Roadmap for the Development of the Safety Key Performance Indicators in ATM

2ND SAFREP TF Report
to the Provisional Council

EUROCONTROL

Executive Summary

Background

This report contains a safety roadmap for the development of high-level safety Key Performance Indicators (KPIs). It has been developed by the Director General's 2nd Safety Data Reporting and Data Flow Task Force (SAFREP TF) at the request of the Provisional Council.

The roadmap aims to develop and validate a limited set of high-level safety indicators to measure the global safety performance of the European ATM system and to monitor compliance with EUROCONTROL's strategic safety objectives, encompassing the outcome of SESAR.

Stakeholders' Requirements

A good safety performance measurement system provides managers and policy makers with good-quality information to enable decision making for the purposes of safety improvement. SAFREP TF recognises the importance of the focus on safety improvement being the sole objective of safety KPIs in the principles they have adopted for the development of safety KPIs.

Whilst maintaining a safe system through safety improvement activities is paramount, the information needs of interested parties may differ, for example the information needs of public/society are different from those of regulators and of service providers. Therefore, the requirements for safety KPIs at different levels will include the need for transparency (public/society) and the need for meaningful data comparison (decision makers).

The clarification of roles and responsibilities in the collection analysis and reporting of safety performance information is a key principle adopted by SAFREP. In support of the SAFREP TF key principles for practical interfaces, realistic, user friendly and compatible data flows at each of the different levels need to be established. Duplication of requirements or contradictory definitions must be avoided.

The introduction of a European safety KPI system must not result in focus being placed on optimising the KPI values to the detriment of other contributors to safety improvement being overlooked (managing indicators not safety).

Sound safety management principles require safety metrics to measure and monitor safety performance. Therefore, the metrics must be developed such that they are able to measure true improvement in order to identify the need for action in critical areas.

Types of ATM Safety KPIs

The proposed approach in this report is based on existing initiatives, such as the Safety Framework Maturity Survey, ESIMS audits, ESARR 2, EC Directives 42/2003/EC, 56/1994/EC, CESC Policy on voluntary exchange of safety information and MoUs between various stakeholders. Two main categories of high-level KPIs, based on existing regulations, are used. These are:

- **Lagging indicators** – measure events (e.g. safety occurrences, such as accidents, incidents, system outages etc.) that have happened. They also measure whether safety improvement activities have been effective in mitigating identified risk. **Lagging indicators** measure the outcome of the service delivery.

- **Leading indicators** – are identified principally through the comprehensive analysis of the organisations (providers, regulators, States). They are designed to help identify whether the providers and regulators are taking actions or have processes that are effective in lowering the risk.

The overall roadmap complies with the requirements expressed by a number of stakeholders and it is also in line with the requirements of the draft Performance Review Implementing Rule, in its current draft form. The result of this work is expected to be completed by end-2009.

Robustness of Data Sources

SAFREP TF strongly believes that any system of safety indicators, detailed or high-level, **leading** or **lagging** is only as good as the quality of the source data on which it is based. The data collection formats and data flow standards must be carefully defined, so that consistent, repetitive and harmonised data collection and transmission remains available for all parties concerned. SAFREP TF intends to define, within the framework established in this roadmap, the data collection formats and flows for all safety indicators in accordance with the SAFREP TF safety KPI principles for development.

Examples of areas that need to be improved are:

- The slow improvements in the quality of data (to populate various indicators) returned to EUROCONTROL indicate that it will be many more years before adequate and robust results can be used reliably as a basis for safety performance measurement or policy making at European level;

- The non-availability of exposure data (e.g. flight hours per phase of flight, per type of operations) creates difficulties in normalising the indicators for meaningful tracking over the years;

- The limited implementation of a common taxonomy and the different approaches in severity and risk assessment can distort the ATM safety performance picture;

- ATM stakeholders have a severe lack of adequate qualified resources available to report and investigate safety occurrences, and to populate the national Annual Summary Templates. Resources are also missing to cover, in general, both safety management and safety regulatory oversight processes.

Roadmap Approach to the Development of KPIs

SAFREP proposes a roadmap for the development and implementation of the high-level Safety KPIs to fit within the timescale foreseen by the Final Report for the Draft Implementing Rule on Performance Review (part of the SES Regulations).

It is acknowledged that some Key Performance Areas (KPAs) might not be mature enough for immediate performance measurement due to a lack of robust and commonly agreed KPIs. For **Safety** a progressive approach is proposed. Initially, development of safety metrics will concentrate on the higher level indicators. However, there is strong commitment to build a model of lower-level indicators. A set of safety management metrics will be developed to complement the safety KPIs.

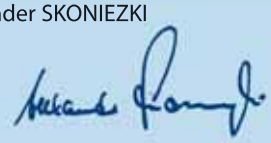
During the development phase, the various breakdown levels of KPIs will be considered, in line with the need to present the results at different levels: European, State, Regulator, ANSP. The level of transparency of these results will be carefully balanced between the protection of sources and the obligation to comply with EU regulations.

The development will focus on both **leading** and **lagging indicators**. The **leading indicators** are considered the "drivers" of **lagging indicators**. There is an assumed relationship between the two that suggests that improved performance in a **leading indicator** will drive better performance in the **lagging indicator**.

Continuous consultation will be carried out with all stakeholders aiming at building a high level of consensus, to ensure a maximum level of agreement and action plan acceptance from all parties, in accordance with the SAFREP TF safety KPI principles for building industry consensus and trust.

Document Approval

The following table identifies the management authorities who approved the initial issue of this document.

Authority	Name and Signature	Date
SRC Chairman and Co-Chair of the SAFREP Task Force	Ron Elder 	04/10/2007
Deputy Director ATM Programmes, Safety Team Chairman & Co-Chair of the SAFREP Task Force	Dr. Erik Merckx 	04/10/2007
ESP Implementation Coordination Group Co-chair & Head of SRU	Peter Stastny 	04/10/2007
ESP Implementation Coordination Group Co-Chair & Head of DAP/SSH	Alexander SKONIEZKI 	04/10/2007
ESP Programme Manager and Secretary of the SAFREP Task Force	Antonio LICU 	04/10/2007

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CHAPTER 1 - Introduction

1.1 Background

1.1.1 The 17th Session of the Provisional Council (PC17, July 2003) agreed that "current safety indicators, established through the EUROCONTROL Safety Measurement and Improvement Programme, adequately meet the safety needs for reactive monitoring and improvement of ATM safety". However, these indicators "require aggregation in order to form an overall picture of ATM safety performance, and that, accordingly, use of high level safety indicators should be investigated as a means to present ATM safety performance in a more overall way".

1.1.2 The Safety Regulation Commission (SRC) briefed PC20 (July 2004) on Safety Key Performance Indicators (KPI). PC20 recommended that combined SRC, PRC and Agency work should pave the way forward for the EUROCONTROL Organisation in establishing a set of safety KPIs for ATM.

1.1.3 Populating a composite index or a limited set of safety KPIs with reliable, consistent and high-quality data is key to monitoring the European ATM system's safety performance, compliance with EUROCONTROL's strategic safety objectives and its contribution to aviation safety overall.

1.2 SAFREP Task Force

1.2.1 The EUROCONTROL Director General established a Safety Data Reporting and Data Flow Task Force (SAFREP) in 2005 to address the priority areas of safety data reporting, legal, managerial and organisational constraints, and safety data flows for European ATM. PC22 (April 2005) further asked the SAFREP TF to address the PRR8 safety recommendations, i.e. to study the issues in establishing Safety KPIs.

1.2.2 SAFREP's report to PC24 (November 2005) stated that the lack of fully effective and harmonised reporting and assessment systems at national level will always pose a challenge to any centralised data flow at European level. The solution in progressing safety KPIs includes making best use of, and building on, the current achievements.

1.2.3 In addition, it was and remains SAFREP's perception that, if not adequately done, the introduction of safety KPIs and safety targets may have an impact on current efforts to promote, implement and support "Just Culture".

1.2.4 A major challenge will be to capture the "positive" aspects of the day-to-day activities of ANSPs. The integration of robust KPIs from a combination of the "positive" and "reactive" metrics will lead to meaningful safety measurements and improvements.

1.3 EC Mandate on Performance Measurement

1.3.1 In 2006, EUROCONTROL accepted a mandate from the European Commission (EC) inviting it to develop draft implementing rules for the examination and evaluation of air navigation performance, in relation to Article 11 of the Single European Sky (SES) "Framework regulation" (EC) n° 549/2004.

1.3.2 In particular, the mandate invited EUROCONTROL to:

- *identify the key performance areas as well as the associated key performance indicators;*
- *identify a relevant s et of information to be provided on a mandatory basis which will*

cover existing information as well as any other information required for performance review in the different key performance areas. This information shall cover both historical and forward looking information;

- *identify different parties and actors involved in the process of performance review and define their rights and obligations;*
- *develop measures for the dissemination to interested parties of the relevant information as well as recommendations in terms of performance in order to meet the objectives of Art 11(2) of the SES Framework regulation in an impartial way; and,*
- *develop measures for the monitoring of actions related to performance as well as the dissemination of best practices.*

1.3.3 Article 11(1) of the Framework regulation refers to the examination and evaluation of "air navigation performance". It then follows that the scope covers all air navigation services (including functions as defined in Article 2 of the SES Framework Regulation). Since support functions (in particular national supervisory functions, EUROCONTROL network coordination and support to regulation functions) have an impact on air navigation performance, they are also included in the scope.

1.3.4 Air navigation performance cannot be captured by one simple KPI. Instead, the entire performance framework should always be considered. This "system" approach highlights the crucial importance of having sufficient data to develop and support each KPA in the proposed performance framework.

1.3.5 The mandate required consideration of the Key Performance Areas (KPA) already developed by the PRC and used by the Agency in its network planning processes. "Safety, capacity and delays, cost-effectiveness, flight efficiency, environment, airports, use of airspace" are referred to explicitly in the mandate. See Figure 1 below:

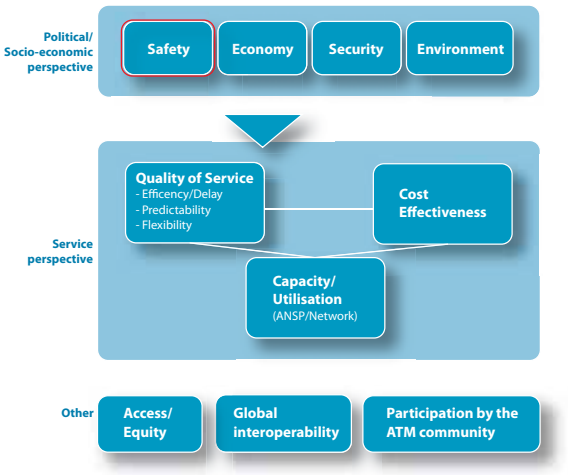


Figure 1 – EC Mandate performance review framework

1.3.6 The regulatory approach proposed and accepted for safety indicators within the EC Performance mandate foresees the need to:

- make use of the existing body of safety Directives (Directive 94/56/EC and 2003/42/EC) and ESARR2 for performance review purposes;
- develop a second package of implementing rules concerning the performance review of ATM safety within three years, based on practical experience with safety KPIs, with due regard to SAFREP conclusions and agreed recommendations;
- assemble information on implementation and maturity of Safety Management Systems in order to identify best practice;
- allow for the provision and analysis of incident reports from airlines for performance review purposes.

1.4 SAFREP TF Safety KPIs principles of development

1.4.1 Without pre-judging any further shape of the safety KPIs and the related action plan, in November 2006 the SAFREP TF adopted the following ten principles, **which they agreed had to be adopted in their entirety:**

(1) ICAO consistency

The Baseline for Safety KPIs development should be in line with ICAO requirements and with the strategic lines given by the Global Aviation Safety Roadmap.

(2) Roles and responsibilities

Roles and responsibilities of various stakeholders need to be clarified in order to define what requires measuring and why.

(3) Safety improvement

The single (sole) objective is to improve safety.

(4) Systemic approach

The technical development ought to be accompanied by an agreement where the results are correlated with what can be achieved legally and institutionally.

(5) Practical interfaces

Practical day-to-day interfaces ought to be included in the development, even only for the simple reason of realistic and user-friendly data flows.

(6) Trust

There is a need for a constant dialogue to build trust. Without trust, no system, irrespective of its technical robustness, will deliver the right output.

(7) Confidentiality

Safety data repository(ies) and their input/processing/output flows are key. It is important to define how they will be managed and how the required level of confidentiality will be ensured and observed.

(8) Consensus

The safety KPI principles need to reach consensus of the ATM industry if not of the aviation-wide stakeholders. Lack of consensus will inevitably lead to endless debates and lack of commitment in an already very sensitive area.

(9) Planning the details

The first step should be the creation of an Action Plan and only then start the development of safety KPIs. The development work should not be limited to the technical details but the system of Safety KPIs should be thoroughly tested and validated before promulgation.

(10) Transparency and progress reporting to decision makers

This report is an interim report to the November 2007 Provisional Council, outlining the roadmap for development and giving initial indications of the expected output.

CHAPTER 2 - Rationale for safety KPIs and safety targets in ATM

2.1 Introduction

2.1.1 A good safety performance measurement system provides managers and policy makers with good quality information to enable decision making for the purposes of safety improvement. SAFREP recognises the importance of the focus on safety improvement being the sole objective of safety KPIs in the principles they have adopted for the development of safety KPIs (see Chapter 1, 1.4).

2.1.2 Whilst maintaining a safe system through safety improvement activities is paramount, the information needs of interested parties may differ; for example the information needs of public/society are different from those of regulators and of service providers. Therefore, the requirements for safety KPIs at different levels will include the need for transparency (public/society) and the need for meaningful data comparison (decision makers).

2.2 Stakeholder Requirements

2.2.1 It is important that the definition and purpose of each high-level safety KPI is documented and clearly communicated to all stakeholders. SAFREP has gathered stakeholder requirements for safety performance. Figure 2 indicates the key principles for KPIs for different stakeholders, while recognising the need to assist stakeholders in obtaining appropriate understanding of safety levels and outcomes.

2.2.2 The clarification of roles and responsibilities in the collection analysis and reporting of safety performance information is a key principle adopted by SAFREP (see Chapter1, 1.4).

2.2.3 In support of the SAFREP key principle for practical interfaces (see Chapter 1, 1.4) realistic, user-friendly and compatible data flows at each of the different levels need to be established. Duplication of requirements or contradictory definitions must be avoided.

2.2.4 The introduction of a European safety KPI system must not result in focus being placed on optimising the KPI values whilst other contributors to safety improvement are overlooked (*managing indicators not safety*).

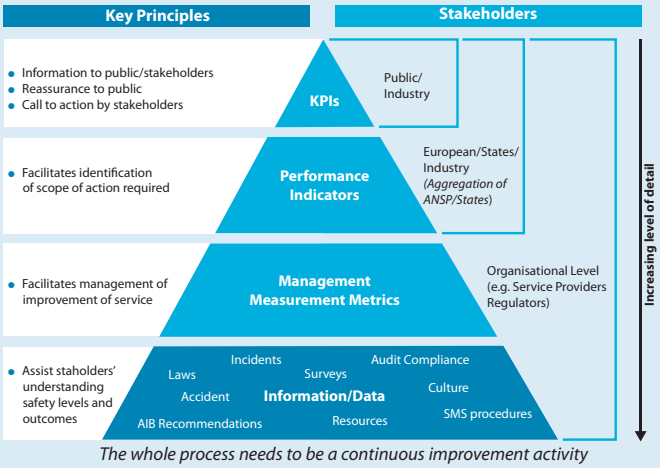


Figure 2 – Key principles on Stakeholders' requirements for safety performance

2.2.5 Sound safety management principles require safety metrics to measure and monitor safety performance. Therefore, the *metrics* must be developed such that they are *able to measure true improvement* in order to identify the need for action in critical areas.

2.3 Safety Regulation Performance Indicators

2.3.1 Review of safety regulation performance is a vital part in the measurement of overall aviation safety performance. The effectiveness of safety oversight provides a good indication of the aviation industry's commitment to safety. While safety oversight is the responsibility of each individual State, any failure to meet the required standards can threaten aviation safety on a global scale.

2.3.2 In November 2002, the Permanent Commission (CN) approved the establishment of the EUROCONTROL Implementation Monitoring and Support (ESIMS) Programme (CN Decision N° 92), which will form the basis for creating KPIs for Safety Regulation. There is a wealth of information available from ESIMS and ICAO USOAPs audits to build up and use regulatory ATM Safety KPIs. A full description of ESIMS Objectives and Scope together with examples of the type of indicators that may be developed at a later stage are to be found in Appendix C of this report.

2.3.3 The first principle adopted by SAFREP for the development of Safety KPIs (see Chapter 1, 1.4) is that of ICAO consistency. It therefore follows that the ATM safety KPIs for regulators that are based on audit findings are grouped according to the eight Safety Critical Elements (CE) identified by ICAO (ref: ICAO Safety Oversight Manual Doc 9734-AN/959). A detailed description of the eight Critical Elements is given in Appendix C.

2.3.4 The ATM elements within current initiatives (e.g. ESIMS, IUSOAP etc.) will be mapped against the eight ICAO critical elements during the development of Safety KPIs to ensure a complete and integrated system for KPIs for ATM Safety Regulation.

2.4 Approach to the Development of Safety Key Performance Indicators

2.4.1 It is acknowledged that some KPAs might not be mature enough for immediate performance measurement due to a lack of robust and commonly agreed KPIs. For Safety, **a progressive approach is proposed**. Initially, development of safety metrics will concentrate on the higher level indicators. However, there is strong commitment to build a model of lower-level indicators.

2.4.2 A set of safety management metrics will be developed to complement the safety KPIs.

2.4.3 Existing regulations will be used. This is in accordance with the regulatory approach proposed and accepted for safety indicators within the EC Performance mandate, to make use of the existing body of safety Directives (Directive 94/56/EC and 2003/42/EC) and ESARR2 for performance review purposes.

2.4.4 Clear reporting requirements together with roles and responsibilities will be defined.

CHAPTER 3 - Safety KPIs in ATM - the current position

3.1 Introduction

3.1.1 Currently, ATM Safety performance is measured at several different levels: at the Europe-wide level; at the State level; and at the level of the individual ANSP.

3.1.2 It is widely acknowledged amongst those who use safety performance data to drive safety improvement, that it is necessary to have a common, reliable and robust approach to the collection and analysis of data in order to derive meaningful conclusions from shared safety data.

3.1.3 Organisations have adopted different approaches to analysing safety data and it is therefore difficult to achieve such a harmonised approach. SAFREP considers that an important step towards harmonising data is the establishment of common principles for measuring the severity and risk of recurrence of incidents.

3.2 Types of Safety Indicators

3.2.1 To ensure that safety levels are maintained or improved, systematic safety monitoring processes should evaluate, as a matter of routine, achieved safety performance in all safety-related operational activities.

3.2.2 Safety performance indicators are used to analyse trends and detect unwanted degradation of safety levels, supporting the development of effective improvement plans. They can also be used to assess the extent to which political, strategic, regulatory and industry safety targets are being met.

3.2.3 In addition to measuring the core safety task, a measurement system that can incorporate error tolerance, reaction and recovery level will be explored.

Note: Some mature organisations are also considering including supporting elements such as: anticipation, incident history and likelihood of reoccurrence.

3.2.4 SAFREP identified two main categories performance indicators for consideration in the development of KPIs:

- **Lagging indicators**, which:
  - measure events that have happened (e.g. safety occurrences, such as accidents, incidents, system outages etc.);
  - measure whether safety improvement activities have been effective in mitigating identified risk;
  - measure the outcome of the service delivery;
  - represent the consequences of actions previously taken;
  - frequently focus on results at the end of a time period and characterise historical performance (e.g. the end of the supply chain i.e. ATM service provision).
- **Leading indicators**, which:
  - are identified principally through the comprehensive analysis of the organisations (providers, regulators, States);
  - are designed to help identify whether the providers and regulators are taking actions or have processes that are effective in lowering the risk;
  - are considered the "drivers" of **lagging indicators**. There is an assumed relationship between the two, which suggests that improved performance in a **leading indicator** will drive better performance in the **lagging indicator**. Improved rules, regulations, oversight, procedures etc will lead hopefully to fewer errors within various layers of organisation and hence to less safety occurrences.

3.3 Example of Lagging Indicators

3.3.1 Decision N° 80 of the EUROCONTROL Permanent Commission has implemented the EUROCONTROL Safety Measurement and Improvement Programme (ESARR2), through which a broad system of **lagging safety indicators** was established.

3.3.2 These currently measure safety in terms of accidents, ATM-related incidents and ATM specific occurrences. These indicators support **detailed analysis of causal factors and related criteria pertaining to each occurrence type**, and are the basis of the SRC Annual Safety Report to the Provisional Council (Ref Appendix A).

3.3.3 However, ESARR 2 application is not uniform across States. Furthermore, the current system is not considered relevant for top-level, policy-making performance measurement.

3.3.4 Therefore, a top-level set of **lagging** KPIs ought to be defined. In this respect, **lagging** KPIs built around aircraft proximities (in the air and on the ground), runway incursions and near CFIT could be an example to be further validated within the SAFREP TF life expectancy.

3.4 Example of Leading Indicators

3.4.1 An absence of safety incidents is not a true measure of the safety of a system. It is important to view safety performance information in the context of the health of the safety management system. Indicators will be developed to measure the output of important elements of the safety management system to clarify that excellent safety performance is attributable to a safe system and not attributable to a lack of reporting of safety incidents.

3.4.2 Currently, the safety framework maturity measurement focuses on the status of the development and implementation of safety management and safety oversight mechanisms within the ECAC region. The details of the development of the scoring system are presented in Appendix B1 to this report. In recognising the importance of such a study, as it would allow a take of the "temperature" of the safety system in the Region, following EANPG 48 meeting (Nov 2006) ICAO approached EUROCONTROL with the request to extend the scope of the survey to cover the whole ICAO EUR Region. EUROCONTROL responded favourably and a programme was agreed together with the ICAO EUR/NAT Office, to include the remaining States in the EUR Region in the 2007 exercise. It is ICAO intent to carry out these measurements annually.

3.4.3 Along with the results from the EUROCONTROL/ICAO audits (i.e. ESIMS/IUSOAP) these measurements are considered a basis for the development of **leading** KPIs.

3.4.4 In the Operational environment, **leading** metrics use information gathered from normal day-to-day operations for the identification of behaviours, activities, processes or procedures that lower risk, e.g. analysis of the ratio of corrected read-backs to undetected wrong read-backs.

3.4.5 It is important to conduct routine monitoring of the safety performance of the system against expectations. This enables actions to be taken to prevent degradations in safety. The conduct of safety surveys as required by ESARR 3 is one means of achieving this. The outcome of the safety surveys should provide recommendations on improvements where needed, and assurance to managers of the safety of activities within their areas. Appendix B1 describes a safety survey approach in more detail.

3.4.6 Further work is needed to increase transparency and understanding of **leading indicators** and the associated methodologies by all stakeholders.

3.5 Safety Targets

3.5.1 Safety targets are derived to meet either political, strategic, regulatory, industry safety objectives or management performance-driven improvements.

3.5.2 A cautious approach in setting targets is recommended. If targets are set too early in the process, or if they are unduly correlated with other performance indicators (such as efficiency or pay), the whole process may be threatened. The starting point for setting targets should be **leading indicators** and subsequently with improved maturity of the system the targets for **lagging indicators** (see Chapter 5 – Robustness of data sources for the development of safety indicators; and Appendix A).

3.5.3 In this context, an initial start has been made using the ECAC Strategy for 2000+, which sets targets for ATM-related accidents and serious incidents. Data now exists that enable measurement against this objective as far as accidents are concerned, but not yet for incidents. SAFREP intends to further develop the maturity KPIs to enable comprehensive measurement for all aspects of the ECAC Strategy.

CHAPTER 4 - Roadmap for the development of high-level Safety KPIs

4.1 SAFREP proposes a roadmap for the development and implementation of the high-level Safety KPIs to fit within the timescale foreseen by the Final Report for the Draft Implementing Rule on Performance Review (part of the SES Regulations).

4.2 The Roadmap includes key milestones for which further developments and buy-in from key stakeholders will be required. Continuous consultation will be carried out with all stakeholders aiming at building a high level of consensus, to ensure a maximum level of agreement and action plan acceptance from all parties in accordance with the SAFREP safety KPI principles for building industry consensus and trust (see Chapter 1, 1.4).

4.3 Figure 3 below describes the planned SAFREP TF key Roadmap milestones of safety indicators and input and output activities for every category.

4.4 In accordance with the SAFREP safety KPI principles for detailed planning (see Chapter 1, 1.4) a schedule has been developed. This is illustrated graphically in Figures 4 and 5 below, and complies with the requirements expressed by a number of stakeholders. It is also in line with the requirements of the draft Performance Review Implementing Rule, in its current draft form.

4.5 The result of this work will be complete by end-2009 at the latest.

4.6 Activities include, but are not limited to:

- development of relevant KPIs for ATM Safety & Regulation;
- definition of data requirements and flows;
- definition of level of access for each group of stakeholders;
- testing and validation of KPIs .

4.7 During the development phase, the various breakdown levels of KPIs (ref Figure 2) will be considered, and the level of transparency of these results will be carefully balanced between the protection of sources and the obligation to comply with EU regulations.

4.8 The activities identified for the Agency to successfully complete the Roadmap are included and budgeted in the on-going SRC/SRU and Agency work programmes.

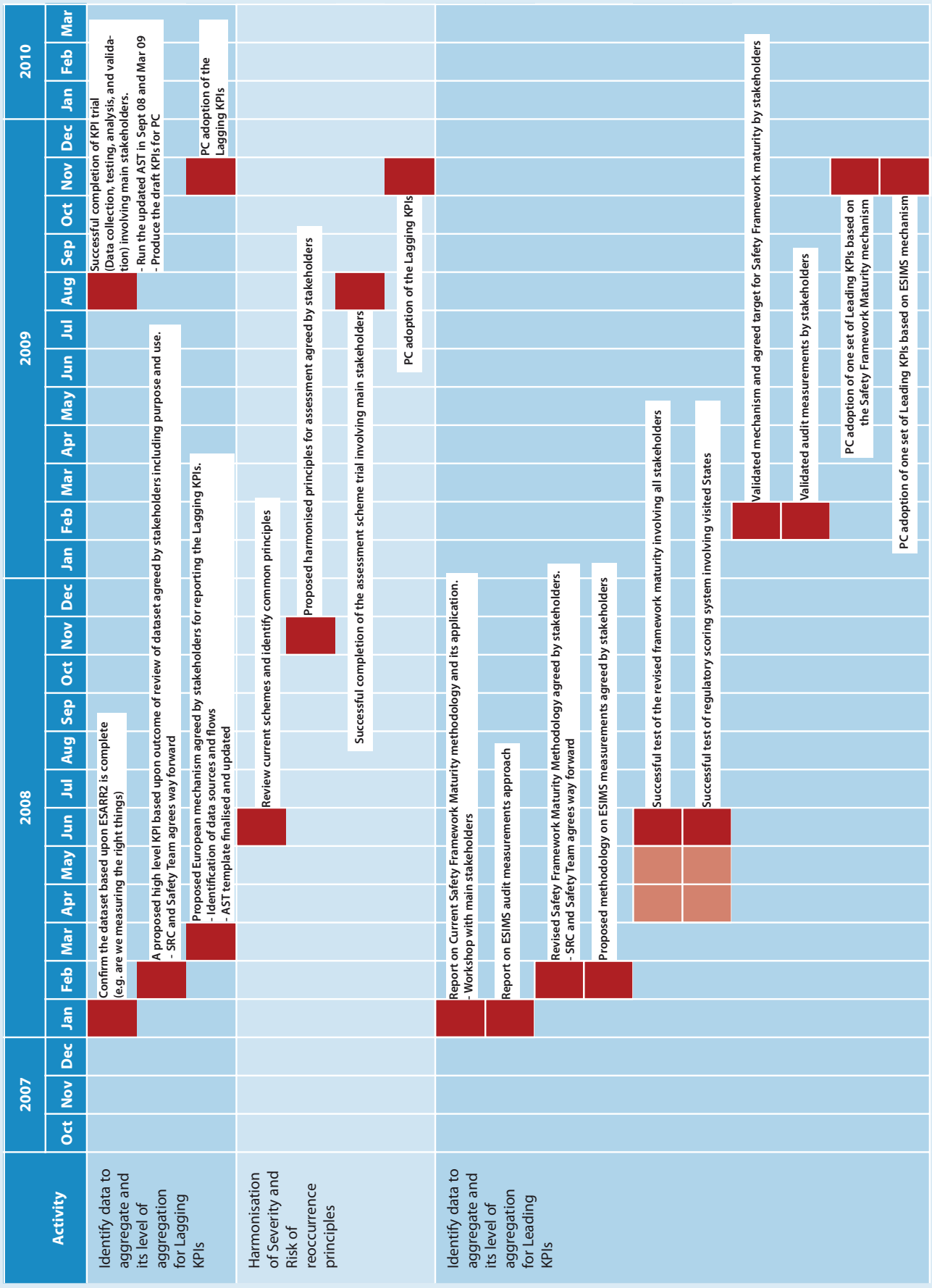


Figure 3 – Major milestones in the Safety KPI Roadmap - Major Milestones

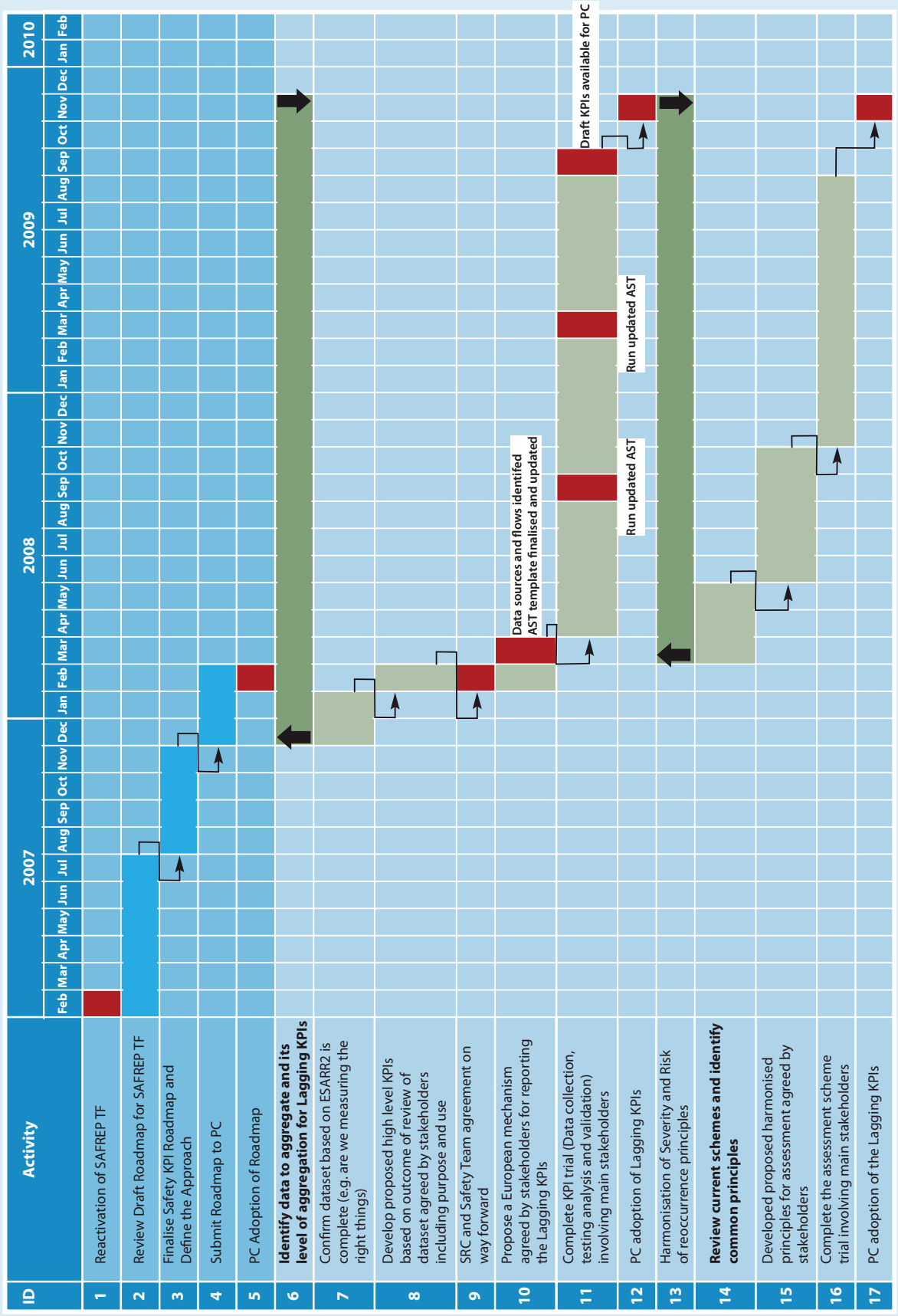


Figure 4 – Safety KPI Roadmap development

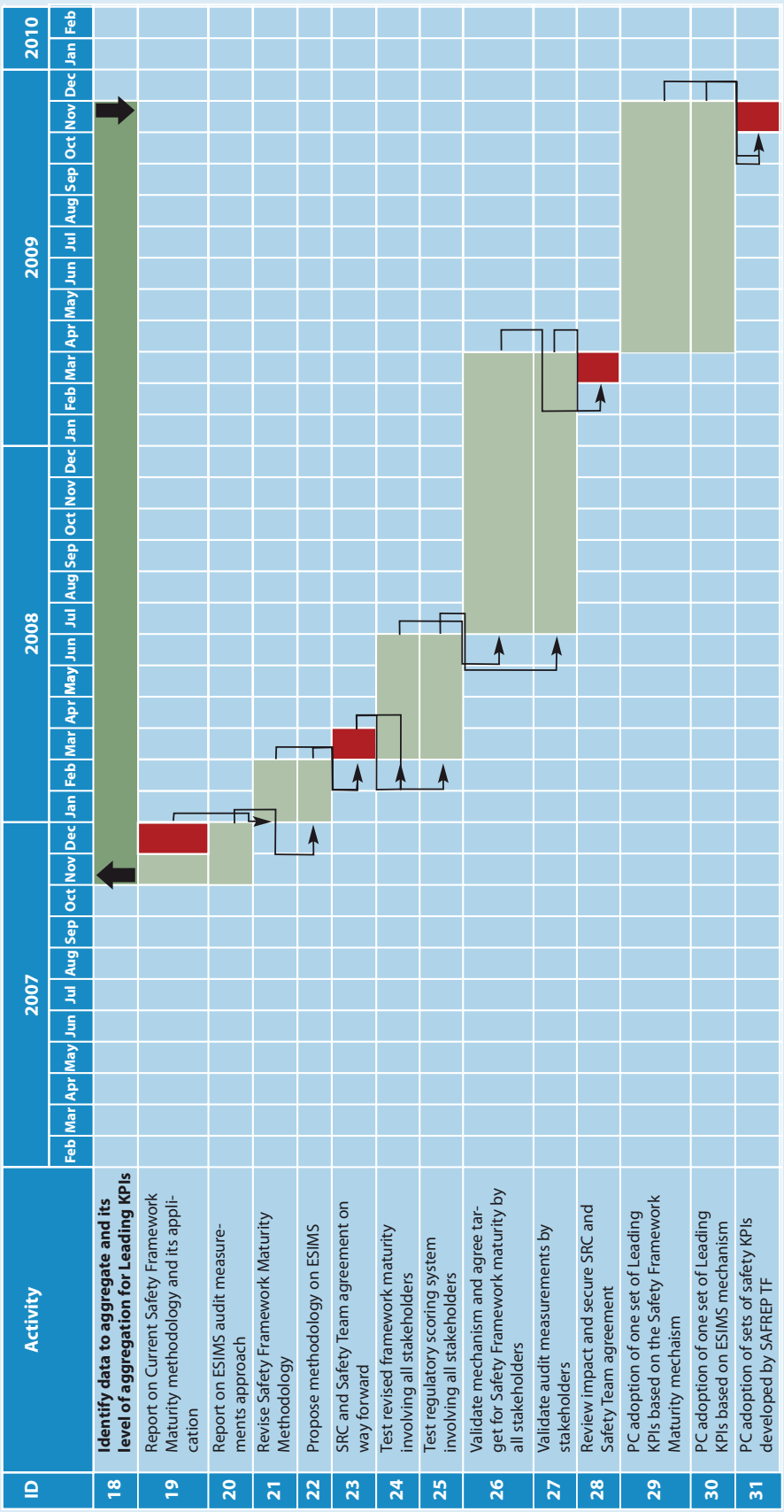


Figure 5 – Safety KPI Roadmap development (cont'd)

CHAPTER 5 - Robustness of data sources for the development of safety indicators

5.1 Introduction

5.1.1 SAFREP TF strongly believes that any system of safety indicators, detailed or high-level, **leading** or **lagging** is only as good as the quality of the source data on which it is based.

5.1.2 The data collection formats and data flow standards must be carefully defined, so that consistent, repetitive and harmonised data collection and transmission remains available for all parties concerned. SAFREP TF intends to define, within the framework established in this roadmap, the data collection formats and flows for all safety indicators in accordance with the SAFREP safety KPI principles for development (see Chapter 1, 1.4).

5.2 Collection of Safety data - The Annual Summary Template (AST)

5.2.1 Currently, although the number of AST returns continues to increase year-on-year, there is still less than total coverage of EUROCONTROL and ECAC Member States.

5.2.2 The slow improvements in the quality of data returned indicate that it will be many more years before adequate and robust results can be used reliably as a basis for safety performance measurement or policy making at European level.

5.2.3 Since regular reporting started, a number of States have failed to submit a single report to EUROCONTROL, while others have reported irregularly. The reasons for lack of reporting are unclear but may include blurred responsibilities following organisational change or lack of adequate resources at State and/or ANSP level.

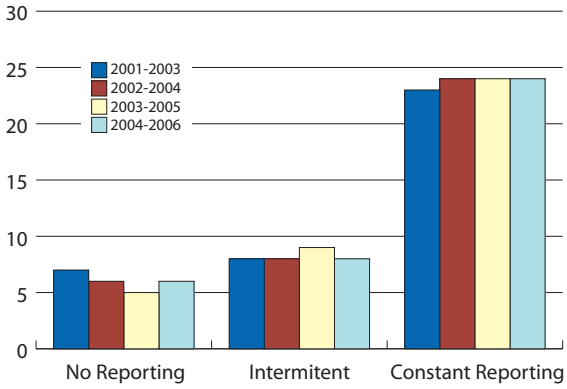


Figure 6 – Incident reporting levels to EUROCONTROL through ESARR2 mechanisms

Figure 6 above shows the situation for the 38 EUROCONTROL Member States.

5.2.4 The availability of exposure data, as identified by the Second JSSI – Occurrence Data Analysis Working Group (ODA2) report, sets the limit to what statistical rates can be calculated presently. Exposure data are needed to turn absolute numbers of safety events into more comparable rates (e.g. between regions or group of stakeholders).

5.2.5 The non-availability of exposure data[1] (e.g. flight hours per phase of flight, per type of operations) creates difficulties in normalising the indicators for meaningful tracking over the years.

5.2.6 The limited implementation of a common taxonomy and the different approaches in severity and risk assessment can distort the ATM safety performance picture.

1- Chapter 4 – Exposure Data Specification and Appendix D – Exposure Data Capability Specification of the (ODA2) report - Second JSSI – Occurrence Data Analysis Working group elaborates on the scope, applicability, data availability, quality and consistency or the exposure data.

5.2.7 The backlog of incident reports still under investigation at the end of each year appears to be increasing, as shown in Figure 7 below. This may indicate a resource problem at local level, a problem already mentioned in this report. Large numbers of safety occurrence reports awaiting investigation can distort the real situation.

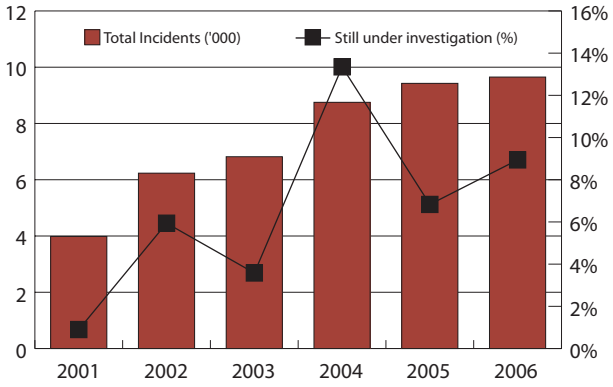


Figure 7 – Total numbers of ATM incidents investigated, as reported to EUROCONTROL

5.2.8 SAFREP would encourage sustained efforts to increase the number of investigated ATM related reports within States and then reported to EUROCONTROL. Non-compliance with EUROCONTROL and/or EU regulations is unacceptable from any Member State. It is hoped that, with increased transparency from ICAO and EUROCONTROL surveys, more pressure will be put on States to fulfil their obligations.

5.3 Collection of data through the Safety Framework Maturity Measurements

5.3.1 The Safety Framework Maturity measurements are based on data and information collected through a combination of electronic questionnaires and telephone interviews. The results are therefore based on the views and perceptions of the safety professionals contacted in the ECAC States. These views and perceptions are to a certain extent independently verified by comparing report information to the questionnaire returned. Any differences between the LCIP information and questionnaire returns are extensively explored and clarified. In the case of regulators, the ESIMS results are also considered, within the limits of the confidentiality clauses.

5.3.1 Every Safety Framework Maturity measurement exercise so far has had a response rate of less than 100%. The response rate needs to be improved if the data is to be used for performance measurement.

5.3.3 There is a need to ensure that making the results more transparent does not have a negative impact on the willingness to respond to the survey in an open and honest way.

5.3.4 ESIMS and IUSOAP are considered more robust than any self-assessment methodology discussed above as they follow state-of-the-art auditing techniques: they are evidence-based and are supported by on-site visits (1-2 weeks) where the compliance to the critical elements and objectives and requirements is verified.

CHAPTER 6 - Safety KPIs in other industries

6.1 SAFREP researched Safety KPIs in other industries (e.g. nuclear, chemical, railway, road transport etc) to identify if any best practices could be adopted by aviation and ATM.

6.2 Safety is a common goal to all involved in the design, operation and regulation of nuclear and chemical industries. There is a general understanding of the attributes that a nuclear power or chemical plant must have in order to operate safely. The challenge lies in measuring these attributes.

6.3 The challenges facing the safety critical industries surveyed (nuclear, chemical, railway), are in many ways similar to the ATM environment. These challenges include competitiveness, pressure to reduce costs, ageing infrastructure, policy changes, industry reorganisation, restructuring, mergers and globalisation. They demand systematic and highly-focused attention to safety management in the light of these challenges.

6.4 The industries surveyed use the traditional KPIs of accident-rates and fatalities with corresponding targets (i.e. **lagging indicators**) but a new thinking is emerging – to incorporate **leading indicators** in addition to the traditional **lagging** (or reactive) **indicators**. Two areas of specific interest in chemical and nuclear industries are "risk based" indicators and "safety culture" indicators. However, there is currently no measure that could be easily and directly applicable in ATM. In all surveyed industries, the promotion of Safety Management Systems is consistent with ESARR 3 approach to SMS.

6.5 Figures 8 & 9 below show examples of safety performance indicators from the oil and gas producing industries:

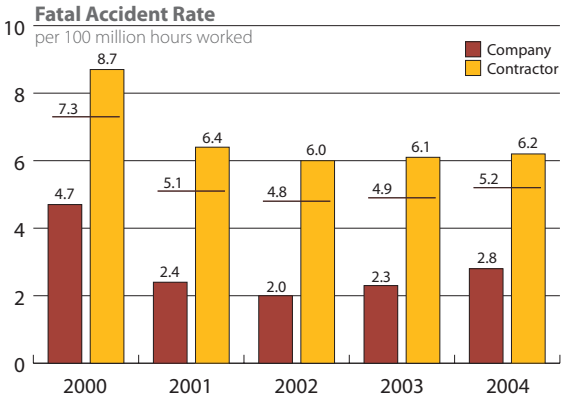


Figure 8 – Fatal Accident Rate / million hours

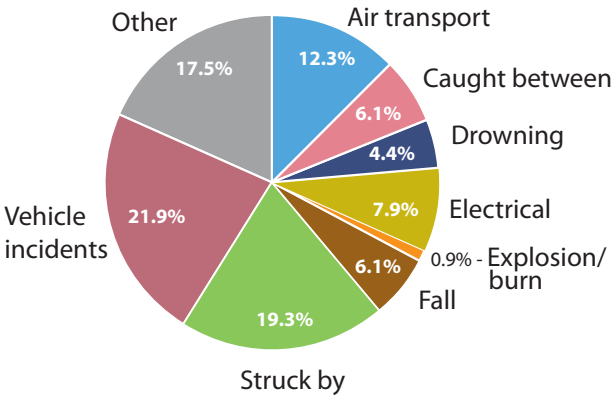


Figure 9 – Fatality Causes 2004

NOTE: OGP – International Organisation for Oil and Gas Producers is the Source for Figs 8 & 9.

6.6 Appendix A provides details of similar indicators already used in ATM. The EUROCONTROL Safety Measure and Improvement Programme (based on ESARR2) is a comprehensive framework of **lagging Safety Performance indicators** for measuring the health of the ATM system. Output from this system is used to for trend analysis and identification of ATM key risk areas.

CHAPTER 7 - Conclusions

7.1 From the present state of-the-art safety KPIs in ATM, SAFREP TF concluded:

1. The Safety Indicators established through the EUROCONTROL Safety Measurement and Improvement Programme (SMIP - ESARR2) provide a sound basis[2] for monitoring and improving ATM safety in a reactive way (**lagging indicators**). They can also support the production of a limited number of higher-level indicators, sufficient to monitor compliance with EUROCONTROL's strategic safety objectives (Ref Chapter 1, 1.1.1 and 1.1.2, Chapter 3, 3.3, Chapter 5, 5.2 and Appendix A).

2. Safety Framework Maturity measurement is considered an appropriate basis for development of **leading** KPIs. The survey is also recognised by ICAO as a best practice and will be applied from 2007 in the whole ICAO EUR Region. It is considered that this **leading indicator** potentially could serve for all ICAO Regions along with the results from the EUROCONTROL/ICAO audits (i.e. ESIMS/ IUSOAP). These measurements are considered to be a basis for the development of leading KPIs. (Ref Chapter 2, 2.3, Chapter 3, 3.4, Chapter. 5, 5.3 and Appendix B1).

3. The major issue today is the lack of reliable and consistent safety data from States in order to meaningfully populate all safety indicators. Many States lack adequate qualified resources needed to report and investigate safety occurrences in ATM, and to further report data to EUROCONTROL. The same limited resources are used in a majority of cases to respond to the Safety Framework Maturity questionnaires and interviews (Ref Chapter 5, 5.2 and 5.3).

4. Safety targets are derived to meet either political, strategic, regulatory, industry safety objectives or management performance-driven improvements. If targets are set too early in the process or if they are unduly correlated with other performance indicators (such as efficiency or pay), the whole process may be threatened. A cautious approach in setting targets is recommended. The starting points for setting targets should be **leading indicators** and subsequently with improved maturity of the system the targets for **lagging indicators**. (Ref Chapter 3, 3.5; Chapter 6, 6.1 to 6.6).

5. The aim is to develop initially a limited set of indices, which would measure the "health" of the ATM safety system. Year-on-year trend analysis could then be used to determine whether the safety situation is improving or not. Clearly, any KPI system will rely on the wide variety of safety measurements already in place within EUROCONTROL Organisation (Ref Chapter 1, 1.1, 1.2, 1.3.4; Chapter 3; and Chapter 5).

6. A progressive approach to the development of Safety KPIs is proposed. Initially, development of safety metrics will concentrate on the higher-level indicators. However, there is strong commitment to build a model of lower-level indicators The range of indicators selected must be capable of responding to many inputs, should remain robust irrespective of newly emerging hazards and be capable of measuring true safety performance (Ref Chapter 1, 1.1, 1.2, 1.3.4; Chapter 2 , 2.2.6; Chapter 3; Chapter 4; and Chapter 5).

7. Whilst maintaining a safe system through safety improvement activities is paramount, the information needs of interested parties may differ. For example, the information needs of public/society are different from those of regulators and of service providers. Therefore, the requirements for safety KPIs at different levels will include the need for transparency (public/society) and the need for meaningful data comparison (decision makers) (Ref Chapter 4).

2- Conclusion stemming from PC 17 and PC 20 and still confirmed by SAFREP TF

CHAPTER 8 - Recommendations

8.1 The SAFREP TF recommends:

1. The Safety Indicators system established through the EUROCONTROL Safety Measurement and Improvement Programme (SMIP-ESARR2) should be further enforced to collect Annual Summary Templates from all ECAC States (Ref Conclusion 7.1).

2. The Safety Framework Maturity measurement should become a standard measurement on an annual basis beyond the European Safety Programme (ESP) lifetime, subject however to further refinements of its baseline and weightings. ESIMS audits should remain the main thread for developing the ATM Safety regulators' performance indicators (Ref Conclusion 7.2).

3. States should ensure that ATM stakeholders have adequate qualified resources available to report and investigate safety occurrences in ATM, and to populate the national Annual Summary Templates. Resources should be available to cover all safety management and safety regulatory processes. Failing to secure adequate resources to support robust KPIs that can measure the "health" of European ATM safety, may adversely affect the safety outcome (Ref Conclusion 7.3).

4. It is recommended to adopt a cautious approach when setting targets. The starting priority for setting targets should be for **leading indicators**. However, based on existing and agreed actions, further practical progress could also be made on capturing and measuring targets on **lagging indicators** using accidents such as in the example given in Appendix A (Ref Conclusion 7.4).

5. It is recommended that by November 2009, the SAFREP TF produce a range of key indices, which would measure the state or "health" of the ATM safety system. The development shall make best use of existing practices, data flows, rules and regulations with the scope of minimising new approaches and will observe the roadmap described in Chapter 4 of this report (Ref Conclusion 7.5).

6. Before releasing any final system of Safety KPIs to further improve the EC mandate on ATM safety performance, there is a need to have a priori wide consultation with all interested stakeholders. SAFREP TF, while continuing to report to the Provisional Council, will endeavour to secure the stakeholders' buy-in through SRC and Safety Team consultation and endorsement of the KPIs related deliverables thought the planning reflected by the roadmap (Ref Conclusion 7.6).

7. Provisional Council to agree and support the SAFREP TF proposed roadmap (as presented in Chapter 4) and invite stakeholders to provide appropriate resources to ensure the development of Safety KPIs by 2009 (Ref Conclusion 7.7). Provisional Council to maintain commitment to the development of Safety KPIs.

APPENDICES

APPENDIX A -

EUROCONTROL Safety Measurement and Improvement Programme (Example of a Lagging Indicator)

A.1 The Safety Regulation Commission (SRC) has developed a comprehensive framework of **lagging Safety Performance Indicators** for measuring the health of the ATM system. The system is sufficiently mature to monitor achieved safety levels, identify safety-significant trends, and detect any degradation of safety levels, thereby permitting corrective actions to be identified.

A.2 The system is based on the reporting requirements of ESARR 2. It requires States to report to EUROCONTROL, through the mechanism of Annual Summary Template (AST), occurrence data categorised as:

A.2.1 Accidents - Total numbers, including ATM contribution, and in five subcategories:

- Mid-Air Collisions
- Controlled Flights Into Terrain – CFITs
- Collisions on the ground between Aircraft
- Collisions between Aircraft and Vehicle /another Aircraft on the Ground
- Collisions between Aircraft and Vehicle/ Person(s) / Obstructions(s).

A.2.2 Incidents - Total numbers, and in six subcategories, together with severity classification:

- Separation Minima Infringement
- Near CFIT
- Runway Incursions
- Unauthorised Penetration of Airspace
- Aircraft Deviation from Applicable ATM Regulation
- Aircraft Deviation from ATC Clearance.

A.2.3 ATM Specific Occurrences - Total numbers and further subcategories, together with severity classification:

- Inability to provide ATM Services
- The distribution of the occurrences related to the ATM support functions namely:
  - Failure of Communication, Surveillance and Navigation Functions
  - Failure of Data Processing and Distribution Function
  - Failure of Information Support Function

A.3 SRC publishes an Annual Safety Report which summarises the key features of safety performance. The reports are submitted to the Provisional Council, and (with their approval) are made available publicly on the EUROCONTROL Website.

A.4 The examples presented below, which are based on the latest data available (2006), illustrate the level of information published, and the way in which these statistics are used for trend analysis and identification of ATM key risk areas. Specifically, it should be noted that overall levels of reporting are continuing to rise, as a result of continued cooperation between EUROCONTROL and its member states in further development of safety reporting systems.

A.5 To avoid this effect masking other safety trends, for each indicator type a separate analysis is conducted of high-severity occurrences. It has been found that increases in reporting tend to focus on less severe events, whereas the high-severity cases are those which tend to have been recorded in previous years.

Figures 10 A to F below are Samples of SRC Safety indicators published annually

Accidents on the Ground between Aircraft (example subcategory)

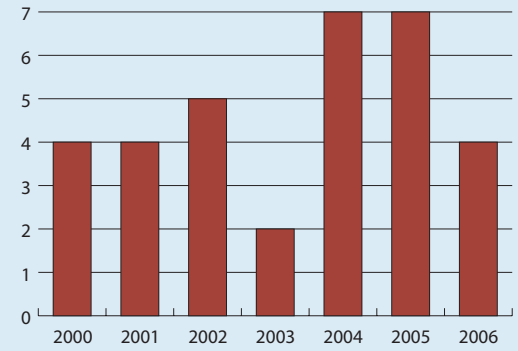


Fig. 10 A - Number of Collisions on the Ground between Aircraft

2006 has seen a reduction in numbers of collisions on the ground, four having been reported with two indicated as having an ATM indirect contribution. None were fatal. Although the numbers have decreased, the potential for ATM involvement in this category of accident is high, and continued improvement efforts are needed.

Incidents (example subcategories)

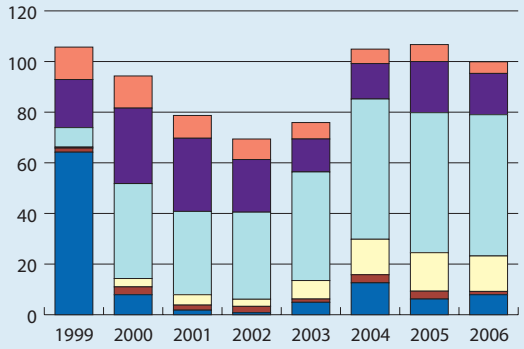
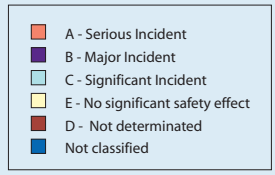


Fig. 10 B - Separation Minima Infringements
(occurrence per million flight hours and severity)



For most incident categories, trend information is available from 1999.

The severity classification system is fully specified in ESARR 2, and the categories are defined in a manner consistent with ICAO definitions.

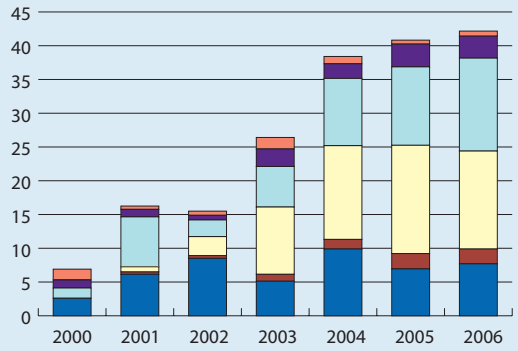


Fig. 10 C - Runway Incursions
(occurrence per million flight hours and severity)

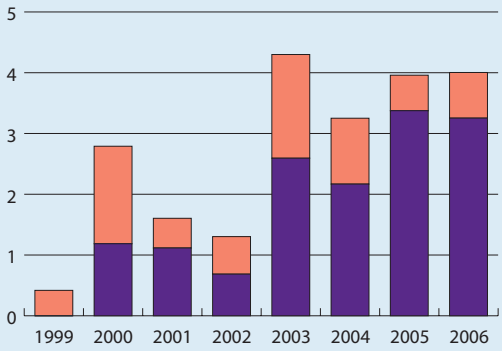


Fig. 10 D - Runway Incursions
(high risk occurrences per million flight hous and severity)

ATM Specific Occurrences - Total number (example subcategory)

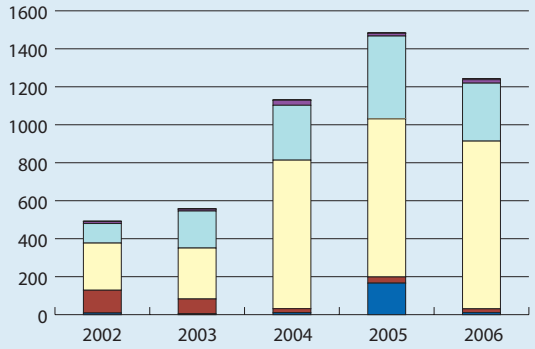
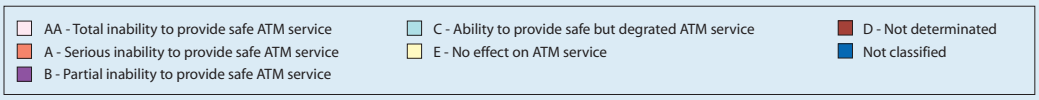


Fig. 10 E - Total ATM Specific Occurrences
(per million flight hours and severity)

Fig. 10 F - Total ATM Specific Occurrences
(high risk occurrences per million flight hours and severity)



A.6 Achieved Level of Safety

A.6.1 The ECAC Strategy for ATM 2000+ set a high-level safety objective:

" …. To improve safety levels by ensuring that the number of ATM induced accidents and serious, or risk bearing, incidents do not increase and, where possible, decrease"

A.6.2 The achieved level of safety has then been compared with the predicted target.

The graph below depicts the number of accidents involving Commercial Aircraft with Direct ATM Contribution, as reported through the AST.

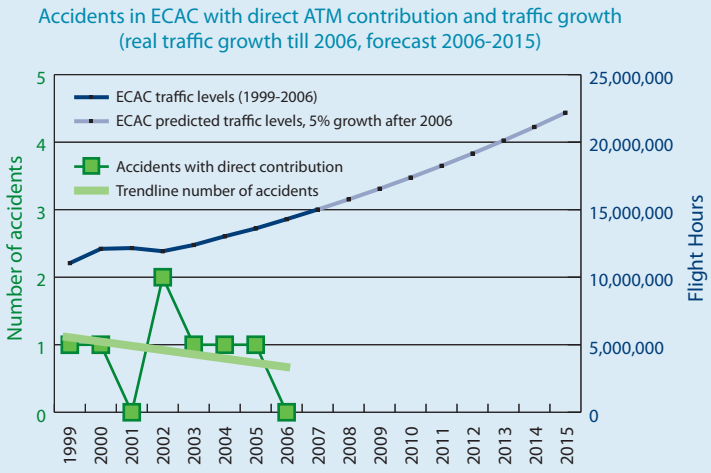


Figure 11 – Achieved Level of Safety based on Accidents figures

The number of accidents varies year to year, as may be expected, but the overall trend does not increase against a background of increasing traffic levels. Thus, the ECAC safety objective is being met as far as accidents are concerned. However, the development of safety data reporting by States has not so far allowed a similar comparison to be undertaken for serious incidents.

A.6.3 It must be stressed that the above calculations are based on a number of critical assumptions, including the rates of forecast traffic growth and the percentage contribution of ATM within the overall number of accidents.

A.6.4 These assumptions are being further validated and improved, supported by increased levels of safety data reporting by states, and by the work being undertaken as part of the development of a Risk Classification Scheme for the Design of ATM.

A.6.5 The development of safety data reporting by states has not so far allowed a similar comparison to be undertaken for serious incidents.

APPENDIX B1 -

Safety Maturity Framework Measurement Methodology (Example of a Leading Indicator)

B1.1 The review of ATM safety management and safety regulation frameworks is undertaken through the collection and analysis of data and information elicited from ANSPs, regulators and other stakeholders within the ECAC region. The data are collected through a combination of electronic questionnaires (separate, bespoke questionnaires were developed for the ANSPs, regulators and stakeholders respectively) and follow-up telephone interviews.

B1.2 The overall status of ATM safety management and safety regulation has been assessed through the review of a number of key elements of safety management (or "Study Areas"). The Study Areas have been identified as "A" areas and "B" areas. "A" areas are concerned with the current system while "B" areas relate to the future situation with regards to safety in ECAC.

B1.3 The Maturity Level of individual Regulator and Service Provider is derived from the average score across a set of key elements of a safety management, called "Study Areas".

B1.4 The following is an exemplification of what elements are being measured in the study areas "A" and "B":

- A1 – States' Safety Capability
- A2 – The collection and dissemination of incident data
- A3 – Safety Performance Measurement
- A4 – Promotion of Best Practices
- A5 – Organisational Structure for Safety
- A6 – Current Safety Rules and Procedures
- A7 – Current Safety Culture
- A8 – This area is closed and has been combined with A3
- A9 – Current Perceived Safety Levels
- A10 – Disclosure of Safety Information
- B1 – The Implementation of SMS
- B2 – Timely Compliance with International Organisations.

In addition to the Study Areas described above, there are five further areas that were not mapped to individual questions in the survey, but are asked in order to solicit broader information from participants. These are as follows:

- B3 – Identification of specific safety programmes within States that address national safety issues
- B4 – Issues affecting the implementation of ESARRs
- B5 – Potential weaknesses in the safety of air navigation that warrant special or immediate attention
- B6 – Current safety concerns of the airspace users representative bodies
- B7 – Current safety concerns of the Air Traffic Controller's representatives.

B1.5 While the methodology uses similar questions, different questionnaires are used for regulators and service providers. The questionnaires have a graded scale of responses that corresponded to categories of safety maturity. They also allow for the possibility of a "No response" when Stakeholders are not in a position to answer some of the questions. The answer to the questions are weighted to reflect the different contribution that each of the questions made to the particular objective being considered in each Study Area.

B1.6 The results after 4 measurements (2002, 2004, 2006 and 2007) are showing a positive trend with good chances of meeting the 70% target by the end of 2008/beginning of 2009.

Figures 12 A & B – ANSPs and REGs Global Safety Framework Maturity based on the latest 2007 measurements

APPENDIX B2 -

ICAO/EUROCONTROL/Transport Canada SMS survey approach (sample of preventive indicators)

B2.1 Most organisations operate within a safety 'envelope' which is limited at one extreme by a boundary beyond which it would be unsafe to continue. A boundary at the other extreme indicates the region beyond which limitations would be so restrictive that operations or production could not proceed. This is illustrated in Figure 13[3] below.

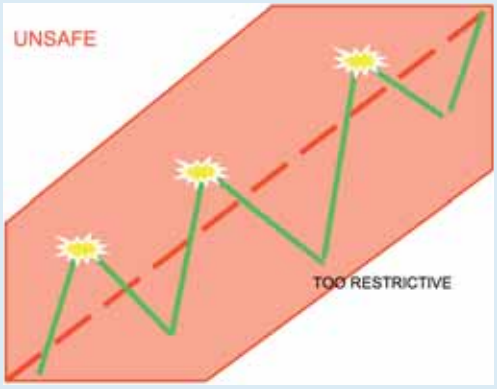


Figure 13 – The Operating Envelope Of an Organisation - The Balance Between Production & Protection

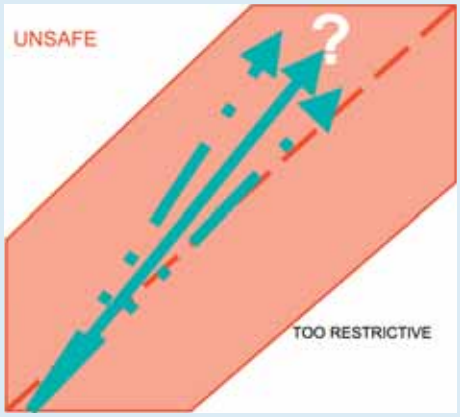


Figure 14 – The Difficulty In Assessing Safety Performance in ANSPs

B2.2 In the case of manufacturing industries or industrial processes where low-consequence accidents and serious incidents occur relatively routinely, the organisation's activities can be seen to react by 'tightening up' the rules each time an accident or serious incident occurs.

B2.3 For ANSPs, where there is potential for high-consequence but very infrequent safety events, the absence of this pattern means that it can be extremely difficult to identify safety trends, as illustrated in Figure 14 above. For example, how is the senior management of an ANSP able to determine whether safety standards are improving or declining from year to year? An ANSP needs to be proactive in the absence of actual accidents and search for evidence of safety performance by conducting regular and effective Safety Surveys.

B2.4 The basic Regulatory requirement[4] for ANSP Safety Surveys may be summarised such that ATM service providers should normally establish processes to carry out Safety Surveys as a matter of routine to review operational units and significant areas of activity. Such surveys should examine the safety performance of the whole unit in general and in some specific areas. Specifically, they should look at the safety performance of the SMS.

B2.5 Derived from a Transport Canada approach to grant AO licences, EUROCONTROL and ICAO have developed a survey technique that it does not only look at SMS components in place, it verifies whether the SMS is integrated in all layers of the organisation.

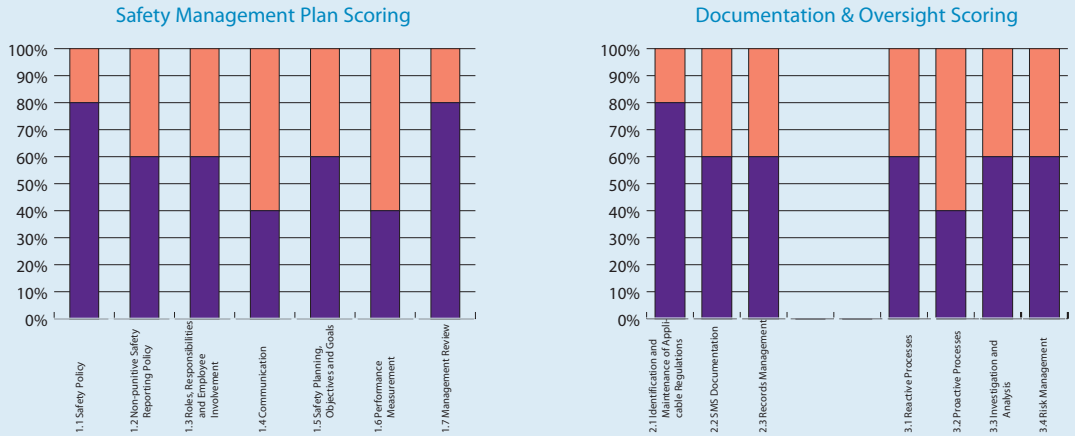
3- From Reason J, '*Managing The Risks Of Organisational Accidents*' , Ashgate, London, 1997.
4- ESARR 3 requires that ANSPs have in place an SMS which will ensure that Safety Surveys are carried out as a matter of routine as an integral part of their safety assurance activity. Section 5.3.1 of ESARR 3 stipulates that: *"Within the operation of the SMS, the ATM service-provider shall ensure that Safety Surveys are carried out as a matter of routine to recommend improvements where needed, to provide assurance to managers of the safety of activities within their areas, and to confirm conformance with applicable parts of their SMS."*

B2.6 The technique has scoring levels that are based on a set of defined expectations. The expectations relate to an element being assessed. For example, a safety management plan must contain a safety policy. An expectation of the safety policy is that it should contain a clear declaration of commitment and objectives. As safety management systems are progressive in their development, we expect to see continuous improvement in the system. We also expect to see a variation in the type of safety policy we see.

B2.7 When building the scoring, the following bottom-up approach is followed:

- A score of (1) shows that the system is considered to be not documented and not implemented.
- A score of (2) is indicates partially implementation but not effective. In other words, the organisation does not have all of the criteria required for an award level of (3).
- A score of (3) is considered when the organisation has met the minimum acceptable standard of assessment. As such, to be considered as having an acceptable level, all required elements have to be rated as per the criteria at an award level of (3). The score of (3) in all criteria reflects only the minimum requirements for compliance to ESARRs.
- Any additional requirements and Best Practices (BP) in the guideline protocol represent bonus points in addition to the (3) award level (i.e. the respective ANSP is expected to pass the certification process of his regulator).
- A score of (4) is an indication of exceeding the minimum acceptable standard of assessment. To receive this award level, the element is considered to meet all of (3) plus some aspects of (5).
- A score of (5) is considered to meet all of the criteria for an award level of (4) plus all of the additional requirements listed under the criteria for that element. To achieve an award level of (5), an organisation would have to meet the regulatory requirements as well as demonstrate industry best practices at a very high level.

B2.8 One table has been included below in this annex for exemplifying how the results could be grouped and presented. Further to that, a sample of how individual SMS surveyed areas could be benchmarked are illustrated in Figure 15 below.



Figures 15 – Safety Survey scoring examples

Table 1: SMS Measurement Table – hypothetical measurement result in an ANSP

Component	Element	ESARR Compliant	Element Score	Component Score
1. Safety Management Plan	1.1 Safety Policy	Y / N	4	
	1.2 Non-punitive Safety Reporting Policy	Y / N	3	
	1.3 Roles, Responsibilities and Employee Involvement	Y / N	3	
	1.4 Communication	Y / N	2	
	1.5 Safety Planning, Objectives and Goals	Y / N	3	
	1.6 Performance Measurement	Y / N	2	
	1.7 Management Review	Y / N	4	
		Total:	21/35	60%
2. Documentation	2.1 Identification and Maintenance of Applicable Regulations	Y / N	4	
	2.2 SMS Documentation	Y / N	3	
	2.3 Records Management	Y / N	3	
		Total:	10/15	67%
3. Safety Oversight	3.1 Reactive Processes	Y / N	3	
	3.2 Proactive Processes	Y / N	2	
	3.3 Investigation and Analysis	Y / N	3	
	3.4 Risk Management	Y / N	3	
		Total:	11/20	55%
4. Training	4.1 Training, Awareness and Competence	Y / N	4	
		Total:	4/5	80%
5. Quality Assurance	5.1 Operational Quality Assurance*	Y / N	3	
		Total:	3/5	60%
6. Emergency Preparedness	6.1 Emergency Preparedness and Response	Y / N	3	
		Total:	3/5	60%
			Component Score Total:	
			Overall SMS Score (Component Score Total / # of Components):	52/85 62%

APPENDIX C -

Regulatory safety oversight audits (e.g. ESIMS/USOAP), (leading indicators for regulators)

C.1 ESIMS Background

C.1.1 In 2002, EUROCONTROL started the initial ESARR Implementation and Support (ESIMS) Programme (CN Decision 92 refers). An approach based on 'fact-finding visits' was implemented by the Programme until mid-2004 and most ECAC States were visited in that period. The result was a significant improvement in the level of visibility of the safety regulatory situation across Europe.

C.1.2 After that initial experience, the Provisional Council approved, in July and November 2004, a renewed ESIMS Programme in line with the proposals made within the Strategic Safety Action Plan (SSAP). The programme was institutionalised and further strengthened. It adopted a pure auditing approach, and was aligned as much as possible with the ICAO Universal Safety Oversight Audit Programme (USOAP).

C.1.3 The Memorandum of Co-operation signed in 2005 between ICAO and EUROCONTROL regarding safety oversight auditing set the basis for that alignment and the effective co-ordination of both activities at working level.

C.1.4 Commission Regulation (EC) 2096/2005 establishes that the EC, acting in cooperation with EU Member States, shall arrange peer reviews of National Supervisory Authorities (NSAs). Recital 10 of this Regulation states that these peer reviews should be co-ordinated with the activities undertaken within the ESIMS Programme and USOAP to avoid the duplication of work.

C.1.5 All the above audit approaches indicate that there is wealth of information about the regulators' capability to exercise their function at national level. This information is felt to measure in a proactive manner the industry level of safety. All mechanisms (except the peer reviews exercise, which is currently in the design stage) are well established and no additional requirements need to be placed on stakeholders.

C.2 ESIMS Audit Objectives and Scope

C.2.1 The duration and frequency of audits, as well as the size of the audit team, is determined through a review of the information submitted by the State. As a basis, States will be visited at least once in any six-year period, with follow-up visits conducted as required. In six years, national safety regulators would have been visited once by ICAO and once by EUROCONTROL.

C.2.2 The ESIMS audits are focused on States' overall safety oversight capabilities[5] and, as such, address the following areas:

- Legislative and institutional arrangements in place allowing States to meet their obligations with respect to EUROCONTROL. This includes the transposition of those obligations through national legislation and applicable EC rules;
- Safety regulatory framework for ATM, related arrangements and capacity (policy and principles, procedures for rulemaking and safety oversight, resources and, staff competency);

5- As a result of the alignment with USOAP agreed by the EUROCONTROL Commission, for ESIMS the term 'safety oversight capabilities' is consistent with the approach of ICAO Document 9734-A, which describes the critical elements of a State's safety oversight.

- Current ATM safety regulations applicable in the State, their implementation and State's level of compliance with ESARRs.

C.2.3 ESIMS audits address ESARRs at national level. However, there is traceability between ESARR requirements and equivalent ICAO and EC requirements. Therefore, addressing the ESIMS objectives will, de facto, allow for the verification of the adherence to ICAO SARPs falling within the scope of ESARRs[6], as well as compliance with key principles of the SES Regulations, essentially with regard to the ESARR provisions transposed into EC legislation and the supervision of ATM safety.

C.2.4 ESIMS focus on the State's overall system and related obligations. Consequently, the scope of each audit not only addresses the ATM safety regulatory framework applicable to civilian air navigation service providers but also the framework applicable to military organisations providing air navigation services to GAT. Equally, should a State have delegated the responsibility of service provision to a foreign ANSP, the safety regulatory framework applicable to those delegated services will be addressed within the ESIMS audits.

C.3 ICAO USOAP

C.3.1 During 1995-1997 the Universal Oversight Programme was a voluntary assessment of a State's implementation of the ICAO Standards and Recommended Practices (SARPs).

C.3.2 The 32nd Session of the ICAO Assembly (September – October 1998) reviewed the recommendations of the Council and adopted Assembly Resolution A32-11 — "Establishment of an ICAO Universal Safety Oversight Audit Programme (USOAP)". In recognition of the success achieved by the USOAP, the 33rd Session of the Assembly (September – October 2001), through Assembly Resolution A33-8, resolved that USOAP be expanded to include audits of Annexes 11 — Air Traffic Services and 14 — Aerodromes as of 2004, and other safety related fields, such as aircraft accident and incident investigation (Annex 13 — Aircraft Accident and Incident Investigation), provided resources would be available for further expansion.

C.3.3 The preparatory activity with respect to the expansion of the Programme, showed that a piecemeal approach to audit only limited Annexes (11, 13 and 14) was no longer viable and that there was a need to address safety-related provisions contained in all safety-related Annexes at the same time.

C.3.4 Accordingly, the 35th Session of the ICAO Assembly considered the recommendation of the Council and adopted Assembly Resolution A35-6, which requested the USOAP to be further expanded to include the safety-related provisions contained in all safety-related Annexes to the Convention on International Civil Aviation as of 2005.

C.3.5 The primary objectives of an ICAO safety oversight audit are to:

- observe and assess the State's adherence to ICAO Recommended Practices, associated procedures, guidance material and safety-related practices;

- determine the degree of conformance of the State in implementing ICAO Standards;

6- EAM/ICAO demonstrates that if an ESARR is effectively implemented, the relevant ICAO provision is met

- determine the effectiveness of a State's implementation of a safety oversight system, through the establishment of legislation, regulations, licensing, certification and control capabilities;
- determine State capability for safety oversight, and;
- provide advice to Contracting States to improve their safety oversight capabilities.

C.3.6 ICAO Contracting States, in their effort to establish and implement an effective safety oversight system, need to consider the critical elements for safety oversight (CE). States are expected to implement safety oversight critical elements in a way that assumes the shared responsibility of the State and the aviation community. The effective implementation of the CE is an indication of a State's capability for safety oversight.

C.3.7 ICAO has identified and defined the following critical elements of a State's safety oversight system:

- **[CE1] Primary aviation legislation:** The provision and effective aviation law consistent with the environment and complexity of the State's aviation activity and compliant with the international requirements.
- **[CE2] Specific operating regulations:** The provision of adequate regulations[7] to address, at a minimum, national requirements emanating from the primary aviation legislation and providing standardised operational procedures, equipment and infrastructure (including safety management and training).
- **[CE3] State civil aviation system8 and safety oversight functions:** The establishment of a Civil Aviation Authority (CAA) and/or other relevant authorities or government agencies, headed by a Chief Executive Officer, supported by the appropriate and adequate technical and non-technical staff and provided with adequate resources. The State authority must have stated safety regulatory functions, objectives and safety policies.
- **[CE4] Technical personnel qualification and training:** The establishment of minimum knowledge and experience requirements for the technical personnel performing safety oversight functions and the provisions of appropriate training to maintain and enhance their competence at the desired level.
- **[CE5] Technical guidance, tools and the provision of safety-critical information:** The provisions of technical guidance (including processes and procedures), tools (including facilities and equipment) and safety critical information, as applicable to the technical personnel to enable them to perform their safety oversight functions in accordance with established requirements and in a standardised manner. In addition, this includes the provisions of technical guidance by the oversight authority to the aviation industry on the implementation of applicable regulations and instructions.
- **[CE6] Licensing, certification, authorisation and approval obligations:** The implementation of processes and procedures to ensure that personnel and organisations performing an aviation activity meet the established requirements before they are allowed to exercise the privileges of a licence, certificate, authorisation, and/or approval to conduct the relevant aviation activity.

7- The term "regulations" is used in a generic sense to include but it is not limited to instructions, rules, edicts, directives, sets of law, requirements, policies and orders.
8- The term "State civil aviation system" is used in a generic sense to include all authorities with aviation safety oversight responsibilities which may be established by the State as separate entities, such as CAA, Airport Authorities, Air Traffic Services Authorities, Accident Investigation Authorities, Meteorological Authorities, National Supervisory Authorities.

- **[CE7] Surveillance obligations:** The implementation of processes, such as inspections and audits, to proactively ensure that aviation licence, certificate, authorisation and/or approval holders continue to meet the established requirements before, and function at, the level of competency and safety required by States to undertake an aviation-related activity for which they have been licensed, certified, authorised and/or approved to perform. This includes the surveillance of designated personnel who perform safety oversight functions on behalf of the CAA.

- **[CE8] Resolution of safety concerns:** The implementation of processes and procedures to resolve identified deficiencies impacting aviation safety, which may have been residing in the aviation system and have been detected by the regulatory authority or other appropriate bodies.

C.4. Presentation of audit results

C.4.1 There is a need for any audit information being released to a wider audience to be objective, reliable, up to date and easy to understand, so that the audience (be it professionals or public) can make informed decisions.

C.4.2 EUROCONTROL concluded that the option chosen by ICAO currently represents the most appropriate basis for ESIMS disclosure to the public and should be implemented by EUROCONTROL, subject to ESIMS audit protocols being formally classified and associated with a critical element, as defined in **ICAO Doc 9734**-*Safety Oversight manual, Part A - The establishment and Management of a State's safety oversight system*.

C.4.3 Adopting the same approach would ease the communication to the public and would enable a form of comparison of USOAP and ESIMS findings, hence a form of monitoring of progress made at national level between audits (necessarily limited however, as European requirements are more demanding).

C.4.4 In order to provide an easy to understand representation of the national situation, ICAO has developed a chart depicting, on a scale 1 to 10, the status of implementation of each critical element in the audited State. It is easy to derive, per critical element, the ratio of audit protocols found to be non-satisfactory (i.e. subject to a non-conformity) as a proportion of the total number of audit protocols. The chart can also show the level of implementation of the critical elements at regional level, (based on the total number of audits conducted at the time).

C.4.5 The SES Regulations and EC Regulation N° 2096/2005 (Common Requirements) foresee the implementation of Peer Reviews between National Supervisory Authorities (NSA). Considering that the safety regulatory elements of the SES result largely from a transposition of ESARRs into EC law, ESIMS could be considered as an initial phase of Peer Reviews in the safety area provided the EC could access the full ESIMS audit reports. Such a sharing of safety information with the EC would also ensure co-ordination between the EC, EUROCONTROL and ICAO of support actions towards States.

C.4.6 The scale results of 1 to 10 for each of the eight Safety oversight Critical Elements could form a basis for **leading regulatory indicators**. A further link with how the ATM safety oversight capability is measured from a total aviation system approach would need to be worked out by November 2009.

ESIMS/IUSOAP SAMPLE OF AUDIT RESULTS

State: **Auditland** **Audit Period:** **2006**

Level of Implementation of the Critical Elements of a Safety Oversight System,

CRITICAL ELEMENT	1 = Not Implemented 10 = Fully Implemented ■ = State's Level of Implementation ■ = ECAC Average									
	1	2	3	4	5	6	7	8	9	10
Primary Aviation Legislation	□	□	□	□	□	□	□	□	■	□
Specific Operating Regulations	□	□	□	□	□	□	□	□	□	■
State Civil Aviation System and Safety Oversight Functions	□	□	□	□	□	□	□	□	□	■
Technical Personnel Qualification and Training	□	□	□	□	□	□	□	□	□	■
Technical Guidance, Tools and the Provision of Safety-Critical Information	□	□	□	□	□	□	□	■	□	□
Licensing, Certification, Authorisation and Approval Obligations	□	□	□	□	□	□	□	□	□	■
Surveillance Obligations	□	□	□	□	□	□	□	■	□	□
Resolution of Safety Concerns	□	□	□	□	□	□	□	□	□	■

State's Comments and Updates on Progress Made Since the Conduct of the ESIMS Audit

APPENDIX D - Glossary of Acronyms and Terms

For the purposes of this document the following definitions shall apply:

Acronym	Definition
ANSPs	Air Navigation Service Providers
AST	Annual Summary Template
ATC	Air Traffic Control
ATM	Air Traffic Management
ATS	Air Traffic Services
CAA	Civil Aviation Authority/Administration (UK/US)
CEO	Chief Executive Officer
CE	Critical Elements
CESC	Chief Executive Standing Conference
CFIT	Controlled Flight Into Terrain
CN	Permanent Commission
DAP/SSH	Safety Security and Human Factors Division (EUROCONTROL)
EATM	European Air Traffic Management
EC	European Community – (also used for European Commission)
ECAC	European Civil Aviation Conference
ECIP	European Convergence & Implementation Plan
ESARR	EUROCONTROL Safety Regulatory Requirement
ESIMS	EUROCONTROL Support Implementation and Monitoring of ESARRs
ESP	European Safety Programme for ATM
EUROCONTROL	European Organisation for the Safety of Air Navigation
ICAO	International Civil Aviation Organisation
KPIs	Key Performance Indicators
KPAs	Key Performance Areas
LCIP	Local Coordination and Implementation Plan
MoU	Memorandum of Understanding
NSA	National Supervisory Authority
ODA	Operational Data Analysis Group
PC	Provisional Council
PRC	Performance Review Commission
PRU	Performance Review Unit
REGs	ATM Safety Regulators
SAFREP TF	Safety Data Reporting and Data Flow Task Force
SES	Single European Sky
SM	Safety Management
SMIP	Safety Measurement and Improvement Programme
SMS	Safety Management System
SRC	Safety Regulation Commission
SRU	Safety Regulation Unit
SSAP	Strategic Safety Action Plan
USOAP	(ICAO) Universal Safety Oversight Audit Programme

APPENDIX E -

Composition of the second SAFREP TF and its Ad-Hoc Group

Chairmanship:

The Second Safety Data Reporting & Data Flow Task Force has been co-chaired by Ron ELDER – SRC Chairman (UK SRG) and Dr. Erik MERCKX the EATM Deputy Director of ATM Programmes.

Secretariat:

The secretary function of SAFREP TF was ensured by Tony LICU – ESP Programme Manager DAP/SSH, assisted by Eve Grace-Kelly.

External Stakeholders:

Job BRUGGEN and Paul ENGELLEN – LVNL, Francis SCHUBERT – SKYGUIDE, Ben ALCOTT - UK CAA – SRG, Gretchen BURRETT* and Jane GOTHARD – UK NATS, Jan BOREN*, Lars HEDBLOM* and Carin CASSBORG* – Swedish CAA, Silvano MANERA*, Daniele Giuseppe CARRABBA* and Gianni SEMENZATO* – ENAC Italy, Corrado RUGGIERI*, Maurizio SCHOLTZE* and Massimo GARBINI*– ENAV Italy, Alain PRINTEMPS* - DGAC France, Anne FRISCH - DSNA France, Peter SORENSEN – IATA, Mike AMBROSE* – ERA, Roberto SALVARANI*, Gernot KESSLER* and Jean-Pol HENROTTE - European Commission, Marc BAUMGARTNER and Geert MAESEN – IFATCA, Hans-Juergen MORSCHECK and Heino KUESTER – DFS – Germany, Janne ENARVI* and Tom HATINEN – FINAVIA – Finland, Bogdan DONCIU – ROMATSA*.

EUROCONTROL SRU, Agency and PRU:

Peter STASTNY - Head of SRU, Charlie GOVAARTS and Florin CIORAN – Expert SRU, Alexander SKONIEZKI Head of DAP/SSH Dragica STANKOVIC and Gilles LE GALO* - Safety Experts DAP/SSH, Eve GRACE-KELLY – ESP Programme Coordinator DAP/SSH, Roderick Van DAM – Head of Legal Service, Ann-Frederique POTHIER – Expert Legal Service, Xavier FRON – Head of PRU, Radu CIOPONEA – Expert PRU, Catherine HENNESSEY *– Assistant PRU and Secretary of PRC.

*) – indicates participation only via correspondence

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