

ELEVENTH AIR NAVIGATION CONFERENCE

Montreal, 22 September to 3 October 2003

Agenda Item 2: Safety and security in air traffic management (ATM)
2.1: Safety management systems and programmes

UNITED STATES SAFETY MANAGEMENT SYSTEM DEVELOPMENT

(Presented by the United States)

SUMMARY

This paper outlines the safety management system under development in the United States per the ICAO Annex 11 requirement. It asserts the United States commitment to meeting ICAO requirements in a way that enhances the safety of a system that has been demonstrated to be among the safest in the world. The paper summarizes the development approach employed, the findings in comparing ICAO SMS requirements to existing FAA processes and procedures, safety risk management in the FAA, and implementation and evolution of the system.

REFERENCES

Annex 11 to the Convention on International Civil Aviation, Air Traffic Services, 13th Edition, July 2001.
ICAO Document 4444 (ATM/501) *Procedures for Air Navigation Services, Air Traffic Management*, 14th Edition - 2001.

1. INTRODUCTION

1.1 The United States Federal Aviation Administration (FAA) is currently developing a safety management system (SMS) for the provision of air traffic services. The FAA SMS will enhance an already safe air traffic control system by continuing the evolution and advancement of safety in the United States national airspace system (NAS) to the highest practical level. The FAA SMS will also support the FAA goal

of meeting the requirement that ICAO Member States establish key elements of an SMS by November 2003¹. When fully implemented, the FAA SMS will provide a common framework to assess the safety risk to the United States NAS when making changes to equipment (hardware/software), air traffic control procedures, separation standards, and airspace (enroute, terminal, and ground/taxi). Figure 1 illustrates the components of the SMS framework.

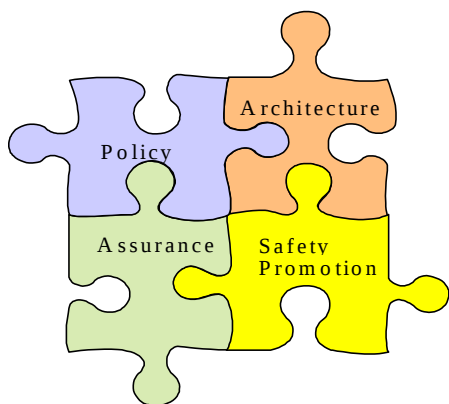


Figure 1.

1.2 The FAA SMS development strategy is to build on existing internal processes and procedures, which have allowed the FAA to have an unparalleled safety environment and focus. The FAA SMS will organize these multi-level processes with rigor and enhance the documentation of safety-related risk assessments and decisions. In developing the SMS, the FAA will leverage best practices and lessons learned from other ICAO Member States, industry, and government. It is anticipated that implementation of a full SMS within FAA will be done in several phases and will be completed in a similar timeframe taken by other ICAO Member States. The FAA SMS will be suited for the current United States structure of the provision of air traffic services, but will be adaptable if the FAA moves to a more regulatory structure in the future.

2. DISCUSSION

2.1 Approach to development

2.1.1 The goal of the FAA's SMS is to enhance an already safe United States national airspace system, while also meeting ICAO requirements. To reach this goal, a development team was established that consisted of subject matter experts representing a broad spectrum of operational and technical disciplines (e.g. air traffic controllers, engineers who maintain the equipment, pilots, safety management experts). The FAA began development by conducting a gap analysis to compare the SMS requirements outlined by ICAO [in Annex 11 — *Air Traffic Services* and the *Procedures for Air Navigation Services — Air Traffic Management* (PANS-ATM, Doc 4444)] to existing FAA processes and procedures. It was concluded that current FAA processes meet and many times exceed the vast majority of ICAO SMS requirements. There

¹ Requirements published in *Annex 11 to the Convention on International Civil Aviation, Air Traffic Services*, 13th Edition — July 2001 and *ICAO Document 4444 (ATM/501) Procedures for Air Navigation Services, Air Traffic Management*, 14th Edition — 2001.

were no areas where the FAA did not have existing processes or procedures that at least partially met ICAO requirements. Implementing an SMS will further formalize safety risk assessment and safety risk management processes within the FAA.

2.1.2 The team's approach, based upon interaction and lessons learned sessions with other ICAO Member States who have developed and implemented SMSs, is to: a) build upon current FAA processes and b) adopt safety management "best practices" already used by ICAO Member States, as well as industry and government (e.g. nuclear, pharmaceutical). Figure 2 illustrates this approach.

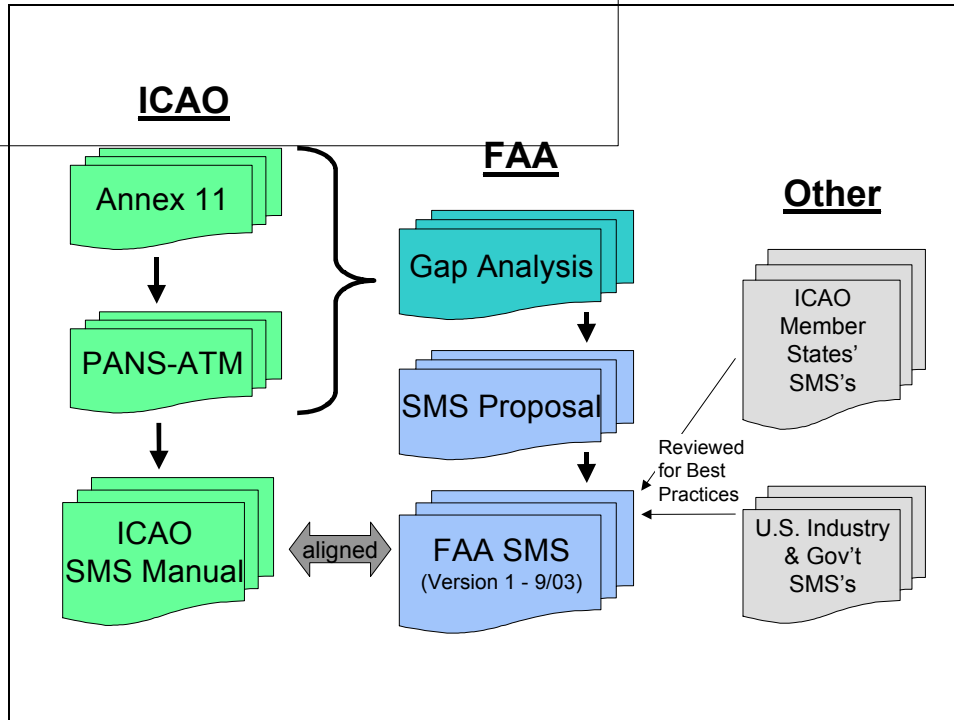


Figure 2.

2.2 Compliance with ICAO requirements

2.2.1 The FAA started SMS development by comparing ICAO requirements to existing processes and procedures. It found that many FAA processes already meet and often exceed ICAO SMS requirements. Specific examples include:

- extensive operational processes/procedures in place that are applied to mitigate the risks associated with a changing operational air traffic control environment (due to capacity, equipment failures, poor weather, etc.);
- FAA operational performance is continually monitored and measured. Extensive equipment and personnel certification processes are in place;
- internal air traffic control oversight, evaluation, and quality assurance programs provide monitoring of compliance with safety related orders and directives; and

- d) new FAA air traffic control equipment is delivered using standard acquisition processes that incorporate rigorous performance verification. National laboratory assets are often used, which allow extensive simulation and testing prior to actual operational use.

2.2.2 The primary opportunity for enhancement by implementing an SMS within FAA is to formalize safety risk assessment and management. Currently, risk assessments are performed at various levels and degrees of complexity (consistent with ICAO). However, the processes used are not as formal as they will be with an SMS. In addition, documentation of decision-making logic/methodology will become more formalized and diverse risk assessment tools will be supplemented and brought together under a SMS framework. The FAA SMS will provide additional opportunities for corporate learning, and encourage use of risk analysis tools that best match the situation (complexity, impact, timeliness).

2.2.3 The comparison to existing processes also yielded an interesting by-product. The United States structure is unique in that the two boundaries of typical air traffic management (ATM) SMS systems: airplanes/pilots (commercial and private) and airports [or aerodromes] are safety regulated by FAA across the entire United States and our sovereign airspace. This has allowed the FAA to actively address safety related issues that cross typical ATM boundaries, such as pilot deviations and runway incursions. The FAA's SMS will leverage this advantage by including "boundary" safety related issues within the FAA's SMS for the provision of air traffic services.

2.3 Safety risk management

2.3.1 The FAA currently has a variety of safety risk management efforts, in which hazards are assessed, classified according to risk, and mitigated to an acceptable level. For instance in the case of new ATC equipment, hazards are identified, categorized, and managed. Hazards that cannot be mitigated are tracked. In the case of hazards that can be mitigated, the strategies/controls used are monitored and assessed for effectiveness. System performance is also monitored after implementation, and again risk is assessed, categorized, and mitigated. Within the SMS framework, these efforts will be applied more consistently and documentation of the findings will be more consistent.

2.3.2 Per Annex 11, the purpose of the safety risk management program is to:

- a) "identify actual and potential hazards and determine the need for remedial action;
- b) ensure that remedial action necessary to maintain an acceptable level of safety is implemented; and
- c) provide for continuous monitoring and regular assessment of the safety level achieved."²

² Annex 11 to the Convention on International Civil Aviation, Air Traffic Services, Thirteenth Edition, July 2001, Section 2.26.4.

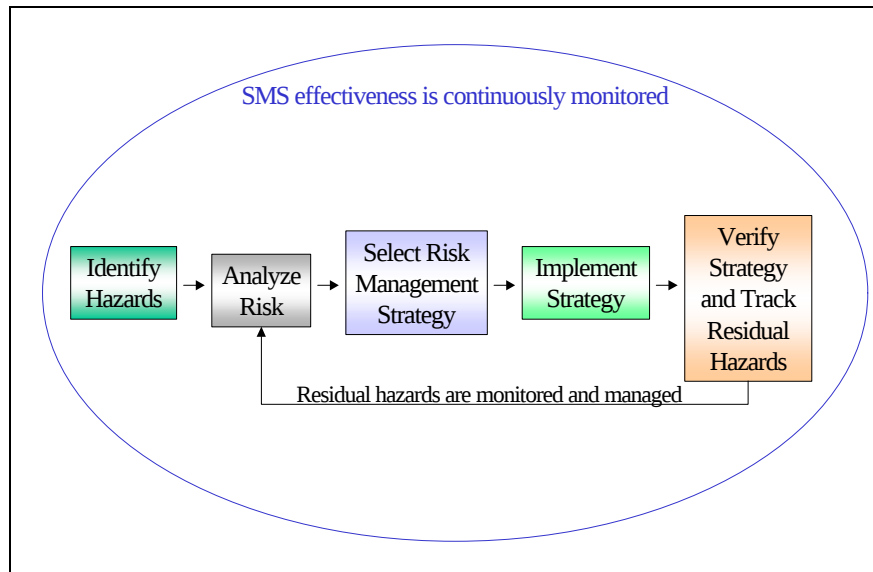


Figure 3.

2.3.3 The FAA's high-level approach is illustrated in Figure 3. Consistent with other SMS models, the FAA's SMS will allow the use of multiple tools to conduct the safety risk assessment. Operational experience and sound engineering judgment will be applied throughout the assessment process. The SMS will provide a library of acceptable assessment tools, as well as recommendations for which tools work best for various circumstances. In addition, the output and documentation requirements of the safety risk assessment will be consistent regardless of the tools employed or the change evaluated.

2.3.4 As illustrated in Figure 4, risk will be assessed and categorized according to severity and likelihood. As it is propagated into FAA service areas, likelihood and severity will be tailored to the specific risk environments. For instance, the definitions used to assess new systems, may be different than those used to assess air traffic procedures. However, the process, framework, and terminology will be consistent, fostering better communication among the various safety stakeholders in the FAA.

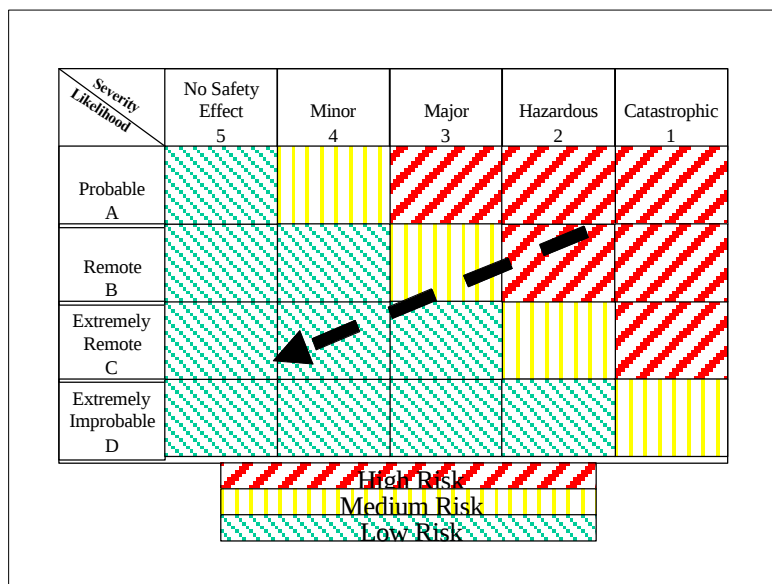


Figure 4.

2.4 **Implementation**

2.4.1 The prime principle of the FAA's SMS implementation strategy is to build upon existing processes as identified in the gap analysis. As existing safety processes are enhanced and a common safety risk management framework is established and implemented across the FAA, two primary drivers are critical to successful implementation of SMS. The first is a culture shift that highlights not just the importance of safety (long engrained in FAA), but also the importance of safety management. The second is a safety management training program presented in a tailored method to all employees who have a stake in safety. Lessons learned from other ICAO member states confirm FAA's proposed approach of training not just safety risk management practitioners, but also: senior leadership/decision-makers, middle management, and working level employees in safety critical positions.

2.4.2 Based upon experience gained from other ICAO Member States, it is estimated that full implementation of the FAA SMS will take four to five years. The implementation process being used by FAA is one that has been successful for other large-scale implementations in the FAA. Specifically, the SMS tools and processes will be implemented within targeted programs/elements that make changes to operational procedures, make changes to airspace, and modify or replace equipment related to the provision of air traffic services. The experience and feedback from these practitioners will be used to refine the SMS. This targeted initial implementation effort will build upon the SMS development team's use of "challenger" sessions. These sessions bring together safety management experts from both inside and outside FAA (e.g. industry and government) to solicit feedback on our evolving SMS.

3. **CONCLUSION**

3.1 FAA's SMS will enhance an already safe air traffic control system by continuing the evolution and advancement of safety in the United States NAS to the highest practical level, as well as meet ICAO requirements. When implemented, the FAA SMS will provide a common framework to assess the safety risk when making system changes. The FAA SMS development strategy is to build on existing processes and leverage best practices and lessons learned from numerous sources. The FAA SMS will organize these within a consistent framework, and enhance the consistency and depth of the documentation of safety-related risk assessments and decisions. It is anticipated that implementation of a full SMS within the FAA will be completed in four to five years, which is consistent with the time taken by other ICAO Member States.

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