users of small general aviation aerodromes that do not usually have an SMS.

While it may be easy to involve local safety players in these committees (the aerodrome operator, AFIS, local ATC services, etc.), airlines that are not based on the aerodromes usually cannot take part in all the committees on all the platforms. Several airlines are looking into the possibility of grouping together so that they can take part in all the committees and exchange information.

Safety: looking beyond the occurrence

In addition to the processing of safety occurrences, SMS regulations also demand another tool that is essential to risk management: change management. This proactive initiative aims to identify the risks associated with a given change (e.g. works on a runway or changes to ground routing, be they temporary or otherwise) and to take compensatory measures that keep them at an acceptable level.

Safety studies and the associated measures must involve all of the third parties that may be impacted by the change, to guarantee that:

- all the risks have been properly identified,
- all the operators accept the chosen actions,
- and, at the very least, all the operators are informed of the measures taken.

Other initiatives, in addition to occurrence analysis (statistical studies, surveys, general safety problems notified by the industry), can also be taken to propose risk-reduction measures.

Nationwide and international cross-functional risk management

Exchanges between operators

Several structures have already been set up so that similar operators can discuss the main safety questions. A number of examples already exist in France:

- the Alfa ACI, is a group of French airports that has set up a joint SMS audit system between aerodromes and AFIS service providers,
- the Centre West cooperation brings together the airports in Bergerac, Poitiers, Limoges, Brive and Angoulême,
- methods and tools are shared within the Air France group.

Cross-functional risk management can also take the shape of exchanges between operators on safety occurrences. But this process faces a number of difficulties:

- the occurrence may reflect badly on the safety of a given operation in a competitive environment[12], whereas reporting the occurrence actually demonstrates the operator's ambition to improve its safety and that of its peers,
- if the occurrence is not analysed, or only partially analysed, simply being informed of the notification is not enough to understand the risks associated with the occurrence.
- some databases are very large and it is quite difficult to correctly identify the occurrences associated with a given risk, especially since the coding is rarely performed in a consistent way.

For all these reasons, rather than relying on occurrence databases, many operators prefer sourcing their safety information from occurrences that have been comprehensively analysed, preferably with an indication of the risk-reduction measures. These sources include:

- reports by the French Accident Investigation Board (BEA) or other organisations that investigate serious accidents or incidents,
- safety bulletin type documents published by other operators or safety information sites, such as Skybrary.aero.

(12) It is difficult to respect anonymity when the safety problems are associated with an individual infrastructure, such as an aerodrome.

Several international groups (Eurocontrol, CANSO, FABEC, ICAO, etc.) address these questions and share feedback and best practices, or conduct joint research and discussions of identified safety problems. Eurocontrol's action plans are an important source of safety information, such as the EAPPRI plan to prevent runway incursions, or the EAPAIRR plan against airspace infringements, etc.

The French State safety programme

ICAO standards require the States to implement a process, called the State Safety Programme, that covers all of the authority's activities related to air safety. In this process, the States strive to reach their own strategic objective in terms of air safety by optimising the activities within their scope, and in particular by allocating the available human and financial resources to those actions thought to be the most useful in the reduction of risks.
The State Safety Programme can act on three levers to achieve its objectives: regulation, oversight and the promotion of safety. It can also call on processes for the continuous improvement of safety inside the administration and on the safety management systems of the civil aviation operators, which interact with one another.

Occurrence notifications and the transfer of significant occurrence analyses that are sent to the DSAC allow it to identify the risks incurred by air activity in France and to inform the operators, either as part of oversight operations (while making sure that suitable measures are taken to reduce risks), or as part of efforts to promote safety (publication of safety or information bulletins, advice given to operators and feedback received from them).

Many operators feel that the DGAC's ECCAIRS database is the most comprehensive database of occurrences on French territory. But it is not directly accessible, because the anonymity of the notifying organisations cannot be guaranteed.
The preparations for the Symposium highlighted a number of requests that operators want to address to the DGAC:

- better feedback on safety occurrences that are notified,
- the construction of a platform for exchanges on safety information.

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